ROHDE&SCHWARZ

Test and Measurement
Division

Operating Manual

Software Options

WCDMA UE TX Test (3GPP/FDD)

R&S® CMU-K65
1115.4891.02

WCDMA (3GPP/FDD, DL) Generator
R&S® CMU-K66
1115.5100.02

WCDMA UE Band I/…/XIV / S / L Signalling
R&S® CMU-K57/…/-K59/-K61/…/-K63/-K67/…/-K69/-K15/…/-K19/-K11

HSDPA 3.6 Mbps / 10 Mbps
R&S® CMU-K64 / CMU-K60

HSUPA 5.76 Mbps
R&S® CMU-K56

WCDMA Application Testing
R&S® CMU-K96

Wideband AMR Codec (for WCDMA)
R&S® CMU-K46

R&S Smart Alignment (for WCDMA)
R&S® CMU-K47

Assisted GPS (remote interface for WCDMA)
R&S® CMU-K90

Printed in Germany

Dear Customer,

throughout this manual, CMU-Kxx is generally used as an abbreviation for the software options R&S® CMU-Kxx (e.g. CMU-K69 is used for R&S® CMU-K96). The Universal Radio Communication Tester R&S® CMU 200 is abbreviated as CMU200.

R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG.
Trade names are trademarks of the owners.

Tabbed Divider Overview

List of Figures and Tables

Certificate of Quality
List of R&S Representatives

Contents of Manuals for Universal Radio Communication Tester CMU

Tabbed Divider

1	**Chapter 1:**	**Installation**
2	**Chapter 2:**	**Getting Started**
3	**Chapter 3:**	**Manual Operation**
4	**Chapter 4:**	**Functions and their Application**
5	**Chapter 5:**	**Remote Control – Basics**
6	**Chapter 6:**	**Remote Control – Commands**
9	**Chapter 6:**	**Error Messages**
7	**Chapter 7:**	**Remote Control – Program Examples**
8	**Chapter 8:**	**HSDPA 3.6 Mbps (Option R&S CMU-K64), HSUPA 5.76 Mbps (Option R&S CMU-56) (including remote control reference)**
9	**Chapter 9:**	**WCDMA Application Testing (Option R&S CMU-K96) R&S Smart Alignment (Option R&S CMU-K47) (including remote control reference)**
10	**Error Messages, Index**	

WCDMA Functionality of R&S CMU Models

WCDMA-UE measurements can be performed with the following R&S CMU 200 models:

- **Universal Radio Communication Tester** R&S CMU 200, stock no. 1100.0008.02. If equipped with the appropriate options (as stated in the relevant sections), this model provides the full WCDMA-UE functionality described in this manual. All WCDMA and WCDMA-related options are supported by this R&S CMU model.
- **High End Service Tester** R&S CMU 200v10, stock no. 1100.0008.10. This model supports all WCDMA TX measurements. With option R&S CMU-B68 it also provides a WCDMA downlink generator. If options R&S CMU-B21 var. 54 and option R&S CMU-B56 are available in addition, the service tester supports WCDMA signalling (operating bands I to XIV). Optional extensions of the service tester are listed below; note that not all WCDMA options described in this manual are supported.
- **Non Signalling Tester** R&S CMU 200v30, stock no. 1100.0008.30. This model supports all WCDMA TX measurements in Non Signalling mode. The functionality of R&S CMU options which are particularly relevant for production (R&S CMU-K14, R&S CMU-K47, R&S CMU-K48) is included in the basic configuration of the non signalling tester. With option R&S CMU-B68 this model also provides a WCDMA generator in order to perform single-ended RX tests (with mobile-assisted BER evaluation). Optional extensions of the non signalling tester, in particular the options required for HSDPA tests, are listed below. Note that not all WCDMA options described in this manual are supported.

The different R&S CMU 200 models are also described in the product brochures.

The high end service tester and the non signalling tester also support the GSM, CDMA2000/1xEV-DO, and AMPS network standards. For details refer to the relevant operating manuals.

Table 1 Basic configuration and options for service tester R&S CMU 200v10

Functionality	**Option**	**Remarks**
Basic configuration (included in WCDMA-UE software package for R&S CMU 200v10)		
WCDMA UE TX Tests	Correspond. R&S CMU 200 options: R&S CMU-K65	
WCDMA generator (DL)	R&S CMU-K66	Requires layer 1 board (3GPP/FDD DL + UL), option R&S CMU-B68
WCDMA signalling op. band I	R&S CMU-K68	Requires layer 1 board (3GPP/FDD DL + UL, option R&S CMU-B68), universal signalling unit (option R&S CMU-B21 var. 54), and WCDMA signalling option R&S CMU-B56
WCDMA signalling op. band II	R&S CMU-K69	
WCDMA signalling op. band III	R&S CMU-K67	
WCDMA signalling op. band IV	R&S CMU-K61	
WCDMA signalling op. band V	R&S CMU-K62	
WCDMA signalling op. band VI	R&S CMU-K63	
WCDMA signalling op. band VII	R&S CMU-K57	
WCDMA signalling op. band VIII	R&S CMU-K58	
WCDMA signalling op. band IX	R&S CMU-K59	
WCDMA signalling op. band X	R&S CMU-K16	
WCDMA signalling op. band S	R&S CMU-K15	
WCDMA signalling op. bands >X	R&S CMU-K17	
Reference oscillator		OXCO, aging $3.5*10^{-8}$/year

Functionality	Option	Remarks
Additional options		
Universal signalling unit	R&S CMU-B21 var. 54	Required for WCDMA signalling
Audio generator and analyzer	R&S CMU-B41	–
Speech codec	R&S CMU-B52	Requires option R&S CMU-B21 var. 54
WCDMA Signalling unit	R&S CMU-B56	Required for WCDMA signalling
WCDMA layer 1 board (3GPP/FDD DL + UL)	R&S CMU-B68	Required for WCDMA signalling and WCDMA generator
Additional RF generator	R&S CMU-B96	–

Table 2 Basic configuration and options for non signalling tester R&S CMU 200v30

Functionality	Option	Remarks
Basic configuration (included in WCDMA-UE software package for R&S CMU 200v30)		
WCDMA UE TX Tests	Correspond. R&S CMU 200 options: R&S CMU-K65	Non Signalling TX tests
WCDMA generator (DL)	R&S CMU-K66	Requires layer 1 board (3GPP/FDD DL + UL), option R&S CMU-B68
FM stereo transmitter R&S smart alignment I/Q versus slot	R&S CMU-K14 R&S CMU-K47 R&S CMU-K48	Extended functionality, relevant for production tests
Additional options		
Universal signalling unit	R&S CMU-B21 var. 54	Required for RX tests with BER evaluation by the R&S CMU and HSDPA tests (non signalling mode)
Audio generator and analyzer	R&S CMU-B41	–
WCDMA layer 1 board (3GPP/FDD DL + UL)	R&S CMU-B68	Required for WCDMA generator and HSDPA tests (non signalling mode)
HSDPA Non Signalling measurements	R&S CMU-U62	Required for HSDPA tests; the upgrade kit also requires options R&S CMU-B21 and R&S CMU-B68
Reference oscillator	R&S CMU-B11 R&S CMU-B12	OXCO, aging $2*10^{-7}$/year OXCO, aging $3.5*10^{-8}$/year

Contents of Manuals for Universal Radio Communication Tester R&S CMU

The user documentation for the R&S CMU 200/300 is divided in a Quick Start Guide, the operating manual for the basic instrument (including options R&S CMU-B41, R&S CMU-B17, R&S CMU-K14) and separate manuals for individual software and hardware options. The complete documentation is available on CD-ROM, stock no. 0758.1070.52.

The latest revisions of all manuals are posted on the R&S CMU Customer Web on GLORIS.

Operating Manual R&S CMU-K56/…/-K69/-K96

The present operating manual describes the application of the WCDMA UE function groups listed on the title page. It gives comprehensive information about the installation of the software, about manual as well as remote control of the instrument. Typical measurement tasks are explained in detail using the functions of the graphical user interface and a selection of program examples.

The manual is organized as follows:

Chapter 1 Describes the steps necessary for installing the software and putting the instrument into operation.

Chapter 2 Gives an introduction to the application of the CMU for WCDMA UE tests and presents typical and advanced measurement examples.

Chapter 3 Gives an overview of the user interface and describes the concepts of measurement control and instrument configuration.

Chapter 4 Represents the reference chapter providing detailed information on all functions of the user interface and their application.

Chapter 5 Describes the basics of remote control of the instrument for WCDMA UE tests.

Chapter 6 Lists all remote control commands for WCDMA UE tests (with the exception of commands listed in chapters 8 and 9).

Chapter 7 Contains program examples for selected applications.

Chapter 8 Describes the HSDPA options (including the HSDPA downlink generator, HSDPA signalling, and HSDPA measurements) and the HSUPA option.

Chapter 9 Describes option *WCDMA Application Testing* including the *RLC BLER* measurement for evaluating the data throughput, option *R&S Smart Alignment* and the remote control interface of option *Assisted GPS*.

Chapter 10 Contains an index for the operating manual.

What's New in this Revision...

This operating manual describes versions V5.20 and higher of the WCDMA UE software options. Rohde & Schwarz provides two different firmware versions V5.xx (xx ≥ 20):

- Version V5.xx (e.g. V5.20), stock no. 1115.4927.00, is optimized for production tests.
- Version V5.xxA (e.g. V5.20A), stock no. 1115.4956.00, is optimized for R&D applications. Compared to the production software V5.xx, the R&D software version supports the additional options and features listed in Table 0-1 below. Some of the features are already supported by the earlier firmware versions V5.10 … V5.14.

The R&D software V5.xxA is installed on new instruments which are ordered with options R&S® CMU-K90/-K96/-K18/-K19/-K11. Should you desire to upgrade another instrument, you can download the R&D software free of charge from the R&S® CMU customer web.

Table 0-1: Additional features in version V5.xxA

New Features	Description	Refer to Operating Manual...
Signalling – New Measurements and Connection Control		
Segmented TPC test patterns (V5.10)	To improve the accuracy of *the Inner Loop TPC* power steps, it is possible to split the TPC patterns for test steps E, G, G, and H into segments.	Chapter 4, → Power Measurements
MILENAGE (V5.10)	Support of the MILENAGE algorithm set for the 3GPP authentication and key generation functions	Chapter 4, → Connection Control (Signalling) – Network
Fractional DPCH (V5.10)	Support of the fractional DPCH (F-DPCH) in *Signaling* mode including TPC tests	Chapter 4, → Connection Control (Signalling) – BS Signal
Multi-call extensions (V5.10)	New combinations of voice calls and parallel data end-to-end connections: Voice 12.2kbps (AMR) + 64 kbps Downlink / HSUPA Voice 12.2kbps (AMR) + 384 kbps Downlink / HSUPA Voice 12.2kbps (AMR) + HSDPA / HSUPA	Chapter 9, → WCDMA Application Testing
SEM measurement (V5.11)	Extension to *Spectrum Emission Mask* measurement in *Signaling* mode: 100 kHz measurement bandwidth for “additional requirements” from 3GPP TS 34.121	Chapter 4, → Spectrum Measurements
Reject PDP Context Activation (V5.14)	New network parameter, prevents a PS attached UE from initiating a packet switched (PS) connection.	Supplement for V5.14
Paging Timeout: Off (V5.20A)	The R&S CMU can send paging messages for a (practically) unlimited period of time	Chapter 4, → Connection Control (Signalling) – Network
New HSUPA Features (with option R&S CMU-K56)		
SRB 2.5 kbps + HSPA (β_d = 0) (V5.20A)	New *Radio Bearer Setup* for HSUPA test mode, supports HSUPA subtest no. 5 with β_d = 0	Chapter 4, → Connection Control (Signalling) – BS Signal

New Features	Description	Refer to Operating Manual...
New Options		
R&S CMU-K18 R&S CMU-K19 (V5.10)	Extended operating band S: 190 MHz Duplex and 170 MHz Duplex	Chapter 4, → Connection Control (Signalling)
R&S CMU-K90 (V5.10) (V5.20A)	Support of assisted GPS tests and of the A-GPS control application New parameter “Additional Assistance Data Request”	Chapter 9, → Assisted GPS
R&S CMU-K11	Operating band L	Supplement for V5.14

Frequently Used Abbreviations

3GPP	*3rd Generation Partnership Project*
Abs.	*Absolute*
ACLR	*Adjacent Channel Leakage power Ratio*
ACP	*Adjacent Channel Power*
AGS	*Absolute Grant Scope*
AICH	*Acquisition Indicator Channel*
AM	*Acknowledged Mode*
AMR	*Adaptive Multi Rate*
ARQ	*Automatic Repeat Request*
Avg.	*Average*
BCH	*Broadcast Control Channel*
BER	*Bit Error Rate*
BLER	*Block Error Rate*
BTFD	*Blind Transport Format Detection*
CCPCH	*Common Control Physical Channel*
CCTrCH	*Coded Composite Transport Channel*
CDE	*Code Domain Error*
CDMA	*Code Division Multiple Access*
CDP	*Code Domain Power*
CD-ρ	*Code Domain ρ-factor*
Chan.	*Channel*
Channel.	*Channelization*
CPICH	*Common Pilot Channel*
CQI	*Channel Quality Indicator (HSDPA)*
CRC	*Cyclic Redundancy Check*
CTFC	*Calculated Transport Format Combination*
Curr.	*Current*
DBLER	*Data Block Error Rate*
DCCH	*Dedicated Control Channel*
Disp.	*Display*
DL	*Downlink*
DPCCH	*Dedicated Physical Control Channel*
DPCH	*Dedicated Physical Channel*
DPDCH	*Dedicated Physical Data Channel*
DTCH	*Dedicated Traffic Channel*
Err.	*Error*
E-AGCH	*Enhanced DCH Absolute Grant Channel*
E-HICH	*Enhanced DCH Hybrid ARQ Indicator Channel*
E-RGCH	*Enhanced DCH Relative Grant Channel*
E-RNTI	*Enhanced DCH Radio Network Temporary Identifier*
EVM	*Error Vector Magnitude*
Ext./Extern.	*External*
FBI	*Feedback information*
FDD	*Frequency Division Duplex*
FDR	*False transmit format Detection Ratio*
FFT	*Fast Fourier Transform*
Freq.	*Frequency*
GPIB	*General Purpose Interface Bus = IEEE488 Bus*
H-ARQ	*Hybrid ARQ*
HPSK	*Hybrid Phase Shift Keying*
HSDPA	*High Speed Downlink Packet Access*
HS-DPCCH	*High Speed Dedicated Physical Control Channel*
HS-DPDCH	*High Speed Dedicated Physical Data Channel*
HS-S(P)DSCH	*High Speed (Physical) Downlink Shared Channel*
HS-SCCH	*High Speed Shared Control Channel*
HSUPA	*High Speed Uplink Packet Access*
I	*In-phase*
IF	*Intermediate Frequency*
IMEI	*International Mobile station Equipment Identity*
Int.	*Internal*
IPDL	*Idle Periods in the DownLink*
LAC	*Location Area Code*
Lev.	*Level*
MAC	*Medium Access Control*
Magn.	*Magnitude*
Max.	*Maximum*
MCC	*Mobile Country Code*
ME	*Magnitude Error*
Meas.	*Measurement*

Min.	*Minimum*
MNC	*Mobile Network Code*
OBW	*Occupied Bandwidth*
OCNS	*Orthogonal Channel Noise Simulator*
OTDOA	*Observed Time Difference Of Arrival*
OVSC	*Orthogonal Variable Spreading Code*
P-CCPCH	*Primary Common Control Physical Channel*
PCDE	*Peak Code Domain Error*
PCPCH	*Physical Common Packet Channel*
P-CPICH	*Primary Common Pilot Channel*
PDCP	*Packet Data Convergence Protocol*
PDSCH	*Physical Downlink Shared Channel*
PDU	*Protocol Data Unit*
PE	*Phase Error*
PEP	*Peak Envelope Power*
PICH	*Page Indicator Channel*
Pk.	*Peak*
P-SCH	*Primary Synchronization Channel*
Q	*Quadrature-phase*
QPSK	*Quadrature Phase Shift Keying*
RAB	*Radio Access Bearer*
RAT	*Radio Access Technology*
RBW	*Resolution Bandwidth*
Ref.	*Reference (marker)*
Rel.	*Relative*
RF	*Radio Frequency*
RLC	*Radio Link Control*
RRC	*Root-raised cosine (filter)*
RSCP	*Received Signal Code Power*
RV	*Redundancy and Constellation Version (Coding Sequence, HSDPA)*
RX	*Receiver*
SCCPCH	*Secondary Common Control Physical Channel*
S-CCPCH	*Secondary Common Control Physical Channel*
SCH	*Synchronization Channel*
Scr.	*Scrambling*
SDU	*Service Data Unit*
SEM	*Spectrum Emission Mask*
SRB	*Signalling Radio Bearer*
S-SCH	*Secondary Synchronization Channel*
SW	*Software*
Sym.	*Symbol*
Sync./Synch.	*Synchronization*
TF	*Transport Format*
TFC	*Transport Format Combination*
TFCI	*Transport Format Combination Indicator*
TFI	*Transport Format Indicator*
TM	*Transparent Mode*
TPC	*Transmit Power Control*
TrCH	*Transport Channel*
Trg.	*Trigger*
TTI	*Transmission Time Interval*
TTI	*Transmission Time Intervals*
UARFCN	*UTRA Absolute Radio Frequency Channel Number*
UE	*User equipment*
UICC	*Universal Integrated Circuit Card*
UL	*Uplink*
USIM	*UMTS Subscriber Identity Module*
UTRA(N)	*Universal Terrestrial Radio Access (Network)*
Vect.	*Vector*
WCDMA	*Wideband CDMA*

Glossary of Terms

The following list contains definitions of terms that are often used throughout this manual. For a comprehensive overview of WCDMA definitions and abbreviations please refer also to 3GPP TS 21.905 "Vocabulary for 3GPP Specifications" (Release 1999).

Adjacent channel power (ACP) Power emitted in the first and second adjacent channels, i.e. at ±5 MHz and ±10 MHz from the carrier frequency.

Adjacent channel leakage power ratio (ACLR) Ratio of the power measured in an adjacent channel (Adjacent Channel Power, ACP) to the transmitted carrier power, expressed in dB. This definition differs from the 3GPP specification by a minus sign but is in line with other systems like GSM and TDMA.

Carrier frequency error Deviation of the UE modulated carrier frequency from the frequency received from the base station (node B). In the CMU: deviation of the UE modulated carrier frequency from the nominal carrier frequency.

Carrier spacing Frequency offset between two adjacent carriers (5 MHz).

Channel raster Frequency offset between the allowed positions of WCDMA carriers (200 kHz).

Channelization code Orthogonal Variable Spreading Factor (OVSF) codes that preserve the orthogonality between a user's different physical channels. The channelization codes used in the uplink WCDMA signal are OVSF codes with a length (spreading factor) between 4 and 256. In the downlink, a spreading factor of 512 may be used in addition.

Chip rate Product of the symbol rate and the spreading factor. For the 3GPP WCDMA system a fixed chip rate of 3.84 Mcps is specified.

Code domain The entire set of channelization codes involved in a WCDMA signal configuration. Measuring a parameter in code domain means to determine its values as a function of the individual channelization codes.

For standard uplink WCDMA DPCH signals the assignment between the physical channel contributions and the channelization codes in the I and Q branch is fixed. Therefore, any code domain measurement result can be represented as a function of the physical channel contributions as well.

Code domain error Ratio of the RMS-averaged power of the error vector projected onto the code domain to the RMS-averaged power of the composite reference signal, expressed in dB.

Code domain power Power in the individual code channels normalized to the power of the composite signal, expressed in dB.

Code domain ρ factor Correlated power of an individual channel (ρ factor) divided by the total power of the composite WCDMA signal.

Crest factor Peak to average ratio: ratio of the peak transmit power in a slot (peak envelope power) to the average transmit power in a slot.

Downlink WCDMA signal Signal transmitted by a WCDMA base station (node B) to be received by the UE. With option CMU-K66, *WCDMA (3GPP/FDD, DL) Generator,* the CMU provides a downlink WCDMA signal consisting of a P-CPICH, P-CCPCH, P-SCH, S-SCH, and DPCH. The individual channels are spread, multiplexed and scrambled according to the rules defined in the standard.

Emission mask Tolerance template for the spectral emissions in a range between 2.5 MHz and 12.5 MHz away from the UE center carrier frequency. The spectrum emission mask is divided into several areas the power in these areas must be measured with Gaussian filters of different bandwidth.

Error vector Difference vector connecting the measured and the ideal modulated signal vector.

Error vector magnitude RMS value of the error vector divided by the RMS value of the reference signal (ideal modulated signal vector), expressed in percent. The error vector magnitude (EVM) is the critical quantity to assess the modulation accuracy of the UE transmitter.

Inner Loop TPC Transmit Power Control mode where the UE transmitter adjusts its output power in accordance with a series of TPC command received in the downlink.

I/Q imbalance Difference between the estimated I and Q amplitudes of the measured signal, normalized and expressed in dB units.

I/Q origin offset Ratio of the I/Q offset vector (i.e. the estimated DC offset of the measured signal) to the average offset-corrected signal vector.

Magnitude error Difference in magnitude between the measured and the ideal modulated signal vector, normalized to the magnitude of the ideal vector.

Maximum power Operating mode where the UE is set to its maximum power control level.

Minimum power Operating mode where the UE is set to its minimum power control level.

Modulation accuracy Ability of the UE transmitter to generate an ideal QPSK-modulated signal.

Occupied bandwidth Width of a frequency range around the assigned channel frequency containing 99% of the total integrated power of the transmitted spectrum.

OFF power Operating mode where the UE is set to is set to the transmit OFF power state where it does not transmit except during uplink compressed mode.

Peak code domain error Maximum Code Domain Error for all codes in a considered code domain at a specific spreading factor. The Code Domain Error for every code corresponds to the projection of the EVM onto that code. The PCDE is expressed in dB.

Peak envelope power Maximum power of the RF envelope.

Phase error Difference in phase between the measured and the ideal modulated signal vector.

Power class Determines the maximum output power of a WCDMA UE and its tolerances. The four power classes 1 to 4 specified correspond to maximum output powers of +33 dBm, +27 dBm, +24 dBm and +21 dBm.

Power step Relative power difference between the average power of the target timeslot and the average power of the original timeslot in inner loop power control. The powers are averaged not including the transient duration.

RF channel number Integer number assigned to an RF channel centered on an integer multiple of the 200 MHz channel raster. The assignment between channel numbers *N* and carrier frequencies *F* is $N = 5 \cdot (F / MHz), \quad 0.0\ MHz \le F \le 3276.6\ MHz$.

The WCDMA UE is designed to operate in the uplink band between 1920 MHz and 1980 MHz, corresponding to channel numbers 9600 to 9900. The downlink band ranges from 2110 MHz to 2170 MHz, corresponding to channel numbers 10550 to 10850.

Spectrum emissions Unwanted emissions immediately outside the nominal channel resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. An uplink WCDMA signal must conform to a specified spectrum *emission mask*.

Spreading factor Length or maximum number of the channelization codes used to spread the WCDMA signal. The spreading factor is the ratio of the WCDMA chip rate of 3.84 Mcps and the symbol rate.

Symbol rate WCDMA chip rate divided by the spreading factor. The WCDMA standard allows variable symbol rates of 7.5 ksps (downlink only), 15 ksps, 30 ksps, 60 ksps, 120 ksps, 240 ksps, 480 ksps and 960 ksps.

Transmit Power Control The process of adjusting the output power of the UE transmitter in order to optimize the transmission quality of the connection and the network capacity.

Uplink WCDMA signal Signal transmitted by a WCDMA UE to be received by the base station (node B). An uplink DPCH signal consists of one DPCCH plus up to 6 DPDCHs that are spread, multiplexed and scrambled according to fixed rules.

Waveform quality Normalized correlated power between the actual and the ideal waveform, sampled at the constellation points. The waveform quality (ρ factor) is a measure of the modulation accuracy. For an ideal transmitter (ideal correlation), it is equal to 1, otherwise it is a positive number smaller than 1.

References

The 3GPP specifications for the WCDMA measurements and settings described in this manual are quoted throughout the text. In general, the test functionality of the R&S CMU200 complies with standard 3GPP TS 34.121, “Terminal Conformance Specification Radio transmission and reception (FDD)”.

Supplement to the Operating Manual
Options R&S® CMU-K56/.../-K69/-K96
WCDMA UE Software Options including HSDPA/HSUPA

New Features in Version 5.14 (with Base System V5.1x)

Dear Customer,

Version V5.14 of the WCDMA UE software for the Universal Radio Communication Tester R&S® CMU 200 provides the following new features.

Operating Band L 1

PDP Context Activation Reject 3

Operating Band L

See: Chapter 4, Connection Control (Signalling) → Connection (State Signal Off) → Band Select

Option R&S® CMU-K11 provides additional channels for operating band L. In *Signalling* mode, the R&S® CMU supports connections on the new channels including inter-band handovers (use *Connection Control – Connection – Band Select* to activate band L). In *Non Signalling* mode, the R&S® CMU recognizes the uplink and downlink channel numbers and assigns the corresponding frequencies.

The new channels cover uplink frequencies between 1626.5 MHz and 1660.5 MHz. The RX/TX frequency separation (duplex spacing) is 101.5 MHz. The R&S® CMU transmits the System Information Blocks SIB 5 including the Frequency Band Indicator 21 in order to inform the UE about operating band L.

In an alternative operating mode *(Connect. Control – Node B Settings – RX/TX Separation Band L: Off)*, no fixed RX/TX frequency separation is used. This means that any combination of the downlink and uplink channels from Table 1 and Table 2 below is allowed. The *RX/TX Separation* parameter is ignored; downlink and uplink channels must be set independently using the *BS Signal* and *UE Signal* tabs.

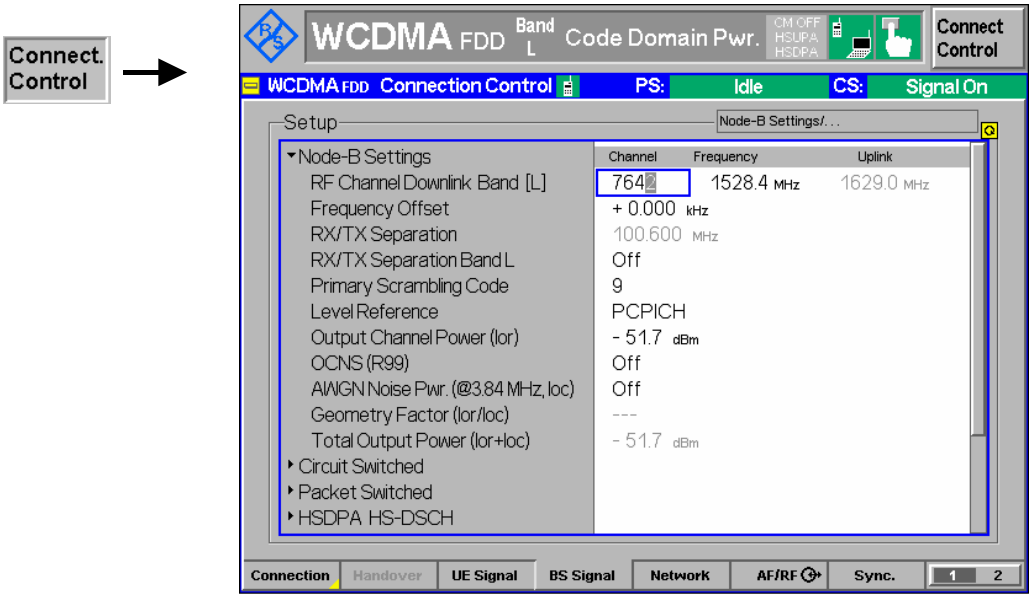


Fig. 4-61 Connection Control – Analyzer (panel)

The uplink and downlink channels in operating band L are listed below

Table 1 Extended UTRA operating band L and channel numbers: Uplink

Operating Band	UARFCN formula offset $F_{UL, Offset}$ [MHz]	Assigned Channels	Assigned Center Frequencies $F_{UL, Low}$ [MHz] to $F_{UL, High}$ [MHz]
L	0 –30.1 (for additional channels)	8145 to 8290, 8295 to 8441	1629.0 to 1658.0, 1628.9 to 1658.1*)

*) The additional channels need to bet by their channel number.

Table 2 Extended UTRA operating band L and channel numbers: Downlink

Operating Band	UARFCN formula offset $F_{DL, Offset}$ [MHz]	Assigned Channels	Assigned Center Frequencies $F_{DL, Low}$ [MHz] to $F_{DL, High}$ [MHz]
L	–30.1 0 (for additional channels)	7788 to 7933, 7637 to 7783	1527.5 to 1556.5, 1527.4 to 1556.6*)

*) The additional channels need to bet by their channel number.

Remote control command for band selection (Signalling mode only):
`CONFigure:NETWork:OBANd OBL`

The following commands also accept the new parameter `OBL`:

```
CONFigure:BSSignal[:COMBined]:OCHannel
CONFigure:RXQuality:UEReport:NCELl:WCDMa:OBANd
CONFigure:UESignal[:COMBined]:OCHannel
```

The following new remote control command has been introduced with firmware version V5.14.

CONFigure:BSSignal:FSBL *<Enable>* RX/TX Separation Band L

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Use fixed 101.5 MHz frequency separation Accept independent UL and DL channels	ON	–	V5.14

Description of command	Sig. State
This command sets a fixed or a variable RX/TX frequency separation for operating band L.	all

Reject PDP Context Activation

See: Chapter 4, Connection Control (Signalling) → Network → Requested UE Data

If enabled, the *Reject PDP Context* parameter will cause the R&S CMU to reject any ACTIVATE PDP CONTEXT REQUEST message from the UE using an ACTIVATE PDP CONTEXT REJECT response. As a result, a PS attached UE cannot initiate a packet switched (PS) connection. If *Reject PDP Context* is disabled, the R&S CMU accepts PDP context requests from the UE.

With enabled *Reject PDP Context* parameter, it is possible to establish a circuit switched (e.g. voice) connection and perform measurements while the R&S CMU remains in the PS attached state. For a detailed description of the connection schemes refer to section *Packet Switched (PS) Connections* on p. 4.212 and Fig. 4.93 on p. 4.215.

CONFigure:NETWork:REQuest:RPDP *<Enable>* Reject PDP Context

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Reject every PDP context request Accept every PDP context request	OFF	–	V5.14

Description of command	Sig. State
This command qualifies whether the R&S CMU will reject or accept ACTIVATE PDP CONTEXT REQUEST messages from the UE.	SOFF, SON, REG / ATT Q: all

Basic Safety Instructions

Always read through and comply with the following safety instructions!

All plants and locations of the Rohde & Schwarz group of companies make every effort to keep the safety standards of our products up to date and to offer our customers the highest possible degree of safety. Our products and the auxiliary equipment they require are designed, built and tested in accordance with the safety standards that apply in each case. Compliance with these standards is continuously monitored by our quality assurance system. The product described here has been designed, built and tested in accordance with the attached EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards. To maintain this condition and to ensure safe operation, you must observe all instructions and warnings provided in this manual. If you have any questions regarding these safety instructions, the Rohde & Schwarz group of companies will be happy to answer them.

Furthermore, it is your responsibility to use the product in an appropriate manner. This product is designed for use solely in industrial and laboratory environments or, if expressly permitted, also in the field and must not be used in any way that may cause personal injury or property damage. You are responsible if the product is used for any intention other than its designated purpose or in disregard of the manufacturer's instructions. The manufacturer shall assume no responsibility for such use of the product.

The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and a basic knowledge of English. It is therefore essential that only skilled and specialized staff or thoroughly trained personnel with the required skills be allowed to use the product. If personal safety gear is required for using Rohde & Schwarz products, this will be indicated at the appropriate place in the product documentation. Keep the basic safety instructions and the product documentation in a safe place and pass them on to the subsequent users.

Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before and when using the product. It is also absolutely essential to observe the additional safety instructions on personal safety, for example, that appear in relevant parts of the product documentation. In these safety instructions, the word "product" refers to all merchandise sold and distributed by the Rohde & Schwarz group of companies, including instruments, systems and all accessories.

Symbols and safety labels

Notice, general danger location Observe product documentation	Caution when handling heavy equipment	Danger of electric shock	Warning! Hot surface	PE terminal	Ground	Ground terminal	Be careful when handling electrostatic sensitive devices

ON/OFF supply voltage	Standby indication	Direct current (DC)	Alternating current (AC)	Direct/alternating current (DC/AC)	Device fully protected by double (reinforced) insulation

Tags and their meaning

The following signal words are used in the product documentation in order to warn the reader about risks and dangers.

indicates a hazardous situation which, if not avoided, will result in death or serious injury.

indicates a hazardous situation which, if not avoided, could result in death or serious injury.

indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

indicates the possibility of incorrect operation which can result in damage to the product.
In the product documentation, the word ATTENTION is used synonymously.

These tags are in accordance with the standard definition for civil applications in the European Economic Area. Definitions that deviate from the standard definition may also exist in other economic areas or military applications. It is therefore essential to make sure that the tags described here are always used only in connection with the related product documentation and the related product. The use of tags in connection with unrelated products or documentation can result in misinterpretation and in personal injury or material damage.

Operating states and operating positions

The product may be operated only under the operating conditions and in the positions specified by the manufacturer, without the product's ventilation being obstructed. If the manufacturer's specifications are not observed, this can result in electric shock, fire and/or serious personal injury or death. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.

1. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products: predefined operating position is always with the housing floor facing down, IP protection 2X, pollution severity 2, overvoltage category 2, use only indoors, max. operating altitude 2000 m above sea level, max. transport altitude 4500 m above sea level. A tolerance of ±10 % shall apply to the nominal voltage and ±5 % to the nominal frequency.
2. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves). An installation that is not carried out as described in the product documentation could result in personal injury or death.
3. Do not place the product on heat-generating devices such as radiators or fan heaters. The ambient temperature must not exceed the maximum temperature specified in the product documentation or in the data sheet. Product overheating can cause electric shock, fire and/or serious personal injury or death.

Electrical safety

If the information on electrical safety is not observed either at all to the extent necessary, electric shock, fire and/or serious personal injury or death may occur.

1. Prior to switching on the product, always ensure that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.
2. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with an earthing contact and protective earth connection.
3. Intentionally breaking the protective earth connection either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.
4. If the product does not have a power switch for disconnection from the AC supply network, the plug of the connecting cable is regarded as the disconnecting device. In such cases, always ensure that the power plug is easily reachable and accessible at all times (corresponding to the length of connecting cable, approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply network. If products without power switches are integrated into racks or systems, a disconnecting device must be provided at the system level.
5. Never use the product if the power cable is damaged. Check the power cable on a regular basis to ensure that it is in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, you can ensure that the cable will not be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.
6. The product may be operated only from TN/TT supply networks fused with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
7. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, sparks that result in fire and/or injuries may occur.
8. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
9. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
10. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC60950-1/EN60950-1 or IEC61010-1/EN 61010-1 standards that apply in each case.
11. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
12. If a product is to be permanently installed, the connection between the PE terminal on site and the product's PE conductor must be made first before any other connection is made. The product may be installed and connected only by a licensed electrician.
13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.

14. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
15. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.
16. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1. Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.
17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.
18. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

Operation

1. Operating the products requires special training and intense concentration. Make sure that persons who use the products are physically, mentally and emotionally fit enough to do so; otherwise, injuries or material damage may occur. It is the responsibility of the employer/operator to select suitable personnel for operating the products.
2. Before you move or transport the product, read and observe the section titled "Transport".
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a Rohde & Schwarz product, consult a physician immediately to determine the cause and to prevent health problems or stress.
4. Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal", item 1.
5. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn babies require increased protection, pregnant women must be protected by appropriate measures. Persons with pacemakers may also be exposed to risks from electromagnetic radiation. The employer/operator must evaluate workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the potential danger.
6. Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.
7. If a laser product (e.g. a CD/DVD drive) is integrated into a Rohde & Schwarz product, absolutely no other settings or functions may be used as described in the product documentation. The objective is to prevent personal injury (e.g. due to laser beams).

Repair and service

1. The product may be opened only by authorized, specially trained personnel. Before any work is performed on the product or before the product is opened, it must be disconnected from the AC supply network. Otherwise, personnel will be exposed to the risk of an electric shock.
2. Adjustments, replacement of parts, maintenance and repair may be performed only by electrical experts authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

Batteries and rechargeable batteries/cells

If the information regarding batteries and rechargeable batteries/cells is not observed either at all or to the extent necessary, product users may be exposed to the risk of explosions, fire and/or serious personal injury, and, in some cases, death. Batteries and rechargeable batteries with alkaline electrolytes (e.g. lithium cells) must be handled in accordance with the EN 62133 standard.

1. Cells must not be taken apart or crushed.
2. Cells or batteries must not be exposed to heat or fire. Storage in direct sunlight must be avoided. Keep cells and batteries clean and dry. Clean soiled connectors using a dry, clean cloth.
3. Cells or batteries must not be short-circuited. Cells or batteries must not be stored in a box or in a drawer where they can short-circuit each other, or where they can be short-circuited by other conductive materials. Cells and batteries must not be removed from their original packaging until they are ready to be used.
4. Keep cells and batteries out of the hands of children. If a cell or a battery has been swallowed, seek medical aid immediately.
5. Cells and batteries must not be exposed to any mechanical shocks that are stronger than permitted.
6. If a cell develops a leak, the fluid must not be allowed to come into contact with the skin or eyes. If contact occurs, wash the affected area with plenty of water and seek medical aid.
7. Improperly replacing or charging cells or batteries that contain alkaline electrolytes (e.g. lithium cells) can cause explosions. Replace cells or batteries only with the matching Rohde & Schwarz type (see parts list) in order to ensure the safety of the product.
8. Cells and batteries must be recycled and kept separate from residual waste. Rechargeable batteries and normal batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.

Transport

1. The product may be very heavy. Therefore, the product must be handled with care. In some cases, the user may require a suitable means of lifting or moving the product (e.g. with a lift-truck) to avoid back or other physical injuries.

2. Handles on the products are designed exclusively to enable personnel to transport the product. It is therefore not permissible to use handles to fasten the product to or on transport equipment such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport or lifting. Observe the safety regulations of the manufacturer of the means of transport or lifting. Noncompliance can result in personal injury or material damage.
3. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely and properly. The manufacturer assumes no responsibility for accidents or collisions. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident.

Waste disposal

1. If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.
2. If handling the product releases hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation. The improper disposal of hazardous substances or fuels can cause health problems and lead to environmental damage.

Informaciones elementales de seguridad

Es imprescindible leer y observar las siguientes instrucciones e informaciones de seguridad!

El principio del grupo de empresas Rohde & Schwarz consiste en tener nuestros productos siempre al día con los estándares de seguridad y de ofrecer a nuestros clientes el máximo grado de seguridad. Nuestros productos y todos los equipos adicionales son siempre fabricados y examinados según las normas de seguridad vigentes. Nuestro sistema de garantía de calidad controla constantemente que sean cumplidas estas normas. El presente producto ha sido fabricado y examinado según el certificado de conformidad adjunto de la UE y ha salido de nuestra planta en estado impecable según los estándares técnicos de seguridad. Para poder preservar este estado y garantizar un funcionamiento libre de peligros, el usuario deberá atenerse a todas las indicaciones, informaciones de seguridad y notas de alerta. El grupo de empresas Rohde & Schwarz está siempre a su disposición en caso de que tengan preguntas referentes a estas informaciones de seguridad.

Además queda en la responsabilidad del usuario utilizar el producto en la forma debida. Este producto está destinado exclusivamente al uso en la industria y el laboratorio o, si ha sido expresamente autorizado, para aplicaciones de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa pueda sufrir daño. El uso del producto fuera de sus fines definidos o sin tener en cuenta las instrucciones del fabricante queda en la responsabilidad del usuario. El fabricante no se hace en ninguna forma responsable de consecuencias a causa del mal uso del producto.

Se parte del uso correcto del producto para los fines definidos si el producto es utilizado conforme a las indicaciones de la correspondiente documentación del producto y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso del producto hace necesarios conocimientos técnicos y ciertos conocimientos del idioma inglés. Por eso se debe tener en cuenta que el producto solo pueda ser operado por personal especializado o personas instruidas en profundidad con las capacidades correspondientes. Si fuera necesaria indumentaria de seguridad para el uso de productos de Rohde & Schwarz, encontraría la información debida en la documentación del producto en el capítulo correspondiente. Guarde bien las informaciones de seguridad elementales, así como la documentación del producto, y entréguelas a usuarios posteriores.

Tener en cuenta las informaciones de seguridad sirve para evitar en lo posible lesiones o daños por peligros de toda clase. Por eso es imprescindible leer detalladamente y comprender por completo las siguientes informaciones de seguridad antes de usar el producto, y respetarlas durante el uso del producto. Deberán tenerse en cuenta todas las demás informaciones de seguridad, como p. ej. las referentes a la protección de personas, que encontrarán en el capítulo correspondiente de la documentación del producto y que también son de obligado cumplimiento. En las presentes informaciones de seguridad se recogen todos los objetos que distribuye el grupo de empresas Rohde & Schwarz bajo la denominación de "producto", entre ellos también aparatos, instalaciones así como toda clase de accesorios.

Símbolos y definiciones de seguridad

Aviso: punto de peligro general Observar la documentación del producto	Atención en el manejo de dispositivos de peso elevado	Peligro de choque eléctrico	Adver-tencia: superficie caliente	Conexión a conductor de protección	Conexión a tierra	Conexión a masa	Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)

Tensión de alimentación de PUESTA EN MARCHA / PARADA	Indicación de estado de espera (Standby)	Corriente continua (DC)	Corriente alterna (AC)	Corriente continua / Corriente alterna (DC/AC)	El aparato está protegido en su totalidad por un aislamiento doble (reforzado)

Palabras de señal y su significado

En la documentación del producto se utilizan las siguientes palabras de señal con el fin de advertir contra riesgos y peligros.

PELIGRO identifica un peligro inminente con riesgo elevado que provocará muerte o lesiones graves si no se evita.

ADVERTENCIA identifica un posible peligro con riesgo medio de provocar muerte o lesiones (graves) si no se evita.

ATENCIÓN identifica un peligro con riesgo reducido de provocar lesiones leves o moderadas si no se evita.

AVISO indica la posibilidad de utilizar mal el producto y, como consecuencia, dañarlo.
En la documentación del producto se emplea de forma sinónima el término CUIDADO.

Las palabras de señal corresponden a la definición habitual para aplicaciones civiles en el área económica europea. Pueden existir definiciones diferentes a esta definición en otras áreas económicas o en aplicaciones militares. Por eso se deberá tener en cuenta que las palabras de señal aquí descritas sean utilizadas siempre solamente en combinación con la correspondiente documentación del producto y solamente en combinación con el producto correspondiente. La utilización de las palabras de señal en combinación con productos o documentaciones que no les correspondan puede llevar a interpretaciones equivocadas y tener por consecuencia daños en personas u objetos.

Estados operativos y posiciones de funcionamiento

El producto solamente debe ser utilizado según lo indicado por el fabricante respecto a los estados operativos y posiciones de funcionamiento sin que se obstruya la ventilación. Si no se siguen las indicaciones del fabricante, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte. En todos los trabajos deberán ser tenidas en cuenta las normas nacionales y locales de seguridad del trabajo y de prevención de accidentes.

1. Si no se convino de otra manera, es para los productos Rohde & Schwarz válido lo que sigue: como posición de funcionamiento se define por principio la posición con el suelo de la caja para abajo, modo de protección IP 2X, grado de suciedad 2, categoría de sobrecarga eléctrica 2, uso solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4500 m sobre el nivel del mar. Se aplicará una tolerancia de ±10 % sobre el voltaje nominal y de ±5 % sobre la frecuencia nominal.
2. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptos para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (p. ej. paredes y estantes). Si se realiza la instalación de modo distinto al indicado en la documentación del producto, pueden causarse lesiones o incluso la muerte.
3. No ponga el producto sobre aparatos que generen calor (p. ej. radiadores o calefactores). La temperatura ambiente no debe superar la temperatura máxima especificada en la documentación del producto o en la hoja de datos. En caso de sobrecalentamiento del producto, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

Seguridad eléctrica

Si no se siguen (o se siguen de modo insuficiente) las indicaciones del fabricante en cuanto a seguridad eléctrica, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

1. Antes de la puesta en marcha del producto se deberá comprobar siempre que la tensión preseleccionada en el producto coincida con la de la red de alimentación eléctrica. Si es necesario modificar el ajuste de tensión, también se deberán cambiar en caso dado los fusibles correspondientes del producto.
2. Los productos de la clase de protección I con alimentación móvil y enchufe individual solamente podrán enchufarse a tomas de corriente con contacto de seguridad y con conductor de protección conectado.
3. Queda prohibida la interrupción intencionada del conductor de protección, tanto en la toma de corriente como en el mismo producto. La interrupción puede tener como consecuencia el riesgo de que el producto sea fuente de choques eléctricos. Si se utilizan cables alargadores o regletas de enchufe, deberá garantizarse la realización de un examen regular de los mismos en cuanto a su estado técnico de seguridad.
4. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de conexión como interruptor. En estos casos se deberá asegurar que el enchufe siempre sea de fácil acceso (de acuerdo con la longitud del cable de conexión, aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en bastidores o instalaciones, se deberá colocar el interruptor en el nivel de la instalación.
5. No utilice nunca el producto si está dañado el cable de conexión a red. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegúrese, mediante las medidas de protección y de instalación adecuadas, de que el cable de conexión a red no pueda ser dañado o de que nadie pueda ser dañado por él, p. ej. al tropezar o por un choque eléctrico.
6. Solamente está permitido el funcionamiento en redes de alimentación TN/TT aseguradas con fusibles de 16 A como máximo (utilización de fusibles de mayor amperaje solo previa consulta con el grupo de empresas Rohde & Schwarz).
7. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. La no observación de estas medidas puede provocar chispas, fuego y/o lesiones.
8. No sobrecargue las tomas de corriente, los cables alargadores o las regletas de enchufe ya que esto podría causar fuego o choques eléctricos.
9. En las mediciones en circuitos de corriente con una tensión U_{eff} > 30 V se deberán tomar las medidas apropiadas para impedir cualquier peligro (p. ej. medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).
10. Para la conexión con dispositivos informáticos como un PC o un ordenador industrial, debe comprobarse que éstos cumplan los estándares IEC60950-1/EN60950-1 o IEC61010-1/EN 61010-1 válidos en cada caso.
11. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar lesiones, fuego o daños en el producto.

12. Si un producto se instala en un lugar fijo, se deberá primero conectar el conductor de protección fijo con el conductor de protección del producto antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.
13. En el caso de dispositivos fijos que no estén provistos de fusibles, interruptor automático ni otros mecanismos de seguridad similares, el circuito de alimentación debe estar protegido de modo que todas las personas que puedan acceder al producto, así como el producto mismo, estén a salvo de posibles daños.
14. Todo producto debe estar protegido contra sobretensión (debida p. ej. a una caída del rayo) mediante los correspondientes sistemas de protección. Si no, el personal que lo utilice quedará expuesto al peligro de choque eléctrico.
15. No debe introducirse en los orificios de la caja del aparato ningún objeto que no esté destinado a ello. Esto puede producir cortocircuitos en el producto y/o puede causar choques eléctricos, fuego o lesiones.
16. Salvo indicación contraria, los productos no están impermeabilizados (ver también el capítulo "Estados operativos y posiciones de funcionamiento", punto 1). Por eso es necesario tomar las medidas necesarias para evitar la entrada de líquidos. En caso contrario, existe peligro de choque eléctrico para el usuario o de daños en el producto, que también pueden redundar en peligro para las personas.
17. No utilice el producto en condiciones en las que pueda producirse o ya se hayan producido condensaciones sobre el producto o en el interior de éste, como p. ej. al desplazarlo de un lugar frío a otro caliente. La entrada de agua aumenta el riesgo de choque eléctrico.
18. Antes de la limpieza, desconecte por completo el producto de la alimentación de tensión (p. ej. red de alimentación o batería). Realice la limpieza de los aparatos con un paño suave, que no se deshilache. No utilice bajo ningún concepto productos de limpieza químicos como alcohol, acetona o diluyentes para lacas nitrocelulósicas.

Funcionamiento

1. El uso del producto requiere instrucciones especiales y una alta concentración durante el manejo. Debe asegurarse que las personas que manejen el producto estén a la altura de los requerimientos necesarios en cuanto a aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario u operador es responsable de seleccionar el personal usuario apto para el manejo del producto.
2. Antes de desplazar o transportar el producto, lea y tenga en cuenta el capítulo "Transporte".
3. Como con todo producto de fabricación industrial no puede quedar excluida en general la posibilidad de que se produzcan alergias provocadas por algunos materiales empleados, los llamados alérgenos (p. ej. el níquel). Si durante el manejo de productos Rohde & Schwarz se producen reacciones alérgicas, como p. ej. irritaciones cutáneas, estornudos continuos, enrojecimiento de la conjuntiva o dificultades respiratorias, debe avisarse inmediatamente a un médico para investigar las causas y evitar cualquier molestia o daño a la salud.
4. Antes de la manipulación mecánica y/o térmica o el desmontaje del producto, debe tenerse en cuenta imprescindiblemente el capítulo "Eliminación", punto 1.

5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalizar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.
7. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).

Reparación y mantenimiento

1. El producto solamente debe ser abierto por personal especializado con autorización para ello. Antes de manipular el producto o abrirlo, es obligatorio desconectarlo de la tensión de alimentación, para evitar toda posibilidad de choque eléctrico.
2. El ajuste, el cambio de partes, el mantenimiento y la reparación deberán ser efectuadas solamente por electricistas autorizados por Rohde & Schwarz. Si se reponen partes con importancia para los aspectos de seguridad (p. ej. el enchufe, los transformadores o los fusibles), solamente podrán ser sustituidos por partes originales. Después de cada cambio de partes relevantes para la seguridad deberá realizarse un control de seguridad (control a primera vista, control del conductor de protección, medición de resistencia de aislamiento, medición de la corriente de fuga, control de funcionamiento). Con esto queda garantizada la seguridad del producto.

Baterías y acumuladores o celdas

Si no se siguen (o se siguen de modo insuficiente) las indicaciones en cuanto a las baterías y acumuladores o celdas, pueden producirse explosiones, incendios y/o lesiones graves con posible consecuencia de muerte. El manejo de baterías y acumuladores con electrolitos alcalinos (p. ej. celdas de litio) debe seguir el estándar EN 62133.

1. No deben desmontarse, abrirse ni triturarse las celdas.
2. Las celdas o baterías no deben someterse a calor ni fuego. Debe evitarse el almacenamiento a la luz directa del sol. Las celdas y baterías deben mantenerse limpias y secas. Limpiar las conexiones sucias con un paño seco y limpio.
3. Las celdas o baterías no deben cortocircuitarse. Es peligroso almacenar las celdas o baterías en estuches o cajones en cuyo interior puedan cortocircuitarse por contacto recíproco o por contacto con otros materiales conductores. No deben extraerse las celdas o baterías de sus embalajes originales hasta el momento en que vayan a utilizarse.
4. Mantener baterías y celdas fuera del alcance de los niños. En caso de ingestión de una celda o batería, avisar inmediatamente a un médico.
5. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.

6. En caso de falta de estanqueidad de una celda, el líquido vertido no debe entrar en contacto con la piel ni los ojos. Si se produce contacto, lavar con agua abundante la zona afectada y avisar a un médico.
7. En caso de cambio o recarga inadecuados, las celdas o baterías que contienen electrolitos alcalinos (p. ej. las celdas de litio) pueden explotar. Para garantizar la seguridad del producto, las celdas o baterías solo deben ser sustituidas por el tipo Rohde & Schwarz correspondiente (ver lista de recambios).
8. Las baterías y celdas deben reciclarse y no deben tirarse a la basura doméstica. Las baterías o acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de eliminación y reciclaje.

Transporte

1. El producto puede tener un peso elevado. Por eso es necesario desplazarlo o transportarlo con precaución y, si es necesario, usando un sistema de elevación adecuado (p. ej. una carretilla elevadora), a fin de evitar lesiones en la espalda u otros daños personales.
2. Las asas instaladas en los productos sirven solamente de ayuda para el transporte del producto por personas. Por eso no está permitido utilizar las asas para la sujeción en o sobre medios de transporte como p. ej. grúas, carretillas elevadoras de horquilla, carros etc. Es responsabilidad suya fijar los productos de manera segura a los medios de transporte o elevación. Para evitar daños personales o daños en el producto, siga las instrucciones de seguridad del fabricante del medio de transporte o elevación utilizado.
3. Si se utiliza el producto dentro de un vehículo, recae de manera exclusiva en el conductor la responsabilidad de conducir el vehículo de manera segura y adecuada. El fabricante no asumirá ninguna responsabilidad por accidentes o colisiones. No utilice nunca el producto dentro de un vehículo en movimiento si esto pudiera distraer al conductor. Asegure el producto dentro del vehículo debidamente para evitar, en caso de un accidente, lesiones u otra clase de daños.

Eliminación

1. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (polvos con contenido de metales pesados como p. ej. plomo, berilio o níquel). Por eso el producto solo debe ser desmontado por personal especializado con formación adecuada. Un desmontaje inadecuado puede ocasionar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes a la eliminación de residuos.
2. En caso de que durante el trato del producto se formen sustancias peligrosas o combustibles que deban tratarse como residuos especiales (p. ej. refrigerantes o aceites de motor con intervalos de cambio definidos), deben tenerse en cuenta las indicaciones de seguridad del fabricante de dichas sustancias y las normas regionales de eliminación de residuos. Tenga en cuenta también en caso necesario las indicaciones de seguridad especiales contenidas en la documentación del producto. La eliminación incorrecta de sustancias peligrosas o combustibles puede causar daños a la salud o daños al medio ambiente.

Qualitätszertifikat
Certificate of quality
Certificat de qualité

Certified Quality System
ISO 9001

Certified Environmental System
ISO 14001

Sehr geehrter Kunde,
Sie haben sich für den Kauf eines Rohde&Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Qualitätsmanagementsystems entwickelt, gefertigt und geprüft. Das Rohde&Schwarz-Qualitätsmanagementsystem ist u.a. nach ISO 9001 und ISO 14001 zertifiziert.

Der Umwelt verpflichtet
- Energie-effiziente, RoHS-konforme Produkte
- Kontinuierliche Weiterentwicklung nachhaltiger Umweltkonzepte
- ISO 14001-zertifiziertes Umweltmanagementsystem

Dear Customer,
You have decided to buy a Rohde&Schwarz product. You are thus assured of receiving a product that is manufactured using the most modern methods available. This product was developed, manufactured and tested in compliance with our quality management system standards. The Rohde&Schwarz quality management system is certified according to standards such as ISO 9001 and ISO 14001.

Environmental commitment
- Energy-efficient products
- Continuous improvement in environmental sustainability
- ISO 14001-certified environmental management system

Cher client,
Vous avez choisi d'acheter un produit Rohde&Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests respectent nos normes de gestion qualité. Le système de gestion qualité de Rohde&Schwarz a été homologué, entre autres, conformément aux normes ISO 9001 et ISO 14001.

Engagement écologique
- Produits à efficience énergétique
- Amélioration continue de la durabilité environnementale
- Système de gestion de l'environnement certifié selon ISO 14001

ROHDE&SCHWARZ

1171.0200.11 V 04.01

Customer Support

Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz equipment, contact one of our Customer Support Centers. A team of highly qualified engineers provides telephone support and will work with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz equipment.

Up-to-date information and upgrades

To keep your instrument up-to-date and to be informed about new application notes related to your instrument, please send an e-mail to the Customer Support Center stating your instrument and your wish. We will take care that you will get the right information.

Europe, Africa, Middle East

Phone +49 89 4129 12345
customersupport@rohde-schwarz.com

North America

Phone 1-888-TEST-RSA (1-888-837-8772)
customer.support@rsa.rohde-schwarz.com

Latin America

Phone +1-410-910-7988
customersupport.la@rohde-schwarz.com

Asia/Pacific

Phone +65 65 13 04 88
customersupport.asia@rohde-schwarz.com

ROHDE&SCHWARZ

1171.0200.22-05.00

Contents

1 Installation 1.1

Installation Instructions 1.2

Software Installation or Update 1.2

Creating a new Software Configuration 1.5

Enabling Software Options 1.7

1 Installation

This chapter describes the installation and update of the WCDMA UE software options for the Universal Radio Communication Tester R&S CMU200. The options provide the following functionality:

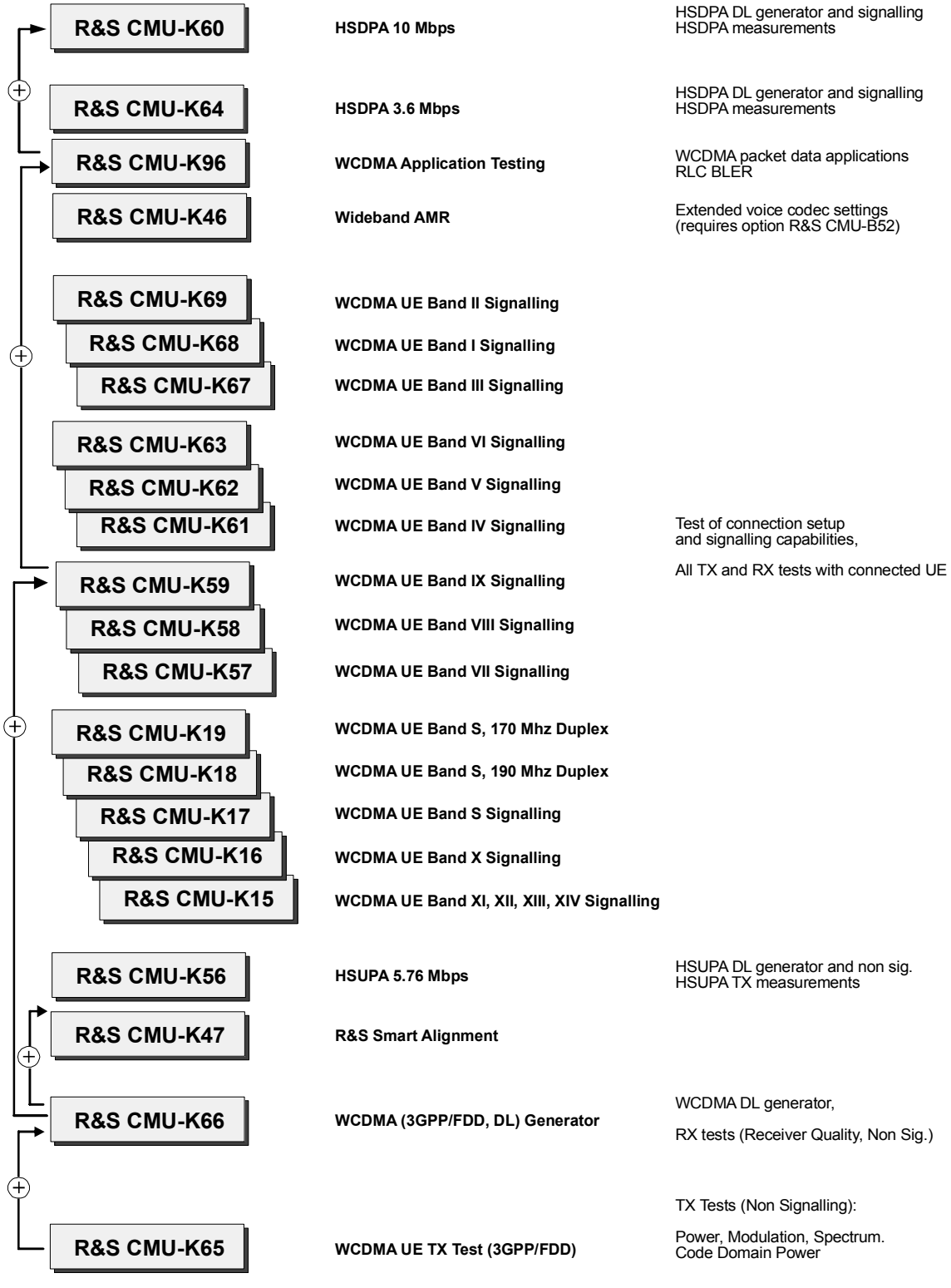


Fig. 1-1 WCDMA UE options

Installation Instructions

Before proceeding to perform any of the steps described in this manual, please make sure that the instrument is properly connected and put into operation according to the instructions given in chapter 1 of the CMU200 manual. The hardware and software options available are shown in the *Startup* menu. The status of the software options for WCDMA UE tests is indicated in the lines *CMU-K61* to *CMU-K69* and *CMU-K96:*

- If a version number is indicated, the CMU is ready to perform GSM mobile tests. In this case you may skip this chapter, except if you wish to update the current software version or activate another version.
- If *disabled* is indicated, the software option must be enabled using a key code; see section *Creating a new Software Configuration* on page 1.5.
- If *not installed* is indicated, the software must be installed via the PCMCIA interface or the floppy disk drive, see below.

All options described in this manual are included in the WCDMA UE software package. There is no need to install these supplementary options separately; however, they must be enabled by means of a separate key code supplied with the option (see section *Enabling Software Options* on p. 1.7).

Software Installation or Update

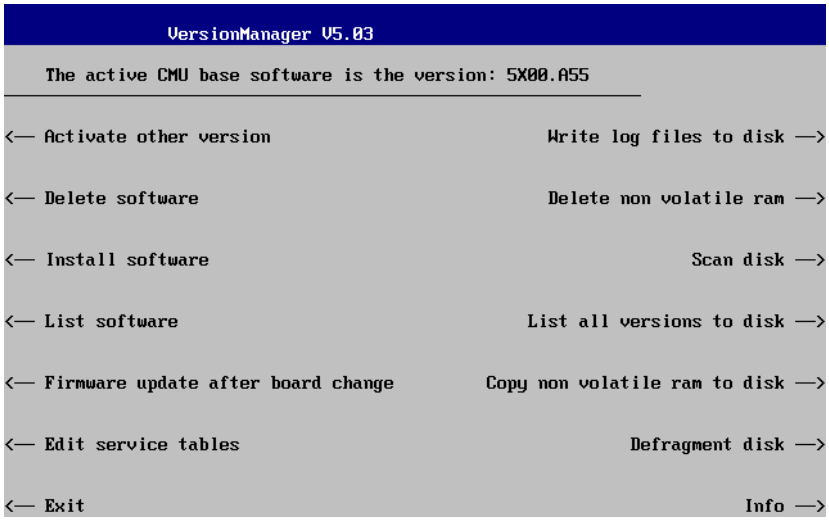
The CMU is always delivered with the latest software version available. New CMU software versions are available for download on the R&S Lotus Notes Service board. To be loaded via the PCMCIA interface, the software must be copied to one or several flash disks/memory cards or PCMCIA hard disks. An appropriate memory card CMU-Z1, order no. 1100.7490.02, can be obtained from Rohde & Schwarz.

Note: *If your CMU is equipped with a floppy disk drive (option CMU-U61), a set of installation floppy disks must be generated instead of a flash disk. All other steps do not depend on the storage medium.*

To install the *WCDMA* options proceed as follows:

- ➢ Switch off the CMU.
- ➢ Insert the flash disk into one of the two slots of the PCMCIA interface.
- ➢ Switch on the CMU.

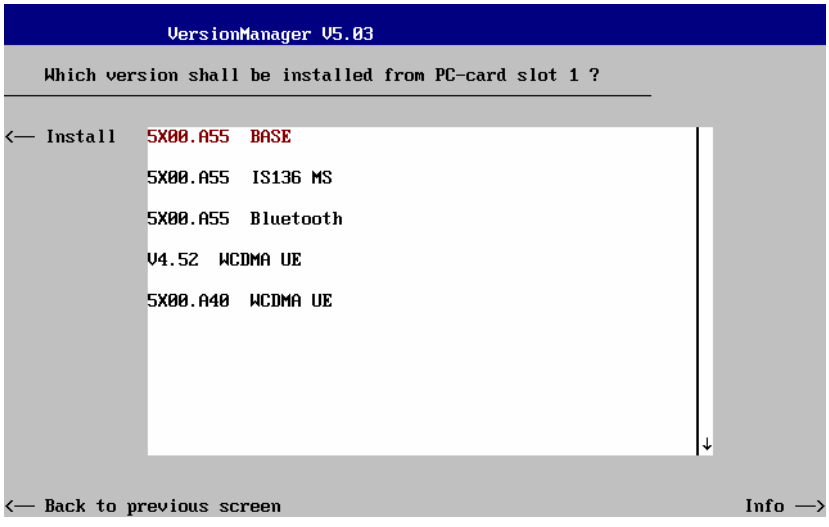
The installation is started automatically while the CMU performs its start-up procedure. To this end the *VersionManager* is called up (for a detailed description of the *VersionManager* refer to chapter 1 of the CMU operating manual or to the on-line help accessible via *Info):*



Softkey no. 5 on the left softkey bar, *Install software...,* is used to install new software from an external storage medium. The CMU automatically recognizes the storage medium and indicates the corresponding slot number: Slot 0 or 1 denotes the left or right slot of the PCMCIA interface. If a floppy disk is used the menu option reads *Install software version <version> from floppy.*

➢ Press left softkey no. 5 *(Install software...)* to start the installation.

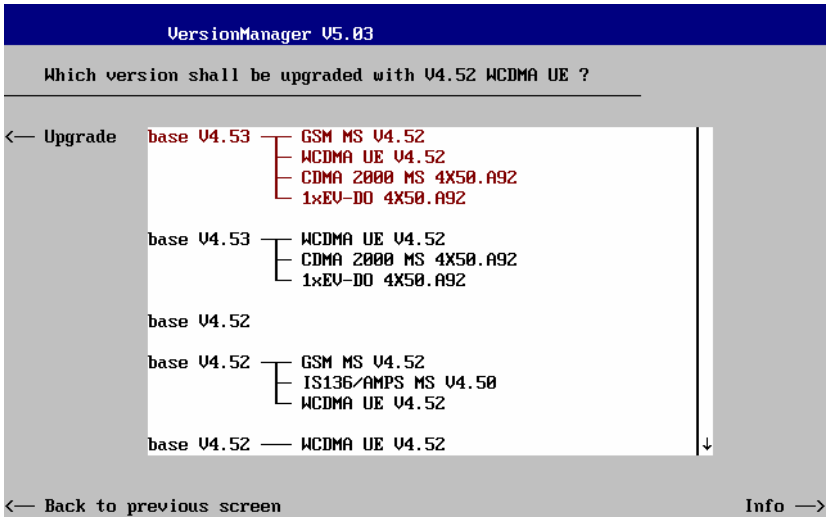
If your storage medium contains several installation versions, the software version selection dialog is opened:



➢ Use the rotary knob or the cursor keys to scroll the list and select the *WCDMA* software version you intend to install.

➢ Press *Install* to start the installation.

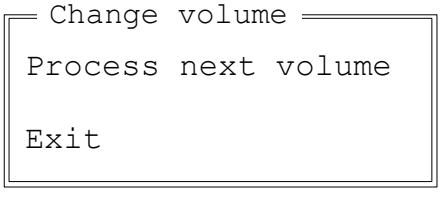
The installation is started. To be operable on your instrument, a network option must be combined with a compatible version of the CMU base software. Any base software version installed on the CMU hard disk can be combined with one or several network options to form an independent software configuration. If none of the configurations is compatible to the new *WCDMA* option, the *VersionManager* displays an error message and takes you back to the software selection dialog; see section *Creating a new Software Configuration* on page 1.5. Otherwise, the following upgrade selection dialog is opened:



The upgrade selection dialog displays a list of base software versions that can be combined with the new *WCDMA* software.

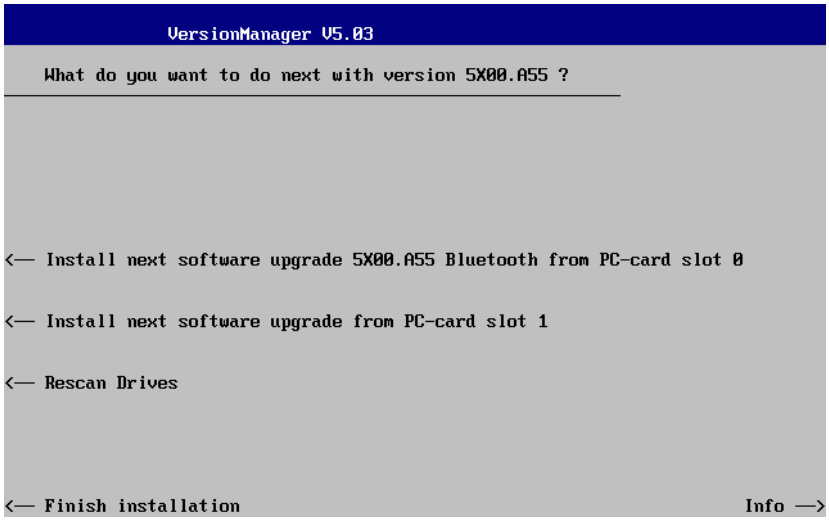
- Select the appropriate base version and press *Upgrade*.

The new *WCDMA* option is added to the configuration or updates the previous *WCDMA* version of the configuration. To indicate that the storage medium must be changed the CMU issues the *Change volume* message:



- Replace the current disk with the disk requested.
- Use the cursor up/down keys to select “Process next volume” (default setting).
- Press *ENTER* to confirm that the new disk has been inserted and to continue the installation.

After processing the last disk the CMU displays the following screen:



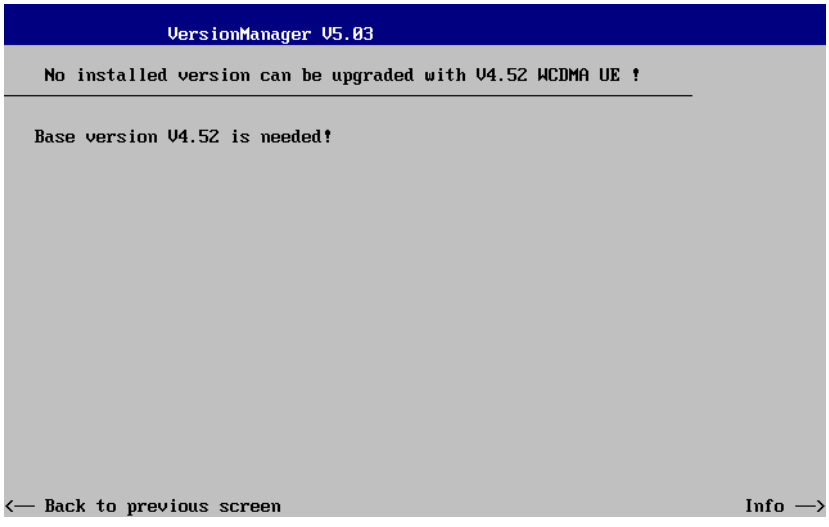
- If you wish to install or upgrade other software versions, press left softkey no 4 or 5 *(Install next software...)* or insert new storage medium into the PCMCIA slot or floppy disk drive and press *Change disks*.
- To finish the installation, remove all disks from the drive and press *Finish installation*.

The *VersionManager* is closed and the CMU is rebooted. The new firmware options are now operational and listed in the *Menu Select* menu together with their version number. Besides, the last software configuration installed is automatically taken as the active one in the next measurement session.

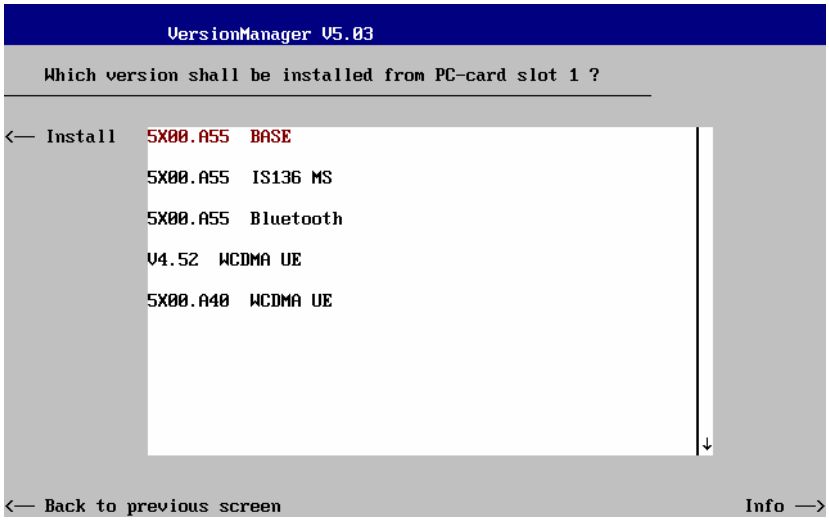
Creating a new Software Configuration

The CMU handles base software versions and network options on a separate basis. Different versions of the base software can be combined with different options to create new firmware configurations. For example, it is possible to update the base software without affecting the associated network options or vice versa. Moreover, the same base software version can be installed several times and combined with different network options (and vice versa), so it may enter into several firmware configurations.

If no compatible base software version can be found on the hard disk, then the CMU will refuse to install a new *WCDMA* software option selected in the software selection dialog (see previous section). Instead, it displays the following error message:



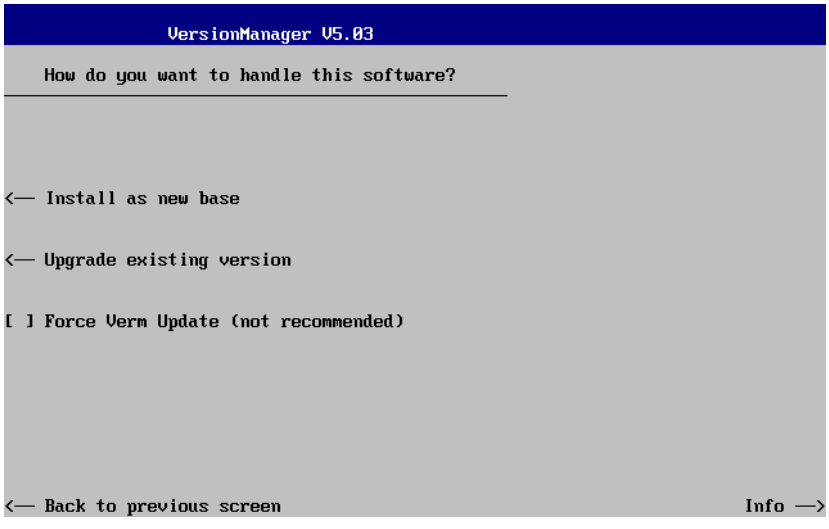
- Press *Back to installation* to return to the software version selection dialog.



➢ Select a base software version that is compatible to your *WCDMA* software option and press *Install*.

Note: *As a rule, firmware versions for the base system and for network options are compatible if they differ only in the last digit. WCDMA UE firmware versions 3.80 to 3.89 (if available) can be run together with base system version 3.80 to 3.89 (if available).*

With a new base software version, it is possible to either update an existing configuration or create a new one. A dialog to select between the two alternatives is opened:

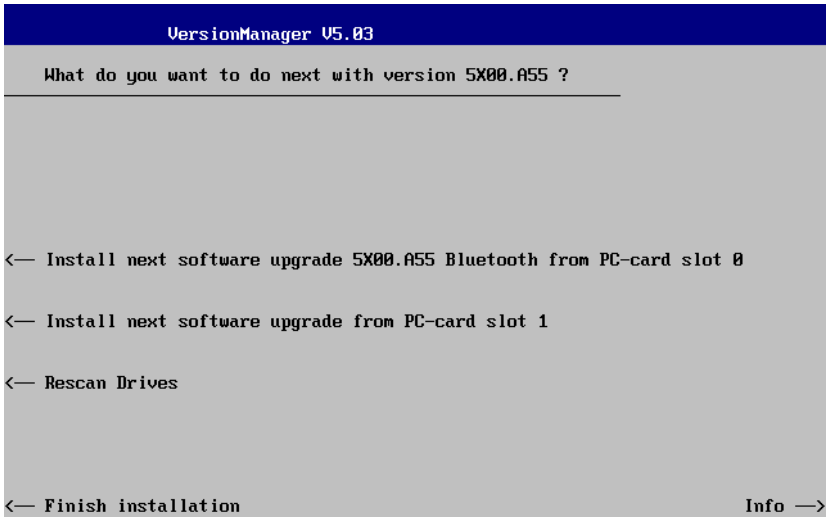


Note: *This dialog is skipped if the new base software version is not compatible with any of the existing configurations. An incompatible new base software must be installed as a new base software.*

➢ If you wish to add a new configuration to your hard disk, press *Install as new base*.

➢ To upgrade an existing configuration with the selected base software version in order to make it compatible to the new *WCDMA* software option, press *Upgrade existing version*. The existing version to be upgraded must be selected in an additional dialog.

The installation is performed as described in section *Software Installation or Update* on p. 1.2 ff. After adding the new base software as a new configuration or updating the existing configuration, the CMU displays the following screen:



➢ Press left softkey no 4 or 5 *(Install next software...)* and proceed as described in section *Software Installation or Update* on p. 1.2 ff. to install the new *WCDMA* version and assign it to the new configuration.

Enabling Software Options

A new CMU software option purchased is ready to operate after it is enabled by means of a key code supplied with the option. This key code is to be entered into the *Option Enable* popup window which in turn can be opened via from the *Setup* – *Options* menu. For details refer to Chapter 4 of the CMU200 operating manual.

Note: *Software installation and enabling of software options are completely independent from each other. All options described in this manual are included in the WCDMA UE software package. There is no need to install these options separately; however, they must be enabled by means of a separate key code supplied with the option.*

Contents

2 Getting Started 2.1

Preparing a WCDMA UE TX Test 2.2

Non Signalling Measurements 2.6

Power Measurements 2.6

Modulation Measurements 2.12

Application Example for P/Slot Table 2.16

CMU and UE Configuration for Receiver Quality Tests 2.17

HSDPA ACK Test (with Option R&S CMU-K64) 2.20

WCDMA Signalling Measurements 2.24

Accelerating the Connection 2.25

ON/Off Time Mask 2.26

Transmit Power Control Tests 2.28

Power Setting in Uplink Compressed Mode 2.29

Video Echo Tests 2.32

Phase Discontinuity Measurement 2.33

PRACH Preamble Quality Measurement 2.33

EVM Test with HS-DPCCH 2.35

EVM & PhD with HS-DPCCH 2.38

CQI Reporting Test under Fading Conditions 2.40

Maximum Output Power with HS-DPCCH and E-DCH 2.42

Parameter Settings in CMU 2.42

Test Procedure 2.48

Measurement Wizard 2.52

HSDPA Max. Throughput 2.53

HSUPA Max. Throughput 2.54

HSPA Max. Throughput 2.55

HSDPA 2.56

2 Getting Started

The following chapter presents a sample WCDMA UE test with the universal radio communication tester CMU200 and the WCDMA UE software options CMU-K65/.../-K69. It is intended to provide a quick overview of the function groups and to lead through the most common tests which are performed on a WCDMA UE.

Before starting any measurement with the CMU, please note the instructions given in Chapter 1 of the operating manual for the CMU basic unit for putting the instrument into operation. In Chapters 2 to 4 of that manual you will also find information on customizing the instrument and the display according to your personal preferences. Installation instructions for the WCDMA UE software options (CMU-K65/.../-K69) can be found in Chapter 1 of the present manual.

The tests reported below include

- Connection of the UE and selection of function group
- *Power* measurements and basic settings in *Non Signalling* mode
- *Modulation* measurements in *Non Signalling* mode
- *Receiver Quality* measurements in *Non Signalling* mode
- Signalling parameters and call setup

The steps to perform are explained on the left side of each double-page together with the results obtained on the CMU screen. On the right side, additional information is given. We also point out alternative settings and related measurements which could not be reported in detail.

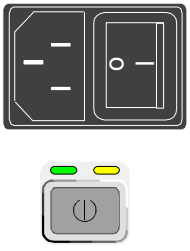
The principles of manual operation are discussed in Chapter 3. For a systematic explanation of all menus, functions and parameters refer to the reference part in Chapter 4.

Note: *The WCDMA DL generator (option CMU-K66, WCDMA (3GPP/FDD, DL) Generator) can be configured in the* Generator *tab of the* Connection Control *menu. The functionality and use of the option is described in Chapter 4, section* Generator Settings.

The Signalling function groups (options CMU-K67/.../-K69) are accessed from the Menu Select *menu. See section WCDMA Signalling on p. 2.24 ff.*

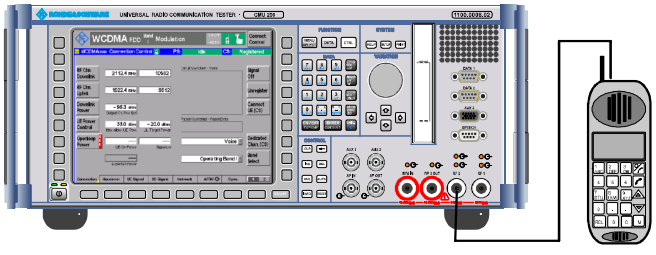
Preparing a WCDMA UE TX Test

This chapter describes how to use the CMU200 for WCDMA UE TX tests. As a prerequisite for starting the session, the instrument must be correctly set up and connected to the AC power supply as described in Chapter 1 of the CMU operating manual. Furthermore, the WCDMA UE software options must be properly installed following the instructions given in Chapter 1 of the present manual. The measurement example described in this and the following sections require option R&S CMU-K65.



Step 1

- Switch on the CMU using the mains switch at the rear. ①
- Check the operating mode of the instrument at the *ON/STANDBY* key on the front panel.②



Step 2

- Connect the bi-directional RF connector RF 2 of the CMU to the antenna connector of the WCDMA UE. ③
- Make sure that the WCDMA UE is supplied with the correct operating voltage (battery or power supply) and switched on. ④

- Switch on the CMU by pressing the *ON/STANDBY* key on the front panel.

Additional Information...

Alternative Settings and Measurements

... on Step 1

① **Mains switch on the rear panel**

When the mains switch at the rear is set to the OFF position, the complete instrument is disconnected from the power supply. When the mains switch is set to the ON position, the instrument is in standby mode or in operation, depending on the position of the power switch on the front panel.

☞ Chapter 1 of CMU manual

② ***ON/STANDBY* key on the front panel**

The *ON/STANDBY* key at the front of the instrument determines whether the instrument is in standby mode or in operation.

Standby mode:
Only the reference frequency oscillator is supplied with operating voltage, and the yellow LED (STANDBY) is illuminated.

O*peration:*
The green LED (ON) is illuminated and all modules of the instrument are supplied with operating voltage.

☞ Chapter 1 of CMU manual

... on Step 2

③ **RF connection of the WCDMA UE**

A high-quality coax cable should be used for this connection, ideally with an attenuation of less than 0.5 dB.

The CMU provides two bi-directional RF connectors RF1 and RF2 differing by their input and output level ranges. RF2 is the recommended standard connector for WCDMA UEs.

The unidirectional connectors RF4 IN and RF3 OUT are intended for connection of modules requiring high input levels or modules with low RF output levels. RF4 IN and RF3 OUT can also be used to connect WCDMA UEs off the air via antennas.

☞ Chapter 4

Input and output connectors can be selected in the *AF/RF* ⊶ tab of the *Connect. Control* menu.

④ **Output signal of the WCDMA UE**

The purpose of function group is to analyze RF signals with 3GPP WCDMA characteristics and to check whether the output signal of an UE transmitter conforms to 3GPP specifications. The analyzed signal may be:

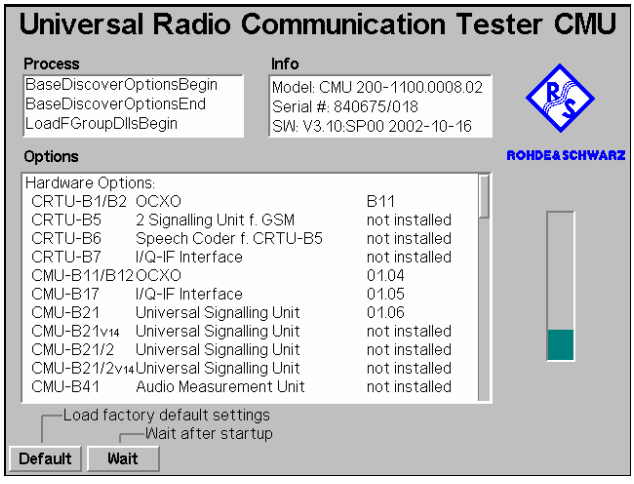
- A single QPSK-modulated signal with a chip rate of 3.84 Mcps
- An uplink WCDMA signal containing one DPCCH plus up to 6 DPDCHs, multiplexed according to 3GPP specifications.

Some measurement menus and parameters can differ according to the configuration of the analyzed signal.

☞ Chapter 4, p.

Some measurement menus and parameters differ according to the configuration of the analyzed signal (QPSK or WCDMA). E.g. the *Modulation* measurement can be accelerated if the analyzed signal is known to be a single QPSK signal.

Note: *A signal containing 7 or more DPDCHs cannot be measured in* Modulation *or* Code Domain Power *measurements. The excess DPDCHs are treated as noise.*

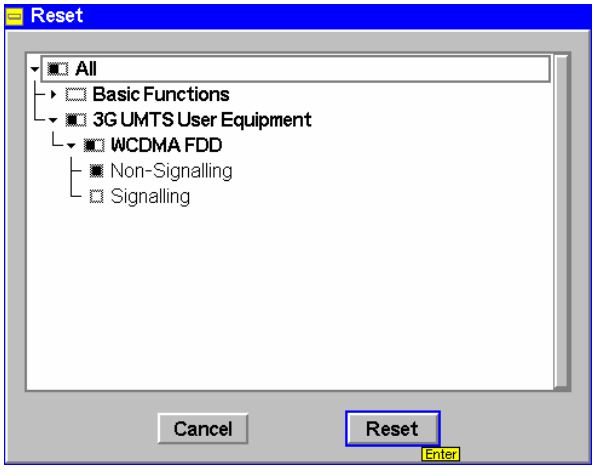


Step 3

The startup menu is displayed while the CMU performs a power-up test. ⑤

After a few seconds the CMU displays the last menu used in the previous session.

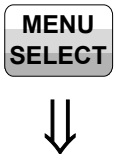
- Press the RESET key to open the Reset popup menu.



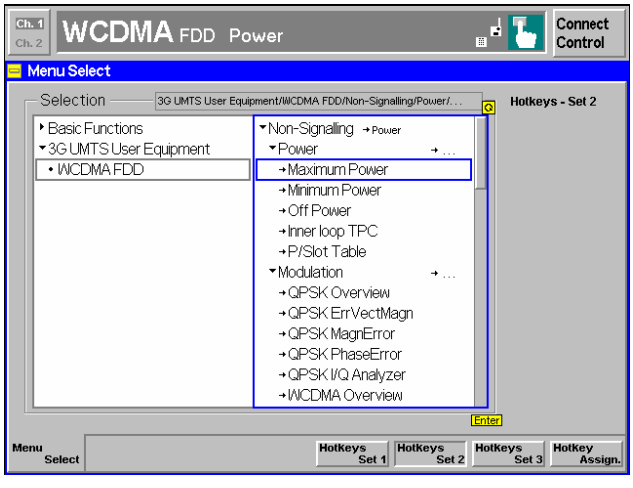
- Proceed as described in Chapter 4 of the CMU200/300 operating manual, section *Reset of Instrument Settings*, to expand the tree of function groups.
- Select the function group *WCDMA FDD Non Signalling* to be reset (the corresponding nodes must be black).
- Use the cursor keys to activate the *Reset* button and press *ENTER*. In the popup box opened *(Are you sure?),* select *Yes* to confirm the reset.

The CMU indicates that it performs a partial reset of the selected function group and is then ready to carry out the following steps. The *Reset* popup menu is closed automatically.

Step 4



- Press the *Menu Select* key to open the *Menu Select* menu.⑥



The *Menu Select* menu indicates the function groups available. If a function group is selected the corresponding modes and measurement menus are indicated.

- Select the *WCDMA FDD* function group.
- Select the *Non Signalling* test mode.
- Select the *Power* measurement menu.
- Press the *Enter* key to activate the measurement selected and open the *Power* menu.

Additional Information...

Alternative Settings and Measurements

... on Step 3

⑤ **Startup menu**

The startup menu displays the following information:

- The status of the startup test *(Process)*
- The device name, serial number and software version *(Info)*
- The options and equipment installed *(Options)*
- The progress of the startup test (*Startup* bar graph)

Before starting a measurement, a reset is recommended to set the instrument with all its functions into a definite state.

☞ Chapter 4 of CMU manual

That chapter also contains information on customizing the CMUe.g. by setting the date and time zone, selecting the printer etc.

... on Step 4

⑥ **Menu Select menu**

The *Menu Select* menu shows all function groups installed and enabled on your CMU. Function groups and menus that are often needed can be assigned to a softkey/hotkey combination in the *Menu Select* menu, so they can be accessed by a single key stroke.

Function group *WCDMA FDD* is subdivided into the two measurement modes *Non Signalling* and *Signalling*, each containing a number of measurement menus. Each measurement group is divided into several applications that are displayed in the right half of the table.

☞ Chapter 4 of CMU manual

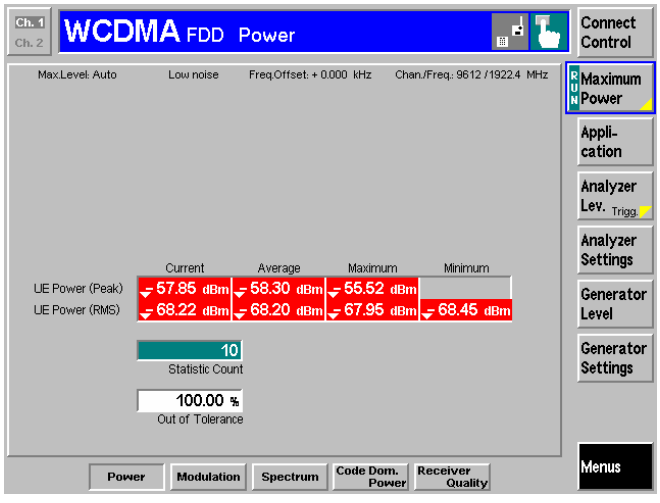
For an overview of the menu structure of the WCDMA UE function groups see Chapter 3 of the present manual.

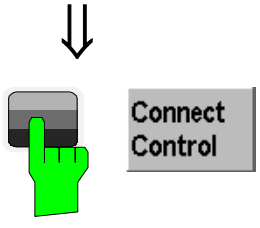
Non Signalling Measurements

In the *Non Signalling* mode, the CMU generates a downlink WCDMA signal (option CMU-K66) and analyzes the uplink WCDMA signal transmitted by the DUT. Compared to *Signalling* mode test times may be reduced considerably. Moreover, the measurements are not restricted to the specified channel and UE output power ranges of the network. The most common application is module test. Besides the measurements in the two test modes are largely analogous.

Power Measurements

As described above, all measurement menus can be called up from the *Menu Select* menu. Once a measurement menu is opened, the hotkeys across the bottom of the menu can be used to switch over to any of the other measurements.





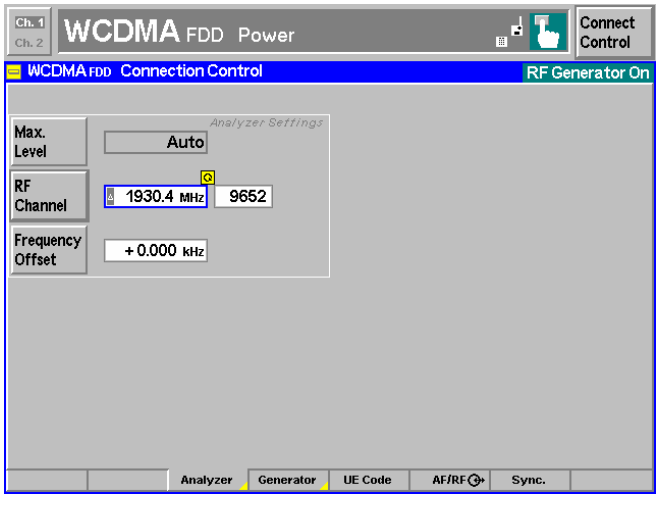
Step 1

The *Power* menu shows the power of the received RF carrier signal. ①

The results are presented in a table containing the peak and RMS-averaged power in the current slot plus a statistical evaluation of these peak and RMS powers. To obtain valid and reasonable measurement results, the RF analyzer of the CMU must be set to be in accordance with the properties of the RF input signal.

Step 2

➢ Press the *Connect Control* softkey on top of the right softkey bar to open the *Connection Control* popup menu.



The *Connection Control* menu configures the RF analyzer and the output connectors of the CMU and defines the properties of the input signal that can be measured. At present, the *Analyzer* tab is active. The other tabs of the *Connection Control* menu are accessible via the hotkeys across the bottom of the menu. ②

The field next to the *Max. Level* softkey shows *Auto* indicating that the input path is automatically adapted to the peak envelope power (PEP) of the applied signal. ③

➢ Press the RF Channel softkey and set the RF channel number equal to the channel number of the input signal. ④

Additional Information...

... on Step 1

① **Power menu**

The *Power* menu shows the peak output power of the UE *(UE Power (Peak)),* i.e. the Peak Envelope Power (PEP) of the WCDMA signal and the output power averaged over the transmit slot *(UE Power (RMS))*. The PEP is usually a few dB higher than the RMS-averaged WCDMA signal power; the level difference is termed crest factor.

Both the *UE Power (Peak)* and the *UE Power (RMS)* can be measured in various operating modes of the UE. In the *Maximum Power* mode, the UE is expected to transmit at its maximum power control level.

For various reasons, an output field may fail to show a valid measurement result (indication "---" or a red output field, if the results exceeds the tolerances):

- The analyzer settings do not match the properties of the input signal.
- The input signal is missing.
- The measurement is switched off *(OFF* is indicated in the softkey controlling the measurement).

... on Step 2

② **Connection Control menu**

The *Connection Control* menu provides general settings that are valid for all WCDMA measurements. Part of the settings can be overwritten in the individual measurement groups.

The left half of the softkey-oriented version of the *Analyzer* tab contains a panel for configuration of the RF analyzer. The *Analyzer* hotkey switches between the softkey-oriented version of the tab and a table-oriented version with extended functionality. A yellow triangle on a hotkey indicates that the hotkey toggles between different menus.

③ **Max. Level**

The *Max. Level* softkey sets the maximum RF input power which can be measured and is used to adjust the RF input path to the expected power of the measured signal. The permissible range *Max. Level* depends on the RF connector and the external attenuation used.

④ **WCDMA Channels**

The assignment between carrier frequencies and channel numbers (UARFCN, UTRA Absolute Radio Frequency Channel Number) is according to 3GPP specifications. The analyzed signal represents an uplink signal (signal transmitted by the WCDMA UE and received by the Node B / base station). However, the CMU is not restricted to the designated uplink band between 1920 MHz and 1980 MHz (Operating Band I).

Alternative Settings and Measurements

☞ Chapter 4.

In addition to *Maximum Power*, three other operating modes of the UE (applications) are provided.

In the *Minimum Power* mode, the UE transmits on its minimum power control level.

In the *Off Power* mode, the UE transmitter is set to the transmit OFF power.

In the *Inner Loop TPC* mode, the UE transmitter is set to change its output power with variable step size.

All modes can be selected by means of the *Application* softkey (see also note on *Applications* on p. 2.13). The UE must be set to comply to the CMU settings.

☞ Chapter 4

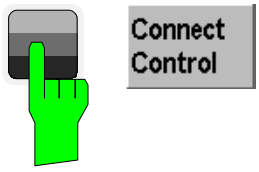
To facilitate and speed up the operation, many CMU settings are accessible from different menus. The RF analyzer settings can be accessed via the *Analyzer Level* and *Analyzer Settings* softkeys in the *Power* measurement menu as well.

☞ Chapter 4

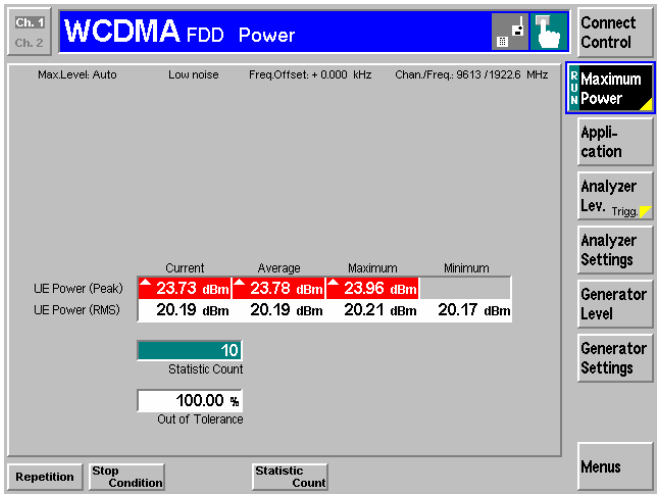
The RF *Max. Level* can also be set in all measurement menus (softkey *Analyzer Level*, hotkey *Max. Level)*.

☞ Chapter 4

The RF frequency can be set in multiples of 200 kHz. With an additional *Frequency Offset*, an RF signal with an arbitrary frequency that is in the range supported by the tester can be analyzed.



➢ Press the *Escape* key or the *Connect Control* softkey again to close the *Connection Control* popup menu and return to the *Power* menu.

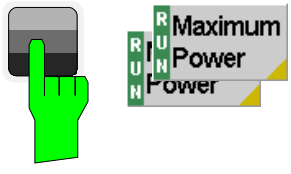


Step 3

The peak and average slot power of the RF carrier signal is now indicated in the output fields associated to the *Power* softkey.

If a result exceeds the error tolerances, the corresponding output field turns red, and an arrow pointing upwards/downwards indicates that the result is above/below the limit. In out example, the average output power of the DUT *(UE Power (RMS))* matches the limit whereas the *UE Power (Peak)* is too high.

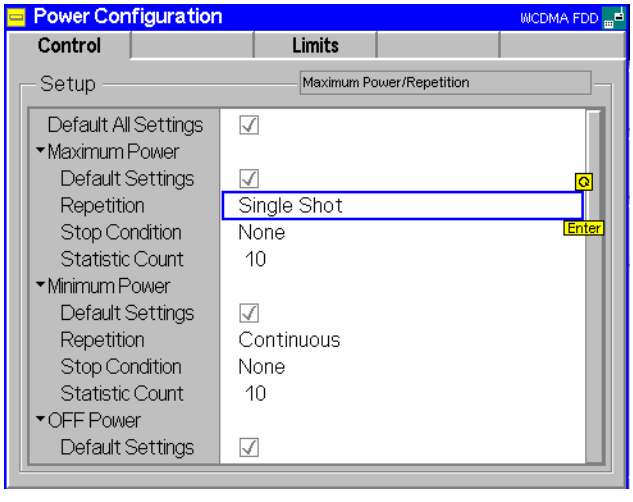
The analyzer settings from the *Connection Control* menu are displayed in a parameter line above the diagram. The *Maximum Power* softkey indicates the measurement state *RUN.* ①



Step 4

➢ Select (press) the *Maximum Power* softkey.

➢ Press the selected *Maximum Power* softkey again to call up the *Power Configuration* menu. ②



The *Control* tab of the *Power Configuration* menu defines the scope of the *Power* measurement. To pick just one example of the settings, we limit the number of slots measured and adjust the tolerance limits to the expected properties of our WCDMA signal.

➢ Press the *ON/OFF* key to expand the menu tables.

➢ Select *Maximum Power – Repetition: Single Shot.*③

Additional Information...

Alternative Settings and Measurements

... on Step 3

① **Measurement State**

The state indication of the different measurements is included in the measurement control softkeys (2nd softkey in the right softkey bar of each measurement menu). For ongoing measurements *(RUN* state), the results in the output fields are constantly updated.

A measurement can be switched on and off after selecting the measurement control softkey by means of the toggle key *ON/OFF*.

☞ CMU manual.

See the sections on measurement control in Chapter 3 and 5.

The options for the measurement state are *RUN* (default) and *OFF*. A third state, *HLT*, occurs after a single-shot measurement is terminated (see p. 2.11).

... on Step 4

② **Power Configuration menu**

The *Power Configuration* menu contains two tabs defining

- The scope of the measurement *(Control)*
- The tolerances of the results *(Limits)*

Analogous configuration popup menus are available for all measurement groups. Settings pertaining to different measurement applications are grouped together in separate sections of the configuration menus.

☞ Chapter 3.

Settings made in the *Power Configuration* menu apply to power measurements only.

Settings made in the *Connect. Control* menus apply to the entire function group.

③ **Repetition mode and stop condition**

The *Repetition* mode determines whether the measurement is

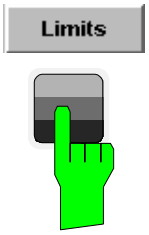
- Continued until it is explicitly stopped by the operator *(Continuous)*
- Stopped after one statistic count *(Single Shot)*

By default, a statistic count comprises 10 basic evaluation periods. In the *Power* measurement, an evaluation period corresponds to 1 WCDMA slot with a duration of 10/15 ms comprising 2560 chips.

☞ Chapter 3.

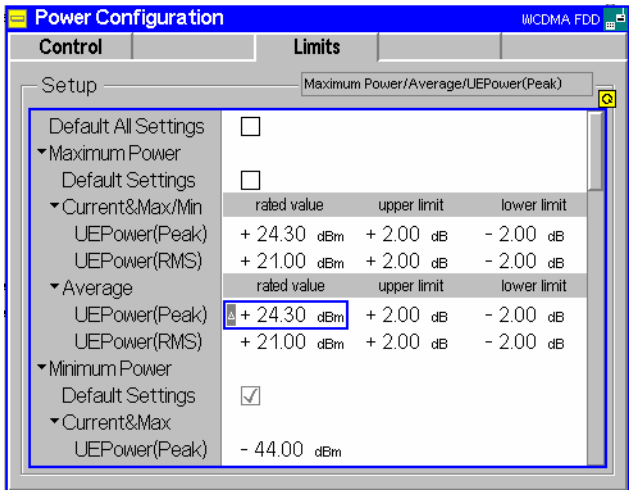
In addition, the running measurement can be stopped after the first slot which is out of tolerance. To this end, *Stop Condition* = *On Limit Failure* must be selected.

This is suitable if the limit check represents the main purpose of the measurement.



Step 5

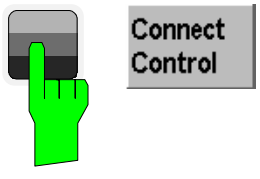
➢ Press the *Limits* key to activate the *Limits* tab of the configuration menu.



The *Limits* tab of the *Power Configuration* menu defines the rated values and the upper and lower limits for the peak and RMS power measured. ①

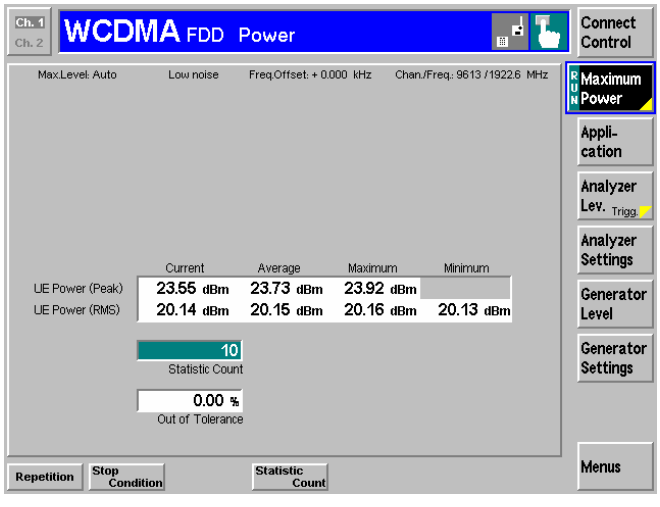
➢ Press the *ON/OFF* key to expand the menu tables.

➢ Adapt the *rated value* of the *UE Power (RMS)* to the power class of your DUT and allow for a crest factor corresponding to the analyzed signal. ②



Step 6

➢ Press the *Escape* key or the *Connect Control* softkey again to close the *Power Configuration* popup menu and return to the *Power* menu.



The *Power* measurement is stopped after one statistics cycle. The status indication next to the *Power* softkey is set to *HLT*. ③

The *UE Power (RMS)* measurement passed the limit check so the output fields are no longer red.

Additional Information...

Alternative Settings and Measurements

... on Step 5

① WCDMA Maximum Output Powers

WCDMA equipment is divided into four power classes. For each power class the 3GPP standard defines the maximum output power of the UE transmitter and its tolerance. E.g. for power class 4 the maximum output power (rated value) is +21 dBm with a tolerance of ±2 dB.

The maximum output power corresponds to the *UE Power (RMS)* measured in the *Maximum Power* application. In the *Limits* tab, the *rated value* and the tolerance *(upper limit, lower limit)* can be set in *UE Power (RMS)* row of the *Maximum Power – Current & Max./Min.* section.

☞ Chapter 4

The *rated value* and the tolerance values *(upper limit, lower limit)* set in *Current & Max./Min.* sections of the *Limits* tab apply to the measurement results in the *Current*, *Maximum* and *Minimum* columns of the output table in the *Power* measurement menu. Different values can be set for the *Average* results (e.g. smaller upper and lower limits corresponding to the smaller variation of the *Average* results).

② Peak and RMS powers

☞ Chapter 4

The superposition of several channels to a composite WCDMA signal enhances the variations of the power in time and leads to a peak to average ratio (crest factor) that is higher than in conventional TDMA systems. The crest factor varies with the signal configuration (i.e. the number of active channels and their channelization codes) and on the data content of the channels. As a consequence, the *UE Power (Peak)* limits must generally be adjusted to the RMS limits and the properties of the analyzed signal.

③ Measurement in the HLT state

☞ CMU200 manual

The state indication of the different measurements is included in the measurement control softkeys (2nd softkey in the right softkey bar of each measurement menu). In the single shot mode (i.e. if the *Repetition* mode is set to *Single Shot)* the measurement is stopped after each statistics cycle and assumes the *HLT* state. The next single shot measurement can be initiated by pressing the toggle key *ON/OFF*.

Note that with remote control, the most common (and default) repetition mode is *Single Shot*, while manual measurements are generally performed in *Continuous* mode.

See the sections on measurement control in Chapter 3 and 5.

Out-of-tolerance power measurements

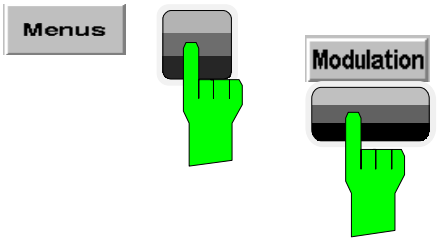
If a power measurement is out of tolerance, please first ensure that the attenuation of any cables and/or antenna couplers used is being taken into account by the CMU. As the power levels must be within a 4 dB range around the rated value, even a small attenuation can result in an out-of-tolerance measurement.

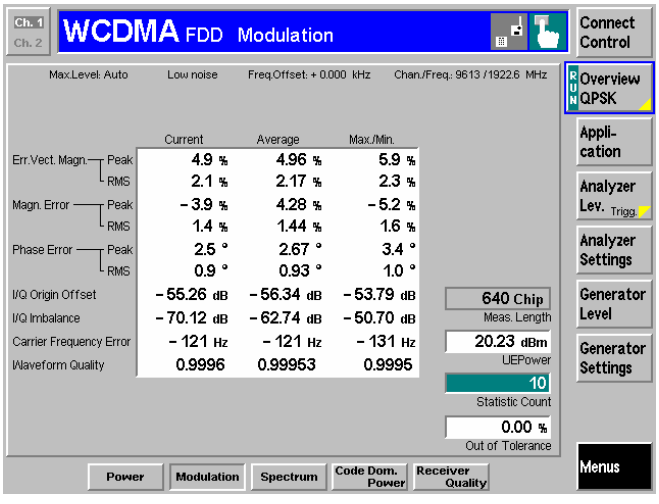
External attenuation values for each input may be entered in the *RF* ⊶ tab of the *Connect. Control* menu.

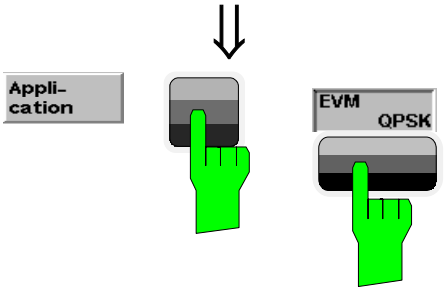
The cables, RF connections and antenna couplers must also be in good condition for satisfactory measurements. Dirty or broken RF connections can cause problems at the high frequencies used by WCDMA networks.

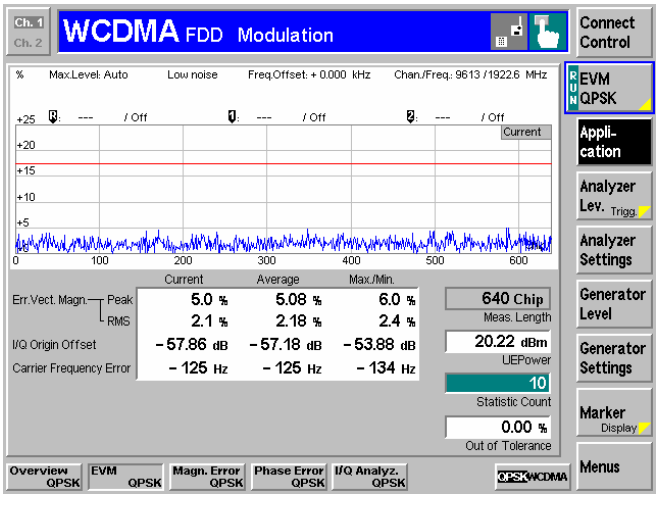
Modulation Measurements

To switch over to the *Modulation* measurement, we use the hotkey bar.









Step 1

- Press the *Menus* softkey to display all measurement groups of the function group.
- Press the *Modulation* hotkey to open the *Modulation* menu.

The *Modulation – Overview QPSK* menu displays the main results of the *Modulation* measurement. ①

If a result exceeds the tolerances, the corresponding output field turns red, and an arrow pointing upwards/downwards indicates that the result is above/below the limit.

In the default setting, the measurement extends over 640 chips, corresponding to the first quarter of a WCDMA slot. The *Meas. Length* is indicated in the menu; it can be changed in the *Modulation Configuration* menu (see p. 2.14). The following diagrams are based on a *Meas. Length* of 640 chips (1/4 slot).

Step 2

- Press the *Application* softkey to display the different applications within the *Modulation* menu.②
- Press the *EVM QPSK* hotkey to switch over to the *EVM (Error Vector Magnitude)* application.

The *Modulation – EVM QPSK* menu displays the Error Vector Magnitude (EVM) of the current slot as a function of time. ③

The output fields below are a subset of the ones shown in the *Overview QPSK* application.

Additional Information...

.... on Step 1

① **Statistical quantities**

The table in the *Overview QPSK* menu reports peak and RMS-averaged values of quantities characterizing the errors of the modulation vector. In addition, the scalar modulation results *Origin Offset, I/Q Imbalance, Carrier Frequency Error* and *Waveform Quality* are indicated. The values in the three columns of the table are calculated as follows:

- The *Current* column contains the results for the current slot.
- The *Average* column contains the currents results referenced to the last statistics cycle.
- The *Max./Min.* column contains the extreme values of the current results for all slots measured.

... on Step 2

② **Applications**

Applications are different measurements belonging to the same measurement group. Each application is assigned its own set of configuration parameters. Therefore, the applications of a measurement group can be configured individually and serviced in parallel.

The *Modulation* menu comprises the eight applications *Overview QPSK/WCDMA*, *Error Vector Magnitude QPSK/WCDMA, Magnitude Error QPSK/WCDMA, Phase Error QPSK/WCDMA.*

③ **Measurement diagram**

The diagrams in the different applications of the *Modulation* menu show a measurement curve representing the EVM, the magnitude error and the phase error of the modulation vector as a function of time. The measurement curve extends over the *Meas. Length* indicated below the diagram. In the *Modulation Configuration* menu, this parameter can be set to 1 slot (chip 0 to chip 2559) or to the first quarter of a slot (chip 0 to chip 639).

The display mode of the curve *(Current)* is indicated in the right upper corner of the diagram; it can also be changed in the configuration menu; see note on *Display Mode* on p. 2.15.

The measurement menu also contains a red, horizontal line representing the limit for the measured quantity.

Alternative Settings and Measurements

☞ Chapter 3.

The averaging prescription for the different results in the table is explained in detail in Chapter 3.

☞ Chapter 4.

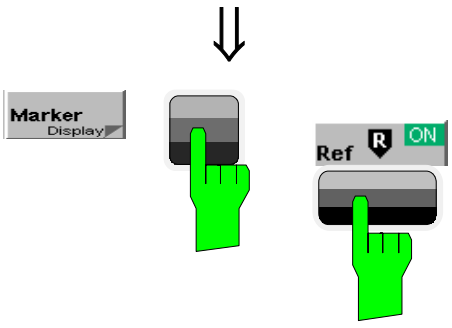
If the *Overview QPSK* measurement fails, make sure that your signal configuration is QPSK-like. A composite signal with a DPCCH plus more than one DPDCH will result in wrong results

☞ Chapter 5 of CMU200 manual

☞ Chapter 4.

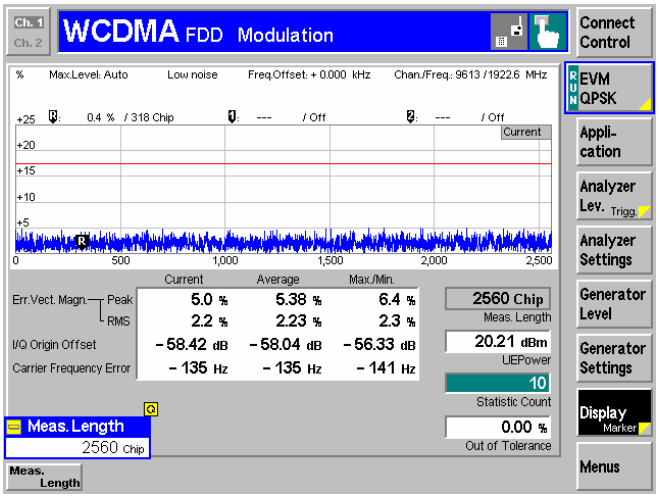
The principle of *Modulation* measurements and the measured quantities are explained at the beginning of section *Modulation Measurements.*

In the *Control* tab of the *Modulation Configuration* menu, it is possible to remove the grid in the measurement diagram.



Step 3

➢ Press the *Marker/Display* softkey and the *Ref. R* hotkey to open an input field for the x-axis value of the reference marker. ① ②

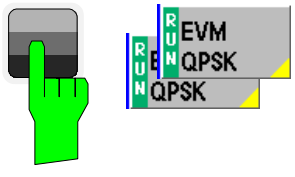


➢ Press the *Marker/Display* softkey again.

The labeling of the *Marker/Display* softkey changes to *Display/Marker*. At the same time, the hotkey bar is changed.

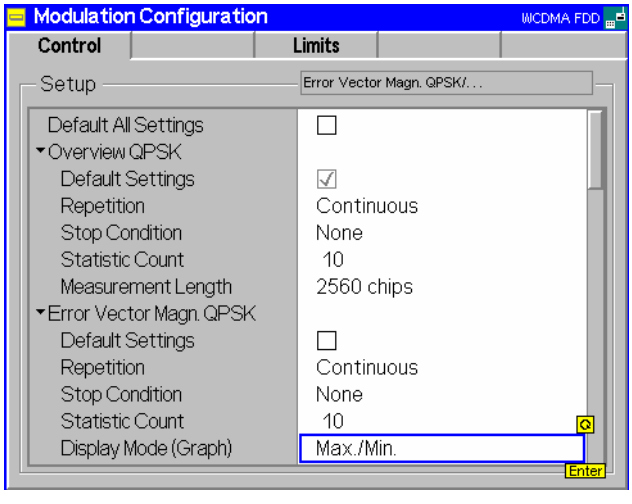
➢ Press the *Meas. Length* hotkey and change the diagram scale to 2560 bits (1 slot).

Step 4



➢ Select (press) the *EVM QPSK* softkey.

➢ Press the selected *EVM QPSK* softkey again to call up the *Modulation Configuration* menu.



The *Control* tab of the *Modulation Configuration* menu defines the scope of the *Modulation* measurement. Most settings are identical with the ones provided in the *Control* tab of the *Power Configuration* menu. The *Display Mode* is a parameter which only affects the measurement curves:

➢ Press the *ON/OFF* key to expand the menu tables.

➢ Select *Max./Min.* in the *Display Mode (Graph)* table line of the *Error Vector Magn. QPSK* section. ③

➢ Press the ESCAPE key to close the *Modulation Configuration* menu and return to the main menu.

With the *Max./Min.* display mode the measurement curve is only changed if the current measurement result exceeds all previous results.

Additional Information...

Alternative Settings and Measurements

... on Step 4

① **Softkeys and hotkeys**

The functionality of each softkey on the right side is extended by hotkeys assigned to the softkeys. These hotkeys are displayed across the hotkey bar below the diagram when the softkey is selected.

Some of the softkey/hotkey combinations offer settings that can be also accessed via configuration menus. For example, the settings offered by the *Analyzer Level* softkey are also provided in the *Analyzer* tab of the *Connection Control* menu. Identical settings overwrite each other; the last value entered is valid for the whole function group.

The names of the softkeys and hotkeys and their function are standardized as much as possible; see the list on the right side.

☞ Chapter 4.

The *Application* softkey switches between the different applications of a measurement.

The *Analyzer Level* softkey controls the level in the input signal path and provides the trigger settings.

The *Analyzer Settings* softkey determines the frequency of the analyzed RF signal.

The *Menus* softkey provides the hotkeys to switch over to other measurement menus.

② **Markers**

Markers are a graphical tool used to locate points on a measurement curve and read out their coordinates. A reference marker and two delta markers may be defined in the *Modulation* menu.

The reference marker R M1 measures the absolute level of the measurement curve, the delta markers 1 and 2 measure the distance between their position and the reference marker.

☞ Chapter 4.

In addition to markers, a D-line can be used to measure a particular value in the diagram.

... on Step 5

③ **Display Mode**

If the measurement extends over several slots the CMU calculates three different measurement curves one of which can be selected in the *Display Mode* panel. The purpose of the four measurement curves is to give an overview of the range and arithmetic mean value of the levels detected at any point on the time axis. In the *EVM QPSK* application the following measurement curves can be displayed:

Current	Result in the current slot
Max./Min.	Maximum or minimum of the results of all slots measured, whichever has the larger absolute value
Average	Average of the results referenced to the last statistics cycle

The *Statistic Count* input field defines how many evaluation periods form a statistics cycle. The evaluation period for Modulation measurements is equal to the measurement length set by means of the *Display/Marker – Meas. Length* hotkey.

☞ Chapter 3.

To refine the statistical evaluation, a suitable combination of the statistic count, repetition mode, stop condition and display mode should be selected.

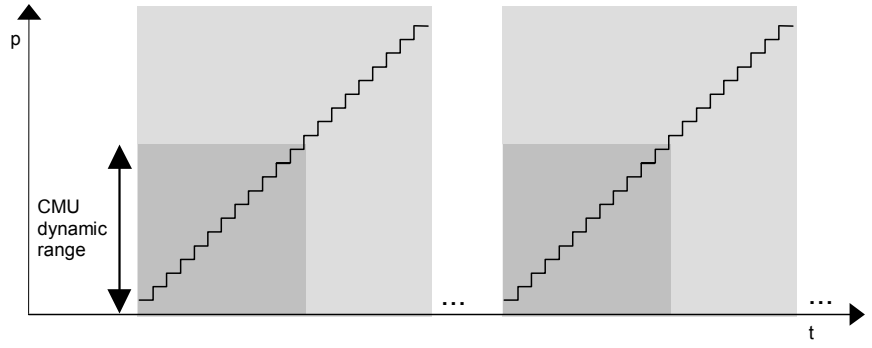
The operating principle of the other TX measurements *(Spectrum, Code Domain Power)* is analogous to the *Power* and *Modulation* measurements. For detailed information on all functions refer to Chapter 4 of this manual.

Application Example for P/Slot Table

P/Slot Table is a real-time measurement that was primarily designed for quick evaluation of power steps of the UE transmitter over a wide dynamic range. The measurement can even be extended beyond the dynamic range of the CMU provided that the UE signal is repeated. The following example also illustrates which steps are required to carry out a general *P/Slot Table* measurement and how the test settings are adapted to a typical power step measurement.

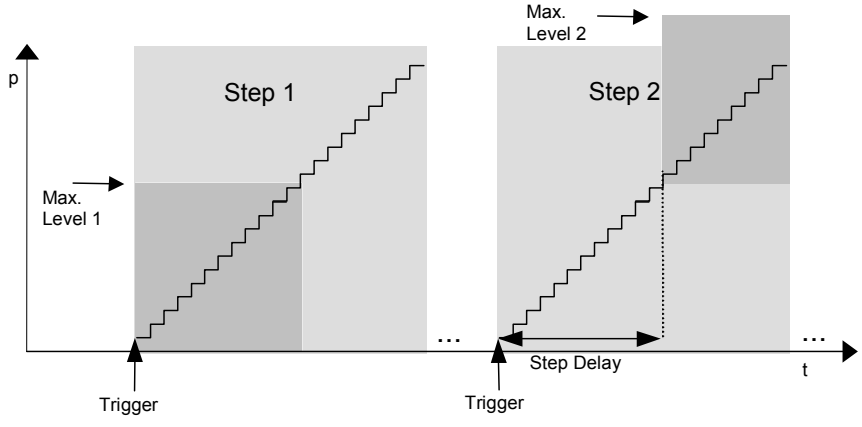
Measurement task

A WCDMA UE periodically transmits a series of regular power steps, i.e. its output power changes after every n^{th} slot by a certain amount. The power ramp exceeds the dynamic range of the CMU. Nevertheless the CMU shall evaluate the entire power ramp as quickly as possible.



Solution

The CMU performs 2 subsequent single shot measurements. The *Max. Level* and the trigger delay parameters are changed between the 1st and the 2nd measurement.



Procedure

General configuration of the UE and the CMU:

1. Switch on the UE transmitter and provide a trigger signal that is synchronized with the beginning of the UE power ramp. Note the conditions for the external trigger signal described in section *Trigger (Connection Control – Trigger)* in chapter 4.
2. Apply the trigger signal at pin no. 8 of the AUX3 connector.
3. In the *Power* menu, press the *Analyzer Level – Trigger Source* softkey to select *External* trigger. If necessary, use the *Slot Delay* and *Delay Offset* parameters in the *Analyzer* tab of the *Connection Control* menu and correct the trigger time to exactly match the beginning of the power ramp.
4. Press *Analyzer Settings – RF Channel* to adapt the analyzer frequency to the frequency of the input signal.
5. Select the *P/Slot Table* application *(Application – P/Slot Table).*

6. Press *P/Slot Table – Step Width* to adapt the step width of the measurement to the step width (n) of the power ramp.

CMU configuration for step 1:

7. Press *Analyzer Level – Max. Level* to set the input level to Max. Level 1 (see figure above).

The CMU measures all power steps up to its *Max. Level.* Beyond the maximum level the output table shows invalid results (the table entries are "–"). The invalid results can be eliminated by reducing the number of measured values *(P/Slot Table – Step Count).* For values that are not measured, the table indicates *Off.*

CMU configuration for step 2:

8. Press *Analyzer Level – Max. Level* to set the input level to Max. Level 2 (see figure above).
9. Set *Analyzer Level – Step Delay* equal to the number of steps measured before.

The measurement is now delayed by the measurement time of step 1. The CMU measures all power steps between Max. Level 1 and Max. Level 2. If necessary the reset of *Max. Level* and *Step Delay* can be repeated several times.

CMU and UE Configuration for Receiver Quality Tests

Performing a *Receiver Quality* test involves 4 steps:

1. The CMU generator (option CMU-K66) provides a WCDMA DL signal to which the UE can synchronize.
2. The UE receives the DL signal and loops back the received data on a specific UL channel.
3. The CMU receives the UL signal from the UE.
4. The CMU calculates the BER test results

The measurement can fail especially if the settings in steps 1 to 3 are incompatible. The following tables describe a sample test session and can serve as a checklist for the configuration of the CMU and the UE in *Non Signalling* mode.

For Receiver Quality measurements the R&S CMU requires an UL slot format 0 as specified in the standard.

Receiver Quality *measurements are largely simplified if performed in* Signalling *mode; see section* Measurements in Signalling Mode *in Chapter 3.*

1. CMU Generator Settings

The DL generator signal is configured in the *Generator* tab of the *Connection Control* menu (see section *Generator Settings (Connection Control – Generator)* in chapter 4.

Signal ON

- Press the *Connect. Control* softkey and the *Generator* hotkey to open the configuration menu for the RF generator. If necessary, press *Generator* again to access the softkey-oriented version of the *Generator* tab.
- Select the *Generator* softkey and press the *ON/OFF* key to switch the RF generator on.

The default generator signal levels are appropriate for *Receiver Quality* tests.

DL channel type

- Press the *Generator* hotkey to open the table-oriented version of the tab. Make sure that the generator provides a 3GPP reference measurement channel: The *Dedicated Channel Mode* must be set to *3GPP Reference.*

The *Receiver Quality* measurement can be performed with any data rate *(Reference Channel Type)* and any pseudo random bit sequence *(Channel Data Source DTCH)* provided:

- Select the 12.2 kbps *Reference Channel Type* and a PRBS9 *Channel Data Source DTCH.*

2. UE Configuration

UE receiver settings

- Make sure that the UE receiver frequency and the expected scrambling codes are compatible with the configuration of the DL generator signal.

By default the generator signal is at a frequency of 2112.4 MHz. The primary and secondary scrambling code numbers are both 0. The settings can be changed in the *Generator* tab of the *Connection Control* menu.

Close test loop

- Close the test loop at the UE.

For all *Receiver Quality* measurements the UE must be set to operate in test loop 2 mode where it effectively loops back the received transport block data and CRC bits.

Channel symmetry

- Configure the UE transmitter to generate a modified 12.2 kbps reference measurement channel with a transport block size of 260 bit, disabled UL CRC and a TFCI of 2 or 3 (indicating a non-empty DTCH).

Depending on the required measurement results (and on the capacity of the UE), it is possible to select either symmetric or asymmetric DL/UL transport block size. In the symmetric case the DL and UL *Reference Channel Type* must be the same. In the asymmetric case the DL and UL *Reference Channel Type* must still match although the UL channel represents a modified reference measurement channel with extended transport block size.

Output power

- Select an appropriate UE transmitter output power.

The UE transmitter output power must be adapted in order to exclude bit errors on the uplink as far as possible. Standard TS 34.121 specifies the uplink TX power for many test cases including BER tests.

Table 2-1 Transport block size and CRC bits for different RMC types

Reference Channel Type	Transport Block Size	Size of CRC
12.2 kbit/s, symmetric UL/DL **12.2 kbit/s, asymmetric UL/DL**	244 bit 260 bit	16 bit 0 bit
64 kbit/s, symmetric UL/DL **64 kbit/s, asymmetric UL/DL**	1280 bit 1296 bit	16 bit 0 bit
144 kbit/s, symmetric UL/DL **144 kbit/s, asymmetric UL/DL**	2880 bit 2896 bit	16 bit 0 bit
384 kbit/s, symmetric UL/DL **384 kbit/s, asymmetric UL/DL**	3840 bit 3856 bit	16 bit 0 bit

3. CMU Analyzer Settings

In order to receive the UL signal correctly, the settings in the *Receiver Quality* menu must match the configuration of the UE:

Scrambling code

➢ Press the *UE Code/Analyzer Settings* softkey to set the UL *Scrambling Code* used by the UE.

RF frequency

➢ Press *UE Code/Analyzer Settings – RF Channel* to set the analyzer frequency equal to the frequency of the UL signal.

Symmetry

➢ Press the *BER* measurement control softkey to select asymmetric UL/DL *Transport Block Size*.

The CMU analyzer is automatically adapted to the actual transport block size (260 bit for the 12.2 kbps reference measurement channel, see Table 2-1 above) as soon as symmetric or asymmetric UL/DL *Transport Block Size* is selected.

DL/UL timing

The CMU expects the looped-back UL signal to be transmitted 1024 chips in offset from the DL signal. A modification of the expected DL/UL timing can be necessary to compensate for a path delay or a deviation of the UE from the nominal timing.

➢ If the CMU issues the warning message *Receiver out of synchronization,* press the *BER – DL/UL Timing* hotkey to adjust the DL/UL timing offset.

4. Start BER measurement

The *Receiver Quality* measurement can be started and stopped using the *BER* measurement control softkey.

➢ Press *BER* and use the *ON/OFF* key to start and stop a continuous measurement. To stop the measurement after one cycle and read the results, use the *CONT/HLT* key.

Results

In the output fields on the left side of the *Receiver Quality* menu the CMU displays the measured BER, DBLER and BLER.

HSDPA ACK Test (with Option R&S CMU-K64)

Performing a *HSDPA ACK* test in *Non Signalling* mode involves the following steps:

1. The R&S CMU generator (option R&S CMU-K66) provides a WCDMA DL signal to which the UE can synchronize. In addition the HSDPA generator (option R&S CMU-K64) provides the specific HSDPA DL channels.
2. The UE receives and decodes the DL signal and answers via an UL channel that is compatible with the DL data rate.
3. The R&S CMU receives the UL signal from the UE.
4. The R&S CMU calculates the test results.

The measurement can fail especially if the settings in steps 1 to 3 are incompatible. The following tables describe a sample test session and can serve as a checklist for the configuration of the CMU and the UE in *Non Signalling* mode.

1. CMU generator settings

The WCDMA and HSDPA DL generator signals are configured in the *Generator* tab of the *Connection Control* menu (see Chapter 8).

Signal ON

1. Press the *Connect. Control* softkey and the *Generator* hotkey to open the configuration menu for the RF generator. If necessary, press *Generator* again to access the softkey-oriented version of the *Generator* tab.
2. Select the *Generator* softkey and press the *ON/OFF* key to switch the RF generator on.

The default generator signal levels are appropriate for *HSDPA ACK* tests.

DL channel type

3. Press the *Generator* hotkey to open the table-oriented version of the tab. Note the *Frequency* and *Primary Scrambling Code* settings for the generator signal, because the UE must be configured accordingly.
4. Make sure that the generator provides a 3GPP reference measurement channel (RMC) or a 3GPP DCCH: The *Dedicated Channel Mode* must be set either to *3GPP Reference* or to *3GPP DCCH.*

The Receiver Quality measurement can be performed with any of the available data rates *(Reference Channel Type / DCCH Channel Type)* and data *(Channel Data Source DTCH / TFCI Bits):*

5. If you decide to use an RMC, proceed with the settings in section 2a. If you choose a 3GPP DCCH, proceed with the settings in section 2b.

2a. UE configuration with RMC

UE receiver settings

1. In the *3GPP DL Reference Channel* section of the *Generator* tab select the 12.2 kbps *Reference Channel Type* (other channel types are also supported; see below).
2. Make sure that the UE receiver frequency and the expected scrambling codes are compatible with the configuration of the DL generator signal.
3. Wait until the UE synchronizes to the R&S CMU cell.

UE transmitter settings

To obtain the *HSDPA ACK* test results, the CMU doesn't have to evaluate any data transmitted on the DL and looped back by the UE (UL DPDCH). The CMU only decodes the UL DPCCH, which is possible if the UL slot format is correct (recommended slot format: 0 as specified in the standard, if a different UL DPCCH slot format is used, the *Slot Format* parameter in the *UE Code* tab of the *Connection Control* menu must be adjusted). This means that any UL RMC can be combined with any possible downlink channel type (RMC, DCCH).

4. Configure the UE transmitter to generate a compatible UL RMC (slot format 0, see above), e.g. a 12.2 kbps UL RMC.
5. Note the *RF Channel Uplink* and *UL Scrambling Code* settings for the UL signal, because the R&S CMU analyzer must be configured accordingly (see below, CMU analyzer settings).
6. Select a sufficient UE transmitter output power in order to exclude transmission errors on the uplink.

For an overview of UL and DL RMCs and their slot formats see Table 2-2 below. A schematic test setup is shown in Fig. 2-1 below.

Table 2-2 Slot formats for DL and UL RMCs

RMC Type	Slot format, DL	Specified slot format, UL
12.2 kbps	11	0
64 kbps	13	0
144 kbps	14	0
384 kbps	15	0

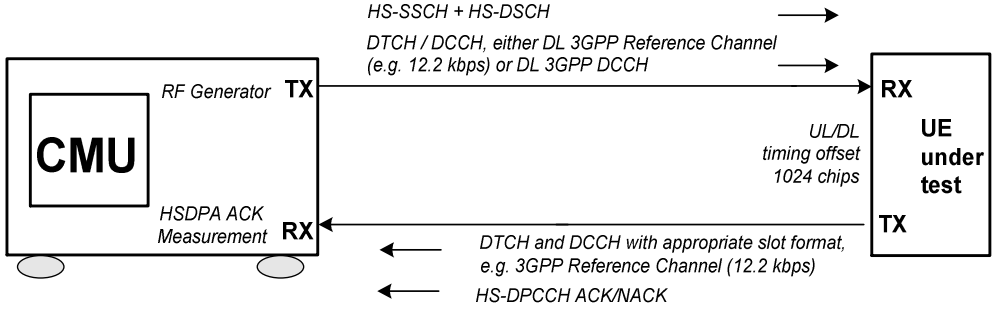


Fig. 2-1 Test setup for HSDPA ACK tests

2b. UE configuration with 3GPP DCCH

UE receiver settings

1. In the *3GPP DL DCCH Channel* section of the *Generator* tab select the 3.4 kbps *DCCH Channel Type* (other channel types are also supported; see table below). Select a *TFCI Value* and note the resulting slot format.
2. Make sure that the UE receiver frequency and the expected scrambling codes and slot format are compatible with the configuration of the DL generator signal.
3. Wait until the UE synchronizes to the R&S CMU cell.

UE transmitter settings

An UL DPCCH that the R&S CMU can demodulate is most easily provided by generating an UL RMC; see section 2a above.

A schematic test setup is shown in Fig. 2-1 above.

Table 2-3 Slot formats for DL 3GPP DCCHs

	SRB 1.7	SRB 2.5	SRB 3.4	SRB 13.6
Slot Format, TFCI = 0, 1	1	7	5	9
Slot Format, TFCI = None	0	6	4	8

3. CMU analyzer settings

In order to receive the UL signal correctly, the analyzer settings must match the configuration of the UE:

Scrambling code

1. Press the *UE Code/Analyzer Settings* softkey to set the UL *Scrambling Code* used by the UE.

RF frequency

2. Press UE Code/Analyzer Settings – RF Channel to set the analyzer frequency equal to the frequency of the UL signal.
3. Press *Menus – Spectrum* and *Application – ACLR Filter* to check the received UL signal.

DL/UL timing

The CMU expects the UL signal to be transmitted 1024 chips in offset from the DL signal. A modification of the expected DL/UL timing can be necessary to compensate for a path delay or a deviation of the UE from the nominal timing. The following steps are required, especially if the R&S CMU displays the warning message *Receiver out of synchronization.*

4. Press the *Menu Select* front panel key and select *Non Signalling – Modulation – WCDMA Overview.*
5. Check the measured *Transmit Time Error.* If it is smaller than approx. 5 chips then skip the next instruction.
6. Press *Menus – Receiver Quality,* select the *HSDPA ACK* application *(Application – HSDPA ACK),* and press *HSDPA ACK – DL/UL Timing.* Add the measured *Transmit Time Error* (with the indicated sign) to the DL/UL timing offset. Skip the next instruction.
7. Press *Menus – Receiver Quality* and *Application – HSDPA ACK* to return to the HSDPA measurement application.

Note: *The UL signal timing must not differ from the expected value by more than 5 chips. Moreover, it must not show a significant drift.*

4. Start HSDPA ACK measurement

The *Receiver Quality* measurement can be started and stopped using the *HSDPA ACK* measurement control softkey.

1. Press *HSDPA ACK – Measure Subframes* and select the number of subframes you wish to measure per measurement cycle.
2. Use the *ON/OFF* or *CONT/HLT* key to start and stop a single shot measurement. The measurement is always halted after the selected number of subframes.

Results In the output fields in the left half of the *Receiver Quality* menu the CMU displays the data throughput and additional statistical quantities that assess the receiver quality.

WCDMA Signalling Measurements

A typical *WCDMA UE Signalling* measurement session (with Option R&S CMU-K67/-K68/-K69) consists of the following stages:

1. Selection of the RF connectors; configuration of the RF input path
2. Connection of the UE to the CMU
3. Setup of a radio connection between the CMU and the UE under test, where the CMU mimics a UTRAN cell.
4. Selection of a measurement menu, start of the measurement and evaluation of the results

Steps 2 and 4 can be carried out in close analogy to *Non Signalling* measurements; for detailed examples see the previous section and the reference description in Chapter 4. The following operating sequence shows you how to set up a measurement in *Signalling* mode.

Preconditions

For the following we assume that options R&S CMU-K65/-K66 and one of the options R&S CMU-K67/-K68/-K69 (corresponding to the Operating Band of your UE) are properly installed on your Universal Radio Communication Tester R&S CMU 200 and that the instrument is correctly set up and connected to the AC power supply as described in Chapter 1 of the CMU200/300 operating manual.

1. To configure the RF path...

1. Switch on the instrument to initiate the startup process and access the *Menu Select* menu (see section *Preparing a WCDMA UE TX Test* on p. 2.2 ff.).
2. Select *WCDMA FDD – Signalling* and your preferred measurement application.

The menu opened depends on the last measurement session.

3. If the *Connection Control* menu is not opened automatically, press the *Connect. Control* softkey on top of the right softkey bar. Press the *RF* hotkey.
4. Ensure that RF 2 is selected as *RF Input* and *RF Output*.
5. Press the 1 / 2 and the *Analyzer* hotkey and check the analyzer level *Mode*.

Note: *The default analyzer level mode is* Auto. *In this mode the CMU automatically adjusts its input path to the received signal level. If needed you can select a* Manual Level *appropriate for your UE, depending on the* Expected PRACH Power *and* UE Target Power *(see* Connection *tab of the* Connection Control *menu).*

6. Press the 1 / 2 and the *Connection* hotkey. Press the *Band Select* softkey and select the Operating Band of your UE. If the title bar of the *Connection* tab does not show *Signal Off,* press the *Signal Off* softkey.

2. To connect your UE...

1. Use a coax cable to connect your UE to the *RF 2* front panel output connector (see section *Preparing a WCDMA UE TX Test* on p. 2.2 ff.).
2. Make sure that the UE is supplied with the correct operating voltage and switched on.

3. To set up a radio connection...

1. In the *Connection (Signal Off)* menu, press the *Signal On* softkey to switch on the WCDMA signal for synchronization.

The CMU enters the *Signal On* state. Your UE is now able to synchronize to the WCDMA signal of the CMU and to initiate a registration/location update procedure. The CMU reaches the *Registered* state.

2. In the *Connection (Registered)* menu, press the *Connect UE* softkey.

The CMU enters the *Alerting* state as the UE starts ringing.

3. Accept the connection at the UE.

The CMU enters the *Connected* state and automatically closes the *Connection Control* menu. In this state a dedicated channel (a Signalling Radio Access Bearer) is allocated between the CMU/UTRAN and the UE and TX measurements can be performed.

4. To start a measurement...

In the *Connected* state a dedicated channel between the CMU/UTRAN and the UE is established and TX measurements can be performed in analogy to the *Non Signalling* mode. Refer to the examples in the previous sections.

Failed Registration?

If registration fails, check the following items:

- The UE capabilities must be in accordance with the *Requested UE Data* settings in the *Network* tab of the *Connection Control* menu, in particular with the authentication and security mode. Registration can fail if authentication or security is disabled but the UE expects/requires an authentication or security procedure. It can also fail if authentication or security is enabled but not supported by the UE.
- The test USIM used must be in accordance with the relevant specifications (3GPP TS 31.101, 3GPP TS 31.102). An appropriate 3GPP UICC/USIM can be obtained from Rohde & Schwarz (R&S CRT-Z3, stock no. 1139.1005.02).

Accelerating the Connection

The CMU provides several parameters to define how a connection is set up and to force the UE under test to a definite operating mode. The following settings will minimize the time required to establish a connection:

Skip Alerting

In the default configuration, the CMU uses a Signalling Radio Access Bearer (SRAB) to set up and maintain a connection. Each call must be accepted at the UE before the CMU can enter the *Connected* state.

The CMU provides an alternative connection scheme where the dedicated channel is a configurable 3GPP Reference Measurement Channel (RMC) and the UE under test is forced into its test mode or into a test loop mode. In this scheme the *Alerting* state is skipped so there is no need to accept the call.

To force the DUT into its test loop mode 2...

1. Proceed as described in the previous section, to configure the RF path and establish a physical connection to the DUT.
2. In the *WCDMA 1900 FDD – Signalling* function group open the *Connection Control* menu. The title bar of the *Connection* tab shows *Signal On.*
3. Press the *Dedicated Channel* softkey and select *RMC.*
4. Open the *BS Signal* tab and select *RMC Settings – Test Mode = Loop Mode 2.*
5. Open the *Network* tab, expand the *Requested UE Data* section, and ensure that the following settings are active: *SRB Reconfiguration: On, Keep RRC Connection: On, Skip RAB Release: On.*
6. In the same *Requested UE Data* section, reduce the ***Activation Time Offset*** (i.e. the delay used by the RRC for the calculation of the activation time in peer messages) to the minimum value supported by your UE.
7. Return to the *Connection (Signal On)* tab and switch on your UE.

After the UE synchronizes to the WCDMA signal of the CMU and initiates a registration/location update procedure, the CMU reaches the *Registered* state.

8. In the *Connection (Registered)* menu, press the *Connect UE* softkey.

The CMU directly enters the *Connected* state and automatically closes the *Connection Control* menu. In this state a Reference Measurement Channel is allocated between the CMU/UTRAN and the UE and the UE is in its test loop mode 2. This configuration is suitable for **RX and TX** measurements.

Minimize requested UE data

In the default configuration, the CMU requests the UE to transfer its UE Radio Access Capability information. This data transfer slows down the registration process.

If there is no need to check the UE data, open the *Network* tab of *the Connection Control* menu and disable the request of UE data *(Requested UE Data – UE Radio Access Capability = Off).*

Avoid multiple registrations

Changing the cell-specific parameters (e.g. the network parameters MCC, MNC...) with registered UE causes a delay because the UE must repeat the registration procedure. To obtain maximum measurement speed, it is recommended to set all cell-specific parameters while the CMU is in the *Signal Off* state.

Avoid Connection Release

By default, the R&S CMU releases the connection when an attempted reconfiguration of a RAB or physical channel (e.g. change of gain factors, HSDPA settings,…) during the connection fails. The parameter *Connection Control – Network – Requested UE Data – Skip RAB Release* can be used to disabled the release of the connection in order to save time for the following measurement steps.

Similarly the parameter *Connection Control – Network – Requested UE Data – N313* can delay a connection release.

Use Fast Packet Data Connections

Measurements in HSDPA test mode do not require a circuit-switched connection. Access to this test mode (signalling state *PS: Established, CS: Registered)* is faster than a combined circuit-switched / packet data connection.

An additional circuit-switched connection can be set up nonetheless *(Connection Control – BS Signal – Circuit Switched – RMC Settings – Reference Channel Type: 12.2 kbps + HSDPA 34.108* or *12.2 kbps (+ HSDPA))*. Use this setting only if you want to measure in compliance with specification 3GPP TS 34.108. Use the *12.2 kbps (+ HSDPA)* reference channel if you want to measure CS channels and HSDPA channels in different stages.

Use Combined Remote Control Commands

The R&S CMU provides a wide range of settings for the generated and analyzed WCDMA channels. In remote control channel configuration is fastest and most efficient using the following combined commands (see chapter 6 and chapter 8):

```
SOURce:RFGenerator:PHYSical:LEVe
CONFigure:BSSignal:PHYSical:LEVel
SOURce:HSDPa:PHYSical:LEVel
SOURce:HSPA:PHYSical:LEVel
CONFigure:BSSignal:HSDPa:PHYSical:LEVel
CONFigure:BSSignal:HSDSch[:COMBined]:CANack
CONFigure:HSDPA[:COMBined]:FRCHannel
CONFigure:HSDPA[:COMBined]:CQIChannel
CONFigure:HSDPA[:COMBined]:UDCHannel
CONFigure:UESignal:COMBined:OCHannel
CONFigure:BSSignal:COMBined:OCHannel
```

ON/Off Time Mask

The *On/Off Time Mask* application is part of the *Power* measurement group. The application is to measure the PRACH preamble power and therefore available in *Signalling* mode only.

Performing a On/Off Time Mask measurement

PRACH preambles are transmitted during registration and connection setup; see description of random access procedure in Chapter 4, section *Network Parameters*. The UE must send at least two consecutive preambles with a known distance so that the CMU can measure the Off power.

To perform a complete *On/Off Time Mask* measurement, proceed as follows:

1. Open the *On/Off Time Mask* menu.
2. To ensure that the UE sends more than a single preamble per preamble cycle, press *On/Off Time Mask – Random Access Settings* and set *Max. Retransmission* to a value larger or equal to 2.
3. Press *On/Off Time Mask – Measured Preamble* to select a measured preamble within the preamble cycle *(Measured Preamble* must be smaller than *Max. Retransmission)*.
4. If necessary, open the *Connection Control* menu and switch the BS signal on *(Connection – Signal On;* the *Signal On* state is indicated by a blinking symbol in the title bar of each measurement menu).
5. Switch on the UE.

A first measurement result is obtained when the UE synchronizes to the BS signal and attempts a registration towards the CMU. The *On/Off Time Mask* measurement is halted *(HLT* state).

6. Switch on the measurement again and set up a connection to the UE in order to obtain a second result.

Advanced Settings

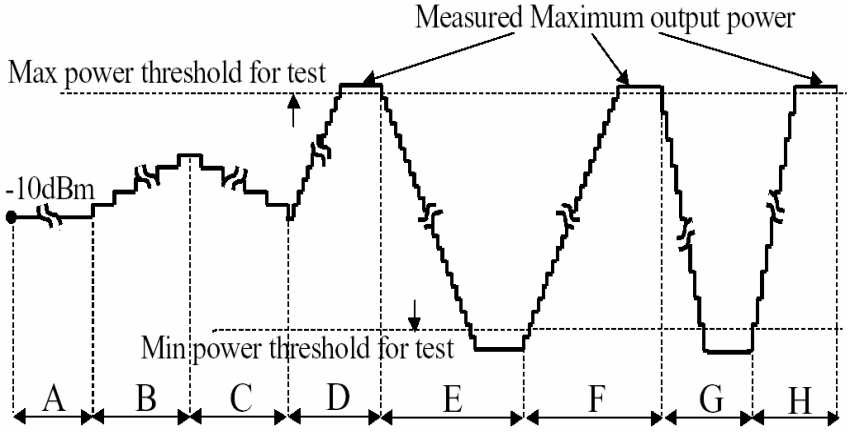
- Use *UE Signal – Openloop Power Ctrl* to define the initial power of the UE at random access (first preamble power, see p. 4.166 of the operating manual).
- Use *On/Off Time Mask – Random Access Set – Step Size* to specify the power step between two consecutive preambles.
- To select a different sequence of frames for the preamble transmission, open the *Network* tab of the *Connection Control* menu and vary the *Available Subchannels* bit sequence in the *Random Access Settings – Preamble* section. The available subchannels must be limited to 1, i.e. the bit sequence must consist of all zeros with a single 1. The 1 may be at any position within the sequence.

Further Hints

- Varying the *Random Access Settings* for the *On/Off Time Mask* measurement may cause a subsequent connection setup to fail (e.g. if the UE must transmit a large numbers of preambles at increasing power without receiving an AICH from the CMU). The default *Random Access Settings* are optimized for a connection setup.
- The CMU must be able to measure the first PRACH preamble in the preamble cycle (as a timing reference), the *Measured Preamble* and the *Next Preamble* using the same analyzer settings. The measurement provides unpredictable results if the power difference between the *Next Preamble* and the first preamble (corresponding to the *Measured Preamble* times the *Step Size)* exceeds the dynamic range. You can easily reduce the power difference by selecting a smaller Measured Preamble or Step Size.
- In autoranging mode *(Analyzer Level – Mode: Auto)* the preambles are measured with a high overdrive reserve, which means that the dynamic range of the measurement is reduced. The accuracy of the *Off Power Before* and *Off Power After* results is not affected. To increase the dynamic range, it is possible to switch autoranging off *(Analyzer Level – Mode: Manual)* and define an appropriate *Max. Level.*

Transmit Power Control Tests

The *BS Signal* tab of the *Connection Control* menu *(Signalling* mode) provides pre-configured test set-ups to account for the requirements of the conformance test specification 3GPP TS 34.121, section 5.4.2. The test setups are labeled A to H and can be activated one after another. They have been designed to induce a power ramp of the following shape:



The actual UE power steps can be evaluated in a *P/Slot Table* measurement. This measurement also includes a limit check for each power step.

The test steps A to H must be measured at different TPC step sizes and TPC algorithms. When a test step is selected, the CMU automatically sets the two parameters according to the test specification:

Test Step	TPC Step Size	TPC Algorithm
A, B, C	1 dB	Algorithm 2
D, E, F	1 dB	Algorithm 1
G, H	2 dB	Algorithm 1

Tip: *To customize the TPC pattern measurement you can change the predefined TPC step size and TPC algorithm for each test step. Press* BS Signal Settings – TPC Pattern Config. *to open the* TPC Pattern Configuration *popup menu, select a* TPC Pattern Setup *and then adjust the* TPC Algorithm *and the* TPC Step Size*.*

To obtain the power ramp according to 3GPP TS 34.121, section 5.4.2, proceed as follows:

Start Conditions

1. Reset the instrument and set up a call to the UE, allocating a 3GPP Reference Measurement Channel *(BS Signal – Circuit Switched – DCH (Dedicated Chn.) Type: RMC)*.

   The TPC algorithm is set to *Algorithm 2,* the step size is 1 dB. A TPC pattern type with *Closed Loop* power control is active, commanding the UE to transmit at a specific *UL Target Power.*

2. To force the initial output power of the UE into the specified range, open the *UE Signal* tab of the *Connection Control* menu and set the *UL Target Power* to –10 dBm*.*
3. Close the *Connection Control* menu and open the *P/Slot Table* measurement.
4. Press *P/Slot Table – Measure Mode* and select the *TPC Test Steps* mode.

TPC Steps

5. Press *BS Signal Settings – TPC Pattern Setup* and select *Test Step A.* Press *Activate Pattern* to initiate the measurement.

The measurement result is displayed in the *Step* table. A *Trigger not Found* message indicates that the instrument waits for the next *Activate Pattern* trigger.

6. Repeat the *P/Slot Table* measurement for *Test Step B* through *Test Step H*.

Note: *When measuring a single test step instead of the whole power ramp, ensure that the measurement starts at the appropriate initial UE power.*

Advanced Settings

➢ Use *Display – Result View: Delta Step* to display the difference of the UE power from one slot to another instead of the absolute power values.

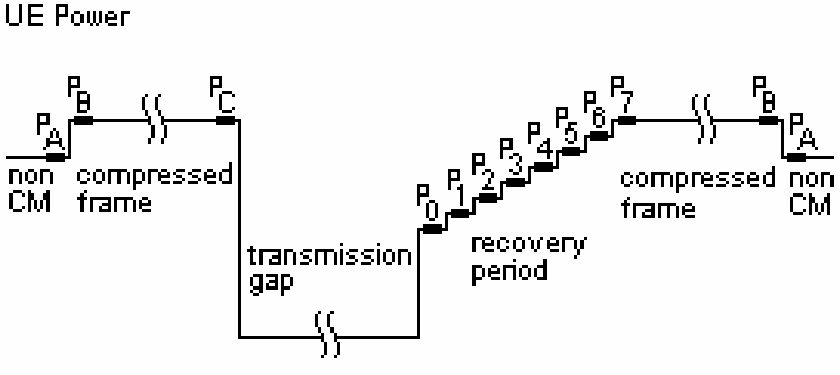
Further Hints

- According to the conformance test specification, the power ramp must be measured using a *Reference Measurement Channel (Dedicated Channel: RMC)*. A voice channel *(Dedicated Channel: Voice)* typically causes a discontinuous UE transmitter output power; therefore it is not recommended for power ramp tests.
- It is recommended to perform P/Slot Table measurements in autoranging mode *(Analyzer Level – Mode: Auto)* and using a Signalling trigger *(Trigger – Trigger Source: Signalling)*. Both settings are used by default.
- A low-loss physical connection between the CMU and the UE under test (low external input attenuation) generally ensures a stable radio link during the entire power ramp measurement.

Note: *A program example for TPC tests is reported in Chapter 7.*

Power Setting in Uplink Compressed Mode

The *BS Signal* tab of the *Connection Control* menu *(Signalling* mode) provides a pre-configured test setup to account for the requirements of the conformance test specification 3GPP TS 34.121, section 5.7. The compressed mode test is handled as a special *Measure Mode: UL CM TX Test* of the *P/Slot Table* measurement application. The R&S CMU commands the UE under test to operate in compressed mode using one of the compressed mode patterns A or B defined in the specification. An appropriate TPC pattern *(A Rising, A Falling*, or *B,* corresponding to tables 5.7.6, 5.7.7, or 5.7.8 in the specification) is then synchronized to the expected compressed frames and transmission gap(s) of the UE. During the test, the UE is commanded to use TPC power control algorithm 1 so that each TPC_cmd results in a UE power step and the appropriate step size. Schematically, the TPC patterns induce a UE power ramp of the following shape:



The actual UE power steps can be evaluated in a *P/Slot Table* measurement. This measurement also includes a limit check for each step.

To perform the compressed mode test according to 3GPP TS 34.121, section 5.7, proceed as follows:

Start Conditions

1. Reset the instrument and set up a call to the UE, allocating a 12,2 kbps 3GPP Reference Measurement Channel *(BS Signal – Circuit Switched – DCH (Dedicated Chn.) Type: RMC)*.

The RMC connection is set up with the specified gain factors β_c = 8 (quantized amplitude ratio 8/15 = 0,5333) and β_d = 15 (quantized amplitude ratio 15/15 = 1,0); see overview in the *UE Signal* tab of the *Connection Control* menu. The TPC algorithm and step size will be adjusted automatically by selecting the *UL CM TX Test* mode and the *Pattern Type;* see below.

Test Mode Settings

2. Select the *Power – P/Slot Table* application and the measurement mode *P/Sot Table – Measure Mode – UL CM Test Step*.
3. Open the *Connection Control – BS Signal* tab.
4. Select *Compressed Mode Settings – Pattern Selection: UL CM TX Test Steps.*
5. Select *Compressed Mode Settings – UL CM TX Test Pattern – Pattern Type: Pattern A (rising TPC).*
6. Select *TPS Settings – TPC Pattern Setup: UL CM TX Test Steps* to adjust the TPC settings including the TPC algorithm 1.

Note that the *TPC Step Size* is set in accordance with the selected *Pattern Type:* For the selected pattern A, the step size is 2 dB. For pattern B, a 1 dB step size is used.

7. Select *TPS Settings – Test Step Preconditions: Auto* and set the *UL Target Power* to –36 dBm.

The last step is recommended because it implicitly selects a *Closed Loop* TPC pattern type with the appropriate target power, causing the UE to transmit at the specified output power before the test is started. Alternatively, you can use e.g. test *Set 1* to achieve the correct UE output power settings.

Trigger and Analyzer Settings

8. Press *Trigger – Trigger Source* and make sure that one of the following trigger sources is active: *Signalling, Compressed Mode,* or *Auto.*

The three triggers are equivalent and denote a compressed mode trigger as long as the *UL CM TX Test* is active.

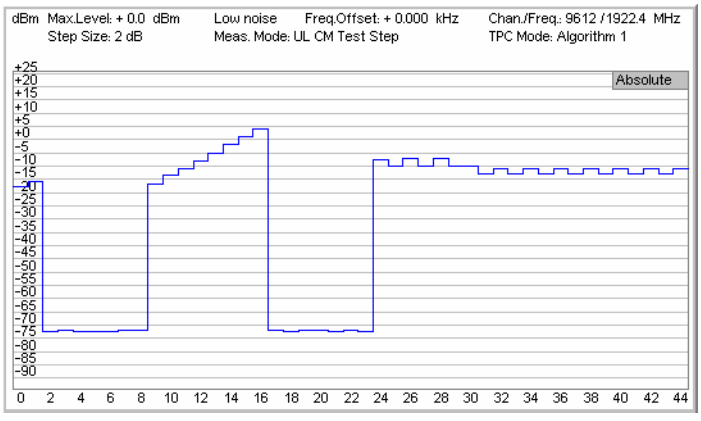
9. Press *Analyzer Lev. – Mode* and make sure that autoranging *(Auto)* is active.

The last step is recommended because the R&S CMU will adjust the input path of the analyzer to the expected power steps (according to the standard) **over the entire range** of measured TPC steps and normally avoid an overflow or underflow.

Measurement and Results

10. Press the *P/Slot Table* measurement control softkey and ON | OFF to start the measurement (—> measurement state *RUN).*
11. Press *P/Slot Table – Display Mode* and select the *Absolute Graph* view.
12. Press *BS Signal Settings – Activate Pattern.* (Alternatively, use *Connection Control – BS Signal – CM Sttings – UL CM TX Test Pattern – Execute).*

The measurement result is displayed in the selected result view. Example of an *"Absolute Graph"* view:



Example of a *Delta Step* table:

Max.Level: + 0.0 dBm
Step Size: 2 dB
Low noise
Freq.Offset: + 0.000 kHz
UL CM Test Step
Chan./Freq.: 9612 /1922.4 MHz
TPC Mode: Algorithm 1

Delta Step

Step								
0 ... 7	---	1.9	GAP	GAP	GAP	GAP	GAP	GAP
8 ... 15	GAP	- 1.0	3.0	2.8	2.8	3.0	3.1	3.0
16 ... 23	2.9	GAP	GAP	GAP	GAP	GAP	GAP	GAP
24 ... 31	- 11.4	- 2.7	2.8	- 2.8	2.8	- 2.8	0.0	- 2.8
32 ... 39	1.8	- 1.8	1.8	- 1.8	1.8	- 1.8	1.8	- 1.8
40 ... 47	1.8	- 1.8	1.8	- 1.8	1.8	OFF	OFF	OFF
48 ... 55	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
56 ... 63	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
64 ... 71	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
72 ... 79	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
80 ... 87	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
88 ... 95	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
96 ... 99	OFF	OFF	OFF	OFF			All Values in **dB**	

13. Repeat the measurement using the other pattern types *(Pattern A (falling TPC)* and *Pattern B).*

Further Hints

- According to the conformance test specification, the power ramp must be measured using a Reference Measurement Channel (Dedicated Channel: RMC). A voice channel (Dedicated Channel: Voice) typically causes a discontinuous UE transmitter output power; therefore it is not recommended for power ramp tests.
- A low-loss physical connection between the CMU and the UE under test (low external input attenuation) generally ensures a stable radio link during the entire power ramp measurement.
- The R&S CMU also performs a limit check for the UE power steps. You can vary the limits using the *Power Configuration – Limits* tab. For more information refer to the reference chapter 4.

Note: *A program example for the* UL CM TX Test *is reported in Chapter 7.*

Video Echo Tests

The R&S CMU can set up a circuit-switched video call and loop back video data including audio to a UE offering video communication. To this end a new *Dedicated Channel (Type): Video Echo* has been introduced in the *Connection* or in the *BS Signal* tab of the *Connection Control* menu. The allocated video channel provides a symmetric 64 kbps bit rate.

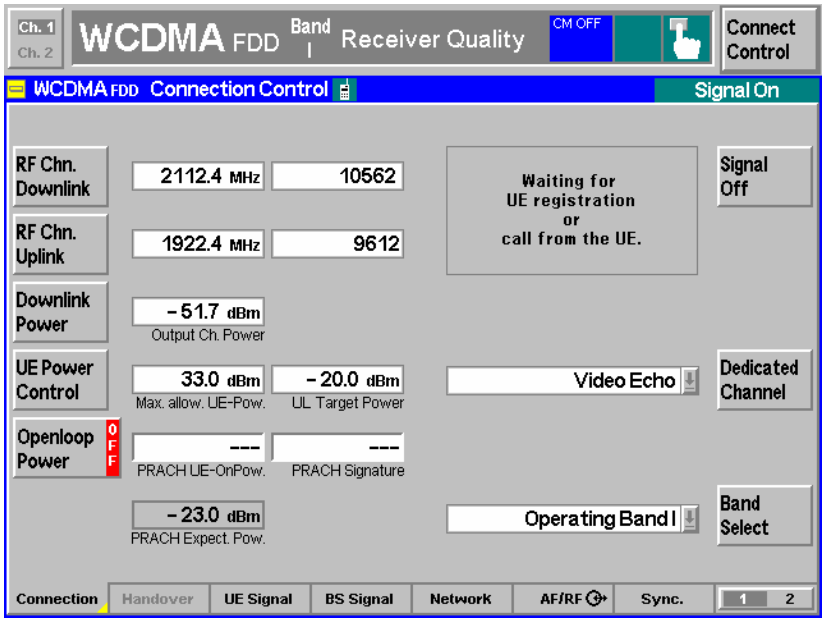


Fig. 2-2 Video echo call selection

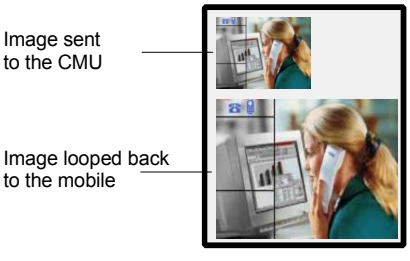
Video tests

Video calls may be set up from the UE or from the R&S CMU.

To set up a video call…

From the R&S CMU:

1. Open the Connection tab of the Connection Control menu and select Dedicated Channel: Video Echo.
2. Connect your UE and wait until the R&S CMU has entered the *Registered* state.
3. Press *Connect UE* and wait until the R&S CMU has entered the *Alerting* state.
4. Accept the incoming video call at your mobile and send your video data to the R&S CMU (automatically or after acknowledgement, depending on the mobile)
5. Observe the sent and the looped back object at your mobile.



From the UE:

1. Connect your UE, wait until the R&S CMU has entered the *Registered* state, and set up a video call from the UE.

The R&S CMU automatically recognizes the incoming video call. There is no need to select *Dedicated Channel: Video Echo* explicitly.

While a video connection is active, the R&S CMU can perform TX measurements on the received (uplink) signal.

Phase Discontinuity Measurement

Phase discontinuity is the change in phase between any two adjacent timeslots. The phase discontinuity is measured in accordance with the definition of the conformance test specification 3GPP TS 34.121:

Performing a Phase Discontinuity Test

Phase Discon(tinuity) is an application of the *Modulation* measurement group in *Signalling* mode. The R&S CMU is preconfigured to perform the entire *UE Phase Discontinuity* test described in the conformance test specification.

Preparations

1. Press *MENU SELECT* and open the *Signalling – Modulation – Phase Discontinuity* application.
2. Reset the *Signalling* function group and set up a connection to your UE.
3. Press *UE Signal – UL Target Power* and set the target power to the maximum output power of your UE. Wait until the UE has reached its maximum power.
4. Press *BS Signal Settings – TPC Pattern Setup* and select: *Test Step PhD Down*.

Measurement

5. Press *BS Signal Settings – Activate Pattern*, observing the measurement results in the graphical measurement menu. Repeat this step until the UE has reached its minimum power.

The autoranging capability of the R&S CMU (default setting, *Connection Control – Analyzer Analyzer Level – Mode: Auto*) ensures that the analyzer level is adjusted over the entire output power range of the UE.

6. Press *BS Signal Settings – TPC Pattern Setup* and select: *Test Step PhD Up*.
7. Press *BS Signal Settings – Activate Pattern*, observing the measurement results in the graphical measurement menu. Repeat this step until the UE has again reached its maximum power.

The Phase Discontinuity measurement can be performed with arbitrary TPC patterns and trigger settings. It is recommended to use one of the following trigger sources: Signalling *(default),* TPC*, or* Auto*. It is also recommended to de-activate autoranging and set an appropriate analyzer manually.*

The fixed parameters for the Test Step PhD Up *and* Test Step PhD Down *pattern setups are displayed in the* BS Signal *tab of the* Connection Control *menu.*

Automatic preconditions

After a preset the preconditions for the *Test Step PhD* and *Test Step PhD Up* are ignored. *Precondition* can be set *(Connection Control – TPC Settings – Test Step Precondition: Auto)* in order to ensure a stable initial power before each test step. This is recommendable especially if a particular test step is repeated several times.

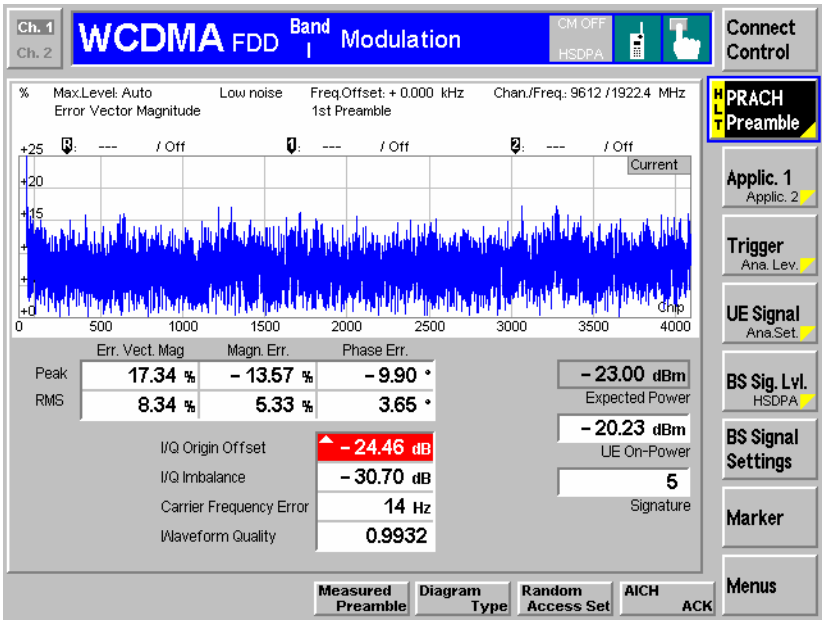
PRACH Preamble Quality Measurement

The PRACH preamble quality is a measure of the ability of the UE to transmit the PRACH preamble in accordance with the core requirements so that the Node B can reliably decode the PRACH. The CMU can measure the PRACH preamble quality in accordance with the initial conditions stated in the conformance test specification 3GPP TS 34.121. The *Modulation – PRACH Preamble* menu shows the modulation parameters for a single PRACH preamble; among these parameters, the *Error Vector Magnitude* (EVM), the *Carrier Frequency Error,* and the *Signature* are relevant for the conformance test.

Performing a PRACH Preamble Quality Test

PRACH Preamble is an application of the *Modulation* measurement group in *Signalling* mode. PRACH preambles are transmitted during registration and connection setup; see description of random access procedure in Chapter 4.

1. Press MENU SELECT and open the Signalling – Modulation – PRACH Preamble Quality application.



2. Reset the *Signalling* function group. Close the *Connection Control* menu, if it is opened automatically.
3. In the *Modulation* menu, press *Trigger/Ana. Level – Trigger Source* and select *Auto* (see section *Extended Trigger Settings* in Chapter 4).
4. Switch the UE on.

The UE synchronizes to the BS signal and can attempt a registration towards the R&S CMU. The openloop power results are available after the R&S CMU has received the first PRACH preamble from the UE. The measurement state is *HLT,* the results are not updated when the CMU receives further RACH preambles.

5. To measure the preamble transmitted when a connection is set up, open the *Connection Control* menu, select the *Connection* tab and press *Connect to UE.*

The *PRACH Preamble* results are updated after the CMU has received the first PRACH preamble from the UE.

6. To repeat the entire measurement, switch off your UE (to make sure that it has to register again) and re-start at step 2.

Configuration of test parameters

Static and random parameters for PRACH quality tests are specified in the conformance test specification. These parameters can be set as shown in Table 2-4 and Table 2-5 below.

Table 2-4 Static test parameters for PRACH quality

Static parameter (3GPP TS 34.121, Table 5.13.4.1)	**R&S CMU Parameter Name**	**Accessible from (Connection Control menu)**
I_{or}	Output Channel Power	BS Signal – Node B Settings
Nominal CPICH_RSCP	P-CPICH	BS Signal – Downlink Phys. Channel
Primary CPICH TX power	Rep. P-CPICH Power	UE Signal – UE Power Control – Open Loop
UL Interference	UL Interference	UE Signal – UE Power Control – Open Loop
Constant Value	Constant Value	UE Signal – UE Power Control – Open Loop
Expected nominal UE TX power	(PRACH) Exp(ected) Power	No setting value; calculated and displayed e.g. in the *Modulation – PRACH Preamble* menu
Preamble Retrans. Max.	Max. Preamble Cycles	Network – Random Access Settings – Preamble

Table 2-5 Random test parameters for PRACH quality

Random parameter (3GPP TS 34.121, Table 5.13.4.2)	**R&S CMU Parameter Name**	**Accessible from (Connection Control menu)**
Available RACH Sub Channels	Available Subchannels	Network – Random Access Settings – Preamble
Available PRACH Signatures	Available Signatures	Network – Random Access Settings – Preamble
AICH Transmission Timing	AICH Transmission Timing	Network – Random Access Settings – Preamble

EVM Test with HS-DPCCH

The following application example describes a half slot EVM measurement for an UL HSDPA signal configuration with a half slot timing offset between the UL DPCH and the HS-DPCCH (see standard 3GPP TS 34.121 V7.2.0, test procedure 5.13.1A.4.2). The measurement is carried out in *Signalling* mode where the R&S CMU has full control over the UL signal of the UE. The *Modulation* measurements in the two half slot periods where the UE is at its maximum and minimum power must be performed in two consecutive steps.

Connection setup

To prepare the test, you must connect you UE to the R&S CMU and set up a packet switched connection in *HSDPA Test Mode.* Proceed as described in Chapter 4, section *Packet Switched Connections*.

General UE signal settings

To obtain results according to the conformance test specification, you have to control the UL WCDMA signal of your UE appropriately:

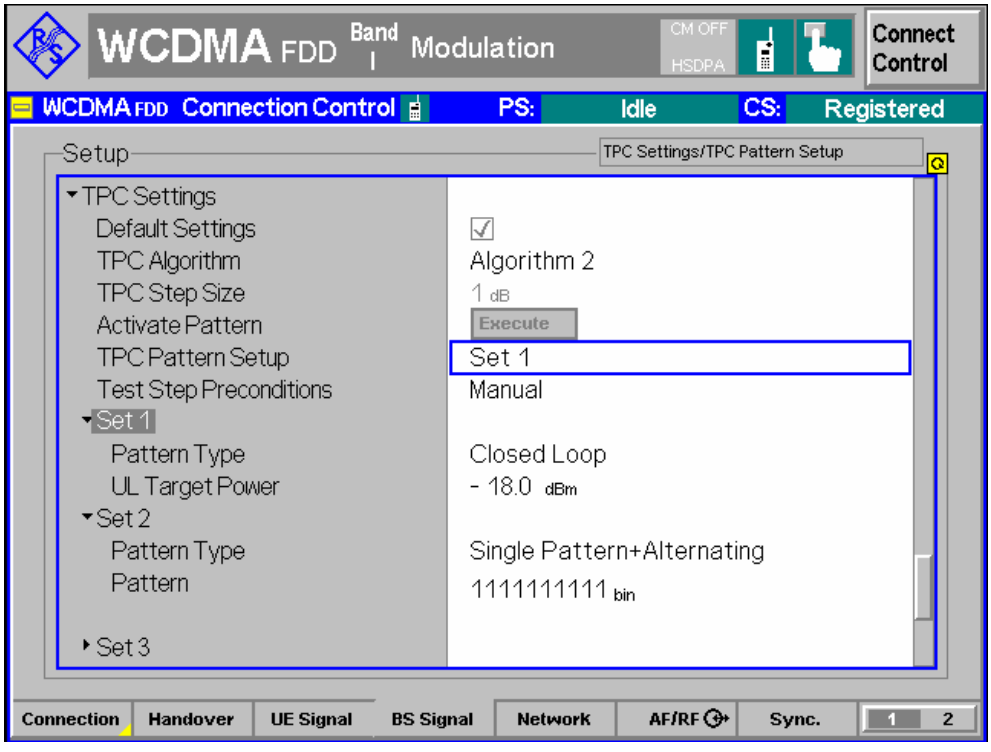
1. To ensure a ½-slot delay between the UL DPCH and the HS-DPCCH, open the *BS Signal* tab of the *Connection Control* menu and select *Downlink Physical Channels – DL DPCH Timing Offset: 6 * 256 chips*.
2. To ensure that the periodicity of the ACK/NACK and CQI slots is in accordance with the spec, expand the *HSDPA HS-DSCH* parameter section and select *CQI Feedback Cycle: 4 ms, CQI Repetition Factor: 1, ACK/NACK Repetition Factor: 1*.

3. Configure an appropriate set of gain factors *(Connection Control – UE Signal – UE Gain Factors)* in order to obtain an UE signal power according to the requirements of the test specification.

UE power control

The EVM test must be performed at maximum UE power and at –18 dBm UE power. Once the UE has reached the specified power, power control algorithm 2 and an alternating TPC command sequence is used to keep the power constant. The UE power can be achieved with predefined TPC settings *(Connection Control – BS Signal – TPC Settings).*

1. To command the UE to its maximum power (and keep it at this constant value), select *TPC Pattern Setup: Set 2,* then press the *Execute* button repeatedly.
2. To command the UE to transmit at –18 dBm, select *TPC Pattern Setup: Set 1* and *Set 1 – UL Target Power: –18 dBm.*



Trigger Settings

The measurement is most conveniently performed with a HSDPA trigger, which is also the *Auto* trigger source for HSDPA tests *(Connection Control – Trigger – Source: HSDPCCH)*. The HS-DPCCH trigger event occurs at the beginning of each UL-DPCH slot during which the R&S CMU expects which the R&S CMU expects an ACK/NACK slot followed by a CQI slot from the UE. The UE signal settings described above generate a signal with a repeat pattern of 12 ms (6 HSDPA subframes). The signal power varies due to the discontinuous HS-DPCCH and the gain factors for the ACK/NACK and CQI slots. A typical section of the 12 ms pattern with ΔACK = ΔNACK > ΔCQI is shown below. The example shows that:

- You can trigger a half slot EVM measurement at minimum power (i.e. where the HS-DPCCH is inactive) using a HS-DPCCH trigger with zero trigger slot delay.
- You can trigger a half slot EVM measurement at maximum power (i.e. during the ACK/NACK slot of the HS-DPCCH) using a HS-DPCCH trigger plus a trigger slot delay of 1 slot.

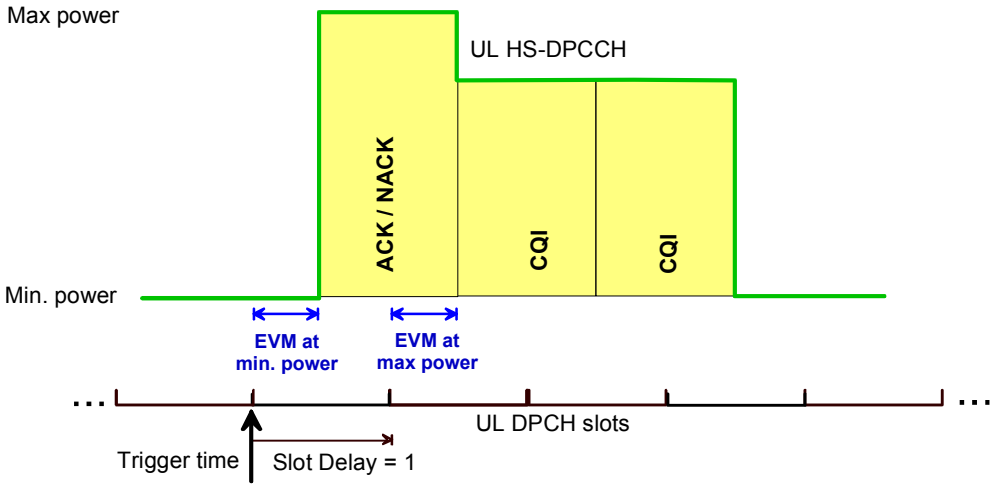


Fig. 2-3 Trigger settings for half slot EVM measurements

The trigger slot settings can be adjusted to different HS-DPCCH configurations in a straightforward way. In particular, the slot delay can be increased to obtain EVM half slot results in the following HSDPA subframes.

Condensed EVM measurement procedure

Once the R&S CMU has reached the *HSDPA Test Mode,* and the UE signal is configured as described below, the EMV half slot test can be performed as follows:

1. Select the *EVM WCDMA* application of the *Modulation* menu, press the measurement control softkey and select *Meas. Length: 1260 chip* (hotkey).
2. Press the *Trigger/Ana. Level* softkey and use the hotkeys to select *Trigger Source: HSDPCCH, Trigger Slot Delay: 0 Slot.*
3. Open the *BS Signal* tab of the *Connection Control* menu and command the UE to its maximum power (see *UE Power Control* above), then close the *Connection Control* menu.

With an UL signal configuration according to Fig. 2-3 above, the measurement menu shows the EVM in the half slot where the UE transmits at its minimum power.

4. Press the *Trigger Slot Delay* hotkey again and select a *1 Slot* delay.

With an UL signal configuration according to Fig. 2-3 above, the measurement menu shows the EVM in the half slot where the UE transmits at its maximum power.

5. Open the *BS Signal* tab of the *Connection Control* menu and command the UE to transmit at –18 dBm power (see *UE Power Control* above), then close the *Connection Control* menu.
6. Repeat the EVM measurement for both slot delays.

EVM & PhD with HS-DPCCH

The following application example describes an EVM and phase discontinuity measurement for an UL HSDPA signal configuration with a half slot timing offset between the UL DPCH and the HS-DPCCH (see standard 3GPP TS 34.121 V7.2.0, test procedure 5.13.1AA). The measurement is carried out in *Signalling* mode where the R&S CMU has full control over the UL signal of the UE and where the HS-DPCCH trigger can synchronize the measurement to the beginning of the specified sequence of 6 HSDPA subframes. The EVM and phase discontinuity results are measured over a time interval of up to 46 slots (92 half slots).

Connection setup

To prepare the test, you must connect you UE to the R&S CMU and set up a packet switched connection in *HSDPA Test Mode.* Proceed as described in Chapter 4, section *Packet Switched Connections*.

General UE signal settings

To obtain results according to the conformance test specification, you have to control the UL WCDMA signal of your UE appropriately:

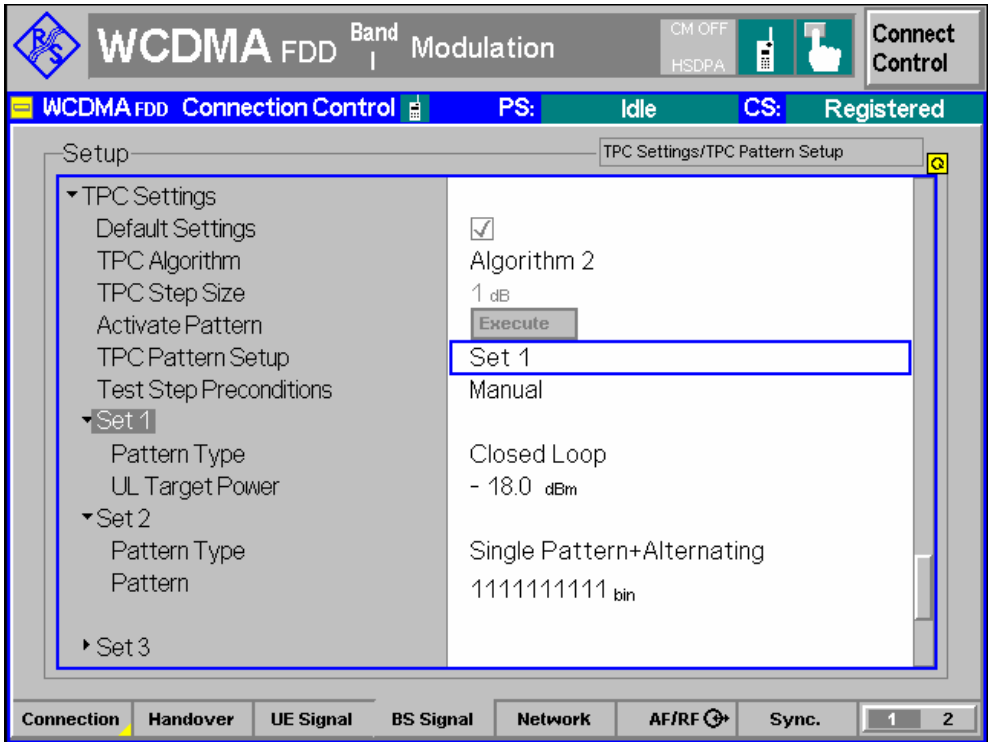
7. To ensure a ½-slot delay between the UL DPCH and the HS-DPCCH, open the *BS Signal* tab of the *Connection Control* menu and select *Downlink Physical Channels – DL DPCH Timing Offset: 6 * 256 chips*.
8. To ensure that the periodicity of the ACK/NACK and CQI slots is in accordance with the spec, expand the *HSDPA HS-DSCH* parameter section and select *CQI Feedback Cycle: 4 ms, CQI Repetition Factor: 1, ACK/NACK Repetition Factor: 1*.
9. Configure an appropriate set of gain factors *(Connection Control – UE Signal – UE Gain Factors)* and use appropriate TPC settings in order to obtain an UE signal power according to the requirements of the test specification.

These UE signal settings generate a signal with a repeat pattern of 12 ms (6 HSDPA subframes). The signal power varies due to the discontinuous HS-DPCCH and the gain factors for the ACK/NACK and CQI slots.

UE power control

The EVM test must be performed at maximum UE power and at –18 dBm UE power. Once the UE has reached the specified power, power control algorithm 2 and an alternating TPC command sequence is used to keep the power constant. The UE power can be achieved with predefined TPC settings *(Connection Control – BS Signal – TPC Settings).*

1. To command the UE to its maximum power (and keep it at this constant value), select *TPC Pattern Setup: Set 2,* then press the *Execute* button repeatedly.
2. To command the UE to transmit at –18 dBm, select *TPC Pattern Setup: Set 1* and *Set 1 – UL Target Power: –18 dBm.*



Trigger Settings

The measurement is most conveniently performed with a HS-DPCCH trigger, which is also the *Auto* trigger source for HSDPA tests *(Connection Control – Trigger – Source: HSDPCCH)*. The HS-DPCCH trigger event occurs at the beginning of each UL-DPCH slot during which the R&S CMU expects an ACK/NACK slot followed by a CQI slot from the UE.

Condensed EVM measurement procedure

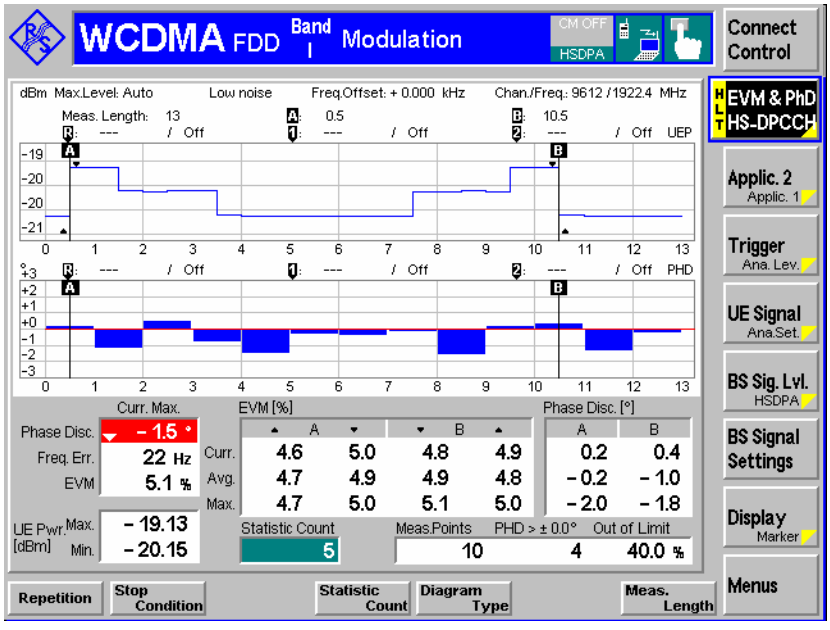
Once the R&S CMU has reached the *HSDPA Test Mode,* and the UE signal is configured as described below, the EMV and phase discontinuity test can be performed as follows:

1. Select the *EVM WCDMA* application of the *Modulation* menu (see description in Chapter 8), press the measurement control softkey and select *Meas. Length: 13, Section A: 0.5, Section B: 10.5* (hotkey).
2. Press the *Trigger/Ana. Level* softkey and use the hotkeys to select *Trigger Source: HSDPCCH, Trigger Slot Delay: 0 Slot.*
3. Open the *BS Signal* tab of the *Connection Control* menu and command the UE to its maximum power (see *UE Power Control* above), then close the *Connection Control* menu.

The diagrams in the measurement menu show the measured UE power in 26 consecutive half slots and the phase discontinuity which is calculated between any adjacent HS-DPCCH slots (13 results). The relevant half slots from the test specification are to the right and to the left of the A and B marker lines; the corresponding EVM and phase discontinuity values are displayed in the *EVM* and *Phase Disc.* tables below the diagrams.

4. Open the *BS Signal* tab of the *Connection Control* menu and command the UE to transmit at –18 dBm power (see *UE Power Control* above), then close the *Connection Control* menu.

All results are now measured at the reduced nominal UE power.



You can also select the EVM or Frequency Error for display in the diagrams; see description of the *EVM & PhD HS-DPCCH* application in Chapter 8.

CQI Reporting Test under Fading Conditions

The following application example outlines the basic steps and preconditions for a CQI reporting test using a fading environment (see standard 3GPP TS 34.121, section 9.3.2). The measurement is carried out in *Signalling* mode where the R&S CMU has full control over the UL signal of the UE.

Connection and test setup

To prepare the test, you must connect you UE to the R&S CMU and set up a packet switched connection in *HSDPA Test Mode.* Proceed as described in Chapter 4, section *Packet Switched Connections*.

In addition you need an external fading simulator to provide a BS signal with fading characteristics. The recommended equipment is an R&S ABFS fading simulator or a R&S SMU signal generator. The R&S CMU baseband signal is routed to the R&S ABFS/SMU and back through the *I/Q-IF Interface* (option R&S CMU-B17), provided that the correct signal routing is set:

➢ Open the *I/Q-IF* tab of the *Connection Control* menu and select *I/-IF Interface – I/Q-IF: Fading.*

For more information about the I/Q-IF interface refer to the R&S CMU200/300 operating manual.

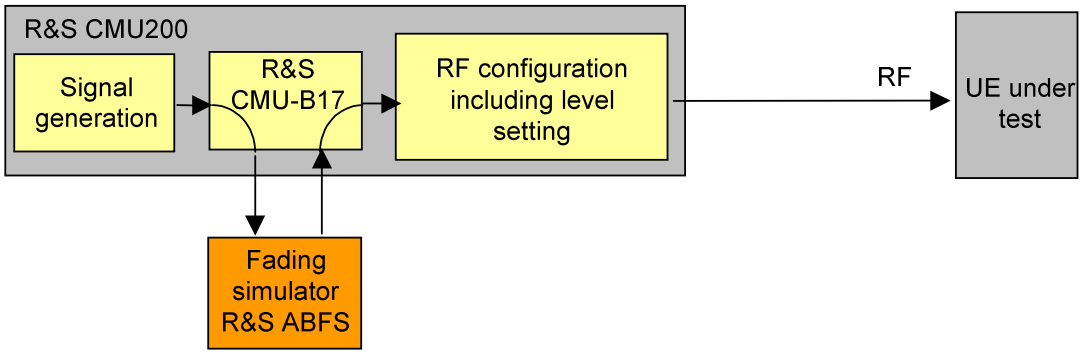


Fig. 2-4 Test setup for fading tests

BS signal settings

The conformance test specification 3GPP TS 34.121 specifies the BS signal properties in detail:

1. Use the downlink physical channel levels from TS 34.121, section E.5, to set up the HSDPA connection and perform the measurement *(Connection Control – BS Signal – Downlink Physical Channels…)*.
2. To ensure that the periodicity of the ACK/NACK and CQI slots is in accordance with the spec, expand the *HSDPA HS-DSCH* parameter section and select *CQI Feedback Cycle: 2 ms, CQI Repetition Factor: 1, ACK/NACK Repetition Factor: 1*.
3. Still in the *HSDPA HS-DSCH* parameter section, select *Channel Configuration Type: CQI.*
4. Expand the *CQI Channel Configuration* subsection and configure the CQI channel as follows: *CQI Table Index: Conformance Test, Start Value: 16, No. of H-ARQ Processes: 2.*

Measurement settings

5. Close the *Connection Control* menu and select the *HSDPA CQI* application of the *Receiver Quality* measurement.
6. Press *HSDPA CQI – Test Case: Fading*.
7. Start a single shot measurement (default repetition mode).

The CQI reporting test is performed automatically in two stages as described in chapter 8 of this manual. All results are displayed in the measurement menu.

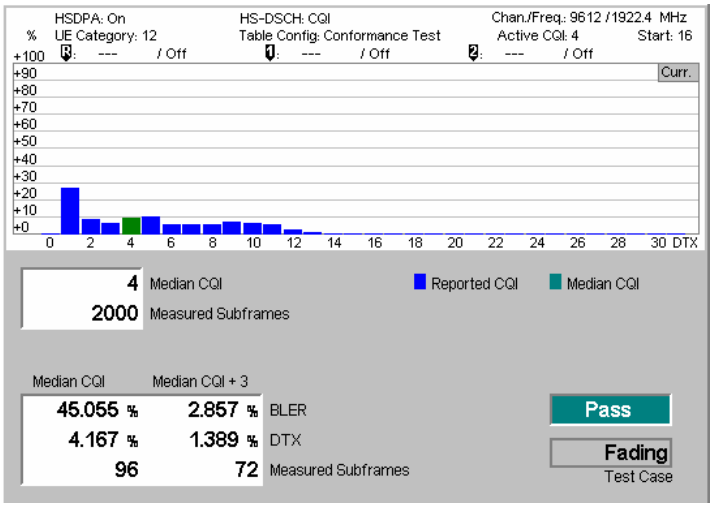


Fig. 2-5 CQI reporting test results under fading conditions

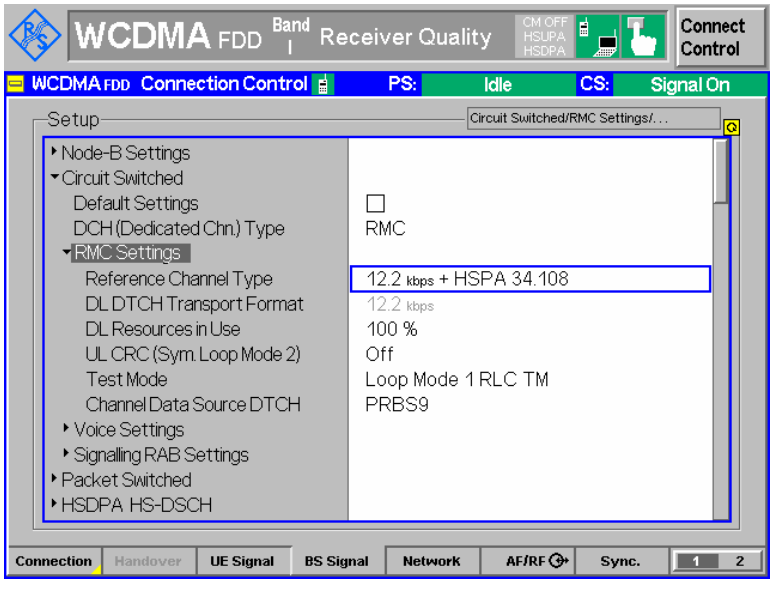
Maximum Output Power with HS-DPCCH and E-DCH

The following sections give an overview of typical test settings and procedures, to be used for the “Maximum Output Power with HS-DPCCH and E-DCH” test described in standard 3GPP TS 34.121, section 5.2B.

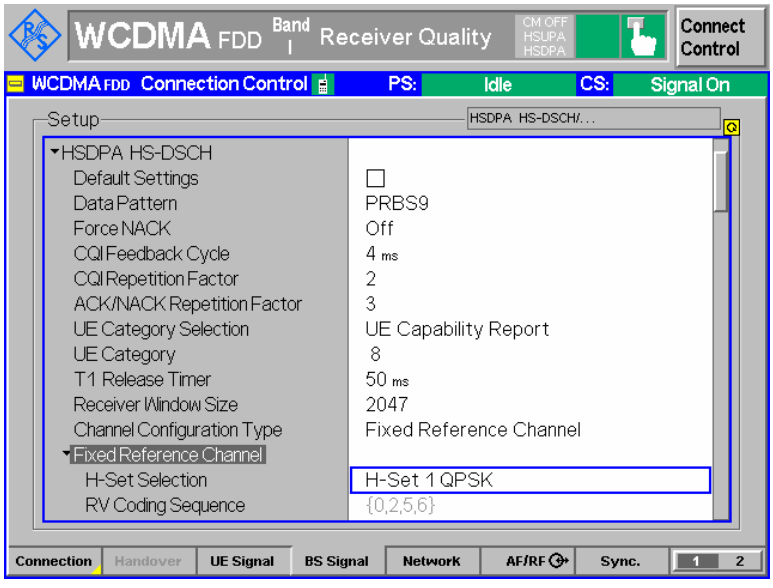
Parameter Settings in CMU

Starting with the default settings (reset the WCDMA signalling function group), set the following parameters.

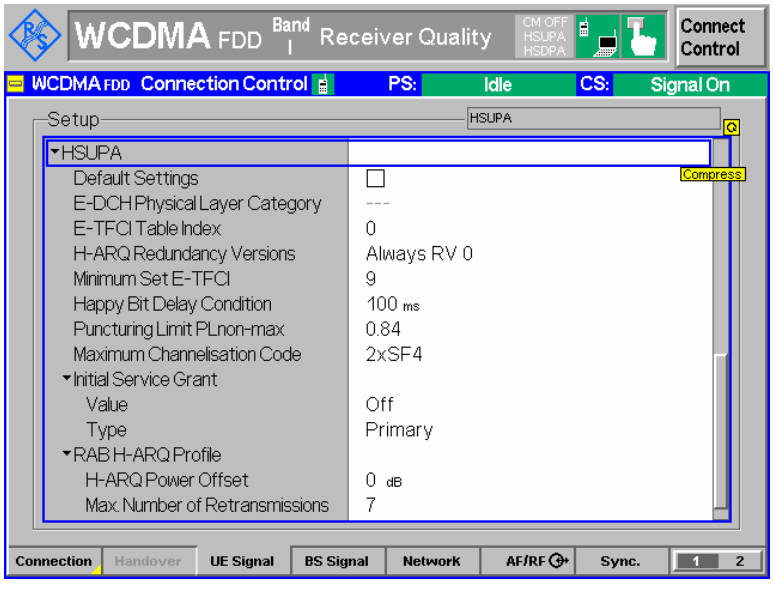
- **Test mode connection**:
  For subtest 1 to 4: RMC 12.2 kbps + HSPA 34.108 with loop mode 1
  For subtest 5: SRB 2.5 kbps + HSPA (β_d = 0) in section *Packet Switched*



- **HS-DSCH settings**:
  Fixed Reference Channel with H-Set 1
  ACK-NACK repetition factor = 3
  CQI feedback cycle = 4ms
  CQI repetition factor = 2



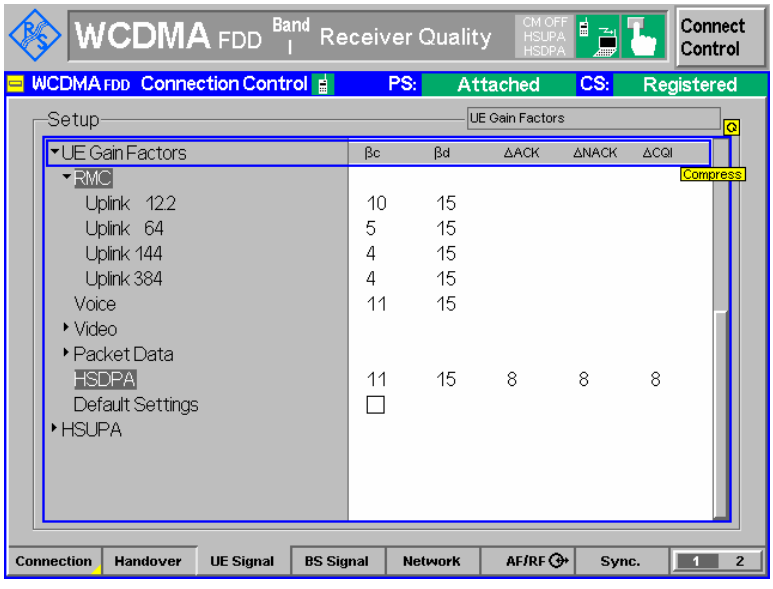
- **HSUPA-specific signalling settings**:
  E-TFCI table index = 0
  E-DCH minimum set E-TFCI = 9 (for subtest 1-4)
  E-DCH minimum set E-TFCI = 67 (for subtest 5)
  PLnon-max = 0.84
  Max. number channelization codes = 2xsf4
  Initial Serving Grant Value = Off



- **Gain Factors**:
  Beta values and Absolute Grant values (derived from TS 34.121 Annex C):

Subtest	βc	βd	ΔACK	ΔNACK	ΔCQI	ΔE-DPCCH
1	10	15	8	8	8	6
2	6	15	8	8	8	8
3	15	9	8	8	8	8
4	2	15	8	8	8	5
5	15	0	0	0	0	0

Screenshot of βc, βd, ΔACK, ΔNACK and ΔCQI for subtest 1:



- **HSUPA Gain Factors**

Subtest	ΔE-DPCCH
1	6
2	8
3	8
4	5
5	0

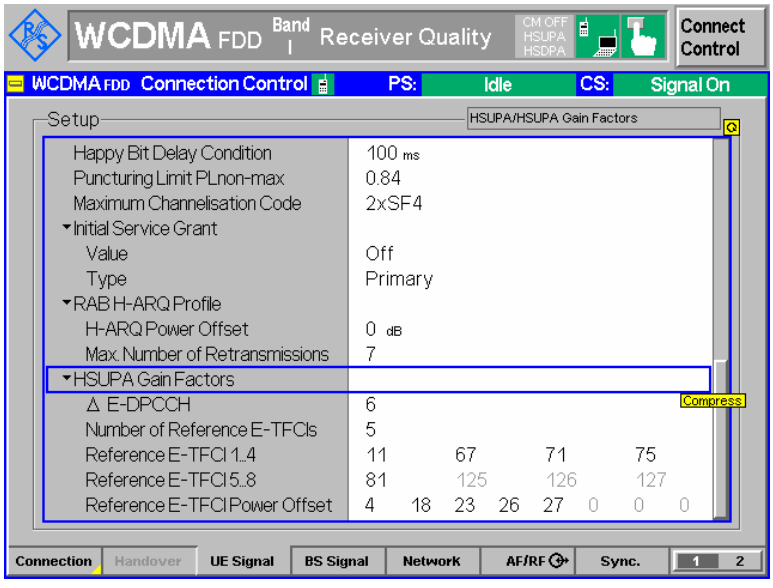
- **HSUPA Reference E-TFCIs**:

Subtest	1, 2, 4				
Number of Ref. E-TFCIs	5				
Reference E-TFCI	11	67	71	75	81
Ref. E-TFCI PO	4	18	23	26	27

Subtest	3	
Number of Ref. E-TFCIs	2	
Reference E-TFCI	11	92
Ref. E-TFCI PO	4	18

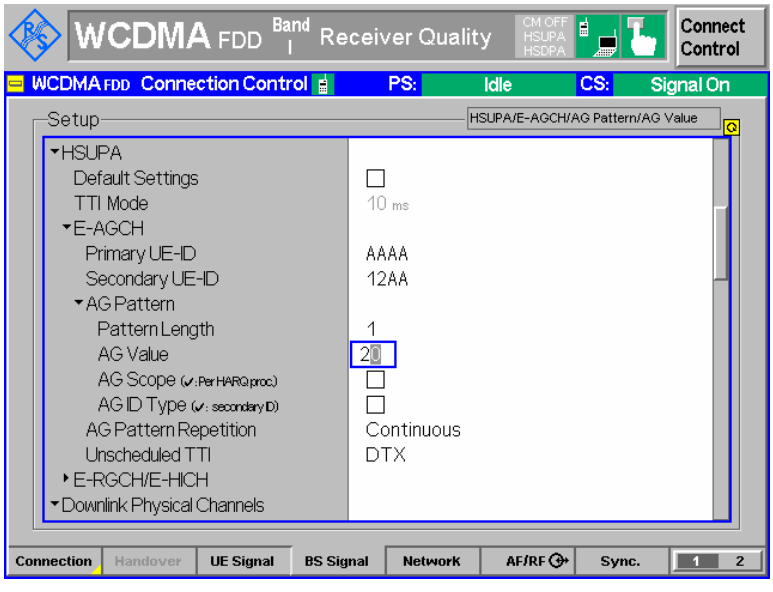
Subtest	5
Number of Ref. E-TFCIs	1
Reference E-TFCI	67
Ref. E-TFCI PO	18

Screenshot for ΔE-DPCCH and Reference E-TFCIs for subtest 1:

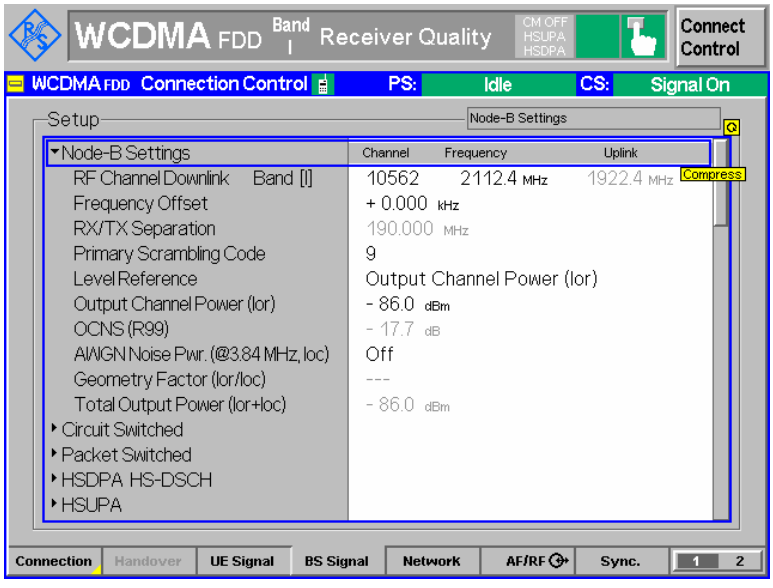


- **HSUPA-specific generator parameters:**

Subtest	AG Value
1	20
2	12
3	15
4	17
5	12

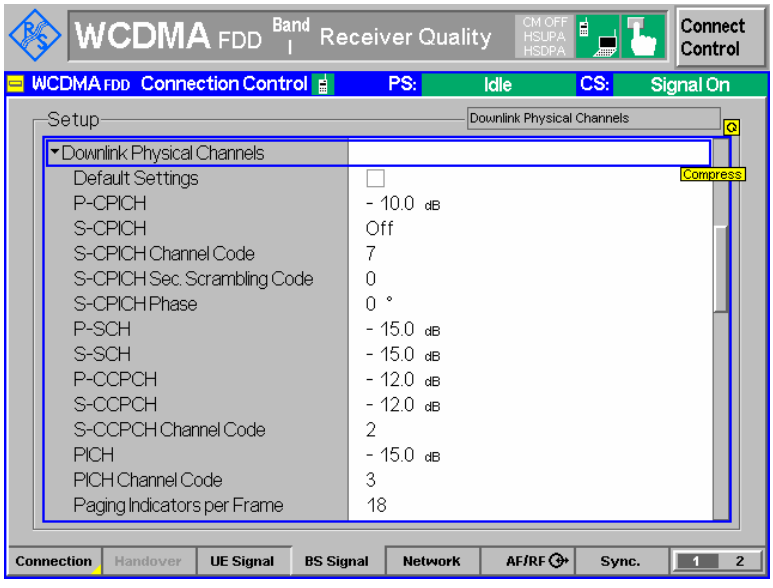


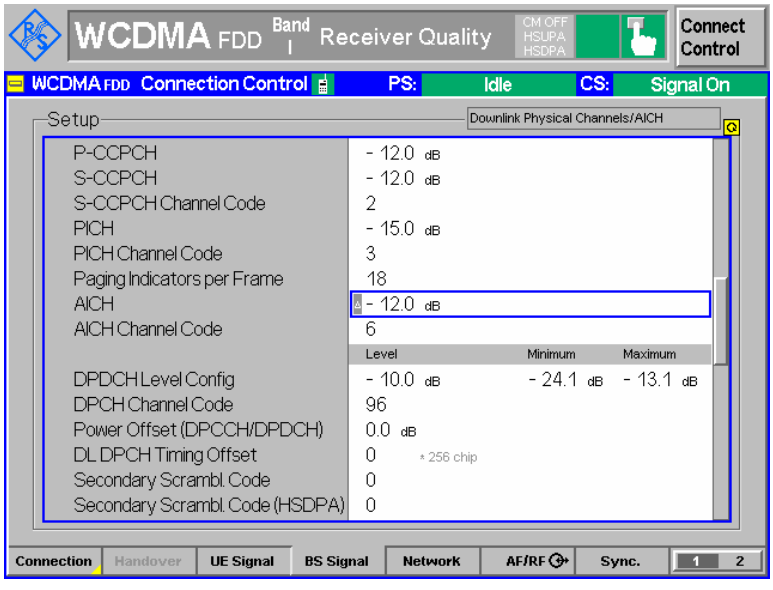
- **Power and Channel Level settings (from TS 34.121 Annex E)**:
  Set Level Reference to Output Channel Power
  Set Output Channel Power to -86 dBm

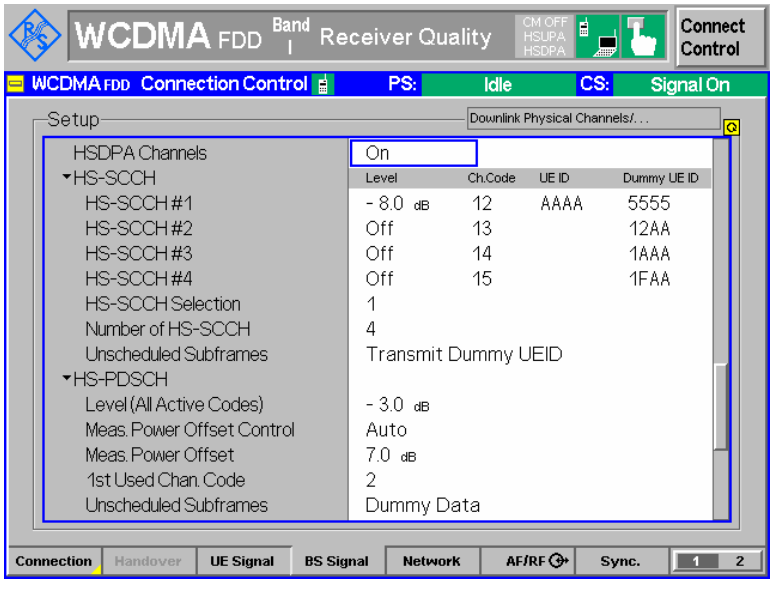


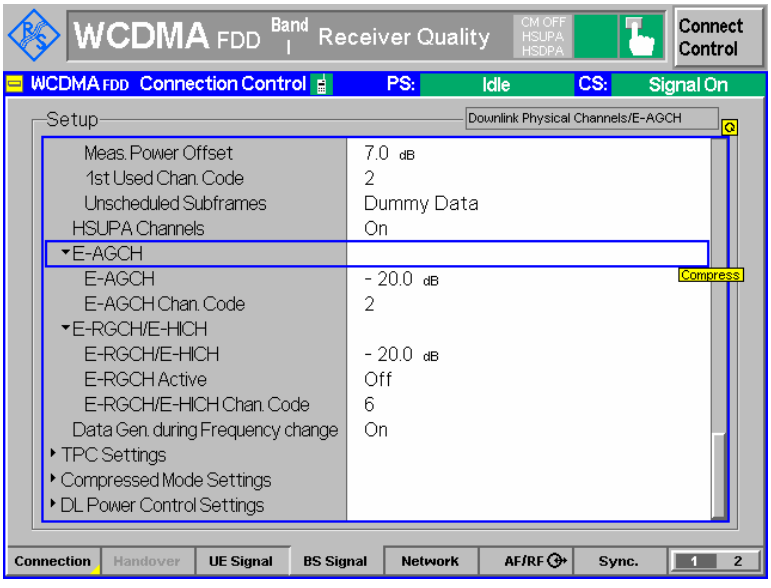
Set the following levels in the Downlink Physical Channels section:
(note that the value for S-CCPCH and AICH are not specified for the test and could also be set to a different value, these channels are only used for connection setup)

Channel	Level
P-CPICH	-10
S-CPICH	Off
P-SCH	-15
S-SCH	-15
P-CCPCH	-12
S-CCPCH	-12
PICH	-15
AICH	-12
DPDCH	-10
HS-SCCH	-8
HS-PDSCH	-3
E-AGCH	-20
E-RGCH/E-HICH	-20
E-RGCH Active	Off


WCDMA FDD Band I Receiver Quality
CM OFF HSUPA HSDPA
Connect Control
WCDMA FDD Connection Control
PS: Idle
CS: Signal On
Setup
Downlink Physical Channels
Compress
Default Settings
P-CPICH - 10.0 dB
S-CPICH Off
S-CPICH Channel Code 7
S-CPICH Sec. Scrambling Code 0
S-CPICH Phase 0 °
P-SCH - 15.0 dB
S-SCH - 15.0 dB
P-CCPCH - 12.0 dB
S-CCPCH - 12.0 dB
S-CCPCH Channel Code 2
PICH - 15.0 dB
PICH Channel Code 3
Paging Indicators per Frame 18
Connection Handover UE Signal BS Signal Network AF/RF Sync. 1 2


WCDMA FDD Band I Receiver Quality
CM OFF HSUPA HSDPA
Connect Control
WCDMA FDD Connection Control
PS: Idle
CS: Signal On
Setup
Downlink Physical Channels/AICH
P-CCPCH - 12.0 dB
S-CCPCH - 12.0 dB
S-CCPCH Channel Code 2
PICH - 15.0 dB
PICH Channel Code 3
Paging Indicators per Frame 18
AICH - 12.0 dB
AICH Channel Code 6
Level Minimum Maximum
DPDCH Level Config - 10.0 dB - 24.1 dB - 13.1 dB
DPCH Channel Code 96
Power Offset (DPCCH/DPDCH) 0.0 dB
DL DPCH Timing Offset 0 * 256 chip
Secondary Scrambl. Code 0
Secondary Scrambl. Code (HSDPA) 0
Connection Handover UE Signal BS Signal Network AF/RF Sync. 1 2


WCDMA FDD Band I Receiver Quality
CM OFF HSUPA HSDPA
Connect Control
WCDMA FDD Connection Control
PS: Idle
CS: Signal On
Setup
Downlink Physical Channels/...
HSDPA Channels On
HS-SCCH
Level Ch.Code UE ID Dummy UE ID
HS-SCCH #1 - 8.0 dB 12 AAAA 5555
HS-SCCH #2 Off 13 12AA
HS-SCCH #3 Off 14 1AAA
HS-SCCH #4 Off 15 1FAA
HS-SCCH Selection 1
Number of HS-SCCH 4
Unscheduled Subframes Transmit Dummy UEID
HS-PDSCH
Level (All Active Codes) - 3.0 dB
Meas. Power Offset Control Auto
Meas. Power Offset 7.0 dB
1st Used Chan. Code 2
Unscheduled Subframes Dummy Data
Connection Handover UE Signal BS Signal Network AF/RF Sync. 1 2



Test Procedure:

Procedure from 3GPP TS 34.121 for subtest 1-4:

1) Set the *Absolute Grant* according to Table C.11.1.3.
2) The SS starts transmitting HSDPA and the UE loops the received data back on E-DCH.
3) Set the UE power to be at least 7.5 dB lower than the maximum output power. Wait 150 ms.
4) Send power control bits to give one TPC_cmd = +1 command to the UE.
5) The SS checks the received E-TFCI for 150 ms. If UE does not send any decreased E-TFCI (DTX on E-DPDCH is also considered decreased E-TFCI) within the 150 ms then go back to step 4, otherwise proceed to step 6.
6) Send power control bits to give one TPC_cmd = –1 command to the UE and wait 150 ms.
7) The SS checks the received E-TFCI for 150 ms. If UE sends any decreased E-TFCI (DTX on E-DPDCH is also considered decreased E-TFCI) within the 150 ms, then send new power control bits to give another TPC_cmd = –1 command to the UE and wait 150 ms.
8) Confirm that the E-TFCI transmitted by the UE is equal to the target E-TFCI in Table C.11.1.3. If the E-TFCI transmitted by the UE is not equal to the target E-TFCI, then fail the UE.
9) Measure the mean power of the UE. The mean power shall be averaged over at least one timeslot.
10) Repeat the measurement for the different combinations of beta values for sub-test 1 to 4 as given in table C.11.1.3.

Procedure from 3GPP TS 34.121 for subtest 5:

1) Set the *Absolute Grant* according to sub-test 5 in Table C.11.1.3.
2) The SS starts transmitting HSDPA and the UE loops the received data back on E-DCH.
3) Set the UE power to be at least 7.5 dB below the maximum output power. Wait 150 ms.

4) Set and send continuously *Up* power control commands to the UE. Wait 150 ms.

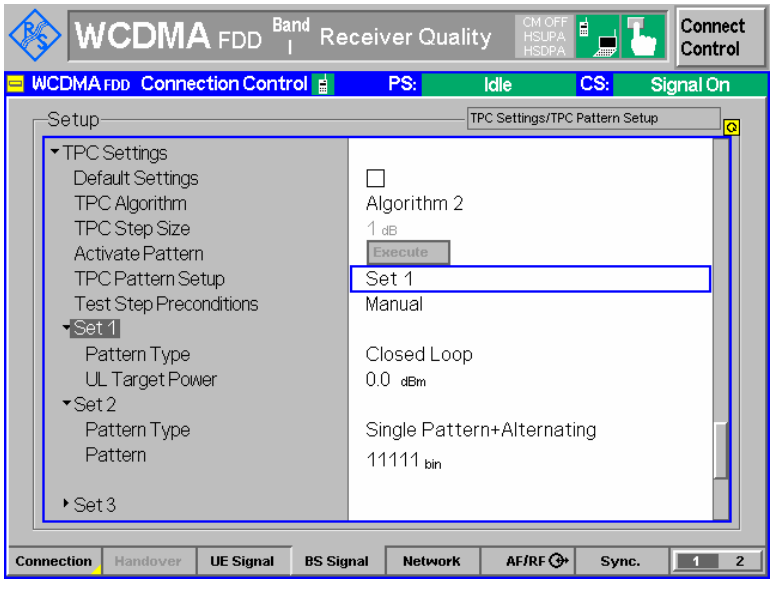
5) Measure the mean power of the UE. The mean power shall be averaged over at least one timeslot.

Realization of the 3GPP procedure at the R&S CMU:

Set the parameters for a certain subtest according to the values described above in the parameter section.

Set up a test mode connection by pressing *Connect UE* in the connection tab.

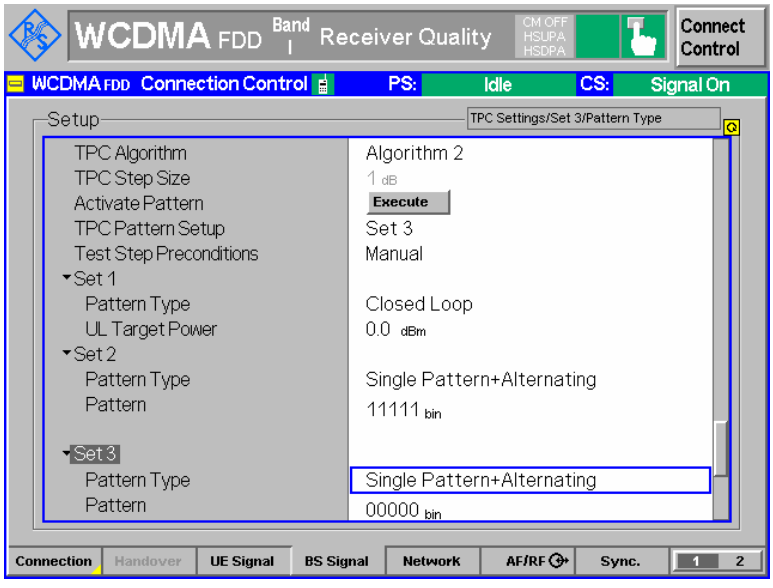
In order to set the UE power to a desired value (at least 7.5 dB lower than the maximum output power), use the *UL Closed Loop Power Control* functionality of the CMU with an appropriate *UL Target Power*, see screenshot:



In order to give one TPC_cmd = +1, use the TPC pattern type *Single Pattern + Alternating* with a *11111* pattern *(Set 2* in the screenshot). To activate the TPC command, press *Activate Pattern.*

In order to give one TPC_cmd = –1, use the TPC pattern type *Single Pattern + Alternating* with a *00000* pattern *(Set 3* in the screenshot). To activate the TPC command, press *Activate Pattern*.

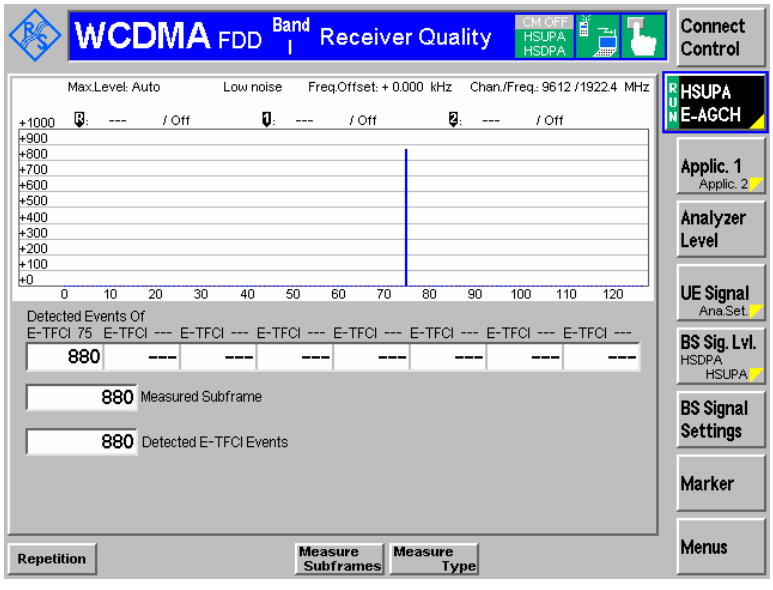
In order to send continuously Up power control commands to the UE, use the TPC pattern type *All 1*.



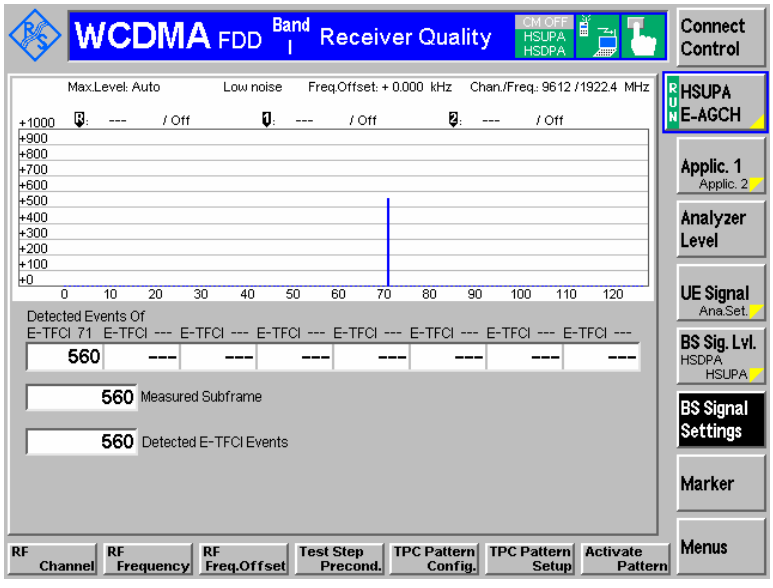
To measure the E-TFCI transmitted by the UE, use the E-AGCH measurement with measurement type *General Histogram*.

The target E-TFCI values according to table C.11.1.3 for each subtest are:

subtest	Target E-TFCI
1	75
2	67
3	92
4	71
5	67



In the screenshot above, the target E-TFCI 75 is measured. When the UE power is increased further for subtest 1–4, a point is reached when the UE decreases the transmitted E-TFCI, for example down to E-TFCI 71 (the value may vary depending on the UE power) as shown in the following measurement:



The UE power can be measured by means of the *Off Power* measurement of the CMU

Test requirement from 3GPP 34.121:

The maximum output power with HS-DPCCH and E-DCH, derived in step 6), shall not exceed the range prescribed by the maximum output power and tolerance in table 5.2B.5.

Table 5.2B.5: Maximum Output Powers with HS-DPCCH and E-DCH for test

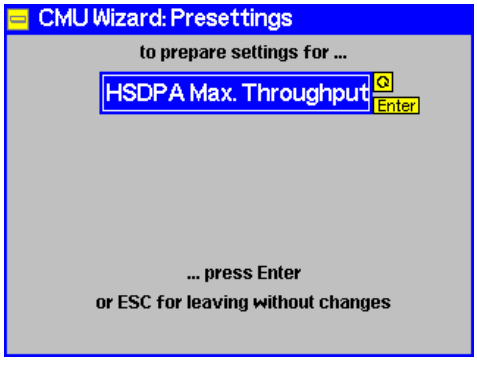
Sub-test in table C.11.1.3	Power Class 3		Power Class 4	
	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)
1	+24	+1.7/–6.7	+21	+2.7/–5.7
2	+22	+3.7/–5.2	+19	+4.7/–4.2
3	+23	+2.7/–5.2	+20	+3.7/–4.2
4	+22	+3.7/–5.2	+19	+4.7/–4.2
5	+24	+1.7/–3.7	+21	+2.7/–2.7

Measurement Wizard

The measurement wizard provides predefined BS Signal settings for HSDPA and HSUPA tests in *Signalling* mode. In general, selecting the predefined settings represents the simplest and fastest way of configuring the instrument. Moreover all settings can be further refined after the wizard has prepared a basic measurement configuration.

Practical use

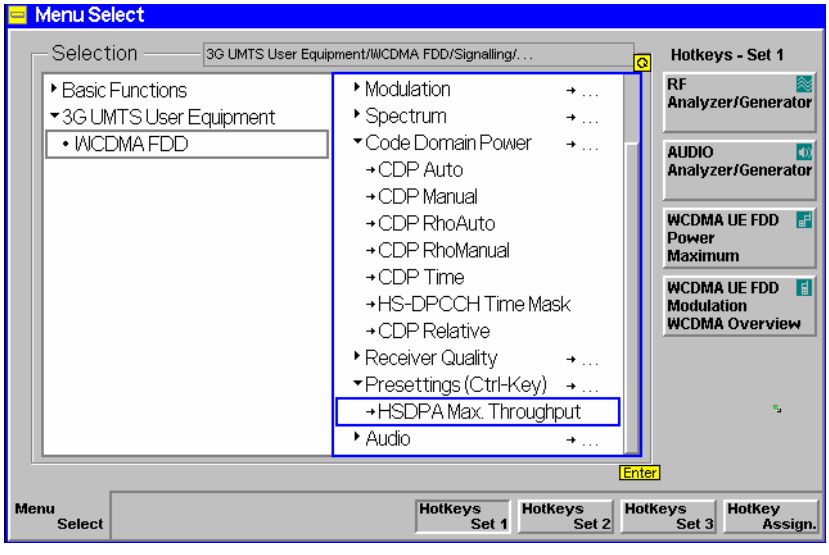
1. To call up the wizard, enter the WCDMA FDD Signalling test mode and press the *CTRL* key on the front panel of your R&S CMU.



2. Press *ENTER* to start the wizard and configure the CMU or *ESCAPE* to close without changing any instrument settings.

The actions and settings performed by the wizard are listed in Table 2-6 below.

Tip: *The wizard functions are also accessible from the* Presettings (Ctrl Key) *section in the* Menu Select *menu. Selecting the* HSDPA Max. Throughput *presettings is equivalent to pressing the ENTER key in the wizard menu.*



HSDPA Max. Throughput

The purpose of the *HSDPA Max. Throughput* wizard is to establish a valid BS signal configuration for a given UE category which ensures a maximum throughput for HSDPA tests, both in HSDPA test mode and for HSDPA data application tests. The wizard uses the *UE Category* value in the *BS Signal* tab of the *Connection Control* menu *(BS Signal – HSDPA HS-DSCH – UE Category)* and adjusts the parameters listed in Table 2-6.

Depending on the *BS Signal – HSDPA HS-DSCH – UE Category Selection* parameter, you can set the UE category value manually or update it upon registration of your UE under test *(BS Signal – HSDPA HS-DSCH – UE Category Selection: UE Capability Report)*. You should start the wizard after the correct UE category has been set. You can use the wizard in all signalling states, however, with automatic update of the UE *category, the Registered/Attached* state should be reached before the wizard is started.

Table 2-6 Predefined settings of the measurement wizard

BS Signal Parameter	Value
Packet Data	
Data Rate	HSDPA / 384 kbps uplink
HSDPA HS-DSCH	
T1 Release Timer	200 ms
Channel Configuration Type	User Defined
User Defined Channel	
MAC-d PDU Size Control	Manual
MAC-d PDU Size	656
No of H-ARQ Processes	6
Inter TTI Distance	Depending on UE category, according to Minimum Inter TTI Distance in Table 5.1a (from 3GPP TS 25.306 V7.5.0)
Transport Block Size Index	48 for UE cat. 1 to 8, 11,12; 44 for UE cat. 9; 62 for UE Cat. 10
No. of Phys. Channel Codes	Maximum number of HS-DSCH codes received in Table 5.1a
Modulation	16 QAM for UE cat. 1 to 10, QPSK for UE cat. 11, 12
Downlink Physical Channels	
DPDCH Level Config	5.0 dB
DPDCH Channel code	2
HS-SCCH#1 Level	3.0 dB
HS-SCCH Channel code	6
HS-PDSCH	
Level (All Active Codes)	+10.0 dB
1st Used Chan. Code	1
E-AGCH	
E-AGCH	–6.0 dB
E-AGCH Chan. Code	2
E-RGCH/E-HICH	
E-RGCH/E-HICH Chan. Code	7
Selected measurement application	Receiver Quality – HSDPA ACK (continuous mode)

The following table lists the HS-DSCH physical layer categories according to the conformance test specification 3GPP TS 25.306 V7.5.0, Table 5.1a, and the maximum possible throughput obtained with the R/S CMU 200.

Table 2-7 FDD HS-DSCH physical layer categories and maximum possible throughput

HS-DSCH category	Maximum number of HS-DSCH codes received	Mini-mum inter-TTI interval	Maximum number of bits of an HS-DSCH transport block received within an HS-DSCH TTI	Total number of soft chan-nel bits	Supported modulations without MIMO operation	Max.poss. Throughput with R&S CMU 200 in kbps
Category 1	5	3	7298	19200	QPSK, 16QAM	524.167
Category 2	5	3	7298	28800		791.333
Category 3	5	2	7298	28800		1187.000
Category 4	5	2	7298	38400		1581.000
Category 5	5	1	7298	57600		3649.000
Category 6	5	1	7298	67200		3649.000
Category 7	10	1	14411	115200		7205.500
Category 8	10	1	14411	134400		7205.500
Category 9	15	1	20251	172800		10125.500
Category 10	15	1	27952	172800		13976.000
Category 11	5	2	3630	14400	QPSK	590.500
Category 12	5	1	3630	28800		1815.000

Remote control: `PROCedure:WIZard:ACTion HDMax`

HSUPA Max. Throughput

The purpose of the *HSUPA Max. Throughput* wizard is to establish a valid BS signal configuration for a given E-DCH physical layer category which ensures a maximum throughput for HSUPA tests, both in HSUPA test mode and for HSUPA data application tests. The wizard uses the *E-DCH Physical Layer Category* value signalled by the UE under test (displayed under *UE Signal – HSUPA – E-DCH Physical Layer Category)* and adjusts the parameters listed in Table 2-8.

Table 2-8 Predefined settings of the measurement wizard

BS Signal Parameter	Value
Packet Switched DCH (Dedicated Chn.) Type	HSUPA Test Mode
Packet Data Data Rate	384 kbps Downlink / HSUPA
HSUPA Test Mode Radiobearer Setup	SRB 3.4 kbps + HSPA
HSUPA TTI Mode	Minimum value according to the UE E-DCH physical layer category: 10 ms for categories 1, 3, 5; 2 ms for categories 2, 4, 6
AG Pattern AG Index	31
Selected measurement application	Receiver Quality – HSUPA E-HICH (continuous mode)

The following table lists the E-DCH physical layer categories according to the conformance test specification 3GPP TS 25.306 V7.5.0, Table 5.1g, and the maximum possible throughput obtained with the R/S CMU 200.

Table 2-9 FDD HS-DSCH physical layer categories and maximum possible throughput

HS-DSCH category	Maximum number of E-DCH codes transmit-ted	Minimum spread-ing factor	Support for 10 ms and 2 ms TTI E-DCH	Maximum number of bits of an E-DCH transport block transmitted within a 10 ms E-DCH TTI	Maximum number of bits of an E-DCH trans-port block transmitted within a 2 ms E-DCH TTI	**Max.poss. Throughput with R&S CMU 200** in kbps
Category 1	1	SF4	10 ms TTI only	7110	–	695.900
Category 2	2	SF4	10 ms and 2 ms TTI	14484	2798	1399.000
Category 3	2	SF4	10 ms TTI only	14484	–	1445.300
Category 4	2	SF2	10 ms and 2 ms TTI	20000	5772	2886.000
Category 5	2	SF2	10 ms TTI only	20000	–	2000.000
Category 6	4	SF2	10 ms and 2 ms TTI	20000	11484	5742.000

Remote control: `PROCedure:WIZard:ACTion HUMax`

HSPA Max. Throughput

The purpose of the *HSPA Max. Throughput* wizard is to establish a valid BS signal configuration for a given UE category and E-DCH physical layer category which ensures a maximum throughput for HSDPA and HSUPA tests, both in test mode and for data application tests. The wizard is a combination of the *HSDPA Max. Throughput* wizard and the *HSUPA Max. Throughput* wizard. The wizard uses the *UE Category* value in the *BS Signal* tab of the *Connection Control* menu *(BS Signal – HSDPA HS-DSCH – UE Category)* and the *E-DCH Physical Layer Category* value signalled by the UE under test (displayed under *UE Signal – HSUPA – E-DCH Physical Layer Category)* and adjusts the parameters listed in Table 2-10.

Table 2-10 Predefined settings of the measurement wizard

BS Signal Parameter	Value
Packet Switched DCH (Dedicated Chn.) Type	HSUPA Test Mode
HSUPA Test Mode Radiobearer Setup	SRB 3.4 kbps + HSPA
Packet Data Data Rate	HSDPA / HSUPA
HSDPA HS-DSCH T1 Release Timer Channel Configuration Type	200 ms User Defined
User Defined Channel MAC-d PDU Size Control MAC-d PDU Size No of H-ARQ Processes Inter TTI Distance Transport Block Size Index No. of Phys. Channel Codes Modulation	 Manual 656 6 Depending on UE category, according to Minimum Inter TTI Distance in Table 5.1a (from 3GPP TS 25.306 V7.5.0) 48 for UE cat. 1 to 8, 11,12; 44 for UE cat. 9; 62 for UE Cat. 10 Maximum number of HS-DSCH codes received in Table 5.1a 16 QAM for UE cat. 1 to 10, QPSK for UE cat. 11, 12

BS Signal Parameter	Value
Downlink Physical Channels	
DPDCH Level Config	5.0 dB
DPDCH Channel code	2
HS-SCCH#1 Level	3.0 dB
HS-SCCH Channel code	6
HS-PDSCH	
Level (All Active Codes)	+10.0 dB
1st Used Chan. Code	1
E-AGCH	
E-AGCH Chan. Code	2
E-RGCH/E-HICH	
E-RGCH/E-HICH Chan. Code	7
HSUPA	
TTI Mode	Minimum value according to the UE E-DCH physical layer category: 10 ms for categories 1, 3, 5; 2 ms for categories 2, 4, 6
AG Pattern	
AG Index	31
Selected measurement application	Receiver Quality – RLC BLER

Remote control: `PROCedure:WIZard:ACTion HSMax`

HSDPA

The purpose of the *HSDPA* wizard is to establish a valid BS signal configuration for tests requiring a fixed reference channel with a ½ slot offset between the UL DPCH and the HS-DPCCH. A typical example is the *CDP Relative* measurement described in chapter 8. The wizard adjusts the parameters listed in Table 2-11.

Table 2-11 Predefined settings of the measurement wizard

Parameters	Value
BS Signal – HSDPA HS-DSCH	
Channel Configuration Type	Fixed Reference Channel
Fixed Reference Channel	
H-Set Selection	H-Set 1 QPSK
BS Signal – Downlink Physical Channels	
DL DPCH Timing Offset	6 [*256 chip]
UE Signal – UE Gain Factors	
HSDPA / HSUPA	$\Delta_{ACK} = \Delta_{NACK} = 7$, $\Delta_{CQI} = 7$
Trigger	
Source	HS-DPCCH
Selected measurement application	Code Domain Power – CDP Relative

Remote control: `PROCedure:WIZard:ACTion HDMSettings`

Contents

3 Manual Control 3.1

Menu Structure 3.1

Test Mode 3.1

Configurations 3.3

Measurement Groups 3.4

Measurements in Signalling Mode 3.6

Special Parameter Settings 3.9

General Settings 3.9

Averaging and Statistical Evaluation 3.11

Calculation of Average Values 3.11

Calculation of Statistical Values 3.13

3 Manual Control

This chapter gives a brief survey of the operating concept and structure of the user interface for WCDMA UE tests. The CMU was designed for maximum operating convenience and flexibility. All instrument functions are grouped together in menus; each of them provides a number of related configuration settings or displays a group of measured quantities. All menus show a similar structure so that many settings, once defined, can be used in several menu groups. Switchover between the different menu groups is possible at any time.

In the following, the different measurement modes and measured quantities are discussed. Settings and measurement parameters frequently encountered are explained from a general point of view.

The formal aspects of measurement control are discussed in more detail in chapter 5 *(Remote Control – Basics)* and in chapter 5 of the CMU200/300 operating manual.

Menu Structure

The menus used to control WCDMA UE measurements can be arranged in different ways. From a functional point of view, they form the following groups:

- The two test modes *Signalling* and *Non Signalling*
- General configurations *(Connection Control),*
- Measurement groups *(Power, Modulation, Spectrum, Code Domain Power, Receiver Quality)* and configurations specific to these measurement groups *(Power Configuration, Modulation Configuration, Spectrum Configuration, Code Domain Power Configuration, Receiver Quality Configuration)*.

In a formal sense, the CMU uses main menus, popup menus, graphical measurement menus and dialog windows of various size. This aspect is discussed in chapter 3 of the operating manual for the CMU basic unit.

Test Mode

WCDMA UE measurements are performed in one of the two modes *Signalling* or *Non Signalling*. The *Non Signalling* mode is typically used for module tests or test of UEs in a special "test mode". The *Signalling* mode serves to measure the UE performance under realistic operating conditions where the CMU mimics an UTRAN cell.

Definition

The term signalling denotes all actions that are necessary to establish, control and terminate a communication between the Node B (CMU) and the UE. The signalling messages conveyed allow the UE and the network to discuss the management of issues either related to the user or concerning technical aspects of the communication.

Non Signalling TX Test Mode

In *Non Signalling* mode, the CMU analyzes the channel coded and modulated uplink WCDMA signal transmitted by the device under test. To conform to 3GPP WCDMA specifications, this signal must have definite properties with respect to its power, modulation, frequency, spectrum and code domain power. No signalling parameters are transferred, and no call connection is set up, so that test times are reduced considerably. The test signal may be inside or outside the designated WCDMA channel range.
The TX tests provided in this test mode are listed in section *Measurement Groups* on p. 3.4.

Non Signalling Synchronized Mode

With option CMU-K66, *WCMDA (3GPP/FDD, DL) Generator*, the CMU can generate a WCDMA downlink signal to which the UE can synchronize. The generator signal can be used to transfer data to the UE, e.g. a Transmit Power Control (TCP) command pattern that instructs the UE to perform power steps.

If option CMU-B68/CMU-U68, *Layer 1 Board for WCDMA,* is fitted in addition, the CMU is able to perform *Receiver Quality* tests based on a comparison of the data transferred to the UE and the data looped back.

All TX and RX tests are listed in section *Measurement Groups* on p. 3.4.

Signalling Mode

In *Signalling* mode, the CMU transmits a downlink WCDMA signal *(BS Signal)* to which the mobile phone can synchronize. When it receives this signal, the UE can initiate a registration to the UTRAN/CMU, after which a connection may be set up from either side.

The CMU is able to configure a broad range of network parameters, to vary the settings for the different channels in its WCDMA downlink signal, and to check parameters like the UE radio access capability. In addition the CMU can establish an packet switched connection for HSDPA tests or WCDMA Application Tests.

All TX and RX tests provided in this test mode are listed in section *Measurement Groups* on p. 3.4.

Symbols for Signalling Mode and State

The *test mode* and *state* is indicated to the left of the operating mode in each main menu and graphical measurement menu (see chapter 3 of CMU200/300 operating manual). The following symbols occur the WCDMA UE function groups*:*

Ciruit switched connections

Non signalling mode, TX tests

Signalling mode, Signal Off

Signalling mode, Signal On (icon blinks)

Signalling mode, Registered

Signalling mode, Alerting

Signalling mode, Connected

Packet data connections

The connection setup for packet switched connections is shown by an analogous series of symbols.

Other symbols

In *Non Signalling* mode, *HSDPA* and *HSUPA* indicate that the corresponding options are available so that the R&S CMU supports HSDPA or HSUPA measurements.

In Signalling mode, *CM ON* on a green background indicates that the UE operates in compressed mode. *HSDPA* on a green background indicates that the R&S CMU has entered the *HSDPA Test Mode.*

Configurations

The CMU offers a wide range of settings for the RF signal generators and analyzers, the signal inputs and outputs signalling procedures, reference frequency, RF input path, trigger, and the individual measurements. Configurations may apply to the whole function group *(Connection Control, signalling parameters)* or to a particular measurement.

Connection Control

The *Connect. Control* softkey is located to the right of the title bar in each measurement menu. It opens a popup menu with several tabs controlling

- The RF analyzer settings *(Analyzer* in Non Signalling, *UE Signal* in Signalling mode) and the properties of the WCDMA signal from the UE that can be analyzed *(UE Code)*
- The properties of the RF generator signal *(Generator/BS Signal*, with option CMU-K66, *WCDMA (3GPP/FDD, DL) Generator* only)
- The RF connectors to be used and the external attenuation *(RF Input/Output)*
- The reference signal and the system clock *(Sync.)*
- The trigger settings *(Trigger)*
- The routing of the I/Q and IF signals *(I/Q-IF,* with option CMU-B17 only)
- In *Signalling* mode (with option CMU-K67/-K68/-K69), all actions changing the CMU's signalling state *(Connection)*
- In *Signalling* mode, parameters of the network and the mobile station under test *(Network)*
- In *Signalling* mode, parameters to control the display *(Misc.)*

All settings made in the *Connect. Control* menu are valid for the whole function group. Many of them can be accessed and overwritten, however, by means of the softkeys and hotkeys offered in the measurement menus.

Configuration of measurements

A popup menu offering specific settings is assigned to each measurement group *(Power, Modulation, Spectrum, Code Domain Power, Receiver Quality).* The following general parameters can be defined in separate tabs:

- The repetition mode, stop condition, statistic count and display mode for the measurement *(Control)*
- Tolerances for the measured quantities *(Limits, Limit Lines)*

These settings are explained in more detail below (see section *General Settings* on page 3.9). For measurement-specific settings provided in the measurement configuration menus refer to Chapter 4.

Configuration via hotkeys

The softkeys and associated hotkeys in the measurement menus provide the most important configurations for the current measurement; see chapter 4 and chapter 3 of the CMU200/300 operating manual. Settings may via hotkeys supersede the corresponding settings made in the configuration menus.

Measurement Groups

Measurement results are indicated in two different ways:

- Discrete values and parameters are displayed in output fields, lists and tables. In remote control, these results are referred to as scalars.
- Traces are displayed in a Cartesian coordinate system, the time or frequency forming the x-axis scale. Relatively small sets of test points are generally viewed in a bar graph. In remote control, results of this type are referred to as arrays.

While the measurement is running in repetition mode *Continuous* (see page 3.9), the results are constantly updated. An overview of the measurements is given in the table below.

Table 3-1 Measurement groups in *Signalling* and *Non Signalling* mode

Non Signalling	**Signalling**
Power Application *Max. Power/Min. Power/Off Power* Measurement of the peak and RMS-averaged transmitter output power in different operating modes of the WCDMA UE. Application *Inner Loop TPC:* Test of the inner loop Transmit Power Control (TPC). Application *P/Slot Table* Quick evaluation of power steps of the UE transmitter over a wide dynamic range. Application *R&S Smart Alignment* (option R&S CMU-K47) Quick evaluation of power steps of the UE transmitter over a wide dynamic range and frequency range. A statistical evaluation and a limit check is performed for the measured quantities (exception: *P/Slot Table)*.	**Power** Application *Max. Power/Min. Power/Off Power* Measurement of the peak and RMS-averaged transmitter output power in different operating modes of the WCDMA UE. Application *Inner Loop TPC:* Test of the inner loop Transmit Power Control (TPC). Application *P/Slot Table* Quick evaluation of power steps of the UE transmitter over a wide dynamic range. Power ramp measurements according to the conformance test specification 3GPP TS 34.121 including limit check can be performed. Application *On/Off Time Mask* UE power during the UE's random access procedure. A statistical evaluation and a limit check is performed for the measured quantities.
Modulation Measurement of the error vector magnitude, magnitude error or phase error derived from the modulation vector as a function of time. Scalar modulation quantities such as the frequency error, average and RMS phase error, I/Q imbalance, I/Q origin offset, waveform quality, as well as statistical results (peak and RMS values) and the results of the limit check are indicated in addition. Single QPSK modulated signals or 3GPP standard uplink WCDMA signals with a chip rate of 3.84 Mcps and channel coding can be analyzed. For the latter, the peak code domain error is also available. Application *Overview QPSK/WCDMA* Table showing a statistical evaluation of modulation parameters for QPSK and WCDMA signals. Application *EVM QPSK/WCDMA* Diagram showing the error vector magnitude (EVM) within the burst as a function of time plus a statistical evaluation of the modulation parameters. Application *Magn. Error QPSK/WCDMA* Diagram showing the magnitude error within the burst as a function of time plus a statistical evaluation of the modulation parameters.	**Modulation** Measurement of the error vector magnitude, magnitude error or phase error derived from the modulation vector as a function of time. Scalar modulation quantities such as the frequency error, average and RMS phase error, I/Q imbalance, I/Q origin offset, waveform quality, as well as statistical results (peak and RMS values) and the results of the limit check are indicated in addition. Single QPSK modulated signals or 3GPP standard uplink WCDMA signals with a chip rate of 3.84 Mcps and channel coding can be analyzed. For the latter, the peak code domain error is also available. Application *Overview QPSK/WCDMA* Table showing a statistical evaluation of modulation parameters for QPSK and WCDMA signals. Application *EVM QPSK/WCDMA* Diagram showing the error vector magnitude (EVM) within the burst as a function of time plus a statistical evaluation of the modulation parameters. Application *Magn. Error QPSK/WCDMA* Diagram showing the magnitude error within the burst as a function of time plus a statistical evaluation of the modulation parameters.

Non Signalling	Signalling
Application *Phase Error QPSK/WCDMA* Diagram showing the phase error within the burst as a function of time plus a statistical evaluation of the modulation parameters. A statistical evaluation and a limit check is performed for the measured quantities.	Application *Phase Error QPSK/WCDMA* Diagram showing the phase error within the burst as a function of time plus a statistical evaluation of the modulation parameters. A statistical evaluation and a limit check is performed for the measured quantities.
Application *I/Q analyzer QPSK/WCDMA* Analysis of the UE signal in the I/Q plane: Constellation diagram, vector diagram and eye pattern.	Application *I/Q analyzer QPSK/WCDMA* Analysis of the UE signal in the I/Q plane: Constellation diagram, vector diagram and eye pattern.
Application *Phase Discontinuity* Change in phase between any two adjacent timeslots.	Application *PRACH Preamble* PRACH preamble quality; ability of the UE to transmit the PRACH preamble in accordance with the core requirements. Application *Phase Discontinuity* Change in phase between any two adjacent timeslots.
Application *EVM & PhD with HS-DPCCH* Change in phase due to the presence of a HS-DPCCH, EVM and frequency error evaluation.	Application *EVM & PhD with HS-DPCCH* Change in phase due to the presence of a HS-DPCCH, EVM and frequency error evaluation.
Spectrum Measurement of the adjacent channel leakage power ratio (ACLR) at definite off-carrier frequencies (application *ACLR Filter)*, or as a continuous function of the frequency (application *ACLR FFT/OBW)*. From the measurement curve in the ACLR FFT/OBW application, the occupied bandwidth (OBW) is derived. The off-carrier power can be measured with different filter characteristics to obtain the spectrum emissions. Statistical evaluations and a limit check are performed in addition.	**Spectrum** Measurement of the adjacent channel leakage power ratio (ACLR) at definite off-carrier frequencies (application *ACLR Filter)*, or as a continuous function of the frequency (application *ACLR FFT/OBW)*. From the measurement curve in the ACLR FFT/OBW application, the occupied bandwidth (OBW) is derived. The off-carrier power can be measured with different filter characteristics to obtain the spectrum emissions. Statistical evaluations and a limit check are performed in addition.
Code Domain Power Measurement of the code domain power or of the rho factor of the code domain channels (*DCP/Code Auto* or *DCP/Code Rho Auto* representation) or of the physical channels (*DCP/Code Manual* or *DCP/Code Rho Manual* representation). Statistical evaluations and a limit check are provided in addition. With option R&S CMU-K64, *HSDPA 3.6 Mbps,* the power ad rho factor of the HS-DPCCH can be measured in addition. With option R&S CMU-K56, *HSUPA 5.76 Mbps,* the power ad rho factor of the E-DPCCH and the E-DPDCHs can be measured in addition. Application *CDP vs. Time* Code power and the gain factors for all UL channels including HSDPA and HSUPA channels. Application *HS-DPCCH Time Mask* Code power and power steps of the UL channels over a 4-slot period.	**Code Domain Power** Measurement of the code domain power or of the rho factor of the code domain channels (*DCP/Code Auto* or *DCP/Code Rho Auto* representation) or of the physical channels (*DCP/Code Manual* or *DCP/Code Rho Manual* representation). Statistical evaluations and a limit check are provided in addition. With option R&S CMU-K64, *HSDPA 3.6 Mbps,* the power ad rho factor of the HS-DPCCH can be measured in addition. Application *CDP vs. Time* Code power and the gain factors for all UL channels including HSDPA and HSUPA channels. Application *HS-DPCCH Time Mask* Code power and power steps of the UL channels over a 4-slot period.
Receiver Quality Measurement of quantities assessing the quality and performance of the UE receiver (Bit Error Rate, Block Error Rate, Data Block Error Rate and related quantities) in synchronized mode, where the CMU provides a data stream transferred on the DL channel and the UE loops back the received data in different transport block formats. Blind Transport Format Detection, statistical evaluations and a limit check are provided in addition.	**Receiver Quality** Measurement of quantities assessing the quality and performance of the UE receiver (Bit Error Rate, Block Error Rate, Data Block Error Rate and related quantities) in synchronized mode, where the CMU provides a data stream transferred on the DL channel and the UE loops back the received data in different transport block formats. Blind Transport Format Detection, the UE Reports, statistical evaluations, statistical (confidence) testing, and a limit check are provided in addition.

Non Signalling	Signalling
Application *HSDPA ACK* (with option R&S CMU-K64) Transmission of the HSDPA downlink signals configured in the *BS Signal* tab of the *Connection Control* menu and evaluation of the demodulation of the HS-DSCH and the data throughput.	Application *HSDPA ACK* (with option R&S CMU-K64) Transmission of the HSDPA downlink signals configured in the *BS Signal* tab of the *Connection Control* menu and evaluation of the demodulation of the HS-DSCH and the data throughput.
Application *HSDPA CQI* (with option R&S CMU-K64) Allocation of a HSDPA CQI test channel to the UE and test of the accuracy of CQI reporting under AWGN or fading conditions.	Application *HSDPA CQI* (with option R&S CMU-K64) Allocation of a HSDPA CQI test channel to the UE and test of the accuracy of CQI reporting under AWGN or fading conditions.
Application *HS-DPCCH Logging* (with option R&S CMU-K64) Evaluation of the ACK/NACK messages and reported CQI values that the UE returns in a sequence of 120 consecutive HS-DPCCH subframes (24 WCDMA frames).	Application *HS-DPCCH Logging* (with opt. R&S CMU-K64) Evaluation of the ACK/NACK messages and reported CQI values that the UE returns in a sequence of 120 consecutive HS-DPCCH subframes (24 WCDMA frames). Application *RLC BLER* (with option R&S CMU-K96) Measurement of the PDU/SDU throughput and the downlink Block Error Rate including statistical evaluation for *WCDMA Application Testing*.

A graphical overview of the menus is given at the end of this chapter.

Measurements in Signalling Mode

The scope and functionality of the *Signalling* measurement applications is the same as in *Non Signalling* mode. In *Signalling* tests the CMU maintains a connection to the DUT and is able to transmit and receive signalling information and data, using the settings defined in the *Connection Control* menu, in particular the uplink and downlink signal settings from the *UE Signal* and *BS Signal* tabs. A typical example is given below.

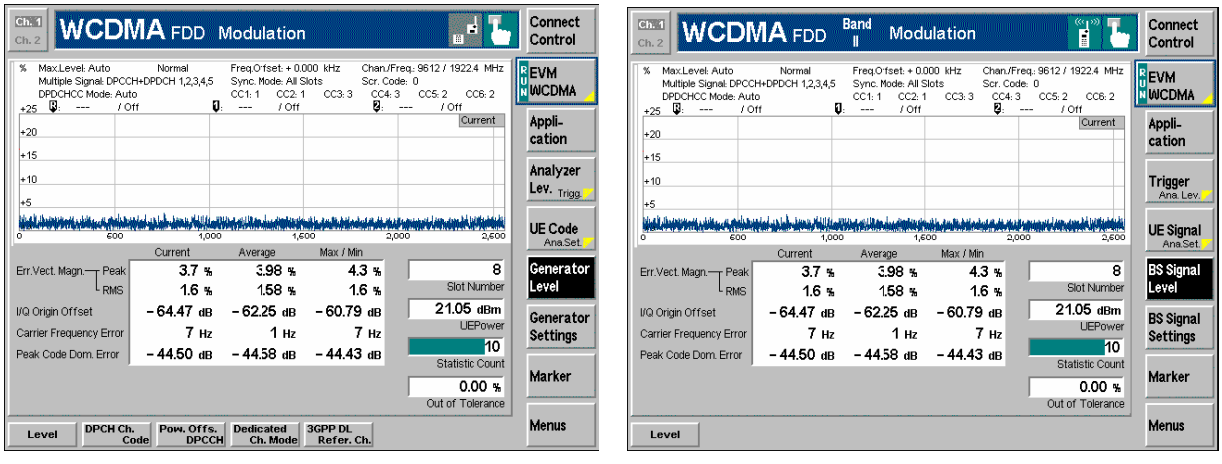


Fig. 3-1 Comparison of Non Signalling and Signalling measurement menu

The exchange of data in *Signalling* mode generally simplifies the measurements, because a connection can be set up, maintained or released using the default signal configuration and because there is no need to configure the CMU and the DUT separately.

All TX measurements *(Power, Modulation, Spectrum, Code Domain Power)* can be made irrespective of the *Dedicated Channel Type* and the *Test Mode* (see Chapter 4). To perform a *Receiver Quality* measurement, an RMC connection must be set up and the UE must be in its *Loop mode 1 RLC TM* or *Loop mode 2.*

The table below gives an overview the measurement applications in *Signalling* mode and the differences between the two test modes. For a general overview of the measurement functionality in both test modes see Chapter 3, section *Measurement Groups.*

Table 3-2 Measurements in Signalling mode

Measurement	**Behavior in Signalling mode (if different from Non Signalling mode)**
Power:	
Max Power	–
Min Power	–
Off Power	–
Inner Loop TPC	No need to adjust the *TPC Mode* (TPC algorithm) and the *Step Size* at the CMU: Both parameters are directly taken from signalling; see *Connection Control – BS Signal – TPC Settings*[1].
Modulation:	
Overview QPSK	–
EVM QPSK	–
Phase Error QPSK	–
Magn. Error QPSK	–
I/Q Analyzer QPSK	–
Overview WCDMA EVM WCDMA Phase Error WCDMA Magn. Error WCDMA I/Q Analyzer WCDMA	No need to set the *UE Code* parameters *Multiple Signal* and *Sym. Rate/Chan. Code.* The parameters are implicitly included in the dedicated channel settings. The *UL Scrambling Code* that the UE shall use can be set in the *UE Signal* tab and doesn't have to be configured at the UE.
PRACH	Not available in *Non Signalling* mode.
PHDisc	–
EVM &PhD with HS-DPCCH	–
Spectrum	
ACLR Filter	–
ACLR FFT/OBW	–
Emission Mask	–
Code Domain Power[2] CDP/Code Auto CDP/Code Rho Auto CDP/Code Manual CDP/Code Rho Manual	No need to set the *UE Code* parameters *Multiple Signal, Sym. Rate/Chan. Code, DPDCH Sym. Rate.* The parameters are implicitly included in the dedicated channel settings. The *UL Scrambling Code* that the UE shall use can be set in the *UE Signal* tab and doesn't have to be configured at the UE.
Receiver Quality	
BER	*Connection Info* displayed in the *Settings* table in the measurement menu. No need to set the *DL/UL Timing* parameter: UE is synchronized to the BS Signal when a connection is established. *UL CRC (Sym. Loop Mode 2)* in the *BS Signal* tab *(see Chapter 4)* replaces the *DL/UL Transport Block Size* in the *Receiver Quality Configuration* menu: *UL CRC (Sym. Loop Mode 2) = Off* sets an asymmetric UL/DL transport block size and enables the BLER measurement. In addition, it is possible to perform *Receiver Quality* tests with different RMCs in the downlink and the uplink. CMU checks whether the *Loop Mode 1 or 2* is active. If this is not true an error message is generated.

[1] The *Non Signalling* command CONFigure:POWer:ILTPc:CONTrol:TPCControl <ProfileLength>, <StepSize>, <TPCMode> is replaced by CONFigure:POWer:ILTPc:CONTrol:PLENgth <ProfileLength> in *Signalling;* see remote control documentation.

[2] In *Non Signalling* mode the *Code Domain Power* measurement is based on the *UE Code* settings from the *Connection Control* menu. In *Signalling* mode the UE code settings are taken from the 3.4 kbps radio bearer used to establish and maintain the connection between the CMU and the UE under test.

Measurement	Behavior in Signalling mode (if different from Non Signalling mode)
	Note: To make a *Receiver Quality measurement in* Signalling *mode it is sufficient to set the following parameters:* ➢ *Select a RMC as* Dedicated Channel Type *(see Chapter 4, Connection Control – Connection) and set the Test Mode (Connection Control – BS Signal – … RMC Settings – Test Mode*) *to either Loop Mode 1 RLC TM or Loop Mode 2.* ➢ *To enable the BLER measurement, select UL CRC = Off (Connection Control – BS Signal – … RMC Settings – UL CRC).* *If desired, change the Channel Data Source DTCH (Connection Control – BS Signal – … RMC Settings – Channel Data Source DTCH) or modify other signal settings.*
UE Report BTFD tests (FDR and UL TFCI Faults) HSDPA tests RLC BLER	Not available in *Non Signalling* mode.

Important hints concerning the Signalling measurements:

Modulation The **QPSK** applications in the *Modulation* measurement group provide a fast analysis of signals with undisturbed QPSK modulation characteristics (e.g. a single DPCCH, a single DPDCH, or a combination of a DPCCH with one DPDCH). The measurement requires an uplink signal with **equal gain factors** in its I and Q component. The gain factors can be adjusted by the UTRAN/CMU. They are equal if the *Dedicated Channel Type (Connection Control – Connection)* is set to *Sign. RAB – Cell DCCH*.

Note: *The standard 3GPP Reference Measurement Channels* (Dedicated Channel Type = RMC) *are specified with unequal gain factors for the DPCCH and DPDCH, so the QPSK modulation analysis on RMCs is bound to fail and the* Modulation ... WCDMA *applications must be used.*

Spectrum The *Spectrum* measurement provides the RF spectrum emissions in the frequency domain. While measuring on off-channel frequencies the CMU may not be able to receive signalling data from the UE. This does not affect the measurement results but can cause the analyzer to temporarily ignore actions initiated from the DUT.

Special Parameter Settings

Some of the measurements require a special signal configuration or operating mode of the R&S CMU. The conditions for each measurement are described in the reference chapters Chapter 4 and Chapter 8 (for HSDPA) of this manual. The following table gives an overview.

Table 3-3 Measurements in Signalling mode

Measurement	Parameters	Conditions
General	Trigger Source	Some measurements require a particular trigger source; see table *Trigger settings for WCDMA TX measurements* in Chapter 4.
Spectrum (all applications)	HS-DPCCH Trigger CQI Feedback Cycle	If *Spectrum* measurements are performed with HS-DPCCH trigger, the *CQI Feedback Cycle* must not be switched off (see section *HS-DPCCH Trigger* in Chapter 4).
Spectrum Emission Mask	HSDPA gain factors ΔACK, ΔNACK, and ΔCQI	The gain factors should be equal for accurate SEM results (see section *HS-DPCCH Trigger* in Chapter 4).
Modulation WCDMA CDP (all applications)	Slot Delay Offset	The trigger *Slot Delay Offet* has no impact on the measurement results; they are always slot-aligned (see section *Trigger Offsets for TX Measurements* in Chapter 4).

General Settings

A number of settings can be made in several of the configuration menus assigned to the measurement groups. In combination, these settings define the scope of the measurement, i.e. the number of slots/evaluation periods measured and the results displayed. The following brief overview is intended to avoid confusion of terms.

Application *Applications* are different measurements belonging to the same measurement group. They effectively split up a measurement group into various related subgroups which can be configured separately.

They are selected via the *Application* softkey in the measurement menus.

Statistic Count The term *statistic count* denotes the integer number of slots/evaluation periods which form one measurement cycle. Together with the *repetition mode* and the *stop condition,* the statistic count determines when exactly the measurement is stopped.

The *statistic count* is set in the *Control* tab of the configuration popup-menus assigned to the four measurement groups *Power, Modulation*, *Spectrum,* and *Code Domain Power.*

Repetition Mode

The *repetition mode* defines when a measurement that is not stopped by a limit failure (see stop condition *On Limit Failure* below) will be terminated. Two modes are available for all measurements:

Single Shot The measurement is stopped after one *statistic count*.

Continuous The measurement is continued until explicitly terminated by the user; the results are periodically updated.

A third repetition mode is available with remote control:

Counting Repeated single shot measurement with a fixed number of statistic counts. The calculation of average, minimum and maximum curves (see *Display Mode* below) starts again from the beginning after each measurement cycle.

The *repetition mode* is set in the *Control* tab of the configuration popup-menus assigned to the four measurement groups *Power*, *Modulation, Spectrum* and *Code Domain Power.*

Note: *In contrast to other measurement settings, thee repetition modes in manual and remote control are independent and do not overwrite each other. In most measurements, the default repetition mode in manual control is* Continuous *(observe results over an extended period of time), the default mode in remote control is* Single Shot *(perform one measurement and retrieve results).*

Stop Condition

A *stop condition* can be set for most measurements:

None The measurement is performed according to its repetition mode, irrespective of the measurement results and the limits set.

On Limit Failure The measurement is stopped as soon as one of the limits is exceeded, irrespective of the repetition mode set. If no limit failure occurs, it is performed according to its repetition mode.

The *stop condition* is set in the *Control* tab of the configuration popup-menus assigned to the measurement groups.

Display Mode

In graphical measurement diagrams, the *display mode* defines which of the measured and calculated curves is displayed if the measurement extends over several slots/evaluation periods. In general, curves are evaluated at a set of fixed, equidistant test points (samples). After n slots/evaluation periods, n measurement results per test point have been taken.

Current The current slot, i.e. the last result for all test points, is displayed.

Minimum At each test point, the minimum value of all slots/evaluation periods measured is displayed.

Maximum At each test point, the maximum value of all slots/evaluation periods measured is displayed.

Max./Min. At each test point, the extreme value of all slots/evaluation periods measured is displayed, i.e. the maximum or minimum, whichever has a larger absolute value.

Average At each test point, a suitably defined average over all slots/evaluation periods measured is displayed; see section *Averaging and Statistical Evaluation below*.

The *display mode* is set in the *Control* tab of the configuration popup-menus assigned to the measurement groups *Modulation, Spectrum,* and *Code Domain Power.*

Averaging and Statistical Evaluation

In WCDMA transmitter tests, the test parameters are typically evaluated with a basic evaluation period (measurement length) corresponding to one transmit slot comprising 2560 chip periods or an integer fraction of it. Continuous measurements may extend over many consecutive slots/evaluation periods; the wealth of information obtained in such a measurement is further processed and output as average and statistical quantities.

Calculation of Average Values

Average values can be taken in two steps:

1. A test parameter is averaged over one slot (or an integer fraction of it termed the measurement length) to yield the *Current* result.
2. The *Current* result is averaged once again over several consecutive slots/evaluation periods to yield *Average* quantities.

The settings used to obtain the different types of results are explained in section *General Settings* on p. 3.9 (see display mode). The formulas applied for step 1 and 2 are described below.

Current results

Assume that a test parameter *Par* has been measured at N test points covering the whole measurement length (e.g. the slot). The RMS average of *Par* is defined by the following equation:

$$Par(RMS) = \sqrt{\frac{1}{N}\sum_{n=1}^{N} \left| Par(n) \right|^2}$$ (Equation 3-1).

Equation 3-1 is used to average all power parameters, e.g. the UE Power (RMS) displayed in all measurement menus, and all quantities derived from power parameters, e.g. the ACLR provided in the *Spectrum* menu. It is also for the calculation of the Phase Error (RMS) in the *Modulation* menu. The values *EVM (RMS)* and *Magn. Error (RMS)* in the *Modulation* menu are obtained by dividing the RMS-averaged magnitude of the error vector and the RMS-averaged magnitude error by the magnitude of the RMS-averaged ideal modulation vector. All three quantities are RMS-averaged according to Equation 3-1.

Average results: measurement curves

The *Average* curves in the *Modulation* and *Spectrum* menus are obtained as follows:

Let c be the number of slots/evaluation periods forming one statistics cycle (one *statistic count)* and assume that n slots/evaluation periods have been measured since the start of the measurement. In calculating the *Average* curve, the following two situations are distinguished:

n ≤ c Single shot measurement or continuous measurement during the first statistics cycle: At each test point, *Average* curve no. n is calculated from *Average* curve no. n – 1 and *Current* curve no. n according to the following recurrence:

$$Avg(n) = \frac{n-1}{n} Avg(n-1) + \frac{1}{n} Curr(n) \quad (n = 1, \ldots, c)$$ (Equation 3-2).

The *Average* curve represents the arithmetic mean value over all n slots/evaluation periods measured.

n > c Continuous measurement after the first statistics cycle: At each test point, *Average* curve no. n is calculated from *Average* curve no. n – 1 and *Current* curve no. n according to

$$Avg(n) = \frac{c-1}{c} Avg(n-1) + \frac{1}{c} Curr(n) \qquad (n > c) \qquad \text{(Equation 3-3).}$$

The formulas hold for n = 1 where the average curve becomes equal to the current curve (statistics off).

Average results: scalar values

Scalar quantities and the results displayed in bar graphs are generally averaged in analogy to Average curves using Equation 3-2 and Equation 3-3. Please note the following two exceptions:

For RMS-averaged Current values that were obtained by means of Equation 3-1, Equation 3-2 is replaced by an RMS-type averaging prescription:

$$Avg(n)_{RMS} = \sqrt{\frac{n-1}{n} \left| Avg(n-1)_{RMS} \right|^2 + \frac{1}{n} \left| Curr(n)_{RMS} \right|^2} \qquad (n = 1, \ldots, c) \qquad \text{(Equation 3-4).}$$

and an analogous formula with constant weighting factors (c – 1)/c, 1/c replaces Equation 3-3. Equation 3-4 is used to average the quantities Err. Vect. Magn. (RMS), Phase Error (RMS) and Magn. Error (RMS) in the Modulation menu over several slots/evaluation periods.

For Current values that are expressed in logarithmic units (dB or dBm), averaging is done before logarithmation so that Equation 3-2 is replaced by the following averaging rule:

$$Avg(n)_{dB} = 10 \cdot \log\left(\frac{n-1}{n} 10^{Avg(n-1)_{dB}/10} + \frac{1}{n} 10^{Curr(n)_{dB}/10} \right) (n = 1, \ldots, c) \qquad \text{(Equation 3-5).}$$

and an analogous formula replaces Equation 3-3. Equation 3-5 is used to average the quantities Origin Offset, I/Q Imbalance and Peak Code Domain Error in the Modulation menu as well as the ACLR in the Spectrum menu and the Code Domain Power in the Code Domain Power measurement menu.

Calculation of Statistical Values

Besides the *Average* procedures described in the previous section, the CMU provides the statistics functions *Minimum, Maximum* and *Max./Min.* For a test parameter which is measured at N test points, the following definitions apply:

- The *Maximum* is the largest of the N measurement values.
- The *Minimum* is the smallest of the N measurement values.
- The *Max./Min.* value is either the *Maximum* or the *Minimum*, whichever has the larger absolute value. In other words, it is the *Maximum* of the absolute value times the sign of the test parameter at the maximum point. The *Max./Min.* function is applied to parameters with alternating sign that must be confined to a symmetric range centered around zero, e.g. the phase error of the modulation vector.

If a test parameter is measured over several slots/evaluation periods, the statistics functions can be combined in analogy to the different averages described in section *Calculation of Average Values above*:

1. The test parameter *Par* is averaged (either RMS-average or arithmetic mean value) or maximized over one slot (or an integer fraction of it termed the measurement length) to yield the *Current* results denoted *Par (Average), Par (RMS), Par (Peak)*.
2. The *Current* results are once again averaged, maximized or minimized over several consecutive slots/evaluation periods to yield *Average, Maximum, Minimum, Max./Min.* results.

An overview of the statistical values determined in the WCDMA measurement menus together with the formulas used for averaging is given below.

Table 3-4 Statistical values in WCDMA measurements

Meas. menu	Application	Slot with c test points	N consecutive slots
Power	Maximum Power	UE Power (Peak): Current UE Power (RMS): Current (*Equation 3-1*)	UE Power (Peak): Average (*Equation 3-5*) UE Power (Peak): Maximum UE Power (RMS): Average (*Equation 3-5*) UE Power (RMS): Maximum UE Power (RMS): Minimum
	Minimum Power Off Power	UE Power (Peak): Current UE Power (RMS): Current (*Equation 3-1*)	UE Power (Peak): Average (*Equation 3-5*) UE Power (Peak): Maximum UE Power (RMS): Average (*Equation 3-5*) UE Power (RMS): Maximum
	P/Slot Table/ Inner Loop TPC	UE Power (RMS): Current (*Equation 3-1*)	No statistical evaluation
Modulation	Overview QPSK (each of the other QPSK applications offers a subset of the Overview QPSK parameters)	Err. Vect. Magn. (Peak): Current Err. Vect. Magn. (RMS): Current (*Equation 3-1*) Magn. Error (Peak): Current Magn. Error (RMS): Current (*Equation 3-1*) Phase Error (Peak): Current Phase Error (RMS): Current (*Equation 3-1*) I/Q Origin Offset: Current I/Q Imbalance: Current (*Equation 3-1*) Carrier Frequency Error: Current Waveform Quality: Current	Err. Vect. Magn. (Peak): Average (*Equation 3-4*) Err. Vect. Magn. (Peak): Max./Min. Err. Vect. Magn. (RMS): Average (*Equation 3-4*) Err. Vect. Magn. (RMS): Max./Min. Magn. Error (Peak): Average (*Equation 3-4*) Magn. Error (Peak): Max./Min. Magn. Error (RMS): Average (*Equation 3-4*) Magn. Error (RMS): Max./Min. Phase Error (Peak): Average (*Equation 3-4*) Phase Error (Peak): Max./Min. Phase Error (RMS): Average (*Equation 3-4*) Phase Error (RMS): Max./Min. I/Q Origin Offset: Average (*Equation 3-5*) I/Q Origin Offset: Max./Min. I/Q Imbalance: Average (*Equation 3-5*) I/Q Imbalance: Max./Min. Carrier Freq. Error: Average (*Equation 3-2*) Carrier Frequency Error: Max./Min. Waveform Quality: Average (*Equation 3-2*) Waveform Quality: Max./Min.
	Overview WCDMA (each of the other WCDMA applica-tions offers a subset of the Overview QPSK parameters)	all parameters of the Overview QPSK application. In addition: Peak Code Dom. Error: Current Transmit Time Error: Current	Peak Code Dom. Error: Average (*Equation 3-5*) Peak Code Domain Error: Max./Min. Transmit Time Error: Average (*Equation 3-2*) Transmit Time Error: Max./Min.
Spectrum	ACLR Filter	ACLR (Peak): Current ACLR (RMS): Current (*Equation 3-1*)	ACLR (Peak): Maximum ACLR (RMS): Average (*Equation 3-5*) ACLR (RMS): Maximum
	ACLR FFT/OBW	ACLR (RMS): Current OBW: Current	ACLR (RMS): Average (*Equation 3-5*) ACLR (RMS): Maximum OBW: Average (*Equation 3-2*) OBW: Maximum
	Emission Mask	ACLR (RMS): Current	ACLR (RMS): Average (*Equation 3-5*) ACLR (RMS): Maximum
Code Domain Power	CDP/Code Manual (application CDP/Code Auto offers a subset of the parameters)	Code Domain Power (RMS): Current	Code Dom. P. (RMS): Average (*Equation 3-5*) Code Domain Power (RMS): Maximum Code Domain Power (RMS): Minimum
	CDP/Code Rho Manual (application CDP/Code Rho Auto offers a subset of the parameters)	CD-ρ (RMS): Current	CD-ρ (RMS): Average (*Equation 3-2*) CD-ρ (RMS): Maximum CD-ρ (RMS): Minimum

Contents

4 Functions and their Application 4.1

Power Measurements 4.2

Test Scenarios for Inner Loop TPC 4.4

Measurement Menu (Power) 4.6

Test Settings 4.7

Measurement Results 4.11

Maximum Power, Minimum Power, Off Power 4.11

Inner Loop TPC 4.13

Change of TFC Measurement 4.16

P/Slot Table 4.18

On/Off Time Mask 4.22

Measurement Configurations (Power Configuration) 4.25

Measurement Control (Power Configuration – Control) 4.25

Tolerance Values (Power Configuration – Limits) 4.35

Modulation Measurements 4.40

Measurement of Modulation Parameters 4.40

Uplink WCDMA Signal 4.44

QPSK Measurements (Modulation – QPSK) 4.46

Test Settings 4.46

Measurement Results 4.50

Scalar Results (Overview) 4.50

Test Diagrams (EVM, Phase Error, Magn. Error) 4.51

Display of the Modulation Vector (I/Q Analyzer) 4.53

WCDMA Measurements (Modulation – WCDMA) 4.56

Test Settings 4.57

Measurement Results 4.60

Scalar Results (Overview) 4.60

Test Diagrams (EVM, Phase Error, Magn. Error) 4.62

Display of the Modulation Vector (I/Q Analyzer) 4.63

PRACH Preamble Quality Measurement 4.64

PRACH Preamble Quality Measurement Results 4.65

Phase Discontinuity Measurement 4.66

Phase Discontinuity Measurement Results 4.66

Measurement Configurations (Modulation Configuration) 4.68

Measurement Control (Modulation Configuration – Control) 4.69

Tolerance Values (Modulation Configuration – Limits) 4.72

Spectrum Measurements 4.75

Measurement Menu (Spectrum) 4.77

Test Settings 4.77

Measurement Results 4.79

ACLR Filter Measurement 4.79

ACLR FFT/OBW Measurement 4.81

Emission Mask Measurement 4.84

Measurement Configurations (Spectrum) 4.87
Measurement Control (Spectrum Configuration – Control) 4.87
Emission Mask (Spectrum Configuration – Limit Lines) 4.89
Tolerance Values for ACLR and OBW (Spectrum Configuration – Limits)....4.94
Selection of Measurement Points (Spectrum Configuration – Meas. X)....4.97

Code Domain Power Measurements 4.98

CDP vs. Time Measurement 4.99

Measurement Menu (Code Domain Power)....4.102
Test Settings 4.103
Measurement Results 4.106
CDP/Code Auto and CDP/Code Rho Auto....4.106
CDP/Code Manual and CDP/Code Rho Manual....4.108
CDP vs. Time 4.110

Measurement Configurations (Code Domain Power) 4.113
Measurement Control (Code Domain Power Configuration – Control)....4.113
Tolerance Values (Code Domain Power Configuration – Limits) 4.115

Receiver Quality Measurements 4.118

Test Loops for BER, BLER and DBLER Tests....4.120

BTFD and FDR (Signalling only) 4.123
Statistical Receiver Quality Tests....4.124

Main Menu (Receiver Quality)....4.127
Test Settings 4.128
Measurement Results 4.129
BER Results 4.129
UE Report (Signalling only) 4.132

Measurement Configurations (Receiver Quality Configuration)....4.136
Measurement Control (Receiver Quality Configuration – Control)....4.136
Upper Limits for Bit Error Rate (Receiver Quality Configuration – Limits) 4.141

Audio Measurements 4.142

Connection Control (Non Signalling) 4.143

Analyzer Settings (Connection Control – Analyzer)....4.143
Panel Oriented Version 4.143
Table Oriented Version 4.145

Generator Settings (Connection Control – Generator)....4.147
Downlink Channels and Synchronization 4.148
Panel Oriented Version 4.151
Table Oriented Version 4.155
Code Conflict Handling for WCDMA DL Generator 4.167
Aux TX Signal 4.169
Signal Configuration 4.170
RF Connector Settings 4.171

Uplink Signal (Connection Control – UE Code)....4.171

RF Connectors (Connection Control – RF Connectors)....4.177
Frequency-Dependent External Attenuation 4.179

Reference Frequency (Connection Control – Sync.)....4.182

Trigger (Connection Control – Trigger) 4.184
HS-DPCCH Trigger 4.187
Trigger Offsets for TX Measurements 4.190
I/Q-IF Interface (Connection Control – I/Q-IF) 4.191

Connection Control (Signalling) 4.194

Connection – State Signal Off (CS) 4.196
Connection – State Signal On (CS) 4.198
Connection – State Registered (CS) 4.199
Connection – State Alerting (CS) 4.201
Connection – State Connected (CS) 4.202
Connection – RF Channel and Power 4.208
Connection – SMS 4.211
Packet Switched (PS) Connections 4.212
Parameters for Packet Switched Connections 4.216
Handover to GSM (Connection Control – Handover) 4.220
Handover – Destination Selection 4.221
Handover – GSM Prepare Session 4.221
Inter-Band Handover 4.225
Activation of WCDMA Cell during GSM Operation 4.226
Uplink Signal (Connection Control – UE Signal) 4.227
Gain Factors for the UE Signal 4.233
Downlink Signal (Connection Control – BS Signal) 4.236
TPC Settings 4.247
Segmented TPC Test Patterns 4.253
Compressed Mode Configuration 4.254
Downlink Power Control 4.260
WCDMA Signal Levels for TX and RX Tests 4.262
Channel Powers for Non-HSDPA Test Cases 4.264
Channel Powers for HSDPA Test Cases 4.265
Network Parameters (Connection Control – Network) 4.268
RF Connectors (Connection Control – AF/RF) 4.279
Reference Frequency (Connection Control – Sync.) 4.281
Trigger (Connection Control – Trigger) 4.281
Trigger Output at AUX3 ....4.286
I/Q-IF Interface (Connection Control – I/Q-IF) 4.288
Analyzer Settings (Connection Control – Analyzer) 4.288
Display Control (Connection Control – Misc.) 4.289

4 Functions and their Application

This chapter provides detailed information on the measurement and configuration menus defined in the WCDMA UE function groups. It is organized like a typical measurement session including the following stages:

1. Measurement menus *(Power, Modulation, Spectrum, Code Domain Power, Receiver Quality):* purpose and principle of the measurements and relation to conformance test specifications, description of measurement results, specific measurement configurations. The measurements are largely analogous in Non Signalling and Signalling mode. Menu examples are taken from Non Signalling mode; differences between both modes are pointed out through the text.
2. Global configurations in Non Signalling mode *(Connection Control)*
3. Measurements and global configurations in Signalling mode *(Connection Control)*

This reference chapter is thus organized according to the provided measurements and configurations (see graphical overview at the end of chapter 3). In contrast to chapter 6, *Remote Control – Commands,* general measurement configurations are relegated to the end of each section. The description of each softkey, select or input field is followed by the corresponding remote-control commands. Similarly, the description of the commands in chapter 6 also contains the corresponding menus of the user interface.

Each menu and each panel is briefly described first and then illustrated together with its call button. The menu functions are explained in the following way:

Softkey	Short function definition
Designation of select/input field	Definition of field function. Further description of the field: purpose, interaction with other settings, notes... *Parameter 1* Description of parameter 1 *Parameter 2* Description of parameter 2 ... Further description of the parameters: purpose, interaction with other settings, notes...
Remote control	`Remote-control command (long form) Parameter1 | Parameter2 ...`

For all numerical values, including their ranges and default settings, please refer to the description of the remote-control commands in chapter 6.

The description of the operating concept is to be found in chapter 3 of the operating manual for the CMU200/CMU300 basic instrument. Besides, a description of measurement control and the essential settings and an overview of the most important menus is given at the end of chapter 3 in the present WCDMA manual. A comprehensive index listing important keywords and the proper names of all menus, dialog elements and softkeys is appended to the end of this manual.

Power Measurements

The menu group *Power* comprises the functions for measuring the power of the received RF carrier signal and testing the inner loop power control. The results are displayed in the measurement menu *Power,* the popup menu *Power Configuration* is used for configuration of the measurements.

WCDMA Power Control

In CDMA networks, control of the UE transmitter power is essential to ensure stable transmission and an efficient radio resource management within the system. Generally speaking, an output power of the UE transmitter that is too low decreases the coverage area while an excess output power may cause interference to other channels or systems. Both effects decrease the system capacity.

The *Power* measurement group is used to determine the peak output power of the UE *(UE Power (Peak)),* i.e. the Peak Envelope Power (PEP) of the WCDMA signal and the output power averaged over the transmit slot *(UE Power (RMS))*. The PEP is usually a few dB higher than the RMS-averaged WCDMA signal power; the level difference is termed crest factor. Both the *UE Power (Peak)* and the *UE Power (RMS)* can be measured under various operating conditions of the UE and the tester. The operating conditions correspond to the five power *Applications* that can be selected on the CMU:

Maximum Power

In the *Maximum Power* application, the tester commands the UE to transmit at its maximum power control level by continuously sending Up power control commands to the UE. When the maximum power control level is reached, the UE output power is measured and averaged over the whole transmit slot (666.7 µs).

The *Maximum Power* is measured with a wide-band filter with a bandwidth >5 MHz.

Minimum Power

In the *Minimum Power* application, the tester commands the UE to transmit at its minimum power control level by continuously sending Down power control commands to the UE. When the minimum power control level is reached, the UE output power is measured and averaged over the whole transmit slot (666.7 µs).

The *Minimum Power* is measured with a wide-band filter with a bandwidth >5 MHz.

OFF Power

In the *OFF Power* application, the UE transmitter is set to the transmit OFF power state where it does not transmit except during uplink compressed mode. The OFF power (leakage power) is measured as the maximum power within the transmit channel bandwidth while the transmitter is off (i.e. excluding any transitory periods). This power is averaged over the whole transmit slot (666.7 µs).

The *OFF Power* measurement is performed on the carrier frequency of the transmit channel with a filter that has a RRC filter response with a roll-off α = 0.22 and a bandwidth equal to the chip rate (3.84 MHz).

Inner Loop TPC

In the *Inner Loop TPC* application, the UE transmitter is set to change its output power with a step size of 1 dB, 2 dB, or 3 dB (3 dB in Non Signalling mode only). Depending on the transmit power control algorithm used, power steps may occur after each slot or after groups of 5 slots only. The UE power level is averaged over the transmit slot minus a guard period of 25 µs at the beginning and at the end of the slot and the power step error is measured in a variable number of consecutive slots. A limit check on the power step errors taking into account the minimum and the maximum power thresholds is performed in addition.

The *Inner Loop TPC* measurement is performed on the carrier frequency of the transmit channel with a wide-band filter with a bandwidth >5 MHz.

P/Slot Table

In the *P/Slot Table* application, the RMS UE transmitter power can be measured in up to 100 consecutive or equidistant slots. *P/Slot Table* is a real-time measurement that was primarily designed for quick evaluation of power steps of the UE transmitter over a wide dynamic range (see also the application example reported in Chapter 2).

The *P/Slot Table* measurement is performed on the carrier frequency of the transmit channel with a wide-band filter. The accuracy of all *Power* measurements is quoted in the data sheet.

On/Off Time Mask

The *On/Off Time Mask* measurement provides the UE power during the UE's random access procedure. The measurement can be used to analyze any of the PRACH preambles transmitted when the UE initiates a registration or when a connection is set up and calculate the power steps between consecutive preambles.

	The *On/Off Time Mask* measurement not available in *Non Signalling* mode. For an application example refer to Chapter 2.
Openloop Power	The openloop power measurement provides the power of the first PRACH preamble transmitted when the UE initiates a registration or when a connection is set up. The openloop power measurement is not available in *Non Signalling* mode and not treated as an application of the *Power* menu. It is controlled in the *Connection* tab of the *Connection Control* menu; see section *Connection – RF Channel and Power.*
NPOWer	An additional fast power measurement is available in remote control; see description of `NPOWer` commands in Chapter 6.
R&S Smart Alignment	*R&S Smart Alignment* (option R&S CMU-K47) is a supplementary software option extending the WCDMA UE network test options. The option has been designed for fast UE transmitter and receiver adjustments (TX and RX calibrations) in *Non Signalling* mode over a wide range of channels and powers. To enable parallel UE transmitter and receiver tests, the R&S CMU can simultaneously change its generator and analyzer settings after equal time periods (step widths) of 3 to 60 slots. Option *R&S Smart Alignment* is described in Chapter 9 of this manual.

Important Note 1: OFF Power

At present, the CMU is not able to command the UE to enter its transmit OFF state. This must be reached by other means before selecting a Power *application.*

Important Note 2: Maximum Power, Minimum Power

By default, the CMU changes its TPC pattern to command the UE to transmit at maximum or minimum power as soon as the corresponding power application is initiated. Alternatively, it is possible to deactivate automatic power setting in order to set the UE power manually; see TPC *parameter in section Measurement Control (Power Configuration – Control)* on p. *4.25. It is also possible to change the TPC pattern sent to the UE while the power application is active, e.g. to test the drift of the UE transmitter.*

Important Note 3: Inner Loop TPC

To achieve correct Inner Loop TPC *results, it is necessary to stimulate the UE to perform power steps, to adjust the CMU test settings to the UE signal and to use an appropriate trigger. Possible test setups are listed in section Test Scenarios for Inner Loop TPC on p.* 4.3*.*

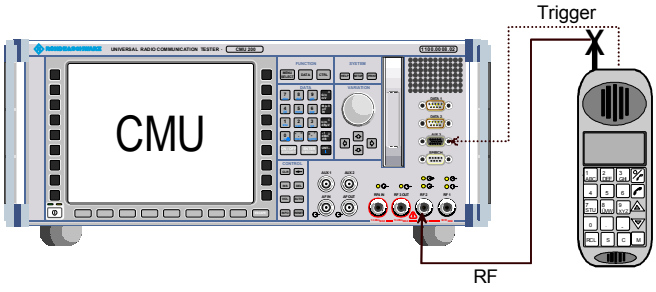
Important Note 4: P/Slot Table

The P/Slot Table measurement requires an external trigger with a correct timing; see Fig. 4-12 on p. 4.34*. Ideally the UE provides an external trigger signal that is correlated to its power steps to be measured. If no such external trigger is available the measurement can be performed with the internal frame trigger provided by the DL generator.*

Test Scenarios for Inner Loop TPC

An *Inner Loop TPC* measurement can be performed in different ways. The following scenarios are intended as a short introduction; all test settings are explained in detail in the following sections.

Scenario 1: Independent UE under test

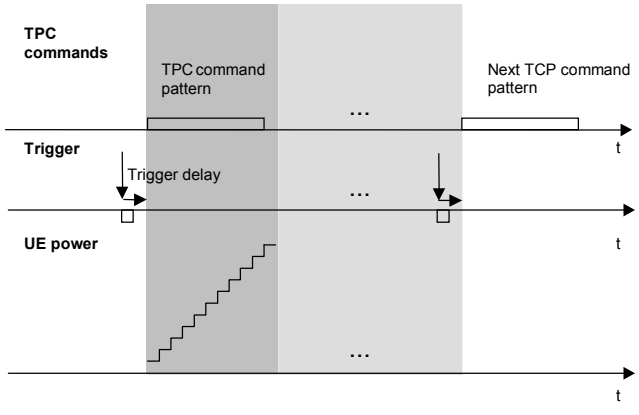


The UE receives a TPC command pattern (to be set internally or by external means) and is stimulated to perform power steps, obeying the rules described below. The CMU test settings are set to comply with the expected RF signal from the UE *(TPC command pattern, TPC Mode, Step Size).*

- If the *TPC Mode* at the CMU is set to *Off*, the TPC command pattern may be arbitrary (unknown) but the UE must change its power after each slot. The measurement can be performed in *Free Run* mode, or an *External* trigger from the UE can be used.
- If the *TPC Mode* is set to *Algorithm 1* or *Algorithm 2*, the UE must provide a TPC command pattern that is periodic in time and a periodic external trigger signal *(Trigger Source = External).*

External trigger settings:

The figure below illustrates the way a measurement is performed and the trigger timing. The dark shaded area corresponds to the measured and displayed time range (section A, integer number of slots). The light shaded area shows the time elapsed until the start of the next measurement cycle (including section B, if it is activated).

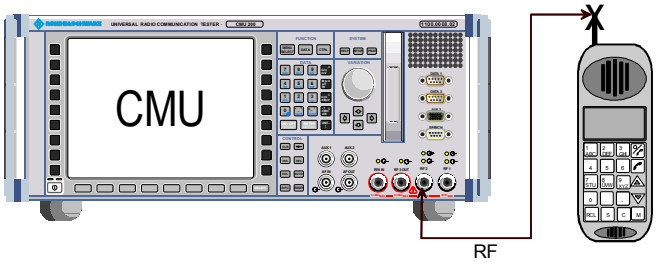


An external trigger can be set as follows:

- The trigger signal must be related to both the periodic UE signal and the start of the measurement (section A).
- The CMU is capable of compensating for a possible delay between the trigger time in the UE signal and the start of section A; see *Trigger Delay* in section *Trigger (Connection Control – Trigger)* on p. **4.184**.

Note the *Rules for UE power steps and TPC commands* below.

Scenario 2: Synchronization via RF Generator (with Option CMU-K66)



The CMU's internal RF generator synchronizes the UE under test and triggers the measurement *(Trigger Source = Internal).* It also transfers the TPC command pattern to the UE. The internal trigger signal is a TPC trigger: The trigger time coincides with the beginning of the TPC profile of the UL signal (see description of internal trigger in section *Trigger (Connection Control – Trigger)* on p.

4.184. The UE is stimulated to perform power steps, using the TPC command pattern received and obeying the rules described below. The CMU test settings are set to comply with the expected RF signal from the UE *(TPC Mode, Step Size)*.

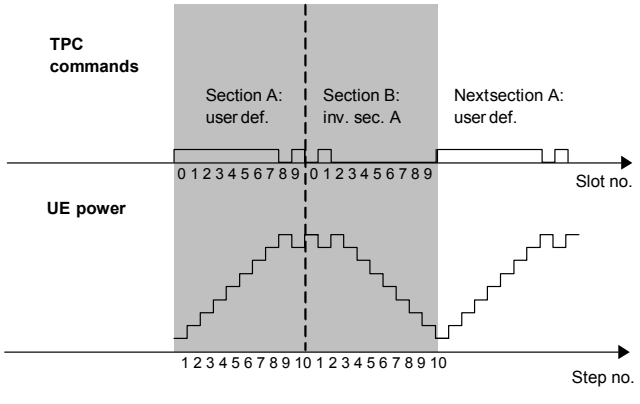
- Use of *TPC Mode = Off* at the CMU is possible but typically used in test scenario 1 where no TPC command pattern is transferred.
- *TPC Mode = Algorithm 1* or *Algorithm 2* is set at the CMU and at the UE. In contrast to scenario 1, no external trigger is required.

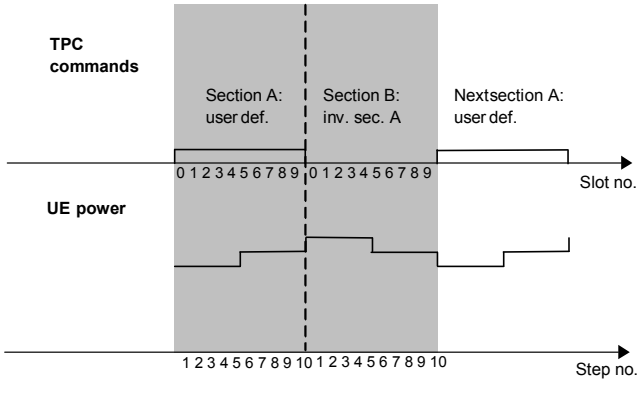
Note: *In the* Inner Loop TPC *measurement with internal trigger, the timing is exclusively determined by the TPC trigger time and the trigger delay parameters* (Slot Delay + Delay Offset). *In contrast to other measurements the CMU does not perform a correlation analysis to exactly pin down the beginning of the UL slot (see Fig. 4-72 on p. 4.170). The accuracy of the (corrected) trigger time must be «25 µs to ensure that the measurement range is actually confined to the central domain of the slot (see Fig. 4-11 on p. 4.33).*

Synchronized Inner Loop TPC measurements can be performed in Non Signalling and in Signalling mode.

Rules for UE power steps and TPC commands

The UE test settings must not conflict with the measurement settings and algorithms of the CMU. The following few rules will help to avoid trouble, especially if the UE under test is operated according to test scenario 1 or if section B is switched on.





1. In the *TPC Mode = Algorithm 1* setting the CMU expects the TPC command pattern to be symmetric in time and inverted in sections A and B of the test diagram. The resulting power ramp is symmetric in time. The section A and section B patterns must follow each other without a time gap.

   (Let the total number of TPC commands per section be N (N = 7 or 10). Then a TPC command 1 in slot no. n of section A implies a TPC command 0 in slot no. N – n in section B and vice versa. This condition can be ignored if section B is switched off.)

2. In the *TPC Mode = Algorithm 2* setting the output power can be changed after each 5th slot only. The number of commands in the TPC command pattern must be a multiple of 5. The start of each pattern must be aligned to slot 0, 5, or 10 of any frame. To obtain a symmetric UE power ramp from a symmetric TPC pattern, one of the following conditions must be met:
   - Section A and B contain 10 power steps each (see figure on the left side).
   - The TPC command pattern is such that the UE power is constant over both sections (0 dB power steps only).

3. In the *TPC Mode* = *Algorithm* 1 or *Algorithm 2* settings the TPC command pattern used by the UE must be repeated periodically in time if the measurement is to be made in *Continuous* mode. An alternative is a measurement with a single TPC pattern transferred to the UE *(TPC Pattern Type* = *Single Pattern + All 0/Single Pattern + All 1/Single Pattern +Alternating; see* Table 4-27 on p. 4.249) and (preferably) section B switched off.
4. The TPC command pattern may be longer than the number of slots measured, however, the residual part of the pattern must not effectively change the UE output power between the last slot measured and the first slot of the next measurement cycle. Otherwise subsequent measurements will be performed at increasing or decreasing power levels.

Measurement Menu (Power)

The *Power* measurement menu shows the results of the *Power* measurement.

- The measurement control softkey *Maximum Power* (which changes to *Minimum Power*, *OFF Power* etc., depending on the power measurement application selected) controls the *Power* measurement, indicates its status *(RUN | HLT | OFF)*, and opens the configuration menu *Power Configuration*. The hotkeys associated with the measurement control softkey define the scope of the *Power* measurement.
- The other softkeys to the right of the test diagram are combined with various hotkeys (e.g. the hotkeys *RF Channel, RF Frequency,* and *RF Frequ. Offset* are associated with the softkey *Analyzer Settings)*. If a softkey is selected and an associated hotkey pressed, a popup window will appear which indicates the current setting and enables an entry.

The measurement menu *Power* can be accessed from any other measurement menu of the WCDMA UE function group using the *Power* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).

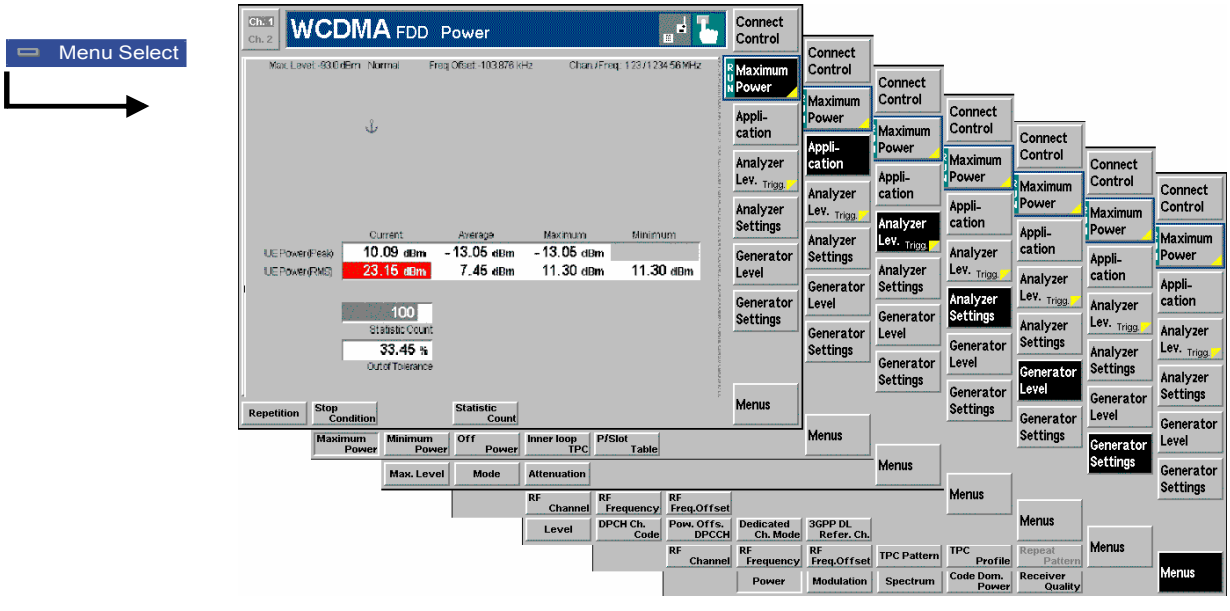


Fig. 4-1 Measurement menu Power

Test Settings

The basic settings for the *Power* measurement are directly accessible from the measurement menu via softkey/hotkey combinations. If a softkey is selected and an associated hotkey is pressed, a popup window will appear which indicates the current setting and enables an entry.

Example:

Analyzer Settings

The *Analyzer Settings* softkey displays a hotkey bar including the hotkey *RF Channel*.

RF Channel

The *RF Channel* hotkey defines the WCDMA channel number of the analyzed RF signal.

Input windows indicate the current parameter value (in this case: the WCDMA channel number of the analyzed RF signal) or a list of possible settings. Parameters are changed by

- Overwriting/incrementing numerical values (for numeric parameters)
- Selecting from the list of parameters (for select parameters)

Many of the basic settings are also accessible from the *Power Configuration* popup menu. They are explained in more detail in the *Measurement Configurations (Power Configuration)* section on page 4.25. All softkeys and hotkeys in the *Maximum Power* application are shown in Fig. 4-1 above.

Maximum Power

The *Maximum Power* softkey controls the maximum power measurement and indicates its status *(RUN | HLT | OFF)*. This softkey changes to *Minimum Power* or *OFF Power,* or *Inner Loop TPC*, depending on the power measurement application selected; see *Application* softkey below.

The measurement status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status of the measurement is unaffected upon switchover to other menus controlling a *Power* measurement; however, a running measurement is restarted.

Remote control

```
INITiate:POWer:<Application>
ABORt:POWer:<Application>
STOP:POWer:<Application>
CONTinue:POWer:<Application>
```

Measurement configuration

Pressing the Maximum Power softkey twice opens the popup menu Power Configuration (see page 4.25). Besides, hotkeys defining the scope of the measurement are associated with the *Maximum Power* softkey. The settings are also provided in the Control tab of the Power Control menu and described in section *Measurement Control (Power Configuration – Control)* on page 4.25). Some of them are not available for all applications.

Application

The *Application* softkey sets the operating condition of the UE where the Power measurement is performed. For a detailed description see background information in section *Power Measurements* on p. 4.2.

The alternative measurements (applications) are displayed in different measurement menus. When an application is selected, the corresponding measurement menu is called up. The configuration settings for all applications, however, are listed in a common popup menu (see p. 4.25).

Maximum Power

The *Maximum Power* hotkey selects the measurement of the maximum power the UE is able to transmit.

Remote control
The *Maximum Power* application is selected by the keyword `:MAXimum` in the 3rd level of the `POWer` commands, e.g. `CONFigure:POWer:MAXimum...`

Minimum Power

The *Minimum Power* hotkey selects the measurement of the minimum power the UE is able to transmit.

Remote control
The *Minimum Power* application is selected by the keyword `:MINimum` in the 3rd level of the `POWer` commands, e.g. `CONFigure:POWer:MINimum...`

OFF Power

The *OFF Power* hotkey selects the measurement of the maximum output transmit power within the channel bandwidth when the transmitter is OFF.

Remote control
The *OFF Power* application is selected by the keyword `:OFF` in the 3rd level of the `POWer` commands, e.g. `CONFigure:POWer:OFF...`

Inner Loop TPC

The *Inner Loop TPC* hotkey selects the Inner loop Transmit Power Control measurement.

Remote control
The *Inner Loop TPC* application is selected by the keyword `:ILTPc` in the 3rd level of the `POWer` commands, e.g. `CONFigure:POWer:ILTPc...`

P/Slot Table

The *P/Slot Table* hotkey selects the measurement of the RMS power of the UE in up to 100 slots, displayed in a table.

Remote control
The *P/Slot Table* application is selected by the keyword `:XSLot` in the 3rd level of the `POWer` commands, e.g. `CONFigure:POWer:XSLot...`

On/Off Time Mask

The *On/Off Time Mask* hotkey selects the measurement of the UE power during the UE's random access procedure.

Remote control
The *On/Off Time Mask* application is selected by the keyword `:ONOFf` in the 3rd level of the `POWer` commands, e.g. `CONFigure:POWer:ONOFf...`

Analyzer Level Trigg.

The *Analyzer Level/Trigger* toggle softkey controls the level in the RF input signal path and provides the trigger settings for the *Power* measurement. Pressing this softkey repeatedly toggles between the input level and the trigger settings

The input level settings are described in more detail in section *Analyzer Settings (Connection Control – Analyzer)* on p. 4.143.; the trigger settings in section *Trigger (Connection Control – Trigger)* on p. 4.184.

Analyzer Settings

The *Analyzer Settings* softkey determines the frequency of the RF signal analyzed. The *RF Channel* and *RF Frequency* settings override each other according to the definition of the WCDMA channels. The analyzer settings and the WCDMA channel structure are described in more detail in section *Analyzer Settings (Connection Control – Analyzer)* on p. 4.143.

UE Code
Ana. Sett.

The *UE Code* softkey defines properties of the multiple uplink WCDMA signal that the CMU analyzes to test the *Inner Loop TPC*. This softkey is available only if application *Inner Loop TPC* is selected.

For a description of the WCDMA signal see background information in section *WCDMA Measurements (Modulation – WCDMA)* on page 4.56 f. More *UE Code* settings are accessible via the *UE Code* tab of the *Connection Control* menu; see section *Uplink Signal (Connection Control – UE Code)* on p. ***4.171***. The *Inner Loop TPC* measurement fails if the input signal does not conform to the *UE Code* settings.

If pressed once again, the selected *UE Code* softkey changes to the *Analyzer Settings* softkey, see above.

Generator Level

The *Generator Level* softkey (with option CMU-K66, *WCDMA (3GPP/FDD, DL) Generator*, only) configures the downlink Dedicated Physical Channel (DPCH) in the RF generator signal and sets the levels of all physical channels including the OCNS and AWGN contributions. The generator settings are described in more detail in section *Generator Settings (Connection Control – Generator)* on p. *4.147*.

Generator Settings

The *Generator Settings* softkey (with option CMU-K66, *WCDMA (3GPP/FDD, DL) Generator*, only) determines the frequency of the generated RF carrier signal and the TPC pattern. The generator settings are described in more detail in section *Generator Settings (Connection Control – Generator)* on p. *4.147*. *TPC Pattern Config.* opens a popup menu to define the *Transmit Power Control (TPC)* information transmitted on the DPCH.

Marker
Display

The *Marker/Display* softkey positions up to 3 markers in the test diagram and displays their values.

If pressed once again, the selected *Marker/Display* softkey changes to the *Display/Marker* softkey, see below. Both softkeys are only available in the *Inner loop TPC* application where a two graphical diagrams are displayed.

Markers — The markers are graphical tools for marking points on the measurement curve and for numerical output of measured values. The measurement menu *Power* provides a reference marker and two additional absolute markers for each of the two diagrams.
The coordinates of the three markers are indicated in the format Ordinate value (absolute or relative power) / abscissa value (slot no.) in a parameter line above the test diagram. The position of the reference marker is expressed in absolute units (absolute power in dBm, relative power in the lower diagram in dB and time in bits), the delta marker by absolute or relative values (relative power in dB or time differences from the reference marker).

Ref R

The hotkey *Ref. R* switches the reference marker on or off (use the *ON/OFF* key).

The reference marker is represented by the symbol R in the test diagram. The marker position (abscissa) is defined in the input field *Ref. Marker R*. The marker is switched off in the default setting *(Off)*. The marker value represents the measurement result at the marker position. The position of all markers can be varied using the roll-key.

Remote control
No command, screen configuration only.

Abs. 1

The *Abs. 1 (2)* hotkeys switch marker 1 (2) on or off (use the *ON/OFF* key). The marker 1 (2) is represented by the symbol 1 (2) in the test diagram. If configured as an absolute marker, it is equivalent to the reference marker.

The toggle switch *Marker* pops up when the hotkey is pressed for the second time. It defines whether the position of marker 1 is measured and indicated in *absolute* units or *relative* to the reference marker. Selecting *relative* changes the hotkey labeling into *Rel. 1 (2)*.

Remote control
No command, screen configuration only.

UE P. Error

The *UE P. / Error* toggle switch activates the marker settings for either the upper *(UE Power)* or the lower *(Power Step)* diagram.

Remote control
No command, screen configuration only.

Display
Marker

The *Display/Marker* softkey scales the axes and provides further display configurations for the *Inner Loop TPC* diagrams. It is activated by pressing the *Marker/Display* softkey twice. If pressed once again, the selected *Display/Marker* softkey changes back to the *Marker/Display* softkey, see above.

All *Display/Marker* settings are explained in more detail in section *Measurement Control (Power Configuration – Control)* on p. 4.25.

Menus

The *Menus* softkey displays the hotkey bar for changing to the other measurement groups. Pressing a hotkey directly opens the main measurement menu within the corresponding measurement group.

Measurement Results

The values shown in the *Power* measurement menu can be divided into three groups:

- Settings
- Single measurement results (referred to as scalar values in remote control; see Chapters 5 and 6)
- Curves and bar graphs plotted in diagrams as a function of time (referred to as arrays in remote control)

The measurement menus for the three applications *Max. Power, Min. Power*, and *Off Power* are analogous. They show scalar UE power results but no graphical diagram. The *Inner Loop TPC* and *ON/Off Time Mask* menus contain diagrams to show the UE power and the power steps in a sequence of slots or preambles. The *P/Slot Table* menu contains a table to display the (scalar) RMS powers in up to 100 slots.

Maximum Power, Minimum Power, Off Power

The three measurement menus for the applications *Maximum Power, Minimum Power,* and *OFF Power* contain a parameter line, an output table, and two additional output fields. Except for the minimum of the *UE Power (RMS),* the results in the three applications are analogous.

Parameter line

Output table

Output fields

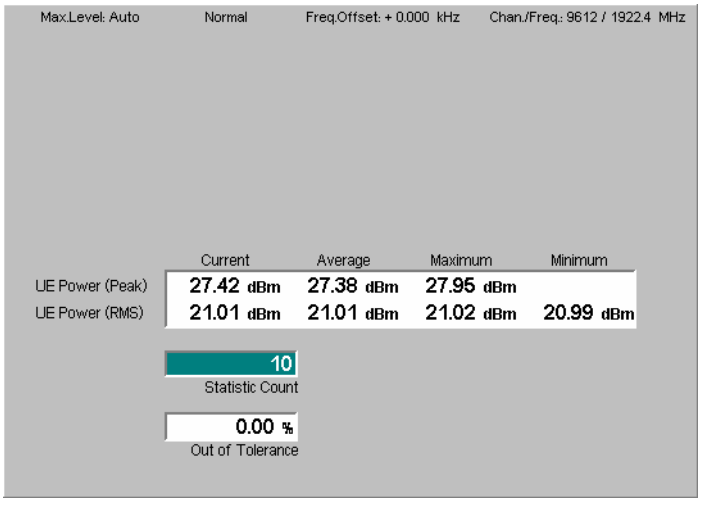


Fig. 4-2 Display of results (Maximum Power)

Test settings

The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.9) are indicated in a parameter line across the top of the measurement menu:

Max. Level	Maximum expected input level in dBm
Attenuation	Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal WCDMA channel frequency
Chan./Freq.	RF channel measured and associated nominal carrier frequency

The output fields below the table contain the following settings:

Statistic Count Number of slots per statistics cycle as set in the *Control* tab of the *Power Configuration* menu; see p. 4.25. The colored bar indicates the relative progress of the measurement within the statistics cycle.

Remote control
Settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Scalar measurement results

The quantities in the output table are measured for consecutive slots. The results of the current slot are entered in the first table column. From the *Current* results, the *Average* referenced to a statistics cycle (see averaging rules in Chapter 3, section *General Settings)* and the *Maximum* and *Minimum* of all values determined in the current measurement is calculated. The *Current* results are measured as follows:

UE Power (Peak) Maximum output power of the UE transmitter within the transmit slot

UE Power (RMS) Output power of the UE transmitter averaged over the whole transmit slot (666.7 µs)

The measurements are done with the filter settings quoted in section *Power Measurements* on p. 4.2.

Note: *A* Minimum *value that is clearly distinct from the noise floor can be expected for* Maximum Power *measurements only. In the* Maximum Power *test, both upper and lower limits are specified in 3GPP. Excess power causes the increase of interference to other code channels, and less power causes the degradation of the own code channel. In the two other applications, a small power is desirable, so no lower limits are specified and the* Minimum *column of the output table is omitted.*

In addition, the following scalar result is indicated:

Out of Tolerance Relative number of slots that are out of the tolerances defined by the limits.

Limit Check

A red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Power Configuration* menu, see p. 4.35.

Remote control

```
READ[:SCALar]:POWer<Application>?
CALCulate[:SCALar]:POWer<Application>:MATChing:LIMit?
FETCh[:SCALar]:POWer<Application>?
SAMPle[:SCALar]:POWer<Application>?
```

Inner Loop TPC

The results in the *Inner Loop TPC* measurement menu are displayed in two parameter lines, two diagrams, and various output fields.

Parameter line

Output table

Output fields

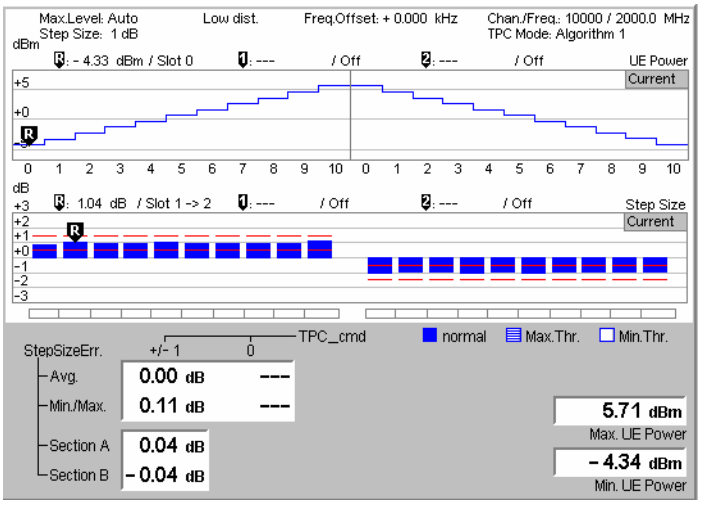


Fig. 4-3 Display of results (Inner Loop TPC)

Test Settings/ Scalar results

Scalar measurement results and settings are indicated in the two parameter lines above the test diagram and in the output table below.

1st parameter line

The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.9) are indicated in a parameter line across the top of the measurement menu:

Max. Level	Maximum expected input level in dBm
Attenuation	Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal WCDMA channel frequency
Chan./Freq.	RF channel measured and associated nominal carrier frequency

2nd parameter line

The second parameter line contains *Inner Loop TPC* test settings defined in the configuration menu (see section *Measurement Control (Power Configuration – Control)* on p. 4.25):

Step Size	Transmitter output power step size (inner loop power step)
TPC Mode	Algorithm for processing TPC commands

Remote control
Settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Upper diagram: UE Power

The upper diagram in the *Inner Loop TPC* measurement menu contains two sections (termed A and B). In each section, the average transmitter output power of the UE is displayed in 8 or 11 consecutive slots, depending on the *Profile Length* settings (slot no. 0 to n where n is the *Profile Length*; see p. 4.28). The UE power is averaged over the measured slots, not including the transient duration, which is from 25 µs before the slot boundary to 25 µs after the slot boundary.

The measurement in section B can be switched on or off to meet the particular requirements of a measurement task (see *Section B Analysis* on p. 4.29, note in

particular the trigger conditions for section B). Unless the *TPC Mode* is set to *Off* or only a single shot measurement is made, the TPC command pattern determining the UE power steps (see *Step Control* on p. 4.31) must be periodic and repeat without gaps. Although section B is measured in a second cycle, it is expected to be directly adjacent to section A. The TPC commands in section A and B must be symmetric. The symmetry of the diagram depends on the power control algorithm; for details refer to section *Test Scenarios for Inner Loop TPC* on p. 4.3.

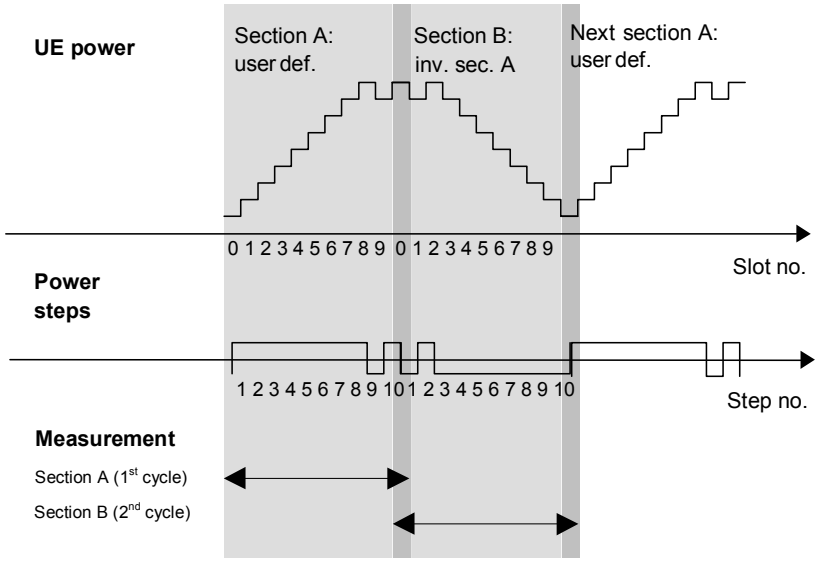


Fig. 4-4 Display of UE power and power steps

In the UE power diagram, the last slot (slot no. 7 or 10) of section A in the first measurement cycle corresponds to the first slot (slot no. 0) of section B in the second cycle. Up to the delay between the first (section A) and the second (section B) measurement cycle, both sections are measured and displayed with a 1-slot overlap. The UE power in the overlapping slot must be identical unless the UE shows a power drift between the first and the second cycle. The time scale of a measurement with *Profile Length* = *10 Slots* is shown in Fig. 4-4 above. The repetition of the overlapping slot ensures a consistent representation of the UE power, the power steps (lower diagram) and their symmetry in both diagram sections.

The y-axis scale of the diagram is automatically adapted to the input power range. The results are in absolute (dBm) units.

Remote control

```
READ:ARRay:POWer:ILTPc:UEPower:CURRent?
FETCh:ARRay:POWer:ILTPc:UEPower:CURRent?
SAMPle:ARRay:POWer:ILTPc:UEPower:CURRent?
```

Lower diagram: Power Step

The lower diagram in the *Inner Loop TPC* measurement menu contains two sections (termed A and B). In each section, one of the quantities selected via *Step Analysis* (*Power Step, Abs. Power Step*, or *Power Step Error;* see p. 4.29) is displayed in 7 or 10 consecutive slots, depending on the *Profile Length* settings (see p. 4.28). To obtain the power steps, the UE power of the original slot is subtracted from the UE power of the target slot. The UE powers are measured according to the rules described above for the upper diagram.

The measurement in section B can be switched on or off to meet the particular requirements of a measurement task (see *Section B Analysis* on p. 4.29). The

symmetry of the diagram depends on the displayed quantities and the power control algorithm; for details refer to section *Test Scenarios for Inner Loop TPC* on p. 4.3.

The y-axis scale of the diagram is automatically adapted to the range of input values. The results are in relative (dB) units.

Remote control
```
READ:ARRay:POWer:ILTPc:STEP:CURRent?
FETCh:ARRay:POWer:ILTPc:STEP:CURRent?
SAMPle:ARRay:POWer:ILTPc:STEP:CURRent?
```

Limit Check (Power Step)

The pairs of horizontal red lines in the diagram represent the power step tolerances set in the *Limits* tab of the configuration menu; see section *Tolerance Values (Power Configuration – Limits)* on p. 4.35. If a limit is exceeded, the corresponding section of the bar across the bottom of the diagram turns red.

The legend *(normal, Max. Thr., Min. Thr.)* below the diagram refers to the *Max. Threshold* and *Min. Threshold* values set in the *Limits* tab:

- A hatched blue bar indicates that the current power step increases the UE power to a value above the *Max. Threshold*. The lower power step error limit is no longer valid so the lower limit line is erased.
- A white bar indicates that the current power step decreases the UE power to a value below the *Min. Threshold*. The upper power step error limit is no longer valid so the upper limit line is erased.
- A solid blue bar is displayed in all other cases. In particular, if the final UE power is in the range between *Min. Threshold* and *Max. Threshold*, both the lower and the upper power step error limits are checked.

Note: *The Step Analysis parameter (see p. 4.29) determines the displayed quantity and the diagram but does not affect the limit check. If* Abs. Power Steps *are displayed, a sign error (e.g. a power step of –1 dB following a TPC_cmd value of +1) does not show in the diagram* (Abs. Power Step = + 1 dB *and therefore below the default limit line), but is indicated in the bar across the bottom of the diagram.*

Remote control
```
CALCulate:ARRay:POWer:ILTPc:STEP:CURRent:MATCHing:LIMit?
CALCulate:ARRay:POWer:ILTPc:THReshold:CURRent:MATChing:LIMit?
```

Output Table: Power Step Err.

The output table below the diagram lists the *Power Step Error* as a function of the transmitter output power *Step Size* and as an average over half of the diagram width. This quantity is equal to the error in the inner loop power step, i.e. the difference between the average output power of the target slot and the average output power of the original slot. The nominal power step is equal to TPC_cmd times the *Step Size* (see also *Step Analysis* softkey on p. 4.29). TPC_cmd is derived from the TPC command settings transmitted to the UE *(Step Control)* according to the test algorithm *(TPC Mode);* see section *Measurement Control (Power Configuration – Control)* on p. 4.25.

Avg. — *Power Step Error* averaged over the (7 or 10, 14 or 20) power steps shown in sections A and B (if activated) of the lower diagram

Min./Max. — Extreme value (minimum or maximum, whichever has the larger absolute value) of the power steps shown in sections A and B (if activated) of the lower diagram

Section A — Accumulated power difference, i.e. the difference between the UE powers in the last and the first slot in section A of the upper

diagram

Section B Accumulated power difference, i.e. the difference between the UE powers in the last and the first slot in section B of the upper diagram

The *Section A* and *Section B* results provide the power step errors after 7 or 10 equal power steps; see *Table 4-5* on p. 4.36. The UE powers are measured according to the rules described above for the upper diagram.

Note: *In the TPC Modes* Off *and* Algorithm 1*, TPC_cmd can not be equal to zero. The corresponding output fields show invalid results ("---"). In the* Off *mode, where the intermediate power steps are generally not known in advance, the* Section A *and* Section B *results are also marked invalid.*

Additional Fields

The two output fields in the lower right part of the menu indicate the maximum output power *(Max. UE Power)* and the minimum output power *(Min. UE Power)* of the UE transmitter within the current measurement. Both values are averaged over a slot, not including the transient duration. This means that the output values correspond to the highest and the lowest power level indicated in the upper (UE Power) diagram.

Limit Check (Scalar Results)

In general, a red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Power Configuration* menu, see p. 4.35. The standard specifies two different types of limits for inner loop TPC power steps:

- The *Step individual* limits are indicated in the lower diagram; see above. No limit is specified and no limit check is performed for the *Avg.* and *Min./Max.* values.
- The *Step Section A/B* limits hold for the *Section A* and *Section B* values. The limit check requires that the UE performs 7 or 10 equal power steps in each section (all TPC_cmd values equal to –1, 0, or +1; see *Table 4-5* on p. 4.36) and that the UE power does not exceed the *Max. Threshold* or the *Min. Threshold*. If one of these condition is not met, no limit check will be performed.

Remote control

```
READ[:SCALar]:POWer:ILTPc:CURRent?
CALCulate[:SCALar]:POWer:ILTPc:CURRent:MATChing:LIMit?
FETCh[:SCALar]:POWer:ILTPc:CURRent?
SAMPle[:SCALar]:POWer:ILTPc:CURRent?
```

Change of TFC Measurement

The *Inner Loop TPC* application also supports *Change of TFC* measurements according to the conformance test specification 3GPP TS 34.121, section 5.6. The measurements are available in *Signalling* mode.

Test purpose

The purpose of the measurement is to verify the power steps of the UE caused by a changing data rate. More specifically, the UE is induced to transmit a discontinuous DPDCH1; the R&S CMU measures and compares the mean output power of the UE in slots where the DPDCH is on and where the DPDCH is off.

To generate the discontinuous DPDCH1, an RMC call with 50 % *DL Resources in Use* is set up, causing the UE to send data in every second DPDCH1 frame only. To prevent the power control mechanism from counterbalancing the induced power steps, a power control algorithm 2 with alternating TPC pattern is selected. The measurement is most conveniently triggered by a “Change of TFC” trigger,

causing a trigger event one slot before the beginning of the frame where the TFC change occurs.

Test procedure

1. From the *Menu Select* dialog, access the *WCDMA FDD – Signalling – Power – Inner Loop TPC* dialog.
2. Open the *Connection Control – BS Signal* tab and select *Circuit Switched – DCH (Dedicated Chn.) Type: RMC*.
3. Still in the *BS Signal* tab, select *Circuit Switched – RMC Settings – DL Resources in Use: 50 %*.
4. Still in the *BS Signal* tab, select *TPC Settings – Set 1 – Pattern Type: Alternating 0,1*.
5. Press 1/2 to access the second group of *Connection Control* tabs. Select *Trigger – Meas. Trigger – Source: Change of TFC*.
6. Switch on your UE and establish a circuit-switched connection.
7. Close the Connection Control dialog (if it is not closed automatically) and return to the *Power* measurement dialog.
8. Press *Inner Loop TPC – Measure Mode: Change of TFC* to activate the measurement.
9. If you wish to modify the limit settings, press *Inner Loop TPC* twice to open the *Power Configuration* dialog and select *Limits – Inner Loop TPC –Current – Change of TFC – Step Size 7 dB*.

Test procedure

The result of the *Change of TFC* measurement is displayed in the measurement dialog.

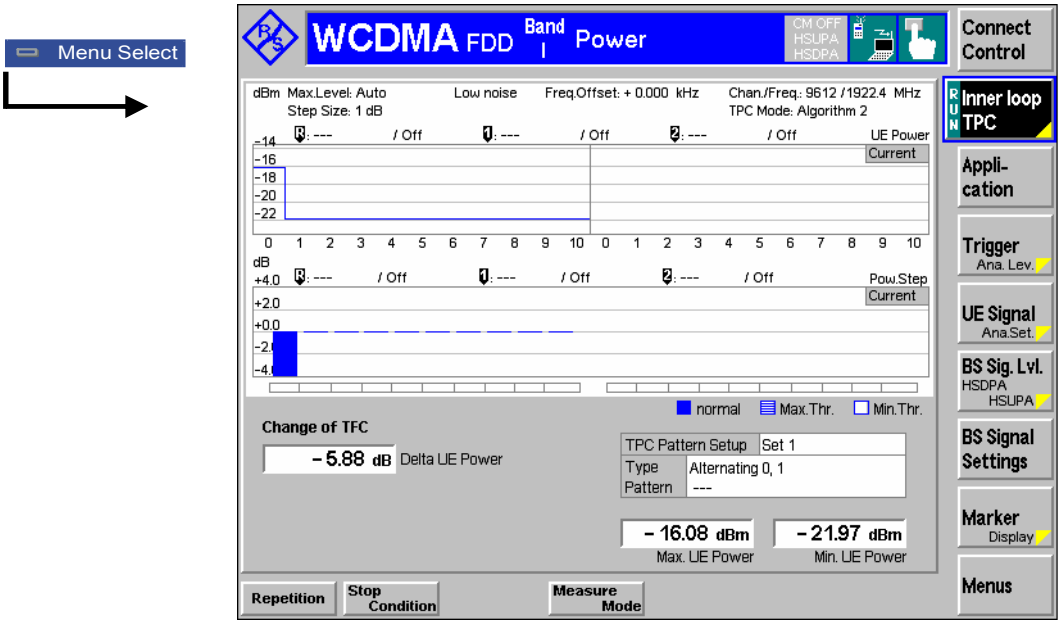


Fig. 4-5 Change of TFC test results

Diagrams

The *Change of TFC* results appear in the left half of the measurement diagram. The measurement extends over a 10-slot period, starting one slot before the DPCCH1 is switched on or off.

The UE Power, averaged over the center of the slots (excluding the 25 µs transient periods) is displayed in the upper diagram. The lower diagram displays the power steps between two consecutive slots. In the example above, the UE power of

approx. 16 dBm dropped by –5.88 dB when the DPDCH1 was switched off. The power step *(Delta UE Power)* and the minimum and maximum power in all ten slots measured *(Max. UE Power, Min. UE Power)* is displayed below the diagrams.

The right half of the diagrams is not used when the *Change of TFC* measurement is active.

The nominal size of the power control step is governed by the gain factors β_c and β_d. The default gain factors induce a step size of ±7 dB. Adjust the gain factors (Connection Control – UE Signal – UE Gain Factors – RMC – Uplink 12.2…) if you wish to test different step sizes. Note that the limit check range is not adjusted when the step size is varied.

Remote control

```
CONFigure:POWer:ILTPc:COTFc:CONTrol:MODE
CONFigure:POWer:ILTPc:COTFc:STEP:CURRent:LIMit[:SCALar]:
  SYMMetric[:COMBined]:VALue  .
READ[:SCALar]:POWer:ILTPc:COTFc:CURRent?  etc.
CALCulate[:SCALar]:POWer:ILTPc:COTFc:CURRent:MATChing:LIMit?
```

P/Slot Table

The *P/Slot Table* menu shows the average UE transmitter output power in up to 100 slots. The results can be displayed in a table or in a graph (2D chart).

Parameter lines

Output table

Additional output fields

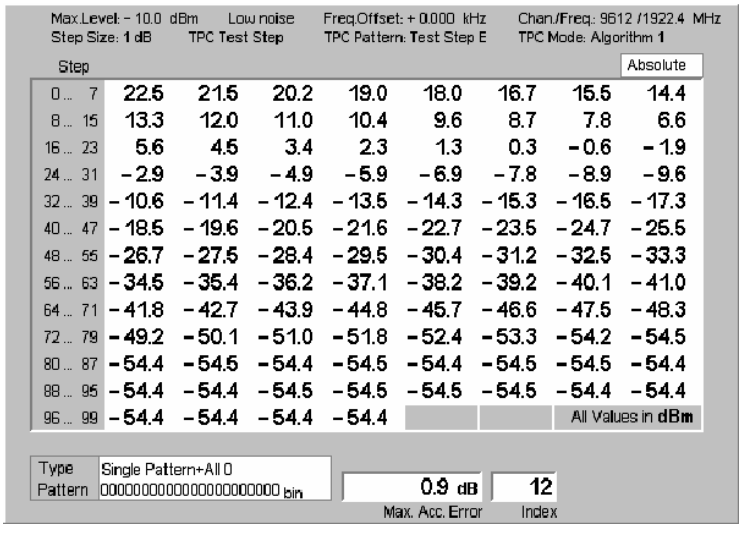


Fig. 4-6 Display of results (P/Slot Table)

Test settings

The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.9) are indicated in two parameter lines across the top of the measurement menu. The first parameter line is identical to the first parameter line of the test diagram in the *Maximum Power* application (see p. 4.11); the second line shows the *Transmit Power Control* (TPC) settings defined via *Generator Settings* (in *Non Signalling* mode) or *BS Signal Settings* (in *Signalling* mode). In addition the TPC pattern type and the pattern are shown below the output table.

Results (output tables)

The *P/Slot Table* application measures the average UE transmitter output power in up to 100 slots which may be consecutive or separated by up to 14 intermediate (skipped) slots. The average is taken over a section of the slot or over the whole slot minus 25 µs at the beginning an at the end of the slot.

The settings can be defined via hotkeys or in the *Control* tab of the *Power Configuration* menu; see p. 4.25. In this tab it is also possible to set the *Display Mode* in order to specify whether the table shows absolute powers or the differences between consecutive steps (in the latter configuration, the first result is not available and the *Absolute Power* of the first slot is displayed below the table).

The table displays up to 100 results at the same time (see *Step Count* parameter in section *Measurement Control (Power Configuration – Control)* on p. 4.25). If the *Step Count* is set to a number < 100, the table shows *Off* for all results that are not measured. To be consistent with the numbering of the timeslots within a frame, the *Step* count in the table starts from 0. Note, however, that the slots to be measured are exclusively determined by the trigger conditions (see description of the *Step Delay* parameter on p. 4.33).

The CMU provides different measurement modes *(P/Slot Table – Meas. Mode)* for manual or automatic adjustment of the input level range; see *Measure Mode* on p. 4.31. The result in slot no. 0 is invalid if a negative trigger delay is set; see *Step Delay* parameter on p. 4.33.

Note 1: *The measurement results are obtained and displayed in real time. With a WCDMA frame period of 10 ms, the time to measure 100 consecutive slots is 1/15 seconds. In* Continuous *measurements (Repetition = Continuous), this results in a high update rate of the table.*

Note 2: *The P/Slot Table measurement requires an external trigger with a correct timing; see Fig. 4-12 on p. 4.34. Ideally the UE provides an external trigger signal that is correlated to its power steps to be measured. If no such external trigger is available the measurement can be performed with the internal frame trigger provided by the DL generator.*

Note 3: *In Signalling mode, two additional measurement modes* TPC Test Step and UL CM Test Step *are available. The first mode makes the* P/Slot Table *measurement suitable for power ramp measurements according to the conformance test specification 3GPP TS 34.121, section 5.4.2. The second mode is suited for the* Power setting in compressed mode *test, 3GPP TS 34.121, section 5.7. For detailed information refer to the measurement examples in Chapter 2. The additional measurement modes can be activated via* P/Slot Table – Measure Mode *or in the configuration menu; see* Measure Mode *on p.* 4.31. See also *UL CM Test Step* on p. 4.20.

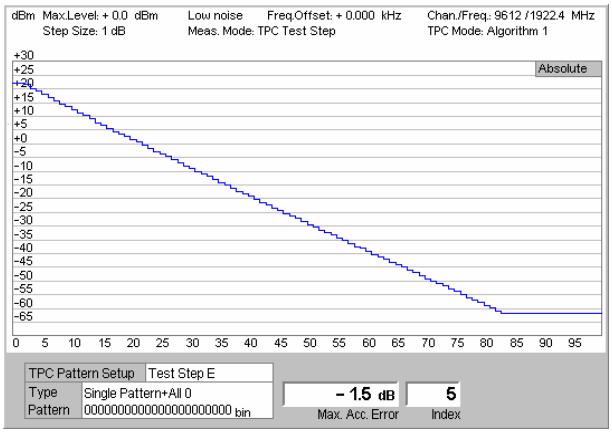
Remote control

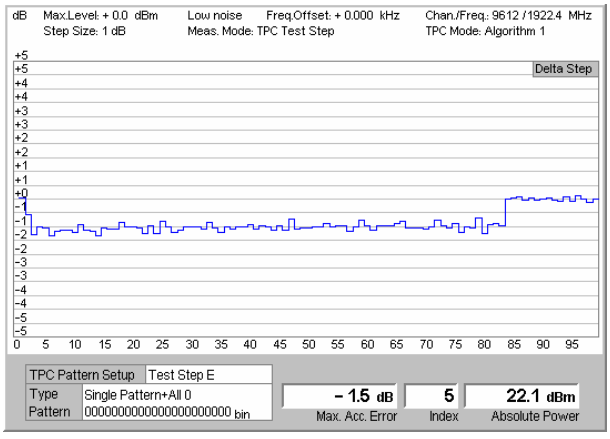
`READ[:SCALar]:POWer:XSLOT:CURRent?` etc.
`READ[:SCALar]:POWer:XSLOT:ABSolute?` etc.
`READ[:SCALar]:POWer:XSLOT:DELTa?` etc.
`READ[:SCALar]:POWer:XSLOT:MAERror?` etc.

Results (graphs)

The *P/Slot Table* application provides an alternative representation where the powers or power steps are displayed in a 2D chart (graph). The graphical display can be switched on by means of the *Display Mode* function (press *P/Slot Table – Display Mode* or open the *Control* tab of the *Power Configuration* menu).

The tables and the graphs (2D charts) show the same results.





Results (additional output fields)

Below the *Step* table, the following measurement results are displayed:

Max. Acc. Error Maximum of the sum of all errors in any 10 consecutive slots. To obtain this result, the CMU moves a 10-slot wide evaluation window across the entire table and calculates the accumulated error at each window position.

Index Position of the slot range where the max. accumulated error occurred: First slot of the evaluation window where the accumulated error reached its maximum.

In test steps B and C, where 50 1s and 50 0s are transmitted to the UE, the *Max. Acc. Error* is the sum of all 50 slots; the *Index* is always zero.

Absolute Power Absolute Power in dBm of the first slot measured. This value is available in the *Delta* display mode where the table shows the differences between consecutive steps *(P/Slot Table – Display Mode)*.

Limit Check

In general, a red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Power Configuration* menu, see p. 4.35.

Remote control

```
CALCulate[:SCALar]:POWer:XSLot:DELTa:MATChing:LIMit?
CALCulate:ARRay:POWer:XSLot:DELTa:MATChing:LIMit?
CALCulate[:SCALar]:POWer:XSLot:MAERror:MATChing:LIMit?
```

UL CM Test Step

The *UL CM Test Step* measurement mode is suited for the *Power setting in compressed mode* test, 3GPP TS 34.121, section 5.7. A measurement example is reported in Chapter 2. Some of the information in the measurement menus is specific to the *UL CM Test Step* mode.

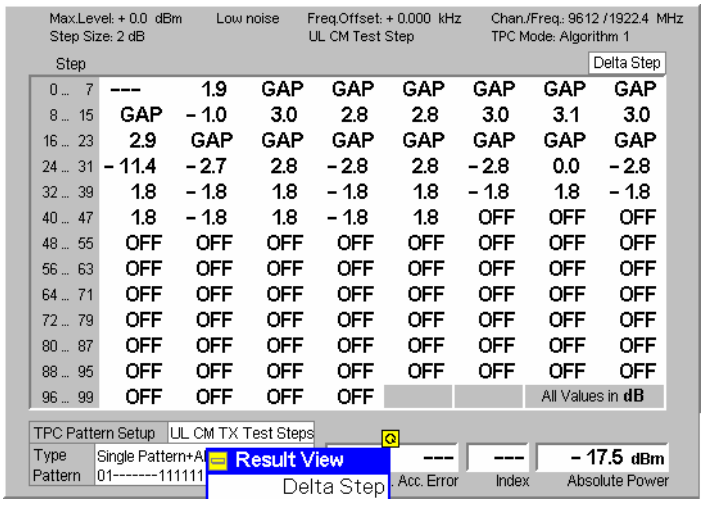


Fig. 4-7 Display of results (P/Slot Table, UL CM Test Step)

Results (tables)

The output tables show the measured power steps over the entire TPC pattern length. The CM (test) patterns A (rising and falling) extend over 45 slots; pattern B extends over 60 slots. Besides the measurement is performed with a ½ slot *Power Measurement Width*, a 1 slot *Step Width*, and a 0 slot *Step Delay*. Beyond the pattern length, nothing is measured *(OFF)*.

If the measurement fails (e.g. because one of the preconditions listed in Chapter 2 was not fulfilled), the table shows invalid results ("---"). The first delta step is necessarily invalid, because no previous slot is available for comparison.

Compressed mode transmission gaps are displayed as follows:

- In the *Delta Step* table, *GAP* is displayed. The first slot after the gap contains the initial power step, which is the power step compared to the last slot before the gap.
- In the *Absolute* table, the actual measured power is displayed. Gaps are characterized by very low UE power values.

The *Max. Accumulated Error* is the maximum of the sum of all errors in the *Recovery Period* comprising the 7 rising of falling power steps after each gap. This value is available for CM patterns A only. *Index* denotes the position of the first slot of the *Recovery Period;* it has the fixed value of 9*. Absolute Power* is the power at the beginning of the measurement (slot no. 1).

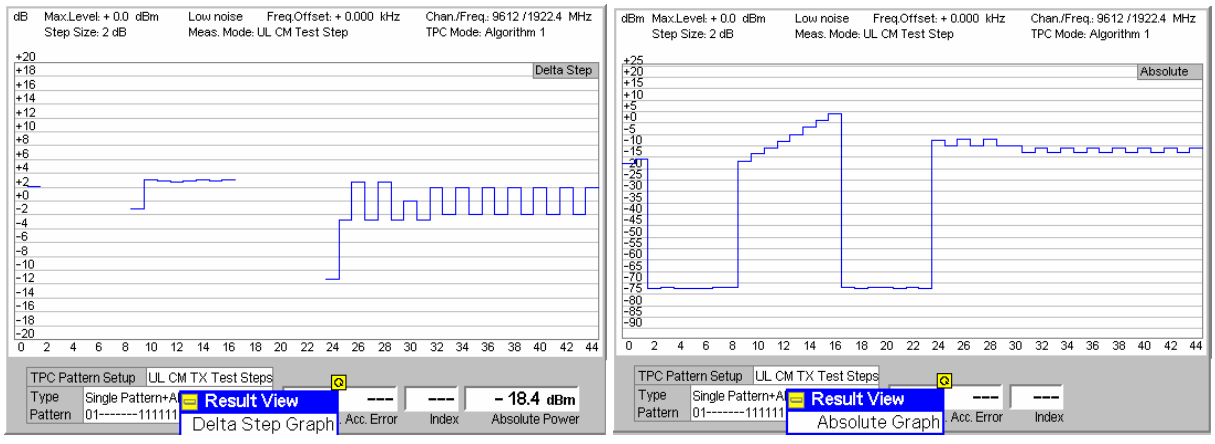
Remote control

`READ[:SCALar]:POWer:XSLOT:CURRent?` etc.
`READ[:SCALar]:POWer:XSLOT:ABSolute?` etc.
`READ[:SCALar]:POWer:XSLOT:DELTa?` etc.
`READ[:SCALar]:POWer:XSLOT:MAERror?` etc.

Results (graphs)

Tables and graphs show the same results. Again the *Delta Step* and the *Absolute* graphs differ in the way they show compressed mode transmission gaps:

- In the *Delta Step Graph*, the measurement curve is interrupted during the gap. The first slot after the gap contains the power step compared to the last slot before the gap.
- In the *Absolute Graph*, the actual measured power is displayed. Gaps are characterized by very low UE power values.



Limit Check In general, a red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Power Configuration* menu, see p. 4.35.

Remote control
```
CALCulate[:SCALar]:POWer:XSLot:DELTa:MATChing:LIMit?
CALCulate:ARRay:POWer:XSLot:DELTa:MATChing:LIMit?
CALCulate[:SCALar]:POWer:XSLot:MAERror:MATChing:LIMit?
```

On/Off Time Mask

The results in the *On/Off Time Mask* measurement menu are displayed in two parameter lines, a diagram, and various output fields.

Parameter lines

Output table

Output fields

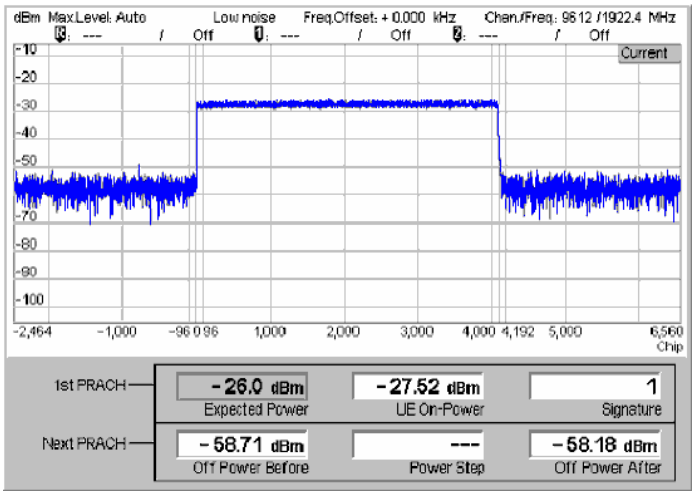


Fig. 4-8 Display of results (Inner Loop TPC)

1st parameter line The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.9) are indicated in a parameter line across the top of the measurement menu:

Max. Level	Maximum expected input level in dBm
Attenuation	Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal WCDMA channel frequency

Chan./Freq. RF channel measured and associated nominal carrier frequency

Remote control
Settings are read out using the query corresponding to the setting command (setting command with appended question mark).

2nd parameter line

The second parameter line contains the following marker values:

R Measurement result and time of reference marker

1 Measurement result and time of delta marker 1 (setting *absolute*) or difference from reference marker (setting *relative*)

2 Measurement result and time of delta marker 2 (setting *absolute*) or difference from reference marker (setting *relative*)

Diagram

The measurement curve in the diagram shows the power (in dBm) of the nth PRACH preamble measured during registration or connection setup where n is set via *On/Off Time Mask – Measured Preamble*. The preamble power is plotted as a function of time (in chip periods). The entire preamble has a nominal length of 4096 chips.

Note: *On/Off Time Mask is a single-shot measurement. It enters the HLT state as soon as all measurement results have been acquired.*

Remote control
```
READ:ARRay:POWer:ONOFf:CURRent?
FETCh:ARRay:POWer:ONOFf:CURRent?
SAMPle:ARRay:POWer:ONOFf:CURRent?
```

Output fields

Below the diagram the CMU displays two rows of output fields. The upper row contains the following results from the *n^{th} PRACH* preamble *(Measured Preamble):*

Expected Power	Expected n^{th} preamble power
UE On Power	Average power of the nth PRACH preamble
Signature	Measured signature of the nth PRACH preamble

For a detailed description of the parameters above refer to section *Connection – RF Channel and Power* on p. 4.208.

The lower row of output fields contains results from the *Next PRACH* preamble. To obtain these results the UE must send a $(n + 1)^{st}$ PRACH preamble and the periodicity of the preambles must be known (see Fig. 4-9 and application example in Chapter 2).

Off Power Before Average UE transmitter off power measured in a 1-slot wide interval ending 25 ms before the beginning of the (n + 1)st PRACH preamble from the UE.

Power Step Measured difference between the average power of the (n + 1)st and the nth preamble. The measured *Power Step* should be close to the nominal *Step Size* which belongs to the *Random Access Settings (On/Off Time Mask – Random Access Set).* It is positive because the preambles are transmitted at increasing power.

Off Power After Average UE transmitter off power measured in a 1-slot wide interval starting 25 ms after the end of the (n + 1)st PRACH preamble from the UE.

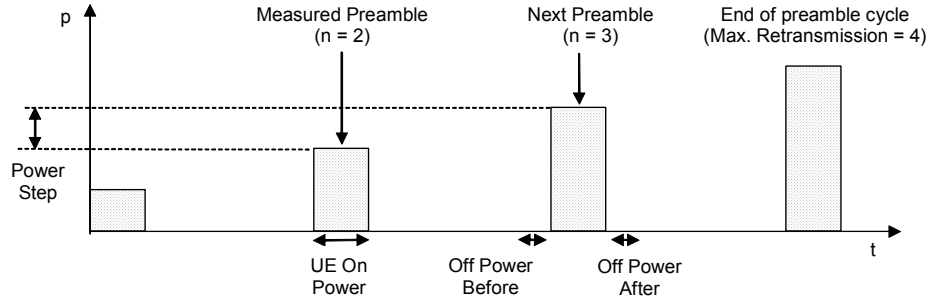


Fig. 4-9 On/Off Time Mask results

Remote control

```
READ[:SCALar]:POWer:ONOFf:CURRent?
FETCh[:SCALar]:POWer:ONOFf:CURRent?
SAMPle[:SCALar]:POWer:ONOFf:CURRent?
CALCulate[:SCALar]:POWer:ONOFf:CURRent:MATChing:LIMit?
CALCulate[:SCALar]:POWer:ONOFf:CURRent:ALL:MATChing:LIMit?
```

Measurement Configurations (Power Configuration)

The popup menu *Power Configuration* contains two tabs to determine the parameters that control the power measurement and to define the tolerance limits.

The popup menu *Power Configuration* is activated by pressing the softkey at the top right in the graphical measurement menu *Power* twice. It is possible to change between the tabs by pressing the associated hotkeys.

Measurement Control (Power Configuration – Control)

The *Control* tab controls the power measurement by determining

- The *Repetition* mode
- The *Stop Condition* for the measurement (not for *P/Slot Table* measurements)
- The number of slots/evaluation periods forming a statistics cycle *(Statistic Count,* not for *Inner Loop TPC* and *P/Slot Table* measurements)

The following settings configure the *Inner Loop TPC* measurement:

- Display of a *Grid* in the graphical diagrams
- Parameters defining the scope of the *Inner Loop TPC* measurement *(Profile Length, Step Size, Section B Analysis),* the power control algorithm *(TPC Mode),* and the type of results *(Step Analysis)*
- The TPC command sequence *(Step Control)*

The following settings configure the *P/Slot Table* measurement:

- The *Repetition* mode
- Use of the *P/Slot Table* as a general measurement or in its configuration for TPC test steps *(Measurement Mode)*
- Display of absolute powers or relative power stept *(Display Mode).*
- The measurement time for a single measurement step *(Power Meas. Width)*
- The number of slots elapsed between two consecutive measurements *(Step Width)*
- The number of slots measured *(Step Count)*
- A delay time (number of slots) between the trigger time and the start of the measurement *(Step Delay)*

The following settings configure the *On/Off Time Mask* measurement:

- Display of a *Grid* in the graphical diagram
- The number of the measured preamble within the preamble cycle *(Measured Preamble)*
- A type of measurement results *(Measured Item)*

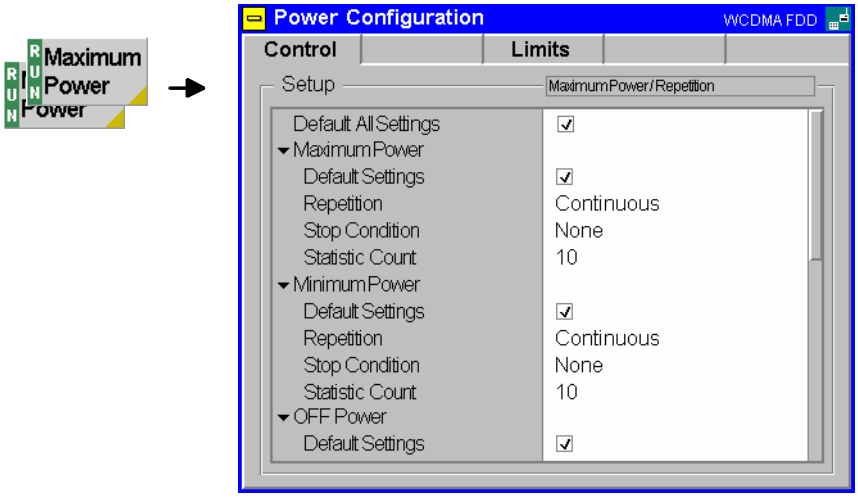


Fig. 4-10 Power Configuration – Control

The settings can be defined separately for the different applications of the *Power* measurement group.

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Control* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual applications are provided.

Remote control
```
DEFault:POWer<Application>:CONTrol  ON | OFF etc.
```

The following statistical settings are not available for the *On/Off Time Mask* application.

Repetition The *Repetition* field determines the repetition mode of the measurement:

Single Shot Single shot measurement: the measurement is stopped after a statistics cycle (or after a stop condition is met, see below). A stopped measurement is indicated by the status display *HLT* in the *Power* softkey.

Unless otherwise stated, a statistics cycle corresponds to the number of slots/evaluation periods set under *Statistic Count*.

Continuous Continuous measurement: The CMU continues the measurement until it is terminated explicitly (or until the stop condition for the measurement is met, see below). The measurement results are valid after one statistics cycle; however, the measurement is continued, and the output is continuously updated. An ongoing measurement is indicated by the status display *RUN* in the *Power* softkey.

Single shot should be selected if only a single measurement result is required under fixed conditions. The continuous measurement is suitable for monitoring the evolution of a measured quantity in time, e.g. for adjustments.

Note: *In remote mode, the counting measurement (counting mode) is available as a further measurement mode with a defined number of measurement cycles to be performed, see chapter 6 of this manual.*

Remote control
```
CONFigure:POWer<Application>:CONTrol:REPetition
        CONTinuous | SINGleshot | 1 ... 10000,<StopCondition>,
                                          <Stepmode> etc.
```

Stop Condition The *Stop Condition* field defines a stop condition for the measurement:

None Continue measurement irrespective of the results of the limit check

On Limit Failure Stop measurement as soon as the limit check fails (one of the tolerances is exceeded)

Remote control
```
CONFigure:POWer<Application>:CONTrol:REPetition
        <Repetition>,SONerror | NONE, <Stepmode> etc.
```

Statistic Count The input field *Statistic Count* defines the number of slots that form a statistics cycle. The settings *1* and *OFF* (press *ON/OFF* key) are equivalent. A statistics cycle is equal to the duration of single shot measurements; see *Repetition Mode* above.

The *Inner Loop TPC* measurement always extends over a definite number of slots that is given by the *Profile Length,* the *TPC Mode*, and the *Section B Analysis* settings (see *Table 4-1* on p. 4.30). No additional *Statistic Count* needs to be set.

Remote control
```
CONFigure:POWer<Application>:CONTrol:STATistics
  1 ... 1000 | NONE
```

The following **Power Control** parameter is available for the *Maximum Power* and *Minimum Power* application.

TPC Qualifies whether the CMU commands the UE transmitter to transmit at its minimum or maximum power.

Automatic After activating the *Maximum Power* or *Minimum Power* application, the CMU sends a constant sequence of Up or Down TPC bits to the UE so that it keeps transmitting at its maximum or minimum power. The Up or Down bits replace the previous TPC pattern.

Manual After activating the *Maximum Power* or *Minimum Power* application, the downlink TPC pattern is not changed.

In both power control modes, it is possible to change the TPC pattern while the measurement is running, e.g. to test a drift of the UE transmitter. The changed pattern remains valid after the end of the *Maximum Power* or *Minimum Power* measurement (see also Table 4-29 on p. 4.251).

Remote control
```
CONFigure:POWer<Application>:TPControl
  AUTO | MANual
```

The following **TPC Settings** are valid for *Inner Loop TPC* measurements only.

Note: *Unless otherwise stated, all TPC parameters can be set independently. However, in view of the limit specifications, only a limited number of combinations really makes sense. These combinations are listed in Table 4-4 on p. 4.36 and in Table 4-5 on p. 4.36.*

Grid *Grid* switches the grid in the graphical test diagram on or off. By default, the grid is switched on.

Remote control
No command, display configuration only.

Profile Length

The *Profile Length* parameter selects the number of power steps to be measured and displayed in each diagram section (section A and B, corresponding to the left and the right side of the graphical diagrams). Evaluation of a power step and of the *Power Step Error* involves the comparison of an original and a target slot, so the number of results in the upper *(UE Power)* diagram exceeds the number of results in the lower *(Power Step)* diagram by one (see also section *Inner Loop TPC* on p. 4.13).

7 Slots The measurement extends over 8 slots for each diagram section. The upper *(UE Power)* diagram shows 8 slots; the lower diagram *(Power Step)* shows 7 steps per section.

10 Slots The measurement extends over 11 slots for each diagram section. The upper *(UE Power)* diagram shows 11 slots; the lower diagram *(Power Step)* shows 10 steps per section.

The profile length settings are in accordance with the specified average TPC tolerances; see *Table 4-5* on p. 4.36.

Remote Control
```
CONFigure:POWer:ILTPc:CONTrol:TPCControl
<ProfileLength>, <StepSize>, <TPCMode>
```

Step Size

The *Step Size* parameter selects the relative power difference between two consecutive measured slots that the UE transmitter shall use. Step sizes of 1 dB, 2 dB, and 3 dB can be set.

The nominal inner loop *Power Step,* i.e. the difference between the average output power of the original slot and the average output power of the target slot, is equal to TPC_cmd times the *Step Size.* TPC_cmd is derived from the TPC command settings transmitted to the UE *(Step Control*, see below) according to the power control algorithm *(TPC Mode*, see below). The step size has an impact on the transmitter power control tolerances; see section *Tolerance Values (Power Configuration – Limits)* on p. 4.35.

Note: *A step size of 0 dB is not available, however, constant UE power levels can be achieved by selecting power control* Algorithm 2*; see below.*

The Step Size doesn't have to be set in Signalling mode, where the value is taken from signalling; see Connection Control – BS Signal – TPC Settings. The maximum step size in Signalling mode is 2 dB. In Non Signalling mode the Step Size overwrites the corresponding parameter in the Generator *tab of the Connection Control menu.*

Remote Control
```
CONFigure:POWer:ILTPc:CONTrol:TPCControl
<ProfileLength>, <StepSize>, <TPCMode>
```

TPC Mode

The *TPC Mode* parameter selects the inner loop Transmit Power Control algorithm for the UE transmitter.

Off The UE is in a test mode where it performs power steps of ± *Step Size* (see above), but with a generally unknown TPC command sequence (see paragraph on *Step Control* on p. 4.31). 0-dB steps can not be evaluated correctly. The measurement can be performed in *Free Run* or *External* trigger mode. This TPC mode is particularly useful if the internal RF generator CMU-K66 is not available and if it is not intended or possible to set a TPC command sequence at the UE; see section *Test Scenarios for Inner Loop TPC* on p. 4.3.

Algorithm 1 The UE is power-controlled according to *Algorithm 1 for processing TPC commands,* specified in standard 3GPP TS 25.214: One TPC command is received in each slot. If the received TPC command is equal to 1 (0), then the power control parameter TPC_cmd for that slot is +1 (–1). This implies that the UE transmitter output power changes after each slot.

Algorithm 2 The UE is power-controlled according to *Algorithm 2 for processing TPC commands,* specified in standard 3GPP TS 25.214: One TPC command is received in each slot. The slots are grouped into sets of 5 slots, aligned to the frame boundaries, so that there is no overlap between different sets of 5 slots. If the received TPC command is equal to 1 (0) in all 5 slots of a set, then the power control parameter TPC_cmd for the 5th slot is +1 (–1). Otherwise TPC_cmd for the 5th slot is 0. This implies that the UE transmitter output power only changes if the same TPC command is received in a complete set of 5 slots.

Algorithm 2 requires either a 10-slot *Profile Length* or an UE power that is constant over both diagram sections; see section *Test Scenarios for Inner Loop TPC* on p. 4.3.

The sequence of TPC commands for *Algorithm 1* and *Algorithm 2* is defined in the *Step Control* section; see p. 4.31. Both algorithms require a trigger (external or internal; no *Free Run* measurement).

Note: *The TPC Mode doesn't have to be set in Signalling mode; where the value is taken from signalling; see Connection Control – BS Signal – TPC Settings. In Non Signalling mode the TPC mode overwrites the corresponding parameter in the* Generator *tab of the Connection Control menu.*

Remote Control
```
CONFigure:POWer:ILTPc:CONTrol:TPCControl
<ProfileLength>, <StepSize>, <TPCMode>
```

Step Analysis The *Step Analysis* parameter selects the quantity to be displayed in the lower *(Power Step)* diagram:

Power Step Difference of the UE power in two consecutive measured slots, $P(Slot_n) – P(Slot_{n–1})$.

Abs. Power Step Absolute value of *Power Step*. The diagram is re-scaled to show only positive values, but with a higher resolution.

Power Step Error Error of the *Power Step: Power Step* minus the *Step Size* commanded at the UE transmitter; see previous softkey.

The quantities in the output fields below the diagram and the limit check are not affected. For more information on the measurement results see section *Inner Loop TPC* on p. 4.13.

Remote Control
```
CONFigure:POWer:ILTPc:CONTrol:SANalysis PST | PSTA | PSTE
```

Section B Analysis The *Section B Analysis* parameter switches the measurement in the second profile length (see *Profile Length* softkey on p. 4.28) *On* or *Off*. Switching off section B accelerates the measurement and leaves the right half of the diagrams empty.

The TPC command sequence in sections A and B must be symmetric as explained in section *Inner Loop TPC* on p. 4.13. The *Section B Analysis* setting is therefore not available if the *TPC Mode* is set to *Off* (measurement with unknown TPC

command sequence, see above).

The CMU needs two consecutive trigger events to measure sections A and B, respectively. If section B is switched on and no second trigger event is received, only the section A results are available and the statistical results are based on section A alone.

The trigger condition must be observed in particular if the inner loop TPC is measured with a single TPC pattern transferred to the UE *(Internal* or *Signalling* trigger and *TPC Pattern Type = Single Pattern + All 0/Single Pattern + All 1/Single Pattern +Alternating;* see *Table 4-27* on p. *4.249*). In this case, pressing *Repeat Pattern* sends a single TPC pattern and simultaneously generates a trigger event. The section B results are available after *Repeat Pattern* is pressed for the second time. At the same time, all statistical results are updated.

The two symmetric sections A and B correspond to typical inner loop TPC measurement tasks:

Example 1: Set the UE to power control *Algorithm 1,* transmit a sequence of 10 TPC commands with the value 1, then transmit a sequence of 10 TPC commands with the value 0.

–> Activate *Section B Analysis*.

Example 2: Set the UE to power control *Algorithm 1,* transmit a sequence of 10 TPC commands with the value 1 while the UE operates at the maximum power threshold.

–> Deactivate *Section B Analysis*.

Remote Control

```
CONFigure:POWer:ILTPc:CONTrol:BSECtion ON | OFF
```

An overview of the *Inner Loop TPC* control parameters and the resulting measurement duration is given below.

Table 4-1 Inner Loop TPC measurement settings and duration

TPC Mode	Profile Length	Section B Analysis	Measurement length
Off	7 Slots	(always Off)	8 slots
Off	10 Slots	(always Off)	11 slots
Algorithm 1/2[1]	7 Slots	Off	8 slots
Algorithm 1/2	10 Slots	Off	11 slots
Algorithm 1/2[1]	7 Slots	On	2*8 slots 1 slot overlap, see Fig. 4-4
Algorithm 1/2	10 Slots	On	2*10 slots 1 slot overlap, see Fig. 4-4

[1] Algorithm 2 is compatible with a 7-slot profile length if no power steps occur over the whole measurement length.

Step Control – Section A

The *Step Control – Section A* defines the TPC command values for the 10 power steps that can be displayed in section A. If a 7-slot *Profile Length* is selected, the last three values are ignored. The TPC command values for section B are derived from the section A values according to the following condition: a TPC command 1 in slot no. n of section A implies a TPC command 0 in slot no. 10 – n in section B and vice versa.

The TPC commands for *Algorithm 1* and *Algorithm 2* are set independently. The values determine the TPC_cmd parameters and the UE transmitter output power steps between the measured slots; see paragraph on the *TPC Mode* above. The TPC command values are not used if *TPC Mode* is set to *Off.*

Remote Control
`CONFigure:POWer:ILTPc:CONTrol:TPCProfile:ALG<nr>`

The following settings are valid for ***P/Slot Table*** measurements only.

Measure Mode

The *Measure Mode* defines whether the input level range for *P/Slot Table* is adjusted manually or automatically. Three different *Measure Modes* are available:

Ref. Lev. Switch Off The *P/Slot Table* measurement is performed with constant input level range; see Table 4-2 below. In *Signalling* mode, autoranging *(Analyzer Level – Mode: Auto)* can be used.

Ref. Lev. Switch Auto If necessary the CMU automatically re-adjusts its input level range during the *P/Slot Table* measurement so that the entire dynamic range of the UE can be measured in a single shot; see Table 4-2 below.

TPC Test Step Special test mode for power ramp measurements according to the conformance test specification 3GPP TS 34.121. In *TPC Test Steps* mode,

- The Step Settings are not valid.
- The measurement width is ½ slot.
- Each measurement sequence is initiated by a TPC trigger (BS Signal Settings – Activate Pattern), see below.
- After *Activate Pattern*, the selected TPC pattern (typically: a Test Step A … G setup) is measured only once; the result remains valid until the next measurement sequence is initiated.

The *TPC Test Steps* should be measured with a good RF connection between the CMU and the UE under test.

UL CM Test Step Test mode for power measurements according to the conformance test specification 3GPP TS 34.121, section 5.7, *Power setting in uplink compressed mode.*

The measurement mode *UL CM Test Step* is available in *Signalling* mode only. For detailed information refer to the measurement examples in Chapter 2.

Remote Control
`CONFigure:POWer:XSLot:CONTrol:MMODe <Mode>`

Table 4-2 Comparison of *P/Slot Table* measurement modes

Measurement Mode	Ref. Lev. Switch Off	Ref. Lev. Switch Auto
Typical application	UE test steps over a smaller, known dynamic range. Low UE output power range.	UE test steps over a wide dynamic range, good RF connection between the CMU and the UE under test.
Test modes	Non Signalling (no autoranging), Signalling	Non Signalling, Signalling *(Connected* state only)
Behavior with autoranging *(Analyzer Level – Mode: Auto)*	Only in *Signalling* mode: The *Max. Level* for each single shot *P/Slot Table* measurement is determined automatically according to the UE power in the first slot. This *Max. Level* is valid for the entire single shot.	No difference between autoranging and manual *Max. Level* setting. To avoid overflow or underflow, the manual *Max. Level* should be set in accordance with the expected UE power in the first measured slot. If necessary, the *Max. Level* is re-adjusted during a single shot *P/Slot Table* measurement to extend the dynamic range. *Note: Avoid power steps >5 dB because they can cause an overflow or underflow of the input path. If a large power step (>10 dB) marks the start of the measured power ramp (e.g. to provide an IF trigger event), the first slot should be skipped by means of an appropriate Step Delay or Slot Delay.*
Behavior with manual *Max. Level* setting *(Analyzer Level – Mode: Manual)*	The *Max. Level* is valid for the entire measurement. If possible, the Max. Level should be set to approx. 20 dB above the expected peak level in the first step.	

Display Mode Specifies whether the table in the *P/Slot Table* menu shows absolute powers or the differences between consecutive steps ans selects the graphical representation. The tables and the graphs (2D charts) show the same results.

Absolute Absolute slot powers in dBm, displayed in a table.

Delta Step Power steps in dB, displayed in a table. The first result is not available because each result requires two consecutive absolute powers. Instead the *Absolute Power* of the first slot is displayed below the table.

Absolute Graph Absolute slot powers in dBm, displayed in a 2D chart

Delta Step Graph Power steps in dB, displayed in a 2D chart. The first result is not available because each result requires two consecutive absolute powers. Instead the *Absolute Power* of the first slot is displayed below the graph.

Remote Control
No explicit command for switchover; the absolute and delta results are retrieved using the `READ[:SCALar]:POWer:XSLot:ABSolute?` and `READ[:SCALar]:POWer:XSLot:DELTa?` commands, respectively.

Power Meas. Width

The *Power Meas. Width* parameter selects the measurement time for a single measurement step. The power in a slot can be measured and averaged over ¼, ½ or 1 slot. A *Power Measurement Width* of 1 slot is available only if the *Step Width* (see below) is larger than 1 slot.

The measurement width is in accordance with the test specification for *Maximum Power, Minimum Power*, and *OFF Power* measurements: The measurement range is restricted to the useful part of the slot, excluding a guard period of 25 µs (96 chip periods) at the beginning and at the end of the slot. A measurement width of 1 slot therefore corresponds to 666.7 µs – 2*25 µs = 616.7 µs. The other two settings correspond to integer fractions of the total slot length of 666.7 µs (333.3 µs and 167.7 µs).

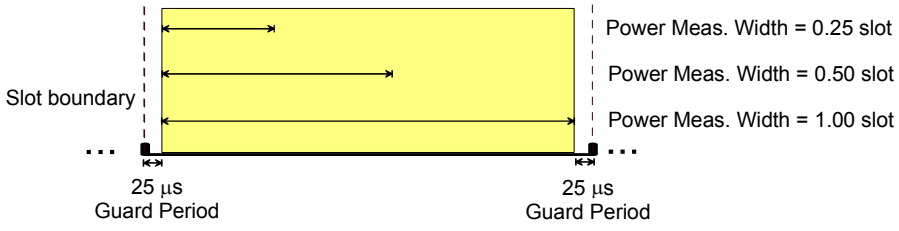


Fig. 4-11 Power measurement width

Remote Control
`CONFigure:POWer:XSLot:CONTrol:PMWidth <Width>`

Step Count

The *Step Count* parameter selects the number of slots measured.

Remote Control
`CONFigure:POWer:XSLot:CONTrol:SCOunt <StepCount>`

Step Width

The *Step Width* parameter selects the number of slots skipped between two consecutive measurements. With a step width of 1 (slot), each slot is measured.

The step width can be used to select particular slots where the UE is expected to change its ouput power. With a *Step Width* of 15 the CMU measures a particular slot in each frame: the measurement is frame-periodic.

Remote Control
`CONFigure:POWer:XSLot:CONTrol:SWIDth <StepWidth>`

Step Delay

The *Step Delay* parameter selects a delay time between the trigger time and the start of the measurement. *Step Delay* is defined in multiples of the *Step Width* (see above): a step delay of 2 at a step width of 5 means an actual delay of 2*5 slots = 10 slots. The *P/Slot Table* measurement must be performed with an external trigger fed in via pin no. 8 of the AUX 3 connector. The *Step Delay* is added to the trigger delay *(Slot Delay + Delay Offset)* defined in the *Trigger* tab of the *Connection Control* menu (see section *Trigger (Connection Control – Trigger)* on p. *4.184*).

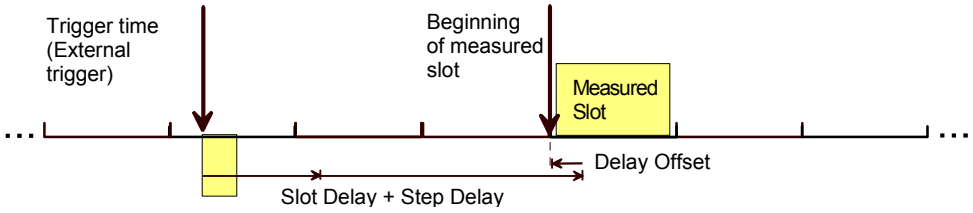


Fig. 4-12 Trigger delay and step delay for P/Slot Table measurement

The external trigger time ideally coincides with the slot boundary of the UL WCDMA signal. In this case *Slot Delay* and *Delay Offset* can be set to 0 and the *Step Delay* simply defines an offset between the trigger time and the measured slot. As explained above (see *Fig. 4-11*) the *P/Slot Table* measurement always starts 25 µs after the beginning of the measured slot.

Note: *In the P/Slot Table measurement with external trigger, the timing is exclusively determined by the external trigger time and the trigger delay parameters* (Slot Delay + Delay Offset). *In contrast to other measurements the CMU does not perform a correlation analysis to exactly pin down the beginning of the UL slot (see* ***Fig. 4-72*** *on p.* ***4.170****). The accuracy of the (corrected) trigger time must be «25 µs to ensure that the measurement range is actually confined to the central domain of the slot (see Fig. 4-11 on p. 4.33).*

If the sum of all trigger delay parameters is negative (i.e. Slot Delay = Step Delay = 0 *and* Delay Offset < 0 *so that the beginning of the measured slot precedes the real trigger time) the CMU skips the first slot (slot no. 0 in the result table) and shows an invalid "–" result. Otherwise, the measurement immediately starts at the corrected trigger time.*

Remote Control
`CONFigure:POWer:XSLot:CONTrol:SDELay <StepDelay>`

The following settings are valid for ***On/Off Time Mask*** measurements only.

Measured Preamble

Preamble within the preamble cycle that is measured and displayed in the *On/Off Time Mask* measurement menu (the number n in the description of the measurement menu). The selected value must be compatible with the length of the preamble cycle, i.e. it must be smaller than *Max. Retransmission,* where *Max. Retransmission* is set in the *Network* tab of the *Connection Control* menu.

Remote Control
`CONFigure:POWer:ONOFf:CONTrol:MPReamble <Preamble_No>`

Measured Item

Defines whether the *On/Off Time Mask* measurement provides the *Off Power Before* and the *Off Power After* the next preamble *(Power On/IOff)* or the *Power Step* from the measured preamble to the next preamble *(Power On/Step)*.

Remote Control
`CONFigure:POWer:ONOFf:CONTrol:MITem <Item>`

Tolerance Values (Power Configuration – Limits)

The *Limits* tab defines tolerance values for all peak and average UE output power results and for the power control steps that can be obtained in the *Power* measurement. For an explanation of the four applications *Maximum Power, Minimum Power*, *OFF Power,* and *Inner Loop TPC* refer to the beginning of section *Power Measurements* on p. 4.2.

Conformance requirements

In CDMA networks, power control is essential to ensure stable transmission and an efficient radio resource management within the system. Generally speaking, an output power of the UE transmitter that is too low decreases the coverage area while an excess output power may cause interference to other channels or systems. Both effects decrease the system capacity. The power tolerances are reported in standard 3GPP TS 25.101.

Maximum Power

WCDMA user equipment is divided into four power classes. In the standard, the maximum output power of the UE transmitter (averaged over the transmit slot) and its tolerance is defined according to the power class of the UE as shown in *Table 4-3 below*.

Table 4-3 Power classes and maximum output power

Power Class	Maximum Output Power (Rated Value)	Tolerance
1	+33 dBm	+1/−3 dB
2	+27 dBm	+1/−3 dB
3	+24 dBm	+1/−3 dB
4	+21 dBm	±2 dB

Minimum Power

According to the standard, the minimum output power of the UE transmitter must be below –50 dBm.

OFF Power

According to the standard, the *OFF Power* (i.e. the maximum output transmit power within the channel bandwidth when the UE transmitter is OFF) must be below –56 dBm.

Inner Loop TPC

According to the standard, the Transmitter Power Control (TPC) tolerances are divided into two sets. The first set refers to individual power steps and depends on the step size. The values are quoted in *Table 4-4 below*. The values in *Table 4-4* hold in the UE transmitter output power range between the minimum power threshold of –50 dBm (see *Minimum Power* above) and the maximum power threshold depending on the power class (e.g. +21 dBm – 2 dB = +19 dBm for devices with power class 4; see *Table 4-3 above*). For UE transmitter output powers above the maximum threshold, the lower limits are not applicable. For UE transmitter output powers below the minimum threshold, the upper limits are not applicable.

The second set of tolerances refers to either 7 or 10 equal TPC_cmd values. Again these average tolerance values depend on the step size; see *Table 4-5 below*. The values in *Table 4-5* hold in the UE transmitter output power range between the minimum and the maximum power threshold.

P/Slot Table

The default limit values have been chosen in accordance with the test requirements for the TPC test steps A to H listed in standard 3GPP TS 34.121. The *CM Steps* and their limits are specified in section 5.7 of this standard.

Table 4-4 Inner loop individual TPC tolerance

Step Size / dB	Max. Power Step Error / dB	TPC_cmd Values	Typical CMU Settings
0	± 0.5	TPC_cmd = 0	Arbitrary Step Size TPC Mode = Algorithm 2 Profile Length = 10 Steps (or 7 steps and constant UE power)
1	± 0.5	TPC_cmd = ± 1	Step Size = 1 dB TPC Mode = Algorithm 1 or 2 Profile Length = 10 Steps
2	± 1.0	TPC_cmd = ± 1	Step Size = 2 dB TPC Mode = Algorithm 1 (or 2) Profile Length = 10 Steps
3	± 1.5	TPC_cmd = ± 1	Step Size = 3 dB TPC Mode = Algorithm 1 (or 2) Profile Length = 7 Steps UE compressed mode power control

Table 4-5 Inner loop average TPC tolerance

Step Size / dB	Max. Power Step Error after 7 Steps / dB	Max. Power Step Error after 10 Steps / dB	TPC_cmd Values	CMU Settings
0	± 1.0	see below	TPC_cmd = 0	Arbitrary Step Size TPC Mode = Algorithm 2 Profile Length = 7 Steps and constant UE power
0	see above	± 1.0	TPC_cmd = 0	Arbitrary Step Size TPC Mode = Algorithm 2 Profile Length = 10 Steps and constant UE power
1	not applicable	± 2.0	TPC_cmd = ± 1	Step Size = 1 dB TPC Mode = Algorithm 1 Profile Length = 10 Steps with equal TPC commands
2	not applicable	± 4.0	TPC_cmd = ± 1	Step Size = 2 dB TPC Mode = Algorithm 1 Profile Length = 10 Steps with equal TPC commands
3	± 5.0	not applicable	TPC_cmd = ± 1	Step Size = 3 dB TPC Mode = Algorithm 1 Profile Length = 7 Steps with equal TPC commands UE compressed mode power control

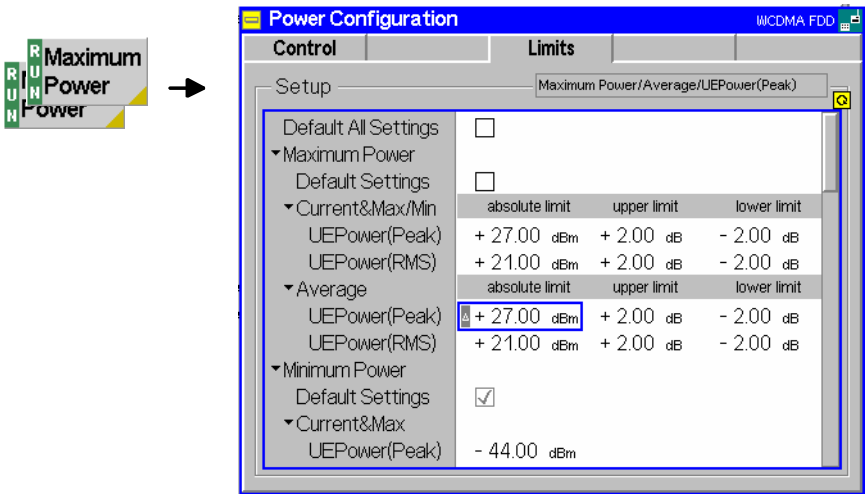


Fig. 4-13 Power Configuration – Limits

Default Settings

The *Default All Settings* switch assigns default values to all settings in the *Control* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual applications are provided.

Remote control

```
DEFault:POWer<Application>:LIMit  ON | OFF etc.
```

Maximum Power

The table section *Maximum Power* defines upper and lower limits for the peak and average UE output power determined under the conditions of a *Maximum Power* measurement. Two different sets of limit values can be defined:

Current & Max./Min. Common limits for the *Current,* the *Minimum and the Maximum* results (see description of output table in section *Measurement Results* on p. 4.11)

Average Limits for the *Average* results

The tolerances for each result are specified by a rated maximum output power *(rated value,* in dBm) and an upper and a lower limit value *(upper limit, lower limit),* which is defined relative to the *rated value* (in dB). The limit check passes if the measurement result is in the range *[rated value + lower limit, rated value + upper limit]; see also Table 4-3* on p. 4.35.

Remote control

```
CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:
  UPPer:VALue <Upper_Limit_Peak>,<Upper_Limit_RMS>
CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:
  LOWer:VALue
CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:
  RVALue
```

analogous commands for `AVERage` instead of `CMMax`.

Minimum Power/ OFF Power

The table sections *Minimum Power* and *OFF Power* define absolute upper limits for the peak and average UE output power determined under the conditions of a *Minimum Power* and *OFF Power* measurement. Two different limit values are provided for the *Current & Max.* and for *Average* results (in contrast to the *Maximum Power* measurement, the *Minimum* results don't make sense).

The limit check passes if the measurement result is below the specified limit.

Remote control
```
CONFigure:POWer:MINimum:CMAX:LIMit[:SCALar]:SYMMetric
  [:COMBined]:VALue
CONFigure:POWer:MINimum:AVERage:LIMit[:SCALar]:SYMMetric
  [:COMBined]:VALue
```
analogous commands for `OFF` instead of `MINimum`.

Inner Loop TPC

The table section *Inner Loop TPC* defines symmetric limits for the UE output power steps that the UE transmitter uses for inner loop power control and a minimum and maximum threshold limiting the power control range; see explanations at the beginning of this section. The *Limit Info* diagram visualizes how the limit check is handled above *Max. Threshold*, in the power control range and below *Min. Threshold*.

Max. Threshold Upper limit of the power control range. By default, *Max. Threshold* is defined as the lowest permissible output power for the UE power class (e.g. +21 dBm – 2 dB = +19 dBm for devices with power class 4; see *Table 4-3 above*). In the output power range above *Max. Threshold,* the lower individual power step limits *(Step individual)* in *Table 4-4* and all average power step limits in *Table 4-5* are ignored.

Min. Threshold Lower limit of the power control range. By default, *Min. Threshold* is defined as –50 dBm; see *Minimum Power* above). In the output power range below *Min. Threshold,* the upper individual power step limits *(Step Section A/B)* in *Table 4-4* and all average power step limits in *Table 4-5* are ignored.

Step individual Symmetric power step limits for individual power steps; see *Table 4-4* above. The individual limits and limit check results are indicated in the lower diagram. Beyond the *Min. Threshold* and the *Max. Threshold,* the limits are no longer evaluated symmetrically.

Step Section A/B Symmetric power step limits for either 7 or 10 equal TPC_cmd values; see *Table 4-5 above*. The section A/B limit check results are indicated in the *Section A* and *Section B* output fields below the diagrams. These limits are not valid beyond the *Min. Threshold* and the *Max. Threshold*.

Remote control
```
CONFigure:POWer:ILTPc:THReshold:CURRent:LIMit[:SCALar]
  :ASYMmetric[:COMBined]:VALue
  <MaxThreshold_Limit_Current>, <MinThreshold_Limit_Current>
CONFigure:POWer:ILTPc:STEP:CURRent:LIMit[:SCALar]
  :SYMMetric[:COMBined]:VALue
```

P/Slot Table

In the *Limits* tab of the *Power Configuration* menu it is possible to specify limits for the *P/Slot Table* measurement. The limits are analogous to the *Inner Loop TPC* limits described above. They are only available in *Signalling* mode.

Step Dependent Symmetric power step limits for individual power steps

Step Accumulate Symmetric power step limits for 10 and 50 equal TPC_cmd values.

The *CM Steps* limits are used if the measurement mode *UL CM Test Step* is active. A schematic diagram characterizes the position of the individual power steps within the CM pattern. For each power step type, it is possible to specify an expected step size (the actual step size is calculated by the UE from the CM parameters and synchronously transmitted TPC pattern) and a symmetric limit. CM step limits that are marked invalid are not defined in the conformance test specification and not evaluated. The actual positions of the power steps within the CM test patterns A (rising and falling TPC) and B are shown above the expected power steps, in the lines "Slot Numbers", which denote each first and last slot of each power step and the recovery period, respectively. The slot numbers cannot be edited.

The table contains a minimum set of values for all pattern types. Note the following peculiarities:

- The *non CM / CM* power step and limit associated with pattern B also applies to the CM / non CM transition with inverse sign.
- The default *accumulated* power step is equal to 7 times the limit for the single *recovery* steps. For test purposes it is possible to select a different value.

Remote control

```
CONFigure:POWer:XSLot:THReshold:DELTa:LIMit[:SCALar]:
  ASYMmetric[:COMBined]:VALue
CONFigure:POWer:XSLot:STEP:DELTa:LIMit[:SCALar]:
  SYMMetric[:COMBined]:VALue
CONFigure:POWer:XSLot:STEP:DELTa:LIMit:ENABle
DEFault:POWer:XSLot:LIMit
CONFigure:POWer:XSLot:CMSTeps:EXPected[:SCALar]:VALue
CONFigure:POWer:XSLot:CMSTeps:LIMit[:SCALar]
:SYMMetric[:COMBined]:VALue
```

On/Off Time Mask

The limits defined in section *On/Off Time Mask* apply to the *On/Off Time Mask* application and do not overwrite analogous limits in the other *Power* applications.

Open Loop Limit Maximum difference between the *PRACH UE-On Power* and the *Expected PRACH Power.*

Max. Power Limit Rated value and tolerance for the *PRACH UE-On Power* if it is measured near the maximum UE transmitter output power.

Off Power Limit Maximum of the measured *Off Power Before* and the *Off Power After.* The limit check for this value is performed before and after each measured preamble.

PRACH PowStep Maximum deviation of the measured *Power Step* (i.e. the difference between the average power of the $(n + 1)^{st}$ and the nth preamble) from the selected *Step Size (On/Off Time Mask – Random Access Set).*

The output fields in the *On/Off Time Mask* menu turn red if one of the limits is exceeded.

Remote control

```
CONFigure:POWer:ONOFf:CURRent:LIMit
DEFault:POWer:ONOFf:LIMit
```

Modulation Measurements

The menu group *Modulation* measures the modulation accuracy of the RF signal from the UE. Modulation accuracy is the ability of the UE transmitter to generate an ideal QPSK-modulated signal. Several graphical measurement menus are provided to display the measurement results. The popup menu *Modulation Configuration* is used for configuration of the measurements.

The characteristics of the modulation measurement, the measured quantities and the measurement menus depend largely on the signal configuration selected by means of the *Application – QPSK / WCDMA* hotkey in the *Modulation* measurement menu:

- The *QPSK*[2] mode is used to measure the QPSK modulated signal with a chip rate of 3.84 Mcps. Examples of valid signals are a single DPCCH signal, a single DPDCH signal or a combination of a DPCCH with one DPDCH (see Fig. 4-16 on p. 4.44) and equal gain factors: The DPCCH and the DPDCH are summed to a complex-valued signal with a constellation diagram that is still QPSK-like). The channelization code, scrambling code and the symbol rate are irrelevant to the measurement. This mode is faster than the *WCDMA* mode and is useful to adjust the modulator of the UE transmitter (see description in section *QPSK Measurements (Modulation – QPSK)* on p. 4.46).
- The *WCDMA* mode is used to measure the WCDMA signal, i.e. a 3GPP standard uplink signal with a chip rate of 3.84 Mcps and channel coding (see description in section *WCDMA Measurements (Modulation – WCDMA)* on p. 4.56).

For the sake of clarity, the two signal configurations are explained separately throughout the remainder of the *Modulation Measurements* section.

In addition to the QPSK… and WCDMA… applications, the following *Modulation* measurement applications are available:

- Phase discontinuity *(PHDisc)* provides the change in phase between any two adjacent timeslots. The phase discontinuity is measured in accordance with the definition of the conformance test specification 3GPP TS 34.121 (see section *Phase Discontinuity Measurement* on p. 4.66). The *PHDisc* application is available in *Non Signalling* and in *Signalling* mode.
- The *PRACH* preamble quality is a measure of the ability of the UE to transmit the PRACH preamble in accordance with the core requirements so that the Node B can reliably decode the PRACH. The CMU can measure the PRACH preamble quality in accordance with the initial conditions stated in the conformance test specification 3GPP TS 34.121 (see section PRACH Preamble Quality Measurement on p. 4.64). This application is available in *Signalling* mode only.
- *EVM & PhD HS-DPCCH* provides the change in phase due to the transmission of the HS-DPCCH and an evaluation of the corresponding EVM and frequency error values. This application covers the *EVM and Phase Discontinuity with HS-DPCCH* conformance test (see standard 3GPP TS 34.121 V7.2.0, test procedure 5.13.1AA) and is described in chapter 8, *HSDPA Options*. The *PHDisc* application is available in *Non Signalling* and in *Signalling* mode.

Measurement of Modulation Parameters

The purpose of this section is to illustrate the meaning of the physical parameters determined in the *Modulation* measurement. For a discussion of the different averaging procedures involved please refer to Chapter 3.

Definition of measured quantities:

According to the Terminal Conformance Specification TS 34.121, the quality of the modulated uplink WCDMA signal is primarily assessed by its *Error Vector Magnitude (EVM)* and *Peak Code Domain Error (PCDE)*. The EVM quantifies the modulation quality of the composite signal, the PCDE quantifies the modulation quality of the individual code channels in a considered code domain. The combination of both parameters ensures that the entire WCDMA signal as well as all code channels satisfy the requirements of the conformance specification.

2 The modulation scheme used in the uplink is actually a modified QPSK scheme that is often referred to as HPSK modulation (Hybrid Phase Shift Keying).

The measurement of both parameters is based on a comparison between the modulation vector Z in the I/Q-plane, measured over the complete slot or a fraction of it (termed the *Measurement Length* in the CMU), and an ideal, calculated reference signal R'; see *14 below*. The modulation parameters of the conformance specification are defined as follows:

Error Vector Magnitude, EVM (RMS)	RMS value of the error vector E = R' – Z divided by the RMS value of the reference signal R', expressed in percent.
PCDE	Maximum Code Domain Error for all codes in a considered code domain at a specific spreading factor. The Code Domain Error for every code corresponds to the projection of the EVM onto that code. The PCDE is expressed in dB.

The CMU not only provides the EVM (RMS) value but also the (positive definite) normalized error vector EVM = E/R' over the whole measurement range. In addition to this time-dependent EVM, the comparison of Z and R' yields two additional non-redundant quantities; see *14 below*:

Phase Error	Difference in phase between the measured and the ideal modulated signal vector.
Magnitude Error	Difference between the magnitudes of the measured and the ideal modulated signal vector.

The EVM, phase error and magnitude error can be displayed in three separate graphical measurement menus. In addition, the CMU provides a statistical evaluation of all three quantities.

The frequency accuracy is assessed by means of the following parameter:

Carrier Frequency Error	Difference of the measured UE modulated carrier frequency from the expected (nominal) frequency.

In addition to the previous parameters, specified in standard TS 34.121, the CMU provides the following results:

I/Q Origin Offset	Origin offset in the I/Q constellation diagram reflecting a DC offset in the baseband signal (see *Fig. 4-15* on page 4.43 and *Equation 4-1*). The origin offset corresponds to a RF carrier feedthrough in spectral representation.
I/Q Imbalance	Amplitude difference between the in-phase (I) to the quadrature (Q) components of the measured signal, normalized and logarithmized (see *Fig. 4-15* on page 4.43 and *Equation 4-2*). The I/Q imbalance corresponds to an unwanted signal in the opposite sideband in spectral representation.
Waveform Quality	Normalized correlated power between the actual and the ideal waveform.

A **limit check** is provided for all three error curves and all scalar results.

In annex B of standard TS 34.121, the different steps to obtain the *Modulation* parameters are outlined as follows:

1. **Acquire the signal Z and calculate the reference signal R**

   The actual modulation vector of the output signal of the UE under test is measured over a complete slot and stored as Z, using a matched filter (an RRC filter with a roll-off α = 0.22 and a bandwidth equal to the chip rate). A reference signal R with variable timing, RF carrier frequency f_{Carr} and power (gain factors; see Fig. 4-16 on p. 4.44 and Fig. 4-17 on p. 4.45), is constructed mathematically and filtered by the same matched filter.

2. **Derive the Code Domain Power and Frequency Error**

   The timing, carrier frequency f_{Carr} and power of the reference signal R is varied in order to achieve best fit with the measured signal Z, i.e. to minimize the RMS value of the difference Z – R. This yields the measured values of the *Frequency Error,* the *Code Domain Power* (see section *Code Domain Power Measurements* on p. 4.98) and the varied reference signal R'.

3. Calculate the EVM, Phase Error and Magnitude Error as a function of time

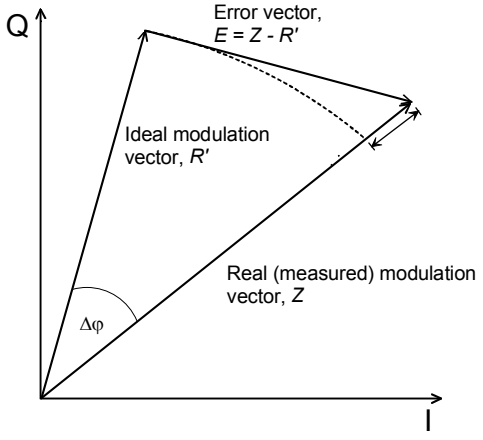


Fig. 4-14 Modulation errors in the I/Q vector diagram

The error vector $E = Z - R'$ is calculated as an array at each sample in the measurement interval. From E and Z the following arrays can be calculated:

$\lvert E \rvert = \lvert Z - R' \rvert$	Magnitude of the error vector, calculated at each sample in the measurement interval.
$\Delta\varphi$	Phase error
$\lvert Z \rvert - \lvert R' \rvert$	Magnitude error

The *Modulation* measurement diagrams show the relative magnitude error and the relative EVM, i.e. the quantities defined above divided by the magnitude of the ideal modulation vector $\lvert R' \rvert$.

Note: *The test functionality of the CMU is beyond the requirements of the standard where nothing regarding the phase error and magnitude error is specified.*

4. Calculate the EVM (RMS) and PCDE

The EVM (RMS) is calculated as the ratio of the RMS value of E to the RMS value of R' in percent, i.e.

*EVM = RMS (E) / RMS (R') * 100%*

The Peak Code Domain Error (PCDE) is calculated as follows:

The error vector $E = Z - R'$ is descrambled and projected onto all code channels of a specific spreading factor SF. For each of the resulting projected error vectors E_k (k = 0 to SF – 1), the RMS value is calculated. The PCDE is calculated as the ratio of the maximum of the RMS values of E_k to the RMS value of R' in dB, i.e.

$$PCDE = 20 * \log [\max_k RMS (E_k) / RMS (R')] \text{ dB}$$

In addition to the previous parameters, CMU provides the Origin Offset, the I/Q Imbalance and the Waveform Quality:

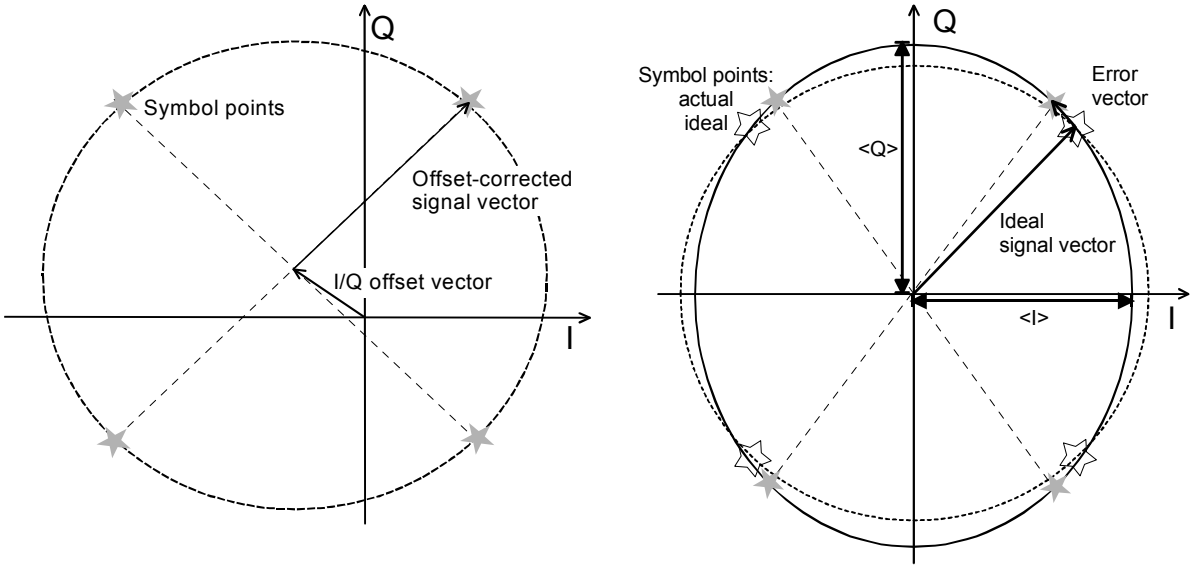


Fig. 4-15 Modulation errors in the I/Q constellation diagram

Origin offset

Fig. 4-15 is an idealized representation of the modulation errors where the effects of a pure origin offset (left diagram) and of a pure I/Q imbalance (right diagram) are completely disentangled. The I/Q offset in dB is the logarithmic ratio of the I/Q offset vector (i.e. the estimated DC-offset of the measured signal) to the average offset-corrected signal vector:

$$\text{Origin Offset} = 20\log\frac{|\text{I/Q offset vector}|}{|\text{Offset - corrected signal vector}|_{RMS}} \quad \text{(Equation 4-1).}$$

In *Equation 4-1*, | Offset - corrected signal vector | $_{RMS}$ denotes the magnitude of the offset-corrected signal vector that is RMS-averaged over all samples.

Analysis Mode

In the *UE Code* tab of the *Connection Control* menu (see section *UE Code* on p. **4.144**), two alternative *Analysis Modes* can be set:

In the analysis *With Origin Offset*, which conforms to 3GPP specifications, the modulation vectors R and Z in *Fig. 4-20* are measured from the origin of the I/Q plane, so the results for the EVM, phase error and magnitude error include a possible origin offset.

In the analysis *Without Origin Offset*, the modulation vectors R and Z in *Fig. 4-20* are measured from the coordinates of the I/Q offset vector, so the origin offset is subtracted out in the EVM, phase error and magnitude error results.

Note: *The I/Q imbalance is always calculated without origin offset regardless of the* Analysis Mode *set (see Fig. 4-15). Conversely, the waveform quality is always calculated with origin offset.*

I/Q imbalance

The I/Q imbalance in dB is equal to the difference between the estimated I and Q amplitudes of the measured signal, which are normalized and logarithmized as follows:

$$\text{I/Q Imbalance} = 20\log\frac{|<\text{I}> - <\text{Q}>|}{|<\text{I}> + <\text{Q}>|} \quad \text{(Equation 4-2).}$$

Waveform quality

The waveform quality or ρ factor is a measure for the modulation accuracy and corresponds to the normalized correlated power between the actual waveform and the ideal waveform sampled at the constellation points. According to standard

TIA/EIA/SP-4583, it is defined as:

$$\text{Waveform Quality} = \frac{|\sum_k R'_k Z_k^* |^2}{\sum_k |R'_k|^2 \sum_k |Z_k|^2} \quad \text{(Equation 4-3),}$$

where R'_k is the kth sample of the ideal signal, Z_k is the kth sample of the measured signal (both in complex representation) and the sums run over all samples. For an ideal transmitter ($Z_k = R_k$ for all k), the waveform quality is equal to 1. For real transmitters, the waveform quality is a positive real number smaller than 1.

Uplink WCDMA Signal

As a prerequisite to the WCDMA modulation measurement, the CMU commands the UE to transmit an uplink WCDMA signal. Its properties are as defined in 3G TS 25.213, *Spreading and modulation (FDD):*

The WCDMA signal is composed of one control channel (DPCCH) and n data channels (DPDCH), where n is between 0 and 6. The symbols of all channels are first spread to the chip rate by the channelization codes c, weighted by gain factors β and summed to form a complex-valued stream of chips. This complex-valued signal is then scrambled by a long or short scrambling code and finally QPSK modulated. For a WCDMA signal consisting of the DPCCH plus one DPDCH, the different spreading and modulation stages are shown in see Fig. 4-16 below.

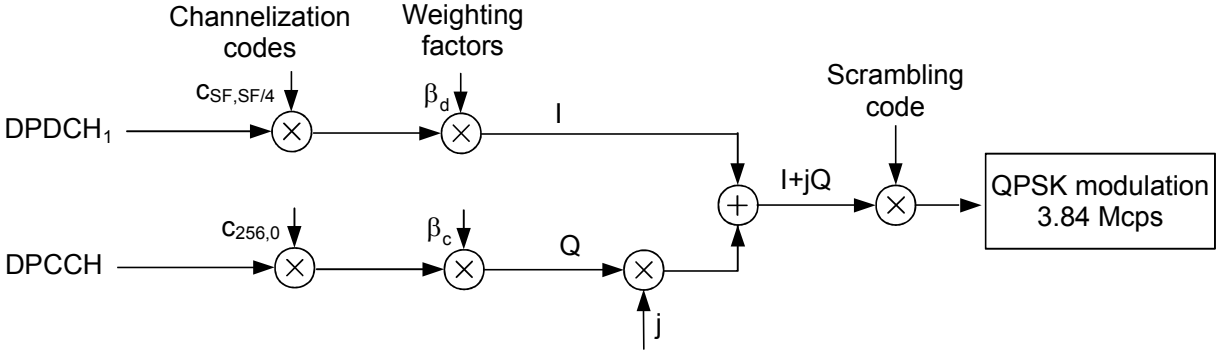


Fig. 4-16 Uplink WCDMA signal with up to 1 data channel

The **channelization codes** are defined in terms of the spreading factors SF and an index k ranging from 0 to SF – 1. The spreading factor relates the chip rate of the total WCDMA signal to the symbol rate of the individual channel: SF (Channel) x Symbol rate (Channel) = 3.84 Mcps.

According to the standard, the DPCCH is always spread with code $c_{256,0}$, corresponding to a symbol rate of 15 kbps. In the signal configuration of Fig. 4-16, where one DPDCH is transmitted, spreading factors of 4, 8, 16, 32, 64, 128 or 256 may be used, and the corresponding DPDCH channelization codes are $c_{SF,SF/4}$. The CMU sets the spreading factor implicitly as the symbol rate for the first DPDCH can be selected. With several DPDCHs, DPDCH$_n$ is spread by $c_{4,k}$, where k = 1 if n ∈ {1, 2}, k = 3 if n ∈ {3, 4}, and k = 2 if n ∈ {5, 6}. The corresponding signal configuration is shown in Fig. 4-17 below.

The CMU is able to analyze standard WCDMA signals with an arbitrary number of DPDCHs and arbitrary channelization codes.

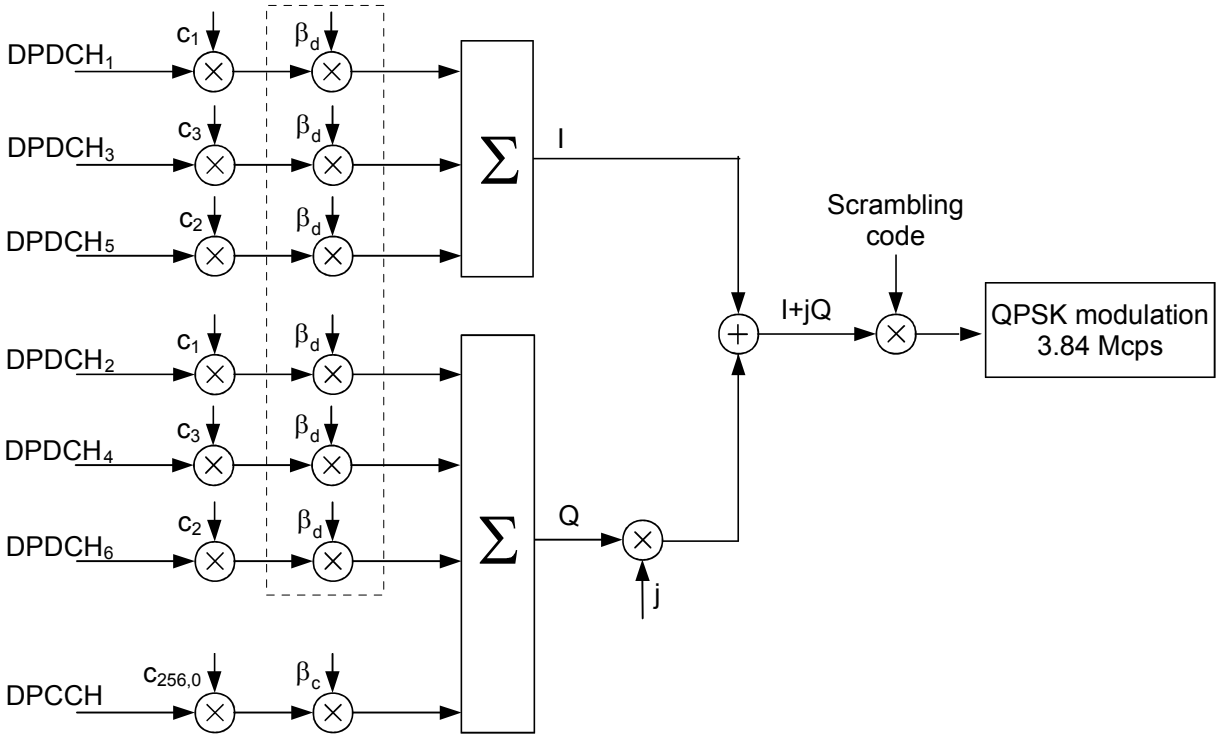


Fig. 4-17 Uplink WCDMA signal with up to 6 data channels

The **weighting factors** are equal for all transmitted DPDCHs, so they essentially determine the DPCCH/DPDCH power ratio.

The **scrambling code** is a complex-valued sequence of either long or short type that is distinguished by its scrambling code number. The CMU supports long codes only.

The uplink HSDPA and HSUPA channels are spread in an analogous way; see Chapter 8.

QPSK Measurements (Modulation – QPSK)

If the QPSK signal configuration is selected (see *Application* softkey in section *Test Settings* on page 4.46), the graphical measurement menu *Modulation* displays quantities characterizing the modulation accuracy of a single QPSK-modulated signal with a chip rate of 3.84 Mcps.

- The measurement control softkey *Overview QPSK* (which changes to *EVM QPSK, Magn. Error QPSK, Phase Error QPSK*, or *I/Q Analyz. QPSK* if the corresponding application is selected) controls the measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Modulation Configuration* (press twice). The hotkeys associated with the measurement control softkey define the scope of the Modulation measurement.
- The other softkeys to the right of the test diagram are combined with various hotkeys. The softkey/hotkey combinations provide test settings and switch over between different measurements. The entry of values is described in section *Measurement Menu (Power)* on page 4.6.

The measurement menu *Modulation* can be accessed from any other measurement menu of the WCDMA UE function group using the *Modulation* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).

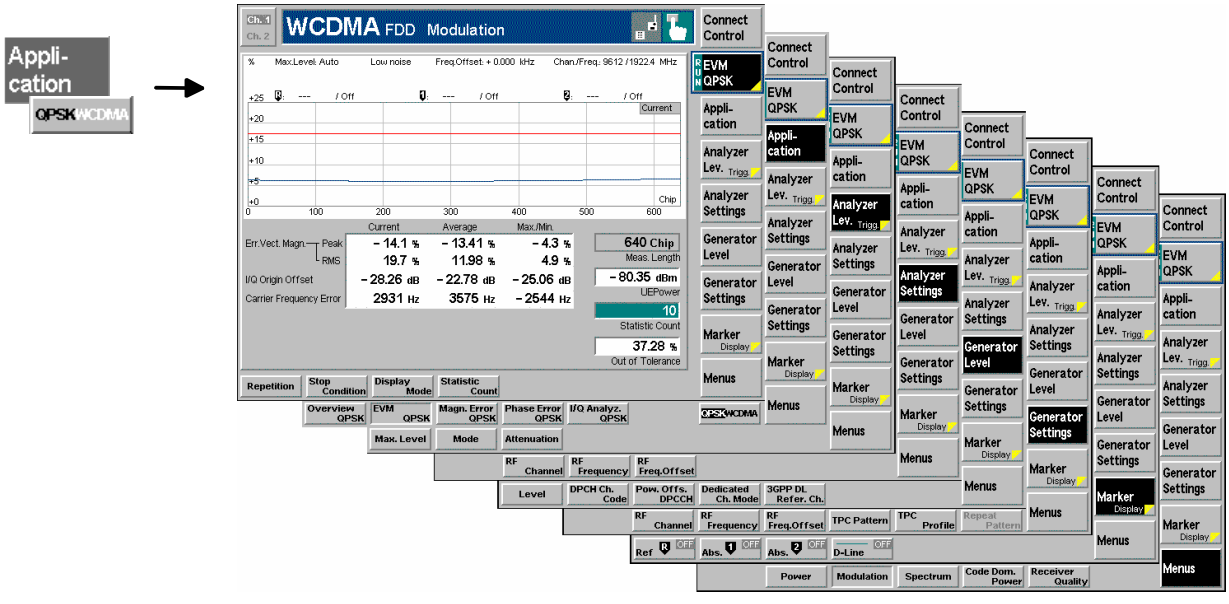


Fig. 4-18 Measurement menu Modulation – EVM QPSK

Test Settings

The *Analyzer Level, Analyzer Settings* and *Menus* test settings are identical with those in the *Power* menu (see section *Test Settings* on page 4.7). The following softkeys and hotkeys differ from the *Power* measurement:

Overview QPSK

The *Overview QPSK* softkey controls the QPSK modulation measurement and indicates its status *(RUN | HLT | OFF)*.

This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status of the measurement is unaffected upon switchover to other menus controlling a *Modulation* measurement, however, a running measurement is restarted.

Remote control
`INITiate:MODulation:OVERview:QPSK`

```
ABORt:MODulation:OVERview:QPSK
STOP:MODulation:OVERview:QPSK
CONTinue:MODulation:OVERview:QPSK
```
etc.

Measurement configuration

Pressing the *Overview QPSK* softkey twice opens the popup menu *Modulation Configuration* (see page 4.66). Besides, the hotkeys *Repetition, Stop Condition,* and *Statistic Count* defining the scope of the measurement are associated with the *Overview QPSK* softkey. The function of these hotkeys is explained in the *Power* menu section (see section *Test settings* on page 4.7); they are identical with the parameters set in the *Control t*ab of the *Modulation Configuration* menu (see page 4.66).

Application

The *Application* softkey selects the measurement application and the signal configuration.

The alternative diagrams (applications) are displayed in different measurement menus. When an application is selected, the corresponding measurement menu is called up. The configuration settings for all applications, however, are listed in a common popup menu (see p. 4.66).

Overview QPSK

The *Overview QPSK* hotkey selects all scalar modulation results to be displayed. For an explanation of the measured quantities see section *Measurement of Modulation Parameters* on page 4.40.

Remote control
No explicit switchover command. All *Overview QPSK* measurements are identified by the 3rd/4th level keywords `...OVERview:QPSK...`

EVM QPSK

The *EVM QPSK* hotkey selects the magnitude of the error vector to be displayed. The error vector connects the measured signal from the UE and the ideal signal vector at the symbol points, see explanation in section *Measurement of Modulation Parameters* on page 4.40. The diagram shows the relative magnitude (in percent), i.e. the ratio of the magnitude of the error vector to the magnitude of the ideal signal vector.

Remote control
No explicit switchover command. All *EVM QPSK* measurements are identified by the 3rd/4th level keywords `...EVMagnitude:QPSK...`

Magn. Err. QPSK

The *Magnitude Error QPSK* hotkey selects the magnitude error of the modulation vector to be displayed.

The magnitude error is the difference in magnitude between the measured signal from the UE and an ideal signal waveform at the symbol points, see explanation in section *Measurement of Modulation Parameters* on page 4.40. The diagram shows the relative magnitude error (in percent), i.e. the ratio of the absolute magnitude error to the magnitude of the ideal signal vector.

Remote control
No explicit switchover command. All *Magn. Error QPSK* measurements are identified by the 3rd/4th level keywords `...MERRor:QPSK...`

Phase Err. QPSK

The *Phase Error QPSK* hotkey selects the phase error of the modulation vector to be displayed.

The phase error is the difference in phase between the measured signal from the UE and an ideal signal waveform at the symbol points (in deg), see explanation in section *Measurement of Modulation Parameters* on page 4.40.

Remote control
No explicit switchover command. All *Phase Error QPSK* measurements are identified by the 3rd/4th level keywords `...PERRor:QPSK...`

I/Q Analyz. QPSK

The *I/Q Analyz. QPSK* hotkey selects the diagrams to display the modulation vector in the I/Q plane (constellation diagram, vector diagram) and the I and Q amplitude vs. time *(I Phase, Q Phase, I Phase & Q Phase).*

The diagram type is selected via *Display – Waveform* or in the configuration menu; see section *Measurement Control (Modulation Configuration – Control)* on page 4.69. This application is available in *Non Signalling* mode only.

Remote control
No explicit switchover command. All *I/Q Analyz QPSK* measurements are identified by the 3rd/4th level keywords `...IQANalyzer:QPSK...`

QPSK WCDMA

The *QPSK WCDMA* hotkey toggles between *QPSK* mode and *WCDMA* signal configuration.

The current signal configuration is marked in inverse video (white typeface on a dark background). Selecting another signal configuration also changes the *Modulation* measurement menu; see section *WCDMA Measurements (Modulation – WCDMA)* on page 4.56.

Remote control
QPSK and WCDMA signals are identified by the keywords `:QPSK` and `:WCDMa:DPCH` in the command headers, respectively.

Marker Display

The *Marker/Display* softkey positions up to 3 markers and a D-line in the test diagram and displays their values.

If pressed once again, the selected *Marker/Display* softkey changes to the *Display/Marker* softkey, see below. Both softkeys are not available in the *Overview* application where no measurement curve is displayed.

Markers — The markers are graphical tools for marking points on the measurement curve and for numerical output of measured values. The measurement menu *Modulation* provides a reference marker and two further markers that permit to measure distances (delta marker 1 and 2).
The coordinates of the three markers are indicated in the format Ordinate value (EVM or magnitude error or phase error)/abscissa value (time) in a parameter line above the test diagram. The position of the reference marker is expressed in absolute units (EVM and magnitude error in percent, phase error in deg, and time/abscissa value in chip periods), the delta marker can be defined by absolute or relative values (e.g. time differences from the reference marker).

D-line — The D-line is a horizontal line that can be positioned to mark or read out an arbitrary level in the test diagram.

Ref R

The hotkey *Ref. R* switches the reference marker on or off (use the *ON/OFF* key).

The reference marker is represented by the symbol R in the test diagram. The marker position (abscissa) is defined in the input field *Ref. Marker R*. The marker is switched off in the default setting *(Off).* The marker value is given by the measurement curve at the marker position.

The position of all markers can be varied using the roll-key.

Remote control
No command, screen configuration only.

Rel 1

The *Rel. 1* hotkey switches the delta marker 1 on or off (use the *ON/OFF* key).

The delta marker 1 is represented by the symbol 1 in the test diagram. The marker position (abscissa) is defined in the input field *Rel. Marker 1*. The marker is switched off in the default setting *(Off)*. The marker value is given by the measurement curve at the marker position.

The toggle switch *Rel 1 Config* pops up when the hotkey is pressed for the second time. It defines whether the position of delta marker 1 is measured and indicated in absolute units or relative to the reference marker.

Remote control
No command, screen configuration only.

Rel 2

The *Rel. 2* hotkey switches the delta marker 2 on or off (use the *ON/OFF* key). Functions and remote control are analogous to delta marker 1.

D-Line

The *D-Line* hotkey switches the D-line in the test diagram on or off.

The D-line is a horizontal, colored auxiliary line in the test diagram and is used for marking an ordinate value or for measuring differences. The ordinate value is determined in the input field *D-Line* and indicated on the D-line. The permissible value range is the diagram area, the default setting is *Off*.

Remote control
No command, screen configuration only.

Display
Marker

The *Display/Marker* softkey selects the x-axis range for the graphical display. It is activated by pressing the *Marker/Display* softkey twice. If pressed once again, the selected *Display/Marker* softkey changes back to the *Marker/Display* softkey, see above.

All *Display* settings are also provided in the configuration menu; see section *Measurement Control (Modulation Configuration – Control)* on page 4.69.

Measurement Results

The values shown in the *Modulation* measurement menus can be divided into three groups:

- Setting values
- Scalar measurement results (single values)
- Arrays (curves plotted as a function of time)

The measurement menu for the *Overview* application shows all scalar results but no curve. The measurement menus for the *EVM, Magn. Err.* and *Phase Err.* applications are analogous to each other and show the phase error, the (relative) magnitude error or the (relative) error vector magnitude as a function of time and the corresponding peak and effective values. The range and unit of the y-axis is adjusted to the measured quantity. The *I/Q Analyzer* application provides a graphical analysis of the modulation vector in the I/Q plane.

Scalar Results (Overview)

The measurement menu for the application *Overview QPSK* shows all scalar results. Most of the values are displayed in tabular form:

Parameter line

Output table and additional fields

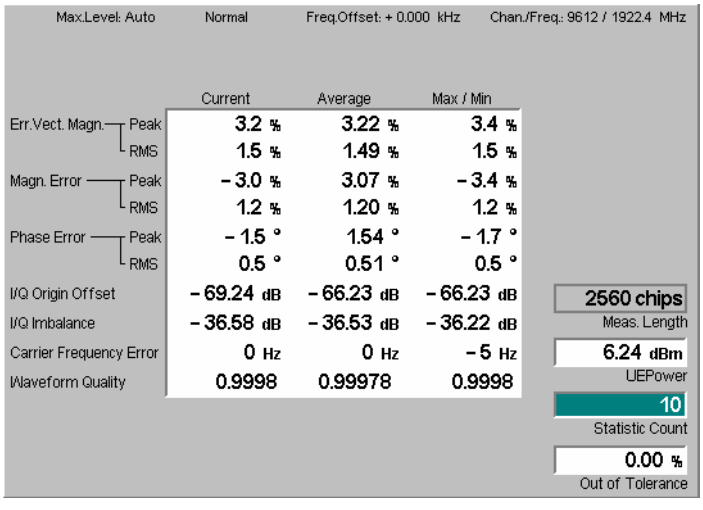


Fig. 4-19 Display of results (Modulation – Overview QPSK)

Parameter line

The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.9) are indicated in a parameter line across the top of the measurement menu:

Max. Level	Maximum expected input level in dBm
Attenuation	Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal WCDMA channel frequency
Chan./Freq.	RF channel measured and associated nominal carrier frequency

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Output table

The scalar values in the output table are explained in section *Measurement of Modulation Parameters* on p. 4.40. They are calculated for all evaluation periods measured and displayed in the *Current* column. From the *Current* results the

average referenced to a statistics cycle (*Average,* see averaging rules in Chapter 3, section *General Settings)* and the extreme value over all evaluation periods measured during the ongoing measurement *(Max/Min)* is calculated. Peak and RMS values are taken over the whole *Meas. Length,* see below. For a discussion of the different averaging rules used refer to Chapter 3.

Limit Check A red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Modulation* configuration menu, see section *Tolerance Values (Modulation Configuration – Limits)* on p. 4.72.

Additional fields Four output fields to the right of output table indicate the following results and settings:

Meas. Length Number of chips measured and used to calculate average and peak values as set in the *Control* tab of the *Modulation Configuration* menu, see section *Measurement Control (Modulation Configuration – Control)* on p. 4.69.

UE Power Average power in the current evaluation period (irrespective of the display mode selected and of the curve in the other QPSK applications).

Statistic Count Number of evaluation periods per statistics cycle. The colored bar indicates the relative measurement progress in the statistics cycle.

Out of Tolerance Percentage of evaluation periods where the tolerances are exceeded.

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

```
READ[:SCALar]:MODulation:OVERview:QPSK? etc.
CALCulate[:SCALar]:MODulation:OVERview:QPSK:
  MATChing:LIMit?
```

Test Diagrams (EVM, Phase Error, Magn. Error)

The graphical measurement menus for the three applications *EVM QPSK*, *Magn. Error QPSK*, and *Phase Error QPSK* are analogous. The results are indicated in two parameter lines, the test diagram, and a tabular overview below:

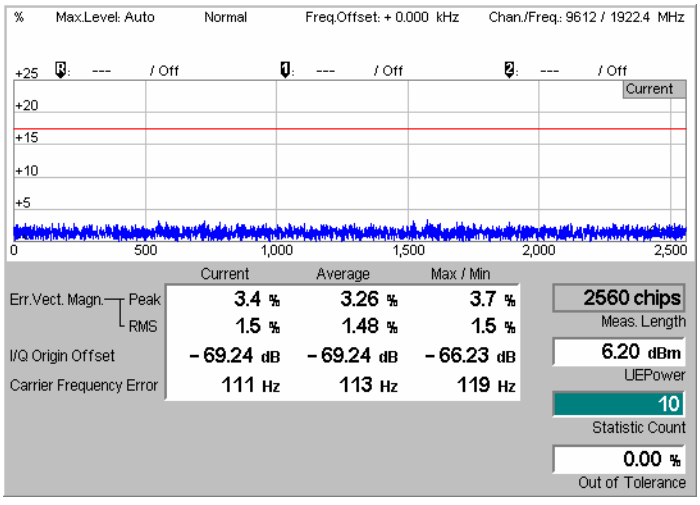


Fig. 4-20 Display of results (Modulation – EVM / Phase Error / Magn. Error QPSK)

Settings/ Scalar results

Scalar measurement results and settings are indicated in the two parameter lines above the test diagram and in the output table below.

1st parameter line

The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.9) are indicated in a parameter line across the top of the measurement menu:

Max. Level	Maximum expected input level in dBm
Attenuation	Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal WCDMA channel frequency
Chan./Freq.	RF channel measured and associated nominal carrier frequency

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

2nd parameter line

The second parameter line contains the following marker values:

R	Measurement result and time of reference marker
1	Measurement result and time of delta marker 1 (setting *absolute*) or difference from reference marker (setting *relative*)
2	Measurement result and time of delta marker 2 (setting *absolute*) or difference from reference marker (setting *relative*)

Output table/ Additional fields

The output table shows a subset of the results provided in the *Overview* application; see section *Scalar Results (Overview)* on page 4.50. The four output fields to the right of the output table are also provided in the *Overview* application.

Measurement curves (arrays)

The continuous curve in the test diagram shows the measured quantity as a function of time (in chip periods). The curve depends on the display mode *(Current, Max./Min., Average)* that can be set in the *Control* tab of the configuration menu (see section *Measurement Control (Modulation Configuration – Control)* on p. 4.69 f). The display mode is indicated in the upper right corner of the diagram.

The measurement curve extends over the *Meas. Length* indicated in the output field

below, one slot comprising 2560 chips. The curve is derived from equidistant measurement points with a 1-chip spacing. The y-axis range is fixed for any of the three measured quantities (applications):

0 % to +25 % for the error vector magnitude

–20 % to +20 % for the magnitude error

–20 deg to +20 deg for the phase error

The red, horizontal lines in the test diagram mark the tolerance range of the measured quantities as set in the *Limits* tab of the *Modulation Configuration* menu (see p. 4.72).

Remote control

`READ:ARRay:MODulation:EVMagnitude:QPSK:CURRent?` etc.

Display of the Modulation Vector (I/Q Analyzer)

The *I/Q Analyz. QPSK* application provides five different graphical menus to display and analyze the modulation vector of the received QPSK signal. The diagram type is selected via *Display – Waveform* or in the configuration menu; see section *Measurement Control (Modulation Configuration – Control)* on page 4.69. This application is available in *Non Signalling* mode only.

a) Representation in the I/Q Plane

The *Constellation* and the *Vector* diagram both show the basic properties of the QPSK modulation vector in the I/Q plane. The menus display a parameter line, the actual test diagram, and six output fields for the standard modulation parameters.

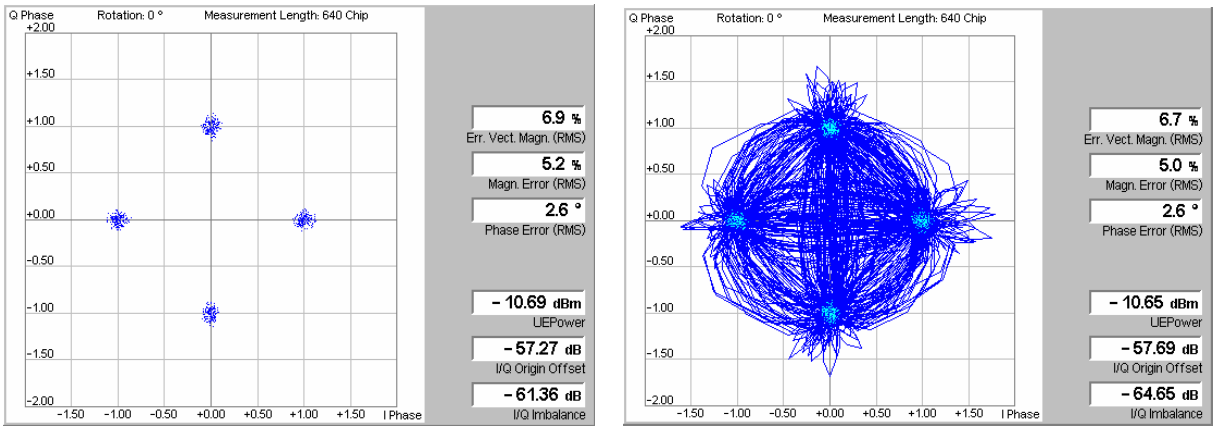


Fig. 4-21 Display of results (Modulation – I/Q Analyzer – Constellation/Vector)

Settings/ Scalar results Settings and scalar measurement results are indicated in the parameter line above the test diagram and in the output table on the right side.

Parameter line The display settings (as set via the *Display* softkey or in the configuration menu; see section *Measurement Control (Modulation Configuration – Control)* on p. 4.69) are indicated in a parameter line across the top of the diagram:

Rotation The default setting for the rotation angle for I/Q representation *(Rotation = 0°)* corresponds to the standard WCDMA QPSK modulation scheme where the constellation points are located on

the I and Q axes of the diagrams. A rotation by 45° corresponds to an alternative convention for the initial phase reference; see description of diagram below.

Meas. Length Time interval (number of consecutive chips) to be measured per single shot, equal to the number of points in the constellation diagram (640 chips or 2560 chips, corresponding to 1 complete WCDMA slot).

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Output fields The output table shows the most important scalar modulation parameters; see section *Measurement of Modulation Parameters* on p. 4.40. The *I/Q Imbalance* is a measure of the I/Q asymmetry of the diagram and therefore depends on the *Rotation* angle. The value for a rotation of 0° corresponds to the *I/Q Imbalance* displayed in the *Overview* application.

Remote control
`READ[:SCALar]:MODulation:IQANalyzer:QPSK?` etc.

Diagrams The constellation and vector diagrams trace the QPSK modulation vector in the normalized I/Q plane over a definite time interval. The normalized I amplitude <I> scales the horizontal axis, the normalized Q amplitude <Q> scales the vertical axis. The phase angle is given by

$$\varphi = \arctan(< Q > / < I >),$$

and the normalization is chosen so that the signal amplitude at the constellation points averaged over the measurement length is equal to 1.
The two diagrams differ in the way the result is displayed.

Constellation diagram In the *Constellation* diagram the modulation vector is only traced at the constellation points; the diagram shows a dot for each chip symbol. The constellation diagram of an ideal QPSK-modulated signal contains 4 constellation points with distance 1 from the origin and relative angles of $\pi/2$. Large variations of the symbol point positions in the constellation diagram indicate a poor signal quality; see Fig. 4-14 on p. 4.42.

In the QPSK application the symbol mapping between the logic data and the constellation points is not evaluated. As a consequence the overall phase of the diagram is random; a logic symbol may correspond to any of the four constellation points.

Note: *Due to the complex scrambling codes, even a single DPDCH or DPCCH generates a pattern with 4 constellation points.*

Vector diagram In the *Vector* diagram the modulation vector is traced with an oversampling factor of 4; the diagram shows a continuous curve. The vector diagram shows that the QPSK modulation scheme allows transitions between each pair of constellation points.

Settings A single shot measurement extends over the *Measurement Length* indicated in the parameter line above the diagram. The number of points in the constellation diagram after one single shot is equal to the measurement length in chips (each chip is mapped onto one QPSK constellation point). To customize the graphical representation it is possible to zoom the diagrams, keeping the origin at fixed position, and to display or remove the grid. Moreover, a fixed offset may be added to the phase angles *(Rotation)*; see section *Measurement Control (Modulation Configuration – Control)* on p. 4.69.

Remote control
```
READ:ARRay:MODulation:IQANalyzer:QPSK:IPHase?
READ:ARRay:MODulation:IQANalyzer:QPSK:QPHase? etc.
```

b) Representation of the Amplitudes vs. Time

The *I Phase,* the *Q Phase,* and the *I Phase & Q Phase* diagrams show the normalized amplitudes of the I and Q components of the modulation vector as a function of time (eye diagrams). The menus display a parameter line and the actual test diagrams. All diagrams are Cartesian diagrams, the time forming the x-axis.

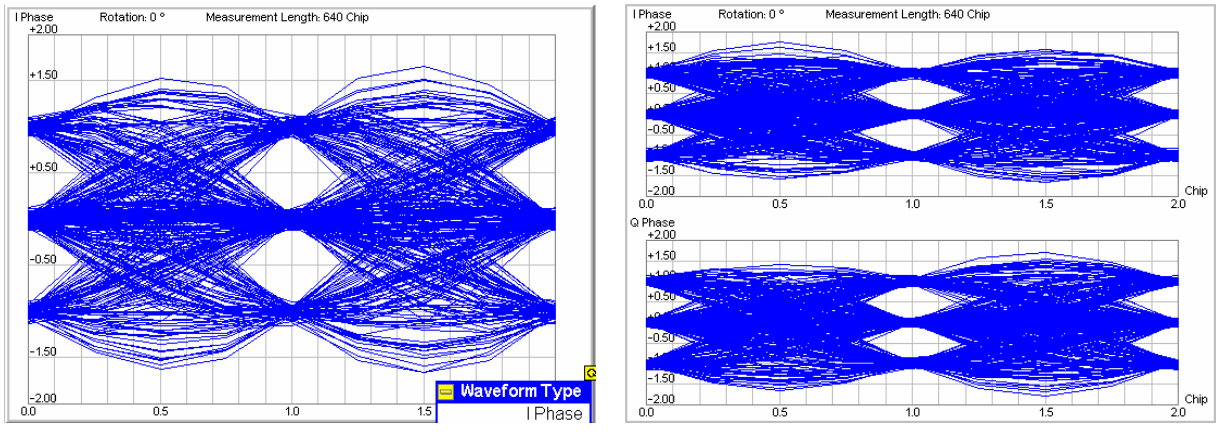


Fig. 4-22 Display of results (Modulation – I/Q Analyzer – I Phase / Q Phase)

Settings

The parameter line above the test diagram displays the same settings as the constellation and vector diagrams; see section *Representation in the I/Q Plane* on p. 4.53.

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Diagram

The *I Phase,* the *Q Phase,* and the *I Phase & Q Phase* diagrams trace the normalized I and Q amplitudes as a function of time. Diagrams of this type are often referred to as eye diagrams. The horizontal axis covers a fixed 2-chip time interval, starting at the time of a constellation point, whereas the total duration of a single shot measurement is given by the *Measurement Length.* The measurement curve restarts at the left diagram edge after each 2-chip period so that the complete diagram for a measurement length of 640 chips (2560 chips) contains 320 (1280) superimposed curves.

The number of nodes on the vertical axis of the I or Q eye diagram is equal to the number of different I or Q amplitudes in the constellation diagram. The number of eyes is equal to the number of nodes minus one. Smeared-out nodes and small eye apertures indicate a poor signal quality.

The *I Phase* and *Q Phase* diagrams are analogous; the combined *I Phase & Q Phase* diagram displays the *I Phase* diagram on top of the *Q Phase* diagram.

To customize the graphical representation it is possible to zoom the diagrams in vertical direction, keeping the zero-amplitude reference at fixed position, and to display or remove the grid. Moreover, a fixed offset may be added to the phase angles *(Rotation)*; see section *Measurement Control (Modulation Configuration –*

Control) on p. 4.69. A rotation angle of 0° corresponds to the scenario in *Fig. 4-22* with 3 nodes on the vertical axis. The number of nodes is reduced to 2 (and the number of eyes to 1) if a rotation angle of 45° is selected.

Remote control
`READ:ARRay:MODulation:IQANalyzer:QPSK:IPHase?`
`READ:ARRay:MODulation:IQANalyzer:QPSK:QPHase?` etc.

WCDMA Measurements (Modulation – WCDMA)

If the *WCDMA* signal configuration is selected (see *Application* softkey in section *Test Settings* on page 4.46), the graphical measurement menu *Modulation* displays quantities characterizing the modulation accuracy of a 3GPP standard uplink signal with a chip rate of 3.84 Mcps and channel coding.

- The measurement control softkey *Overview WCDMA* (which changes to *EVM WCDMA, Magn. Error WCDMA, Phase Error WCDMA*, or *I/Q Analyz. WCDMA* if the corresponding application is selected) controls the measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Modulation Configuration* (press twice). The hotkeys associated with the measurement control softkey define the scope of the Modulation measurement.
- The other softkeys to the right of the test diagram are combined with various hotkeys. The softkey/hotkey combinations provide test settings and switch over between different measurements. The entry of values is described in section *Measurement Menu (Power)* on page 4.6.

The measurement menu *Modulation* can be accessed from any other measurement menu of the WCDMA UE function group using the *Modulation* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).

NOTE

In the Modulation WCDMA applications (Overview WCDMA, EVM WCDMA, Magn. Error WCDMA, Phase Error WCDMA), the R&S CMU can assess the modulation accuracy of a WCDMA uplink signal over full slot or half slot periods. The measurement interval is controlled by the Measurement Length parameter described on p. 4.69. The feature is available in Non-Signalling and in Signalling mode. An application example for the half slot measurement is given in Chapter 2, section EVM Test with HS-DPCCH.

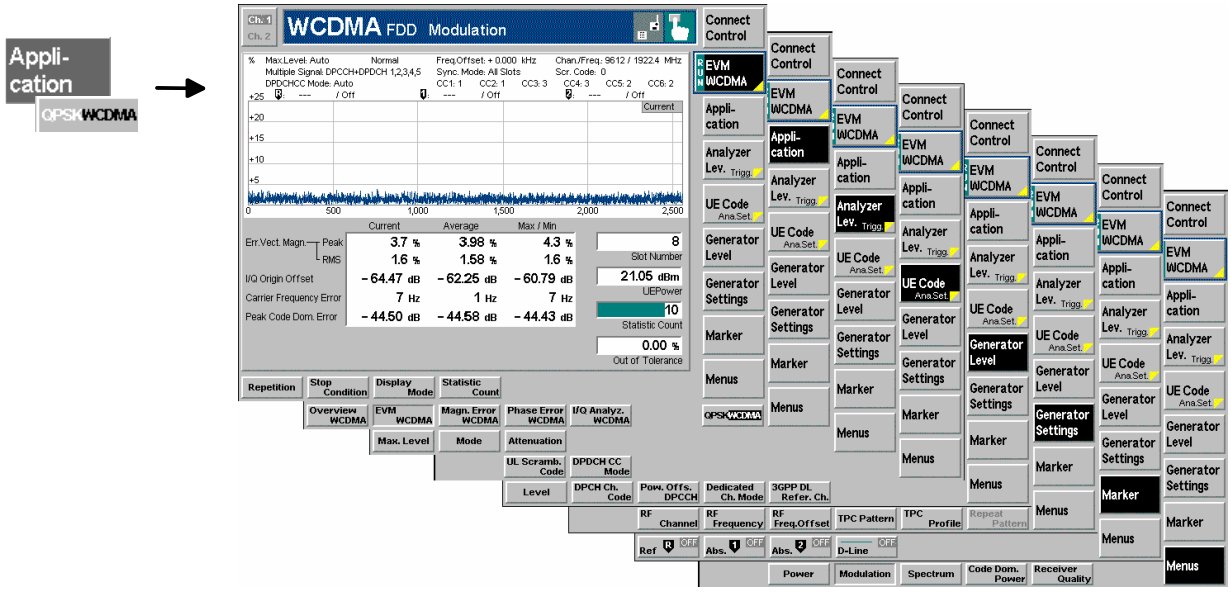


Fig. 4-23 Measurement menu Modulation – EVM WCDMA

Test Settings

The *Analyzer Level, Analyzer Settings* and *Menus* test settings are identical with those in the *Power* menu (see section *Test Settings* on page 4.7). The *Overview WCDMA* measurement control softkey and the *Marker* and *Display* softkeys behave like in the QPSK signal configuration; see section *Test Settings* on page 4.46. The following softkeys and hotkeys differ from the *Modulation – QPSK* measurement:

Application

The *Application* softkey selects the measurement application and the signal configuration.

The alternative diagrams (applications) are displayed in different measurement menus. When an application is selected, the corresponding measurement menu is called up. The configuration settings for all applications, however, are listed in a common popup menu (see p. 4.66).

Overview WCDMA

The *Overview WCDMA* hotkey selects all scalar modulation results to be displayed. For an explanation of the measured quantities see section *Measurement of Modulation Parameters* on page 4.40.

Remote control
No explicit switchover command. All *Overview WCDMA* measurements are identified by the 3rd/4th/5th level keywords `...OVERview:WCDMa:DPCH...`

EVM WCDMA

The *EVM WCDMA* hotkey selects the magnitude of the error vector to be displayed. The error vector connects the measured signal from the UE and the ideal signal vector at the symbol points, see explanation in section *Measurement of Modulation Parameters* on page 4.40. The diagram shows the relative magnitude (in percent), i.e. the ratio of the magnitude of the error vector to the magnitude of the ideal signal vector.

Remote control
No explicit switchover command. All *EVM WCDMA* measurements are identified by the 3rd/4th level keywords `...EVMagnitude:WCDMa:DPCH...`

Phase Err. WCDMA

The *Phase Error WCDMA* hotkey selects the phase error of the modulation vector to be displayed.

The phase error is the difference in phase between the measured signal from the UE and an ideal signal waveform at the symbol points, see explanation in section *Measurement of Modulation Parameters* on page 4.40.

Remote control
No explicit switchover command. All *Phase Error WCDMA* measurements are identified by the 3rd/4th level keywords `...PERRor:WCDMa:DPCH...`

Magn. Err. WCDMA

The *Magnitude Error WCDMA* hotkey selects the magnitude error of the modulation vector to be displayed.

The magnitude error is the difference in magnitude between the measured signal from the UE and an ideal signal waveform at the symbol points, see explanation in section *Measurement of Modulation Parameters* on page 4.40. The diagram shows the relative magnitude error (in percent), i.e. the ratio of the absolute magnitude error to the magnitude of the ideal signal vector.

Remote control
No explicit switchover command. All *Magn. Error WCDMA* measurements are identified by the 3rd/4th level keywords `...MERRor:WCDMa:DPCH...`

I/Q Analyz. WCDMA

The *I/Q Analyz. WCDMA* hotkey selects the diagrams to display the modulation vector in the I/Q plane (constellation diagram, vector diagram) and the phase of the I and Q component *(I Phase, Q Phase, I Phase & Q Phase)*.

The diagram type is selected via *Display – Waveform* or in the configuration menu; see section *Measurement Control (Modulation Configuration – Control)* on page 4.69.

Remote control
No explicit switchover command. All *I/Q Analyz WCDMA* measurements are identified by the 3rd/4th level keywords `...IQANalyzer:WCDMa...`

QPSK WCDMA

The *QPSK WCDMA* hotkey toggles between QPSK or WCDMA signal configuration.

The current signal configuration is marked in inverse video (white typeface on a dark background). Selecting another signal configuration also changes the *Modulation* measurement menu; see section *Measurement of Modulation Parameters* on page 4.40.

Remote control
QPSK and WCDMA modulation is selected by the keywords `:QPSK` and `:WCDMA` in the command headers, respectively.

UE Code Ana. Set.

The *UE Code* softkey defines the properties of the multiple uplink WCDMA signal that the CMU is able to analyze. For a description of the WCDMA signal see background information in section *WCDMA Measurements (Modulation – WCDMA)* on page 4.56 f. Most of the *UE Code* settings are also accessible via the *UE Code* tab of the *Connection Control* menu p. **4.144**. The measurement fails if the input signal does not conform to the *UE Code* settings.

If pressed once again, the selected *UE Code* softkey changes to the *Analyzer Settings* softkey, see section *Test Settings* on page 4.7.

Note: *In Signalling mode, there is no need to set the* UE Code *parameters* Multiple Signal and Sym. Rate/Chan. Code. *The parameters are implicitly included in the dedicated channel settings. The* UL Scrambling Code *that the UE shall use can be set in the* UE Signal *tab and doesn't have to be configured at the UE.*

Multiple Signal

The hotkey *Multiple Signal* selects the physical channels that contribute to the multiple uplink WCDMA signal.

DPCCH Signal consists of one single Dedicated Physical Control Channel

DPCCH+DPDCH1,...n Signal consists of one DPCCH to which n Dedicated Physical Data Channels are added. n can vary between 1 and 6 so that it is possible to superimpose up to 7 signals as shown in *Fig. 4-17* on p. 4.45.

This setting is ignored if the *DPDCH CC Mode* is set to *Auto*.

Remote control
`CONFigure:UECode:DPDCh:MANual:MSIGnal <Channels>`

UL Scramb. Code

The *UL Scramb. Code* hotkey selects the number of the long code that is used to scramble the WCDMA signal. The scrambling code number must be in the range 0 to FFFFFF (hex), corresponding to 0 to 16777215 decimal.

If the input signal does not conform to the *Scrambling Code* settings the measurement fails and the CMU displays the warning message *Scrambling code or Slot Format does not match input signal.*

Remote control
```
CONFigure:UECode:DPCH:SCODe <Code>
```

DPDCH CC Mode

The *DPDCH CC Mode* hotkey selects one of the following DPDCH channelization code modes:

Auto The CMU analyzes the signal from the WCDMA UE and searches for the DPDCH channelization codes. The conditions for the code search are defined in the *Auto Settings* section in the *UE Code* tab of the *Connection Control* menu; see p. **4.144**.: They comprise the symbol rate and a power threshold to distinguish the DPDCH from unwanted noise.

The code search also works with more than one data channel where the symbol rate is known to be 960 kbps: The CMU detects all DPDCHs with a power above the threshold.

If the DPDCH symbol rate set must be larger or equal than the actual symbol rate of the measured signal, otherwise the measurement will fail.

Manual The CMU analyzes the signal from the WCDMA UE under the assumption that the symbol rates, channelization codes and multiple signal configuration are as set in the *Manual Settings* section in the *UE Code* tab of the *Connection Control* menu; see p. **4.144**. The *Manual Settings* are equivalent to the hotkeys *Multiple Signal* and *Sym. Rate Chan. Code*.

The measurement speed in *Manual* mode is higher than in *Auto* mode. *Auto* mode can be used if the channelization code of the signal to be analyzed is unknown.

Remote control
```
CONFigure:MODulation:WCDMa:DPCH:CONTrol:CCMode
  MANual | AUTomatic
```

Symbol Rate

The *Symbol Rate* hotkey calls up a list of the symbol rate and channelization code for the DPCCH and each of the six CPDCHs that can contribute to the multiple WCDMA signal. If a *DPCCH+DPDCH1* multiple signal is analyzed, the symbol rate of the data channel *DPDCH1* can be set; the channelization code will be automatically adapted according to the rules in the 3GPP standard. For other multiple signal configurations, symbol rates and channelization codes are fixed.

The *Sym. Rate* settings are ignored if the *DPDCH CC Mode* is set to *Auto;* see above.

Remote control
```
CONFigure:UECode:DPDCh:MANual:DPDCh1:SRCCode <Rate>,<Code>
```

Measurement Results

The values shown in the *Modulation* measurement menus can be divided into three groups:

- Setting values
- Scalar measurement results (single values)
- Arrays (curves plotted as a function of time)

The measurement menu for the *Overview* application shows all scalar results but no curve. The measurement menus for the *EVM, Magn. Err.* and *Phase Err.* applications are analogous to each other and show the phase error, the (relative) magnitude error or the (relative) error vector magnitude as a function of time and the corresponding peak and effective values. The range and unit of the y-axis is adjusted to the measured quantity. The *I/Q Analyzer* application provides a graphical analysis of the the modulation vector in the I/Q plane.

Scalar Results (Overview)

The measurement menu for the application *Overview WCDMA* shows all scalar results. Most of the values are indicated in tabular form:

Parameter lines

Output table and additional fields

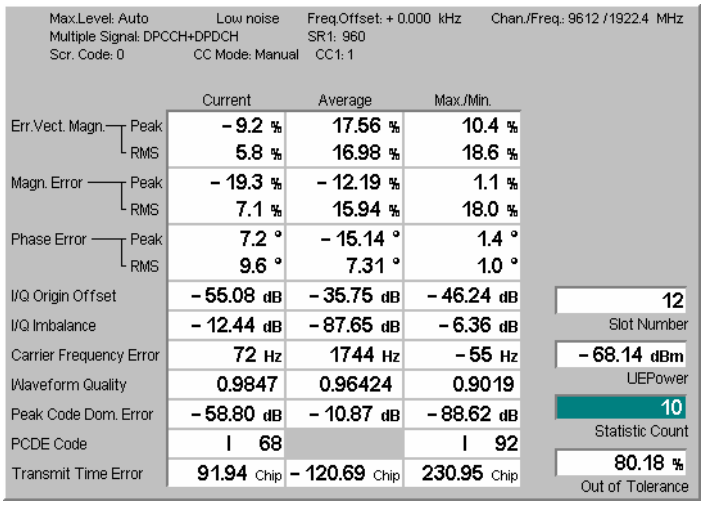


Fig. 4-24 Display of results (Modulation – Overview WCDMA)

Parameter lines The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.9) are indicated in a parameter line across the top of the measurement menu:

Max. Level Maximum expected input level in dBm

Attenuation Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*

Freq. Offset Frequency offset with respect to the nominal WCDMA channel frequency

Chan./Freq. RF channel measured and associated nominal carrier frequency

The two lines below indicate the properties of the measurement and of the analyzed WCDMA signal as defined by means of the *UE Code* softkey (see p. 4.58) and/or the *UE Code* tab of the *Connection Control* menu; *p.* **4.144**.:

Multiple Signal Physical channels that contribute to the WCDMA signal

Sync. Mode Synchronization between the WCDMA signal and the CMU: *All Slots*

Scr. Code Scrambling code number of the WCDMA signal

DPDCH CC Mode Manual or automatic detection of the channelization code

CCn Channelization codes of the data channels $DPDCH_1$ to $DPDCH_6$

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Output table

The scalar values in the output table are explained in section *Measurement of Modulation Parameters* on p. 4.40. In addition to the values in the QPSK application (see section *Scalar Results (Overview)* on page 4.40., the following values are displayed:

Peak Code Domain Error The maximum EVM of all code channels.

PCDE Code Code number with the largest code domain error.

Transmit Time Error Deviation (in units of chip periods and rounded to ¼ chip values) from the nominal DL/UL timing offset of 1024 chips. Negative values mean that the uplink signal arrives early.

Note: *The transmit time error is measured relative to the timing of the DL signal generated by the R&S CMU. The DL timing is only available if* Internal *trigger or an appropriate external trigger signal is used. With* Free Run *trigger, no transmit time error results can be obtained.*

Limit Check

A red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Modulation* configuration menu, see p. 4.72.

In a half slot measurement *(Measurement Length: 1280 Chips),* the *Modulation* parameters are measured over the entire *Measurement Length,* however, the 25 µs transient periods at the end of each DPCH slot or DPCH half slot where the mean power is expected to change are not taken into account for the limit check. This rule is in accordance with the conformance test specifications for EVM tests with HS-DPCCH; see application example in Chapter 2.

Additional fields

Four output fields to the right of output table indicate the following results and settings:

Slot Number Number of the measured slot of the captured signal within the 10 ms frame and in the range 0 to 14. The CMU detects the slot number from the pilot bits in the captured signal. ***4.171***.

UE Power Average power in the current evaluation period (irrespective of the display mode selected and of the curve in the other WCDMA applications).

Statistic Count Number of evaluation periods per statistics cycle. The colored bar indicates the relative measurement progress in the statistics cycle.

Out of Tolerance Percentage of evaluation periods where the tolerance limits are exceeded.

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

```
READ[:SCALar]:MODulation:OVERview:WCDMa:DPCH?
```
etc.

```
READ[:SCALar]:MODulation:OVERview:WCDMa:DPCH:CMMax:PCDE?
```
etc.

```
CALCulate[:SCALar]:MODulation:OVERview:WCDMa:DPCH:
      MATChing:LIMit?
```

Test Diagrams (EVM, Phase Error, Magn. Error)

The graphical measurement menus for the three applications *EVM WCDMA*, *Magn. Error WCDMA*, and *Phase Error WCDMA* are analogous. The results are indicated in a parameter line, the test diagram, and a tabular overview below:

Parameter line

Test diagram

Output fields

and table

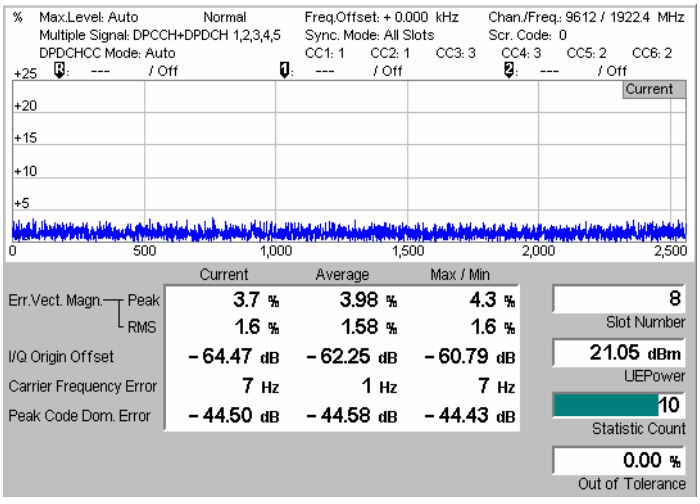


Fig. 4-25 Display of results (Modulation – EVM / Phase Error / Magn. Error WCDMA)

Settings/ Scalar results

The parameter lines above the graphical diagram are identical to the ones shown in the *Overview* application; see section *Scalar Results (Overview)* on page 4.60.

Output table/ Additional fields

The output table shows a subset of the results provided in the *Overview* application; see section *Scalar Results (Overview)* on page 4.60. The four output fields to the right of the output table are also provided in the *Overview* application.

Curves (arrays)

The graphical diagram is analogous to the diagram in the QPSK application, see section *Test Diagrams (EVM, Phase Error, Magn. Error)* on page 4.51. The curve refers to the multiple WCDMA signal measured.

Remote control
`READ:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?` etc.

Limit Check

A red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Modulation* configuration menu, see p. 4.72.

In a half slot measurement *(Measurement Length: 1280 Chips),* the *Modulation* parameters are measured over the entire *Measurement Length,* however, the 25 µs transient periods at the end of each DPCH slot or DPCH half slot where the mean power is expected to change are not taken into account for the limit check. This rule is in accordance with the conformance test specifications for EVM tests with HS-DPCCH; see application example in Chapter 2.

Display of the Modulation Vector (I/Q Analyzer)

The *I/Q Analyz. WCDMA* application provides five different graphical menus to display and analyze the modulation vector of the received WCDMA signal. The diagram type is selected via *Display – Waveform* or in the configuration menu; see section *Measurement Control (Modulation Configuration – Control)* on page 4.69. This application is available in *Non Signalling* mode only.

c) Representation in the I/Q Plane

The *Constellation* and the *Vector* diagram both show the basic properties of the WCDMA modulation vector in the I/Q plane. The menus display the actual test diagram and seven output fields for the slot number and the essential modulation parameters. The example below shows a WCDMA signal configuration with 1 DPCCH and 2 DPDCHs, all with equal amplitude.

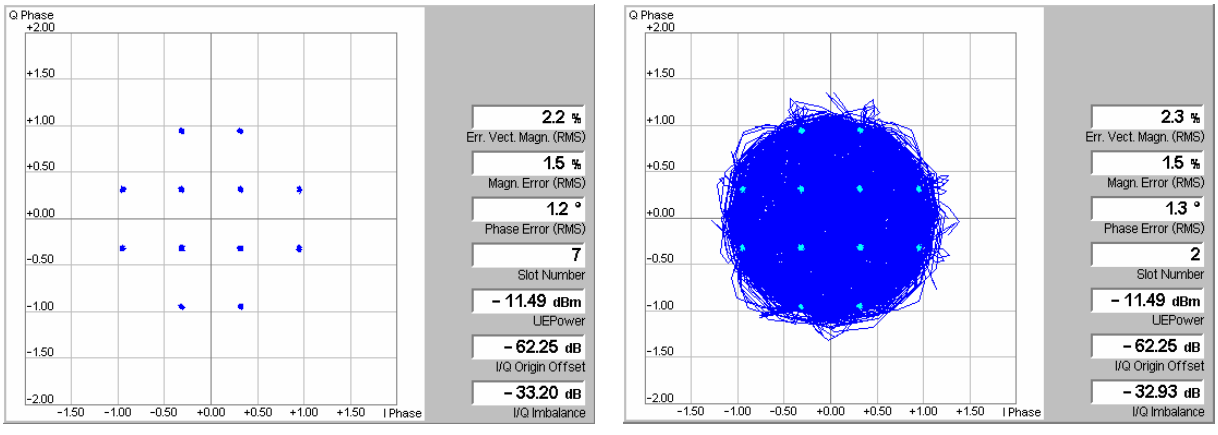


Fig. 4-26 Display of results (Modulation – I/Q Analyzer – Constellation/Vector)

Settings/ Scalar results

The scalar modulation parameters indicated in the output fields on the right side are analogous to the *I/Q Analyz. QPSK* menus; see section *Representation in the I/Q Plane* on p. 4.53. The slot number is indicated in addition. In contrast to the QPSK menus no parameter line is displayed, because the overall phase of the diagram and the measurement length are fixed. This means that the *I/Q Imbalance* is also unambiguous; it corresponds to the value displayed in the *Overview* application.

Remote control
`READ[:SCALar]:MODulation:IQANalyzer:WCDMa?` etc.

Diagram

The constellation and vector diagrams are analogous the diagrams for single QPSK-modulated signals, however, more constellation points occur if several signals with different power contribute to the analyzed WCDMA signal. The example in *Fig. 4-26* shows a WCDMA signal configuration with 1 DPCCH and 2 DPDCHs, all with equal amplitude. In contrast to the QPSK application, the WCDMA measurement does evaluate the symbol mapping between the logic data and the constellation points. This means that the phase ambiguity of the diagrams is resolved; no additional rotation angle is provided.

Remote control
`READ:ARRay:MODulation:IQANalyzer:WCDMa:IPHase?`
`READ:ARRay:MODulation:IQANalyzer:WCDMa:QPHase?` etc.

d) Representation of the Amplitudes vs. Time

The *I Phase,* the *Q Phase,* and the *I Phase & Q Phase* diagrams show the normalized amplitudes of the I and Q components of the modulation vector as a function of time (eye diagrams). All diagrams are Cartesian diagrams, the time forming the x-axis.

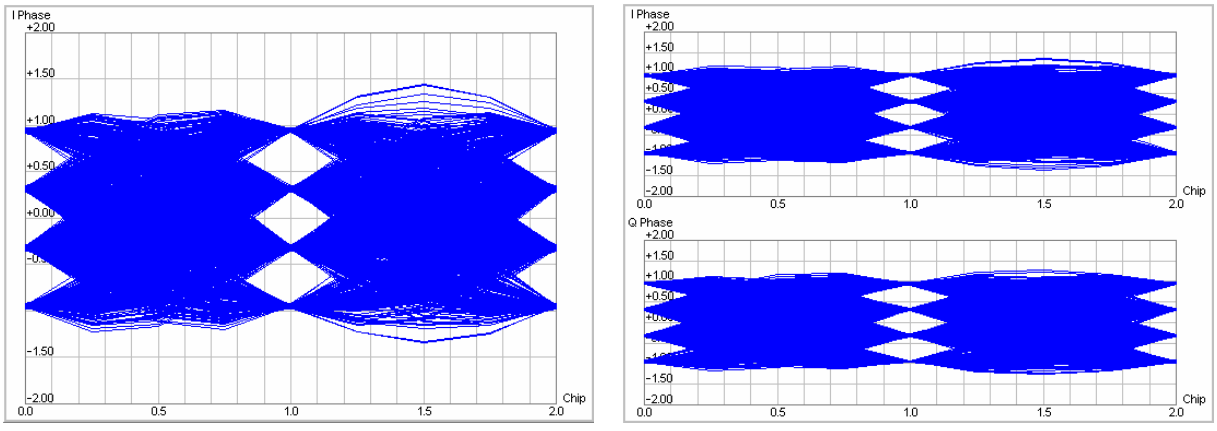


Fig. 4-27 Display of results (Modulation – I/Q Analyzer – I Phase / Q Phase)

Diagram The *I Phase,* the *Q Phase,* and the *I Phase & Q Phase* diagrams are analogous to the diagrams for single QPSK-modulated signals, however, more nodes and eyes occur as several signals with different power contribute to the analyzed WCDMA signal and the constellation diagram becomes more complex.

Remote control

```
READ:ARRay:MODulation:IQANalyzer:WCDMa:IPHase?
READ:ARRay:MODulation:IQANalyzer:WCDMa:QPHase?   etc.
```

PRACH Preamble Quality Measurement

The PRACH preamble quality is a measure of the ability of the UE to transmit the PRACH preamble in accordance with the core requirements so that the Node B can reliably decode the PRACH. The CMU can measure the PRACH preamble quality in accordance with the initial conditions stated in the conformance test specification 3GPP TS 34.121. The *Modulation – PRACH Preamble* menu shows the modulation parameters for a single PRACH preamble; among these parameters, the *Error Vector Magnitude* (EVM), the *Carrier Frequency Error,* and the *Signature* are relevant for the conformance test.

An application example for PRACH preamble quality tests is reported in Chapter 2.

PRACH Preamble Quality Measurement Results

The graphical measurement menu for the *PRACH Preamble Quality* application contains three parameter lines, a test diagram, and a tabular overview below:

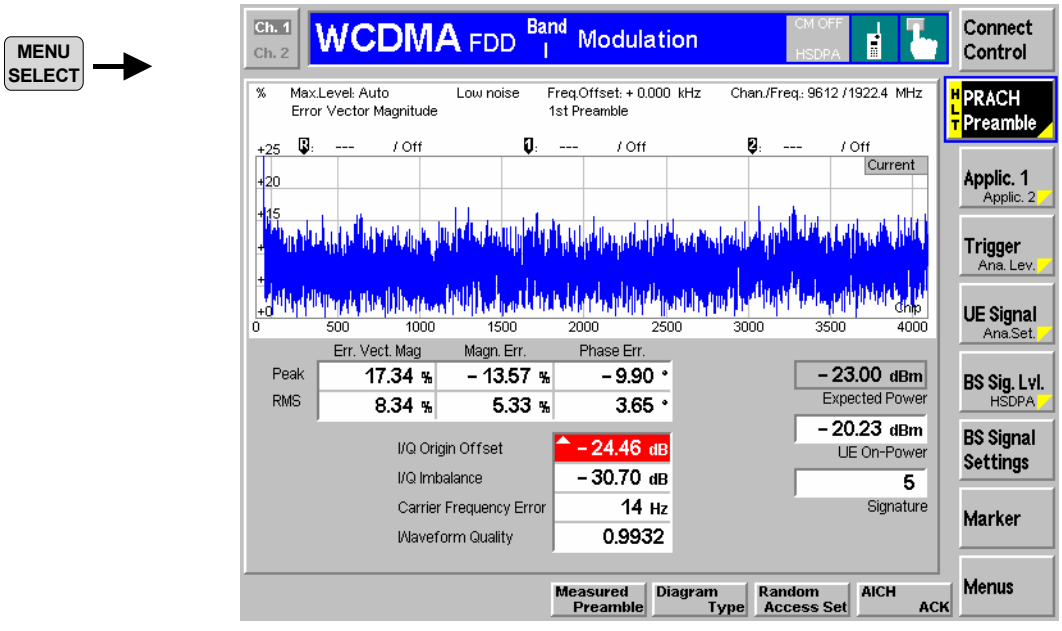


Fig. 4-28 Display of results (Modulation – PRACH Preamble Quality)

Test settings The parameter lines show the essential test settings and the marker values.

Diagram: EVM / Phase Error / Magnitude Error The diagram shows the *Error Vector Mag. (EVM)* over the whole PRACH preamble length of 4096 chips. Alternatively, it is possible to switch over to the *Magnitude Error* or to the *Phase Error (PRACH Preamble – Diagram Type).* The diagram scales are fixed.

Remote control
`READ:ARRay:MODulation:PRACh:EVMagnitude?`
`READ:ARRay:MODulation:PRACh:MERRor?`
`READ:ARRay:MODulation:PRACh:PERRor?` etc.

Output values Below the diagram, the menu shows the current values of the peak and RMS *Error Vector Magnitude*, the *Magnitude Error,* and the *Phase Error* for the selected preamble (1 of 5; see *Measured Preamble* parameter in section *Measurement Control (Modulation Configuration – Control)* on page 4.69). Together with the modulation parameters below, these quantities are also displayed in other applications of the *Modulation* menu (e.g. *Overview).* They are described in section *Modulation Measurements* on p. 4.40.

The *Expected Power,* the *UE-On Power,* and the *Signature* are described in section *Connection – RF Channel and Power* on p. 4.208.

Limit Check (Scalar Results) In general, a red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Modulation Configuration* menu.

Note: *The limit check is calculated according to the conformance test specification: The results in the transient periods at the beginning and at the end of the slot (25 µs or 96 chips) are not taken into account.*

Remote control
`CALCulate[:SCALar]:MODulation:PRACh:MATChing:LIMit?`

Phase Discontinuity Measurement

Phase discontinuity is the change in phase between any two adjacent timeslots. The phase discontinuity is measured in accordance with the definition of the conformance test specification 3GPP TS 34.121:

The phase error is determined by minimizing the error vector in each slot as described in section *Measurement of Modulation Parameters* on p. 4.40. This phase error curve can be displayed using one of the *Modulation – Phase Error* applications.

A linear best-fit to the phase error curve in each slot (excluding the 25 µs transient periods on either side of the timeslot boundaries) and an extrapolation onto the slot boundaries yields an estimate of the phase error at the beginning and at the end of each slot. The phase discontinuity is defined as the difference between the extrapolated phase at the end of the timeslot preceding the slot boundary and the extrapolated phase at the start of the timeslot following the slot boundary.

The Phase Discontinuity *measurement is available in* Non Signalling *and in* Signalling *mode. The special TPC patterns for phase discontinuity measurements are only available in* Signalling *mode. An application example for a phase discontinuity measurement is reported in Chapter 2.*

Phase Discontinuity Measurement Results

The graphical measurement menu for the *Phase Discontinuity* application contains three parameter lines, two test diagrams, and a tabular overview below:

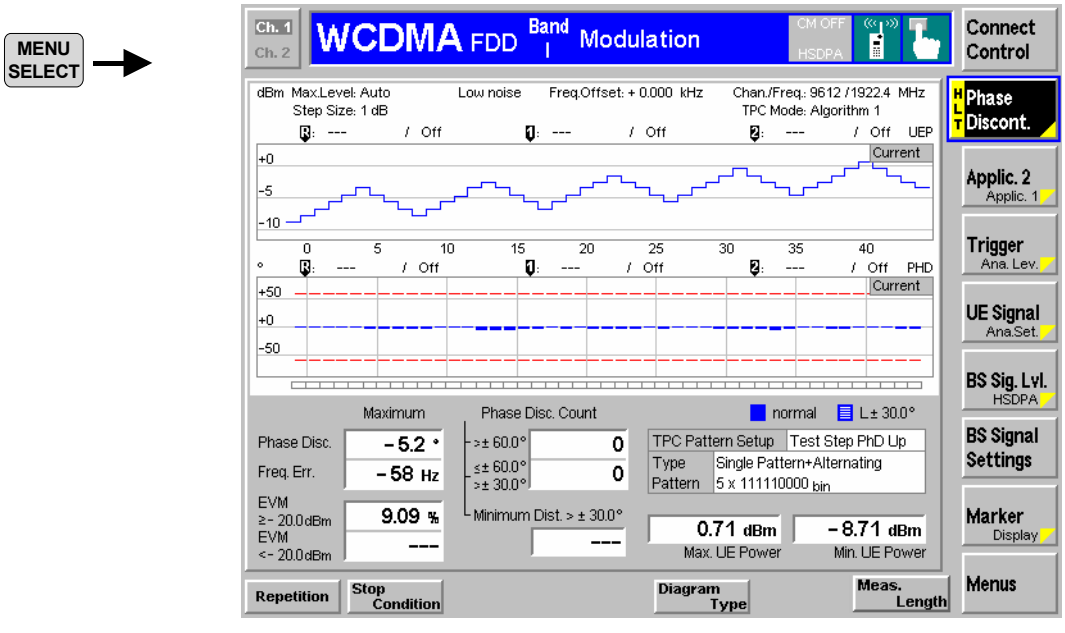


Fig. 4-29 Display of results (Modulation – Phase Discontinuity)

Test settings

The parameter lines show the essential test settings and the marker values.

Upper diagram: UE Power

The upper diagram shows the measured UE power in up to 46 consecutive slots (corresponding to up to 5*9 = 45 power steps), corresponding to the last TPC pattern sent to the UE (see measurement example in Chapter 2). The measurement results are updated each time a new pattern is sent *(Activate Pattern).*

To select the number of measured slots, use the *Phase Discont. – Meas. Length* hotkey.

The measured UE power is averaged as described in section *Power Measurements* on p. 4.2). The y-axis scale can be changed using the *Display – UE Power Scale Y* softkey.

Remote control
`READ:ARRay:MODulation:PHDiscont:UEPower?` etc.

Lower diagram: Phase disc. etc.

The lower diagram shows the phase discontinuity at the measured power steps. The modulation parameters *Error Vector Mag. (EVM)* and *Frequency Error* (see section *Measurement of Modulation Parameters* on p. 4.40) are relevant for the limit check according to the conformance specification; therefore it is possible to switch over between the *Phase Discont.* and these quantities *(Phase Discon. – Diagram Type).* The y-axis scales of the diagrams can be changed using the *Display – <Diag. Type> Scale Y* softkey.

The bars in the *Error Vector Mag.* and *Phase Discont.* are either solid or hatched:

- In the *Error Vector Mag.* diagram a solid (hatched) blue bar represents a slot where the UE power is above (below) the *Threshold EVM* defined in the *Limits* tab of the *Modulation Configuration* menu.
- In the *Phase Discon.* diagram a solid (hatched) blue bar represents a step where the *Static (Dynamic)* limit defined in the configuration menu was the crucial factor for the limit check. More specifically, a hatched bar means that the slot belongs to a group of 4 slots after a slot where the dynamic (but not the static) limit was exceeded and that the slot does not exceed the static limit. All other slots are solid.

The *Threshold EVM* and *Dynamic* limits are both relevant for the test requirement; see below.

Remote control
```
READ:ARRay:MODulation:PHDiscont:PHDiscont?
READ:ARRay:MODulation:PHDiscont:EVMagnitude?
READ:ARRay:MODulation:PHDiscont:CFERror? etc.
```

Limit Check (lower diagram)

The limit check indication in the lower diagram depends on the diagram type:

- The symmetric red limit lines in the *Frequency Error* diagram represent the tolerances for the *Carrier Frequency Error.*
- The red limit line in the *Error Vector Magn.* diagram represents the upper limit for the *Error Vector Magn.*
- For solid bars in the *Phase Discont.* diagram, the symmetric red limit lines represent the *Static Phase Discontinuity* limits. A measured phase discontinuity above the static limit always fails in passing the limit check. If a phase discontinuity is between the dynamic and the static limit, the next four steps must fall below the dynamic limit to pass the limit check.
- For hatched bars in the *Phase Discont.* diagram, the symmetric red limit lines represent the Dynamic *Phase Discontinuity* limits.

If a limit is exceeded in a particular slot or step, the corresponding section of the bar across the bottom of the diagram turns red. All limits can be changed in the configuration menu; see section *Tolerance Values (Modulation Configuration – Limits)* on p. 4.72.

Remote control
```
CALCulate:ARRay:MODulation:PHDiscont:PHDiscont:MATChing:LIMit?
CALCulate:ARRay:MODulation:PHDiscont:PHDiscont:CONDition:LIMit?
CALCulate:ARRay:MODulation:PHDiscont:EVMagnitude:MATChing:LIMit?
CALCulate:ARRay:MODulation:PHDiscont:EVMagnitude:CONDition:LIMit?
CALCulate:ARRay:MODulation:PHDiscont:CFERror:MATChing:LIMit?
```

Output values

Below the diagrams, the menu shows the legend for the bars in the lower diagram, an overview of the current Transmit Power Control settings, and the following measurement results:

Phase Disc.	Maximum of the measured phase discontinuity
Freq. Err.	Maximum frequency error
EVM	Maximum EVM in all slots and steps. A distinction is made between the slots with a UE power above or below the *Threshold EVM* defined in the *Limits* tab of the *Modulation Configuration* menu.
Phase Disc. Count	Number of steps with a phase discontinuity above the static limit and with a phase discontinuity between the dynamic and the static limit.
Minimum Dist.	Minimum distance between 2 consecutive steps where the phase discontinuity exceeds the dynamic limit. The test requirement in the conformance test specification implies that this value must be 5 or larger. An invalid result "---" indicates that the dynamic limit wasn't exceeded more than once.
Max./Min. UE Power	Maximum and minimum of the measured UE power (see description of the upper diagram above).

Limit Check (Scalar Results)

In general, a red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Modulation Configuration* menu, see section *Tolerance Values (Modulation Configuration – Limits)* on p. 4.72. The EVM in slots with a UE power below the *Threshold EVM* is not limit-checked.

Remote control
```
CALCulate[:SCALar]:MODulation:PHDiscont:MATChing:LIMit?
```

Measurement Configurations (Modulation Configuration)

The popup menu *Modulation Configuration.* contains two tabs to determine the parameters of the *Modulation* measurement including the error tolerances.

The popup menu *Modulation Configuration* is activated by pressing the measurement control softkey (labeled *Overview QPSK, EVM QPSK, ...* depending on the signal configuration and application selected) in the top right of the graphical measurement menu *Modulation* twice. By pressing the associated hotkeys, it is possible to change between the tabs.

Measurement Control (Modulation Configuration – Control)

The *Control* tab controls the *Modulation* measurement by defining

- The *Repetition* mode
- The *Stop Condition* for the measurement (except for the *I/Q Analyzer* applications)
- The measurement curve displayed *(Display Mode*, not for applications *Overview QPSK* and *Overview WCDMA* and the *I/Q Analyzer* applications*)*
- The number of slots/evaluation periods forming a statistics cycle *(Statistic Count,* except for the *I/Q Analyzer* applications*)*
- The number of chips measured and displayed in the graphical diagrams *(Measurement Length*)
- The *Channelization Code Mode* (for WCDMA signal configuration only)
- The display settings for the *I/Q Analyzer (Rotation, Zoom, Waveform Type)*
- The *Diagram Type* for the *Phase Discontinuity* measurement (use the hotkey to set the *Meas. Length)*

Besides, it influences the graphical measurement menus by adding or removing the *Grid*.

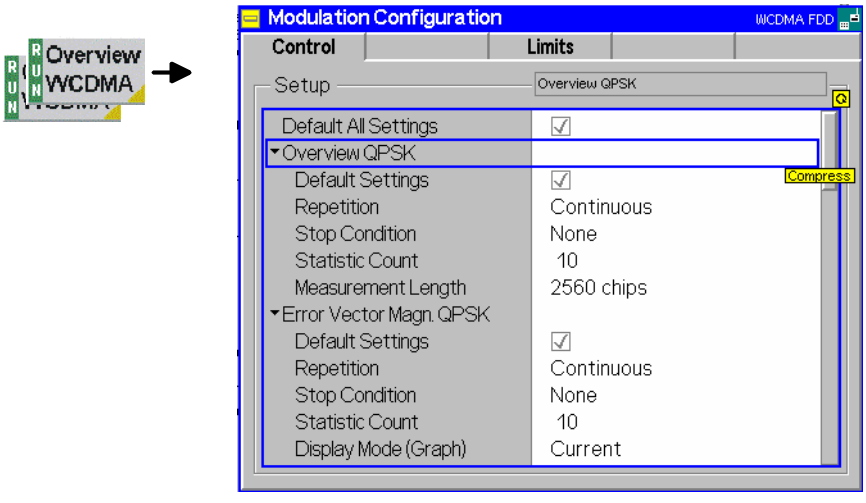


Fig. 4-30 Modulation Configuration – Control

The settings can be defined separately for the different applications of the Modulation measurement group. Most functions comply with those of the *Control* tab of the *Power Configuration* menu (see page 4.25). In the remote-control commands, the keywords `POWer:<Pow_Application>` are to be replaced by `MODulation:<Mod_Application>`. The following parameters are specific to the *Modulation* measurement:

Default Settings

The *Default All Settings* switch assigns default values to all settings in the *Control* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual signal configurations are provided.

Remote control
`DEFault:MODulation:OVERview:QPSK:CONTrol ON | OFF etc.`

Measurement Length

The *Measurement Length* parameter selects the time interval (half slot or slot) for each single shot modulation measurement. The time range in the graphical diagrams is adjusted to the selected *Measurement Length*. The following values are provided in the modulation applications except *Phase Discontinuity:*

2560 Chips The measurement extends over the complete DPCH slot

comprising 2560 chips.

640 Chips The measurement extends over the first quarter of the DPCH slot (QPSK applications only).

1280 Chips The measurement extends over the first half of the DPCH slot (WCDMA applications only; see application example in Chapter 2).

A short measurement length reduces the number of samples acquired and the measurement time. The beginning of the WCDMA slot is determined by detecting the pilot bits in the DPCCH. This means that the position of the measured time interval within the DPCH slot is fixed (in the *Code Domain Power* measurement, this position can be modified by the trigger settings).

In the *Phase Discontinuity* application, a measurement length between 1 and 46 slots can be set *(Phase Discont. – Meas. Length* hotkey*)*.

Remote control

```
CONFigure:MODulation:<Applic>:QPSK:CONTrol:MLENgth
  640 | 2560
CONFigure:MODulation:<Applic>:WCDMa:DPCH:CONTrol:MLENgth
  1280 | 2560 where
  <Applic> = OVERview | EVMagnitude | PERRor | MERRor |
  IQANalyzer
CONFigure:MODulation:PHDiscont: CONTrol:MLENgth
```

Display Mode

The *Display Mode* hotkey selects one of the following display modes for the measurement curve:

Current Measured value for current evaluation period

Max./Min. Extreme value of a number of evaluation periods (maximum or minimum, whichever has the larger absolute value)

Average Average value of a number of evaluation periods, referenced to a statistics cycle

The basic evaluation period can be set to either an entire slot or the first quarter of a slot; see *Measurement Length* above and Chapter 3.The calculation of the measurement curves and the rules for averaging is also described in Chapter 3, section *General Settings*. No *Display Mode* is available in the *Overview...* applications where no measurement curve is displayed.

Remote control

No display mode set explicitly, the three measurement curves are accessible via:

```
FETCh:ARRay:MODulation:EVMagnitude:QPSK:CURRent?
FETCh:ARRay:MODulation:EVMagnitude:QPSK:MMAX?
FETCh:ARRay:MODulation:EVMagnitude:QPSK:AVERage? etc.
```

Channelization Code Mode

The *Channelization Code* function defines whether the CMU analyzes the received WDCMA signal and searches for the channelization codes *(Auto)* or whether the channelization codes are assumed to be known *(Manual)*. It is equivalent to the *DPDCH CC Mode* softkey described on p. 4.59.

Remote control

```
CONFigure:MODulation:WCDMa:DPCH:CONTrol:CCMode
            MANual | AUTomatic
```

The following parameters are valid for the *I/Q Analyzer* measurements only:

Rotation

Rotation defines the initial phase reference (φ = 0) in the *Correlation* and *Vector* diagram of the QPSK applications:

0° The diagrams are rotated so that the constellation points are located on the I and Q axes (standard WCDMA QPSK convention).

45° The diagrams are rotated so that the constellation points are located on the angle bisectors between the I and Q axes.

In the QPSK application the symbol mapping between the logic data and the constellation points is not evaluated. As a consequence the overall phase of the diagram is random; a logic symbol may correspond to any of the four constellation points. In the WCDMA application, where the symbol mapping is evaluated and the position of the constellation points is fixed, no rotation angle is provided.

The rotation angle also has an impact on the eye diagrams; see section *Representation of the Amplitudes vs. Time* on p. 4.55.

Remote control
`CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:ROTation 0 | 1`

Zoom

Zoom magnifies the diagram with an equal factor in horizontal and vertical direction, leaving the center (i.e. the intersection between the I and Q axis) at fixed position:

Normal The normalized I and Q amplitudes range between –2 and +2.

Factor n The normalized I and Q amplitudes range between –2/n and +2/n, where n = 2, 5, 10, 20.

Remote control
no command, display configuration only.

Waveform Type

Waveform Type selects the diagram type:

Correlation Correlation diagram; see section *Representation in the I/Q Plane* on p. 4.53.

Vector Vector diagram; see section *Representation in the I/Q Plane* on p. 4.53.

I Phase Eye diagram of the I amplitude; see section *Representation of the Amplitudes vs. Time* on p. 4.55.

Q Phase Eye diagram of the Q amplitude; see section *Representation of the Amplitudes vs. Time* on p. 4.55.

I Phase & Q Ph. Eye diagrams of the I and Q amplitude in a single diagram; see section *Representation of the Amplitudes vs. Time* on p. 4.55.

Remote control
no command, display configuration only.

The following parameters are valid for the *PRACH Preamble* measurement only:

Measured Preamble

Preamble number (1st to 5th) to be analyzed in the *PRACH Preamble* measurement. The *Measured Preamble* has an impact on the *Expected Power* displayed in the measurement menu. See also description of the *Random Access Settings* in section *Network Parameters* on p. 4.268.

Remote control
`CONFigure:MODulation:PRACh:CONTrol:MPReamble`

Diagram Type *Diagram Type* selects the measured quantity for the *PRACH Preamble* measurement menu.

Remote control
No switchover command; the different quantities are retrieved via
`READ:ARRay:MODulation:PRACh:PHDiscont?`
`READ:ARRay:MODulation:PRACh:EVMagnitude?`
`READ:ARRay:MODulation:PRACh:CFERror?` etc.

The following parameter is valid for the *Phase Discontinuity (PHDisc)* measurement only:

Diagram Type *Diagram Type* selects the measured quantity for the lower diagram in the *Phase Discontinuity* measurement menu. The *Phase Discont(inuity),* the *Error Vector Mag. (EVM)* and the *Frequency Error* are relevant for the limit check according to the conformance specification.

Remote control
No switchover command; the different quantities are retrieved via
`READ:ARRay:MODulation:PHDiscont:PHDiscont?`
`READ:ARRay:MODulation:PHDiscont:EVMagnitude?`
`READ:ARRay:MODulation:PHDiscont:CFERror?` etc.

Tolerance Values (Modulation Configuration – Limits)

The *Limits* tab defines upper and lower error limits for the parameters of the *Modulation* measurement.

Conformance requirements A poor modulation accuracy of the UE transmitter increases the transmission errors in the uplink channel of the WCDMA network.

The Error Vector Magnitude (EVM) is the critical quantity to assess the modulation accuracy of a WCDMA UE. According to the 3GPP standard, the EVM measured at UE output powers ≥ −20 dBm and under normal operating conditions shall not exceed 17.5 %. In addition, the Peak Code Domain Error, which is the maximum EVM of all code channels, shall not exceed –15 dB. The frequency error shall not exceed ±0.1 ppm.

PRACH Preamble According to the conformance test specification 3GPP TS 34.121 the following requirements hold for the modulation parameters in the *PRACH Preamble* test:

- The EVM (RMS) shall not exceed 17.5%.
- The *Carrier Frequency Error* shall not exceed ±(0.1 ppm + 10 Hz), corresponding to ±210 Hz at a carrier frequency of 2 GHz.

Phase discontinuity

According to the conformance test specification 3GPP TS 34.121 the following requirements hold for the *Phase Discontinuity* test:

- The EVM of every measured slot which is above –20 dBm *(Threshold EVM)* shall not exceed the *Error Vector Magn.* Limit of 17.5%.
- The *Carrier Frequency Error* shall not exceed 0.1 ppm (corresponding to 200 Hz at a carrier frequency of 2 GHz).
- The *Phase Discontinuity* between any two adjacent slots shall be below the *Static* limit of 60 degrees. If the measured phase discontinuity in a slot is greater than the *Dynamic* limit of 30 degrees and less than the *Static* limit of 60 degrees, then the next four slots shall be less than or equal to the *Dynamic* limit of 30 degrees.

NOTE

The Phase Discontinuity criterion only makes sense if the Static limit exceeds the Dynamic limit.

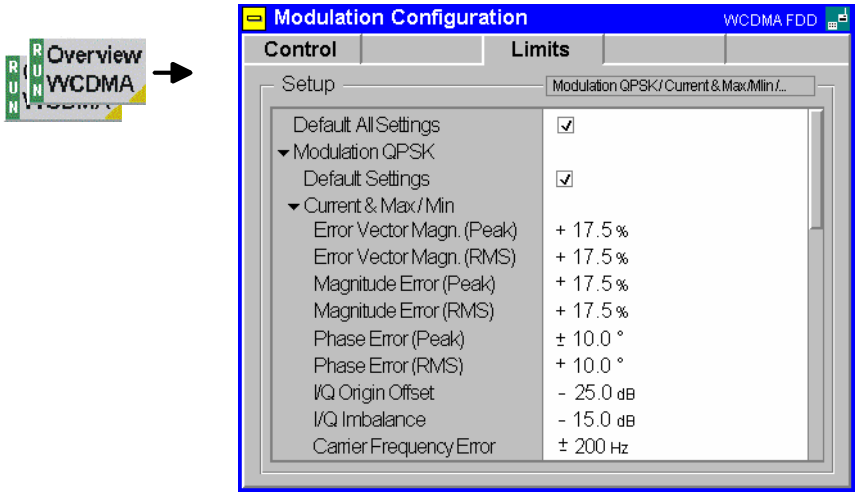


Fig. 4-31 Modulation Configuration – Limits

Default Settings

The *Default All Settings* switch assigns default values to all settings in the *Limits* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual signal configurations are provided.

Remote control

```
DEFault:MODulation:OEMP:QPSK:LIMit ON | OFF
DEFault:MODulation:OEMP:WCDMa:DPCH:LIMit ON | OFF
```

Modulation QPSK

The *Modulation QPSK* table section defines upper limits for the different modulation parameters in single channel signal configuration (application *QPSK)*.

Current & Max./Min. Common limits for the *Current* scalar results and for the *Minimum/Maximum* scalar results

Average Limits for the *Average* measurement scalar results

The meaning of the error limits is the same for the *Current* or *Minimum/Maximum (Current & Max.)* and the *Average* results. The modulation parameters are explained in section *Measurement of Modulation Parameters* on p. 4.40.

The *Phase Error (Peak)* and the *Frequency Error* are quantities with alternating sign; the corresponding limits are symmetric to the origin (i.e. the absolute value of both quantities must fall below the specified positive limit).

Remote control
```
CONFigure:MODulation:OEMP:QPSK:CMMax:LIMit:[SCALar]:
          SYMMetric:[COMBined]:VALue
CONFigure:MODulation:OEMP:QPSK:AVERage:LIMit:[SCALar]:
          SYMMetric:[COMBined]:VALue
```

Modulation WCDMA (DPCH)

The *Modulation WCDMA (DPCH)* table section defines upper limits for the different modulation parameters in multiple channel signal configuration (application WCDMA). Most of the settings are analogous to the Modulation QPSK section, see above.

Compared to the QPSK measurement, the allowed range of WCDMA carrier Frequency Error limits is smaller. Moreover, a limit for the Peak Code Domain Error is provided.

Remote control
```
CONFigure:MODulation:OEMP:WCDMa:DPCH:CMMax:LIMit:[SCALar]:
          SYMMetric:[COMBined]:VALue
CONFigure:MODulation:OEMP:WCDMa:DPCH:AVERage:LIMit:[SCALar]:
          SYMMetric:[COMBined]:VALue
```

PRACH Preamble

The *PRACH Preamble*) section defines the limits for the PRACH preamble quality test, see background information above.

Remote control
```
CONFigure:MODulation:PRACh:LIMit:[SCALar]:
          SYMMetric:[COMBined]:VALue
```

Phase Discontinuity

The *Phase Discontinuity*) section defines the limits for the phase discontinuity test, see background information above.

The limit check for the *Phase Discontinuity, Error Vector Magnitude,* and *Carrier Frequency Error* can be disabled separately. Disabling the *Threshold EVM* means that the EVM limit is always checked, irrespective of the measured UE power in the slot.

Remote control
```
CONFigure:MODulation:PHDiscont:LIMit:[SCALar]:
          SYMMetric:[COMBined]:VALue
CONFigure:MODulation:PHDiscont:LIMit:[SCALar]:
          SYMMetric:[COMBined]:ENABle
```

Spectrum Measurements

The menu group *Spectrum* comprises the functions for measurement of the output RF spectrum emissions that are plotted in the frequency domain. The measurement results are displayed in the graphical measurement menu *Spectrum,* the popup menu *Spectrum Configuration* is used for configuration of the measurements.

The *Spectrum* measurement serves to measure the amount of energy that spills outside the designated radio channel. An excess amount of off-carrier power increases the interference with adjacent channels and decreases the system capacity. The off-carrier power can be assessed by several different parameters:

ACLR	The Adjacent Channel Leakage power Ratio (ACLR) measured by the CMU is the ratio of the power measured in an adjacent channel (Adjacent Channel Power, ACP) to the transmitted carrier power, expressed in dB. This definition differs from the 3GPP specification by a minus sign but is in line with other systems like GSM and TDMA.
OBW	The Occupied Bandwidth (OBW) is the width of a frequency range around the assigned channel frequency containing 99% of the total integrated power of the transmitted spectrum.
Emission Mask	The *Spectrum Emission Mask* is a template to limit the out-of-band emissions in a frequency range between 2.5 MHz and 12.5 MHz away from the UE center carrier frequency.

Fig. 4-32 below illustrates the different quantities that can be obtained in the *Spectrum* measurement. *Fig. 4-32*

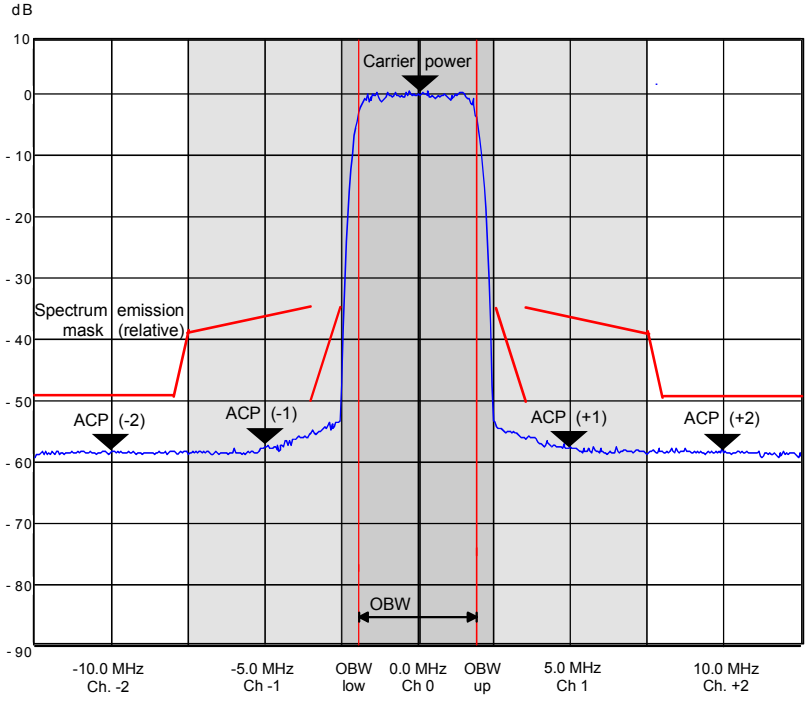


Fig. 4-32 Test parameters in the Spectrum measurement

To determine the ACLR and OBW, the CMU applies one of the following measurement methods:

ACLR

According to the standard, the Adjacent Channel Leakage power Ratio (ACLR) is measured at maximum output power of the UE and with an RRC filter that has a roll-off α = 0.22 and a bandwidth equal to the chip rate. The measurement is carried out at the nominal carrier frequency, at ±5 MHz from the nominal frequency (1st adjacent channels), and at ±10 MHz (2nd adjacent channels or alternate channels). To activate this measurement method, the *ACLR Filter* application must be selected.

The CMU provides an alternative measurement method for the ACLR where the signal power is first measured as a function of time at constant frequencies using a filter of definite bandwidth and then transformed to the frequency domain by means of a Fast Fourier

Transform (FFT). After resampling in the frequency domain with an appropriate resolution, the FFT provides a spectral curve representing the current transmit power in a 25 MHz wide frequency range centered around the carrier frequency.

The resampled FFT curve is weighted with an RRC filter response, integrated in the frequency domain and divided by the power at the carrier frequency. This is done numerically on a point by point basis. This second filter stage yields a curve representing the ACLR which is smoothed and rescaled compared to the original FFT curve. The filtered ACLR curve is suitable to derive average and statistical quantities. To activate the FFT measurement method, the *ACLR FFT/OBW* application must be selected.

OBW

According to the standard, the Occupied Bandwidth (OBW) is measured at maximum output power of the UE, over a frequency span of 10 MHz and using a resolution filter of Gaussian shape with a bandwidth of less than 30 kHz. The CMU uses the FFT method to determine the OBW. From the spectral curve, the lower and upper OBW limit frequencies below and above which 0.5% of the total integrated power is transmitted are calculated. The OBW is then the difference between the upper and lower limit frequency. To obtain the OBW values, the *ACLR FFT/OBW* application must be selected.

Spectrum Emission

According to the standard (3GPP TS 34.121, section 5.9.1), the spectrum emission of the UE is measured at maximum output power of the UE, in a frequency range between 2.5 MHz and 12.5 MHz away from the UE center carrier frequency and in a resolution filter of Gaussian shape with a bandwidth of 30 kHz (for frequencies between 2.515 MHz and 3.485 MHz from the carrier) or 1 MHz (for frequencies between 4 MHz and 12 MHz). To test the “additional requirements” for operating bands V, XII, XIII, and XIV, the 1 MHz filter is replaced by a 100 KHz filter. All measured spectrum emission values are relative to the mean UE output power measured in a 3.84 MHz bandwidth (reference power).

Again, the CMU uses the FFT method to determine the spectrum emission. It is possible to use the same spectral curve as for the ACLR and OBW measurement, however, to account for the narrow-band Gaussian filter specified in the standard, the curve is resampled with a finer resolution. This improves the accuracy but increases the measurement time. *Spectrum* measurements will therefore be faster if there is no need to calculate the spectrum emissions. The filtered curve is displayed in three diagrams showing the frequency ranges where the bandwidth of the specified resolution filter is constant. To obtain the spectrum emission values, the *Emission Mask* application must be selected.

A *Spectrum* measurement in *Signalling* mode with a *Closed Loop* TPC pattern causes a strong increase of the UE output power while the CMU measures at off-carrier frequencies. To prevent this behavior, all *Spectrum* measurements are performed as follows (see also ; see Table 4-29 on p. 4.251):

- If a *Spectrum* measurement is switched *ON* while a *Closed Loop* pattern is active, this pattern is suspended and replaced by an *Alternating 0,1* pattern. *Alternating 0,1* is indicated in the *BS Signal* tab of the *Connection Control* menu. *Closed Loop* is re-activated the end of the *Spectrum* measurement.
- All other TPC patterns are left unchanged when a *Spectrum* measurement is switched on.
- While the *Spectrum* measurement is running, the TPC pattern can be changed, and it is even possible to activate a *Closed Loop* pattern. The changed patterns remain valid after the end of the *Spectrum measurement.*

Important Note: TPC Settings, Autoranging

Observe the TPC Pattern *settings when performing* Spectrum *measurements. In particular, keep in mind that activating* Closed Loop *in a running* Spectrum *measurement is likely to cause undesirable changes of the UE power. To measure the ACLR and OBW at maximum transmitter output power of the UE as stipulated in the conformance test specification, use an* All 1 *TPC pattern.*

ACLR measurements should be performed with autoranging switched off (Analyzer Level – Mode: Manual).

Measurement Menu (Spectrum)

The graphical measurement menu *Spectrum* displays the measurement results for the output RF spectrum emissions.

- The measurement control softkey *ACLR Filter* (which changes to *ACLR FFT/OBW or Emission Mask* if one of these applications is selected) controls the measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Spectrum Configuration*. The hotkeys associated with the measurement control softkey define the scope of the *Spectrum* measurement.
- The softkeys *Application, Analyzer Level, Analyzer Settings, Marker* and *Menus* to the right of the test diagram are combined with various hotkeys. The softkey/hotkey combinations provide test settings and switch over between different measurements. The entry of values is described in section *Measurement Menu (Power)* on page 4.6.

The measurement menu *Spectrum* can be accessed from any other measurement menu of the WCDMA UE function group using the *Spectrum* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).

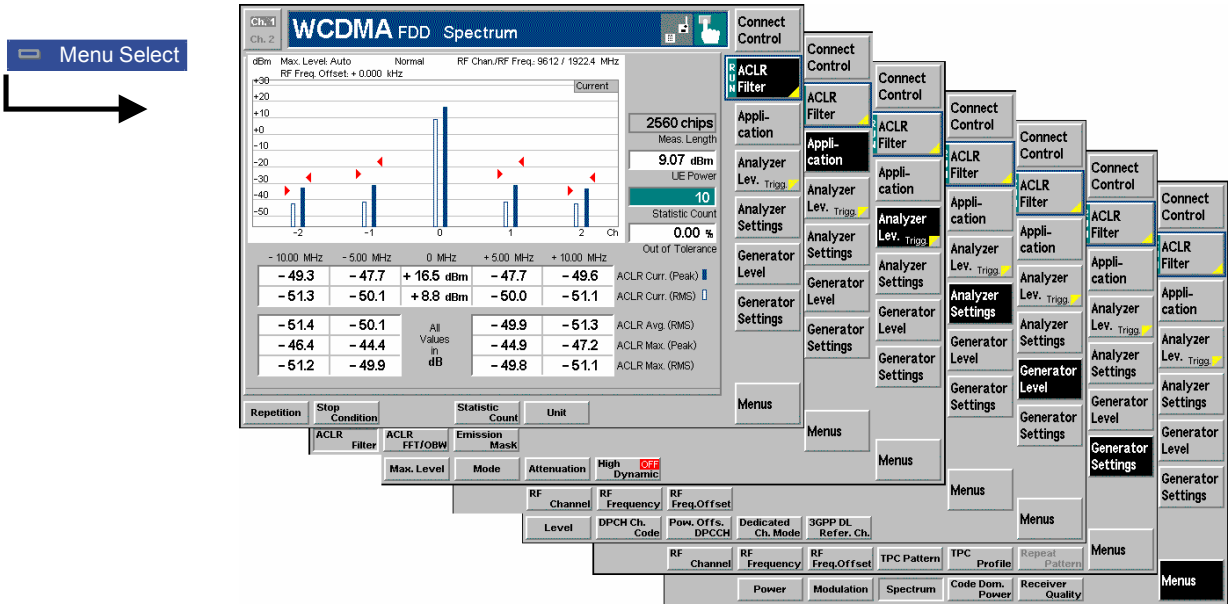


Fig. 4-33 Measurement menu Spectrum

Test Settings

The *Analyzer Level, Analyzer Settings, Marker* (for application *ACLR FFT/OBW)*, and *Menus* test settings are identical with those in the *Power* menu (see section *Test Settings* on page 4.7). The following softkeys and hotkeys differ from the *Power* measurement:

ACLR Filter

The *ACLR Filter* softkey (which changes to *OBW* or *Emission Mask* if one of these applications is selected) controls the *Spectrum* measurement and indicates its status *(RUN | HLT | OFF)*.

This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status of the measurement is unaffected upon switchover to other menus controlling a *Spectrum* measurement, however, a running measurement is restarted.

Remote control
`INITiate:SPECtrum:MFILter`

```
ABORt:SPECtrum:MFILter
STOP:SPECtrum:MFILter
CONTinue:SPECtrum:MFILter etc.
```

Measurement configuration

Pressing the *ACLR Filter* softkey twice opens the popup menu *Spectrum Configuration* (see page 4.66). Besides, the hotkeys *Repetition, Stop Condition,* and *Statistic Count* defining the scope of the measurement are associated with the *ACLR Filter* softkey. The function of these hotkeys is explained in the *Power* menu section (see section *Test Settings* on page 4.7); they are identical with the parameters set in the *Control t*ab of the *Spectrum Configuration* menu (see section *Measurement Control (Spectrum Configuration – Control)* on page 4.87). The *Display Mode* hotkey, which is available in the *ACLR FFT/OBW* application, is also provided in the *Control* tab.

The *ACLR Filter* and *ACLR FFT/OBW* hotkey bars contain an additional hotkey:

Application

The *Application* softkey selects the measurement method for the *Spectrum* measurement and the type of measurement parameters. For a detailed description see background information in section *Spectrum Measurements* on p. 4.75.

The alternative applications call up different measurement menus. The configuration settings for all *Spectrum* applications, however, are listed in a common popup menu (see p. 4.84).

ACLR Filter

The *ACLR Filter* hotkey selects the measurement of the Adjacent Channel Leakage power Ratio (ACLR) using the direct filter method. This measurement method yields ACLR values at five distinct frequencies (at the carrier frequency, at ±5 MHz and at ±10 MHz from the carrier frequency).

Remote control
The *ACLR Filter* application is selected by the keyword `:MFILter` in the 3rd level of the `Spectrum` commands, e.g. `CONFigure:SPECtrum:MFILter...`

ACLR FFT/OBW

The *ACLR FFT/OBW* hotkey selects the measurement of the Adjacent Channel Leakage power Ratio (ACLR) and of the Occupied Bandwidth (OBW) using the Fast Fourier Transform (FFT) method. This measurement method yields the ACLR as a continuous curve in the a 25 MHz wide frequency range centered around the carrier frequency.

Remote control
The *ACLR FFT/OBW* application is selected by the keyword `:MFFT` in the 3rd level of the `Spectrum` commands, e.g. `CONFigure:SPECtrum:MFFT...`

Emission Mask

The *Emission Mask* hotkey selects the measurement of the spectrum emissions using the Fast Fourier Transform (FFT) method.

Remote control
The *Emission Mask* application is selected by the keyword `:EMASk` in the 3rd level of the `Spectrum` commands, e.g. `CONFigure:SPECtrum:EMASk...`

Analyzer Level

The *Analyzer Level* softkey controls the level in the RF input signal path and provides the trigger settings for the *Spectrum* measurement.

Compared to the *Power* measurement, the *Analyzer Level* hotkey bar contains an addtional hotkey:

High Dynamic

The *High Dynamic* hotkey sets the RF input path in such a way that the dynamic range of the *Spectrum* measurement is maximized. The setting is valid for all applications of the *Spectrum* measurement group. It does not overwrite the *Attenuation* setting that remains valid for all other measurement groups. The *Attenuation* setting is also used as long as *High Dynamic* is switched off.

Remote control
`CONFigure:SPECtrum:CONTrol:HDYNamic ON | OFF`

Measurement Results

The *Spectrum* menu group contains three separate measurement menus corresponding to the three applications *ACLR Filter, ACLR FFT/OBW* and *Emission Mask*. These menus contain different test diagrams.

ACLR Filter Measurement

In the *ACLR Filter* measurement, the (peak and effective) Adjacent Channel Leakage power Ratio ACLR at five distinct frequencies (at the carrier frequency, at ±5 MHz and at ±10 MHz from the carrier frequency) is displayed. The results and the corresponding measurement settings are indicated in two parameter lines, the test diagram (bar graph) and a tabular overview:

Parameter lines

Bar graph and Output fields

Output tables

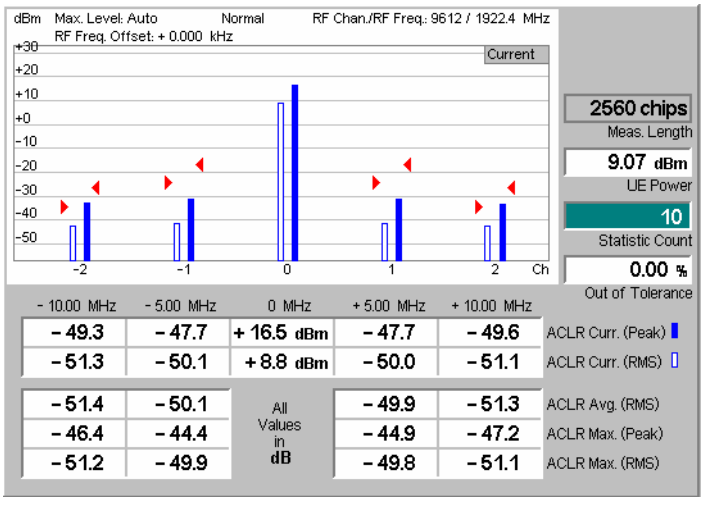


Fig. 4-34 Display of results (ACLR Filter)

Parameter lines The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.9) are indicated in two parameter lines across the top of the measurement menu:

Max. Level	Maximum expected input level in dBm
Attenuation	Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal WCDMA channel frequency
RF Chan./Freq.	RF channel measured and associated nominal carrier frequency

Output fields

To the right of the diagram, the following results and settings are displayed:

Meas. Length Time interval measured (number of consecutive chips) as set in the *Control* tab of the configuration menu, see section *Measurement Control (Spectrum Configuration – Control)* on p. 4.87.

UE Power Average (RMS) power in the current evaluation period. This value is measured with a a wide band filter, so it should be slightly higher than the *ACLR Curr. (RMS)* value of Ch. 0 indicated in the first table below the diagram. The UE Power measurement can be switched off to accelerate the *ACLR Filter* measurement; see section *Measurement Control (Spectrum Configuration – Control)* on p. 4.87.

Statistic Count Number of evaluation periods per statistics cycle. The colored bar indicates the relative measurement progress in the statistics cycle.

Out of Tolerance Percentage of evaluation periods where the tolerance limits are exceeded.

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Bar graph

The bar graph shows the current *ACLR Peak* (solid bars) and *ACLR RMS* values (contour bars) in channels no. –2 to +2 (see output table below). The values are measured with an RRC filter that has a roll-off α = 0.22 and a bandwidth equal to the chip rate. The red triangles indicate the upper relative limits for both quantities as set in the *Spectrum Configuration – Limits* menu (see section *Tolerance Values for ACLR and OBW (Spectrum Configuration – Limits)* on p. 4.94).

Upper output table

The values in the output tables are measured with an RRC filter that has a roll-off α = 0.22 and a bandwidth equal to the chip rate. The upper output table contains the following scalar values:

ACLR Peak/RMS Peak and average power in the current evaluation period and in channels no. –2 to +2. The central values (carrier powers) are always expressed in absolute units (dBm). The adjacent channel results can be expressed either in absolute units (adjacent channel powers in dBm) or in relative units (ACLR in dB); see *Display Unit* parameter on p. 4.88.

The *ACLR Peak* and *ACLR RMS* values are calculated for all evaluation periods measured and displayed in the upper output table.

Lower output table

The lower output table contains the average values referenced to a statistics cycle (*Average,* see averaging rules in Chapter 3, section *General Settings)* and the peak values of all evaluation periods measured *(Maximum),* calculated from the *Current* results in the upper output table:

ACLR Avg. (RMS) Average of all ACLR RMS values referenced to the last statistics cycle

ACLR Max. (Peak) Maximum of all ACLR Peak values in the measurement (=maximum power ever measured)

ACLR Max. (RMS) Maximum of all ACLR RMS values in the measurement

These statistical results can be expressed either in absolute (dBm) or in relative units (dB); see *Display Unit* parameter on p. 4.88. The relative powers are calculated first for all evaluation periods. From these *Current* relative powers, the

statistical results are derived:

$$ACLR\ Avg.(RMS)_{rel}^{Ch.n} = ACLR\ Avg.(Curr.(RMS)_{rel})^{Ch.n} = ACLR\ Avg.\left(\frac{Curr.(RMS)^{Ch.n}}{Curr.(RMS)^{Ch.0}}\right)$$

$$ACLR\ Max.(Peak)_{rel}^{Ch.n} = ACLR\ Max.(Curr.(Peak)_{rel})^{Ch.n} = ACLR\ Max.\left(\frac{Curr.(Peak)^{Ch.n}}{Curr.(Peak)^{Ch.0}}\right)$$

$$ACLR\ Max.(RMS)_{rel}^{Ch.n} = ACLR\ Max.(Curr.(RMS)_{rel})^{Ch.n} = ACLR\ Max.\left(\frac{Curr.(RMS)^{Ch.n}}{Curr.(RMS)^{Ch.0}}\right)$$

Remote control
`READ[:SCALar]:SPECtrum:MFILter:RELative?`
`FETCh[:SCALar]:SPECtrum:MFILter:RELative?`
`SAMPle[:SCALar]:SPECtrum:MFILter:RELative?` etc.
The following commands retrieve additional power values:
`READ[:SCALar]:SPECtrum:MFILter:EXTended:ABSolute?` etc.

Limit Check

A red output field indicates that the measurement result exceeds the upper relative limits set in the *Limits* tab of the *Spectrum* configuration menu, and that the absolute power in the channel is above the absolute limit set, see section *Tolerance Values for ACLR and OBW (Spectrum Configuration – Limits)* on p. 4.94.

Remote control
`CALCulate[:SCALar]:SPECtrum:MFILter:MATChing:LIMits?`

ACLR FFT/OBW Measurement

In the *ACLR FFT/OBW* measurement, the Adjacent Channel Leakage power Ratio ACLR determined by means of the FFT method is plotted as a function of the frequency. A statistical evaluation of the ACLR at different frequencies and of the Occupied Bandwidth (OBW) is displayed in addition. The results and the corresponding measurement settings are indicated in three parameter lines, the test diagram and a tabular overview below:

Parameter lines

Test diagram

Output table

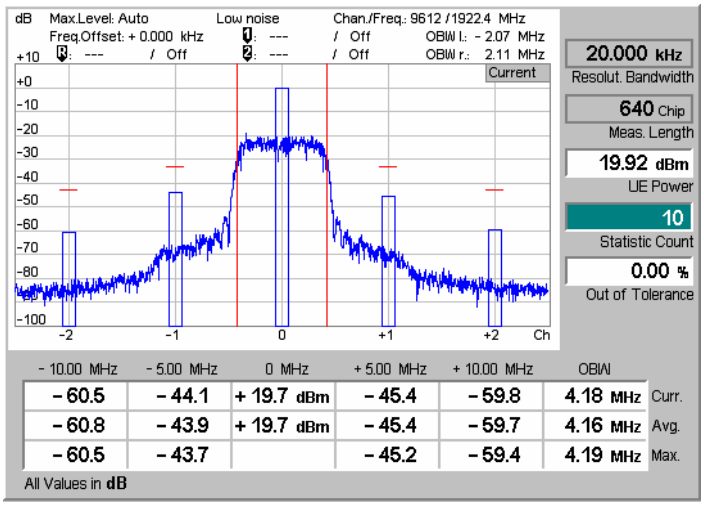


Fig. 4-35 Display of results (ACLR FFT/OBW)

Settings/ Results

Scalar measurement results and settings are indicated in the three parameter lines above the test diagram and in the output table below.

1st / 2nd Parameter line

The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.9) are indicated in the first and second parameter lines across the top of the measurement menu:

Max. Level	Maximum expected input level in dBm
Attenuation	Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal WCDMA channel frequency
Chan./Freq.	RF channel measured and associated nominal carrier frequency

2nd / 3rd parameter line

The second and third parameter lines contain the following marker values and results:

R	Measurement result and frequency (distance from the carrier) of reference marker
1	Measurement result and frequency of delta marker 1 (setting *absolute*) or difference from reference marker (setting *relative*)
2	Measurement result and frequency of delta marker 2 (setting *absolute*) or difference from reference marker (setting *relative*)
OBW left	Lower limit frequency of the Occupied Bandwidth (OBW) calculation: 0.5% of the total integrated power of the spectrum is transmitted in the range below this frequency.
OBW right	Upper limit frequency of the Occupied Bandwidth (OBW) calculation: 0.5% of the total integrated power of the spectrum is transmitted in the range above this frequency.

Output fields

To the right of the diagram, the following settings are displayed:

Resol. Bandwidth	Fixed bandwidth of the resolution filter used to obtain the spectral FFT curve displayed in the diagram from the Fast Fourier Transform data.
Meas. Length	Time interval measured (number of consecutive chips) as set in the *Control* tab of the configuration menu, see section *Measurement Control (Spectrum Configuration – Control)* on p. 4.87.
UE Power	Average power in the current evaluation period, irrespective of the display mode set. This value is measured with a wide band filter, so it should be slightly higher than the *Curr.* value of Ch. 0 indicated in the center of the table below the diagram.
Statistic Count	Number of evaluation periods per statistics cycle. The colored bar indicates the relative measurement progress in the statistics cycle.
Out of Tolerance	Percentage of evaluation periods where the tolerance limits are exceeded.

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Diagram

The lower (blue) continuous curve in the test diagram shows the spectral FFT curve in a 25 MHz wide frequency range centered around the nominal carrier frequency. The display mode for the curve is always *Current*, irrespective of the display mode set. The curve is calculated by means of the FFT method described in section

Spectrum Measurements on p. 4.75. The fixed y-axis range extends from –80 dB to +10 dB relative to the power at 0 MHz measured with a 3.84 MHz RRC filter *(Ref. Power)*.

The bars in the diagram correspond to the ACLR values in the output table below.

If the option *OBW Line Display* is activated in the *Control* tab of the configuration menu, the limits *OBW left* and *OBW right* are also indicated as two vertical red lines left and right from the carrier frequency.

Remote control
```
READ:ARRay:SPECtrum:MFFT::WFSPectrum:CURRent?
FETCh:ARRay:SPECtrum:MFFT::WFSPectrum:CURRent?
SAMPle:ARRay:SPECtrum:MFFT::WFSPectrum:CURRent?
```
etc.

Output table

The output table below the diagram shows the ACLR calculated from the FFT curve by applying a numerical RRC filter and the Occupied Bandwidth (OBW). The ACLR is normalized to the *Ref. Power* by definition, i.e. its central (0 MHz) value is 0 dB. The OBW is the difference between the *OBW left* and *OBW right* values shown in the parameter lines above the diagram.

The values are calculated for all evaluation periods measured and displayed in the upper table row *(Curr.)*. From these *Current* results the average values referenced to a statistics cycle (*Avg.,* see averaging rules in Chapter 3, section *General Settings)* and the peak values of all evaluation periods measured *(Max.)* are calculated.

The central values (carrier powers) are always expressed in absolute units (dBm). The adjacent channel results can be expressed either in absolute units (adjacent channel powers in dBm) or in units relative to the carrier powers (ACLR in dB); see *Display Unit* parameter on p. 4.88.

Remote control
```
READ[:SCALar]:SPECtrum:MFFT:RELative?
FETCh[:SCALar]:SPECtrum:MFFT:RELative?
SAMPle[:SCALar]:SPECtrum:MFFT:RELative?
```

Limit Check

A red output field indicates that the measurement result exceeds the upper relative limits set in the *Limits* tab of the *Spectrum* configuration menu, and that the absolute power in the channel is above the absolute limit set, see section *Tolerance Values for ACLR and OBW (Spectrum Configuration – Limits)* on p. 4.94.

Remote control
```
CALCulate[:SCALar]:SPECtrum:MFFT:MATChing:LIMits?
```

Emission Mask Measurement

In the *Emission Mask* measurement, the spectrum emissions are plotted in three diagrams showing the frequency ranges where the bandwidth of the Gaussian resolution filter used to derive the result from the FFT curve is constant. The margin relative to the limit lines and a statistical evaluation of the reference power is displayed in addition. The results and the corresponding measurement settings are indicated in two parameter lines, the three test diagrams and several output fields below:

Parameter lines

Test diagrams

Margin display

Output fields

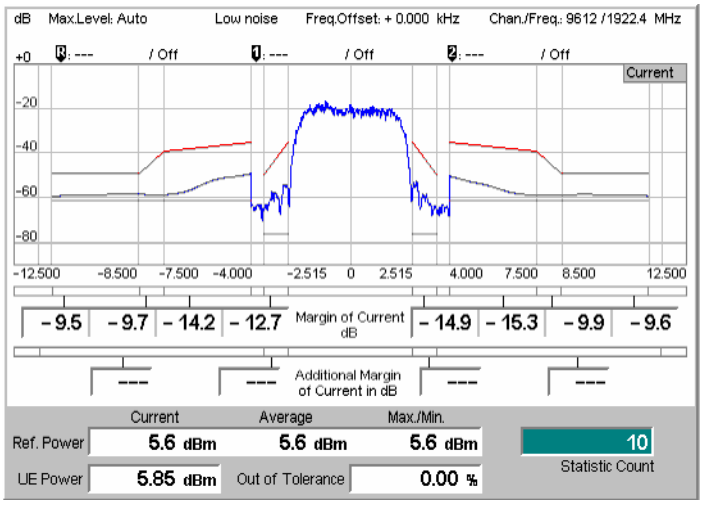


Fig. 4-36 Display of results (Spectrum Emission Mask)

Settings/ Results

Scalar measurement results and settings are indicated in the parameter lines above the test diagram and in the output table below.

1st parameter line

The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.9) are indicated in the first parameter line across the top of the measurement menu:

Max. Level	Maximum expected input level in dBm
Attenuation	Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal WCDMA channel frequency
Chan./Freq.	RF channel measured and associated nominal carrier frequency

2nd parameter line

The second parameter line contains the following marker values and results:

R	Measurement result and frequency (distance from the carrier) of reference marker
1	Measurement result and frequency of delta marker 1 (setting *absolute*) or difference from reference marker (setting *relative*)
2	Measurement result and frequency of delta marker 2 (setting *absolute*) or difference from reference marker (setting *relative*)

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Diagrams

The blue curves in the three diagrams show the spectrum emissions in three frequency ranges:

- Left diagram: frequencies between –12 MHz and –4 MHz from the carrier, obtained with a 1 MHz Gaussian filter
- Central diagram: frequencies between –3.485 MHz and +3.485 MHz from the carrier, obtained with a 30 kHz Gaussian filter
- Right diagram: frequencies between +4 MHz and +12 MHz from the carrier, obtained with a 1 MHz Gaussian filter

The display mode (*Current, Maximum, Average*) for the curves is indicated in the upper right corner of the diagram. It can be set in the *Control* tab of the configuration menu, see section *Measurement Control (Spectrum Configuration – Control)* on p. 4.87. The curve is calculated as described in section *Spectrum Measurements* on p. 4.75. The fixed y-axis range extends from –90 dB to +0 dB relative to the *Ref. Power*.

The red curves in the test diagram show the emission mask (limit lines) which can be set in the *Limit Lines* tab of the configuration menu, see section *Emission Mask (Spectrum Configuration – Limit Lines)* on p. 4.89.

Remote control
`READ:ARRay:SPECtrum:EMASk:CURRent,`
`FETCh:ARRay:SPECtrum:EMASk:CURRent,`
`SAMPle:ARRay:SPECtrum:EMASk:CURRent` etc.

Diagram extensions (Signaling mode only)

The R&S CMU accounts for the additional absolute test requirements of the conformance test specification; see desription of the SEM Mode on p. 4.92. This introduces the following additional display elements:

- The additional limit line *(Limit H),* consisting of two horizontal line segments on either side of the carrier center frequency. In most test configurations, this limit line appears in the upper part of the diagram.
- In mode C and D, where a 100 kHz filter is specified for the outer limit line segments, the 100 kHz measurement curve is displayed in addition to the 1 MHz curve. The 100 kHz curve appears approx. 10 dB below the 1 MHz curve and shows more structure; see example below.

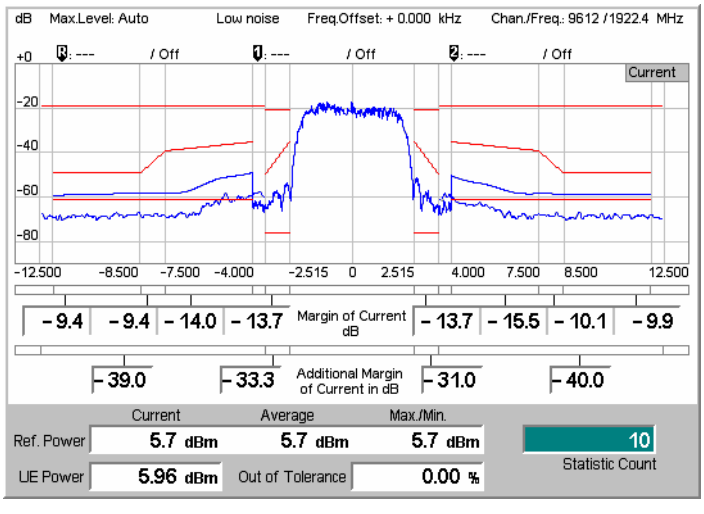
The following figure shows a SEM measurement in mode C.

Limit H

1 MHz curve
100 kHz curve

Margin

Additional margin



Remote control
`READ:ARRay:SPECtrum:EMASk:ADDitional:CURRent,`
`FETCh:ARRay:SPECtrum:EMASk:ADDitional:CURRent,`

`SAMPle:ARRay:SPECtrum:EMASk:ADDitional:CURRent` etc.

Limit Check

The two bars below the diagram are divided into several sections corresponding to the limit line areas defined in the standard. If the curve exceeds the limits in an area, the corresponding section of the bars turns red.

Remote control
```
CALCulate:ARRay:SPECtrum:EMASk:CURRent:MATCHing:LIMit?
CALCulate:ARRay:SPECtrum:EMASk:AVERage:MATCHing:LIMit?
CALCulate:ARRay:SPECtrum:EMASk:MAXimum:MATCHing:LIMit?
CALCulate:ARRay:SPECtrum:EMASk:ADDitional:CURRent
  :MATCHing:LIMit?
```
etc.

Margin

The margin values are displayed across the bottom of the diagram.

Definition: *The margin is the maximum of all distances between the measurement curve and the limit line within a limit line area. Suppose that i = 1 to N numbers the measurement points (x_i, y_i) in a limit line area, then:*

$$\text{Margin} = \max_{i=1}^{N} [\, y_i - \text{limit line}(x_i) \,]$$

A negative margin indicates a passed limit check (the smaller the margin, the closer the measurement curve gets to the limit line). A positive margin indicates a failed limit check.

In SEM mode A (see desription of the SEM Mode on p. 4.92) the margin values are based on an evaluation of all enabled limits (relative limits, absolute *Limit G,* additional *Limit H* for bands II, IV, V, X, XII, XIII, or XIV). No *Additional Margin* values are available.

In SEM modes B, C, and D, the (upper) margins evaluate the relative limits plus the absolute *Limit G.* The *Additional Margin* values correspond to the maximum distance between the additional limit line *(Limit H)* and the measurement curve. In mode C and D the additional margins are referenced to the additional 100 kHz curves.

The margin values are calculated from the displayed measurement curves so they depend on the *Display Mode* (Current, Average, Maximum).

Remote control
```
READ[:SCALar]:SPECtrum:EMASk:CURRent:MARGin?
```
etc.
```
READ[:SCALar]:SPECtrum:EMASk:ADDitional:CURRent:MARGin
```
etc.

Output fields

Below the diagram, the following settings are displayed:

Ref. Power UE output power measured in a 3.84 MHz bandwidth (reference power). The three output fields show the *Current, Average* and *Maximum* results. The spectrum emission curve is calculated as the ratio of the *Current, Average* or *Maximum* off-carrier power to the *Current, Average* or *Maximum* reference power.

UE Power Average power in the current evaluation period. This value is measured with a wide band filter, so it should be slightly higher than the *Current* value of the *Ref. Power*.

Statistic Count Number of evaluation periods per statistics cycle. The colored bar indicates the relative measurement progress in the statistics cycle.

Out of Tolerance Percentage of evaluation periods where the tolerance limits are exceeded.

Remote control
```
READ[:SCALar]:SPECtrum:EMASk?
FETCh[:SCALar]:SPECtrum:EMASk?
SAMPle[:SCALar]:SPECtrum:EMASk?
```

Measurement Configurations (Spectrum)

The popup menu *Spectrum Configuration* contains three tabs to define the parameters of the *Spectrum* measurement including the error tolerances.

The popup menu *Spectrum Configuration* is called up by pressing the measurement control softkey in the top right of the graphical measurement menu *Spectrum* twice (this softkey reads *ACLR Filter* or *ACLR FFT/OBW*, depending on the selected application). By pressing the associated hotkeys, it is possible to change between the tabs.

Measurement Control (Spectrum Configuration – Control)

The *Control* tab controls the *Spectrum* measurement by defining

- The *Repetition* mode
- The *Stop Condition* for the measurement
- The measurement curve displayed *(Display Mode*, for application *ACLR FFT/OBW)*
- The number of slots/evaluation periods forming a statistics cycle *(Statistic Count)*
- The unit for the ACLR values displayed in tables *(Display Unit)*
- The number of chips measured *(Measurement Length*)

Besides, it influences the graphical measurement menus by adding or removing the *Grid* and the OBW line *(OBW Line Display;* for application *ACLR FFT/OBW)*.

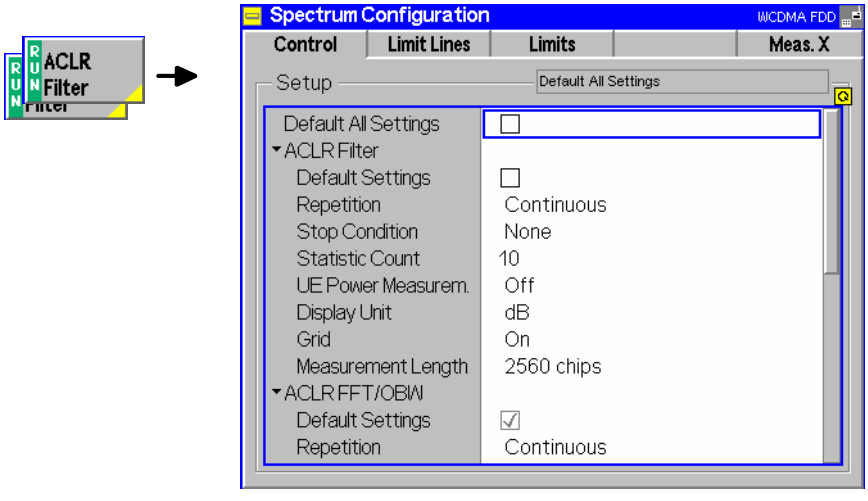


Fig. 4-37 Spectrum Configuration – Control

The settings can be defined separately for the different applications of the *Spectrum* measurement group. Most functions comply with those of the *Control* tab of the *Power Configuration* menu (see page 4.25). In the remote-control commands, the keywords `POWer:<Pow_Application>` are to be replaced by `SPECtrum:<Spec_Application>`. The following parameters are specific to the *Spectrum* measurement:

Default Settings

The *Default All Settings* switch assigns default values to all settings in the *Control* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual applications are provided.

Remote control
```
DEFault:SPECtrum:<Spec_Application>:CONTrol ON | OFF
```

UE Power Measurem.

The *UE Power Measurem.* switches the measurement of the UE Power in the ACLR Filter application on or off. If the measurement is switched off, the UE Power output field shows an invalid result "---" but the whole ACLR Filter measurement is faster.

Remote control
```
CONFigure:SPECtrum:MFILter:CONTrol:UEPMeasure ON | OFF
```

Display Unit

The *Display Unit* parameter selects the display unit for scalar ACLR results. It is possible to select absolute (dBm) or relative units (dB). Switchover to relative units affects the ACLR results for the adjacent channels displayed in the tables below the *ACLR Filter* and *ACLR FFT/OBW* diagrams. The diagram scales are not affected. The calculation of relative statistical values is explained in sections *ACLR Filter Measurement* on p. 4.79 and *ACLR FFT/OBW Measurement* on p. 4.81.

Remote control
no explicit switchover command; relative and absolute results can be retrieved with a keyword RELative or ABSolute annexed to the measurement results commands, e.g.:
```
READ[:SCALar]:SPECtrum:MFILter:ABSolute?
READ[:SCALar]:SPECtrum:MFILter:RELative? etc.
```

Measurement Length

The *Measurement Length* parameter selects a time interval (number of consecutive chips) to be measured. The following values are provided:

2560 Chips	The measurement extends over the complete WCDMA slot comprising 2560 chips.
1280 Chips	The measurement extends over half of the WCMDA slot.
640 Chips	The measurement extends over a quarter of the WCMDA slot.
320 Chips	The measurement extends over an eighth of the WCMDA slot.

A short measurement length reduces the measurement time. The position of the time interval measured within the slot is generally not critical for the *Spectrum* results; it depends on the trigger settings:

- In the *Free Run* trigger setting, the position is random.
- In the *External* or *Internal* trigger setting, the position is determined by the external trigger time.

Note that this differs from the *Modulation* measurement where the *Measurement Length* always starts at the beginning of the slot.

Note: *In the ACLR FFT/OBW and Emission Mask applications, the actual measurement length is longer than the selected number of chips. Measurement length settings of 320 chips, 640 chips, 1280 chips, and 2560 chips correspond to actual measurement lengths of 512, 1024, 2048, and 4096 chips, respectively.*

Remote control
```
CONFigure:SPECtrum:<Spec_Application>:CONTrol:MLENgth
  <No_chips>
```

Display Mode

The *Display Mode* hotkey selects one of the following display modes for the measurement curve in the *ACLR FFT/OBW* diagram:

Current	Measured value for current evaluation period
Maximum	Maximum of a number of evaluation periods
Average	Average value of a number of evaluation periods, referenced to a statistics cycle

The calculation of the measurement curves and the rules for averaging is described in Chapter 3, section *General Settings*. No *Display Mode* is available in the *ACLR Filter* application where no measurement curve is displayed.

Remote control
No display mode set explicitly, the three measurement curves are accessible via:
`FETCh:ARRay:SPECtrum:<Spec_Application>:CURRent?`
`FETCh:ARRay:SPECtrum:<Spec_Application>:MAXimum?`
`FETCh:ARRay:SPECtrum:<Spec_Application>:AVERage?` etc.

OBW Line Display

The *OBW Line Display* switches the indication of the limit frequencies *OBW left* and *OBW right* in the *ACLR FFT/OBW* diagram on or off. The two values are indicated by two vertical red lines. The frequency difference *OBW right – OBW left* is equal to the Occupied Bandwidth (OBW).

Remote control
No remote configuration, screen configuration only.

Emission Mask (Spectrum Configuration – Limit Lines)

The *Limit Lines* tab defines relative and absolute upper limits for the spectrum emissions.

Conformance requirements

The energy that spills outside the designated radio channel increases the interference with adjacent channels and decreases the system capacity.

According to the 3GPP standard, the amount of unwanted off-carrier energy is assessed by the Occupied Bandwidth (OBW) and the out-of-band emissions (excluding spurious emissions) that are specified in terms of a spectrum emission mask and the Adjacent Channel Leakage power Ratio (ACLR). The OBW and ACLR limits are defined in the *Limits* tab; see section *Tolerance Values for ACLR and OBW (Spectrum Configuration – Limits)* on p. 4.94. The spectrum emission mask (SEM) is specified as follows:

Table 4-6 3GPP spectrum emission mask

Frequency offset from carrier Δf	Minimum requirement[4)]	Measurement bandwidth
2.5 MHz to 3.5 MHz	−35.0 dBc − 15*(Δf/MHz – 2.5) dBc	30 kHz[1]
3.5 MHz to 7.5 MHz	−35.0 dBc − 1*(Δf/MHz − 3.5) dBc	1 MHz[2]
7.5 MHz to 8.5 MHz	−39.0 dBc − 10*(Δf/MHz – 7.5) dBc	1 MHz[2]
8.5 MHz to 12.5 MHz	−49.0 dBc	1 MHz[2]

Note 1: *The first and last measurement position with a 30 kHz filter is 2.515 MHz and 3.485 MHz.*

Note 2: *The first and last measurement position with a 1 MHz filter is 4 MHz and 12 MHz.*

Note 3: *The limit specifications in Table 4-6 above only apply if the power in the measured frequency range exceeds the absolute limit of –50.0 dBm referenced to a 3.84 MHz filter. This implies that the absolute spectrum emissions must be:*

- *above* $-50.0\,\mathrm{dBm} + 10 \cdot \log_{10}\left(\frac{1}{3.84}\right)\mathrm{dB} \approx -55.8\,\mathrm{dBm}$ *at frequencies where they are measured with a 1 MHz filter,*
- *above* $-50.0\,\mathrm{dBm} + 10 \cdot \log_{10}\left(\frac{0.03}{3.84}\right)\mathrm{dB} \approx -71.1\,\mathrm{dBm}$ *at frequencies where they are measured with a 30 kHz filter.*

Signals with smaller powers always pass the entire limit check.

Note 4 The minimum requirements listed in the table differ from the test requirements in standard 3GPP TS 34.121. The test requirements allow for an additional measurement uncertainty. Δf is the separation between the carrier frequency and the center of the measurement bandwidth.

For operation in bands II, IV, V, X, XII, XIII, and XIV, the additional requirements in the following tables are specified. The total minimum requirement is calculated from the minimum requirement in Table 4-6 above or the additional requirement, whichever is tighter.

Table 4-7 Additional spectrum emission limits for bands II, IV, X

Frequency offset from carrier Δf	Frequency offset of meas. filter center from the carrier frequency, f_offset	Additional requirements for band II, IV, X	Measurement bandwidth
2.5 MHz ≤ Δf < 3.5 MHz	2.515 MHz ≤ f_offset < 3.485 MHz	–15 dBm	30 kHz
3.5 MHz ≤ Δf ≤ 12.5 MHz	4.0 MHz ≤ f_offset < 12.0 MHz	–13 dBm	1 MHz

Table 4-8 Additional spectrum emission limits for band V

Frequency offset from carrier Δf	Frequency offset of meas. filter center from the carrier frequency, f_offset	Additional requirements for band V	Measurement bandwidth
2.5 MHz ≤ Δf < 3.5 MHz	2.515 MHz ≤ f_offset < 3.485 MHz	–15 dBm	30 kHz
3.5 MHz ≤ Δf ≤ 12.5 MHz	3.55 MHz ≤ f_offset < 12.45 MHz	–13 dBm	100 kHz

Table 4-9 Additional spectrum emission limits for bands XII, XIII, XIV

Frequency offset from carrier Δf	Frequency offset of meas. filter center from the carrier frequency, f_offset	Additional requirements for band XII, XIII, XIV	Measurement bandwidth
2.5 MHz ≤ Δf < 2.6 MHz	2.515 MHz ≤ f_offset < 2.585 MHz	–13 dBm	30 kHz
2.6 MHz ≤ Δf ≤ 12.5 MHz	2.65 MHz ≤ f_offset < 12.45 MHz	–13 dBm	100 kHz

The complete spectrum emission mask (for band II) is shown in *Fig. 4-38 below*.

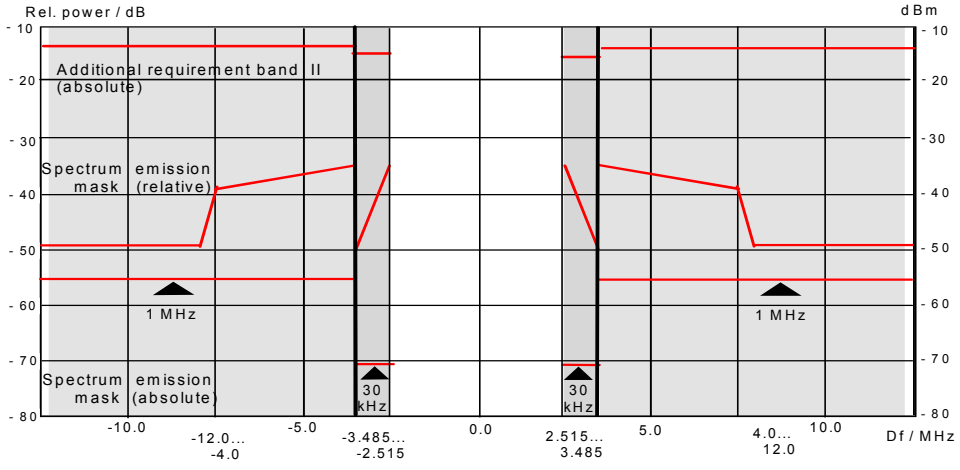


Fig. 4-38 Spectrum emission mask

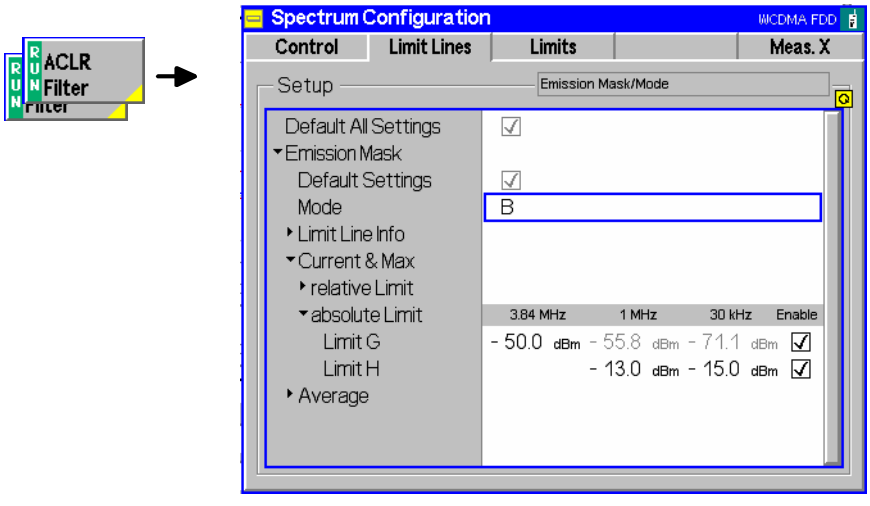


Fig. 4-39 Spectrum Configuration – Limits

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Limit Lines* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual applications are provided.

Remote control

```
DEFault:SPECtrum:EMASk:LIMit:LINE  ON | OFF
```

In SEM mode A (see desription of the SEM Mode on p. 4.92) the margin values are based on an evaluation of all enabled limits (relative limits, absolute *Limit G,* additional *Limit H* for bands II, IV, V, X, XII, XIII, or XIV). No *Additional Margin* values are available.

In SEM modes B, C, and D, the (upper) margins evaluate the relative limits plus the absolute *Limit G.* The *Additional Margin* values correspond to the maximum distance between the additional limit line *(Limit H)* and the measurement curve. In mode C and D the additional margins are referenced to the additional 100 kHz curves.

Mode

Mode allows you to select the spectrum emission mask type in accordance with the operating band:

A Limit lines according to Table 4-6. If the R&S CMU operates in one of the bands II, IV, V, X, XII, XIII, or XIV, the additional requirements from Table 4-7 are applied. The additional limit values *(Limit H*, see limit line info below) can be edited; the margin values include the effect of these limits. No additional margins for the *Limit H* segments are available. This mode ensures backward compatibility with older firmware versions.

B Limit lines according to Table 4-6 plus additional requirements from Table 4-7. All limit values are editable. The R&S CMU shows the additional limit lines in the measurement diagram and evaluates additional margins for the *Limit H* segments. This mode is particularly suited for operating bands II, IV, and X but available in all operating bands.

C Limit lines according to Table 4-6 plus additional requirements from Table 4-8. The R&S CMU behaves like in mode B. Mode C is particularly suited for operating band V but available in all operating bands.

D Limit lines according to Table 4-6 plus additional requirements from Table 4-9. The R&S CMU behaves like in mode B. Mode D is particularly suited for operating bands XII, XIII, and XIV but available in all operating bands.

Note: *The Mode selection is available in Signaling mode only. Non Signaling measurements are performed according to mode A, but with no additional margin results.*

Activating an SEM mode does not change the Limit H values. Ensure correct limit settings if you switch from one SEM mode to another.

Tip: ***SEM tests according to the standard***

Proceed as follows to test different operating bands in accordance with the specifications:

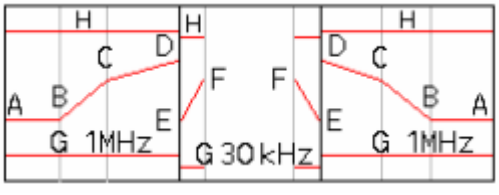
Operating bands II, IV, X: Mode A or B
Operating band V: Mode C
Operating bands XII, XIII, and XIV: Mode D
All others: Mode A or any other mode with disabled additional limit check.

Remote control
`DEFault:SPECtrum:EMASk:LIMit:MODE A | B | C | D`

Limit Line Info

The *Limit Line Info* diagram shows a preview of the spectrum emission mask that represents a simplified version of Fig. 4-38. The diagram shows three tpyes of limit lines:

- The the limit lines for the minimum **relative** requirements (all operating bands) consist of four line segments with different slopes. The relative line segments are defined by the coordinates of their start and end points labeled A to F.
- The **absolute** limit lines are defined by three values corresponding to the filter bandwidths 3.84 MHz, 1 MHz and 30 kHz (sections G).
- The limit lines for the **additional** absolute requirements in band II, IV, V, X, XII, XIII, and XIV consist of two line segments, corresponding to the filter bandwidths 1 MHz / 100 kHz (depending on the band, see Table 4-7, Table 4-8, and Table 4-9) and 30 kHz (sections H).



Current & Max. The *Current & Max* table section defines relative and absolute limits for the *Current* and for the *Maximum* spectrum emission curve. All limits are symmetric to the carrier frequency.

The upper *relative Limits* are given by the start and end points of the individual line sections. These points are located at fixed frequencies:

Limit A Start point of section 1, corresponding to a frequency of ±12 MHz from the carrier

Limit B End point of section 1 and start point of section 2, corresponding to a frequency of ±8.5 MHz from the carrier

Limit C End point of section 2 and start point of section 3, corresponding to a frequency of ±7.5 MHz from the carrier

Limit D End point of section 3 corresponding to a frequency of ±4 MHz from the carrier

Limit E Start point of section 4, corresponding to a frequency of ±3.845 MHz from the carrier

Limit F End point of section 4 corresponding to a frequency of ±2.515 MHz from the carrier

Enable Switches the relative limit check in sections 1 to 3 (1 MHz filter, *Limit A-D)* or in section 4 (30 kHz filter, *Limit E-F)* **including the absolute limit check** G and H on or off

The *absolute Limit G* is defined by the 3.84 MHz reference value. From this value, the 1 MHz and 30 kHz limits are calculated according to the formulas of Note 3 on p. 4.90.

Limit G, 3.84 MHz Reference value for the absolute limit for the UE carrier frequency measured with a 3.84 MHz RRC filter. This value is used to calculate all absolute limits of the spectrum emission mask. It is not correlated to the absolute level that can be set in the *Limits* tab; see section *Tolerance Values for ACLR and OBW (Spectrum Configuration – Limits)* on p. 4.94.

Limit G, 1 MHz Absolute limit for the spectrum emission in the frequency domain where it is measured with a 1 MHz Gaussian filter, corresponding to the current 3.84 MHz reference value (not editable, grayed).

Limit G, 30 kHz Absolute limit for the spectrum emission in the frequency domain where it is measured with a 30 kHz Gaussian filter, corresponding to the current 3.84 MHz reference value (not editable, grayed).

Enable Switches the absolute limit check of limit G on or off

The *absolute Limit H* accounts for the additional requirements in Table 4-7, Table 4-8, and Table 4-9. It is not available if SEM mode A with an operating band other than II, IV, V, X, XII, XIII, or XIV is active. If a measurement result exceeds the absolute limit H, the UE under test is out of tolerance, irrespective of the result of the relative limit check.

Note: *In realistic test scenarios, the limit G is always smaller than the limit H. Results smaller than G are passed, results larger than H are failed.*

Remote control

```
CONFigure:SPECtrum:EMASk:RELative:CMAX:LIMit:LINE:SYMmetric:
        [COMBined]:VALue
CONFigure:SPECtrum:EMASk:ABSolute:CMAX:LIMit:LINE:SYMmetric:
        [COMBined]:VALue
CONFigure:SPECtrum:EMASk:ADDition:CMAX:LIMit:LINE
        :SYMMetric:[COMBined]:VALue
```

Priority and indication of limit checks

Under normal operating conditions, the relative limit check represents the critical criterion because the absolute check is a secondary condition which a WCDMA UE is very likely to fulfil. Consequently, the CMU deactivates the absolute limit check if the relative limit check is entirely switched off. In the measurement diagram, the absolute limit lines are indicated only if both the relative and the absolute limit checks are active.

Average

The *Average* table section diagram defines relative and absolute limits for the *Average* spectrum emission curve. The settings are analogous to the *Current & Max.* settings described above.

Remote control

```
CONFigure:SPECtrum:EMASk:RELative:AVERage:LIMit:LINE:
        SYMmetric:[COMBined]:VALueCONFigure:SPECtrum:EMASk:AB
Solute:AVERage:LIMit:LINE:
        SYMmetric:[COMBined]:VALue
CONFigure:SPECtrum:EMASk:ADDition:AVERage:LIMit:LINE
        :SYMMetric:[COMBined]:VALue
```

Tolerance Values for ACLR and OBW (Spectrum Configuration – Limits)

The tab *Limits* defines upper limits for the parameters of the *Spectrum* measurement.

Conformance requirements

The energy that spills outside the designated radio channel increases the interference with adjacent channels and decreases the system capacity.

According to the 3GPP standard, the amount of unwanted off-carrier energy is assessed by the Occupied Bandwidth (OBW) and the out of band emission (excluding spurious emissions) that are specified in terms of a spectrum emission mask and Adjacent Channel Leakage power Ratio (ACLR). The spectrum emission mask is defined in the *Limit Lines* tab; see section *Emission Mask (Spectrum Configuration – Limit Lines)* on p. 4.89. The OBW and ACLR limits are specified as follows:

For both power class 3 and power class 4 UE, the ACLR shall not exceed –33 dB at frequencies ±5 MHz from the carrier (channels ±1) and –43 dB at frequencies ±10 MHz from the carrier (channels ±2)[3]. The limits must be met if the adjacent channel power is larger than –50 dBm (absolute limit); they must hold even in the presence of switching transients.

For the OBW, an upper limit of 5 MHz based on a chip rate of 3.84 MHz is specified.

[3] To keep our results in line with networks like GSM and TDMA, we define the ACLR and the limits with a relative minus sign compared to the 3GPP standard. The role of upper and lower limits is accordingly interchanged.

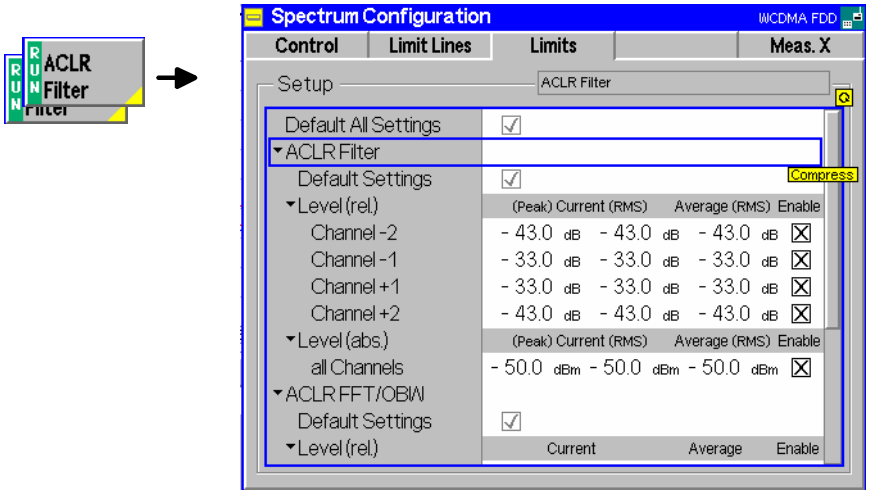


Fig. 4-40 Spectrum Configuration – Limits

Default Settings

The *Default All Settings* switch assigns default values to all settings in the *Limits* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual applications are provided.

Remote control

```
DEFault:SPECtrum:MFILter:LIMit <Enable>
DEFault:SPECtrum:MFFT:LIMit <Enable>
```

ACLR Filter

The *ACLR Filter* table section defines upper limits for the ACLR measured with the direct filter method. The following relative values *Level (rel.)* can be set for channels ±1 (at ±5 MHz from the carrier) and ±2 (at ±10 MHz from the carrier):

Curr.&Max (Peak) Upper limit for the peak ACLR of the current evaluation period (first table row in the upper table of the *ACLR Filter* menu)

Curr.&Max (RMS) Upper limit for the effective ACLR of the current evaluation period (second table row in the upper table of the *ACLR Filter* menu)

Average (RMS) Upper limit for the average of all *Current (RMS)* values referenced to the last statistics cycle (first table row in the lower table of the *ACLR Filter* menu)

Enable Switches the limit check in the corresponding channel on or off

The absolute limits *Level (abs.)* are the powers in dBm below which no relative limit check needs to be performed. Common absolute limits for all channels can be set in the *All channels table section.*

Remote control

```
CONFigure:SPECtrum:MFILter:RPEak:CURRent:LIMit[:SCALar]:
        ASYMmetric:UPPer:CHANnel<nr>:VALue <ACLR_Limit>
CONFigure:SPECtrum:MFILter:RRMS:CURRent:LIMit[:SCALar]:
        ASYMmetric:UPPer:CHANnel<nr>:VALue <ACLR_Limit>
CONFigure:SPECtrum:MFILter:RRMS:AVERage:LIMit[:SCALar]:
        ASYMmetric:UPPer:CHANnel<nr>:VALue <ACLR_Limit>
CONFigure:SPECtrum:MFILter:RELative:LIMit[:SCALar]:
        ASYMmetric:UPPer:CHANnel<nr>:Enable <Enable>
CONFigure:SPECtrum:MFILter:APEak:CURRent:LIMit[:SCALar]:
        ASYMmetric:UPPer:VALue <ACLR_Limit>
CONFigure:SPECtrum:MFILter:ARMS:CURRent:LIMit[:SCALar]:
        ASYMmetric:UPPer:VALue <ACLR_Limit>
CONFigure:SPECtrum:MFILter:ARMS:AVERage:LIMit[:SCALar]:
        ASYMmetric:UPPer:VALue <ACLR_Limit>
```

```
CONFigure:SPECtrum:MFILter:ABSolute:LIMit[:SCALar]:
        ASYMmetric:UPPer:Enable <Enable>
```

ACLR FFT/OBW

The *ACLR FFT/OBW* table section defines upper limits for the ACLR measured with the FFT method and for the OBW. The following relative values *Level (rel.)* can be set for the ACLR in channels ±1 (at ±5 MHz from the carrier) and ±2 (at ±10 MHz from the carrier) and for the OBW:

Curr.&Max Upper limit for the ACLR or OBW of the current slot (first table row in the output table of the *ACLR FFT/OBW* menu)

Average Upper limit for the average of all *Current* values referenced to the last statistics cycle (second table row in the output table of the *ACLR FFT/OBW* menu)

Enable Switches the limit check in the corresponding channel (or for OBW) on or off

The absolute limits *Level (abs.)* are the powers in dBm below which no relative limit check needs to be performed. Common absolute limits for all channels can be set in the *All channels table section.*

Remote control

```
CONFigure:SPECtrum:MFFT:RELative:CMAX:LIMit[:SCALar]:
        ASYMmetric:UPPer:CHANnel<nr>:VALue <ACLR_Limit>
CONFigure:SPECtrum:MFFT:RELative:AVERage:LIMit[:SCALar]:
        ASYMmetric:UPPer:CHANnel<nr>:VALue <ACLR_Limit>
CONFigure:SPECtrum:MFFT:RELative:LIMit[:SCALar]:ASYMmetric:UP
Per:    CHANnel<nr>:Enable <Enable>
CONFigure:SPECtrum:MFFT:ABSolute:CMAX:LIMit[:SCALar]:
        ASYMmetric:UPPer: VALue <ACLR_Limit>
CONFigure:SPECtrum:MFFT:ABSolute:AVERage:LIMit[:SCALar]:
        ASYMmetric:UPPer: VALue <ACLR_Limit>
CONFigure:SPECtrum:MFFT:ABSolute:LIMit[:SCALar]:
        ASYMmetric:UPPer:Enable <Enable>
```

Priority and indication of limit checks

Under normal operating conditions, the relative limit check represents the critical criterion because the absolute check is a secondary condition which a WCDMA UE is very likely to fulfil. Consequently, the CMU deactivates the absolute limit check if the relative limit check is switched off. The limit markers in the *ACLR Filter* measurement diagram show the relative limit check.

Selection of Measurement Points (Spectrum Configuration – Meas. X)

The tab *Meas. X* determines at which channels/frequencies a *ACLR Filter* measurement is performed.

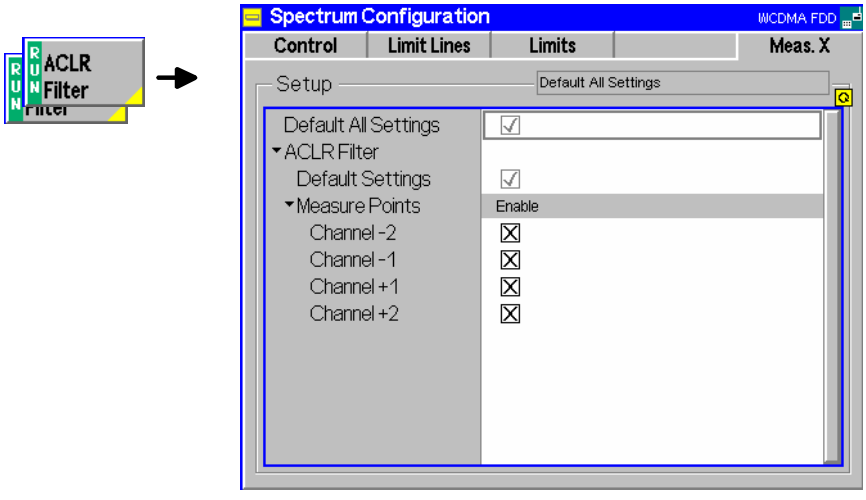


Fig. 4-41 Spectrum Configuration – Meas. X

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Meas. X* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual applications (at present, the *ACLR Filter* application) are provided.

Remote control
`DEFault:SPECtrum:MFILter:MEASx <Enable>`

Measure Points The *Measure Points* table section enables (*Enable* box checked) or disables the spectrum measurement on individual channels. Channels ±1 (at ±5 MHz from the carrier) and ±2 (at ±10 MHz from the carrier) can be selected. A reduction of the measurement points enhances the measurement speed.

Remote control
`CONFigure:SPECtrum:MFILter:MEASx:CHANnel<nr>:ENABle <Enable>`

Code Domain Power Measurements

The menu group *Code Domain Power* comprises the functions for measurement of the relative power and the waveform quality (ρ factor) in the individual code or physical channels of an uplink WCDMA signal. The measurement results are displayed in the graphical measurement menu *Code Domain Power,* the popup menu *Code Domain Power Configuration* is used for configuration of the measurements.

The *Code Domain Power* measurement serves to assess the average power and the modulation accuracy in each code channel. This is done by means of two different quantities:

CDP The Code Domain Power (CDP) is the ratio of the power in an individual code channel to the power of the composite WCDMA signal, expressed in dB.

CD-ρ The CD-ρ factor is the correlated power (ρ factor) of an individual channel divided by the total power of the composite WCDMA signal. It is calculated in analogy to the waveform quality for the whole signal (see *Equation 4-3* on p. 4.44), but with the measured signal vector Z_k replaced by the measured signal vector in the code channels.

The waveform quality for the whole signal approaches 1 as the signal approaches the ideal signal. Analogously, the CD-ρ factor, which is a measure for the modulation accuracy of an individual code channel signal, approaches 1/<number of code channels> as the code channel signal approaches the ideally modulated signal. For an ideal WCDMA uplink signal comprising 1 DPCCH plus 6 DPDCHs, the CD-ρ factor of all physical channels is 1/7 ≈ 0.142.

The quantities CDP and CD-ρ can be displayed in two alternative ways:

- In the code channel representation (applications *CDP ... Auto)*, the CDP and CD-ρ factor of the I and Q signal are displayed in two separate bar graphs as a function of the channelization code. The channelization codes are determined assuming a symbol rate and power threshold as set in the *Auto Settings* section in the *UE Code* tab of the *Connection Control* menu.
- In the physical channel representation (applications *CDP ... Manual)*, the CDP and CD-ρ factor are displayed in a single bar graph as a function of the physical channels contributing to the WCDMA signal (DPCCH, DPDCH1,..., DPDCH6). The symbol rates and channelization codes must be set in the *Manual Settings* section in the *UE Code* tab of the *Connection Control* menu.

For WCDMA standard uplink signals, both representations are equivalent as the I/Q phase and the channelization code uniquely defines the physical channel and vice versa; see *Fig. 4-17* on p. 4.45. The measurement speed in *Manual* mode, however, is higher than in *Auto* mode. On the other hand, the *Auto* measurements represent the more universal applications. They can be used if the channelization codes or the symbol rate of the analyzed signal are unknown, e.g. because the signal configuration does not conform to 3GPP specifications or because the UE transmitter uses non-standard channelization codes.

A limit check is provided in the physical channel representation only, because it is more conveniently visualized in the corresponding diagram.

The R&S CMU provides the following additional CDP applications:

CDP vs. Time The *CDP vs. Time* measurement provides the code power and the gain factors for all UL channels. See section *CDP vs. Time Measurement* on p. 4.99.

HS-DPCCH Time Mask The *HS-DPCCH Time Mask* measurement provides the code power of the UL channels over a 4-slot period. The main purpose of this measurement is to assess the steps of the UL transmission power due to the transmission of ACK/NACK or CQI over the HS-DPCCH. For a detailed description refer to Chapter 8.

HS-DPCCH CDP The HS-DPCCH CDP measurement is integrated in the *CDP/Code Manual* and *CDP/Code Rho Manual* applications. The measurement requires option R&S CMU-K64, *HSDPA 3.6 Mbps*. For a detailed description refer to Chapter 8.

HSUPA CDP

The CDP measurement of the UL HSUPA channels (E-DPCCH and E-DPDCH1 to E-DPDCH4) is integrated in the *CDP/Code Manual* and *CDP/Code Rho Manual* applications. The measurement requires option R&S CMU-K56, *HSUPA*. For a detailed description refer to Chapter 8.

CDP vs. Time Measurement

The *CDP vs. Time* measurement provides the code power and the gain factors for all UL channels. The measurement is available in *Non Signalling* and in *Signalling* mode.

- The code power is measured on the DPCCH, on all DPDCHs (DPDCH 1 to DPDCH6, if present), and the HS-DPCCH, E-DPCCH, and E-DPDCH channels (if one is active).
- The gain factors determining the relative strength of the code channels are also measured for the DPCCH, all DPDCHs, and the HS-DPCCH, E-DPCCH, and E-DPDCH channels.

The CDP vs. Time measurement requires the hardware option R&S CMU-U65Var04. Measuring the HSDPA and HSUPA uplink channels requires the software options R&S CMU-K64 and R&S CMU-K65, respectively. For a description of HSDPA and HSUPA CDP measurement results refer to Chapter 8.

A program example for a CDP vs. Time measurement is reported in Chapter 7.

Measurement procedure and purpose

The measurement can extend over a duration of up to 47 slots or 3 frames plus one slot before and one slot afterwards. The R&S CMU 200 acquires 10 values in each slot, which corresponds to a measurement time of 256 chips or 1 symbol length of the fixed rate (SF = 256) HS-DPCCH or E-DPCCH (see also sections *HSDPA Code Domain Power* and *HSUPA Code Domain Power* in Chapter 8). This means that a single shot measurement yields up to 470 results for the code powers or beta values in each channel.

The *CDP vs. Time* measurement is intended for monitoring the power of the uplink channels for an extended period of time. E.g. a direct comparison between the total UE power and the HS-DPCCH power shows how the UE power varies depending on the transmission of ACK/NACK and CQI over the HS-DPCCH. Requirements for the transmit power of the composite DPCCH + DPDCH + HS-DPCCH signal are specified in standard 3GPP TS 34.121, section 5.7A.

The *CDP vs. Time* measurement can be used as well to verify to which degree of accuracy the actual gain factors of the UL channels comply with the gain factors signalled to the UE; see section *UE Signal*.

Channel detection

A channel is considered to be active if its signal power, averaged over a slot, exceeds the *Threshold* value defined in the *UE Code* or *UE Signal* tab of the *Connection Control* menu *(UE Code – DPDCH Settings – Auto Settings – Threshold* in Non Signalling mode or *UE Signal – Measurement Settings – Threshold* in Signalling mode). The R&S CMU provides no power results and gain factors for inactive channels; the `READ…` `/FETCh…/SAMPle…` commands return `NAN` values. The following exceptions apply:

- The DPCCH is assumed to be always active. Its measured power and gain factor is always indicated (no NAN values), irrespective of the threshold.
- In Signalling mode or in Non Signalling mode with the setting *DPDCH CC Mode: Auto,* the DPDCH 1 is also assumed to be active.

- In Non Signalling mode with the setting *DPDCH CC Mode: Manual*, all DPDCHs selected manually are assumed to be active.

Calculation of gain factors

The gain factors are calculated from the measured powers in each 256-chip interval. They are normalized as follows:

- The strongest of all active DPCCH and DPDCH channels is assigned a gain factor of 15.
- All other gain factors β_{ch} are calculated from the power ratio of the channels relative to the strongest DPCCH/DPDCH channel (value P_{ch} in dB):

  $\beta_{ch} = 15 * 10\text{^}(P_{ch} / 20\ dB)$

- The HS-DPCCH can be stronger than the strongest DPCCH/DPDCH, therefore its gain factor can be larger than 15.

Normalization means that only the ratios between the gain factors are actually measured. The signalled values for the gain factors and the corresponding power ratios are listed in Table 4-10 below.

If desired the normalization can be changed using a different Power Reference Beta Fact. *(see p. 4.115).*

Measurement settings

The *CDP vs. Time* measurement is most conveniently triggered via a frame trigger. This trigger source is automatically activated if an *Auto* trigger is set and the measurement is initiated. In *Signalling* mode, it is also possible to use a *Change of TFC* trigger (see description of trigger sources in the *Trigger section* on p. **4.281**).

In *Signalling* mode, the measurement can be performed for all *Dedicated Channel* types. The UL gain factors must be set before a connection is established. The *Change of TFC* trigger requires a *Dedicated Channel* type where the UE actually changes the Transport Format Combination, e.g. a *Voice* call. Moreover it is recommended to use the DPCCH power as a reference for the UL target power *(Connection Control – UE Signal – UE Power Control – UL Target Power – Reference: DPCCH Power).*

Table 4-10 Signalled values for gain factors and channel powers

Signalled values for β_c and β_d	**Quantized amplitude ratios β_c and β_d**	**Relative Power** ***P_{ch} = 20 * log(β)***
15	15/15	0 dB
14	14/15	–0.6 dB
13	13/15	–1.2 dB
12	12/15	–1.9 dB
11	11/15	–2.7 dB
10	10/15	–3.5 dB
9	9/15	–4.4 dB
8	8/15	–5.5 dB
7	7/15	–6.6 dB
6	6/15	–8.0 dB
5	5/15	–9.5 dB
4	4/15	–11.5 dB
3	3/15	–13.9 dB
2	2/15	–17.5 dB
1	1/15	–23.5 dB
0 (not used)		– (Switch off)

Signalled values for Δ_{ACK}, Δ_{NACK}, Δ_{CQI} and $\Delta_{E\text{-}DPCCH}$	**Quantized amp. ratios** ***$A_{hs} = \beta_{hs} / \beta_c$*** ***$A_{ec} = \beta_{ec} / \beta_c$***	**Relative Power** ***P_{ch} = 20 * log(A)***
–	–	–
–	–	–
–	–	–
–	–	–
–	–	–
–	–	–
–	–	–
8	30/15	+6.0 dB
7	24/15	+4.1 dB
6	19/15	+2.1 dB
5	15/15	0 dB
4	12/15	–1.9 dB
3	9/15	–4.4 dB
2	8/15	–5.5 dB
1	6/15	–8.0 dB
0	5/15	–9.5 dB

Signalled values for $\Delta_{E\text{-}DPDCH}$	**Quantized amplitude ratios** ***$A_{ed} = \beta_{ed,k} / \beta_c$***[4]	**Relative Power** ***P_{ch} = 20 * log(A)***
29	168/15	+21.0 dB
28	150/15	+20.0 dB
27	134/15	+19.0 dB
26	119/15	+18.0 dB
25	106/15	+17.0 dB
24	95/15	+16.0 dB
23	84/15	+15.0 dB
22	75/15	+14.0 dB
21	67/15	+13.0 dB
20	60/15	+12.0 dB
19	53/15	+11.0 dB
18	47/15	+9.9 dB
17	42/15	+8.9 dB
16	38/15	+8.1 dB
15	34/15	+7.1 dB

Signalled values for $\Delta_{E\text{-}DPDCH}$	**Quantized amplitude ratios** ***$A_{ed} = \beta_{ed,k} / \beta_c$***	**Relative Power** ***P_{ch} = 20 * log(A)***
14	30/15	+6.0 dB
13	27/15	+5.1 dB
12	24/15	+4.1 dB
11	21/15	+2.9 dB
10	19/15	+2.1 dB
9	17/15	+1.1 dB
8	15/15	0.0 dB
7	13/15	–1.2 dB
6	12/15	–1.9 dB
5	11/15	–2.7 dB
4	9/15	–4.4 dB
3	8/15	–5.5 dB
2	7/15	–6.6 dB
1	6/15	–8.0 dB
0	5/15	–9.5 dB

[4] The index k numbers the four E-DPDCH channels E-DPDCH$_1$ to E-DPDCH$_4$.

The result for the different code channel powers obtained in a *CDP vs. Time* measurement in HSDPA test mode are shown below.

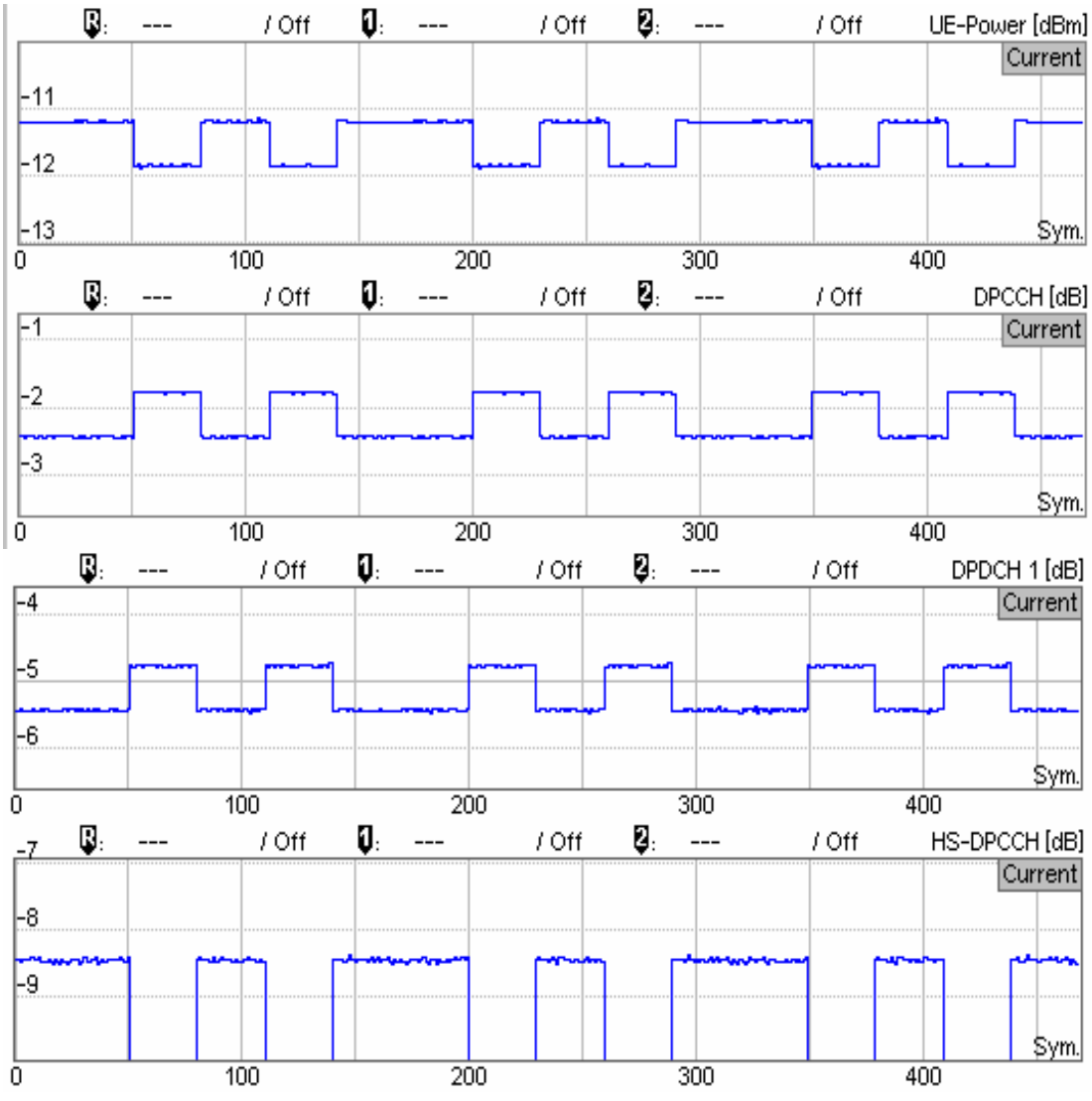


Fig. 4-42 CDP vs. Time – measurement example

Measurement Menu (Code Domain Power)

The graphical measurement menu *Code Domain Power* displays the results of the code domain power and waveform quality measurement.

- The measurement control softkey *CDP/Code Auto* (which changes to *CDP/Code Manual, CDP/Code Rho Auto* etc. if one of the other applications is selected) controls the measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Code Domain Power Configuration*. The hotkeys associated with the measurement control softkey define the scope of the *Code Domain Power* measurement.
- The softkeys *Application, Analyzer Level, UE Code/Analyzer Set., Marker* and *Menus* to the right of the test diagram are combined with various hotkeys. The softkey/hotkey combinations provide test settings and switch over between different measurements. The entry of values is described in section *Measurement Menu (Power)* on page 4.6.

The measurement menu *Code Domain Power* can be accessed from any other measurement menu of the WCDMA UE function group using the *Code Domain Power* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).

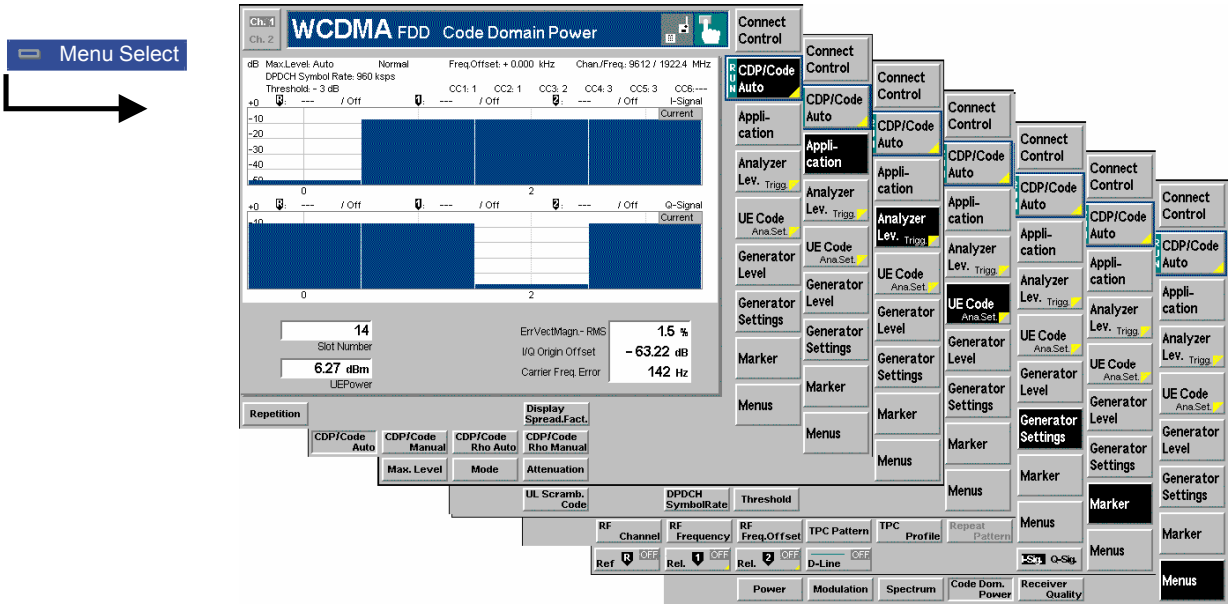


Fig. 4-43 Measurement menu Code Domain Power

Test Settings

The *Analyzer Level* test settings and the *Menus* functions are identical with those in the *Power* menu (see section *Test Settings* on page 4.7). The same holds for the *Marker* functions. In the *CDP/Code Auto* and *CDP Rho Auto* applications, where the I and Q signal components are displayed in two separate diagrams, two marker sets are available. They are activated by pressing the *I-Sig Q-Sig* toggle switch.

The following softkeys and hotkeys differ from the other measurements:

CDP/Code Auto

The *CDP/Code Auto* softkey controls the *Code Domain Power* measurement of the WCDMA signal with automatic search of the channelization codes and indicates its status *(RUN | HLT | OFF)*.

This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status of the measurement is unaffected upon switchover to other menus controlling a *Code Domain Power* measurement; however, a running measurement is restarted.

Remote control

```
INITiate:CDPower:AUTomatic
ABORt:CDPower:AUTomatic
STOP:CDPower:AUTomatic
CONTinue:CDPower:AUTomatic etc.
FETCh:CDPower:AUTomatic:STATus?
```

Measurement configuration

Pressing the *CDP/Code Auto* softkey twice opens the popup menu *Code Domain Power Configuration* (see page 4.66). Besides, the hotkeys *Repetition* and *Display Spread.Fact.* defining the scope of the measurement are associated with the *CDP/Code Auto* softkey. These hotkeys are identical with the parameters set in the *Control* tab of the *Code Domain Power Configuration* menu (see section *Measurement Control (Code Domain Power Configuration – Control)* on page 4.87).

The *Display Mode* hotkey, which is available in the *CDP ... Manual* applications, is also provided in the *Control* tab.

Application

The *Application* softkey selects the measurement method for the *Code Domain Power* measurement and the type of measurement parameters. For a detailed description see background information in section *Code Domain Power Measurements* on p. 4.98.

The alternative applications call up different measurement menus containing bar graphs and various output fields; see section *Measurement Results* on p. 4.106. The configuration settings for all *Code Domain Power* applications, however, are listed in a common popup menu (see section *Measurement Configurations (Code Domain Power)* on p. 4.113).

CDP/Code Auto

The *CDP/Code Auto* measurement provides the Code Domain Power (CDP) of all code channels. This measurement method yields the relative WCDMA transmit power at up to 256 different channelization codes.

Remote control
The *CDP/Code Auto* application is selected by the keywords `:CDPower:AUTomatic` in the 2nd and 3rd level of the *Code Domain Power* commands, e.g. `CONFigure:CDPower:AUTomatic...`

CDP/Code Manual

The *CDP/Code Manual* measurement provides the power in the dedicated physical channels which contribute to the uplink WDCMA signal analyzed. This measurement method yields the relative WCDMA transmit power in one DPCCH and up to 6 DPDCHs.

Remote control
The *CDP/Code Auto* application is selected by the keywords `:CDPower:MANual` in the 2nd and 3rd level of the *Code Domain Power* commands, e.g. `CONFigure:CDPower:MANual...`

CDP/Code Rho Auto

The *CDP/Code Rho Auto* measurement provides the normalized correlated power (ρ factor) of all code channels. This measurement method yields the ρ factor at up to 256 different channelization codes.

Remote control
The *CDP/Code Rho Auto* application is selected by the keywords `:CDPower:RAUTomatic` in the 2nd and 3rd level of the *Code Domain Power* commands, e.g. `CONFigure:CDPower:RAUTomatic...`

CDP/Code Rho Manual

The *CDP/Code Rho Manual* measurement provides the normalized correlated power (ρ factor) in the dedicated physical channels contributing to the uplink WDCMA signal analyzed. This measurement method yields the ρ factor in one DPCCH and up to 6 DPDCHs.

Remote control
The *CDP/Code Rho Auto* application is selected by the keywords `:CDPower:RMANual` in the 2nd and 3rd level of the *Code Domain Power* commands, e.g. `CONFigure:CDPower:RMANual...`

CDP/Time

The *CDP/Time* measurement provides the code power and the gain factors for all UL channels.

Remote control
The *CDP/Time* application is selected by the keywords `:CDPower:TIME` in the 2nd and 3rd level of the *Code Domain Power* commands, e.g.

```
CONFigure:CDPower:TIME...
```

HS-DPCCH Time Mask

The *HS-DPCCH Time Mask* measurement is described in Chapter 8.

UE Code Ana. Set.

The *UE Code* softkey defines the properties of the multiple uplink WCDMA signal that the CMU is able to analyze. For a description of the WCDMA signal see background information in section *WCDMA Measurements (Modulation – WCDMA)* on page 4.56 f. The UE Code settings are also accessible via the *UE Code* tab of the *Connection Control* menu; see *section Uplink Signal (Connection Control – UE Code)* on p. 4.171.

The hotkeys associated with the UE Code softkeys depend on the selected application:

- In the *CDP ... Auto* applications, the WCDMA signal is analyzed in the channelization code domain. The CMU searches for the DPDCH channelization codes assuming a definite scrambling code, DPDCH symbol rate, and power threshold. In this mode, the *UL Scrambling Code, DPDCH Symbol Rate* and *Threshold* hotkeys are available.
- In the *CDP ... Manual* applications, the WCDMA signal is analyzed in the physical channel domain. The CMU analyzes the signal from the WCDMA UE assuming definite symbol rates and channelization codes. In this mode, the *Multiple Signal* configuration, the *UL Scrambling Code* and the symbol rate and channelization codes *(Sym. Rate Chan. Code)* can be set.

If pressed once again, the selected *UE Code* softkey changes to the *Analyzer Settings* softkey, see section *Test Settings* on page 4.7.

Note: *In Signalling mode, there is no need to set the* UE Code *parameters* Multiple Signal, DPDCH CC Mode, Sym. Rate/Chan. Code. *The parameters are implicitly included in the dedicated channel settings. The* UL Scrambling Code *that the UE shall use can be set in the* UE Signal *tab and doesn't have to be configured at the UE.*

UL Scramb. Code

The *UL Scramb. Code* hotkey selects the number of the long code that is used to scramble the WCDMA signal. The scrambling code number must be in the range 0 to FFFFFF (hex), corresponding to 0 to 16777215 decimal. The measurement fails if the input signal does not conform to the *Scrambling Code* settings.

The scrambling code setting is valid for both the *CDP ... Auto* and the *CDP ... Manual* applications.

Remote control

```
CONFigure:UECode:DPCH:SCODe <Code>
```

The following hotkeys are not available (and the settings are ignored) in the *CDP ... Auto* applications; see above, *UE Code* softkey.

Multiple Signal

The hotkey *Multiple Signal* selects the physical channels that contribute to the multiple uplink WCDMA signal.

DPCCH Signal consists of one single Dedicated Physical Control Channel

DPCCH+DPDCH1,...n Signal consists of one DPCCH to which n Dedicated Physical Data Channels are added. n can vary between 1 and 6 so that it is possible to superimpose up to 7 signals as shown in *Fig. 4-17* on p. 4.45.

Remote control
`CONFigure:UECode:DPDCh:MANual:MSIGnal <Channels>`

Sym. Rate Chan. Code

The *Sym. Rate Chan. Code* hotkey calls up a list of the symbol rate and channelization code for the DPCCH and each of the six CPDCHs that can contribute to the multiple WCDMA signal. If a *DPCCH+DPDCH1* multiple signal is analyzed, the symbol rate of the data channel *DPDCH1* can be set. The channelization code will be automatically adapted according to the rules in the 3GPP standard. For other multiple signal configurations, symbol rates and channelization codes are fixed.

Remote control
`CONFigure:UECode:DPDCh:MANual:DPDCh1:SRCCode <Rate>,<Code>`

The following hotkeys are not available (and the settings are ignored) in the *CDP ... Manual* applications; see above, *UE Code* softkey. They are explained in more detail in section *Uplink Signal (Connection Control – UE Code)* on p. ***4.171***.

DPDCH Sym. Rate

The *DPDCH Symbol Rate* hotkey selects the symbol rate of the DPDCH.

Remote control
`CONFigure:UECode:DPDCh:AUTO:SRATe <Rate>`

Threshold

The *Threshold* hotkey defines a mimimum signal strength of each $DPDCH_n$ in the WCDMA signal to be detected in the automatic channelization code search.

Remote control
`CONFigure:UECode:DPDCh:AUTO:THReshold <Threshold>`

Measurement Results

The *Code Domain Power* menu group contains four separate measurement menus corresponding to the four applications *CDP/Code Auto, CDP/Code Manual, CDP/Code Rho Auto* and *CDP/Code Rho Manual*. The menus in the two *Auto* applications are analogous to each other but differ from the *Manual* menus.

CDP/Code Auto and CDP/Code Rho Auto

In the *CDP/Code Auto (CDP/Code Rho Auto)* measurement, the relative transmit power (normalized correlated power or ρ factor) is projected onto all code channels of the WCDMA signal. The results and the corresponding measurement settings are indicated in four parameter lines, two test diagrams (one bar graph for the I and Q signal component) and several output fields:

Parameter lines

I-Signal bar graph

Q-Signal bar graph

Output fields

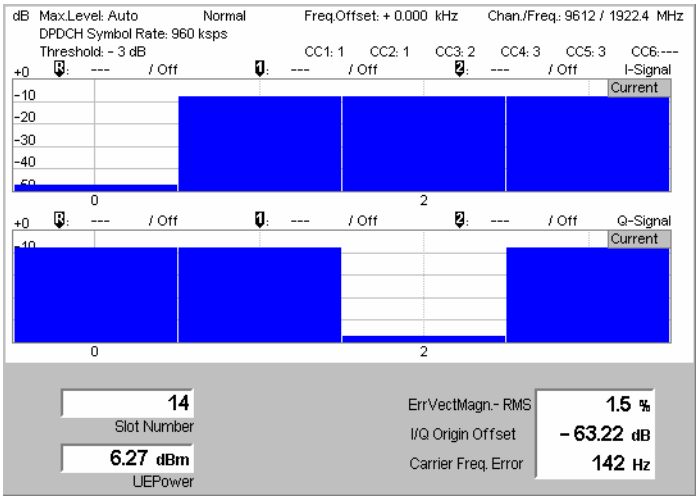


Fig. 4-44 Display of results (CDP/Code Auto)

Parameter lines The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.9) are indicated in a parameter line across the top of the measurement menu:

Max. Level Maximum expected input level in dBm

Attenuation Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*

Freq. Offset Frequency offset with respect to the nominal WCDMA channel frequency

Chan./Freq. RF channel measured and associated nominal carrier frequency

The two lines below indicate the properties of the measurement and of the analyzed WCDMA signal as defined by means of the *UE Code* softkey (see p. 4.58) and/or in the *UE Code* tab of the *Connection Control* menu; see section *Uplink Signal (Connection Control – UE Code)* on p. ***4.171***.:

Multiple Signal Physical channels that contribute to the WCDMA signal

Sync. Mode Synchronization between the WCDMA signal and the CMU: *All Slots Scr. Code* Scrambling code number of the WCDMA signal

CCn Channelization codes of the data channels $DPDCH_1$ to $DPDCH_6$

4th parameter line The fourth parameter line contains the following marker values and results:

R Measurement result and code channel of reference marker

1 Measurement result and channel of delta marker 1 (setting *absolute*) or difference from reference marker (setting *relative*)

2 Measurement result and channel of delta marker 2 (setting *absolute*) or difference from reference marker (setting *relative*)

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Bar graphs The bar graphs in the *CDP/Code Auto (CDP/Code Rho Auto)* measurement menu show the relative WCDMA transmit power (normalized correlated power or ρ factor) of the current slot, projected to the individual code channels of the WCDMA signal. The number of code channels and thus the width of the individual bars and the x-axis scale can vary between 4 and 256 (in powers of 2), depending on the *Display Spreading Factor* selected in the *Control* tab of the configuration menu (see section

Measurement Control (Code Domain Power Configuration – Control) on p. 4.113. The results for the I and Q components of the signal are displayed in two separate diagrams.

The values are measured with an RRC filter that has a roll-off α = 0.22 and a bandwidth equal to the chip rate. The y-axis scale of the diagrams is fixed: The results for the *CDP/Code Auto* measurement are expressed in dB units relative to the total power of the multiple WCDMA signal, also measured with an RRC filter. The ρ factors determined in the *CDP/Code Rho Auto* application are dimensionless numbers that can vary between 0 and 1/<number of code channels>. No limit check is performed.

For a standard uplink WCDMA signal, the DPCCH is always assigned to channelization code 0 (actually $C_{256,0}$) of the Q-signal. This code is not used by any data channel, so it is possible to represent the DPCCH plus the data channels in a common bar graph irrespective of the *Display Spreading Factor* and the actual spreading factor of the analyzed signal. *Fig. 4-44 above* shows a standard uplink WCDMA signal with one DPCCH plus 5 DPDCHs.

Remote control
`READ:ARRay:CDPower:AUTomatic:ISIGnal:CURRent?`
`READ:ARRay:CDPower:RAUTomatic:ISIGnal:CURRent?` etc.

Output fields

Below the diagram, the following timing, power and modulation parameters are displayed:

Slot Number Number of the measured slot of the captured signal within the 10 ms frame and in the range 0 to 14.

UE Power Average power in the current evaluation period, irrespective of the display mode set.

The modulation parameters displayed in the output fields on the right side are explained in section *Measurement of Modulation Parameters* on p. 4.40. They are also displayed and monitored in the *CDP...* measurement menus to show a possible relation between the modulation accuracy and the code domain parameters (e.g. poor modulation accuracy may result in noise or non-orthogonal components that are detected as fictitious channels).

Err. Vect. Magn. Error Vector Magnitude (EVM) RMS averaged over the current slot

I/Q Origin Offset Origin offset in the I/Q constellation diagram

Carrier Freq. Err. Difference between measured and expected (nominal) signal frequency

The modulation parameters are not limit-checked.

Remote control
`READ[:SCALar]:CDPower:AUTomatic?`
`READ[:SCALar]:CDPower:RAUTomatic?`

CDP/Code Manual and CDP/Code Rho Manual

In the *CDP/Code Manual (CDP/Code Rho Manual)* measurement, the relative transmit power (normalized correlated power or ρ factor) is projected onto all physical channels (DPCCH plus up to 6 DPDCHs) contributing to the uplink WDCMA signal. The results and the corresponding measurement settings are indicated in four parameter lines, the test diagram, an output table and several output fields:

Parameter lines

Test diagram

Output table

Output fields

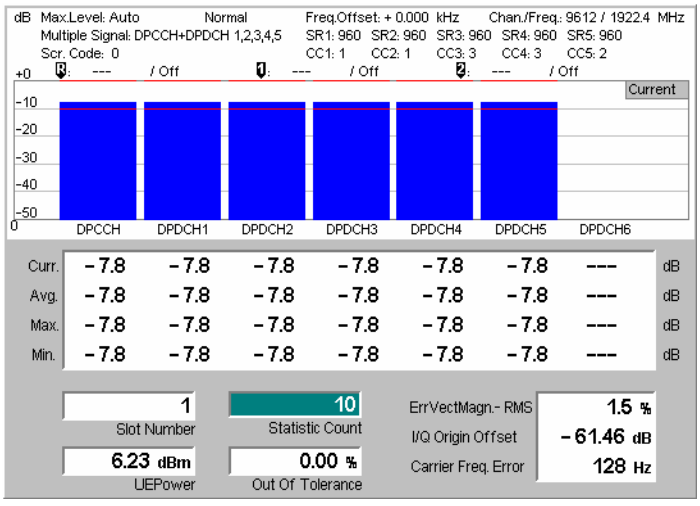


Fig. 4-45 Display of results (CDP/Code Manual)

Parameter lines The test settings and results (marker values) displayed in the four parameter lines are analogous to settings and results in the *CDP/Code Auto (CDP/Code Rho Auto)* menus; see section *CDP/Code Auto and CDP/Code Rho Auto* on p. 4.106.

Bar graph The bar graph in the *CDP/Code Manual (CDP/Code Rho Manual)* measurement menu shows the relative WCDMA transmit power (normalized correlated power or ρ factor) projected to all dedicated physical channels (DPCCH plus up to 6 DPDCHs) contributing to the uplink WDCMA signal. The values depend on the display mode *(Current, Average, Maximum or Minimum)* that can be set in the *Control* tab of the configuration menu (see section *Measurement Control (Code Domain Power Configuration – Control)* on p. 4.113. The display mode is indicated in the upper right corner of the diagram.

The x-axis is fixed: It is labeled by the Dedicated Physical Control Channel (DPCCH) and the Dedicated Physical Data Channels no. 1 to 6 (DPDCH1 to DPDCH6). If the WCDMA signal contains less than 6 data channels (see *Multiple Signal* softkey on p. 4.105), the corresponding bars are omitted.

The values are measured with an RRC filter that has a roll-off α = 0.22 and a bandwidth equal to the chip rate. The y-axis scale of the diagram is fixed: The results for the *CDP/Code Manual* measurement are expressed in dB units relative to the total power of the multiple WCDMA signal measured with the same RRC filter. The ρ factors determined in the *CDP/Code Rho Manual* application are dimensionless numbers that can vary between 0 and 1/<number of physical channels>.

Remote control
```
READ:ARRay:CDPower:MANual:CURRent? ,
READ:ARRay:CDPower:MANual:AVERage?
READ:ARRay:CDPower:MANual:MAXimum?
READ:ARRay:CDPower:MANual:MINimum? etc.
```

Limit Check The pairs of horizontal red lines in the diagram represent the limit lines set in the *Limits* tab of the configuration menu; see section *Tolerance Values (Code Domain Power Configuration – Limits)* on p. 4.115.

Remote control
```
CALCulate:ARRay:CDPower:MANual:CURRent:MATChing:LIMit?
CALCulate:ARRay:CDPower:MANual:AVERage:MATChing:LIMit?
```

Output table

The output table below the diagram shows the relative transmit power (or the ρ factor, depending on the application) in all dedicated physical channels (DPCCH plus up to 6 DPDCHs) contributing to the uplink WDCMA signal.

The values are calculated for all measured channels in the current slot and displayed in the upper table row *(Curr.)*. From these *Current* results the average values referenced to a statistics cycle (*Avg.,* see averaging rules in Chapter 3, section *General Settings)* and the maximum and minimum values of all slots measured *(Max., Min.)* are calculated.

All remarks concerning the physical units of the bar graphs remain valid: The *CDP/Code Manual* results are expressed in dB units, the ρ factors determined in the *CDP/Code Rho Manual* application are dimensionless numbers.

Remote control
`READ[:SCALar]:CDPower:MANual?`
`READ[:SCALar]:CDPower:RMANual?` etc.

Limit Check

A red output field indicates that the measurement result exceeds the upper limit set in the *Limits* tab of the *Code Domain Power* configuration menu, see section *Tolerance Values for ACLR and OBW (Spectrum Configuration – Limits)* on p. 4.94.

Remote control
`CALCulate:ARRay:CDPower:MANual:CURRent:MATChing:LIMit?` etc.

Output fields

The slot number, power and modulation parameters below the diagram are equivalent to the parameters in the *CDP/Code Auto (CDP/Code Rho Auto)* menus; see section *CDP/Code Auto and CDP/Code Rho Auto* on p. 4.106. The following additional statistical quantities are displayed:

Statistic Count Number of slots per statistics cycle. The colored bar indicates the relative measurement progress in the statistics cycle.

Out of Tolerance Percentage of slots where the tolerance limits are exceeded.

Remote control
`READ[:SCALar]:CDPower:MANual?`
`READ[:SCALar]:CDPower:RMANual?` etc.

CDP vs. Time

In the *CDP / Time* menu, the code power for all UL channels is shown in two diagrams. The measured gain factors for the individual channels are displayed below.

For a description of HSDPA and HSUPA CDP measurement results refer to Chapter 8.

Parameter lines

Upper diagram

Lower diagram

Output fields

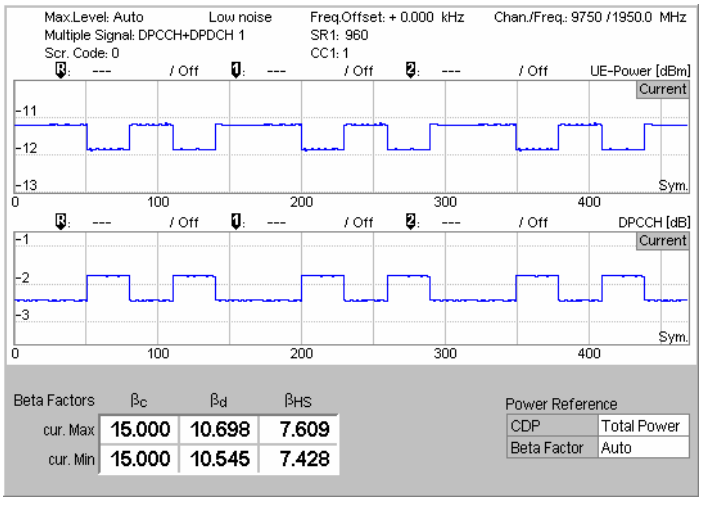


Fig. 4-46 Display of results (CDP vs. Time)

Parameter lines The test settings and results (marker values) displayed in the four parameter lines are analogous to the settings and results in the *CDP/Code Auto (CDP/Code Rho Auto)* menus; see section *CDP/Code Auto and CDP/Code Rho Auto* on p. 4.106.

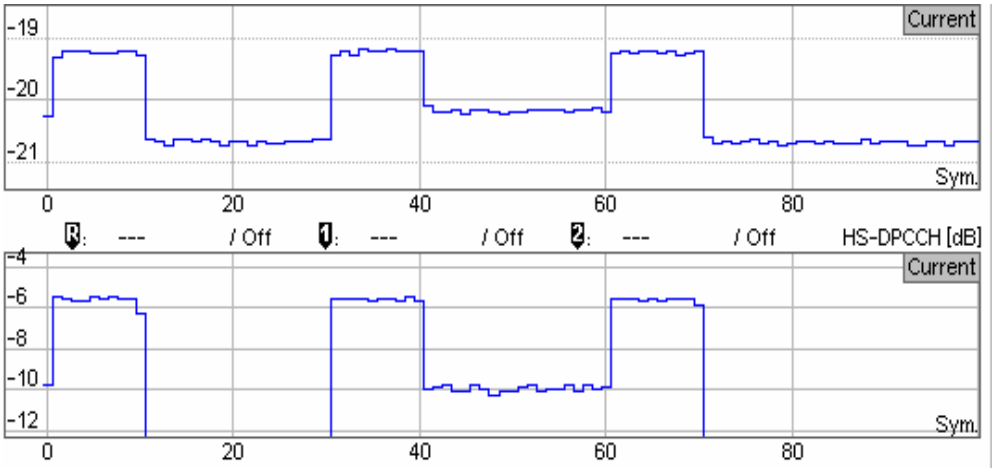
Diagrams The diagrams in the *CDP vs. Time* measurement menu show the absolute *UE Power* (the sum of all UL channels in dBm) and the relative powers of the DPCCH and the DPDCHs. HS-DPCCH, E-DPCCH and E-DPDCH channels can be displayed in addition; see Chapter 8. The results are measured as described in section *CDP vs. Time Measurement* on p. 4.99. The hotkeys associated with the measurement control softkey provide the following measurement settings:

- Channel selection for the upper and for the lower diagram *(Diagram Type)*
- *Power Reference* for the relative channel powers. The relative powers can be referenced to either the UE power (sum of all channels) or to the DPCCH power. Both power references are always measured over the entire measurement length.
- The *Measurement Length* in multiples of 10 symbol periods.

These measurement settings are also accessible from the *Control* tab of the *Connection Control* menu; see section *Measurement Control (Code Domain Power Configuration – Control)* on p. 4.113. Both diagrams can be scaled independently using the hotkeys associated with the *Display/Marker* softkey:

UE Power Scale Y and *DPCCH Scale Y* define the scale span; the upper edge of the diagram is automatically adjusted according to the maximum power across the evaluation period.

The following result was obtained by zooming in on a time range of 100 symbols and appropriate level ranges.



Remote control
`READ:ARRay:CDPower:TIME:UEPower?` etc.
`READ:ARRay:CDPower:TIME:DPCCH:CPOWer?` etc.
`READ:ARRay:CDPower:TIME:DPDCH<nr>:CPOWer?` etc.
`READ:ARRay:CDPower:TIME:HSDPcch:CPOWer?` etc.

The following commands retrieve the maximum and minimum code powers of all channels:
`READ[:SCALar]:CDPower:TIME:CPOWer?` etc.

Output fields

The output fields below the diagram show the minimum and maximum gain factors that the R&S CMU determined across the entire measurement range. The gain factors define the relative strength of the uplink channels (see standard TS 25.213), they are calculated and normalized as described in section *CDP vs. Time Measurement* on p. 4.99.

- β_c is the gain factor for the DPCCH; its signalled value is an integer number between 0 and 15.
- β_d is the common gain factor for the data channels $DPDCH_1$ to $DPDCH_6$; its signalled value is an integer number between 1 and 15.

In *Signalling* mode the R&S CMU can also configure the gain factors. For a detailed description refer to section *Gain Factors for the UE Signal* in this chapter.

Remote control
`READ[:SCALar]:CDPower:TIME:BFACtor?` etc.

The following commands retrieve the gain factors across the entire measurement range:
`READ:ARRay:CDPower:TIME:DPCCH:BFACtor?` etc.
`READ:ARRay:CDPower:TIME:DPDCH<nr>:BFACtor?` etc.
`READ:ARRay:CDPower:TIME:HSDPcch:BFACtor?` etc.

Measurement Configurations (Code Domain Power)

The popup menu *Code Domain Power Configuration* contains two tabs that define the parameters of the CDP measurement including the error tolerances.

The popup menu *Code Domain Power Configuration* is called up by pressing the measurement control softkey in the top right of the graphical measurement menu *Code Domain Power* twice (this softkey reads *CDP/Code Auto* etc., depending on the selected application). By pressing the associated hotkeys, it is possible to change between the tabs.

Measurement Control (Code Domain Power Configuration – Control)

The *Control* tab controls the *Code Domain Power* measurement by defining

- The number of code channels displayed *(Display Spreading Factor,* for *CDP/Code Auto* and *CDP/Code Rho Auto* measurements)
- The *Repetition* mode
- The measurement curve displayed *(Display Mode*, for applications *CDP/Code Manual* and *CDP/Code Rho Manual))* and the *Power Reference* (for application *CDP/Code Manual)*
- The *Stop Condition* and the number of slots/evaluation periods forming a statistics cycle *(Statistic Count,* for applications *CDP/Code Manual* and *CDP/Code Rho Manual)*
- Specific settings fort the *CDP/Time* application.

Besides, it influences the graphical measurement menus by adding or removing the *Grid* (for applications *CDP/Code Auto* and *CDP/Code Rho Auto)*.

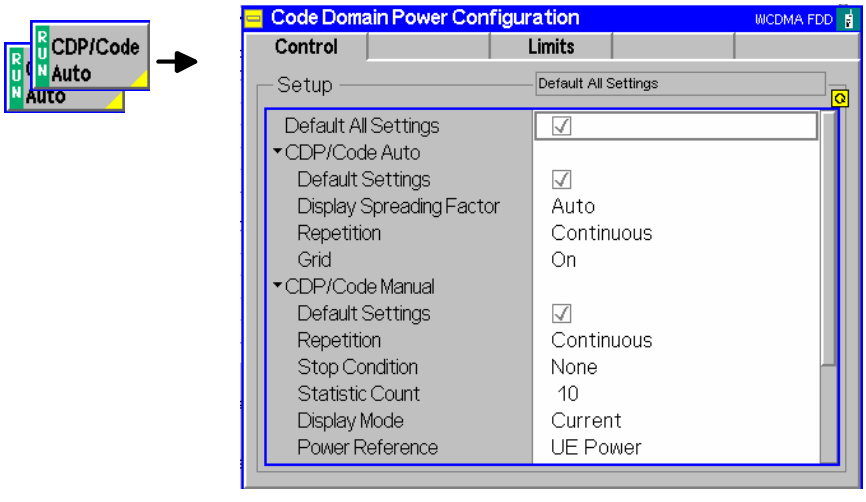


Fig. 4-47 Code Domain Power Configuration – Control

The settings can be defined separately for the different applications of the *Code Domain Power* measurement group. Most functions comply with those of the *Control* tab of the *Power Configuration* menu (see page 4.25). In the remote-control commands, the keywords `POWer:<Pow_Application>` are to be replaced by `CDPower:<CDP_Application>`. The following parameters are specific to the *Code Domain Power* measurement:

Default Settings

The *Default All Settings* switch assigns default values to all settings in the *Control* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual applications are provided.

Remote control
`DEFault:CDPower:<CDP_Application>:CONTrol ON | OFF`

Display Spreading Factor

The *Display Spreading Factor* field selects the number of code channels within the WCDMA signal that are displayed in the *CDP/Code Auto* and *CDP/Code Rho Auto* diagrams.

Auto The CMU analyzes the uplink signal from the WCDMA UE, determines its DPDCH symbol rate and derives the spreading factor (= chip rate / symbol rate). It projects the signal onto all possible channelization codes, calculates and displays the results.

SF Change to the arbitrary spreading factor from the DPDCH symbol rate (= chip rate/ spreading factor) in the range between 4 and 256 and in powers of 2.

The *CDP/Code...Auto* measurements will also work if the actual spreading factor of the displayed signal (see section *WCDMA Measurements (Modulation – WCDMA)* on p. 4.56) differs from the *Display Spreading Factor* set.

Remote control
```
CONFigure:CDPower:<CDP_Auto_Application>:CONTrol:DSFactor
  AUTomatic | 4 | 8 | 16 | 32 | 64 | 128 | 256
```

If the display spreading factor is determined automatically, it is possible to query the actual display spreading factor using
`CONFigure:CDPower:<CDP_Auto_Application>:CONTrol:DSFactor:AUTMode?`. The response is equal to the length of the output arrays of
`READ:ARRay:CDPower:AUTomatic:ISIGnal:CURRent?` etc.

Display Mode

The *Display Mode* hotkey selects one of the following display modes for the *CDP ... Manual* diagrams:

Current	Measured value for current slot
Minimum	Minimum of a number of slots
Maximum	Maximum of a number of slots
Average	Average value of a number of slots, referenced to a statistics cycle

The calculation of the measurement curves and the rules for averaging is described in Chapter 3, section *General Settings*. No *Display Mode* is available in the *CDP ... Auto* diagrams.

Remote control
No display mode set explicitly, the four measurement curves are accessible via:
```
READ:ARRay:CDPower:MANual:CURRent?
READ:ARRay:CDPower:MANual:AVERage?
READ:ARRay:CDPower:MANual:MAXimum?
READ:ARRay:CDPower:MANual:MINimum?
```
etc.

Power Reference

The code powers in the *CDP/Code Manual* diagrams are always displayed in dB, either relative to the *UE Power* (the sum of all UL channels displayed in the measurement menu) or relative to the *DPCCH Power.*

Note that the DPCCH is always active so that both the UE power and the *DPCCH Power* are always available.

Remote control
```
CONFigure:CDPower:MANual:CONTrol:PREFerence:CDP
  TPOWer | DPCCh
```

The following parameters are *CDP vs. Time*-specific.

Power Reference CDP

The power of the *DPCCH, DPDCH 1,* and *HS-DPDCH* code channels is always displayed in dB, either relative to the *UE Power* (the sum of all UL channels displayed in the measurement menu) or relative to the *DPCCH Power.*

Note that the DPCCH is always active so that both the UE power and the *DPCCH Power* are always available.

Remote control
```
CONFigure:CDPower:TIME:CONTrol:PREFerence:CDP TPOWer | DPCCh
```

Power Reference Beta Fact.

Selects the normalization rule for all gain factors. In *Auto* mode the gain factors are calculated and normalized as described on p. 4.100.

If the gain factors are normalized to the weaker channel *(DPCCH* or *DPDCH)* then the gain factor of the stronger channel is above 15.

Remote control
Gain factors are always normalized to the strongest channel *(Auto* mode).

Upper / Lower Diagram Type

Selects the absolute *UE Power* or the relative powers of the *DPCCH, DPDCH 1,* and *HS-DPDCH* code channels for the diagrams in the measurement menu.

Remote control
```
CONFigure:CDPower:TIME:CONTrol:PREFerence:BFACtor
       AUTO | DPCCh | DPDCh
```

Measure Length

Number of symbols measured. The measure length can be varied in multiples of 10 symbols corresponding to one WCDMA slot; see description of the measurement process in section *CDP vs. Time Measurement* on p. 4.99.

Remote control
–

Tolerance Values (Code Domain Power Configuration – Limits)

The tab *Limits* defines upper and lower limits for the code domain power and the code domain ρ factor. The limits are defined for the physical channel representation (applications *CDP/Code Manual* and *CDP/Code Rho Manual).* However, this doesn't mean a restriction because of the correspondence between physical channels and code channels.

CDP limits

To be detected by the 3GPP Node B, the signal level in every physical and code channel contributing to the WCDMA signal must exceed a certain minimum threshold. In addition, the code domain power is defined relative to the total power of the signal, so none of the individual CDP contributions can be larger than 0 dB.

For realistic WCDMA signals, the code domain power is therefore restricted to a range of values that can be defined by an upper and lower limit.

CDP Rho limits

As shown in section *Code Domain Power Measurements* on p. 4.98, the CD-ρ factor is equivalent to the CDP for a WCDMA signal with ideal modulation characteristics:

$$CDP_{ideal} = 10 \cdot \log_{10}(CD\rho_{ideal}) \quad ; \qquad \text{(Equation 4)}$$

For signals with reasonable modulation accuracy, CDP and the CD-ρ factor will still be closely related. This means that it makes sense to impose upper and lower limits to the CD-ρ factors of the individual physical channels that are derived from the CDP limits according to *Equation 4*.

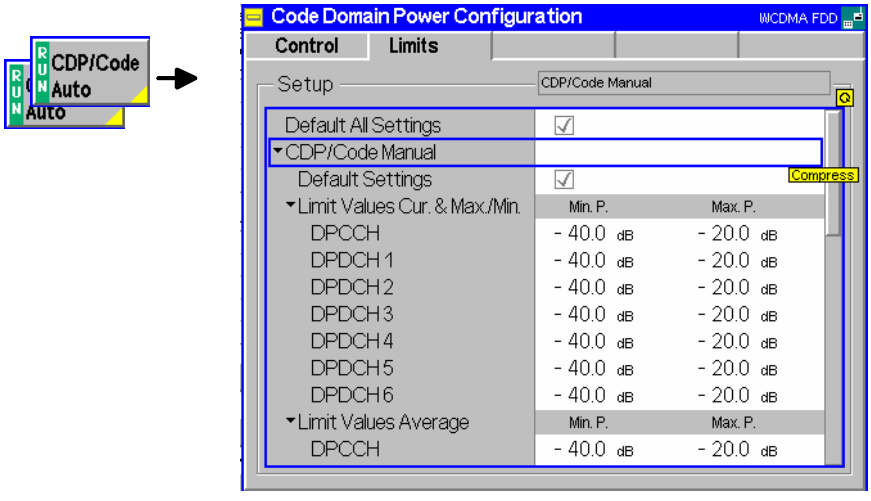


Fig. 4-48 Code Domain Power Configuration – Limits

Default Settings

The *Default All Settings* switch assigns default values to all settings in the *Limits* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual applications are provided.

Remote control

```
DEFault:CDPower:MANual:LIMit <Mode>
DEFault:CDPower:RMANual:LIMit <Mode>
```

CDP/Code Manual

The *CDP/Code Manual* table section defines upper and lower limits for the code domain power. Separate values can be defined for the *Current, Maximum* and *Minimum (Curr.&Max./Min.)* and for *Average* results. The following values can be set for all physical channels that may contribute to the WCDMA signal:

Min. P. Lower limit for the CDP in dB

Max. P. Upper limit for the CDP in dB

Remote control

```
CONFigure:CDPower:MANual:CMMax:LIMit:POINt:ASYMmetric:
        UPPer:CHANnel<nr> <CDP_Limit>
CONFigure:CDPower:MANual:CMMax:LIMit:POINt:ASYMmetric:
        LOWer:CHANnel<nr> <CDP_Limit>
CONFigure:CCDPower:MANual:AVERage:LIMit:POINt:ASYMmetric:
        UPPer:CHANnel<nr> <CDP_Limit>
CONFigure:CDPower:MANual:AVERage:LIMit:POINt:ASYMmetric:
        LOWer:CHANnel<nr> <CDP_Limit>
```

CDP/Code Rho Manual

The *CDP/Code Rho Manual* table section defines upper and lower limits for the CD-ρ factor. Separate values can be defined for the *Current, Maximum* and *Minimum (Curr.&Max./Min.)* and for *Average* results. The following values can be set for all physical channels that may contribute to the WCDMA signal:

Min. Rho Lower limit for the ρ factor

Max. Rho Upper limit for the ρ factor

Remote control

```
CONFigure:CDPower:RMANual:CMMax:LIMit:POINt:ASYMmetric:
        UPPer:CHANnel<nr> <CD-ρ_Limit>
CONFigure:CDPower:RMANual:CMMax:LIMit:POINt:ASYMmetric:
        LOWer:CHANnel<nr> <CD-ρ_Limit>
CONFigure:CDPower:RMANual:AVERage:LIMit:POINt:ASYMmetric:
        UPPer:CHANnel<nr> <CD-ρ_Limit>
CONFigure:CDPower:RMANual:AVERage:LIMit:POINt:ASYMmetric:
        LOWer:CHANnel<nr> <CD-ρ_Limit>
```

Receiver Quality Measurements

The menu group *Receiver Quality* (with option CMU-K66, *WCDMA (3GPP/FDD, DL) Generator*, and CMU-B68/CMU-U68, *Layer 1 Board for WCDMA*) tests the transmission performance on the complete signal path from the CMU to the UE under test and back. To this end the UE is set to test loop operation where it returns the received data blocks back to the tester. The measurement is especially suitable to assess the characteristics and the performance of the UE receiver at low RF power levels. UE test loops and bit error rates for conformance tests are specified in standard TS 34.109.

The popup menu *Receiver Quality Configuration* is used to configure the measurements; the measurement results and the most important test settings are indicated in the main menu *Receiver Quality*.

Principle of the BER and BLER measurement

The *Receiver Quality* measurement is based on a comparison of the output signal of the CMU with the signal received and decoded by the UE under test. To this end, the UE must return the received signal to the CMU in loop back mode. Because of the higher signal level, transmission errors produced on the way back (from the UE to the CMU) can usually be neglected.

Standard TS 34.109 specifies the functional behavior of the UE in two different test loop modes and defines scenarios for receiver quality tests (see *Table 4-11 below*). The CMU uses a method of measurement that provides the BER and BLER results (plus an additional DBLER, see below) in parallel (exception: See *RLC BLER* below). The *WCDMA (3GPP/FDD, DL) Generator* (option CMU-K66) provides a reference measurement channel (RMC) with variable information bit rate *(Reference Channel Type)* and test data pattern *(Channel Data Source)*. The UE must be set to operate in test loop mode 2 and with either symmetric or asymmetric DL/UL block size. The method of measurement corresponds to the scenario in the shaded cell in *Table 4-11*.

Note: *In Non Signalling mode, the CMU can receive data only if the uplink TFCI sent by the UE indicates a non-empty DTCH. The CMU expects the TFCI assignment in* ***Table 4-14*** *on p.* ***4.163****, i.e. a TFCI of 2 or 3. The Receiver Quality measurement fails if the UE uses another TFCI, even though the looped-back uplink signal may be correct.*

In Signalling mode, the TFCI assignment in the downlink and uplink is identical, so the CMU automatically receives a valid TFCI.

UE Report

A second *Receiver Quality* application displays a selection of measurement results provided by the UE and transferred in the UE measurement report message, including the information about detected WCDMA or GSM neighbor cells. This *UE Report* application requires a connection between the R&S CMU and the UE and is available in *Signalling* test mode only.

HSDPA Tests

The three applications *HSDPA ACK, HSDPA CQI,* and *HS-DPCCH Logging* require option R&S CMU-K64, *HSDPA 3.6 Mbps*. For a detailed description refer to Chapter 8.

RLC BLER

The application *RLC BLER* requires option R&S CMU-K96, *WCDMA Application Testing*. For a detailed description refer to Chapter 9.

A similar BLER measurement may be performed with an RMC that is transmitted in RLC acknowledged mode; see *Connection Control – Network – Circuit Switched – RMC Settings – RLC Mode (Sym. Loop Mode 1)*. Bit error rate (BER) tests are not possible with this signal configuration.

Statistical Testing

Bit error rate tests are based on the assumption of statistical independence of the single bit error events: The probability of a bit error is equal for each received bit. The exact bit error rate is given by the limit of the ratio <bit errors>/<no. of received bits>, where the number of received bits tends to infinity. As test times are limited, any real bit error rate test necessarily provides an approximation to the exact bit error rate.

The CMU is not only capable of measuring (approximate) bit error rates for a fixed number of received bits but can also use the preliminary results to predict a confidence interval for the exact bit error rate. Confidence BER tests can reduce test times considerably. For more information and application examples see section *Statistical Receiver Quality Tests* on p. 4.124.

For Receiver Quality measurements the R&S CMU requires an UL slot format 0 as specified in the standard. A comprehensive measurement example for Receiver Quality *tests in* Non Signalling *mode is reported in Chapter 2. Receiver Quality measurements are considerably simplified in* Signalling *mode; see* Measurements in Signalling Mode *in Chapter 3.*

Table 4-11 UE test loop modes according to TS 34.109

	Test loop mode 1	**Test loop mode 2**
Loopback point	Above layer 2	Effectively on transport layer (higher layers in Transparent Mode)
Data looped back	RLC/PDCP SDUs	Transport block data and CRC bits
Block size	DL block size = UL block size (symmetric) or DL block size ≠ UL block size (asymmetric)	UL transport block ≥ DL transport block + DL CRC (otherwise UL transport block truncated)
Specified test scenarios	BER test in RLC Transparent Mode (TM) and on 12.2 kbps 3GPP reference measurement channel at symmetric DL/UL block size –> Receiver characteristics BLER test in RLC Acknowledged Mode (AM) and on 64, 144 or 384 kbps ref. measurement channel at symmetric or asymmetric DL/UL block size –> Receiver performance	BLER test on 12.2, 64, 144 or 384 kbps 3GPP reference measurement channel at symmetric or asymmetric DL/UL block size, but with UL transport block ≥ DL transport block + DL CRC –> Receiver performance Test scenario used by the CMU for BER, BLER, and DBLER tests.

Definition of bit and block error rates

The Bit Error Rate *(BER,* sometimes also termed Bit Error Ratio) is the ratio of bit errors in the data part of the transport block to the total number of transferred data bits in percent:

BER = Data bit errors / total number of data bits * 100%

The BER can be obtained with any (symmetric or asymmetric) DL/UL transport block configuration; see section *Test Loops for BER, BLER and DBLER Tests* on p. 4.120.

The Block Error Rate (BLER, sometimes also termed Block Error Ratio) is the ratio of data blocks that contain bit errors in their data or CRC field to the total number of transferred blocks in percent:

BLER = Blocks with erroneous data or CRC fields / total number of blocks * 100%

To obtain the BLER on the CMU, the UE must use an asymmetric DL/UL transport block configuration; see section *Test Loops for BER, BLER and DBLER Tests* on p. 4.120.

The Data Block Error Rate (DBLER) is the ratio of data blocks that contain bit errors in their data field (excluding the CRC) to the total number of transferred blocks in percent:

DBLER = Blocks with erroneous data fields / total number of blocks * 100%

The DBLER can be obtained with any (symmetric or asymmetric) DL/UL transport block configuration; see section *Test Loops for BER, BLER and DBLER Tests* on p. 4.120. It is generally a good approximation to the BLER; see below.

Relation between BER,

The BER, BLER and DBLER are independent quantities characterizing the quality of the UE receiver. It is instructive, however, to consider a simple stochastic model

BLER and DBLER

where the BLER and DBLER are both determined by the BER and the transport block size. This model relies on the following approximations:

1. The probability for a bit error is the same for all bits in a transport block, including the CRC; it is therefore equal to the BER.
2. Additional effects due to channel coding and imperfect interleaving are negligible.

Consider a transport block with k data bits and (n – k) CRC bits so that the total number of bits in the block is n. The BLER and DBLER can be calculated as follows:

BLER = 1 – <Probability that all bits are correct>
= 1 – <Probability that 1 bit is correct>^{n} = 1 – (1 – BER)^n

DBLER = 1 – <Probability that all bits are correct>
= 1 – <Probability that 1 bit is correct>^{k} = 1 – (1 – BER)^k

Conclusions and Example

In this approximation it is obvious that BLER > DBLER for 0 < BER < 1 and that DBLER = BLER = 0 for BER = 0 and DBLER = BLER = 1 for BER = 1. The relation between the three quantities for the transport block size of the 12.2 kbps 3GPP reference measurement channel (n = 260, k = 244) is plotted in *Fig. 4-49 below*.

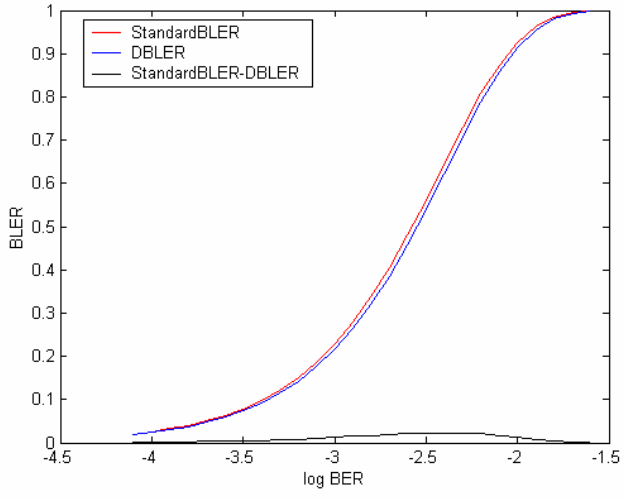


Fig. 4-49 Approximate relation between BER, BLER and DBLER

Test Loops for BER, BLER and DBLER Tests

The Block Error Rate (BLER) and the Data Block Error Rate (DBLER) can both be obtained with test loop scenario 2 of the UE but with a different DL/UL transport block configuration (parameter *DL/UL Transport Block Size* on p. 4.139).

1. Symmetric DL/UL transport blocks (–> DBLER, BER)

The DBLER can also be obtained in a simplified test loop configuration with symmetric (equal) DL/UL block size. The UL CRC is enabled, so the UE attaches a new (correct) UL CRC to the UL transport block. This means that the simple CRC check doesn't provide any reliable information on the BLER.

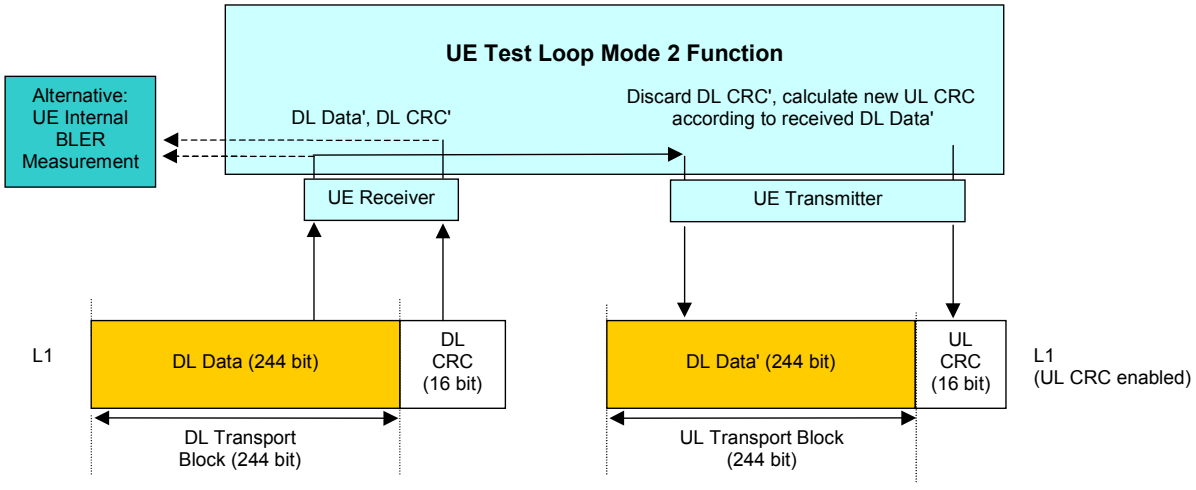


Fig. 4-50 Symmetric DL/UL transport block size for a 12.2 kbps reference meas. channel

To determine the Data Block Error Rate (DBLER) the CMU checks whether the UE had to change the CRC; i.e. whether the CRC of the retransmitted DL Data' (= UL CRC) is equal to the DL CRC, and divides the number of detected data block errors by the total number of transferred blocks. In addition the CMU compares the data bits retransmitted to the original data bits to obtain the BER. Alternatively, the two results plus the BLER can be obtained in an additional UE internal BLER measurement.

2. Asymmetric DL/UL transport blocks (–> BLER, DBLER, BER)

The test loop and DL/UL transport block configuration for the BLER measurement is described in standard TS 34.109. The UE must use an asymmetric DL/UL block size. The UL transport size must be bigger or equal to the sum of DL transport block size and number of CRC bits. The UL CRC is disabled. The DL CRC' (including a possible error produced in the UE receiver) is incorporated into the UL transport block and received by the tester.

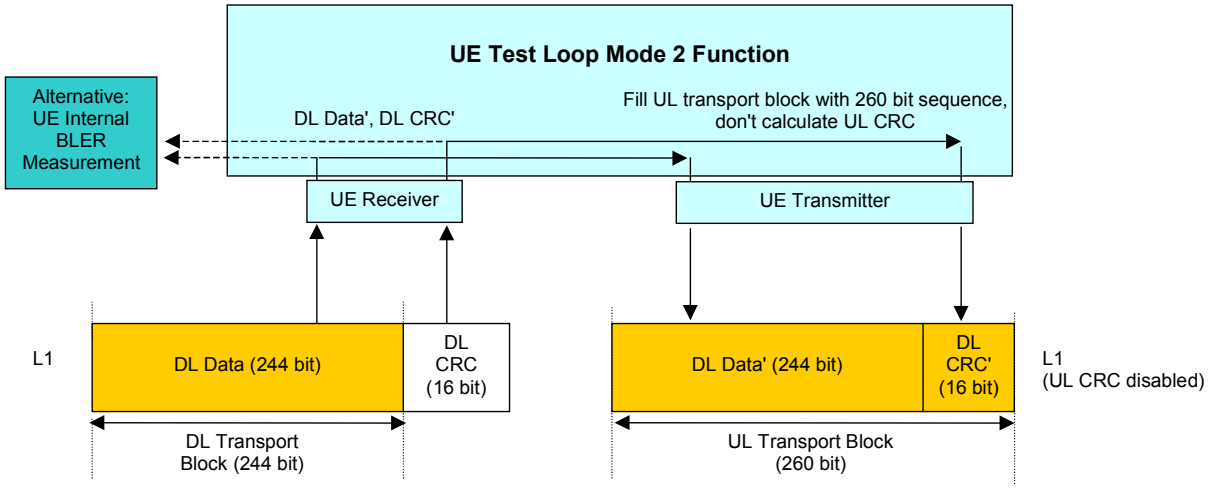


Fig. 4-51 Asymmetric DL/UL transport block size for a 12.2 kbps reference meas. channel

To determine the Block Error Rate (BLER) the CMU checks whether the received and retransmitted DL CRC' matches the retransmitted DL Data' and divides the number of detected block errors by the total number of transferred blocks. In addition the CMU directly compares the data bits retransmitted to the original data bits to obtain the BER and DBLER. Alternatively, all results can be obtained in an additional UE internal BLER measurement.

3. Asymmetric RMC data rate (–> DBLER, BER)

Receiver Quality tests at high data rates are to ensure that the UE receiver performance does not deteriorate under stress conditions. With asymmetric RMCs, the BER and DBLER can be measured even if the UE does not support high data rates in the uplink.

The number of information bits per RMC transport block increases with the data rate. Assume that the DL data rate corresponds to N + n information bits per block, the smaller UL data rate to N information bits per block. Out of the N + n received bits, the UE loops back N bits plus a new UL CRC. Based on the UL information bits, the *Receiver Quality* test results are calculated as follows:

- The Bit Error Rate (BER) is the ratio of the number of bit errors in the retransmitted data bits divided by the total number of retransmitted bits. Assuming statistical independence of the bit errors this ratio is equal to the BER of all DL bits.
- The Data Block Error Rate (DBLER) is calculated as the ratio of the number of UL data blocks with bit errors to the total number of transferred blocks. The smaller UL block size means that this result is a lower limit for the DBLER that would be obtained by evaluating all N + n received DL bits.

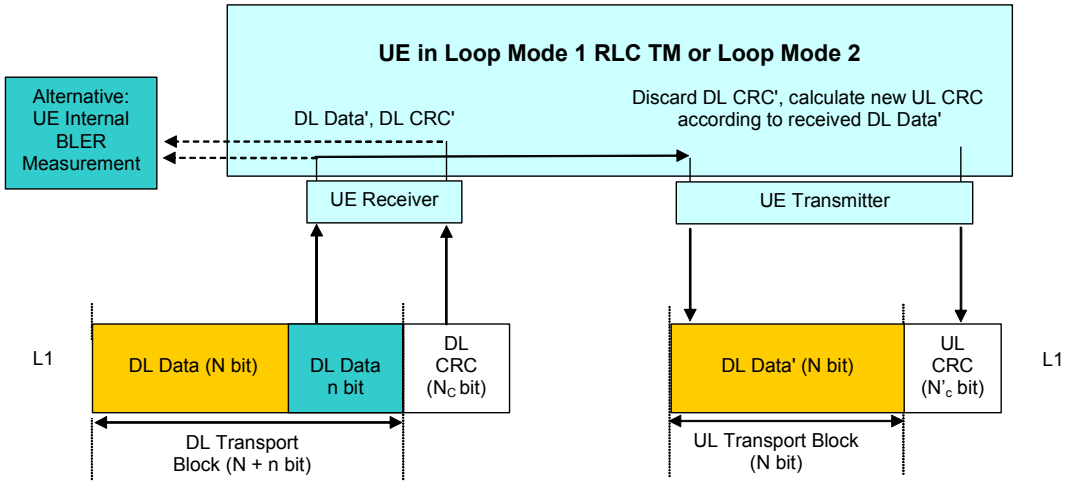


Fig. 4-52 BER and DBLER measurement with asymmetric RMCs

Preconditions

Receiver Quality tests with asymmetric RMC data rates are provided in *Signalling* mode only. They are configured in the *RMC Settings* section of the *BS Signal* tab of the *Connection Control* menu.

To perform an asymmetric *Receiver Quality* test, the UE must be set to either *Loop Mode 1 RLC TM* or *Loop Mode 2.* A *Reference Channel Type* with different data rates in the DL and UL must be selected. With this configuration the uplink CRC is always enabled; the *UL CRC (Sym. Loop Mode 2)* setting is ignored.

4. UL BLER with Symmetric Transport Blocks

The *DL BLER* measurement is based on a test loop with asymmetric DL and UL transport blocks (corresponding to a disabled UL CRC; test loop no. 2). Its purpose is to assess the block errors in the downlink path.

In contrast the *UL BLER* is measured with symmetric transport blocks and assesses the block errors in the uplink path. UL and DL BLER are displayed in the same output field; the BLER type is selected implicitly via the block symmetry. To activate a *UL BLER* measurement:

➢ In *Non Signalling* mode, select *Receiver Quality Configuration – Control – BER – UL/DL Transport Block Size: Symmetric.*

➢ In *Signalling* mode, select *Connection Control – BS Signal – Dedicated Channel (DCH) – RMC Settings – UL CRC (Sym. Loop Mode 2): On.*

To obtain the *DL BLER* the R&S CMU compares the looped-back data (DL Data') with the UL CRC calculated by the UE (UL CRC check). The UL BLER is equal to the ratio of blocks with failed UL CRC check to the total number of blocks (see Fig. 4-53 below).

Note: *To ensure that the transmission errors in the UL do not distort the (DL) UE receiver quality results, blocks with failed UL CRC check are not considered for the calculation of the BER and the DBLER.*

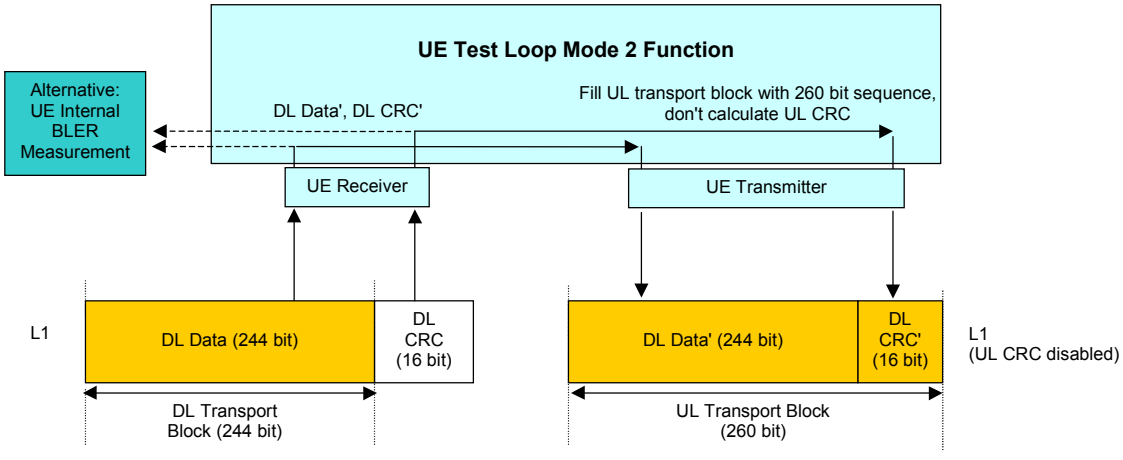


Fig. 4-53 Symmetric test scenario for UL BLER tests

In the remote control commands for the BER results (`READ[:SCALar]RXQuality:BER:…?`, `FETCh[:SCALar]RXQuality:BER:…?`), the *UL BLER* replaces the *(DL) BLER* whenever a test loop with symmetric DL and UL transport blocks is used.

BTFD and FDR (Signalling only)

Blind Transport Format Detection (BTFD) means that the UE receives transport blocks that contain no Transport Format Combination Index (TFCI), recognizes the transport format and loops back the transport blocks after adding the correct TFCI.

According to the conformance specification, BTFD tests are performed on a special set of Reference Measurement Channels (RMCs) with variable DL DTCH transport format, corresponding to data rates between 1.95 kbps and 12.2 kbps. The BTFD RMCs are specified in standard 3GPP TS 25.101 and 34.121, the CMU is able to set up the full set of 9 different BTFD RMCs.

BTFD tests are integrated into the *Receiver Quality* measurement menu. The R&S CMU provides the following results related to BTFD.

FDR The False transmit format Detection Ratio (FDR) is the percentage of transport blocks which passed the UE receiver's CRC check(s) but were detected with a wrong transport format. The CMU calculates the FDR from a comparison of the downlink BTFD blocks with the blocks retransmitted by the UE.

The FDR is usually a very small number because the probability of a block error is much larger than the probability of detecting a wrong TF.

UL TFCI Faults

The UL TFCI Faults ratio measures the percentage of transport blocks which the UE receiver detected with a wrong transport format, irrespective of the result of the CRC check(s). This means that blocks received in error contribute to the UL TFCI Faults so that this ratio is always larger than the FDR.

Performing a BTFD test

To obtain the *FDR* and *UL TFCI Faults* proceed as follows:

1. In one of the Signaling states *Signal Off, Signal On* or *Registered,* open the *BS Signal* tab of the *Connection Control* menu and select the reference channel set for BTFD tests *(Dedicated Channel (DCH) – RMC Settings – Reference Channel Type).*
2. Select the *DL DTCH Transport Format* for which you intend to perform the test.
3. Make sure that the *Test Mode* is set to default *(Loop Mode 2)* so that the UE will loop back the received blocks after detecting the transport format and adding the TFCI.
4. Connect to the UE and open the *Receiver Quality* menu with the *BER* application activated to view the results.
5. Reopen the *BS Signal* tab, change the *DL DTCH Transport Format* and repeat the test with all transport formats needed.

Note: *You can change the reference channel type and transport format while the UE is connected. The BER measurement will be re-started each time you change the transport format.*

Statistical Receiver Quality Tests

In a normal bit error rate test, a fixed number of bits is transmitted, leading to a fixed test time for each BER result. The idea behind statistical testing is to apply probability theory and predict a range for the BER at an early stage of the measurement. The prediction can be used to stop the measurement if the probability of the DUT to pass or fail the receiver quality test is large enough (early pass or early fail decision). Statistical testing can reduce test times considerably, especially if the exact BER of a receiver is very low or very high.

The general rules for statistical testing are described in the Terminal Conformance Specification 3GPP TS 34.121. The CMU parameters *(Confidence Settings)* and the preconditions for the test are described on p. 4.137. The purpose of the present section is to explain the principle of the test and outline some typical applications.

Performing a confidence BER test

A confidence BER test generally involves the following steps:

1. Activate the test: In the *Receiver Quality* menu, select *Application – BER* and use the *Stop Condition* hotkey associated to the *BER* measurement control softkey to select the stop condition *Confidence Level.*
2. Set the test parameters: Press *BER* for a second time to open the *Receiver Quality Configuration* menu. In the *Control* tab, scroll to the *BER – Common Settings – Confidence Settings* section to select the parameters appropriate for your test (see remainder of this section). Close the configuration menu.
3. View results: Select the measurement control softkey *BER* again and press the *CONT/HALT* key to initiate a single-shot measurement. The result is indicated in an output field together with the *Specified Class II limit.*

Probability distribution

Confidence BER tests are based on the statistical independence of the bit error events: The probability of a bit error is equal for each received bit. The exact bit error rate is given by the limit of the ratio n_e/n_s, where n_e denotes the number of bit errors and n_s the number of received bits, and where the number of received bits

tends to infinity. Any real bit error rate test necessarily provides an approximation to the exact bit error rate.

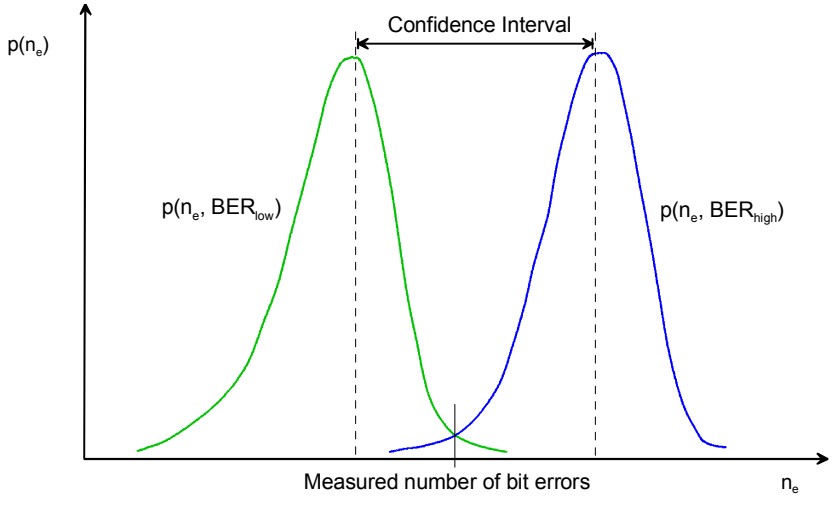
Given the statistical independence of the bit error events, the probability p for any number of bit errors n_e at a given exact BER and a given number of received bits n_s can be described by a binomial distribution or an appropriate approximation, such as the Chi Square distribution. Estimates of the exact BER are based on this distribution.

Confidence Levels

The distributions $p(n_e, n_s, BER)$ provide a confidence interval $[BER_{low}, BER_{high}]$ for the exact BER at any n_e and n_s. The confidence interval has the following meaning:

- The probability for the exact BER to be larger than BER_{low} is larger than the lower confidence level.
- The probability for the exact BER to be smaller than BER_{high} is smaller than the upper confidence level.

In the figure below the lower confidence level is the sum of all probabilities $p(n_e, n_s, BER_{low})$ up to the measured number of bit errors. The upper confidence level is the sum of all probabilities $p(n_e, n_s, BER_{high})$ above the measured number of bit errors.



Example: Assume that 20 bit errors were measured after 1000 received bits (n_e = 20, n_s = 1000, preliminary BER = n_e/n_s = 2 %). The probability of the exact BER to be smaller than 1.1 % is 1 % (lower confidence level: 99 %). The probability of the exact BER to be larger than 3.3 % is 1 % (upper confidence level: 99 %).

If the specified upper BER limit is 1 %, then the measurement can be stopped and the receiver can be failed with a risk of less than 1 % that the exact BER is below the specified limit.

Confidence Fail, Confidence Pass, Bad DUT Factor

In analogy to the calculation in the example above it is possible to calculate confidence intervals $[a(BER_{limit}), b(BER_{limit})]$ for the measured preliminary BER around the specified limit:

- At a given confidence level, any measured preliminary BER below $a(BER_{limit})$ means that the exact BER of the receiver is below BER_{limit} so that the receiver should pass the test (early pass decision, test stopped).
- At a given confidence level, any measured preliminary BER above $b(BER_{limit})$ means that the exact BER of the receiver is above BER_{limit} so that the receiver should fail the BER test (early fail decision, test stopped). $b(BER_{limit})$ is termed the early fail limit; the complement of the confidence level for $b(BER_{limit})$, i.e. the number F = 1 – <Confidence Level>, can be set as *Wrong Decision* value (the

risk to fail a good DUT).

- If a preliminary BER inside the confidence interval [a(BER_{limit}), b(BER_{limit})] is measured, no decision is possible so that the measurement must be continued.

The calculation can be performed for arbitrary BER_{limit} values and confidence levels. Increasing BER_{limit} by multiplication with a factor M > 1 also shifts the confidence interval and increases the number of early pass decisions, causing a further reduction of test times. In practice, a factor M = 1.5 has been proved to provide a reasonable compromise between test time and accuracy requirements.

- At a given confidence level, any measured preliminary BER below the lower interval border a(M*BER_{limit}) means that the exact BER of the receiver is below M*BER_{limit} so that the receiver should pass the test (early pass decision, test stopped). a(M*BER_{limit}) is termed the early pass limit; the complement of the confidence level for a(M*BER_{limit}), i.e. the number F = 1 – <Confidence Level>, can be set as *Wrong Decision* value (the risk to pass a bad DUT). The factor M itself is fixed to the value 1.5 and termed the *Bad DUT Factor.*

Evolution in time, Target Test Time

The probability distribution gets relatively narrower as the measurement goes on and the numbers n_e and n_s increase. For infinitely long measurement times, the early fail limit tends towards the specified limit, the early pass limit tends towards the specified limit times M. This translates into the behavior of the early pass and early fail limits shown in the figure below:

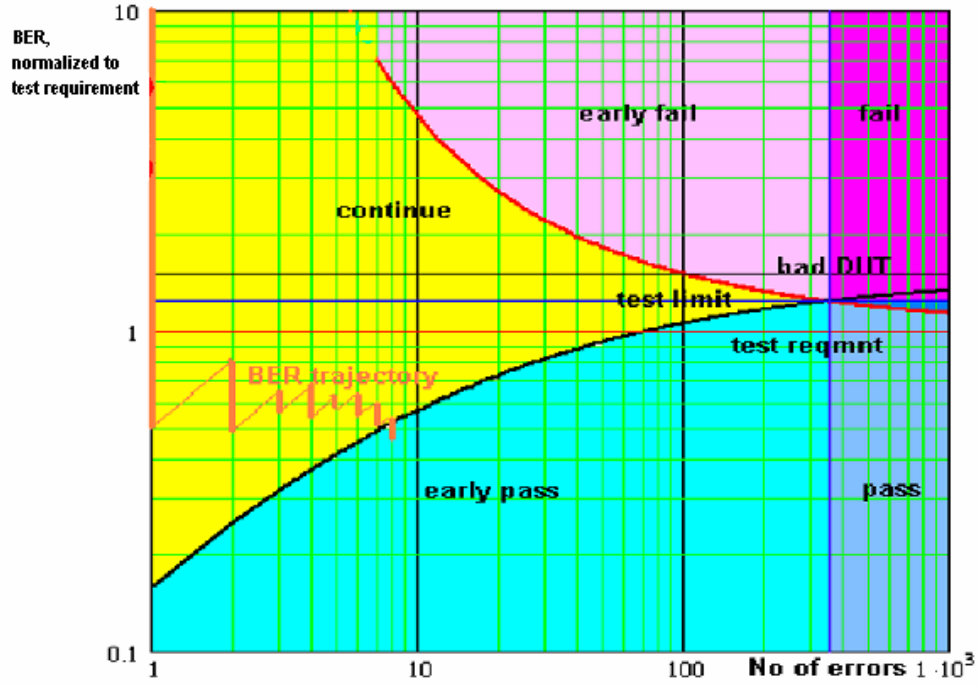


Fig. 4-54 Single-limit confidence BER

For M > 1 the early pass and early fail limits cross at a definite number of errors. If no *Min. Test Time* is set as an additional condition (see below), the crossing corresponds to the maximum possible test time (target test time). After the target test time, the test has either failed or passed the DUT.

The figure also shows an example evolution of the normalized BER in time: At the beginning of the test, an artificial error is introduced to ensure that the BER trajectory starts above the early pass limit. The preliminary BER is recalculated each time that a new error occurs. At n_e = 8, the trajectory crosses the early pass limit and the test is stopped.

Min. Test Time Some test conditions introduce fluctuations that disturb the statistical independence of the bit error events and must be averaged out. This is achieved by means of a minimum test time during which no early fail or early pass decisions are taken. The standard stipulates minimum test times for multipath fading, birth/death propagation, and moving propagation conditions.

Dual-Limit Test The single-limit BER test described above can be extended to restrict the BER to a band between two limits. For practical reasons, the lower band limit is calculated as <BER Limit> (1 – n %), the upper band limit is calculated as <BER Limit> (1 + n %). Factors of 10 %, 20 % and 30 % are provided; see *Result Window* parameter.

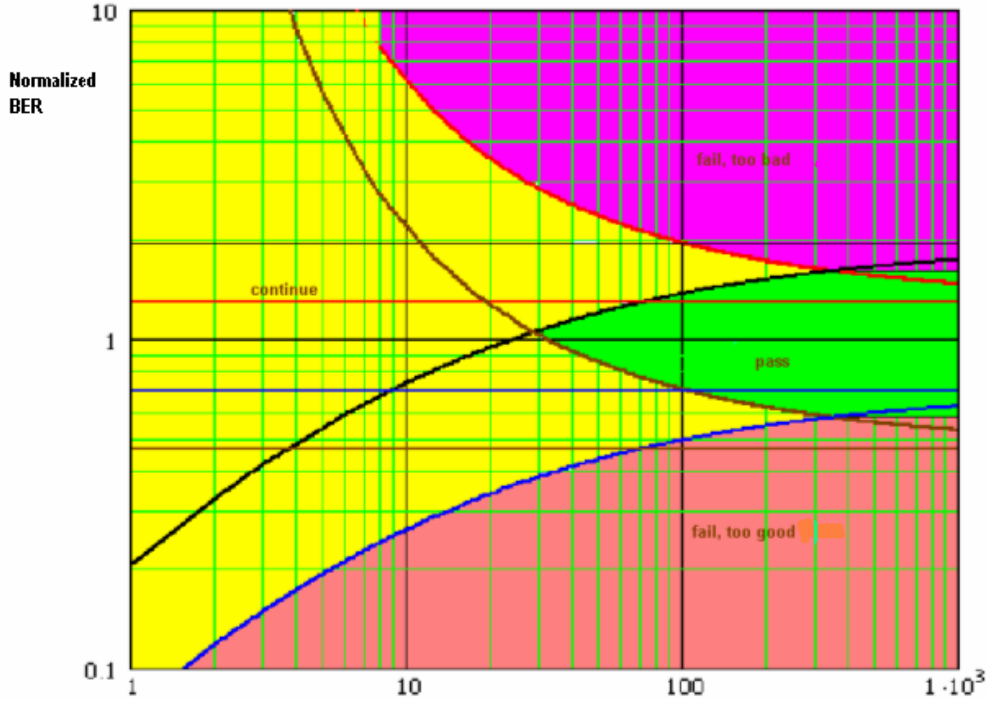


Fig. 4-55 Dual-limit confidence BER

In a dual-limit test, the DUT is failed if it is either too good or too bad. For more information refer to the test specification.

Other Receiver Quality Results The statistical analysis is not limited to BER results; it can be based on other measured quantities in a strictly analogous manner. The R&S CMU provides independent limits and *Wrong Decision* values for the *BER, BLER, DBLER, FER* and *UL TFCI Faults* results.

The conformance test specification 3GPP TS 34.121 specified statistical tests based on the BER and BLER performance. The statistical *DBLER, FER* and *UL TFCI Faults* tests are beyond the scope of the test specification.

Main Menu (Receiver Quality)

The main menu *Receiver Quality* shows the results and the most important parameters of the *Receiver Quality* measurement.

- The measurement control softkey *BER* (which changes to *UE Report* if this application is selected) controls the *Receiver Quality* measurement, indicates its status *(RUN, HLT, OFF)* and opens the configuration menu *Receiver Quality Configuration*. The hotkeys associated with the measurement control softkey define the scope of the measurement.

- The softkeys *Application, Analyzer Level, Analyzer Settings/UE Code, Generator Level, Generator Settings* and *Menus* on the right softkey bar are combined with various hotkeys. When a softkey is selected and an associated hotkey pressed, a popup window appears which indicates a setting or enables an entry.
- In the tables in the center of the menu, the test settings of the current *Receiver Quality* measurement and the results are displayed.

The measurement menu *Receiver Quality* is opened from the main menu *Menu Select* (with the associated key at the front of the instrument) or from the menu group *WCDMA UE TX Test (3GPP/FDD)* using the hotkey *Receiver Quality*.

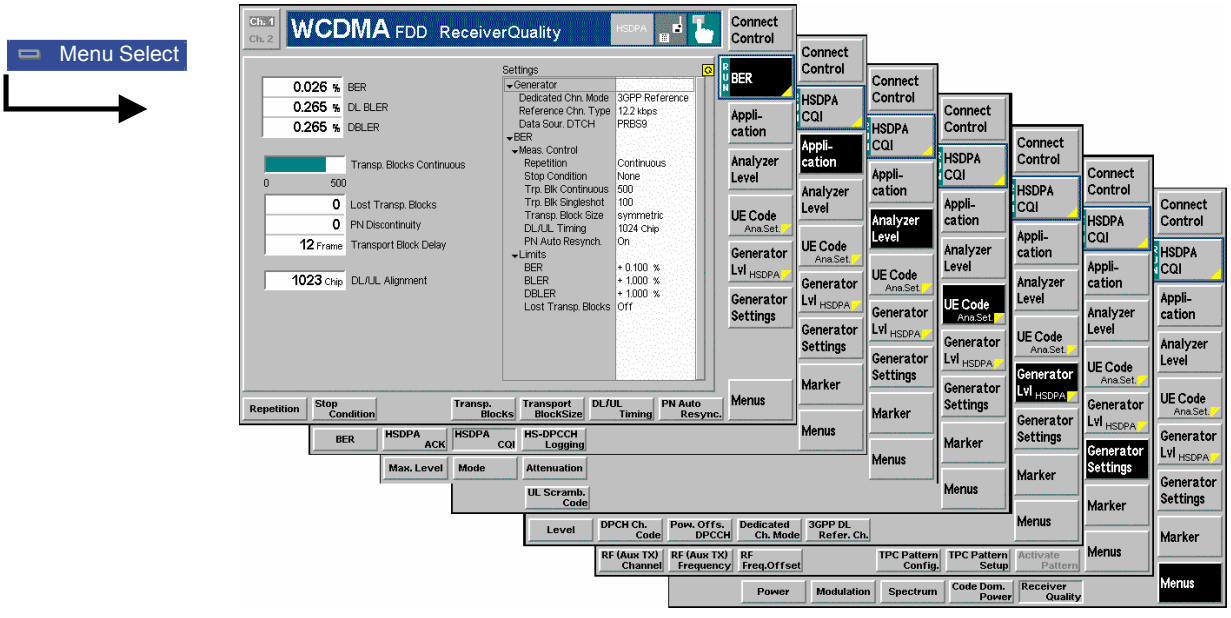


Fig. 4-56 Main menu Receiver Quality (BER, Non Signalling)

Test Settings

The settings associated with the *Analyzer Level, Analyzer Settings, Generator Level,* and *Generator Settings* softkeys and the function of the *Menus* softkey are identical with the *Power* menu (see section *Test Settings* on page 4.7). The following softkey/hotkey combinations differ from the *Power* measurement:

BER

The *BER* softkey controls the receiver quality measurement in the BER application and indicates its status *(RUN | HLT | OFF* for BER, *RUN | OFF* for UE Report). In *Signalling* mode, this softkey changes to *UE Report,* depending on the measurement application selected; see *Application* softkey below.

This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status of the measurement is unaffected upon switchover to other menus controlling a *Receiver Quality* measurement; however, a running measurement is restarted.

Remote control

```
INITiate:RXQuality:<Applic>
ABORt:RXQuality:<Applic>
STOP:RXQuality:<Applic>
CONTinue:RXQuality:<Applic>
FETCh:RXQuality:<Applic>:STATus?
```

Measurement configuration

Pressing the *BER* softkey twice opens the popup menu *Receiver Quality Configuration*. Besides, hotkeys defining the scope of the measurement are associated with the *BER* softkey. These hotkeys are also provided in the configuration menu; see section *Measurement Configurations (Receiver Quality Configuration)* on page 4.136.

Application

The *Application* softkey selects the *Receiver Quality* application. This softkey is not available in *Non Signalling* mode where only a single application *BER* is available.

The alternative measurements (applications) are displayed in different measurement menus. When an application is selected, the corresponding measurement menu is called up. The configuration settings for all applications, however, are listed in a common popup menu (see p. 4.136).

The HSDPA options R&S CMU-K64 and R&S CMU-K60 provide the additional applications HSDPA ACK, HSDPA CQI, HS-PDSCH Logging; *see Chapter 8. Option R&S CMU-K96, WCDMA Application Testing, provides the additional option RLC BLER; see Chapter 9.*

BER

BER selects the measurement of the receiver quality parameters (BER, BLER, DBLER) by the CMU.

Remote control
The *BER* application is selected by the keyword `:BER` in the 3rd level of the `RXQuality` commands, e.g. `CONFigure:RXQuality:BER...`

UE Report

The *UE Report* hotkey selects the display of information elements provided by the UE and transferred in the UE measurement report message.

Remote control
The *UE Report* application is selected by the keyword `:UEReport` in the 3rd level of the `RXQuality` commands, e.g. `CONFigure:RXQuality:UEReport...`

Measurement Results

In *Signalling* mode, the *Receiver Quality* menu group contains two separate measurement menus corresponding to the applications *BER* and *UE Report*. The *UE Report* menu is not available in *Non Signalling* mode.

BER Results

The test settings of the current *BER* measurement and the results are displayed in the tables in the center of the menu.

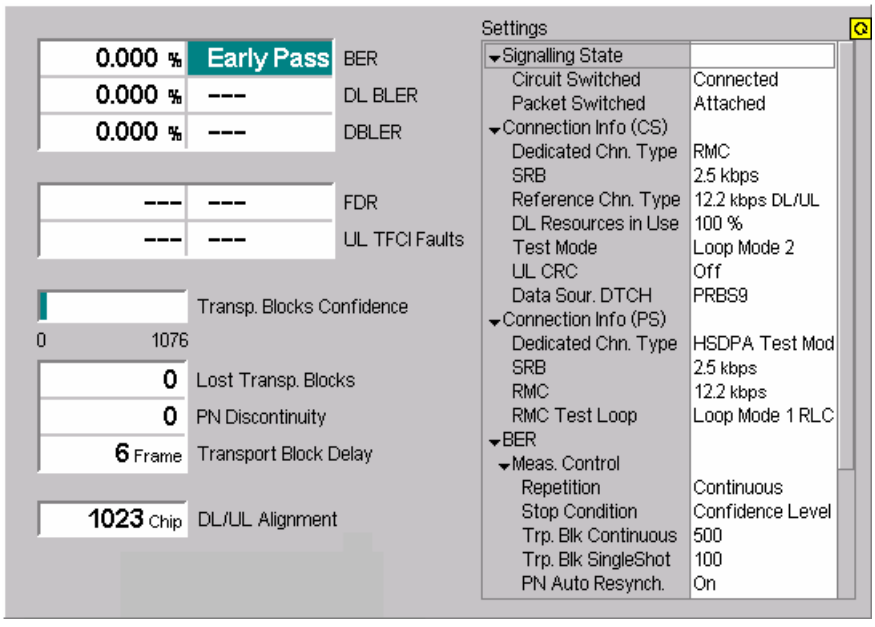


Fig. 4-57 Display of test settings and measurement results (BER, Signalling)

Results

The output in the left half of the menu shows the results of the *Receiver Quality* measurement:

BER Bit Error Rate, ratio of data bit errors to total number of transferred data bits.

DL BLER Block Error Rate, ratio of blocks received with wrong data or CRC bits to total number of received blocks. This result is available with asymmetric *Transport Block Size* only. The *DL BLER* result is updated every time the measurement is re-started. The displayed value describes the current measurement (measurement state *RUN).* In the *HLT* state, the measurement displays the result of the last terminated measurement.

DBLER Data Block Error Rate, ratio of blocks received with wrong data bits to total number of received blocks.

The three quantities are explained in more detail in section *Receiver Quality Measurements* on p. 4.118.

The next two results are available if Blind Transport Format Detection is measured and not present in *Non Signalling* mode; see section *BTFD and FDR (Signalling only)* on p. 4.123.

FDR False transmit format Detection Ratio; the percentage of transport blocks which passed the UE receiver's CRC check(s) but were detected with a wrong transport format.

UL TFCI Faults Percentage of transport blocks which the UE receiver detected with a wrong transport format, irrespective of the result of the CRC check(s).

A bar below the table indicates the relative measurement progress, i.e. the ratio between the current measurement time and the total measurement time. The total number of transport blocks per measurement cycle *(Measurement Length)* is indicated below the bar.

Below the progress bar the following additional measurement results are displayed:

Lost Transp. Bl. Difference between the number of blocks sent and the number of blocks received from the UE under test. Lost blocks do not enter into the calculation of the BLER and DBLER, so the number of lost transport blocks is an additional indicator for the quality of the whole connection from the CMU to the UE and back.

PN Discontinuity Number of transport blocks that the R&S CMU corrected (i.e. re-ordered) in the *PN Auto Resynch.* procedure (see p. 4.139).

Transport Block Delay Delay between the transport block sent and the transport block received in frame units. A change of the transport block delay indicates a *PN Discontinuity,* see above. According to the specification, the maximum transport block delay is equal to 10 times the TTI.

DL/UL Alignment Measured time offset (in integer chip periods) between the UL signal transmitted by the UE relative to the received DL signal from the CMU. The nominal DL/UL timing amounts to 1024 chips. To facilitate synchronization of the CMU to the UL signal, a correction to the nominal DL/UL timing can be defined; see *DL/UL Timing* parameter in section *Measurement Control (Receiver Quality Configuration – Control)* on p. 4.136.

Limit Check

A red output field indicates that the measurement result exceeds the upper limit set in the *Limits* tab of the *Receiver Quality* configuration menu; see p. 4.141.

Remote Control

```
READ[:SCALar]:RXQuality:BER?
FETCh[:SCALar]:RXQuality:BER?
SAMPle[:SCALar]:RXQuality:BER?
CALCulate[:SCALar]:RXQuality:BER:MATChing:LIMit?
```

Confidence BER results

If a confidence BER test is performed (i.e. if the stop condition *Confidence Level* is set), an additional output field displays one of the following measurement results:

Running Measurement still running, no early fail or early pass decision made.

Early Fail Measurement stopped because an early fail limit was exceeded. The DUT is probably out of tolerance.

Early Pass Measurement stopped because an early pass limit was exceeded. The DUT is probably within tolerance.

Fail Measurement terminated with a *Min. Test Time* larger than the tartet test time so that no early pass or early fail decision could be made; bit errors exceed upper limit (see *Fig. 4-54* on p. 4.126).

Pass Single-limit test: Measurement terminated with a *Min. Test Time* larger than the tartet test time so that no early pass or early fail decision could be made, bit errors below the lower limit.

Dual-limit test: Measurement terminated with no upper or lower limit exceeded (see *Fig. 4-* on p. 4.127).

Too High Upper limit exceeded in a dual-limit test (*Fig. 4-* on p. 4.127).

Too Low Upper limit exceeded in a dual-limit test.

The *Confidence Settings* are described on p. 4.137. For background information and application examples refer to section *Statistical Receiver Quality Tests* on p. 4.124.

Remote Control

```
READ[:SCALar]:RXQuality:BER:CONFidence?
FETCh[:SCALar]:RXQuality:BER:CONFidence?
SAMPle[:SCALar]:RXQuality:BER:CONFidence?
```

Settings

The *Settings* table gives an overview of the configuration of the current measurement. This includes the settings made via the softkeys and hotkeys of the *Receiver Quality* menu or in the *Control* tab of the configuration menu, and the tolerances set in the *Limits* tab of the *Receiver Quality Configuration* menu, see section *Upper Limits for Bit Error Rate (Receiver Quality Configuration – Limits)* on page 4.141.

The parameters depend on the current application and the measurement mode.

Remote control

See sections *Test Settings* on page 4.128 and *Upper Limits for Bit Error Rate (Receiver Quality Configuration – Limits)* on p. 4.141.

UE Report (Signalling only)

The *UE Report* menu shows the results for the *current cell*, together with the UTRA or GSM channel number and the scrambling code *(SCR Code)*. In addition it provides UTRA and GSM neighbor cell results.

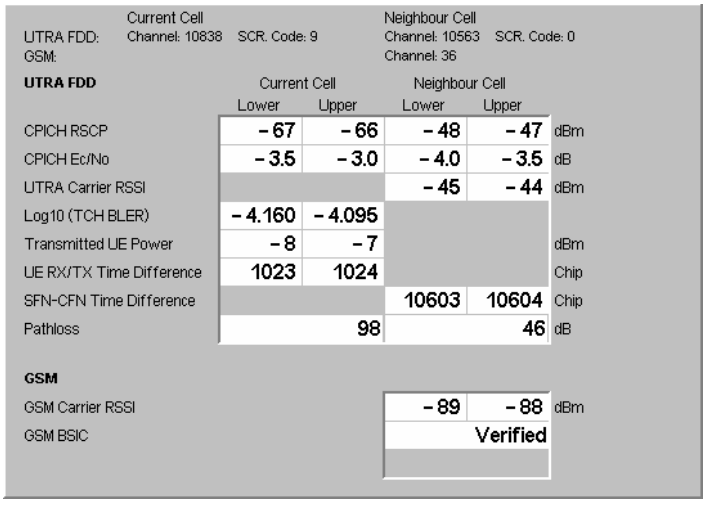


Fig. 4-58 Display of test settings and measurement results (UE Report)

The channel no. and scrambling code (for UTRA cells) of the current cell and the neighbor cell are displayed above the result tables on top of the diagram. The table is divided into two *Current Cell* and two *Neighbor Cell* rows.

Current Cell

The table shows a value or an interval for each of the following information elements provided by the UE and transferred in the measurement report message:

CPICH RSCP Integer 1-dB interval for the Received Signal Code Power of the CPICH. For CPICH RSCPs below –115 dBm (above –25 dBm), no lower (upper) limit is indicated.

CPICH E_c/I_0 0.5-dB interval for the ratio of the received energy per PN chip for the CPICH to the total received power spectral density at the UE antenna connector. For E_c/I_0 below –24 dB (above 0 dB), no lower (upper) limit is indicated.

Log 10(TCH BLER) Estimate of the transport channel (TCH) block error rate (BLER). 64 intervals for the logarithm of the TCH BLER are available. The maximum logarithmic TCH BLER is 0, corresponding to a BLER of 1. For values below –4.03 the lower limit is –∞, corresponding to a BLER of 0.

Transmitted UE Power Integer 1-dB interval for the total UE transmitted power on one carrier measured at the antenna connector of the UE. The power must be in the range between –50 dBm and above +34 dBm.

UE RX/TX Time Difference Interval for the difference in time between the UE uplink DPCCH/DPDCH frame transmission and the first detected path (in time) of the downlink DPCH frame from the measured radio link. The time difference is expressed in multiples of a chip period. For time differences below 768 chips (above 1280 chips), no lower (upper) limit is indicated.

Pathloss Downlink pathloss in dB = *Reported P-CPICH Power - CPICH RSCP*. Values below +46 dB (above +158 dB) are reported as +46 dB (+158 dB). The reported P-CPICH power corresponds to the value set in the *UE Signal* tab of the *Connection Control* menu; the *CPICH RSCP* is measured by the UE. To simulate real propagation conditions the reported P-CPICH power is much larger than the actual power of the BS signal, so the order of magnitude of the reported pathloss is 80 dB.

UTRA neighbor cell

A detected UTRA neighbor cell is described with the following additional parameters (see standard 3GPP TS 25.225):

UTRA Carrier RSSI *Received Signal Strength Indicator* defining a 1-dB interval for the received wide band power, including thermal noise and noise generated in the receiver.

SFN-CFN Time Diff. Time difference between the System Frame Number and the Connection Frame Number in chip units. Connection frames are related to the transmission from the UE in the serving TDD cell. System frames are related to the signal received at the UE from a neighbor cell.

The remaining parameters are identical to the current cell results.

Note: *In the* Control *tab of the* Receiver Quality Configuration *menu, it is possible to select the UTRA / GSM serving cell and neighbor cell parameters measured and displayed in the* UE Report *menu; see* *UE Report (Signalling only)* on p. 4.132.

The settings in the Control *tab also specify the basic parameters of the WCDMA or GSM neighbor cell signal that the mobile station shall measure. In particular, the transmitted P-CPICH level of a WCDMA*

neighbor cell can be reported, which the UE will use to calculate the pathloss.

GSM neighbor cell

A detected GSM neighbor cell is described with the following parameters (see standard 3GPP TS 25.225):

GSM Carrier RSSI — *Received Signal Strength Indicator* defining a 1-dB interval for the received wide band power within the GSM channel bandwidth, measured on a GSM BCCH carrier.

GSM BSIC — Indication whether the *Base transceiver station (BTS) Identity Code* of the neighbor cell is *Verified* or *Non Verified.* The BSIC is *Verified* if the compressed mode measurement *GSM Initial BSIC* or *GSM BSIC Reconfirmation* is enabled.

The measurement report message is described in standard 3GPP TS 34.123; the information elements in standard 3GPP TS 25.215. The information elements in the message are optional and can be switched off separately in the *Control* tab of the *Receiver Quality Configuration* menu (see p. 4.136) in case that the UE under test does not provide a particular result.

To display the results, the measurement control softkey *UE Report* must be switched on.
Remote Control
`[SENSE]:RXQuality:UEReport<nr>?`

Obtaining neighbor cell results

To obtain any neighbor cell results you have to configure the UE to operate in compressed mode (see section *Compressed Mode Configuration* on p. 4.254). Proceed as follows:

1. Provide a neighbor cell using one of the methods described below and establish a connection between the CMU and the UE.
2. Open the *BS Signal* tab of the *Connection Control* menu and go to the *Compressed Mode Settings.*
3. Select a *UE Report Pattern* and go to the *UE Report Pattern* configuration section.
4. Depending on the available neighbor cell type, enable the *FDD* or *GSM* measurement (*CM Pattern: On)*.
5. To obtain the *GSM BSIC* enable the measurements *GSM* plus *GSM Initial BSIC* or *GSM BSIC Reconfirmation.*
6. Select *Pattern Activation by: UE Report* for the enabled measurements.
7. Open the *UE Report* menu to view the results.

Providing and measuring a neighbor cell

To provide a GSM neighbor cell use one of the following methods:

- Use the *Aux TX* signal of the CMU (option R&S CMU-B95, *Additional RF Generator)* to superimpose a GSM BCCH to the UTRAN cell. Refer to section *Handover to GSM* on p. 4.220.
- Use a second CMU to provide a GSM cell.
- Capture a GSM BCCH off the air.

The NCC, BCC, channel number and GSM band of the GSM neighbor cell must be set in the *Control* tab of the *Receiver Quality Configuration* menu (see below); otherwise, the UE will not be able to detect the neighbor cell and provide the *UE Report* results.

To provide a WCDMA neighbor cell use one of the following methods:

- Use a second CMU to provide a UTRA cell.

- Capture a downlink WCDMA signal off the air.

The UARFCN, operating band, primary scrambling code and P-CPICH power of the WCDMA neighbor cell must be set in the *Control* tab of the *Receiver Quality Configuration* menu (see below); otherwise, the UE will not be able to detect the neighbor cell and provide the *UE Report* results.

Selecting UE Report parameters

The *UE Report* parameters measured and displayed can be selected in the *Control* tab of the *Receiver Quality Configuration* menu; see section *UE Report Configuration* below.

Measurement Configurations (Receiver Quality Configuration)

The popup menu *Receiver Quality Configuration* contains two tabs to define the parameters for the bit error rate measurement. It is opened by pressing the measurement control softkey *BER* at the top right in the main menu *Receiver Quality* twice. It is possible to change between the tabs by pressing the associated hotkeys.

Measurement Control (Receiver Quality Configuration – Control)

The *Control* tab controls the *Receiver Quality* measurement by determining

- The parameters for statistical receiver quality tests *(Confidence Settings)*
- The *Repetition* mode
- The *Stop Condition* for the measurement
- The number of transport blocks per measurement cycle *(Transp. Blocks Continuous/Single Shot))*
- The relative size of UL and DL transport blocks *(DL/UL Transport Block Size,* in *Non Signalling* mode only)
- The UE report information elements to be displayed and the reporting interval *(UE Report,* in *Signalling* mode only)

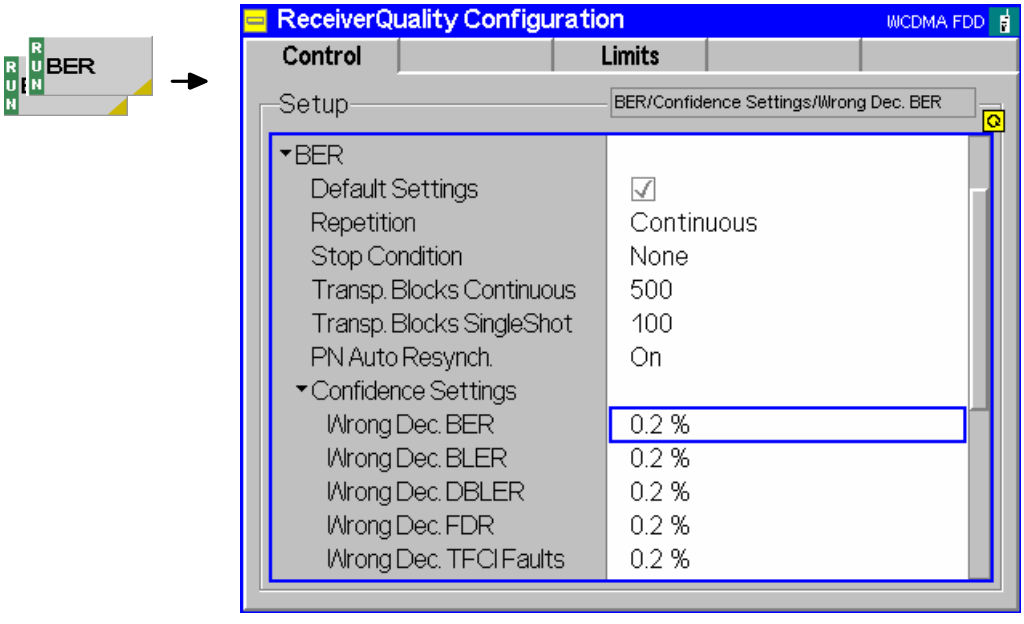


Fig. 4-59 Receiver Quality – Control (Signalling)

The *Repetition* mode complies with the corresponding settings in the *Control* tab of the *Power Configuration* menu (see page 4.25). In the remote-control commands, the keywords `POWer:<Pow_Application>` are to be replaced by `RXQuality:BER`. The following parameters are specific to the *Receiver Quality* measurement:

Default The *Default* switches overwrite all settings in the *Control* tab with default values. The default values are quoted in the command description in chapter 6 of this manual.

Remote control
`DEFault:RXQuality:CONTrol ON | OFF`

DL/UL Timing

The *DL/UL Timing* parameter sets the delay time (in integer chip periods) of the UL signal transmitted by the UE relative to the received DL signal from the CMU. The default value corresponds to the nominal DL/UL timing offset of 1024 chips. A different value can be necessary to compensate for a path delay or a deviation of the UE from the nominal timing.

If the actual DL/UL timing offset differs too much from the *DL/UL Timing,* the CMU is unable to synchronize to the UL signal and generates the warning message *RX not synchronized*. The measured *UL/DL Alignment* is indicated in the *Receiver Quality* menu; see section *Measurement Results* on p. 4.129.

Note: *This parameter is valid for all Receiver Quality applications. In Signalling mode the DL/UL Timing is not needed. The UE synchronizes to the BS signal in order to set up a connection.*

Remote control
`CONFigure:RXQuality:CONTrol:TIMing <Chips>`

The statistical BER test *(Confidence BER)* requires the following configuration of the R&S CMU 200.

Table 4-12 Prerequisites for statistical BER test

Measurement	Activation	Configuration	Applications	Test Modes	Results
Confidence Level	Receiver Quality Configuration – Control – Stop Condition: Confidence Level	Control – Confidence Settings	BER	Non Signalling, Signalling	BER BLER DBLER FDR UL TFCI Faults

Confidence Settings

The *Confidence Settings* section sets the parameters for statistical receiver quality tests. For background information and application examples refer to section *Statistical Receiver Quality Tests* on p. 4.124. The settings are valid in the *BER* application.

Note: *The limit settings settings determine which of the measurement results* BER, DL BLER, DBLER, UL TFCI Faults *provides the pass/fail criteria. See also* *Limit settings for statistical tests on p. 4.142*. *The UL BLER measurement* (Connection Control – BS Signal – Dedicated Channel (DCH) – RMC Settings – UL CRC (Sym. Loop Mode 2): On) *ignores the confidence settings.*

Statistical testing is activated by setting *Stop Condition = Confidence Level;* see below. The results *(Early Fail, Early Pass etc.)* are displayed in the measurement menu. The following confidence settings are provided:

Wrong Decision Confidence level for early fail and early pass decisions; the *Probability of wrong decision F* used in the test specification:

After the *Min. Test Time*, the confidence test is stopped with an *"Early Fail"* message as soon as the probability for the DUT to have a BER (or another measured quantity) below the specified upper limit (see section *Upper Limits for Bit Error Rate (Receiver Quality Configuration – Limits)* on p. 4.141) is smaller than F. F corresponds to the risk to fail a good DUT.

After the *Min. Test Time*, the confidence test is stopped with an *"Early Pass"* message as soon as the probability for the DUT to have a BER (or another measured quantity) above the specified upper limit **times the *Bad DUT* factor** of 1.5 is smaller than F. F

corresponds to the risk to pass a bad DUT.

The R&S CMU provides five independent *Wrong Decision* factors which are related to the *BER, BLER, DBLER, UL TFCI Faults* limits, respectively.

Bad DUT Fixed bad DUT factor of 1.5; see section *Statistical Receiver Quality* Tests on p. 4.124.

Result Window BER range factor for statistical dual-limit BER tests. A factor of n % means that the BER must be within the range [<BER Limit> (1 – n %), <BER Limit> (1 + n %)]. The *OFF* setting corresponds to a single-limit BER test.

Min. Test Time Minimum test time before a check of the early pass and early fail limits can stop the measurement. Minimum test times are necessary in particular if the test conditions introduce some fluctuations that disturb the statistical independence of the single bit error events and must be averaged out (e.g. multipath fading, birth/death propagation, moving propagation).

Remote control

```
CONFigure:RXQuality:BER:CONTrol:CONFidence:WDECision
CONFigure:RXQuality:BER:CONTrol:CONFidence:BDUT?
CONFigure:RXQuality:BER:CONTrol:CONFidence:RWINdow
CONFigure:RXQuality:BER:CONTrol:CONFidence:MTTIme
```

Stop Condition

The *Stop Condition* parameter defines a stop condition for the measurement:

None Continue measurement even in case of error

On Limit Failure Stop measurement on first error (tolerance exceeded)

The following stop condition is only available for the *BER* application in *Signalling* mode:

Confidence Level Stop measurement as soon as the BER confidence level exceeds the values set in the *Confidence Settings* section described on p. 4.137.

Remote control

```
CONFigure:RXQuality:BER:CONTrol:REPetition
  <Repetition>, SONerror | CLEVel | NONE, <StepMode>
```

Transport Blocks

The *Transport Blocks* parameter defines the number of transport blocks to be measured or averaged per statistics cycle. The number of transport blocks sent can be larger than the specified value because transport blocks may be lost on the way to the UE and back.

Transp. Blocks Continuous Number of received transport blocks used for averaging in continuous measurements (statistics count). The continuous measurement is continued after the CMU has received the specified number of transport blocks from the UE, however, average results are referenced to the last statistics count (see Chapter 3).

Transp. Blocks Single Shot Number of received transport blocks for single shot measurements. The single shot measurement is terminated after the CMU has received the specified number of transport blocks from the UE.

For statistical receiver quality tests, a measurement cycle may be completed before the specified number of blocks has been measured.

Remote control
`CONFigure:RXQuality:BER:CONTrol:TBLocks <Blocks>`

DL/UL Transport Block Size

The *DL/UL Transport Block Size* parameter defines whether DL and UL transport block sizes are different *(asymmetric)* or the same *(symmetric).* An asymmetric block size is required to obtain the Block Error Rate (BLER). The Bit Error Rate (BER) and Data Block Error Rate (DBLER) can be measured irrespective of the *Transport Block Size;* see section *Test Loops for BER, BLER and DBLER Tests* on p. 4.120.

Note: *In Signalling mode the UL CRC (Sym. Loop Mode 2) parameter in the BS Signal tab replaces the DL/UL Transport Block Size.*

Remote control
`CONFigure:RXQuality:BER:CONTrol:TBSize <Symmetry>`

PN Auto Resynch.

Activates a correction mechanism for the order of looped back transports blocks. The setting is relevant in case that the UE eliminates or reorders some of the received blocks carrying an irregular bit pattern, in particular a PN sequence (PRBS).

On The R&S CMU checks the BER within each individual received block and corrects its PN phase and its position in the block sequence, if necessary. The BER result in the *Receiver Quality* menu is based on the bit stream of the corrected block sequence. It can be zero although the UE has eliminated or reordered some blocks. The number of corrected blocks is counted and displayed in the *PN Discontinuity* output field in the *BER* measurement menu.

Off The received block sequence is not corrected. No *PN Discontinuity* is detected.

Automatic Resynchronization setting takes effect if the BER measurement is performed with a PRBS *(Connection Control – Channel Settings – 3GPP DL Reference Channel – Channel Data Source DTCH).* The setting is not time-critical; its main purpose is to check whether a high BER actually results from a reordering of blocks by the UE.

Remote control
`CONFigure:RXQuality:BER:CONTrol:ARESynch ON | OFF`

UE Report

The toggle switches in the *UE Report* section enable or disable the evaluation and display of the optional individual information elements included in the UE measurement report message. The purpose of this section is to adjust the CMU display to the UE capabilities. For a definition of the information elements refer to section *UE Report (Signalling only)* on p. 4.132.

In the default configuration *(Default Settings* on) all information elements are displayed. As an alternative to switching off all elements, use the measurement control softkey to switch off the entire UE Report.

Reporting Interval Sets the interval between two consecutive measurement report messages. Reduce the interval to check whether the UE can cope with a high repetition rate.

Remote control
`DEFault:RXQuality:UEReport:ENABle`

```
CONFigure:RXQuality:UEReport:CONTrol:RINTerval <Time>
CONFigure:RXQuality:UEReport<nr>[:CCELl]:ENABle
CONFigure:RXQuality:UEReport<nr>:NCELl:ENABle
         (<nr> = 1 to 6)
```

WCDMA Neighbor Cell

The parameters in the *WCDMA Neighbor Cell* section define the basic properties of a WCDMA neighbor cell that the UE shall detect.

RF Channel Downlink — UARFCN (UTRA Absolute Radio Frequency Channel Numbers) of the neighbor cell signal to be measured by the UE. The range and default channel depends on the *Operating Band;* see also list of UTRA operating bands and downlink channel numbers in section *Generator Settings* on p. 4.147.

Operating Band — One of the operating bands I to IX.

Primary Scrambling Code — Primary SC of the neighbor cell in the range 0 to 1FF (hex).

P-CPICH Power — Absolute level of the Primary Common Pilot Channel of the neighbor cell signal as it is transmitted by the Node B. The UE calculates the *Pathloss* of the neighbor cell as the difference of the transmitted P-CPICH level defined here minus the received (measured) P-CPICH level.

The cell parameters are communicated to the UE under test. *RF Channel Downlink, Operating Band,* and *Primary Scrambling Code* must be in accordance with the actual WCDMA neighbor cell signal, otherwise the UE under test will fail to detect the cell and provide neighbor cell results. A wrong reported *P-CPICH Power* will result in a wrong neighbor cell *Pathloss.*

Remote control

```
CONFigure:RXQuality:UEReport:NCELl:WCDMa:CHANnel
CONFigure:RXQuality:UEReport:NCELl:WCDMa:OBANd
CONFigure:RXQuality:UEReport:NCELl:WCDMa:SCODe:PRIMary
CONFigure:RXQuality:UEReport:NCELl:WCDMa:CPICh:PRIMary
```

GSM Neighbor Cell

The parameters in the *GSM Neighbor Cell* section define the basic properties of a GSM neighbor cell that the UE shall detect.

BSIC – NCC — Network Color Code of the neighbor cell in the range between 0 and 7. The NCC is the first part of the 6-bit Base Transceiver Station Identity Code = NCC (PLMN Color Code) + BCC (BTS Color Code)

BSIC – BCC — BTS Color Code in the range between 0 and 7.

BCCH Channel — Broadcast Control Channel (BCCH) number of the GSM neighbor cell signal to be measured by the UE. The range and default channel number depends on the GSM *Band Indicator*.

Band Indicator — GSM band of the neighbor cell, if the band is either GSM1800 or GSM1900. If the MS supports this parameter and the neighbor cell band is either one of the GSM1800 or GSM1900 bands, all GSM channels are interpreted according to the bandwidth indicator. The information on the band is essential because the two bands partially use the same channel numbers for different frequencies.

The cell parameters are communicated to the UE under test. They must be in accordance with the actual GSM neighbor cell signal, otherwise the UE under test will fail to detect the cell and provide neighbor cell results.

Remote control
```
CONFigure:RXQuality:UEReport:NCELl:GSM:NCC
CONFigure:RXQuality:UEReport:NCELl:GSM:BCC
CONFigure:RXQuality:UEReport:NCELl:GSM:ARFCn
CONFigure:RXQuality:UEReport:NCELl:GSM:BINDicator
```

Upper Limits for Bit Error Rate (Receiver Quality Configuration – Limits)

The *Limits* tab defines the upper limits for the individual measured quantities in the *Receiver Quality* menu. The standard TS 34.121 specifies a maximum BER of 0.1% and a maximum BLER of 1% for most test cases. The DBLER is closely related to the BLER; see *Fig. 4-49 on p. 4.120.*

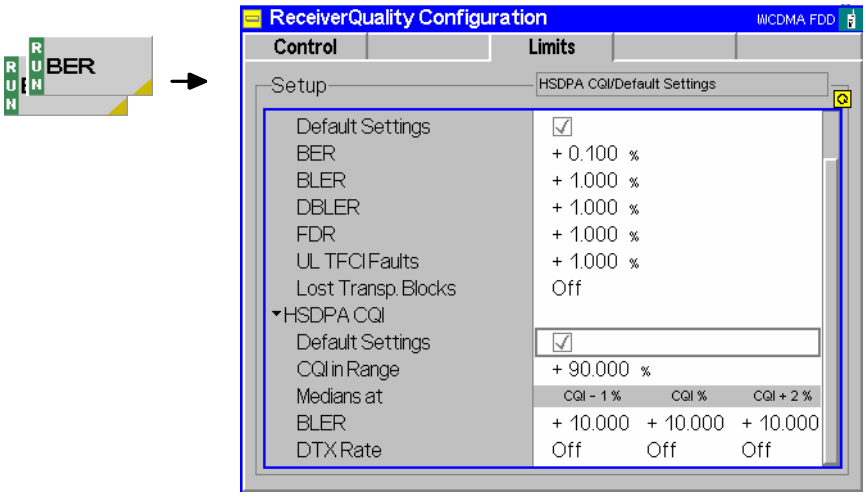


Fig. 4-60 Receiver Quality Configuration – Limits

Default Settings The *Default* switches overwrite all settings in the *Limits* tab with default values. The default values are quoted in the command description in chapter 6 of this manual.

Remote control
```
DEFault:RXQuality:LIMit <Enable>
DEFault:RXQuality:BER:LIMit <Enable>
DEFault:RXQuality:HCQI:LIMit <Enable>
```

BER The *BER* section defines upper limits for the three different bit error rates and the remaining results obtained in the *Receiver Quality* measurement (see section *BER Results* on p. 4.129). All limits are in the value range 0% to 100%. Off disables the limit check, which is particularly important for statistical receiver quality tests (see below).

Remote control
```
CONFigure:RXQuality:BER:CURRent:LIMit[:SCALar]:ASYMmetric
   :UPPer:VALue  <Limit_BER>, <Limit_BLER>, <Limit_DBLER>
CONFigure:RXQuality:BER:BTFD:CURRent:LIMit[:SCALar]
   :ASYMmetric:UPPer:VALue
CONFigure:RXQuality:BER:TBLocks:CURRent:LIMit[:SCALar]
   :ASYMmetric:UPPer:VALue
```

Limit settings for statistical tests

Statistical receiver quality tests in the BER application can be based on the measured *BER, DL BLER, DBLER, FDR,* or *UL TFCI Faults*. The limit settings determine which of the measured quantities provide the pass/fail criteria:

- To perform a statistical BER (BLER, DBLER …) test, select an appropriate BER (BLER, DBLER …) limit and disable all other limit checks (Off).
- To obtain statistical DL BLER results, ensure that asymmetric UL/DL transport blocks are transmitted *(Connection Control – BS Signal – Dedicated Channel (DCH) – RMC Settings – UL CRC (Sym. Loop Mode 2): Off).* The UL BLER measurement ignores the confidence settings.
- If you enable more than a single limit check for statistical receiver quality tests, the measurement will stop as soon as any of the enabled quantities produces an early fail result. It will also stop after all enabled quantities produce an early pass result.
- The statistical BER and DL BLER tests described in the conformance test specification use different settings, so they should be performed separately.

Audio Measurements

The menu group *Audio* comprises the functions for generating and measuring single or multitone audio signals. The menu group is available with option CMU-B41, *Audio Generator and Analyzer*. All *Audio* menus and remote-control commands are described in the CMU 200/300 operating manual.

The *Audio* option supports two independent test circuits. In *Non Signalling* mode the input and output connectors for both circuits are fixed; they are indicated in the *AF/RF* ⊶ tab of the *Connection Control* menu; see section *AF/RF Connectors (Connection Control – AF/RF)* on p. 4.177. This test mode corresponds to the standalone Audio tests described in the CMU 200/300 operating manual.

In Signalling mode, it is possible to send and receive audio data modulated onto the RF carrier and thus test the audio circuit of a connected mobile phone (see section *AF/RF Connectors (Connection Control – AF/RF)* on p. 4.279).

Connection Control (Non Signalling)

The popup menu *Connection Control* contains several tabs to configure the inputs and outputs of the CMU and the respective signals in the function group *WCDMA UE TX Test* (3GPP/FDD). The functions of the *WCDMA (3GPP/FDD, DL) Generator* (option R&S CMU-K66) are integrated in the *Connection Control* menu; see section *Generator Settings (Connection Control – Generator)* on p. 4.147.

The menu group is activated via the softkey *Connect. Control* to the right of the header of each measurement menu. The individual popup menus *(Analyzer, Generator (with option R&S CMU-K66 only), UE Code, AF/RF* ⊙→ and *Sync.)* can be accessed via the hotkeys at the lower edge of the screen.

The settings in the *Connection Control* menu are general settings that are valid for the entire *Non Signalling* function group. Changing general settings in any application will have an impact on all measurements and applications of the function group.

Analyzer Settings (Connection Control – Analyzer)

The *Analyzer* tab of the *Connection Control* menu controls the level in the RF input signal path and defines the frequency of the RF signal analyzed as well as the trigger settings. The CMU provides a panel oriented version of the *Analyzer* tab and a table oriented version with extended functionality. The *Analyzer* hotkey toggles between the two versions if it is pressed repeatedly.

Panel Oriented Version

The panel oriented version of the *Analyzer* tab controls:

- The maximum expected input level (Max. Level)
- The RF channel (RF Channel) and corresponding nominal channel frequency
- The Frequency Offset of the signal analyzed by the CMU (Analyzer Settings)

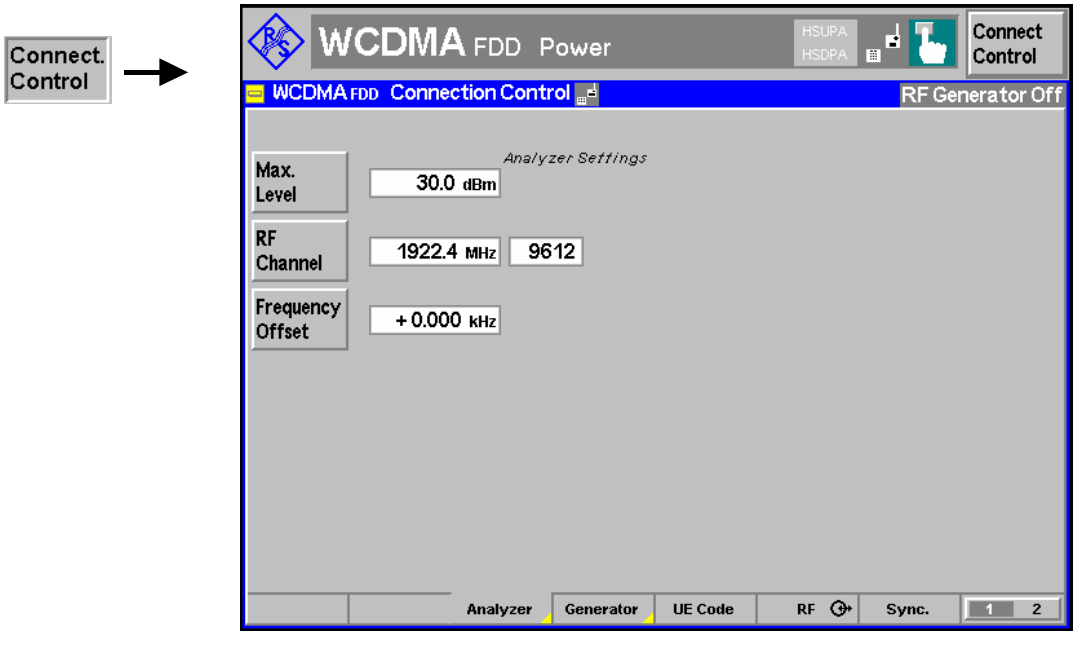


Fig. 4-61 Connection Control – Analyzer (panel)

Max. Level

The *Max. Level* softkey sets the maximum expected input level (overload level). This level corresponds to the maximum peak envelope power (PEP) of the WCDMA signal that the CMU is able to measure. Input levels exceeding the *Max. Level* overdrive the input path and cause invalid results ("– – –").

In the table oriented version of the *Analyzer* tab, either manual or automatic setting of the input level can be selected. The behavior of the *Max. Level* softkey depends on the way the input level is set:

- In manual mode, the input level is indicated in the input field to the right of the softkey. This field can be activated and the level can be changed by pressing the *Max. Level* softkey. Note the remarks on *external input attenuation* on p. 4.145.
- If autoranging is selected, *Auto* is indicated in the input field to the right of the softkey. *Max. Level* is not active. To change the input level and mode, the table oriented *Analyzer* tab must be opened by pressing the *Analyzer* hotkey again.

Remote control
`[SENSe:]LEVel:MAXimum <Level>`

RF Channel

The *RF Channel* softkey defines the carrier frequency and channel number (UARFCN, UTRA Absolute Radio Frequency Channel Number) of the measured signal. The assignment between channel numbers *N* and carrier frequencies *F* is defined in the 3GPP specification (TS 25.141); see Table 4-25 on p. 4.228.

It is possible to enter arbitrary RF frequencies, provided that the frequencies are in multiples of 100 kHz and within the specified range of the RF generator (see data sheet). For unassigned frequencies, the R&S® CMU displays an invalid channel number ("---").

Moreover, the analyzer frequency can be modified by an additional *Frequency Offset* entered by means of the softkey below so that the analyzer can be set to any frequency within the specified range.

Note: *Some carrier frequencies are used in different operating bands and assigned to different channel numbers. E.g. the downlink frequency 2112.4 MHz corresponds to channel no. 10562 in operating band I, and to channel no. 3112 in operating band X. As a consequence, the channel number is not always predictable if a carrier frequency is used in several operating bands. To avoid confusion, you can either enter channel numbers (channel numbers are unique, even across operating bands) or always use frequencies, disregarding the assigned channel numbers.*

The 100/200 kHz frequency raster of the UARFCN frequencies must not be confused with the much wider WCDMA carrier spacing of 5 MHz.

Remote control
`UNIT:RFANalyzer:FREQuency <Unit>`
`[SENSe:]RFANalyzer:FREQuency <Frequency>`

Frequency Offset

The *Frequency Offset* softkey defines an offset for the frequency set under RF Channel. This enables fine tuning of the frequency measured by the CMU, e.g. in order to simulate a Doppler shift (caused by a relative movement between UE and Node B) or detuning of the UE.

Remote control
`[SENSe:]RFANalyzer:FOFFset <Offset>`

Table Oriented Version

The table oriented version of the *Analyzer* tab controls:

- The maximum expected input level *(Max. Level)* and the way it is defined *(Mode)*
- An external input attenuation or gain *(Attenuation)*
- The analyzer frequency *(Analyzer Settings)*

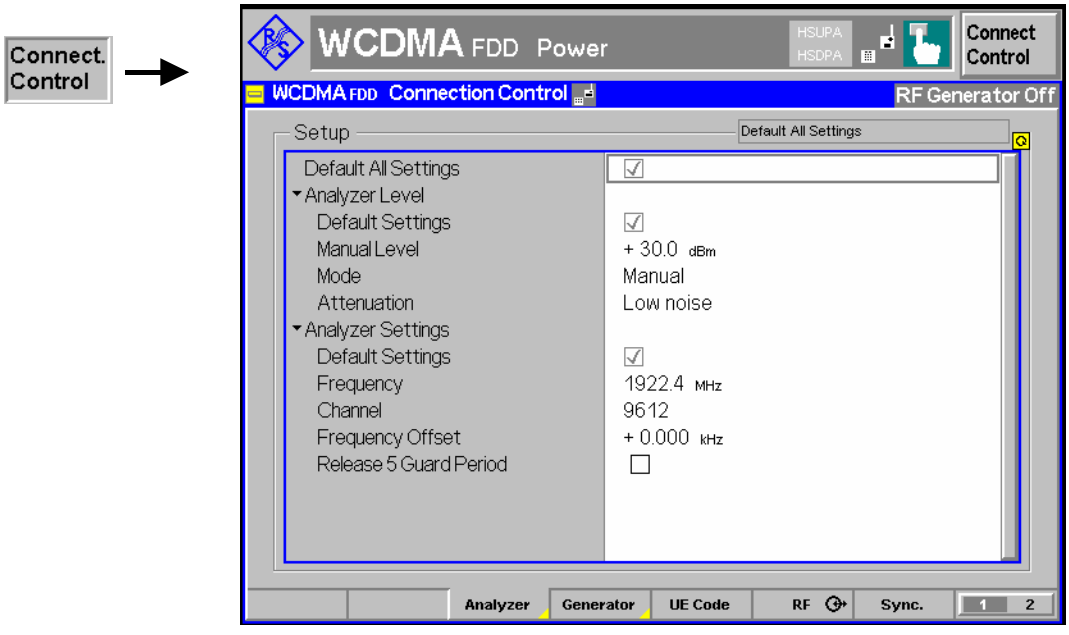


Fig. 4-62 Connection Control – Analyzer (table)

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Analyzer* tab (the default values are quoted in the command description in chapter 6 of this manual).

Remote control
`DEFault:LEVel ON | OFF`

Analyzer Level – Mode The *Analyzer Level* table section sets the maximum input level that can be measured. Two alternative *Modes* for defining this value are provided:

Manual Manual input of maximum input level in the *Manual Level* field

Auto Automatic setting of maximum input level *(autoranging)* according to the peak power (PEP) of applied signal

Remote control
`[SENSe:]LEVel:MODE <Mode>`

Analyzer Level – Manual Level The maximum input level can be entered in the *Manual Level* input field.

Remote control
`[SENSe:]LEVel:MAXimum <Level>`

External input attenuation The range of *Max. Level* values depends on the RF input used. If an external input attenuation is reported to the instrument to compensate for a known path loss (see

section *RF Connectors (Connection Control – RF Connectors)* on page 4.145), all levels measured are referenced to the output of the DUT and therefore shifted with respect to the actual level at the input connectors of the CMU. The level ranges for the input connectors are shifted as well.

Error messages

If the value determined for *Max. Level* is too high or too low, a window with the error message *"<Max_Level> is out of range. <permissible max. value> is limit*." and three fields will appear:

Accept The permissible max. value is accepted as Max. Level,

Re-edit Max. Level is entered once again,

Cancel The last valid input value is maintained.

When switching over to another input, the current value of *Max. Level* is automatically adapted, if required:

- Towards lower values to the maximum value of the new input,
- Towards upper values to the minimum value of the new input.

Note: *A maximum input level can be entered even if automatic level setting (autoranging) is selected. The entered level is used as a start value for the autoranging routine and is also important to ensure safe switchover to manual setting.*

Analyzer Level – Attenuation

The *Attenuation* field defines how the RF analyzer of the CMU is tuned to meet the requirements of the current measurement type. In general, a compromise between the acceptable noise level in the displayed result and the contribution of internally generated distortion must be reached.

Normal Mixer level in normal range,

Low noise Mixer level enhanced by +10 dB (full dynamic range of CMU, therefore recommended for *Power* and *Spectrum* measurements),

Low distortion Mixer level reduced by –10 dB (high intermodulation spacing, therefore recommended for *Modulation* measurements).

The *Attenuation* setting permits the CMU to be adapted to the requirements of the measurement. The advantages and disadvantages of the settings *Low noise* and *Low distortion* are listed in the following table.

	Advantages	**Disadvantages**
Low noise	Low noise high dynamic range	No RF overdrive reserve Risk of intermodulation
Low distortion	High intermodulation spacing	Lower dynamic range

Remote control

```
[SENSe:]LEVel:ATTenuation NORMal | LNOise | LDIStortion
```

Analyzer Settings

The *Analyzer Settings* table section defines the RF analyzer frequency. Most of the settings are also provided in the softkey-oriented version of the *Analyzer* tab; see section *Panel Oriented Version* on p. 4.143. The following additional parameter is available:

Release 5 Guard Period Enables or disables the guard period for the UE signal evaluation according to release 5 of the 3GPP FDD standard. Enabling the

guard period means that signal evaluation starts 25 µs after the beginning of the slot and ends 25 µs before the end of the slot. The setting is relevant for the Code Domain Power and WCDMA Modulation measurement; it does not affect any of the other measurements (see Table 4-26 on p. 4.230).

Remote control

```
[SENSe:]RFANalyzer:FREQuency <Frequency>
[SENSe:]RFANalyzer:FOFFset <Offset>
[SENSe:]RFANalyzer:GPERiod <Enable>
```

Generator Settings (Connection Control – Generator)

The *Generator* tab of the *Connection Control* menu controls the CMU's RF generator and configures the generated RF signal. It is available with option CMU-K66, *WCDMA (3GPP/FDD, DL) Generator,* only. The CMU provides a panel oriented version of the *Generator* tab and a table oriented version with extended functionality. The *Generator* hotkey toggles between the two versions if it is pressed repeatedly.

RF Generator

The RF generator provides a WCDMA downlink signal at arbitrary carrier frequency and variable level. The signal includes the following physical channels:

- Downlink Dedicated Physical Channel (DPDCH, DPCCH)
- Primary Common Pilot Channel (P-CPICH)
- Primary and Secondary Synchronization Channel (P-SCH, S-SCH)
- Primary Common Control Physical Channel (CCPCH)
- Page Indicator Channel (PICH)

The total signal level and the relative levels of the individual physical channel contributions can be varied over a wide range. The dedicated channels can be configured in three alternative ways:

- The *3GPP DL Reference Channel* is defined on transport channel level. The data sequence to be transferred is directly fed into the DTCH and DCCH. The transport channels are channel coded, multiplexed and mapped onto a dedicated physical channel (DPCH) with variable data rate. The downlink reference measurement channel generated in this way is to be used for various transmitter and receiver tests specified in standard 3GPP TS 25.101.
- The *DL Physical Channel* is defined in terms of its slot format. The data sequence to be transferred is fed into the data fields of the DPDCH without channel coding. The DPDCH is time-multiplexed with the DPCCH according to standard 3GPP TS 25.211.
- The *3GPP DL DCCH* is a DL Signalling Radio Bearer (SRB) according to 3GPP TS 34.108 which is defined in terms of its data rate.

All settings are explained in detail in the following subsections.

Application

The purpose of the generator is to provide a WCDMA signal which can be used to synchronize the UE and to transfer data from the tester to the UE. The RF generator signal represents a flexible WCDMA downlink test signal and a valuable tool for performing TX and RX measurements, such as

- Inner loop Transmit Power Control (TPC); see section *Test Scenarios for Inner Loop TPC* on p. 4.4. To control the *Inner Loop TPC* measurement a set of *TPC Settings* is provided at the generator; see p. 4.166.
- Bit Error Rate (BER) tests with known data sequence transmitted on the downlink channel and UE-assisted evaluation or calculation of the BER, BLER and DBLER by the tester; see section *Receiver Quality Measurements* on p. 4.118.
- The RF generator is also used in *Signalling* test mode where it provides the *Node B* signal (see section *Downlink Signal (Connection Control – BS Signal)* on p. 4.236), which is necessary to set up a connection and make measurements.

Synchronization of the UE and data transfer is described in section *Downlink Channels and Synchronization* on p. 4.148.

The HSDPA channels that the R&S CMU provides with option R&S CMU-K64 and the HSUPA channels (option R&S CMU-K56) are described in Chapter 8.

The WCDMA uplink and downlink signals differ in their channel structure and in the way the physical channels are built. Table 4-13 *below* summarizes the parameters that are relevant for this section.

Table 4-13 WCDMA specifications

Parameter	Uplink	Downlink
Chip rate	3.84 Mcps	3.84 Mcps
Frame structure	10 ms radio frame divided into 15 slots (2560 chips/slot)	10 ms radio frame divided into 15 slots (2560 chips/slot)
Spreading codes	Orthogonal Variable Spreading Factor (OVSF) channelization codes and long and short scrambling codes (Gold sequences) for user separation	Orthogonal Variable Spreading Factor (OVSF) channelization codes for channel separation, Gold sequences of length $2^{18} - 1$ for cell and user separation
Spreading factors / symbol rates	4, 8, 16, ..., 256 960 ksps, ..., 15 ksps	4, 8, 16, ..., 512 960 ksps, ..., 7.5 ksps
Channel multiplexing	Control and pilot channel time-multiplexed, I/Q multiplexing for data and control channels	Data and control channels time-multiplexed

Downlink Channels and Synchronization

The RF generator provides a set of five downlink physical channels sufficient for synchronization of the UE and data transfer. In addition, it generates the PICH which is to be used in many of the conformance tests described in standard TS 34.121. Other channels that are exclusively intended to carry signalling information are not included in the generator signal.

Downlink physical channels

The radio resources in a WCDMA system are divided into physical channels characterized by a specific carrier frequency, scrambling and channelization code, and duration. The time duration is conveniently defined in integer multiples of chips, slots and radio frames. With a chip rate of 3.84 Mcps, a slot corresponds to 2560 chips. A frame consists of 15 slots, i.e. 38400 chips or 10 ms.

The standard specifies different physical channel types. The channels are generated by mapping transport channel information into a physical channel and differ in their physical parameters. Common channels carry messages that are not directed at a particular UE; they are point-to-multipoint channels. Dedicated channels carry information related to a particular connection; they are point-to-point bidirectional channels. An overview of the physical channels of the CMU DL generator signal is given in Table 4-14 below.

Table 4-14 Downlink physical channels in the CMU generator signal

Channel type	Purpose	Properties
Primary Common Pilot Channel P-CPICH	Determination of the scrambling code out of a scrambling code group (2nd stage of scrambling code detection, see below) Phase reference for SCH and other downlink physical channels Reference for the generator signal strength	Fixed rate (30 kbps, SF = 256) Fixed channelization code $c_{256, 0}$ Primary scrambling code Predefined symbol sequence
Secondary Common Pilot Channel S-CPICH	Alternative phase reference for the cell; also used as a phase reference for some conformance tests	Fixed rate (30 kbps, SF = 256) Primary or secondary scrambling code Zero, one or several S-CPICH channels per cell (the R&S CMU generates zero or one S-SPICHs) Channelization codes can be set between 2 and 255.
Primary Synchronization Channel P-SCH	Slot synchronization between CMU and UE (1st synchronization step, see below)	Fixed 256-chip code (primary synchronization code) Time-multiplexed with P-CCPCH No channelization, no scrambling
Secondary Synchronization Channel S-SCH	Frame synchronization between CMU and UE (2nd synchronization step, see below) Provides the scrambling code group (1st stage of scrambling code detection, see below)	256-chip code depending on the slot no. and the scrambling code group (secondary synchronization code) Time-multiplexed with P-CCPCH No channelization, no scrambling
Primary Common Control Physical Channel P-CCPCH	Transmits the System Frame Number (SFN) and is used as a timing reference for all physical channels Carries the BCH transport channel (filled with an All 0 sequence by the CMU generator)	Fixed rate (30 kbps, SF = 256) Fixed channelization code $c_{256, 1}$ Primary scrambling code Time-multiplexed with SCH
Dedicated Physical Channel DPCH	Transfer of control information and user data to the UE	Spreading factors from 512 down to 4 Primary or secondary scrambling code DPDCH and DPCCH time-multiplexed
Page Indicator Channel PICH	Transfer of paging indicators to the UE. Required to be present in many conformance tests.	Fixed rate (SF = 256) physical channel. Primary scrambling code Channelization codes can be set between 2 and 255. All PICH bits fixed to –1.

The CMU uses the scheme defined in TS 25.213 to spread and combine the downlink channels (see *Fig. 4-63 below*). The real-valued P-CPICH, S-CPICH, P-CCPCH, DPCH and PICH symbols are first mapped to an I and Q branch. The I and Q branches of each channel are spread to the chip rate using the same channelization code $C_{SF,m}$. The channelization codes of the P-CPICH and P-CCPCH are fixed. The spreading factor (SF) for the DPCH is given by its slot format number (see *Table 4-20* on p. 4.165) and the selectable *DPCH Channelization Code* m. The complex-valued chip sequences are scrambled with primary or secondary scrambling codes S^p or S^s; see paragraph on *Downlink scrambling codes* on

p. 4.158, weighted with individual factors G and then combined using complex addition. The G factors are directly related to the individual channel levels set at the CMU.

The complex-valued synchronization channels P-SCH and S-SCH are not spread but weighted separately and then added to the combined P-CPICH, S-CPICH, P-CCPCH, DPCH and PICH.

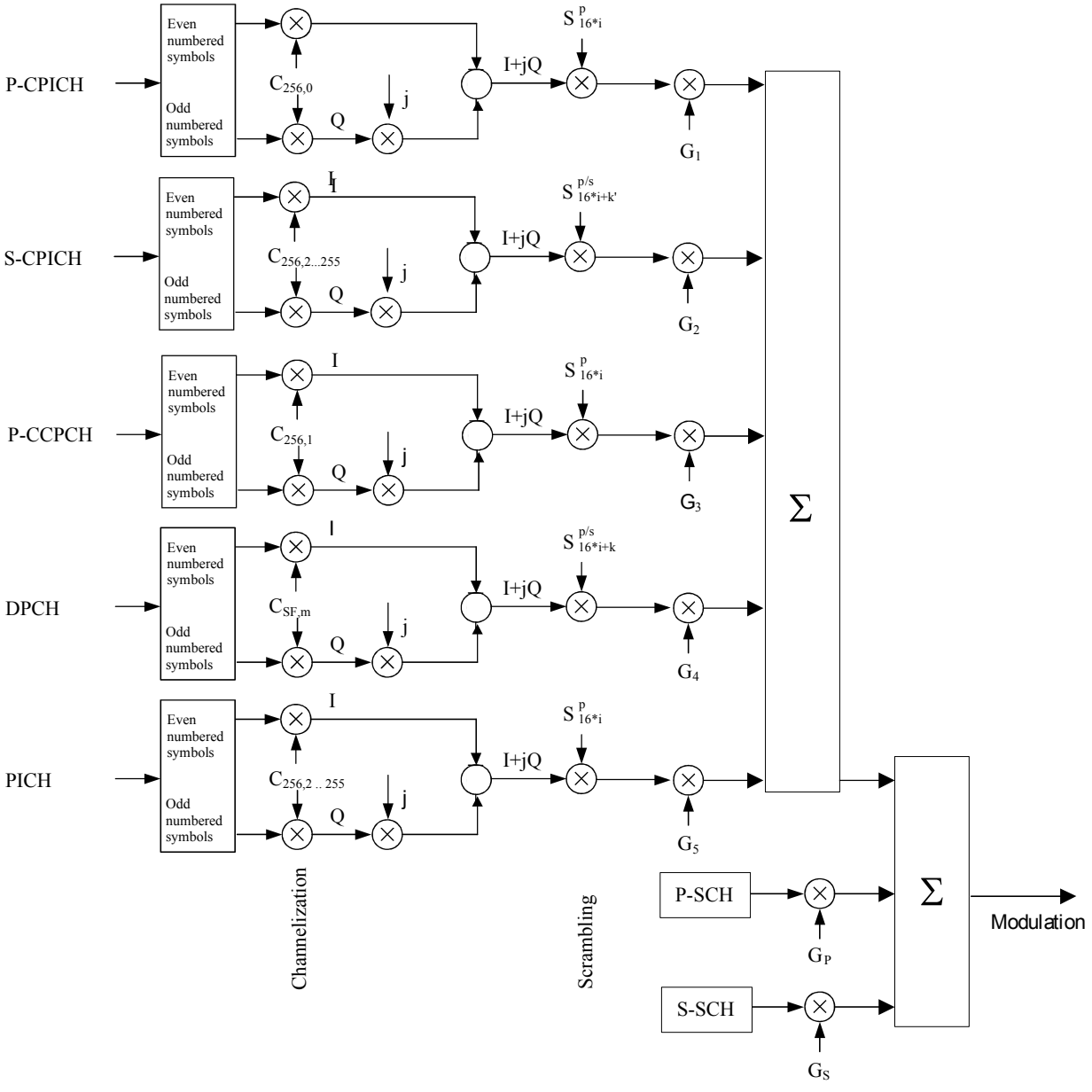


Fig. 4-63 Spreading of the downlink channels

With the channels of the CMU generator signal, synchronization of the UE is a three-step process:

1. Slot synchronization

The UE searches for the P-SCH and detects the primary synchronization code using correlation methods. The start of the P-SCH marks the beginning of a slot (see *Fig. 4-65* on p. 4.153).

2. Frame synchronization and scrambling code group identification

The UE detects the secondary synchronization code transmitted on the S-SCH to obtain the frame time and the scrambling code group. If needed, it also determines the System Frame Number (SFN) transmitted on the P-CCPCH.

3. Scrambling code identification and data evaluation

The UE detects the P-CPICH to determine the primary scrambling code within the scrambling code group obtained in step 2. Using this information, it is possible to detect the scrambling code of the DPCH and to decode the data.

Panel Oriented Version

The panel oriented version of the *Generator* tab provides softkeys used to

- Control the CMU's RF generator (Generator)
- Define the levels in the individual physical channels (*P-CPICH Level abs.* etc.)
- Define the *RF Channel* and *Frequency Offset* of the signal generated by the CMU *(Generator Settings* panel)

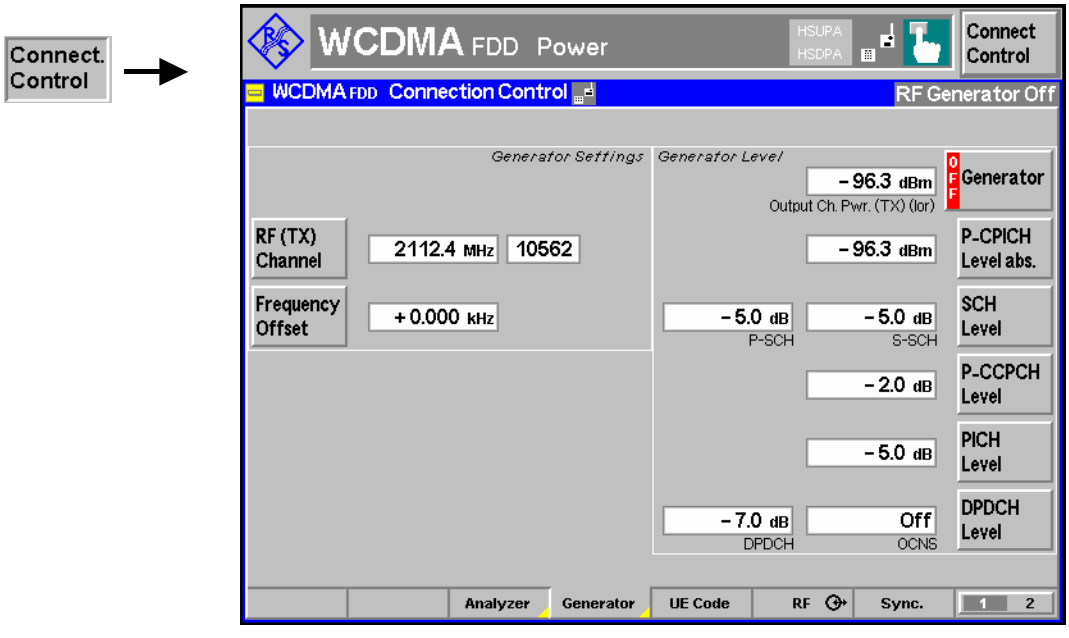


Fig. 4-64 Connection Control – Generator (panel)

Generator

The *Generator* softkey indicates the operating status of the RF generator *(ON* or *OFF)*. Pressing the *Generator* softkey and the *ON/OFF* key switches the generator on or off.

The *Output Ch. Power* field shows the total output power of the RF generator in the RF channel, averaged over 1 frame but not taking into account a possible DTX mode for the TFCI bits (see *TFCI* on p. 4.160). The output power depends on the power settings of the individual physical channels (see softkeys *P-CPICH Level abs.* below).

Remote control

```
INITiate:RFGenerator
ABORt:RFGenerator
FETCh:RFGenerator:STATus?
```

The properties and use of the following channels are described in section *Downlink Channels and Synchronization* on p. 4.148.

P-CPICH Level abs.

The *P-CPICH Level abs.* softkey sets the absolute level of the Primary Common Pilot Channel (P-CPICH).

The P-CPICH is used as a reference for the total generator signal strength. It must be active in all generator signal configurations. In contrast, the DPCH channel can be switched off using the *ON/OFF* key or in the table-oriented version of the *Generator* menu.

Remote control
`SOURce:RFGenerator:SCHannel:LEVel:PCPich <Level>`
`SOURce:RFGenerator:PHYSical:Level` sets all channel levels at once (recommended command)

SCH Level

The *SCH Level* softkey sets the level of the Primary Synchronization Channel (P-SCH) and the Secondary Synchronization Channel (S-SCH). The level is set relative the *Output Channel Power* or to the *P-CPICH Level abs.*, depending on the selected *Level Reference* (see p. 4.157). The two levels can be entered in two separate input fields. If it is defined relative to the *P-CPICH Level abs.,* the *P-SCH Level* is equal to the ratio of the weighting factors G_p/G_1 in *Fig. 4-63* (see p. 4.150). The *S-SCH Level* is equal to the ratio of the weighting factors G_s/G_1 in *Fig. 4-63*.

The P-SCH carries a complex-valued 256-chip code c_p depending on the STTD encoding on the P-CCPCH and is used for slot synchronization between CMU and UE. It is time-multiplexed with the P-CCPCH as shown in *Fig. 4-65 below*.

The S-SCH carries a complex-valued 256-chip code $c^{k,i}_s$ depending on the slot no. i (i=0, 1, ... 14), the scrambling code group k (k = 0, 1, ..., 63; see background information on *Downlink scrambling codes* on p. 4.158), and the STTD encoding on the P-CCPCH. It is used for frame synchronization between CMU and UE. It is time-multiplexed with the P-CCPCH as shown in *Fig. 4-65 below*.

Remote control
`SOURce:RFGenerator:SCHannel:LEVel:PSCH <Level>`
`SOURce:RFGenerator:SCHannel:LEVel:SSCH <Level>`

P-CCPCH Level

The *P-CCPCH Level* softkey sets the level of the Primary Common Control Physical Channel (P-CCPCH). The level is set relative the *Output Channel Power* or to the *P-CPICH Level abs.*, depending on the selected *Level Reference* (see p. 4.157). If it is defined relative to the *P-CPICH Level abs.,* the *P-CCPCH Level* is equal to the ratio of the weighting factors G_2/G_1 in *Fig. 4-63* (see p. 4.150).

The P-CCPCH carries the BCH transport channel and transmits the System Frame Number (SFN). It is used as the timing reference for all physical channels and is time-multiplexed with the SCHs as shown in *Fig. 4-65 below*.

Remote control
`SOURce:RFGenerator:DBCHannel:LEVel:PCCPch <Level>`

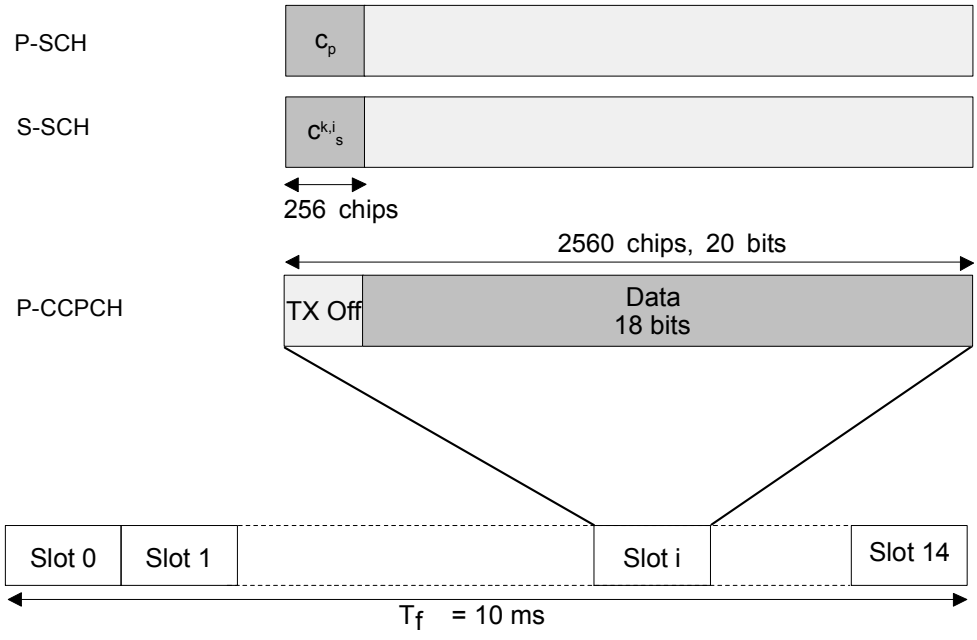


Fig. 4-65 Frame structure for the SCH and P-CCPCH

PICH Level

The *PICH Level* softkey sets the level of the Page Indicator Channel (PICH).). The level is set relative the *Output Channel Power* or to the *P-CPICH Level abs.*, depending on the selected *Level Reference* (see p. 4.157). If it is defined relative to the *P-CPICH Level abs.,* the *PICH Level* is equal to the ratio of the weighting factors G_4/G_1 in *Fig. 4-63*.

The PICH is a fixed-rate (SF = 256) physical channel used to carry the paging indicators. All PICH bits are set to –1. The channelization code can be set in the table-oriented version of the *Generator* tab.

Remote control
`SOURce:RFGenerator:DBCHannel:LEVel:PICH <Level>`

DPDCH Level

The *DPDCH Level* softkey sets the level of the data part (DPDCH) of the Dedicated Physical Channel (DPCH). The level is set relative the *Output Channel Power* or to the *P-CPICH Level abs.*, depending on the selected *Level Reference* (see p. 4.157). The level of the control part can be set to be different from the *DPDCH Level;* see *Power Offset* parameter on p. 4.160. For a 0-dB power offset and if it is defined relative to the *P-CPICH Level abs.,* the *DPDCH Level* is equal to the ratio of the weighting factors G_3/G_1 in *Fig. 4-63* (see p. 4.150). The DPCH (including the DPCCH part) can be switched off by means of the *ON/OFF* key.

The *OCNS* input field sets the level of the Orthogonal Channel Noise Simulator (OCNS, see background information below) relative to the *P-CPICH Level abs.* The OCNS can be set if all levels are relative to the P-CPICH level *(Level Reference = PCPICH).* For *Level Reference = Output Channel Power* it is calculated automatically as the difference between the total output channel power and the individual physical channel contributions.

The OCNS is calculated as specified in the terminal conformance specification 3GPP TS 34.121, release 99. If the HSDPA generator is turned *On,* the OCNS is according to release 05 of the spec, taking into account the additional HSDPA channels. The release (R99 or R5) is indicated in the table-oriented version of the *Generator* tab.

Further DPCH settings are provided in the table-oriented version of the *Generator* tab; see section *Table Oriented Version* on p. 4.155 and Fig. 4-69 on p. 4.165.

Remote control
```
SOURce:RFGenerator:DBCHannel:LEVel:DPDCh <Level>
SOURce:RFGenerator:OCNS <Level>
```

OCNS

The Orthogonal Channel Noise Simulator (OCNS) is used to simulate the users or control signals on the other orthogonal channels of a downlink. The DPCH Channelization Code and relative level settings for OCNS signals are specified in the terminal conformance specification 3GPP TS 34.121; see Table 4-15 below. The spreading factor of the OCNS signal is 128. The DPCH data for each channelization code are uncorrelated with each other and with any wanted signal over the period of any measurement. The parameters are chosen to simulate a signal with realistic Peak to Average Ratio.

The OCNS must not cause code channel conflicts with the physical DL channels, therefore the definition in Table 4-15 is inappropriate for HSDPA receiver tests. A modified OCNS definition for HSDPA tests has been published in release 5 of the terminal conformance specification; see Table 4-16 below.

Table 4-15 OCNS signal for non-HSDPA receiver tests (TS 34.121, release 99 and release 5)

Channelization Code (SF = 128)	**Relative Level Setting / dB**	**Channelization Code (SF = 128)**	**Relative Level Setting / dB**
2	–1	62	–4
11	–3	69	–6
17	–3	78	–5
23	–5	85	–9
31	–2	94	–10
38	–4	125	–8
47	–8	113	–6
55	–7	119	0

Table 4-16 OCNS signal for HSDPA receiver tests (TS 34.121, release 5)

Channelization Code (SF = 128)	**Relative Level Setting / dB**	**Channelization Code (SF = 128)**	**Relative Level Setting / dB**
122	0	125	–4
123	–2	126	–1
124	–2	127	–3

RF Channel

The *RF Channel* softkey defines the carrier frequency and channel number (UARFCN, UTRA Absolute Radio Frequency Channel Number) of the generated signal. The assignment between channel numbers *N* and carrier frequencies *F* is defined in the 3GPP specification (TS 25.141); see Table 4-28 on p. 4.238.

It is possible to enter arbitrary RF frequencies, provided that the frequencies are in multiples of 100 kHz and within the specified range of the RF generator (see data sheet). For unassigned frequencies, the R&S® CMU displays an invalid channel number ("---").

Moreover, the generator frequency can be modified by an additional *Frequency Offset* entered by means of the softkey below so that any frequency within the specified range can be used as a generator frequency.

Note: *Some carrier frequencies are used in different operating bands and assigned to different channel numbers. E.g. the downlink frequency 2112.4 MHz corresponds to channel no. 10562 in operating band I, and to channel no. 3112 in operating band X. As a consequence, the channel number is not always predictable if a carrier frequency is used in several operating bands. To avoid confusion, you can either enter channel numbers (channel numbers are unique, even across operating bands) or always use frequencies, disregarding the assigned channel numbers.*

The 100/200 kHz frequency raster of the UARFCN frequencies must not be confused with the much wider WCDMA carrier spacing of 5 MHz.

Remote control
```
UNIT:RFGenerator:FREQuency <Unit>
SOURce:RFGenerator:FREQuency <Frequency>
```

Frequency Offset

The *Frequency Offset* softkey defines an offset for the frequency set under *RF Channel*. This enables an arbitrary modification or fine tuning of the generated frequency.

Remote control
```
SOURce:RFGenerator:FOFFset <Number>
```

Table Oriented Version

The table oriented version of the *Generator* tab provides settings to

- Select a *CW* or *WCDMA* signal type *(Output Signal)*
- Select a particular signal source *(Transmitter)*
- Control the RF generator *(Control)* and configure additive interfering signals *(OCNS, AWGN)*
- Define channel-independent settings *(Generator Settings)*
- Configure the *Synchronization Channels*, the *Dedicated & Broadcast Channels*, the *3GPP DL Reference Channel*, and the *DL Physical Channel*
- Define the *TPC Profile* to be transmitted to the UE.

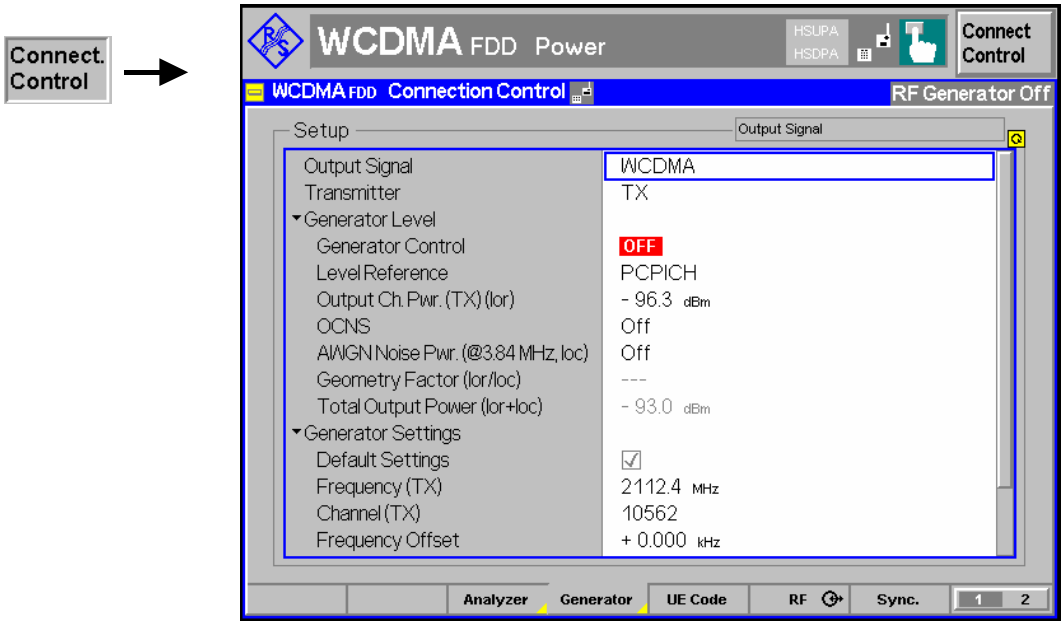


Fig. 4-66 Connection Control – Generator (table)

Default Settings The *Default* switches assign default values to several sections in the *Generator* tab (the default values are quoted in the command description in chapter 6 of this manual).

Remote control
`DEFault:RFGenerator:SETTings` etc.

Output Signal Selects one of the following RF signal types:

WCDMA The RF generator transmits a DL WCDMA signal with all properties defined in the *Generator* tab. The CW signal represents an additional test signal.

Continuous Wave The RF generator transmits a CW signal at the frequency and level defined in the *Generator Level* and *Generator Settings* sections. This WCDMA signal is appropriate for all *Non Signalling* measurements.

Remote Control
`SOURce:RFGenerator:OUTPut CW | WCDMa`

Transmitter Selects one of the following RF signal sources: .

TX, Aux TX Normal TX or Aux TX signal. The level of both signals can be set in 0.1-dB steps.

Aux TX Over Range Overrange signal for higher levels, to be set in 1-dB steps. The level accuracy of the over range signal is quoted in the data sheet.

The Aux TX signals are described in section *Aux TX Signal* on p. 4.169. Refer to the remote control description for the output level ranges of all signals.

Remote Control
`SOURce:RFGenerator:TRANsmitter TX | AUXTx | OAUXtx`

Generator Level – Control

The *Generator Level* section indicates the generator state and defines the total generator power as well as the noise contributions to the DL WCDMA signal.

Control Indicates whether the RF generator is switched on or off. The generator state can be changed by means of the *Generator* softkey in the panel oriented version of the *Generator* tab.

Level Reference Defines whether the power of all channels and the OCNS is expressed relative to the P-CPICH *(PCPICH)* or to the *Output Channel Power.*

Output Ch. Power Total output power of the BS signal, averaged over 1 frame but not taking into account a possible DTX mode for the TFCI bits. The output level range at the default connector RF2 is sufficient for the *Maximum Input Level* test according to standard 3GPP TS 34.121, section 6.3.

OCNS Level of the Orthogonal Channel Noise Simulator (OCNS, see description on p. 4.153) relative to the *P-CPICH* level. If the *Output Channel Power* is used as a *Level Reference,* then the OCNS level is calculated automatically as the difference between the total output channel power and the individual physical channel contributions.

AWGN Noise Pwr. (@3.84 MHz, Ioc) Total level in dBm of the Additional White Gaussian Noise (AWGN) interferer (the spectral density integrated across the bandwidth of 3.84 MHz). The AWGN signal is added to the DL WCDMA signal unless it is switched *Off.* Like the channel power, the AWGN level is varied as a function of the external output attenuation setting. The range of values is sufficient for all tests specified in the conformance test specification 3GPP TS 34.121.

The properties of the AWGN interferer comply with the requirements of 3GPP TS 34.121, section 7.1.2 (minimum bandwidth 5.76 MHz, flatness less than ±0.5 dB, peak to average ratio at a probability of 0.001 % above 10 dB). An AWGN signal source simulates realistic propagation conditions of the DL signal; it is needed for many of the *Performance* tests and *Support of RRM* tests described in TS 34.121.

Geometry Factor (Ior/Ioc) Ratio of the *Output Ch. Power (TX) (Ior)* to the AWGN power Ioc. Together with the absolute output channel power, the geometry factor is a measure for the signal quality. An external output attenuation has the same effect on Ior and Ioc, so that the geometry factor corresponds to the received channel power spectral density Îor divided by Ioc at the UE receiver (see 3GPP TS 34.121).

Changing the geometry factor affects the output channel power but leaves the AWGN power unchanged. The geometry factor cannot be increased above the limit where the total output power exceeds the maximum power of the selected RF connector.

Total Output Power Sum of the *Output Ch. Power (TX) (Ior)* and the *AWGN Noise Power (Ioc).* This value cannot be set but is displayed for information.

Remote control

```
FETCh:RFGenerator:STATus?
SOURCE:RFGenerator:LREFerence PCPich | OPOWer
SOURce:RFGenerator:OPOWer <Power>
SOURce:RFGenerator:OCNS <Power>
SOURce:RFGenerator:AWGN
```

```
SOURce:RFGenerator:GMTFactor?
SOURce:RFGenerator:TOPower?
```

Generator Settings

The *Generator Settings* table section defines channel-independent properties of the generated RF signal:

Frequency Carrier frequency of the generator signal (see *RF Channel* softkey description on p. 4.155)

Channel UARFCN (see *RF Channel* softkey description on p. 4.155)

Frequency Offset Frequency offset with respect to the carrier frequency

Primary Scrambling Code Number of the primary scrambling code for the DL WCDMA signal. The scrambling code must be in the range 0 to 1FF (hex), corresponding to 0 to 511 decimal; see background information on *Downlink scrambling codes below*.

Remote control

```
SOURce:RFGenerator:FREQuency
UNIT:RFGenerator:FREQuency
SOURce:RFGenerator:FOFFSet
SOURce:RFGenerator:SCODe:PRIMary
```

Downlink scrambling codes

Downlink scrambling codes are used to separate different cells and users. According to standard 3GPP TS 25.213, the complex downlink scrambling codes are constructed by combining two real sequences generated by means of two generator polynomials of degree 18. Of these $2^{18} - 1$ scrambling codes, only a subset of 512 primary scrambling codes (numbered n = 16*i where i = 0 to 511) and 15*512 secondary codes (numbered n = 16*i + k where i = 0 to 511 and k = 1 to 15) are used. Hence the total number of primary and secondary codes is 8192.

The 512 primary scrambling codes are further divided into 64 groups, each consisting of 8 codes. The scrambling code group information is transmitted on the S-SCH; see *Fig. 4-65* on p. 4.153.

Each cell is allocated one and only one primary scrambling code. The P-CPICH, P-CCPCH and PICH are always transmitted using the primary scrambling code. The other downlink physical channels in the CMU generator signal can be transmitted with either the primary scrambling code or one of the secondary scrambling codes associated with the primary scrambling code of a cell. The secondary SC of the S-SPICH may be different from the secondary SC of the other channels.

Channel Settings Synchronization Channels

The *Channel Settings* table section defines channel-dependent properties of the RF signal. In the *Synchronization Channels* section, the level of the P-CPICH, the P-SCH and the S-SCH can be set; see *P-CPICH Level abs.* softkey on p. 4.152 and the following softkeys.

The P-CPICH is entered in absolute units (dBm) and is used as a reference for all other (relative) levels. Therefore the P-CPICH must be active in all generator signal configurations.

Remote control

```
SOURce:RFGenerator:SCHannel:LEVel:PCPich
SOURce:RFGenerator:SCHannel:LEVel:PSCH
SOURce:RFGenerator:SCHannel:LEVel:SSCH
SOURce:RFGenerator:PHYSical:Level
```

sets all channel levels except S-CPICH at once (recommended command)

S-CPICH channel settings

The S-CPICH is switched off by default; it is switched on when a S-CPICH level is selected. The S-CPICH is configured with the following additional parameters:

S-CPICH Channel. Code Channelization code (Orthogonal Variable Spreading Code, OVSC) number assigned to the S-CPICH. The S-CPICH is a fixed rate (SF = 256) physical channel with channelization code numbers ranging from 2 to 255. The channelization codes $C_{256,0}$ and $c_{256,1}$ are reserved for the P-CPICH and P-CCPCH, respectively, and can not be assigned. Besides the channelization codes for the PICH, S-CPICH and the DPCH must be compatible; see background information on *PICH/ S-CPICH/DPCH channelization* **codes** on p. 4.161.

S-CPICH Secondary Scrambling Code Number of the secondary scrambling code that is used to scramble the S-CPICH; see background information on *Downlink scrambling codes* on p. 4.158. The scrambling code must be in the range 0 to F (hex). The value 0 means that the primary scrambling code is used for the S-CPICH.

S-CPICH Phase Phase of the S-CPICH in deg relative to the P-CPICH phase. The *DPCH Phase Reference* parameter in the *Dedicated and Broadcast Channels* section can be used to select the S-CPICH as a phase reference for the DPCH.

Remote control

```
SOURce:RFGenerator:SCHannel:LEVel:SCPich
SOURce:RFGenerator:SCHannel:SCPich:CODE
SOURce:RFGenerator:SCHannel:SCPich:SCODe:SECondary
SOURce:RFGenerator:SCHannel:SCPich:PHASe
```

Channel Settings Dedicated & Broadcast Channels

The *Dedicated & Broadcast Channels* section defines the level of the P-CCPCH, the PICH and the DPDCH. The DPCH (including the DPCCH part) can be switched off by unchecking the DPDCH *Enable* box. Besides, the following DPCH settings are provided:

PICH Channel. Code Channelization code (Orthogonal Variable Spreading Code, OVSC) number assigned to the PICH. The PICH is a fixed rate (SF = 256) physical channel with channelization code numbers ranging from 2 to 255. The channelization codes $C_{256,0}$ and $c_{256,1}$ are reserved for the P-CPICH and P-CCPCH, respectively, and can not be assigned. Besides the channelization codes for the PICH and the DPCH must be compatible; see background information on *PICH/ S-CPICH/DPCH channelization codes* on p. 4.161.

DPCH Channel. Code Channelization code (Orthogonal Variable Spreading Code, OVSC) number assigned to the DPCH. The channelization code numbers depend on the spreading factors SF; they range from 0 to SF – 1. The spreading factors are given by the slot format (slot format numbers 0 to 16 for physical channels; see *Table 4-20* on p. 4.165 and slot format depending on the information bit rate for 3GPP reference measurement channels). The channelization codes $C_{256,0}$ and $c_{256,1}$ are reserved for the P-CPICH and P-CCPCH, respectively, and can not be assigned. Besides the channelization codes for the DPCH and the PICH must be compatible; see background information on *PICH/ S-CPICH/DPCH channelization codes* on p. 4.161.

DL DPCH Timing Offset Offset between the DL P-CCPCH timing and the DL DPCH timing. The *DL DPCH Timing Offset* is a multiple of 256 chips (1/10 slot). An additional nominal DL-UL timing offset of 1024 chips (4/10 slots) separates the UL DPCH from the DL DPCH (see standard 3GPP TS 25.211, Chapter 7).

The *DL DPCH Timing Offset* has an impact on the *Frame Trigger* and *Slot Trigger* output signals fed to the AUX 3 connector. Due to the fixed timing relation between the DL DPCH and the UL DPCH this parameter is also relevant for all UL channels including the HS-DPCCH timing and trigger; see section *HS-DPCCH Trigger* on p. 4.187.

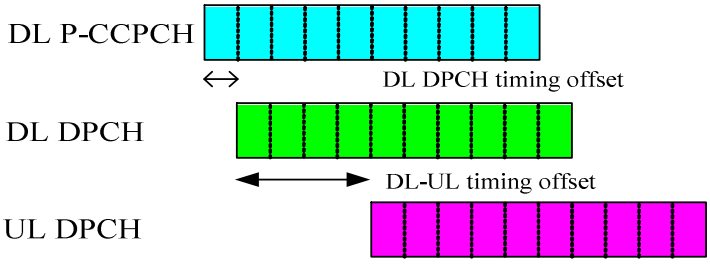


Fig. 4-67 DL DPCH Timing Offset

The timing relationship for all physical channels relative to the P-CCPCH frame timing is described in standard TS 25.211. The following definitions are relevant for HSDPA measurements on the R&S CMU:

- The UL DPCH starts 1024 chips + n * 256 chips after the P-CCPCH. n is the *DL DPCH Timing Offset*.
- The HS-DPCCH is at a fixed ½ slot offset after the P-CCPCH. It is not influenced by the *DL DPCH Timing Offset*.

Power Offset (DPCCH/DPDCH) DPCCH power offset; relative power of the control part of the DPCH compared to the power in the data part (see *DPDCH Level* softkey on p. 4.153).

Secondary Scrambling Code Number of the secondary scrambling code that is used to scramble the DPCH component of the WCDMA signal; see background information on *Downlink scrambling codes* on p. 4.158. The scrambling code must be in the range 0 to F (hex). The value 0 means that the primary scrambling code is used for the DPCH.

DPCH Phase Reference Pilot channel (P-CPICH or S-CPICH) that serves as a phase reference for channel estimation.

Dedicated Channel Mode Configuration of the dedicated channel as a 3GPP downlink (DL) reference channel according to 3GPP TS 25.101, as a 3GPP DCCH (DL SRB according to 3GPP TS 34.108), as a physical channel, or as a *Fractional DPCH* (F-DPCH) for Transmit Power Control (TPC) tests. The parameters of the different channel types are defined in the table sections below. The F-DPCH requires no additional parameters; refer to the background information below.

TFCI State TFCI presence in the 3GPP downlink (DL) reference channel: The Transport Format Combination Indicator

(TFCI) is optional; it may be present *(On)* or omitted *(Off)*. This setting is ignored if the dedicated channel is configured as a physical channel (see *Dedicated Channel Mode* above).

In the *On* state, the TFCI bits of the 3GPP DL reference measurement channel are calculated according to the *TFCI Bits* setting; see below.

In the *Off* state, DTX is used in all TFCI fields. The effect on the total generator output power is neglected (see section *Output Ch. Power*): The output power is always calculated for a continuous signal.

A possible application of the *Off* state is to test the UE blind transport format detection.

Remote control

```
SOURce:RFGenerator:DBCHannel:LEVel:PCCPch
SOURce:RFGenerator:DBCHannel:LEVel:DPDCh
SOURce:RFGenerator:DBCHannel:LEVel:PICH
SOURce:RFGenerator:DBCHannel:PICH:CODE
SOURce:RFGenerator:DBCHannel:DPDCh:CODE
SOURce:RFGenerator:DBCHannel:DPCH:TOFFset
SOURce:RFGenerator:DBCHannel:POFFset <Level>
SOURce:RFGenerator:SCODe:SECondary
SOURce:RFGenerator:DBCHannel:DPCH:PREFerence
SOURce:RFGenerator:DBCHannel:DPDCh:MODE
      PHYS | TGPP | DCCH | FDPC
SOURce:RFGenerator:DBCHannel:TSTate <Enable>
```

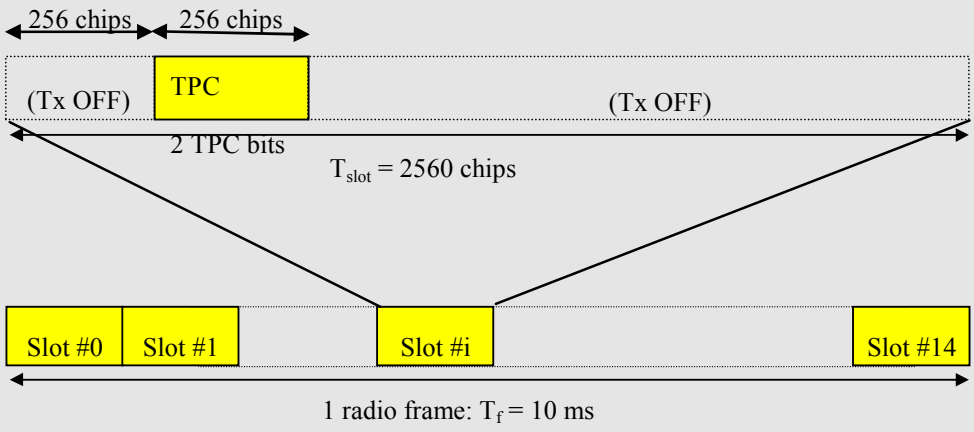
PICH/ S-CPICH/DPCH channelization codes

Channelization codes are used to separate different physical channels of the same carrier frequency, cell and user. They are defined in terms of the spreading factors SF and a code number k ranging from 0 to SF – 1. In the DL signal, a channelization code $c_{SF, k}$ must not be used more than once. Moreover, if a code $c_{m, n}$ is used, the codes $C_{m+1, 2n}$, $c_{m+1, 2n+1}$ are no longer available. The latter rule holds recursively so that a used channelization code with a small spreading factor bars many codes with larger spreading factors.

The spreading factor of the PICH and S-CPICH is always 256 whereas the spreading factors of the DPCH vary between 4 and 512, depending on the slot format (see *Table 4-20* on p. 4.165). When a PICH, S-CPICH or DPCH code number k is selected the R&S CMU checks and possibly auto-corrects the code; see section *Code Conflict Handling for WCDMA DL Generator* on p. 4.167.

Fractional DPCH

The fractional DPCH (F-DPCH) is a special case of a downlink DPCCH carrying TPC information (see standard 3GPP TS 25.211). The F-DPCH is a fixed-rate dedicated channel (SF = 256). Each F-DPCH slot is subdivided into 10 256-chip periods. The second 256-chip period is used to transmit 2 TPC bits; during the remainder of the slot, the TX power is switched off. The time offset of the F-DPCH relative to the P-CCPCH is UE-specific, which allows to superimpose several F-DPCHs in order to allocate TPC information to up to 10 different UEs using a single, time-multiplexed code channel. All other data (including higher-layer signalling) is transmitted on the HSDPA channels.



If the *Dedicated Channel Mode* is set to *Fractional DPCH,* the R&S CMU generates an F-DPCH with the following properties:

- The F-DPCH slot starts n * 256 chips after the start of the P-CCPCH where n is the *DL DPCH Timing Offset.* The R&S CMU transmits the TPC bit sequence selected in the *TPC Settings* section of the *Generator* tab.
- The F-DPCH level during TPC transmission is equal to the DPCCH level, i.e.
  $p_{F\text{-}DPCH} = p_{DPDCH}$ + *power offset (DPCCH / DPDCH)*
  Switching the DPCH off also eliminates the F-DPCH.
- The F-DPCH uses the DPCH channelization and scrambling codes.

Channel Settings 3GPP DL Reference Channel

The *3GPP DL Reference Channel* section configures the 3GPP reference channel. According to 3GPP TS 25.101, the data content of the *3GPP DL Reference Channel* is defined on transport channel level. The data sequence to be transferred is directly fed into the Dedicated Traffic Channel (DTCH) and Dedicated Control Channel (DCCH). The transport channels are channel coded, multiplexed and mapped onto a Dedicated Physical Channel (DPCH) with variable data rate; see Fig. 4-68 below.

The downlink reference measurement channel generated in this way is to be used for various transmitter and receiver tests specified in standard 3GPP TS 25.101. The channel settings apply if the *Dedicated Channel Mode* parameter is set to *3GPP Reference*.

Reference Channel Type — Information bit rate of the reference channel (12.2 kbps, 64 kbps, 144 kbps, or 384 kbps). The information bit rate determines various physical and transport channel parameters of the reference channel. An example (12.2 kbps) is given in Table 4-18 and Table 4-19 below.

Channel Data Source DTCH — Bit pattern transmitted as user information on the DTCH: Bit sequence consisting of zeros *(All 0)*, ones *(All 1)* 010101... *(Alternating)*, or pseudo-random bit sequences of variable length *(PRBS9, PRBS11, PRBS13, PRBS15).*

Channel Data Source DCCH — Fixed *All 0* bit pattern transmitted on the DCCH.

TFCI Value — Code number between 0 and 3 for the TFCI bit sequence. The TFCI labels four different configurations of the standard 3GPP DL reference measurement channel; see background information below.

The Transport Format Indicator (TFI) is a label for a specific transport format of a transport channel (TrCH). If several TrCHs are multiplexed in one transport bearer, each of them carries its own TFI defining the number and size of transport blocks in the TrCH.

The 3GPP DL reference measurement channel contains two TrCHs, one of them carrying the DTCH, the other carrying the DCCH (see Fig. 4-68 below). Both channels can be configured either with the transport block size defined in the standard (see Table 4-19 below) or as an empty channel with transport block size 0[1] according to standard 3GPP TS 25.331. The four possible combinations translate into a TFCI range between 0 and 3.

The CMU assigns the TFCI values as listed in Table 4-17 below. TFCI = 3 identifies the standard 3GPP DL reference measurement channel with no empty transport channels. Note that, in *Non Signalling* mode, *Receiver Quality* measurements can be performed for all 3GPP DL measurement channel (RMC) configurations with non-empty DTCHs.

Remote control
`SOURce:RFGenerator:RCHannel...`

Table 4-17 TFCI assignment in the CMU

TFCI (FW Vers. <V4.10)	TFCI (FW Vers. ≥V4.10)	DL RFC	Receiver Quality Measurement
2	0	Empty TrCH	No
0	1	DCCH only	No
1	2	DTCH only	Yes
3	3	DTCH + DCCH	Yes

The following example illustrates the generation of a 3GPP reference measurement channel from the DTCH and DCCH transport channels and the parameters for an information bit rate of 12.2 kbps. For other bit rates refer to standard 3GPP TS 25.101.

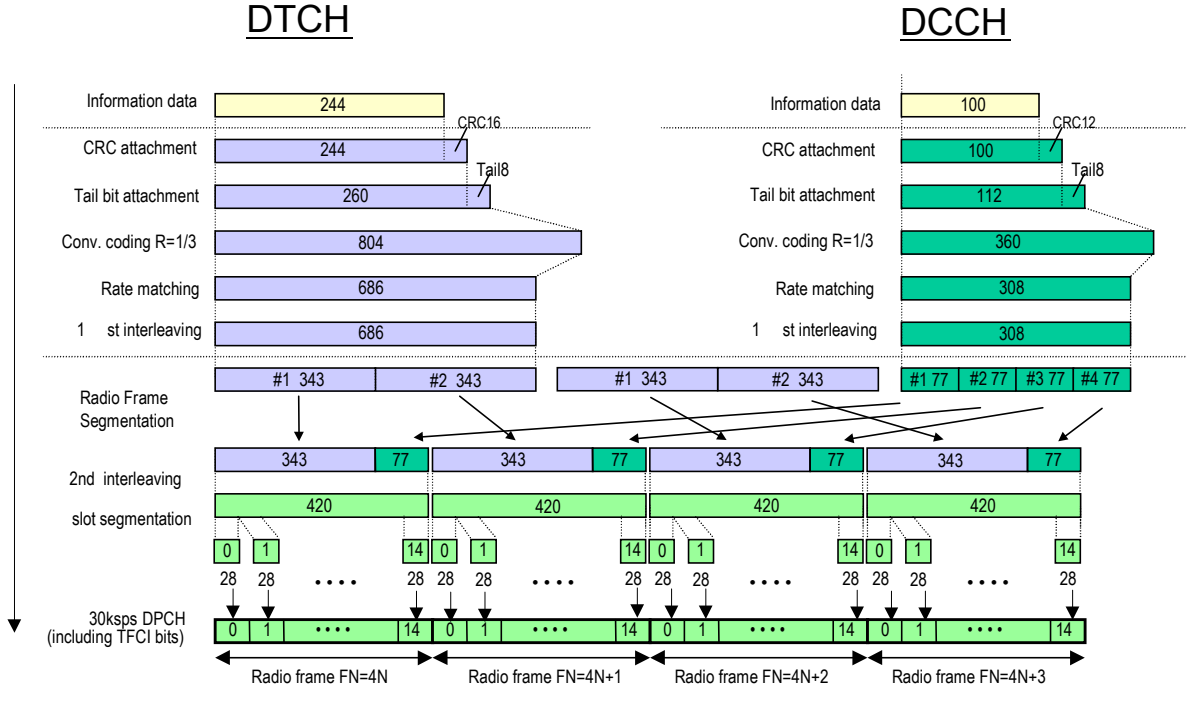


Fig. 4-68 Channel coding of DL reference measurement channel (12.2 kbps)

1 To generate an empty channel, the CMU replaces the data bits in the transport block by DTX bits (discontinuous transmission). These empty data blocks are channel coded according to the standard scheme of Fig. 4-68.

Table 4-18 DL reference measurement channel, physical parameters (12.2 kbps)

Parameter	Level	Unit
Information bit rate	12.2	kbps
DPCH	30	ksps
Slot Format #i	11	-
TFCI	On	-
Power offsets PO1, PO2 and PO3	0	dB
Puncturing	14.7	%

Table 4-19 DL reference measurement channel, transport channel parameters (12.2 kbps)

Parameter	DTCH	DCCH
Transport Channel Number	1	2
Transport Block Size	244	100
Transport Block Set Size	244	100
Transmission Time Interval	20 ms	40 ms
Type of Error Protection	Convolutional Coding	Convolutional Coding
Coding Rate	1/3	1/3
Rate Matching attribute	256	256
Size of CRC	16	12
Position of TrCH in radio frame	fixed	fixed

Channel Settings DL Physical Channel

The *DL Physical Channel* section defines the properties of the physical channel. The *DL Physical Channel* is defined in terms of its slot format. The data sequence to be transferred is fed into the data fields of the DPDCH without channel coding. The DPDCH is time-multiplexed with the DPCCH according to standard 3GPP TS 25.211. If any TFCI bits are used (see *TFCI* on p. 4.160), all of them are set to 0. The channel settings apply if the *Dedicated Channel Mode* parameter is set to *Physical*.

Slot Format Slot format number determining the properties of the DL physical channel. The CMU supports all slot formats 0 to 16; the corresponding channel parameters are listed in *Table 4-20 below*.

Data Source Bit pattern transmitted as user information on the DPDCH: Bit sequence consisting of zeros *(All 0)*, ones *(All 1)* 010101... *(Alternating)*, or pseudo-random bit sequences of variable length *(PRBS9, PRBS11, PRBS13, PRBS15)*.

Remote control
`SOURce:RFGenerator:PCHannel...`

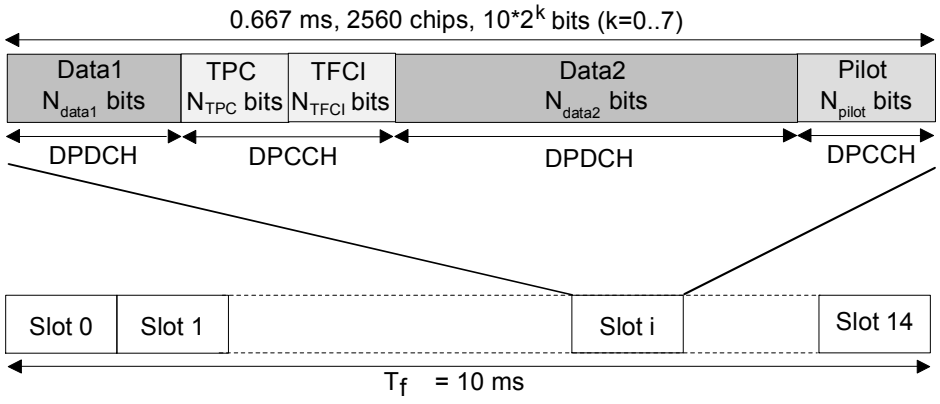


Fig. 4-69 Structure of an downlink DPCH in time domain

DPCCH Dedicated Physical Control Channel
DPDCH Dedicated Physical Data Channel
TFCI Transport Format Combination Indicator
TPC Transmit Power Control

Table 4-20 Downlink DPDCH and DPCCH slot formats

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Slot	DPDCH Bits/Slot		DPCCH Bits/Slot			Transmitted slots per radio frame N_{Tr}
					N_{Data1}	N_{Data2}	N_{TPC}	N_{TFCI}	N_{Pilot}	
0	15	7.5	512	10	0	4	2	0	4	15
1	15	7.5	512	10	0	2	2	2	4	15
2	30	15	256	20	2	14	2	0	2	15
3	30	15	256	20	2	12	2	2	2	15
4	30	15	256	20	2	12	2	0	4	15
5	30	15	256	20	2	10	2	2	4	15
6	30	15	256	20	2	8	2	0	8	15
7	30	15	256	20	2	6	2	2	8	15
8	60	30	128	40	6	28	2	0	4	15
9	60	30	128	40	6	26	2	2	4	15
10	60	30	128	40	6	24	2	0	8	15
11	60	30	128	40	6	22	2	2	8	15
12	120	60	64	80	12	48	4	8	8	15
13	240	120	32	160	28	112	4	8	8	15
14	480	240	16	320	56	232	8	8	16	15
15	960	480	8	640	120	488	8	8	16	15
16	1920	960	4	1280	248	1000	8	8	16	15

If TFCI bits are not used, the CMU always uses DTX in the TFCI field.

Channel Settings 3GPP DL DCCH Channel

The *3GPP DL DCCH Channel* section defines the properties of the DL DCCH, i.e. the DL SRB according to 3GPP TS 34.108. The *3GPP DL DCCH* is defined in terms of its data rate; see Table 4-21 below. The DPCH timing is equal to the P-CCPCH frame timing, i.e. the parameters τ_{DPCH} equal to zero for all DPCHs. The channel settings apply if the *Dedicated Channel Mode* parameter is set to *3GPP DCCH*.

The main purpose of the 3GPP DL DCCH is to be used in combination with the downlink HSDPA channels and perform HSDPA receiver tests; see Chapter 8.

DCCH Channel Type Data rate determining the properties of the 3GPP DL DCCH; see Table 4-21 below. The 3GPP DL DCCHs are termed DL SRBs in standard 3GPP TS 34.108. The CMU supports the 1.7 kbps, 3.4 kbps, and 13.6 kbps DCCHs described in the standard. Besides, a 2.4 kbps DCCH can be configured in analogy to the 3GPP reference measurement channel.

TFCI Value Code number 0 or 1 for the TFCI bit sequence. 0 means that an empty channel with transport block size 0 is generated; 1 means that the predefined DCCH sequence (a fixed all 0 pattern) is transmitted. If *None* is set, then no TFCI bits are sent; the UE must rely on blind transport format detection.

The TFCI has an impact on the generated slot format; see Table 4-21 below.

Remote control
```
SOURce:RFGenerator:DCCH:TYPE
SOURce:RFGenerator:DCCH:TVALue
DEFault:RFGenerator:DCCH
```

Table 4-21 3GPP downlink DCCH parameters

	SRB 1.7	**SRB 2.5 (used with RMC)**	**SRB 3.4**	**SRB 13.6**
Slot Format	1 (TFCI = 0, 1) 0 (TFCI = None)	7 (TFCI = 0, 1) 6 (TFCI = None)	5 (TFCI = 0, 1) 4 (TFCI = None)	9 (TFCI = 0, 1) 8 (TFCI = None)
No. of Transport Channels	1	1	1	1
Coding Type	Convolutional, Rate 1/3	Convolutional, Rate 1/3	Convolutional, Rate 1/3	Convolutional, Rate 1/3
Rate Matching Attribute	155	256	155	155
CRC Size	16 bits	12 bits	16 bits	16 bits
TTI	80 ms	40 ms	40 ms	10 ms
TFS (TFCI = 0, TFCI = 1)	0 x 148 bits, 1 x 148 bits	0 x 100 bits, 1 x 100 bits	0 x 148 bits, 1 x 148 bits	0 x 148 bits, 1 x 148 bits

TPC Settings

The *TPC Settings* section defines the inner loop Transmit Power Control (TPC) information transmitted on the DPCH. The TPC settings are largely identical to the TPC settings in Signalling mode described on p. 4.247.

Note the following differences between Non Signalling and Signalling mode:

- In Non Signalling mode, the *TPC Algorithm* and the *TPC Step Size* is not signalled to the UE under test, however, it should be set in accordance with the actual UE configuration. Correct TPC algorithm and step size settings are particularly important in closed loop mode where the R&S CMU must calculate a TPC pattern in order to command the UE to a specified target power. The TPC algorithm and step size is also used for the *Inner Loop TPC* measurement, so that incorrect settings will cause misleading limit check results.

- The *UL Target Power* for *TPC Pattern Type: Closed Loop* can be set in the *Generator – TPC Settings* section or in the *UE Code* tab of the *Connection Control menu.*

Note: ***Variable input power***

If the CMU measures the uplink signal of an UE transmitter that is stimulated to change its output power (e.g. in an Inner Loop TPC *measurement), the input path configuration, in particular the* Max. Level *setting (see section Analyzer Settings (Connection Control – Analyzer) on p. 4.143), must be adapted to the expected maximum power. The R&S CMU can do this automatically (autoranging). The transmitter output power must be compatible with the input level range of the CMU input connectors.*

Generator restrictions for closed loop uplink power control

In remote control the WCDMA DL generator can be used while the R&S CMU performs measurements in a function group other than WCDMA Non Signalling. While closed loop uplink power control is active, the RF analyzer must be constantly available to measure the UL WCDMA power. To avoid a resource conflict with the other measurements, the R&S CMU behaves in accordance with the *Task Priority Management* setting in the base system (Setup – Remote; see R&S CMU 200/300 operating manual):

- If *Task Priority Management* is enabled (releasable measurements and generators), the WCDMA generator is switched off when another function group is activated and vice versa.
- If *Task Priority Management* is disabled (persistent measurements and generators), the WCDMA generator must be switched off explicitly when another function group is activated and vice versa.

No restrictions arise in manual control where the WCDMA generator is simply suspended while another measurement is performed. The described behavior also applies to other generator settings which depend on the RF analyzer, e.g. a HSDPA signal with *Follow UL CQI* setting (see Chapter 8).

Remote control

```
DEFault:RFGenerator:TPC ON | OFF
SOURce:RFGenerator:TPC:SSIZe
SOURce:RFGenerator:TPC:MODE
SOURce:RFGenerator:TPC:PSET<nr>
SOURce:RFGenerator:TPC:PCONditions
SOURce:RFGenerator:TPC:PTYPe<nr>
SOURce:RFGenerator:TPC:PATTern<nr>
SOURce:RFGenerator:TPC:RPATtern
SOURce:RFGenerator:TPC:CURRent? <Setup>, <Type>, <Pattern>
```

Code Conflict Handling for WCDMA DL Generator

To avoid inconsistent DL generator settings, the R&S CMU checks – and possibly auto-corrects – the channelization codes for the physical channels in the WCDMA DL signal. Code Conflict Handling (CCH) is applied to the following channels:

Non Signalling:	P-CPICH	S-CPICH	P-CCPCH	PICH	DPCH
	HS-SCCH	HS-DSCH	E-AGCH	E-RGCH	E-HICH
Signalling:	All *Non Signalling* channels plus:		AICH	S-CCPCH	

provided that the following conditions are fulfilled:

- The channel is turned on
- The channel uses the primary scrambling code (for channels which use a secondary scrambling code other than the primary scrambling code no CCH is done)

A channel fulfilling both conditions is said to be *active for CCH*. The effects of CCH depend on the physical channel type; see table below.

Automatic correction of the channelization codes requires the RF generator/BS Signal to be switched on. When the generator is switched from OFF to ON, a notice box is displayed in case of a code conflict (no automatic correction).

Table 4-22 Code Conflict Handling for physical DL channels

Channel type	Properties	Effects of CCH
P-CPICH	Reserved (fixed) channelization code $c_{256, 0}$	No other channel can block the reserved channelization code.
S-CPICH	Fixed-rate code $c_{256, 2}$ to $c_{256, 255}$	Automatic correction if the channel is active for CCH and if the code is set to an inconsistent value. **Exceptions:** No auto-correction (notice box only) if a previously inactive channel becomes active for CCH.
P-CCPCH	Reserved (fixed) channelization code $c_{256, 1}$	No other channel can block the reserved channelization code.
PICH	Fixed-rate code $c_{256, 2}$ to $c_{256, 255}$	Always active for CCH. Automatic correction if the code is set to an inconsistent value.
DPCH	Variable spreading factor and code	Automatic correction if the channel is active for CCH and if the code is set to an inconsistent value. **Exceptions:** No auto-correction (notice box only) if the spreading factor is changed or if a previously inactive channel becomes active for CCH.
HS-SCCH	Fixed rate code $c_{128, 1}$ to $c_{128, 127}$	Automatic correction if the channel is active for CCH and if the code is set to an inconsistent value. **Exceptions:** No auto-correction (notice box only) if a previously inactive channel becomes active for CCH.
HS-PDSCH	Fixed rate code $c_{16, 1}$ to $c_{16, 15}$	Automatic correction if the channel is active for CCH and if the first used code is set to an inconsistent value. **Exceptions:** No auto-correction (notice box only) if the number of channelization codes changes or if a previously inactive channel becomes active for CCH.
E-AGCH	Fixed-rate code $c_{256, 2}$ to $c_{256, 255}$	Automatic correction if the channel is active for CCH and if the code is set to an inconsistent value. **Exceptions:** No auto-correction (notice box only) if a previously inactive channel becomes active for CCH.
E-RGCH / E-HICH	Fixed rate code $c_{128, 1}$ to $c_{128, 127}$	Automatic correction if the channel is active for CCH and if the code is set to an inconsistent value. **Exceptions:** No auto-correction (notice box only) if a previously inactive channel becomes active for CCH. **Note:** The R&S CMU also ensures that the E-RGCH and E-HICH signatures are different from each other (signature conflict handling).
OCNS	Fixed rate code $c_{128, 2}$, $c_{128, 11}$, …, $c_{128, 119}$	No auto-correction (notice box only) if the OCNS is turned on, causing a code conflict with any other channel.

Channel type	Properties	Effects of CCH
Additional Signalling Channels		
AICH	Fixed-rate code $c_{256, 2}$ to $c_{256, 255}$	Always active for CCH. Automatic correction if the code is set to an inconsistent value.
S-CCPCH	Variable spreading factor and code	Always active for CCH. Automatic correction if the code is set to an inconsistent value.

Automatic correction

In case of an automatic correction a message box indicating *Value within an undefined interval. Input will be corrected.* is displayed. If no free channel for automatic correction is available, the channelization code remains unchanged, and a notice box indicating the code conflict is displayed.

CCH in remote control

If a channel is active for CCH and its channelization code is changed by remote control, the R&S CMU checks for a code conflict but does not perform an automatic correction. The reason for the code conflict can be read using `SYST:ERR?`

Example: Error message in case of a PICH code conflict

```
Setting conflict; PICH code conflict -
VALUE CURRENTLY NOT CHANGEABLE
```

There is no error indication if a code conflict occurs after switching a channel on. Thus for checking for code conflicts, the channelization code should be set again after the channel is switched on. The same applies for changing the scrambling code of a channel or switching the generator on.

Aux TX Signal

With option CMU-B96, *Additional RF Generator,* two additional RF generator signals are available in *Non Signalling* mode:

1. The low-level signal *Aux TX* with a level range equal to the normal RF generator *(TX)* signal.
2. The *Aux TX Over Range* signal providing higher signal levels.

Only one RF generator signal can be active at any one time. The output connectors and external attenuation values for the three signals can be selected independently. The same holds for the levels. The frequencies/RF channels of the two Aux TX signals must be equal, however, they can be different from the TX frequency. The remaining *RF Generator* settings are valid for all three signals.

To activate and configure the *Aux TX* or *Aux TX Over Range* signal proceed as follows:

1. In the *Generator* tab of the *Connection Control* menu, select *Transmitter: Aux Tx* or *Transmitter: Aux Tx Over Range*.
2. In the *Generator Level* and *Generator Settings* sections, adjust the *Output Chan. Power* and the *Frequency* or *Channel* of the generated signal.
3. Open the *RF* ⊶ tab of the *Connection Control* menu and select the output connectors and external attenuation factors for the generated signal.

The Aux TX signals can be used for all TX and RX *Non Signalling* tests. *TX* and *Aux TX* can be used as two independent signals with predefined settings; *Aux TX Over Range* represents an additional high-level signal.

Signal Configuration

The Aux TX signals are configured in the *Generator* tab of the *Connection Control* menu.

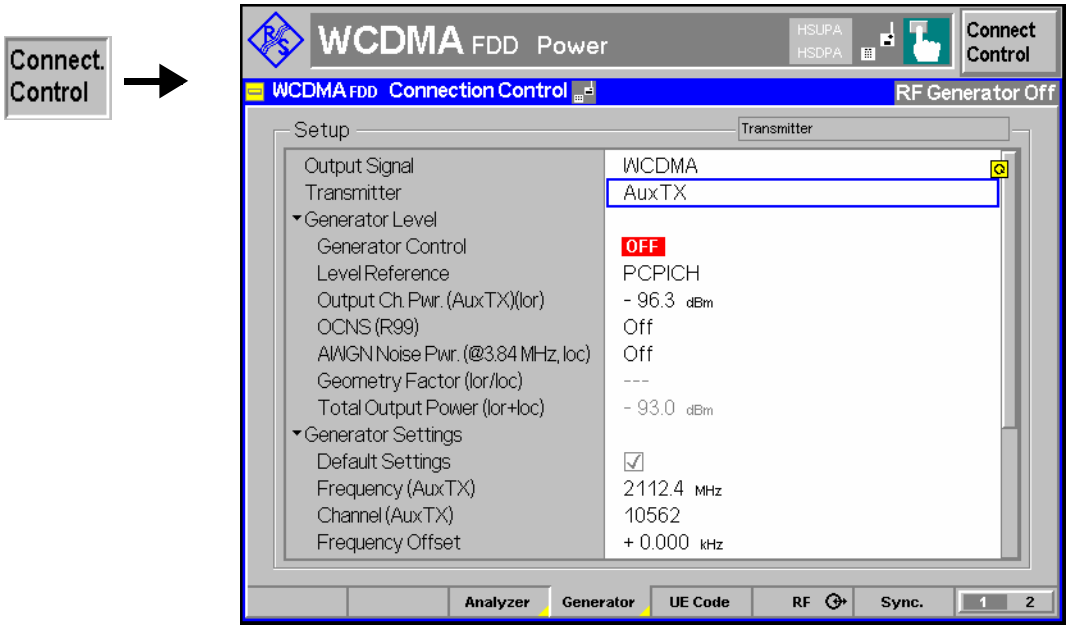


Fig. 4-70 Connection Control – RF generator settings (table)

Transmitter Selects one of the following RF signal sources: .

TX, Aux TX Normal TX or Aux TX signal. The level of both signals can be set in 0.1-dB steps.

Aux TX Over Range Overrange signal for higher levels, to be set in 1-dB steps. The level accuracy of the over range signal is quoted in the data sheet.

Refer to the remote control description for the output level ranges of all signals.

Remote Control
`SOURce:RFGenerator:TRANsmitter TX | AUXTx | OAUXtx`

Output Chan. Power Defines the total level of the generated RF signals in dBm. The value range depends on the selected RF output (RF 1, RF 2 or RF 3 OUT) and on the signal type (see *Transmitter* above).

Remote control
`SOURce:RFGenerator:OPOWer <Level>` (depending on transmitter selection)

Frequency *Frequency* defines the frequency of the generated RF signals.

Note: *The frequency of the two Aux Tx signals must be equal. It is restriced to several distinct ranges.*

Remote control
`SOURce:RFGenerator:FREQuency <Frequency>`
`SOURCe:RFGenerator:AUXTx:FREQuency <Frequency>`
(for Aux TX **and** Aux TX Over Range signal)

RF Connector Settings

The output connectors for the AuxTx signals and the external attenuations are selected in the *RF* ⊶ tab of the *Connection Control* menu. The tab always corresponds to the active RF signal type *(Generator – Transmitter: TX* or *Aux TX* or *Aux TX Over Range).*

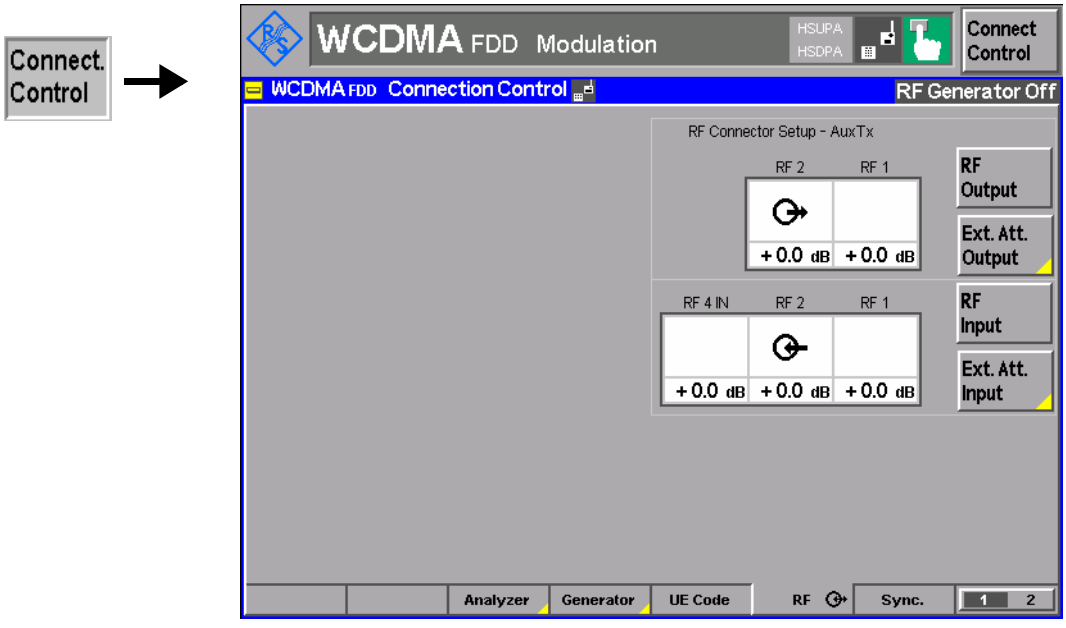


Fig. 4-71 Connection Control – RF inputs/outputs

RF Output

The *RF Output* softkey selects the output connector for the active signal. *Aux Tx* must be output at RF1 or RF2; the *TX* and *Aux TX Over Range* signals can be fed to RF1, RF2, or RF3 OUT.

Remote control

```
OUTPut[:STATe] RF1 | RF2 | RF3
OUTPut:AUXTx[:STATe] RF1 | RF2
OUTPut:AUXTx:OLEVel[:STATe] RF1 | RF2 | RF3
```

Ext. Att. Output

The softkey *Ext. Att. Output* defines an external attenuation (or gain, if the value is negative) at the selected RF output.

Independent external attenuation factors can be assigned to the *TX, Aux TX,* and *Aux TX Over Range* signals.

Remote control

```
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]
SOURce:CORRection:LOSS:OUTPut<nr>:AUXTx[:MAGNitude]
SOURce:CORRection:LOSS:OUTPut<nr>:AUXTx:OLEVel[:MAGNitude]
```

Uplink Signal (Connection Control – UE Code)

The *UE Code* tab defines the properties of the uplink WCDMA signal that the CMU is able to analyze and configures the measurement. This includes the setting of:

- The *Chip Rate* of the WCDMA signal
- Inclusion of a possible origin offset in the measurement results *(Analysis Mode)*

- The properties of the Dedicated Physical Channel *(DPCH WCDMA Settings)*
- The properties of the Dedicated Physical Data Channel *(DPDCH Settings)*
- The *UL Target Power* for closed loop TPC tests

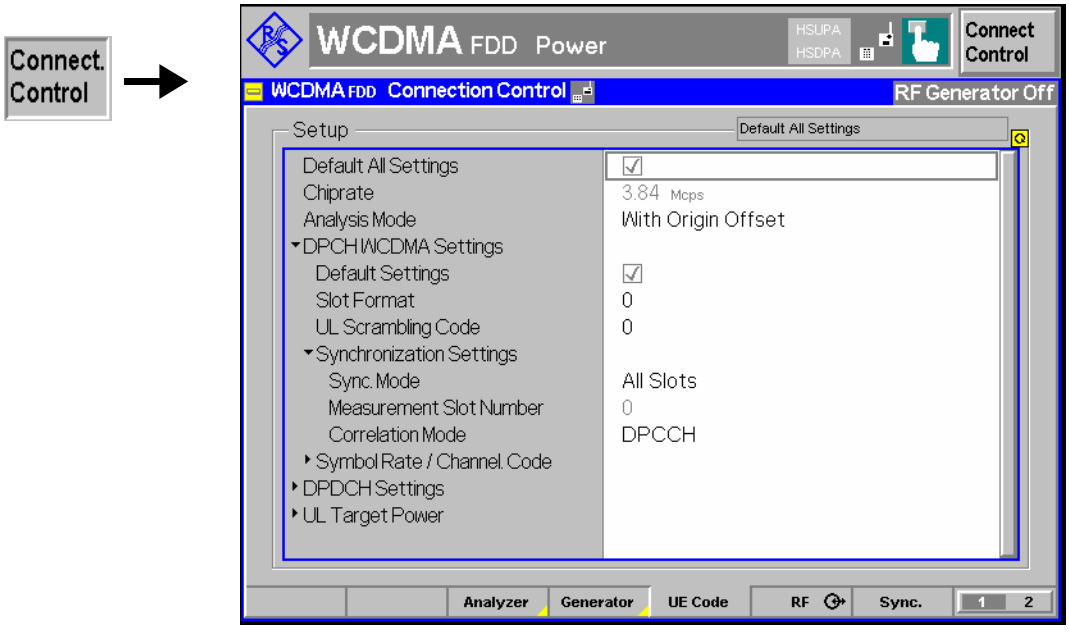


Fig. 4-72 Connection Control – RF connectors

Default Settings The *Default All Settings* switch assigns default values to all settings in the *UE Code* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual channel types are provided.

Remote control
`DEFault:UECode:DPCH ON | OFF` etc.

Chip rate The *Chip rate* field indicates the fixed chip rate of the analyzed WCDMA signal (3.84 Mcps).
Remote control
No command, indicated constant value only.

Analysis Mode The *Analysis Mode* parameter selects whether a possible origin offset is included in the measurement results or subtracted out. The analysis mode has an impact on most of the parameters determined in a *Modulation* measurement and on the modulation (EVM) results indicated in the *Code Domain Power* menus.

With Origin Offset The modulation vectors R and Z in Fig. 4-12 are measured from the origin of the I/Q plane, so the results for the *EVM*, *Phase Error* and *Magnitude Error* include a possible origin offset. This mode conforms to 3GPP specifications,

Without Origin Offset The modulation vectors R and Z in Fig. 4-12 are measured from the coordinates of the I/Q offset vector, so the origin offset is subtracted out in the *EVM*, *Phase Error* and *Magnitude Error* results.

Note: *The* I/Q Imbalance *is always calculated without origin offset regardless of the* Analysis Mode *set (see Fig. 4-13). Conversely, the* Waveform Quality*, the* Peak Code Domain Error*,* Code Domain Power (CDP) *and* CDP Rho *are always calculated with origin offset.*

Remote control
`CONFigure:UECode:AMODe WOOFfset | WIOFfset`

DPCH WCDMA Settings

The *DPCH WCDMA Settings* table section configures the uplink Dedicated Physical Channel (DPCH) and the conditions for the *WCDMA Modulation* measurement described on p. 4.56 and for *Code Domain Power* measurement described on p. 4.98 The DPCH is a traffic channel for transmission of voice or user data consisting of multiple parallel (code and I/Q-multiplexed) variable rate services (one DPCCH plus up to 6 DPDCHs; see Fig. 4-15). If only one DPDCH is allocated, it has the following structure:

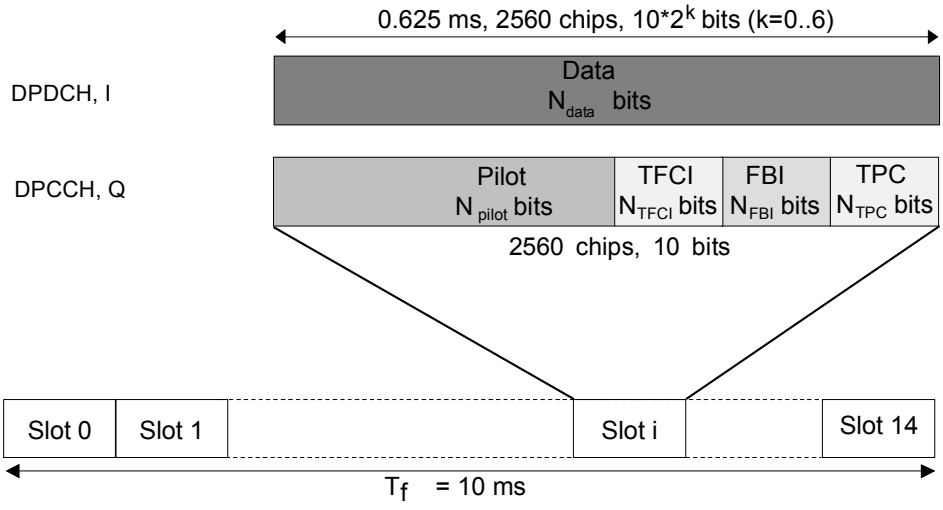


Fig. 4-73 Structure of an uplink DPCH in time domain

DPCCH	Dedicated Physical Control Channel
DPDCH	Dedicated Physical Data Channel
TFCI	Transport Format Combination Indicator
FBI	Feedback Information
TPC	Transmit Power Control
Pilot	Pilot Symbols

Slot Format

Uplink DPCCH slot format in the range between 0 and 5. The slot format defines the length of the individual data fields in the DPCCH; see Table 4-23 below.

NOTE

All TX measurements can be performed with arbitrary UL slot formats, including the slot formats with variable transport format (1, 3, 4). For Receiver Quality measurements the R&S CMU requires an UL slot format 0 as specified in the standard. Slot format 0 is also recommended for HSDPA tests; see Chapter 8.

Table 4-23 Uplink DPCCH slot formats

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Slot	N_{Pilot}	N_{TPC}	N_{TFCI}	N_{FBI}	Transmitted slots per radio frame
0	15	15	256	15	6	2	2	0	15
1	15	15	256	15	8	2	0	0	8 to 15
2	15	15	256	15	5	2	2	1	15

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Slot	N_{Pilot}	N_{TPC}	N_{TFCI}	N_{FBI}	Transmitted slots per radio frame
3	15	15	256	15	7	2	0	1	8 to 15
4	15	15	256	15	6	2	0	2	8 to 15
5	15	15	256	15	5	1	2	2	15

Scrambling Code Number of the long code that is used to scramble the uplink WCDMA signal; see Fig. 4-15. The scrambling code number must be in the range 0 to FFFFFF (hex) corresponding to 0 to 16777215 decimal.

Sync. Mode Method that the CMU uses to synchronize to the captured (channel coded and scrambled) uplink WCDMA signal and analyze the slot number.

In the *All Slots* mode, the measured slot number is random ($0 \leq$ meas. slot number ≤ 14). The CMU performs a correlation analysis of the captured signal to detect the start of the slot and then deduces the slot number from the pilot bits. The detected slot number is displayed in the *WCDMA Modulation* and *Code Domain Power* measurement menus and generally varies from one measurement cycle to another.

In the *Synchronous* mode, the measurement is performed under the assumption that the slot number of the captured signal is as specified by *Measurement Slot Number;* see below. The beginning of the slot is searched in a symmetric time range around the specified point, which is given by the trigger time plus the defined trigger delay plus the *Measurement Slot Number* (see *Fig. 4-74 below*). The search range covers ±380 chip periods from the specified point and is thus much smaller than that of the *All Slots* mode so that the *Synchronous* measurement is faster. The trigger must be set as explained below.

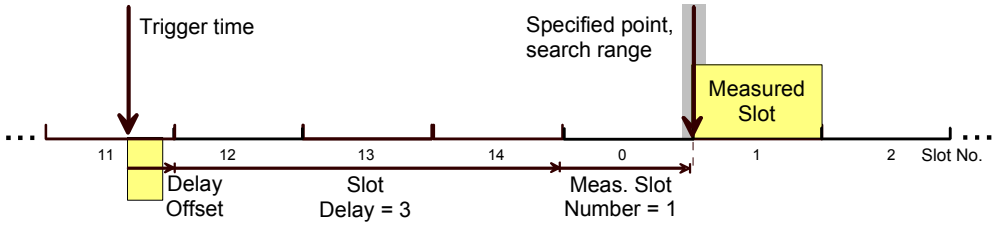


Fig. 4-74 Measured slot in Synchronous mode

Trigger settings in *Synchronized* mode:

In the *Synchronized* mode the beginning of the measured slot can be detected only if it is inside the search range around the specified point (see *Fig. 4-74 above*). Furthermore, the slot must be in accordance to the *Measurement Slot Number* settings. This implies that the CMU must be configured as follows:

- Select *External* trigger with a frame-periodic trigger signal or *Internal* trigger (see trigger settings on p. 4.184; *Synchronous* mode with *Free Run* trigger is not possible).
- Use the trigger delay parameters to compensate for a delay between the trigger time and the beginning of the next uplink frame. If the delay amounts to n integer slots plus approx. k chip periods, then select *Slot Delay = n* and *Delay Off-*

set = k. The corrected trigger time approximately coincides with the beginning of the frame (frame trigger).

The CMU will detect the start of the measured slot and perform measurements for arbitrary *Measurement Slot Number* settings. If the trigger time is not correctly set, the CMU is unable to synchronize to the UL WCDMA signal and generates an error message *Scrambling code or slot format does not match input signal.*

Meas. Slot Number Slot number to be measured in the range 0 to 14. The CMU expects this slot to be captured if *Sync. Mode* is set to *Synchronous*. The *Meas. Slot Number* is displayed in the *WCDMA Modulation* and *Code Domain Power* measurement menus. In the *All Slots* mode, the *Measured Slot Number* is ignored.

Correlation Mode Defines which DPCH contributions are used for the correlation analysis. The *DPCCH + DPDCH* mode improves the reception of the UE signal, especially if a large frequency offset occurs or if the DPCCH level is much smaller than the DPDCH level. On the other hand the DPCCH mode accelerates the measurement.

Symbol Rate/Channel. Code DPCCH
Indication of the fixed symbol rate of 15 ksps and the fixed channelization code 0 of the Dedicated Physical Control Channel; see explanation of channelization codes in section *Measurement Menu (Modulation WCDMA)* on p. 4.56. The symbol rate and channelization code settings are ignored if the *DPDCH CC Mode* in the *Modulation* menu is set to *Auto* and in the *CDP ... Auto* applications.

Note: *An error message* Scrambling code or slot format does not match input signal. *is displayed if the CMU is unable to correctly detect the beginning of a slot because the analyzed signal does not conform to the* Scrambling Code *or the* Slot Format *set. At the same time bit no. 13 in the* `STATus:OPERation:CMU:SUM1|2:CMU<nr>` *sub-register is set.*

Remote control
```
CONFigure:UECode:DPCH:SFORmat <Number>
CONFigure:UECode:DPCH:SCODe <Code>
CONFigure:UECode:DPCH:CMODe <Mode>
CONFigure:UECode:DPCH:SYMode <Mode>
```

DPDCH Settings The *DPDCH Settings* table section configures the Dedicated Physical Data Channels (DPDCH) that contribute to the multiple WCDMA signal; see section *Measurement Menu (Modulation WCDMA)* on p. 4.56.

Release 6 Channel coding of the uplink signal according to 3GPP release 6 or release 99. The parameter is effective for DPCH/HSDPA uplink signal configurations without HSUPA channels: If *Release 6* is selected, the DPDCH channel coding is assumed to comply with release 6, otherwise with release 99. In the presence of HSUPA channels, the parameter is ignored (the R&S CMU always assumes channel coding according to release 6).

Auto Settings: The *Auto Settings* section defines the conditions of the channelization code search that is activated by setting the *DPDCH CC Mode* in the *Modulation* menu to *Auto* or by activating one of the *CDP ... Auto* applications. The *Auto Settings* are ignored if *DPDCH CC Mode* is set to *Manual* or in the *CDP ...*

Manual applications.

DPDCH Symbol Rate Symbol rate of the DPDCH. The CMU analyzes the WCDMA signal assuming it to have the specified symbol rate and derives its channelization codes according to the specified properties; see section *Measurement Menu (Modulation WCDMA)* on p. 4.56.

Threshold Minimum signal strength of each $DPDCH_n$ in the WCDMA signal to be detected in the automatic channelization code search. The threshold is defined as a ratio of the individual $DPDCH_n$ to the DPCCH and expressed in dB. If $DPDCH_n$/DPCCH < Threshold, $DPDCH_n$ is not detected.

The power threshold is important to distinguish the DPDCH from unwanted signals, e.g. noise or non-orthogonal components that may be detected as fictitious DPDCHs. A low threshold value represents a weaker selection criterion and increases the risk of detecting unwanted signals. On the other hand a high threshold may prevent the real DPDCH signals from being detected and cause a failure of the channelization code search.

Manual Settings: The *Manual Settings* section defines the properties of the multiple WCDMA signal that can be analyzed if the *DPDCH CC Mode* in the *Modulation* menu is set to *Manual* or if one of the *CDP ... Manual* applications is active. The *Manual Settings* are ignored if *DPDCH CC Mode* is set to *Auto* or in the *CDP ... Auto* applications.

Multiple Signal Selection of the code channels (physical channels) that contribute to the multiple uplink WCDMA signal. In the *DPCCH* setting, the signal consists of one single Dedicated Physical Control Channel. In the *DPCCH + DPDCH1,...,n* setting, the signal consists of one DPCCH to which n Dedicated Physical Data Channels are added. n can vary between 1 and 6 so that it is possible to superimpose up to 7 signals as shown in Fig. 4-15.

Symb. Rate/C. Code Channel. Table of the symbol rate and channelization code for each of the six CPDCHs that can contribute to the multiple WCDMA signal. If a *DPCCH+DPDCH1* multiple signal is analyzed, the symbol rate of the data channel *DPDCH1* can be set; the channelization code will be automatically adapted according to the rules in the 3GPP standard. For other multiple signal configurations, symbol rates and channelization codes are fixed.

Remote control

```
CONFigure:UECode:DPDCh:REL6
CONFigure:UECode:DPDCh:AUTO:SRATe <Rate>
CONFigure:UECode:DPDCh:AUTO:THReshold <THReshold>
CONFigure:UECode:DPDCh:MANual:MSIGnal <Channels>
CONFigure:UECode:DPDCh:MANual:DPDCh1:SRCCode <Channels>
```

UL Target Power The *UL Target Power* defines the target power for closed loop TPC tests. The values are used if the *TPC Pattern Type* in the *Generator* tab of the *Connection Control* menu is set to *Closed Loop* (see section *TPC Settings* on p. 4.166).

The meaning of the parameters and their use is analogous to Signalling mode; see *UL Target Power* on p. 4.231.

Remote control
```
DEFault:UECode:TPOWer
CONFigure:UECode:TPOWer:VALue
CONFigure:UECode:TPOWer:REFerence
```

RF Connectors (Connection Control – RF Connectors)

The popup menu *RF* configures the RF connectors of the CMU. This includes selection of

- The RF input and output of the CMU (RF Output, RF Input)
- An external attenuation at the connectors (Ext. Att. Output, Ext. Att. Input)
- A frequency-dependent external input and output attenuation *(Freq. Dep. Att.)*

The configuration of the output connectors is relevant only if option CMU-K66, *WCDMA (3GPP/FDD, DL) Generator,* is available.

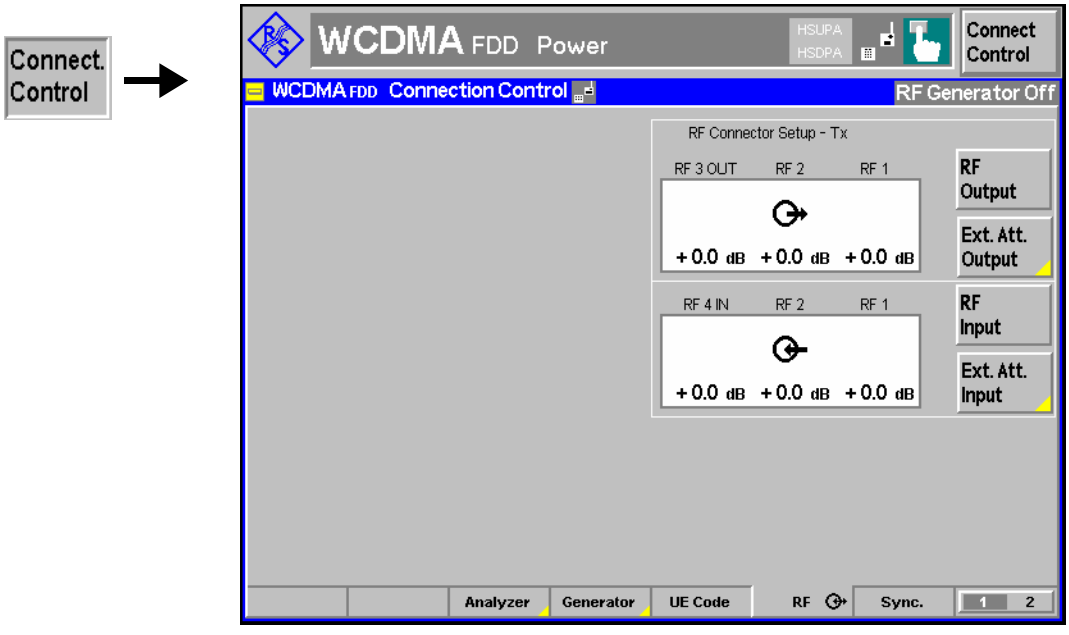


Fig. 4-75 Connection Control – RF connectors

RF Output

The *RF Output* softkey defines which of the three connectors RF 1, RF 2 and RF 3 OUT is to be used as RF output connector. A symbol indicates the selected RF output.

Note: *Input and output connectors can be arbitrarily combined. The bidirectional connectors RF 1 and RF 2 can be selected as RF inputs and outputs at the same time.*

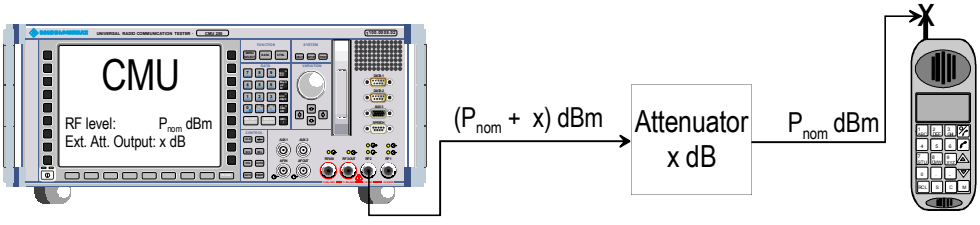
The LEDs on the front panel are only „on“ (light) if the output level is switched on.

Remote control
```
OUTPut[:STATe] RF1 | RF2 | RF3
```

Ext. Att. Output

The softkey *Ext. Att. Output* defines an external attenuation (or gain, if the value is negative) at the selected RF output. Input of an external attenuation is suitable, for example, if a path attenuation (cable) is included in the test setup, which is to be corrected by an increased signal level.

If an external attenuation is defined, the output signal level is referred to the input of the DUT, the generator level is therefore shifted with respect to the actual level at the input connector of the CMU. The default value for the generator power and the level ranges for the RF outputs are also shifted provided that the generator can output the required power, compensating for the external attenuation or gain. Otherwise it is adapted to the level closest to the shifted default value.



Note: RF User Correction

In addition to the static external output attenuation setting, the CMU provides a systematic correction of the generated RF power by means of user-defined, frequency and level-dependent correction tables; see section RF User Correction in Chapter 1 of the CMU operating manual.

Remote control

```
[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]
```

RF Input

The *RF Input* softkey determines which of the three connectors RF 1, RF 2 and RF 4 IN is to be used as RF input connector. If a connector is selected as RF input, a symbol will appear in the respective field. Input and output connectors can be arbitrarily combined.

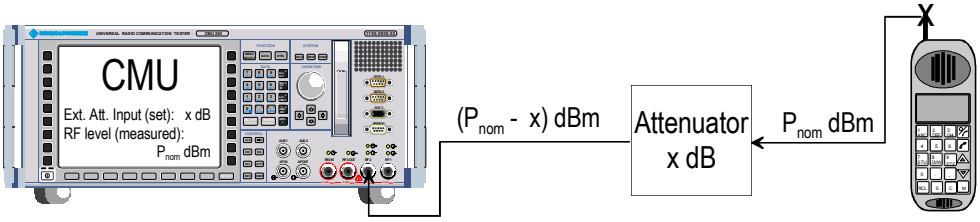
Remote control

```
INPut[:STATe] RF1 | RF2 | RF4
```

Ext. Att. Input

The softkey *Ext. Att. Input* enters the value of the external attenuation (or gain) at the selected RF input. Input of an external attenuation is required if, for example, external attenuator pads are used for protection of the sensitive RF inputs of the CMU or if a path attenuation is included in the test setup.

If an external input attenuation is reported to the instrument (see section *RF Connectors (Connection Control – RF Connectors)* on page 4.145), all levels measured are referred to the output of the DUT and therefore shifted with respect to the actual level at the input connectors of the CMU. The level ranges for the input connectors are shifted as well.



Note: *The LEDs on the front panel are only "on" (light) if the measurement is active.*

Note: RF User Correction

In addition to the static external input attenuation setting, the CMU provides a systematic correction of the measured RF power by means of user-defined, frequency and level-dependent correction tables; see section RF User Correction in Chapter 1 of the CMU operating manual.

Remote control
`[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]`
`SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude]`

Freq. Dep. Att.

The *Freq. Dep. Att.* softkey opens a popup menu to define the external input and output attenuation factors as a function of the RF input (analyzer) and output (generator) frequency. See section *Frequency-Dependent External Attenuation* on p. 4.179.

Frequency-Dependent External Attenuation

The *Freq. Dep. Att.* softkey in the *RF* ⊶ tab of the *Connection Control* menu opens a popup menu to define the external input and output attenuation factors as a function of the RF input (analyzer) and output (generator) frequency. The frequency-dependent attenuations have the same meaning and effect as the global (frequency-independent) attenuations *Ext. Att. Input* and *Ext. Att. Output:*

- A positive (negative) output attenuation increases (decreases) the RF generator level so that the generator compensates for the external attenuation or gain.
- A positive (negative) input attenuation increases (decreases) the displayed RF analyzer level so that the displayed result corresponds to the output transmit power of the DUT.

Frequency-dependent attenuations replace the global (frequency-independent) attenuations *Ext. Att. Input* and *Ext. Att. Output.* In contrast to the global attenuations, they are valid for all function groups (in remote control, the commands must be addressed in the R&S CMU base system).

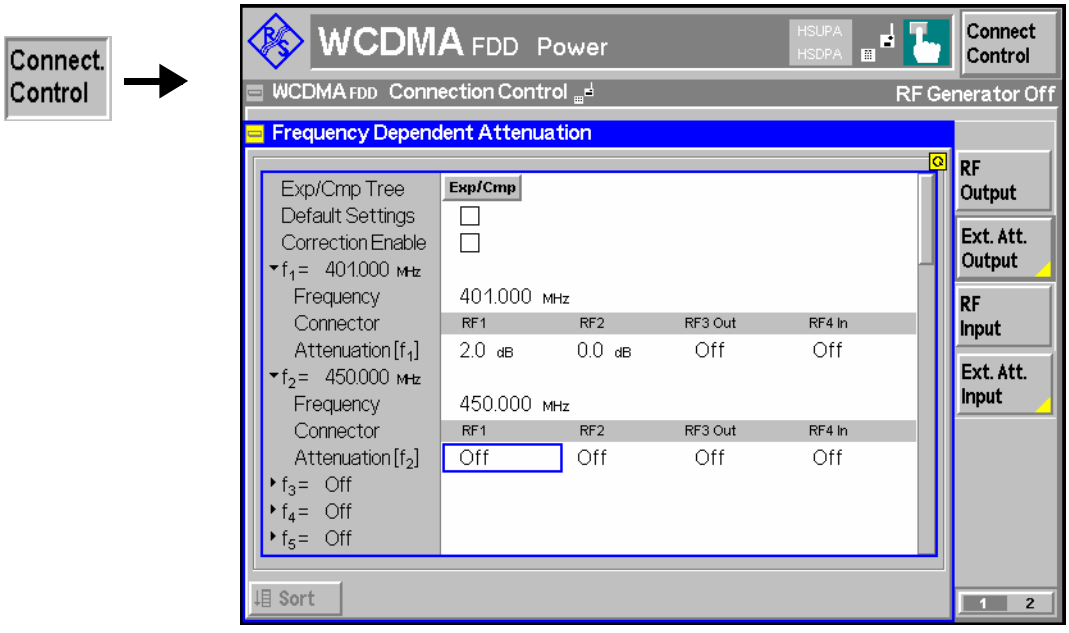


Fig. 4-76 Frequency-dependent attenuation

The frequency-dependent attenuations are defined in a popup menu which is opened by pressing the *Freq. Dep. Att.* softkey.

Default Settings Disables the frequency-dependent correction and sets all frequency values and all external attenuation factors to *Off*.

Note: *Frequency-dependent attenuations are valid for all function groups. They are not affected by a reset of the individual network function groups but can be set to default by resetting the R&S CMU base system.*

Correction Enable Enables the frequency-dependent attenuations, causing the global input and output attenuation to be replaced. A red status message in the *RF* ⊶ tab indicates that the frequency-dependent attenuations are enabled.

f_1 to f_{50} List of 50 frequency values, to be set to a specific frequency in the RF input/output frequency range of the R&S CMU (see data sheet) or to *Off,* if the frequency point is not used.

Attenuation

External input and output attenuation factors at the frequency point f_n assigned to the four RF connectors *RF1, RF2, RF3 Out* and *RF4 In*. The values for the bidirectional connectors *RF1* and *RF2* are used as input **and** output attenuations, affecting both the analyzer and the generator. Note that, due to the duplex spacing between downlink and uplink channels, the input and output attenuation for UE tests can still be different. The *RF3 Out* value is an output attenuation, the *RF4 In* value is an input attenuation.

The frequency points don't have to be defined in ascending order. Off the specified frequency points the attenuation factors are calculated as follows:

- In and interval between two adjacent frequency points, the attenuations are linearly interpolated.
- The attenuation a the lowest frequency point is valid for all analyzer and generator frequencies below and up to this frequency.
- The attenuation a the highest frequency point is valid for all analyzer and generator frequencies above this frequency.

Following these rules, it is possible to define attenuation factors for the entire frequency range using an arbitrary number of frequency points between zero (no attenuation) and 50. Using a single frequency point is equivalent to the global (frequency-independent) attenuations *Ext. Att. Input* and *Ext. Att. Output.*

Generator *RF Level* and analyzer *Max. Level* ranges

In analogy to the global attenuation factors *Ext. Att. Input* and *Ext. Att. Output,* the frequency-dependent attenuation factors modify the setting ranges for the generator and analyzer level.

- A positive (negative) output attenuation decreases (increases) the setting range of the RF generator level because the actual generator level must be larger (smaller) than the setting value.
- A positive (negative) input attenuation increases (decreases) the maximum analyzer level *(RF Max. Level)* because the displayed analyzer level result is larger (smaller) than the actual level at the input connectors of the R&S CMU.

To avoid conflicting level settings at varying input and output frequencies, the R&S CMU restricts the generator and analyzer setting ranges according to the maximum and minimum attenuation in the entire downlink and uplink frequency range of the selected operating band. The attenuations in the downlink frequency band define the modification of the generator level, the attenuations in the uplink frequency band define the modification of the maximum analyzer level.

In *Non Signalling* mode the RF generator and analyzer can be set to frequencies outside the downlink and uplink frequency ranges so that conflicting level settings may still occur. If this happens, the R&S CMU displays a notice box:

Some level settings failed due to external attenuation!

Bit 4 of the `STATus:OPERation:CMU:SUM1|2:CMU<nr>` register *(Measurement Invalid, MINV)* is set at the same time.

Sorts the frequencies f_1 to f_{50} in ascending order.

Remote control:

The commands for the frequency-dependent attenuation are part of the CMU base system (see CMU200/300 operating manual):

```
DEFault:USER:CORRection:LOSS
CONFigure:USER:CORRection:LOSS:TABLe:ENABle
CONFigure:USER:CORRection:LOSS:TABLe:LINE<nr>
CONFigure:USER:CORRection:LOSS:TABLe?
SORT:USER:CORRection:LOSS:TABLe
```

Reference Frequency (Connection Control – Sync.)

The popup menu *Sync.* defines the reference signals for synchronization. This includes

- The internal or external Reference Frequency
- The output mode for the network-specific system clock (REF OUT 2)

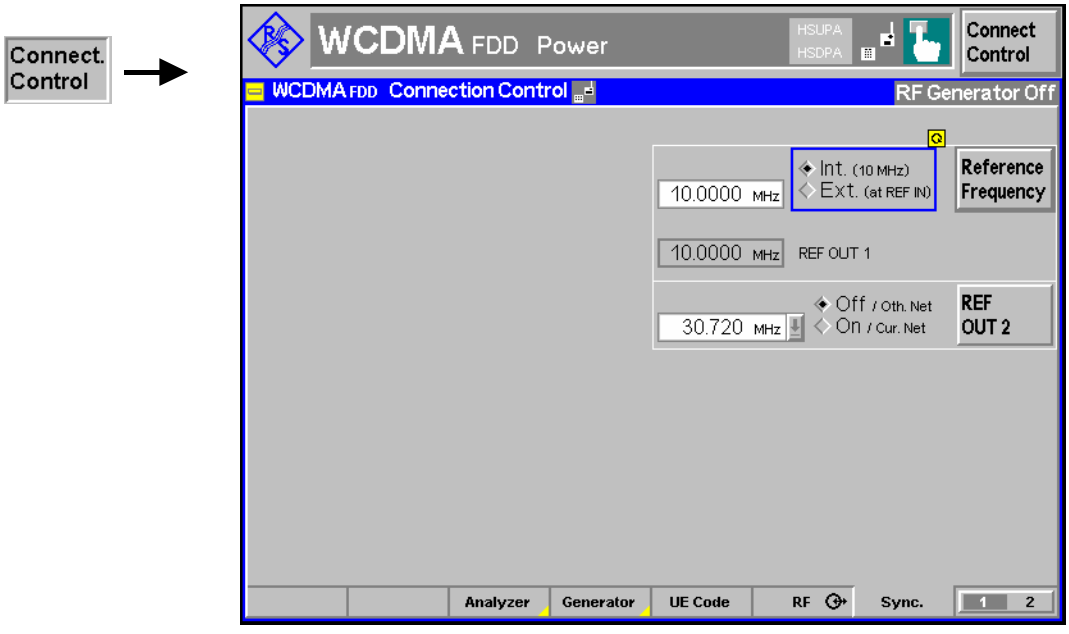


Fig. 4-77 Connection Control – Sync.

Reference Frequency

The *Reference Frequency* softkey determines the source and the frequency of the reference signal.

The associated field permits to select between two alternatives:

Int. (10 MHz) Internal synchronization with 10 MHz (TCXO or OCXO, CMU-B11/-B12) applied to output REF OUT 1 at the rear of the instrument.

Ext. (at REF IN) External reference signal to be fed in via input *REF IN* and applied to output REF OUT 1 at the rear of the instrument.

The frequency of the external reference signal must be entered in the input field to the left of the *Ext. (at REF IN)* radio button.

The reference signal used is applied to output *REF OUT 1* so that it can be fed to other instruments as well. It can be used for synchronization to another instrument.

Notes:

1. *When external synchronization is selected, the header cyclically displays a warning Reference frequency not synchronized if the synchronization failed, e.g. because of a missing or faulty input signal. At the same time, bit no. 6 (RFNL, Reference Frequency Not Locked) is set in the STATus:OPERation:CMU:SUM1:CMU1 sub-register associated to the CMU base system.*
2. *In the case of external synchronization with squarewave signals (TTL) ensure correct signal matching to avoid reflections. Otherwise, resulting overshoots may cause trigger problems at the CMU input. A possible remedy is to use a lowpass filter or an attenuator pad directly at the CMU input. Correct synchronization may be checked by comparing the signal REF OUT 1 with the input signal.*
3. *This configuration is valid in all CMU function groups.*

Remote control
The commands for the reference frequency are part of the CMU base system (see CMU200/300 operating manual):

```
CONFigure:SYNChronize:FREQuency:REFerence:MODE
          INTernal | EXTernal
CONFigure:SYNChronize:FREQuency:REFerence <Frequency>
```

REF OUT 2

The softkey *REF OUT 2* configures a network-specific system clock REF OUT 2 to be fed to the output REF OUT 2 at the rear of the instrument.

The associated field permits to select between two alternatives:

OFF (other network) The clock frequency of the current function group is not fed to the output *REF OUT 2*.

With this setting the system clock of another active function group (e.g. the network GSM1800 while the current function group) is still applied to *REF OUT 2* provided that the output *REF OUT 2* is switched on in the other function group. However, if *REF OUT 2* is explicitly switched over from *On* to *Off* the clock signal is definitely removed.

On (current network) The network-specific system clock of the current function group is fed to output REF OUT 2. The system clock of any other function group applied to REF OUT 2 before is replaced.

Besides the basic clock frequency of 39 MHz one of the following clock frequencies may be selected:

0.960 0.991 1.024 1.059 1.097 1.138 1.181 1.229 1.335 1.396
1.463 1.536 1.617 1.706 1.807 1.920 2.028 2.194 2.363 2.560
2.793 3.072 3.143 3.840 4.388 5.120 6.144 7.680 10.240 15.360
30.720

(The values are calculated according to the formula $F_{out} = 30.720\ MHz / n$ where $n = 1, ..., 31$.)

The clock frequency can be used to synchronize other instruments.

Remote control

```
SOURce:DM:CLOCk:STATe ON | OFF
SOURce:DM:CLOCk:FREQuency <Frequency>
```

Trigger (Connection Control – Trigger)

The *Trigger* tab is part of the second group of tabs in the *Connection Control* menu. It is accessible after pressing the *1 / 2* toggle hotkey once. Pressing *1 / 2a* again switches back to the first group of tabs described above.

The *Trigger* tab defines the trigger settings for the measurement.

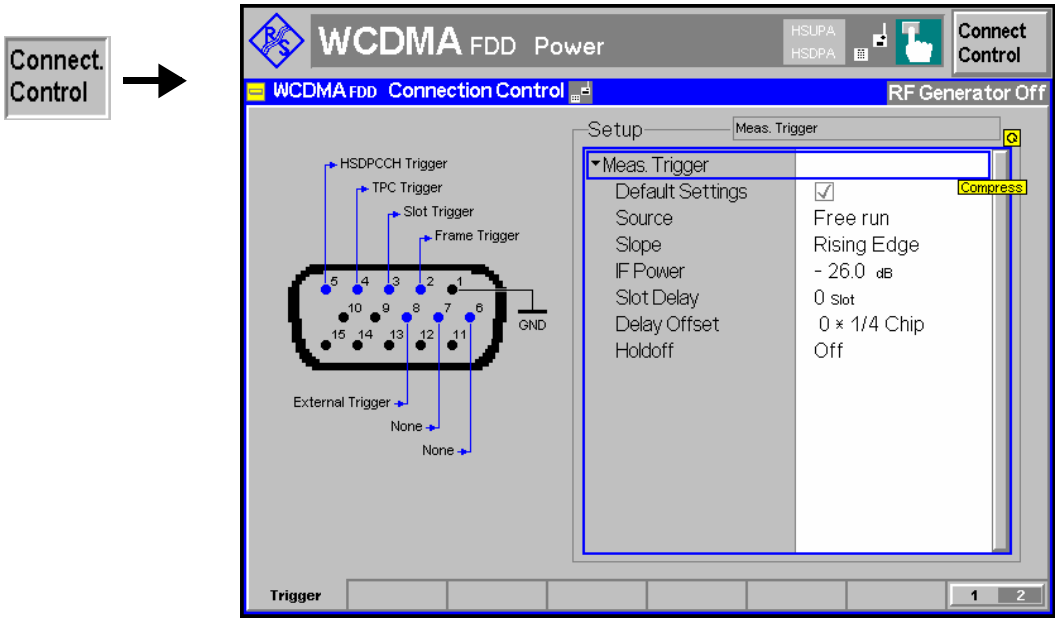


Fig. 4-78 Connection Control – Trigger

Trigger – Source

The *Source* parameter determines how the measurement is triggered:

Free Run Trigger provided by analyzed RF signal: The CMU decodes the RF signal to derive its slot timing.

External External trigger signal fed in via connector AUX 3 (pin 8)[2]. The required timing information is provided by the rising or falling edge (see *Slope* setting below) of an external trigger signal to which a trigger delay can be added. The beginning of the measured slot is searched in a symmetric time range of ±380 chips around the specified point, which is given by the trigger time plus the defined trigger delay (see *Fig. 4-80 below*). Compared to the *Free Run* mode, the search range is smaller so that the measurement is faster.

Internal Trigger provided by internal RF generator (with option CMU-K66, *WCDMA (3GPP/FDD, DL) Generator*, only), according to the frame timing of the UL signal re-transmitted by the UE under test (frame trigger). The CMU assumes a delay of 1024 chip periods between the downlink and the uplink timing (3GPP standard timing offset). The beginning of the measured slot is searched as described for the *External* trigger (exception: *Inner Loop TPC* measurement; see section *Test Scenarios for Inner Loop TPC* on p. 4.4). Again, a trigger delay can be added to the frame trigger time (see *Fig. 4-80 below*). In addition to the frame trigger, a slot trigger signal at the beginning of each DL slot and a TPC trigger signal at the beginning of each TPC profile is provided.

2 The external trigger signal at AUX 3 must be a high or low pulse with the following characteristics: Rise/fall time <20 ns; minimum high or low time ≥ 200 ns. The impedance of the trigger source must be ≤ 50 Ω.

The frame and slot trigger signals are always available while the RF generator is switched on. The TPC trigger is available while the generator transfers a TPC pattern. The trigger signals are also fed to pin 2 (frame trigger), pin 3 (slot trigger), and pin 4 (TPC trigger) of the AUX 3 connector at the front of the instrument where they can be tapped off to synchronize external devices. All trigger signals are low-pulse TTL signals with a length of ¼ slot (166 ⅔ µs); see *Fig. 4-80 below*.

In the *Internal* trigger mode, the TPC trigger is used for the *Inner Loop TPC* measurement; see section *Test Scenarios for Inner Loop TPC* on p. 4.4. The frame trigger is used for all other measurements. The slot trigger is for external use only.

IF Power The measurement is triggered by the level of the IF signal (rising or falling edge; see *Slope* setting below), the trigger level is specified via the *Level* parameters. Narrow-band IF power trigger.

Slot Trigger event at the beginning of each UL DPCH slot (DL DPCH slot plus a 1024-chip delay)[3]. A slot trigger output signal which is synchronous to the **DL** DPCH slots is also fed to pin 3 of the AUX 3 connector while one of the trigger source settings *Internal* or *Slot* is active. The trigger output signals don't depend on the trigger *Slot Offset* and the *Slot Delay Offset.*

Frame Trigger event at the beginning of each UL frame (DL frame plus a 1024-chip delay)[1]. A frame trigger output signal which is synchronous to the **DL** DPCH frames is also fed to pin 2 of the AUX 3 connector while one of the trigger source settings *Internal* or *Frame* is active. The trigger output signals don't depend on the trigger *Slot Offset* and the *Slot Delay Offset.*

TPC Trigger event one slot before the beginning of each TPC profile sent to the UE. A *TPC* trigger output signal synchronous to the DL slots is fed to pin 4 of the AUX 3 connector.

HS-DPCCH Trigger event at the beginning of each UL-DPCH slot during which the R&S CMU expects ACK or NACK symbols from the mobile; see section *HS-DPCCH Trigger* on p. 4.187. A *HS-DPCCH* trigger output signal synchronous to the DL slots is fed to pin 5 of the AUX 3 connector.

Auto The trigger source is selected automatically according to the requirements of the current measurement; see Table 4 below.

Table 4-47 on p. 4.284 gives and overview of the compatibility between the different trigger sources and WCDMA measurements.

Remote control

```
TRIGger[:SEQuence]:SOURce FRUN | EXTern | INTern | IFPower
```

3) The slot and frame trigger depends on the *DL DPCH Timing Offset;* see p. 4.160.

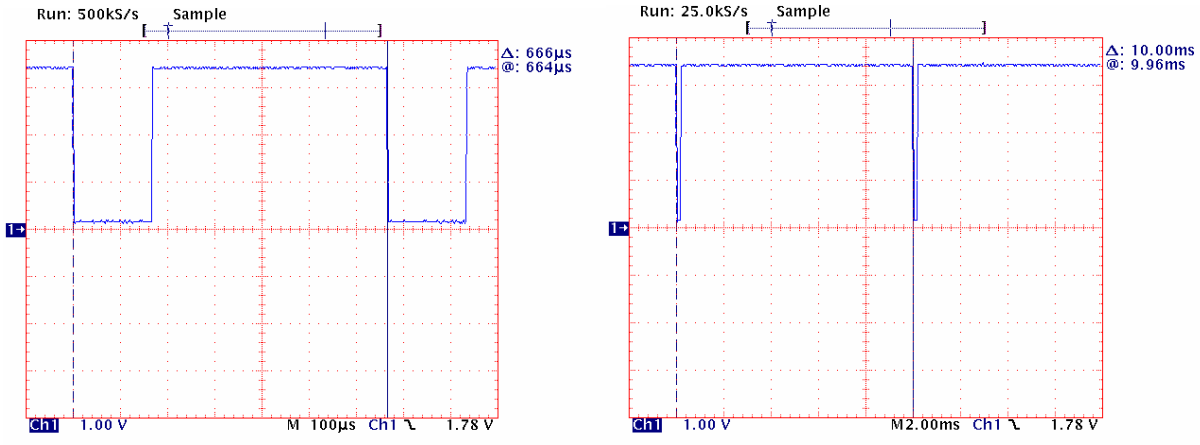


Fig. 4-79 Slot trigger and frame trigger

Slope

Slope qualifies whether the trigger event occurs on the *Rising Edge* or on the *Falling Edge* of the trigger signal. The setting has is relevant for *IF Power* or *External* trigger sources.

Remote control
`TRIGger[:SEQuence]:SLOPe POSitive | NEGative`

IF Power

IF Power parameter defines the trigger threshold if the measurement is triggered by the *IF Power* (see *Source* function above). The trigger threshold is the IF trigger signal level beyond which the trigger condition is satisfied and a measurement is initiated. The threshold is defined relative to the maximum input level set in the *Analyzer* tab.

IF power trigger threshold = <RF Max. Level> + <IF Power>

Note: *The trigger levels are always relative to the **current** maximum input level. If RF Max. Level is set manually (RF Mode = Manual), the current input level is constant and equal to the setting value. In autoranging mode (RF Mode = Auto), the current maximum input level is dynamically adapted to the measured RF input level; the trigger levels change accordingly.*

Remote control
`TRIGger[:SEQuence]:THReshold:IFPower <Power>`

Trigger – Slot Delay

The *Slot Delay* parameter defines a delay time (integer number of slots) between the trigger time and the start of the measurement. If a frame-periodic internal or external trigger signal is available, *Slot Delay* can be used to select any slot of the frame as measured slot. An additional *Delay Offset* can be added to the *Slot Delay;* see *Fig. 4-80 below*.

The *Slot Delay* parameter is ignored in *Free Run* measurements; see above.

Remote control
`TRIGger[:SEQuence]:DELay <Slot_Delay>, <Delay_Offset>`

Trigger – Delay Offset

The *Delay Offset* parameter defines a delay time in multiples of ¼-chip periods between the trigger time (plus a *Slot Delay*, if defined) and the start of the measurement. In general a *Delay Offset* is used to compensate for an offset between the (external or internal) trigger time and the beginning of the uplink slot to be measured. This can be necessary for various reasons:

- If *Internal* trigger is set the CMU is triggered by the TPC trigger (application *Inner Loop TPC)* or by the frame trigger of the internal DL generator (all other measurements). Compared to the internal trigger time, the UL signal from the UE is delayed by the standard DL/UL timing offset of 1024 chip periods. In order to coincide with the UL timing the internal trigger signal is also delayed by the nominal timing offset. No additional *Delay Offset* is required to compensate for the nominal timing offset.
- If *External* trigger is set, an appropriate *Delay Offset* compensates for a trigger timing error.
- In addition the *Delay Offset* can be used to correct a possible propagation delay in the signal path from the CMU to the UE and back.

The *Delay Offset* parameter is ignored in *Free Run* measurements; see above.

Remote control
`TRIGger[:SEQuence]:DELay <Slot_Delay>, <Delay_Offset>`

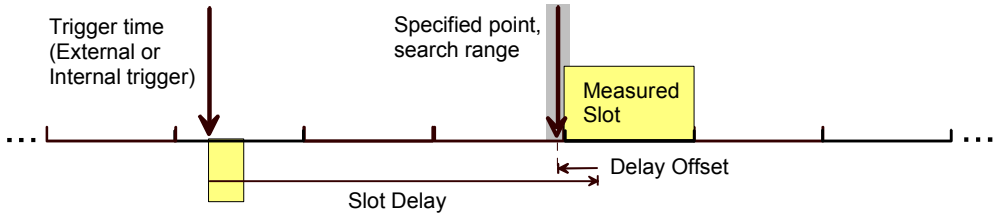


Fig. 4-80 Slot Delay and Delay Offset

Trigger – Holdoff

The *Holdoff* parameter defines a holdoff time (in µs) after each trigger event during which the trigger system is locked so that the R&S generates no further trigger events. The holdoff time can be defined irrespective of the trigger source, however, it is only effective if the trigger events are derived from the (rising or falling) edge of a trigger signal (trigger source *IF Power, External).*

An appropriate holdoff time prevents the R&S CMU to generate multiple trigger events in case the trigger signal shows rippled edges (e.g. due to modulation effects). The maximum holdoff time of 50 µs corresponds to twice the guard time specified for many WCDMA TX tests. *Off* corresponds to a 0 µs holdoff time.

Remote control
`TRIGger[:SEQuence]:HOFF <Holdoff_Time> | OFF`

HS-DPCCH Trigger

The HS-DPCCH trigger event occurs at the beginning of each UL-DPCH slot during which the R&S CMU expects ACK or NACK symbols from the UE. The minimum delay between two trigger events is 1 HSDPA subframe (3 slots); see Fig. 4-81 below. The R&S CMU calculates the trigger time according to the known timing relationship between the physical downlink and uplink channels and generates a trigger event irrespective of the actual ACK/NACK or CQI symbols transmitted.

The HSDPA trigger is valid for all measurements except the *Spectrum* measurement*;* see *Modification* below.

In Signalling mode, the HS-DPCCH trigger event is suppressed if the expected ACK/NACK slot is not directly followed by a CQI slot. The periodicity of ACK/NACK and CQI slots (and possible DTX periods between the slots) depends on the CQI Feedback Cycle, ACK/NACK Repetition Factor, *and* CQI Repetition Factor *(Connection Control – BS Signal – HSDPA HS-DSCH). See also application examples about* EVM Test with HS-DPCCH *and* EVM & PhD with HS-DPCCH *in chapter 2.*

HSDPA measurements are described in Chapter 8 of this manual.

ACK and CQI

The ACK messages and reported CQI values are transferred on the HS-DPCCH (see also *HS-DPCCH Logging* in Chapter 8). The timing offset between the HS-DPCCH and the UL-DPCH is relevant for the *Code Domain Power* measurement (see section *HSDPA in CDP Measurement* in Chapter 8) where the power of the HS-DPCCH can be measured over 1 complete slot (10 consecutive symbols). If the offset does not correspond to an integer multiple of a slot duration, then the (fixed) measurement range overlaps with two consecutive slots with possibly different symbol types (ACK or CQI).

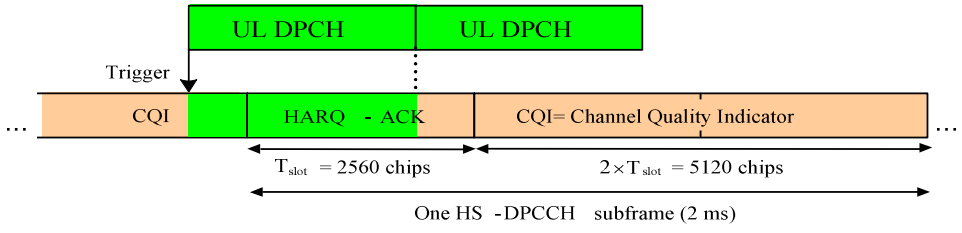


Fig. 4-81 HS-DPCCH trigger and HS-DPCCH timing

Use an appropriate trigger offset to move the measurement interval within the HS-DPCCH subframe, e.g. in order to measure only CQI symbols. See section *Trigger Offsets for TX Measurements on p. 4.190.*

UL DPCH and HS-DPCCH timing

The timing relationship for all physical channels relative to the P-CCPCH frame timing is described in standard TS 25.211. The following definitions are relevant for HSDPA measurements on the R&S CMU:

- The UL DPCH starts 1024 chips + n * 256 chips after the P-CCPCH. n is the DL DPCH Timing Offset, to be set in the *RF Generator* or *BS Signal* tab of the *Connection Control* menu (see p. 4.160).
- The HS-DPCCH is at a fixed ½ slot offset after the P-CCPCH. It is not influenced by the *DL DPCH Timing Offset.*

Example 1

With a *DL DPCH Timing Offset* value of 1 (*256 chip periods), the UL DPCH offset relative to the P-CCPCH is (4 * 256 + 1 * 256) chips = 1280 chips, which equals to ½ slot.

The HS-DPCCH starts ½ slot after the P-CCPCH, thus the HS-DPCCH and the UL DPCH are slot-aligned.

Use DL DPCH Timing Offset *values of 1, 11, 21,… to perform slot-aligned HSDPA measurements.*

Example 2

With a *DL DPCH Timing Offset* value of 6 (*256 chip periods), the UL DPCH offset relative to the P-CCPCH is (4 * 256 + 6 * 256) chips = 2560 chips, which equals to

1 slot.

The HS-DPCCH starts ½ slot after the P-CCPCH, which results in an offset of ½ slot between the HS-DPCCH and the UL DPCH.

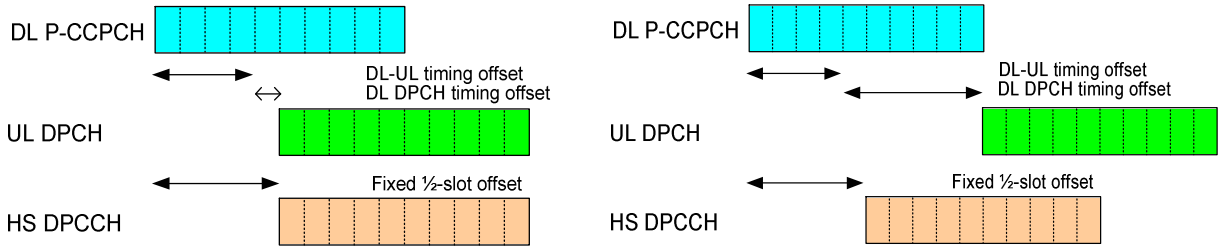


Fig. 4-82 HSDPA slot timing according to example 1 (left) and 2

Modification: Spectrum measurement

The Adjacent Channel Leakage power Ratio (ACLR) is a measure of the out-of-band emissions due to modulation effects and switching transients. To obtain the ACRL the R&S CMU measures the RRC filtered mean power. According to section 5.10A of the conformance test specification 3GPP TS 34.121, the ACLR with HS-DPCCH must be measured at constant HS-DPCCH power.

The *Spectrum Emission Mask* (SEM) consists of several areas, measured at different filter bandwidths and times. These areas should also be measured at constant signal power.

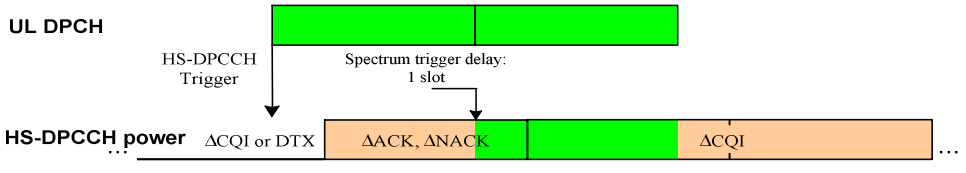
Hence, in order to ensure stable and correct results, HS-DPCCH trigger events for all *Spectrum* measurements are only generated if the HS-DPCCH power in the CQI slots following the ACK or NACK symbols is not switched off (no DTX). In addition, the measurement is delayed by one slot relative to the trigger event, so that the measurement range contains ACK/NACK symbols followed by CQI symbols or CQI symbols only (for DPCH slot-aligned HSDPA subframes).

The output trigger signal at pin 5 of AUX3 is still synchronous to the DL DPCH so that the *Spectrum* measurement starts 1 slot plus 1024 chips after the output trigger signal.

NOTE

To obtain accurate Spectrum (in particular: SEM) results the gain factors ΔACK, ΔNACK, and ΔCQI should be equal.

Spectrum *measurements with HS-DPCCH trigger fail if the CQI feedback cycle (see Chapter 8) is switched off so that no CQI symbols are transmitted.*



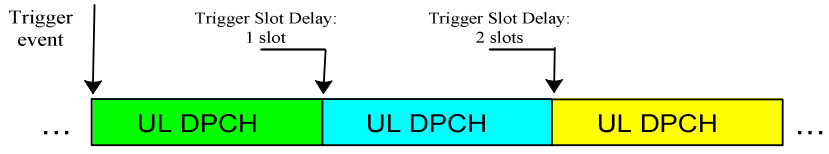
This modification is automatically enabled while a *Spectrum* measurement application is running.

Trigger Offsets for TX Measurements

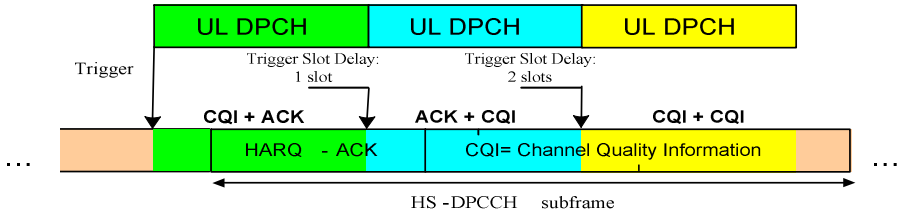
The timing of the trigger events initiating the measurement and of the trigger output signals can be modified by means of the *Slot Delay* and *Slot Delay Offset* parameters in the *Trigger* tab of the *Connection Control* menu. The impact of the *Slot Offset* is equal for all TX measurements; the impact of the *Slot Delay Offset* is measurement-specific. The *Slot Delay Offset* is added to the *Slot Offset.*

Slot Offset

With a slot offset of n slots, all TX measurements start at the beginning of the nth UL slot after the trigger event. This means that measurements on non-HSDPA channels (UL DPCHs) are slot-aligned.



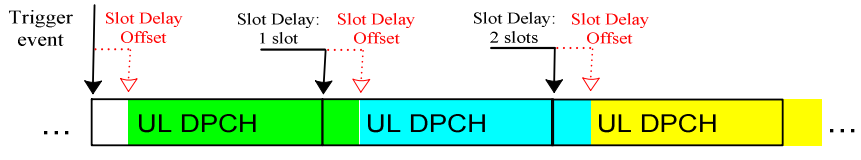
HSDPA channels have an offset relative to the UL DPCH, depending on the *DPCH Timing Offset* parameter in the *RF Generator* or *BS Signal* tab of the *Connection Control* menu (see section *HS-DPCCH Trigger* on p. 4.187).



With *DPCH Timing Offset* values of 1, 11, 21,... the HSDPA measurements are also slot-aligned.

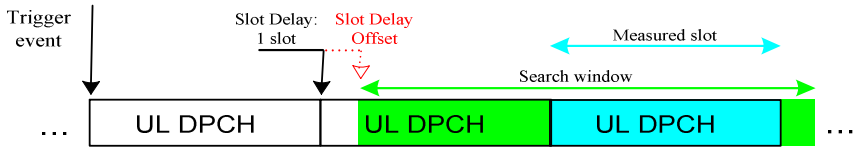
Slot Delay Offset

With a slot delay offset of n ¼-chip periods, the evaluation and display range is moved relative to the range with zero slot delay offset.



Exceptions: *To obtain the Modulation WCDMA and Code Domain Power results in accordance with the requirements of the conformance test specification, the R&S CMU must demodulate the UL WCDMA signal in an entire slot, including the pilot bits. As a result, Modulation WCDMA and Code Domain Power measurements are always UL DPCH slot-aligned, irrespective of the selected slot delay offset.*

To obtain slot-aligned *Modulation WCDMA* and *Code Domain Power* results the CMU analyzes the received signal in a sufficiently large search window. The search window is moved according to the slot delay offset, whereas the display range and the measurement results are slot-aligned:



The figure above shows that, with a sufficiently large slot delay offset, it is possible to change the measured slot relative to the trigger time.

I/Q-IF Interface (Connection Control – I/Q-IF)

The *I/Q-IF* tab is part of the second group of tabs in the *Connection Control* menu. It is accessible after pressing the *1 / 2* toggle hotkey once. Pressing *1 / 2* again switches back to the first group of tabs described above.

The *I/Q-IF* tab configures the signal paths for I/Q and IF signals. With option CMU-B17, *I/Q and IF Interfaces,* I/Q and IF signals can be used in the framework of *RF* measurements and in many network tests. For a detailed description of rear panel connectors for I/Q and IF input/output signals, test scenarios and application examples refer to the CMU200/300 operating manual.

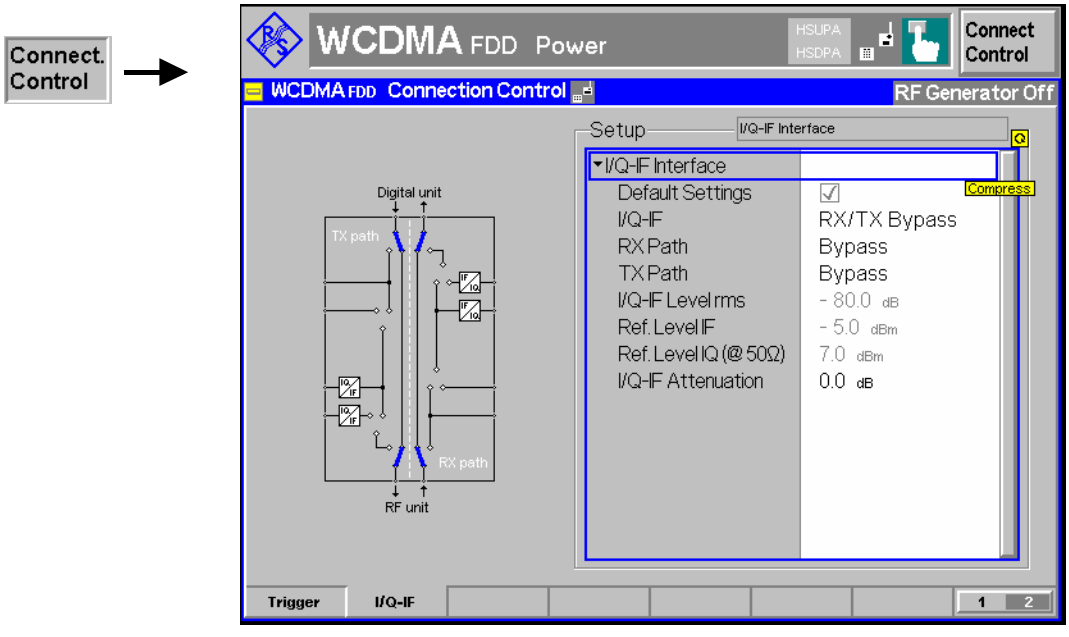


Fig. 4-83 Connection Control – I/Q-IF

Default Settings The *Default Settings* checkbox assigns the default setting to all functions in the *I/Q-IF* tab.

Remote control `IQIF:DEFault ON | OFF`

I/Q-IF Selects the I/Q-IF test scenario, overwriting the current *RX Path* and *TX Path* settings. Six different predefined test scenarios with fixed RX and TX path are provided; see *Table 4-24 below*.

Additional scenarios may be defined by selecting any other combination of RX and TX paths. When this is done *I/Q-IF* is set to *User-defined.* The circuit diagram to the left of the *Setup* table shows the current RX and TX signal paths.

Remote control
```
CONFigure:IQIF:RXTXcombined
        BYP | BYIQ | XOIO | IOIO | IOXO | FPAT | UDEF
```

RX Path

Selects the RX signal path, leaving the *TX Path* unchanged but adapting the I/Q-IF test scenario to the new RX/TX path combination: If the combination corresponds to a predefined scenario, then *I/Q-IF* is set to the predefined scenario; otherwise it is set to *User-defined*.

The circuit diagram to the left of the *Setup* table shows the current RX and TX signal paths.

Remote control
```
CONFigure:IQIF:RXPath
        BYP | BYIQ | XOIO | IOIO | IOXO | FPAT | UDEF
```

TX Path

Selects the TX signal path, leaving the *RX Path* unchanged but adapting the I/Q-IF test scenario to the new RX/TX path combination: If the combination corresponds to a predefined scenario, then *I/Q-IF* is set to the predefined scenario; otherwise it is set to *User-defined*.

The circuit diagram to the left of the *Setup* table shows the current RX and TX signal paths.

Remote control
```
CONFigure:IQIF:TXPath
        BYP | BYIQ | XOIO | IOIO | IOXO | FPAT | UDEF
```

I/Q-IF Level rms

Indicates the IF output level in the TX path relative to the *Ref. Level IF* displayed below. The *Ref. Level IF* is equal to the maximum IF input/output level (PEP) cited in the data sheet.

The *I/Q-IF Level rms* is also equal to the I/Q output level in the TX path relative to the *Ref Level IQ (@ 50 Ω)* displayed below. The *Ref Level IQ (@ 50 Ω)* corresponds to the max. peak input voltage of the analog I/Q inputs cited in the data sheet, converted into an equivalent level at 50 Ω reference impedance.

The *I/Q-IF Level rms* can be reduced using the *I/Q-IF Attenuation.*

Remote control
```
[SENSe:]IQIF:IFLevel?
```

Ref. Level IF / Ref Level I/Q

Indicates the IF and I/Q reference levels according to the data sheet. These values are fixed; see description of *I/Q-IF Level rms* above.

I/Q-IF Level Attenuation

Controls the I/Q and IF output levels in the TX path *(I/Q-IF Level rms)*. An attenuation can prevent excess output levels.

Remote control
```
[SENSe:]IQIF:IFLevel:ATTenuation
```

Table 4-24 I/Q-IF scenarios and path settings

I/Q-IF	**RX Path**	**TX Path**	**Remark/Application** (see also CMU manual)
RX/TX Bypass	Bypass	Bypass	No I/Q or IF inputs/outputs connected Direct signal analysis and transmission with full measurement accuracy
Byp. w. I/Q-OF OUT	Bypass w. I/Q-IF OUT	Bypass w. I/Q-IF OUT	No I/Q or IF inputs connected Analysis of received and transmitted signal via I/Q or IF
I/Q IN/OUT	I/Q IN/OUT	I/Q IN/OUT	Insertion of signal to be analyzed and transmitted on I/Q level
IF IN_I/Q IN/OUT	IF IN_I/Q IN/OUT	IF IN_I/Q IN/OUT	Additional processing of received and transmitted signal on IF level (filters etc.) and analysis via I/Q
IF IN/OUT	IF IN/OUT	IF IN/OUT	Insertion of signal to be analyzed and transmitted on IF level
Fading	Bypass	I/Q IN/OUT	Direct analysis of received signal Modification (fading) of transmitted signal by means of an external fading simulator (SMIQ, ABFS)
User-defined	Any combination of RX Path and TX Path not listed above		Any combination of RX and TX test cases listed above

Connection Control (Signalling)

The menu group *Connection Control* controls the communication between the CMU and the UE (connection setup and release, UE and BS signals, network parameters), configures the inputs and outputs with the external attenuation values and the reference frequency, and defines the trigger settings.

Circuit switched and packet switched services

The UMTS core network consists of two service domains, the circuit switched (CS) and the packet switched (PS) domain. A UE that supports both CS and PS services can be connected to one of the service domains or to both domains. The connection schemes for both domains are independent from each other.

The connection scheme described in this section is valid for CS services. The R&S CMU also supports the packet switched connection scheme; see section Packet Switched (PS) Connections on p. *4.212.*

The term signalling denotes all procedures that are necessary for setup, control and release of a connection in the UTRAN. In the case of WCDMA UE tests, a distinction is made between five different circuit switched (CS) signalling states:

Signal Off	CMU transmits no signal; no connection to the UE is possible
Signal On	CMU emulates a UTRAN cell, transmitting a WCDMA signal *(BS Signal)* to which a UE can synchronize. After synchronization the UE can initiate a registration towards the CMU, and the CMU can page the UE in order to attempt a connection.
Registered	Synchronization with the UE and registration performed
Alerting	CMU is attempting a connection to the UE; UE is responding (ringing) but connection not yet accepted at the CMU. This state is optional and can be skipped using the *Dedicated Channel Type = RMC* and *Test Mode = ON* or *Test Mode = Loop Mode 1 RLC TM/Loop Mode 2* settings; see *Fig. 4-85* on p. 4.195.
Connected	RRC connection between CMU and UE established. This means that dedicated channels are allocated between the CMU/UTRAN and the UE. Depending on the Radio Access Bearer (RAB) configuration, the dedicated channel can consist of the Signalling Radio Bearer (SRB) used to set up the connection or other RABs, e.g. a Reference Measurement Channel (RMC) or voice channel (AMR).

A number of control commands which can be initiated both by the CMU *(Call to UE, UE Terminating Call)* and by the UE *(Call from UE, UE Originated Call)* switch between these states (the dashed lines in *Fig. 4-84* denote processes initiated by the UE).

Many applications within the function group *WCDMA UE Signalling (3GPP/FDD)* are only possible or useful in particular signalling states. (For example, the parameters describing the *UE Radio Access Capability,* displayed in a table in the left half of the *Connection* tabs, are provided by the UE after registration or after a connection is established. They are not available in the *Signal Off* and *Signal On* states.) This implies that the functionality of menus may vary depending on the signalling state. For reference see the *Sig. State* field in the command tables in Chapter 6.

The purpose of the *Signalling* test mode is to perform transmitter and receiver tests with an existing call (or data transfer) connection between the CMU and the UE. Therefore the menus for setting up a connection (*Connection Control – Connection)* appear immediately after the function group and mode *WCDMA UE Signalling (3GPP/FDD)* is activated. Besides, all the tabs in the *Connection Control* menu can be called up by pressing the *Connect. Control* softkey at the top right in every measurement menu. They are linked with each other via the hotkey bar at the lower edge of the screen. Pressing the *Escape* key closes the active *Connection Control* menu and re-activates the underlying measurement menu.

The signalling state machine of the CMU depends on the *Dedicated Channel Type* (see p. 4.239) and *Test Mode* (see p. 4.242) settings. In all settings except *Dedicated Channel Type = RMS* and *Test Mode = ON* or *Test Mode = Loop Mode 1 RLC TM/Loop Mode 2,* a connection initiated from the CMU is set up via the *Alerting* state. Alternatively the connection can be initiated from the UE:

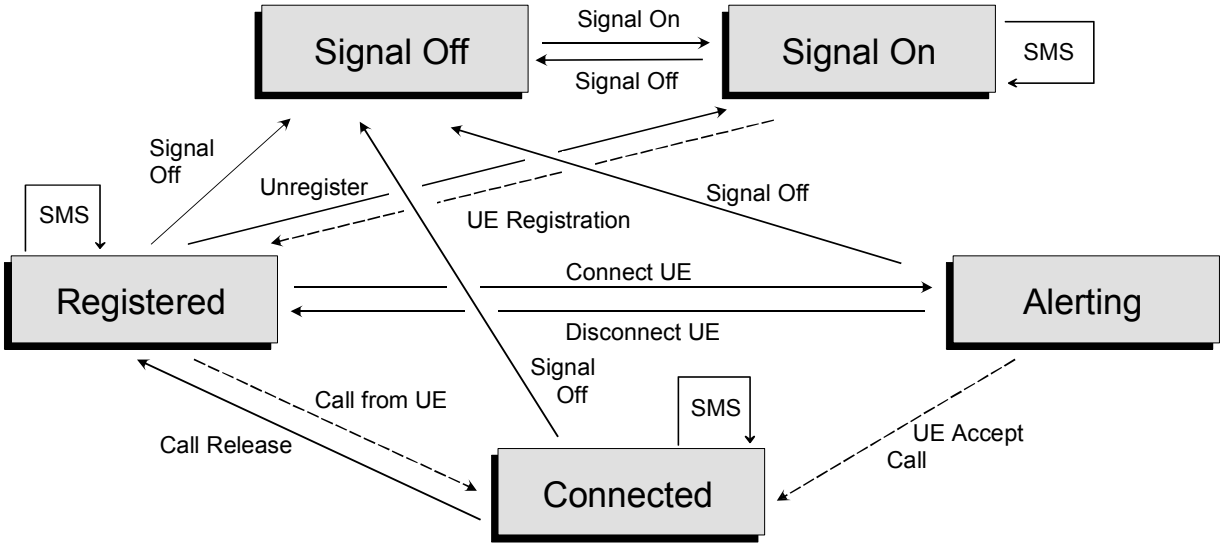


Fig. 4-84 Signalling states of the CMU: Connection with Alerting

If *Dedicated Channel Type = RMC* and *Test Mode = ON* or *Test Mode = Loop Mode 1 RLC TM/Loop Mode 2,* the *Alerting* state is skipped if the CMU initiates the connection, and no call from the UE is possible:

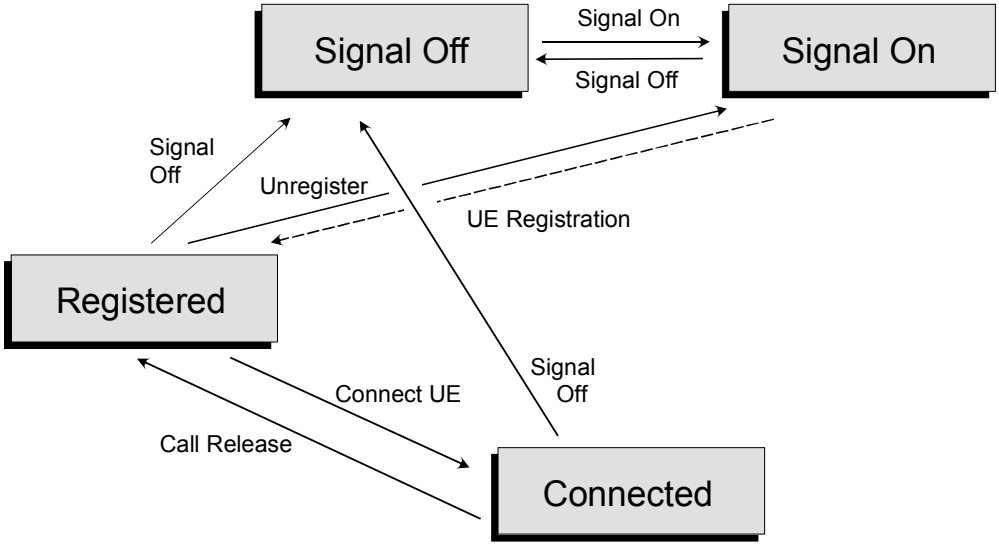


Fig. 4-85 Signalling states of the CMU: Connection without Alerting

Corresponding to the five possible signalling states, five different *Connection* tabs are available. When one of the signalling states *Signal Off, Signal On, Registered* or *Alerting* is reached, the corresponding tab is opened automatically. On the other hand the *Connected* tab is closed immediately after the CMU reaches the *Connected* state so that a measurement can be started. To change this behavior the *Connect. Control Guidance* parameter is provided; see section *Display Control (Connection Control – Misc.)* on p. 4.289.

Note: Paging State

The CMU displays a message "Paging in progress " while it attempts to establish a connection and before it enters the Alerting *or* Connected *state. In remote control,* Paging *is a separate transitory signalling state, to be queried with the* `FETCh:SIGNalling:STATus?` *command.*

Note: General recommendation for speeding up Signalling tests:

Refer to Chapter 2, section Accelerating the Connection.

Connection – State Signal Off (CS)

The *Connection (Signal Off)* tab provides a list of parameters describing the capabilities of the UE. Besides, the tab contains softkeys which lead to other operating modes or signalling states:

- Select the *Dedicated Channel* to be allocated between the CMU/UTRAN and the UE.
- Set up a UTRAN cell; activate the WCDMA signal *(BS Signal)* to which the UE can synchronize *(Signal On)*

The CMU provides a second version of the *Connection* tab where the info table on the left side is replaced by softkeys. The softkeys provide RF channel and power settings and control the *Openloop Power* measurement; see section *Connection – RF Channel and Power* on p. 4.208. The *Connection* hotkey toggles between the two versions of the tab if it is pressed repeatedly.

The tab *Connection (Signal Off)* is opened when the function group *WCDMA UE Signalling (3GPP/FDD)* is selected, or if the WCDMA signal is switched off *(Signal Off* softkey*)* while the system is in another signalling state. It is replaced by the *Connection (Signal On)* tab after the WCDMA signal *(BS Signal)* of the CMU is switched on so that the CMU emulates a UTRAN cell (softkey *Signal On, Fig. 4-84*).

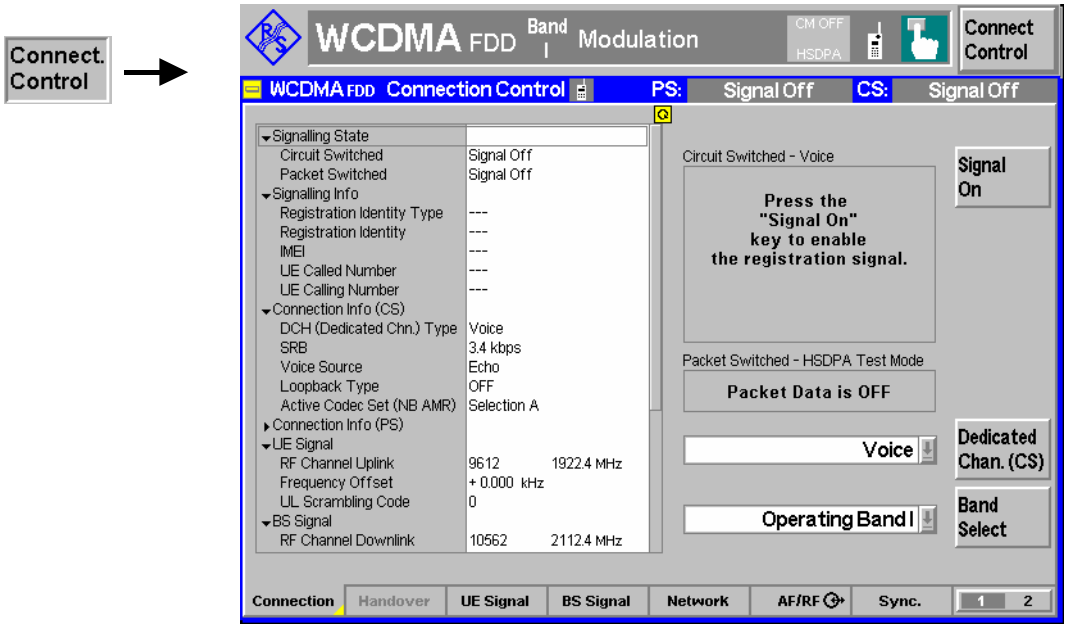


Fig. 4-86 Connection Control – Connection (Signal Off)

The parameter overview in the left half of the menu is also indicated in the other *Connection* tabs and is described in section *Connection – State Connected* on p. 4.202. Some parameters are not always available, depending on the current and previous signalling states and settings. In this case the table shows invalid or unavailable settings ("---").

Message Box A message box (here: *Press the Signal On key to enable the synchronization signal)* in the right half of each *Connection* tab informs on the current instrument state or indicates how to proceed to get to other signalling states.

Signal On

The *Signal On* softkey switches on a WCDMA signal *(BS Signal)* to which the UE can synchronize. By switching on the signal, the CMU changes to the signalling state *Signal On*. A user prompt below the header indicates the function of this softkey.

Remote control
`PROCedure:SIGNalling:ACTion SON`

Dedicated Channel

The *Dedicated Channel* softkey selects the dedicated channel to be allocated between the CMU/UTRAN and the UE; see description of the *Dedicated Channel Type* on p. 4.239.

Remote control
`CONFigure:BSSignal:DCH:TYPE RMC | VOIC | SRAB | SRF`

Band Select

The *Band Select* softkey selects the UTRA/FDD frequency band for the connection:

- Operating Band I comprises uplink frequencies between 1920 MHz and 1980 MHz, and downlink frequencies between 2110 MHz and 2170 MHz. Operating Band I requires option R&S CMU-K68.
- Operating Band II comprises uplink frequencies between 1850 MHz and 1910 MHz, and downlink frequencies between 1930 MHz and 1990 MHz. Operating Band II requires option R&S CMU-K69.
- Operating Band III comprises uplink frequencies between 1710 MHz and 1785 MHz, and downlink frequencies between 1805 MHz and 1880 MHz. Operating Band III requires option R&S CMU-K67.
- Operating Band IV comprises uplink frequencies between 1710 MHz and 1755 MHz, and downlink frequencies between 2110 MHz and 2155 MHz. Operating Band IV requires option R&S CMU-K61.
- Operating Band V comprises uplink frequencies between 824 MHz and 849 MHz, and downlink frequencies between 869 MHz and 894 MHz. Operating Band V requires option R&S CMU-K62.
- Operating Band VI comprises uplink frequencies between 830 MHz and 840 MHz, and downlink frequencies between 875 MHz and 885 MHz. Operating Band VI requires option R&S CMU-K63.
- Operating Band VII comprises uplink frequencies between 2500 MHz and 2570 MHz, and downlink frequencies between 2620 MHz and 2690 MHz. Operating Band IV requires option R&S CMU-K57.
- Operating Band VIII comprises uplink frequencies between 880 MHz and 915 MHz, and downlink frequencies between 925 MHz and 960 MHz. Operating Band V requires option R&S CMU-K58.
- Operating Band IX comprises uplink frequencies between 1750 MHz and 1784.8 MHz, and downlink frequencies between 1845 MHz and 1879.8 MHz. Operating Band VI requires option R&S CMU-K59.
- Operating Band X covers uplink frequencies between 1710 MHz and 1770 MHz, and downlink frequencies between 2110 MHz and 2170 MHz. Operating Band X requires option R&S CMU-K16.
- Operating Band XI covers uplink frequencies between 1428 MHz and 1452.8 MHz, and downlink frequencies between 1476 MHz and 1500.8 MHz. Operating Band X requires option R&S CMU-K17.

- Operating Band XII covers uplink frequencies between 698 MHz and 716 MHz, and downlink frequencies between 728 MHz and 746 MHz. Operating Band X requires option R&S CMU-K17.
- Operating Band XIII covers uplink frequencies between 777 MHz and 787 MHz, and downlink frequencies between 746 MHz and 756 MHz. Operating Band X requires option R&S CMU-K17.
- Operating Band XIV covers uplink frequencies between 788 MHz and 798 MHz, and downlink frequencies between 758 MHz and 768 MHz. Operating Band X requires option R&S CMU-K17.
- Operating Band S covers uplink frequencies between 2000 MHz and 2020 MHz, and downlink frequencies between 2180 MHz and 2200 MHz. Operating Band S requires option R&S CMU-K15.
- Operating Band S, 190 MHz Duplex, covers uplink frequencies between 2000 MHz and 2010 MHz, and downlink frequencies between 2190 MHz and 2200 MHz. Operating Band S requires option R&S CMU-K18.
- Operating Band S, 170 MHz Duplex, covers uplink frequencies between 2010 MHz and 2020 MHz, and downlink frequencies between 2180 MHz and 2190 MHz. Operating Band S requires option R&S CMU-K19.

All uplink and downlink channel numbers and frequencies are quoted in Table 4-25 on p. 4.228 and in Table 4-28 on p. 4.238, respectively.

NOTE

The R&S CMU transmits the System Information Blocks SIB 5 (for operating bands I to III and V to VIII, S, X to XIV) or SIB 5bis (operating bands IV and IX) including the Frequency Band Indicator (for operating bands I to VII, S) or Frequency Band Indicator 2 (operating bands VIII and IX, X to XIV) in order to inform the UE about the current operating band.

Remote control

```
CONFigure:NETWork:OBANd OB1 | OB2 … OB14 | OBS | OBS1 | OBS2
```

Connection – State Signal On (CS)

In addition to the parameter overview and the *Dedicated Channel, Domain Type* and *Band Select* softkeys described in section *Connection – State Signal Off* on p. 4.196, the *Connection (Signal On)* tab contains the following softkeys which lead to other signalling states:

- Switch off the WCDMA signal *(BS Signal)* for synchronization *(Signal Off)*

Downlink WCDMA signal

The downlink WCDMA signal that the CMU transmits in the *Signal On* state has all the properties that are necessary to mimic a UTRAN cell, allowing the UE to synchronize, to initiate a registration/location update towards the network, and to set up a RRC connection. The WCDMA signal has the following channel contributions:

- The synchronization channels P-CPICH, S-CPICH, P-SCH and S-SCH
- The broadcast channels P-CCPCH, S-CCPCH, PICH, AICH
- The dedicated physical channel DPCH (DPDCH, DPCCH)

The power of all channels can be changed individually in the *BS Signal* tab; see section *Downlink Signal (Connection Control – BS Signal)* on p. 4.236.

The tab Connection *(Signal On)* is opened after the WCDMA signal *(BS Signal)* of the CMU is switched on so that the CMU emulates a UTRAN cell (softkey *Signal On* in the tab Connection *(Signal On))* or if the CMU forces a previously registered UE to initiate a new registration (softkey *Unregister* in the tab Connection *(Registered))*. It is replaced by the *Connection (Registered)* tab after the UE initiates a registration (see *Fig. 4-84*).

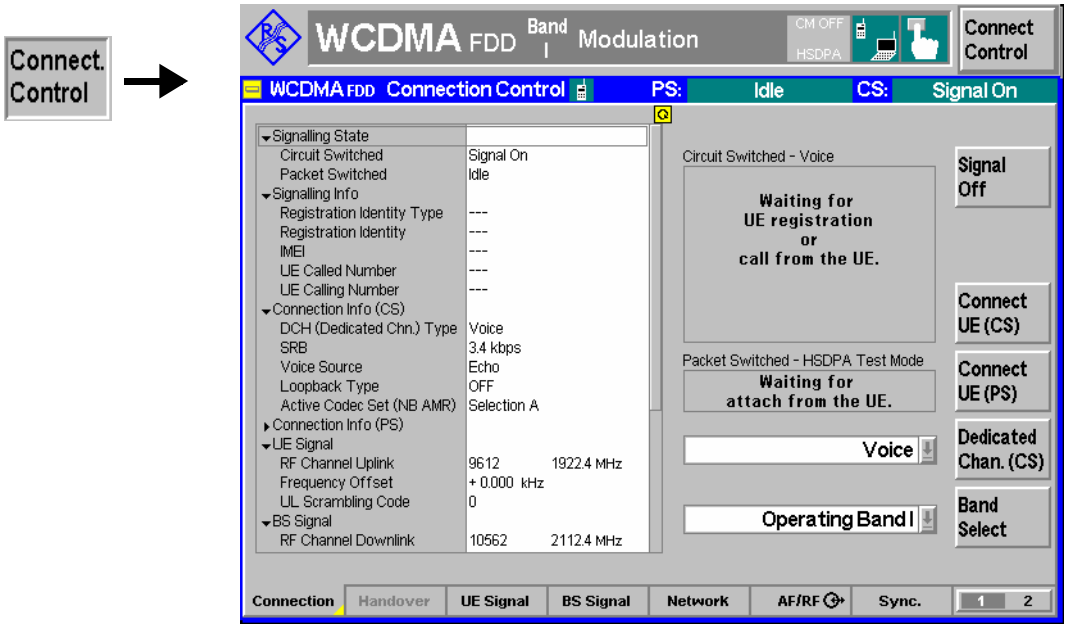


Fig. 4-87 Connection Control – Connection (Signal On)

The parameter overview in the left half of the menu is also indicated in the other *Connection* tabs and is described in section *Connection – State Connected* on p. 4.202. Some parameters are not always available, depending on the current and previous signalling states and settings. In this case the table shows invalid or unavailable settings ("---").

Message box A message box (here: *Waiting for UE synchronization or call from the UE)* in the right half of each *Connection* tab informs on the current instrument state or indicates how to proceed to get to other signalling states.

Signal Off The *Signal Off* softkey switches off the CMU's WCDMA cell signal *(BS Signal)* so that synchronization of the UE is lost. The CMU changes to the signalling state *Signal Off*.

Remote control

```
PROCedure:SIGNalling:ACTion SOFF
```

Connection – State Registered (CS)

In addition to the parameter overview and the *Dedicated Channel, Domain Type* and *Band Select* softkeys described in section *Connection – State Signal Off* on p. 4.196, the *Connection (Registered)* tab contains the following softkeys which lead to other signalling states:

- Deactivation of the WCDMA signal *(BS Signal)* for synchronization *(Signal Off)*
- Return to the *Signal On* state where the UE can attempt a new registration *(Unregister* -> return to state *Signal On)*
- Establishing a connection to the UE (*Connect UE (CS)* -> state *Alerting)*

The tab Connection *(Registered)* is opened when a successful RRC connection (in which case a registration/location update is considered as being already performed) is released *(Disconnect UE (CS)* softkey in the *Alerting* or in the *Connected* state, UE connection release, loss of radio link) or when a registration is initiated by the UE. It is replaced by the *Connection (Alerting)* tab if the CMU initiates a connection to the UE (softkey *Connect UE (CS)),* or by the *Connection (Connected)* tab if the UE initiates a connection to the CMU, see *Fig. 4-84* on page 4.195.

Note: *The parameter settings in the Requested UE Data section of the Network tab have and influence on the registration procedure; see p. 4.273. If registration fails, check whether the UE capabilities are in accordance with the Requested UE Data settings.*

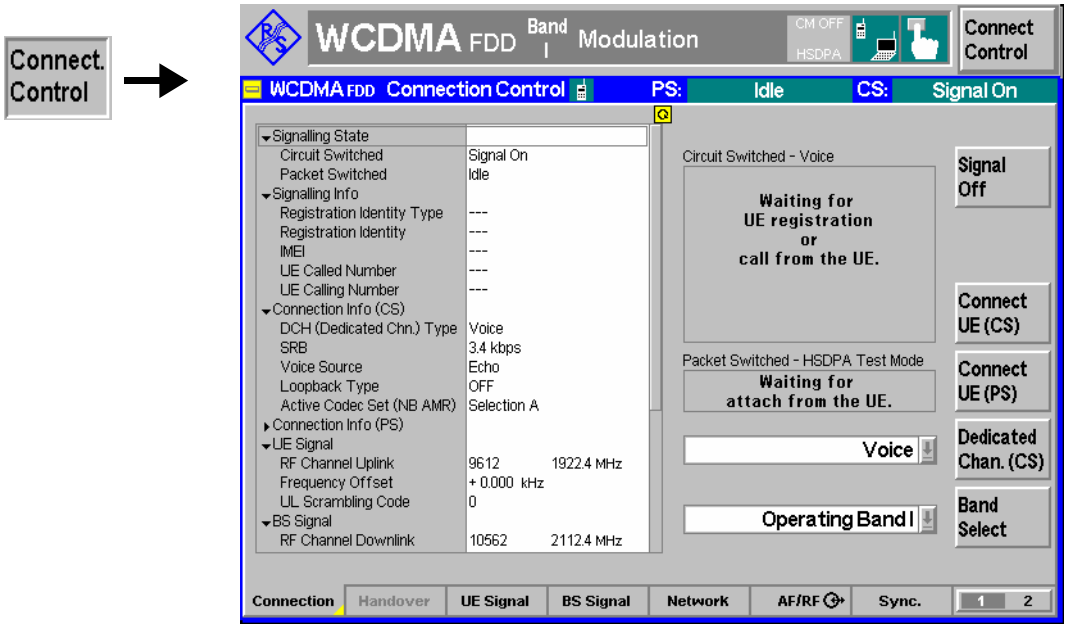


Fig. 4-88 Connection Control – Connection (Registered)

The softkey *Signal Off* is described in section *Connection – State Signal On* on page 4.198.

The parameter overview in the left half of the menu is also indicated in the other *Connection* tabs and is described in section *Connection – State Connected* on p. 4.202. Some parameters are not always available, depending on the current and previous signalling states and settings. In this case the table shows invalid or unavailable settings ("---").

Message box A message box (here: *Make a call from the UE or press the "Connect UE" key)* in the right half of each *Connection* tab informs on the current instrument state or indicates how to proceed to get to other signalling states.

Unregister The softkey *Unregister* resets the CMU to the *Signal On* state where the UE can attempt a new registration or a connection. This feature can be useful if the UE is replaced without switching the WCDMA signal *(BS signal)* off.

Remote control
`PROCedure:SIGNalling:ACTion UNR`

Connect UE (CS) The softkey *Connect UE (CS)* initiates a connection between the CMU and the UE. The CMU pages the UE on the CS domain and reaches the signalling state *Alerting* while the UE starts ringing. As soon as the connection is accepted at the UE the CMU changes to the CS signalling state *Connected*.

Remote control
`PROCedure:SIGNalling:ACTion CTM`

Connection – State Alerting (CS)

In addition to the parameter overview and the *Dedicated Channel, Domain Type* and *Band Select* softkeys described in section *Connection – State Signal Off* on p. 4.196, the *Connection (Alerting)* tab contains the following softkeys which lead to other signalling states:

- Deactivation of the WCDMA signal *(BS Signal)* for synchronization and connection release *(Signal Off)*
- *Disconnect UE (CS)* while keeping the WCDMA signal *(BS Signal)* switched on (–> *Registered)*

The tab Connection *(Alerting)* is opened while the UE is ringing during a connection setup *(Connect UE (CS)* softkey in the *Signal On* or in the *Registered* state). It is replaced by the *Connection (Connected)* tab when the UE accepts the connection (is picked up*),* or by the *Connection (Registered)* tab if the connection is released *(Disconnect UE (CS)* softkey, UE connection release), see *Fig. 4-84*.

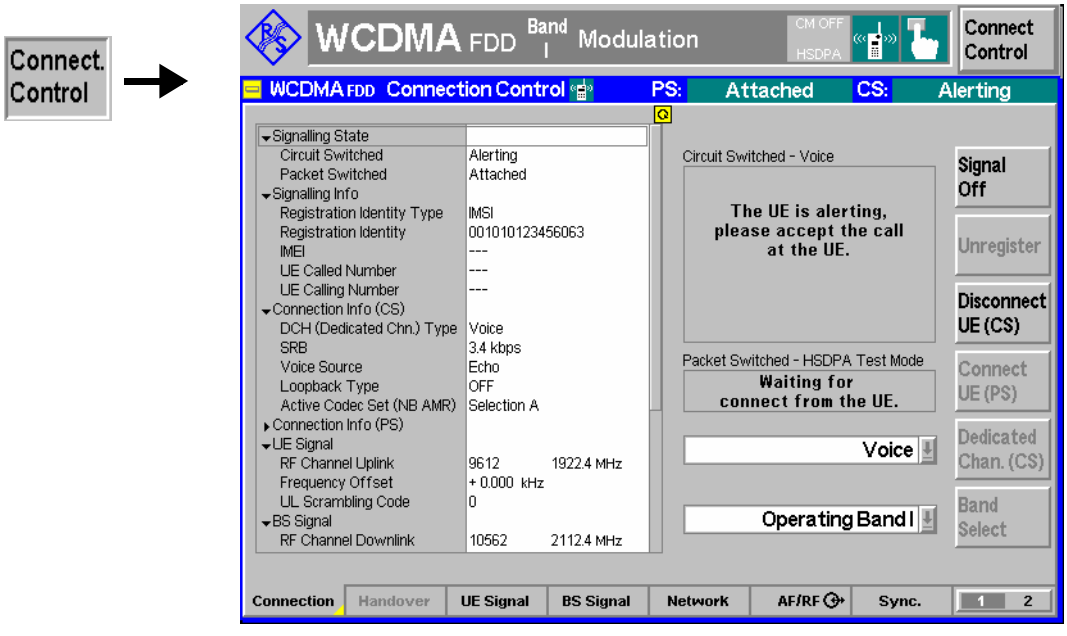


Fig. 4-89 Connection Control – Connection (Alerting)

The softkey *Signal Off* is described in section *Connection – State Signal On* on page 4.198.

The parameter overview in the left half of the menu is also indicated in the other *Connection* tabs and is described in section *Connection – State Connected* on p. 4.202. Some parameters are not always available, depending on the current and previous signalling states and settings. In this case the table shows invalid or unavailable settings ("---").

Message box A message box in the right half of each *Connection* tab informs on the current instrument state or indicates how to proceed to get to other signalling states.

Disconnect UE (CS)

The *Disconnect UE (CS)* softkey releases the CS connection to the UE. The CMU changes to the signalling state *Registered (CS)*.

Remote control
`PROCedure:SIGNalling[CSWitched]:ACTion CREL`

Connection – State Connected (CS)

In its left half the *Connection (Connected)* tab displays a list of signalling parameters describing the capabilities of the UE. The right half contains, in addition to the *Dedicated Channel, Domain Type* and *Band Select* softkeys described in section *Connection – State Signal Off* on p. 4.196, the following softkeys which lead to other signalling states:

- Deactivation of the signal for synchronization and release of the connection to the UE *(Signal Off)*
- Release of the connection to UE (*Disconnect UE (CS)* –> state *Registered)*

The tab Connection *(Connected)* can be opened after a connection attempt from the CMU *(Connect UE (CS)* softkey in the *Signal On* or in the *Registered* state) is accepted at the UE or after a successful connection attempt from the UE. It is replaced by the *Connection (Registered)* tab if the connection is released *(Disconnect UE (CS)* softkey, UE connection release) see *Fig. 4-84*.

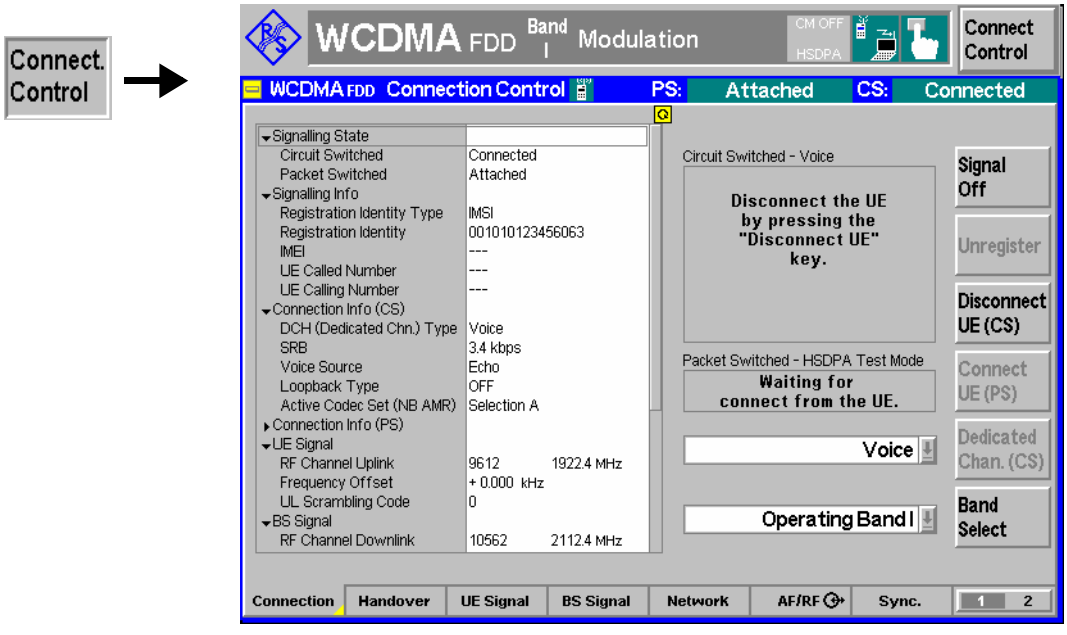


Fig. 4-90 Connection Control – Connection (Connected)

The function of the *Signal Off* softkey is described in section *Connection – State Signal Off* on page 4.196, the *Disconnect UE (CS)* softkey in section *Connection – State Alerting* on page 4.201.

Message box A message box in the right half of each *Connection* tab informs on the current instrument state or indicates how to proceed to get to other signalling states.

The parameter overview in the left half of the menu is also indicated in the other *Connection* tabs. In the *Connected* signalling state, all parameters are available, provided that the UE returns a valid result.

Signalling Info The *Signalling Info* parameter group contains information about UE and Node B identification.

Registration Identity Type Type of Mobile Identity: IMSI, IMEI, IMSISV, TMSI, P-TMSI or None. This information is transferred during registration.

Registration Identity Code number identifying the UE, depending on the *Identity Type*. This information is transferred during registration.

IMEI International Mobile station Equipment Identity of the UE. The IMEI transferred during registration if the re-

quest is enabled in the *Network* tab; see p. 4.273.

The following information is available in the *Connected* state:

UE Called Number — Number dialed at the UE attempt a connection to the CMU

UE Calling Number — Number dialed at the CMU to attempt a connection to the UE

CTM Text Telephony (TTY) — Support of TTY. In general this information is available during a voice or video call.

Remote control

```
[SENSe]:SIGNalling:RIType?
[SENSe]:SIGNalling:RIDentity?
[SENSe]:SIGNalling:IMEI?
[SENSe]:SIGNalling:DNUMber?
[SENSe]:SIGNalling:CNUMber?
[SENSe]:SIGNalling:TTY?
```

Connection Info

The *Connection Info* section displays BS signal settings which are relevant during the connection. Refer to the description of the *BS Signal* tab on p. 4.236.

The AMR codec information depends on the (wideband or narrowband) AMR settings, on the actual voice connection and the transmitted data (e.g. voice or silence). The R&S CMU displays the percentage of time where the UE codec was in one of its possible operating modes. The *Current* results are evaluated over the last second, the *Total Results* over the entire call (since the current voice connection was set up). The AMR codec information is available while the R&S CMU is *Connected.*

Codec Mode — Percentage of time where the UE used a particular codec mode, transmitting voice data at a definite data rate. The displayed codec modes are in accordance with the codec mode selection in the *BS Signal* tab of the *Connection Control* menu. The information is particularly interesting if codec set M is active, where the UE can switch between 4 different codec modes.

Comfort Noise — Percentage of time where the UE generated comfort noise (see 3GPP TS 26.092).

No Data — Percentage of time where the UE generated no data at all.

The percentages in the *Current* and *Total* columns add up to 100 %.

Remote control

To read parameter settings use the setting command with an appended question mark (query form). The AMR codec modes can be retrieved with the following remote commands:

```
[SENSe:]BSSignal:DCH:VOIce:NAMR:CURRent?
[SENSe:]BSSignal:DCH:VOIce:NAMR:TOTal?
[SENSe:]BSSignal:DCH:VOIce:WAMR:CURRent?
[SENSe:]BSSignal:DCH:VOIce:WAMR:TOTal?
```

The following parameters characterize the **Radio Access Capability** of the UE. They are described in standard TS 25.306 and the references given therein. The Radio Access Capability information is transferred during registration if the request is enabled in the *Network* tab; see p. 4.273.

PDCP

The *PDCP* section indicates in which way the UE supports the Packet Data Convergence Protocol described in standard TS 25.323:

Loss-less SRNS relocation — Support for loss-less SRMS relocation

RFC 2507 — Support for IP header compression according to RFC 2507

RFC 3095 Support for robust header compression according to RFC 3095

RFC 3095 context relocation Support for context relocation applied for the RFC 3095 header compression protocol.

Header Compression Maximum header compression context size supported by the UE. This parameter is only applicable if the UE supports header compression according to RFC 2507.

Max. ROHC context sess. Maximum number of header compression context sessions supported by the UE. This parameter is only applicable if the UE supports header compression according to RFC3095.

Reverse Decompression Support for reverse decompression: either *Not Supported* or the number of packets that can be reverse decompressed by the decompressor in the UE.

Lossless RLC PDU Size Ch Support for lossless DL RLC PDU Size Change.

Remote control
`[SENSe]:UECapability:PDCP?`

RLC

The *RLC* section indicates in which way the UE supports Radio Link Control Acknowledged Mode (RLC AM):

AM Buffer Size Maximum total buffer size across all RLC AM entities supported by the UE

Max. RLC Window Size Maximum RLC window size supported by the UE

Max. AM Entities Maximum number of AM entities supported by the UE

Remote control
`[SENSe]:UECapability:RLC?`

Physical Downlink – Transport Channel

The *Physical Downlink – Transport Channel* section describes the capacity of the UE to simultaneously process and store downlink transport channels:

Simultaneous Tr. Chn. Maximum number of downlink transport channels that the UE is capable to process simultaneously, not taking into account the rate of each transport channel.

Simultaneous CCTrCH Maximum number of downlink Coded Composite Transport Channels (CCTrCHs) that the UE is capable to process simultaneously. CCTrCH should be interpreted as consisting of DCH, FACH or DSCH.

TTI Transport Blocks Maximum total number of transport blocks received within Transmission Time Intervals (TTIs) that end within the same 10 ms interval. This includes all transport blocks that are to be simultaneously received by the UE on DCH, FACH, PCH and DSCH transport channels.

Number of TFC Maximum number of Transport Format Combinations (TFC) in a downlink transport format combination set that the UE can store.

Number of TF Maximum number of downlink Transport Formats (TF) that the UE can store, where all transport formats for all downlink transport channels are counted.

Turbo Decoding Support for turbo decoding

Received Bits (Tr. Blocks) Maximum number of bits of all transport blocks being received at an arbitrary time instant. This section com-

prises three values, corresponding to bits that are *Convolutionally Coded,* bits that are *Turbo Coded* and the sum of *All* bits.

Remote control
`[SENSe]:UECapability:PDOWnlink?`

Physical Downlink – Physical Channel FDD

The *Physical Downlink – Physical Channel FDD* section describes the capacity of the UE to process and store downlink physical channels:

DPCH Codes Maximum number of DPCH codes to be simultaneously received. For DPCH in soft/softer handover, each DPCH is only calculated once. The capability does not include codes used for S-CCPCH.

Physical Channel Bits Maximum number of physical channel bits received in any 10 ms interval (DPCH, PDSCH, S-CCPCH). For DPCH in soft/softer handover, each DPCH is only calculated once.

SF 512 Support for Spreading Factor (SF) 512 in downlink.

Remote control
`[SENSe]:UECapability:PDOWnlink?`

Physical Uplink – Transport Channel

The *Physical Uplink – Transport Channel* section describes the capacity of the UE to simultaneously process and store uplink transport channels:

Simultaneous Tr. Chn. Maximum number of uplink transport channels that the UE is capable to process simultaneously, not taking into account the rate of each transport channel.

Simultaneous CCTrCH Maximum number of uplink Coded Composite Transport Channels (CCTrCHs) that the UE is capable to process simultaneously. This feature is relevant in FDD mode only.

TTI Transport Blocks Maximum total number of transport blocks transmitted within Transmission Time Intervals (TTIs) that start at the same time.

Number of TFC Maximum number of Transport Format Combinations (TFC) in an uplink transport format combination set that the UE can store.

Number of TF Maximum number of uplink Transport Formats (TF) that the UE can store, where all transport formats for all uplink transport channels are counted.

Turbo Decoding Support for turbo decoding

Transmitted Bits (Tr. Blocks) Maximum number of bits of all transport blocks being transmitted at an arbitrary time instant. This section comprises three values, corresponding to bits that are *Convolutionally Coded,* bits that are *Turbo Coded* and the sum of *All* bits.

Remote control
`[SENSe]:UECapability:PUPLink?`

Physical Uplink – Physical Channel FDD

The *Physical Uplink – Physical Channel FDD* section describes the capacity of the UE to process and store uplink physical channels:

DPDCH Bits per 10 ms Maximum number of DPDCH bits the UE can transmit in 10 ms. The value applies to UE operation in non-

compressed mode (if the value is <9600) or in both compressed and non-compressed mode (if the value is ≥9600).

Remote control
`[SENSe]:UECapability:PUPLink?`

RF Parameters

Support of Band Support of the different WCDMA operating bands.

Power Class Indicates the UE power class for each supported band as defined in 3GPP TS 25.101, *UE Radio Transmission and Reception (FDD)*.

Tx/Rx Frequ. Separation Indicates the uplink/downlink frequency separation for each band supported by the UE (frequency or frequency range).

Remote control
`[SENSe]:UECapability:RFParameters?`

Multi Mode

UTRA FDD/TDD Indicates whether the UE supports UTRA FDD or TDD.

Remote control
`[SENSe]:UECapability:MMODe?`

Multi RAT

The *Multi RAT* section indicates the Radio Access Technology that the UE supports:

GSM Indicates whether the UE supports GSM.

Mult Carrier Mode Indicates whether the UE supports multi carrier mode.

UTRAN to GERAN NACC Indicates whether the UE supports UTRAN to GERAN NACC.

Security Indicates whether the UE supports several ciphering and integrity algorithms

Handover to GAN Indicates whether the UE supports CS Handover to GAN.

Inter-RAT PS Handover Indicates whether the UE supports Inter-RAT PS Handover.

Remote control
`[SENSe]:UECapability:MRAT?`

UE Position

The *UE Position* section contains parameters related to UE positioning:

Standalone Loc. Method Indicates if a UE can measure its location by some means unrelated to UTRAN (e.g. if the UE has access to a standalone GPS receiver).

Network Assisted GPS Indicates if a UE supports either of the two types of assisted GPS schemes, namely "Network based", "UE based", "Both", or "none".

GPS Reference Time Indicates if a UE has the capability to measure GPS reference time as defined in standard TS 25.215, *Physical layer - Measurements (FDD)*.

IPDL Indicates if a UE has the capability to use Idle Periods in the DownLink (IPDL) to enhance its "SFN-SFN observed time difference –type 2" measurement.

OTDOA UE based method Indicates if a UE supports the Observed Time Differ-

ence Of Arrival (OTDOA) UE based schemes.

Rx/Tx Time Difference Indicates if a UE has the capability to perform the Rx-Tx time difference type 2 measurement.

CELL_PCH/URA_PCH Indicates whether the UE positioning measurements using the assisted GPS method are valid in CELL_PCH and URA_PCH RRC states.

SFN-SFN Time Difference Indicates whether the UE has the capability to perform the SFN-SFN observed time difference type 2 measurement.

Remote control
`[SENSe]:UECapability:UEPosition?`

Measurement Related

The *Measurement Related* section displays measurement capability information (see standard 3GPP TS 25.331). A pair of two values is indicated for each combination of a target FDD frequency band (↓) and a current *(Curr.)* frequency band:

DL/UL Indicates whether the UE needs DL/UL compressed mode in order to perform measurements on a particular target band while it operates in the current band (*Need for DL/UL Compressed Mode)*. An invalid result generally indicates that the UE does not support the corresponding current band or target band.

Example:

The following values indicate that the UE needs DL compressed mode for measurements in FDD band III while it operates in band II or band III. Moreover, the UE needs UL compressed mode for measurements in band III and IV while it operates in band III.

DL/UL CM Meas. ↓ / Curr.	**…**	**Band II**	**Band III**	**…**
…	…	…	…	…
Band III	…	Y/N	Y/Y	…
Band IV	…	N/N	N/Y	…
…	…	…	…	…

Remote control
`[SENSe]:UECapability:MRELated?`

General

Release Indicator Access Stratum Release Indicator, e.g. Rel. 99, Rel. 5.

Benefits Batt. Consum. Opt. Indicates whether or not the UE benefits from NW-based battery consumption optimization

Remote control
`[SENSe]:UECapability:GENeral?`

HSDPA

The *HSDPA* section displays HSDPA-related information (see 3GPP TS 25.306).

Support of HS-PDSCH Indicates whether the UE supports the HS-PDSCH.

Physical layer category HS-DSCH physical layer category of the UE; integer number between 1 and 12.

DL cap. with simult.

HS-DSCH Supported DPCH data rate in case an HS-DSCH is configured simultaneously.

Remote control
`[SENSe]:UECapability:HSDPa?`

HSUPA The *HSUPA* section displays HSUPA-related information (see 3GPP TS 25.306).

Support of HSUPA Indicates whether the UE supports HSUPA.

Physical layer category E-DCH physical layer category of the UE; integer number between 1 and 7.

Remote control
`[SENSe]:UECapability:MRELated?`

Connection – RF Channel and Power

The CMU provides a second version of the *Connection* tab where the info table on the left side is replaced by softkeys. The softkeys provide the following RF channel and power settings:

- Definition of the RF channel of the BS signal and the UE signal *(RF Chn. Downlink, RF Chn. Uplink).*
- RF power and power control settings *(Downlink Power, UE Power Control)*
- Control of the *Openloop Power* measurement.

The results of the *Openloop Power* measurement and the *Expected PRACH Power* are also displayed on the left side of the tab.

The RF channel and power softkeys are available in all signalling states. The *Connection* hotkey toggles between the two versions of the *Connection* tab if it is pressed repeatedly. The right half with the connection control softkeys is identical in both versions of the tab.

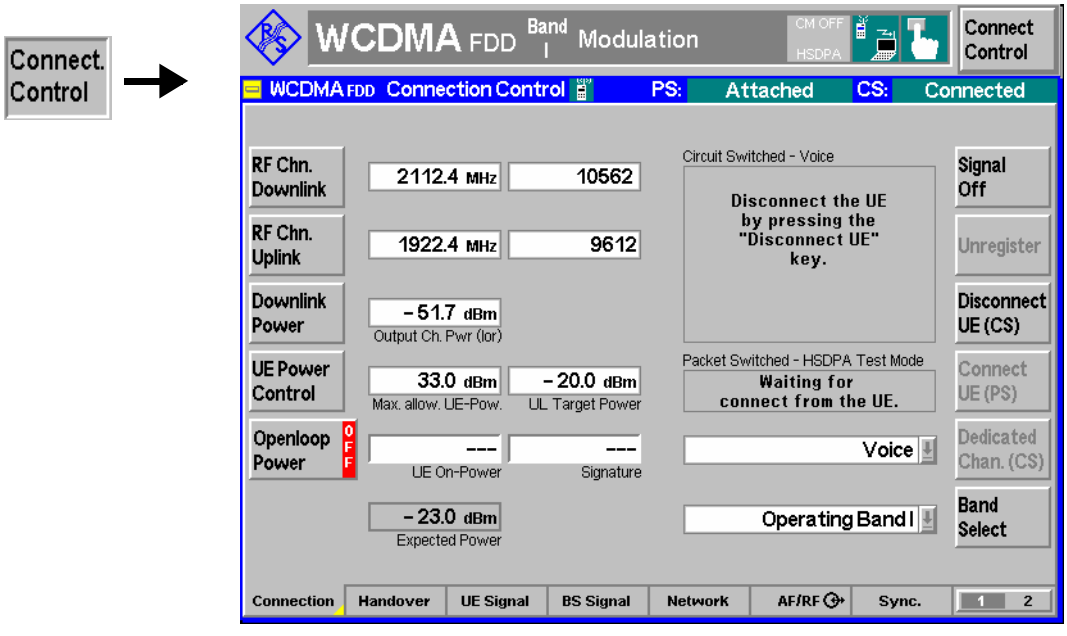


Fig. 4-91 Connection Control – Connection (RF Channel and Power)

The in the right half of the *Connection* tab are described in the previous section. The left half of the tab contains the following controls:

RF Chn. Downlink

Defines the carrier frequency and channel number (UARFCN, UTRA Absolute Radio Frequency Channel Number) of the generated signal. The parameters are analogous to the RF generator parameters described in section *Generator Settings (Connection Control – Generator)* on p. 4.147.

Remote control
```
UNIT:BSSignal:CHANnel <Unit>
CONFigure:BSSignal:CHANnel <UARFCN>
```

RF Chn. Uplink

Defines the carrier frequency and channel number (UARFCN, UTRA Absolute Radio Frequency Channel Number) of the measured signal. The parameters are described in section *Analyzer Settings (Connection Control – Analyzer)* on p. 4.143.

Remote control
```
CONFigure:UESignal:CHANnel <Unit>
UNIT:UESignal:CHANnel <CHANnel>
```

Downlink Power

Defines the total output power of the BS Signal, averaged over 1 frame but not taking into account a possible DTX mode for the TFCI bits. The parameter is described in section *Downlink Signal (Connection Control – BS Signal)* on p. 4.236.

Remote control
```
CONFigure:BSSignal:OPOWer <UARFCN>
```

UE Power Control

Sets the maximum output power of the UE transmitter (averaged over the transmit slot) and the *UL Target Power*. The settings are also provided in the *UE Signal* tab; see section *Uplink Signal (Connection Control – UE Signal)* on p. 4.227.

Remote control
```
CONFigure:UESignal:PCONtrol:UEPower <Power>
CONFigure:UESignal:PCONtrol:TPOWer:VALue
```

Openloop Power

Controls the PRACH preamble power and signature measurement and indicates its status *(RUN | HLT | OFF)*. Once initiated, the openloop power measurement is re-activated every time that the *Connection Control* menu is opened.

The openloop power measurement is suitable for testing the first power step of the PRACH preamble during random access and verifying compliance with the *Open loop power control tolerance* specified in standard 3GPP TS 34.121. The measurement provides the following results:

PRACH UE-On Pow. Average (RMS) power of the first PRACH preamble received after the *Openloop Power* measurement is switched on. The preamble power depends on various parameters that can be set in the *UE Signal* tab of the *Connection Control* menu. The PRACH power is averaged over the preamble length of 4096 chips excluding 25 µs (96 chips) at the beginning and at the end of the preamble. The measurement result is in units of dBm.

PRACH Signature Measured signature of the first PRACH preamble received after the *Openloop Power* measurement is switched on. The preamble signature is in the range 0 to 15 and determines the channelization code of the RACH message part; see 3GPP TS 25.213.

Important Note

The Openloop Power *measurement only runs if the underlying TX measurement is turned off. Press the* Connect Control *softkey to close the* Connection Control *menu and check the status of the current underlying measurement.*

The conflict does generally not occur in remote control mode since remote control measurements are typically run in single shot mode.

Performing a PRACH test

PRACH preambles are transmitted during registration and connection setup; see description of random access procedure and Fig. 4-110 on p. 4.272. To obtain a measurement result, proceed as follows:

1. Reset the instrument and make sure that all TX measurements are turned off.
2. Open the *Connection Control* menu and press the *Signal Off* softkey in the *Connection* tab.
3. Press *Openloop Power* and the *ON/OFF* key to initiate the openloop power measurement.
4. Press *Signal On* to switch on the *BS Signal.*
5. Switch the UE on.

The UE synchronizes to the BS signal and can attempt a registration towards the R&S CMU. The openloop power results are available after the R&S CMU has received the first PRACH preamble from the UE. The measurement state is *HLT,* the results are not updated when the CMU receives further RACH preambles.

6. To measure the preamble transmitted when a connection is set up, press the 1 / 2 hotkey to access the second group of *Connection Control* tabs. In the *Misc.* tab, deactivate *Close automatically if connected.*
7. Return to the *Connection* tab of the *Connection Control* menu.
8. Press *Openloop Power* and *ON/OFF* to re-start the measurement or simply close and re-open the *Connection Control* menu.
9. Press *Connect to UE*.

The openloop power results are updated after the CMU has received the first PRACH preamble from the UE.

10. To repeat the entire measurement, switch off your UE (to make sure that it has to register again) and go to step 2.

It is possible to initiate the openloop power measurement during the random access procedure. To be sure to measure the first preamble of the retransmission cycle in this case (the single preamble that meets openloop conditions), it is recommended to set the *Max. Retransmission* parameter in the *Network* tab to 1.

The openloop power measurement requires a Signalling, Auto, or a Preamble trigger (see section Trigger (Connection Control – Trigger) on p. 4.281. Signalling *(equiv. to* Preamble) *is the default trigger source.*

Remote Control

```
INITiate:OLP; ABORt:OLP
FETCh:OLP:STATus?
READ[:SCALar]:OLP?
FETCh[:SCALar]:OLP?
```

Limit check

A red output field and an arrow pointing upwards or downwards indicates that the *PRACH UE-On Power* result differs from the *Expected PRACH Power* indicated below by more than the symmetric upper or lower limit set in the *UE Signal* tab of the *Connection Control* menu.

Remote Control
```
CALCulate[:SCALar]:OLP:MATChing:LIMit?
```

Expect. PRACH Pow.

Indicates the expected average initial preamble power of the UE according to the current settings of the *Reported P-CPICH Power* and the remaining open loop power control parameters (see formula for *Ppreamble* on p. 4.232).

Note: *While the Openloop Power measurement is running, the CMU monitors* Expected PRACH Power *and generates an error message if it exceeds the* Max. Allowed UE Power.

Remote control
```
READ[:SCALar]:OLP?
FETCh[:SCALar]:OLP?
```

Connection – SMS

The third version of the *Connection* tab provides the Short Message Service (SMS) functionality of the R&S CMU:

- Entry of the text for a short message to be sent to the UE *(SMS).*
- Display of a message from the UE *(Received Message).*

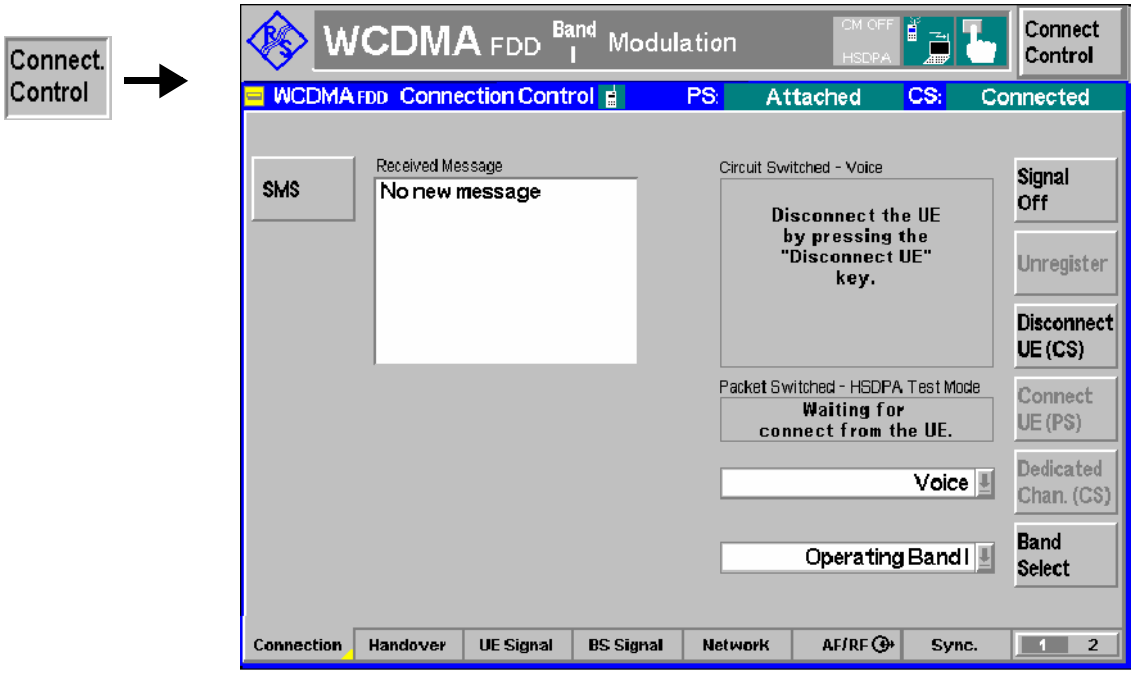


Fig. 4-92 Connection Control – Connection (SMS)

The in the right half of the *Connection* tab are described in the previous sections. The left half of the tab contains the following controls:

SMS

The *SMS* softkey opens the *Short Message Service* popup menu:

A text with a maximum of 160 alphanumeric characters can be entered in the input field. Two front panel keys control the short message service menu:

CLR Clear the whole short message from the input field

ENTER Send the short message in the input field to the UE. This may be done in the signalling states *CS: Signal On*, *CS: Registered,* or even *CS: Connected* (voice call). Some UEs show the message only after the current connection has been released.

Remote control

```
PROCedure:SIGNalling:ACTion SMS
CONFigure:SIGNalling:SMS <Text>
SENSe:SIGNalling:SMS?
```

Received Message

Displays the text of a received message from the UE (or *No new message,* if no message is available). You can dial any phone number to send a message to the R&S CMU.

Packet Switched (PS) Connections

In addition to the circuit switched (CS) connection scheme described in the previous sections, the R&S CMU provides a complementary scheme for packet switched (PS) connections. Packet switched connections are relevant for HSDPA and HSUPA tests in *Signalling* mode (see Chapter 8) and for *WCDMA Application Testing* (including application tests on HSDPA connections; see Chapter 9).

Connection Setup

The R&S CMU can set up a circuit switched WCDMA connection (e.g. for voice transfer or various test modes) or a packet switched connection for data transfer. Two different packet switched connection types are available:

- The *HSDPA Test Mode* for production tests of UEs supporting HSDPA.
- The *HSUPA Test Mode* for production tests of UEs supporting HSUPA.
- The *Packet Data* mode for data application test using option R&S CMU-K96, *WCDMA Data Application Testing*.

The five circuit-switched signalling states *Signal Off, Signal On, Registered, Alerting, Connected* of the R&S CMU are complemented by the following packet switched signalling states:

Signal Off CMU transmits no signal.

Idle CMU transmits a DL WCDMA signal and mimics a UTRAN cell. A WCDMA UE can detect this signal, synchronize to its timing and frequency and then read the packet switched domain information. In particular, the MS learns that the CMU (representing the serving cell in a real network) supports packet switched services and can initiate a PS attach.

Attached The UE is PS-attached. From this state, it is possible to initiate a connection either from the UE (for packet data tests) or from the R&C CMU (for HSDPA tests).

Connection in Progress	Transitory state: The CMU attempts to access the *PS Established* state.
Disconnection in Progress	Transitory state: The PS connection is being released.
PS Established	The UE is in the connected state and ready to perform packet data application tests (after a connection initiated from the UE) or HSDPA tests (after a connection initiated from the R&S CMU).

A number of actions or control commands which can be initiated either by the CMU (e.g. *Signal On, Signal Off)* or by the UE (e.g. *MS Attach/Detach)* switch between the different signalling states. In Fig. 4-93 on p. 4.215, dashed lines represent processes initiated from the UE.

Activating packet data services

The CMU mimics a UTRAN cell which may or may not support packet data services. The packet switched domain must be enabled **before** a (CS or PS) connection is set up (enabled by default).

- Open the *Network* tab of the *Connection Control* menu and ensure that the PS domain is enabled *(Packet Switched Domain: On)*.

A packet data connection can be set up as described below.

PS Connection: Preparations

To prepare a PS connection take the following steps:

1. In the *Menu Select* menu, select one of the menus in *WCDMA Signalling* mode.

   The *Connection Control* menu is opened. If no previous connection has been established, the CMU is in the signalling state *PS: Idle, CS: Signal On*.
2. Switch on your UE and wait until the R&S CMU has reached the signaling state *PS: Attached, CS: Registered*.

The following steps depend on whether you wish to perform HSDPA, HSUPA, or packet data application tests (which may be performed on HSDPA/HSUPA channels, too), and which HSDPA/HSUPA connection scheme you prefer.

HSDPA Test Mode with direct PS connection

In the following fast connection scheme, no circuit-switched but only a packet data connection is set up.

3. Open the *BS Signal* tab and open the *Packet Switched – HSDPA Test Mode* section where you can select the *Radio Bearer Setup* that the R&S CMU uses to set up the packet switched connection.
4. Still in the *BS Signal* tab, switch the HSDPA channels in the downlink signal on *(Downlink Physical Channels – HSDPA Channels: On).*
5. Open the *Connection* tab and press *Connect UE (PS)* to set up a packet switched connection. Do not attempt a call from the UE or a simultaneous circuit switched connection.
6. Close the *Connection Control* menu (if it is not closed automatically).

The CMU is in the signalling state *PS: Established, CS: Registered* where it is ready to perform HSDPA tests. HSDPA tests may also be performed with a CS connection; see below.

HSDPA Test Mode with CS connection

HSDPA tests with an additional CS connection are an alternative to HSDPA tests in the signalling state *PS: Established, CS: Registered*. The additional CS connection takes time, however, measurements can be performed in accordance with specification 3GPP TS 34.108.

3. In the *PS: Attached, CS: Registered* signalling state, open the *BS Signal* tab and select *Circuit Switched – DCH (Dedicated Chn.) Type: RMC.*
4. Select *Circuit Switched – RMC Settings – Reference Channel Type: 12.2 kbps + HSDPA 34.108* or *12.2 kbps (+ HSDPA)*.
5. Perform the other *BS Signal* settings as described above.
6. Open the *Connection* tab and press *Connect UE (CS)* to set up the circuit switched RMC connection.

The connection setup depends on the selected reference channel type:

- With a *12.2 kbps + HSDPA 34.108* reference channel, the packet switched connection is set up automatically after the circuit switched connection so that the R&S CMU reaches the signalling state *PS: Established, CS: Connected.*
- With a *12.2 kbps (+ HSDPA)* reference channel, the R&S CMU reaches the signalling state *PS: Attached, CS: Connected.* Measurements on CS channels can be performed in this state. In addition it is possible to set up the additional packet switched connection *(Connect UE (PS))*.

HSUPA Test Mode with direct PS connection

In the following fast connection scheme, no circuit-switched but only a packet data connection set up.

3. Open the *BS Signal* tab and open the *Packet Switched – HSUPA Test Mode* section where you can select the *Radio Bearer Setup* that the R&S CMU uses to set up the packet switched connection.
4. Still in the *BS Signal* tab, switch the HSUPA channels in the downlink signal on *(Downlink Physical Channels – HSUPA Channels: On).*
5. Open the *Connection* tab and press *Connect UE (PS)* to set up a packet switched connection. Do not attempt a call from the UE or a simultaneous circuit switched connection.
6. Close the *Connection Control* menu (if it is not closed automatically).

The CMU is in the signalling state *PS: Established, CS: Registered* where it is ready to perform HSUPA tests. HSUPA tests may also be performed with a CS connection; see below.

HSUPA Test mode with CS connection

HSUPA tests with an additional CS connection are an alternative to HSUPA tests in the signalling state *PS: Established, CS: Registered*. The additional CS connection takes time, however, measurements can be performed in accordance with specification 3GPP TS 34.108.

3. In the *PS: Attached, CS: Registered* signalling state, open the *BS Signal* tab and select *Circuit Switched – DCH (Dedicated Chn.) Type: RMC.*
4. Select *Circuit Switched – RMC Settings – Reference Channel Type: 12.2 kbps + HSPA 34.108* or *12.2 kbps (+ HSPA)*.
5. Perform the other *BS Signal* settings as described above.
6. Open the *Connection* tab and press *Connect UE (CS)* to set up the circuit switched RMC connection.

The connection setup depends on the selected reference channel type:

- With a *12.2 kbps + HSPA 34.108* reference channel, the packet switched connection is set up automatically after the circuit switched connection so that the R&S CMU reaches the signalling state *PS: Established, CS: Connected.*
- With a *12.2 kbps (+ HSPA)* reference channel, the R&S CMU reaches the signalling state *PS: Attached, CS: Connected.* Measurements on CS channels

can be performed in this state. In addition it is possible to set up the additional packet switched connection *(Connect UE (PS))*.

Packet Data Application Tests (including HSDPA and HSUPA)

3. Open the *BS Signal* tab and open the *Packet Switched – Packet Data* section where you can select the data rate for the application tests (including application tests on HSDPA connections with different uplink data rates, application tests on HSUPA connections with different downlink data rates, or combined HSDPA/HSUPA application tests).
4. Set up a packet switched connection from your UE. Do not attempt a call from the R&S CMU.

The CMU is in the signalling state *PS: Established, CS: Registered* where it is ready to perform data application tests. Note that the parameter *Packet Switched – DCH (Dedicated Chn.) Type* has no influence on mobile-originated calls.

Packet Data Application Tests with CS connection (multi-call)

3. Press *Connect UE (CS)* to establish a circuit-switched call (or initiate a call from the UE.
4. Open the *BS Signal* tab and open the *Packet Switched – Packet Data* section where you can select the data rate for multi-call application tests (see section *Multi-Call Application Test Scenarios* in chapter 9).
5. Set up a packet switched connection from your UE. Do not attempt a call from the R&S CMU.

The CMU is in the signalling state *PS: Established, CS: Connected* where it is ready to perform data application tests and test on the CS connection in parallel. Note that the parameter *Packet Switched – DCH (Dedicated Chn.) Type* has no influence on mobile-originated calls.

Remote control

```
CONFigure:BSSignal:PSWitched:DCH:TYPE
CONFigure:BSSignal:PSWitched:DCH:HSTMode:RBSetup
CONFigure:BSSignal:PSWitched:DCH:HUTMode:RBSetup
```

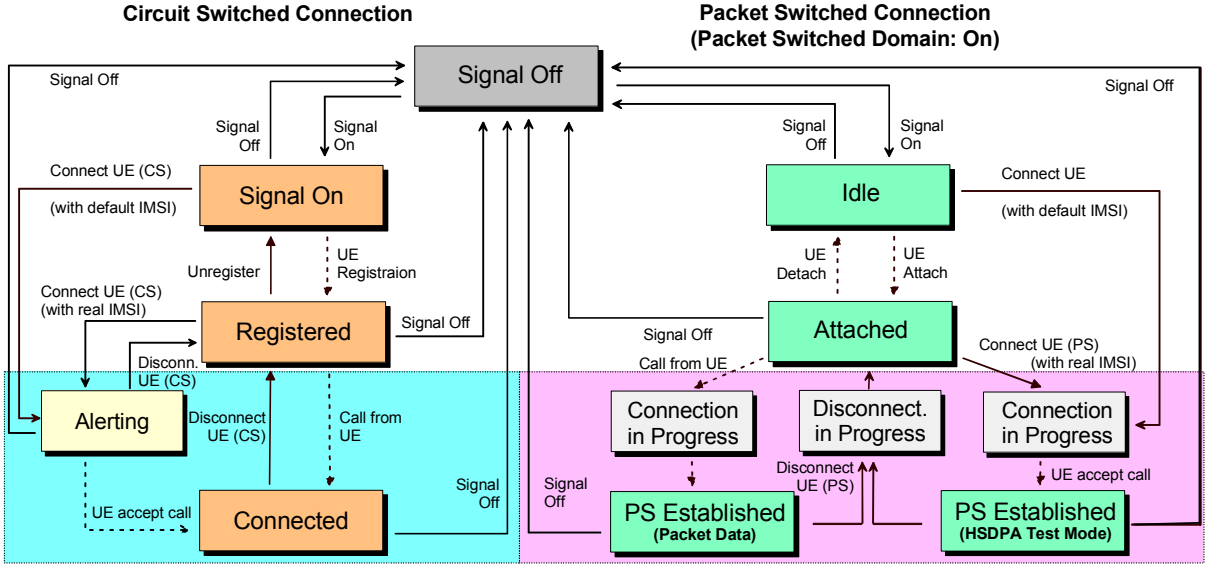


Fig. 4-93 Packet switched and circuit switched signalling states

1. The CS and PS states are independent from each other until the R&S CMU has reached the PS: Attached *and* CS: Registered *states.*

2. A CS connection (signalling state CS: Connected) *suspends the PS connection scheme; a PS connection (signalling state* PS: Established) *suspends the CS connection scheme (no multicall capability).*

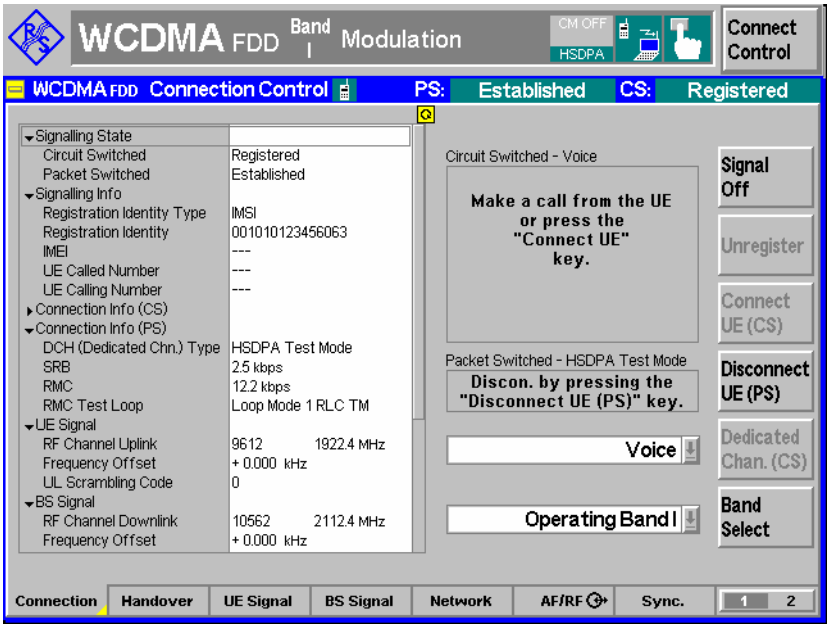
3. Signal Off also releases the circuit switched connection.

Connection Setup

A packet switched connection is controlled by the *Signal On* and *Signal Off* and by the *Connect UE (PS)* and *Disconnect UE (PS)* softkeys in the *Connection* tab of the *Connection Control* menu. The remaining actions shown in Fig. 4-93 above can be initiated from the UE.

When a signalling state is reached, the current packet switched and circuit switched signalling state of the CMU is displayed in the title bar of the *Connection Control* menu. The icons in the title bar of the measurement menus also show the signalling state for both connection types (see Chapter 3). The HSDPA/HSUPA test mode is indicated in addition:

- *HSDPA* appears on a green background if the HSDPA channels are switched on and the *PS Established (HSDPA Test Mode)* state is reached.
- *HSUPA* appears on a green background if the HSUPA channels are switched on and the *PS Established (HSUPA Test Mode)* state is reached.



In HSUPA test mode with a 10 ms TTI, it is still possible to activate the compressed mode; see section *Compressed Mode Configuration on p. 4.254**.*

Remote control

```
PROCedure:SIGNalling:PSWitched:ACTion
[SENSe]:SIGNalling:PSWitched:STATe?
```

Parameters for Packet Switched Connections

In the *Packet Switched* section of the *Connection Control – BS Signal* tab the R&S CMU provides parameters for the packet switched connections and for HSDPA and HSUPA test mode. These test mode

parameters are independent of the HSDPA and HSUPA signal configuration described in Chapter 8. The different connection schemes are described in section Parameters for on p. 4.216.

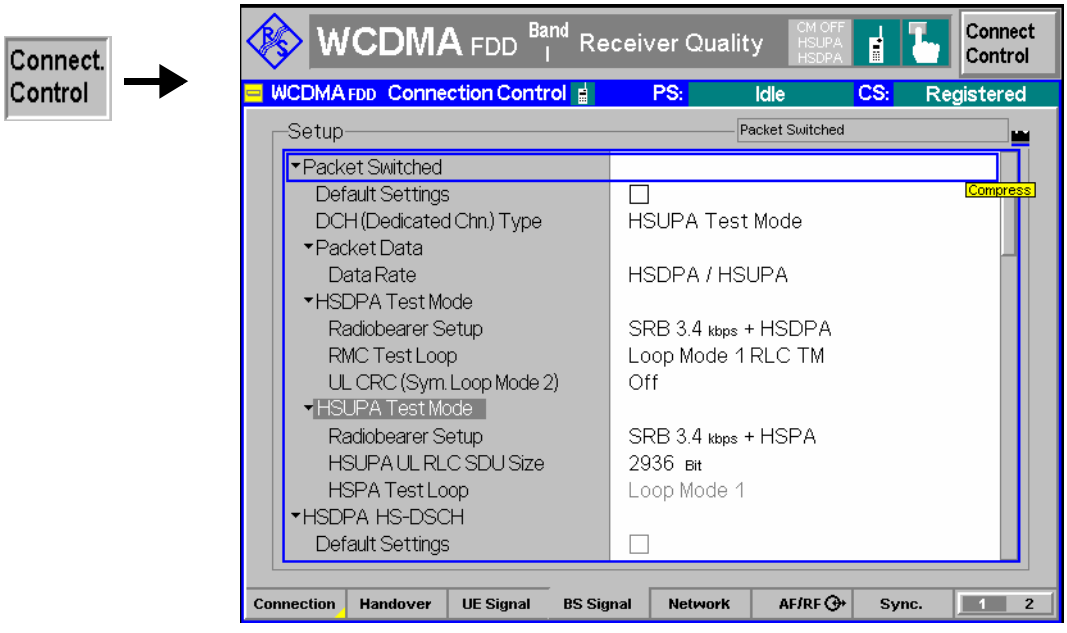


Fig. 4-94 Connection Control – HSDPA and HSUPA connection parameters

DCH Type

Packet switched connection for HSDPA tests *(HSDPA Test Mode)* or HSUPA tests *(HSUPA Test Mode).*

If a connection for data application tests is set up from the UE (see Fig. 4-93 on p. 4.215), the DCH type setting is not ignored. Instead *Packet Data* is displayed for information after the connection is established (no setting value).

Remote control
`CONFigure:BSSignal:PSWitched:DCH:TYPE HSTM | HUTM |`

Packet Data

Provides parameters for a UE-originated packet data connection.

Data Rate Data rate for the packet data connection. The R&S CMU supports connections with various symmetric and asymmetric data rates. With the HSDPA and HSUPA options it is also possible to set up HSDPA, HSUPA, or combined HSDPC/HSUPA connections for WCDMA data application tests; see Chapter 9.

Remote control
`CONFigure:BSSignal:PSWitched:DCH:PDATa:RATE`

HSDPA Test Mode

The following parameters configure the HSDPA test mode.

Radio Bearer Setup Channel configuration that the R&S CMU uses to connect to *HSDPA Test Mode* (connection initiated from the R&S CMU): *SRB 3.4 kbps + HSDPA* (simple connection according to the test specification), *RMC 12.2 kbps + HSDPA,* or *F-DPCH + HSDPA*. The RMC connection can be configured with or without a test loop at the UE; see *RMC Test Loop* and *UL CRC* parameters below. The properties of the Fractional DPCH (F-DPCH) are described on p. 4.161

With active *F-DPCH + HSDPA* radiobearer test setup, the F-DPCH replaces the DPCH while a connection is active. Sig-

naling messages are transmitted over the HSDPA channels. All DPCH settings are also valid for the F-DPCH. Transmission of TPC patterns over the F-DPCH is possible without restrictions, therefore it may be used for Transmit Power Control (TPC) tests. See also description of *F-DPCH TPC Error Rate Target* in section *Downlink Power Control* on p. 4.260.

RMC Test Loop UE operation if a *RMC 12.2 kbps + HSDPA* radio bearer setup is selected. *Off* means that the UE test loop is never closed; no data is returned. Alternatively, the UE can be commanded to operate in *Loop Mode 1 RLC TM* or in *Loop Mode 2.* These two test loop modes are suitable for TX tests as well as for BER tests *(Loop Mode 1)* and BLER tests *(Loop Mode 2)* on the 12.2 kbps RMC in parallel to the HSDPA test mode; see description in standard 3GPP TS 34.109. Both measurements can be carried out with the *Receiver Quality* menu (application *BER)*.

The RMC test loop setting is not effective for a *SRB 3.4 kbps + HSDPA* radio bearer setup.

UL CRC (Sym. Loop Mode 2) If the uplink Cyclic Redundancy Check is enabled *(On),* the UE sends a 16-bit CRC sequence, the DL/UL transport block size is symmetric and the CMU can measure the BER and DBLER (see Chapter 2 and section *Test Loops for BER, BLER and DBLER Tests* on p. 4.293). If the uplink Cyclic Redundancy Check is disabled *(Off),* the UE sends no CRC sequence, the DL/UL transport block size is asymmetric and the CMU can measure the BER, DBLER and BLER.

The *UL CRC (Sym. Loop Mode 2)* setting is only valid if the RMC *Loop Mode 2* is active and the symmetric *RMC 12.2 kbps + HSDPA* is selected. For all other configurations the UL CRC is on.

SRB Message Version Defines the SRB message version as R5 (release 5) or R99 (release 99), in accordance with the specification in standard 3GPP TS 34.121. In firmware versions <V4.34, SRB R99 messages were used.

This setting is only effective for a *SRB 3.4 kbps + HSDPA* radio bearer setup. The RMC and SRB message versions for-circuit-switched connections can be defined separately; see section *Downlink Signal (Connection Control – BS Signal)* on p. 4.236.

Remote control

```
CONFigure:BSSignal:PSWitched:DCH:HSTMode:RBSetup
                    HSRB | HRMC HFDP
CONFigure:BSSignal:PSWitched:DCH:HSTMode:RTLoop
                    OFF | LM1 | LM2
CONFigure:BSSignal:PSWitched:DCH:HSTMode:UCRC ON | OFF
CONFigure:BSSignal:PSWitched:DCH:HSTMode:SMVersion R99 | R5
```

HSUPA Test Mode

The following parameters configure the HSUPA test mode.

Radio Bearer Setup Channel configuration that the R&S CMU uses to connect to *HSUPA Test Mode* (connection initiated from the R&S CMU): *SRB 3.4 kbps + HSUPA* (simple connection according to the test specification) or *RMC 12.2 kbps + HSUPA*.

Radio bearer setup *SRB 2.5 kbps + HSUPA (β_d = 0)* corresponds to a channel configuration where the DPDCH is switched off. Consequently, the UL gain factor β_d is set to the fixed value 0 (see *UL Signal – UE Gain Factors – HSDPA/HSUPA)*. This setup is suitable for the HSUPA subtest 5 according to standard TS 34.121, annex C.11. See also *Maximum Output Power with HS-DPCCH and E-DCH* in chapter 2.

HSUPA UL RLC SDU

Size Integer multiple of the HSDPA DL RLC SDU size of 2936 bit. The reason for multiplying the UL SDU size is to ensure a sufficient data rate in the uplink. With an UL SDU size of n times 2936 bit, the UE can transmit n copies of each received SDU in the uplink. The default value of 8806 bit (n = 3) is sufficient for an uplink user data rate of 2 Mbps, which is the maximum allowed throughput for a 10 ms TTI.

HSPA Test Loop Indicates the loop *mode (Loop Mode 1)* that the R&S CMU uses for the HSDPA/HSUPA test mode. Loop mode 1 is the specified loop mode for HDSPA/HSUPA tests.

The R&S CMU supports a second, parallel *Loop Mode 1* for RMC connections. The RMC loop is also fixed (Loop Mode 1). This loop is suitable for TX tests as well as for BER tests on the 12.2 kbps RMC in parallel to the HSUPA test mode; see description in standard 3GPP TS 34.109. The BER measurement can be carried out with the *Receiver Quality* menu (application *BER)*.

The RMC test loop is not effective for a *SRB 3.4 kbps + HSDPA* radio bearer setup.

Remote control

```
CONFigure:BSSignal:PSWitched:DCH:HUTMode:RBSetup HSRB | HRMC
CONFigure:BSSignal:PSWitched:DCH:HUTMode:URSSize
CONFigure:BSSignal:PSWitched:DCH:HSTMode:HSTLoop HTLM1
```

Handover to GSM (Connection Control – Handover)

The *Handover* tab initiates a handover of the UE registered to an UTRAN cell to a GSM network (circuit switched connection). It is available in the WCDMA signalling states *Registered* and *Connected*. A WCDMA to GSM handover procedure consists of the following stages (see also Fig. 4-97 on p. 4.224):

1. Selection of the GSM destination network *(Destination Selection)*.
2. GSM prepare session with configuration of the essential traffic channel, control channel and network parameters in the GSM network (*Destination Parameters).*
3. Activation of the GSM cell. If necessary, a GSM BCCH can be superimposed to the UTRAN cell using the *Aux TX* signal (with option R&S CMU-B95, Additional RF Generator. For detailed information on the *Aux TX* signal configuration refer to the operating manual GSMxxx-MS for R&S CMU-B21, stock no. 1115.6088.12). The GSM BCCH remains active when the handover prepare session is closed so that it can be measured using the *Receiver Quality – UE Reports* menu. It is switched off if the prepare session is terminated, if the R&S CMU returns to the *Signal On* state, or if the R&S CMU leaves WCDMA.
4. Handover *(Handover,* from the WCDMA *Connected* state only).
5. If desired: return to WCDMA using the inverse (GSM to WCDMA) handover procedure or via *Menu Select.* Handover from GSM to WCDMA is described in the GSMxxx-MS operating manual.

The *Handover* tab changes its functionality according to the current stage.

Steps 1 to 3 can be initiated from the WCDMA Registered or WCDMA Connected signalling states. For some mobile types the GSM cell must be set up using the Aux TX signal before the WCDMA connection is established. For a complete overview of the handover states and transitions see Fig. 4-97 on p. 4.224.

Handover Prerequisites and Conditions

Handover procedures can be initiated between all UTRA/FDD frequency bands and all GSM destination networks. The WCDMA connection must be a voice or a RMC connection; see *Dedicated Channel Type* on p. 4.239. Some mobile types may require additional configurations, e.g. a GSM control channel superimposed to the UTRAN cell (see *GSM Sig. On* softkey).

The CMU supports blind handover from WCDMA to GSM: The UE relies upon the information about the GSM cell transferred in the HANDOVER COMMAND, no check of the destination cell parameters is performed.

Trouble-shooting

If a handover procedure fails, check the following:

- Access the GSM prepare session from the WCDMA *Registered* state and set up a GSM cell before establishing the WCDMA connection.
- Vary the *Handover Activation Time* as described on p. 4.276.

Inter-band handover

In addition to the WCDMA to GSM handover described so far, the R&S CMU supports in inter-band handover between different WCDMA operating bands; see section Inter-Band Handover on p. 4.225*.*

Handover – Destination Selection

In the WCDMA *Registered* or *Connected* state the *Handover* tab provides the following softkeys:

- Selection of the destination network *(Destination Selection).*

The remaining softkeys are disabled until a GSM network is selected.

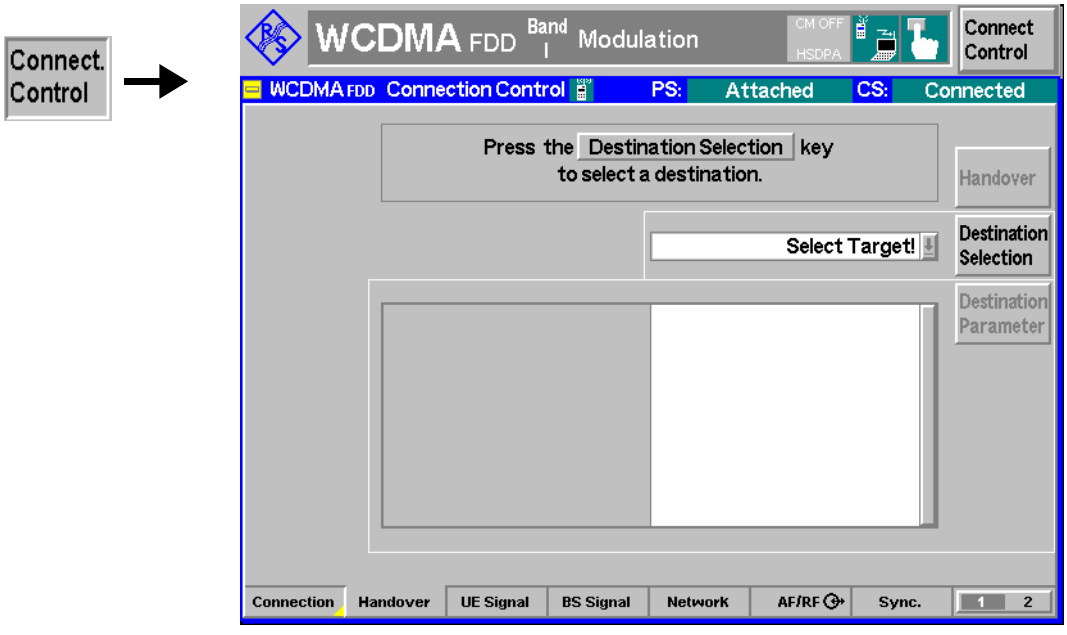


Fig. 4-95 Connection Control – Handover (destination selection)

Destination Selection

The softkey *Destination Selection* selects the target GSM network for handover.

The drop-down list contains all GSM bands installed on the CMU. Once a band is selected, the CMU changes to the GSM prepare session where it is possible to edit the *Destination Parameters* (see below).

Remote control

```
STATus:HANDover:TARGet:LIST?
CONFigure:HANDover:TARGet <Target>
```

Handover – GSM Prepare Session

Once a GSM destination network is selected the *Handover* tab provides the following softkeys:

- Selection of the essential traffic channel, control channel and network parameters in the GSM network (*Destination Parameters)*
- Loading/unloading of the GSM function group and activation/deactivation of the *Aux TX* signal (if option R&S CMU-B95 is available) and the *Call Pending* state *(GSM Sign. On/GSM Sign. Off)*
- Start of the handover procedure *(Handover)*
- Cancel handover preparations and remain in the original network *(Source Param.)*

Note: Call Pending *is an intermediate signalling state that only occurs in the context of a handover process. For a complete overview of the handover states and transitions see Fig. 4-97 on p. 4.224.*

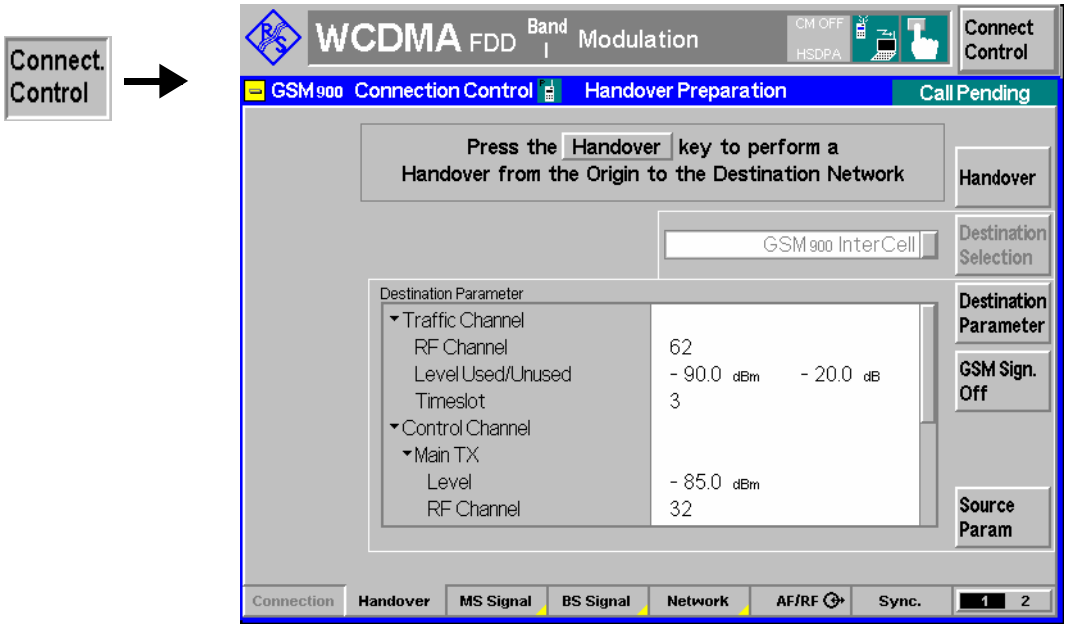


Fig. 4-96 Connection Control – Handover (Call Pending)

Destination Parameter

The *Destination Parameter* softkey configures the GSM signals of the destination network and sets the essential network parameters for the handover procedure. All parameters are set in the GSM destination network; they are described in detail in the operating manual for software options CMU-K20/…/24 *(GSMxxxx-MS for CMU-B21),* stock no. 1115.6088.12.

Traffic Channel GSM channel number, level and used timeslot of the traffic channel.

Control Channel Control channel parameters. The GSM control channel signal can be provided by the *Main TX* generator or by the *Aux TX* generator (with option CMU-B95, *Additional RF Channel)*. If the Aux TX signal is switched on (the Aux TX *Channel Type* is *BCCH),* then a WCDMA downlink channel and a GSM control channel can be superimposed at the same RF output connector; see *GSM Signal Off* softkey below.

The GSM BCCH of the *Aux TX* remains active when the handover prepare session is closed so that it can be measured using the *Receiver Quality – UE Reports* menu. It is switched off if the prepare session is terminated, if the R&S CMU returns to the *Signal On* state, or if the R&S CMU leaves WCDMA.

The *Main TX* parameters are active while the Aux TX signal is switched off; the *Aux TX* parameters are active while it is on.

The Aux Tx signal is switched off automatically during an inter cell handover from GSM to WCDMA FDD but can be re-activated in the handover prepare session.

Network Selects the GSM speech or channel coder *(Traffic Mode)*, the time (number of frames) after which the mobile station starts transmitting a GSM UL signal after receiving the GSM channel *(Starting Time)*, and the data that the GSM network shall request from the mobile *(Requested Mobile Data)*.

Alerting Qualifies whether or not alerting is initiated at the mobile so that it starts ringing before the GSM connection is established. This setting is only relevant if a WCDMA RMC connection (see *Dedicated Channel Type* on p. 4.239) is handed over to GSM; it is ignored for WCDMA voice connections. Alerting *with GSM Setup Message* forces the mobile to set up a GSM speech call, so that both the RF and audio circuits can be tested in the destination network.

Cell Sync. Selects the procedure for physical channel establishment in a WCDMA to GSM handover; see standard 3GG TS 44.018. In the network, finely synchronized cell synchronization is applied if the MS knows that the timing advance with the new cell is not out of range.

Remote control
All destination parameters are set in the destination network. The following commands are described in the operating manual for software options CMU-K20/…/24:

```
CONFigure:BSSignal[:CSWitched][:TCH]…
CONFigure:BSSignal:CCH[:TX]…
CONFigure:BSSignal:CCH:AUXTx…
CONFigure:NETWork[:CSWitched]:SMODe:TRAFfic
CONFigure:NETWork[:CSWitched]:SMODe:STIMe
CONFigure:NETWork[:CSWitched]:REQuest…
CONFigure:HANDover:ALERting NONE | WGSM
CONFigure:HANDover:CSYNC FSYN | NSYN
```

GSM Sign. Off

Activates the *Signal Off* state where the Aux TX signal is always switched off and the GSM function group is no longer initialized. In the *Signal Off* state, *GSM Sign. Off* is replaced by *GSM Sign. On* to return back to the *Signal Pending* state from where a handover to GSM can be initiated (see Fig. 4-97 on p. 4.224). To this end *GSM Sign. On* initializes the GSM function group, which takes a short while.

The exact function of *GSM Sign. Off/GSM Sign. On* depends on the *Aux TX* signal configuration (see *Destination Parameters* above):

- If the *Aux TX* signal is switched on (the Aux TX *Channel Type* is *BCCH),* then *GSM Sign. On* switches on the Aux TX signal providing the GSM control channel and activates *Call Pending.* The mobile can receive the GSM control channel while it is still connected to the UTRAN cell. Some mobiles require this scenario for a successful handover initiation. *GSM Sign. Off* switches the Aux TX signal off.
- If the *Aux TX* signal is switched off (or if option CMU-B95 is not available), then *GSM Sign. On* activates *Call Pending* without switching on a GSM control channel signal. The GSM signal is generated when handover is initiated and replaces the WCDMA downlink signal.

Aux TX can be switched on or off in both the *Signal On* and *Call Pending* state. The main purpose of the *GSM Sign. Off/On* toggle softkeys is to switch on or off Aux TX with a single keystroke.

Remote control

```
PROCedure:SIGNalling:HANDover:TARGet:PREPare ON | OFF
```

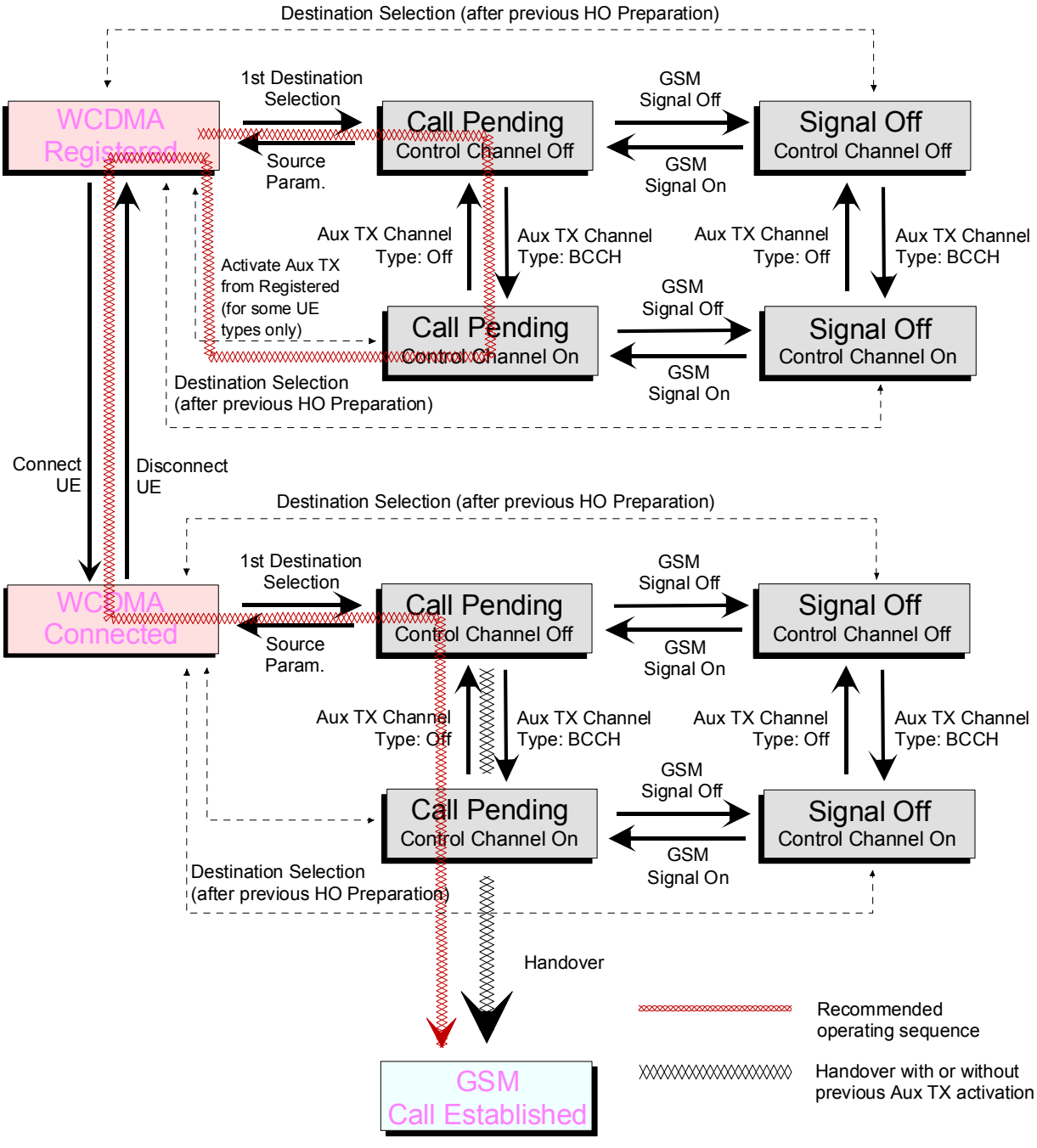


Fig. 4-97 Handover State Machine

Handover

The *Handover* softkey initiates a handover to the destination GSM network. This softkey is only available if the CMU was in the *Connected* state before entering the handover preparation session.

The basic steps to initiate a handover and the most common error sources are described in section *Handover to GSM (Connection Control – Handover)* beginning on p. 4.220.

After a handover, the UE is in the GSM *Call Established* state where all GSM measurements can be performed. The UE is even registered in the GSM network with the *Default IMSI* set in the *Network* tab of the GSM *Connection Control* menu.

Remote control
PROCedure:SIGNalling:ACTion HANDover

Source Param.

The *Source Param.* softkey terminates the handover preparation session so that the CMU returns to the WCDMA *Registered* or *Connected* signalling state.

The destination parameters defined in the *Signal Off* or *Call Pending* state are maintained and the *Handover* softkey is still active. To cancel the *Handover* procedure and return to the measurement mode, press the *ESCAPE* key or the *Connection Control* softkey.

Remote control
–

Inter-Band Handover

The R&S CMU can change the operating band during an established connection (inter-band handover). The inter-band handover from a source band to an arbitrary UL channel in the destination band is a simple three-step procedure:

1. Before the UE is registered: In the *Connection* tab of the *Connection Control* menu, select the *destination* band and the *RF Chn. Uplink* you want to access.

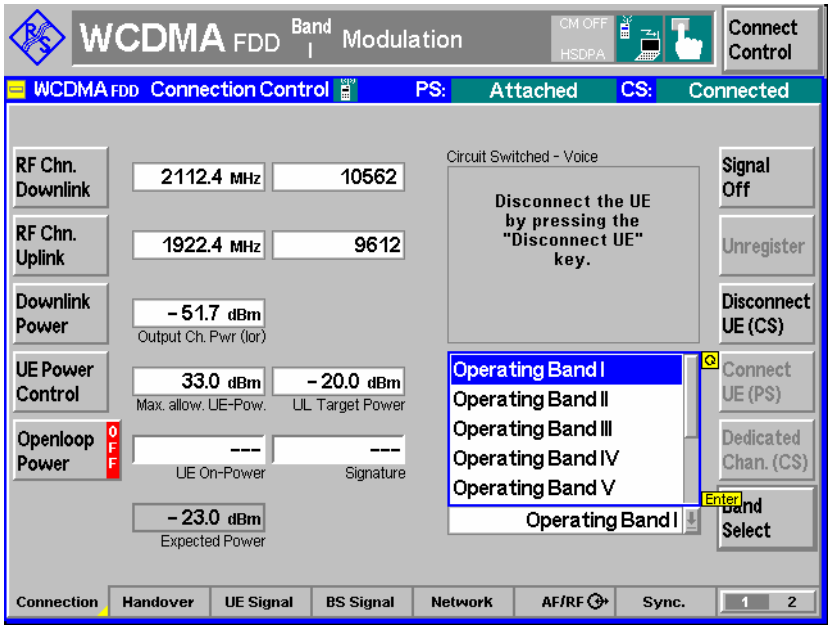


Fig. 4-98 Connection Control

2. Select the *source* band (with another *RF Chn. Uplink)* and set up a connection to the UE.
3. When the UE is connected: Reopen the *Connection* tab of the *Connection Control* menu and select the *destination* band.

The inter-band handover is performed automatically; the UE uses the selected *RF Chn. Uplink*. If no destination channel is selected prior to registration, the UE uses the default channel in the destination band.

Inter-band handover is also supported with an established packet switched connection for HSDPA tests (signalling state PS Established *and* HSDPA Test Mode *activation). Handover from WCDMA to GSM and vice versa is not possible in HSDPA test mode or in packet data connections.*

Remote control The following remote control command sequence corresponds to steps 1 to 3:

```
CONFigure:NETWork:OBANd OB5
CONFigure:UESignal:CHANnel 4230 CH
CONFigure:NETWork:OBANd OB2
    (Set up connection)
CONFigure:NETWork:OBANd OB5
```

Activation of WCDMA Cell during GSM Operation

The RF signal of option R&S CMU-B96, *Additional RF Generator,* can be used to emulate a UTRAN cell while the R&S CMU prepares a *WCDMA FDD InterCell* handover from a GSM band to a WCDMA band. The GSM and UTRAN cells are superimposed, which can largely improve the handover process. Without an Aux TX signal, the target UTRAN cell is created during the handover and replaces the GSM cell (blind handover).

The Aux TX signal can be switched on or off during the WCDMA handover prepare session:

- Establish a GSM connection and open the *Handover* tab of the *Connection Control* menu.
- Press *Destination Selection* and select *WCDMA FDD InterCell* handover.
- Press *Destination Parameter.*

The Aux TX signal is switched on by default but can be switched off using the *WCDMA (Aux TX)* softkey. The properties of the Aux TX signal (channel number, level) comply with the *BS Signal* settings. The Aux TX signal is automatically switched off after the handover is completed (press *Handover)* or after the prepare session is canceled *(Cancel Prepar.)*.

The R&S CMU does not support an Aux TX signal for operating band VII. The Aux TX signal is deactivated automatically when operating band VII is selected.

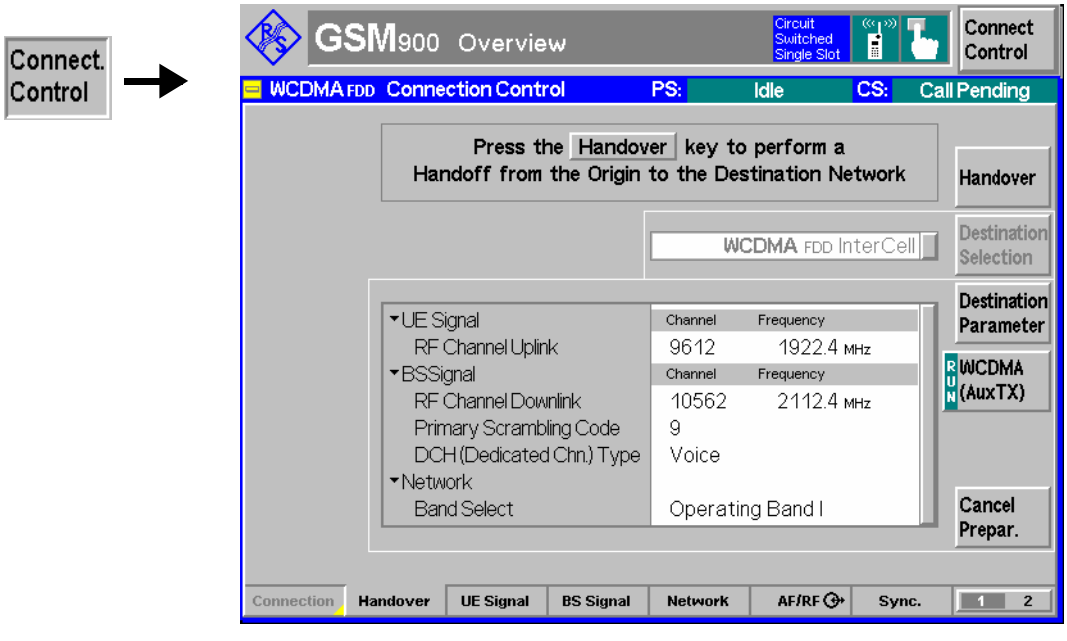


Fig. 4-99 Connection Control – Handover (Call Pending, WCDMA FDD InterCell handover)

Remote control
```
CONFigure:BSSignal:AUXTx ON | OFF
[SENSe:]AUXTx:STATe?
```

Uplink Signal (Connection Control – UE Signal)

The *UE Signal* tab defines the RF input signal. This comprises:

- Inclusion of a possible origin offset in the measurement results *(Analysis Mode)*
- The frequency of the measured signal *(Analyzer Settings)*
- The channel characteristics of the measured signal *(Channel Settings)* including the synchronization settings *(Sync. Mode, Measurement Slot Number, Correlation Mode, Threshold)*
- Parameters for *Open Loop Power Control*
- Gain factors for the different channels of the UL WCDMA signal; see section *Gain Factors for the UE Signal* on p. 4.233.

Some settings may not be available in all signalling states of the CMU. Exact description is provided in the remote control command description in Chapter 6.

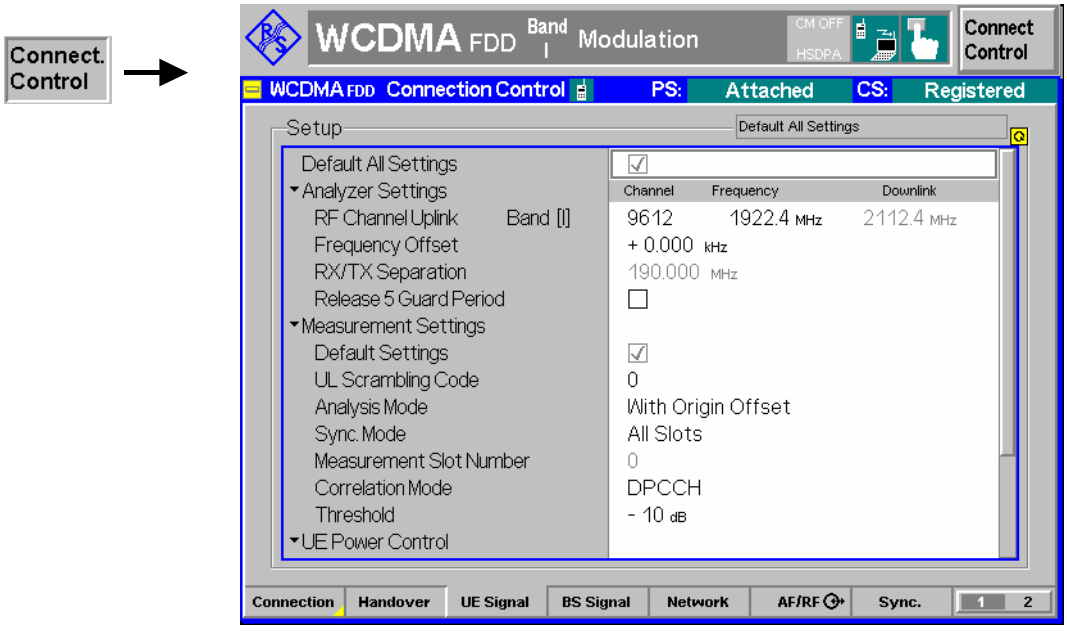


Fig. 4-100 Connection Control – UE Signal

Default Settings The *Default All Settings* switch assigns default values to all settings in the *UE Signal* tab (the default values are quoted in the command description in Chapter 6). Additional default switches are provided for the individual section in the *UE Signal* tab.

Remote control
```
DEFault:UESignal
DEFault:UESignal:PCONtrol
```

Analyzer Settings – RF Channel Uplink

RF Channel Uplink defines the carrier frequency and channel number (UARFCN, UTRA Absolute Radio Frequency Channel Number) of the analyzed signal. The assignment between channel numbers *N* and carrier frequencies *F* is defined in the 3GPP specification (TS 25.141).

$$N = 5 \cdot (F_{UL} / MHz - F_{UL,Offset} / MHz), \quad F_{UL,Low} \le F_{UL} \le F_{UL,High}$$

The band-specific offset frequencies F_{offset} are listed in Table 4-25 below.

The CMU accepts the entry of frequencies **or** channel numbers inside the selected operating bands.

In operating bands II, IV, V, VI, VII, X and S additional center frequencies are specified, which are shifted by 100 kHz relative to the normal raster, see Table 4-25 below.

The RF channel and frequency offset can be changed in all signalling states including *Connected* (inter-frequency handover: the R&S CMU performs a physical channel reconfiguration).

Remote control

```
CONFigure:UESignal:CHANnel <Unit>
CONFigure:UESignal:COMBined:OCHannel
      (fast combined channel and band selection)
UNIT:UESignal:CHANnel <CHANnel>
CONFigure:UESignal:FOFFset <Offset>
```

Table 4-25 UTRA operating bands and channel numbers: Uplink

Operating Band	UARFCN formula offset $F_{UL, Offset}$ [MHz]	Assigned Channels	Assigned Center Frequencies $F_{UL, Low}$ [MHz] to $F_{UL, High}$ [MHz]
I	0	9612 to 9888	1922.4 to 1977.6
II	0 1850.1 (for additional channels)	9262 to 9538, 12, 37, 62, 87, 112, 137, 162, 187, 212, 237, 262, 287	1852.4 to 1907.6, 1852.5, 1857.5, 1862.5, 1867.5, 1872.5, 1877.5, 1882.5, 1887.5, 1892.5, 1897.5, 1902.5, 1907.5
III	1525	937 to 1288	1712.4 to 1782.6
IV	1450 1850.1 (for additional channels)	1312 to 1513, 1162, 1187, 1212, 1237, 1262, 1287, 1312, 1337, 1362	1712.4 to 1752.6, 1712.5, 1717.5, 1722.5, 1727.5, 1732.5, 1737.5, 1742.5, 1747.5, 1752.5
V	0 670.1 (for additional channels)	4132 to 4233, 782, 787, 807, 812, 837, 862	826.4 to 846.6, 826.5, 827.5, 831.5, 832.5, 1 827.5, 842.5
VI	0 670.1 (for additional channels)	4162 to 4188, 812, 837	832.4 to 837.6, 832.5, 837.5
VII	2100 2030.1 (for additional channels)	2012 to 2338 2362, 2387, 2412, 2437, 2462, 2487, 2512, 2537, 2562, 2587, 2612, 2637, 2662, 2687	2502.4 to 2567.6 2502.5, 2507.5, 2512.5, 2517.5, 2522.5, 2527.5, 2532.5, 2537.5, 2542.5, 2547.5, 2552.5, 2557.5, 2562.5, 2567.5
VIII	340	2712 to 2863	882.4 to 912.6
IX	0	8762 to 8912	1752.4 to 1782.4

Operating Band	UARFCN formula offset $F_{UL, Offset}$ [MHz]	Assigned Channels	Assigned Center Frequencies $F_{UL, Low}$ [MHz] to $F_{UL, High}$ [MHz]
X	1135 1075.1 (for additional channels)	2887 to 3163 3187, 3212, 3237, 3262, 3287, 3312, 3337, 3362, 3387, 3412, 3437, 3462	1712.4 to 1767.6 1712.5, 1717.5, 1722.5, 1727.5, 1732.5, 1737.5, 1742.5, 1747.5, 1752.5, 1757.5, 1762.5, 1767.5
XI	733	3487 to 3587	1430.4 to 1450.4
XII	–22.0 –39.9 (for additional channels)	3612 to 3678, 3702, 3707, 3732, 3737, 3762, 3767	700.4 to 713.6 700.5, 701.5, 706.5, 707.5, 712.5, 713.5
XIII	21 11.1 (for additional channels)	3792 to 3818 3842, 3867	779.4 to 784.6 779.5, 784.5
XIV	12 2.1 (for additional channels)	3892 to 3918 3942, 3967	790.4 to 795.6 790.5, 795.5
S	0 1000.1 (for additional channels)	10012 to 10088, 5012, 5037, 5062, 5087	2002.4 to 2017.6, 2002.5, 2007.5, 2012.5, 2017.5
S, 190 MHz Duplex	0 1000.1 (for additional channels)	10012 to 10038, 5012, 5037	2002.4 to 2007.6, 2002.5, 2007.5
S, 170 MHz Duplex	0	10062 to 10088	2012.4 to 2017.6

Analyzer Settings (contd.)

The *Analyzer Settings* section defines the carrier frequency and channel number (UARFCN, UTRA Absolute Radio Frequency Channel Number) of the measured signal and an offset to this carrier frequency. The parameters are described in section *Analyzer Settings (Connection Control – Analyzer)* on p. 4.143. They can be changed in all signaling states including *Connected.*

Release 5 Guard Period

Enables or disables the guard period for the UE signal evaluation according to release 5 of the 3GPP FDD standard. Enabling the guard period means that signal evaluation starts 25 µs after the beginning of the slot and ends 25 µs before the end of the slot. The setting is relevant for the Code Domain Power and WCDMA Modulation measurement; it does not affect any of the other measurements.

Table 4-26 below gives an overview of the measurement lengths in the different TX measurements (the meas. length is not relevant for RX Quality tests).

Remote control
`CONFigure:UESignal:GPERiod`

Table 4-26 Measurement length in different TX measurements

Measurement	Rel. 99 (Guard Period Off)	Rel. 5 (Guard Period On)
WCDMA Modulation: applications Overview, EVM, Phase Error, Magnitude Error, IQ-Analyzer	Slot	Slot – GP
-> Exception: Frequency Error result	Slot	
QPSK Modulation: all applications	1/4; 1 Slot (according to the selected *Measurement Length)*	
Code Domain Power: applications CDP Manual, CDP Auto, CDP/Rho Manual, CDP/Rho Auto	Slot	Slot – GP
Power: applications Max. Power, Min. Power, Off Power	Slot	
Power: Innerloop TPC	Slot – GP	
Power: Power vs. Slot	¼; ½ Slot; 1 Slot – GP (according to the selected *Power Meas. Width)*	
Power: Openloop Power	4096 chips – GP	
Power: TX On/Off Timemask, UE On Power	4096 chips – GP	
-> Exception: Off Power result	Slot – GP	
Spectrum: applications ACLR Filter, FFT, SEM	1/8; ¼; ½; 1 Slot (according to the selected *Measurement Length)*	

Channel Settings The *Channel Settings* section configures the UL WCDMA signal generated by the UL.

UL Scrambling Code Number of the long code that the UE shall use to scramble the uplink WCDMA signal; see Fig. 4-15 on p. 4.45. The scrambling code number must be in the range 0 to FFFFFF (hex) corresponding to 0 to 16777215 decimal.

Analysis Mode The *Analysis Mode* parameter selects whether a possible origin offset is included in the measurement results or subtracted out. The analysis mode has an impact on most of the parameters determined in a *Modulation* measurement and on the modulation (EVM) results indicated in the *Code Domain Power* menus.

For detailed information refer to p. 4.172.

The following synchronization settings are described in detail in section *Uplink Signal (Connection Control – UE Code)* on p. 4.171. The settings *Sync. Mode, Meas. Slot Number, Correlation Mode,* and *Threshold* are relevant for *Code Domain Power* measurements.

Sync. Mode Method that the CMU uses to synchronize to the captured (channel coded and scrambled) uplink WCDMA signal and analyze the slot number.

Meas. Slot Number Slot number to be measured in the range 0 to 14. The CMU expects this slot to be captured if *Sync. Mode* is set to *Synchronous*. In the *All Slots* mode, the *Measured Slot Number* is ignored.

Correlation Mode Defines which DPCH contributions are used for the correlation analysis. The *DPCCH + DPDCH* mode improves the reception of the UE signal, especially if a large frequency offset occurs or if the DPCCH level is much smaller than the DPDCH level. On the other hand the DPCCH mode accelerates the measurement.

Threshold Minimum signal strength of each $DPDCH_n$ in the WCDMA signal to be detected in the automatic channelization code search. The threshold is defined as a ratio of the individual $DPDCH_n$ to the DPCCH and expressed in dB. If $DPDCH_n$/DPCCH < Threshold, $DPDCH_n$ is not detected.

Remote control

```
CONFigure:UESignal:SCODe:SECondary <Code>
CONFigure:UESignal:AMODe WOOFfset | WIOFfset
CONFigure:UESignal:DPCH:SYMode
CONFigure:UESignal:DPCH:SNUMber
CONFigure:UESignal:DPCH:CMODe
CONFigure:UESignal:DPDCh:AUTo:THReshold
```

UE Power Control

The *UE Power Control* section sets the maximum power of the UE and parameters required to define the initial power of the UE at random access *(Open Loop* power control).

Max. All. UE Power Maximum output power of the UE transmitter (averaged over the transmit slot). WCDMA user equipment is divided into four power classes. In standard 3GPP TS 25.101, the maximum output power of the UE transmitter (averaged over the transmit slot) and its tolerance is defined according to the power class of the UE as shown in *Table 4-27 below*.

A *Max. Allowed UE Power* below the maximum output power further restricts the output power range of the UE. The *Max. Allowed UE Power* and the maximum *Analyzer Level* are independent parameters, however, the UE power should be below the maximum *Analyzer Level*.

The *Max. Allowed UE Power* can be changed in all signalling states including *Connected.*

UL Target Power Fixed output power of the UE transmitter. The value is used if the *TPC Pattern Type* (see p. 4.248) in the *BS Signal* tab of the *Connection Control* menu is set to *Closed Loop* and if a connection is set up*:* in this case the CMU sends a TPC pattern to the UE to command it to the target power. The target power is not relevant for the other pattern types. The meaning of *UL Target Power* depends on the *UL Target Power Reference,* see below.

Note: *Correct setting of the UE target power requires a level calibration of the TX and RX path. To do this, open the* Menu Select *menu, select* Basic Functions – Base – Maintenance *and run the* L1CoPro Level Calib. *Test.*

Reference Target power reference, i.e. the UL signal contribution that is used as the *UL Target Power.* The *Total Power* corresponds to the average slot power *(UE Power)* displayed in many measurement menus. Selecting the (constant) *DPCCH Power* as a reference results in a larger UE transmit power. The power difference depends on the *Dedicated Channel Type (see p.* 4.239*)* and the data rate:

- *If an RMC is allocated, the power difference is fixed. It depends on the weighting factors β_c and β_d which are given in terms of the data rate.*
- *If a voice channel is allocated, the power difference varies as a function of the data traffic.*

The power of the control and data channels in the UL signal can be monitored in the *Code Domain Power* menu.

Typical application: Change UL Target Power and monitor the received UE Power

1. Establish a connection to the UE.
2. Open the *BS Signal* tab of the *Connection Control* menu and select *Closed Loop* as the TPC pattern type of the active setup.
3. Open the *UE Signal* tab of the *Connection Control* menu and make sure that the *UL Target Power Reference* is *Total Power*.
4. Close the *Connection Control* menu and access the *Power, Modulation* or *Code Domain Power* menu.
5. Press *UE Signal – UL Target Power* and vary the target power. Observe the *UE Power* output field and check whether the UE follows the target power.

Remote control

```
CONFigure:UESignal:PCONtrol:UEPower <Power>
CONFigure:UESignal:PCONtrol:TPOWer:VALue
CONFigure:UESignal:PCONtrol:TPOWer:REFerence
```

Table 4-27 Maximum output power

Power Class	Maximum Output Power (Rated Value)	Tolerance
1	+33 dBm	+1/−3 dB
2	+27 dBm	+1/−3 dB
3	+24 dBm	+1/−3 dB
4	+21 dBm	±2 dB

Open Loop Power Control

The *Open Loop Power Control* section sets the parameters required to define the initial power of the UE at random access. According to standard TS 25.331, the UE calculates the initial preamble power (prior to PRACH or PCPCH transmission; see *Fig. 4-110 below*) as follows:

$P_{preamble}$ = *UL Interference + Constant Value + Reported P-CPICH Power – CPICH_RSCP*

When establishing the first DPCCH, the UE starts the UL inner loop power control at the following power level:

P_{DPCCH} = *DPCCH Power Offset – CPICH_RSCP*

CPICH_RSCP denotes the CPICH Received Signal Code Power, i.e. the received signal power on one code, measured by the UE on the pilot bits of the P-CPICH. This power corresponds to the P-CPICH Power at the CMU connector, to be set in the *BS Signal* tab (see section *Downlink Signal (Connection Control – BS Signal)* on p. 4.236). The parameters written in italics are broadcast to the UE as defined in the *Open Loop Power Control* section.

UL Interference Estimated UL interference in dBm, contained in System Information Block type 7. In a network, the *UL Interference* can change fast. A large interference value increases the initial preamble power.

Constant Value Constant offset for the initial preamble power. The larger the constant value, the larger the initial preamble power.

Reported P-CPICH

Power DL Primary CPICH TX power reported to the UE. In the network, the *Reported P-CPICH Power* is the actual Node B transmit power, the DL path loss is equal to the difference *Reported P-CPICH Power – CPICH_RSCP.* The larger the path loss, the larger the initial preamble power.

Note: *The CMU simulates a real network, although the exact meaning of the power control parameters and their individual values are of minor importance. According to the formula for $P_{preamble}$ quoted above, increasing any of the parameters* UL Interference, Constant Value, Reported P-CPICH Power *increases the initial preamble power, increasing the P-CPICH power in the* BS Signal tab *decreases the initial preamble power. The default reported P-CPICH power is much larger than the actual power of the BS signal; the order of magnitude of the simulated pathloss is 80 dB.*

DPCCH Power Offset Reference value for the initial DPCCH power of the UE: The larger the *DPCCH Power Offset,* the larger the initial DPCCH power.

PRACH UE On Power Limit Tolerance value for the *Openloop Power* measurement (see. P. 4.209). According to standard 3GPP TS 34.121, *Open Loop Power Control in the Uplink*, the openloop power must not differ from the *Expected PRACH Power* by more than ±9 dB.

Remote control

```
CONFigure:UESignal:PCONtrol:OLPC:INTerference
CONFigure:UESignal:PCONtrol:OLPC:CVALue
CONFigure:UESignal:PCONtrol:OLPC:PCPich:Rpower
CONFigure:UESignal:PCONtrol:OLPC:DPCCh:POFFset
CONFigure:OLP:LIMit[:SCALar]:SYMmetric[:COMBined]:VALue
```

Gain Factors for the UE Signal

The gain factors that the UE is to use for *RMC, Voice, Video*, and *HSDPA Test Mode* connections can be set in the *UE Signal* tab of the *Connection Control* menu. The gain factors define the relative strength of the uplink channels (see standard TS 25.213):

- βc is the gain factor for the DPCCH; its signalled value is an integer number between 1 and 15.
- βd is the common gain factor for the data channels DPDCH1 to DPDCH6; its signalled value is an integer number between 1 and 15. The βc and βd gain factors have an impact on the reference TFC.
- The power offset parameters ΔACK, ΔNACK, and ΔCQI determine the HS-DPCCH power offset for HS-DPCCH slots carrying ACK, NACK, and CQI messages, respectively (see standard TS 25.214). The gain factors β_{hs} in Fig. 4-101 below are calculated from the HS-DPCCH power offset. The signalled values for all three power offset parameters are integer numbers between 0 and 8.

HSDPA measurements are described in Chapter 8 of this manual.

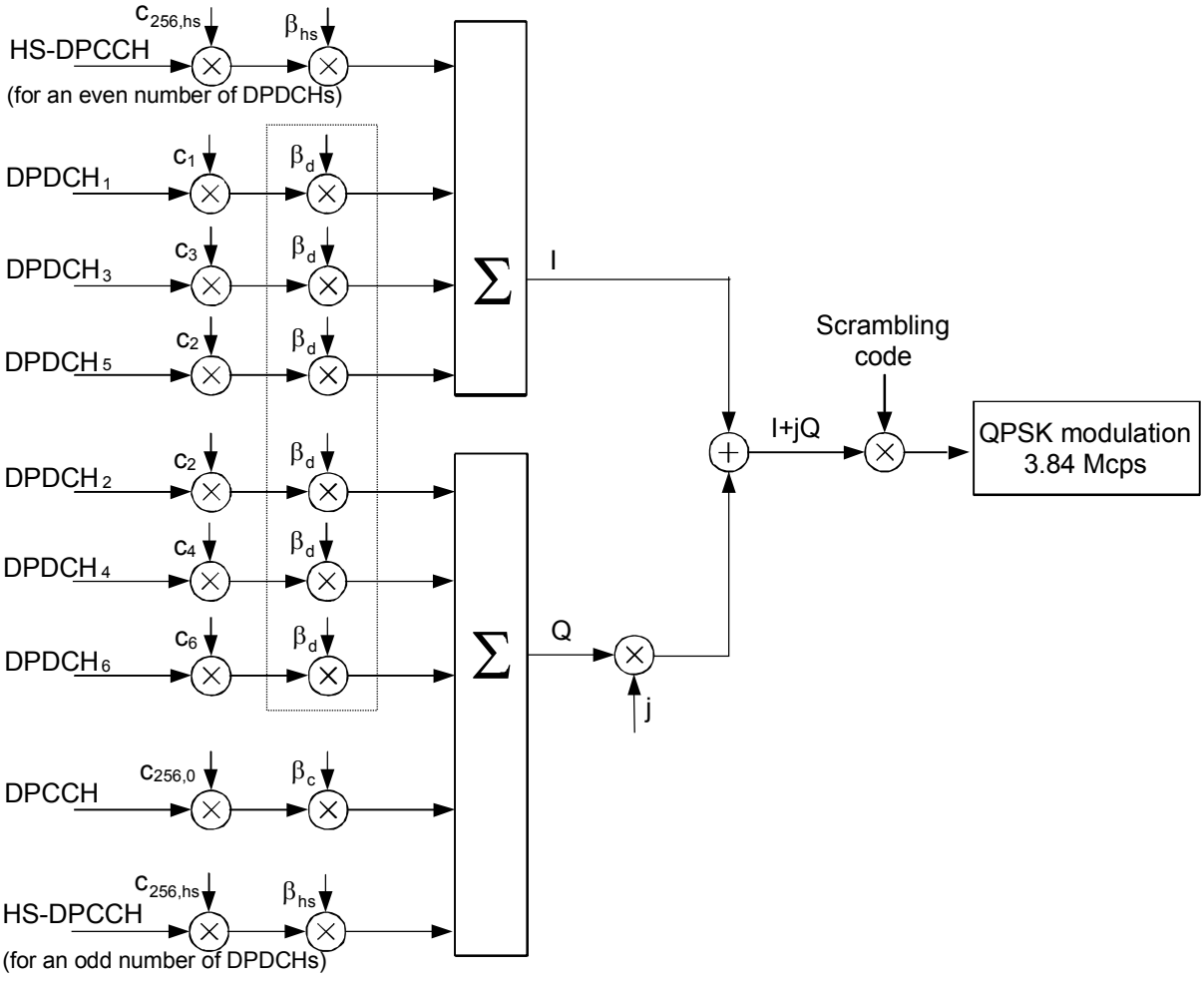


Fig. 4-101 Spreading of the uplink channels and gain factors

Note that, according to TS 25.213, at least one of the factors β_c or β_d must be one at every instant in time, corresponding to a signalled value of 15. The R&S CMU automatically ensures that this condition is fulfilled.

Use the CDP vs. Time measurement to verify to which degree of accuracy the actual gain factors of the UL channels comply with the gain factors signalled to the UE.

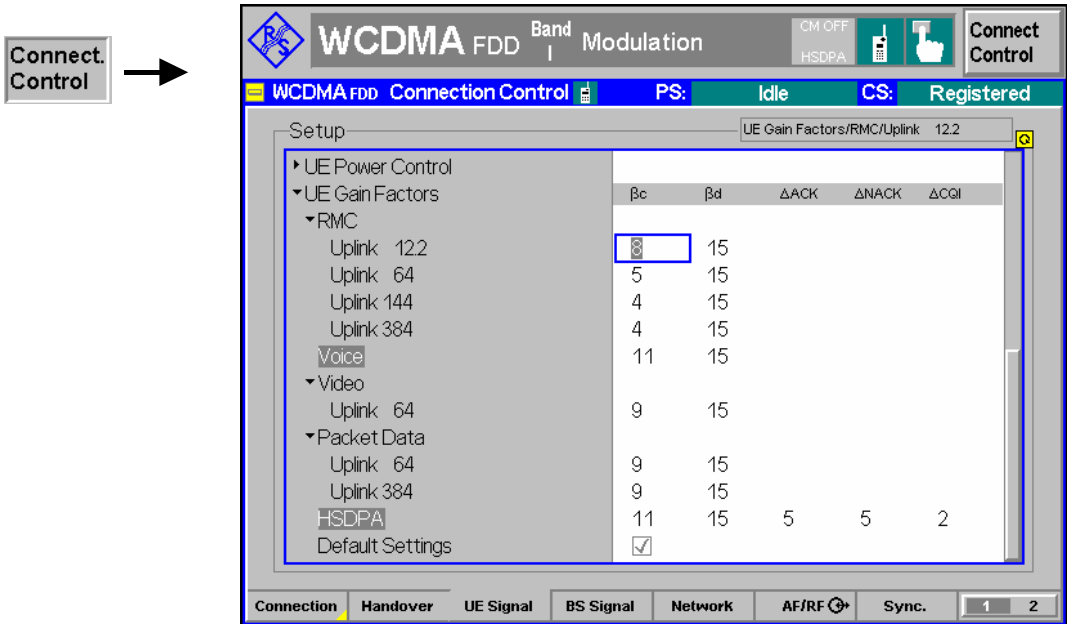


Fig. 4-102 Connection Control – UE Signal, gain factors

The gain factors for the different *Dedicated Channel* types are set in the *UE Gain Factors* section of the *UE Signal* tab. They can still be changed after the R&S CMU has entered the *Connected* state.

RMC / Voice / Video / Packet Data

Gain factors β_c or β_d for RMC connections (with different data rates), voice, video, and mobile-initiated packet data connections (with different data rates). The R&S CMU ensures that one of the factors is 15 at any time.

For calls with constant data rates, the specified gain factors are valid for the entire duration of the connection. For voice connections the UE can use DTX and switch off the DPDCHs if no data is being transferred.

Remote control:
```
CONFigure:UESignal:GFACtor:RMC:UPLMode<nr>
CONFigure:UESignal:GFACtor:VOICe
CONFigure:UESignal:GFACtor:VIDeo
CONFigure:UESignal:GFACtor:PDATa:UPLMode<nr>
```

HSDPA/HSUPA Test Mode

Gain factors β_c or β_d and power offset parameters Δ_{ACK}, Δ_{NACK}, and Δ_{CQI} for HS-DPCCH slots carrying ACK, NACK, and CQI messages. The R&S CMU ensures that one of the β factors is 15 at any time.

While a *SRB 2.5 kbps + HSUPA (β_d = 0)* radio bearer setup is active, β_d is set to the fixed value 0; see *Radio Bearer Setup* on p. 4.218.

Enable BS Signal – HS-DSCH – Force NACK *if you want to stimulate your UE to transmit NACK messages. Force NACK means that 50% of the HSDPA transmission packets are randomly sent with a wrong CRC so that the UE is expected to return an equal number of ACK and NACK messages.*

Remote control:
```
CONFigure:UESignal:GFACtor:HSTMode
```

Default Settings

Sets all gain factors to default values. The default values are quoted in the command description.

Remote control:
```
DEFault:UESignal:GFACtor
```

Downlink Signal (Connection Control – BS Signal)

The *BS Signal* tab configures the CMU's operating mode and the generated DL WCDMA signal. It defines:

- The frequency of the generated signal, the scrambling code and general power settings *(Node B Settings)*
- Additive interfering signals *(OCNS, AWGN)*
- The type and the properties of the *Dedicated Channel* to be allocated between the UTRAN/CMU and the UE.
- The properties of all *Physical Channels* contributing to the BS Signal
- The Transmit Power Control settings *(TPC Settings)*
- The parameters for the compressed mode; see section *Compressed Mode Configuration* on p. 4.254.
- The parameters for downlink power control; see section *Downlink Power Control* on p. 4.260.

Some settings may not be available in all states of the CMU. Exact description is provided in the remote control command description in Chapter 6.

Downlink WCDMA Signal

The BS signal is a RF signal with DL WCDMA characteristics that the CMU transmits to emulate a UTRAN cell and communicate with the UE under test. The UE can synchronize to the BS signal, initiate a registration/location update towards the network, and set up an RRC connection using different dedicated channel types. The BS signal has the following physical channel contributions:

- The synchronization channels P-CPICH, S-SPICH, P-SCH and S-SCH
- The broadcast channels P-CCPCH, S-CCPCH, PICH, AICH (necessary to set up a connection)
- The dedicated physical channel DPCH (DPDCH, DPCCH)
- The downlink HSDPA channels HS-SCCH and HS-PDSCH described in Chapter 8 (with option R&S CMU-K64)

The *BS Signal* tab defines the physical properties of the BS signal. Most of them are analogous to the properties of the RF generator signal described on p. 4.147. Parameters including higher layers can be set in the *Network* tab of the *Connection Control* menu.

The HSDPA channels that the R&S CMU provides with option R&S CMU-K64 are described in Chapter 8.

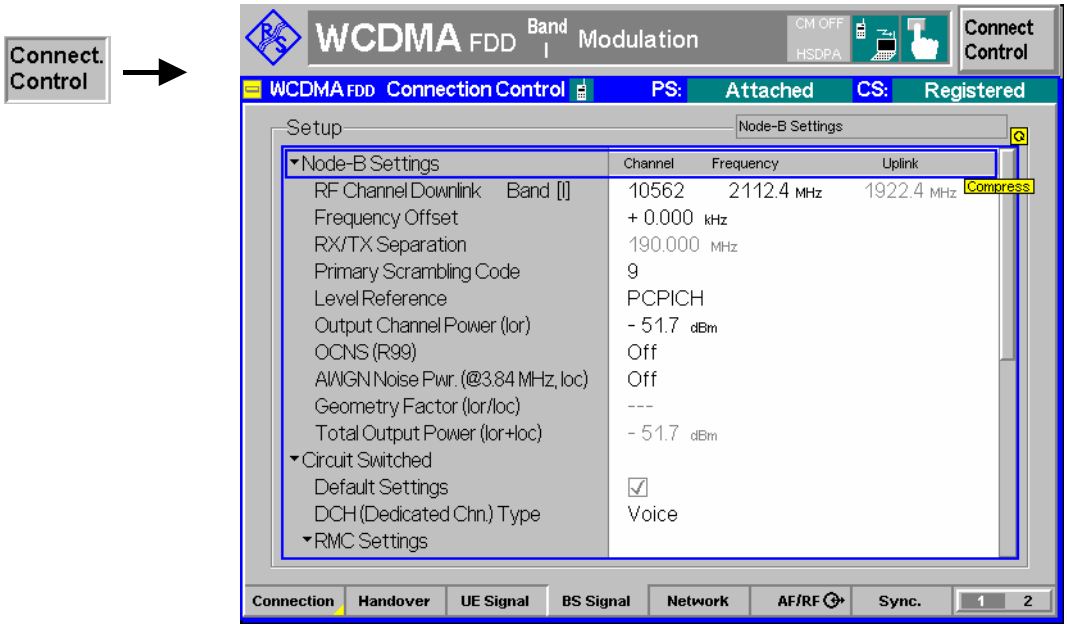


Fig. 4-103 Connection Control – BS Signal

Default Settings

The *Default All Settings* switch assigns default values to all settings in the *BS Signal* tab (the default values are quoted in the command description in Chapter 6). Additional default switches are provided for the individual section in the *BS Signal* tab.

Remote control
–

Node B Settings – RF Channel Downlink

The *RF Channel* softkey defines the carrier frequency and channel number (UARFCN, UTRA Absolute Radio Frequency Channel Number) of the generated signal. The assignment between channel numbers *N* and carrier frequencies *F* is defined in the 3GPP specification (TS 25.141):

$$N = 5 \cdot (F_{DL} / MHz - F_{DL,Offset} / MHz), \quad F_{DL,Low} \le F_{DL} \le F_{DL,High}$$

The band-specific offset frequencies F_{offset} are listed in Table 4-28 below.

The CMU accepts the entry of frequencies **or** channel numbers inside the selected operating bands.

In operating bands II, IV, V, VI, VII, X, and S additional center frequencies are specified, which are shifted by 100 kHz relative to the normal raster, see Table 4-28 below.

The RF channel and frequency offset can be changed in all states including *Connected* (inter-frequency handover: the R&S CMU performs a physical channel reconfiguration).

Remote control

```
UNIT:BSSignal:CHANnel <Unit>
CONFigure:BSSignal:CHANnel <UARFCN>
CONFigure:BSSignal:COMBined:OCHannel
```

(fast combined channel and band selection)

```
CONFigure:BSSignal:FOFFset <Offset>
```

Table 4-28 UTRA operating bands and channel numbers: Downlink

Operating Band	UARFCN formula offset $F_{DL, Offset}$ [MHz]	Assigned Channels	Assigned Center Frequencies $F_{DL, Low}$ [MHz] to $F_{DL, High}$ [MHz]
I	0	10562 to 10838	2112.4 to 2167.6
II	0 1850.1 (for additional channels)	9662 to 9938, 412, 437, 462, 487, 512, 537, 562, 587, 612, 637, 662, 687	1932.4 to 1987.6, 1932.5, 1937.5, 1942.5, 1947.5, 1952.5, 1957.5, 1962.5, 1967.5, 1972.5, 1977.5, 1982.5, 1987.5
III	1575	1162 to 1513	1807.4 to 1877.6
IV	1805 1735.1 (for additional channels)	1537 to 1738, 1462, 1487, 1512, 1537, 1562, 1587, 1612, 1637, 1662	2112.4 to 2152.6, 2112.5, 2117.5, 2122.5, 2127.5, 2132.5, 2137.5, 2142.5, 2147.5, 2152.5
V	0 670.1 (for additional channels)	4357 to 4458, 1007, 1012, 1032, 1037, 1062, 1087	871.4 to 891.6, 871.5, 872.5, 876.5, 877.5, 1 882.5, 887.5
VI	0 670.1 (for additional channels)	4387 to 4413, 1037, 1062	877.4 to 882.6, 877.5, 882.5
VII	2175 2105.1 (for additional channels)	2237 to 2563 2587, 2612, 2637, 2662, 2687, 2712, 2737, 2762, 2787, 2812, 2837, 2862, 2887, 2912	2622.4 to 2687.6 2622.5, 2627.5, 2632.5, 2637.5, 2642.5, 2647.5, 2652.5, 2657.5, 2662.5, 2667.5, 2672.5, 2677.5, 2682.5, 2687.5
VIII	340	2937 to 3088	927.4 to 957.6
IX	0	9237 to 9387	1847.4 to 1877.4
X	1490 1430.1 (for additional channels)	3112 to 3388 3412, 3437, 3462, 3487, 3512, 3537, 3562, 3587, 3612, 3637, 3662, 3687	2112.4 to 2167.6 2112.5, 2117.5, 2122.5, 2127.5, 2132.5, 2137.5, 2142.5, 2147.5, 2152.5, 2157.5, 2162.5, 2167.5
XI	736	3712 to 3812	1478.4 to 1498.4
XII	–37 –64.9 (for additional channels)	3837 to 3903 3927, 3932, 3957, 3962, 3987, 3992	730.4 to 743.6 730.5 to 743.5
XIII	-55 -64.9 (for additional channels)	4017 to 4043 4067, 4092	748.4 to 753.6 748.5, 753.5
XIV	-63 -72.9 (for additional channels)	4117 to 4143 4167, 4192	760.4 to 765.6 760.5, 765.5
S	0 1000.1 (for additional channels)	10912 to 10988, 5912, 5937, 5962, 5987	2182.4 to 2197.6, 2182.5, 2187.5, 2192.5, 2197.5
S, 190 MHz Duplex	0 1000.1 (for additional channels)	10962 to 11038, 5962, 5987	2192.4 to 2197.6, 2192.5, 2197.5
S, 170 MHz Duplex	0	10912 to 10938	2182.4 to 2187.6

Node B Settings (contd.)

The *Node B Settings* section defines the carrier frequency and channel number (UARFCN, UTRA Absolute Radio Frequency Channel Number) of the generated signal, an offset to this carrier frequency and the primary scrambling code for the DL WCDMA signal. The parameters are analogous to the RF generator parameters described in section *Generator Settings (Connection Control – Generator)* on p. 4.147.

Level Reference Defines whether the power of all channels is expressed relative to the P-CPICH *(PCPICH)* or to the *Output Channel Power.*

Output Ch. Power Total output power of the BS signal, averaged over 1 frame but not taking into account a possible DTX mode for the TFCI bits. Control channels that are only active while the connection is set up (AICH, S-CCPCH) do not contribute to the *Output Channel Power*. The output level range at the default connector RF2 is sufficient for the *Maximum Input Level* test according to standard 3GPP TS 34.121, section 6.3.

Note: *The* Output Ch. power *is stored whenever the CMU reaches the* Connected *state and reused when the* Connected *state is released. This ensures that a change of the* BS Signal *level during the connection (e.g. a reduced level for a* Receiver Quality *test) does not impair the next connection.*

The OCNS, AWGN Noise Power, *and the* Geometry Factor are described on p. 4.153.

Total Output Power Sum of the *Output Ch. Power (TX) (Ior)* and the *AWGN Noise Power (Ioc).* This value cannot be set but is displayed for information.

Remote control

```
CONFigure:BSSignal:SCODe:PRIMary
CONFigure:BSSignal:LREFerence <Reference>
CONFigure:BSSignal:OPOWer <Abs_Power>
CONFigure:BSSignal:OCNS <Rel_Power>
CONFigure:BSSignal:AWGN
CONFigure:BSSignal:GMTFactor?
CONFigure:BSSignal:TOPower?
```

Circuit Switched Channel Settings

The *Circuit Switched* table section selects the dedicated channel type for the circuit switched connection and configures the Reference Measurement Channel *(RMC)*, the *Voice Settings,* and the Signalling Radio Bearer *(SRB).*

DCH (Dedicated Chn.) Type

Dedicated Channel Type selects the dedicated channel to be allocated between the CMU/UTRAN and the UE.

Sign. RAB – Cell DCH The CMU uses a Signalling Radio Bearer (SRB) of variable data rate to establish and maintain the connection. The SRB is configured in the *Signalling RAB Settings* subsection. This simple and fast connection type can be used for TX measurements.

RMC The CMU uses a fixed 2.5 kbps Signalling Radio Bearer (SRB) to set up a connection and allocate a Reference Measurement Channel. The Dedicated Channel configuration in the *Connected* state depends on the *Test Mode* settings; see *RMC Settings* subsection. With this channel type it is possible to command the UE to a test loop mode.

Voice The CMU uses a Signalling Radio Bearer (SRB) to set up a con-

nection and allocate a voice (AMR) channel. The voice channel is configured in the *Voice Settings* subsection. The CMU can loop back the received speech data or make TX measurements on the received signal. The SRB data rate depends on the selected codec mode: A 1.7 kbps SRB is used for the codec modes 4.75 kbps and 5.15 kbps (set H and set G); a 3.4 kbps SRB is used for the other codec modes and mixed codec modes (set M).

Sign. RAB – Cell FACH The CMU commands the UE to enter the CELL_FACH state while it sets up a connection. No configuration of the RAB properties is required. The CELL_FACH state is needed for test purposes, e.g. for the Spurious Emissions test for UE receivers reported in standard 3GPP TS 34.121.

Video Echo The R&S CMU sets up a circuit-switched video call and loop back video data including audio to a UE offering video communication. An application example for video echo tests is described in Chapter 2.

Note: *A handover to a GSM network requires an* RMC *or* Voice connection*; see section* *Handover to GSM (Connection Control – Handover)* on p. 4.221*.*

Remote control

```
CONFigure:BSSignal:DCH:TYPE  RMC | VOIC | SRAB | SRF | VIDeo
```

RMC Settings

The *RMC Settings* section configures a 3GPP reference measurement channel and selects an UE test mode. The *RMC Settings* take effect when an RMC connection is established *(Dedicated Channel Type = RMC;* see above).

According to 3GPP TS 25.101, the data content of the *3GPP DL Reference Channel* is defined on transport channel level. The data sequence to be transferred is directly fed into the Dedicated Traffic Channel (DTCH) and Dedicated Control Channel (DCCH). The transport channels are channel coded, multiplexed and mapped onto a Dedicated Physical Channel (DPCH) with variable data rate. For more information see paragraphs on the *3GPP DL Reference Channel* on p. 4.162.

By default, all RMCs are in transparent RLC mode. For some data rates, it is possible to configure acknowledged mode RMCs in order to perform BLER tests.

RMC Settings – Reference Channel Type

Information bit rate of the downlink and uplink reference channel (12.2 kbps, 64 kbps, 144 kbps, or 384 kbps). The information bit rate determines various physical and transport channel parameters of the reference channel. An example (12.2 kbps) is given in *Table 4-18* and *Table 4-19*.

The slot formats of the reference channels are 11 (for 12.2 kbps), 13 (64 kbps), 14 (144 kbps), and 15 (384 kbps). At high data rates (144 kbps or 384 kbps), the energy per symbol decreases so that it can be necessary to increase the signal level.

The CMU provides asymmetric RMC data rates in the downlink and in the uplink. *Receiver Quality* tests can be performed with asymmetric RMCs; see section *Test Loops for BER, BLER and DBLER Tests.*

BTFD Selects the reference measurement channels for Blind Transport Format Detection Tests; see section *BTFD and FDR (Signalling only)* on p. 4.123 Selecting this RMC channel type enables *DL DTCH Transport Format;* see below.

12.2 kbps + HSDPA 34.108, 12.2 kbps + HSPA 34.108
12.2 kbps reference channel for HSDPA or HSDPA/HSUPA connections in accordance with specification 3GPP TS 23.108. This means that the connection is set up in two steps (see also *Packet Switched (PS) Connections* on p. 4.212):

1. A circuit-switched 12.2 kbps RMC connection is set up for call control. The R&S CMU enters the signalling state *CS: Connected.*
2. The HSDPA or HSUPA channels are switched on and a PS HSDPA/HSUPA connection is established. The R&S CMU enters the signalling state *PS: Established* (HSDPA/HSUPA Test Mode).

This connection type complies with the 3GPP specification but is slower than the ordinary packet-switched HSDPA/HSUPA connection. All HSDPA and HSUPA measurements can be performed with both connections.

12.2 kbps (+HSDPA), 12.2 kbps (+HSPA)
Same as *12.2 kbps + HSDPA 34.108* or *12.2 kbps + HSPA 34.108* but with an optional additional PS connection that must be set up manually (see *Packet Switched (PS) Connections* on p. 4.212). This connection type is appropriate for combined CS and PS measurements that are performed in two steps:

1. Measurements with a (CS) RMC connection, no HSDPA/HSUPA channels (signalling state *CS: Connected, PS: Idle* or *Attached)*.

2. Measurements in HSDPA or HSUPA test mode (signalling state *CS: Connected, PS: Established)*. There is no need to release the RMC connection in order to reach this signalling state, therefore the connection is faster.

Remote control
`CONFigure:BSSignal:DCH:RMC:TYPE <Type>`

RMC Settings – remaining settings

DL DTCH Transport Format Data rate for BTFD RMCs; see *Reference Channel Type* above.

DL Resources in Use Percentage of DL RMC transport blocks that are filled with information bits. The percentages are rounded and correspond to values 1, ½, ¼, 1/6, …, 1/30, 1/32. A value 1/n means that out of n transport blocks, only one is fully filled with data, (n – 1) blocks are empty. The effective data rate decreases by the factor 1/n.

Restricting the DL resources can be necessary to prevent a buffer overflow in the UE, especially in cases where BLER tests are performed with asymmetric RMCs with a different Transmission Time Interval (TTI) for the DL and UL (384 kbps DL RMC and a lower-rate UL RMC, see also section *Test Loops for BER, BLER and DBLER Tests* on p. 4.120).

Note: *The uplink DPDCH is only active (and filled with data) as long as the UE transmits data. In closed test loop mode, this means that the DPDCH power and therefore the total UL power decreases if the effective DL data rate is reduced (i.e. if a smaller factor for* DL Resources in Use *is selected).*

The variation of the total UL power as a function of the DL Resources in Use *should be kept in mind if closed loop Transmit Power Control of the UE is used (TPC Pattern Type = Closed Loop). To exclude an impact of the* DL Resources in Use*, the UL Target Power (see p. 4.231) can be defined relative to the constant DOCCH power.*

RLC Mode (Sym. Loop Mode 1) Selection of RLC transparent mode (TM) or acknowledged mode

(AM) for the RMC transmission. The AM setting is only valid if *Loop Mode 1* is active and one of the following asymmetric data rates is selected: 64 kbps Downlink / 12.2 kbps Uplink, 144 kbps Downlink / 12.2 kbps Uplink, 384 kbps Downlink / 12.2 kbps Uplink.

With an RMC in AM, it is possible to perform all AM ACK/NACK BLER tests listed in section C.6.2 of the conformance test specification 3GPP TS 34.121. This is similar to the RLC BLER tests during a packet data connection for application tests (see chapter 9). Bit error rate (BER) tests are not possible with this signal configuration.

UL CRC (Sym. Loop Mode 2)

If the uplink Cyclic Redundancy Check is enabled *(On),* the UE sends a 16-bit CRC sequence, the DL/UL transport block size is symmetric and the CMU can measure the BER and DBLER (see Chapter 2 and section *Test Loops for BER, BLER and DBLER Tests* on p. 4.293). If the uplink Cyclic Redundancy Check is disabled *(Off),* the UE sends no CRC sequence, the DL/UL transport block size is asymmetric and the CMU can measure the BER, DBLER and BLER.

The *UL CRC (Sym. Loop Mode 2)* setting is only valid if *Loop Mode 2* is active and a symmetric *Reference Channel Type* is selected. For all other configurations the UL CRC is on.

Test Mode

Operating mode that the UE enters after connecting to the UTRAN/CMU. The test mode is a stable connected state of the UE which can be quickly accessed. It belongs to the UE conformance testing functions specified in standard TS 34.109.

If the test mode is switched Off, the CMU attempts to set up a standard connection and allocate an RMC without forcing the UE to the test mode.

If the test mode is switched On, the CMU sets up an RMC connection and forces the UE to the UE radio bearer test mode. The connection is fast (without Alerting) and must be initiated by the CMU.

If the *Loop Mode 1 RLC TM/Loop Mode 2* test mode is selected, the CMU sets up an RMC connection and forces the UE to the UE test loop mode 1 or 2. The loop modes are submodes of the UE radio bearer test mode, suitable for RX tests. The connection is fast (without Alerting) and must be initiated by the CMU.

Note: *RMC connections leading to UE test modes* (Test Mode = On *or* Loop Mode 1 RLC TM/Loop Mode 2) *must be initiated from the CMU (MTC only). The connections are faster than any other connection types because the* Alerting *state is skipped. An attempt to initiate a connection from the UE (MOC) while* Test Mode = On *or* Loop Mode 1 RLC TM/Loop Mode 2 *results in an error message.*

The use and functionality of the three test mode settings is listed in Table 4-29 below.

Channel Data Source

DTCH

Bit pattern transmitted as user information on the DTCH: Bit sequence consisting of zeros *(All 0)*, ones *(All 1)* 010101... *(Alternating)*, or pseudo-random bit sequences of variable length *(PRBS9, PRBS11, PRBS13, PRBS15). RMC with HSDPA Settings – Message*

Versions

Defines the SRB and RMC message versions as any combination of R5 (release 5) and R99 (release 99), in accordance with

the specification in standard 3GPP TS 34.121. In firmware versions < V4.34, SRB R99 with RMC R5 were used. The setting is valid for the combined reference channel types *12.2 kbps (+HSDPA)* and *12.2 kbps + HSDPA 34.108*. The SRB message version for the packet switched HSDPA test mode can be set independently; see section *Parameters for Packet Switched Connections* on p. 4.216.

Remote control

```
CONFigure:BSSignal:DCH:RMC:TFORmat <Rate>
CONFigure:BSSignal:DCH:RMC:RLCMode AM | TM
CONFigure:BSSignal:DCH:RMC:UCRC <Enable>
CONFigure:BSSignal:DCH:RMC:TMODe OFF  | ON | MODE2
CONFigure:BSSignal:DCH:RMC:SDTCh <Sequence>
CONFigure:BSSignal:DCH:HRMC:MVERsion R9R9 | R9R5 | R5R5
```

Table 4-29 Overview of RMC test modes

Test Mode	Off	On	Loop Mode 1/2
Connection setup	MTC or MOC	MTC without Alerting	MTC without Alerting
UE test mode	–	UE radio bearer test mode	UE test loop mode 1/2 UE loops back data and CRC
Supported measurements	TX tests	TX tests	TX tests, RX tests
Purpose	RMC connection for UEs under development that do not support the test modes	Fast RMC connection for TX tests	Fast RMC connection for Receiver Quality tests

Voice Settings

The *Voice Settings* section configures the voice channel. The *Voice Settings* take effect when a voice channel connection is established *(Dedicated Channel Type = Voice;* see above).

Voice Settings – Voice Source

Selects the signal path for voice data:

Echo The CMU uses loopback with delay, i.e. it sends back all data received on the dedicated channel after a delay time without invoking the speech coder. The delay is approx. 50 WCDMA frames (500 ms).

Off Nothing is looped back.

Speechcodec The CMU sends and receives speech data that is routed to the internal speech codec (option CMU-B52). Analog signals are provided via the *SPEECH* connector at the front panel of the instrument. The analog input signal at connector *SPEECH* is amplified by 22.5 dB.

Speechc. Low The CMU sends and receives speech data that is routed to the internal speech codec (option CMU-B52). Analog signals are provided via the *SPEECH* connector at the front panel of the instrument. The analog input signal at connector *SPEECH* is not amplified.

Decoder Cal The speech codec (option CMU-B52) provides a 1 kHz sinewave signal at its analog output. This signal is used for external calibration of the analog output paths.

Encoder Cal The speech codec (option CMU-B52) loops the input signal after digital/analog conversion directly to the analog output. This signal is used for external calibration of the analog input paths.

It is possible to change the voice source even while the CMU is *Connected*.

Voice Settings – Voice Source, Adaptive Multi Rate

Voice Source selects one of the two possible Adaptive Multi Rate (AMR) voice codecs of the R&S CMU. The narrow-band codec *NB AMR* is always available if option R&S CMU-B52 is fitted. The supplementary option R&S CMU-K46 provides an additional wide-band codec *WB AMR.* The WB AMR provides more and higher data rates.

NB/WB Adaptive Multi Rate (AMR)

Active Code Set Code sets A to M. The Active Codec Set (ACS) contains a subset of the UMTS AMR (Adaptive Multi-Rate) codec modes that can be selected for transmission. According to standard 3GPP TS 26.103, the ACSs in uplink and downlink are identical.

The active code sets A to H (NB AMR) or A to I (WB AMR) correspond to a fixed single data rate. The data rates are mapped in descending order so that code set A corresponds to the highest data rate, code set H to the lowest data rate of the AMR speech coder. Code set M is a set with 4 (NB AMR) or 3 (WB AMR) different data rates.

Codec Modes The codec modes for all ACSs are viewed in a graphical overview. The modes are valid in uplink and downlink.

Selecting one of the codec modes A to H (NB AMR) or A to I (WB AMR) means that a fixed codec mode is used in both the uplink and the downlink so that it is possible to perform voice tests at any fixed data rate. In mode M, the CMU and the UE can use one of 4 different data rates (active codec modes); the actual data rate used is displayed in the *Connection Info* section of the setup table *(Connection Control – Connection;* see p.). In *Echo* mode, the UL and DL codec modes are always equal.

A possible application of mode M is to send an *All 1* TPC pattern to the UE under test until it reaches its maximum output power and is forced to select a lower data rate. The active codec mode must be monitored at the UE itself.

Remote control

```
CONFigure:BSSignal:DCH:VOICe:SOURce <Mode>
CONFigure:BSSignal:DCH:VOICe:ACSet A to H | M
CONFigure:BSSignal:DCH:VOICe:ACODer NB | WB
CONFigure:BSSignal:DCH:VOICe:WBACset A to I | M
```

Signalling RAB Settings

The *Signalling RAB Settings* section selects the SRB (Signalling Radio Access Bearer) used to set up and maintain the connection. The *Signalling RAB Settings* take effect when a SRB connection is established *(Dedicated Channel Type = Sign. RAB – Cell DCH;* see above). The other connection types are set up with a fixed-rate SRB.

SRB Cell DCH Data rate of the SRB in kbit/s. To test the capabilities of the UE, several data rates are provided.

Remote control

```
CONFigure:BSSignal:DCH:SRAB:SRB K1_7 | K2_5 | K3_4 | K13_6
```

Caller ID

The *Caller ID* for SMS and circuit switched calls can be entered as a 1 to 20-digit number. The caller ID is equal to the number digits (octets 4 etc.) of the *Calling Party BCD Number* described in standard 3GPP; its purpose is to identify the origin of a call. The caller ID of the R&S CMU is usually displayed at the UE under test.

The number digit values are in the range 0 to 9, *, #. Each of the number digit values encodes a four-bit number as described in the standard.

Table 4-30: Number digits according to Table10.5.118/3GPP TS 24.008

Number digit value	Bits
0	0 0 0 0
1	0 0 0 1
2	0 0 1 0
3	0 0 1 1
4	0 1 0 0
5	0 1 0 1
6	0 1 1 0
7	0 1 1 1
8	1 0 0 0
9	1 0 0 1
*	1 0 1 0
#	1 0 1 1

Remote control
`CONFigure:BSSignal:CSWitched:CAID`

Packet Switched

The parameters in the *Packet Switched* section specify how the packet switched connection is set up. See section *Parameters for Packet Switched Connections* on p. 4.216.

For a description of the HSDPA and HSUPA channel configuration refer to Chapter 8 of this manual.

Downlink Physical Channels

The *Downlink Physical Channels* section defines the level of the P-CPICH, S-CPICH, P-SCH, S-SCH, P-CCPCH, the PICH and the DPDCH (see section *Panel Oriented Version* on p. 4.151).

Note 1: *The P-CPICH can be entered in absolute units (dBm) and used as a reference for all other (relative) levels (see* Level Reference *setting above). Synchronization of the UE is described in section Downlink Channels and Synchronization on p. 4.148.*

Note 2: *The DPDCH level, together with its allowed* Minimum *and* Maximum, *is relevant for downlink power control; see section Downlink Power Control on p. 4.260.*

In addition to the signal levels the section defines the channelization codes for the S-SPICH, the PICH and the DPCH as well as the DPCCH/DPDCH power offset, the *DL DPCH Timing Offset* (see p. 4.160), and the secondary scrambling code of the S-CPICH, the DPDCH (see p. 4.158) and the HSDPA channels (see Chapter 8). Inconsistent entries for the channelization codes are auto-corrected; see section *Code Conflict Handling for WCDMA DL Generator* on p. 4.167. For the S-CPICH, a phase relative to the P-CPICH can be set.

Note 3: *In Signalling mode, the S-CPICH state automatically determines the DPCH phase reference. The P-CPICH is used as a phase reference for channel estimation as long as the S-CPICH is turned off; otherwise the DPCH is transmitted with the S-CPICH phase. This differs from Non Signalling mode where the DPCH phase reference must be specified explicitly.*

Compared to Non Signalling mode, the PICH channel can be configured with the following additional parameter:

Paging Indicators per Frame Number N_p of paging indicators that the R&S CMU

transmits in each PICH frame. According to the 3GPP TS 25.211 specification, this number is either 18, 36, 72, or 144. The parameter N_p occurs in the conformance test specification 3GPP TS 34.121, e.g. in the *Demodulation of Paging Channel (PCH)* test.

Remote control
`CONFigure:BSSignal:PHYSical:CODE:PINDicator <Number>`

DL Physical Channels: S-CCPCH, AICH

The *DL Physical Channels* section contains two channels that carry higher-layer messages and are therefore not part of the *Non Signalling* RF generator signal:

S-CCPCH Level of the Secondary Common Control Physical Channel relative to the *Level Reference;* see above.

S-CCPCH Channel. Code Channelization code (Orthogonal Variable Spreading Code, OVSC) number assigned to the S-CCPCH. The set of possible code numbers is the same as for the DPCH: They depend on the spreading factors SF and range from 0 to SF – 1. The spreading factors are given by the slot format (slot format numbers 0 to 16 for physical channels; see *Table 4-20* on p. 4.165) which in turn is a function of the information bit rate for 3GPP reference measurement channels (see description of *Reference Channel Type* parameter on p. 4.240). The channelization codes $c_{256,0}$ and $c_{256,1}$ are reserved for the P-CPICH and P-CCPCH, respectively, and can not be assigned. Besides the channelization codes for the S-CCPCH, the DPCH, the PICH, and the AICH must be compatible. The CMU auto-corrects incompatible entries; see section *Code Conflict Handling for WCDMA DL Generator* on p. 4.167.

AICH Level of the Acquisition Indicator Channel relative to the *Level Reference;* see above.

AICH Channel. Code Channelization code (Orthogonal Variable Spreading Code, OVSC) number assigned to the AICH. The AICH is a fixed rate (SF = 256) physical channel with channelization code numbers ranging from 2 to 255. The channelization codes $c_{256,0}$ and $c_{256,1}$ are reserved for the P-CPICH and P-CCPCH, respectively, and can not be assigned. Besides the channelization codes for the AICH, the PICH, the DPCH, and the S-CCPCH must be compatible. The CMU auto-corrects incompatible entries; see section *Code Conflict Handling for WCDMA DL Generator* on p. 4.167.

Note: S-CCPCH and AICH levels and Output Channel Power

The S-CCPCH and the AICH is only active while a connection is set up, so it does not contribute to the Output Channel Power (defined as the total DL WCDMA signal power during a connection). Still the levels should be kept in mind for the R&S CMU's analyzer settings: If the Max. Level is adjusted to the Output Channel Power, high additional S-CCPCH and AICH levels can overdrive the instrument while the connection is set up.

Data Gen. during Signalling Change If this parameter is *Off,* the data stream transferred on the Reference Measurement Channels (RMCs) is interrupted during an inter-frequency handover and during a

change of the RF channel. If it is *On,* the data stream is continuous.

This setting is relevant for the DL channel configurations *Circuit Switched – DCH (Dedicated Ch.) Type: RMC* or *Packet Switched – HSDPA Test Mode: RMC 12.2 kbps + HSDPA.* The data generation is interrupted for the duration of the physical channel reconfiguration that occurs when the *RF Channel Downlink* or *RF Channel Uplink* is changed during a connection. For most DUTs, this setting does not affect the measurement results (including BER).

Remote control

```
DEFault:BSSignal:PHYSical
CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary
CONFigure:BSSignal:PHYSical:LEVel:SCH:PRIMary
CONFigure:BSSignal:PHYSical:LEVel:SCH:SECondary
CONFigure:BSSignal:PHYSical:LEVel:CCPCh:PRIMary
CONFigure:BSSignal:PHYSical:LEVel:CCPCh:SECondary
CONFigure:BSSignal:PHYSical:LEVel:PICH
CONFigure:BSSignal:PHYSical:LEVel:AICH
CONFigure:BSSignal:PHYSical:LEVel:DPDCh
CONFigure:BSSignal:PHYSical:Level
```

sets all channel levels at once (recommended command)

```
CONFigure:BSSignal:PHYSical:CODE:CCPCh:SECondary
CONFigure:BSSignal:PHYSical:CODE:PICH
CONFigure:BSSignal:PHYSical:CODE:AICH
CONFigure:BSSignal:PHYSical:CODE:DPDCh
CONFigure:BSSignal:PHYSical:DPCH:POFFset  <Level>
CONFigure:BSSignal:PHYSical:DPCH:TOFFset
CONFigure:BSSignal:SCODe:SECondary
CONFigure:BSSignal:PHYSical:DGFChange  ON | OFF
```

TPC Settings

The *TPC Settings* section defines the uplink Transmit Power Control (TPC) parameters transferred to the UE.

WCDMA Uplink Power Control

In CDMA networks, control of the UE transmit power is essential to ensure stable transmission and an efficient radio resource management within the system. Generally speaking, an output power of the UE transmitter that is too low decreases the coverage area while an excess output power may cause interference to other channels or systems. Both effects decrease the system capacity.

The Node B transmits a series of Transmit Power Control (TPC) commands on the DL channel. The UE receives the TPC commands and adjusts its transmit power according to one of the following algorithms for uplink power control (see standard 3GPP TS 25.214):

Algorithm 1 One TPC command is received in each slot. If the received TPC command is equal to 1 (0), then the power control parameter TPC_cmd for that slot is +1 (–1). This implies that the UE transmitter output power changes after each slot.

Algorithm 2 One TPC command is received in each slot. The slots are grouped into sets of 5 slots, aligned to the frame boundaries, so that there is no overlap between different sets of 5 slots. If the received TPC command is equal to 1 (0) in all 5 slots of a set, then the power control parameter TPC_cmd for the 5th slot is +1 (–1). Otherwise TPC_cmd for the 5th slot is 0. This implies that the UE transmitter output power only changes if the same TPC command is received in a complete set of 5 slots.

For both algorithms, the UE transmitter output power changes by TPC_cmd times the *TPC Step Size* of 1 dB or 2 dB.

TPC Algorithm Power control algorithm 1 or 2 used to control the UE transmit power. See background information above. The TPC algorithm can be changed in all signalling states including *Connected.* Some of the *TPC Pattern Setup* settings use their own TPC algorithm so that the parameter is grayed.

TPC Step Size Relative power difference of the UE between two consecutive slots if the power control algorithm commands the R&S CMU to change its output power. The step size is always a positive dB value (1 dB or 2 dB); the actual generator power may be increased or decreased by the step size, depending on the *TPC Algorithm*. Some of the *TPC Pattern Setup* settings use their own step size so that the parameter is grayed.

Note: *According to the standard, the TPC step size for Algorithm 2 is always 1 dB. The step size for Algorithm 1 can be 1 dB or 2 dB.*

Activate Pattern Enabled for *TPC Pattern Type = Single Pattern + All 0, Single Pattern + All 1* or *Single Pattern + Alternating*. Pressing the *Execute* button terminates the running alternating bit sequence at the next matching frame boundary and replaces it by <Pattern>000..., <Pattern>111..., or <Pattern>(0)1010...*; see* Table 4-31 and rules for the transfer of TPC patterns below. The function can be used repeatedly to insert single patterns into the bit sequence.

TCP Pattern Setup The CMU provides five different predefined setups with different TPC patterns. It is possible to select one of these TPC patterns or modify each pattern according to the needs of a specific application.

TCP Pattern Setup selects the TPC pattern setup to be used. All setups no. 1 to 5 are defined by the *TPC Pattern Type* and the single *Pattern;* see Table 4-32 *below.* In addition a series of fixed test setups labeled test steps A to H and test setups for phase discontinuity measurements or *UL CM TX Test Steps* are available; see below.

Test Step Precondition Preconditions are relevant for test step A to H, *PhD Up/Down*, and *UL CM TX Test Steps*; see below.

Segmented Enables or disables segmented TPC test patterns; see section *Segmented TPC Test Patterns* on p. 4.253.

Pattern definition (Set 1 to 5) The patterns for the different test steps are defined by means of the following settings:

TPC Pattern Type TPC command sequence transferred to the UE. Together with the power control algorithm and the step size, the TPC profile determines the power steps of the UE transmitter between consecutive slots. The timing of the TPC pattern is trigger-controlled. In order to meet the periodicity conditions for inner loop power control, the start of the pattern always coincides with the beginning of a frame. For more information on the inner loop TPC measurement refer to section *Power Measurements* on p. 4.2.

The actual pattern transferred depends on the finite single *Pattern* defined below, the *TPC Pattern Type* and the *Activate Pattern* setting*;* see Table 4-31 and rules for the transfer of TPC patterns below.

Pattern TPC command sequence of finite length (single pattern) used to construct the pattern transferred to the UE; see *TPC Pattern Type* above.

Remote control

```
CONFigure:BSSignal:TPC:MODE
CONFigure:BSSignal:TPC:SSIZe
CONFigure:BSSignal:TPC:PSET<nr>
CONFigure:BSSignal:TPC:PTYPe<nr>
CONFigure:BSSignal:TPC:PATTern<nr>
CONFigure:BSSignal:TPC:RPATtern
CONFigure:BSSignal:TPC:SEGmentation ON | OFF
```

Table 4-31 Single pattern and TPC Pattern Type

TPC Pattern Type	Transferred pattern for a single pattern <Pattern>	Trigger events
Alternating 0, 1	101010... (if last bit in current frame/before the start of the pattern is 0) 010101... (if last bit in current frame/before the start of the pattern is 1)	10-slot raster, frame-aligned in every 2nd frame
All 0	000000... (irrespective of <Pattern>)	10-slot raster, frame-aligned in every 2nd frame
All 1	111111... (irrespective of <Pattern>)	10-slot raster, frame-aligned in every 2nd frame
Continuous Pattern	<Pattern><Pattern><Pattern><Pattern>...	Trigger event at the beginning of each <Pattern>
Single Pattern + All 0	010101(0)<Pattern>000... (<Pattern> must be triggered by *Activate Pattern* event) The first bit of Pattern is always different from the last alternating bit.	See *All 0*[4]
Single Pattern + All 1	010101(0)<Pattern>111... (<Pattern> must be triggered by *Activate Pattern* event) The first bit of Pattern is always different from the last alternating bit.	See *All 1*[4]
Single Pattern + Alternating	010101(0)<Pattern>(0)10101... (<Pattern> triggered by *Activate Pattern*) The first bit of Pattern is always different from the last alternating bit.; the first bit after <Pattern> is always different from the last bit in <Pattern>	See *Alternating 0, 1*[4]
Closed loop	The CMU generates a TPC pattern that will command the UE to transmit at the UL Target Power defined in the UE Signal tab (see p. 4.231). Closed Loop is suspended if a *Min. Power, Max. Power* or *Spectrum* measurement is switched on, see Table 4-33 below.	10-slot raster, frame-aligned in every 2nd frame

Rules for the transfer of TPC patterns:

- A new pattern following an *All 0* or *All 1* pattern starts at the beginning of the first frame after the current frame.
- A new pattern following an *Alternating* pattern always starts at the next frame boundary where the last bit of the *Alternating* pattern is different from the first bit of the new pattern. This may be the first or second frame after the current frame.
- A running *Continuous Pattern* is immediately interrupted by a new pattern. The new pattern starts at the beginning of the first frame after the current frame.

Example: Single Pattern + Alternating *can be used to first change the (average) UE power by a definite number of steps and then maintain the new (average) UE power. Due to the rules quoted above, the first and the last bit in <Pattern> cancel the effect of the preceding and the following bits. The rules tend to stabilize the net UE power and minimize the effect of <Pattern>.*

4 *Activate Pattern* causes a trigger event for the transmission of <Pattern>. See *Rules for the transfer of TPC patterns.*

It is easy to show this mechanism for power control algorithm 1 where the UE power changes after each slot by a definite Step Size*: If the first and the last bits in <Pattern> are different, the net UE power change caused by these bits is zero. If both the first and the last bit in <Pattern> are 1 (0), then the net UE power change caused by these 2 bits equals to the step size times 1 (–1); the effect of one bit is cancelled. In contrast, each of the central 0 and 1 bits in <Pattern> (i.e. all bits except the first and the last bit) causes a UE power change of the step size times –1 and 1, respectively.*

a) 1st and last bit in <Pattern> different

Pattern: 1 1 0 0
Net UE power unchanged

Alternating Single Pattern Alternating

b) 1st and last bit in <Pattern> equal

Pattern: 0 0
Net UE power change: –1 x <Step_Size>

TPC Setups Set 1 to Set 5

The default patterns are inspired by the conformance test specification 3GPP TS 34.121; see Table 4-32 below.

Remote control
```
CONFigure:BSSignal:TPC:PSET SET1 | SET2 | … | SET5
CONFigure:BSSignal:TPC:CURRent? <Setup>, <Type>, <Pattern>
```

Table 4-32 Default TPC Patterns

Setup No.	TPC Pattern Type	Pattern	Description
1	Closed loop	01	UE transmits at *UL Target Power*, pattern ignored.
2	Single Pattern + Alternating	1111111111	UE increases its output power on each <Activate Pattern> event; otherwise it maintains its power.
3	Single Pattern + Alternating	0000000000	UE decreases its output power on each <Activate Pattern> event; otherwise it maintains its power.
4	Continuous Pattern	1111111111 0000000000	UE periodically increases and decreases its output power in 10-slot intervals. The average UE power over 20 slots is constant irrespective of the TPC algorithm.
5	Continuous Pattern	1000001001 1111011010	UE increases and decreases its output power according to an irregular pattern that contains one set of 5 consecutive "0" and "1" commands which both do not commence in the 1st, 6th or 11th slots of a frame (see TS 34.101). The average UE power over 20 slots is constant for TPC algorithm 1; for TPC algorithm 2 the UE power does not change.

Table 4-33 UE power depending on measurement settings

Measurement	Measurement Settings	TPC Pattern Type	UE Power
Min. Power Max. Power	TPC = Automatic UL Target Power = x dBm	All patterns, set before measurement is switched on	TPC pattern suspended during the measurement, UE transmits at its minimum or maximum power. UL target power ignored.
		Closed Loop, set after measurement is switched on	x dBm
		All other patterns, set after measurement is switched on	UE transmits according to the received TPC commands, UL target power ignored.
	TPC = Manual UL Target Power = x dBm	Closed Loop	x dBm
		All other patterns	UE transmits according to the received TPC commands, UL target power ignored.
Spectrum	UL Target Power = x dBm	Closed Loop, set before measurement is switched on	Closed loop suspended during the measurement, replaced by *Alternating 0,1* pattern. UE transmits in a fixed power range (x dBm ± 1 power step).
		Closed Loop, set after measurement is switched on	**Attention:** Closed loop at off-carrier frequencies causes fast UE power changes.
		All other patterns	UE transmits according to the received TPC commands, UL target power ignored.
All other measurements	UL Target Power = x dBm	Closed Loop	x dBm
		All other patterns	UE transmits according to the received TPC commands, UL target power ignored.

Fixed TPC Steps

The fixed test setups labeled A to H have been designed to account for the requirements of the conformance test specification 3GPP TS 34.121. The test steps induce a power ramp of the following shape:

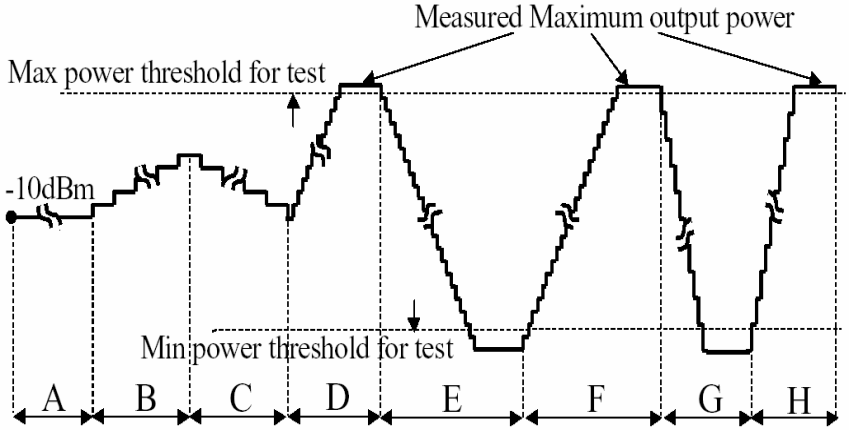


Fig. 4-104 Fixed test steps

The actual UE power steps can be evaluated in a *P/Slot Table* measurement. This measurement also includes a limit check for each power step. For a comprehensive application example refer to Chapter 2 of this manual.

Remote control
```
CONFigure:BSSignal:TPC:PSET TA | TB | … | TH
CONFigure:BSSignal:TPC:CURRent? <Setup>, <Type>, <Pattern>
```

Test UL CM TX Power Steps

The fixed *Test UL CM TX* test setup has been designed to account for the requirements of the conformance test specification 3GPP TS 34.121, section 5.7, *Power Setting in Uplink Compressed Mode*. The test steps induce a power ramp of the following shape:

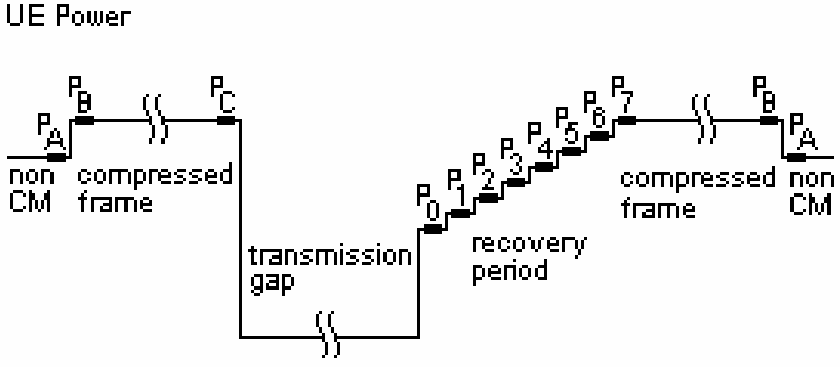


Fig. 4-105 Test UL CM TX power steps

Dashes in the TPC pattern indicates a transmission gap.

The actual UE power steps can be evaluated in a *P/Slot Table* measurement. This measurement also includes a limit check for each power step. For a comprehensive application example refer to Chapter 2 of this manual.

While the *Test UL CM TX* test setup is active, the R&S CMU behaves as follows:

- No TPC trigger events are generated
- *Activate Pattern: Execute* is disabled. Instead the test sequence is started from the measurement or by means of *Connection Control – BS Signal – CM Settings – UL CM TX Test Pattern – Execute*; see example in Chapter 2. The actual pattern transferred is selected in the *UL CM TX Test Pattern* section.

Remote control
```
CONFigure:BSSignal:TPC:PSET TULC
CONFigure:BSSignal:TPC:CURRent? <Setup>, <Type>, <Pattern>
```

Test Step Preconditions

Specifies whether the preconditions for the test steps A to H, PhD Up/Down are valid.

Manual The preconditions are ignored. It is possible to command the UE manually to a definite state.

Auto The UE is commanded to transmit according to the preconditions before a definite TPC pattern is sent. This setting is recommendable especially if a particular test step is repeated several times.

In the *Auto* setting, the R&S CMU performs the following actions:

1. After test step selection the R&S CMU commands the UE to transmit according to the precondition and waits until the UE has reached a stable state (corresponding to a *Closed Loop, All 0 or All1).*

2. *Activate Pattern* triggers a bit sequence <Pattern>000..., <Pattern>111..., or <Pattern>(0)1010. *Activate Pattern* is unavailable for some *TPC Pattern Setups.*
3. If *Activate Pattern* is pressed repeatedly the precondition is set again before the bit sequence is transmitted.

Remote control
```
CONFigure:BSSignal:TPC:PCONditions MANual | AUTO
```

Preconditions for test steps A to H

The preconditions for test steps A to H have been chosen in accordance with the requirements of the conformance test specification 3GPP TS 34.121, section 5.4.2.4.2 (see Fig. 4-104 above).

Test Steps A, B, C Precondition *Closed Loop:* The UE is commanded to the *UL Target Power* before *Activate Pattern* is executed. An appropriate target power can be set before each test step.

Test Steps D, F, H Precondition *All 0:* The UE is commanded to reach its min. power threshold.

Test Steps E, G Precondition *All 1:* The UE is commanded to reach its max. power threshold.

Preconditions for Phase Discontinuity

The *Closed Loop* precondition for the fixed TPC patterns has been chosen such that the UE transmits at the *UL Target Power* before *Activate Pattern* is executed. Refer to the measurement example for *Phase Discontinuity Measurements* in Chapter 2 for more information.

Remote control
```
CONFigure:BSSignal:TPC:PSET PUP | PDOWn
CONFigure:BSSignal:TPC:CURRent? <Setup>, <Type>, <Pattern>
```

Preconditions for UL CM TX Test Steps

The *Closed Loop* precondition for the *UL CM TX Test* ensures that the UE transmits at the *UL Target Power* before the measurement is started. Refer to the measurement example for the *Power Setting in Uplink Compressed Mode* test in Chapter 2 for more information.

Remote control
```
CONFigure:BSSignal:TPC:PSET PUP | PDOWn
CONFigure:BSSignal:TPC:CURRent? <Setup>, <Type>, <Pattern>
```

Optimizing the speed of TPC step measurements in remote control

The order of the different configurations and test steps has a critical impact on the speed of a TPC test sequence. See section Speed Improvement for TPC Step Measurements *in Chapter 7.*

Segmented TPC Test Patterns

To improve the accuracy of the *Inner Loop TPC* power steps, it is possible to split the TPC patterns for test steps E, G, G, and H into segments *(BS Signal – TPC Settings – Segmented: On)*.

Segmentation means that the R&S CMU200 inserts inverse TPC commands into each of the four test step patterns: A …1111…1111… changes to …11011…11011…, a …0000…0000… pattern changes to …00100…00100… The positions of the inverse TPC commands (segment borders) are fixed. The inverse TPC periods are used to adjust the R&S CMU200 hardware to the next input power range. The two UE power steps before and after each segment border are assumed to be equal. A difference in the **measured** UE power steps is attributed to the changed hardware settings and subtracted off:

- For the falling TPC patterns (E, G), the power steps after the segment borders are corrected.
- For the rising TPC patterns (F, H), the power steps before the segment borders are corrected.

As a consequence, the corrections in the segment near the maximum UE output power is zero, and the segment near the minimum UE output power contains the sum of all corrections in the test step.

Advantages of segmented TPC test patterns, possible drawback:

Unsegmented TPC test patterns correspond to the unmodified patterns described in standard 3GPP TS 34.121, however, segmented test patterns still comply with 3GPP specifications. Use segmented TPC test patterns to measure all power steps with maximum accuracy. Observe the hardware settings described below and note that the corrections may add up to a systematic error of the measured **absolute** powers, especially in the segments near the minimum UE output power.

If the UE power steps are systematically above or below the specified values, the UE power towards the end of a test step may get outside the linear analyzer range, causing the *Inner Loop TPC* measurement to generate an *Overflow* or *Underflow* message. This can be due to the fixed segment borders and the correction method. It does not necessarily mean that any of the single UE power steps are out of their specified range.

Recommended hardware settings:

	Falling test steps (E, G)	**Rising test steps (F, H)**
Non Signaling or Analyzer Level – Mode: Manual	The hardware is adjusted to the manual level setting. For a 12.2 kbps RMC, the manual level should be approx. 8 dB above the maximum UE output power.	Fixed hardware settings, based on a minimum UE output power between –56 dBm and –65 dBm.
Signaling and Analyzer Level – Mode: Auto	The expected maximum input level is the minimum of the following levels: • The maximum UE output power, according to its power class (read from the UE Capability report, if available) • The maximum allowed UE power (default value: +33 dBm) • The maximum power threshold (configuration of Power measurement) The level settings are valid for a 12.2 kbps RMC.	Fixed hardware settings, based on a minimum UE output power between –56 dBm and –65 dBm.

Compressed Mode Configuration

The compressed mode is activated and configured in the *BS Signal* tab of the *Connection Control* menu. The compressed mode is a prerequisite for *UE Report* measurements on UTRA or GSM neighbor cells; see section *UE Report (Signalling Only)* on p. 4.132. All compressed mode settings can still be changed while a connection is established.

The parameters of the different UE Report Patterns, Single Patterns *and of the* User Defined Pattern *are listed below; see Table 4-36 on p. 4.259.*

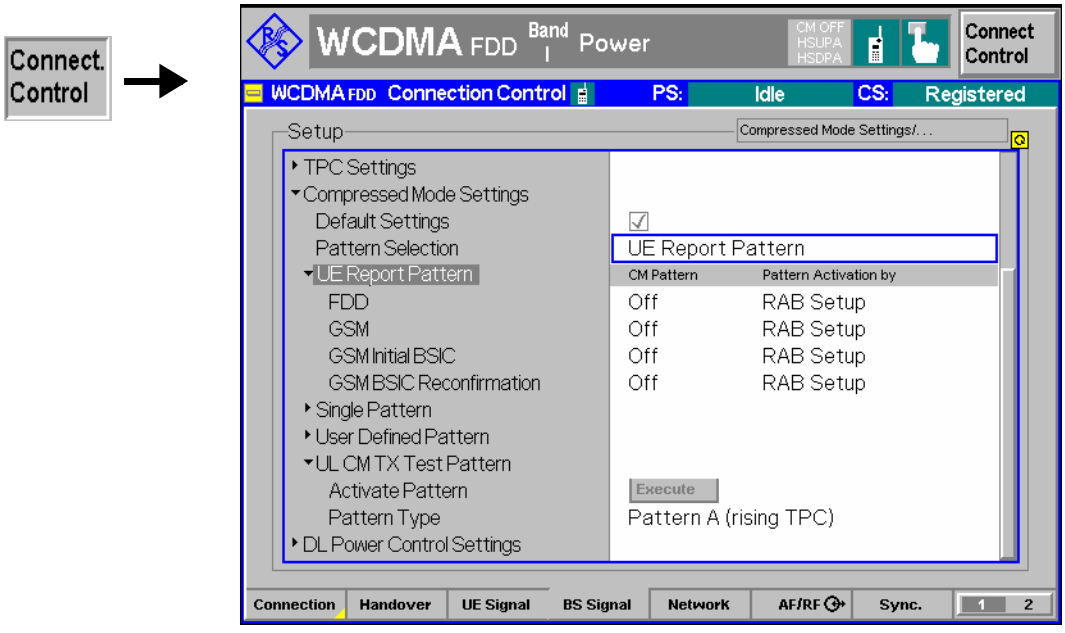


Fig. 4-106 Connection Control – BS Signal (Compressed Mode Settings)

Compressed Mode Settings – Pattern Selection

In the *Compressed Mode Settings* section, it is possible to enable the compressed mode and control the behavior of the UE while it operates in compressed mode. The R&S CMU provides the following alternative transmission gap patterns:

UE Report Pattern Up to four transmission gap patterns for different measurement purposes can be used in parallel. The predefined pattern settings ensure the compatibility of all patterns.

Single Pattern Selection of a single transmission gap pattern for a definite measurement purpose

User Defined Pattern Configuration of a single pattern using the compressed mode parameters.

None No transmission gap pattern; the compressed mode is not activated.

UL CM TX Test Steps Special compressed mode pattern according to the conformance test specification 3GPP TS 34.121, section 5.7, *Power Setting in Uplink Compressed Mode*.

UE Report Pattern

The UE report pattern enables up to four different neighbor cell measurements. The measurements are independent from each other and can be activated in parallel, provided that they are supported by the UE:

FDD Monitor WCDMA neighbor cells.

GSM Monitor GSM neighbor cells and measure the GSM carrier RSSI.

GSM Initial BSIC Search for the BSIC and decode it when detecting a new GSM neighbor cell.

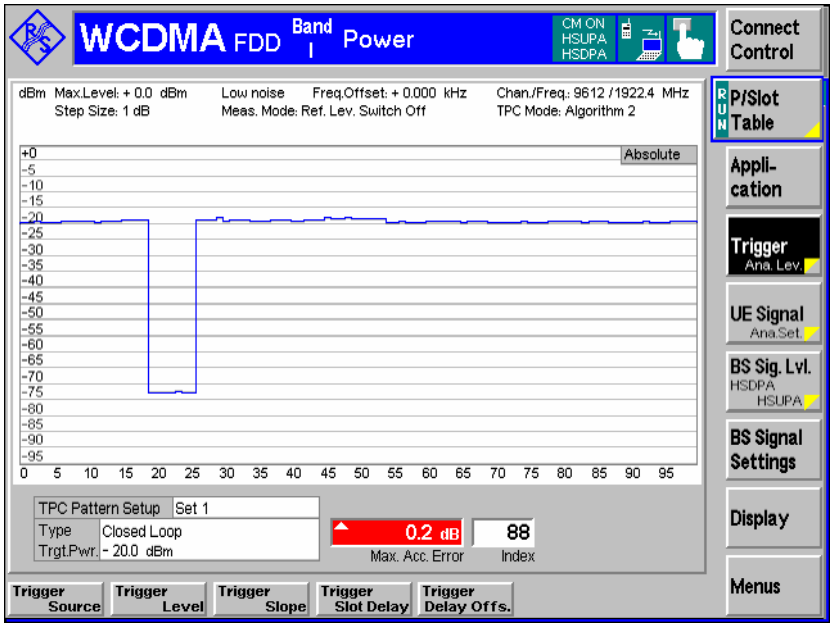
GSM BSIC Reconfirmation Track and decode the BSIC of a GSM cell after initial BSIC identification has been performed.

Refer to standard 3GPP TS 25.133 for a detailed description of the neighbor cell measurements.

NOTE

Compressed mode with monitoring of WCDMA neighbor cells is also supported in HSUPA test mode with a 10 ms TTI. This is shown in the example below where the UE goes into compressed mode (UL

signal switched off) while operating in HSUPA test mode.



Pattern Activation

Each compressed mode measurement can be activated for the whole duration of the connection *(RAB Setup)* or for the duration of a *UE Report* measurement only. In the latter case the UE starts measuring the neighbor cells when the *UE Report* measurement is switched on (see section *UE Reports* on p. 4.132) and terminates the measurement when the *UE Report* measurement is switched off.

Pattern activation by RAB Setup *is required to perform a Receiver Quality (BER) test in compressed mode. TX measurements provide wrong results if data is recorded during the compressed mode gaps.*

Single Pattern

Selection of a single transmission gap pattern for a definite measurement purpose. The patterns are listed in Table 4-34 below.

User Defined Pattern

The user defined transmission gap pattern is a single pattern which is defined in terms of the compressed mode parameters specifying the length and periodicity of the transmission gaps, their position within the radio frames and other properties. For details refer to standard 3GPP TS 25.215.

Note: *The R&S CMU leaves a maximum of flexibility in defining the user defined pattern parameters. Ensure that your parameter selection is consistent and avoid setting errors when using this pattern type. Keep in mind that the predefined patterns have been tested to cause no settings conflicts.*

The user defined pattern consists of an elementary pattern *TG Pattern 1* which is repeated a definite number of times (see Fig. 4-107 on p. 4.258).

The meaning of the compressed mode parameters is described in Table 4-35 below. Patterns for UE conformance tests are specified in standards 3GPP TS 34.121, 3GPP TS 25.101 and 3GPP TS 25.133. The user defined pattern can be configured for the measurement purposes of the *UE Report Pattern*, but also for *TDD* and *Multi Carrier* measurements.

Tip: *The CMU provides a compressed mode trigger output signal to monitor the transmission gap pattern; see section Compressed Mode Trigger on p. 4.287 and Fig. 4-113.*

UL CM TX Test Pattern

The *UL CM TX Test Pattern* section provides a special compressed mode patterns according to the conformance test specification 3GPP TS 34.121, section 5.7, *Power Setting in Uplink Compressed Mode*. For an application example for this pattern refer to Chapter 2 of this manual.

Activate Pattern Initiates a P/Slot Table measurement with the selected CM test pattern.

Pattern Type One of the three CM test patterns specified in the standard. *Pattern A (rising TPC)* is defined in table 5.7.6, *Pattern A (falling TPC)* in table 5.7.7, and *Pattern B* in table 5.7.8.

Remote control: `CONFigure:BSSignal:COMPressed…`

Status symbol

The compressed mode state *CM ON* or *CM OFF* is displayed in the title bar of each measurement menu. *CM ON* means that the UE actually operates in compressed mode, which can last for the duration of a *UE Report* measurement or for the entire connection (see *Pattern Activation by*…).

Table 4-34 Single patterns

Patten Name	Measurement Purpose	Source
RF A	FDD	3GPP TS 34.121 Tab. 5.7.5
RF B	FDD	3GPP TS 34.121 Tab. 5.7.8
A	FDD	3GPP TS 34.121 Tab. C.5.2 Set 1
B	GSM RSSI	3GPP TS 34.121 Tab. C.5.2 Set 2
C	GSM initial BSIC	3GPP TS 25.133 Tab. 8.7 pattern 2
D	GSM BSIC reconfirmation	3GPP TS 25.133 Tab. 8.8 pattern 2
E	FDD	3GPP TS 34.121 Tab. C.5.1 Set 1

Table 4-35 Parameters for user defined transmission gap pattern

Parameter	Values	Default Value	Meaning
TGPRC	0 to 511	0	Number of transmission gap patterns within the Transmission Gap Pattern Sequence (0 means that the pattern is repeated continuously)
TGCFN frame no.	0 to 255	0	Connection Frame Number of the first frame of the first pattern
TGSN slot no.	0 to 14	2	Slot number of the first transmission gap slot within the TGCFN
TGPL1	0 frames to 144 frames	3	Duration of transmission gap pattern 1
Transmission Gap 2	On | Off	Off	Presence of the second transmission gap within the transmission gap pattern
TGL1	1 slot to 14 slots	7	Length of first transmission gap within the transmission gap pattern
DeltaSIR1	0 to 30 (unit: dB/10)	0	Delta in DL SIR target value to be set in the UE during compressed frames due to the first transmission gap
DeltaSIR after 1	0 to 30 (unit: dB/10)	0	Delta in DL SIR target value to be set in the UE one frame after the compressed frames due to the first transmission gap
TGL2	1 slot to 14 slots	7	Length of second transmission gap within the transmission gap pattern (not used if *Transmission Gap 2* is *Off)*

Parameter	Values	Default Value	Meaning
DeltaSIR2	0 to 30 (unit: dB/10)	0	Delta in DL SIR target value to be set in the UE during compressed frames due to the second transmission gap (not used if *Transmission Gap 2* is *Off)*
DeltaSIR after 2	0 to 30 (unit: dB/10)	0	Delta in DL SIR target value to be set in the UE one frame after the compressed frames due to the second transmission gap (not used if *Transmission Gap 2* is *Off)*
Measurement Purpose	See Table 4-34 above	FDD	One of the measurement purposes defined in the conformance test specification.
TGD	15 slots to 270 slots	15	Duration between the starting slots of two consecutive transmission gaps within a transmission gap pattern (270 represents undefined)
RPP	Mode 0 | Mode 1	Mode 1	Recovery Period Power control mode, specifies the uplink power control algorithm applied during recovery period (1 frame) after each transmission gap in compressed mode. Mode 0 denotes normal PC mode, mode 1 denotes compressed PC mode; see 3GPP TS 25.214.
ITP	Mode 0 | Mode 1	Mode 1	Initial Transmit Power mode, specifies the uplink power control method to be used to compute the initial transmit power after the compressed mode gap; see 3GPP TS 25.214.
UL/DL Mode	Uplink | Downlink | Up- & Downlink	Up- & Downlink	Defines whether only DL, only UL, or combined UL & DL compressed mode is used
Downlink Compressed Mode	SF/2	SF/2	Method for generating downlink compressed mode gap (not used if *UL/DL Mode* is *Uplink)*
Uplink Compressed Mode	SF/2 | Higher Layer Scheduling	SF/2	Method for generating uplink compressed mode gap (not used if *UL/DL Mode* is *Downlink)*
Downlink Frame Type	A | B	A	Downlink compressed frame structure

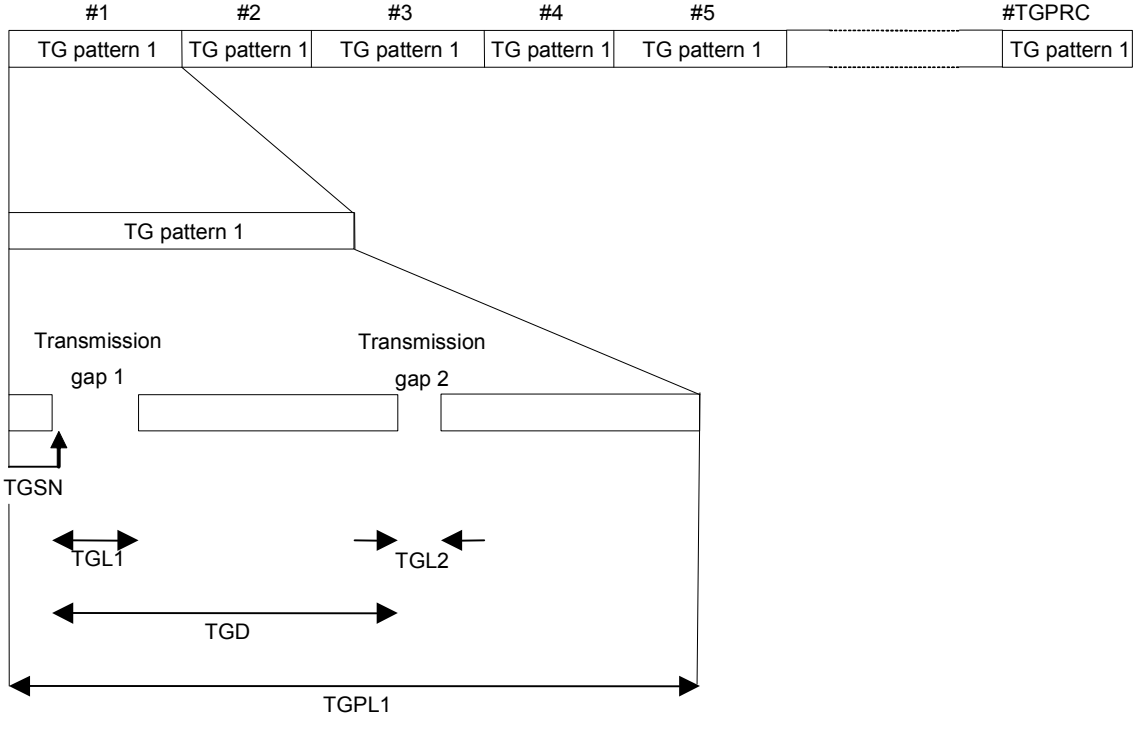


Fig. 4-107 Transmission gap pattern sequence

Table 4-36 Parameter overview for all compressed mode patterns

	TGPRC	TGSN	TGL1	TGL2 in use	TGL2	TGPL1	DeltaSIR1	DeltaSIRafter1
UE Report: FDD	0	4	7	FALSE	0	16	30	30
UE Report: GSM	0	4	7	FALSE	0	16	30	30
UE Report: GSM Initial BSIC	0	4	7	FALSE	0	8	30	30
UE Report: BSIC Reconfirmation	0	4	7	FALSE	0	16	30	30
Single: RF A	0	2	7	FALSE	0	3	0	0
Single: RF B	0	8	14	FALSE	0	4	0	0
Single: A	0	4	7	FALSE	0	3	0	0
Single: B	0	4	7	FALSE	0	12	0	0
Single: C	0	4	7	FALSE	0	8	30	30
Single: D	0	4	7	FALSE	0	8	30	30
Single: E	0	11	7	FALSE	0	4	30	30
User Defined (default)	0	2	7	FALSE	0	3	0	0

	DeltaSIR2	DeltaSIRafter2	TGD	RPP	ITP	UL DL Mode	DL CM Mode
UE Report: FDD	0	0	270	mode0	mode0	UL+DL	sf_2
UE Report: GSM	0	0	270	mode0	mode0	UL+DL	sf_2
UE Report: GSM Initial BSIC	0	0	270	mode0	mode0	UL+DL	sf_2
UE Report: BSIC Reconfirmation	0	0	270	mode0	mode0	UL+DL	sf_2
Single: RF A	0	0	15	mode1	mode1	UL+DL	sf_2
Single: RF B	0	0	270	mode0	mode0	UL+DL	sf_2
Single: A	0	0	270	mode0	mode0	UL+DL	sf_2
Single: B	0	0	270	mode0	mode0	UL+DL	sf_2
Single: C	0	0	270	mode0	mode0	UL+DL	sf_2
Single: D	0	0	270	mode0	mode0	UL+DL	sf_2
Single: E	0	0	270	mode0	mode0	UL+DL	sf_2
User Defined (default)	0	0	15	mode1	mode1	UL+DL	sf_2

	ULCM Mode	DL Frame Type	nidentifyAbort	treconfirmAbort	Measurement Purpose
UE Report: FDD	sf_2	FrameTypeB	0	0	fdd_Measurement
UE Report: GSM	sf_2	FrameTypeB	0	0	gsm_CarrierRSSIMeasurement
UE Report: GSM Initial BSIC	sf_2	FrameTypeB	66	0	gsm_initialBSICIdentification
UE Report: BSIC Reconfirmation	sf_2	FrameTypeB	0	11	gsmBSICReconfirmation
Single: RF A	sf_2	FrameTypeA	0	0	fdd_Measurement
Single: RF B	sf_2	FrameTypeA	0	0	fdd_Measurement
Single: A	sf_2	FrameTypeB	0	0	fdd_Measurement
Single: B	sf_2	FrameTypeB	0	0	gsm_CarrierRSSIMeasurement
Single: C	sf_2	FrameTypeB	0	0	gsm_initialBSICIdentification
Single: D	sf_2	FrameTypeB	0	0	gsmBSICReconfirmation
Single: E	sf_2	FrameTypeB	0	0	fdd_Measurement
User Defined (default)	sf_2	FrameTypeA	0	0	fdd_Measurement

Downlink Power Control

In *Signalling* mode, the R&S CMU can vary its DL DPCH power in response to a series of TPC commands from the UE until the UE has reached a specified DTCH target link quality. The *DTCH Target Quality* is communicated to the UE before it starts the DL power control procedure. A typical DL power control test consists of comparing the actual BLER at the UE to the DTCH target quality after the R&S CMU has reached a stable DPDCH level.

More downlink power control tests are described in standard 3GPP TS 34.121, section 7.8.

Testing DL power control

DL power control must be switched on before the R&S CMU has established a connection to the UE. Most parameters can still be varied during the connection.

1. Open the *BS Signal* tab of the *Connection Control* menu and expand the *DL Power Control Settings* section.
2. Select *DL Power Control: Mode 0* to enable the DL power control measurement.
3. If desired, vary the *DTCH Target Quality.*
4. Set up a connection to the UE.

After the *Connection Control* menu is closed you can open the *BER* application of the *Receiver Quality* menu and compare the *DL BLER* to the selected *DTCH Target Quality*.

The *BS Signal* tab of the *Connection Control* menu provides all DL power control settings.

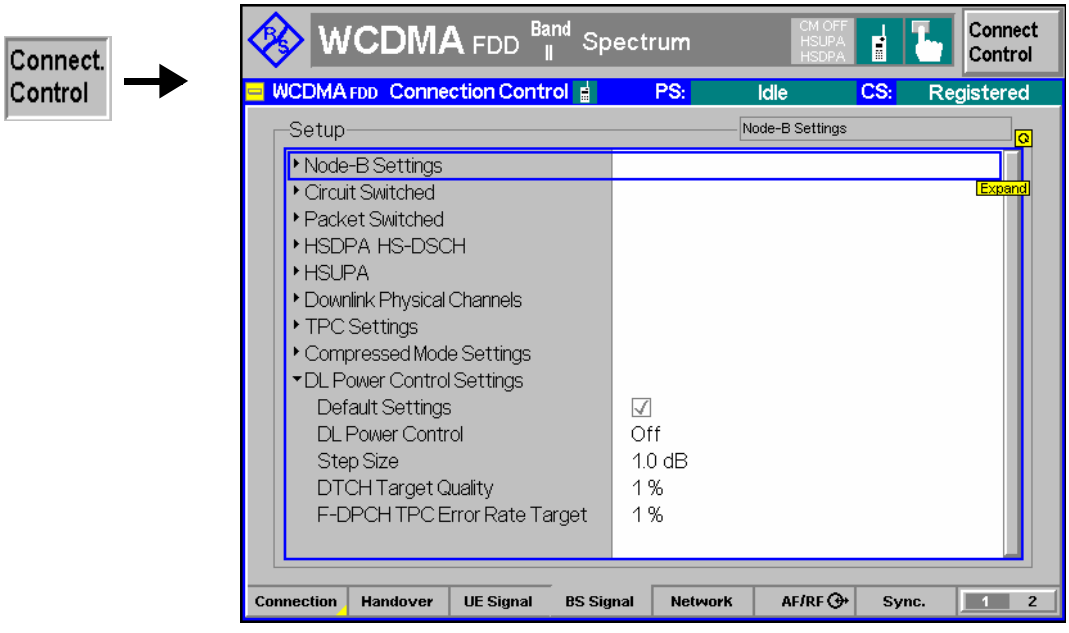
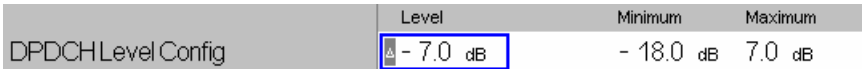


Fig. 4-108 Connection Control – BS Signal (DL Power Control Settings)

DPDCH Level Config

The *DPDCH Level Config* parameter in the *DL Physical Channels* section specifies the power range for the DPDCH Level during the DL power control test. The test fails if the *DTCH Target Quality* cannot be reached at a DL DPDCH level within the specified range.



Level Shows the current DPDCH level during a DL power control test. The DPDCH *Level* can be varied as long as no DL power control test is running. This condition is met as long as the R&S CMU has not reached the *Connected* state or if *DL Power Control* is switched off. The level is grayed as soon as a connection is established and the DL power control test is active. During the test the level is adjusted until the *DTCH Target Quality* is reached; see below .

Minimum Minimum DPDCH level during the DL power control test

Maximum Maximum DPDCH level during the DL power control test

Remote control

```
CONFigure:BSSignal:PHYSical:LEVel:DPDCh:MINimum
CONFigure:BSSignal:PHYSical:LEVel:DPDCh:MAXimum
```

DL Power Control Settings

The *DL Power Control Settings* enable or disable power control and specify the conditions for the DL power control test.

DL Power Control Disables *(Off)* or enables DL power control and selects the DL power control mode (DPC Mode). The DPC Mode defines the frequency of the power adjustment of the DL DPCH in response to the UE transmitted TPC commands: In mode 0, the DL power is adjusted in every slot. In mode 1, the TPC commands are estimated over three slots and the DL power is adjusted in every three slots.

Step Size DL power control step size Δ_{TPC}; the power change of the DL DPCH after the R&S CMU has received a TP command.

DTCH Target Quality DTCH target link quality at the UE, expressed as a target BLER that must be reached at the end of the DL power control procedure. The *DTCH Target Quality* is signaled to the UE before the DL power control procedure is started.

F-DPCH TPC Error Rate Target Target error rate for TPC tests using the fractional DPCH (F-DPCH). This parameter replaces the DPCH-related *DTCH Target Quality,* if an F-DPCH radiobearer setup is active *(Packet Switched – HSDPA Test Mode – Radiobearer Setup: F-DPCH + HSDPA). F-DPCH TPC Error Rate Target* is the target link quality at the UE, expressed as a target *TPC error rate* that must be reached at the end of the DL power control procedure. The TPC error rate is the percentage of TPC commands which caused a wrong power step at the UE (see standard 3GPP TS 34.108). The *F-DPCH TPC Error Rate Target* is signaled to the UE before the DL power control procedure is started.

Remote control

```
DEFault:BSSignal:DPCS ON | OFF
CONFigure:BSSignal:DPCS:PCONtrol ON | OFF
CONFigure:BSSignal:DPCS:SSIZe
CONFigure:BSSignal:DPCS:DTQuality
CONFigure:BSSignal:DPCS:FDPCh:TPCError
```

Power adjustment of the R&S CMU generator

A TPC command from the UE adjusts the DPCH level (DPCCH and DPDCH) across all symbols. If the OCNS is switched on, it is also adjusted so that the *Output Channel Power (Ior)* is kept constant. DPCH and OCNS adjustment are synchronous.

WCDMA Signal Levels for TX and RX Tests

Annex E of the conformance test specification 3GPP TS 34.121 defines the downlink physical channels needed for setting up a connection and for performing TX and RX tests. The specification covers both non-HSDPA and HSDPA test cases. The following supplement describes how the WCDMA signal level settings of the R&S CMU relate to the quantities in the standard and how the specified channel levels can be set at the R&S CMU.

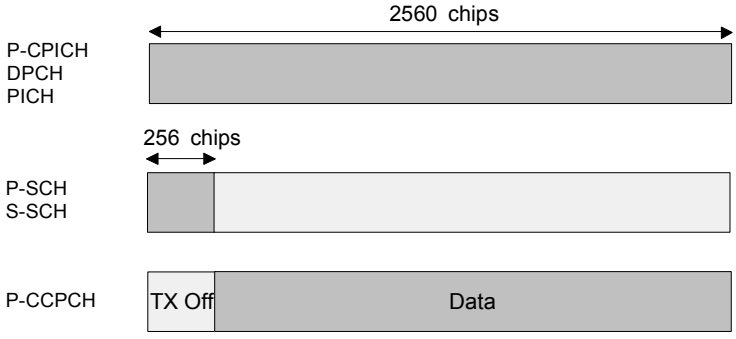
General Considerations

The *Level Reference* parameter in the *BS Signal* tab defines whether the power of all channels is expressed relative to the P-CPICH *(PCPICH)* or to the *Output Channel Power.* The standard uses both level references.

If the *Output Channel Power* is used as a level reference the Orthogonal Channel Noise Simulator (OCNS) is automatically switched on; see OCNS description on p. 4.153. The DPCH is not used as a level reference in the R&S CMU because it can be switched off entirely.

Conversion formulas

The P-CPICH, DPCH, and PICH are transmitted over the whole slot whereas the SCHs and the P-CCPCH are time-multiplexed as shown below:



During the first 256 chips of a slot the channel levels are related as follows:

$$E_C^{P-CPICH} + E_C^{DPCH} + E_C^{PICH} + E_C^{P-SCH} + E_C^{S-SCH} + OCNS = I_{or},$$

where I_{or} denotes the total output power *(Output Channel Power).* During the remainder of the slots (2304 chips) the following relation holds:

$$E_C^{P-CPICH} + E_C^{DPCH} + E_C^{PICH} + E_C^{P-CCPCH} + OCNS = I_{or}.$$

The formulas have been used to obtain the calculated results (marked with a ⇨) in the tables below (the calculation implies a division by the power reference and a conversion between linear power ratios and logarithmic (dB) values). Note that some of the channels can be turned off depending on the application. Moreover, additional AICH and S-CCPCH contributions must be considered during the connection setup.

PICH and DPCH levels

According to standard TS 25.211, the PICH is only transmitted during the first 288 of 300 bits in each frame. The power formulas hold in slots no. 0 to 13; they are modified in slot 14. The PICH power averaged over a frame is reduced by a factor of 0.96.

A constant DPCH power corresponds to a DPCCH/DPDCH power offset of 0 dB, which is the default setting of the R&S CMU.

P-SCH and S-SCH levels

The P-SCH and S-SCH are both transmitted during the first 256 chips of a slot as shown above (see also Fig. 4-65 on p. 4.153 ff). The sum of both channel contributions must correspond to the SCH levels specified in the standard. This is most easily achieved by reducing the level of both SCHs by 3 dB.

AICH and S-CCPCH levels

Control channels that are only active while the connection is set up (AICH, S-CCPCH) are not included in most of the channel tables below. Where they are present, their levels are simply added to the left side of Equation 1 and Equation 2.

HSDPA channels

The output channel power I_{or} is calculated under the assumption that the downlink HSDPA channels (HS-SCCH and HS-DSCH) are transmitted continuously. This corresponds to an Inter TTI distance of 1 *(Connection Control – BS Signal – HSDPA HS-DSCH – User Defined Channel – Inter TTI Distance: 1)* **or** transmission of dummy data in the unscheduled subframes *(Connection Control – BS Signal – Downlink Physical Channels – HS-SCCH / HS-PDSCH – Unscheduled Subframes: Transmit Dummy UE ID / Dummy Data)*.

The presence of HSDPA channels modifies Equation 1 and Equation 2 as follows:

$$E_c^{P-CPICH} + E_c^{DPCH} + E_c^{PICH} + E_c^{P-SCH} + E_c^{S-SCH} + E_c^{HS-SCCH} + E_c^{HS-DSCH} + OCNS = I_{or},$$

(Equation 3)

$$E_c^{P-CPICH} + E_c^{DPCH} + E_c^{PICH} + E_c^{P-CCPCH} + E_c^{HS-SCCH} + E_c^{HS-DSCH} + OCNS = I_{or} .$$

(Equation 4)

In the following tables, the downlink physical channels from standard 3GPP TS 34.121, annex E, are expressed relative to the *Output Channel Power* (I_{or}) and relative to the *P-CPICH* level. The level specifications from the standard appear on a shaded background. All calculated values are marked with a ⇨ and rounded to 0.1 dB.

Channel Powers for Non-HSDPA Test Cases

Table 4-37 Downlink Physical Channel without dedicated connection (TS 34.121, E.2.2)

Physical Channel	**Power, rel. to Output Channel Power I_{or}**	**Power, relative to P-CPICH**
Output Channel Power (I_{or})	Test dependent power <I_{or}>	<I_{or}>
P-CPICH	–3.9 dB	⇨ <I_{or}> – 3.9 dB
P-CCPCH	–8.3 dB	–4.4 dB
SCH	–8.3 dB (set P-SCH and S-SCH to –11.3 dB)	–4.4 dB (set P-SCH and S-SCH to –7.4 dB)
PICH	–8.3 dB	–4.4 dB
S-CCPCH	–5.3 dB	–6.4 dB
OCNS	⇨ Turned off	Turned off

Table 4-38 Downlink Physical Channel for TX tests (TS 34.121, E.3.1)

Physical Channel	**Power, relative to DPCH**	**Power, relative to Output Channel Power I_{or}**	**Power, relative to P-CPICH**
I_{or}	–93 dBm / 3.84 MHz	–93 dBm / 3.84 MHz	–93 dBm / 3.84 MHz
P-CPICH	7 dB	–3.3 dB	⇨ –96.3 dBm
P-CCPCH	5 dB	–5.3 dB	–2 dB
SCH	5 dB (set both SCHs to –8 dB)	–5.3 dB (set both SCHs to –8.3 dB)	–2 dB (set both SCHs to –5 dB)
PICH	2 dB	–8.3 dB	–5 dB
DPCH	–103.3 dBm / 3.84 MHz	–10.3 dB	–7 dB
OCNS	⇨ Turned off	Turned off automatically	Turned off

Table 4-39 Downlink Physical Channel for RX tests (TS 34.121, E.3.2.1)

Physical Channel	Power, relative to DPCH	Power, relative to Output Channel Power I_{or}	Power, relative to P-CPICH
I_{or}	⇨ <DPCH> + 10.3 dB	⇨ <DPCH> + 10.3 dB	⇨ <DPCH> + 10.3 dB
P-CPICH	7 dB	–3.3 dB	⇨ <DPCH> + 7 dB
P-CCPCH	5 dB	–5.3 dB	–2 dB
SCH	5 dB (set both SCHs to –8 dB)	–5.3 dB (set both SCHs to –8.3 dB)	–2 dB (set both SCHs to –5 dB)
PICH	2 dB	–8.3 dB	–5 dB
DPCH	Test dependent power <DPCH>	–10.3 dB	–7 dB
OCNS	Turned off	Turned off automatically	Turned off

Table 4-40 Downlink Physical Channel for RX tests (TS 34.121, E.3.2.2)

Physical Channel	Power, rel. to Output Channel Power I_{or}	Power, relative to P-CPICH
I_{or}	⇨ –81.9 dBm /3.84 MHz	⇨ –81.9 dBm /3.84 MHz
P-CPICH	–4.1 dB	–86 dBm / 3.84 MHz
P-CCPCH	–6.1 dB	–2 dB
SCH	–6.1 dB (set both SCHs to –9.1 dB)	–2 dB (set both SCHs to –5 dB)
PICH	–9.1 dB	–5 dB
S-CCPCH	–6.1 dB	–2 dB
OCNS	Turned off automatically	Turned off

Channel Powers for HSDPA Test Cases

Table 4-41 Downlink Physical Channels for HSDPA connection setup (TS 34.121, E.5.0)

Physical Channel	Power, rel. to Output Channel Power I_{or}	Power, relative to P-CPICH
Output Channel Power (I_{or})	Test dependent power <I_{or}>	<I_{or}>
P-CPICH	– 10.0 dB	⇒ <I_{or}> – 10.0 dB
P-CCPCH	– 12.0 dB	– 2.0 dB
SCH	– 12.0 dB (set P-SCH and S-SCH to -15.0 dB)	– 2.0 dB (set P-SCH and S-SCH to -5.0 dB)
PICH	– 15.0 dB	– 5.0 dB
HS-PDSCH	off	off
HS-SCCH	off	off
DPCH	– 5.0 dB	+ 5.0 dB
OCNS	– 3.1 dB	+ 6.9 dB

Table 4-42 Downlink Physical Channels for HSDPA testing for single link performance (TS 34.121, chapter 9.2.1 and table E.5.1)

Physical Channel	**Power, rel. to Output Channel Power I_{or}**				**Power, relative to P-CPICH**			
Output Channel Power (I_{or})	Test dependent power <I_{or}>				<I_{or}>			
P-CPICH	– 10.0 dB				⇒ <I_{or}> – 10.0 dB			
P-CCPCH	– 12.0 dB				– 2.0 dB			
SCH	– 12.0 dB (set both SCHs to -15.0 dB)				– 2.0 dB (set both SCHs to -5.0 dB)			
PICH	– 15.0 dB				– 5.0 dB			
HS-PDSCH	Test specific, for tests in TS 24.121 ch. 9.2.1: [1]							
	– 12.0dB	– 9.0 dB	– 6.0 dB	– 3.0 dB	– 2.0 dB	+ 1.0 dB	+ 4.0dB	+ 7.0dB
HS-SCCH_1 [2]	No value specified, sufficient power allocation so that probability of misdetection is very low, e.g. – 8.0 dB				+ 2.0 dB			
HS-SCCH_2 HS-SCCH_3 HS-SCCH_4	off				off			
DPCH [2]	No value specified, e.g. – 9.0 dB				+ 1.0 dB			
OCNS [2] ⇒	– 3.4 dB	– 4.0 dB	– 5.7 dB	–16.8 dB	+ 6.6 dB	+ 6.0 dB	+ 4.3 dB	– 6.8 dB

Note 1: The values of -6.0 dB and -3.0 dB for HS-PDSCH are used for minimum performance requirements for all H-Sets. The values of -12.0 dB and -9.0 dB for HS-PDSCH are only used for enhanced performance requirements.

Note 2: For HS-SCCH_1 and DPCH no specific level values are given in the specification TS 23.121 chapter 9.2.1. The power allocation must be high enough, so that the channels can be detected by the mobile. The OCNS level is used to fill up the output channel power and depends on the settings of HS-SCCH_1 and DPCH.

Table 4-43 Downlink Physical Channels for HSDPA testing for reporting of channel quality indicator (TS 34.121, chapter 9.3 and table E.5.1)

Physical Channel	**Power, rel. to Output Channel Power I_{or}**			**Power, relative to P-CPICH**		
Output Channel Power (I_{or})	Test dependent power <I_{or}>			<I_{or}>		
P-CPICH	– 10.0 dB			⇒ <I_{or}> – 10.0 dB		
P-CCPCH	– 12.0 dB			– 2.0 dB		
SCH	– 12.0 dB (set both SCHs to -15.0 dB)			– 2.0 dB (set both SCHs to -5.0 dB)		
PICH	– 15.0 dB			– 5.0 dB		
	Fading 1 [1] (ch. 9.3.2)	**Fading 2 [1] (ch. 9.3.2)**	**AWGN [1] (ch.9.3.1)**	**Fading 1 (ch. 9.3.2)**	**Fading 2 (ch. 9.3.2)**	**AWGN (ch.9.3.1)**
HS-PDSCH	– 8.0 dB	– 4.0 dB	– 3.0 dB	+ 2.0 dB	+ 6.0 dB	+ 7.0 dB
HS-SCCH_1	– 8.5 dB	– 8.5 dB	– 10.0 dB	+ 1.5 dB	+ 1.5 dB	0.0 dB
HS-SCCH_2 HS-SCCH_3 HS-SCCH_4	off			off		
DPCH	– 6.0 dB	– 6.0 dB	– 10.0 dB	+ 4.0 dB	+ 4.0 dB	0.0 dB
OCNS ⇒	– 5.9 dB	– 18.0 dB	– 9.8 dB	+ 4.1 dB	– 8.0 dB	+ 0.2 dB

Note 1: The levels for HS-PDSCH, HS-SCCH_1, DPCH and OCNS are test-specific. The level values are given for the following three tests: AWGN Propagation Conditions (ch. 9.3.1), Fading Propagation Conditions Test 1 and Fading Propagation Conditions Test 2 (ch. 9.3.2)

Table 4-44 Downlink Physical Channels for HSDPA receiver testing for HS-SCCH detection performance (TS 34.121, chapter 9.4 and table E.5.4)

Physical Channel	**Power, rel. to Output Channel Power I_{or}**					**Power, relative to P-CPICH**				
Output Channel Power (I_{or})	Test dependent power <I_{or}>					<I_{or}>				
P-CPICH	– 10.0 dB					⇒ <I_{or}> – 10.0 dB				
P-CCPCH	– 12.0 dB					– 2.0 dB				
SCH	– 12.0 dB (set both SCHs to -15.0 dB)					– 2.0 dB (set both SCHs to -5.0 dB)				
PICH	– 15.0 dB					– 5.0 dB				
HS-PDSCH	– 10.0 dB					0.0 dB				
HS-SCCH_1	Test-specific, for tests in TS 24.121 ch. 9.4: [1]									
	– 15.6	– 12.0	– 10.0	– 9.9	– 9.0	– 5.6	– 2.0	0.0	+ 0.1	+ 1.0
HS-SCCH_2	– 15.6	– 12.0	– 10.0	– 9.9	– 9.0	– 5.6	– 2.0	0.0	+ 0.1	+ 1.0
HS-SCCH_3	– 15.6	– 12.0	– 10.0	– 9.9	– 9.0	– 5.6	– 2.0	0.0	+ 0.1	+ 1.0
HS-SCCH_4	– 15.6	– 12.0	– 10.0	– 9.9	– 9.0	– 5.6	– 2.0	0.0	+ 0.1	+ 1.0
DPCH	– 8.0 dB					+ 2.0 dB				
OCNS ⇒	– 3.6	– 5.3	– 8.3	– 8.6	– 13.5	+ 6.4	+ 4.7	+ 1.7	+ 1.4	– 3.5

Note 1: All HS-SCCHs have equal levels.
The values of -10.0 dB, -9.9 dB and -3.0 dB for HS-SSCH are used for minimum performance requirements (ch.9.4.1).
The values of -15.6 dB and -12.0 dB for HS-SSCH are only used for enhanced performance requirements (ch.9.4.1A).

Table 4-45 Downlink Physical Channels for HSDPA receiver testing Maximum Input Level for HS-PDSCH reception (TS 34.121, chapter 6.3A and table E.5.1)

Physical Channel	**Power, rel. to Output Channel Power I_{or}**	**Power, relative to P-CPICH**
Output Channel Power (I_{or})	Test dependent power <I_{or}>	<I_{or}>
P-CPICH	– 10.0 dB	⇒ <I_{or}> – 10.0 dB
P-CCPCH	– 12.0 dB	– 2.0 dB
SCH	– 12.0 dB (set both SCHs to -15.0 dB)	– 2.0 dB (set both SCHs to -5.0 dB)
PICH	– 15.0 dB	– 5.0 dB
HS-PDSCH	– 3.0 dB	+ 7.0 dB
HS-SCCH_1 [2]	– 13.0 dB	– 3.0 dB
HS-SCCH_2 HS-SCCH_3 HS-SCCH_4	off	off
DPCH [2]	– 13.0 dB	– 3.0 dB
OCNS [2] ⇒	– 6.9 dB	+ 3.1 dB

Table 4-46 Downlink Physical Channels for HSDPA testing for Transmitter characteristics with HS-DPCCH (TS 34.121, chapter 5.2A, 5.9A, 5.10A and 5.13A with table E.5.1 and table E.5.4)

Physical Channel	Power, rel. to Output Channel Power I_{or}	Power, relative to P-CPICH
Output Channel Power (I_{or})	Test dependent power <I_{or}>	<I_{or}>
P-CPICH	– 10.0 dB	⇒ <I_{or}> – 10.0 dB
P-CCPCH	– 12.0 dB	– 2.0 dB
SCH	– 12.0 dB (set both SCHs to -15.0 dB)	– 2.0 dB (set both SCHs to -5.0 dB)
PICH	– 15.0 dB	– 5.0 dB
HS-PDSCH	– 3.0 dB	+ 7.0 dB
HS-SCCH_1 [2]	– 8.0 dB	+ 2.0 dB
HS-SCCH_2 HS-SCCH_3 HS-SCCH_4	off	off
DPCH [2]	– 9.0 dB	+ 1.0 dB
OCNS [2] ⇒	–16.8 dB	– 6.8 dB

Network Parameters (Connection Control – Network)

The *Network* tab defines various parameters that the CMU, simulating the UTRAN, reports to the UE.

- The WCDMA operating band. This network parameter can also be defined in the *Connection* tab; see section *Connection – State Signal Off* on p. 4.196.
- Handling of the *Packet Switched Domain* information.
- Various code numbers defining the *Network Identity*
- Parameters for *Random Access* of the UE to the network
- Check of UE properties during registration *(Requested UE Data)*
- *Cell Reselection Information* that the R&S CMU transmits in the system information blocks SIB3 and SIB11
- The WCDMA and GSM neighbor cell lists broadcast to the UE.

Some settings may not be available in all signalling states of the CMU. Exact description is provided in the remote control command description in Chapter 6.

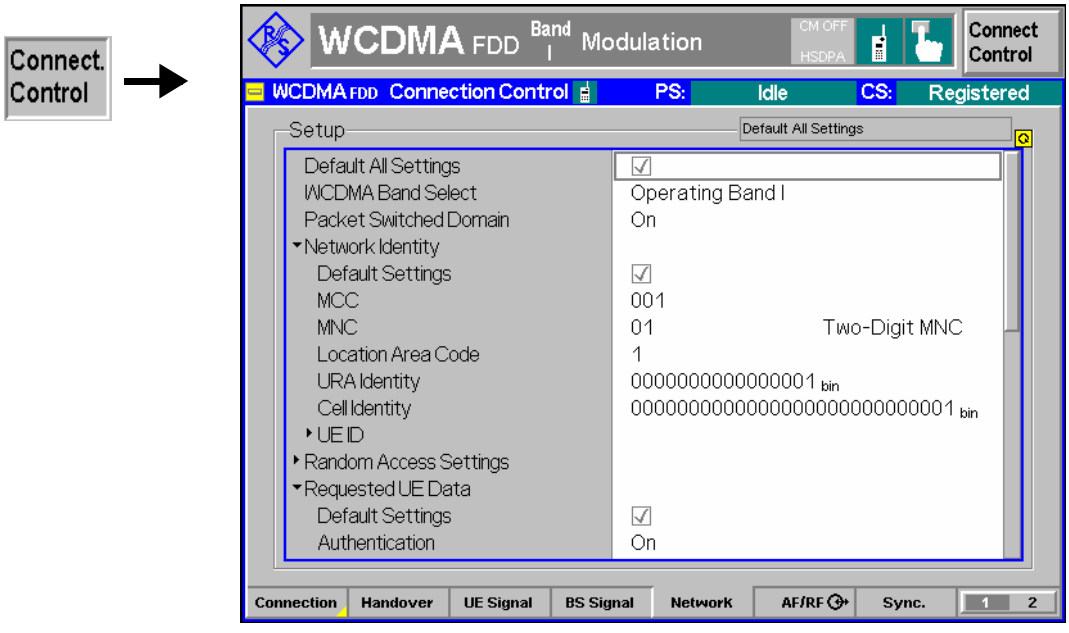


Fig. 4-109 Connection Control – Network parameters

The following settings are not provided in the *Connection* tab.

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Network* tab (the default values are quoted in the command description in Chapter 6). Additional default switches are provided for the individual section in the *Network* tab.

Remote control
```
DEFault:NETWork
DEFault:NETWork:IDENtity
DEFault:NETWork:RAC
```

WCDMA Band Select Selects the UTRA/FDD frequency band in which the R&S CMU/UE operates; see *Band Select* on p. 4.197.

Remote control
```
CONFigure:NETWork:OBANd
      OB1 | OB2 | OB3 | OB4 | OB5 | OB6 | OB7 | OB8 | OB9 |
      OB10 | OBS
CONFigure:UESignal:COMBined:OCHannel
CONFigure:BSSignal:COMBined:OCHannel
```
(fast combined channel and band selection)

Network – Packet Switched Domain

The *Packet Switched Domain* softkey in the *Network* tab of the *Connection Control* menu specifies whether the R&S CMU acts as a Node B that supports circuit switched connections only or also packet data connections.

Off Circuit switched operation only. The packet switched signalling states and the *HSDPA Test Mode* are not accessible, however, the connection is accelerated.

On Circuit switched operation with packet data support: The CMU reports to the UE that the CMU/current cell supports packet switched services. The UE can attempt a PS attach provided that it is configured accordingly (attach always / attach on demand). Switching on the packet switched domain makes it easier for some UEs to register.

The *Packet Switched Domain* parameter is available only before the MS is connected (i.e. in the signalling states *Signal Off*, *Signal On/Idle, Registered/Attached).* Enabling the packet switched domain is a pre-condition for WCDMA data application tests and the *HSDPA Test Mode*.

Remote control

```
CONFigure:NETWork:PSWitched:DOMain ON | OFF
```

Network Identity

The *Network Identity* section contains parameters of the radio network that the CMU transfers to the UE under test.

MCC 3-digit Mobile Country Code, set to 001 by default

MNC Mobile Network Code. A two or three-digit MNC can be set. If *Two-Digit MNC* is selected while a three-digit MNC is active, then the MNC is reset to the default value 01.

Location Area Code LAC in the range 0 hex to F hex

URA Identity UTRAN Registration Area (URA) identity in the range 0000 0000 0000 0000 bin to 1111 1111 1111 1111 bin

Cell Identity Cell Identity (CI) in the range 0000 0000 0000 0000 0000 0000 0001 bin to 1111 1111 1111 1111 1111 1111 1111 bin

Remote control

```
CONFigure:NETWork:IDENtity:MCC  <MCC>
CONFigure:NETWork:IDENtity:MNC  <MNC>
CONFigure:NETWork:IDENtity:MNC:DIGits TWO | THR
CONFigure:NETWork:IDENtity:LAC  <LAC>
CONFigure:NETWork:IDENtity:URA  <URA>
CONFigure:NETWork:IDENtity:CELL  <CI>
```

Network Identity – UE ID

The *Network Identity – UE ID* section contains parameters of the radio network that the CMU transfers to the UE under test.

Usage of Default IMSI
Indication whether the R&S CMU uses the default IMSI specified below (box checked) or the ID received from the UE on registration (box unchecked). Once an ID from the UE has been received, this *Identity* and the *Identity Type* are displayed below.

IMSI (Default)
15-digit International Mobile Subscriber Identity that the R&S CMU can use before the UE is registered. With an appropriate UE configuration this IMSI can be used as well to speed up the paging procedure (see also *Requested UE Data – Attach/Detach* below).

The IMSI consists of the MCC (first 3 digits), the MNC (following 2 or 3 digits), and the 10- or 9-digit Mobile Subscriber ID (MSIN). The default values for the *MCC, MNC,* and the *IMSI* are compatible, however, the three parameters can be used independently. The *IMSI (Default)* value is replaced by the default IMSI of the USIM card R&S CRT-Z3 while *Network – Requested UE Data – Use 2G SIM* is enabled.

The following parameters are not available ("---") while the R&S CMU uses the default IMSI (usually before registration). They are also displayed in the *Setup* tab in the *Connection* tab of the *Connection Control* menu.

Identity (UE Registration)
Code number identifying the UE. The format of the identity depends on the *Identity Type*.

Identity Type (UE Registration)
Type of Mobile Identity: IMSI, IMEI, IMSISV, TMSI, P-TMSI or None.

Remote control
```
CONFigure:NETWork:IDENtity:IMSI  <IMSI>
[SENSe]:SIGNalling:RIType?
```
(also for checking whether the default IMSI is in use)
```
[SENSe]:SIGNalling:RIDentity?
```
(also for checking whether the default IMSI is in use)

Random Access Settings

The *Random Access Settings* section sets the parameters required for initiating a physical random access procedure of the UE (TS 25.214).

Random access procedures are used when establishing the layer 1 communication between the UE and UTRAN, i.e. when the UE attempts a registration towards the CMU or a connection. In brief they consist of randomly selecting access slots and transmitting RACH preambles at increasing power until the Node B sends an ACK/NACK on the AICH or until the maximum number of preambles within one cycle is exceeded. After receiving an ACK the UE transmits a message, otherwise the ramping cycle is repeated. For an explanation of the parameters see *Fig. 4-110 below*.

DRX Cycle L.
Length of the Discontinuous Reception (DRX) cycle that the UE uses in idle mode in order to reduce power consumption (see standard TS 25.304). The DRX cycle length is in the range between 2^6 frames and 2^9 frames (corresponding to 640 ms to 5.12 s): When DRX is used the UE needs only to monitor one Page Indicator (PI) in one Paging Occasion per DRX cycle.

RACH TTI
Length of the RACH Transmission Time Interval in ms. In FDD mode, a RACH may employ either 10 or 20 ms TTI.

Max. Preamble Cycles Maximum number of times the preamble cycle is repeated

The following parameters define a single preamble cycle:

Step Size Transmit power difference between two consecutive preambles

AICH Transmission Timing Minimum time delay between two consecutive preambles; see footnote of *Fig. 4-110 below*

Max. Retransmission Maximum number of preambles to be transmitted before a single preamble cycle is terminated

RACH Msg. Part Power Offset Power difference between the last preamble transmitted and the RACH message part

Remote control

```
CONFigure:NETWork:RAC:DRXCycle  <DRX_Cycle>
CONFigure:NETWork:RAC:TTI
CONFigure:NETWork:RAC:PREamble:MCYCles
CONFigure:NETWork:RAC:PREamble:SSIZe
CONFigure:NETWork:RAC:PREamble:TAICh
CONFigure:NETWork:RAC:PREamble:MRETurn
CONFigure:NETWork:RAC:PREamble:POFFset
```

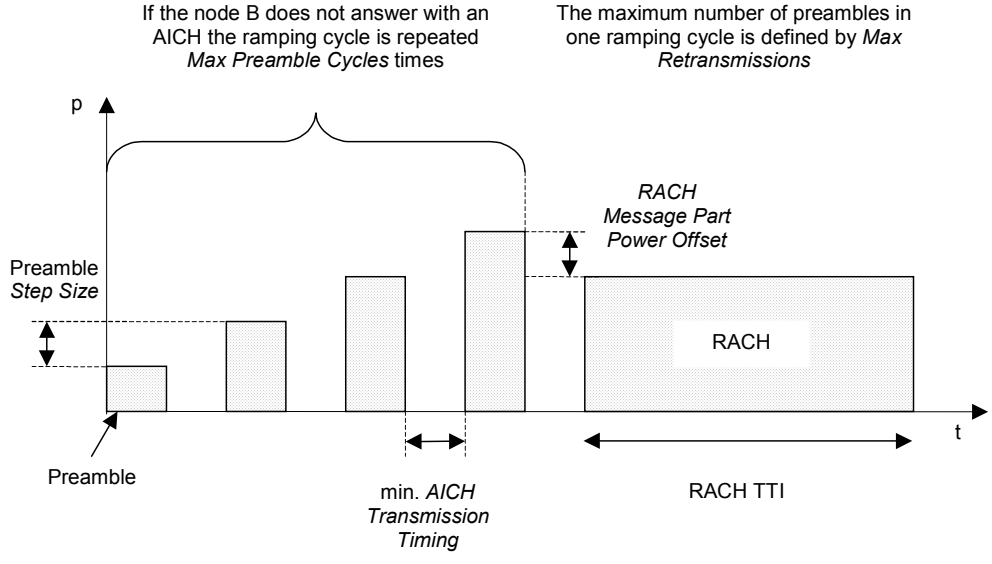


Fig. 4-110 Connection Control – random access settings[5]

The *Random Access Settings* section provides the following additional Preamble settings:

5 In the random access procedure, only the minimum delay between two consecutive preambles is a predefined value. The actual time delay is not necessarily constant as it is selected by the UE; see TS 25.214.

AICH Acknowledge

Defines how the CMU acknowledges PRACH preambles received from the UE.

Positive Normal operation: The R&S CMU will acknowledge or negatively acknowledge the preambles, appropriately. The UE can be registered and a connection can be set up.

Negative Negative acknowledge: The R&S CMU always responds with negative acknowledgements so that the random access procedure fails after the maximum number of preamble cycles has been reached. The UE will reinitiate a new preamble cycle after a while but not succeed in performing a registration or establishing a connection. This setting can be used for repeated tests of the random access procedures.

OFF No acknowledge: The R&S CMU does not transmit acknowledge or negative acknowledge on all UE transmission attempts. The UE will continue transmitting preambles.

Remote control
`CONFigure:NETWork:RAC:PREamble:ACK POS | NEG | OFF`

Available Subchannels

12-digit binary value to define the available RACH subchannels. A RACH subchannel defines a subset of the total set of uplink access slots; see standard 3GPP TS 25.214.

The frames for PRACH transmission are randomly selected from the set of available subchannels. To obtain a periodic PRACH transmission, the number of available subchannels must be restricted to 1, i.e. the bit sequence must contain a single 1 inserted at an arbitrary position. This setting is required for the *On/Off Time Mask* measurement (see p. 4.22).

Remote control
`CONFigure:NETWork:RAC:PREamble:SUBChannel <Channels>`

Available Signatures

16-digit binary value to define the available signatures associated with the PRACH. The 4096-bit preamble code is built from one out of 16 signatures and a complex scrambling code. Each of the 16 signatures consists of 256 repetitions of a 16-bit Hadamard code (3GPP TS 25.213).

Remote control
`CONFigure:NETWork:RAC:PREamble:SIGNature <Channels>`

Available Signature – Index Select

Selection of the available signatures. In the default setting, the UE can use the full signature *(Use All);* although a restriction to the first 8 indices is common. Alternatively, the UE only uses the first index of the signature *(Use first index only).* In other terms, both the Available Signature Start Index and the Available Signature End Index are 0. This corresponds to the “ASC Setting” that the conformance test specification stipulates for the PRACH Quality test; see table 5.13.4.2 in standard 3GPP TS 34.121.

Remote control
`CONFigure:NETWork:RAC:PREamble:SINDex ALL | FIRS`

Requested UE Data

The *Requested UE Data* section defines which UE data are requested and transferred to the CMU during registration and how the registration is performed.

In general, disabling the check of UE data accelerates the registration process or connection setup. Besides, it can be useful to test UEs under development that fail to provide their data.

Authentication Enable *(On)* or disable *(Off)* the authentication procedure during registration. Authentication requires a test USIM. An appropriate 3GPP UICC/USIM can be obtained from Rohde & Schwarz (R&S CRT-Z3, stock no. 1139.1005.02). If authentication is enabled, the *Security* mode can be activated in addition.

The R&S CMU also supports the MILENAGE algorithm as an alternative to standard SOM authentication; see below.

Security Enable *(On)* or disable *(Off)* the security mode during authentication. With enabled security mode, the UE performs an integrity check. Security is always disabled if authentication is switched off.

Secret Key K 128-bit (16-byte) value which is used for the authentication procedure including a possible integrity check. For convenient data entry, the value is split into two 8-byte parts (Part 1, Part 2) encoded as 16-digit hexadecimal numbers.

The integrity check fails unless the *Secret Key K* set at the CMU is equal to the value stored on the test USIM of the UE under test. The default value corresponds to the *Secret Key K* specified by 3GPP for test purposes, so there is no need to change the value if the test USIM is in accordance with the standard..

Note: *The 3GPP test USIM R&S CRT-Z3 contains the standard Secret Key K, therefore it is compatible with the default setting of the R&S CMU.*

The Secret Key K is ignored if Authentication *is switched off to disable the authentication procedure and the integrity check.*

Op_c Specific 128-bit (16-byte) input variable for the MILENAGE algorithm, see standard 3GPP TS 35.206, section 2.3. *Op_c* is used if *Authentication* and *Use Milenage* is enabled.

Use 2G SIM If set to *On,* this parameter enables registration of the WCDMA UE with a 2G SIM card, instead of a 3G USIM. It is also possible to set up a connection and use the full R&S CMU200 test functionality. With firmware version V5.01 and later versions, *Use 2G SIM* also overwrites the *Network – Network Identity – UE ID – IMSI (Default)* value using the IMSI values of the USIM card R&S CRT-Z3. The original default IMSI is restored as soon as *Use 2G SIM* is disabled.

Use Milenage If both *Use Milenage* and *Authentication* are enabled, the R&S CMU uses the MILENAGE algorithm set for the 3GPP authentication and key generation functions f1, f1*, f2, f3, f4, f5 and f5* (see standard 3GPP TS 35.206). MILENAGE authentication is an alternative to standard USIM authentication during the registration process. To perform tests with MILENAGE authentication, the *Secret Key K* and the *Op_c* variable must be set in accordance with the values on the USIM of the UE under test.

Attach/Detach Enable *(On)* or disable *(Off)* the circuit switched registration procedure (see 3GPP TS 24.008). If registration is disabled, the UE will listen to paging messages as soon as it has detected the R&S CMU's UTRAN cell.

Disabling the *Attach/Detach* requires the *Default IMSI* to be set properly. UEs that are configured to always attach to the packet switched domain *(packet data always on* or equivalent setting)

will ignore the *Attach/Detach: Off* setting.

UE Radio Access Capability Enable *(On)* or disable *(Off)* request of radio access capability. This information is displayed in the Connection tab; see p. 4.203.

IMEI Enable *(On)* or disable *(Off)* request of the International Mobile station Equipment Identity. This information is displayed in the *Connection* tab; see p. 4.202.

Tip: **IMEI request without registration**

IMEI request also works for connections without previous UE registration: If the IMEI request is enabled when a connection to a non-registered UE is established, the R&S CMU sends an *Identity Request*. The result is displayed after a delay caused by the exchange of signalling messages. A signalled IMEI is deleted after the connection is closed and the R&S CMU has reached the *Signal On / Idle* state, because no assignment to the DUT is possible any more.

SRB Reconfiguration Enable *(On)* or disable *(Off)* fast registration, connection setup, and connection release using a fixed 13.6 kbps SRB. For circuit switched connections the 13.6 SRB is reconfigured to fit the SRB appropriate for the selected *DCH (Dedicated Chn.) Type* after the connection has been established. For packet switched connections, it is reconfigured to fit the SRB specified in the *Radio Bearer Setup.*

SRB Reconfiguration can be set for all connection types involving a radio bearer setup procedure (e.g. RMC, Video, Voice, packet data connections). *SRB Reconfiguration: On* is ignored for connection types with fixed SRB (e.g. *Sign. RAB – CELL DCH* for circuit switched, *SRB 3.4 kbps + HSDPA* for packet data connections).

The SRB reconfiguration involves an RLC re-establish procedure which can be disabled in case of connection problems.

RLC Reestablish Enable *(On)* or disable *(Off)* the RLC re-establish procedure associated with a *SRB Reconfiguration*. Some UE types require a disabled RLC re-establish procedure in order to set up a connection with SRB reconfiguration.

Keep RRC Connection Keep *(On)* or release *(Off)* a RRC (Radio Resource Control) connection established during registration. After the RRC is released, the UE is in idle mode where the transmitter is switched off and *Off Power* measurements can be performed. On the other hand, a released RRC connection must be re-established in order to set up a connection, so activating *Keep RRC Connection* accelerates the subsequent connection setup.

Note: *To use the* Keep RRC Connection *feature and save time during the connection setup, the SRB data rates must not be changed in the* Registered *state. The SRB data rates are defined implicitly depending on the* Dedicated Channel Type *(see p. 4.239).*

Example: *The UE is registered with an RMC call (SRB 2.5 kbps). The Dedicated Channel Type is changed so that a voice call (SRB 3.4 kbps or 1.7 kbps) can be set up. As a consequence,* Keep RRC Connection *is ignored so that no gain in speed is achieved. To make use of the* Keep RRC Connection *feature*, *select the voice call before the registration.*

Skip RAB Rel. Enables or disables the RAB release while the connection is set up. If the RAB release is skipped (i.e. the RAB is not released; *Skip RAB Release: On),* the connection release can be accelerated considerably.

Release after RAB Reconfig. Failure Qualifies whether a connection is released when an attempted reconfiguration of a RAB or physical channel (e.g. change of gain factors, HSDPA settings, …) during the connection failed. An error message indicates a RAB reconfiguration failure; at the same time, bit no. 9 in the status reporting system is set.
The release of the connection can be disabled to save time for the following measurement steps. However, it is essential to monitor reconfiguration failures in order to avoid misleading measurement results.

Activation Time Offset Delay used by the RRC for the calculation of the activation time in peer messages, e.g. for channel changes within the band. The offset is defined in multiples of eight WCDMA frames with a duration of 80 ms. The offset can be reduced, if the UE supports smaller values, to speed up signalling. See description of the *Handover Activation Time* below.

Handover Activation Time Delay time (in multiples of eight WCDMA frames with a duration of 80 ms) before the UE, after receiving a HANDOVER COMMAND from the CMU, initiates the handover by releasing the WCDMA connection and attempting a connection to the GSM cell (see also section *Handover to GSM (Connection Control – Handover)* on p. 4.220. This parameter can be changed to remedy a failure of a WCDMA to GSM inter cell handover:

- If the handover fails because the mobile no longer sees the (previous) WCDMA cell, it is recommended to reduce the HO activation time.
- If the handover fails because the mobile can not detect the (new) GSM cell, it is recommended to extend the HO activation time.

T3212 Timeout Sets the value of the timer T3212 for the periodic UE location updating in decihours (6 min). If a value between 1 and 255 is set the UE is expected to initiate a new location updating in periodic intervals. If the selected interval (plus an appropriate delay) expires without a new location updating from the mobile, the R&S CMU enters the *Signal On* state. If 0 is set, no periodic location updating is performed.

The timer is only used in the *Registered* state. It is ignored while a connection is set up and is restarted every time the CMU enters the *Registered* state.

If registration fails, the UE capabilities may not be in accordance with the Requested UE Data settings, in particular with the authentication and security mode. Registration can fail if authentication or security is disabled but the UE expects/requires an authentication or security procedure. It can also fail if authentication or security is enabled but not supported by the UE.

Registration may also fail after the UE has initiated a PS attach. Prevent a PS attach so that the R&S CMU remains in the PS: Idle state (see Attach/Detach *parameter above) or deactivate the*

packet-switched domain altogether (Connection Control – Network – Packet Switched Domain: Off).

The following two timeout parameters determine how long a connection is maintained if the UE or the R&S CMU receives no signal.

T313 Timeout Maximum time after which the connected UE, having waited for a signal from the R&S CMU, initiates the clearing of the connection by sending a disconnect request.

N313 Maximum number of successive "out of sync" indications received from L1 before the UE considers a “radio link failure” condition and a connection release; see standard 3GPP TS 25.331, section 8.5.6. A specific value for N313 is required for some conformance tests; see e.g. standard 3GPP TS 34.121, section 5.4.4.

Out of Sync Tim. Maximum time after which the R&S CMU, having waited for a signal from the connected UE, releases the connection and returns to the *Registered* signalling state.

The following timeout parameter limits the duration of the paging process, if no answer is received from the UE.

Paging Timeout Maximum duration of the paging process. The *Paging Timeout* must be larger than the *Out of Sync Timeout;* inconsistent settings are auto-corrected. The *Paging Timeout* can be used to control the duration of measurements performed during the paging process, preferably in combination with the setting *Connection Control – Network – Random Access Settings – Preamble – AICH Acknowledge: Negative,* where the random access cycle is repeated periodically.

If the paging timeout is turned *Off,* the R&S CMU transmits paging messages for a (practically) unlimited period of time; the paging process is terminated only by an answer from the UE.

Remote control

```
CONFigure:NETWork:REQuest:ADETach ON | OFF
CONFigure:NETWork:REQuest:ACAPability ON | OFF
CONFigure:NETWork:REQuest:IMEI ON | OFF
CONFigure:NETWork:REQuest:SRBReconfig ON | OFF
CONFigure:NETWork:REQuest:RLCReestab ON | OFF
CONFigure:NETWork:REQuest:AUTHenticat ON | OFF
CONFigure:NETWork:REQuest:SECurity ON | OFF
CONFigure:NETWork:REQuest:SKEY  <Part 1>, <Part 2>
CONFigure:NETWork:REQuest:S2G ON | OFF
CONFigure:NETWork:REQuest:RRCC ON | OFF
CONFigure:NETWork:REQuest:SRAB ON | OFF
CONFigure:NETWork:REQuest:RRAB ON | OFF
CONFigure:NETWork:REQuest:ATOFfset  <Frames>
CONFigure:NETWork:REQuest:HACTime <Frames>
CONFigure:NETWork:REQuest:TTIMeout <Decihours>
CONFigure:NETWork:REQuest:T31Timeout 0 s to 15 s
CONFigure:NETWork:REQuest:N31Sync <Indicators>
CONFigure:NETWork:REQuest:OSTimeout 2 s to 30 s
CONFigure:NETWork:REQuest:PTIMeout 2 s to 30 s
```

Cell Reselection Information

List of cell reselection parameters that the R&S CMU transmits in its system information blocks SIB3 and SIB11. The parameters control the measurement rules of the UE for cell reselection; for detailed information refer to standard 3GPP TS 25.304. All cell reselection parameters except *Qqualmin* and *Qrxlevelmin* are optional and may be omitted *(Off)*.

CPICH E_c/N_0

Qhyst2s Hysteresis value (in dB), to be used for FDD cells if the quality measure for cell selection and reselection is set to CPICH Ec/No.

$S_{intrasearch}$ Threshold (in dB) for intra frequency measurements and for the Hierarchical Cell Structure (HCS) measurement rules

$S_{intersearch}$ Threshold (in dB) for inter-frequency measurements and for the HCS measurement rules

$S_{searchHCS}$ When HCS is used, this parameter specifies the limit for the cell reselection RX level value Srxlev in the serving cell below which the UE shall initiate measurements of all neighboring cells of the serving cell. When HCS is not used, it specifies the limit for Srxlev in the serving cell below which the UE ranks inter-frequency neighboring cells of the serving cell.

Qqualmin Minimum required quality level in the cell in dB. The value is not applicable for GSM cells.

Qrxlevelmin Minimum required RX level in the cell in dBm.

T3312 Timeout Timer *T3312* controls the periodic routing area updating procedure, see standard 3GPP TS 04.08. The value of the timer T3312 is set in integer multiples of 2 s. “0 s” means that no routing area update is performed.

Reselection Timer The *Reselection Timer* is specified in standard TS 25.304, section 5.2.6.1.5 (value of $Treselection_s$). The value “0” means “no cell reselection”.

The R&S CMU provides additional cell reselection parameters for GSM neighbor cells; see *GSM Neighbor Cell List* below.

Remote control

```
CONFigure:NETWork:CRINfo:QH2S
CONFigure:NETWork:CRINfo:INTRasearch
CONFigure:NETWork:CRINfo:INTersearch
CONFigure:NETWork:CRINfo:SHCS
CONFigure:NETWork:CRINfo:QQUalmin
CONFigure:NETWork:CRINfo:QRXLevmin
CONFigure:NETWork:CRINfo:T33Timeout
CONFigure:NETWork:CRINfo:TRESelection
```

WCDMA Intra Neighbor Cell List

List of up to 32 WCDMA neighbor cells that the R&S CMU broadcasts to the registered UE. The cells in the intra neighbor cell list are characterized by their *Primary Scrambling Code* and occupy the same RF channel as the BS Signal (serving cell). The list transferred to the UE contains only enabled cells.

Remote control

```
CONFigure:NETWork:NCELl:WCDMa:INTRa<nr> <SC>, <Enable>
```

WCDMA Inter Neighbor Cell List

List of up to 32 WCDMA neighbor cells that the R&S CMU can broadcast to the registered UE. The cells in the inter neighbor cell list are characterized by their *Primary Scrambling Code* and *RF Channel*, which can be different from the BS Signal (serving cell) channel. The list transferred to the UE contains a maximum of 18 enabled cells.

Remote control

```
CONFigure:NETWork:NCELl:WCDMa:INTer<nr>
      <Channel>, <SC>, <Enable>
```

GSM Neighbor Cell List

List of up to 32 GSM neighbor cells that the R&S CMU can broadcast to the registered UE. The cells in the GSM neighbor cell list are characterized by their *RF Channel*, Network Color Code *(NCC)*, and Base Station Color Code *(NCC)*. The *Band Indicator* distinguishes the GSM1800 and GSM1900 bands where the same channel numbers are used. The list transferred to the UE contains a maximum of 18 enabled cells.

The remaining cell reselection parameters can be transmitted in the system information blocks SIB11 in order to control the measurement rules of the UE for cell reselection. The parameters are used for GSM neighbor cells; for detailed information refer to standard 3GPP TS 25.304.

Enable Cell Reselection Information Qualifies whether or not the R&S CMU transmits the cell reselection parameters *Qoffset* $1_{s,n}$ and *Qrxlevelmin* to the UE. Both parameters are optional according to the standard.

Qoffset $1_{s,n}$ Level offset between two cells.

Qrxlevelmin Minimum required RX level in the cell in dBm.

Remote control

```
CONFigure:NETWork:NCELl:GSM<nr>
      <Channel>, <NCC>, <BCC>, <Band>, <Enable>
CONFigure:NETWork:NCELl:GSM:CRINfo:ENABle
CONFigure:NETWork:NCELl:GSM:CRINfo:QO1Sn
CONFigure:NETWork:NCELl:GSM:CRINfo:QRXLevmin
```

RF Connectors (Connection Control – AF/RF)

The *AF/RF* ⨁ tab selects the connectors for RF signals. This includes the setting of

- The RF input and output at the CMU (RF Output, RF Input)
- An external attenuation at the connectors (Ext. Att. Output, Ext. Att. Input)
- The input source of the CMU speech encoder and the output destination of its speech decoder

If the *Audio Generator and Analyzer* (option CMU-B41) is not fitted, the speech codec (option CMU-B52) is connected to the 9-pole *SPEECH* (handset) connector on the CMU front panel, see chapter 8 of the CMU operating manual. The *Speech Encoder* and *Speech Decoder* settings are not available.

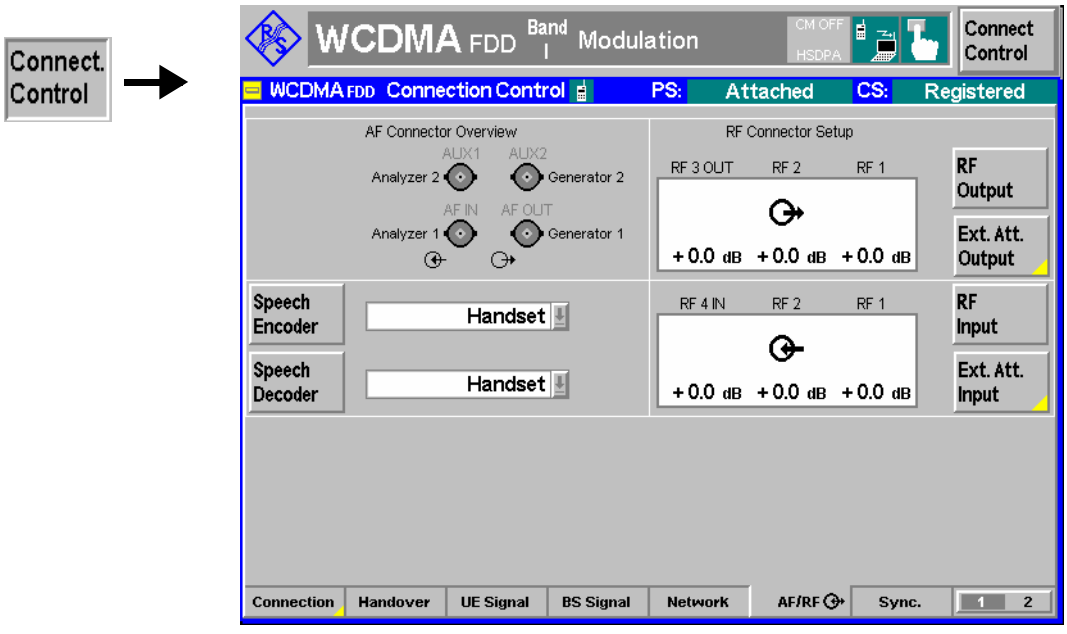


Fig. 4-111 Connection Control – AF/RF connectors

With the exception of the *Speech Encoder* and *Speech Decoder* routing, all functions of this menu are described in section *RF Connectors (Connection Control – RF Connectors)* on p. 4.177.

Speech Encoder

The *Speech Encoder* softkey selects the input source for the CMU speech encoder (option CMU-B52). The following two input sources are available:

Generator Use the audio generator signal which is also fed to the *AF OUT* connector on the CMU front panel

Handset Use the signal of the 9-pole *SPEECH* (handset) connector on the CMU front panel

Remote control
`ROUTe:SPENcoder[:INPut] HANDset | GENerator`

Speech Decoder

The *Speech Decoder* softkey selects the output destination for the CMU speech decoder (option CMU-B52). The following output destinations are available:

Handset Route speech decoder output to the 9-pole *SPEECH* (handset) connector on the CMU front panel

Analyzer Route speech decoder output to audio analyzer. The standard analyzer input socket *AF IN* is disabled *(Off).*

Analyzer 2 Route speech decoder output to secondary audio analyzer. The standard secondary analyzer input socket *AUX 1* is disabled *(Off).*

Analyzer Both Route speech decoder output to primary audio analyzer. The standard primary and secondary analyzer input sockets *AF IN* and *AUX 1* are disabled *(Off).*

The primary and secondary audio circuits are described in detail in chapter 4 and 6 of the CMU200/300 operating manual.

Remote control
`ROUTe:SPDecoder[:OUTPut] HANDset | ANALyzer | ANA2 | ABOTh`

AF Connector Overview

The *AF Connector Overview* shows the destination of the input signals fed in via AF IN and AUX 1 and the signal sources for the two audio output connectors AF OUT and AUX 2. The routing of input and output signals does not depend on the *Speech*

Encoder settings but is a function of the *Speech Decoder* output destination. In the default configuration *(Speech Decoder = Handset),* the connectors AF IN and AF OUT are used as input and output for the primary audio circuit (Analyzer 1, Generator 1). AUX 1 and AUX 2 are used as input and output for the secondary audio circuit (Analyzer 2, Generator 2). If the *Speech Decoder* output is routed to one of the Analyzers, it replaces the external audio input signal. The corresponding input connector is disabled *(Off)*.

Reference Frequency (Connection Control – Sync.)

The *Sync.* tab determines the reference signal for synchronization. This includes

- The selection of internal or external reference frequency
- The output mode for the reference frequency (RF REF OUT 2)

The functions of this menu are described in section *Reference Frequency (Connection Control – Sync.)* on p. 4.182.

Remote control

```
CONFigure:SYNChronize:FREQuency:REFerence:MODE
      INTernal | EXTernal
CONFigure:SYNChronize:FREQuency:REFerence <Frequency>
SOURce:DM:CLOCk:STATe ON | OFF
SOURce:DM:CLOCk:FREQuency <Frequency>
```

Trigger (Connection Control – Trigger)

The *Trigger* tab is part of the second group of tabs in the *Connection Control* menu. It is accessible after pressing the *1 / 2* toggle hotkey once. Pressing *1 / 2a* again switches back to the first group of tabs described above.

The functions of this menu are described on page 4.184. Compared to the *Non Signalling* mode, the *Signalling* trigger provides the following additional features:

- Additional trigger sources *Preamble, PRACH Msg. Part, Compressed mode, Change of TFC*
- Automatic trigger output at pin no. 5 of AUX 3 if none of the additional trigger sources and no *HS-DPCCH* trigger is active; see section *Trigger Output at AUX3* on p. 4.286.

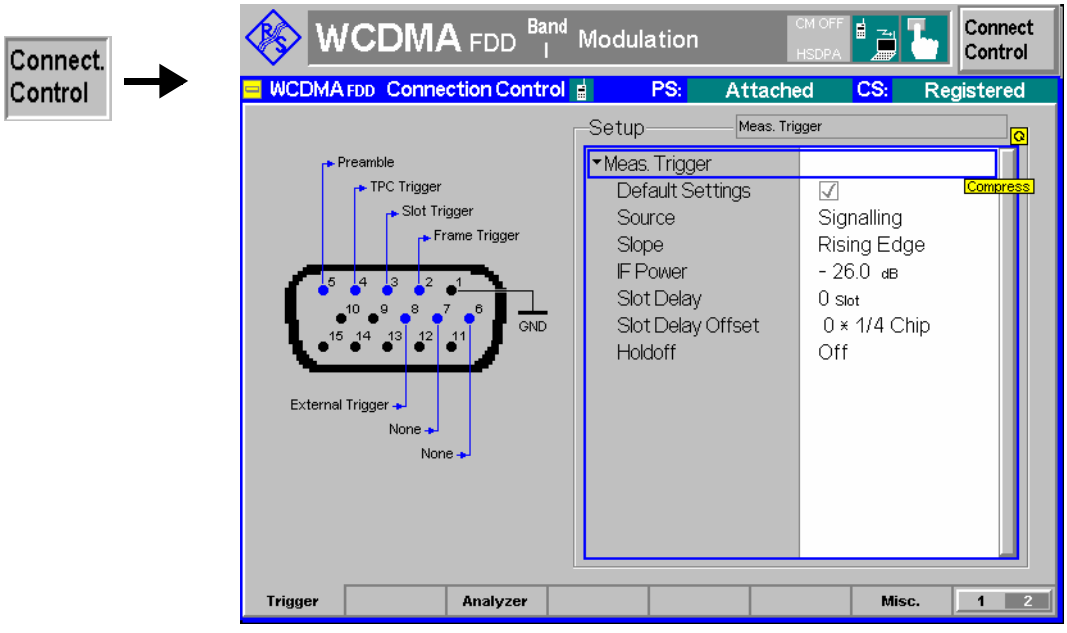


Fig. 4-112 Connection Control – AF/RF connectors

Meas. Trigger – Source

The *Internal* trigger source in *Non Signalling* mode is replaced by a *Signalling* trigger with analogous properties:

- The trigger signal is derived from the *BS Signal*, taking into account the 3GPP standard DL/UL timing offset of 1024 chip periods.
- The beginning of the measured UL slot is searched in a symmetric range around the expected time.
- A frame trigger, a slot trigger and a TPC trigger signal is generated.

Note: *In Signalling mode the first frame trigger event after* Signal On *is always generated in a 80 ms Transmission Time Interval (TTI). The following frame trigger events no longer depend on the TTI.*

In addition to the other trigger sources described on p. 4.184 f, the following trigger sources are available:

Preamble The trigger event is caused by the rising edge of the first preamble in the UE's preamble cycle. This trigger source is appropriate for PRACH preamble measurements; an additional PRACH preamble output trigger signal is available at pin 5 of AUX 3 (see p. 4.206 of the operating manual). A *Preamble* trigger output signal synchronous to the DL slots is fed to pin 5 of the AUX 3 connector.

PRACH Msg. Part The trigger event occurs at the beginning of the frame following the detection of a PRACH message part. A *PRACH Msg. Part* trigger output signal synchronous to the DL slots is fed to pin 5 of the AUX 3 connector.

Compressed Mode Periodic trigger during compressed mode (CM) operation of the UE. The trigger event occurs at the beginning of each UL frame where a transmission gap begins. A *Compressed Mode* trigger output signal synchronous to the DL slots is fed to pin 5 of the AUX 3 connector.

Change of TFC Trigger event at the beginning of each frame following a change of the Transmit Format Combination (TFC) in the measured UE signal. A change of TFC means that the UL power (gain factors; see section *Gain Factors for the UE Signal*

on p. 4.233) varies according to the changed data rate. This can be observed e.g. in the *CDP Manual* measurement applications or in the *CDP vs. Time* measurement. For this trigger source a connection with variable TFC (e.g. a voice call) is necessary. A *Change of TFC* trigger output signal synchronous to the DL slots is fed to pin 5 of the AUX 3 connector.

Modifications of the Change of TFC trigger

In CDP vs. Time *and* Phase Discontinuity *measurements, the* Change of TFC *trigger timing is corrected so that the measurement starts one slot before the beginning of the frame where the TFC changes occur. The output trigger signal is not affected.*

Remote control

`TRIGger[:SEQuence]:SOURce`

Table 4-47 on p. 4.284 gives and overview of the compatibility between the different trigger sources and WCDMA measurements.

Legend for Table 4-47

—	Trigger setting incompatible with measurement application (or not recommended)
☑	Trigger setting compatible with measurement application
⇨ Frame	*Internal* (in Non Signalling mode) or *Signalling* trigger setting (in Signalling mode) implies that a *Frame* trigger is used
Auto	The trigger setting is actually used in *Auto* trigger mode (non compressed UE operation)
Auto (CM)	The trigger setting is actually used in *Auto* trigger mode (compressed UE operation, in *Signalling* mode only)
Synchronized/All Slots	*Sync. Mode* setting in the *UE Code* (Non Signalling) or *UE Signal* (Signalling) tab of the Connection Control menu. The *Sync. Mode* has an impact on the *Modulation (WCDMA)* and on the *Code Domain Power* measurements.

Global trigger sources and trigger problems

If the automatic trigger source is active, the trigger is adjusted to the measurements, so there is no risk to experience trigger problems after changing the measurement application. All other trigger sources are global parameters. If you cannot start a measurement application, check Table 4-47 *for compatibility and change the trigger source, if necessary.*

Trigger delay parameters

The effect of the trigger Slot Offset *and* Slot Delay Offset *parameters is also measurement-dependent; see section Trigger Offsets for TX Measurements* on p. *4.190*.

Table 4-47 Trigger settings for WCDMA TX measurements

Measurement application	Free Run	External	IF Power	Internal (Non Signalling)	Signalling (Signalling)	Slot	Frame	TPC	HSDPCCH	Preamble (Sig. only)	Compressed Mode (Sig. only)	Change of TFC (Sig. only)
Max Power / Min. Power / Off Power	☑	☑	–	☑ (⇨ Frame)	☑ (⇨ Frame)	**Auto**	☑	–	–	–	**Auto (CM)**	☑
Inner Loop TPC	–	☑	–	☑ (⇨ TPC)	☑ (⇨ TPC)	–	–	**Auto**	–	–	–	–
P/Slot Table (TPC Test Steps)	–	☑	–	☑ (⇨ TPC)	☑ (⇨ TPC)	–	–	**Auto**	–	–	–	–
P/Slot Table (Rev. Lev. Switch Off/Auto)	–	☑	☑	☑ (⇨ Frame)	☑ (⇨ Frame)	☑	**Auto**	–	–	–	–	☑
On/Off Time Mask	–	☑	☑	–	☑ (⇨ Preamble)	–	–	–	–	**Auto**	–	–
Openloop power	–	–	–	–	☑ (⇨ Preamble)	–	–	–	–	**Auto**	–	–
Smart Alignment	–	☑	**Auto**	☑	–	☑	☑	☑	**–**	**–**	–	–
Modulation (QPSK appl.)	–	☑	–	☑ (⇨ Frame)	☑ (⇨ Frame)	**Auto**	☑	–	☑	–	–	☑
Modulation (WCDMA appl., Synchronized)	–	☑	–	☑ (⇨ Frame)	☑ (⇨ Frame)	–	**Auto**	–	☑	–	**Auto (CM)**	☑
Modulation (WCDMA appl., All Slots)	–	☑	–	☑ (⇨ Frame)	☑ (⇨ Frame)	**Auto**	☑	–	☑	–	–	☑
PRACH Preamble	–	☑	☑	–	☑ (⇨ Preamble)	–		–	–	**Auto**	–	–
Phase Discontinuity	☑	☑	☑	–	Auto	☑	☑	☑	–	**–**	–	–
EVM & PhD with HS-DPCCH	–	☑	–	–	–	–	–	–	**Auto**	–	–	–

Measurement application	Free Run	External	IF Power	Internal (Non Signalling)	Signalling (Signalling)	Slot	Frame	TPC	HSDPCCH	Preamble (Sig. only)	Compressed Mode (Sig. only)	Change of TFC (Sig. only)
Spectrum	☑	☑	–	☑	☑	**Auto**	☑	–	☑	–	**Auto (CM)**	☑
CDP (Synchronized)	–	☑	–	☑ (⇨ Frame)	☑ (⇨ Frame)	–	**Auto**	–	☑	–	**Auto (CM)**	☑
CDP (All Slots)	–	☑	–	☑ (⇨ Frame)	☑ (⇨ Frame)	**Auto**	☑	–	☑	–	–	☑
CDP (HS-DPCCH Time Mask)	–	☑	–	–	–	–	–	–	**Auto**	–	–	–
CDP vs. Time		☑	–	–	–	–	**Auto**	–	☑	–	–	☑

Trigger Output at AUX3

In *Signalling* mode pin 5 of the AUX 3 connector on the front panel provides three different types of trigger output signals:

- The *PRACH preamble* trigger indicates that the UE attempts a registration or a connection.
- The *compressed mode* trigger indicates the transmission gaps in compressed mode.
- The *change of TFC* trigger indicates a change of the uplink TFCI from the UE.

The three trigger types can be distinguished because they occur in different, non-simultaneous operating modes of the CMU and the UE.

CMU Signalling State	Compressed mode	Possible trigger output
Signal On, Registered	Off	PRACH preamble
Connected	Off	Change of TFCI
Connected	On	Compressed mode

The following trigger sources generate their own trigger output signals: Preamble, PRACH Msg. Part, Compressed mode, Change of TFC, HS-DPCCH*. If one of these trigger sources is selected, the* PRACH preamble / compressed mode / change of TFC *trigger output signals at pin 5 of AUX 3 are replaced by the trigger output signal of the current trigger source. This also holds for automatic trigger source selection* (Trigger Source – Auto), *if one of the trigger sources listed above is selected by the measurement.*

PRACH Preamble Trigger

The PRACH preamble trigger is generated each time the R&S CMU measures a PRACH preamble. The trigger event is given by the falling edge of a low-pulse TTL signal which occurs approx. 790 µs after the start of the measured preamble. This is before the end of the preamble which is of length 4096 chips (1066 2/3 µs). The length of the trigger pulse discriminates between two different states of the CMU:

- A short pulse with a length of 220 µs indicates that the R&S CMU will not answer the current preamble with an AICH so that the UE has to continue the random access procedure.
- A longer pulse with a length of 400 µs indicates that the R&S CMU will answer the current preamble with an AICH in order to complete the random access procedure.

Monitoring the PRACH preambles

PRACH preambles are transmitted during registration and connection setup; see description of random access procedure in section *Network Parameters (Connection Control – Network)* on p. 4.268. To test the PRACH preamble trigger, proceed as follows:

1. Open the *Connection Control* menu and press the *Signal Off* softkey in the *Connection* tab.
2. Press *Signal On* to switch on the *BS Signal.*
3. Switch on the UE.

The UE synchronizes to the BS signal and can attempt a registration towards the CMU.

Observe the PRACH preamble trigger pulses at pin 5 of AUX 3.

The number of pulses should be smaller or equal to the product of *Max. Retransmission* times *Max. Preamble Cycles* defined in the *Network* tab of the *Connection Control* menu. The last trigger pulse is longer, indicating that the CMU will answer the random access procedure with an AICH.

4. Press *Connect to UE* and observe the PRACH preamble trigger pulses that the CMU generates when establishing a connection.

Compressed Mode Trigger

The compressed mode trigger is derived from the beginning of each frame (frame boundary, beginning of slot 0) where a transmission gap pattern begins, starting with the frame containing the first transmission gap pattern after the compressed mode is initiated[6]. Due to the periodicity of the transmission gap pattern sequence, the compressed mode trigger is periodic while the UE operates in compressed mode (during the connection or during the *UE Report* measurement).

Example: *Suppose that a user defined pattern consisting of the two parts TG Pattern 1 and TG Pattern 2 is active; see Fig. 4-113 on p. 4.287. The number of compressed mode trigger pulses is equal to the number of transmission gap patterns within the transmission gap parameter sequence (parameter TGPRC; the number is not limited for TGPRC = 0). The periodicity of the pulses is equal to the transmission gap pattern length (the sum of TGPL1 + TGPL2).*

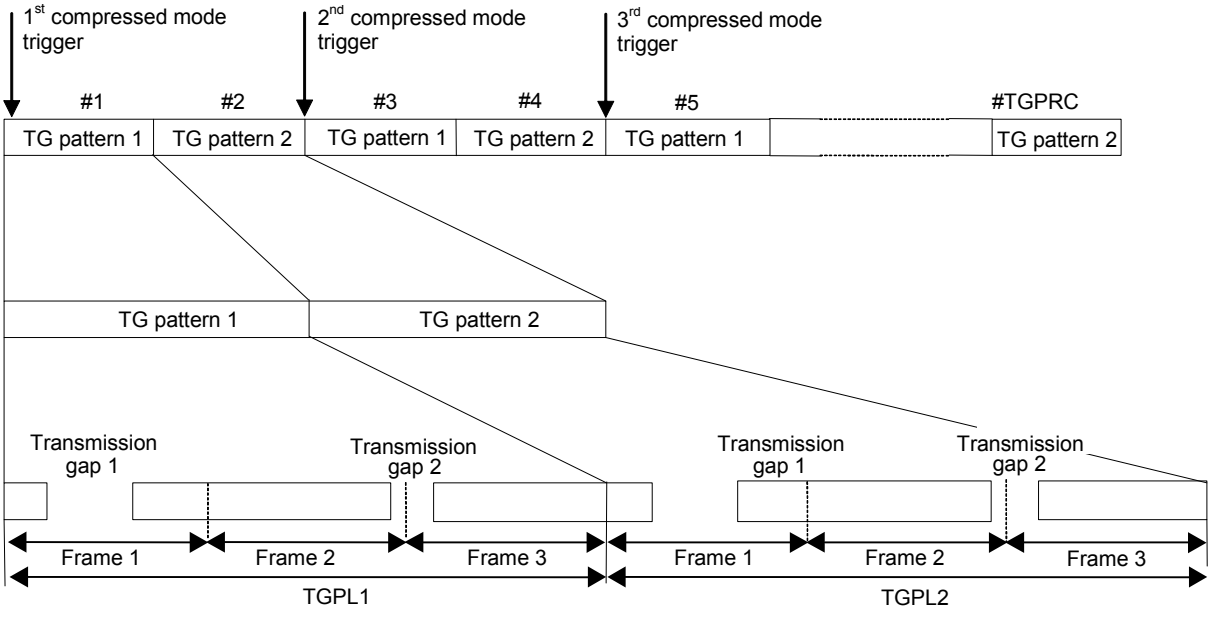


Fig. 4-113 Compressed mode trigger events (TGPL1 = TGPL2 = 3 frames)

The trigger event is given by the falling edge of a low-pulse TTL signal which length of 1/4 slot (166 2/3 µs) and is aligned to the downlink frame clock.

6 Exception: In a *P/Slot Table* measurement with measure mode *UL CM Test Step* and pattern type B, the CM trigger event occurs one complete frame earlier so that the slot preceding the gap can be measured, too.

Monitoring the compressed mode

The compressed mode can be activated for the entire connection; see section *Compressed Mode Configuration* on p. 4.254. To monitor the transmission gaps proceed as follows:

1. Establish a connection to the UE.
2. Open the *BS Signal* tab of the *Connection Control* menu and go to the *Compressed Mode Settings – Pattern Selection* to select a *User Defined Pattern.*
3. Observe the trigger pulses that the CMU generates according to the selected *Pattern.*
4. Vary the periodicity of the trigger pulses using the parameters *TGPL1* and *TGPL2* of the user defined pattern.

Change of TFCI Trigger

The change of TFCI trigger is generated each time that the CMU detects a change of the Transport Format Combination Index (TFCI) in the uplink signal. The trigger event is given by the falling edge of a low-pulse TTL signal with a length of 1/4 slot (166 2/3 µs) and coincides with the next frame boundary of the downlink frame clock after a change of TFCI:

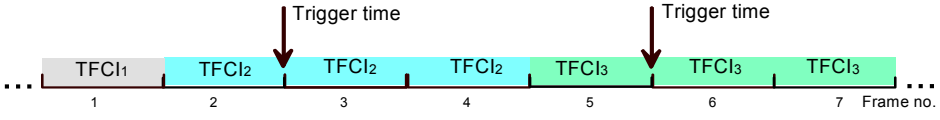


Fig. 4-114 Change of TFCI trigger timing

The change of TFCI trigger is deactivated while the compressed mode is switched on.

I/Q-IF Interface (Connection Control – I/Q-IF)

The *I/Q-IF* tab is part of the second group of tabs in the *Connection Control* menu. It is accessible after pressing the *1 / 2* toggle hotkey once. Pressing *1 / 2* again switches back to the first group of tabs described above.

The *I/Q-IF* tab configures the signal paths for I/Q and IF signals. The functions of this menu are described in section *I/Q-IF Interface (Connection Control – I/Q-IF)* on p. 4.191.

Analyzer Settings (Connection Control – Analyzer)

The *Analyzer* tab configures the RF input path of the CMU. This comprises:

- The maximum expected input level, the way it is defined and the RF attenuation *(Analyzer Level)*

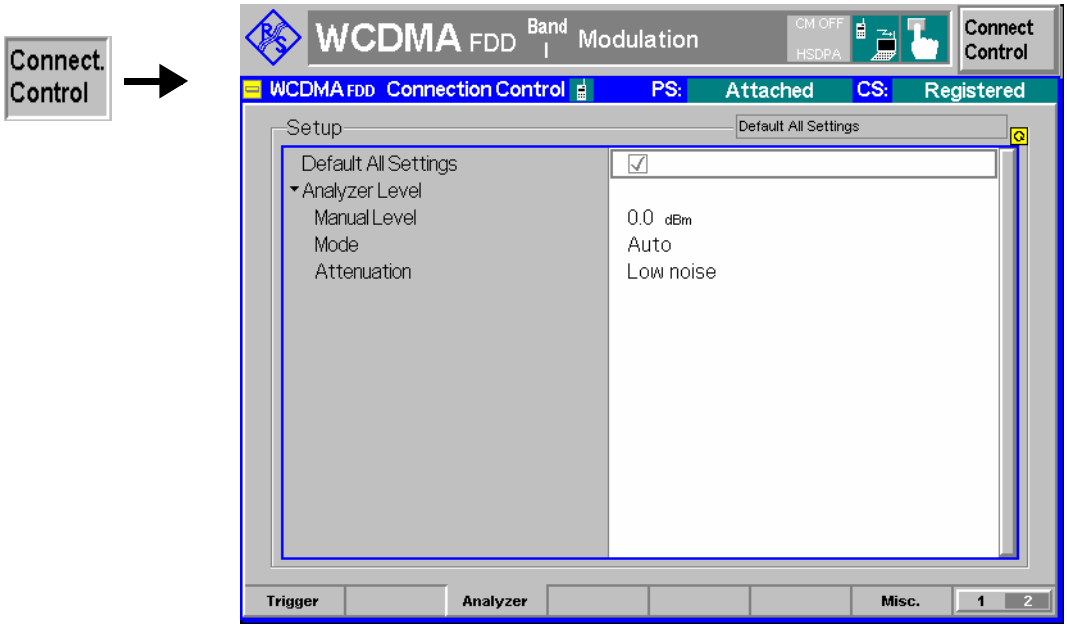


Fig. 4-115 Connection Control – Analyzer

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Analyzer* tab (the default values are quoted in the command description in Chapter 6).

Remote control
```
DEFault:LEVel
```

Analyzer Level The Analyzer Level section configures the RF input path of the CMU. The parameters are described in section *Analyzer Settings (Connection Control – Analyzer)* on p. 4.143.

*R*emote control
```
[SENSe:]LEVel:MAXimum <Level>
[SENSe:]LEVel:MODE  MANual | AUTomatic
[SENSe:]LEVel:ATTenuation NORMal | LNOise | LDIStortion
```

Display Control (Connection Control – Misc.)

The *Misc.* tab is part of the second group of tabs in the *Connection Control* menu. It is accessible after pressing the *1 / 2* toggle hotkey once. Pressing *1 / 2* again switches back to the first group of tabs described above.

The *Misc.* tab defines in what instances the *Connection Control* popup menu is automatically opened or closed *(Connect. Control Guidance),* enables message logging, and defines the host (PC) and DNS server addresses used for WCDMA data application tests.

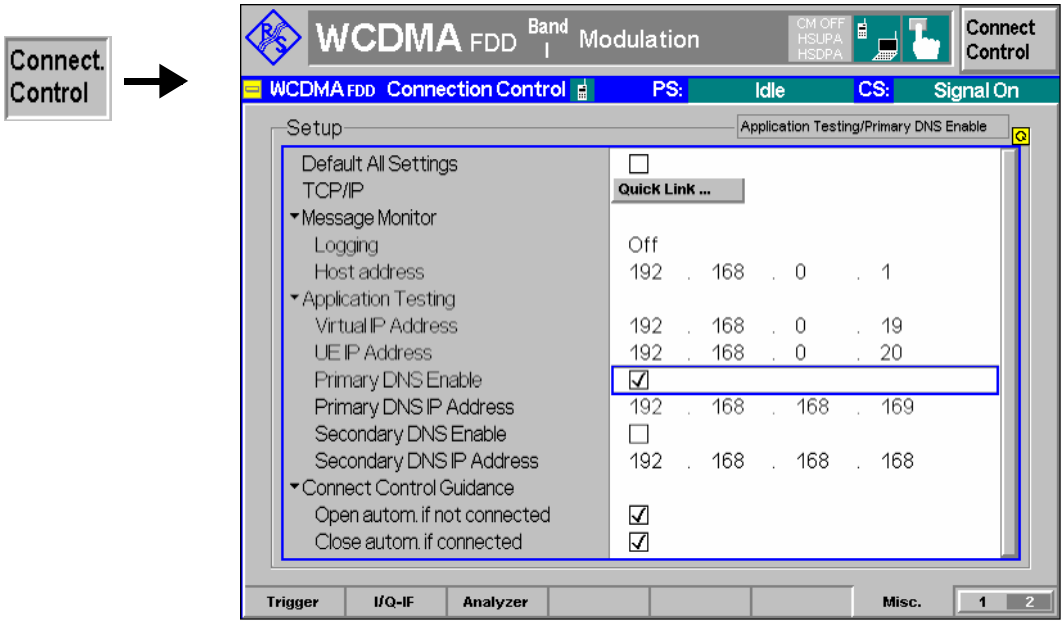


Fig. 4-116 Connection Control – Misc

Default Settings The *Default All Settings* switch sets all parameters of the *Misc* tab to their default values (see command description in Chapter 6).

Remote control –

Connect. Control Guidance Defines in what instances the *Connection Control* popup menu is automatically opened or closed:

Open autom. if not connected

In the *Open automatically* mode, the *Connection Control* menu is automatically opened each time the WCDMA function group is accessed in *Signalling* test mode, each time a measurement menu is opened while the DUT is not connected and each time a connection is lost. Otherwise the menu must be opened manually.

Close autom. if connected

In the *Close automatically* mode, the *Connection Control* menu is automatically closed as soon as the CMU reaches the *Connected/Call Established* state. Otherwise the menu must be closed manually.

Remote control No command; screen configuration only.

TCP/IP Opens the *TCP/IP* tab of the *Setup* menu. The *Setup* menu belongs to the R&S CMU base system and configures the R&S CMU with the IP address information necessary for communicating with other hosts and applications through an IP network. See Chapter 4 of the R&S CMU200/300 operating manual.

Application Testing

Defines IP addresses required for *WCDMA Application Testing* (option R&S CMU-K96). The addresses are communicated to the UE when a packet switched connection is set up for application testing (with option R&S CMU-K96); see Chapter 9 of this manual.

It is also possible to define two arbitrary DNS server addresses. To use a single DNS server address, *Primary DNS Enable* must be selected. To use both addresses *Primary DNS Enable* and *Secondary DNS Enable* must be selected.

Remote control

The following commands define the virtual and the UE IP address (see Chapter 6):

```
CONFigure:ATESt:VIPaddress <IP1>, <IP2>, <IP3>, <IP4>
CONFigure:ATESt:UEIPaddress <IP1>, <IP2>, <IP3>, <IP4>
CONFigure:ATESt:DNS:PRIPaddress:ENABle
CONFigure:ATESt:DNS:PRIPaddress
CONFigure:ATESt:DNS:SEIPaddress:ENABle
CONFigure:ATESt:DNS:SEIPaddress
```

Message Monitor

The *Message Monitor* section defines the address information necessary for connecting the *WCDMA Message Analyzer* installed on a PC to the CMU. The connection can be established through Ethernet (dedicated or non-dedicated connection), so it is necessary to use unique addresses assigned by the network.

The *WCDMA Message Analyzer* is an optional accessory for the WCDMA options (option R&S CMU-Z46) to capture, interpret, and display the WCDMA downlink and uplink messages exchanged between a CMU200 and a UE. For more information refer to the separate R&S CMU-Z46 operating manual, stock no. 1159.0956.12.

Logging Enables *(On)* or disables message logging. Both actions cause a connection to a DUT to be released and the CMU to enter the *Signal On* state. With disabled logging, no messages are stored to the active message log file. As an alternative, logging can be stopped or paused in the *Message Recorder* module of R&S CMU-Z46.

Host address IP address of the PC. The IP address of the R&S CMU can be changed in the *SETUP* menu, accessible via *TPC/IP – has moved to…*

Remote Control

```
CONFigure:MMONitor:LOGGing ON | OFF
CONFigure:MMONitor:HOST
<Host 1>, <Host 2>, <Host 3>, <Host 4>
```

Contents

5 Remote Control – Basics 5.1

Structure of WCDMA Function Group 5.1

Measurement Control 5.3

Measurement Groups 5.3

Measurement Statistics 5.4

Specifying Limits 5.6

Status Reporting System 5.7

Special Terms and Notation 5.10

5 Remote Control – Basics

This chapter gives a survey of the basic features and concepts of WCDMA remote control commands. Remote control can be described in terms analogous to the ones used in Chapter 3 for the classification of measurement and configuration menus. In the following, we will particularly point out the similarities and differences between manual and remote control.

Structure of WCDMA Function Group

Chapter 6 of this manual lists gives a description of all WCDMA remote control commands, including their parameters, as well as the default values and ranges of all numerical parameters.

Function group and test modes

The WCDMA UE function group provides the two test modes *Signalling* and *Non Signalling*. Many commands in the two test modes have the same syntax.

Addressing

The CMU uses extended addressing: The instrument is assigned a primary address while the WCDMA function groups are identified via secondary addresses. In principle, this concept allows the same remote commands and program parts to be used in WCDMA and in function groups and test modes from other networks:

```
ibwrt(h_WCDMA19UEFDD_NSig,"[:SENSe]:LEVel:MODE AUTomatic")
ibwrt(h_GSM900MS_Sig, "[:SENSe]:LEVel:MODE AUTomatic")
ibwrt(h_GSM1800MS_NSig, "[:SENSe]:LEVel:MODE AUTomatic")
```

provided that the variables `h_WCDMA19UEFDD_NSig` etc. have been appropriately defined, see program examples in Chapter 7 of the CMU operating manual.

The remote control commands for first `(SYST:COMM:GPIB:ADDR)` and secondary `(SYST:REM:ADDR:SEC)` addressing are described in the CMU operating manual. The `SYST:REM:ADDR:SEC` command uses the following names to address the WCDMA function groups:

WCDMA19UEFDD_NSig, WCDMA19UEFDD_Sig

Order of commands

The commands are arranged to form groups belonging to the same measurement or to the same type of configurations. These command groups are identified by the second-level keyword (as in `POWer`). Applications belonging to a measurement group (see Chapter 5 of the CMU operating manual) are identified by the lower-level keywords of each command (as in `MODulation:EVMagnitude:QPSK`). Chapter 6 is organized as follows:

General configurations in Non Signalling mode:

Second-level keywords `LEVEL, RFANalyzer, RFGenerator, UECode, INPut, OUTPut, CORRection:LOSS, DM:CLOCk, TRIGger`

Common command and measurement groups (identical or almost identical in Non Signalling and Signalling mode:

`MMEMory, SYSTem:OPTions, SYSTem:RESet, IQIF, POWer` (including the applications `MAXimum, MINimum, OFF, ILTPc, XSLot`), `MODulation:OVERview` (including the applications `QPSK` and `WCDMa:DPCH`), `MODulation:EVMagnitude` (including the applications `QPSK` and `WCDMa:DPCH`), `MODulation:PERRor` (including the applications `QPSK` and `WCDMa:DPCH`), `MODula-`

tion:MERRor (including the applications QPSK and WCDMa:DPCH), MODulation:IQANalyzer, MODulation:PHDscont, SPECtrum:MFILter, SPECtrum:MFFT, SPECtrum:EMAK, CDPower (including the applications :AUTomatic, :RAUTomatic, :MANual, :RMANual, :TIME), RXQuality:BER, NPOWer.

Measurement groups, provides in Signalling mode only:

POWer:ONOFf, MODulation:PRACh, RXQUality:UEReports

WCDMA Signalling:

General configurations and signalling (SIGNalling, OLP, HANDover, UECapability, UESignal, BSSignal, NETWork, INPut, OUTPut, CORRection:LOSS, DM:CLOCk, TRIGger, LEVel).

NOTE

Additional commands for HSDPA and HSUPA tests (with options R&S CMU-K64/-K56) are listed in Chapter 8 of this manual. Additional tests for the RLC BLER measurement (with option R&S-K96, WCDMA Application Testing) and for option R&S Smart Alignment (R&S CMU-K47) are listed in Chapter 9.

The structure of Chapter 6 differs from Chapter 4 *(Functions and their Application)* where the measurements are presented first and configurations pertaining to the whole function group and test mode are reported at the end of each section.

The menu of the graphical user interface corresponding to a group of commands is quoted at the beginning of each section. Alphabetical lists of all commands are annexed to Chapter 6.

SCPI Conformity

In view of the particular requirements of WCDMA measurements not all commands could be taken from the SCPI standard. However, the syntax and structure of all commands is based on SCPI rules. For a detailed description of the SCPI standard refer to Chapter 5 of the CMU operating manual.

SCPI confirmed and SPCI approved commands are explicitly marked throughout Chapter 6.

Remote Control

All commands may be used for control of the CMU via GPIB interface or serial (RS-232) interface.

Measurement Control

The commands in the measurement groups quoted above (`POWer...`, `MODulation...`, `SPECtrum...`, `CDPower...`, `RXQuality...`) have an analogous structure and syntax. The measurements are controlled according to the common concepts outlined in Chapter 5 of the CMU operating manual. The following sections show how the general concepts are applied to WCDMA measurements.

Measurement Groups

The measurement groups are referred to as *measurement objects* (keyword <meas_obj>) in remote control. For WCDMA measurements, the following measurement objects are defined:

Table 5-1 List of measurement objects

Measurement Object	Applications	Functionality
POWer…	**MAXimum**	Peak and RMS-averaged transmitter output power of the UE that transmits at maximum power, including limit check and statistical evaluation.
	MINimum	Peak and RMS-averaged transmitter output power of the UE that transmits at minimum power, including limit check and statistical evaluation.
	OFF	Peak and RMS-averaged transmitter output power of the UE that is set to its transmit OFF power state, including limit check and statistical evaluation.
	XSLot	Fast measurement of RMS-averaged transmitter output power of the UE in up to 100 consecutive slots.
	ILTPc	Test of inner loop Transmit Power Control (TPC) of the UE including limit check.
	ONOFf	UE power during its random access procedure (PRACH preamble power, Signalling only).
MODulation…	**OVERview**	Scalar parameters characterizing the modulation accuracy of the UE transmitter generating a single QPSK-modulated signal `(QPSK)` or a multiple WCDMA signal (`WCDMa:DPCH)`, including limit check and statistical evaluation.
	EVMagnitude	Error vector magnitude of a single QPSK-modulated signal `(QPSK)` or a multiple WCDMA signal (`WCDMa:DPCH)` plotted over one slot, including limit check and statistical evaluation.
	MERRor	Magnitude error of a single QPSK-modulated signal `(QPSK)` or a multiple WCDMA signal (`WCDMa:DPCH)` plotted over one slot, including limit check and statistical evaluation.
	PERRor	Phase error of a single QPSK-modulated signal `(QPSK)` or a multiple WCDMA signal (`WCDMa:DPCH)` plotted over one slot, including limit check and statistical evaluation.
	IQANalyzer	Analysis of the UE signal in the I/Q plane.
	PHDiscont	Change in phase between any two adjacent timeslots.
	RRACh	PRACH preamble quality; ability of the UE to transmit the PRACH preamble in accordance with the core requirements (Signalling only).
	EPHSdpcch	Change in phase due to the presence of a HS-DPCCH, EVM and frequency error evaluation (with option R&S CMU-K64; see Chapter 8).

Measurement Object	Applications	Functionality
SPECtrum…	**MFILter**	Adjacent Channel Leakage power Ratio (ACLR) at definite off-carrier frequencies, including limit check and statistical evaluation.
	MFFT	ACLR as a continuous function of the frequency, calculated by means of a Fast Fourier Transform. A filtered, continuous ACLR and the Occupied Bandwidth (OBW) is derived from the FFT curve. A limit check and a statistical evaluation is provided in addition.
	EMASk	Spectrum emissions in the frequency range between 2.5 MHz and 12.5 MHz from the carrier frequency measured with different Gaussian filters including limit check.
CDPower…	**AUTomatic** **RAUTomatic**	Code domain power `(AUTOmatic)` and Code Domain Rho Factor `(RAUTomatic)` in all code domain channels contributing to the uplink WCDMA signal.
	MANual **RMANual**	Code domain power `(MANual)` and Code Domain Rho Factor `(RAUTomatic)` in all physical channels contributing to the uplink WCDMA signal. A limit check and a statistical evaluation is provided in addition.
	TIME	Code power and the gain factors for all UL channels including HSDPA and HSUPA channels.
	HTMask	Code power and power steps of the UL channels over a 4-slot period.
RXQuality…	**BER**	Bit Error Rate, Block Error Rate, and Data Block Error Rate in synchronized mode (with options CMU-K76 and CMU-B68/U68).
	UEReport	UE receiver reports for the current cell and UTRAN and GSM neighbor cells (Signalling only).
	HACK	Evaluation of the demodulation of the HS-DSCH and the data throughput (with option R&S CMU-K64; see Chapter 8).
	HCQI	Allocation of a HSDPA CQI test channel to the UE and test of the accuracy of CQI reporting under AWGN or fading conditions (with option R&S CMU-K64; see Chapter 8).
	HSLog	Evaluation of the ACK/NACK messages and reported CQI values that the UE returns in a sequence of 60 consecutive HS-DPCCH subframes (with option R&S CMU-K64; see Chapter 8).
	RLCBler	Measurement of the data throughput and the downlink Block Error Rate for a configurable number of RLC blocks sent to the UE for *WCDMA Application Testing* (with option R&S CMU-K96; see Chapter 9).

The measurement objects in *Table 5-1* are complemented by groups of commands used to retrieve results that are automatically provided by the mobile station (e.g. the UE Radio Access Capabilities reported by the mobile phone). These command groups do not represent real measurement objects; they consist of queries only and are called pseudo measurement objects. For a complete overview of all commands, see the lists of remote control commands at the end of chapters 6, 8, and 9.

Measurement Statistics

In the WCDMA network, the (modulated) RF signal is divided into periodic slots serving as basic evaluation periods for the measurement and for the calculation of statistical results.

Together with the *Statistic Count*, the *Repetition Mode* defines how many evaluation periods are measured if the measurement is not stopped explicitly (measurement control commands `STOP...`, `ABORT...`) or by a limit failure. With remote control the three repetition modes *Single Shot, Continuous* and *Counting* are available (*Counting* is not available in manual control, see chapter 3).

In MODulation and CDPower measurements, different traces corresponding to the result in the current evaluation period, the maximum, minimum, extreme value, or average over a set of evaluation periods (bursts) are determined. These results can be queried independently.

Table 5-2 Repetition mode in remote control

Setting	Description	Command
Statistic Count	Integer number of evaluation periods forming one statistics cycle. An evaluation period is equal to a slot. The statistic count is set together with the measured quantity.	CONFigure:<meas_obj>:CONTrol:STATistics 1 ... 1000 | NONE (<meas_obj> = POWer... | MODulation... | SPECtrum..., CDPower..., RXQuality; see Table 5-1 on p. 5.3)
Repetition mode Single Shot	The measurement is stopped after one statistics cycle.	CONFigure:<meas_obj>:CONTrol:REPetition **SINGleshot**, <StopCondition>, <Stepmode> (<meas_obj> = POWer... | MODulation... | SPECtrum..., CDPower..., RXQuality; see Table 5-1 on p. 5.3
Continuous	The measurement is continued until stopped explicitly or by a limit failure. Average results are calculated according to the rules given in chapter 3.	CONFigure:<meas_obj>:CONTrol:REPetition **CONTinuous**, <StopCondition>, <Stepmode> (<meas_obj> = POWer... | MODulation... | SPECtrum..., CDPower..., RXQuality; see Table 5-1 on p. 5.3)
Counting	Repeated single shot measurement with configured statistics cycles.	CONFigure:<meas_obj>:CONTrol:REPetition **1 ... 10000**, <StopCondition>, <Stepmode> (<meas_obj> = POWer... | MODulation... | SPECtrum..., CDPower..., RXQuality; see Table 5-1 on p. 5.3) A counting measurement with 1 evaluation period is equivalent to a single shot measurement..
Measurement Curves	The specifiers CURRent, MAXimum, MINimum, MMAX, and AVERage denote the traces for the current evaluation period, the maximum, minimum, extreme value, or average of a set of evaluation periods. They correspond to the *Display Mode* set in the measurement configuration menus. In general several traces are evaluated during the measurement. They are selected via the specifiers used as last keywords in the READ..., FETCh... or SAMPle... queries.	Measurement results: READ:ARRay:MODulation:EVMagnitude...<disp>? READ:SUBarrays:MODulation:EVM...<disp>? ... <disp> = :CURRent | :AVERage | :MMAX | MINimum Limit matching: CALCULATE:ARRay:CDPower...<disp>:MATChing:LIMit? .... <disp> = :CURRent | :AVERage | :MAXimum | MINimum Analogous commands for other MODulation and CDPower applications and for <meas_obj> = SPECtrum:MFFT

Specifying Limits

The following table gives an overview of the types of limits and possible results of the limit check.

Table 5-3 Limits and limit check

Type	Description	Command

Scalar limits	Limit values for a single (scalar) measured quantity. Depending on the measured quantity, either an upper limit or upper and lower limits can be defined.	`CONFigure:<meas_obj>:<disp>:LIMit [SCALar]:<Spec.>:VALue`
		`<disp> = :CMMax | :AVERage | :CMAX` for display modes Current & Max./Min. or Average or Current & Maximum
		`<meas_obj> = POWer... | MODulation... | SPECtrum..., CDPower..., RXQuality`
		`<Spec.> = ASYMmetric:UPPer | ASYMmetric:LOWer | SYMMetric[:COMBined]` for upper limits, lower limits, or combined upper and lower limits.

Limit lines	For the spectrum emission measurement a tolerance template (emission mask) can be defined.	`CONFigure:<meas_obj>:<disp>:LIMit:LINE :<Spec.> <Limit>`
		`<meas_obj> = SPECtrum:EMASk`
		`<disp> = :CMax | :AVERage` for display modes Current & Max./Min. or Average
		`<Spec.>` denotes an array of keywords specifying the upper or lower limit line in a definite channel.

Limit check	All scalar limits belonging to the same measurement group are read out together with the command on the right side.	`CALCulate[:SCALar]:<meas_obj.> ...:MATChing:LIMit?`
	Possible results of the scalar limit check are listed on the right side. Further messages assessing, e.g., the power ramp or the result of the BER test in general, may be issued in particular cases (see detailed command description in Chapter 6).	`NMAU` not matching, underflow `NMAL` not matching, overflow `INV` measured value invalid `OK` no limit failure

	In some instances the command to calculate the limit check depends on the statistics settings (see section *Measurement Statistics* on page 5.4).	`CALCULATE:ARRay:<meas_obj>: <disp>:MATChing:LIMit? ....`
		`<meas_obj> = CDPower:MANual or CDPower:RMANual`
		where `<disp> = :CURRent | :AVERage | :MAXimum | :MINimum`

Status Reporting System

A general description of SCPI status registers and of the status reporting system is given in Chapter 5 of the CMU operating manual. The present section is devoted to the particular features concerning WCDMA measurements.

The CMU offers 30 independent `STATus:OPERation:CMU:SUM1|2:CMU<nr>` sub-registers (<nr>=1 ... 15) which are implemented in hierarchical form. The bits of the 30 `STATus:OPERation` registers are set only after the registers are assigned to a function group and measurement mode.

In the `CONDition` part, the `STATus:OPERation` register contains information on which actions the instrument is being executing or, in the EVENt part, information on which actions the instrument has executed since the last readout. All fife parts of the registers can be read using one of the commands of the subsystem `STATus:OPERation:SUM1|2:CMU<nr>:...`

WCDMA tests comprise the two signalling modes *Non Signalling* and *Signalling* so that two secondary addresses are used.

In the status registers for the *Non Signalling* mode the following bits are assigned:

Table 5-4 Meaning of the bits used in the `STATus:OPERation:CMU:SUM1|2:CMU<nr>` sub-register assigned to the *WCDMA UE Non Signalling*

Bit-No.	Meaning	Symbol in `STAT:OPER:SYMB...`
2	**Synchronization Lost** This bit is set during a *Receiver Quality* measurement if the UL signal from the WCDMA UE can not be received with the expected timing. In this case it may be necessary to adjust the *DL/UL Timing.*	**SLOS**
4	**Measurement Invalid** This bit is set if the active measurement could not performed and terminated correctly (e.g. because of a low signal level) so that the measurement results are invalid. It is also set if a frequency-dependent external attenuation caused conflicting level settings.	**MINV**
9	**Transport Channel Reconfiguration Failed** This bit is set if an attempted radio bearer oder physical channel reconfiguration failed. This bit should be monitored in particular if the connection is not released after a RAB reconfiguration failure (`CONFigure:NETWork:REQuest:RRAB OFF`).	**E10**
10	**Trigger Not Found** This bit is set during a *Power* measurement (applications *Maximum Power, Minimum Power, Off Power, Power vs. Slot* or *Inner Loop TPC)* if the CMU was not able to detect the external trigger signal.	**TRNF**
11	**RF Input Overdriven** This bit is set if the RF input level exceeds the *Max. Level* defined in the *Analyzer* tab of the *Connection Control* menu.	**RFIO**
12	**RF Input Underdriven** This bit is set if the RF input level falls below the measurement range given by the *Max. Level* defined in the *Analyzer* tab of the *Connection Control* menu..	**RFIU**

13	**Scrambling code or slot format does not match input signal** This bit is set if the CMU is unable to correctly detect the beginning of a slot because the analyzed signal does not conform to the *Scrambling Code* or the *Slot Format* set in the UE Code tab of the Connection Control menu. The error may occur in all measurements with channel decoding, e.g. in the *Modulation...WCDMA* applications or in a *Code Domain Power* measurement. If the error occurs, the measurement results are very likely to be wrong.	**SCPW**

In the status registers for the *Signalling* mode the bit assignment is as follows:

Table 5-5 Meaning of the bits used in the `STATus:OPERation:CMU:SUM1|2:CMU<nr>` sub-register assigned to the *WCDMA UE Signalling*

Bit-No.	Meaning	Symbol in `STAT:OPER:SYMB...`
0	**Call from UE** This bit is set when the CMU receives a call from the mobile under test. It also indicates a UE-originated PDP call.	**CFUE**
1	**Release from UE** This bit is set when the connection to the mobile is being released. It also indicates a UE-originated PDP call release.	**RFUE**
2	**Synchronization Lost** This bit is set during a *Receiver Quality* measurement if the UL signal from the WCDMA UE can not be received with the expected timing. In this case it may be necessary to adjust the *DL/UL Timing*.	**SLOS**
3	**Registration Completed** This bit is set while a location update is being performed. It also indicates the PS-attached state.	**REG**
4	**Measurement Invalid** This bit is set if the active measurement could not performed and terminated correctly (e.g. because of a low signal level) so that the measurement results are invalid. It is also set if a frequency-dependent external attenuation caused conflicting level settings.	**MINV**
6	**Paging failed** This bit is set if the mobile does not respond to the CMU's paging messages within a fixed period of time.	**PFA**
7	**UE has Unregistered** This bit is set if the UE had to cancel registration. It also indicates the PS-detached state.	**UNREG**
8	**SMS received** This bit is set if a short message has been received but not yet read.	**SMSR**
9	**Transport Channel Reconfiguration Failed** This bit is set if an attempted radio bearer or physical channel reconfiguration failed. This bit should be monitored in particular if the connection is not released after a RAB reconfiguration failure (`CONFigure:NETWork:REQuest:RRAB OFF`).	**TCRF**

10	**Trigger Not Found** This bit is set during a *Power* measurement (applications *Maximum Power, Minimum Power, Off Power, Power vs. Slot* or *Inner Loop TPC)* if the CMU was not able to detect the external trigger signal.	**TRNF**
11	**RF Input Overdriven** This bit is set if the RF input level exceeds the *Max. Level* defined in the *Analyzer* tab of the *Connection Control* menu.	**RFIO**
12	**RF Input Underdriven** This bit is set if the RF input level falls below the measurement range given by the *Max. Level* defined in the *Analyzer* tab of the *Connection Control* menu..	**RFIU**
13	**Scrambling code or slot format does not match input signal** This bit is set if the CMU is unable to correctly detect the beginning of a slot because the analyzed signal does not conform to the *Scrambling Code* or the *Slot Format* set in the UE Code tab of the Connection Control menu. The error may occur in all measurements with channel decoding, e.g. in the *Modulation...WCDMA* applications or in a *Code Domain Power* measurement. If the error occurs, the measurement results are very likely to be wrong.	**SCPW**

Special Terms and Notation

Below we list some particular features in the syntax of the WCDMA commands. The general description of the SCPI command syntax can be found in Chapter 5 of the CMU operating manual, section *"Structure and Syntax of Device Messages"*.

Description of commands

The commands are arranged in tables. From top to bottom, the table rows contain the following entries:

1. Complete command syntax including the parameter list and a short description of the command
2. List and description of the parameters with their default values and the units
3. Detailed description of the command, required firmware version

To make it clear how the commands are structured and related to each other, groups of analogous commands are described in common tables.

Order of commands

The commands are arranged according to their function specified by the keyword in the second level or in the second/third level combined. Lower-level keywords define the command in more detail. This means that commands with the same second-level, third-level etc. keywords are generally grouped together in the same sections.

Example: `CONFigure:POWer:MAXimum:CONTrol:REPetition`

Commands with the keyword *POWer* in the second level belong to the power measurement. The keyword in the third level denotes the application (maximum output power of the UE transmitter). The keywords in the fourth and fifth level indicate that the command controls the repetition mode of the power measurement.

Scalar results and arrays

To limit the number of remote control commands, scalar results are always measured together and output in lists. Arrays (e.g. the traces for `MODulation` measurements) are output as lists of values separated by commas; it is possible to retrieve either the whole list (see commands `READ:ARRay...` etc.) or the values located in a number of subranges that are part of the total measurement range (see commands `READ:SUBarrays...`; the subarrays are defined via `CONFigure:SUBarrays...`).

Parameters

Setting commands are usually supplemented by a parameter or a list of several parameters. Parameters either provide alternative options (setting a or setting b or setting c ..., see special character "|"), or they form a list separated by commas (setting x,y).

<Par_Name>

In the command tables and lists, parameters are generally described by a name (literal) written in angle brackets (<>). This literal merely serves as a parameter description; in an application program it must be replaced by one of the possible settings reported in the detailed parameter description.

Example:
```
CONFigure:POWer:OFF:CONTrol
                          <Mode>, <Statistics>,...
```
with
```
<Mode>       = SCALar | ARRay
<Statistics> = 1 ... 10000 | NONE
...
```
possible command syntax: `CONF:POW:OFF:CONT SCAL,NONE,..`

NAN NAN (not a number) is generally used to represent missing data, e.g. if a portion of a trace has not been acquired yet. It is also returned after invalid mathematical operations such as division by zero. As defined in the SCPI standard, NAN is represented as 9.91 E 37.

INV INV (invalid) is returned if a limit check is performed without defining the appropriate tolerance values.

Upper / lower case Upper/lower case characters characterize the long and short form of the keywords in a command. The short form consists of all upper-case characters, the long form of all upper case plus all lower case characters. On the CMU, either the short form or the long form are allowed; mixed forms will generally not be recognized. Note that the instrument itself does not distinguish upper case and lower case characters.

Special characters

| A vertical stroke in the parameter list characterizes alternative parameter settings. Only one of the parameters separated by | must be selected.

Example: The following command has two alternative settings:

```
TRIGger:SEQuence:DEFault ON | OFF
```

[ ] *Key words* in square brackets can be omitted when composing the command header (see Chapter 5 of the CMU manual, section "Structure of a Command"). The complete command must be recognized by the instrument for reasons of compatibility with the SCPI standard.

Parameters in square brackets are optional as well. They may be entered in the command or omitted.

{ } Braces or curly brackets enclose one or more parameters that may be included zero or more times.

<nr> This symbol denotes a numeric suffix, e.g. an enumeration index for input and output connectors.

Lists of commands

Command: The *Command* column of the table contains all remote control commands arranged according to their function (configurations or measurement objects). Within a section, the commands are listed in alphabetical order.

Parameters: The *Parameter* column lists the parameters of the commands.

Remarks: The *Remarks* column gives additional information about the commands which

- Have no query form *(no query)*
- Have only a query form *(query only)*

Can be used both as setting commands and as queries (*with query*, this applies to all commands belonging to none of the two preceding categories)

Alphabetical Lists Chapter 6 concludes with alphabetical command lists for both test modes.

Contents

6 Remote Control – Commands 6.1

Connection Control (Non Signalling) 6.1

Subsystem LEVel (Input Level) 6.1

Subsystem RFANalyzer (Analyzed Input Signals) 6.3

Subsystem RFGenerator (Generator control) 6.4

Channel-Independent Generator Settings 6.4

Subsystem RFGenerator:AUXTx (Aux TX signal) 6.9

Subsystem RFGenerator:SCHannel (Synchronization Channels) 6.10

Subsystem RFGenerator:DBCHannel (Dedicated & Broadcast Channels) 6.11

Subsystem RFGenerator:RCHannel (Reference Channel) 6.14

Subsystem RFGenerator:PCHannel (Physical Channel) 6.15

Subsystem RFGenerator:DCCH (3GPP DCCH) 6.16

Subsystem RFGenerator:TPC (Transmit Power Control) 6.16

Subsystem UECode (UE Code Channels) 6.20

Subsystem UECode:DPCH (Dedicated Physical Channel) 6.20

Subsystem UECode:DPDCh (Dedicated Physical Data Channel) 6.21

Subsystem UECode:TPOWer (UL Target Power) 6.23

Inputs and Outputs (External Attenuation) 6.24

Subsystem DM:CLOCk (Synchronization) 6.26

Subsystem TRIGger (Trigger Mode) 6.27

Common Measurements and Command Groups 6.29

Configuration File Management – System MMEMory 6.29

Option Query 6.30

Partial Reset 6.30

I/Q-IF Interface 6.31

POWer Measurements 6.33

POW:MAX, POW:MIN, POW:OFF 6.33

Control of Measurement – Subsystems POWer... ..... 6.33

Test Configuration 6.34

Subsystem POWer:...CONTrol 6.34

Subsystem POWer:MAXimum:...LIMit 6.36

Subsystems POWer:MINimum:...LIMit and POWer:OFF...LIMit 6.38

Measured Values – Subsystem POWer...? 6.40

POWer:ILTPc 6.42

Control of Measurement – Subsystem POWer:ILTPc 6.42

Test Configuration 6.43

Subsystem POWer:ILTPc:CONTrol 6.43

Subsystem POWer:ILTPc:...LIMit 6.45

Measured Values – Subsystem POWer:ILTPc...? 6.47

POWer:XSLot 6.49

Subsystem POWer:XSLot:CONTrol 6.50

Subsystem POWer:XSLot:…LIMit 6.52

Subsystem POWer:XSLot? 6.55

MODulation Measurements 6.59

General Commands 6.59
MODulation:OVERview 6.59
Control of Measurement – Subsystem MODulation:OVERview 6.60
Test Configuration 6.61
Subsystem MODulation:OVERview:...:CONTrol 6.61
Tolerance values – Subsystem MODulation:OEMP:...:LIMit 6.63
Measured Values – Subsystem MODulation:OVERview:QPSK 6.65
MODulation:EVMagnitude 6.67
Control of Measurement – Subsystem MODulation:EVMagnitude 6.67
Test Configuration 6.68
Subsystem MODulation:EVMagnitude...:CONTrol 6.68
Tolerance values – Subsystem MODulation:OEMP:QPSK:LIMit 6.70
Subsystem SUBarrays:MODulation 6.70
Measured Values – Subsystem MODulation:EVMagnitude:QPSK 6.71
MODulation:MERRor 6.74
Control of Measurement – Subsystem MODulation:MERRor 6.74
Test Configuration 6.75
Subsystem MODulation:MERRor...:CONTrol 6.75
Tolerance values – Subsystem MODulation:OEMP...:LIMit 6.77
Subsystem SUBarrays:MODulation 6.77
Measured Values – Subsystem MODulation:MERRor:...? 6.78
MODulation:PERRor 6.81
Control of Measurement – Subsystem MODulation:PERRor 6.81
Test Configuration 6.82
Subsystem MODulation:PERRor:QPSK:CONTrol 6.82
Tolerance values – Subsystem MODulation:OEMP...:LIMit 6.84
Subsystem SUBarrays:MODulation 6.84
Measured Values – Subsystem MODulation:PERRor:QPSK 6.85
MODulation:IQANalyzer 6.88
Control of Measurement – Subsystem MODulation:IQANalyzer 6.88
Test Configuration 6.89
Subsystem MODulation:IQANalyzer:QPSK:CONTrol 6.89
Subsystem SUBarrays:... ..... 6.90
Measured Values – Subsystem MODulation:IQANalyzer…? 6.91
MODulation:PHDiscont 6.93
Measurement Control 6.93
Test Configuration 6.94
Subsystem MODulation:PHDiscont:CONTrol 6.94
Subsystem MODulation:PHDiscont:...LIMit 6.95
Measured Values – Subsystem MODulation:PHDiscont...? 6.96
SPECtrum Measurements 6.100
SPECtrum:MFILter 6.100
Control of Measurement – Subsystem SPECtrum:MFILter 6.100
Test Configuration 6.101
Subsystem SPECTrum:MFILter:CONTrol 6.101
Subsystem SPECTrum:MFILter:...LIMit 6.103
Subsystem SPECTrum:MFILter:MEASx 6.104
Measured Values – Subsystem SPECtrum:MFILter? 6.105
SPECtrum:MFFT 6.107
Control of Measurement – Subsystem SPECtrum:MFFT 6.107
Test Configuration 6.108
Subsystem SPECTrum:MFFT:CONTrol 6.108
Subsystem SPECTrum:MFFT:...LIMit 6.109
Subsystem SUBarrays:SPECtrum 6.111
Measured Values – Subsystem SPECtrum:MFFT? 6.112
SPECtrum:EMASk 6.115

Control of Measurement – Subsystem SPECtrum:EMASk....6.115
Test Configuration....6.116
Subsystem SPECTrum:EMASk:CONTrol....6.116
Subsystem SPECTrum:EMASk:...LIMit:LINE....6.117
Measured Values – Subsystem SPECtrum:EMASk?....6.120
CDPower Measurements....6.124
CDPower:AUTomatic and CDPower:RAUTomatic....6.124
Control of Measurement – Subsystems CDPower:AUTomatic and CDPower:RAUTomatic....6.124
Test Configuration....6.125
Subsystems CDPower:AUTomatic:CONTrol and CDPower:RAUTomatic:CONTrol....6.125
Measured Values – Subsystems CDPower:AUTomatic and CDPower:RAUTomatic?....6.127
CDPower:MANual and CDPower:RMANual....6.129
Control of Measurement – Subsystems CDPower:MANual and CDPower:RMANual....6.129
Test Configuration....6.130
Subsystems CDPower:MANual:CONTrol and CDPower:RMANual:CONTrol....6.130
Tolerance values – Subsystem CDPower:..:LIMit....6.131
Measured Values – Subsystem CDPower:MANual?....6.133
CDP vs. Time Measurement....6.138
Test Configuration....6.139
Measured Values – Subsystem CDPower:TIME...?....6.140
Receiver Quality Measurements....6.144
RXQuality:BER....6.144
Control of Measurement – Subsystem RXQuality:BER....6.144
Subsystem RXQuality:BER:CONTrol....6.145
Confidence BER – Subsystem RXQuality:BER:CONTrol:CONFidence....6.146
Subsystem RXQuality:BER:LIMit....6.148
Measured Values – Subsystem RXQuality:BER?....6.149
Fast Power Measurement (NPOWer)....6.151
Subsystem NPOWer:CONTrol....6.152
Measured Values – Subsystem NPOWer?....6.153
Measurement Groups (Signalling Only)....6.154
POWer Measurements....6.154
POWer:ONOFf....6.154
Control of Measurement – Subsystem POWer:ONOFf....6.154
Test Configuration....6.155
Subsystem POWer:ONOFf:CONTrol....6.155
Subsystem POWer:ONOFf:...LIMit....6.156
Subsystem SUBarrays:ONOFf....6.156
Measured Values – Subsystem POWer:ONOFf...?....6.157
MODulation Measurements....6.160
MODulation:PRACh....6.160
Measurement Control....6.160
Test Configuration....6.161
Subsystem MODulation:PRACh:CONTrol....6.161
Subsystem MODulation:PRACh:...LIMit....6.161
Subsystem SUBarrays:MODulation:PRACh....6.162
Measured Values – Subsystem MODulation:PRACh...?....6.163
RXQuality Measurements....6.167

RXQuality:UEReports 6.167
RXQuality:UEReports[:CCELl] 6.168
RXQuality:UEReports:NCELl 6.170

Connection Control (Signalling) 6.174

Connection Setup – Subsystem SIGNalling 6.174

Subsystem OLP (Openloop Power) 6.178

Subsystem HANDover 6.179

Subsystem UECapability (Radio Access Capability) 6.180

Subsystem UESignal (UE Signal) 6.185

Subsystem UESignal:PCONtrol (Power Control) 6.189

Subsystem UESignal:GFACtor (Gain Factors) 6.191

Subsystem BSSignal (WCDMA Signal) 6.193

Subsystem BSSignal:DCH (Dedicated Channel) 6.198

Subsystem BSSignal:PHYSical (Downlink Physical Channels) 6.203
Subsystem BSSignal:TPC (Transmit Power Control) 6.209
Subsystem BSSignal:PSWitched (Packet Switched Connections) 6.213
Subsystem BSSignal:COMPressed (Compressed Mode Settings) 6.216
Subsystem BSSignal:COMPressed:ULCMtxtest (UL CM TX Test) 6.220
Subsystem BSSignal:DPCS (Downlink Power Control) 6.221

Subsystem NETWork (Network Parameters) 6.223

Subsystem NETWork:IDENtity 6.223
Subsystem NETWork:RAC... (Random Access Settings) 6.225
Subsystem NETWork:REQuest (Requested UE Data) 6.227
Subsystem NETWork:CRINfo (Cell Reselection Information) 6.233
Subsystem NETWork:NCELl (Neighbor Cell Lists) 6.235

Commands for Input and Output Connectors 6.237

Subsystem DM:CLOCk (Synchronization) 6.238

Subsystem TRIGger (Trigger Mode) 6.239

Subsystem LEVel (Input Level) 6.241

Subsystem MMONitor (Message Monitor) 6.242
Subsystem VIPaddress (Application Testing) 6.243
Subsystem WIZard (Measurement Wizard) 6.245

6 Remote Control – Commands

In the following, all remote control commands for the WCDMA UE test function groups will be presented in tabular form with their parameters and the ranges of values. The chapter is organized in analogy to the reference part for manual operation (Chapter 4):

- The measurement modes *Non Signalling* and *Signalling* are presented separately.
- Within the measurement modes, general configurations *(Connection Control)* and the individual measurement groups are described separately.
- Command and measurement groups that are identical or almost identical in both test modes *(POWer...,SPECtrum..., IQIF*, symbolic status register evaluation etc.) are presented in a separate section between the two test modes.

General notes on remote control in the WDCMA UE test function groups can be found in Chapter 5. An introduction to remote control according to the IEEE 488.2/SCPI standard is given in Chapter 5 of the CMU200/300 operating manual.

This Chapter lists the remote control commands for the functionality reported in Chapter 4. Additional commands for HSDPA tests (with option R&S CMU-K64) are listed in Chapter 8 of this manual. Additional tests for the RLC BLER measurement (with option R&S-K96, WCDMA Application Testing) are listed in Chapter 9.

Connection Control (Non Signalling)

The remote-control commands in this section configure the measurements in the WCDMA function group globally, i.e., they provide settings that are valid for all measurements in the function group. They correspond to the settings in the popup menu of the softkey *Connection Control* located to the right of the headline of each main menu.

Subsystem LEVel (Input Level)

The subsystem *LEVel* controls the level in the RF input signal path. It corresponds to the table section *Analyzer Level* in the *Analyzer* tab of the *Connection Control* menu.

[SENSe:]LEVel:MODE <*Mode*>			Input level – Mode	
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
MANual | AUTomatic	Manual setting Automatic setting corresponding to average power of signal applied	MANual	–	V3.00
Description of command				
This command defines how the maximum input level is set.				

[SENSe:]LEVel:MAXimum <*Level*> Max. Level

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–40.0 dBm to +53.0 dBm	Maximum input level for RF 1	+30.0	dBm	V3.00
–54.0 dBm to +39.0 dBm	Maximum input level for RF 2	+30.0	dBm	
–77.0 dBm to 0.0 dBm	Maximum input level for RF 4 IN	0.0	dBm	

Description of command

This command defines the maximum expected input level. The value range depends on the RF input used and the external attenuation set (see `[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]` command). If option R&S CMU-U99 *(RF 1 with RF 2 Level Range)* is fitted, RF 1 takes on the level range of RF2.

The smallest maximum input levels for *R&S Smart Alignment* measurements (option R&S CMU-K47; see Chapter 9) are –9 dBm (RF1), –23 dBm (RF2), and –48 dBm (RF4 IN).

[SENSe:]LEVel:ATTenuation <*Mode*> Attenuation

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
NORMal |	Mixer level in normal range	LNOise	–	V3.00
LNOise |	Low noise (mixer level 10 dB higher than in normal setting)			
LDIStortion	Low distortion (mixer level 10 dB lower than in normal setting)			

Description of command

This command tunes the RF analyzer for normal setting, low noise level (full dynamic range), or low distortion (high intermodulation spacing). The setting is valid for all measurement groups. Exception: In `SPECtrum`, an additional mode can be set up via `CONFigure:SPECtrum:CONTrol:HDYNamic`.

DEFault:LEVel Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	The parameters are set to default values	ON	–	V3.00
OFF	Some or all parameters differ from the default values			

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem RFANalyzer (Analyzed Input Signals)

The subsystem *RFANalyzer* configures the RF analyzer, i.e., it specifies which type of RF signals can be analyzed. It corresponds to the panel *Analyzer Settings* in the *Analyzer* tab of the popup menu *Connection Control*.

[SENSe:]RFANalyzer:FREQuency <*Number*> RF Channel

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
15 MHz to 2 700 MHz (see also data sheet)	Input frequency (in multiples of 100 kHz)	1922.4	MHz	V3.00

Description of command

This command defines the frequency of the RF signal analyzed. With the command `UNIT:RFANalyzer:FREQuency`, the default frequency unit can be changed, and UARFCN (UTRA Absolute Radio Frequency Channel Numbers) can be entered instead of frequencies. In the latter case, the assignment of channel numbers and frequencies is according to 3GPP specifications (see channel/frequency tables for the different operating bands in chapter 4).

Note: *Some carrier frequencies are used in different operating bands and assigned to different channel numbers. E.g. the uplink frequency 1712.4 MHz corresponds to channel no. 937 in operating band III, and to channel no. 1312 in operating band IV. As a consequence, the channel number is not always predictable if a carrier frequency is used in several operating bands. To avoid confusion, you can either enter channel numbers (channel numbers are unique, even across operating bands) or always use frequencies, disregarding the assigned channel numbers.*

UNIT:RFANalyzer:FREQuency <*Unit*> Frequency Unit

<Unit>	Description of parameters	Def. value	Def. unit	FW vers.
HZ | KHZ | MHZ | GHZ | CH	Frequency unit Channel number (UARFCN)	MHZ	–	V3.00

Description of command

This command defines whether the frequency of the RF signal analyzed is specified in frequency units or as an UARFCN.

[SENSe:]RFANalyzer:FOFFset <*FreqOffset*> Frequency Offset

<FreqOffset>	Description of parameters	Def. value	Def. unit	FW vers.
–100.000 kHz to +100.000 kHz	Offset for channel frequency	0	kHz	V3.00

Description of command

This command defines an offset for the RF analyzer frequency set with the command `[SENSe:]RFANalyzer:FREQuency <Number>`**.** The offset frequency must be in multiples of 1 Hz.

[SENSe:]RFANalyzer:GPERiod <*Enable*> Release 5 Guard Period

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Guard period enabled or disabled	OFF	–	V3.60

Description of command

This command enables or disables the guard period for RF signal evaluation according to release 5 of the 3 GPP FDD standard.

Subsystem RFGenerator (Generator control)

The subsystem *RFGenerator* configures the RF signals generated by the CMU. It corresponds to the softkey *Generator Control* in the *Generator* tab in the popup menu *Connection Control*.

INITiate:RFGenerator	Start RF generator, reserve resources	⇒ *RUN*
ABORt:RFGenerator	Switch off RF generator, release resources	⇒ *OFF*

Description of command	FW vers.
These commands have no query form. They start and stop the RF generator, setting it to the status indicated in the top right column.	V3.05

FETCh:RFGenerator:STATus? — Generator Status

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **ERR**	Generator switched off (`ABORt` or `*RST`) Running (`INITiate`) Switched off (could not be started)	OFF	–	V3.05

Description of command

This command is always a query. It returns the current generator status.

Channel-Independent Generator Settings

The following commands define channel-independent properties of the RF signal. They correspond to the general parameters and the *Generator Settings* section in the *Generator* tab of the popup menu *Connection Control*.

SOURce:RFGenerator:OUTPut <*Signal*> — Output Signal

<Signal>	Parameter description	Def. value	Def. unit	FW vers.
WCDMa | **CW**	DL WCDMA signal Continuous wave signal	WCDMa	–	V3.80

Command description

This command selects the RF output signal type.

SOURce:RFGenerator:TRANsmitter <*Source*> — Transmitter

<Source>	Parameter description	Def. value	Def. unit	FW vers.
TX | **AUXTx |** **OAUXtx**	TX signal Low-level Aux TX signal Aux TX over range signal	TX	–	V3.80

Command description

This command selects the RF output signal source. The level of the different signals is defined by means of a single command `SOURce:RFGenerator:OPOWer`.

SOURce:RFGenerator:FREQuency <*Number*> RF Channel

<*Number*>	Description of parameters	Def. value	Def. unit	FW vers.
10 MHz to 2 700.0 MHz (see also data sheet)	Generator frequency (in multiples of 100 kHz)	2112.4	MHz	V3.05

Description of command

This command defines the frequency of the RF signal generated. The default frequency unit can be changed with the command `UNIT:RFGenerator:FREQuency`, and channel numbers (UARFCNs) can be entered instead of frequencies. In the latter case, the assignment of channel numbers and frequencies is according to 3GPP specifications (see channel/frequency tables for the different operating bands in chapter 4).

Note: *Some carrier frequencies are used in different operating bands and assigned to different channel numbers. E.g. the downlink frequency 2112.4 MHz corresponds to channel no. 10562 in operating band I, and to channel no. 3112 in operating band X. As a consequence, the channel number is not always predictable if a carrier frequency is used in several operating bands. To avoid confusion, you can either enter channel numbers (channel numbers are unique, even across operating bands) or always use frequencies, disregarding the assigned channel numbers.*

UNIT:RFGenerator:FREQuency <*Unit*> Frequency Unit

<*Unit*>	Description of parameters	Def. value	Def. unit	FW vers.
HZ | KHZ | MHZ | GHZ | CH	Frequency unit | Channel number (UARFCN)	MHZ	–	V3.05

Description of command

This command defines whether the frequency of the RF signal generated is specified in frequency units or as a channel number.

SOURce:RFGenerator:FOFFset <*FrequencyOffset*> Frequency Offset

<*FrequencyOffset*>>	Description of parameters	Def. value	Def. unit	FW vers.
–100.000 kHz to +100.000 kHz	Frequency offset	0	kHz	V3.05

Description of command

This command defines an offset for the RF generator frequency set with the command `SOURce:RFGenerator:FREQuency`. The offset frequency must be in multiples of 1 Hz.

SOURce:RFGenerator:SCODe:PRIMary <*Code*> Primary Scrambling Code

<*Code*>>	Description of parameters	Def. value	Def. unit	FW vers.
#H000 to #H1FF	Primary scrambling code	#H0	–	V3.05

Description of command

This command defines the primary scrambling code for the downlink RF generator signal. The range of scrambling code numbers corresponds to 0 to 511 decimal. The input of a scrambing code may be in decimal or in hexadecimal format, the latter preceded by #H (as specified in IEEE 488.2). The output is always in hexadecimal format, preceded by #H.

SOURce:RFGenerator:SCODe:SECondary <*Code*> Secondary Scrambling Code

<*Code*>>	Description of parameters	Def. value	Def. unit	FW vers.
#H0 to #HF	Secondary scrambling code	#H0	–	V3.05

Description of command

This command defines the secondary scrambling code for the downlink RF generator signal. The input of a scrambing code may be in decimal or in hexadecimal format, the latter preceded by #H (as specified in IEEE 488.2). The output is always in hexadecimal format, preceded by #H.

SOURce:RFGenerator:LREFerence <*Reference*> Level Reference

<Reference>	Description of parameters	Def. value	Def. unit	FW vers.
PCPich | OPOWer	Relative to P-CPICH level Relative to Output Channel Power	PCPich	–	V3.15

Description of command

This command qualifies whether all channel power are expressed relative to the (absolute) P-CPICH level (`SOURce:RFGenerator:SCHannel:LEVel:PCPich`) or to the total Output Channel Power (`SOURce:RFGenerator:OPOWer`).

SOURce:RFGenerator:OPOWer <*Level*> Output Channel Power

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–147.0 dBm to –37.0 dBm	Output ch. power if RF 1 is used	–51.6	dBm	V3.15
–147.0 dBm to –15.0 dBm	Output ch. power if RF 2 is used	–51.6	dBm	
–100.0 dBm to +3.0 dBm	O. ch. power if RF 3 OUT is used	–51.6	dBm	

Description of command

This command sets the absolute output channel power of the RF signal. If option R&S CMU-U99 *(RF 1 with RF 2 Level Range)* is fitted, RF 1 takes on the level range of RF2. The output level range at the default connector RF2 is sufficient for the *Maximum Input Level* test according to standard 3GPP TS 34.121, section 6.3.

Note: *The output channel power ranges are changed if an Aux TX or Aux Tx over range signal is active (`SOURce:RFGenerator:TRANsmitter`):*

Aux TX, RF 1	*–132.0 dBm to –82.0 dBm*
Aux TX, RF 2	*–120 dBm to –70 dBm*
Aux TX over range, RF 1	*–120.0 dBm to –38.0 dBm*
Aux TX over range, RF 2	*–100.0 dBm to –24.0 dBm*
Aux TX over range, RF 3 Out	*–80.0 dBm to –1.0 dBm*

SOURce:RFGenerator:OCNS <*Level*> OCNS

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | OFF	Relative OCNS level OCNS switched off	OFF	dB	V3.15

Description of command

This command sets the level of the Orthogonal Channel Noise Simulator relative to the P-CPICH level (see command `SOURce:RFGenerator:SCHannel:LEVel:PCPich`). The setting is ignored if the channel powers are expressed relative to the total output channel power (`SOURce:RFGenerator:LREFerence OPOWer`).

SOURce:RFGenerator:PHYSical:LEVel All Physical Channel Levels
<P-CPICH_abs> | <P-CPICH_rel>, <P-SCH>, <S-SCH>, <P-CCPCH>, <PICH>, <DPDCH>, <Power Offset>

<P-CPICH_abs>	Description of parameters	Def. value	Def. unit	FW vers.
–147.0 dBm to –37.0 dBm*	Absolute P-CPICH level if RF 1 is used	–96.3	dBm	V3.50
–147.0 dBm to –15.0 dBm*	Absolute P-CPICH level if RF 2 is used	–96.3	dBm	
–100.0 dBm to +3.0 dBm*	Abs. P-CPICH level if RF 3 OUT is used	–96.3	dBm	
<P-CPICH_rel>	Description of parameters	Def. value	Def. unit	FW vers.
–30 dB to 0 dB	Relative P-CPICH level	–	dB	V3.50
<P-SCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB |	P-SCH level (level reference = P-CPICH)	–5.0	dB	V3.50
–30 dB to 0 dB	P-SCH level (level reference = total channel power)	–	dB	
<S-SCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB |	S-SCH level (level reference = P-CPICH)	–5.0	dB	V3.50
–30 dB to 0 dB	S-SCH level (level reference = total channel power)	–	dB	
<P-CCPCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB |	P-CCPCH level (level ref. = P-CPICH)	–2.0	dB	V3.50
–30 dB to 0 dB	P-CCPCH level (level reference = total channel power)	–	dB	
<PICH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB |	PICH level (level ref. = P-CPICH)	–5.0	dB	V3.50
–30 dB to 0 dB	PICH level (level reference = total channel power)	–	dB	
<DPDCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB |	DPDCH level (level ref. = P-CPICH)	–7.0	dB	V3.50
–30 dB to 0 dB	DPDCH level (level reference = total channel power)	–	dB	
<Power Offset>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 6.0 dB	DPCCH/DPDCH power offset	0.0	dB	V3.50

Description of command

This command sets all physical channel levels at once. The levels can be set relative to the P-CPICH level (in which case *<P-CPICH_abs>* is used) or relative to the total channel power (*<P-CPICH_rel>* is used), depending on the `SOURce:RFGenerator:LREFerence` setting.

Note: *The instrument checks the levels for consistence before activating the settings. This is important especially if the levels are defined relative to the total channel power and must not exceed this fixed value.*

*) The reported level ranges correspond to the total output power ranges at the three RF output connectors (see command `SOURce:RFGenerator:OPOWer)`. If other channel contributions are switched on, the P-CPICH level must be reduced so that the total output power range is not exceeded. If option R&S CMU-U99 *(RF 1 with RF 2 Level Range)* is fitted, RF 1 takes on the level range of RF2.

SOURce:RFGenerator:AWGN <*Power*> — AWGN Noise Pwr.

<Output Power>	Description of parameters	Def. value	Def. unit	FW vers.
See below	AWGN power (Ioc)	OFF	dBm	V3.85

Description of command

This command defines the total level of the Additional White Gaussian Noise (AWGN) interferer. The AWGN power is in a range between Ior – 44.9 dB and Ior + 25.4 dB, irrespective of the physical DL WCDMA channel settings. Values outside this range are allowed for some physical channel configurations.

Note: Observe the maximum output power at the connectors; see `SOURce:RFGenerator:TOPower?`

SOURce:RFGenerator:GMTFactor <*Ratio*> — Geometry Factor

<Ratio>	Description of parameters	Def. value	Def. unit	FW vers.
–25.4 dB to +44.9 dB	Ior / Ioc	–	dB	V3.85

Description of command

This command defines the ratio of the *Output Ch. Power (TX) (Ior)* (`SOURce:RFGenerator:OPOWer`) to the AWGN power (`SOURce:RFGenerator:AWGN`). Changing the geometry factor affects the output channel power but leaves the AWGN power unchanged. The numeric range quoted above holds for all physical channel configurations. Values outside this range are allowed for some configurations.

Note: Observe the maximum output power at the connectors; see `SOURce:RFGenerator:TOPower?`

SOURce:RFGenerator:TOPower? <*Sum*> — Total Output Power

<Sum>	Description of parameters	Def. value	Def. unit	FW vers.
–147.1 dBm to +10.7 dBm	Ior + Ioc	–	dBm	V3.85

Description of command

This command is always a query and returns the sum of the *Output Ch. Power (TX) (Ior)* (`SOURce:RFGenerator:OPOWer`) and the *AWGN Noise Power (Ioc)* (`SOURce:RFGenerator:AWGN`).

Subsystem RFGenerator:AUXTx (Aux TX signal)

The subsystem *RFGenerator:AUXTx* configures the Aux TX and the Aux TX overrange signals. The corresponding settings are located in the *Generator Settings* section in the *RF Generator* tab of the popup menu *Connection Control*.

SOURce:RFGenerator:AUXTx:FREQuency <*Frequency*> Frequency (R&S CMU-B96)

<Frequency>	Parameter description	Def. value	Def. unit	FW vers.
350 MHz to 550 MHz | 700 MHz to 1100 MHz | 1400 MHz to 2200 MHz	Aux Tx frequency band 1 (path 1 only) Aux Tx frequency band 2 (path 1 and 2) Aux Tx frequency band 3 (path 1 and 2)	2112.4	MHz	V3.80

Command description

This command defines the frequency of the *Aux Tx* and the *Aux TX Over Range* signals, to be selected by means of `SOURce:RFGenerator:TRANsmitter AUXTx | OAUXtx`. The resolution is 200 kHz; all values entered are rounded to 200-kHz steps. If a value between the three distinct frequency bands is entered, the instrument generates an error message. With the command `UNIT:RFGenerator:AUXTx:FREQuency`, the default frequency unit can be changed, and UARFCN (UTRA Absolute Radio Frequency Channel Numbers) can be entered instead of frequencies. In the latter case, the assignment of channel numbers and frequencies meets the 3GPP specifications.

Note: *Operating bands II, IV, V, VI, VII, X to XIV, S, and S 190 MHz Duplex contain additional channels that are off the 200 kHz raster (see tables in Chapter 4). These channels can also be selected with their channel numbers or frequencies.*

UNIT:RFGenerator:AUXTx:FREQuency <*Unit*> Frequency Unit

<Unit>	Description of parameters	Def. value	Def. unit	FW vers.
HZ | KHZ | MHZ | GHZ | CH	Frequency unit | Channel number	MHZ	–	V3.80

Description of command

This command defines whether the frequency of the Aux TX signal generated is specified in frequency units or as a channel number.

Note: *Operating bands II, IV, V, VI, VII, X to XIV, S, and S 190 MHz Duplex contain additional channels that are off the 200 kHz raster (see tables in Chapter 4). These channels can also be selected with their channel numbers or frequencies.*

Subsystem RFGenerator:SCHannel (Synchronization Channels)

The subsystem *RFGenerator...:LEVel* defines the level of the individual channels contributing to the RF signal. It corresponds to the *Synchronization Channels* section in the *RF Generator* tab of the popup menu *Connection Control*.

Note: *The command `SOURce:RFGenerator:LREFerence` sets all physical channel levels at once. Using this command is preferable because it allows the instrument to check the consistence of the entire level set and avoid conflicting settings during the program sequence.*

SOURce:RFGenerator:SCHannel:LEVel:PCPich <*Level_abs*> | <*Level_rel*> — P-CPICH Level

<Level_abs>	Description of parameters	Def. value	Def. unit	FW vers.
–147.0 dBm to –37.0 dBm*	Absolute P-CPICH level if RF 1 is used	–96.3	dBm	V3.05
–147.0 dBm to –15.0 dBm*	Absolute P-CPICH level if RF 2 is used	–96.3	dBm	
–100.0 dBm to +3.0 dBm*	Abs. P-CPICH level if RF 3 OUT is used	–96.3	dBm	
<Level_rel>	Description of parameters	Def. value	Def. unit	FW vers.
–30 dB to 0 dB	Relative P-CPICH level	–	dB	V3.15

Description of command

This command sets the absolute level of the Primary Common Pilot ChannelChannel in absolute units or relative to the total channel power, depending on the `SOURce:RFGenerator:LREFerence` setting.. The absoluteis level is the reference for all other physical and synchronization channel levels and can not be switched off.

*) The reported level ranges quoted above correspond to the total output power ranges at the three RF output connectors (see command `SOURce:RFGenerator:OPOWer`). If other channel contributions are switched on, the P-CPICH level must be reduced so that the total output power range is not exceeded. If option R&S CMU-U99 *(RF 1 with RF 2 Level Range)* is fitted, RF 1 takes on the level range of RF2.

SOURce:RFGenerator:SCHannel:LEVel:PSCH <*Level*> — P-SCH Level

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB |	P-SCH level (level reference = P-CPICH)	–5.0	dB	V3.05
–30 dB to 0 dB |	P-SCH level (level reference = total channel power)	–	dB	V3.15

Description of command

This command sets the level of the Primary Synchronization Channel relative to the P-CPICH level (see command `SOURce:RFGenerator:SCHannel:LEVel:PCPich`) or relative to the total channel power, depending on the `SOURce:RFGenerator:LREFerence` setting. `OFF` turns the P-SCH off (FW vers. ≥ V5.03).

SOURce:RFGenerator:SCHannel:LEVel:SSCH <*Level*> — S-SCH Level

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB |	S-SCH level (level reference = P-CPICH)	–5.0	dB	V3.05
–30 dB to 0 dB | OFF	S-SCH level (level reference = total channel power)	–	dB	V3.15

Description of command

This command sets the level of the Secondary Synchronization Channel relative to the P-CPICH level (see command `SOURce:RFGenerator:SCHannel:LEVel:PCPich`) or relative to the total channel power, depending on the `SOURce:RFGenerator:LREFerence` setting. `OFF` turns the S-SCH off (FW vers. ≥ V5.03).

SOURce:RFGenerator:SCHannel:LEVel:SCPICH <*Level*> S-CPICH Level

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | –30 dB to 0 dB | OFF	S-CPICH level (level reference = P-CPICH) S-CPICH level (level reference = total channel power) S-CPICH channel switched off	OFF	dB	V4.30

Description of command

This command sets the level of the Secondary Common Pilot Channel relative to the P-CPICH level (see command `SOURce:RFGenerator:SCHannel:LEVel:PCPich`) or relative to the total channel power, depending on the `SOURce:RFGenerator:LREFerence` setting.

SOURce:RFGenerator:SCHannel:SCPich:CODE <*Code*> S-CPICH Channel. Code

<Code>	Description of parameters	Def. value	Def. unit	FW vers.
2 to 255	S-CPICH Channelization Code	7	–	V4.30

Description of command

This command assigns a channelization code to the Secondary Common Pilot Channel.

SOURce:RFGenerator:SCHannel:SCPich:SCODe:SECondary <*Code*>
S-CPICH Secondary Scrambling Code

<Code>>	Description of parameters	Def. value	Def. unit	FW vers.
#H0 to #HF	Secondary scrambling code	#H0	–	V4.30

Description of command

This command defines the secondary scrambling code for the S-CPICH in the downlink RF generator signal. The input of a scrambing code may be in decimal or in hexadecimal format, the latter preceded by #H (as specified in IEEE 488.2). The output is always in hexadecimal format, preceded by #H.

SOURce:RFGenerator:SCHannel:SCPich:PHASe <*Phase*> S-CPICH Phase

<Phase>	Description of parameters	Def. value	Def. unit	FW vers.
0 deg | –45 deg | –90 deg | –135 deg | –180 deg | –225 deg | –270 deg | –315 deg	S-CPICH phase	0	deg	V4.30

Description of command

This command defines the phase of the S-CPICH relative to the P-CPICH phase.

Subsystem RFGenerator:DBCHannel (Dedicated & Broadcast Channels)

The subsystem *RFGenerator:DBCHannel* defines the dedicated and broadcast channel settings. It corresponds to the *Dedicated & Broadcast Channel* section in the *Generator* tab of the popup menu *Connection Control*.

Note: *The command `SOURce:RFGenerator:LREFerence` sets all physical channel levels at once. Using this command is preferable because it allows the instrument to check the consistence of the entire level set and avoid errors during the program sequence.*

SOURce:RFGenerator:DBCHannel:LEVel:PCCPch <*Level*> P-CCPCH Level

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB	P-CCPCH level	–2.0	dB	V3.05
–35 dB to +15 dB | –30 dB to 0 dB | OFF	P-CCPCH level (level reference = P-CPICH) P-CCPCH level (level reference = total channel power)	–2.0 –	dB dB	V3.05 V3.15

Description of command

This command sets the level of the Primary Common Control Physical Channel relative to the P-CPICH level (see command *SOURce:RFGenerator:SCHannel:LEVel:PCPich*) or relative to the total channel power, depending on the *SOURce:RFGenerator:LREFerence* setting. OFF turns the P-CCPCH off (FW vers. ≥ V5.03).

SOURce:RFGenerator:DBCHannel:LEVel:DPDCh <*Level*> DPDCH Level

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | OFF	DPDCH level DPDCH channel switched off	–7.0	dB	V3.05
–35 dB to +15 dB | –30 dB to 0 dB	DPDCH level (level reference = P-CPICH) DPDCH level (level reference = total channel power)	–7.0 –	dB dB	V3.05 V3.15

Description of command

This command sets the level of the Dedicated Physical Data Channel relative to the P-CPICH level (see command *SOURce:RFGenerator:SCHannel:LEVel:PCPich*) or relative to the total channel power, depending on the *SOURce:RFGenerator:LREFerence* setting.

SOURce:RFGenerator:DBCHannel:LEVel:PICH <*Level*> PICH Level

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB	PICH level	–5.0	dB	V3.07
–35 dB to +15 dB | –30 dB to 0 dB | OFF	PICH level (level reference = P-CPICH) PICH level (level reference = total channel power)	–5.0 –	dB dB	V3.07 V3.15

Description of command

This command sets the level of the Page Indicator Channel relative to the P-CPICH level (see command *SOURce:RFGenerator:SCHannel:LEVel:PCPich*) or relative to the total channel power, depending on the *SOURce:RFGenerator:LREFerence* setting. OFF turns the PICH off (FW vers. ≥ V5.03).

SOURce:RFGenerator:DBCHannel:DPDCh:CODE <*Code*> DPDCH Channelization Code

<Code>	Description of parameters	Def. value	Def. unit	FW vers.
2 to 511	DPDCH Channelization Code	2	–	V3.05

Description of command

This command assigns a channelization code to the Dedicated Physical Data Channel. The maximum code number is equal to the spreading factor minus one, which in turn depends on the slot format.

SOURce:RFGenerator:DBCHannel:DPDCh:MODE <*Mode*> — Dedicated Channel Mode

<*Mode*>	Description of parameters	Def. value	Def. unit	FW vers.
TGPP |	3GPP DL reference channel	TGPP	–	V3.05
PHYS |	Physical channel			
DCCH |	3GPP DCCH (DL SRB according to 3GPP TS 34.108)			V3.60
FDPC	Fractional DPCH			V4.20

Description of command

This command defines whether the dedicated channel is configured as a downlink reference channel according to 3GPP TS 25.101 (see section *Subsystem RFGenerator:RCHannel (Reference Channel)* on p. 6.14 ff.), as a physical channel (see section *Subsystem RFGenerator:PCHannel (Physical Channel)* on p. 6.15 ff.), as a 3GPP DL DCCH (see section *Subsystem RFGenerator:DCCH (3GPP DCCH)* on p. 6.16 ff.), or as a fractional DPCH (no extra channel settings).

SOURce:RFGenerator:DBCHannel:PICH:CODE <*Code*> — PICH Channelization Code

<*Code*>	Description of parameters	Def. value	Def. unit	FW vers.
2 to 255	PICH Channelization Code	2	–	V3.07

Description of command

This command assigns a channelization code to the Page Indicator Channel.

SOURce:RFGenerator:DBCHannel:POFFset <*Level*> — Power Offset

<*Level*>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 6.0 dB	DPCCH/DPDCH power offset	0.0	dB	V3.05

Description of command

This command sets the ratio of DPCCH to DPDCH power.

SOURce:RFGenerator:DBCHannel:DPCH:TOFFset <*Offset*> — DL DPCH Timing Offset

<*Offset*>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 149	Timing offset in 256-chip periods (1/10 slot)	0	–	V3.80

Description of command

This command specifies an offset between the DL P-CCPCH timing and the UL DPCH timing.

SOURce:RFGenerator:DBCHannel:DPCH:PREFerence <*Channel*> — DPCH Phase Reference

<*Channel*>	Description of parameters	Def. value	Def. unit	FW vers.
PCP |	P-CPICH	PCP	–	V4.30
SCP	S-CPICH			

Description of command

This command selects the pilot channel that serves as a phase reference for the DPCH.

SOURce:RFGenerator:DBCHannel:TSTate <*Enable*> — TFCI State

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | DTX	TFCI bits present or omitted	ON	–	V3.05

Description of command

This command defines whether or not the downlink physical channel contains any Transport Format Combination Indicator (TFCI) bits.

DEFault:RFGenerator:DBCHannel				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.05
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Subsystem RFGenerator:RCHannel (Reference Channel)

The subsystem *RFGenerator:RCHannel* defines the reference channel. It corresponds to the *3GPP DL Reference Channel* section in the *RF Generator* tab of the popup menu *Connection Control*.

SOURce:RFGenerator:RCHannel:TYPE <*Bit_Rate*>			Reference Channel Type	
<Bit_Rate>	Description of parameters	Def. value	Def. unit	FW vers.
12.2 kbps | 64 kbps | 144 kbps | 384 kbps	Information bit rate	12.2	kbps	V3.05
Description of command				
This command sets the information bit rate of the 3GPP DL Reference Measurement Channel.				

SOURce:RFGenerator:RCHannel:SDTCh <*Sequence*>			Channel Data Source DTCH	
<Sequence>	Description of parameters	Def. value	Def. unit	FW vers.
ALL0 | **ALL1 |** **ALT |** **PR9 | PR11 | PR13 | PR15**	Bit sequence consisting of zeros Bit sequence consisting of ones 010101... bit sequence Pseudo-random bit sequences	PR9	–	V3.05
Description of command				
This command defines the bit pattern transmitted on the Dedicated Traffic Channel.				

SOURce:RFGenerator:RCHannel:SDCCh? <*Sequence*>			Channel Data Source DCCH	
<Sequence>	Description of parameters	Def. value	Def. unit	FW vers.
PREDefined	Fixed, predefined bit pattern	PRED	–	V3.05
Description of command				
This command is always a query and returns the bit pattern transmitted on the Dedicated Control Channel.				

SOURce:RFGenerator:RCHannel:TVALue <*Enable*>			TFCI Value	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 3	TFCI bits	0	–	V3.05
Description of command				
This command defines the Transport Format Combination Indicator (TFCI) bits for the downlink physical channel.				

DEFault:RFGenerator:RCHannel			Default Settings	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.05
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Subsystem RFGenerator:PCHannel (Physical Channel)

The subsystem *RFGenerator:PCHannel* defines the physical channel. It corresponds to the *DL Physical Channel* section in the *RF Generator* tab of the popup menu *Connection Control*.

SOURce:RFGenerator:PCHannel:SFORmat <*Number*>			Slot Format	
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 16	Slot format	11	–	V3.05
Description of command				
This command defines the slot format number for the downlink physical channel.				

SOURce:RFGenerator:PCHannel:DSOurce <*Sequence*>			Data Source	
<Sequence>	Description of parameters	Def. value	Def. unit	FW vers.
ALL0 | **ALL1 |** **ALT |** **PR9 | PR11 | PR13 | PR15**	Bit sequence consisting of zeros Bit sequence consisting of ones 010101... bit sequence Pseudo-random bit sequences	ALT	–	V3.05
Description of command				
This command defines the bit pattern transmitted on the downlink physical channel.				

DEFault:RFGenerator:PCHannel			Default Settings	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.05
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Subsystem RFGenerator:DCCH (3GPP DCCH)

The subsystem *RFGenerator:DCCH* defines the 3GPP DCCH. It corresponds to the *3GPP DL DCCH Channel* section in the *RF Generator* tab of the popup menu *Connection Control*.

SOURce:RFGenerator:DCCH:TYPE <*Bit_Rate*>			DCCH Channel Type	
<Bit_Rate>	Description of parameters	Def. value	Def. unit	FW vers.
K1_7 | K2_5 | K3_4 | K13_6	Data rate 1.7 kbps, 2.5 kbps, 3.4 kbps, 13.6 kbps	K3_4	–	V3.60
Description of command				
This command sets the data rate of the downlink DCCH.				

SOURce:RFGenerator:DCCH:TVALue <*Enable*>			TFCI Value	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
0 | 1 NONE	TFCI 0: empty channel (transport block size 0) TFCI 1: standard DCCH with predefined all 0 sequence No TFCI bits sent, the UE uses BTFD	NONE	–	V3.60
Description of command				
This command defines the Transport Format Combination Indicator (TFCI) bit for the downlink DCCH.				

DEFault:RFGenerator:DCCH			Default Settings	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.60
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Subsystem RFGenerator:TPC (Transmit Power Control)

The subsystem *RFGenerator:TPC* defines the Transmit Power Control information transmitted on the DPCH. It corresponds to the *TPC Settings* section in the *RF Generator* tab of the popup menu *Connection Control*.

SOURce:RFGenerator:TPC:MODE <*Algorithm*>			TPC Algorithm	
<Algorithm>	Description of parameters	Def. value	Def. unit	FW vers.
ALG1 | ALG2	TPC algorithm 1 or 2	ALG2	–	V4.20
Description of command				
This command defines the power control algorithm used to control the UE transmit power.				

SOURce:RFGenerator:TPC:SSIZE <*Step*> TPC Step Size

<Step>	Description of parameters	Def. value	Def. unit	FW vers.
1 dB | 2 dB	TPC step size 1 dB or 2 dB	1	dB	V4.20

Description of command

This command defines the relative power difference of the UE between two consecutive slots if it is commanded to change its output power.

Note: *This command is available if TPC algorithm 1 is used. According to the standard, 1 dB must be set for TPC algorithm 2 (see command* `SOURce:RFGenerator:TPC:MODE`*).*

SOURce:RFGenerator:TPC:PSET <*Setup*> TPC Pattern Setup

<Setup>	Description of parameters	Def. value	Def. unit	FW vers.
SET1 |	Setup 1	SET1	–	V3.40
…	…			
SET5 |	Setup 5			
TA |	Test Step A			V4.20
…				
TH |	Test Step H			
PUP |	Test Step PhD UP			
PDOW	Test Step PhD Down			

Description of command

This command the TPC pattern setup to be used. All setups no. 1 to 5 are defined by the *TPC Pattern Type* (`SOURce:RFGenerator:TPC:PTYPe<nr>`) and the single *Pattern* (`SOURce:RFGenerator:TPC:PATTern<nr>`).

SOURce:RFGenerator:TPC:PTYPe<nr> <*Profile*> Pattern Type

<Profile>	Description of parameters	Def. value	Def. unit	FW vers.
ALT |	Alternating 0,1	see be-	–	V3.05,
ALL0 |	Bit sequence consisting of zeros	low		V3.40
ALL1 |	Bit sequence consisting of ones			(suffix)
CPAT |	Continuous pattern			
SPA0 |	Single pattern + All 0			
SPA1 |	Single pattern + All 1			
SPAL |	Single pattern + Alternating			
CLOP	Closed loop			V4.20

Description of command

This command defines the bit pattern transmitted on the Dedicated Traffic Channel. The single pattern is defined via `SOURce:RFGenerator:TPC:PATTern`; see below. The numeric suffix <nr> = 1 to 5 discriminates between the five different test setups; see `SOURce:RFGenerator:TPC:PSET`.

The default pattern type depends on the test setup:

<nr>	1	2	3	4	5
Pattern Type	CLOP	SPAL	SPAL	CPAT	CPAT

Test steps A to H (FW V4.20 and higher) use the following fixed pattern types:

<nr>	6	7	8	9	10	11	12	13
Pattern Type	SPAL	SPAL	SPAL	SPA1	SPA0	SPA1	SPA0	SPA1

The phase discontinuity patterns (FW V4.20 and higher) use the following fixed pattern types:

<nr>	14	15
Pattern Type	SPAL	SPAL

SOURce:RFGenerator:TPC:PATTern<nr> <*Pattern*> Pattern

<Pattern>	Descr. of parameters	Def. value	Def. unit	FW vers.
"<3 bit to 22 bit sequence>"	Single TPC pattern	<nr> = 1: not used <nr> = 2: "1111111111" <nr> = 3: "0000000000" <nr> = 4: "11111111110000000000" <nr> = 5: "10000010011111011010" <nr> = 6, … 15 : query only (see below)	–	V3.07, V3.40 (suffix), V4.20 (test steps, phase disc.)

Description of command

This command defines the single bit pattern that is used to construct the TPC profile; see command `SOURce:RFGenerator:TPC:PTYpe` above. The numeric suffix discriminates between the five different test setups (<nr> = 1 to 5), 8 different TPC test steps (<nr> = 6 to 13), and two test steps for phase discontinuity measurements (<nr> = 14 to 15); see `SOURce:RFGenerator:TPC:PSET`.

The patterns for the TPC test steps (<nr> = 6 to 13) and for the phase discontinuity measurement (<nr> = 14, 15) are fixed. For these pattern, the command can be used only as a query with the corresponding suffixes <nr> = 6,…, 15.

The query for the test steps A to H returns the following pattern identifiers:

<nr>	**Returned value**	**Meaning**
6	B60P	60-bit 3GPP pattern
7	B50H	50 x 1_{bin}
8	B50L	50 x 0_{bin}
9	'11111111111111111111'	22 x 1_{bin}
10	'00000000000000000000'	22 x 0_{bin}
11	'11111111111111111111'	22 x 1_{bin}
12	'00000000000000000000'	22 x 0_{bin}
13	'11111111111111111111'	22 x 1_{bin}

The query for the phase discontinuity patterns returns the following pattern identifiers:

<nr>	**Returned value**	**Meaning**
14	UP	5 x 11110000_{bin}
15	DOWN	5 x 00001111_{bin}

SOURce:RFGenerator:TPC:RPATtern ON Repeat Pattern

Parameter	Description of parameters	Def. value	Def. unit	FW vers.
ON	Send single TPC pattern	–	–	V3.10

Description of command

This command has no query form. It causes a single TPC pattern (defined via `SOURce:RFGenerator:TPC:PATTern`) to be sent at the next allowed frame boundary; see description in Chapter 4. The command is executed only if one of the pattern types `SPA0`, `SPA1` or `SPAL` is selected (command `SOURce:RFGenerator:TPC:PTYPe`); otherwise the CMU generates the SCPI error no. –200, "Execution Error".

In firmware version V4.20 and higher the command is also used to send a TPC pattern according to test steps A to H or one of the TPC patterns PUP or PDOWn for phase discontinuity measurements; see `SOURce:BSSignal:TPC:PSET`.

SOURce:RFGenerator:TPC:PCONditions <*Mode*>			Test Step Preconditions	
<Mode>	Descr. of parameters	Def. value	Def. unit	FW vers.
MANual | AUTOmatic	Preconditions ignored Preconditions valid	MANual	–	V4.20
Description of command				
This command specifies whether the test step preconditions for test steps A to H, PhD Up/Down are valid.				

CONFigure:RFGenerator:TPC:CURRent? <*Setup*>, <*Type*>, <*Pattern*>			Current TPC Settings	
<Setup>	Description of parameters	Def. value	Def. unit	FW vers.
SET1 | … |SET5 | TA | … | TH | PUP | PDOW	Setup 1 to Setup 5 or Test Step A to Test Step H TPC pattern for phase discontinuity meas.	SET1	–	V4.20
<Type>	Description of parameters	Def. value	Def. unit	
ALT | ALL0 | ALL1 | CPAT | SPA0 | SPA1 | SPAL | CLOP	Pattern type, see `SOURce:RFGenerator:TPC:PTYPe<nr>`	CLOP	–	
<Pattern>	Description of parameters	Def. value	Def. unit	
"<3 bit to 22 bit sequence>"	Single TPC pattern; see `SOURce:RFGenerator:TPC:PATTern<nr>`	'01'	–	
Description of command				
This command queries the current TPC setup or test step, the selected pattern type and single TPC pattern.				

SOURce:RFGenerator:TPC:SEGMentation <*Enable*>			Segmented TPC Patterns	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable segmented patterns	OFF	–	V5.10
Description of command				Sig. State
This command enables or disables segmentation of the TPC test patterns E, G, F, and H.				all

DEFault:RFGenerator:TPC			Default Settings	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.05
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Subsystem UECode (UE Code Channels)

The subsystem *UECode* defines the properties of the uplink WCDMA signal from the UE that the CMU is able to analyze. The subsystem corresponds to the *UE Code* tab in the popup menu *Connection Control*.

CONFigure:UECode:AMODe <*Mode*>				Analysis Mode
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
WOOFfset | WIOFfset	Measurement without origin offset Measurement with origin offset	WIOF	–	V3.00
Description of command				
This command defines whether a possible origin offset is included in the measurement results (WIOFfset) or subtracted out (WOOFfset).				

Subsystem UECode:DPCH (Dedicated Physical Channel)

The subsystem *UECode:DPCH* configures the Dedicated Physical Channel (DPCH) and the conditions for the *WCDMA Modulation* and the *Code Domain Power* measurements. The subsystem corresponds to the *DPCH WCDMA Settings* section in the *UE Code* tab of the popup menu *Connection Control*.

CONFigure:UECode:DPCH:SFORmat <*Number*>				Slot Format
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 5	Slot format number of the UE signal	0	–	V3.05
Description of command				
This command defines the slot format number of the UL DPCCH. Many properties of the DPCCH are given in terms of the slot format number; see table in chapter 4.				

CONFigure:UECode:DPCH:SCODe <*Code*>				Scrambling Code
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
0 to FFFFFF (hex)	Scrambling long code number	0	–	V3.00
Description of command				
This command defines the number of the long code that is used to scramble the WCDMA signal. The input of a scrambling code may be in decimal or in hexadecimal format, the latter preceded by #H (as specified in IEEE 488.2). The output is always in hexadecimal format, preceded by #H.				

CONFigure:UECode:DPCH:SYMode <*Mode*>				Sync. Mode
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ASL | SYNC	*All Slots* sync. mode *Synchronous* mode	ASL	–	V3.00
Description of command				
This command defines whether the slot number is to be deduced from the pilot bits in the captured signal *(ASL)* or assumed to be defined by the `CONFigure:UECode: DPCH:SNUMber` command *(SYNC)*.				

CONFigure:UECode:DPCH:SNUMber <*Slot_No*>			Measurement Slot Number	
<Slot_No>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 14	Measurement slot no. within the frame	0	–	V3.00
Description of command				
This command defines the measured slot number of the captured signal within the 10 ms frame. The value is taken into account in the `CONFigure:UECode:DPCH:SYMode SYNC` setting.				

CONFigure:UECode:DPCH:CMODe <*Mode*>			Correlation Mode	
<Slot_No>	Description of parameters	Def. value	Def. unit	FW vers.
0 | **1**	DPCCH DPCCH + DPDCH	0	–	V3.07
Description of command				
This command defines which DPCH contributions are used for the correlation analysis.				

DEFault:UECode:DPCH			Default Settings	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Subsystem UECode:DPDCh (Dedicated Physical Data Channel)

The subsystem *UECode:DPDCh* configures the Dedicated Physical Data Channels (DPDCH) that contribute to the WCDMA signal. The subsystem corresponds to the *DPDCH Settings* section in the *UE Code* tab of the popup menu *Connection Control*.

CONFigure:UECode:DPDCh:REL6				Release 6
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	DPDCH channel coding according to 3GPP release 6 Channel coding depending on the presence of HSPA channels	OFF	–	V4.50
Description of command				
This command specifies whether the R&S CMU assumes channel coding of the uplink signal according to 3GPP release 6 or release 99, if no HSUPA channels are active.				

CONFigure:UECode:DPDCh:AUTO:SRATe <*Rate*>			DPDCH Symbol Rate	
<Rate>	Description of parameters	Def. value	Def. unit	FW vers.
15 | 30 | 60 | 120 | 240 | 480 | 960	Symbol rate of the DPDCH	960	ksps	V3.00
Description of command				
This command defines the symbol rate of the DPDCH. The setting is taken into account if one of the `CDPower:AUTomatic` applications is active or if the synchronization mode in the `MODulation:WCDMA...` application (command `CONF:MOD:WCDM:DPCH:CONT:CCM`) is set to `AUTomatic`.				

CONFigure:UECode:DPDCh:AUTO:THReshold <*THReshold*> Threshold

<Rate>	Description of parameters	Def. value	Def. unit	FW vers.
–25 dB to +10 dB	Power threshold for each $DPDCH_n$	–3	dB	V3.00

Description of command

This command defines the minimum signal strength of each DPDCH in the WCDMA signal to be detected in the automatic channelization code search. The setting is taken into account if one of the `CDPower:AUTomatic` applications is active or if the synchronization mode in the `MODulation:WCDMA...` application (command `CONF:MOD:WCDM:DPCH: CONT:CCM`) is set to `AUTomatic`.

CONFigure:UECode:DPDCh:MANual:MSIGnal <*Channels*> Multiple Settings

<Channels>	Description of parameters	Def. value	Def. unit	FW vers.
0 |	DPCCH only	1	–	V3.00
1 |	DPCCH + DPDCH1			
2 |	DPCCH + DPDCH1,2			
3 |	DPCCH + DPDCH1,2,3			
4 |	DPCCH + DPDCH1,2,3,4			
5 |	DPCCH + DPDCH1,2,3,4,5			
6	DPCCH + DPDCH1,2,3,4,5,6			

Description of command

This command defines which physical channels that contribute to the WCDMA signal analyzed. The setting is taken into account if one of the `CDPower:MANual` applications is active or if the synchronization mode in the `MODulation:WCDMA...` application (command `CONF:MOD:WCDM:DPCH:CONT:CCM`) is set to `MANual`.

CONFigure:UECode:DPDCh:MANual:DPDCh1:SRCCode <*Rate*>,<*Code*> Symbol Rate/C. Code

<Rate>,<Code> for query	Description of parameters	Def. value	Def. unit	
960,1 | **480,2 |** **240,4 |** **120,8 |** **60,16 |** **30,32 |** **15,64**	$DPDCH_1$ at 960 ksps ... $DPDCH_1$ at 15 ksps	960,1	ksps,–	
<Rate>,<Code> for setting	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
960,1 | **480,1 |** **240,1 |** **120,1 |** **60,1 |** **30,1 |** **15,1**	$DPDCH_1$ at 960 ksps ... $DPDCH_1$ at 15 ksps	960,1	ksps,–	V3.00

Description of command

This command sets the symbol rate for the $DPDCH_1$ contributing to the multiple WCDMA signal. The CMU deduces the channelization code from the symbol rate according to 3GPP specifications. The setting is taken into account if one of the `CDPower:MANual` applications is active or if the synchronization mode in the `MODulation:WCDMA...` application (command `CONF:MOD:WCDM:DPCH:CONT:CCM`) is set to `MANual`.

Note: *If this command is used to set the symbol rate, the <Code> parameter 1 must be entered, otherwise the CMU will return an error message. However, the <Code> parameter is ignored and the CMU will use the channelization code according to 3GPP specifications. The query always returns the actual symbol rate and channelization code of the $DPDCH_1$, even if the analyzed signal contains several DPDCHs (see command `CONFigure:UECode:DPDCh:MANual:MSIGnal` **above**).*

DEFault:UECode:DPDCh			Default Settings	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Subsystem UECode:TPOWer (UL Target Power)

The subsystem *UECode:TPOWer* defines the target power for closed loop transmit power control. The subsystem corresponds to the *UE Power Control – UL Target Power* section in the *UE Code* tab of the popup menu *Connection Control*.

CONFigure:UECode:TPOWer:VALue <*Power*>			UL Target Power	
<Power>	Description of parameters	Def. value	Def. unit	FW vers.
– 50 dBm to +33 dBm	UE target power	–20	dBm	V4.20
Description of command				
This command defines the maximum allowed output power of the UE transmitter. The setting is relevant if the TPC pattern type is set to *Closed Loop* (`SOURce:RFGenerator:TPC:PTYPe<nr> CLOP`).				

CONFigure:UECode:TPOWer:REFerence <*Type*>			UL Target Power Reference	
<Power>	Description of parameters	Def. value	Def. unit	FW vers.
TPOW | DPCC	Total power DPCCH power	TPOW	–	V4.20
Description of command				
This command selects the UL signal contribution that is used as the *UL Target Power* (command `CONFigure:UECode:TPOWer:VALue`).				

DEFault:UECode:TPOWer			Default Settings	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V4.20
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Inputs and Outputs (External Attenuation)

The commands in this section configure the input and output connectors. They correspond to the tab *RF* in the popup menu *Connection Control*.

INPut[:STATe] <*State*> RF Input

<*State*>	Description of parameters	Def. value	Def. unit	FW vers.
RF1 | **RF2 |** **RF4**	Connector RF 1 used as input Connector RF 2 used as input Connector RF 4 IN used as input	RF2	–	V3.00

Description of command

This command determines the connector to be used for RF input signals. The bidirectional connectors RF 1 and RF 2 can be used both as input and output connectors in the same measurement (see `OUTPut[:STATe]`).

Only one input and one output may be active at the same time, a new RF input setting supersedes the previous one.

OUTPut[:STATe] <*State*> RF Output

<*State*>	Description of parameters	Def. value	Def. unit	FW vers.
RF1 | **RF2 |** **RF3**	Connector RF 1 used as output Connector RF 2 used as output Connector RF 3 OUT used as output	RF2	–	V3.00

Description of command

This command determines the connector to be used for RF output signals. The bidirectional connectors RF 1 and RF 2 can be used as input and output connectors in the same measurement (see `INPut[:STATe]`).

Only one input and one output may be active at the same time, a new RF output setting supersedes the previous one.

[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude] <*Attenuation*>
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude] <*Attenuation*> Ext. Att. Input

<*Attenuation*>	Description of parameters	Def. value	Def. unit	FW vers.
–50 dB to +90 dB	Value for external attenuation at the input <nr>, where <nr> = 1,2,4	0.0	dB	V3.00

Description of command

This command assigns an external attenuation value to the inputs of the instrument *(RF 1, RF 2, RF 4 IN)*.

[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude] <*Attenuation*>
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude] <*Attenuation*> Ext. Att. Output

<*Attenuation*>	Description of parameters	Def. value	Def. unit	FW vers.
–50 dB to +90 dB	Value for external attenuation at output <nr>, where <nr> = 1,2,3	0.0	dB	V3.00

Description of command

This command assigns an external attenuation value to the outputs of the instrument *(RF 1, RF 2, RF 3 OUT)*.

OUTPut:AUXTx:OLEVel[:STATe] <*State*> RF Output (Overrange)

<State>	Parameter description	Def. value	Default unit	FW vers.
RF1 | **RF2 |** **RF3**	Connector RF1 used as output Connector RF2 used as output Connector RF3 OUT used as output	RF2	–	V3.80

Command description

This command determines the output connector to be used for the *Overrange* signal, to be selected by means of `SOURce:RFGenerator:TRANsmitter OAUXtx`. The bidirectional connectors RF 1 and RF 2 can be used both as input and output connectors in the same measurement.

Ext. Att. Output (Overrange)

[SENSe:]CORRection:LOSS:OUTPut<nr>:AUXTx:OLEVel[:MAGNitude] <*Absorption*>
SOURce:CORRection:LOSS:OUTPut<nr>:AUXTx:OLEVel[:MAGNitude] <*Absorption*>

<Absorption>	Parameter description	Def. value	Default unit	FW vers.
–50 dB to +90 dB	Value for external attenuation at output <nr>, where <nr> = 1, 2, 3	0.0	dB	V3.80

Command description

This command assigns an external attenuation value to the outputs of the instrument. An external attenuation of x dB increases the Aux Tx Over Range signal level (`SOURce:RFGenerator:OPOWer`) by x dB.

OUTPut:AUXTx[:STATe] <*State*> RF Output (Aux Tx)

<State>	Parameter description	Def. value	Def. unit	FW vers.
RF1 **RF2**	Connector RF1 used as output Connector RF2 used as output	RF2	–	V3.80

Command description

This command determines the output connector to be used for the generated Aux Tx signal, to be selected by means of `SOURce:RFGenerator:TRANsmitter AUXTx`. The bidirectional connectors RF 1 and RF 2 can be used both as input and output connectors in the same measurement.

[SENSe:]CORRection:LOSS:OUTPut<nr>:AUXTx[:MAGNitude] <*Absorption*>
SOURce:CORRection:LOSS:OUTPut<nr>:AUXTx[:MAGNitude] <*Absorption*> Ext. Att. Output (Aux TX)

<Absorption>	Parameter description	Def. value	Default unit	FW vers.
–50 dB to +90 dB	Value for external attenuation at output <nr>, where <nr> = 1,2	0.0	dB	V3.80

Command description

This command assigns an external attenuation value to the outputs of the instrument. An external attenuation of x dB increases the Aux Tx signal level (`SOURce:RFGenerator:OPOWer`) by x dB.

Subsystem DM:CLOCk (Synchronization)

The subsystem *DM:CLOCk* sets a system clock specific to the network. This frequency is set in the tab *Synch.* in the popup menu *Connection Control*.

SOURce:DM:CLOCk:STATe <*Mode*>				REF OUT 2 on/off
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Switch on/off system clock	OFF	–	V3.00
Description of command				
This command switches the system clock specific to the network at the *REF OUT 2* connector on or off.				

SOURce:DM:CLOCk:FREQuency <Frequency>				REF OUT 2
<Frequency>	Description of parameters	Def. value	Def. unit	FW vers.
0.960 MHz to 30.720 MHz	System clock frequency	30.720	MHz	V3.00
Description of command				
This command determines the system clock frequency applied to *REF OUT 2*. The frequency entered is internally rounded to one of the following discrete values: 0.960 0.991 1.024 1.059 1.097 1.138 1.181 1.229 1.280 1.335 1.396 1.463 1.536 1.617 1.706 1.807 1.920 2.028 2.194 2.363 2.560 2.793 3.072 3.143 3.840 4.388 5.120 6.144 7.680 10.240 15.360 30.720				

Subsystem TRIGger (Trigger Mode)

The subsystem *TRIGger* determines the trigger mode. It corresponds to the table section *Trigger* in the *Analyzer* tab of the *Connection Control* menu.

TRIGger[:SEQuence]:SOURce <*Source*> — Source

<*Source*>	Description of parameters	Def. value	Def. unit	FW vers.
FRUN |	Trigger by measured timing of the analyzed input signal	FRUN	–	V3.00
EXTern |	External trigger signal via AUX3			
IFPower |	Narrow-band IF power trigger			
INTern |	Internal trigger signal provided by RF generator			V3.05
SLOT |	UL slot trigger			V3.80
FRAMe |	UL frame trigger			
TPC |	Trigger at the beginning of each TPC pattern			
HSDPcch |	HS-DPCCH trigger			
AUTO	Automatic trigger selection according to the meas. application			

Description of command

This command selects the source of the trigger event. The *INTernal, SLOT, FRAMe, TPC,* and *AUTO* trigger signals are available with option CMU-K66, *WCDMA (3GPP/FDD, DL) Generator,* only.

TRIGger[:SEQuence]:DELay <*Slot_Delay*> , <*Delay_Offset*> — Slot Delay, Delay Offset

<*Slots*>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 14,	No. of slots between trigger time and measurement	0	(slots)	V3.05
–10239 to +10239	No of chips between trigger time and measurement (in multiples of ¼ chip periods, i.e. –2559.75 chips to +2559.75 chips)	0	(1/4 chips)	

Description of command

This command defines a delay time (integer number of slots plus additional delay offset) between the trigger time and the start of the measurement. The settings are ignored for free-run measurements (see command *TRIGger[:SEQuence]:SOURce*).

TRIGger[:SEQuence]:THReshold:IFPower <*Threshold*> — Level – IF Power

<*Threshold*>	Parameter description	Def. value	Default unit	FW vers.
–47 dB to 0 dB	IF power threshold	–26	dB	V3.50

Command description

This command sets the IF signal level at which the measurement is triggered. The IF power threshold is defined relative to the maximum RF input level; see `[SENSe:]LEVel:MAXimum`. The setting has effect for trigger source `IFPower` only (see `TRIG:SEQ:SOUR`).

TRIGger[:SEQuence]:SLOPe <*Slope*> — Slope

<*Slope*>	Parameter description	Def. value	Default unit	FW vers.
POSitive |	Rising edge	POS	–	V3.50
NEGative	Falling edge			

Command description

This command qualifies whether the trigger event occurs on the *Rising Edge* or on the *Falling Edge* of the trigger signal. The setting has no influence on *Free Run* measurements (see `TRIG:SEQ:SOUR`).

TRIGger[:SEQuence]:HOFF *<Holdoff>*				Holdoff
<Slots>	Description of parameters	Def. value	Def. unit	FW vers.
1 µs to 50 µs | OFF	Holdoff time (in 1 µs steps) No trigger holdoff	OFF	µs	V4.20
Description of command				
This command defines a holdoff time (in µs) after each trigger event during which the trigger system is locked so that the R&S generates no further trigger events. The setting is effective for *IF Power* or *External* trigger source (see command `TRIGger[:SEQuence]:SOURce`).				

DEFault:TRIGger[:SEQuence]				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Common Measurements and Command Groups

The commands for the measurement groups in this section are identical or almost identical in both test modes. Minor differences between *Non Signalling* and *Signalling* commands are possible; they will be pointed out throughout the section.

Note: ***Measurements and signalling states***

To perform any kind of measurement and obtain a meaningful result, an appropriate test setup is required (see application examples in chapter 2 of this manual). Consequently, if the measurements reported in this section are performed in Signalling mode, the Connected (CEST) signalling state must be reached before any of the commands retrieving test results `(READ...?, FETCh...?, SAMPle...?,` or `CALCulate...LIMit?)` *can be used. Test configurations, however, can be defined any time.*

Configuration File Management – System MMEMory

The `MMEMory` system provides mass storage capabilities for the CMU. The functionality of this system is included in the *Data* menu; see CMU200/300 operating manual.

The mass storage of the CMU may be internal or external. The internal mass storage device is a section on the internal hard disk that is reserved for mass storage (directory c:\temp). The external mass storage device is either a floppy disk or a PCMCIA memory card, depending on the instrument configuration. The *<msus>* (mass storage unit specifier) parameter in the `MMEMory` commands denotes the root directory of the *INTernal* or *EXTernal* mass storage device.

The <FileName> parameter is a string. The contents of the string may contain characters for specifying subdirectories, e.g. "\TEMP\TRASH\test.txt" for the file named *test.txt* in the *TEMP\TRASH* subdirectory of the root directory or "TEMP\TRASH\test.txt" for the file named *test.txt* in the *TEMP\TRASH* subdirectory of the current directory, to be queried with the base system command `MMEMory:DIRectory [:CURRent]?`. The file name itself may contain the period as a separator for extensions.

MMEMory:SAVE:CURRent *<FileName> [,<msus>]*

Save configurations in current function group and test mode

Parameters	Parameter description	Def. value	Def. unit	FW vers.
"<FileName>",	Name of the config. file to be created	–	–	V3.15
INTernal | EXTernal	Storage device of the config. file	INTernal	–	

Description of command	Sig. State
This command saves the configuration of the current function group and test mode to a configuration file. A "?" in the specified file name will be replaced by current numbers that are automatically incremented, starting with zero. The auto-increment function overwrites an existing file with a "9" in its file name. For instrument settings that may be different in manual and remote control (e.g. the repetition mode for many measurements) the manual setting is saved. The command is available in all function groups. This command is CMU-specific.	all

MMEMory:RECall:CURRent *<FileName> [,<msus>]*

Recall configurations in current function group and test mode

Parameters	Parameter description	Def. value	Def. unit	FW vers.
"<FileName>",	Name of the config. file to be recalled	–	–	V3.15
INTernal | EXTernal	Storage device of the config. file	INTernal	–	
Description of command				Sig. State
This command recalls the configuration of the current function group and test mode from a configuration file. The command is available in all function groups. This command is CMU-specific.				all

Option Query

The *Options* subsystem contains the commands for querying information on the instrument and the available options. It corresponds to the *Options* tab in the *Setup* menu opened via the *SETUP* key on the front panel.

SYSTem:OPTions:INFO:CURRent? Device Info

Response	Def. value	Default unit	FW vers.
Example: Rohde&Schwarz,CMU 200-1100.0008.02,840675/018, V3.10C:SP02 2002-10-25"WCDMA19UEFDD_Sig"	–	–	V3.15
Description of command			Sig. State
This command returns the information on the device comprising the manufacturer, model, serial number and firmware version of the current function group. This command is always a query.			all

Partial Reset

The `RESet` subsystem restores the (factory) default values for the current function group and test mode. It is similar to the *Reset* menu opened via the *RESET* key on the front panel.

SYSTem:RESet:CURRent Partial Reset

Command description	FW vers.
This command sets all parameters of the current function group and test mode to default values. The command is available in all function groups. In contrast to the *Reset* menu the command restores the default values defined for remote control operation. In cases where remote and manual control use distinct settings (e.g. the repetition mode for many measurements), the manual control settings are left unchanged.	V3.15 Sig. State all

I/Q-IF Interface

The subsystem *IQIF* configures the signal paths for I/Q and IF signals provided by option CMU-B17, *I/Q and IF Interfaces*. It corresponds to the *I/Q-IF* tab of the *Connection Control* menu.

Hint: *How to make sense out of parameter names*

In all path configurations except bypass, both the I/Q and IF output are connected (to either the RF Unit, the Digital Unit or one of the I/Q-IF inputs). The paths differ in the connection of the input branches: The qualifier IO denotes a connected input (with connected output), XO denotes a disconnected input (with connected output). Many parameters of the IQIF commands are composed of two IO/XO qualifiers, the first one standing for the IF signal, the second for the I/Q signal.

Example: *The parameter IOXO denotes a connected IF input and a disconnected IF output, while both output branches are connected.*

For more information see Chapter 4 and the application examples in the CMU200/300 operating manual.

CONFigure:IQIF:RXTXcombined <*Scenario*> I/Q-IF

<Scenario>	Description of parameters	Def. value	Def. unit	FW vers.
BYP	RX/TX Bypass, `RXPath = BYP, TXPath = BYP`	BYP	–	V3.15
BYIQ	Bypass w. I/Q-OF OUT, `RXPath = TXPath =BYIQ`			
XOIO	I/Q IN/OUT, `RXPath = TXPath = XOIO`			
IOIO	IF IN_I/Q IN/OUT, `RXPath = TXPath = IOIO`			
IOXO	IF IN/OUT, `RXPath = TXPath = IOXO`			
FPAT	Fading Path, `RXPath = BYP, TXPath = XOIO`			
UDEF	User-defined scenario, can not be set but may be returned by the query `CONF:IQIF:RXTX?`			

Description of command

This command selects the I/Q-IF test scenario, overwriting the current RX and TX path settings (see commands `CONFigure:IQIF:RXPath` and `CONFigure:IQIF:TXPath` below). Six different predefined test scenarios with fixed RX and TX path are provided. Additional scenarios may be defined by selecting any other combination of RX and RX paths.

Note: *`UDEF` is not provided as a setting parameter. If the RX/TX path combination defined via `CONFigure:IQIF:RXPath` and `CONFigure:IQIF:TXPath` doesn't correspond to any of the predefined scenarios, then a user-defined scenario is set implicitly, i.e. the query `CONF:IQIF:RXTX?` returns the value `UDEF`.*

CONFigure:IQIF:RXPath <*Path*> RX Path

<Path>	Description of parameters	Def. value	Def. unit	FW vers.
BYP	Bypass	BYP	–	V3.15
BYIQ	Bypass w. I/Q-IF OUT			
XOIO	I/Q IN/OUT			
IOIO	IF IN_I/Q IN/OUT			
IOXO	IF IN/OUT			

Description of command

This command selects the RX signal path, leaving the TX path (see command `CONFigure:IQIF:TXPath` below) unchanged but adapting the I/Q-IF test scenario to the new RX/TX path combination: If the combination corresponds to a predefined scenario, then `CONFigure:IQIF:RXTXcombined` is set to the predefined scenario; otherwise it is set to `UDEF`.

CONFigure:IQIF:TXPath <*Path*> TX Path

<*Path*>	Description of parameters	Def. value	Def. unit	FW vers.
BYP	Bypass	BYP	–	V3.15
BYIQ	Bypass w. I/Q-IF OUT			
XOIO	I/Q IN/OUT			
IOIO	IF IN_I/Q IN/OUT			
IOXO	IF IN/OUT			

Description of command

This command selects the TX signal path, leaving the RX path (see command `CONFigure:IQIF:RXPath` above) unchanged but adapting the I/Q-IF test scenario to the new RX/TX path combination: If the combination corresponds to a predefined scenario, then `CONFigure:IQIF:RXTXcombined` is set to the predefined scenario; otherwise it is set to `UDEF`.

[SENSe:]IQIF:IFLevel? <*TX Level*> IF Level

<*TX Level*>	Description of parameters	Def. value	Def. unit	FW vers.
< 0 dB	IF level	NAN	dB	V3.40

Description of command

This command is always a query and returns the IF output level in the TX path relative to the maximum IF output level (PEP) quoted in the data sheet. The value is equal to the I/Q output level in the TX path relative to the maximum I/Q output voltage quoted in the data sheet.

[SENSe:]IQIF:ATTenuation <*Attenuation*> IF Level Attenuation

<*TX Level*>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 30.0 dB	IF level attenuation	0.0	dB	V4.10

Description of command

This command controls the IF output level in the TX path.

DEFault:IQIF <Enable> Default Settings

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	The parameters are set to their default values	ON	–	V3.40
OFF	Some or all parameters differ from the default values			

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message).

If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.

POWer Measurements

The subsystem *POWer* measures the peak and RMS-averaged power of the received RF carrier signal and the inner loop Transmit Power Control (TPC) of the UE. The subsystem corresponds to the measurement menu *Power* and the associated popup menu *Power Configuration.*

The power can be measured under various operating conditions of the UE. In manual control, these operating conditions correspond to the different applications of the *Power* measurement. In remote control, the applications are distinguished by the third-level keywords in the `POWer` commands:

- The third-level keyword `MAXimum` denotes the *Maximum Power* application.
- The third-level keyword `MINimum` denotes the *Minimum Power* application.
- The third-level keyword `OFF` denotes the *OFF Power* application.
- The third-level keyword `ILTPc` denotes the *Inner Loop TPC* application.

The command syntax is similar for the first three applications, so they will be described in common sections. The *Inner Loop TPC* application is described in section *POWer:ILTPc* on p. 6.42.

POW:MAX, POW:MIN, POW:OFF

The subsystems *`POWer:MAXimum`*, *`POWer:MINimum`*, *`POWer:OFF`* test transmitter output power of the UE under maximum power, minimum power and off power conditions. The subsystems correspond to the measurement menu *Power,* applications *Maximum Power, Minimum Power, Off Power,* and the sections in the popup menu *Power Configuration* that are related to these applications.

Control of Measurement – Subsystems POWer...

The subsystems *POWer:...* controls the power measurement.

INITiate:POWer:MAXimum	Start new measurement	⇒ *RUN*
ABORt:POWer:MAXimum	Abort running measurement and switch off	⇒ *OFF*
STOP:POWer:MAXimum	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:POWer:MAXimum	Next measurement step (only *stepping mode*)	⇒ *RUN*
INITiate:POWer:MINimum	Start new measurement	⇒ *RUN*
ABORt:POWer:MINimum	Abort running measurement and switch off	⇒ *OFF*
STOP:POWer:MINimum	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:POWer:MINimum	Next measurement step (only *stepping mode*)	⇒ *RUN*
INITiate:POWer:OFF	Start new measurement	⇒ *RUN*
ABORt:POWer:OFF	Abort running measurement and switch off	⇒ *OFF*
STOP:POWer:OFF	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:POWer:OFF	Next measurement step (only *stepping mode*)	⇒ *RUN*

Description of command	FW vers.
These commands have no query form. They start and stop the power measurement with a particular application, setting it to the status indicated in the top right column.	V3.00

CONFigure:POWer:MAXimum:EREPorting <*Mode*> Event Reporting
CONFigure:POWer:MINimum:EREPorting <*Mode*>
CONFigure:POWer:OFF:EREPorting <*Mode*>

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.00
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:POWer:MAXimum:STATus? Measurement Status
FETCh:POWer:MINimum:STATus?
FETCh:POWer:OFF:STATus?

Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.00
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle	NONE	–	
NONE,	No counting mode set			
1 to 1000 |	Counter for current evaluation period within a cycle	NONE	–	
NONE	Statistic count set to off			

Description of command

These commands are always queries. They return the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems determine the parameters of the power measurement. They correspond to the *Power Configuration* popup menu. For a detailed explanation of the power tolerances defined in the 3GPP standard see Chapter 4.

Subsystem POWer:...CONTrol

The subsystem *POWer:...CONTrol* defines the repetition mode, statistic count, and stop condition of the *Power* measurement. These settings are provided in the *Control* tab in the popup menu *Power Configuration.*

CONFigure:POWer:MAXimum:CONTrol:STATistics <*Statistics*> Measurement Statistics
CONFigure:POWer:MINimum:CONTrol:STATistics <*Statistics*>
CONFigure:POWer:OFF:CONTrol:STATistics <*Statistics*>

<*Statistics*>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 | **NONE**	Number of evaluation periods per statistics cycle Statistics off (equivalent to 1)	10	–	≥3.0

Description of command

This command defines the number of slots forming a statistics cycle.

CONFigure:POWer:MAXimum:CONTrol:REPetition <*Repetition*>,<*StopCond*>,<*Stepmode*> Test Cycles
CONFigure:POWer:MINimum:CONTrol:REPetition <*Repetition*>,<*StopCond*>,<*Stepmode*>
CONFigure:POWer:OFF:CONTrol:REPetition <*Repetition*>,<*StopCond*>,<*Stepmode*>

<*Repetition*>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** 1 to 10000,	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<*StopCond*>	Description of parameters	Def. value	Def. unit	
SONerror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<*Stepmode*>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.00

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:POWer:MAXimum:TPControl <*Mode*> Power Control
CONFigure:POWer:MINimum:TPControl <*Mode*>

<*Mode*>	Desciption of parameters	Def. value	Def. unit	FW vers.
AUTO | **MANual**	Automatic setting of max. and min. power Manual setting; select appropriate TPC pattern	AUTO	–	V3.40

Description of command

These commands qualify by which mechanism the UE transmitter is set to transmit at its minimum or maximum power.

DEFault:POWer:MAXimum:CONTrol <*Enable*> Default Settings
DEFault:POWer:MINimum:CONTrol <*Enable*>
DEFault:POWer:OFF:CONTrol <*Enable*>

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

DEFault:POWer:CONTrol <*Enable*> Default Settings

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the `POWer...:CONTrol` subsystem including all applications to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem POWer:MAXimum:...LIMit

The subsystem *POWer:MAXimum...LIMit* defines the limits for the *Maximum Power* application. The subsystem corresponds to the *Maximum Power* section in the *Limits* tab of the popup menu *Power Configuration.*

CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:UPPer:VALue
<*Upper_Limit_Peak*>,<*Upper_Limit_RMS*> Upper Limits, Current & Max/Min

<*Upper_Limit_Peak*>	Description of parameters	Def. value	Def. unit	
0.0 dB to 5.0 dB	Upper limit for UE Power (Peak)	2.0	dB	
<*Upper_Limit_RMS*>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 5.0 dB	Upper limit for UE Power (RMS)	2.0	dB	V3.00

Description of command

This command defines the upper limits for the peak and RMS-averaged UE output power calculated for the *Current* slot as well as for the *Maximum* and *Minimum* of several consecutive slots (`CMMax` keyword; compare the commands `CONFigure:POWer: MAXimum:AVERage...` reported below). The keyword `MAXimum` in the command denotes the *Maximum Power* application.

CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:LOWer:VALue
<*Lower_Limit_Peak*>,<*Lower_Limit_RMS*> Lower Limits, Current & Max/Min

<*Lower_Limit_Peak*>	Description of parameters	Def. value	Def. unit	
–5.0 dB to 0.0 dB	Lower limit for UE Power (Peak)	–2.0	dB	
<*Lower_Limit_RMS*>	Description of parameters	Def. value	Def. unit	FW vers.
–5.0 dB to 0.0 dB	Lower limit for UE Power (RMS)	–2.0	dB	V3.00

Description of command

This command defines the lower limits for the peak and RMS-averaged UE output power calculated for the *Current* slot as well as for the *Maximum* and *Minimum* of several consecutive slots (`CMMax` keyword; compare the commands `CONFigure:POWer: MAXimum:AVERage...` reported below). The keyword `MAXimum` in the command denotes the *Maximum Power* application.

CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:RVALue
<Rated_Value_Peak>,<Rated_Value_RMS> Rated Values, Current & Max/Min

<Rated_Value_Peak>	Description of parameters	Def. value	Def. unit	
–60.0 dBm to +53.0 dBm	Rated value for UE Power (Peak)	+21.0	dBm	
<Rated_Value_RMS>	Description of parameters	Def. value	Def. unit	FW vers.
–60.0 dBm to +53.0 dBm	Rated value for UE Power (RMS)	+21.0	dBm	V3.00

Description of command

This command defines the rated values for the peak and RMS-averaged UE output power calculated for the *Current* slot as well as for the *Maximum* and *Minimum* of several consecutive slots (`CMMax` keyword; compare the commands `CONFigure:POWer: MAXimum:AVERage...` reported below). The keyword `MAXimum` in the command denotes the *Maximum Power* application.

CONFigure:POWer:MAXimum:AVERage:LIMit[:SCALar]:ASYMmetric:UPPer:VALue
<Upper_Limit_Peak>,<Upper_Limit_RMS> Upper Limits, Average

<Upper_Limit_Peak>	Description of parameters	Def. value	Def. unit	
0.0 dB to 5.0 dB	Upper limit for UE Power (Peak)	2.0	dB	
<Upper_Limit_RMS>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 5.0 dB	Upper limit for UE Power (RMS)	2.0	dB	V3.00

Description of command

This command defines the upper limits for the peak and RMS-averaged UE output power calculated for the *Average* of several consecutive slots (`AVERage` keyword; compare the commands `CONFigure:POWer:MAXimum:CMMax...` reported above). The keyword `MAXimum` in the command denotes the *Maximum Power* application.

CONFigure:POWer:MAXimum:AVERage:LIMit[:SCALar]:ASYMmetric:LOWer:VALue
<Lower_Limit_Peak>,<Lower_Limit_RMS> Lower Limits, Average

<Lower_Limit_Peak>	Description of parameters	Def. value	Def. unit	
–5.0 dB to 0.0 dB	Lower limit for UE Power (Peak)	–2.0	dB	
<Lower_Limit_RMS>	Description of parameters	Def. value	Def. unit	FW vers.
–5.0 dB to 0.0 dB	Lower limit for UE Power (RMS)	–2.0	dB	V3.00

Description of command

This command defines the lower limits for the peak and RMS-averaged UE output power calculated for the *Average* of several consecutive slots (`AVERage` keyword; compare the commands `CONFigure:POWer:MAXimum:CMMax...` reported above). The keyword `MAXimum` in the command denotes the *Maximum Power* application.

CONFigure:POWer:MAXimum:AVERage:LIMit[:SCALar]:ASYMmetric:RVALue
<Rated_Value_Peak>,<Rated_Value_RMS> Rated Values, Average

<Rated_Value_Peak>	Description of parameters	Def. value	Def. unit	
–60.0 dBm to +53.0 dBm	Rated value for UE Power (Peak)	+21.0	dBm	
<Rated_Value_RMS>	Description of parameters	Def. value	Def. unit	FW vers.
–60.0 dBm to +53.0 dBm	Rated value for UE Power (RMS)	+21.0	dBm	V3.00

Description of command

This command defines the rated values for the peak and RMS-averaged UE output power calculated for the *Average* of several consecutive slots (`AVERage` keyword; compare the commands `CONFigure:POWer:MAXimum:CMMax...` reported above). The keyword `MAXimum` in the command denotes the *Maximum Power* application.

DEFault:POWer:MAXimum:LIMit Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystems POWer:MINimum:...LIMit and POWer:OFF...LIMit

The subsystems *POWer:MINimum...LIMit* and *POWer:OFF...LIMit* define the limits for the *Minimum Power* and *Off Power* applications, respectively. The subsystems correspond to the *Minimum Power* and *Off Power* sections in the *Limits* tab of the popup menu *Power Configuration.*

CONFigure:POWer:MINimum:CMAX:LIMit[:SCALar]:SYMmetric[:COMBined]:VALue
<Upper_Limit_Peak>,<Upper_Limit_RMS>
CONFigure:POWer:OFF:CMAX:LIMit[:SCALar]:SYMmetric[:COMBined]:VALue
<Upper_Limit_Peak>,<Upper_Limit_RMS> Upper Limits, Current & Max

<Upper_Limit_Peak>	Description of parameters	Def. value	Def. unit	
–60.0 dBm to +53.0 dBm	Upper limit for UE Power (Peak)	–50.0 (MINimum) –56.0 (OFF)	dBm dBm	
<Upper_Limit_RMS>	Description of parameters	Def. value	Def. unit	FW vers.
–60.0 dBm to +53.0 dBm	Upper limit for UE Power (RMS)	–50.0 (MINimum) –56.0 (OFF)	dBm dBm	V3.00

Description of command

These commands define the upper limits for the peak and RMS-averaged UE output power calculated for the *Current* slot as well as for the *Maximum* of several consecutive slots (CMAX keyword; compare the commands CONFigure:POWer:MINimum:AVERage... reported below). The keywords MINimum and OFF in the commands denote the *Minimum Power* and *Off Power* applications, respectively.

CONFigure:POWer:MINimum:AVERage:LIMit[:SCALar]:SYMmetric[:COMBined]:VALue
<Upper_Limit_Peak>,<Upper_Limit_RMS>
CONFigure:POWer:OFF:AVERage:LIMit[:SCALar]:SYMmetric[:COMBined]:VALue
<Upper_Limit_Peak>,<Upper_Limit_RMS> Upper Limits, Average

<Upper_Limit_Peak>	Description of parameters	Def. value	Def. unit	
–60.0 dBm to +53.0 dBm	Upper limit for UE Power (Peak)	–50.0 (MINimum) –56.0 (OFF)	dBm dBm	
<Upper_Limit_RMS>	Description of parameters	Def. value	Def. unit	FW vers.
–60.0 dBm to +53.0 dBm	Upper limit for UE Power (RMS)	–50.0 (MINimum) –56.0 (OFF)	dBm dBm	V3.00

Description of command

These commands define the upper limits for the peak and RMS-averaged UE output power calculated for the *Average* of several consecutive slots (AVERage keyword; compare the commands CONFigure:POWer:MINimum:CMAX... reported above). The keywords MINimum and OFF in the commands denote the *Minimum Power* and *Off Power* applications, respectively.

DEFault:POWer:MINimum:LIMit
DEFault:POWer:OFF:LIMit
Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

DEFault:POWer:LIMit
Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the `POWer...:LIMit` subsystem including all applications `(MINimum, MINimum, OFF)` to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystem POWer...?

The subsystem *POWer...?* measures and returns the results of the signal power measurement. They correspond to the measurement menu *Power* with its various display elements.

	Scalar results:
READ[:SCALar]:POWer:MAXimum?	Start single shot measurement and return results
FETCh[:SCALar]:POWer:MAXimum?	Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:MAXimum?	Read out measurement results (synchronized)
READ[:SCALar]:POWer:MINimum?	Start single shot measurement and return results
FETCh[:SCALar]:POWer:MINimum?	Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:MINimum?	Read out measurement results (synchronized)
READ[:SCALar]:POWer:OFF?	Start single shot measurement and return results
FETCh[:SCALar]:POWer:OFF?	Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:OFF?	Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
UE Power (Peak): Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	V3.00
UE Power (Peak): Average,	–100.0 dBm to +60.0 dBm	NAN	dBm	
UE Power (Peak): Maximum,	–100.0 dBm to +60.0 dBm	NAN	dBm	
UE Power (RMS): Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	
UE Power (RMS): Average,	–100.0 dBm to +60.0 dBm	NAN	dBm	
UE Power (RMS): Maximum,	–100.0 dBm to +60.0 dBm	NAN	dBm	
UE Power (RMS): Minimum[1]**,**	–100.0 dBm to +60.0 dBm	NAN	dBm	
Out of Tolerance	0.0 % to 100.0 %	INV	– %	

Description of command

These commands are always queries. They start a `POWer` measurement and/or return all scalar measurement results (see also description of measurement control in Chapter 5 of the CMU200/300 manual). The calculation of results is described in section *Averaging and Statistical Evaluation* in Chapter 3.

Note: The value *UE Power (RMS), Minimum* is returned in the `MAXimum` application only. It is omitted in the output strings for the `MINimum` and `OFF` commands.

CALCulate[:SCALar]:POWer:MAXimum:MATChing:LIMit? Limit Matching
CALCulate[:SCALar]:POWer:MINimum:MATChing:LIMit?
CALCulate[:SCALar]:POWer:OFF:MATChing:LIMit?

Returned values	Value range	Def. value	Def. unit	FW vers.
UE Power (Peak): Current,	NMAU | NMAL | INV | OK	INV	–	V3.00
UE Power (Peak): Average,	NMAU | NMAL | INV | OK	INV	–	
UE Power (Peak): Maximum,	NMAU | NMAL | INV | OK	INV	–	
UE Power (RMS): Current,	NMAU | NMAL | INV | OK	INV	–	
UE Power (RMS): Average,	NMAU | NMAL | INV | OK	INV	–	
UE Power (RMS): Maximum,	NMAU | NMAL | INV | OK	INV	–	
UE Power (RMS): Minimum[1]	NMAU | NMAL | INV | OK	INV	–	

Description of command

These commands are always queries. They indicate whether and in which way the tolerances for the peak and RMS-averaged signal power have been exceeded.

The following messages may be output for all values:

NMAU	Tolerance value underflow	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

Note 1: The value *UE Power (RMS), Minimum* is returned in the `MAXimum` application only. It is omitted in the output strings for the `MINimum` and `OFF` commands.

POWer:ILTPc

The subsystem `POWer:ILTPc` tests the inner loop Transmit Power Control (TPC) of the UE. The subsystem corresponds to the measurement menu *Power,* application *Inner Loop TPC,* and the sections in the popup menu *Power Configuration* that are related to the *Inner Loop TPC* application.

Control of Measurement – Subsystem POWer:ILTPc

The subsystem *POWer:ILTPc* controls the inner loop TPC measurement. It corresponds to the *Inner Loop TPC* softkey in the measurement menu *Power*.

INITiate:POWer:ILTPc	Start new measurement	⇒	*RUN*
ABORt:POWer:ILTPc	Abort running measurement and switch off	⇒	*OFF*
STOP:POWer:ILTPc	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:POWer:ILTPc	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V3.05

CONFigure:POWer:ILTPc:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.05
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:POWer:ILTPc:STATus? Measurement Status

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE	No counting mode set	NONE	–	V3.05

Description of command

This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Inner Loop TPC* measurement. They correspond to the sections in the popup menu *Power Configuration* that are related to the *Inner Loop TPC* application.

Subsystem POWer:ILTPc:CONTrol

The subsystem *POWer:ILTPc:CONTrol* configures the scope of the measurement. It corresponds to the *Control* tab in the popup menu *Power Configuration*.

CONFigure:POWer:ILTPc:CONTrol:RMODe <*Mode*> — Result Mode

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SCALar | ARRay	Scalar values only (incl. limit matching) Scalar measured values and arrays	ARRay	–	V3.00

Description of command

This command specifies the type of measured values.

CONFigure:POWer:ILTPc:CONTrol:REPetition <*Repetition*>,<*StopCond*>,<*Stepmode*> — Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | SINGleshot | 1 to 10000,	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror | NONE,	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | NONE	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.05

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:POWer:ILTPc:CONTrol:TPCControl Profile Length, Step Size, TPC Mode (Non Sig.)
<ProfileLength>, <StepSize>, <TPCMode>

<ProfileLength>	Description of parameters	Def. value	Def. unit	
7 | 10,	No. of power steps to be measured	10	(slots)	
<StepSize>	**Description of parameters**	**Def. value**	**Def. unit**	
1 dB | 2 dB | 3 dB,	Power step size	1	dB	
<TPCMode>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
ALG1 | ALG2 | OFF	Power control algorithm	OFF	–	V3.05

Description of command

This command selects the profile length in section A and B of the diagram, the step size between two consecutive power levels and the power control algorithm of the UE.

Note: *This command is available in Non Signalling mode only. In Signalling mode, the TPC Mode and the Step Size are taken from signalling; the profile length is set by means of* `CONFigure:POWer:ILTPc:CONTrol:PLENgth`.

CONFigure:POWer:ILTPc:CONTrol:PLENgth Profile Length (Signalling)
<ProfileLength>

<ProfileLength>	Description of parameters	Def. value	Def. unit	FW vers.
7 | 10	No. of power steps to be measured	10	(slots)	V3.15

Description of command

This command selects the profile length in section A and B of the diagram.

Note: *This command is available in Signalling mode only. In Non Signalling mode, the TPC Mode and the Step Size must be set in addition; they are defined together with the profile length by means of* `CONFigure:POWer:ILTPc:CONTrol:TPCControl`.

CONFigure:POWer:ILTPc:CONTrol:SANalysis <*Quantity*> Step Analysis

<Quantity>	Description of parameters	Def. value	Def. unit	FW vers.
PST |	Power steps measured	PST	–	V3.05
PSTA |	Absolute power steps measured			
PSTE	Power step errors measured			

Description of command

This command selects the quantity to be measured and returned by the *READ:ARRay:POWer:ILTPc:STEP:CURRent?* etc. commands.

CONFigure:POWer:ILTPc:CONTrol:BSECtion <*Enable*> Section B Analysis
<ProfileLength>, <StepSize>, <TPCMode>

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable measurement in section B	OFF	–	V3.05

Description of command

This command switches the measurement in the second profile length (section B) on or off. Section B can not be enabled while the TPC mode is set to off; see command *CONFigure:POWer:ILTPc:CONTrol:TPCControl*.

CONFigure:POWer:ILTPc:CONTrol:TPCProfile:ALG<nr> <*Enable*> <*ProfileLength*>, <*StepSize*>, <*TPCMode*> Step Control – Section A

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
0 | 1,	Step Control, Slot 0 –> 1	1	–	
...,				
0 | 1	Step Control, Slot 9 –> 10	1	–	V3.07

Description of command

This command defines the TPC command values for the 10 power steps that can be displayed in section A. The numeric suffix numbers the two TPC modes *Algorithm 1* and *Algorithm 2;* see command CONFigure:POWer:ILTPc:CONTrol:TPCControl.

CONFigure:POWer:ILTPc:COTFc:CONTrol:MODE <*Meas. Mode*> Measure Mode

<Meas. Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ILTPc |	Inner Loop TPC	ILTPc	–	V5.10
COTFc	Change of TPC			

Description of command

This command selects the measurement mode of the *Inner Loop TPC* application.

DEFault:POWer:ILTPc:CONTrol <*Enable*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	The parameters are set to default values	ON	–	V3.05
OFF	Some or all parameters differ from the default values			

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem POWer:ILTPc:...LIMit

The subsystem *POWer:ILTPc:...LIMit* defines the limits for the *Inner Loop TPC* measurement. The subsystem corresponds to the *Inner Loop TPC* section in the *Limits* tab of the popup menu *Power Configuration.*

CONFigure:POWer:ILTPc:THReshold:CURRent:LIMit[:SCALar]: ASYMmetric[:COMBined]:VALue <*MaxThreshold*>,<*MinThreshold*> Max. Threshold, Min. Threshold

<MaxThreshold>	Description of parameters	Def. value	Def. unit	
+10.0 dBm to +40.0 dBm	Upper limit of power control range	+19.0	dBm	
<MinThreshold>	Description of parameters	Def. value	Def. unit	FW vers.
–70.0 dBm to –30.0 dBm	Lower limit of power control range	–50.0	dBm	V3.05

Description of command

This command sets the upper and lower limits of the power control range *(Max. Threshold and Min. Threshold* values). The lower (upper) individual power step limits and all average power step limits (see commands below) are ignored in the output power range above *Max. Threshold* (below *Min. Threshold)*.

CONFigure:POWer:ILTPc:STEP:CURRent:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue *<Ind_0dB>, <Ind_1dB>, <Ind_2dB>, <Ind_3dB>, <7Slot_0dB>, <7Slot_3dB>, <10Slot_0dB>, <10Slot_1dB>, <10Slot_2dB>*

Step individual, Step section A/B

<Ind_ndB>	Description of parameters	Def. value	Def. unit	
0.0 dB to 3.0 dB	Step individual limit for step size n dB	0.5 (n = 0, 1) 1.0 (n = 2) 1.5 (n = 3)	dB	
<7Slot_ndB>	Description of parameters	Def. value	Def. unit	
0.0 dB to 9.0 dB	Step section A/B limit for 7-dB pattern length and step size n dB	1.0 (n = 0) 5.0 (n = 3)	dB	
<10Slot_ndB>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 9.0 dB	Step section A/B limit for 10-dB pattern length and step size n dB	1.0 (n = 0) 2.0 (n = 1) 4.0 (n = 2)	dB	V3.05

Description of command

This command sets the symmetric power limits for either 7 or 10 equal TPC_CMD values.

DEFault:POWer:ILTPc:LIMit *<Enable>*

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.05

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

CONFigure:POWer:ILTPc:COTFc:STEP:CURRent:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue *<Step 7 dB>*

Change of TPC Limit

<Step 7 dB>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 10 dB	Power step tolerance	2.0	dB	V5.10

Description of command

This command sets the symmetric limits (tolerances) for *Change of TPC* power steps. The measured positive power steps must be in the range [+7 dB – <Step 7 dB>, +7 dB + <Step 7 dB>]. The measured negative power steps must be in the range [–7 dB – <Step 7 dB>, –7 dB + <Step 7 dB>].

Measured Values – Subsystem POWer:ILTPc...?

The subsystem *POWer:ILTPc...?* measures and returns the results and compares them with tolerance values. The subsystem corresponds to the graphical measurement menu *Power,* application *Inner Loop TPC.*

Scalar Results

READ[:SCALar]:POWer:ILTPc:CURRent? Start single shot measurement and return results
FETCh[:SCALar]:POWer:ILTPc:CURRent? Read measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:ILTPc:CURRent? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Avg. Power Step Error (TPC_cmd = ±1),	–100.0 dB to +100.0 dB	NAN	dB	V3.05
Avg. Power Step Error (TPC_cmd = 0),	–100.0 dB to +100.0 dB	NAN	dB	
Min./Max. Power Step Error (TPC_cmd = ±1),	–100.0 dB to +100.0 dB	NAN	dB	
Min./Max. Power Step Error (TPC_cmd = 0),	–100.0 dB to +100.0 dB	NAN	dB	
Section A,	–100.0 dB to +100.0 dB	NAN	dB	
Section B,	–100.0 dB to +100.0 dB	NAN	dB	
Max. UE Power,	–100.0 dBm to +60.0 dBm	NAN	dBm	
Min. UE Power	–100.0 dBm to +60.0 dBm	NAN	dBm	

Description of command

These commands are always queries. They start a `POWer:ILTPc` measurement (`READ...`) and/or return all scalar measurement results.

CALCulate[:SCALar]:POWer:ILTPc:CURRent:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
Avg. Power Step Error (TPC_cmd = ±1),	For all measured values: NMAU | NMAL | INV | OK	INV	–	
Avg. Power Step Error (TPC_cmd = 0),		INV	–	
Min./Max. Power Step Error (TPC_cmd = ±1),		INV	–	
Min./Max. Power Step Error (TPC_cmd = 0),		INV	–	
Section A,		INV	–	
Section B		INV	–	V3.05

Description of command

This command is always a query. It indicates whether and in which way the tolerances for the scalar measured values (see commands above) are exceeded.

The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

READ:ARRay:POWer:ILTPc:UEPower:CURRent? UE Power bar graph
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:POWer:ILTPc:UEPower:CURRent?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:POWer:ILTPc:UEPower:CURRent?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for UE Power	–100.0 dBm to +60.0 dBm,	NAN	dBm	V3.05
...	... ,	...	...	
nth value for UE Power	–100.0 dBm to +60.0 dBm	NAN	dBm	

Description of command

These commands are always queries. They return the UE power in a series of consecutive slots. The number n of measured values is 16 or 22, depending on the profile length (command *CONFigure:POWer:ILTPc:CONTrol:TPCControl*). If section B analysis is switched off (see command *CONFigure:POWer:ILTPc:CONTrol:BSECtion*) no entries are made in the second half of the output arrays (the default values *NAN* are maintained).

READ:ARRay:POWer:ILTPc:STEP:CURRent? Power Step bar graph
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:POWer:ILTPc:STEP:CURRent?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:POWer:ILTPc:STEP:CURRent?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for abs. power step	–100.0 dB to +100.0 dB,	NAN	dB	V3.05
...	... ,	...	...	
nth value for abs. power step	–100.0 dB to +100.0 dB	NAN	dB	

Description of command

These commands are always queries. They return the absolute power step in a series of consecutive slots. The measured quantity can be changed to the power step or power step error using the *CONFigure:POWer:ILTPc:CONTrol:SANalysis* command. The number n of measured values is 14 or 20, depending on the profile length (command *CONFigure:POWer:ILTPc:CONTrol:TPCControl*). If section B analysis is switched off (see command *CONFigure:POWer:ILTPc:CONTrol:BSECtion*) no entries are made in the second half of the output arrays (the default values *NAN* are maintained).

CALCulate:ARRay:POWer:ILTPc:STEP:CURRent:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for power step error	For all measured values:	INV	–	V3.05
...				
nth value for power step error	NMAU | NMAL | INV | OK	INV	–	

Description of command

This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see commands above) are exceeded.

The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

CALCulate:ARRay:POWer:ILTPc:THReshold:CURRent:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for power step error	For all measured values:	INV	–	V3.07
...				
nth value for power step error	INV | NORM | MAXT | MINT	INV	–	

Description of command

This command is always a query. It indicates whether and in which way the error limits for the arrayss (see commands above) are exceeded.

The following messages may be returned for all measured values:

MAXT	Maximum threshold exceeded
MINT	Minimum threshold exceeded
INV	Measurement invalid
NORM	Result within the tolerance

Change of TFC Results

READ[:SCALar]:POWer:ILTPc:COTFc:CURRent? Start single shot measurement and return results
FETCh[:SCALar]:POWer:ILTPc:COTFc:CURRent? Read measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:ILTPc:COTFc:CURRent? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Delta UE Power	–100.0 dB to +100.0 dB	NAN	dB	V5.10

Description of command

These commands are always queries. They start the *Change of TCF* measurement (`READ...`) and/or return all measurement results. Use `READ[:SCALar]:POWer:ILTPc:CURRent?` etc. to retrieve the *Max. UE Power* and *Min. UE Power* values.

CALCulate[:SCALar]:POWer:ILTPc:COTFc:CURRent:MATChing:LIMit? Change of TFC Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
Avg. Power Step Error	NMAU | NMAL | INV | OK	INV	–	V5.10

Description of command

This command is always a query. It indicates whether and in which way the tolerance for the *Delta UE Power* (see commands above) is exceeded.

The following messages may be returned:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

POWer:XSLot

The subsystem *POWer:XSLot* controls the *Power vs. Slot* measurement. It corresponds to the measurement menu *Power,* application *P/Slot Table,* and the sections in the popup menu *Power Configuration* that are related to the *P/Slot Table* application.

Note: *In Non Signalling mode, the `POWer:XSLot` measurement must be carried out with an external trigger (`TRIGger[:SEQuence]:SOURce EXTern`) or with an internal frame trigger.*

The POWer:XSLot measurement is available in Signalling mode starting with firmware version V3.60.

INITiate:POWer:XSLot	Start new measurement	⇒	*RUN*
ABORt:POWer:XSLot	Abort running measurement and switch off	⇒	*OFF*
STOP:POWer:XSLot	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:POWer:XSLot	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V3.07

CONFigure:POWer:XSLot:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.07
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).

FETCh[:SCALar]:POWer:XSLot:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.07
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 1000 |	Counter for current statistics cycle			
NONE	No counting mode set	NONE	–	

Description of command

This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual).

Subsystem POWer:XSLot:CONTrol

The subsystem *POWer:XSLot:CONTrol* defines the scope of the *P/Slot Table* measurement. The settings are in the *Control* tab of the popup menu *Power Configuration*.

CONFigure:POWer:XSLot:CONTrol:REPetition <*Repetition*>,<*StopCondition*>,<*Stepmode*>

Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous |	Continuous measurement (*continuous*, until `STOP` or `ABORT`)	SING	–	
SINGleshot |	Single measurement *(single shot*, `until Status = RDY`)			
1 to 1000	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror |	Stop measurement in case of error *(stop on error)*	NONE	–	
NONE	Continue measurement even in case of error			
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP |	Interrupt measurement after each statistics cycle	NONE	–	V3.07
NONE	Continue measurement according to its rep. mode			

Description of command

This command determines the number of statistics cycles and the stepping mode for the measurement.

Note: *For READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*

CONFigure:POWer:XSLot:CONTrol:MMODe <*Mode*> Measurement mode

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
TSTeps |	TPC Test Steps	STAN	–	V3.60
SOFF |	Ref. Level Switch Off			V3.80
SAUTo |	Ref. Level Switch Auto			V4.20 (Non Sig.)
CMTS	UL CM Test Step			V4.51 (Sig.)

Description of command

This command selects the *Measurement Mode*, defining whether the measurement is configured for a standard *P/Slot Table* measurement or for TPC test steps in analogy to the conformance test specification. The parameters SOFF (equiv. to STANdard in previous versions) and SAUTo have been introduced with FW version V3.80. The test mode `CMTS` is available in *Signalling* mode only.

CONFigure:POWer:XSLot:CONTrol:PMWidth <*Slots*> Power Mea. Width

<Slots>	Description of parameters	Def. value	Def. unit	FW vers.
0.25 | 0.50 | 1.00	Power measurement width	0.25	(slots)	V3.07

Description of command

This command defines the the measurement time for a single measurement step. A power measurement width of 1 slot, where the CMU measures and averages over the whole useful part of the slot, is available only if the step width set via `CONFigure:POWer:XSLot:CONTrol:SWIDth` is larger than 1 slot.

CONFigure:POWer:XSLot:CONTrol:SCOunt <*Slots*> Step Count

<Slots>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 100	Number of slots measured per statistics cycle	100	(slots)	V3.07

Description of command

This command defines the number of slots measured in one statistics cycle.

CONFigure:POWer:XSLot:CONTrol:SWIDth <*Slots*> Step Width

<*Slots*>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 15	Step width of the measurement	1	(slots)	V3.07

Description of command

This command defines the number of slots skipped between two consecutive measurements. With a step width of 1 (slot), each slot is measured.

CONFigure:POWer:XSLot:CONTrol:SDELay <*Slots*> Step Delay

<*Slots*>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 100	Trigger step delay	0	(slots)	V3.07

Description of command

This command defines a delay time (number of slots) between the trigger time and the start of the measurement. The step delay is added to the *Slot Delay* and the *Delay Offset* defined via `TRIGger[:SEQuence]:DELay <Slot_Delay>, <Delay_Offset>`.

DEFault:POWer:XSLot:CONTrol <Enable> Default Settings

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to their default values The parameters differ from the default values (partially or totally)	ON	–	V3.07

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.

Subsystem POWer:XSLot:…LIMit

The subsystem *POWer:XSLot:…LIMit* defines the limits for the *P/Slot Table* measurement. The settings are in the *Limits* tab of the popup menu *Power Configuration*; they are available in *Signalling Mode* only.

Note: *All limit commands are available in Signalling mode only. In Non Signalling mode, no limit check is performed.*

CONFigure:POWer:XSLot:THReshold:DELTa:LIMit[:SCALar]:ASYMmetric[:COMBined]:VALue <*MaxThreshold*>,<*MinThreshold*> Max. Threshold, Min. Threshold

<*MaxThreshold*>	Description of parameters	Def. value	Def. unit	FW vers.
+10.0 dBm to +40.0 dBm	Upper limit of power control range	+19.0	dBm	V3.60
<*MinThreshold*>	Description of parameters	Def. value	Def. unit	FW vers.
–70.0 dBm to –30.0 dBm	Lower limit of power control range	–50.0	dBm	V3.60

Description of command

This command sets the upper and lower limits of the power control range *(Max. Threshold and Min. Threshold* values). The lower (upper) individual power step limits and all average power step limits (see commands below) are ignored in the output power range above *Max. Threshold* (below *Min. Threshold)*. The command is available in *Signalling* mode.

CONFigure:POWer:XSLot:STEP:DELTa:LIMit[:SCALar]: Step Dep. and Accumulated Limits
SYMMetric[:COMBined]:VALue ***<Step 0 dB>, <Step 1 dB>, <Step 2 dB>, <Accu 10 Steps 0 dB>, <Accu 10 Steps 1 dB>, <Accu 50 Steps 1 dB>, <Accu 10 Steps 2 dB>***

<Step n dB>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 9.0 dB	Step dependent limit for step size n dB	0.5 (n = 0) 0.5 (n = 1) 1.0 (n = 2)	dB	V3.60
<Accu 10 Steps n dB>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 9.0 dB	Step accumulate for 10 steps and step size n dB	1.0 (n = 0) 2.0 (n = 1) 4.0 (n = 2)	dB	V3.60
<Accu 50 Steps 2 dB>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 9.0 dB	Step accumulate for 50 steps and step size 2 dB	4.0	dB	V3.60

Description of command

This command sets the limits for the *Power/Slot Table* measurement. It is available in *Signalling* mode.

CONFigure:POWer:XSLot:STEP:DELTa:LIMit:ENABle Enable Limits
<Step Enable>, <Accu Enable>

<Step Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF,	Enable or disable limit check for step dependent limits	ON	–	V3.60
<Step Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable limit check for accumulated limits	ON	–	V3.60

Description of command

This command enables or disables the limit check for the *Power/Slot Table* measurement. It is available in *Signalling* mode.

CONFigure:POWer:XSLot:CMSTeps:EXPected[:SCALar]:VALue *<Step 1> ... <Step 8>* CM Steps

<Step 1>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to +30.0 dB	Power step for non CM / CM, pattern B	4.0	dB	V4.51
<Step 2>	Description of parameters	Def. value	Def. unit	FW vers.
–30.0 dB to +30 dB	Power step for initial power, pattern A rising	–11.0	dB	V4.51
<Step 3>	Description of parameters	Def. value	Def. unit	FW vers.
–30.0 dB to +30 dB	Power step for initial power, pattern A falling	+11.0	dB	V4.51
<Step 4>	Description of parameters	Def. value	Def. unit	FW vers.
–30.0 dB to +30 dB	Power step for initial power, pattern B	0.0	dB	V4.51
<Step 5>	Description of parameters	Def. value	Def. unit	FW vers.
–9.0 dB to 9.0 dB	Power step for recovery, pattern A rising	+3.0	dB	V4.51
<Step 6>	Description of parameters	Def. value	Def. unit	FW vers.
–9.0 dB to 9.0 dB	Power step for recovery, pattern A falling	–3.0	dB	V4.51
<Step 7>	Description of parameters	Def. value	Def. unit	FW vers.
–30.0 dB to +30 dB	Accumulated power step, pattern A rising	+21.0	dB	V4.51
<Step 8>	Description of parameters	Def. value	Def. unit	FW vers.
–30.0 dB to +30 dB	Accumulated power step, pattern A falling	–21.0	dB	V4.51

Description of command

This command sets the expected power steps for the *UL CM Test Step* measurement mode (`CONFigure:POWer:XSLot:CONTrol:MMODe CMTS`). It is available in *Signalling* mode.

CONFigure:POWer:XSLot:CMSTeps:LIMit[:SCALar]:
SYMMetric[:COMBined]:VALue *<Limit 1> ... <Limit 8>* CM Steps: Limits

<Limit 1>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 9.0 dB	Limit for non CM / CM, pattern B	2.0	dB	V4.51
<Limit 2>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 9.0 dB	Limit for initial power, pattern A rising	4.0	dB	V4.51
<Limit 3>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 9.0 dB	Limit for initial power, pattern A falling	4.0	dB	V4.51
<Limit 4>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 9.0 dB	Limit for initial power, pattern B	3.0	dB	V4.51
<Limit 5>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 9.0 dB	Limit for recovery, pattern A rising	1.5	dB	V4.51
<Limit 6>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 9.0 dB	Limit for recovery, pattern A falling	1.5	dB	V4.51
<Limit 7>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 9.0 dB	Accumulated limit, pattern A rising	5.0	dB	V4.51
<Limit 8>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 9.0 dB	Accumulated limit, pattern A falling	5.0	dB	V4.51

Description of command

This command sets the limits for the *UL CM Test Step* measurement mode (`CONFigure:POWer:XSLot:CONTrol:MMODe CMTS`). It is available in *Signalling* mode.

DEFault:POWer:XSLot:LIMit <*Enable*>			Default Settings	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.60

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*. It is available in *Signalling* mode.

Subsystem POWer:XSLot?

The subsystem *POWer:XSLot* measures power versus slot and returns the results. The subsystem corresponds to the measurement menu *P/Slot Table.*

P/Slot Table Results

READ[:SCALar]:POWer:XSLot:CURRent? Start single shot measurement and return results

FETCh[:SCALar]:POWer:XSLot:CURRent? Read out measurement results (unsynchronized)

SAMPle[:SCALar]:POWer:XSLot:CURRent? Read out measurement results (synchronized)

Returned Values	Description of parameters	Def. value	Def. unit	FW vers.
–100 dBm to 100 dBm, **...** **–100 dBm to 100 dBm**	Avg. power in slot 0, ..., Avg. power in slot Slot 99*)	NAN, ..., NAN	dBm, ..., dBm	V3.07

Description of command

These commands are always queries. They start a measurement (`READ…`) and/or return all measurement results. The returned list contains the average power of the mobile phone in up to 100 consecutive timeslots.

Note: These commands are available in Non Signalling mode only. In Signalling mode, the commands `READ[:SCALar]:POWer:XSLot:ABSolute?, READ[:SCALar]:POWer:XSLot:DELTa?, READ[:SCALar]:POWer:XSLot:MAERror?` etc. are available instead.

*) The total number of slots measured and the number of output values can be limited by means of the `CONFigure:POWer:XSLot:CONTrol:SCOunt` command.

P/Slot Table Results

READ[:SCALar]:POWer:XSLot:ABSolute?
READ[:SCALar]:POWer:XSLot:DELTa?
READ[:SCALar]:POWer:XSLot:MAERror? Start single shot measurement and return results
FETCh[:SCALar]:POWer:XSLot:ABSolute?
FETCh[:SCALar]:POWer:XSLot:DELTa?
FETCh[:SCALar]:POWer:XSLot:MAERror? Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:XSLot:ABSolute?
SAMPle[:SCALar]:POWer:XSLot:DELTa?
SAMPle[:SCALar]:POWer:XSLot:MAERror? Read out measurement results (synchronized)

Returned Values, ABSolute	Description of parameters	Def. value	Def. unit	FW vers.
–100 dBm to 100 dBm, **...** **–100 dBm to 100 dBm**	Absolute power in slot 0, ..., Absolute power in slot Slot 99*)	NAN, ..., NAN	dBm, ..., dBm	V3.60
Returned Values, DELTa	Description of parameters	Def. value	Def. unit	FW vers.
–100 dB to 100 dB, **...** **–100 dB to 100 dB**	Delta step beween slot 1 and slot 0, ..., Absolute power difference in slot Slot 99*)	NAN, ..., NAN	dB, ..., dB	V3.60
Returned Values, MAERror	Description of parameters	Def. value	Def. unit	FW vers.
–100 dB to 100 dB, **0 to 90**	Maximum accumulated error, Index	NAN, NAN	dB, –	V3.60

Description of command

These commands are always queries. They start a *Power/Slot Table* measurement (`READ…`) and/or return the measurement results in up to 100 consecutive timeslots. The keywords `ABSolute` and `DELTa` specify the returned values:

`ABSolute` Absolute UE transmitter output power in dBm.

`DELTa` Difference of the UE power in two consecutive measured slots in dB. The first result is always invalid (NAN) because the calculation of the delta step requires two consecutive results.

`MAERror` Maximum accumulated error and index.

Note: These commands are available in Signalling mode only. In Non Signalling mode, the commands `READ[:SCALar]:POWer:XSLot:CURRent?` etc. are available instead.

In UL CM Test Step mode, NAN can also indicate that a result is beyond the TPC pattern length and therefore not measured

*) The total number of slots measured and the number of output values can be limited by means of `CONFigure:POWer:XSLot:CONTrol:SCOunt`.

CALCulate[:SCALar]:POWer:XSLot:DELTa:MATChing:LIMit? Limit Matching, Global

Returned values	Value range	Def. value	Def. unit	FW vers.
All slots	NMAT | INV | OK	INV	–	V3.60

Description of command

This command is always a query. It returns the result of the limit check. The following messages may be returned:

NMAT	Limit check failed, at least one slot is out of tolerance	*not matching*
INV	Measurement invalid, no limit check result available	*invalid*
OK	Limit check passed for all slots measured	

`CALCulate:ARRay:POWer:XSLot:DELTa:MATChing:LIMit?` retrieves the limit check results for each individual slot measured.

Note: These commands are available in Signalling mode only. In Non Signalling mode, no limit check is performed.

CALCulate:ARRay:POWer:XSLot:DELTa:MATChing:LIMit? Limit Matching, Individual Slots

Returned values	Value range	Def. value	Def. unit	FW vers.
Slot no. 0,	INV	INV	–	V3.60
… ,	For all other slots:	INV	–	
Slot no. n	NMAU | NMAL | INV | OK	INV	–	

Description of command

This command is always a query. It returns the result of the limit check in each individual slot. The following messages may be returned:

NMAU	Meas. result below lower limit	*not matching, underflow*
NMAL	Meas. result exceeds upper limit	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Limit check passed	
GAP	Compressed mode gap, for UL CM Test Step mode	
OFF	Beyond TPC pattern length, not measured, for UL CM Test Step mode	
OVF	Overflow, for UL CM Test Step mode	

The limit check result for the first slot is always invalid because the limits refer to the power steps and require two consecutive results. The number n of slots measured is set via `CONFigure:POWer:XSLot:SCOunt`. `CALCulate[:SCALar]:POWer:XSLot:DELTa:MATChing:LIMit?` retrieves the limit check result for all measured slots.

Note: These commands are available in Signalling mode only. In Non Signalling mode, no limit check is performed.

CALCulate[:SCALar]:POWer:XSLot:MAERror:MATChing:LIMit? Limit Matching, Max. Acc. Error

Returned values	Value range	Def. value	Def. unit	FW vers.
Max. Acc. Error	NMAT | INV | OK	INV	–	V3.60

Description of command

This command is always a query. It checks whether the maximum accumulated error is within the step-accumulated tolerances defined via `CONFigure:POWer:XSLot:STEP:DELTa:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue`. The following messages may be returned:

NMAU	Meas. result below lower limit	*not matching, underflow*
NMAL	Meas. result exceeds upper limit	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Limit check passed	
GAP	Compressed mode gap, for UL CM Test Step mode	
OFF	Beyond TPC pattern length, not measured, for UL CM Test Step mode	
OVF	Overflow, for UL CM Test Step mode	

Note: These commands are available in Signalling mode only. In Non Signalling mode, no limit check is performed.

MODulation Measurements

The subsystem *MODulation* measures the modulation accuracy of the RF signal from the UE. The subsystem corresponds to the measurement menu *Modulation* with its various applications and the associated popup menu *Modulation Configuration.*

The modulation parameters can be measured for a single QPSK-modulated signal or a multiple WCDMA signal with channel coding. In manual control, these signal configurations correspond to the different *QPSK* and *WCDMA* applications of the *Modulation* measurement. In remote control, the signal configurations are distinguished by the fourth-level keywords in the `MODulation` commands:

- The third-level keyword `QPSK` denotes the *QPSK* applications.
- The third-level keyword `WCDMa` denotes the *WCDMA* applications.

The command syntax is similar for both applications, so they will be described in common sections. In contrast, the four applications `OVERview, EVMagnitude, MERRor`, and `PERRor` will be described in separate sections.

General Commands

The commands in this section provide general settings that affect several MODulation measurement applications.

CONFigure:MODulation:WCDMa:DPCH:CONTrol:CCMode <*Mode*> Channelization Code Mode

<*Mode*>	Description of parameters	Def. value	Def. unit	FW vers.
AUTomatic | MANual	Automatic search of channelization codes Channelization codes are set manually	AUT	–	V3.00

Description of command

This command affects all *WCDMA* applications. It determines whether the CMU searches for the channelization codes assuming the *`AUTO`* settings of the *UE Code* tab or whether the channelization code is set manually (`MANual` settings of the *UE Code* tab).

In `CDPower` measurements (see section *CDPower Measurements* on p. 6.124), the applications `AUTomatic` and `RAUTomatic` correspond to `AUTomatic` channelization code mode, the applications `MANual` and `RMANual` correspond to `MANual` channelization code mode.

MODulation:OVERview

The subsystem *MODulation:OVERview* measures scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation,* application *Overview...,* and the sections in the popup menu *Modulation Configuration* that are related to the *Overview*... applications.

Control of Measurement – Subsystem MODulation:OVERview

The subsystem *MODulation:OVERview* controls the modulation measurement. It corresponds to the softkeys *Overview QPSK* and *Overview WCDMA* in the measurement menu *Modulation*.

INITiate:MODulation:OVERview:QPSK	Start new measurement	⇒ *RUN*
ABORt:MODulation:OVERview:QPSK	Abort running measurement and switch off	⇒ *OFF*
STOP:MODulation:OVERview:QPSK	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:OVERview:QPSK	Next measurement step (only *stepping mode*)	⇒ *RUN*
INITiate:MODulation:OVERview:WCDMa:DPCH	Start new measurement	
ABORt:MODulation:OVERview:WCDMa:DPCH	Abort running measurement and switch off	
STOP:MODulation:OVERview:WCDMa:DPCH	Stop measurement after current stat. cycle	
CONTinue:MODulation:OVERview:WCDMa:DPCH	Next meas. step (only *stepping mode*)	

Description of command	FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.	V3.00

CONFigure:MODulation:OVERview:QPSK:EREPorting <*Mode*>
CONFigure:MODulation:OVERview:WCDMa:DPCH:EREPorting <*Mode*>
Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.00
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:MODulation:OVERview:QPSK:STATus?
FETCh:MODulation:OVERview:WCDMa:DPCH:STATus?
Measurement Status

Ret. values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.00
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	

Description of command

These commands are always queries. They return the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *Overview QPSK* and *Overview WCDMA* applications.

Subsystem MODulation:OVERview:...:CONTrol

The subsystem *MODulation:OVERview:QPSK:CONTrol* configures the scope of the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration*.

CONFigure:MODulation:OVERview:QPSK:CONTrol:STATistics <*Statistics*> Meas. Statistics
CONFigure:MODulation:OVERview:WCDMa:DPCH:CONTrol:STATistics <*Statistics*>

<*Statistics*>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 | **NONE**	Number of evaluation periods per statistics cycle Statistics off (equivalent to 1)	10	–	≥3.0

Description of command

This command defines the number of slots forming a statistics cycle.

CONFigure:MODulation:OVERview:QPSK:CONTrol:REPetition Test Cycles
<Repetition>,<StopCond>,<Stepmode>
CONFigure:MODulation:OVERview:WCDMa:DPCH:CONTrol:REPetition
<Repetition>,<StopCond>,<Stepmode>

<*Repetition*>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<*StopCond*>	Description of parameters	Def. value	Def. unit	
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<*Stepmode*>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.00

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*

CONFigure:MODulation:OVERview:QPSK:CONTrol:MLENgth <*Length*> Measurement Length
CONFigure:MODulation:OVERview:WCDMa:DPCH:CONTrol:MLENgth <*Length*>

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
640 | 2560	QPSK: Number of chip periods measured	640	(chips)	V3.00
1280 | 2560	WCDMA: Number of chip periods measured	2560	(chips)	V4.20

Description of command

This command selects the time interval to be measured. A small measurement length accelerates the measurement but does not change the format or length of the output.

DEFault:MODulation:OVERview:QPSK:CONTrol <*Enable*> Default Settings
DEFault:MODulation:OVERview:WCDMa:DPCH:CONTrol <*Enable*>

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	The parameters are set to default values	ON	–	V3.00
OFF	Some or all parameters differ from the default values			

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Tolerance values – Subsystem MODulation:OEMP:...:LIMit

The subsystem *MODulation:OEMP:...:LIMit* defines tolerance values for the modulation measurement **in all applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Limits: Current & Max/Min

CONFigure:MODulation:OEMP:QPSK:CMMax:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue
<Error Vector Magn. (Peak)>, <Error Vector Magn. (RMS)>, <Magnitude Error (Peak)>, <Magnitude Error (RMS)>, <Phase Error (Peak)>, <Phase Error (RMS)>, <I/Q Origin Offset>, <I/Q Imbalance>, <Carrier Frequency Error>, <Waveform Quality>

CONFigure:MODulation:OEMP:WCDMa:DPCH:CMMax:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue
<Error Vector Magn. (Peak)>, <Error Vector Magn. (RMS)>, <Magnitude Error (Peak)>, <Magnitude Error (RMS)>, <Phase Error (Peak)>, <Phase Error (RMS)>, <I/Q Origin Offset>, <I/Q Imbalance>, <Carrier Frequency Error>, <Waveform Quality>, <Peak Code Domain Error>, <Transmit Time Error>

Parameter	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to +20.0 %,	Error Vector Magn. (Peak)	+17.5	%	V3.00
0.0 % to +20.0 %,	Error Vector Magn. (RMS)	+17.5	%	
–20.0 % to +20.0 %,	Magnitude Error (Peak)	±17.5	%	
0.0 % to +20.0 %,	Magnitude Error (RMS)	+17.5	%	
0.0 deg to +20.0 deg,	Phase Error (Peak), symmetric	±10.0	deg	
0.0 deg to +20.0 deg,	Phase Error (RMS)	+10.0	deg	
–80.00 dB to –20.00 dB,	I/Q Origin Offset	–25.0	dB	
–99.00 dB to 0.00 dB,	I/Q Imbalance	–15.0	dB	
0 Hz to +4000 Hz	Carrier Frequency Error, symmetric	±200	Hz	
+0.9000 to +0.9999	Waveform Quality	+0.9440	–	
	For WCDMa:DPCH only:			
–40.0 dB to 0.0 dB	Peak Code Domain Error	–15.0	dB	
–25.0 µs to +25.0 µs	Transmit Time Error (not available in current FW version)	±0.06	µs	

Description of command

This command defines upper limits for the *Current* and *Max./Min*. traces evaluated over the whole evaluation period and for the scalar modulation parameters derived from them. For parameters with symmetric ranges of limits (e.g. the Phase Error (Peak)), the entry of positive or negative values (say +x or –x) is equivalent: The limit will be interpreted in such a way that the parameter must be confined in the range [–x,+x].

Limits: Average

CONFigure:MODulation:OEMP:QPSK:AVERage:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue
<Error Vector Magn. (Peak)>, <Error Vector Magn. (RMS)>, <Magnitude Error (Peak)>, <Magnitude Error (RMS)>, <Phase Error (Peak)>, <Phase Error (RMS)>, <I/Q Origin Offset>, <I/Q Imbalance>, <Carrier Frequency Error>, <Waveform Quality>

CONFigure:MODulation:
OEMP:WCDMa:DPCH:AVERage:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue
<Error Vector Magn. (Peak)>, <Error Vector Magn. (RMS)>, <Magnitude Error (Peak)>, <Magnitude Error (RMS)>, <Phase Error (Peak)>, <Phase Error (RMS)>, <I/Q Origin Offset>, <I/Q Imbalance>, <Carrier Frequency Error>, <Waveform Quality>, <Peak Code Domain Error>, <Transmit Time Error>

Parameter	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to +20.0 %,	Error Vector Magn. (Peak)	+17.5	%	V3.00
0.0 % to +20.0 %,	Error Vector Magn. (RMS)	+17.5	%	
–20.0 % to +20.0 %,	Magnitude Error (Peak)	±17.5	%	
0.0 % to +20.0 %,	Magnitude Error (RMS)	+17.5	%	
0.0 deg to +20.0 deg,	Phase Error (Peak), symmetric	±10.0	deg	
0.0 deg to +20.0 deg,	Phase Error (RMS)	+10.0	deg	
–80.00 dB to –20.00 dB,	I/Q Origin Offset	–25.0	dB	
–99.00 dB to 0.00 dB,	I/Q Imbalance	–15.0	dB	
0 Hz to +4000 Hz	Carrier Frequency Error, symmetric	±200	Hz	
+0.9000 to +0.9999	Waveform Quality	+0.9440	–	
	For WCDMa:DPCH only:			
–40.0 dB to 0.0 dB	Peak Code Domain Error	–15.0	dB	
–25.0 µs to +25.0 µs	Transmit Time Error (not available in current FW version)	±0.06	µs	

Description of command

This command defines upper limits for the *Current* and *Max./Min*. traces evaluated over the whole evaluation period and for the scalar modulation parameters derived from them. For parameters with symmetric ranges of limits (e.g. the Phase Error (Peak)), the entry of positive or negative values (say +x or –x) is equivalent: The limit will be interpreted in such a way that the parameter must be confined in the range [–x,+x].

DEFault:MODulation:OEMP:QPSK:LIMit *<Enable>* Default Settings
DEFault:MODulation:OEMP:WCDMa:DPCH:LIMit *<Enable>*

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	The parameters are set to default values	ON	–	V3.00
OFF	Some or all parameters differ from the default values			

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystem MODulation:OVERview:QPSK

The subsystem *MODulation:OVERview:QPSK* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* application *Overview QPSK* and *Overview WCDMA.*

READ[:SCALar]:MODulation:OVERview:QPSK? Scalar Results:
READ[:SCALar]:MODulation:OVERview:WCDMa:DPCH?

Start single shot measurement and return results

FETCh[:SCALar]:MODulation:OVERview:QPSK?
FETCh[:SCALar]:MODulation:OVERview:WCDMa:DPCH?

Read out meas. results (unsynchronized)

SAMPle[:SCALar]:MODulation:OVERview:QPSK?
SAMPle[:SCALar]:MODulation:OVERview:WCDMa:DPCH?

Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
EVM (Peak) (x3),	0.0 % to 100.0 %	NAN	%	V3.00
EVM (RMS) (x3),	0.0 % to 100.0 %	NAN	%	
Magn. Error (Peak) (x3),	–100.0 % to 100.0 %	NAN	%	
Magn. Error (RMS) (x3),	0.0 % to 100.0 %	NAN	%	
Phase Error (Peak) (x3),	–180.0 deg to +180.0 deg	NAN	deg	
Phase Error (RMS) (x3),	–180.0 deg to +180.0 deg	NAN	deg	
I/Q Origin Offset (x3),	–100.0 dB to 0.0 dB	NAN	dB	
I/Q Imbalance (x3),	–100.0 dB to 0.0 dB	NAN	dB	
Frequency Error (x3),	–5000.0 Hz to +5000.0 Hz	NAN	Hz	
Waveform Quality (x3),	0.0 to +1.0	NAN	–	
Peak Code Dom. Error (x3, WCDMA),	–100.0 dB to 0.0 dB	NAN		
Transmit Time Error (x3, WCDMA),	–500 chips to + 500 chips, (1/4 chip resolution)	NAN	(chips)	V3.52
UE Power Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	V3.00
Out of Tolerance	0.0 % to 100.0 %	NAN	%	
Slot Number (WCDMA)	0 to 14	NAN	–	

Description of command

These commands are always queries. They start a `MODulation:OVERview` measurement `(READ...)` and/or return all scalar measurement results (see Chapter 4). The calculation of results in an *average* or *peak* measurement is described in Chapter 3 (see section *Averaging and Statistical Evaluation*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *Max./Min.* value. Values marked WCDMA are not available in the QPSK application; the QPSK output string is shortened.

READ[:SCALar]:MODulation:OVERview:WCDMa:DPCH:CMMax:PCDE? Scalar Results:
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:OVERview:WCDMa:DPCH:CMMax:PCDE?
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:OVERview:WCDMa:DPCH:CMMax:PCDE?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Branch of max. PCDE (Current)	I | Q	NAN	–	V3.15
PCDE Code (Current),	0 to SF (depending on signal config.)	NAN	–	
Branch of max. PCDE (Max/Min)	I | Q	NAN	–	
PCDE Code (Max./Min.)	0 to SF	NAN	–	

Description of command

These commands are always queries. They start a `MODulation:OVERview` measurement `(READ...)` and/or return the code number with the largest code domain error. The calculation of results in an *average* or *peak* measurement is described in Chapter 3 (see section *Averaging and Statistical Evaluation*).

CALCulate[:SCALar]:MODulation:OVERview:QPSK:MATChing:LIMit? Limit Matching
CALCulate[:SCALar]:MODulation:OVERview:WCDMa:DPCH:MATChing:LIMit?

Returned values	Value range	Def. value	Def. unit	FW vers.
EVM (Peak) (x3),		INV	–	V3.00
EVM (RMS) (x3),		INV	–	
Magn. Error (Peak) (x3),	For all measured values:	INV	–	
Magn. Error (RMS) (x3),		INV	–	
Phase Error (Peak) (x3),		INV	–	
Phase Error (RMS) (x3),		INV	–	
I/Q Origin Offset (x3),	NMAU | NMAL | INV | OK	INV	–	
I/Q Imbalance (x3),		INV	–	
Frequency Error (x3),		INV	–	
Waveform Quality (x3)		INV	–	
for WCDMA only:				
,Peak Code Dom. Error (x3),		INV	–	
Transmit Time Error (x3) (not available in current FW version)	INV, INV, INV	INV	–	

Description of command

These commands are always queries. They indicate whether and in which way the error limits for the scalar measured values (see commands above) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *Max./Min*. value.

The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

MODulation:EVMagnitude

The subsystem *MODulation:EVMagnitude* measures the error vector magnitude as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation,* applications *EVM QPSK* and *EVM WCDMA,* and the sections in the popup menu *Modulation Configuration* that are related to the *EVM*... applications.

Control of Measurement – Subsystem MODulation:EVMagnitude

The subsystem *MODulation:EVMagnitude* controls the modulation measurement. It corresponds to the softkeys *EVM QPSK* and *EVM WCDMA* in the measurement menu *Modulation*.

INITiate:MODulation:EVMagnitude:QPSK	Start new measurement	⇒ *RUN*
ABORt:MODulation:EVMagnitude:QPSK	Abort running measurement and switch off	⇒ *OFF*
STOP:MODulation:EVMagnitude:QPSK	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:EVMagnitude:QPSK	Next measurement step (only *stepping mode*)	⇒ *RUN*
INITiate:MODulation:EVMagnitude:WCDMa:DPCH	Start new measurement	
ABORt:MODulation:EVMagnitude:WCDMa:DPCH	Abort running measurement and switch off	
STOP:MODulation:EVMagnitude:WCDMa:DPCH	Stop measurement after current stat. cycle	
CONTinue:MODulation:EVMagnitude:WCDMa:DPCH	Next meas. step (only *stepping mode*)	

Description of command	FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.	V3.00

CONFigure:MODulation:EVMagnitude:QPSK:EREPorting <*Mode*> Event Reporting
CONFigure:MODulation:EVMagnitude:WCDMa:DPCH:EREPorting <*Mode*>

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.00
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:MODulation:EVMagnitude:QPSK:STATus? Measurement Status
FETCh:MODulation:EVMagnitude:WCDMa:DPCH:STATus?

Ret. values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.00
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	

Description of command

These commands are always queries. They return the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *EVM* applications.

Subsystem MODulation:EVMagnitude...:CONTrol

The subsystem *MODulation:EVMagnitude...:CONTrol* configures the scope of the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration.*

CONFigure:MODulation:EVMagnitude:QPSK:CONTrol:RMODe <*Mode*> Result Mode
CONFigure:MODulation:EVMagnitude:WCDMa:DPCH:CONTrol:RMODe <*Mode*>

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar |	Scalar values only (incl. limit matching)	ARR	–	≥3.0
ARRay,	Scalar measured values and arrays			

Description of command

This command specifies the type of measured values.

CONFigure:MODulation:EVMagnitude:QPSK:CONTrol:STATistics <*Statistics*> Meas. Statistics
CONFigure:MODulation:EVMagnitude:WCDMa:DPCH:CONTrol:STATistics <*Statistics*>

<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 |	Number of evaluation periods per statistics cycle	10	–	≥3.0
NONE	Statistics off (equivalent to 1)			

Description of command

This command defines the number of slots forming a statistics cycle.

CONFigure:MODulation:EVMagnitude:QPSK:CONTrol:REPetition Test Cycles
<Repetition>,<StopCond>,<Stepmode>
CONFigure:MODulation:EVMagnitude:WCDMa:DPCH:CONTrol:REPetition
<Repetition>,<StopCond>,<Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.00

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:MODulation:EVMagnitude:QPSK:CONTrol:MLENgth *<Length>* Measurement Length
CONFigure:MODulation:EVMagnitude:WCDMa:DPCH:CONTrol:MLENgth *<Length>*

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
640 | 2560	QPSK: Number of chip periods measured	640	(chips)	V3.00
1280 | 2560	WCDMA: Number of chip periods measured	2560	(chips)	V4.20

Description of command

This command selects the time interval to be measured. A small measurement length accelerates the measurement and causes the output arrays to be truncated.

DEFault:MODulation:EVMagnitude:QPSK:CONTrol *<Enable>* Default Settings
DEFault:MODulation:EVMagnitude:WCDMa:DPCH:CONTrol *<Enable>*

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Tolerance values – Subsystem MODulation:OEMP:QPSK:LIMit

The subsystem *MODulation:OEMP:...:LIMit* (see section *Tolerance values – Subsystem MODulation:OEMP:...:LIMit* on p. 6.63) defines tolerance values for the modulation measurement **in all four applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Subsystem SUBarrays:MODulation

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:EVMagnitude:QPSK Definition of Subarrays
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}
CONFigure:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}

<Mode>	Description of parameters	Def. value	Def. unit	
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL |** **XMAXimum |** **XMINimum |** **PAVG,**	Return all measurement values Return arithm. mean value in every subrange Return minimum value in every subrange Return maximum value in every subrange Return single interpolated value at <Start> Return x-axis value of maximum and maximum Return x-axis value of minimum and minimum Return arithmetic mean value in every subrange	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	
0 chips to **2559 chips,**	Start time in current range	0	chips	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 2560	Number of samples in current range	640	–	V3.00

Description of command

This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:EVMagnitude...` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of 1 chip period.

For <Mode> = IVAL, the <Samples> parameter is ignored and the R&S CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located between two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation.

The subranges may overlap but must be within the total range of the *Modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. If the measurement length is reduced to the first quarter (half) of a slot (see commands `CONFigure:MODulation:EVMagnitude:…:CONTrol:MLENgth`), then the start value must be in the range between 0 chips and 639 (1279) chips, the maximum number of samples is 640 (1280).

By default, only one range corresponding to the total measurement range is used and all measurement values are returned.

Measured Values – Subsystem MODulation:EVMagnitude:QPSK

The subsystem *MODulation:EVMagnitude:...?* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* applications *EVM QPSK* and *EVM WCDMA.*

READ[:SCALar]:MODulation:EVMagnitude:QPSK? Scalar Results:
READ[:SCALar]:MODulation:EVMagnitude:WCDMa:DPCH?
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:EVMagnitude:QPSK?
FETCh[:SCALar]:MODulation:EVMagnitude:WCDMa:DPCH?
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:EVMagnitude:QPSK?
SAMPle[:SCALar]:MODulation:EVMagnitude:WCDMa:DPCH?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
EVM (Peak) (x3),	0.0 % to 100.0 %	NAN	%	V3.00
EVM (RMS) (x3),	0.0 % to 100.0 %	NAN	%	
I/Q Origin Offset (x3),	–100.0 dB to 0.0 dB	NAN	dB	
Frequency Error (x3),	–5000.0 Hz to +5000.0 Hz	NAN	Hz	
Peak Code Dom. Error (x3, WCDMA),	–100.0 dB to 0.0 dB	NAN		
UE Power Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	
Out of Tolerance	0.0 % to 100.0 %	NAN	%	
Slot Number (WCDMA)	0 to 14	NAN	–	

Description of command

These commands are always queries. They start a `MODulation:EVMagnitude` measurement `(READ...)` and/or return all scalar measurement results (see Chapter 4). The calculation of results in an *average* or *peak* measurement is described in Chapter 3 (see section *Averaging and Statistical Evaluation*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *Max./Min.* value. Values marked WCDMA are not available in the QPSK application; the QPSK output string is shortened.

CALCulate[:SCALar]:MODulation:EVMagnitude:QPSK:MATChing:LIMit? Limit Matching
CALCulate[:SCALar]:MODulation:EVMagnitude:WCDMa:DPCH:MATChing:LIMit?

Returned values	Value range	Def. value	Def. unit	FW vers.
EVM (Peak) (x3),		INV	–	V3.00
EVM (RMS) (x3),	For all measured values:	INV	–	
I/Q Origin Offset (x3),		INV	–	
Frequency Error (x3)	NMAU | NMAL | INV | OK	INV	–	
for WCDMA only:				
,Peak Code Dom. Error (x3)		INV	–	

Description of command

These commands are always queries. They indicate whether and in which way the error limits for the scalar measured values (see commands aboves) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *Max./Min.* value. The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

READ:ARRay:MODulation:EVMagnitude:QPSK:CURRent? EVM in evaluation period
READ:ARRay:MODulation:EVMagnitude:QPSK:AVERage?
READ:ARRay:MODulation:EVMagnitude:QPSK:MMAX?
READ:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?
READ:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?
READ:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:EVMagnitude:QPSK:CURRent?
FETCh:ARRay:MODulation:EVMagnitude:QPSK:AVERage?
FETCh:ARRay:MODulation:EVMagnitude:QPSK:MMAX?
FETCh:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?
FETCh:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?
FETCh:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:EVMagnitude:QPSK:CURRent?
SAMPle:ARRay:MODulation:EVMagnitude:QPSK:AVERage?
SAMPle:ARRay:MODulation:EVMagnitude:QPSK:MMAX?
SAMPle:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?
SAMPle:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?
SAMPle:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to +100.0 %,	1st value for error vector magnitude	NAN	%	V3.00
... ,	...	...	...	
0.0 % to +100.0 %	nth value for error vector magnitude	NAN	%	

Description of command

These commands are always queries. They return the error vector magnitude vs. time at fixed, equidistant test points with a 1-chip spacing. The number n of measured values is equal to the measurement length set via `CONFigure:MODulation:EVMagnitude:<Sig_Type>:CONTrol:MLENgth; <Sig_Type> = QPSK | WCDMa:DPCH`. The available measurement lengths of 2560 (1 slot) or 640 (QPSK) / 1280 (WCDMA, half slot measurement) correspond to a time range of 0 chips to 2559 or 0 chips to 639 / 1259 chips. The calculation of *Current, Average,* and *MMAX* (Max./Min.) results is explained in Chapter 3 (see *display mode*).

READ:SUBarrays:MODulation:EVMagnitude:QPSK:CURRent? Subarray Results
READ:SUBarrays:MODulation:EVMagnitude:QPSK:AVERage?
READ:SUBarrays:MODulation:EVMagnitude:QPSK:MMAX?
READ:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?
READ:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?
READ:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?
Start single shot measurement and return results ⇒ *RUN*
FETCh:SUBarrays:MODulation:EVMagnitude:QPSK:CURRent?
FETCh:SUBarrays:MODulation:EVMagnitude:QPSK:AVERage?
FETCh:SUBarrays:MODulation:EVMagnitude:QPSK:MMAX?
FETCh:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?
FETCh:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?
FETCh:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?
Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:SUBarrays:MODulation:EVMagnitude:QPSK:CURRent?
SAMPle:SUBarrays:MODulation:EVMagnitude:QPSK:AVERage?
SAMPle:SUBarrays:MODulation:EVMagnitude:QPSK:MMAX?
SAMPle:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?
SAMPle:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?
SAMPle:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?
Read results (synchronized) ⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to+ 100.0 %,	1st value for error vector magnitude	NAN	%	V3.00
... ,	...	...	...	
0.0 % to+ 100.0 %	nth value for error vector magnitude	NAN	%	

Description of command

These commands are always queries. They measure and return the error vector magnitude versus time in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:EVMagnitude...` commands. In the default setting of the configuration command the `READ:SUBarrays..., FETCh:SUBarrays..., and SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay..., FETCh:ARRay..., and SAMPle:ARRay...` command group described above.

The `CONFigure:SUBarrays:MODulation:EVMagnitude...` commands define a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum …)` is set, only one value is returned per subrange.

The calculation of *Current, Average, and MMAX* (Max./Min.) results is explained in Chapter 3 (see *display mode*).

MODulation:MERRor

The subsystem *MODulation:MERRor* measures the magnitude error as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation,* applications *Magn. Error QPSK* and *Magn. Error WCDMA,* and the sections in the popup menu *Modulation Configuration* that are related to the *Magn. Error* ... applications.

Control of Measurement – Subsystem MODulation:MERRor

The subsystem *MODulation:MERRor* controls the modulation measurement. It corresponds to the softkeys *Magn. Error QPSK* and *Magn. Error WCDMA* in the measurement menu *Modulation*.

INITiate:MODulation:MERRor:QPSK	Start new measurement	⇒ *RUN*
ABORt:MODulation:MERRor:QPSK	Abort running measurement and switch off	⇒ *OFF*
STOP:MODulation:MERRor:QPSK	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:MERRor:QPSK	Next measurement step (only *stepping mode*)	⇒ *RUN*
INITiate:MODulation:MERRor:WCDMa:DPCH	Start new measurement	⇒ *RUN*
ABORt:MODulation:MERRor:WCDMa:DPCH	Abort running meas. and switch off	⇒ *OFF*
STOP:MODulation:MERRor:WCDMa:DPCH	Stop meas. after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:MERRor:WCDMa:DPCH	Next meas. step (only *stepping mode*)	⇒ *RUN*

Description of command	FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.	V3.00

CONFigure:MODulation:MERRor:QPSK:EREPorting <*Mode*> Event Reporting
CONFigure:MODulation:MERRor:WCDMa:DPCH:EREPorting <*Mode*>

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.00
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:MODulation:MERRor:QPSK:STATus? Measurement Status
FETCh:MODulation:MERRor:WCDMa:DPCH:STATus?

Ret. values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.00
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	

Description of command

These commands are always queries. They return the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *Magn. Error* applications.

Subsystem MODulation:MERRor...:CONTrol

The subsystem *MODulation:MERRor...:CONTrol* configures the scope of the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration.*

CONFigure:MODulation:MERRor:QPSK:CONTrol:RMODe <*Mode*> Result Mode
CONFigure:MODulation:MERRor:WCDMa:DPCH:CONTrol:RMODe <*Mode*>

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar |	Scalar values only (incl. limit matching)	ARR	–	≥3.0
ARRay,	Scalar measured values and arrays			

Description of command

This command specifies the type of measured values.

CONFigure:MODulation:MERRor:QPSK:CONTrol:STATistics <*Statistics*> Meas. Statistics
CONFigure:MODulation:MERRor:WCDMa:DPCH:CONTrol:STATistics <*Statistics*>

<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 |	Number of evaluation periods per statistics cycle	10	–	≥3.0
NONE	Statistics off (equivalent to 1)			

Description of command

This command defines the number of slots forming a statistics cycle.

CONFigure:MODulation:MERRor:QPSK:CONTrol:REPetition Test Cycles
<Repetition>,<StopCond>,<Stepmode>
CONFigure:MODulation:MERRor:WCDMa:DPCH:CONTrol:REPetition
<Repetition>,<StopCond>,<Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.00

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:MODulation:MERRor:QPSK:CONTrol:MLENgth *<Length>* Measurement Length
CONFigure:MODulation:MERRor:WCDMa:DPCH:CONTrol:MLENgth *<Length>*

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
640 | 2560	QPSK: Number of chip periods measured	640	(chips)	V3.00
1280 | 2560	WCDMA: Number of chip periods measured	2560	(chips)	V4.20

Description of command

This command selects the time interval to be measured. A small measurement length accelerates the measurement and causes the output arrays to be truncated.

DEFault:MODulation:MERRor:QPSK:CONTrol *<Enable>* Default Settings
DEFault:MODulation:MERRor:WCDMa:DPCH:CONTrol *<Enable>*

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Tolerance values – Subsystem MODulation:OEMP...:LIMit

The subsystem *MODulation:OEMP:...:LIMit* (see section *Tolerance values – Subsystem MODulation:OEMP:...:LIMit* on p. 6.63) defines tolerance values for the modulation measurement **in all four applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Subsystem SUBarrays:MODulation

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:MERRor:QPSK Definition of Subarrays
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}
CONFigure:SUBarrays:MODulation:MERRor:WCDMa:DPCH
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}

<Mode>	Description of parameters	Def. value	Def. unit	
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL |** **XMAXimum |** **XMINimum |** **PAVG,**	Return all measurement values Return arithm. mean value in every subrange Return minimum value in every subrange Return maximum value in every subrange Return single interpolated value at <Start> Return x-axis value of maximum and maximum Return x-axis value of minimum and minimum Return arithmetic mean value in every subrange	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	
0 chips to **2559 chips,**	Start time in current range	0	chips	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 2560	Number of samples in current range	640	–	V3.00

Description of command

This command configures the `READ:SUBarrays..., FETCh:SUBarrays...,` and `SAMPle:SUBarrays:MODulation:MERRor...` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of 1 chip period.

For <Mode> = IVAL, the <Samples> parameter is ignored and the R&S CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located between two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation.

The subranges may overlap but must be within the total range of the *Modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. If the measurement length is reduced to the first quarter (half) of a slot (see command `CONFigure:MODulation:MERRor…:CONTrol:MLENgth`), then the start value must be in the range between 0 chips and 639 (1279) chips, the maximum number of samples is 640 (1280).

By default, only one range corresponding to the total measurement range is used and all measurement values are returned.

Measured Values – Subsystem MODulation:MERRor:...?

The subsystem *MODulation:MERRor:...?* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* applications *Magn. Error QPSK* and *Magn. Error WCDMA.*

READ[:SCALar]:MODulation:MERRor:QPSK? Scalar Results:
READ[:SCALar]:MODulation:MERRor:WCDMa:DPCH?
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:MERRor:QPSK?
FETCh[:SCALar]:MODulation:MERRor:WCDMa:DPCH?
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:MERRor:QPSK?
SAMPle[:SCALar]:MODulation:MERRor:WCDMa:DPCH?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Magn. Error (Peak) (x3),	–100.0 % to 100.0 %	NAN	%	V3.00
Magn. Error (RMS) (x3),	0.0 % to 100.0 %	NAN	%	
I/Q Origin Offset (x3),	–100.0 dB to 0.0 dB	NAN	dB	
Frequency Error (x3),	–5000.0 Hz to +5000.0 Hz	NAN	Hz	
Peak Code Dom. Error (x3, WCDMA),	–100.0 dB to 0.0 dB	NAN		
UE Power Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	
Out of Tolerance	0.0 % to 100.0 %	NAN	%	
Slot Number (WCDMA)	0 to 14	NAN	–	

Description of command

These commands are always queries. They start a `MODulation:MERRor` measurement `(READ...)` and/or return all scalar measurement results (see Chapter 4). The calculation of results in an *average* or *peak* measurement is described in Chapter 3 (see section *Averaging and Statistical Evaluation*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *Max./Min.* value. Values marked WCDMA are not available in the QPSK application; the QPSK output string is shortened.

CALCulate[:SCALar]:MODulation:MERRor:QPSK:MATChing:LIMit? Limit Matching
CALCulate[:SCALar]:MODulation:MERRor:WCDMa:DPCH:MATChing:LIMit?

Returned values	Value range	Def. value	Def. unit	FW vers.
Magn. Error (Peak) (x3),		INV	–	V3.00
Magn. Error (RMS) (x3),	For all measured values:	INV	–	
I/Q Origin Offset (x3),		INV	–	
Frequency Error (x3)	NMAU | NMAL | INV | OK	INV	–	
for WCDMA only:				
,Peak Code Dom. Error (x3)		INV	–	

Description of command

These commands are always queries. They indicate whether and in which way the error limits for the scalar measured values (see commands aboves) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *Max./Min.* value. The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

READ:ARRay:MODulation:MERRor:QPSK:CURRent? Magn. Error in Evaluation period
READ:ARRay:MODulation:MERRor:QPSK:AVERage?
READ:ARRay:MODulation:MERRor:QPSK:MMAX?
READ:ARRay:MODulation:MERRor:WCDMa:DPCH:CURRent?
READ:ARRay:MODulation:MERRor:WCDMa:DPCH:AVERage?
READ:ARRay:MODulation:MERRor:WCDMa:DPCH:MMAX?
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:MERRor:QPSK:CURRent?
FETCh:ARRay:MODulation:MERRor:QPSK:AVERage?
FETCh:ARRay:MODulation:MERRor:QPSK:MMAX?
FETCh:ARRay:MODulation:MERRor:WCDMa:DPCH:CURRent?
FETCh:ARRay:MODulation:MERRor:WCDMa:DPCH:AVERage?
FETCh:ARRay:MODulation:MERRor:WCDMa:DPCH:MMAX?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:MERRor:QPSK:CURRent?
SAMPle:ARRay:MODulation:MERRor:QPSK:AVERage?
SAMPle:ARRay:MODulation:MERRor:QPSK:MMAX?
SAMPle:ARRay:MODulation:MERRor:WCDMa:DPCH:CURRent?
SAMPle:ARRay:MODulation:MERRor:WCDMa:DPCH:AVERage?
SAMPle:ARRay:MODulation:MERRor:WCDMa:DPCH:MMAX?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 % to +100.0 %,	1st value for magnitude error	NAN	%	V3.00
... ,	...	...	...	
–100.0 % to +100.0 %	nth value for magnitude error	NAN	%	

Description of command

These commands are always queries. They return the magnitude error vs. time at fixed, equidistant test points with a 1-chip spacing. The number n of measured values is equal to the measurement length set via `CONFigure:MODulation:EVMagnitude:<Sig_Type>:CONTrol:MLENgth; <Sig_Type> = QPSK | WCDMa:DPCH`. The available measurement lengths of 2560 (1 slot) or 640 (QPSK) / 1280 (WCDMA, half slot measurement) correspond to a time range of 0 chips to 2559 or 0 chips to 639 / 1259 chips. The calculation of *Current, Average,* and *MMAX* (Max./Min.) results is explained in Chapter 3 (see *display mode*).

READ:SUBarrays:MODulation:MERRor:QPSK:CURRent? Subarray Results
READ:SUBarrays:MODulation:MERRor:QPSK:AVERage?
READ:SUBarrays:MODulation:MERRor:QPSK:MMAX?
READ:SUBarrays:MODulation:MERRor:WCDMa:DPCH:CURRent?
READ:SUBarrays:MODulation:MERRor:WCDMa:DPCH:AVERage?
READ:SUBarrays:MODulation:MERRor:WCDMa:DPCH:MMAX?
Start single shot measurement and return results ⇒ *RUN*
FETCh:SUBarrays:MODulation:MERRor:QPSK:CURRent?
FETCh:SUBarrays:MODulation:MERRor:QPSK:AVERage?
FETCh:SUBarrays:MODulation:MERRor:QPSK:MMAX?
FETCh:SUBarrays:MODulation:MERRor:WCDMa:DPCH:CURRent?
FETCh:SUBarrays:MODulation:MERRor:WCDMa:DPCH:AVERage?
FETCh:SUBarrays:MODulation:MERRor:WCDMa:DPCH:MMAX?
Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:SUBarrays:MODulation:MERRor:QPSK:CURRent?
SAMPle:SUBarrays:MODulation:MERRor:QPSK:AVERage?
SAMPle:SUBarrays:MODulation:MERRor:QPSK:MMAX?
SAMPle:SUBarrays:MODulation:MERRor:WCDMa:DPCH:CURRent?
SAMPle:SUBarrays:MODulation:MERRor:WCDMa:DPCH:AVERage?
SAMPle:SUBarrays:MODulation:MERRor:WCDMa:DPCH:MMAX?
Read results (synchronized) ⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 % to +100.0 %,	1st value for magnitude error	NAN	%	V3.00
... ,	...	...	...	
–100.0 % to +100.0 %	nth value for magnitude error	NAN	%	

Description of command

These commands are always queries. They measure and return the magnitude error versus time in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:MERRor...` commands. In the default setting of the configuration command the `READ:SUBarrays..., FETCh:SUBarrays..., and SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay..., FETCh:ARRay..., and SAMPle:ARRay...` command group described above.

The `CONFigure:SUBarrays:MODulation:MERRor...` commands define a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum, …)` is set, only one value is returned per subrange.

The calculation of *Current, Average, and MMAX* (Max./Min.) results is explained in Chapter 3 (see *display mode*).

MODulation:PERRor

The subsystem *MODulation:PERRor* measures the phase error as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation,* applications *Phase Error QPSK* and *Phase Error WCDMA,* and the sections in the popup menu *Modulation Configuration* that are related to the *Phase Error*... applications.

Control of Measurement – Subsystem MODulation:PERRor

The subsystem *MODulation:PERRor* controls the modulation measurement. It corresponds to the softkeys *Phase Error QPSK* and *Phase Error WCDMA* in the measurement menu *Modulation*.

INITiate:MODulation:PERRor:QPSK	Start new measurement	⇒ *RUN*
ABORt:MODulation:PERRor:QPSK	Abort running measurement and switch off	⇒ *OFF*
STOP:MODulation:PERRor:QPSK	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:PERRor:QPSK	Next measurement step (only *stepping mode*)	⇒ *RUN*
INITiate:MODulation:PERRor:WCDMa:DPCH	Start new measurement	⇒ *RUN*
ABORt:MODulation:PERRor:WCDMa:DPCH	Abort running meas. and switch off	⇒ *OFF*
STOP:MODulation:PERRor:WCDMa:DPCH	Stop meas. after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:PERRor:WCDMa:DPCH	Next meas. step (only *stepping mode*)	⇒*RUN*

Description of command	FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.	V3.00

CONFigure:MODulation:PERRor:QPSK:EREPorting <*Mode*> Event Reporting
CONFigure:MODulation:PERRor:WCDMa:DPCH:EREPorting <*Mode*>

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.00
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:MODulation:PERRor:QPSK:STATus? Measurement Status
FETCh:MODulation:PERRor:WCDMa:DPCH:STATus?

Ret. values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.00
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	

Description of command

These commands are always queries. They return the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *Phase Error* applications.

Subsystem MODulation:PERRor:QPSK:CONTrol

The subsystem *MODulation:PERRor...:CONTrol* configures the scope of the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration.*

CONFigure:MODulation:PERRor:QPSK:CONTrol:RMODe <*Mode*> Result Mode
CONFigure:MODulation:PERRor:WCDMa:DPCH:CONTrol:RMODe <*Mode*>

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar |	Scalar values only (incl. limit matching)	ARR	–	≥3.0
ARRay,	Scalar measured values and arrays			

Description of command

This command specifies the type of measured values.

CONFigure:MODulation:PERRor:QPSK:CONTrol:STATistics <*Statistics*> Measurement Statistics
CONFigure:MODulation:PERRor:WCDMa:DPCH:CONTrol:STATistics <*Statistics*>

<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 |	Number of evaluation periods per statistics cycle	10	–	≥3.0
NONE	Statistics off (equivalent to 1)			

Description of command

This command defines the number of slots forming a statistics cycle.

CONFigure:MODulation:PERRor:QPSK:CONTrol:REPetition Test Cycles
<Repetition>,<StopCond>,<Stepmode>
CONFigure:MODulation:PERRor:WCDMa:DPCH:CONTrol:REPetition
<Repetition>,<StopCond>,<Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.00

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:MODulation:PERRor:QPSK:CONTrol:MLENgth *<Length>* Measurement Length
CONFigure:MODulation:PERRor:WCDMa:DPCH:CONTrol:MLENgth *<Length>*

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
640 | 2560	QPSK: Number of chip periods measured	640	(chips)	V3.00
1280 | 2560	WCDMA: Number of chip periods measured	2560	(chips)	V4.20

Description of command

This command selects the time interval to be measured. A small measurement length accelerates the measurement and causes the output arrays to be truncated.

DEFault:MODulation:PERRor:QPSK:CONTrol *<Enable>* Default Settings
DEFault:MODulation:PERRor:WCDMa:DPCH:CONTrol *<Enable>*

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Tolerance values – Subsystem MODulation:OEMP...:LIMit

The subsystem *MODulation:OEMP...:LIMit* (see section *Tolerance values – Subsystem MODulation:OEMP:...:LIMit* on p. 6.63) defines tolerance values for the modulation measurement **in all four applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Subsystem SUBarrays:MODulation

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:PERRor:QPSK Definition of Subarrays
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}
CONFigure:SUBarrays:MODulation:PERRor:WCDMa:DPCH
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}

<Mode>	Description of parameters	Def. value	Def. unit	
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL |** **XMAXimum |** **XMINimum |** **PAVG,**	Return all measurement values Return arithm. mean value in every subrange Return minimum value in every subrange Return maximum value in every subrange Return single interpolated value at <Start> Return x-axis value of maximum and maximum Return x-axis value of minimum and minimum Return arithmetic mean value in every subrange	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	
0 chips to 2559 chips,	Start time in current range	0	chips	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 2560	Number of samples in current range	640	–	V3.00

Description of command

This command configures the `READ:SUBarrays..., FETCh:SUBarrays...,` and `SAMPle:SUBarrays:MODulation:PERRor...` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of 1 chip period.

For <Mode> = IVAL, the <Samples> parameter is ignored and the R&S CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located between two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation.

The subranges may overlap but must be within the total range of the *Modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. If the measurement length is reduced to the first quarter (half) of a slot (see command `CONFigure:MODulation:PERRor:QPSK: CONTrol:MLENgth`), then the start value must be in the range between 0 chips and 639 (1279) chips, the maximum number of samples is 640 (1280).

By default, only one range corresponding to the total measurement range is used and all measurement values are returned.

Measured Values – Subsystem MODulation:PERRor:QPSK

The subsystem *MODulation:PERRor:...?* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* applications *Phase Error QPSK* and *Phase Error WCDMA.*

READ[:SCALar]:MODulation:PERRor:QPSK? Scalar Results:
READ[:SCALar]:MODulation:PERRor:WCDMa:DPCH?
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:PERRor:QPSK?
FETCh[:SCALar]:MODulation:PERRor:WCDMa:DPCH?
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:PERRor:QPSK?
SAMPle[:SCALar]:MODulation:PERRor:WCDMa:DPCH?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Phase Error (Peak) (x3),	–180.0 deg to +180.0 deg	NAN	deg	V3.00
Phase Error (RMS) (x3),	–180.0 deg to +180.0 deg	NAN	deg	
I/Q Origin Offset (x3),	–100.0 dB to 0.0 dB	NAN	dB	
Frequency Error (x3),	–5000.0 Hz to +5000.0 Hz	NAN	Hz	
Peak Code Dom. Error (x3, WCDMA),	–100.0 dB to 0.0 dB	NAN		
UE Power Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	
Out of Tolerance	0.0 % to 100.0 %	NAN	%	
Slot Number (WCDMA)	0 to 14	NAN	–	

Description of command

These commands are always queries. They start a `MODulation:PERRor` measurement `(READ...)` and/or return all scalar measurement results (see Chapter 4). The calculation of results in an *average* or *peak* measurement is described in Chapter 3 (see section *Averaging and Statistical Evaluation*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *Max./Min.* value. Values marked WCDMA are not available in the QPSK application; the QPSK output string is shortened.

CALCulate[:SCALar]:MODulation:PERRor:QPSK:MATChing:LIMit? Limit Matching
CALCulate[:SCALar]:MODulation:PERRor:WCDMa:DPCH:MATChing:LIMit?

Returned values	Value range	Def. value	Def. unit	FW vers.
Phase Error (Peak) (x3),		INV	–	V3.00
Phase Error (RMS) (x3),	For all measured values:	INV	–	
I/Q Origin Offset (x3),		INV	–	
Frequency Error (x3)	NMAU | NMAL | INV | OK	INV	–	
for WCDMA only:				
,Peak Code Dom. Error (x3)		INV	–	

Description of command

These commands are always queries. They indicate whether and in which way the error limits for the scalar measured values (see commands aboves) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *Max./Min.* value. The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

READ:ARRay:MODulation:PERRor:QPSK:CURRent? Phase Error in evaluation period
READ:ARRay:MODulation:PERRor:QPSK:AVERage?
READ:ARRay:MODulation:PERRor:QPSK:MMAX?
READ:ARRay:MODulation:PERRor:WCDMa:DPCH:CURRent?
READ:ARRay:MODulation:PERRor:WCDMa:DPCH:AVERage?
READ:ARRay:MODulation:PERRor:WCDMa:DPCH:MMAX?
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:PERRor:QPSK:CURRent?
FETCh:ARRay:MODulation:PERRor:QPSK:AVERage?
FETCh:ARRay:MODulation:PERRor:QPSK:MMAX?
FETCh:ARRay:MODulation:PERRor:WCDMa:DPCH:CURRent?
FETCh:ARRay:MODulation:PERRor:WCDMa:DPCH:AVERage?
FETCh:ARRay:MODulation:PERRor:WCDMa:DPCH:MMAX?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:PERRor:QPSK:CURRent?
SAMPle:ARRay:MODulation:PERRor:QPSK:AVERage?
SAMPle:ARRay:MODulation:PERRor:QPSK:MMAX?
SAMPle:ARRay:MODulation:PERRor:WCDMa:DPCH:CURRent?
SAMPle:ARRay:MODulation:PERRor:WCDMa:DPCH:AVERage?
SAMPle:ARRay:MODulation:PERRor:WCDMa:DPCH:MMAX?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–180.0 deg to +180.0 deg,	1st value for phase error	NAN	deg	V3.00
... ,	...	...	...	
–180.0 deg to +180.0 deg	nth value for phase error	NAN	deg	

Description of command

These commands are always queries. They return the phase error vs. time at fixed, equidistant test points with a 1-chip spacing. The number n of measured values is equal to the measurement length set via `CONFigure:MODulation:EVMagnitude:<Sig_Type>:CONTrol:MLENgth; <Sig_Type> = QPSK | WCDMa:DPCH`. The available measurement lengths of 2560 (1 slot) or 640 (QPSK) / 1280 (WCDMA, half slot measurement) correspond to a time range of 0 chips to 2559 or 0 chips to 639 / 1259 chips. The calculation of *Current, Average,* and *MMAX* (Max./Min.) results is explained in Chapter 3 (see *display mode*).

READ:SUBarrays:MODulation:PERRor:QPSK:CURRent? Subarray Results
READ:SUBarrays:MODulation:PERRor:QPSK:AVERage?
READ:SUBarrays:MODulation:PERRor:QPSK:MMAX?
READ:SUBarrays:MODulation:PERRor:WCDMa:DPCH:CURRent?
READ:SUBarrays:MODulation:PERRor:WCDMa:DPCH:AVERage?
READ:SUBarrays:MODulation:PERRor:WCDMa:DPCH:MMAX?
Start single shot measurement and return results ⇒ *RUN*
FETCh:SUBarrays:MODulation:PERRor:QPSK:CURRent?
FETCh:SUBarrays:MODulation:PERRor:QPSK:AVERage?
FETCh:SUBarrays:MODulation:PERRor:QPSK:MMAX?
FETCh:SUBarrays:MODulation:PERRor:WCDMa:DPCH:CURRent?
FETCh:SUBarrays:MODulation:PERRor:WCDMa:DPCH:AVERage?
FETCh:SUBarrays:MODulation:PERRor:WCDMa:DPCH:MMAX?
Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:SUBarrays:MODulation:PERRor:QPSK:CURRent?
SAMPle:SUBarrays:MODulation:PERRor:QPSK:AVERage?
SAMPle:SUBarrays:MODulation:PERRor:QPSK:MMAX?
SAMPle:SUBarrays:MODulation:PERRor:WCDMa:DPCH:CURRent?
SAMPle:SUBarrays:MODulation:PERRor:WCDMa:DPCH:AVERage?
SAMPle:SUBarrays:MODulation:PERRor:WCDMa:DPCH:MMAX?
Read results (synchronized) ⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–180.0 deg to +180.0 deg,	1st value for phase error	NAN	deg	V3.00
... ,	...	...	...	
–180.0 deg to +180.0 deg	nth value for phase error	NAN	deg	

Description of command

These commands are always queries. They measure and return the phase error versus time in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:PERRor...` commands. In the default setting of the configuration command the `READ:SUBarrays..., FETCh:SUBarrays..., and SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay..., FETCh:ARRay..., and SAMPle:ARRay...` command group described above.

The `CONFigure:SUBarrays:MODulation:PERRor...` commands define a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum, …)` is set, only one value is returned per subrange.

The calculation of *Current, Average, and MMAX* (Max./Min.) results is explained in Chapter 3 (see *display mode*).

MODulation:IQANalyzer

The subsystem *MODulation:IQANalyzer* measures the I and Q amplitudes of the received QPSK or WCDMA signal as a function of time. The subsystem corresponds to the measurement menu *Modulation,* applications *I/Q Analyzer QPSK* and *I/Q Analyzer WCDMA,* and the sections in the popup menu *Modulation Configuration* that are related to the *I/Q Analyzer*... applications.

Control of Measurement – Subsystem MODulation:IQANalyzer

The subsystem *MODulation:IQANalyzer* controls the measurement. It corresponds to the softkeys *I/Q Analyzer QPSK* and *I/Q Analyzer WCDMA* in the measurement menu *Modulation*.

INITiate:MODulation:IQANalyzer:QPSK	Start new measurement	⇒ *RUN*
ABORt:MODulation:IQANalyzer:QPSK	Abort running measurement and switch off	⇒ *OFF*
STOP:MODulation:IQANalyzer:QPSK	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:IQANalyzer:QPSK	Next measurement step (only *stepping mode*)	⇒ *RUN*
INITiate:MODulation:IQANalyzer:WCDMa:DPCH	Start new measurement	⇒ *RUN*
ABORt:MODulation:IQANalyzer:WCDMa:DPCH	Abort running meas. and switch off	⇒ *OFF*
STOP:MODulation:IQANalyzer:WCDMa:DPCH	Stop meas. after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:IQANalyzer:WCDMa:DPCH	Next meas. step (only *stepping mode*)	⇒ *RUN*

Description of command	FW vers.
These commands have no query form. They start and stop the measurement, setting it to the status indicated in the top right column.	V3.15

CONFigure:MODulation:IQANalyzer:QPSK:EREPorting <*Mode*> Event Reporting
CONFigure:MODulation:IQANalyzer:WCDMa:DPCH:EREPorting <*Mode*>

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.15
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:MODulation:IQANalyzer:QPSK:STATus? Measurement Status
FETCh:MODulation:IQANalyzer:WCDMa:DPCH:STATus?

Ret. values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.15
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE	No counting mode set	NONE	–	

Description of command

These commands are always queries. They return the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *I/Q Analyzer* applications.

Subsystem MODulation:IQANalyzer:QPSK:CONTrol

The subsystem *MODulation:IQANalyzer...:CONTrol* configures the scope of the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration.*

CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:RMODe <*Mode*> Result Mode
CONFigure:MODulation:IQANalyzer:WCDMa:DPCH:CONTrol:RMODe <*Mode*>

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar | ARRay	Scalar values only (incl. limit matching) Scalar measured values and arrays	ARR	–	V3.15

Description of command

This command specifies the type of measured values.

CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:REPetition Test Cycles
<*Repetition*>,<*StopCond*>,<*Stepmode*>
CONFigure:MODulation:IQANalyzer:WCDMa:DPCH:CONTrol:REPetition
<*Repetition*>,<*StopCond*>,<*Stepmode*>

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | SINGleshot | 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | NONE	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.15

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*

CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:MLENgth <*Length*> Measurement Length
CONFigure:MODulation:IQANalyzer:WCDMa:DPCH:CONTrol:MLENgth <*Length*>

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
640 | 2560	QPSK: Number of chip periods measured	640	(chips)	V3.15
1280 | 2560	WCDMA: Number of chip periods measured	2560	(chips)	V4.20

Description of command

This command selects the time interval to be measured. A small measurement length accelerates the measurement and causes the output arrays to be truncated.

CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:ROTation <*Enable*> Rotation

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
0 | **45**	No rotation (0°) Rotation by 45°	0	–	V3.15

Description of command

This command qualifies whether the constellation and vector diagrams are rotated by 45°. A rotation has an impact on the I/Q imbalance. Any parameter except 0 or 45 causes a "Numeric data error".

DEFault:MODulation:IQANalyzer:QPSK:CONTrol <*Enable*>
DEFault:MODulation:IQANalyzer:WCDMa:DPCH:CONTrol <*Enable*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.15

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem SUBarrays:...

The subsystem *SUBarrays:...* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:IQANalyzer:QPSK
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}
CONFigure:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH
<Mode>,<Start>,<Samples>{,<Start>,<Samples>} Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	
ALL |	Return all measurement values	ALL	–	
ARIThmetical |	Return arithm. mean value in every subrange			
MINimum |	Return minimum value in every subrange			
MAXimum |	Return maximum value in every subrange			
IVAL |	Return single interpolated value at <Start>			
XMAXimum |	Return x-axis value of maximum and maximum			
XMINimum |	Return x-axis value of minimum and minimum			
PAVG,	Return arithmetic mean value in every subrange			

<Start>	Description of parameters	Def. value	Def. unit	
0 to 10239 | 0 to 2559	First sample in current range (depending on measurement length)	0	–	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 10240 | 0 to 2560	Number of samples in current range (depending on measurement length)	2560 10240	–	V3.15

Description of command

This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:IQANalyzer...` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of 1/4 chip period (oversampling factor 4).

For <Mode> = IVAL, the <Samples> parameter is ignored and the R&S CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located between two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation.

The subranges may overlap but must be within the total range of the *I/Q Analyzer* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. If the measurement length is reduced to the first quarter of a slot (see command `CONFigure:MODulation:IQANalyzer:QPSK: CONTrol:MLENgth`), then the start value must be in the range between sample no. 0 and sample no. 2559, the maximum number of samples is 2560.

By default, only one range corresponding to the total measurement range is used and all measurement values are returned.

Measured Values – Subsystem MODulation:IQANalyzer…?

The subsystem *MODulation:IQANalyzer:...?* measures and returns the I and Q amplitudes as a function of time. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* applications *I/Q Analyzer QPSK* and *I/Q Analyzer WCDMA*.

READ[:SCALar]:MODulation:IQANalyzer:QPSK? Scalar Results:
READ[:SCALar]:MODulation:IQANalyzer:WCDMa:DPCH?
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:IQANalyzer:QPSK?
FETCh[:SCALar]:MODulation:IQANalyzer:WCDMa:DPCH?
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:IQANalyzer:QPSK?
SAMPle[:SCALar]:MODulation:IQANalyzer:WCDMa:DPCH?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Error Vector Magnitude (RMS),	0.0 % to 100.0 %	NAN	%	V3.15
Magnitude Error (RMS)	0.0 % to 100.0 %	NAN	%	
Phase Error (RMS),	–180.0 deg to +180.0 deg	NAN	deg	
Slot Number (WCDMA),	0 to 15	NAN	–	
I/Q Origin Offset,	–100.0 dB to 0.0 dB	NAN	dB	
I/Q Imbalance,	–100.0 dB to 0.0 dB	NAN	dB	
UE Power Current	–100.0 dBm to +60.0 dBm	NAN	dBm	

Description of command

These commands are always queries. They start a `MODulation:IQANalyzer` measurement `(READ...)` and/or return all scalar measurement results (see Chapter 4). Values marked WCDMA are not available in the QPSK application; the QPSK output string is shortened.

READ:ARRay:MODulation:IQANalyzer:QPSK:IPHase? Normalized I/Q Amplitude
READ:ARRay:MODulation:IQANalyzer:QPSK:QPHase?
READ:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:IPHase?
READ:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:IQANalyzer:QPSK:IPHase?
FETCh:ARRay:MODulation:IQANalyzer:QPSK:QPHase?
FETCh:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:IPHase?
FETCh:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:IQANalyzer:QPSK:IPHase?
SAMPle:ARRay:MODulation:IQANalyzer:QPSK:QPHase?
SAMPle:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:IPHase?
SAMPle:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–2.0 to +2.0,	1st value for normalized I or Q amplitude	NAN	deg	V3.15
... ,	...	...	...	
–2.0 to +2.0	nth value for normalized I or Q amplitude	NAN	deg	

Description of command

These commands are always queries. They return the normalized I and Q amplitudes. The number n of measured values is equal to the measurement length set via `CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:MLENgth` times 4 (oversampling factor). The available measurement lengths of 2560 or 640 correspond to a time range of 0 chips to 2559 or 0 chips to 639 chips. For WCDMA signals, n is always equal to 4 x 2560 = 10240.

READ:SUBarrays:MODulation:IQANalyzer:QPSK:IPHase? Subarray Results
READ:SUBarrays:MODulation:IQANalyzer:QPSK:QPHase?
READ:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:IPHase?
READ:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?
Start single shot measurement and return results ⇒ *RUN*
FETCh:SUBarrays:MODulation:IQANalyzer:QPSK:IPHase?
FETCh:SUBarrays:MODulation:IQANalyzer:QPSK:QPHase?
FETCh:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:IPHase?
FETCh:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:SUBarrays:MODulation:IQANalyzer:QPSK:IPHase?
SAMPle:SUBarrays:MODulation:IQANalyzer:QPSK:QPHase?
SAMPle:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:IPHase?
SAMPle:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?
Read measurement results (synchronized) ⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–2.0 to +2.0,	1st value for normalized I or Q amplitude	NAN	deg	V3.15
... ,	...	...	...	
–2.0 to +2.0	nth value for normalized I or Q amplitude	NAN	deg	

Description of command

These commands are always queries. They measure and return the normalized I and Q amplitudes in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:IQANalyzer...` commands. In the default setting of the configuration command the `READ:SUBarrays..., FETCh:SUBarrays..., and SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay..., FETCh:ARRay..., and SAMPle:ARRay...` command group described above.

The `CONFigure:SUBarrays:MODulation:IQANalyzer...` commands define a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum, …)` is set, only one value is returned per subrange.

MODulation:PHDiscont

The subsystem `MODulation:PHDiscont` controls the *Phase Discontinuity* measurement. The subsystem corresponds to the measurement menu *Modulation,* application *Phase Discontinuity,* and the sections in the popup menu *Modulation Configuration* that are related to the *Phase Discontinuity* application.

Measurement Control

The following commands control the *Phase Discontinuity* measurement. They correspond to the *Phase Discont.* softkey in the measurement menu *Modulation*.

INITiate:MODulation:PHDiscont	Start new measurement	⇒	*RUN*
ABORt:MODulation:PHDiscont	Abort running measurement and switch off	⇒	*OFF*
STOP:MODulation:PHDiscont	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:MODulation:PHDiscont	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V3.80

CONFigure:MODulation:PHDiscont:EREPorting <*Mode*> — Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.80
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:MODulation:PHDiscont:STATus? — Measurement Status

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.80
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE	No counting mode set	NONE	–	

Description of command

This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Phase Discontinuity* measurement. They correspond to the sections in the popup menu *Modulation Configuration* that are related to the *Phase Discontinuity* application.

Subsystem MODulation:PHDiscont:CONTrol

The subsystem *MODulation:PHDiscont:CONTrol* configures the scope of the measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration*.

CONFigure:MODulation:PHDiscont:CONTrol:REPetition Test Cycles
<Repetition>, <StopCond>, <Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	FW vers.
CONTinuous | SINGleshot | 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	V3.80
<StopCond>	Description of parameters	Def. value	Def. unit	FW vers.
SONerror | NONE	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	V3.80
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | NONE	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.80

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of `READ` commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:MODulation:PHDiscont:CONTrol:MLENgth *<Length>* Measurement Length

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 46	Number of slots measured	46	(slots)	V4.36

Description of command

This command selects the measurement length (number of slots) .

DEFault:MODulation:PHDiscont:CONTrol *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.80

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem MODulation:PHDiscont:...LIMit

The subsystem *MODulation:PHDiscont:...LIMit* defines the limits for the *Phase Discontinuity* measurement. The subsystem corresponds to the *Phase Discontinuity* section in the *Limits* tab of the popup menu *Modulation Configuration.*

CONFigure:MODulation:PHDiscont:LIMit[:SCALar]:SYMMetric Limit Values
[:COMBined]:VALue ***<Static_PHD>, <Dynamic_PHD>, <EVM>, <Thresh_EVM>, <Freq_Err>***

<Static_PHD>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 deg to 70.0 deg	Static phase discontinuity limit (symmetric)	60.0	deg	V3.80
<Dynamic_PHD>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 deg to 70.0 deg	Dyn. phase discontinuity limit (symmetric)	30.0	deg	V3.80
<EVM>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to 50.0 %	EVM limit	+17.5	%	V3.80
<Thresh_EVM>	Description of parameters	Def. value	Def. unit	FW vers.
–70.0 dBm to +40 dBm	Threshold EVM	–20.0	dBm	V3.80
<Freq_Err>	Description of parameters	Def. value	Def. unit	FW vers.
0 Hz to 4000 Hz	Frequency Error (symmetric)	200.0	Hz	V3.80

Description of command

This command specifies the limit values for the *Phase Discontinuity* measurement.

CONFigure:MODulation:PHDiscont:LIMit[:SCALar]:SYMMetric Limit Values
[:COMBined]:ENABle ***<PHD>, <EVM>, <Thresh_EVM>, <Freq_Err>***

For all parameters	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable limit check	ON	–	V3.80

Description of command

This command enables or disables the limit check for the *Phase Discontinuity* measurement. *<PHD>* enables both the static and the dynamic limit check.

Measured Values – Subsystem MODulation:PHDiscont...?

The subsystem *MODulation:PHDiscont...?* measures and returns the results and compares them with tolerance values. The subsystem corresponds to the graphical measurement menu *Modulation,* application *Phase Discontinuity.*

Scalar Results

READ[:SCALar]:MODulation:PHDiscont? Start single shot measurement and return results
FETCh[:SCALar]:MODulation:PHDiscont? Read measurement results (unsynchronized)
SAMPle[:SCALar]:MODulation:PHDiscont? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Max. Phase Disc.,	–180.0 deg to +180.0 deg	NAN	deg	V3.80
Max. Freq. Error,	–5000.0 Hz to +5000.0 Hz	NAN	Hz	
EVM ≥ Thresh. EVM,	0.0 % to 100.0 %	NAN	%	
EVM < Thresh. EVM,	0.0 % to 100.0 %	NAN	%	
Phase Disc. Count > static limit	0 to 45	NAN	–	
Phase Disc. Count > dyn. limit	0 to 45	NAN	–	
Minimum Dist.	0 to 45	NAN	–	
Max. UE Power,	–100.0 dBm to +60.0 dBm	NAN	dBm	
Min. UE Power	–100.0 dBm to +60.0 dBm	NAN	dBm	

Description of command

These commands are always queries. They start a `MODulation:PHDiscont` measurement (`READ...`) and/or return all scalar measurement results.

CALCulate[:SCALar]:MODulation:PHDiscont:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
Max. Phase Disc.,	NMAU | NMAL | INV | OK	INV	–	V3.80
Max. Freq. Error,	NMAU | NMAL | INV | OK	INV	–	
EVM ≥ Thresh. EVM,	NMAL | INV | OK	INV	–	
Minimum Dist.	NMAU | INV | OK	INV	–	

Description of command

This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see commands above) are exceeded.

The following messages may be returned for all measured values:

NMAL	Result exceeds upper limit, limit check failed
NMAU	Result below lower limit, limit check failed
INV	No valid result available
OK	Limit check passed

READ:ARRay:MODulation:PHDiscont:UEPower? UE Power (upper diagram)
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:PHDiscont:UEPower?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:PHDiscont:UEPower?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for UE power	–100.0 dBm to +60.0 dBm,	NAN	dBm	V3.80
...	... ,	...	...	
46th value for UE power	–100.0 dBm to +60.0 dBm	NAN	dBm	

Description of command

These commands are always queries. They return the UE power in a series of consecutive slots.

READ:ARRay:MODulation:PHDiscont:PHDiscont? Phase Discontinuity
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:PHDiscont:PHDiscont?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:PHDiscont:PHDiscont?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for phase discontinuity	–180.0 deg to +180.0 deg,	NAN	deg	V3.80
...	... ,	...	...	
45th value for phase discontinuity	–180.0 deg to +180.0 deg	NAN	deg	

Description of command

These commands are always queries. They return the phase discontinuity at a series of consecutive steps.

READ:ARRay:MODulation:PHDiscont:EVMagnitude? Error Vector Magnitude
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:PHDiscont:EVMagnitude?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:PHDiscont:EVMagnitude?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for EVM	0% to +100.0 %,	NAN	%	V3.80
...	... ,	...	...	
46th value for EVM	0% to +100.0 %	NAN	%	

Description of command

These commands are always queries. They return the EVM in a series of consecutive slots.

READ:ARRay:MODulation:PHDiscont:CFERror? Frequency Error
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:PHDiscont:CFERror?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:PHDiscont:CFERror?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for frequency error	–5000.0 Hz to +5000.0 Hz,	NAN	kHz	V3.80
...	... ,	...	...	
46th value for frequency error	–5000.0 Hz to +5000.0 Hz	NAN	kHz	

Description of command

These commands are always queries. They return the frequency error in a series of consecutive slots.

CALCulate:ARRay:MODulation:PHDiscont:PHDiscont:MATChing:LIMit? Limit Matching: P. Disc.

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for phase discontinuity	For all measured values:	INV	–	V3.80
...	NMAU | NMAL | INV | OK			
45th value for phase discont.	(see description on p. 6.96)	INV	–	

Description of command

This command is always a query. It indicates whether and in which way the error limits for the phase discontinuity at 45 consecutive steps are exceeded. `CALCulate:ARRay:MODulation:PHDiscont:PHDiscont:CONDition:LIMit?` gives additional information about the limit check.

CALCulate:ARRay:MODulation:PHDiscont:PHDiscont:CONDition:LIMit? Limit Matching: P. Disc.

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for phase discontinuity	For all measured values:	INV	–	V3.80
...				
45th value for phase discont.	STATic | DYNamic | INV	INV	–	

Description of command

This command is always a query. It complements the `CALCulate:ARRay:MODulation:PHDiscont:PHDiscont:MATChing:LIMit?` command, indicating the crucial factor for the limit check.

The following messages may be returned for all measured values:

STAT	The static limit was crucial for the check (not necessarily exceeded, result may be OK).
DYN	The dynamic limit was crucial (not necessarily exceeded, result may be OK). This means that the slot belongs to a group of 4 slots after a slot where the dynamic (but not the static) limit was exceeded **and** that the slot does not exceed the static limit.
INV	Measurement invalid

CALCulate:ARRay:MODulation:PHDiscont:EVMagnitude:MATChing:LIMit? Limit Matching: EVM

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for EVM	For all measured values:	INV	–	V3.80
...	NMAL | INV | OK			
46th value for EVM	(see description on p. 6.96)	INV	–	

Description of command

This command is always a query. It indicates whether and in which way the error limits for the Error Vector Magnitude in 46 consecutive slots are exceeded. `CALCulate:ARRay:MODulation:PHDiscont:EVMagnitude:CONDition:LIMit?` gives additional information about the limit check.

CALCulate:ARRay:MODulation:PHDiscont:EVMagnitude:CONDition:LIMit? Limit Matching: EVM

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for EVM	For all measured values:	INV	–	V3.80
...				
46th value for EVM	NORMal | THReshold | INV	INV	–	

Description of command

This command is always a query. It complements the `CALCulate:ARRay:MODulation:PHDiscont:EVMagnitude:MATChing:LIMit?` command, indicating which kind of limit check was performed.

The following messages may be returned for all measured values:

NORM	UE power above the *Threshold EVM* value, the limit check was performed in the usual way
THR	UE power below the *Threshold EVM* value (and *Threshold EVM* enabled; see `CONFigure:MODulation:PHDiscont:LIMit[:SCALar]:SYMMetric[:COMBined]:ENABle`), the EVM was passed without limit check
INV	Measurement invalid

CALCulate:ARRay:MODulation:PHDiscont:CFERror:MATChing:LIMit?		Limit Matching: Frequency Error		
Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for EVM	For all measured values: NMAU | NMAL | INV | OK	INV	–	V3.80
...				
46th value for EVM	(see description on p. 6.96)	INV	–	
Description of command				
This command is always a query. It indicates whether and in which way the error limits for the Frequency Error in 46 consecutive slots are exceeded.				

SPECtrum Measurements

The subsystem *SPECtrum* measures the output RF spectrum emissions (off-carrier power) and returns them as a function of the frequency. The subsystem corresponds to the measurement menu *Spectrum* with its various applications and the associated popup menu *Spectrum Configuration.*

The off-carrier power can be assessed with different measurement methods. In manual control, these operating conditions correspond to the different applications of the *Spectrum* measurement. In remote control, the applications are distinguished by the third-level keywords in the `SPECtrum` commands:

- The third-level keyword `MFILter` denotes the *ACLR Filter* application.
- The third-level keyword `MFFT` denotes the *ACLR FFT/OBW* application.
- The third-level keyword `EMASk` denotes the *Emission Mask* application.

The three applications will be described in separate sections.

SPECtrum:MFILter

The subsystem *`SPECtrum:MFILter`* measures the Adjacent Channel Leakage power Ratio (ACLR) using an RRC filter and returns the result at the carrier frequency plus four different off-carrier frequencies. The subsystem corresponds to the measurement menu *Spectrum,* application *ACLR Filter,* and the sections in the popup menu *Spectrum Configuration* that are related to the *ACLR Filter* application.

Control of Measurement – Subsystem SPECtrum:MFILter

The subsystem *SPECtrum:MFILter* controls the *Spectrum* measurement. It corresponds to the *ACLR Filter* softkey in the measurement menu *Spectrum*.

INITiate:SPECtrum:MFILter	Start new measurement	⇒	*RUN*
ABORt:SPECtrum:MFILter	Abort running measurement and switch off	⇒	*OFF*
STOP:SPECtrum:MFILter	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:SPECtrum:MFILter	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V3.00

CONFigure:SPECtrum:MFILter:EREPorting <*Mode*> — Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.00
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:SPECtrum:MFILter:STATus?			Measurement Status	
Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	V3.00
1 to 10000 | **NONE,**	Counter for current statistics cycle No counting mode set	NONE	–	
1 to 1000 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	
Description of command				
This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).				

Test Configuration

The commands of the following subsystems configure the *Spectrum* measurement. They correspond to the sections in the popup menu *Spectrum Configuration* that are related to the *ACLR Filter* application..

Subsystem SPECTrum:MFILter:CONTrol

The subsystem *SPECtrum:MFILter:CONTrol* configures the scope of the measurement. It corresponds to the *Control* tab in the popup menu *Spectrum Configuration*.

CONFigure:SPECtrum:MFILter:CONTrol:STATistics <*Statistics*>			Measurement Statistics	
<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 | **NONE**	Number of evaluation periods per statistics cycle Statistics off (equivalent to 1)	10	–	V3.00
Description of command				
This command defines the number of slots forming a statistics cycle.				

CONFigure:SPECtrum:MFILter:CONTrol:REPetition Test Cycles
<Repetition>,<StopCond>,<Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	**Description of parameters**	**Def. value**	**Def. unit**	
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.00

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:SPECtrum:MFILter:CONTrol:MLENgth *<Length>* Measurement Length

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
320 | 640 | 1280 | 2560	Number of chip periods measured	640	(chips)	V3.00

Description of command

This command selects the time interval to be measured. A small measurement length accelerates the measurement but does not change the format or length of the output.

CONFigure:SPECtrum:MFILter:CONTrol:UEPMeasure *<Enable>*
Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Enable UE power measurement Disable UE power measurement	OFF	–	V3.05

Description of command

This command switches the UE power measurement in the `MFILter` application on or off. Without the UE power, the `MFILter` measurement is faster.

DEFault:SPECtrum:MFILter:CONTrol *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

CONFigure:SPECtrum:CONTrol:HDYNamic <*Enable*> High Dynamic Range

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	High dynamic range setting on or off	OFF	–	V3.00

Description of command

This command switches the input path setting for high dynamic range on or off. The setting is valid for all applications of the `SPECtrum` measurement group. It does not supersede the `[SENSe:]LEVel:ATTenuation` setting that remains valid for all other measurement groups.

Subsystem SPECTrum:MFILter:...LIMit

The subsystem *SPECtrum:MFILter:...LIMit* defines the limits for the *ACLR Filter* measurement. The subsystem corresponds to the *ACLR Filter* section in the *Limits* tab of the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum:MFILter:RPEak:CURRent:LIMit[:SCALar]:
ASYMmetric:UPPer:CHANnel<nr>:VALue <*ACLR_Limit*> Relative Limits
CONFigure:SPECtrum:MFILter:RRMS:CURRent:LIMit[:SCALar]:
ASYMmetric:UPPer:CHANnel<nr>:VALue <*ACLR_Limit*>
CONFigure:SPECtrum:MFILter:RRMS:AVERage:LIMit[:SCALar]:
ASYMmetric:UPPer:CHANnel<nr>:VALue <*ACLR_Limit*>

<nr>	Description of parameters	Def. value	Def. unit	
1 | 2 | 3 | 4	Channel number;	–	–	
<ACLR_Limit>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
–80.0 dB to 0.0 dB	Upper limit for the ACLR if <nr> = ±2	–43	dBc	V3.00
–80.0 dB to 0.0 dB	Upper limit for the ACLR if <nr> = ±1	–33	dBc	

Description of command

These commands define upper limits for the ACLR measured with the direct filter method. The numeric suffix <nr> = 1, 2, 3, 4 denotes the channel numbers –2, –1, 1, 2. The channel frequency is the channel number times 5 MHz from the carrier frequency. The 4th and 5th-level keywords in the commands denote the statistical result which the limit refers to:

`RPEak:CURRent`	Peak ACLR of the current slot
`RRMS:CURRent`	RMS-averaged ACLR of the current slot
`RRMS:AVERage`	RMS-averaged ACLR, averaged over several slots

CONFigure:SPECtrum:MFILter:RELative:LIMit[:SCALar]:
ASYMmetric:UPPer:CHANnel<nr>:ENABle <*Enable*> Enable Relative Limits

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable relative limit check in channel <nr>	ON	–	V3.00

Description of command

This command switches the relative limit check in a particular channel <nr> on or off. The numeric suffix <nr> = 1, 2, 3, 4 denotes the channel numbers –2, –1, 1, 2. The relative limits are defined by the `CONFigure:SPECtrum:MFILter:RPEak...VALue` and `CONFigure:SPECtrum:MFILter:RRMS...VALue` commands; see above.

Note: Switching off the relative limit check also disables the absolute limit check.

CONFigure:SPECtrum:MFILter:APEak:CURRent:LIMit[:SCALar]:
ASYMmetric:UPPer:VALue <*ACLR_Limit*>
CONFigure:SPECtrum:MFILter:ARMS:CURRent:LIMit[:SCALar]:
ASYMmetric:UPPer:VALue <*ACLR_Limit*>
CONFigure:SPECtrum:MFILter:ARMS:AVERage:LIMit[:SCALar]:
ASYMmetric:UPPer:VALue <*ACLR_Limit*>

Absolute Limits

<ACLR_Limit>	Description of parameters	Def. value	Def. unit	FW vers.
–80.0 dBm to +33.0 dBm	Absolute limit for the ACLR	–50	dBm	V3.00

Description of command

These commands define absolute limits for the ACLR. If the ACLR in all channels is below the absolute limits, the ACLR measurement will pass the limit check, irrespective of the relative limits.

CONFigure:SPECtrum:MFILter:ABSolute:LIMit[:SCALar]:
ASYMmetric:UPPer:ENABle <*Enable*>

Enable Absolute Limits

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable absolute limit check	ON	–	V3.00

Description of command

This command switches the absolute limit check in all channels on or off. The absolute limits are defined by the `CONFigure:SPECtrum:MFILter:APEak... VALue` and `CONFigure:SPECtrum:MFILter:ARMS...VALue` commands; see above.

DEFault:SPECtrum:MFILter:LIMit <*Enable*>

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem SPECTrum:MFILter:MEASx

The subsystem *SPECtrum:MFILter:MEASx* determines at which channels and frequencies the *ACLR Filter* measurement is performed. The subsystem corresponds to the *Meas. X* tab of the popup menu *Spectrum Configuration.*

Measure Points Enable

CONFigure:SPECtrum:MFILter:MEASx:CHANnel<nr>:ENABle <*Enable*>

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable the measurement in channel <nr>	ON	–	V3.00

Description of command

This command switches the measurement in a particular channel on or off. The numeric suffix <nr> = 1, 2, 3, 4 denotes the channel numbers –2, –1, 1, 2. The fixed channel frequency is the channel number times 5 MHz from the carrier frequency.

DEFault:SPECtrum:MFILter:MEASx <*Enable*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	The parameters are set to default values	ON	–	V3.00
OFF	Some or all parameters differ from the default values			

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystem SPECtrum:MFILter?

The subsystem *SPECtrum:MFILter* measures and returns the ACLR and compares it with tolerance values. The subsystem corresponds to the graphical measurement menu *Spectrum.*

Scalar Results

READ[:SCALar]:SPECtrum:MFILter:ABSolute? Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:MFILter:ABSolute? Read measurement results (unsynchronized)
SAMPle[:SCALar]:SPECtrum:MFILter:ABSolute? Read measurement results (synchronized)
READ[:SCALar]:SPECtrum:MFILter:RELative? Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:MFILter:RELative? Read measurement results (unsynchronized)
SAMPle[:SCALar]:SPECtrum:MFILter:RELative? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Carrier Power (Peak): Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	V3.00
Carrier Power (RMS): Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	
ACLR (Peak): Current (x4),	–100.0 dB to 0.0 dB	NAN	dB/dBm	
ACLR (RMS): Current (x4),	–100.0 dB to 0.0 dB	NAN	dB/dBm	
ACLR (RMS): Average (x4),	–100.0 dB to 0.0 dB	NAN	dB/dBm	
ACLR (Peak): Maximum (x4),	–100.0 dB to 0.0 dB	NAN	dB/dBm	
ACLR (RMS): Maximum (x4),	–100.0 dB to 0.0 dB	NAN	dB/dBm	
UE Power (RMS): Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	
Out of Tolerance	0% to +100.0%	NAN	%	

Description of command

These commands are always queries. They start a `SPECtrum:MFILter` measurement (`READ...`) and/or return all (scalar) measurement results. The symbol (x4) behind a value indicates that the list contains four results corresponding to the channel nos. –2, –1, +1, +2 (<nr> = 1, 2, 3, 4). The keywords ABSolute and RELative in the commands distinguish whether the ACLR results are expressed in absolute units (adjacent channels powers in dBm with a value range between –100.0 dBm and +60.0 dBm) or in relative units (ACLR in dB in the value range quoted above).

Scalar Results

READ[:SCALar]:SPECtrum:MFILter:EXTended:ABSolute? Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:MFILter:EXTended:ABSolute? Read measurement results (unsynchronized)
SAMPle[:SCALar]:SPECtrum:MFILter:EXTended:ABSolute? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Carrier Power (Peak): Maximum,	–100.0 dBm to +60.0 dBm	NAN	dBm	V4.30
Carrier Power (RMS): Maximum,	–100.0 dBm to +60.0 dBm	NAN	dBm	
Carrier Power (RMS): Average,	–100.0 dBm to +60.0 dBm	NAN	dBm	
UE Power (Peak): Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	
UE Power (Peak): Maximum,	–100.0 dBm to +60.0 dBm	NAN	dBm	
UE Power (RMS): Maximum,	–100.0 dBm to +60.0 dBm	NAN	dBm	
UE Power (RMS): Average	–100.0 dBm to +60.0 dBm	NAN	dBm	

Description of command

These commands are always queries. They start a `SPECtrum:MFILter` measurement (`READ...`) and/or return a selection of statistical power values. The *Carrier Power* values are obtained with the RRC filter specified for the ACP measurement. The *UE Power* results are measured with a wide band filter, so they should be slightly higher.

CALCulate[:SCALar]:SPECtrum:MFILter:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
ACLR (Peak): Current (x4),		INV	–	V3.00
ACLR (Peak): RMS (x4),	For all measured values:	INV	–	
ACLR (RMS): Average (x4),		INV	–	
ACLR (Peak): Maximum (x4),	NMAU | NMAL | INV | OK	INV	–	
ACLR (RMS): Maximum (x4)		INV	–	

Description of command

This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see commands above) are exceeded. The symbol (x4) behind a value indicates that the list contains four results corresponding to the channel nos. –2, –1, +1, +2 (<nr> = 1, 2, 3, 4).

The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

SPECtrum:MFFT

The subsystem `SPECtrum:MFFT` determines the Adjacent Channel Leakage power Ratio (ACLR) in frequency domain using a Fast Fourier Transform (FFT) and derives the Occupied Bandwidth (OBW). The subsystem corresponds to the measurement menu *Spectrum,* application *ACLR FFT/OBW,* and the sections in the popup menu *Spectrum Configuration* that are related to the *ACLR FFT/OBW* application.

Control of Measurement – Subsystem SPECtrum:MFFT

The subsystem *SPECtrum:MFFT* controls the *Spectrum* measurement. It corresponds to the *ACLR FFT/OBW* softkey in the measurement menu *Spectrum*.

INITiate:SPECtrum:MFFT	Start new measurement	⇒	*RUN*
ABORt:SPECtrum:MFFT	Abort running measurement and switch off	⇒	*OFF*
STOP:SPECtrum:MFFT	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:SPECtrum:MFFT	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V3.00

CONFigure:SPECtrum:MFFT:EREPorting <*Mode*> — Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.00
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:SPECtrum:MFFT:STATus? — Measurement Status

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.00
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	

Description of command

This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Spectrum* measurement. They correspond to the sections in the popup menu *Spectrum Configuration* that are related to the *ACLR FFT/OBW* application..

Subsystem SPECTrum:MFFT:CONTrol

The subsystem *SPECtrum:MFFT:CONTrol* configures the scope of the measurement. It corresponds to the *Control* tab in the popup menu *Spectrum Configuration*.

CONFigure:SPECtrum:MFFT:CONTrol:RMODe <*Mode*> Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar | ARRay,	Scalar values only (incl. limit matching) Scalar measured values and arrays	ARR	–	V3.00

Description of command

This command specifies the type of measured values.

CONFigure:SPECtrum:MFFT:CONTrol:STATistics <*Statistics*> Measurement Statistics

<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 | NONE	Number of evaluation periods per statistics cycle Statistics off (equivalent to 1)	10	–	V3.00

Description of command

This command defines the number of slots forming a statistics cycle.

CONFigure:SPECtrum:MFFT:CONTrol:REPetition <*Repetition*>,<*StopCond*>,<*Stepmode*> Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | SINGleshot | 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror | NONE	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | NONE	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.00

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:SPECtrum:MFFT:CONTrol:MLENgth <*Length*> Measurement Length

<*Length*>	Description of parameters	Def. value	Def. unit	FW vers.
320| 640 | 1280 | 2560	Number of chip periods measured	640	(chips)	V3.00

Description of command

This command selects the time interval to be measured. A small measurement length accelerates the measurement time but does not restrict the display range for the results in the frequency domain.

DEFault:SPECtrum:MFFT:CONTrol <*Enable*> Default Settings

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem SPECTrum:MFFT:...LIMit

The subsystem *SPECtrum:MFFT:...LIMit* defines the limits for the *ACLR FFT/OBW* measurement. The subsystem corresponds to the *ACLR FFT/OBW* section in the *Limits* tab of the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum:MFFT:RELative:CMAX:LIMit[:SCALar]:
ASYMmetric:UPPer:CHANnel<nr>:VALue <*ACLR_Limit*> Relative ACLR Limits
CONFigure:SPECtrum:MFFT:RELative:AVERage:LIMit[:SCALar]:
ASYMmetric:UPPer:CHANnel<nr>:VALue <*ACLR_Limit*>

<*nr*>	Description of parameters	Def. value	Def. unit	
1 | 2 | 3 | 4	Channel number;	–	–	
<*ACLR_Limit*>	Description of parameters	Def. value	Def. unit	FW vers.
–80.0 dB to 0.0 dB	Upper limit for the ACLR if <nr> = ±2	–43	dBc	V3.00
–80.0 dB to 0.0 dB	Upper limit for the ACLR if <nr> = ±1	–33	dBc	

Description of command

These commands define upper limits for the ACLR determined via FFT. The numeric suffix <nr> = 1, 2, 3, 4 denotes the channel numbers –2, –1, 1, 2. The channel frequency is <nr> * 5 MHz from the carrier frequency. The 5th-level keywords distinguish the limits for the *Current* and *Maximum* display modes `(CMAX)` and for the *Average* display mode `(AVERage)`.

CONFigure:SPECtrum:MFFT:RELative:LIMit[:SCALar]:
ASYMmetric:UPPer:CHANnel<nr>:Enable <*Enable*> Enable Relative ACLR Limits

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable relative limit check in channel <nr>	ON	–	V3.00

Description of command

This command switches the relative limit check in a particular channel <nr> on or off. The numeric suffix <nr> = 1, 2, 3, 4 denotes the channel numbers –2, –1, 1, 2. The relative limits are defined by the `CONFigure:SPECtrum:MFFT:RELative...VALue` commands; see above.

Note: Switching off the relative limit check also disables the absolute limit check.

CONFigure:SPECtrum:MFFT:OBW:CMAX:LIMit[:SCALar]:
ASYMmetric:UPPer:VALue <*OBW_Limit*>
CONFigure:SPECtrum:MFFT:OBW:AVERage:LIMit[:SCALar]:
ASYMmetric:UPPer:VALue <*OBW_Limit*>

OBW Limits

<*OBW_Limit*>	Description of parameters	Def. value	Def. unit	FW vers.
0.00 MHz to 10.00 MHz	Upper limit for the OBW	5.00	MHz	V3.00

Description of command

These commands define upper limits for the OBW determined via FFT. The 5th-level keywords distinguish the limits for the *Current* and *Maximum* display modes `(CMAX)` and for the *Average* display mode `(AVERage)`.

CONFigure:SPECtrum:MFFT:OBW:LIMit[:SCALar]:
ASYMmetric:UPPer:Enable <*Enable*>

Enable OBW Limits

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable relative limit check in channel <nr>	ON	–	V3.00

Description of command

This command switches the relative limit check in a particular channel <nr> on or off. The relative limits are defined by the `CONFigure:SPECtrum:MFFT:OBW...VALue` commands; see above.

CONFigure:SPECtrum:MFFT:ABSolute:CMAX:LIMit[:SCALar]:
ASYMmetric:UPPer:VALue <*ACLR_Limit*>
CONFigure:SPECtrum:MFFT:ABSolute:AVERage:LIMit[:SCALar]:
ASYMmetric:UPPer:VALue <*ACLR_Limit*>

Absolute ACLR Limits

<*ACLR_Limit*>	Description of parameters	Def. value	Def. unit	FW vers.
–80.0 dBm to +33.0 dBm	Absolute limit for the ACLR	–50	dBm	V3.00

Description of command

These commands define absolute limits for the ACLR. If the ACLR in all channels is below the absolute limits, the ACLR measurement will pass the limit check, irrespective of the relative limits. The 5th-level keywords distinguish the limits for the *Current* and *Maximum* display modes `(CMAX)` and for the *Average* display mode `(AVERage)`.

CONFigure:SPECtrum:MFFT:ABSolute:LIMit[:SCALar]:
ASYMmetric:UPPer:Enable <*Enable*>

Enable Absolute ACLR Limits

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable absolute limit check	ON	–	V3.00

Description of command

This command switches the absolute limit check in all channels on or off. The absolute limits are defined by the `CONFigure:SPECtrum:MFFT:ABSolute... VALue` commands; see above.

DEFault:SPECtrum:MFFT:LIMit <*Enable*>

Default Settings

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem SUBarrays:SPECtrum

The subsystem *SUBarrays:SPECtrum* defines the measurement range and the type of output values.

CONFigure:SUBarrays:SPECtrum:MFFT:WFSPectrum Definition of Subarrays
<Mode>,<Start_WFSP>,<Samples_WFSP>{,<Start_WFSP>,<Samples_WFSP>}
CONFigure:SUBarrays:SPECtrum:MFFT:WFSSpectrum
<Mode>,<Start_WFSS>,<Samples_WFSS>{,<Start_WFSS>,<Samples_WFSS>}

<Mode>	Description of parameters	Def. value	Def. unit	
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL |** **XMAXimum |** **XMINimum |** **PAVG,**	Return all measurement values Return arithm. mean value in every subrange Return minimum value in every subrange Return maximum value in every subrange Return single interpolated value at <Start> Return x-axis value of maximum and maximum Return x-axis value of minimum and minimum Return arithmetic mean value in every subrange	ALL	–	
<Start_WFSP>	Description of parameters	Def. value	Def. unit	
–10.12 MHz to +10.12 MHz,	Start frequency for the RRC-filtered FFT curve	–10.12	MHz	
<Samples_WFSP>	Description of parameters	Def. value	Def. unit	
1 to 1013	Number of samples in current range	1013	–	
<Start_WFSS>	Description of parameters	Def. value	Def. unit	
–12.5 MHz to +12.48 MHz,	Start frequency for the raw FFT curve	–12.5	MHz	
<Samples_WFSS>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1250	Number of samples in current range	1250	–	V3.00

Description of command

These commands configure the `READ:SUBarrays..., FETCh:SUBarrays...,` and `SAMPle:SUBarrays:SPECtrum...` commands. They restrict the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start frequency and the number of test points which are located on a fixed, equidistant grid with a step width of 20 kHz.

For <Mode> = IVAL, the <Samples> parameter is ignored and the R&S CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located between two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation.

The subranges may overlap but must be within the total display range of the two measurement curves. Test points outside this range are not measured (result *NAN)* and do not enter into the `ARIThmetical, MINimum, MAXimum, …` values. The display range for the RRC-filtered FFT curve (waveform spectrum, keyword `WFSPectrum`) is smaller than the display range for the raw FFT curve (waveform signal spectrum, keyword `WFSSpectrum`).

By default, only one range corresponding to the total display range is used and all measurement values are returned.

Measured Values – Subsystem SPECtrum:MFFT?

The subsystem *SPECtrum:MFFT...?* measures and returns the results and compares them with tolerance values. The subsystem corresponds to the graphical measurement menu *Spectrum,* application *ACLR FFT/OBW.*

Scalar Results

READ[:SCALar]:SPECtrum:MFFT:ABSolute?	Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:MFFT:ABSolute?	Read measurement results (unsynchronized)
SAMPle[:SCALar]:SPECtrum:MFFT:ABSolute?	Read measurement results (synchronized)
READ[:SCALar]:SPECtrum:MFFT:RELative?	Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:MFFT:RELative?	Read measurement results (unsynchronized)
SAMPle[:SCALar]:SPECtrum:MFFT:RELative?	Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Carrier Power (Peak): Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	V3.00
Carrier Power (RMS): Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	
ACLR (RMS): Current (x4),	–100.0 dB to 0.0 dB	NAN	dB	
ACLR (RMS): Average (x4),	–100.0 dB to 0.0 dB	NAN	dB	
ACLR (RMS): Maximum (x4),	–100.0 dB to 0.0 dB	NAN	dB	
OBW Current,	0.00 MHz to 10.00 MHz	NAN	Hz	
OBW Average,	0.00 MHz to 10.00 MHz	NAN	Hz	
OBW Maximum,	0.00 MHz to 10.00 MHz	NAN	Hz	
OBW left,	–5.00 MHz to +5.00 MHz	NAN	Hz	
OBW right,	–5.00 MHz to +5.00 MHz	NAN	Hz	
UE Power (Current),	–100.0 dBm to +60.0 dBm	NAN	dBm	
Out of Tolerance	0% to +100.0%	NAN	%	

Description of command

These commands are always queries. They start a `SPECtrum:MFFT` measurement (`READ...`) and/or return all (scalar) measurement results. The symbol (x4) behind a value indicates that the list contains four results corresponding to the channel nos. –2, –1, +1, +2 (<nr> = 1, 2, 3, 4). The keywords ABSolute and RELative in the commands distinguish whether the ACLR results are expressed in absolute units (adjacent channels powers in dBm with a value range between –100.0 dBm and +60.0 dBm) or in relative units (ACLR in dB in the value range quoted above). All frequency (OBW) values are expressed in Hz and in exponential representation, e.g. `4.060000E+006`.

CALCulate[:SCALar]:SPECtrum:MFFT:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
ACLR (RMS): Current (x4),		INV	–	V3.00
ACLR (RMS): Average (x4),		INV	–	
ACLR (RMS): Maximum (x4),	For all measured values:	INV	–	
OBW Current,		INV	–	
OBW Average,	NMAU | NMAL | INV | OK	INV	–	
OBW Maximum		INV	–	

Description of command

This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see commands above) are exceeded. The symbol (x4) behind a value indicates that the list contains four results corresponding to the channel nos. –2, –1, +1, +2 (<nr> = 1, 2, 3, 4).

The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

READ:ARRay:SPECtrum:MFFT:WFSPectrum:CURRent? ACLR Curves
READ:ARRay:SPECtrum:MFFT:WFSPectrum:AVERage?
READ:ARRay:SPECtrum:MFFT:WFSPectrum:MAXimum?
READ:ARRay:SPECtrum:MFFT:WFSSpectrum:CURRent?
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:SPECtrum:MFFT:WFSPectrum:CURRent?
FETCh:ARRay:SPECtrum:MFFT:WFSPectrum:AVERage?
FETCh:ARRay:SPECtrum:MFFT:WFSPectrum:MAXimum?
FETCh:ARRay:SPECtrum:MFFT:WFSSpectrum:CURRent?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:SPECtrum:MFFT:WFSPectrum:CURRent?
SAMPle:ARRay:SPECtrum:MFFT:WFSPectrum:AVERage?
SAMPle:ARRay:SPECtrum:MFFT:WFSPectrum:MAXimum?
SAMPle:ARRay:SPECtrum:MFFT:WFSSpectrum:CURRent?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to 0.0 dB,	1st value for ACLR	NAN	dB	V3.00
... ,	...	...	...	
–100.0 dB to 0.0 dB	nth value for ACLR	NAN	dB	

Description of command

These commands are always queries. They return the FFT curve for the ACLR (keyword `WFSSpectrum`) and the five additional, RRC-filtered ACLR values (keyword `WFSPectrum`).

- The raw FFT curve contains 1250 values (waveform signal spectrum, keyword `WFSSpectrum`, n = 1250, frequency range from –12.50 MHz to + 12.48 MHz, fixed 20 KHz frequency spacing).
- The RRC-filtered ACLR values correspond to the first 5 results of the `WFSPectrum` arrays, the remaining values are always NAN (waveform spectrum, keyword `WFSPectrum`, n = 1013, five ACLR results).

The calculation of *Current, Average, and MMAX* (Max./Min.) results is explained in Chapter 3 (see *display mode*). The raw FFT curve is available in *Current* mode only.

READ:SUBarrays:SPECtrum:MFFT:WFSPectrum:CURRent? Subarray Results
READ:SUBarrays:SPECtrum:MFFT:WFSPectrum:AVERage?
READ:SUBarrays:SPECtrum:MFFT:WFSPectrum:MAXimum?
READ:SUBarrays:SPECtrum:MFFT:WFSSpectrum:CURRent?
Start single shot measurement and return results ⇒ *RUN*
FETCh:SUBarrays:SPECtrum:MFFT:WFSPectrum:CURRent?
FETCh:SUBarrays:SPECtrum:MFFT:WFSPectrum:AVERage?
FETCh:SUBarrays:SPECtrum:MFFT:WFSPectrum:MAXimum?
FETCh:SUBarrays:SPECtrum:MFFT:WFSSpectrum:CURRent?
Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:SUBarrays:SPECtrum:MFFT:WFSPectrum:CURRent?
SAMPle:SUBarrays:SPECtrum:MFFT:WFSPectrum:AVERage?
SAMPle:SUBarrays:SPECtrum:MFFT:WFSPectrum:MAXimum?
SAMPle:SUBarrays:SPECtrum:MFFT:WFSSpectrum:CURRent?
Read results (synchronized) ⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to 0.0 dB,	1st value for ACLR	NAN	dB	V3.00
... ,	...	...	...	
–100.0 dB to 0.0 dB	nth value for ACLR	NAN	dB	

Description of command

These commands are always queries. They measure and return the ACLR in the subranges defined by means of the `CONFigure:SUBarrays:SPECtrum:MFFT...` commands. In the default setting of the configuration command the `READ:SUBarrays..., FETCh:SUBarrays..., and SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay..., FETCh:ARRay..., and SAMPle:ARRay...` command group described above.

The `CONFigure:SUBarrays:SPECtrum:MFFT...` commands define a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum, …)` is set, only one value is returned per subrange. The calculation of *Current, Average, and MMAX* (Max./Min.) results is explained in Chapter 3 (see *display mode*).

SPECtrum:EMASk

The subsystem `SPECtrum:EMASk` determines the spectrum emissions using a Fast Fourier Transform (FFT) method. The subsystem corresponds to the measurement menu *Spectrum,* application *Emission Mask,* and the sections in the popup menu *Spectrum Configuration* that are related to the *Emission Mask* application.

Control of Measurement – Subsystem SPECtrum:EMASk

The subsystem *SPECtrum:EMASk* controls the *Spectrum* measurement. It corresponds to the *Emission Mask* softkey in the measurement menu *Spectrum*.

INITiate:SPECtrum:EMASk	Start new measurement	⇒	*RUN*
ABORt:SPECtrum:EMASk	Abort running measurement and switch off	⇒	*OFF*
STOP:SPECtrum:EMASk	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:SPECtrum:EMASk	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V3.00

CONFigure:SPECtrum:EMASk:EREPorting <*Mode*> — Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.00
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:SPECtrum:EMASk:STATus? — Measurement Status

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.00
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	–
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	V3.00

Description of command

This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Spectrum – Emission Mask* measurement. They correspond to the sections in the popup menu *Spectrum Configuration* that are related to the *Emission Mask* application.

Subsystem SPECTrum:EMASk:CONTrol

The subsystem *SPECtrum:EMASk:CONTrol* configures the scope of the measurement. It corresponds to the *Control* tab in the popup menu *Spectrum Configuration*.

CONFigure:SPECtrum:EMASk:CONTrol:RMODe <*Mode*> Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar | ARRay,	Scalar values only (incl. limit matching) Scalar measured values and arrays	ARR	–	V3.00

Description of command

This command specifies the type of measured values.

CONFigure:SPECtrum:EMASk:CONTrol:STATistics <*Statistics*> Measurement Statistics

<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 | NONE	Number of evaluation periods per statistics cycle Statistics off (equivalent to 1)	10	–	V3.00

Description of command

This command defines the number of slots forming a statistics cycle.

CONFigure:SPECtrum:EMASk:CONTrol:REPetition <*Repetition*>,<*StopCond*>,<*Stepmode*> Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | SINGleshot | 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror | NONE	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | NONE	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.00

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:SPECtrum:EMASk:CONTrol:MLENgth <*Length*>				Measurement Length
<Length>	Description of parameters	Def. value	Def. unit	FW vers.
320 | 640 | 1280 | 2560	Number of chip periods measured	640	(chips)	V3.00
Description of command				
This command selects the time interval to be measured. A small measurement length accelerates the measurement time.				

DEFault:SPECtrum:EMASk:CONTrol <*Enable*>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Subsystem SPECTrum:EMASk:...LIMit:LINE

The subsystem *SPECtrum:EMASk:...LIMit:LINE* defines tolerance values for the *Emission Mask* measurement. The subsystem corresponds to the *Emission Mask* section in the *Limits* tab of the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum:EMASk:LIMit:MODE <*Length*>				Mode
<Length>	Description of parameters	Def. value	Def. unit	FW vers.
A | B | C | D	SEM mode	A	–	V5.11
Description of command				
This command selects the SEM mode. It is available in *Signalling* mode only. In *Non Signalling* mode, the R&S CMU operates in mode A.				

CONFigure:SPECtrum:EMASk:RELative:CMAX:LIMit:LINE: SYMmetric:[COMBined]:VALue <*Limit*> **CONFigure:SPECtrum:EMASk:RELative:AVERage:LIMit:LINE: SYMmetric:[COMBined]:VALue <*Limit*>**				Relative Limit Lines
<Limit>	Description of parameters	Def. value	Def. unit	FW vers.
–90.0 dB to 0.0 dB	Relative limit at point A	–49	dB	V3.00
–90.0 dB to 0.0 dB	Relative limit at point B	–49	dB	
–90.0 dB to 0.0 dB	Relative limit at point C	–39	dB	
–90.0 dB to 0.0 dB	Relative limit at point D	–35	dB	
–90.0 dB to 0.0 dB	Relative limit at point E	–49.775	dB	
–90.0 dB to 0.0 dB	Relative limit at point F	–35.225	dB	
Description of command				
These commands define relative limits for the *Current* and *Maximum* spectrum emission curve (5th level keyword `CMAX`) and for the *Average* curve `(AVERage)`.				

CONFigure:SPECtrum:EMASk:RELative:CMAX:LIMit:LINE:SYMmetric:[COMBined]:LIAD:ENABle <*Enable*>
CONFigure:SPECtrum:EMASk:RELative:AVERage:LIMit:LINE:SYMmetric:[COMBined]:LIAD:ENABle <*Enable*>
CONFigure:SPECtrum:EMASk:RELative:CMAX:LIMit:LINE:SYMmetric:[COMBined]:LIEF:ENABle <*Enable*>
CONFigure:SPECtrum:EMASk:RELative:AVERage:LIMit:LINE:SYMmetric:[COMBined]:LIEF:ENABle <*Enable*>

Enable Relative Limit Check

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable relative limit check	ON	–	V3.00

Description of command

These commands switch the relative limit check in the different sections of the emission mask on or off. The keywords `LIAD` and `LIEF` denote the sections *Limit A-D* and *Limit E-F*, respectively. The relative limits are defined by the `CONFigure:SPECtrum:EMASk:RELative... VALue` commands; see above.

Note: Switching off the relative limit check also disables the absolute limit check.

CONFigure:SPECtrum:EMASk:ABSolute:CMAX:LIMit:LINE:SYMmetric:[COMBined]:VALue <*Limit*>CONFigure:SPECtrum:EMASk:ABSolute:AVERage:LIMit:LINE:SYMmetric:[COMBined]:VALue <*Limit*>

Absolute Limit Lines (Limit G)

<*Limit*>	Description of parameters	Def. value	Def. unit	FW vers.
–80.0 dBm to +33 dBm	Absol. limit referenced to a 3.84 MHz filter	–50	dBm	V3.00

Description of command

These commands define the absolute limit G for the *Current* and *Maximum* spectrum emission curve (5th level keyword `CMAX`) and for the *Average* curve `(AVERage)`.

CONFigure:SPECtrum:EMASk:ABSolute:CMAX:LIMit:LINE:SYMmetric:[COMBined]:ENABle <*Enable*>
CONFigure:SPECtrum:EMASk:ABSolute:AVERage:LIMit:LINE:SYMmetric:[COMBined]:ENABle <*Enable*>

Enable Absolute Limit Check (Limit G)

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable absolute limit check	ON	–	V3.00

Description of command

These commands switch the absolute limit check for limit G in all channels on or off. The absolute limits are defined by the `CONFigure:SPECtrum:EMASk:ABSolute... VALue` commands; see above.

CONFigure:SPECtrum:EMASk:ADDition:CMAX:LIMit:LINE:SYMmetric:[COMBined]:VALue <*Limit_1MHz*>, <*Limit_30kHz*>
CONFigure:SPECtrum:EMASk:ADDition:AVERage:LIMit:LINE:SYMmetric:[COMBined]:VALue <*Limit_1MHz*>, <*Limit_30kHz*>

Absolute Limit Lines (Limit H)

<*Limit_1MHz*>	Description of parameters	Def. value	Def. unit	FW vers.
–80.0 dBm to +33 dBm,	Absol. limit H referenced to a 1 MHz filter	–13	dBm	V3.50
<*Limit_30kHz*>	Description of parameters	Def. value	Def. unit	FW vers.
–80.0 dBm to +33 dBm	Absol. limit H referenced to a 30 kHz filter	–15	dBm	V3.50

Description of command

These commands define the absolute limit H (additional requirement for band II) for the *Current* and *Maximum* spectrum emission curve (5th level keyword `CMAX`) and for the *Average* curve (`AVERage`). In *Non Signalling* mode and in SEM mode A (see `CONFigure:SPECtrum:EMASk:LIMit:MODE`), the limit lines are valid for operating bands II, IV, V, X, XII, XIII, and XIV only.

CONFigure:SPECtrum:EMASk:ADDition:CMAX:LIMit:LINE:SYMmetric:[COMBined]:ENABle <*Enable*>
CONFigure:SPECtrum:EMASk:ADDition:AVERage:LIMit:LINE:SYMmetric:[COMBined]:ENABle <*Enable*>

Enable Absolute Limit Check (Limit H)

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable absolute limit check	ON	–	V3.50

Description of command

These commands switch the absolute limit check for limit H in all channels on or off. The absolute limits are defined by the `CONFigure:SPECtrum:EMASk:ADDition... VALue` commands; see above.

DEFault:SPECtrum:EMASk:LIMit:LINE <*Enable*>

Default Settings

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystem SPECtrum:EMASk?

The subsystem *SPECtrum:EMASk...?* measures and returns the results and compares them with tolerance values. The subsystem corresponds to the graphical measurement menu *Spectrum,* application *Emission Mask.*

Scalar Results

READ[:SCALar]:SPECtrum:EMASk? Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:EMASk? Read measurement results (unsynchronized)
SAMPle[:SCALar]:SPECtrum:EMASk? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Ref. Power Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	V3.00
Ref. Power Average,	–100.0 dBm to +60.0 dBm	NAN	dBm	
Ref. Power Maximum,	–100.0 dBm to +60.0 dBm	NAN	dBm	
UE Power (Current),	–100.0 dBm to +60.0 dBm	NAN	dBm	
Out of Tolerance	0% to +100.0%	NAN	%	

Description of command

These commands are always queries. They start a `SPECtrum:EMASk` measurement (`READ...`) and/or return all (scalar) measurement results.

*) The *Ref. Power Average* and *Ref. Power Max.* values are available for firmware version ≥3.07.

READ:ARRay:SPECtrum:EMASk:CURRent? Spectrum Emission Curves
READ:ARRay:SPECtrum:EMASk:AVERage?
READ:ARRay:SPECtrum:EMASk:MAXimum?
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:SPECtrum:EMASk:CURRent?
FETCh:ARRay:SPECtrum:EMASk:AVERage?
FETCh:ARRay:SPECtrum:EMASk:MAXimum?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:SPECtrum:EMASk:CURRent?
SAMPle:ARRay:SPECtrum:EMASk:AVERage?
SAMPle:ARRay:SPECtrum:EMASk:MAXimum?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to 0.0 dB,	1st value for spectrum emission	NAN	dB	V3.00
... ,	...	...	...	
–100.0 dB to 0.0 dB	1340th value for spectrum emission	NAN	dB	

Description of command

These commands are always queries. They return the spectrum emission at fixed test points. The array is divided into three domains with different sampling intervals:

- The values no. 1 to 321 correspond to test points that are separated by 25 kHz and cover the frequency range between –12.000 MHz and –4.000 MHz from the carrier.
- The values no. 322 to 1019 correspond to test points that are separated by 10 kHz and cover the frequency range between –3.485 MHz and +3.485 MHz from the carrier.
- The values no. 1020 to 1340 correspond to test points that are separated by 25 kHz and cover the frequency range between +4.000 and +12.000 MHz from the carrier.

The calculation of *Current, Average, and Maximum* results is explained in Chapter 3 (see *display mode*).

READ:ARRay:SPECtrum:EMASk:ADDitional:CURRent? Spectrum Emission Curves
READ:ARRay:SPECtrum:EMASk:ADDitional:AVERage?
READ:ARRay:SPECtrum:EMASk:ADDitional:MAXimum?
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:SPECtrum:EMASk:ADDitional:CURRent?
FETCh:ARRay:SPECtrum:EMASk:ADDitional:AVERage?
FETCh:ARRay:SPECtrum:EMASk:ADDitional:MAXimum?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:SPECtrum:EMASk:ADDitional:CURRent?
SAMPle:ARRay:SPECtrum:EMASk:ADDitional:AVERage?
SAMPle:ARRay:SPECtrum:EMASk:ADDitional:MAXimum?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to 0.0 dB,	1st value for spectrum emission	NAN	dB	V5.11
... ,	...	...	...	
–100.0 dB to 0.0 dB	786th value for spectrum emission	NAN	dB	

Description of command

These commands are always queries. They return the additional spectrum emission curves in SEM modes C and D (see `CONFigure:SPECtrum:EMASk:LIMit:MODE`). The curves are measured in a 100 kHz filter. The commands are available in *Signalling* mode only.

The test points have a frequency separation of approx. 12.5 kHz; the number of valid results depends on the SEM mode:

- In mode C, the first 72 values of the array are always invalid (NAN). The 714 (potientially) valid test points cover the frequency range between 3.55 MHz and 12.45 MHz.
- In mode D, all 786 test points are potentially valid. They cover the frequency range between 2.65 MHz and 12.45 MHz.

The calculation of *Current, Average, and Maximum* results is explained in Chapter 3 (see *display mode*).

CALCulate:ARRay:SPECtrum:EMASk:CURRent:MATChing:LIMit? Limit Matching
CALCulate:ARRay:SPECtrum:EMASk:AVERage:MATChing:LIMit?
CALCulate:ARRay:SPECtrum:EMASk:MAXimum:MATChing:LIMit?

Returned values	Value range	Def. value	Def. unit	FW vers.
Section AB,		INV	–	V3.00
Section BC,		INV	–	
Section CD,		INV	–	
Section EF,	For all measured values:	INV	–	
Section FE,		INV	–	
Section DC,	NMAU | NMAL | INV | OK	INV	–	
Section CB		INV	–	
Section BA		INV	–	

Description of command

These commands are always queries. They indicate whether and in which way the limits in all areas of the spectrum emission mask (see commands above) are exceeded. Section AB denotes the frequency domain between points A and B; see section *Subsystem SPECTrum:EMASk:...LIMit:LINE* on p. 6.117.

The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

CALCulate:ARRay:SPECtrum:EMASk:ADDitional:CURRent:MATChing:LIMit? Limit Matching
CALCulate:ARRay:SPECtrum:EMASk:ADDitional:AVERage:MATChing:LIMit?
CALCulate:ARRay:SPECtrum:EMASk:ADDitional:MAXimum:MATChing:LIMit?

Returned values	Value range	Def. value	Def. unit	FW vers.
Section AB,		INV	–	V5.11
Section BC,	For all measured values:	INV	–	
Section CB,	NMAU | NMAL | INV | OK	INV	–	
Section BA		INV	–	

Description of command

These commands are always queries. They indicate whether and in which way the additional requirements *(Limit H)* for the spectrum emission mask are fulfilled. The sections are ordered according to ascending frequencies. Sections AB und BA denote the outer frequency domains (large offset from the carrier); sections BC and CB the inner frequency domains.

The commands are available in *Signalling* mode only. To obtain valid results, the SEM modes B, C or D (see `CONFigure:SPECtrum:EMASk:LIMit:MODE`) must be active.

The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

READ[:SCALar]:SPECtrum:EMASk:CURRent:MARGin? Limit Line Margin
READ[:SCALar]:SPECtrum:EMASk:AVERage:MARGin?
READ[:SCALar]:SPECtrum:EMASk:MAXimum:MARGin?
Start single shot measurement and return results ⇒ *RUN*
FETCh[:SCALar]:SPECtrum:EMASk:CURRent:MARGin?
FETCh[:SCALar]:SPECtrum:EMASk:AVERage:MARGin?
FETCh[:SCALar]:SPECtrum:EMASk:MAXimum:MARGin?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle[:SCALar]:SPECtrum:EMASk:CURRent:MARGin?
SAMPle[:SCALar]:SPECtrum:EMASk:AVERage:MARGin?
SAMPle[:SCALar]:SPECtrum:EMASk:MAXimum:MARGin?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to 0.0 dB,	Margin for 1st limit line area (section AB)	NAN	dB	V3.60
... ,	...	...	...	
–100.0 dB to 0.0 dB	Margin for 8th limit line area (section BA)	NAN	dB	

Description of command

These commands are always queries. They return the limit line margin values in the 8 limit line areas, ordered according to ascending frequencies.

The calculation of *Current, Average, and Maximum* results is explained in Chapter 3 of the WCDMA operating manual (see *display mode*).

READ[:SCALar]:SPECtrum:EMASk:ADDitional:CURRent:MARGin? Additional Margins
READ[:SCALar]:SPECtrum:EMASk:ADDitional:AVERage:MARGin?
READ[:SCALar]:SPECtrum:EMASk:ADDitional:MAXimum:MARGin?
Start single shot measurement and return results ⇒ *RUN*
FETCh[:SCALar]:SPECtrum:EMASk:ADDitional:CURRent:MARGin?
FETCh[:SCALar]:SPECtrum:EMASk:ADDitional:AVERage:MARGin?
FETCh[:SCALar]:SPECtrum:EMASk:ADDitional:MAXimum:MARGin?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle[:SCALar]:SPECtrum:EMASk:ADDitional:CURRent:MARGin?
SAMPle[:SCALar]:SPECtrum:EMASk:ADDitional:AVERage:MARGin?
SAMPle[:SCALar]:SPECtrum:EMASk:ADDitional:MAXimum:MARGin?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to 0.0 dB,	Margin for 1st limit line area (section AB)	NAN	dB	V5.11
... ,	...	...	...	
–100.0 dB to 0.0 dB	Margin for 4th limit line area (section BA)	NAN	dB	

Description of command

These commands are always queries. They return the additional margin values in the 4 *Limit H* areas, ordered according to ascending frequencies. The commands are available in *Signalling* mode only. To obtain valid results, the SEM modes B, C or D (see `CONFigure:SPECtrum:EMASk:LIMit:MODE`) must be active.

The calculation of *Current, Average, and Maximum* results is explained in Chapter 3 of the WCDMA operating manual (see *display mode*).

CDPower Measurements

The subsystem *CDPower* measures the relative power and the waveform quality (ρ factor) in the individual code or physical channels of an uplink WCDMA signal. The subsystem corresponds to the measurement menu *Code Domain Power* with its various applications and the associated popup menu *Code Domain Power Configuration.*

The occupied channels can be either determined automatically or explicitly reported to the CMU. In manual control, these two channel search modes correspond to the *CDP/Code...Auto* and *CDP/Code...Manual* applications of the *Code Domain Power* measurement. In remote control, the channel search modes are distinguished by the third/fourth-level keywords in the `CDPower` commands:

- The third/fourth-level keywords `AUTomatic` and `RAUTomatic` denote the *CDP/Code Auto* and *CDP/Code Rho Auto* applications.
- The third/fourth-level keywords `MANual` and `RMANual` denote the *CDP/Code Manual* and *CDP/Code Rho Manual* applications.

The command syntax is similar for applications with the same channel search mode, so they will be described in common sections.

Note: *The equivalence of channelization code modes and `CDPower` applications differs from the `MODulation:...WCDMa` measurements where the channelization code mode is defined as a parameter (see `CONFigure:MODulation:WCDMa:DPCH:CONTrol:CCMode` command on p. 6.59.*

CDPower:AUTomatic and CDPower:RAUTomatic

The subsystems *CDPower:AUTomatic* and *CDPower:RAUTomatic* measure the code domain power and CD-ρ factor in the code domain channels contributing to an uplink WCDMA signal. The subsystem corresponds to the measurement menu *Code Domain Power,* applications *CDP/Code Auto* and *CDP/Code Rho Auto,* and the sections in the popup menu *Code Domain Power Configuration* that are related to the *CDP/Code...Auto* applications.

Control of Measurement – Subsystems CDPower:AUTomatic and CDPower:RAUTomatic

The subsystems *CDPower:AUTomatic* and *CDPower:RAUTomatic* control the code domain power measurement. They correspond to the softkeys *CDP/Code Auto* and *CDP/Code Rho Auto* in the measurement menu *Code Domain Power*.

INITiate:CDPower:AUTomatic	Start new measurement	⇒ *RUN*
ABORt:CDPower:AUTomatic	Abort running measurement and switch off	⇒ *OFF*
STOP:CDPower:AUTomatic	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:CDPower:AUTomatic	Next measurement step (only *stepping mode*)	⇒ *RUN*
INITiate:CDPower:RAUTomatic	Start new measurement	⇒ *RUN*
ABORt:CDPower:RAUTomatic	Abort running measurement and switch off	⇒ *OFF*
STOP:CDPower:RAUTomatic	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:CDPower:RAUTomatic	Next meas. step (only *stepping mode*)	⇒ *RUN*
Description of command		FW vers.
These commands have no query form. They start and stop the code domain power measurement, setting it to the status indicated in the top right column.		V3.00

CONFigure:CDPower:AUTomatic:EREPorting <*Mode*> Event Reporting
CONFigure:CDPower:RAUTomatic:EREPorting <*Mode*>

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.00
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:CDPower:AUTomatic:STATus? Measurement Status
FETCh:CDPower:RAUTomatic:STATus?

Ret. values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.00
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE	No counting mode set	NONE	–	

Description of command

These commands are always queries. They return the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Code Domain Power* measurement. They correspond to the sections in the *Code Domain Power Configuration* menu that are related to the *CDP/Code Auto* and *CDP/Code Rho Auto* applications.

Subsystems CDPower:AUTomatic:CONTrol and CDPower:RAUTomatic:CONTrol

The subsystems *CDPower:AUTomatic:CONTrol* and *CDPower:RAUTomatic:CONTrol* configure the scope of the code domain power measurement. They correspond to the *Control* tab in the popup menu *Code Domain Power Configuration*.

CONFigure:CDPower:AUTomatic:CONTrol:RMODe <*Mode*> Result Mode
CONFigure:CDPower:RAUTomatic:CONTrol:RMODe <*Mode*>

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar |	Scalar values only (incl. limit matching)	ARR	–	V3.00
ARRay	Scalar measured values and arrays			

Description of command

This command specifies the type of measured values.

CONFigure:CDPower:AUTomatic:CONTrol:REPetition Test Cycles
<Repetition>,<Stepmode>
CONFigure:CDPower:RAUTomatic:CONTrol:REPetition
<Repetition>,<Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** 1 to 10000,	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.00

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:CDPower:AUTomatic:CONTrol:DSFactor *<Factor>* Display Spreading Factor
CONFigure:CDPower:RAUTomatic:CONTrol:DSFactor *<Factor>*

<Factor>	Description of parameters	Def. value	Def. unit	FW vers.
AUTO | **4 | 8 | 16 | 32 | 64 |** **128 | 256**	Automatic detection the spreading factor Explicit setting of the spreading factor of the WCDMA uplink signal	AUTO	–	V3.00

Description of command

This command determines the display spreading factor of the WCDMA uplink signal. The display spreading factor defines the length of the output arrays of the commands *`READ:ARRay:CDPower:AUTomatic:ISIGnal:CURRent?`* etc. (see p. 6.128). In the AUTO setting, the actual display spreading factor can be queried via `CONFigure:CDPower:AUTomatic:CONTrol:DSFactor :AUTMode?` and `CONFigure:CDPower:RAUTomatic:CONTrol:DSFactor:AUTMode?`

CONFigure:CDPower:AUTomatic:CONTrol:DSFactor:AUTMode? Query Display Spreading Factor
CONFigure:CDPower:RAUTomatic:CONTrol:DSFactor:AUTMode?

Response	Description of parameters	Def. value	Def. unit	FW vers.
4 | 8 | 16 | 32 | 64 | **128 | 256**	Actual current display spreading factor	NAN	–	V3.60

Description of command

This command queries the actual display spreading factor. The display spreading factor defines the length of the output arrays of the commands `READ:ARRay:CDPower:AUTomatic:ISIGnal:CURRent?` etc.

DEFault:CDPower:AUTomatic:CONTrol <*Enable*> Default Settings
DEFault:CDPower:RAUTomatic:CONTrol <*Enable*>

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystems CDPower:AUTomatic and CDPower:RAUTomatic?

The subsystems *CDPower:AUTomatic* and *CDPower:RAUTomatic* measure and return the code domain power parameters. The subsystems correspond to the various output elements in the measurement menu *CDPower,* applications *CDP/Code Auto* and *CDP/Code Rho Auto.*

READ[:SCALar]:CDPower:AUTomatic? Scalar Results:
READ[:SCALar]:CDPower:RAUTomatic? Start single shot measurement and return results

FETCh[:SCALar]:CDPower:AUTomatic?
FETCh[:SCALar]:CDPower:RAUTomatic? Read out meas. results (unsynchronized)

SAMPle[:SCALar]:CDPower:AUTomatic?
SAMPle[:SCALar]:CDPower:RAUTomatic? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
EVM (RMS) Current,	0.0 % to 100.0 %	NAN	%	V3.00
I/Q Origin Offset Current,	–100.0 dB to 0.0 dB	NAN	dB	
Frequency Error Current,	–500.0 Hz to +500.0 Hz	NAN	Hz	
UE Power Current,	–100.0 dBm to +60 dBm	NAN	dBm	
Slot Number	0 to 14	NAN	–	

Description of command

These commands are always queries. They start a `CDPower:AUTomatic` or `CDPower:RAUTomatic` measurement `(READ...)` and/or return all scalar measurement results (see Chapter 4).

READ:ARRay:CDPower:AUTomatic:ISIGnal:CURRent? CDP and CD-ρ Bar Graphs
READ:ARRay:CDPower:AUTomatic:QSIGnal:CURRent?
READ:ARRay:CDPower:RAUTomatic:ISIGnal:CURRent?
READ:ARRay:CDPower:RAUTomatic:QSIGnal:CURRent?
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:CDPower:AUTomatic:ISIGnal:CURRent?
FETCh:ARRay:CDPower:AUTomatic:QSIGnal:CURRent?
FETCh:ARRay:CDPower:RAUTomatic:ISIGnal:CURRent?
FETCh:ARRay:CDPower:RAUTomatic:QSIGnal:CURRent?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:CDPower:AUTomatic:ISIGnal:CURRent?
SAMPle:ARRay:CDPower:AUTomatic:QSIGnal:CURRent?
SAMPle:ARRay:CDPower:RAUTomatic:ISIGnal:CURRent?
SAMPle:ARRay:CDPower:RAUTomatic:QSIGnal:CURRent?
Read measurement results (synchronized) ⇒ *RUN*

Returned values, AUTomatic	Description of parameters	Def. value	Def. unit	
–100.0 dB to +100.0 dB,	Code domain power in first code channel	NAN	dB	
... ,	...	...	...	
–100.0 dB to +100.0 dB	Code domain power in last code channel	NAN	dB	
Returned values, RAUTomatic	Description of parameters	Def. value	Def. unit	FW vers.
0.0000 to +1.0000,	CD-ρ in first code channel	NAN	–	V3.00
... ,	...	...	...	
0.0000 to +1.0000	CD-ρ in last code channel	NAN	–	

Description of command

These commands are always queries. They start a `CDPower:AUTomatic` or `CDPower:RAUTomatic` measurement `(READ...)` and/or return the CDP and CD-ρ in all code domain channels that may contribute to the WCDMA signal. The channels of the I and Q branches are returned separately (keywords `ISIGnal` and `QSIGnal`). The total number of code channels is given by the display spreading factor set via *`CONFigure:CDPower:AUTomatic:CONTrol:DSFactor`* etc. (see p. 6.126) or via `CONFigure:UECode:DPDCh:AUTO:SRATe` if the `DSFactor` is set to `AUTO`.

The calculation of *Current, Average, Maximum* and *Minimum* results is explained in Chapter 3 (see *display mode*).

CDPower:MANual and CDPower:RMANual

The subsystems *CDPower:MANual* and *CDPower:RMANual* measure the code domain power and CD-ρ factor in the physical channels contributing to an uplink WCDMA signal. The subsystem corresponds to the measurement menu *Code Domain Power,* applications *CDP/Code Manual* and *CDP/Code Rho Manual,* and the sections in the popup menu *Code Domain Power Configuration* that are related to the *CDP/Code...Manual* applications.

Control of Measurement – Subsystems CDPower:MANual and CDPower:RMANual

The subsystems *CDPower:MANual* and *CDPower:RMANual* control the code domain power measurement. They correspond to the softkeys *CDP/Code Manual* and *CDP/Code Rho Manual* in the measurement menu *Code Domain Power*.

INITiate:CDPower:MANual	Start new measurement	⇒ *RUN*
ABORt:CDPower:MANual	Abort running measurement and switch off	⇒ *OFF*
STOP:CDPower:MANual	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:CDPower:MANual	Next measurement step (only *stepping mode*)	⇒ *RUN*
INITiate:CDPower:RMANual	Start new measurement	⇒ *RUN*
ABORt:CDPower:RMANual	Abort running measurement and switch off	⇒ *OFF*
STOP:CDPower:RMANual	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:CDPower:RMANual	Next meas. step (only *stepping mode*)	⇒ *RUN*

Description of command	FW vers.
These commands have no query form. They start and stop the code domain power measurement, setting it to the status indicated in the top right column.	V3.00

CONFigure:CDPower:MANual:EREPorting <*Mode*> Event Reporting
CONFigure:CDPower:RMANual:EREPorting <*Mode*>

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.00
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:CDPower:MANual:STATus? Measurement Status
FETCh:CDPower:RMANual:STATus?

Ret. values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.00
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	

Description of command

These commands are always queries. They return the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Code Domain Power* measurement. They correspond to the sections in the *Code Domain Power Configuration* menu that are related to the *CDP/Code Manual* and *CDP/Code Rho Manual* applications.

Subsystems CDPower:MANual:CONTrol and CDPower:RMANual:CONTrol

The subsystems *CDPower:MANual:CONTrol* and *CDPower:RMANual:CONTrol* configure the scope of the code domain power measurement. They correspond to the *Control* tab in the popup menu *Code Domain Power Configuration*.

CONFigure:CDPower:MANual:CONTrol:RMODe <*Mode*> Result Mode
CONFigure:CDPower:RMANual:CONTrol:RMODe <*Mode*>

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar |	Scalar values only (incl. limit matching)	ARR	–	V3.00
ARRay	Scalar measured values and arrays			

Description of command

This command specifies the type of measured values.

CONFigure:CDPower:MANual:CONTrol:STATistics <*Statistics*> Measurement Statistics
CONFigure:CDPower:RMANual:CONTrol:STATistics <*Statistics*>

<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 |	Number of evaluation periods per statistics cycle	10	–	V3.00
NONE	Statistics off (equivalent to 1)			

Description of command

This command defines the number of slots forming a statistics cycle.

CONFigure:CDPower:MANual:CONTrol:REPetition Test Cycles
<Repetition>,<StopCond>,<Stepmode>
CONFigure:CDPower:RMANual:CONTrol:REPetition *<Repetition>,<StopCond>,<Stepmode>*

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	**Description of parameters**	**Def. value**	**Def. unit**	
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.00

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:CDPower:MANual:CONTrol:PREFerence *<Reference>* Power Reference

<Reference>	Description of parameters	Def. value	Def. unit	FW vers.
TPOWer | **DPCCh**	Channel powers referenced to the total UE power Channel powers referenced to the DPCCH power	TPOW	–	V4.10

Description of command

This command selects the power reference for the relative channel power results.

DEFault:CDPower:MANual:CONTrol *<Enable>* Default Settings
DEFault:CDPower:RMANual:CONTrol *<Enable>*

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Tolerance values – Subsystem CDPower:..:LIMit

The subsystem *CDPower:...:LIMit* defines tolerance values for the code domain power measurement. The subsystem corresponds to the *Limits* tab in the popup menu *Code Domain Power Configuration.*

Upper Limits: Current & Max/Min

CONFigure:CDPower:MANual:CMMax:LIMit:POINt:ASYMmetric:UPPer:CHANnel<nr> <*CDP_Limit*>
CONFigure:CDPower:RMANual:CMMax:LIMit:POINt:ASYMmetric:UPPer:CHANnel<nr> <*CD-ρ_Limit*>

<nr>	Description of parameters	Def. value	Def. unit	FW vers.
1 |	Channel number for DPCCH	–	–	V3.00
2 | 3 | 4 | 5 | 6 | 7 |	Channel number for DPDCH1 to DPDCH6			
8 |	Channel number for HS-DPCCH			V3.80
9 |	Channel number for E-DPCCH			V4.20
10 | 11 | 12 | 13	Channel number for E-DPDCH1 to E-DPDCH4			
<CDP_Limit>	Description of parameters	Def. value	Def. unit	
–50.0 dB to 0.0 dB	Upper limit for code domain power	0.0	dB	
<CD-ρ_Limit>	Description of parameters	Def. value	Def. unit	
0.0000 to 1.0000	Upper limit for CD-ρ	1.000	–	

Description of command

This command defines upper limits for the *Current* and *Max./Min*. results.

Lower Limits: Current & Max/Min

CONFigure:CDPower:MANual:CMMax:LIMit:POINt:ASYMmetric:LOWer:CHANnel<nr> <*CDP_Limit*>
CONFigure:CDPower:RMANual:CMMax:LIMit:POINt:ASYMmetric:LOWer:CHANnel<nr> <*CD-ρ_Limit*>

<nr>	Description of parameters	Def. value	Def. unit	FW vers.
1 |	Channel number for DPCCH	–	–	V3.00
2 | 3 | 4 | 5 | 6 | 7 |	Channel number for DPDCH1 to DPDCH6			
8 |	Channel number for HS-DPCCH			V3.80
9 |	Channel number for E-DPCCH			V4.20
10 | 11 | 12 | 13	Channel number for E-DPDCH1 to E-DPDCH4			
<CDP_Limit>	Description of parameters	Def. value	Def. unit	
–50.0 dB to 0.0 dB	Lower limit for code domain power	–10.0	dB	
<CD-ρ_Limit>	Description of parameters	Def. value	Def. unit	
0.0000 to 1.0000	Lower limit for CD-ρ	0.1000	–	

Description of command

This command defines lower limits for the *Current* and *Max./Min*. results.

Upper Limits: Average

CONFigure:CDPower:MANual:AVERage:LIMit:POINt:ASYMmetric:UPPer:CHANnel<nr> <*CDP_Limit*>
CONFigure:CDPower:RMANual:AVERage:LIMit:POINt:ASYMmetric:UPPer:CHANnel<nr> <*CD-ρ_Limit*>

<nr>	Description of parameters	Def. value	Def. unit	FW vers.
1 |	Channel number for DPCCH	–	–	V3.00
2 | 3 | 4 | 5 | 6 | 7 |	Channel number for DPDCH1 to DPDCH6			
8 |	Channel number for E-DPCCH			V4.20
9 | 10 | 11 | 12	Channel number for E-DPDCH1 to E-DPDCH4			
<CDP_Limit>	Description of parameters	Def. value	Def. unit	
–50.0 dB to 0.0 dB	Upper limit for code domain power	0.0	dB	
<CD-ρ_Limit>	Description of parameters	Def. value	Def. unit	
0.0000 to 1.0000	Upper limit for CD-ρ	1.000	–	

Description of command

This command defines upper limits for the *Average* results.

Lower Limits: Average

CONFigure:CDPower:MANual:AVERage:LIMit:POINt:ASYMmetric:LOWer:CHANnel<nr> <*CDP_Limit*>
CONFigure:CDPower:RMANual:AVERage:LIMit:POINt:ASYMmetric:LOWer:CHANnel<nr> <*CD-ρ_Limit*>

<nr>	Description of parameters	Def. value	Def. unit	FW vers.
1 |	Channel number for DPCCH	–	–	V3.00
2 | 3 | 4 | 5 | 6 | 7 |	Channel number for DPDCH1 to DPDCH6			
8 |	Channel number for E-DPCCH			V4.20
9 | 10 | 11 | 12	Channel number for E-DPDCH1 to E-DPDCH4			
<CDP_Limit>	Description of parameters	Def. value	Def. unit	
–50.0 dB to 0.0 dB	Lower limit for code domain power	–10.0	dB	
<CD-ρ_Limit>	Description of parameters	Def. value	Def. unit	
0.0000 to 1.0000	Lower limit for CD-ρ	0.1000	–	

Description of command

This command defines lower limits for the *Average* results.

DEFault:CDPower:MANual:LIMit <*Enable*> Default Settings
DEFault:CDPower:RMANual:LIMit <*Enable*>

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	The parameters are set to default values	ON	–	V3.00
OFF	Some or all parameters differ from the default values			

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystem CDPower:MANual?

The subsystem *CDPower:MANual* measures and returns the code domain power parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *CDPower,* application *CDP/Code Manual* and *CDP/Code Rho Manual.*

READ[:SCALar]:CDPower:MANual? Scalar Results (DPCCH/DPDCH):
READ[:SCALar]:CDPower:RMANual? Start single shot measurement and return results

FETCh[:SCALar]:CDPower:MANual?
FETCh[:SCALar]:CDPower:RMANual? Read out meas. results (unsynchronized)

SAMPle[:SCALar]:CDPower:MANual?
SAMPle[:SCALar]:CDPower:RMANual? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
EVM (RMS) Current,	0.0 % to 100.0 %	NAN	%	V3.00
I/Q Origin Offset Current,	–100.0 dB to 0.0 dB	NAN	dB	
Frequency Error Current,	–5000.0 Hz to +5000.0 Hz	NAN	Hz	
UE Power Current,	–100.0 dBm to +60 dBm	NAN	dBm	
Out of Tolerance,	0.0% to 100.0%	NAN	%	
Slot Number	0 to 14	NAN	–	V3.00

Description of command

These commands are always queries. They start a `CDPower:MANual` or `CDPower:RMANual` measurement `(READ...)` and/or return all scalar measurement results (see Chapter 4).

READ[:SCALar]:CDPower:MANual:CQI? Scalar Results (CQI):
READ[:SCALar]:CDPower:RMANual:CQI? Start single shot measurement and return results

FETCh[:SCALar]:CDPower:MANual:CQI?
FETCh[:SCALar]:CDPower:RMANual:CQI? Read out meas. results (unsynchronized)

SAMPle[:SCALar]:CDPower:MANual:CQI?
SAMPle[:SCALar]:CDPower:RMANual:CQI? Read out measurement results (synchronized)

Returned values, MANual	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to 0.0 dB	Avg. HS-DPCCH power for all CQI symbols	NAN	dB	V3.80
Returned values, RMANual	Description of parameters	Def. value	Def. unit	FW vers.
0.0000 to +1.0000	Avg. HS-DPCCH CD-ρ for all CQI symbols	NAN	–	V3.80

Description of command

These commands are always queries. They start a `CDPower:MANual` or `CDPower:RMANual` measurement `(READ...)` and/or return the HS-DPCCH results averaged over all CQI symbols.

READ[:SCALar]:CDPower:MANual:ACK? Scalar Results (ACK):
READ[:SCALar]:CDPower:RMANual:ACK? Start single shot measurement and return results

FETCh[:SCALar]:CDPower:MANual:ACK?
FETCh[:SCALar]:CDPower:RMANual:ACK? Read out meas. results (unsynchronized)

SAMPle[:SCALar]:CDPower:MANual:ACK?
SAMPle[:SCALar]:CDPower:RMANual:ACK? Read out measurement results (synchronized)

Returned values, MANual	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to 0.0 dB	Avg. HS-DPCCH power for all ACK symbols	NAN	dB	V3.80
Returned values, RMANual	Description of parameters	Def. value	Def. unit	FW vers.
0.0000 to +1.0000	Avg. HS-DPCCH CD-ρ for all ACK symbols	NAN	–	V3.80

Description of command

These commands are always queries. They start a `CDPower:MANual` or `CDPower:RMANual` measurement `(READ...)` and/or return the HS-DPCCH results averaged over all ACK symbols.

READ:ARRay:CDPower:MANual:CURRent? CDP and CD-ρ Bar Graphs
READ:ARRay:CDPower:MANual:AVERage?
READ:ARRay:CDPower:MANual:MAXimum?
READ:ARRay:CDPower:MANual:MINimum?

READ:ARRay:CDPower:RMANual:CURRent?
READ:ARRay:CDPower:RMANual:AVERage?
READ:ARRay:CDPower:RMANual:MAXimum?
READ:ARRay:CDPower:RMANual:MINimum? Start single shot measurement and return results ⇒ *RUN*

FETCh:ARRay:CDPower:MANual:CURRent?
FETCh:ARRay:CDPower:MANual:AVERage?
FETCh:ARRay:CDPower:MANual:MAXimum?
FETCh:ARRay:CDPower:MANual:MINimum?

FETCh:ARRay:CDPower:RMANual:CURRent?
FETCh:ARRay:CDPower:RMANual:AVERage?
FETCh:ARRay:CDPower:RMANual:MAXimum?
FETCh:ARRay:CDPower:RMANual:MINimum? Read measurement results (unsynchronized) ⇒ *RUN*

SAMPle:ARRay:CDPower:MANual:CURRent?
SAMPle:ARRay:CDPower:MANual:AVERage?
SAMPle:ARRay:CDPower:MANual:MAXimum?
SAMPle:ARRay:CDPower:MANual:MINimum?

SAMPle:ARRay:CDPower:RMANual:CURRent?
SAMPle:ARRay:CDPower:RMANual:AVERage?
SAMPle:ARRay:CDPower:RMANual:MAXimum?
SAMPle:ARRay:CDPower:RMANual:MINimum? Read measurement results (synchronized) ⇒ *RUN*

Returned values, MANual	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to 0.0 dB,	Code domain power in DPCCH	NAN	dB	V3.00
–100.0 dB to 0.0 dB,	Code domain power in DPDCH1	NAN	dB	
... ,	...	...	...	
–100.0 dB to 0.0 dB	Code domain power in DPDCH6	NAN	dB	
Returned values, RMANual	Description of parameters	Def. value	Def. unit	FW vers.
0.0000 to +1.0000,	CD-ρ in DPCCH	NAN	–	V3.00
0.0000 to +1.0000,	CD-ρ in DPDCH1	NAN	–	
... ,	...	...	...	
0.0000 to +1.0000	CD-ρ in DPDCH6	NAN	–	

Description of command

These commands are always queries. They start a `CDPower:MANual` or `CDPower:RMANual` measurement `(READ...)` and/or return the CDP and CD-ρ in all 7 physical channels that may contribute to the WCDMA signal.

The calculation of *Current, Average, Maximum* and *Minimum* results is explained in Chapter 3 (see *display mode*).

If the HSUPA generator is on in Non Signalling mode, then the results for DPDCH1 to DPDCH6 are replaced by the results for the UL HSUPA channels E-DPCCH and E-DPDCH1 to E-DPDCH4 (FW Vers. 4.20 and higher).

READ:ARRay:CDPower:MANual:HSDPcch? CDP and CD-ρ Bar Graphs
READ:ARRay:CDPower:RMANual:HSDPcch? Start single shot measurement and return results⇒ *RUN*

FETCh:ARRay:CDPower:MANual:HSDPcch?
FETCh:ARRay:CDPower:RMANual:HSDPcch? Read measurement results (unsynchronized) ⇒ *RUN*

SAMPle:ARRay:CDPower:MANual:HSDPcch?
SAMPle:ARRay:CDPower:RMANual:HSDPcch? Read measurement results (synchronized) ⇒ *RUN*

Returned values, MANual	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to 0.0 dB,	HSDPcch power in slot 1	NAN	dB	V3.00
... ,	...	...	...	
–100.0 dB to 0.0 dB	HSDPcch power in slot 1	NAN	dB	

Returned values, RMANual	Description of parameters	Def. value	Def. unit	FW vers.
0.0000 to +1.0000,	HSDPcch CD-ρ in slot 1	NAN	–	V3.00
... ,	...	...	...	
0.0000 to +1.0000	HSDPcch CD-ρ in slot 10	NAN	–	

Description of command

These commands are always queries. They start a `CDPower:MANual` or `CDPower:RMANual` measurement `(READ...)` and/or return the HSDPCCH CDP and CD-ρ in ten consecutive symbol periods (1 slot).

CALCulate:ARRay:CDPower:MANual:CURRent:MATChing:LIMit? Limit Matching
CALCulate:ARRay:CDPower:MANual:AVERage:MATChing:LIMit?
CALCulate:ARRay:CDPower:MANual:MAXimum:MATChing:LIMit?
CALCulate:ARRay:CDPower:MANual:MINimum:MATChing:LIMit?

CALCulate:ARRay:CDPower:RMANual:CURRent:MATChing:LIMit?
CALCulate:ARRay:CDPower:RMANual:AVERage:MATChing:LIMit?
CALCulate:ARRay:CDPower:RMANual:MAXimum:MATChing:LIMit?
CALCulate:ARRay:CDPower:RMANual:MINimum:MATChing:LIMit?

Returned values, MANual	Description of parameters	Def. value	Def. unit	FW vers.
CDP in DPCCH		INV	–	V3.00
CDP in DPDCH$_1$	For all measured values:	INV	–	
...	NMAU | NMAL | INV | OK	...	...	
CDP in DPDCH$_6$		INV	–	
CDP in HS-DPCCH		INV	–	V3.80
Returned values, RMANual	Description of parameters	Def. value	Def. unit	FW vers.
CD-ρ in DPCCH		INV	–	V3.00
CD-ρ in DPDCH$_1$	For all measured values:	INV	–	
...	NMAU | NMAL | INV | OK	...	...	
CD-ρ in DPDCH$_6$		INV	–	
CD-ρ in HS-DPCCH		INV	–	V3.80

Description of command

These commands are always queries. They indicate whether and in which way the error limits for the code domain power and the CD-ρ (see commands above) are exceeded.

The following messages may be returned for all measured values:

NMAU	Result below lower limit	*not matching, underflow*
NMAL	Result exceeds upper limit	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

NOTE

If the HSUPA generator is on in Non Signalling mode, then the results for DPDCH1 to DPDCH6 are replaced by the results for the UL HSUPA channels E-DPCCH and E-DPDCH1 to E-DPDCH4 (FW Vers. 4.20 and higher).

CDP vs. Time Measurement

The subsystem *CDPower:TIME* provides the code power and the gain factors for all UL channels. The subsystem corresponds to the measurement menu *Code Domain Power,* application *CDP/Time* and the sections in the popup menu *Code Domain Power Configuration* that are related to the *CDP/Code...Manual* applications.

Note the following differences between manual and remote control:

- The commands `READ:ARRay:CDPower:TIME:DPCCH:BFACtor?` etc. return the gain factors across the entire measurement range (not displayed in the measurement menu).
- The *Measurement Length* can be set in manual control only. The `READ:ARRay:CDPower:…` result arrays comprise always 470 output values. Values beyond the measurement length are replaced by NANs.

INITiate:CDPower:TIME	Start new measurement	⇒	*RUN*
ABORt:CDPower:TIME	Abort running measurement and switch off	⇒	*OFF*
STOP:CDPower:TIME	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:CDPower:TIME	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V3.80

CONFigure:CDPower:TIME:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.80
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:CDPower:TIME:STATus? Measurement Status

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.80
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
NONE	No counting mode set	NONE	–	V3.80

Description of command

This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The subsystem *CDPower:TIME:CONTrol* defines the scope of the measurement.

CONFigure:CDPower:TIME:CONTrol:REPetition Test Cycles
<Repetition>, <StopCond>, <Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	FW vers.
CONTinuous | SINGleshot | 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	V3.80
<StopCond>	Description of parameters	Def. value	Def. unit	FW vers.
SONerror | NONE	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	V3.80
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | NONE	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.80

Description of command

This command determines the number of statistics cycles and the stepping mode for the measurement. The <*Stop_Cond*> parameter is ignored.

Note: In the case of `READ` commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:CDPower:TIME:CONTrol:PREFerence:CDP *<Reference>* Power Reference CDP

<Reference>	Description of parameters	Def. value	Def. unit	FW vers.
TPOWer | DPCCh	Channel powers referenced to the total UE power Channel powers referenced to the DPCCH power	TPOW	–	V4.10

Description of command

This command selects the power reference for the relative channel power results (DPCCH, $DPDCH_1$, HS-DPCCH).

CONFigure:CDPower:TIME:CONTrol:PREFerence:BFACtor *<Reference>* Power Reference Beta Fact.

<Reference>	Description of parameters	Def. value	Def. unit	FW vers.
AUTO | DPCCh | DPDCh	Channel powers referenced to the stronger channel Channel powers referenced to the DPCCH power Channel powers referenced to the $DPDCH_1$ power	AUTO	–	V4.10

Description of command

This command selects the normalization rule for all gain factors.

DEFault:CDPower:TIME:CONTrol *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.80

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystem CDPower:TIME...?

The subsystem *CDPower:TIME...?* measures and returns the results and compares them with tolerance values.

	Minimum and Maximum Code Power
READ[:SCALar]:CDPower:TIME:CPOWer?	Start single shot measurement and return results
FETCh[:SCALar]:CDPower:TIME:CPOWer?	Read measurement results (unsynchronized)
SAMPle[:SCALar]:CDPower:TIME:CPOWer?	Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
UE power (Max),	–100 dBm to +60 dBm	NAN	dBm	V3.80
UE power (Min),	–100 dBm to +60 dBm	NAN	dBm	
DPCCH power (Max),	–100.0 dB to 0.0 dB	NAN	dB	
DPCCH power (Min),	–100.0 dB to 0.0 dB	NAN	dB	
DPDCH$_1$ power (Max),	–100.0 dB to 0.0 dB	NAN	dB	
DPDCH$_1$ power (Min),	–100.0 dB to 0.0 dB	NAN	dB	
…	…	…	…	
DPDCH$_6$ power (Max),	–100.0 dB to 0.0 dB	NAN	dB	
DPDCH$_6$ power (Min),	–100.0 dB to 0.0 dB	NAN	dB	
HS-DPCCH power (Max),	–100.0 dB to 0.0 dB	NAN	dB	
HS-DPCCH power (Min),	–100.0 dB to 0.0 dB	NAN	dB	
E-DPCCH power (Max),	–100.0 dB to 0.0 dB	NAN	dB	V4.20
E-DPCCH power (Min),	–100.0 dB to 0.0 dB	NAN	dB	
E-DPDCH$_1$ power (Max),	–100.0 dB to 0.0 dB	NAN	dB	
E-DPDCH$_1$ power (Min),	–100.0 dB to 0.0 dB	NAN	dB	
…				
E-DPDCH$_4$ power (Max),	–100.0 dB to 0.0 dB	NAN	dB	
E-DPDCH$_4$ power (Min)	–100.0 dB to 0.0 dB	NAN	dB	

Description of command

These commands are always queries. They start a `CDPower:TIME` measurement (`READ...`) and/or return the maximum and minimum code power results for all channels. Maximum and minimum means the largest and smallest of the 470 values obtained via `READ:ARRAY:CDPower:TIME:…CPOWer?`

The HSDPA (HS-DPCCH) and HSUPA (E-DPCCH/E-DPDCH) results are available only if the corresponding options (R&S CMU-K64 and R&S CMU-K56) are installed.

Minimum and Maximum Gain Factors

READ[:SCALar]:CDPower:TIME:BFACtor? Start single shot measurement and return results

FETCh[:SCALar]:CDPower:TIME:BFACtor? Read measurement results (unsynchronized)

SAMPle[:SCALar]:CDPower:TIME:BFACtor? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
UE power (Max),	–100 dBm to +60 dBm	NAN	dBm	V3.80
UE power (Min),	–100 dBm to +60 dBm	NAN	dBm	
DPCCH gain factor (Max),	0.0 to 15.0	NAN	–	
DPCCH gain factor (Min),	0.0 to 15.0	NAN	–	
$DPDCH_1$ gain factor (Max),	0.0 to 15.0	NAN	–	
$DPDCH_1$ gain factor (Min),	0.0 to 15.0	NAN	–	
…	…	…	…	
$DPDCH_6$ gain factor (Max),	0.0 to 15.0	NAN	–	
$DPDCH_6$ gain factor (Min),	0.0 to 15.0	NAN	–	
HS-DPCCH gain factor (Max),	0.0 to 30.0	NAN	–	
HS-DPCCH gain factor (Min)	0.0 to 30.0	NAN	–	
E-DPCCH gain factor (Max),	0.0 to 30.0	NAN	–	V4.20
E-DPCCH gain factor (Min),	0.0 to 30.0	NAN	–	
E-$DPDCH_1$ gain factor (Max),	0.0 to 168.0	NAN	–	
E-$DPDCH_1$ gain factor (Min),	0.0 to 168.0	NAN	–	
…				
E-$DPDCH_4$ gain factor (Max),	0.0 to 168.0	NAN	–	
E-$DPDCH_4$ gain factor (Min)	0.0 to 168.0	NAN	–	

Description of command

These commands are always queries. They start a `CDPower:TIME` measurement (`READ...`) and/or return the maximum and minimum gain factors for all channels. Maximum and minimum means the largest and smallest of the 470 values obtained via `READ:ARRAY:CDPOWer:TIME:…BFACtor?` Only the HSDPA and HSUPA gain factors can be larger than 15.

The HSDPA (HS-DPCCH) and HSUPA (E-DPCCH/E-DPDCH) results are available only if the corresponding options (R&S CMU-K64 and R&S CMU-K56) are installed.

Total UE Power

READ:ARRay:CDPower:TIME:UEPower? Start single shot measurement and return results⇒ *RUN*

FETCh:ARRay:CDPower:TIME:UEPower? Read measurement results (unsynchronized) ⇒ *RUN*

SAMPle:ARRay:CDPower:TIME:UEPower? Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for total UE power	–100 dBm to +60 dBm,	NAN	dBm	V3.80
...	... ,	...	...	
470th value for total UE power	–100 dBm to +60 dBm	NAN	dBm	

Description of command

These commands are always queries. They return the total UE power in 470 consecutive 1/10 slot periods.

Code Channel Powers

READ:ARRay:CDPower:TIME:DPCCh:CPOWer?	Start single shot meas. and return results	⇒ *RUN*
FETCh:ARRay:CDPower:TIME:DPCCh:CPOWer?	Read meas. results (unsynchronized)	⇒ *RUN*
SAMPle:ARRay:CDPower:TIME:DPCCh:CPOWer?	Read meas. results (synchronized)	⇒ *RUN*
READ:ARRay:CDPower:TIME:DPDCh<nr>:CPOWer?	Start single shot meas. and return results	⇒ *RUN*
FETCh:ARRay:CDPower:TIME:DPDCh<nr>:CPOWer?	Read meas. results (unsynchronized)	⇒ *RUN*
SAMPle:ARRay:CDPower:TIME:DPDCh<nr>:CPOWer?	Read meas. results (synchronized)	⇒ *RUN*
READ:ARRay:CDPower:TIME:HSDPcch:CPOWer?	Start single shot meas. and return results	⇒ *RUN*
FETCh:ARRay:CDPower:TIME:HSDPcch:CPOWer?	Read meas. results (unsynchronized)	⇒ *RUN*
SAMPle:ARRay:CDPower:TIME:HSDPcch:CPOWer?	Read meas. results (synchronized)	⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for code channel power	–100.0 dB to 0.0 dB,	NAN	dB	V3.80
...	... ,	...	...	
470th value for code channel power	–100.0 dB to 0.0 dB	NAN	dB	

Description of command

These commands are always queries. They return the code channel powers for the DPCCH, the DPDCHs (<nr> = 1 to 6), and the HS-DPCCH relative to the UE Power in 470 consecutive 1/10 slot periods. The HS-DPCCH results are available with the HSUPA option R&S CMU-K56.

Code Channel Powers, HSUPA

READ:ARRay:CDPower:TIME:EDPCch:CPOWer?	Start single shot meas. and return results	⇒ *RUN*
FETCh:ARRay:CDPower:TIME:EDPCch:CPOWer?	Read meas. results (unsynchronized)	⇒ *RUN*
SAMPle:ARRay:CDPower:TIME:EDPCch:CPOWer?	Read meas. results (synchronized)	⇒ *RUN*
READ:ARRay:CDPower:TIME:EDPDch<nr>:CPOWer?	Start single shot meas. and return results	⇒ *RUN*
FETCh:ARRay:CDPower:TIME:EDPDch<nr>:CPOWer?	Read meas. results (unsynchronized)	⇒ *RUN*
SAMPle:ARRay:CDPower:TIME:EDPDch<nr>:CPOWer?	Read meas. results (synchronized)	⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for code channel power	–100.0 dB to 0.0 dB,	NAN	dB	V4.20
...	... ,	...	...	
470th value for code channel power	–100.0 dB to 0.0 dB	NAN	dB	

Description of command

These commands are always queries. They return the code channel powers for the E-DPCCH and the E-DPDCHs (<nr> = 1 to 4) relative to the UE Power in 470 consecutive 1/10 slot periods. The results are available with the HSUPA option R&S CMU-K56.

Gain Factors

READ:ARRay:CDPower:TIME:DPCCh:BFACtor?	Start single shot meas. and return results	⇒ *RUN*
FETCh:ARRay:CDPower:TIME:DPCCh:BFACtor?	Read meas. results (unsynchronized)	⇒ *RUN*
SAMPle:ARRay:CDPower:TIME:DPCCh:BFACtor?	Read meas. results (synchronized)	⇒ *RUN*
READ:ARRay:CDPower:TIME:EDPDch<nr>:BFACtor?	Start single shot meas. and return results	⇒ *RUN*
FETCh:ARRay:CDPower:TIME:EDPDch<nr>:BFACtor?	Read meas. results (unsynchronized)	⇒ *RUN*
SAMPle:ARRay:CDPower:TIME:EDPDch<nr>:BFACtor?	Read meas. results (synchronized)	⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for gain factor	0.0 to 15.0,	NAN	–	V4.20
...	... ,	...	...	
470th value for gain factor	0.0 to 15.0	NAN	–	

Description of command

These commands are always queries. They return the gain factors for the DPCCH and the DPDCHs (<nr> = 1 to 6) in 470 consecutive 1/10 slot periods.

Gain Factors

READ:ARRay:CDPower:TIME:HSDPcch:BFACtor? Start single shot meas. and return results ⇒ *RUN*
FETCh:ARRay:CDPower:TIME:HSDPcch:BFACtor? Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:CDPower:TIME:HSDPcch:BFACtor? Read meas. results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for gain factor	0.0 to 30.0	NAN	–	V3.80
...	... ,	...	...	
470th value for gain factor	0.0 to 30.0	NAN	–	

Description of command

These commands are always queries. They return the gain factor for the HS-DPCCH in 470 consecutive 1/10 slot periods. The gain factor can be larger than 15 if the HS-DPCCH is stronger than the strongest DPCCH or DPDCH.

Code Channel Powers, HSUPA

READ:ARRay:CDPower:TIME:EDPCch:BFACtor? Start single shot meas. and return results ⇒ *RUN*
FETCh:ARRay:CDPower:TIME:EDPCch:BFACtor? Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:CDPower:TIME:EDPCch:BFACtor? Read meas. results (synchronized) ⇒ *RUN*

READ:ARRay:CDPower:TIME:EDPDch<nr>:BFACtor? Start single shot meas. and return results ⇒ *RUN*
FETCh:ARRay:CDPower:TIME:EDPDch<nr>:BFACtor? Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:CDPower:TIME:EDPDch<nr>:BFACtor? Read meas. results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for gain factor	0.0 to 168.0	NAN	–	V4.20
...	... ,	...	...	
470th value for gain factor	0.0 to 168.0	NAN	–	

Description of command

These commands are always queries. They return the gain factors for the E-DPCCH and the E-DPDCHs (<nr> = 1 to 4) in 470 consecutive 1/10 slot periods. The results are available with the HSUPA option R&S CMU-K56.

Receiver Quality Measurements

The subsystem *RXQuality* comprises the commands for all receiver quality measurements. The subsystem corresponds to the main menu *Receiver Quality* and the associated popup menu *Receiver Quality Configuration.*

The following commands are common to all *Receiver Quality* applications.

CONFigure:RXQuality:CONTrol:TIMing <*Chips*>				DL/UL Timing
<Symmetry>	Description of parameters	Def. value	Def. unit	FW vers.
876 to 1172	DL/UL Timing	1024	(chips)	V3.07
Description of command				
This command sets the delay time (in integer chip periods) of the UL signal transmitted by the UE relative to the received DL signal from the CMU. ***Note:*** *This command is available in Non Signalling mode only. In Signalling mode, the UE is synchronized to the BS Signal when a connection is established, so there is no need to correct the timing.*				

RXQuality:BER

The subsystem `RXQuality:BER` controls the BER, BLER/DBLER and FDR measurement. The subsystem corresponds to the measurement menu *Receiver Quality,* application *BER,* and the sections in the popup menu *Receiver Quality Configuration* that are related to the *BER* application.

Control of Measurement – Subsystem RXQuality:BER

The subsystem *RXQuality:BER* controls the receiver quality measurements.

INITiate:RXQuality:BER	Start new measurement	⇒	*RUN*
ABORt:RXQuality:BER	Abort running measurement and switch off	⇒	*OFF*
STOP:RXQuality:BER	Stop measurement	⇒	*STOP*
CONTinue:RXQuality:BER	Next measurement step (only *stepping mode*)	⇒	*RUN*
Description of command			FW vers.
These commands have no query form. They start or stop the current measurement, setting it to the status indicated in the top right column.			V3.07

CONFigure:RXQuality:BER:EREPorting <*Mode*>				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SRSQ No reporting	OFF	–	V3.07
Description of command				
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).				

FETCh:RXQuality:BER:STATus?			Measurement Status	
Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	V3.07
1 to 1000 | **NONE**	Counter for current evaluation period (frame) Statistic count set to off (only 1 frame)	NONE	–	
Description of command				
This command is always a query. It returns the status of the measurement (see chapter 5).				

Subsystem RXQuality:BER:CONTrol

The subsystem *RXQuality:BER:CONTrol* sets the control parameters for the receiver quality measurement. The subsystem corresponds to the *Control* tab in the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:BER:CONTrol:REPetition <***StopCondition***>,<***Stepmode***>			Test Cycles	
<Repetition>	Description of parameters	Def. value	Def. unit	FW vers.
CONTinuous | **SINGleshot |** **1 to 1000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	V3.07
<StopCond>	Description of parameters	Def. value	Def. unit	FW vers.
SONerror | **NONE** **CLEVel,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error Statistical BER test switched on (Signalling only)	NONE	–	V3.07 V4.25
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.07
Description of command				
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *For READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*				

CONFigure:RXQuality:BER:CONTrol:TBLocks <*Blocks*> Transport Blocks

<*Blocks*>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 50000 | **1 to 500**	Transport blocks for single shot measurements Transport blocks for continuous measurements	100 500	(blocks) (blocks)	V3.07

Description of command

This command defines the number of transport blocks to be sent per measurement cycle. The values for single shot and continuous measurements are stored as two independent variables with different default values. Which value is set and used depends on the current repetition mode; see command `CONFigure:RXQuality:BER:CONTrol:REPetition`.

CONFigure:RXQuality:BER:CONTrol:TBSize <*Symmetry*> Transport Block Size

<*Symmetry*>	Description of parameters	Def. value	Def. unit	FW vers.
ASYM | **SYMM**	DL and UL block of different size DL and UL block of the same size	ASYM	–	V3.07

Description of command

This command defines whether DL and UL transport block sizes are different *(asymmetric)* or the same *(symmetric)*.

Note: *This command is available in Non Signalling mode only. In Signalling mode, the transport block size is set via* `CONFigure:BSSignal:DCH:RMC:UCRC`.

CONFigure:RXQuality:BER:CONTrol:ARESynch <*Enable*> PN Auto Resynch.

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable automatic resynchronization	ON	–	V3.61

Description of command

This command enables or disables automatic PN resynchronization.

DEFault:RXQuality:BER:CONTrol <Enable> Default Settings

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	V3.07

Description of command

As a *setting command* with the setting *ON* this command sets all parameters of the subsystem to default values (the setting *OFF* causes an error message). As a query, this command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Confidence BER – Subsystem RXQuality:BER:CONTrol:CONFidence...

The subsystem *RXQuality:BER:CONTrol:CONFidence...* configures the confidence BER measurement. The settings are provided in the *BER – Confidence Settings* section of the *Control* tab of the *Receiver Configuration* menu.

Note: *In older firmware versions (<V4.50), statistical Receiver Quality tests are available in Signalling mode only.*

CONFigure:RXQuality:BER:CONTrol:CONFidence:WDECision Wrong Decision
<F_BER>, <F_BLER>, <F_DBLER>, <F_FER>, <F_TFCI>

<F_BER>	Description of parameters	Def. value	Def. unit	FW vers.
P5 | P1 | P0_2 | P0_02	5 %, 1 %, 0.2 % or 0.02 % wrong decision value for BER	P0_2	–	V4.25
<F_BLER>	Description of parameters	Def. value	Def. unit	FW vers.
P5 | P1 | P0_2 | P0_02	Wrong decision value for BLER	P0_2	–	V4.25
<F_DBLER>	Description of parameters	Def. value	Def. unit	FW vers.
P5 | P1 | P0_2 | P0_02	Wrong decision value for D-BLER	P0_2	–	V4.25
<F_FER>	Description of parameters	Def. value	Def. unit	FW vers.
P5 | P1 | P0_2 | P0_02	Wrong decision value for FER (Signalling only)	P0_2	–	V4.25
<F_TFCI>	Description of parameters	Def. value	Def. unit	FW vers.
P5 | P1 | P0_2 | P0_02	Wrong decision value for TFCI faults (Signalling only)	P0_2	–	V4.25

Description of command	Sig. State
This command defines the probability of wrong decision value F for early pass and early fail decisions. Note that the *Non Signalling* command has only three parameters for the BER, BLER and D-BLER results.	all

CONFigure:RXQuality:BER:CONTrol:CONFidence:BDUT? Bad DUT Factor

Response	Description of parameters	Def. value	Def. unit	FW vers.
1.5	Fixed value	1.5	–	V4.25

Description of command	Sig. State
This command returns the fixed bad DUT factor of 1.5.	all

CONFigure:RXQuality:BER:CONTrol:CONFidence:RWINdow <*Factor*> Result Window

<Factor>	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **P10 | P20 | P30**	Dual-limit test switched off, single-limit test Dual-limit test with a range of 10 %, 20 %, or 30 %	OFF	–	V4.25

Description of command	Sig. State
This command selects the BER range factor for statistical dual-limit BER tests.	all

CONFigure:RXQuality:BER:CONTrol:CONFidence:MTTime <*Time*> Min. Test Time

<Time>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 s to 100 000.0 s	Minimum Test Time	0.0	s	V4.25

Description of command	Sig. State
This command defines the minimum test time before a check of the early pass and early fail limits can stop the measurement.	all

Subsystem RXQuality:BER:LIMit

The subsystem *RXQuality:BER:LIMit* defines tolerance values for the receiver quality measurements. The subsystem corresponds to the *Limits* tab in the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:BER:CURRent:LIMit[:SCALar]:ASYMmetric:UPPer:VALue Limits
<BER>, <BLER>, <DBLER>

<BER>	Description of parameters	Def. value	Def. unit	FW vers.
0 % to 100 %| OFF,	Upper limit for Bit Error Rate Disable limit check	0.1	%	V3.07
<BLER>	Description of parameters	Def. value	Def. unit	FW vers.
0 % to 100 %| OFF,	Upper limit for Block Error Rate Disable limit check	1.0	%	V3.07
<DBLER>	Description of parameters	Def. value	Def. unit	FW vers.
0 % to 100 %| OFF	Upper limit for Data Block Error Rate Disable limit check	1.0	%	V3.15

Description of command

This command defines upper limits for the BER, the BLER and the DBLER.

CONFigure:RXQuality:BER:TBLocks:CURRent:LIMit[:SCALar]:ASYMmetric:UPPer:VALue
<Limit> Limits: Lost Transport Blocks

<Limit>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 50 000 | OFF	Upper limit for lost transport blocks Disable limit check	OFF	–	V3.60

Description of command

This command defines the upper limit for the number of *Lost Transport Blocks*.

Note: *The total no. of blocks sent represents an upper limit for the number of lost transport blocks. This total number of blocks cannot be set directly at the CMU.* `CONFigure:RXQuality:BER:CONTrol:TBLocks` *defines the number of blocks received per statistics cycle, which is equal to the number of blocks sent minus the number of lost blocks.*

CONFigure:RXQuality:BER:BTFD:CURRent:LIMit[:SCALar]:ASYMmetric:UPPer:VALue
<FDR>, <UL TFCI Faults>
Limits: Blind Transport Format Detection

<FDR>	Description of parameters	Def. value	Def. unit	FW vers.
0.000% to 100.000% | OFF,	Upper limit for FDR Disable limit check	1.0	%	V3.60
<UL TFCI Faults>	Description of parameters	Def. value	Def. unit	FW vers.
0.000% to 100.000% | OFF	Upper limit for UL TFCI Faults Disable limit check	1.0	%	V3.60

Description of command

This command defines the upper limit for the False transmit format Detection Ratio *(FDR)* and for the *UL TFCI Faults.* It is available in *Signalling* mode.

DEFault:RXQuality:BER:LIMit <Enable> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	All parameters are set to their default values	ON	–	V3.07
OFF	Some or all parameters differ from the default values			

Description of command

As a *setting command* with the setting *ON* this command sets all parameters of the subsystem to default values (the setting *OFF* causes an error message). As a query, this command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystem RXQuality:BER?

The subsystem *RXQuality:BER?* measures and returns the different bit error rates and compares them with the tolerance values. The subsystem corresponds to the left output table in the *Receiver Quality* menu.

Scalar Results

READ[:SCALar]:RXQuality:BER? Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:BER? Read out meas. results (unsynchronized)
SAMPle[:SCALar]:RXQuality:BER? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
BER,	0.000% to 100.000%	NAN	%	V3.07
BLER,	0.000% to 100.000%	NAN	%	
DBLER,	0.000% to 100.000%	NAN	%	
Lost Transport Blocks,	0 to <total number of blocks sent>	NAN	(blocks)	
DL/UL Alignment,	0 chips to 2559 chips	NAN	(chips)	
FDR (Sig),	0.000% to 100.000%	NAN	%	V3.60
UL TFCI Faults (Sig),	0.000% to 100.000%	NAN	%	V3.60
PN Discontinuity,	(depending on transport blocks sent)	NAN	–	V3.80
Transport Block Delay	0 frames to 10 times TTI	NAN	(frames)	V3.80

Description of command

These commands are always queries. They start a bit-error-rate test (`READ…`) and/or return the measurement results (see also detailed explanation of measured values in chapter 4). The following results are returned:

BER	Bit error rate
BLER	Block error rate
DBLER	Data block error rate
Lost Transport Blocks	Difference between the number of blocks sent and the number of blocks received
DL/UL Alignment	Measured time offset between UL and DL signal
FDR	False transmit format Detection Ratio (Signalling mode only)
UL TFCI Faults	Percentage of transport blocks detected with wrong transport format, irrespective of the result of the CRC check (Signalling mode only)
PN Discontinuity	Number of transport blocks that the R&S CMU corrected (i.e. re-ordered) in the PN Auto Resynch. procedure
Transport Block Delay	Delay between the transport block sent and the transport block received

The BLER result is not available (NAN) if a symmetric transport block size is selected (see command `CONFigure:RXQuality:BER:CONTrol:TBSize`). The total number of blocks sent is defined via `CONFigure:RXQuality:BER:CONTrol:TBLocks`.

Note: *In Non Signalling mode, the FDR and UL TFCI Faults are omitted. DL/UL Alignment is returned before the Lost Transport Blocks.*

CALCulate[:SCALar]:RXQuality:BER:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
BER,	NMAL | INV | OK	INV	–	V3.07
BLER,	NMAL | INV | OK	INV	–	
DBLER,	NMAL | INV | OK	INV	–	
FDR,	NMAL | INV | OK	INV	–	V3.60
UL TFCI Faults[*)]**,**	NMAL | INV | OK	INV	–	
Lost Transp. Blocks[*)]	NMAL | INV | OK	INV	–	

Description of command

This command is always a query. It indicates whether and in which way the tolerances for the bit error rate test (see command above) have been exceeded.

*) Provided in *Signalling* mode only.

The following messages can be returned for the measured quantities:

NMAL	Overflow	*Not matching, upper limit exceeded*
INV	Invalid measurement	*Invalid*
OK	All tolerances matched	

Confidence (Statistical) Test Results

READ[:SCALar]:RXQuality:BER:CONFidence? Start single shot measurement and return results

FETCh[:SCALar]:RXQuality:BER:CONFidence? Read out meas. results (unsynchronized)

SAMPle[:SCALar]:RXQuality:BER:CONFidence? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Statistical Result BER,	For all results:	INV	–	V4.25
Stat. Result BLER,		INV	–	
Stat. Result DBLER,	RUNN | EFAI | EPAS |	INV	–	
Stat. Result FDR (signalling only),	FAIL | PASS | THIG |	INV	–	
Stat. Result UL TFCI Faults (signalling only)	TLOW | IMP | INV	INV	–	

Description of command

These commands are always queries. They start a bit-error-rate test (`READ…`) and/or return the measurement results. The following results are returned:

RUNN	Confidence test running	*running*
EFAI	Test stopped, failed early	*early fail*
EPAS	Test stopped, passed early	*early pass*
THIG	Test stopped, result too thigh (dual-limit test)	*too high*
TLOW	Test stopped, result too low (dual-limit test)	*too low*
PASS	All tolerances matched	*passed*
FAIL	Not all tolerances matched	*failed*
IMP	Measurement impossible, therefore invalid	*impossible*
INV	Measurement invalid (e.g. because no statistical test is performed for the measured quantity; limits disabled)	*invalid*

Note: *The last two results are available in Signalling mode only.*

Tip: Use `FETCh[:SCALar]:RXQuality:BER:CONFidence?` after `READ[:SCALar]:RXQuality:BER?` to avoid restarting the measurement in order to obtain the confidence test results.

Fast Power Measurement (NPOWer)

The subsystem *NPOWer* measures the power of the signal transmitted by the UE using the RF analyzer configuration of the *Power/Slot Table* measurement including the filter settings.

The narrow-band *NPOWer* measurement yields the average, maximum and minimum UE transmitter output power evaluated over a time range of ½ slot. In addition to these *Current* values the minimum and maximum power in the entire measurement and the average of the average current values, referenced to a statistics cycle, is calculated. No table of consecutive slot powers is available, and no limit check is performed. *NPOWer* is a quick and precise alternative to the *Power/Slot Table* measurement if the center of interest is a statistical overview of the slow powers.

Note: *The `NPOWer` measurement can be performed with all trigger settings. Free Run trigger source (`TRIGger[:SEQuence]:SOURce FRUN`) means that the measurement is started immediately and repeated as fast as possible. To synchronize the measurement to a slot or frame boundary, an appropriate trigger must be used.*

INITiate:NPOWer	Start new measurement	⇒ *RUN*
ABORt:NPOWer	Abort measurement and switch off	⇒ *OFF*
STOP:NPOWer	Stop measurement	⇒ *STOP*
CONTinue:NPOWer	Next measurement step (only *counting mode*)	⇒ *RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status given in the top right column.	V3.60

CONFigure:NPOWer:EREPorting <*Mode*> — Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.60
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU200 operating manual).

FETCh:NPOWer:STATus? — Measurement

Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.60
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE	No counting mode set	NONE	–	
1 to 1000 |	Counter for current evaluation period within a cycle	NONE	–	
NONE	Statistic count set to off			

Description of command

This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual operating manual).

Subsystem NPOWer:CONTrol

The subsystem *NPOWer:CONTrol* defines the repetition mode, statistic count, stop condition, and stepping mode of the *NPOWer* measurement.

CONFigure:NPOWer:CONTrol
Scope of Measurement
<Statistics>*, *<Repetition>*, *<StopCond>*, *<Stepmode>

<Statistics>	Description of parameters	Def. value	Def. unit	
1 to 1000 | **NONE**	No. of bursts within a statistics cycle Statistics off	100	–	
<Repetition>	**Description of parameters**	**Def. value**	**Def. unit**	
CONTinuous | **SINGleshot |** **1 ... 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	**Description of parameters**	**Def. value**	**Def. unit**	
SONerror | **NONE**	Start measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.60

Description of command

This command selects the type of measured values and determines the number of bursts forming one statistics cycle.

CONFigure:NPOWer:CONTrol:STATistics *<Statistics>* Scope of Measurement

<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 | **NONE**	No. of bursts within a statistics cycle Statistics off	100	–	V3.60

Description of command

This command selects the type of measured values and determines the number of bursts forming one statistics cycle.

CONFigure:NPOWer:CONTrol:REPetition <*Repetition*>, <*StopCond*>, <*Stepmode*> Test cycles

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** **1 ... 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	**Description of parameters**	**Def. value**	**Def. unit**	
SONerror | **NONE**	Start measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.60

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*

Measured Values – Subsystem NPOWer?

The following commands retrieve the results of the narrow-band power measurement.

READ[:SCALar]:NPOWer? Start single shot measurement and return results
FETCh[:SCALar]:NPOWer? Read out measurement results (unsynchronized)
SAMPle[:SCALar]:NPOWer? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Avg. Power of current evaluation period,	–137 dBm to +53 dBm	NAN	dBm	V3.60
Min. Power of current evaluation period,	–137 dBm to +53 dBm	NAN	dBm	
Max. Power of current evaluation period,	–137 dBm to +53 dBm	NAN	dBm	
Avg. Power ref. to the last stat. cycle,	–137 dBm to +53 dBm	NAN	dBm	
Min. Power of the entire measurement,	–137 dBm to +53 dBm	NAN	dBm	
Max. Power of the entire measurement	–137 dBm to +53 dBm	NAN	dBm	

Description of command

These commands are always queries. They start the *NPOWer* measurement and return the results.

Measurement Groups (Signalling Only)

The commands for the measurement groups in this section are only available in *Signalling* mode.

POWer Measurements

In *Signalling* mode, the R&S CMU provides an additional `POWer:ONOFf` application.

POWer:ONOFf

The subsystem `POWer:ONOFf` measures the UE power during the UE's random access procedure (ON/Off Time Mask). The subsystem corresponds to the measurement menu *Power,* application *On/Off Time Mask,* and the sections in the popup menu *Power Configuration* that are related to the *On/Off Time Mask* application.

Control of Measurement – Subsystem POWer:ONOFf

The subsystem *POWer:ONOFf* controls the*On/Off Time Mask* measurement. It corresponds to the *On/Off Time Mask* softkey in the measurement menu *Power*.

INITiate:POWer:ONOFf	Start new measurement	⇒	*RUN*
ABORt:POWer:ONOFf	Abort running measurement and switch off	⇒	*OFF*
STOP:POWer:ONOFf	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:POWer:ONOFf	Next measurement step (only *stepping mode*)		⇒ *RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V3.60

CONFigure:POWer:ONOFf:EREPorting <*Mode*> Event Reporting

<*Mode*>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.60
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:POWer:ONOFf:STATus?			Measurement Status	
Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the OFF state (*RST or ABORt) Running (after INITiate, CONTinue or READ) Stopped (STOP) OFF (could not be started) Stepping mode (<stepmode>=STEP) Stopped according to repetition mode and stop condition	OFF	–	V3.60
NONE	Indication that no counting mode set	NONE	–	
Description of command				
This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).				

Test Configuration

The commands of the following subsystems configure the *On/Off Time Mask* measurement. They correspond to the sections in the popup menu *Power Configuration* that are related to the *On/Off Time Mask* application.

Subsystem POWer:ONOFf:CONTrol

The subsystem *POWer:ONOFf:CONTrol* specifies how the measurement is performed. It corresponds to *On/Off Time Mask* settings in the *Control* tab of the *Power Configuration* menu.

CONFigure:POWer:ONOFf:CONTrol:MPReamble <*Preamble_No*> Measured Preamble				
<Preamble_No>	Description of parameters	Def. value	Def. unit	FW vers.
MP1 | MP2 | MP3 | MP4 | MP5	1st or 2nd or 3rd or 4th or 5th preamble	MP1	–	V3.60
Description of command				
This command selects the preamble within the UE's preamble cycle that is measured. The selected preamble must be smaller than the maximum number of retransmissions (`CONFigure:NETWork:RAC:PREamble:MRETrans`), otherwise the command returns invalid results.				

CONFigure:POWer:ONOFf:CONTrol:MITem <*Item*> Measured Item				
<Item>	Description of parameters	Def. value	Def. unit	FW vers.
MIOO | **MIOS**	Power On/Off Power On/Step	MIOO	–	V3.60
Description of command				
This command selects the type of measurement results.				

Subsystem POWer:ONOFf:...LIMit

The subsystem *POWer:ONOFf:...LIMit* defines the limits for the *On/Off Time Mask* measurement. The subsystem corresponds to the *On/Off Time Mask* section in the *Limits* tab of the *Power Configuration* menu.

CONFigure:POWer:ONOFf:CURRent:LIMit Current Limits
<Open Loop>, <Max Power Limit>, <Max Power Rated>, <Off Power>, <PRACH Power Step>

<Open Loop>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to +15.0 dB	Open loop limit	9.0	dB	V3.60
<Max Power Limit>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to +5.0 dB	Max. power limit	2.0	dB	V3.60
<Max Power Rated>	Description of parameters	Def. value	Def. unit	FW vers.
–60.0 dBm to +53.0 dBm	Rated value for PRACH UE-O Power	21.0	dBm	V3.60
<Off Power>	Description of parameters	Def. value	Def. unit	FW vers.
–60.0 dBm to +53.0 dBm	Off power limit	–56.0	dBm	V3.60
<PRACH Power Step>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to +15.0 dB	PRACH power step limit	2.0	dB	V3.60

Description of command

This command sets the limits for the *On/Off Time Mask* measurement. <*Open Loop*> and <*PRACH Power Step*> are symmetric limits (±x dB): the absolute value of the measured quantity must be smaller than the specified limit.

DEFault:POWer:ONOFf:LIMit *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.60

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem SUBarrays:ONOFf

The subsystem *SUBarrays:ONOFf* defines the measurement range and the type of output values.

CONFigure:SUBarrays:POWer:ONOFf:CURRent Definition of Subarrays
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}

<Mode>	Description of parameters	Def. value	Def. unit	
ALL |	Return all measurement values	ALL	–	
ARIThmetical |	Return arithm. mean value in every subrange			
MINimum |	Return minimum value in every subrange			
MAXimum |	Return maximum value in every subrange			
IVAL |	Return single interpolated value at <Start>			
XMAXimum |	Return x-axis value of maximum and maximum			
XMINimum |	Return x-axis value of minimum and minimum			
PAVG,	Return arithmetic mean value in every subrange			

<Start>	Description of parameters	Def. value	Def. unit	
–2464 chips to +6558 chips,	Start time in current range	0	chips	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 4512	Number of samples in current range	4512	–	V3.60

Description of command

This command configures the `READ:SUBarrays..., FETCh:SUBarrays...,` and `SAMPle:SUBarrays:POWer:ONOFf...` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of 2 chip periods.

For <Mode> = IVAL, the <Samples> parameter is ignored and the R&S CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located between two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation.

The subranges may overlap but must be within the total range of the *On/Off Time Mask* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the `ARIThmetical, MINimum, MAXimum`, … values.

By default, only one range corresponding to the total measurement range is used and all measurement values are returned.

Measured Values – Subsystem POWer:ONOFf...?

The subsystem *POWer:ONOFf...?* measures and returns the results and compares them with tolerance values. The subsystem corresponds to the graphical measurement menu *Power,* application *On/Off Time Mask.*

Scalar Results

READ[:SCALar]:POWer:ONOFf:CURRent? Start single shot measurement and return results

FETCh[:SCALar]:POWer:ONOFf:CURRent? Read measurement results (unsynchronized)

SAMPle[:SCALar]:POWer:ONOFf:CURRent? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
UE On Power,	–100.0 dBm to +60.0 dBm	NAN	dBm	V3.60
Off Power Before,	–100.0 dBm to +60.0 dBm	NAN	dBm	
Off Power After,	–100.0 dBm to +60.0 dBm	NAN	dBm	
PRACH Signature,	0 to 15	NAN	–	
Expected PRACH Power,	–100.0 dBm to +60.0 dBm	NAN	dBm	
UE Power Step	–100.0 dB to +100.0 dB	NAN	dB	

Description of command

These commands are always queries. They start a `POWer:ONOFf` measurement (`READ...`) and/or return all scalar measurement results.

CALCulate[:SCALar]:POWer:ONOFf:CURRent:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
Limits for all scalar results	NMAL | INV | OK	INV	–	V3.60

Description of command

This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see `READ[:SCALar]:POWer:ONOFf:CURRent?`) are exceeded.

The following messages may be returned:

NMAL	Upper limit exceeded (for any of the power results)	*not matching, overflow*
INV	Measurement invalid (no valid result available)	*invalid*
OK	All valid power results within the limits	

CALCulate[:SCALar]:POWer:ONOFf:CURRent:ALL:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
UE On Power, **Off Power Before,** **Off Power After,** **UE Power Step**	For all values: NMAU | NMAL | INV | OK	INV	–	V4.10

Description of command

This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see `READ[:SCALar]:POWer:ONOFf:CURRent?`) are exceeded.

The following messages may be returned for each of the measured values:

NMAL	Upper limit exceeded	*not matching, overflow*
NMAU	Lower limit exceeded	*not matching, underflow*
INV	Result invalid	*invalid*
OK	Result within the limits	

On/Off Time Mask Measurement Curve

READ:ARRay:POWer:ONOFf:CURRent?	Start single shot measurement and return results	⇒ *RUN*
FETCh:ARRay:POWer:ONOFf:CURRent?	Read measurement results (unsynchronized)	⇒ *RUN*
SAMPle:ARRay:POWer:ONOFf:CURRent?	Read measurement results (synchronized)	⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for preamble power	–100.0 dBm to +60.0 dBm,	NAN	dBm	V3.60
...	... ,	...	...	
4512th value for preamble power	–100.0 dBm to +60.0 dBm	NAN	dBm	

Description of command

These commands are always queries. They return the power of the kth PRACH preamble where k is set via `CONFigure:POWer:ONOFf:CONTrol:MPReamble`. The 4512 measurement points are located in the time range between –2464 chip periods and +6558 chip periods relative to the start of the preamble; their spacing is 2 chips.

READ:SUBarrays:POWer:ONOFf:CURRent? Subarray Results

Start single shot measurement and return results ⇒ *RUN*

FETCh:SUBarrays:POWer:ONOFf:CURRent?

Read meas. results (unsynchronized) ⇒ *RUN*

SAMPle:SUBarrays:POWer:ONOFf:CURRent?

Read results (synchronized) ⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
1st value for preamble power	–100.0 dBm to +60.0 dBm,	NAN	dBm	V3.60
...	... ,	...	...	
nth value for preamble power	–100.0 dBm to +60.0 dBm	NAN	dBm	

Description of command

These commands are always queries. They measure and return the power of PRACH preamble versus time in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:EVMagnitude...` commands. In the default setting of the configuration command the `READ:SUBarrays..., FETCh:SUBarrays..., and SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay..., FETCh:ARRay..., and SAMPle:ARRay...` command group described above.

The `CONFigure:SUBarrays:MODulation:EVMagnitude...` commands define a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum, …)` is set, only one value is returned per subrange.

The calculation of *Current, Average, and MMAX* (Max./Min.) results is explained in Chapter 3 (see *display mode)*.

MODulation Measurements

In *Signalling* mode, the R&S CMU provides the additional application `MODulation:PRACh`.

MODulation:PRACh

The subsystem `MODulation:PRACh` controls the *PRACH Preamble Quality* measurement. The subsystem corresponds to the measurement menu *Modulation,* application *PRACH Preamble Quality,* and the sections in the popup menu *Modulation Configuration* that are related to the *PRACH Preamble Quality* application.

Measurement Control

The following commands control the *PRACH Preamble Quality* measurement. They correspond to the *PRACH Preamble* softkey in the measurement menu *Modulation*.

INITiate:MODulation:PRACh	Start new measurement	⇒	*RUN*
ABORt:MODulation:PRACh	Abort running measurement and switch off	⇒	*OFF*
STOP:MODulation:PRACh	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:MODulation:PRACh	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V3.80

CONFigure:MODulation:PRACh:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.80
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:MODulation:PRACh:STATus? Measurement Status

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.80
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE	No counting mode set	NONE	–	V3.80

Description of command

This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *PRACH Preamble Quality* measurement. They correspond to the sections in the popup menu *Modulation Configuration* that are related to the *PRACH Preamble Quality* application.

Subsystem MODulation:PRACh:CONTrol

The subsystem *MODulation:PRACh:CONTrol* configures the measured preamble. It corresponds to settings in the *Control* tab in the popup menu *Modulation Configuration*.

CONFigure:MODulation:PRACh:CONTrol:MPReamble <*Number*> — Measured Preamble

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
MP1 to MP5	1st to 5th preamble of the preamble cycle	MP1	–	V3.80

Description of command

This command selects the measured preamble with the UE preamble cycle.

DEFault:MODulation:PRACh:CONTrol <*Enable*> — Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.80

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem MODulation:PRACh:...LIMit

The subsystem *MODulation:PRACh:...LIMit* defines the limits for the *PRACH Preamble Quality* measurement. The subsystem corresponds to the *PRACH Preamble* section in the *Limits* tab of the popup menu *Modulation Configuration.*

CONFigure:MODulation:PRACh:LIMit[:SCALar]:SYMMetric — Limit Values
[:COMBined]:VALue <Error Vector Magn. (Peak)>, <Error Vector Magn. (RMS)>, <Magnitude Error (Peak)>, <Magnitude Error (RMS)>, <Phase Error (Peak)>, <Phase Error (RMS)>, <I/Q Origin Offset>, <I/Q Imbalance>, <Carrier Frequency Error>, <Waveform Quality>

Parameter	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to 50.0 %	Error Vector Magn. (Peak)	+50.0	%	V3.80
0.0 % to 50.0 %	Error Vector Magn. (RMS)	+17.5	%	
0.0 % to 50.0 %	Magnitude Error (Peak)	+50.0	%	
0.0 % to 50.0 %	Magnitude Error (RMS)	+17.5	%	
0.0 deg to +45.0 deg	Phase Error (Peak), symmetric	±45.0	deg	
0.0 deg to +45.0 deg	Phase Error (RMS)	+10.0	deg	
–80.00 dB to –20.00 dB,	I/Q Origin Offset	–25.0	dB	
–99.00 dB to 0.00 dB,	I/Q Imbalance	–15.0	dB	
0 Hz to +4000 Hz	Carrier Frequency Error, symmetric	±200.0	Hz	
+0.9000 to +0.9999	Waveform Quality	+0.9440	–	

Description of command

This command specifies the limit values for the *PRACH Preamble Quality* measurement.

Subsystem SUBarrays:MODulation:PRACh

The following command selects the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:PRACh:EVMagnitude Definition of Subarrays
CONFigure:SUBarrays:MODulation:PRACh:PERRor
CONFigure:SUBarrays:MODulation:PRACh:MERRor
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ALL |	Return all measurement values	ALL	–	V3.80
ARIThmetical |	Return arithm. mean value in every subrange			
MINimum |	Return minimum value in every subrange			
MAXimum |	Return maximum value in every subrange			
IVAL |	Return single interpolated value at <Start>			
XMAXimum |	Return x-axis value of maximum and maximum			
XMINimum |	Return x-axis value of minimum and minimum			
PAVG,	Return arithmetic mean value in every subrange			
<Start>	Description of parameters	Def. value	Def. unit	FW vers.
1 chips to 4096 chips,	Start time in current range	1	chips	V3.80
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 4096	Number of samples in current range	4096	–	V3.80

Description of command

This command configures the `READ:SUBarrays..., FETCh:SUBarrays...,` and `SAMPle:SUBarrays:MODulation:EVMagnitude...` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of 1 chip period.

For <Mode> = IVAL, the <Samples> parameter is ignored and the R&S CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located between two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation.

The subranges may overlap but must be within the total range of the *PRACH Preamble Quality* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values.

By default, only one range corresponding to the total measurement range is used and all measurement values are returned.

Measured Values – Subsystem MODulation:PRACh...?

The subsystem *MODulation:PRACh...?* measures and returns the results and compares them with tolerance values. The subsystem corresponds to the graphical measurement menu *Modulation,* application *PRACH Preamble Quality.*

Scalar Results

READ[:SCALar]:MODulation:PRACh? Start single shot measurement and return results
FETCh[:SCALar]:MODulation:PRACh? Read measurement results (unsynchronized)
SAMPle[:SCALar]:MODulation:PRACh? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
EVM (Peak),	0.0 % to 100.0 %	NAN	%	V3.80
EVM (RMS) (x3),	0.0 % to 100.0 %	NAN	%	
Magn. Error (Peak),	–100.0 % to 100.0 %	NAN	%	
Magn. Error (RMS),	0.0 % to 100.0 %	NAN	%	
Phase Error (Peak),	–180.0 deg to +180.0 deg	NAN	deg	
Phase Error (RMS),	0.0 deg to +180.0 deg	NAN	deg	
I/Q Origin Offset,	–100.0 dB to 0.0 dB	NAN	dB	
I/Q Imbalance,	–100.0 dB to 0.0 dB	NAN	dB	
Frequency Error,	–5000.0 Hz to +5000.0 Hz	NAN	Hz	
Waveform Quality,	0.0 to +1.0	NAN	–	
Expected PRACH Power,	–100 dBm to +60 dBm	NAN	dBm	
PRACH UE-On Power,	–100 dBm to +60 dBm	NAN	dBm	
PRACH signature	0 to 15	NAN	–	

Description of command

These commands are always queries. They start a `MODulation:PRACh` measurement (`READ...`) and/or return all scalar measurement results.

CALCulate[:SCALar]:MODulation:PRACh:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
EVM (Peak),	NMAL | INV | OK	INV	–	V3.80
EVM (RMS),	NMAL | INV | OK	INV	–	
Magn. Error (Peak),	NMAL | INV | OK	INV	–	
Magn. Error (RMS),	NMAL | INV | OK	INV	–	
Phase Error (Peak),	NMAU | NMAL | INV | OK	INV	–	
Phase Error (RMS),	NMAL | INV | OK	INV	–	
I/Q Origin Offset,	NMAL | INV | OK	INV	–	
I/Q Imbalance,	NMAL | INV | OK	INV	–	
Frequency Error,	NMAU | NMAL | INV | OK	INV	–	
Waveform Quality	NMAU | INV | OK	INV	–	

Description of command

This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see commands above) are exceeded.

The following messages may be returned:

NMAL	Result exceeds upper limit, limit check failed
NMAU	Result below lower limit, limit check failed
INV	No valid result available
OK	Limit check passed

READ:ARRay:MODulation:PRACh:EVMagnitude? Error Vector Magnitude
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:PRACh:EVMagnitude?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:PRACh:EVMagnitude?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for EVM	0% to +100.0 %,	NAN	%	V3.80
...	... ,	...	...	
4096th value for EVM	0% to +100.0 %	NAN	%	

Description of command

These commands are always queries. They return the error vector magnitude (EVM) over the entire PRACH preamble length of 4096 chips.

Phase Error

READ:ARRay:MODulation:PRACh:PERRor? Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:PRACh:PERRor? Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:PRACh:PERRor? Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for phase error	–180.0 deg to +180.0 deg,	NAN	deg	V3.80
...	... ,	...	...	
4096th value for phase error	–180.0 deg to +180.0 deg	NAN	deg	

Description of command

These commands are always queries. They return the phase error over the entire PRACH preamble length of 4096 chips.

Magnitude Error

READ:ARRay:MODulation:PRACh:MERRor? Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:PRACh:MERRor? Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:PRACh:MERRor? Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for magnitude error	0% to +100.0 %,	NAN	%	V3.80
...	... ,	...	...	
4096th value for magnitude error	0% to +100.0 %	NAN	%	

Description of command

These commands are always queries. They return the magnitude error over the entire PRACH preamble length of 4096 chips.

READ:SUBarrays:MODulation:PRACh:EVMagnitude? Error Vector Magnitude
Start single shot measurement and return results ⇒ *RUN*
FETCh:SUBarrays:MODulation:PRACh:EVMagnitude?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:SUBarrays:MODulation:PRACh:EVMagnitude?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for EVM	0% to +100.0 %,	NAN	%	V3.80
...	... ,	...	...	
nth value for EVM	0% to +100.0 %	NAN	%	

Description of command

These commands are always queries. They return the error vector magnitude (EVM) in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:PRACh:EVMagnitude...` command. In the default setting of the configuration command the `READ:SUBarrays..., FETCh:SUBarrays..., and SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay..., FETCh:ARRay..., and SAMPle:ARRay...` command group described above.

The `CONFigure:SUBarrays:MODulation:EVMagnitude...` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum, …)` is set, only one value is returned per subrange.

Phase Error
READ:SUBarrays:MODulation:PRACh:PERRor? Start single shot measurement and return results⇒ *RUN*
FETCh:SUBarrays:MODulation:PRACh:PERRor? Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:SUBarrays:MODulation:PRACh:PERRor? Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for phase error	–180.0 deg to +180.0 deg,	NAN	deg	V3.80
...	... ,	...	...	
nth value for phase error	–180.0 deg to +180.0 deg	NAN	deg	

Description of command

These commands are always queries. They return the phase error in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:PRACh:PERRor...` command. In the default setting of the configuration command the `READ:SUBarrays..., FETCh:SUBarrays..., and SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay..., FETCh:ARRay..., and SAMPle:ARRay...` command group described above.

The `CONFigure:SUBarrays:MODulation:PERRor...` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum, …)` is set, only one value is returned per subrange.

READ:SUBarrays:MODulation:PRACh:MERRor? Magnitude Error

Start single shot measurement and return results ⇒ *RUN*

FETCh:SUBarrays:MODulation:PRACh:MERRor?

Read measurement results (unsynchronized) ⇒ *RUN*

SAMPle:SUBarrays:MODulation:PRACh:MERRor?

Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for magnitude error	0% to +100.0 %,	NAN	%	V3.80
...	... ,	...	...	
nth value for magnitude error	0% to +100.0 %	NAN	%	

Description of command

These commands are always queries. They return the magnitude error in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:PRACh:MERRor...` command. In the default setting of the configuration command the `READ:SUBarrays..., FETCh:SUBarrays..., and SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay..., FETCh:ARRay..., and SAMPle:ARRay...` command group described above.

The `CONFigure:SUBarrays:MODulation:MERRor...` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum, …)` is set, only one value is returned per subrange.

RXQuality Measurements

In *Signalling* mode, the R&S CMU provides an additional `RXQuality:UEReports` application. Further `RXQuality` applications require optional extensions to the WCDMA networks:

The *HSDPA ACK* (`RXQuality:HACK`), *HSDPA CQI* (`RXQuality:HCQI`)*, and HS-DPCCH Logging* (`RXQuality:HSLog`) applications require option R&S CMU-K64; see Chapter 8.

The *RLC BLER* (`RXQuality:RLCBler`) application requires option R&S CMU-K96; see Chapter 9.

RXQuality:UEReports

The subsystem *`RXQuality:UEReports`* controls the *UE Reports* application of the *Receiver Quality* measurement.

INITiate:RXQuality:UEReport	Start new measurement	⇒	*RUN*
ABORt:RXQuality:UEReport	Abort running measurement and switch off	⇒	*OFF*
STOP:RXQuality:UEReport	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:RXQuality:UEReport	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column. *) The `STOP…` and `CONTinue…` commands are available with firmware versions ≥ V5.01.	V3.40*)

CONFigure:RXQuality:UEReport:EREPorting <*Mode*> — Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.40
SOPC |	Single operation complete			
SRSQ |	SRQ and SRSQ			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).

FETCh:RXQuality:UEReport:STATus? — Measurement Status

Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.40
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
NONE	Statistic count, always set to off (only 1 frame)	NONE	–	

Description of command

This command is always a query. It returns the status of the measurement (see chapter 5).

DEFault:RXQuality:UEReport:CONTrol <*Enable*>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	All information elements are displayed At least one information element is switched off	ON	–	V3.40

Description of command

As a *setting command* with the setting *ON* this command enables the evaluation and display of all UE report information elements (see `CONFigure:RXQuality:UEReport<nr>[:CCELl]:ENABle`; the neighbor cell settings are not affected but can be reset using `DEFault:RXQuality:CONTrol`). The setting *OFF* causes an error message.

As a query, this command returns whether all parameters are displayed *(ON)* or not *(OFF)*.

CONFigure:RXQuality:UEReport:CONTrol:RINTerval <*Time*>				Reporting Interval
<Time>	Description of parameters	Def. value	Def. unit	FW vers.
0.25 s | 0.5 s | 1 s | 2 s | 3 s | 4 s | 6 s | 8 s | 12 s | 16 s | 20 s | 24 s | 28 s | 32 s | 64 s	Reporting Interval	1	s	V4.30

Description of command

This command sets the interval between two consecutive measurement report messages.

RXQuality:UEReports[:CCELl]

The subsystem `RXQuality:UEReports[:CCELl]` controls the *UE Reports* of the current cell.

CONFigure:RXQuality:UEReport<nr>[:CCELl]:ENABle <*Enable*>				UE Report
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	<nr> = 1: CPICH RSCP	ON	–	V3.40
ON | OFF	<nr> = 2: CPICH E_c/I_0	ON	–	
ON | OFF	<nr> = 3: Log 10(Transport channel BLER)	ON	–	
ON | OFF	<nr> = 4: UE transmitted power	ON	–	
ON | OFF	<nr> = 5: UE RX/TX time difference	ON	–	
ON | OFF	<nr> = 6: Pathloss	ON	–	

Description of command

This command enables or disables the evaluation and display of the optional individual information elements included in the UE measurement report message. Each information element is addressed by a numeric suffix.

The optional keyword [:CCELl] has been introduced with firmware V3.60 to distinguish the command from `CONFigure:RXQuality:UEReport<nr>:NCELl:ENABle`.

CONFigure:RXQuality:UEReport<nr>[:CCELl]:ENABle <*Enable*> UE Report

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	<nr> = 1: CPICH RSCP	ON	–	V3.40
ON | OFF	<nr> = 2: CPICH E_c/I_0	ON	–	
ON | OFF	<nr> = 3: Log 10(Transport channel BLER)	ON	–	
ON | OFF	<nr> = 4: UE transmitted power	ON	–	
ON | OFF	<nr> = 5: UE RX/TX time difference	ON	–	
ON | OFF	<nr> = 6: Pathloss	ON	–	

Description of command

This command enables or disables the evaluation and display of the optional individual information elements included in the UE measurement report message. Each information element is addressed by a numeric suffix.

The optional keyword [:CCELl] has been introduced with firmware V3.60 to distinguish the command from `CONFigure:RXQuality:UEReport<nr>:NCELl:ENABle`.

[SENSe:]RXQuality:UEReport<nr>[:CCELl]? UE Report, Current Cell

Returned values, <nr> = 1	Description of parameters	Def. value	Def. unit	FW vers.
–116*) dBm to –25 dBm, **–115 dBm to –24**) dBm,**	Lower limit for CPICH RSCP Upper limit = lower limit + 1 dB	NAN NAN	dBm dBm	V3.40
Returned values, <nr> = 2	Description of parameters	Def. value	Def. unit	FW vers.
–25*) dB to –0.5 dB, **–24.5 dB to 0**) dB,**	Lower limit for CPICH E_c/I_0 Upper limit = lower limit + 0.5 dB	NAN NAN	dB dB	V3.40
Returned values, <nr> = 3	Description of parameters	Def. value	Def. unit	FW vers.
–4.095*) to –0.065, **–4.03 to 0,**	Lower limit for Log 10(Transport ch. BLER) Upper limit ≥ lower limit	NAN NAN	– –	V3.40
Returned values, <nr> = 4	Description of parameters	Def. value	Def. unit	FW vers.
–50*) dBm to –49 dBm, **+33 dBm to +34**) dBm,**	Lower limit for UE transmitted power Upper limit = lower limit + 1 dB	NAN NAN	dBm dBm	V3.40
Returned values, <nr> = 5	Description of parameters	Def. value	Def. unit	FW vers.
767 chips to 1280 chips, **768 chips to 1281 chips,**	Lower limit for UE RX/TX time difference Upper limit = lower limit + 1 chip	NAN NAN	(chips) (chips)	V3.40
Returned values, <nr> = 6	Description of parameters	Def. value	Def. unit	FW vers.
+46*) dB to +158) dB**	Downlink pathloss	NAN	dB	V3.40

Description of command

This command is always a query. It returns the UE report results enabled by means of `CONFigure:RXQuality:UEReport<nr>[:CCELl]:ENABle <Enable>`. To obtain valid results, the UE report measurement must be running (`INITiate:UEReport`).

The results characterize the current cell. The optional keyword `[:CCELl]` has been introduced with firmware V3.60 to distinguish the command from the neighbor cell command `[SENSe:]RXQuality:UEReport<nr>:NCELl?`.

*) The value actually corresponds to –∞.
**) The value actually corresponds to +∞.

RXQuality:UEReports:NCELI

The subsystem `RXQuality:UEReports:NCELl` controls the *UE Reports* of the neighbor cell.

CONFigure:RXQuality:UEReport<nr>:NCELI:ENABle <Enable>			UE Report, Neighbor Cell	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	<nr> = 1: CPICH RSCP	ON	–	V3.60
ON | OFF	<nr> = 2: CPICH E_c/I_0	ON	–	
ON | OFF	<nr> = 3: UTRA Carrier RSSI	ON	–	
ON | OFF	<nr> = 4: UTRA SFN-CFN Time Difference	ON	–	
ON | OFF	<nr> = 5: UTRA Pathloss	ON	–	
ON | OFF	<nr> = 6: GSM Carrier RSSI	ON	–	
ON | OFF	<nr> = 7: GSM Verify BSIC	ON	–	

Description of command

This command enables or disables the evaluation and display of optional individual information elements included in the UE measurement report message. Each information element is addressed by a numeric suffix.

The information elements characterize the detected neighbor cell. Use `CONFigure:RXQuality:UEReport<nr>[:NCELl]:ENABle` to select the parameters of the current cell.

[SENSe:]RXQuality:UEReport<nr>:NCELI?			UE Report, Neighbor Cell	
Returned values, <nr> = 1	Description of parameters	Def. value	Def. unit	FW vers.
–116*) dBm to –25 dBm, **–115 dBm to –24**) dBm,**	Lower limit for CPICH RSCP Upper limit = lower limit + 1 dB	NAN NAN	dBm dBm	V3.60
Returned values, <nr> = 2	Description of parameters	Def. value	Def. unit	FW vers.
–25*) dB to –0.5 dB, **–24.5 dB to 0**) dB,**	Lower limit for CPICH E_c/I_0 Upper limit = lower limit + 0.5 dB	NAN NAN	dB dB	V3.60
Returned values, <nr> = 3	Description of parameters	Def. value	Def. unit	FW vers.
–101*) dBm to –25 dBm, **–100 dBm to –24**) dBm,**	Lower limit for UTRA Carrier RSSI Upper limit = lower limit + 1 dB	NAN NAN	dBm dBm	V3.60
Returned values, <nr> = 4	Description of parameters	Def. value	Def. unit	FW vers.
0 to 9830399,	Lower limit for UTRA SFN-CFN Time Diff. Upper limit = lower limit + 1	NAN NAN	(chips) (chips)	V3.60
Returned values, <nr> = 5	Description of parameters	Def. value	Def. unit	FW vers.
+46*) dB to +158) dB,**	UTRA neighbor cell downlink Pathloss	NAN	dB	V3.60
Returned values, <nr> = 6	Description of parameters	Def. value	Def. unit	FW vers.
–111*) dBm to –48 dBm, **–110 dBm to –47**) dBm,**	Lower limit for GSM Carrier RSSI Upper limit = lower limit + 1 dB	NAN NAN	dBm dBm	V3.60
Returned values, <nr> = 6	Description of parameters	Def. value	Def. unit	FW vers.
VER | NEVER	GSM Verify BSIC	NAN	–	V3.60

Description of command

This command is always a query. It returns the UE report results enabled by means of `CONFigure:RXQuality:UEReport<nr>:NCELl:ENABle` *<Enable>*. To obtain valid results, the UE report measurement must be running (`INITiate:UEReport`).

The results characterize the detected neighbor cell. Use `[SENSe:]RXQuality:UEReport<nr>[:CCELl]?` to retrieve the parameters of the current cell.

*) The value actually corresponds to –∞.
**) The value actually corresponds to +∞.

The following remote control commands define the basic properties of a WCDMA neighbor cell that the UE shall detect.

CONFigure:RXQuality:UEReport:NCELI:WCDMa:CHANnel <*Number*> RF Channel Downlink

<*Number*>	Description of parameters	Def. value	Def. unit	FW vers.
10562 to 10838 |	UARFCN for Op. Band I	10836	–	V3.60
9662 to 9938 | 412 | 437 | 462 | 487 | 512 | 537 | 562 | 587 | 612 | 637 | 662 | 687	UARFCN for Op. Band II			
1162 to 1513 |	UARFCN for Op. Band III			
1537 to 1738 | 1462 | 1487 | 1512 | 1537 | 1562 | 1587 | 1612 | 1637 | 1662	UARFCN for Op. Band IV			
4357 to 4458 | 1007 | 1012 | 1032 | 1037 | 1062 | 1087 |	UARFCN for Op. Band V			
4387 to 4413 | 1037 | 1062 |	UARFCN for Op. Band VI			
2237 to 2563 | 2587 | 2612 | 2637 | 2662 | 2687 | 2712 | 2737 | 2762 | 2787 | 2812 | 2837 | 2862 | 2887 | 2912	UARFCN for Op. Band VII			
2937 to 3088	UARFCN for Op. Band VIII			
9237 to 9387	UARFCN for Op. Band IX			
3112 to 3388 | 3412 | 3437 | 3462 | 3487 | 3512 | 3537 | 3562 | 3587 | 3612 | 3637 | 3662 | 3687	UARFCN for Op. Band X			V4.34
3712 to 3812	UARFCN for Op. Band XI			V4.50
3837 to 3903 | 3927 | 3932 | 3957 | 3962 | 3987 | 3992	UARFCN for Op. Band XII			V5.00
4017 to 4043 | 4067 | 4092	UARFCN for Op. Band XIII			
4117 to 4143 | 4167 | 4192	UARFCN for Op. Band XIV			
10912 to 10988 | 5912 | 5937 | 5962 | 5987	UARFCN for Op. Band S			V4.50
10962 to 11038 | 5962 | 5987	Op. Band S 190 MHz Duplex			V5.10
10062 to 10088	Op. Band S 170 MHz Duplex			

Description of command	Sig. State
This command selects the UARFCN (UTRA Absolute Radio Frequency Channel Numbers) of the neighbor cell signal to be measured by the UE.	all

CONFigure:RXQuality:UEReport:NCELI:WCDMa:OBANd <*Band*> Operating Band

<*Band*>	Description of parameters	Def. value	Def. unit	FW vers.
OB1 | OB2 | OB3 |	Operating Band I, II, III	OB1	–	V3.60
OB4 | OB5 | OB6|	Operating Band IV, V, VI			V3.60
OB7 |	Operating Band VII,			V4.20
OB8 | OB9 |	Operating Band VIII, IX			V4.10
OBS |	Operating Band S			V4.34
OB10 |	Operating band X			V4.40
OB 11 |	Operating band XI			V4.51
OB12 | OB13 | OB14 |	Operating band XII to XIV			V5.00
OBS1 | OBS2	Op. band S, 190 MHz | 170 MHz Duplex			V5.10

Description of command	Sig. State
This command selects the operating band of the neighbor cell signal to be measured by the UE.	all

CONFigure:RXQuality:UEReport:NCELI:WCDMa:SCODe:PRIMary <*Number*>				Primary Scrambling Code
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
#H000 to #H1FF	Primary scrambling code	#H9	–	V3.60
Description of command				Sig. State
This command defines the primary scrambling code of the neighbor cell signal to be measured by the UE.				all

CONFigure:RXQuality:UEReport:NCELI:WCDMa:CPICh:PRIMary <*Level*>				P-CPICH Level
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–10 dBm to +50 dBm	Expected absolute P-CPICH level	–10.0	dBm	V3.60
Description of command				Sig. State
This command sets the absolute level of the Primary Common Pilot Channel of the neighbor cell signal as it is transmitted by the Node B. The UE calculates the *Pathloss* of the neighbor cell as the difference of the transmitted P-CPICH level defined here minus the received (measured) P-CPICH level.				all

The following remote control commands define the basic properties of a GSM neighbor cell that the UE shall detect:

CONFigure:RXQuality:UEReport:NCELI:GSM:NCC <*Code*>				NCC
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7	Color code of neighbor cell network	0	–	V3.60
Description of command				Sig. State
This command defines the Network Color Code (NCC) of the network providing the GSM neighbor cell.				all

CONFigure:RXQuality:UEReport:NCELI:GSM:BCC <*Code*>				BCC
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7	BTS Color Code	0	–	V3.60
Description of command				Sig. State
This command defines the BTS Color Code *(Base Transceiver Station Color Code, BCC)* of the base station providing the GSM neighbor cell.				all

CONFigure:RXQuality:UEReport:NCELI:GSM:ARFCn <*CCHChannel*>				BCCH – RF Channel
<CCHChannel>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 1023	Number of control channel	36	–	V3.60
Description of command				Sig. State
This command defines the control (BCCH) channel number for the GSM neighbor cell signal. The following channels are assigned in the different GSM bands: 259 to 293 | 306 to 340 GSM400 128 to 251 GSM850 0 to 124 | 955 to 1023 GSM900 512 to 885 GSM1800 512 to 810 GSM1900				all

CONFigure:RXQuality:UEReport:NCELI:GSM:BINDicator <*Band*>				Band Indicator
<Band>	Description of parameters	Def. value	Def. unit	FW vers.
G18 | G19	GSM 1800 GSM 1900	G18	–	V3.60
Description of command				Sig. State
This command defines the GSM band of the neighbor cell, if the band is either GSM1800 or GSM1900.				all

Connection Control (Signalling)

The remote-control commands presented in this section control the signalling procedures between the R&S CMU and the UE, configure the RF analyzer and the generated downlink signal, determine the inputs and outputs, the reference frequency and the trigger settings. They correspond to the settings in the *Connection Control* menu.

Connection Setup – Subsystem SIGNalling

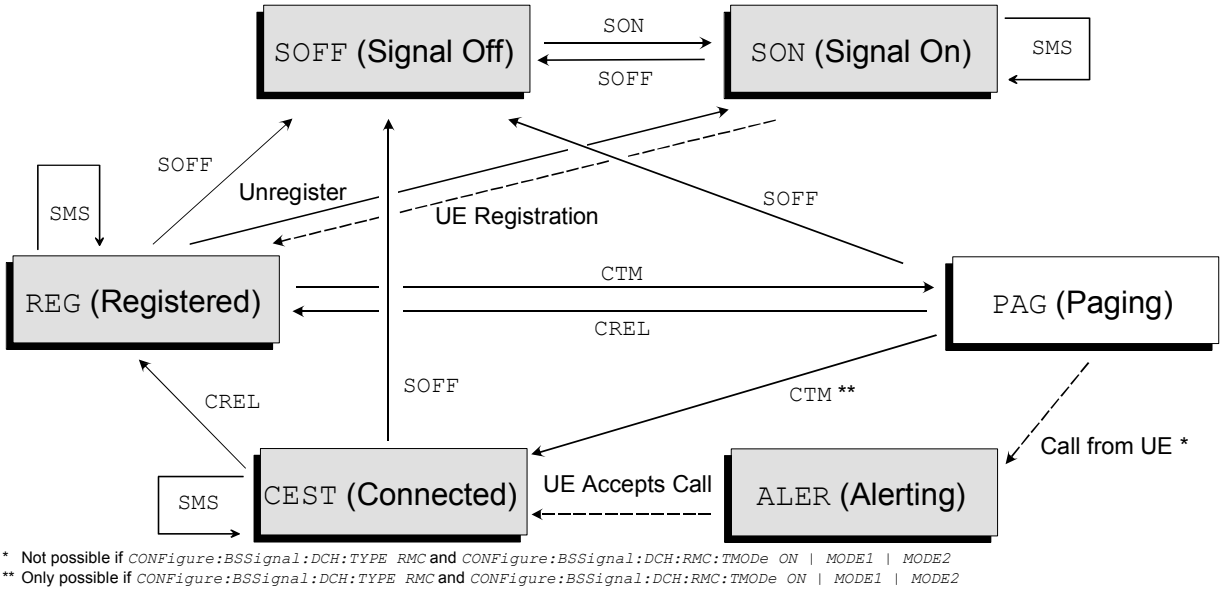
The subsystem *SIGNalling* controls the setup and release of a connection between the CMU and the UE and determines the signalling parameters. It corresponds to the different *Connection* tabs (for different signalling states, see command `PROCedure:SIGNalling:ACTion`) in the popup menu *Connection Control*.

PROCedure:SIGNalling:ACTion <*Action*>			Signalling Control	
<Action>	Description of parameters	Def. value	Def. unit	FW vers.
SOFF |	Switch off WCDMA signal for synchronization *(Signal Off)*	–	–	V3.15
SON |	Switch on WCDMA signal *(Signal On)*			
CTMobile |	Call To Mobile *(Connect UE)**			
UNRegister |	Unregister			
CRELease |	Call release *(Disconnect UE)*			
HANDover |	Handover to GSM target network defined via `CONFigure:HANDover:TARGet` (from CONNected state)			V3.50
SMS	Send short message			V4.30
Description of command				Sig. State
This command has no query form. It changes between the different signalling states of the CMU. The current state can be queried via `SIGN:STAT?` `*)` A `CTM` is only allowed in `REG` state and can lead to the `ALER` or to the `CEST` state, see Fig. 6-1 *below*.				See below

Important Note: ***Signalling States and Local to Remote Switchover***

The default signalling state of the CMU in remote control is `SOFF` (see Fig. 6-1 below). This state is automatically reached on switchover from manual to remote control; an existing connection to the MS under test is dropped.

To suspend this default behavior of the CMU, the base system command `SYSTem:GTRM:COMP` has been introduced. `SYSTem:GTRM:COMP OFF` prevents the instrument from changing the signalling state local to remote switchover. In particular, an existing connection is maintained. The default behavior of the CMU is restored each time the instrument is rebooted. For more information see the documentation of the base system commands in the CMU manual.



* Not possible if *CONFigure:BSSignal:DCH:TYPE RMC* and *CONFigure:BSSignal:DCH:RMC:TMODe ON | MODE1 | MODE2*
** Only possible if *CONFigure:BSSignal:DCH:TYPE RMC* and *CONFigure:BSSignal:DCH:RMC:TMODe ON | MODE1 | MODE2*

Fig. 6-1 Signalling states of the CMU and transitions

Further transitions between the signalling states (not shown in Fig. 6-1) may occur, e.g. in case of errors. For a state diagram of handover procedures refer to chapter 4.

[SENSe:]SIGNalling:STATe? Signalling State

Return	Description of parameters	Def. value	Def. unit	FW vers.
SOFF |	Signal for synchronization switched off *(Signal Off)*	SOFF	–	V3.15
SON |	Signal for synchronization switched on *(Signal On)*			
REG |	Synchronization of CMU and registration performed *(Registered)*			
PAG |	CMU is sending paging messages to attempt a connection			
ALER |	Mobile is ringing *(Alerting)*			
CEST |	Call to mobile set up *(Connected)*			
CPEN |	Call pending			
FPEN	Fallback pending			

Description of command	Sig. State
This command is always a query. It returns the current signalling state. The CPEN (Call Pending) and FPEN (Fallback Pending) state during a WCDMA to GSM handover procedure can be queried in the GSM destination network as well.	all

[SENSe:]SIGNalling:SMS? Short Message Service Text

Return	Description of parameters	Def. value	Def. unit	FW vers.
"<String>"	Short message received	""	–	V4.30

Description of command	Sig. State
This command is always a query. It reads the short message received.	all

CONFigure:SIGNalling:SMS <*Text*>				Short Message Service Text
<Text>	Description of parameters	Def. value	Def. unit	FW vers.
"<String>"	Short message to be sent	"R&S CMU 200 WCDMA UE FDD Short Message Service Text. The quick brown fox jumps over the lazy dog." (160 characters)	–	V4.30
Description of command				Sig. State
This command defines a short message in the form of any alphanumeric string with a maximum of 160 characters.				all

PROCedure:SIGNalling.PSWitched:ACTion <*Action*>				Signalling Control
<Action>	Description of parameters	Def. value	Def. unit	FW vers.
PCONnect | PRELease	Connect UE (PS) (sign. States `IDLE, ATT`) Disconnect UE (PS) (sign. State `PEST`)	–	–	V3.80
Description of command				Sig. State
This command has no query form. It initiates or releases the packet switched signalling state of the CMU. The current state can be queried via `SIGN:PSW:STAT?` `PCONNect` means that the R&S CMU connects to *HSDPA Test Mode* (see Fig. 6-2 below and query `CONFigure:BSSignal:PSWitched:DCH:TYPE?`).				See parameter desciption

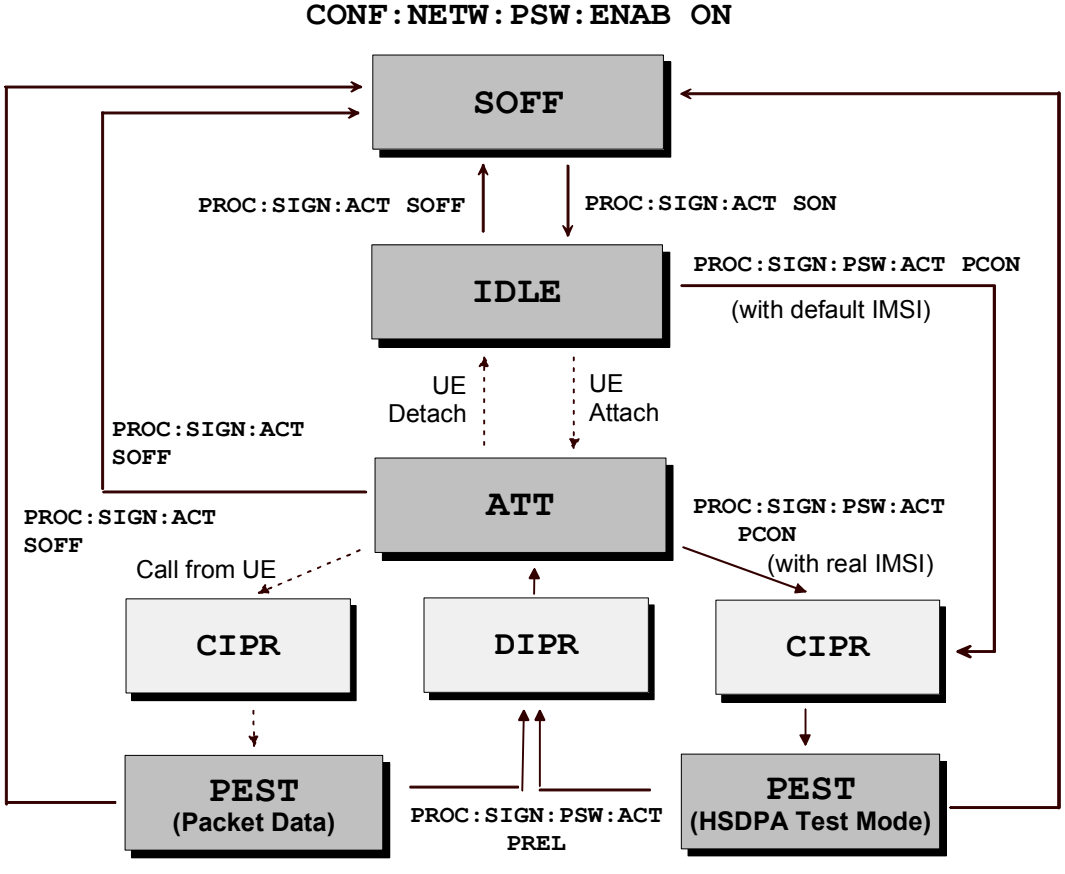


Fig. 6-2 Packet switched signalling states

[SENSe:]SIGNalling:PSWitched:STATe? Signalling State

Return	Description of parameters	Def. value	Def. unit	FW vers.
SOFF | **IDLE |** **ATT |** **CIPR |** **PEST |** **DIPR**	Signal for synchronization switched off *(Signal Off)* No PS attach performed yet PS attach successful R&S CMU attempts a connection (connection in progress) Packet switched connection established Disconnection in progress	SOFF	–	V3.80
Description of command				Sig. State
This command is always a query. It returns the current signalling state.				all

[SENSe:]SIGNalling:RIType? Registration Identity Type.

Return	Description of parameters	Def. value	Def. unit	FW vers.
UNKN | **IMSI | IMEI | IMSISV | TMSI**	Unknown RI type Known RI types	NAN	–	V3.15
Description of command				Sig. State
This command is always a query. It returns the Registration Identity Type of the UE.				REG CEST

[SENSe:]SIGNalling:RIDentity? Registration Identity

Return	Description of parameters	Def. value	Def. unit	FW vers.
<max. 18 digits>	Registration Identity	NAN	–	V3.15
Description of command				Sig. State
This command is always a query. It returns the Registration Identity of the UE.				REG CEST

[SENSe:]SIGNalling:IMEI? IMEI

Return	Description of parameters	Def. value	Def. unit	FW vers.
<max. 18 digits>	Intern. Mobile Equipment Id.	NAN	–	V3.15
Description of command				Sig. State
This command is always a query. It returns the IMEI of the UE. The value is available some time after the CMU enters the *Registered* state.				REG CEST

[SENSe:]SIGNalling:DNUMber? UE Called Number

Return	Description of parameters	Def. value	Def. unit	FW vers.
<max. 129 digits>	Dialed Number	NAN	–	V3.15
Description of command				Sig. State
This command is always a query. It returns the number dialed at the UE.				CEST

[SENSe:]SIGNalling:CNUMber? UE Calling Number

Return	Description of parameters	Def. value	Def. unit	FW vers.
<max. 129 digits>	UE Calling Number	NAN	–	V3.15
Description of command				Sig. State
This command is always a query. It returns the number dialed at the CMU to connect to the UE.				CEST

[SENSe:]SIGNalling:TTY? *CTM Text Telephony (TTY)*				
Return	Description of parameters	Def. value	Def. unit	FW vers.
NSUP | SUPP	Support of TTY	NAN	–	V4.55
Description of command				Sig. State
This command is always a query. It returns TTY support of the connected UE.				CEST

Subsystem OLP (Openloop Power)

The subsystem `OLP` controls the PRACH preamble power and signature measurement. It corresponds the the *Openloop Power* softkey in the *Connection* tab of the *Connection Control* menu.

INITiate:OLP	Start new measurement	⇒	*RUN*
ABORt:OLP	Abort running measurement and switch off	⇒	*OFF*
Description of command			FW vers.
These commands have no query form. They initiate or abort the current measurement, setting it to the status indicated in the top right column.			V3.40

FETCh:OLP:STATus? Measurement Status				
Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	V3.40
NONE	Statistic count, always set to off (only 1 frame)	NONE	–	
Description of command				
This command is always a query. It returns the status of the measurement (see chapter 5).				

CONFigure:OLP:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue <Limit> Limit				
<Limit	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to +15.0 dB	PRACH UE-on power limit	±9.0	dB	V3.40
Description of command				
This command defines a symmetric limit for the difference between the measured initial PRACH preamble power and the expected PRACH power, to be queried via `READ[:SCALar]:OLP?` or `FETCh[:SCALar]:OLP?`				

OLP Results

READ[:SCALar]:OLP? Start single shot measurement and return results
FETCh[:SCALar]:OLP? Read out meas. results (unsynchronized)

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100 dBm to +60 dBm, **0 to 15,** **–100 dBm to +60 dBm**	PRACH UE-On Power PRACH signature Expected PRACH power	NAN NAN NAN	dBm – dBm	V3.40

Description of command

This command is always a query. It returns the openloop power results.

CALCulate[:SCALar]:OLP:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
PRACH UE-On Power	NMAU | NMAL | INV | OK	INV	–	V3.40

Description of command

This command is always a query. It indicates whether and in which way the limit for the PRACH UE-on power (see command above) has been exceeded.

The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

Subsystem HANDover

The subsystem *HANDover* sets the target for handover of the WCDMA connection to a target GSM network. The corresponding softkeys are located in the *Handover* tab in the popup menu *Connect. Control*. The `AUXTx` commands in this section are also relevant for handover procedures.

STATus:HANDover:TARGet:LIST? Destination List

Response	Description of parameters	Def. value	Def. unit	FW vers.
"WCDMA1900UEFDD", **“GSM400MsInterCell",** **"GSM900MsInterCell",** **"GSM1800MsInterCell",** **…** **"GSM400MsDualBand",** **"GSM900MsDualBand",** **"GSM1800MsDualBand",** **"GSM1900MsDualBand",** **…**	Target list (4 entries at maximum): If current network is aGSM network If current netowork is a WCDMA network	–	–	V3.50

Description of command	Sig. State
This command is always a query and returns a list of all networks that are available for a handover. The list depends on the software configuration and on the current network. It can contain all installed and enabled networks except the current network.	REG CONN

CONFigure:HANDover:TARGet <*Target*>			Destination Selection	
<Target>	Description of parameters	Def. value	Def. unit	FW vers.
"GSM400MsDualBand" | **"GSM850MsDualBand" |** **"GSM900MsDualBand" |** **"GSM1800MsDualBand" |** **"GSM1900MsDualBand"**	Possible target networks	NONE	–	V3.50
NONE	No handover			
Description of command				Sig. State
This command selects a handover target. The available targets comprise all installed and enabled GSM networks. The handover itself is started via the `PROCedure:SIGNalling:ACTion HANDover` command.				REG CONN

PROCedure:SIGNalling:HANDover:TARGet:PREPare <*Enable*>			GSM Sig. On/Off	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	GSM Sig. On GSM Sig. Off	OFF	–	V3.50
Description of command				Sig. State
This command loads the GSM function group and activates the *Call Pending* state from where a handover to GSM can be initiated (`PROCedure:SIGNalling:ACTion HANDover`).				REG CONN

CONFigure:BSSignal:AUXTx <*Enable*>			WCDMA (Aux TX)	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Turn on WCDMA (Aux TX) signal Turn off WCDMA (Aux TX) signal	ON	–	V3.85
Description of command				Sig. State
This command switches the WCDMA (Aux TX) signal on or off while the R&S CMU prepares a GSM to WCDMA inter cell handover. Note that the WCDMA signal can be turned on for the duration of the CPEN state only. The query `CONFigure:BSSignal:AUXTx?` returns the state of the WCDMA signal after the R&S CMU enters the CPEN state, `[SENSe:]AUXTx:STATe?` returns the current state.				all

[SENSe:]AUXTx:STATe?			WCDMA (Aux TX)	
Return	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	WCDMA (Aux TX) signal on WCDMA (Aux TX) signal off	–	–	V3.85
Description of command				Sig. State
This command is always a query and returns the state of the WCDMA (Aux TX) signal. Note that the WCDMA signal is turned off unless the R&S CMU is in the CPEN state (GSM to WCDMA inter cell handover prepare session) and the Aux TX signal has been enabled (`CONFigure:BSSignal:AUXTx ON`).				all

Subsystem UECapability (Radio Access Capability)

The subsystem *UECapability* contains queries to read out the Radio Access Capability of the UE. The parameters are displayed in the *Signalling Info* table in the *Connection* popup menu *Connection Control*.

The parameters are transferred during registration and available (if requested; see command `CONFigure:NETWork:REQuest:ACAPability`).

[SENSe:]UECapability:PDCP? — Packet Data Convergence Protocol

Return	Description of parameters	Def. value	Def. unit	FW vers.
SUPP | NSUP,	Support of loss-less SRNS relocation	NAN	–	V3.15 /
SUPP | NSUP,	Support of RFC 2507	NAN	–	V4.30
SUPP | NSUP,	Support of RFC 3095	NAN	–	
SUPP | NSUP,	Support of RFC 3095 context relocation	NAN	–	
512 | 1024 | 2048 | 4096 | 8192| 16384 | 32768 | 65536 | 131072,	Header Compression	NAN	–	
2 | 4 | 8 | 12 | 16 | 24 | 32 | 48 | 64 | 128 | 256 | 512 | 1024 | 16384,	Max. ROHC context sess.	NAN	–	
Not Supported | 1 … 65535,	Reverse Decompression	NAN	–	
SUPP | NSUP	Lossless DL RLC PDU Size Change	NAN	–	V4.55

Description of command	Sig. State
This command is always a query. It returns the PCDP parameters of the UE.	REG CEST

[SENSe:]UECapability:RLC? — Radio Link Control

Return	Description of parameters	Def. value	Def. unit	FW vers.
2 | 10 | 50 | 100 | 150 | 200 | 300 | 400 | 500 | 750 | 1000,	AM Buffer Size	NAN	kByte	V3.15 / V4.30
2047 | 4095,	Max. RLC Window Size	NAN	–	
3 | 4 | 5 | 6 | 8 | 16 | 30	Max. AM Entities	NAN	–	

Description of command	Sig. State
This command is always a query. It returns Radio Link Control parameters of the UE.	REG CEST

[SENSe:]UECapability:PDOWnlink? — Physical Downlink

Return	Description of parameters	Def. value	Def. unit	FW vers.
4 | 8 | 16 | 32,	Simult. Tr. Channel .	NAN	–	V3.15 /
1 to 8,	Simult. CCTr. Channel	NAN		V4.30
4 | 8 | 16 | ... | 512,	TTI Transport Blocks	NAN		
16 | 32 | 48 | ... | 512 | 1024,	Number of TFC	NAN		
32 | 64 | 128 | 256 | 512 | 1024,	Number of TF	NAN		
NSUP | SUPP,	Turbo Decoding	NAN		
640 | 1280 | ... | 163840,	Received Bits All	NAN		
640 | 1280 | ... | 163840,	Received Bits Conv. Coded	NAN		
640 | 1280 | ... | 163840,	Received Bits Turbo coded	NAN		
	Phys Channel FDD			
1 to 8,	DPCH codes	NAN		
600 | 1200 | 2400 | 3600 | 4800 | 7200 | 9600 | 14400 | 19200 | 28800 | 38400 | 48000 | 57600 | 67200 | 76800,	Physical Channel Bits	NAN		
NSUP | SUPP,	SF512	NAN		

Description of command	Sig. State
This command is always a query. It returns the parameters of the physical downlink.	REG CEST

[SENSe:]UECapability:PUPLink? Physical Uplink

Return	Description of parameters	Def. value	Def. unit	FW vers.
4 | 8 | 16 | 32,	Simult. Tr. Channel.	NAN	–	V3.15 / V4.30
1 ... 8,	Simult. CCTr. Channel	NAN		
4 | 8 | 16 | 32 | 48 | 64 | 96 | 128 | 256 | 512,	TTI Transport Blocks	NAN		
16 | 32 | 48 | 64 | 96 | 128 | 256 | 512 | 1024,	Number of TFC	NAN		
32 | 64 | 128 | 256 | 512 | 1024,	Number of TF	NAN		
NSUP | SUPP,	Turbo Encoding	NAN		
640 | 1280 | 2560 | 3840 | 5120 | 6400 | 7680 | 8960 | 10240 | 20480 | 40960 | 81920 | 163840,	Transmitted Bits All	NAN		
640 | 1280 | 2560 | 3840 | 5120 | 6400 | 7680 | 8960 | 10240 | 20480 | 40960 | 81920 | 163840,	Transm Bits Conv. Coded	NAN		
640 | 1280 | 2560 | 3840 | 5120 | 6400 | 7680 | 8960 | 10240 | 20480 | 40960 | 81920 | 163840,	Transm. Bits Turbo Coded	NAN		
600 | 1200 | 2400 | 3600 | 4800 | 7200 | 9600 | 14400 | 19200 | 28800 | 38400 | 48000 | 57600	DPDCH Bits per 10ms	NAN		

Description of command	Sig. State
This command is always a query. It returns the parameters of the physical uplink.	REG CEST

[SENSe:]UECapability:RFParameters? RF Parameters

Return	Description of parameters	Def. value	Def. unit	FW vers.
NSUP | SUPP (x7),	Support of band I to VII	NAN	–	V3.15 / V4.30
1 | 2 | 3 | 4 (x7),	Power class in band I to VII	NAN	–	
134 | 174 | 190 (x7),	TX/RX frequency separation in band I to VII	NAN	MHz	
NSUP | SUPP (x7),	Support of band VIII to XIV	NAN	–	V4.55
1 | 2 | 3 | 4 (x7),	Power class in band VIII to XIV	NAN	–	
134 | 174 | 190 (x7)	TX/RX frequency separation in band VIII to XIV	NAN	MHz	

Description of command	Sig. State
This command is always a query. It returns the RF parameters of the UE. (x7) denotes seven independent values corresponding to the frequency bands I to VII and VIII to XIV, respectively.	REG CEST

[SENSe:]UECapability:MMODe? Multi Mode

Return	Description of parameters	Def. value	Def. unit	FW vers.
FDD |	Frequency Division Duplex	NAN	–	V3.15 / V4.30
TDD |	Time Division Duplex			
FTDD	FDD and TDD			

Description of command	Sig. State
This command is always a query. It returns the multi mode capability of the UE.	REG CEST

[SENSe:]UECapability:MRAT? Multi RAT

Return	Description of parameters	Def. value	Def. unit	FW vers.
NSUP | SUPP,	GSM support	NAN	–	V3.15 /
NSUP | SUPP,	Multi-carrier mode support	NAN		V4.30
NSUP | SUPP,	UTRAN to GERAN NACC	NAN		
	Security			
NSUP | SUPP,	Ciphering Algo UEA0	NAN		
NSUP | SUPP,	Ciphering Algo UEA1	NAN		
NSUP | SUPP,	Integrity Algo UIA1	NAN		
NSUP | SUPP,	Handover to GAN	NAN		V4.55
NSUP | SUPP	Inter-RAT PS Handover	NAN		

Description of command	Sig. State
This command is always a query. It returns information about the Radio Access Technology that the UE supports.	REG CEST

[SENSe:]UECapability:UEPosition? UE Position

Return	Description of parameters	Def. value	Def. unit	FW vers.
NSUP | SUPP,	<Standalone Loc. Method>	NAN	–	V3.15 /
NBASed | UEBased | BOTH | NONE,	<Network Assisted GPS>	NAN		V4.30
NSUP | SUPP,	<GPS Reference Time>	NAN		
NSUP | SUPP,	<IPDL>	NAN		
NSUP | SUPP,	<OTDOA UE Based Method>	NAN		
NSUP | SUPP,	<Rx/Tx Time Difference>	NAN		
NSUP | SUPP,	GPS in CELL_PCH and URA_PCH	NAN		
NSUP | SUPP	SFN-SFN Time Difference	NAN		

Description of command	Sig. State
This command is always a query. It returns parameters related to UE positioning.	REG CEST

[SENSe:]UECapability:MRELated? Measurement Related

Return	Description of parameters	Def. value	Def. unit	FW vers.
YY | NY | YN | NN (x196),	Need for DL/UL compressed mode	NAN	–	V3.15 /
R99 | R4 | R5	Release Indicator	NAN	–	V4.30
	HSDPA:			
NSUP | SUPP	Support of HS-PDSCH	NAN	–	
1 to 12,	Physical Layer Category	NAN	–	
32 | 64 | 128 | 284	DL capability with simult. HS-DSCH	NAN	kbps	

Description of command	Sig. State
This command is always a query. It returns parameters related to inter-frequency or inter-Radio Access Technology (RAT) measurements and to HSDPA support. X196 denotes that the command returns 196 independent pairs of values. The matrix in the *Connection Control* menu is read row by row, i.e. the first 14 value pairs indicate whether the UE needs DL/UL compressed mode in order to perform measurements on a target band I to XIV while it operates in band I.	REG CEST

[SENSe:]UECapability:GENeral?				General
Return	Description of parameters	Def. value	Def. unit	FW vers.
R99 | R4 | R5, **NO | YES**	Release Indicator UE benefits benefits from NW-based battery consumption optimization	NAN NAN	– –	V4.55
Description of command				Sig. State
This command is always a query. It returns general UE parameters.				REG CEST

[SENSe:]UECapability:HSDPa?				HSDPA
Return	Description of parameters	Def. value	Def. unit	FW vers.
NSUP | SUPP **1 to 12,** **32 | 64 | 128 | 284**	Support of HS-PDSCH Physical Layer Category DL capability with simult. HS-DSCH	NAN NAN NAN	– – kbps	V4.55
Description of command				Sig. State
This command is always a query. It returns HSDPA-related parameters.				REG CEST

[SENSe:]UECapability:HSUPa?				HSUPA
Return	Description of parameters	Def. value	Def. unit	FW vers.
NSUP | SUPP, **1 to 6**	Support of HSUPA E-DCH Physical Layer Category	NAN NAN	– –	V4.50
Description of command				Sig. State
This command is always a query. It returns HSUPA-related parameters.				REG CEST

Subsystem UESignal (UE Signal)

The subsystem *UESignal* defines the properties of the uplink WCDMA signal from the UE that the CMU is able to analyze. The subsystem corresponds to the *UE Signal* tab in the popup menu *Connection Control*.

CONFigure:UESignal:CHANnel <*Number*> — RF Channel Uplink

<*Number*>	Description of parameters	Def. value	Def. unit	FW vers.
1922.4 MHz to 1977.6 MHz (ch. no. 9612 to 9888) |	Input frequency for Op. Band I (in multiples of 200 kHz)	1922.4 (ch. no. 9612)	MHz	V4.30
1852.4 MHz to 1907.6 MHz (ch. no. 9262 to 9538) |	Input freq. for Op. Band II (in multiples of 200 kHz)	1852.4 (ch. no. 9262)	MHz	
1712.4 MHz to 1782.6 MHz (ch. no. 937 to 1288)	Input freq. for Op. Band III (in multiples of 200 kHz)	1712.4 (ch. no. 937)	MHz	
1712.4 MHz to 1752.6 MHz (ch. no. 1312 to 1513) |	Input freq. for Op. Band IV (in multiples of 200 kHz)	1712.4 (ch. no. 1312)	MHz	
826.4 MHz to 846.6 MHz (ch. no. 4132 to 4233) |	Input freq. for Op. Band V (in multiples of 200 kHz)	826.4 (ch. no. 4132)	MHz	
832.4 MHz to 837.6 MHz (ch. no. 4162 to 4188) |	Input freq. for Op. Band VI (in multiples of 200 kHz)	832.4 (ch. no. 4162)	MHz	
2502.4 MHz to 2567.6 MHz (ch. no. 2012 to 2388) |	Input freq. for Op. Band VII (in multiples of 200 kHz)	2502.4 (ch. no. 2012)	MHz	
882.4 MHz to 912.6 MHz (ch. no. 2712 to 2863) |	Input freq. for Op. Band VIII (in multiples of 200 kHz)	882.4 (ch. no. 2712)	MHz	
1752.4 MHz to 1782.4 MHz (ch. no. 8762 to 8912) |	Input freq. for Op. Band IX (in multiples of 200 kHz)	1752.6 (ch. no. 8762)	MHz	
1712.4 to 1767.6 (ch. no. 2887 to 3163) |	Input freq. for Op. Band X (in multiples of 200 kHz)	1712.4 (ch. no. 2887)	MHz	V4.34
2002.4 to 2017.6 (ch. no. 10012 to 10088) |	Input freq. for Op. Band S (in multiples of 200 kHz)	2002.4 (ch. no. 10012)	MHz	V4.50
1430.4 to 1450.4 (ch. no. 3487 to 3587) |	Input freq. for Op. Band XI (in multiples of 200 kHz)	1430.4 (ch. no. 3487)	MHz	V4.51
700.4 to 713.6 (Ch. no. 3612 to 3678) |	Input freq. for Op. Band XII (in multiples of 200 kHz)	700.4 (ch. no. 3612)	MHz	V5.01
779.4 to 784.6 (Ch. no. 3792 to 3818) |	Input freq. for Op. Band XIII (in multiples of 200 kHz)	779.4 (ch. no. 3792)	MHz	
790.4 to 795.6 (Ch. no. 3892 to 3918)	Input freq. for Op. Band XIV (in multiples of 200 kHz)	790.4 (ch. no. 3892)	MHz	
2002.4 to 2007.6 (Ch. no. 10012 to 10038)	Input freq. for OB S 190 MHz D. (in multiples of 200 kHz)	2002.4 (ch. no. 10012)	MHz	V5.10
2012.4 to 2017.6 (Ch. no. 10062 to 10088)	Input freq. for OB S 170 MHz D. (in multiples of 200 kHz)	2012.4 (ch. no. 10062)	MHz	

Description of command — Sig. State

This command defines the center frequency of the RF analyzer. With the command `CONFigure:UESignal:CHANnel:UNIT`, the default frequency unit can be changed, and UARFCN (UTRA Absolute Radio Frequency Channel Numbers) can be entered instead of frequencies. In the latter case, the assignment of channel numbers and frequencies follows 3GPP specifications (see Chapter 4). — all

Note: *Operating bands II, IV, V, VI, VII, X to XIV, S, and S 190 MHz Duplex contain additional channels that are off the 200 kHz raster (see tables in Chapter 4). These channels can also be selected with their channel numbers or frequencies.*

CONFigure:UESignal:COMBined:OCHannel <*Band*>, <*Number*>			Band and RF Channel Uplink	
<Band>	Description of parameters	Def. value	Def. unit	
OB1 to OB14 | OBS | OBS1 | OBS2	Operating band 1 to XIV, S OB S 190 MHz | 170 MHz Duplex	OB1	–	
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
1922.4 MHz to 1977.6 MHz (ch. no. 9612 to 9888) |	Input frequency for Op. Band I (in multiples of 200 kHz)	1922.4 (ch. no. 9612)	MHz	V4.30
1852.4 MHz to 1907.6 MHz (ch. no. 9262 to 9538) |	Input freq. for Op. Band II (in multiples of 200 kHz)	1852.4 (ch. no. 9262)	MHz	
1712.4 MHz to 1782.6 MHz (ch. no. 937 to 1288)	Input freq. for Op. Band III (in multiples of 200 kHz)	1712.4 (ch. no. 937)	MHz	
1712.4 MHz to 1752.6 MHz (ch. no. 1312 to 1513) |	Input freq. for Op. Band IV (in multiples of 200 kHz)	1712.4 (ch. no. 1312)	MHz	
826.4 MHz to 846.6 MHz (ch. no. 4132 to 4233) |	Input freq. for Op. Band V (in multiples of 200 kHz)	826.4 (ch. no. 4132)	MHz	
832.4 MHz to 837.6 MHz (ch. no. 4162 to 4188) |	Input freq. for Op. Band VI (in multiples of 200 kHz)	832.4 (ch. no. 4162)	MHz	
2502.4 MHz to 2567.6 MHz (ch. no. 2012 to 2388) |	Input freq. for Op. Band VII (in multiples of 200 kHz)	2502.4 (ch. no. 2012)	MHz	
882.4 MHz to 912.6 MHz (ch. no. 2712 to 2863) |	Input freq. for Op. Band VIII (in multiples of 200 kHz)	882.4 (ch. no. 2712)	MHz	
1752.4 MHz to 1782.4 MHz (ch. no. 8762 to 8912) |	Input freq. for Op. Band IX (in multiples of 200 kHz)	1752.6 (ch. no. 8762)	MHz	
1712.4 to 1767.6 (ch. no. 2887 to 3163) |	Input freq. for Op. Band X (in multiples of 200 kHz)	1712.4 (ch. no. 2887)	MHz	V4.34
2002.4 to 2017.6 (ch. no. 10012 to 10088) |	Input freq. for Op. Band S (in multiples of 200 kHz)	2002.4 (ch. no. 10012)	MHz	V4.50
1430.4 to 1450.4 (ch. no. 3487 to 3587) |	Input freq. for Op. Band XI (in multiples of 200 kHz)	1430.4 (ch. no. 3487)	MHz	V4.51
700.4 to 713.6 (Ch. no. 3612 to 3678) |	Input freq. for Op. Band XII (in multiples of 200 kHz)	700.4 (ch. no. 3612)	MHz	V5.01
779.4 to 784.6 (Ch. no. 3792 to 3818) |	Input freq. for Op. Band XIII (in multiples of 200 kHz)	779.4 (ch. no. 3792)	MHz	
790.4 to 795.6 (Ch. no. 3892 to 3918)	Input freq. for Op. Band XIV (in multiples of 200 kHz)	790.4 (ch. no. 3892)	MHz	
2002.4 to 2007.6 (Ch. no. 10012 to 10038)	Input freq. for OB S 190 MHz D. (in multiples of 200 kHz)	2002.4 (ch. no. 10012)	MHz	V5.10
2012.4 to 2017.6 (Ch. no. 10062 to 10088)	Input freq. for OB S 170 MHz D. (in multiples of 200 kHz)	2012.4 (ch. no. 10062)	MHz	
Description of command				Sig. State
This command changes the operating band and the center frequency of the RF analyzer. This is faster than the separate commands `CONFigure:NETWork:OBANd; CONFigure:UESignal:CHANnel`.				all
Note: *Operating bands II, IV, V, VI, VII, X to XIV, S, and S 190 MHz Duplex contain additional channels that are off the 200 kHz raster (see tables in Chapter 4). These channels can also be selected with their channel numbers or frequencies.*				

UNIT:UESignal:CHANnel <*Unit*> — Frequency Unit

<*Unit*>	Description of parameters	Def. value	Def. unit	FW vers.
HZ | KHZ | MHZ | GHZ | CH	Frequency unit Channel number (UARFCN)	MHz	–	V3.15

Description of command — Sig. State

This command defines whether the frequency of the RF signal analyzed is specified in frequency units or as an UARFCN. — all

Note: *Operating bands II, IV, V, VI, VII, X to XIV, S, and S 190 MHz Duplex contain additional channels that are off the 200 kHz raster. These channels must be selected with* `UNIT:UES:CHAN CH` *and their channel numbers.*

CONFigure:UESignal:FOFFset <*FrequencyOffset*> — Frequency Offset

<*FrequencyOffset*>>	Description of parameters	Def. value	Def. unit	FW vers.
–100.000 kHz to +100.000 kHz	Frequency offset	0	kHz	V3.15

Description of command — Sig. State

This command defines an offset for the RF analyzer frequency set with the command `CONFigure:UESignal:CHANnel`. The offset frequency must be in multiples of 1 Hz. — all

CONFigure:UESignal:GPERiod <*Enable*> — Release 5 Guard Period

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Guard period enabled or disabled	OFF	–	V3.60

Description of command — Sig. State

This command enables or disables the guard period for UE signal evaluation according to release 5 of the 3 GPP FDD standard. — all

DEFault:UESignal:CSETtings <*Enable*> — Default Settings

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.15

Description of command — Sig. State

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*. — all

CONFigure:UESignal:SCODe:SECondary <*Code*> — Scrambling Code

<*Code*>	Description of parameters	Def. value	Def. unit	FW vers.
#H0 to #HFFFFFF	Scrambling long code number	#H0	–	V3.15

Description of command — Sig. State

This command defines the number of the long code that is used to scramble the uplink WCDMA signal. The input of a scrambling code may be in decimal or in hexadecimal format, the latter preceded by #H (as specified in IEEE 488.2). The output is always in hexadecimal format, preceded by #H. — all

CONFigure:UESignal:AMODe <*Mode*>			Analysis Mode	
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
WOOFfset | WIOFfset	Measurement without origin offset Measurement with origin offset	WIOF	–	V3.15
Description of command				Sig. State
This command defines whether a possible origin offset is included in the measurement results (WIOFfset) or subtracted out (WOOFfset).				SOFF SON REG

CONFigure:UESignal:DPCH:SYMode <*Mode*>			Sync. Mode	
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ASL | SYNC	All Slots sync. mode Synchronous mode	ASL	–	V3.15
Description of command				Sig. State
This command defines whether the slot number is to be deduced from the pilot bits in the captured signal *(ASL)* or assumed to be defined by the `CONFigure:UESignale:DPCH: SNUMber` command *(SYNC)*.				all

CONFigure:UESignal:DPCH:SNUMber <*Slot_No*>			Measurement Slot Number	
<Slot_No>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 14	Measurement slot no. within the frame	0	–	V3.15
Description of command				Sig. State
This command defines the measured slot number of the captured signal within the 10 ms frame. The value is taken into account in the `CONFigure:UESignal:DPCH:SYMode SYNC` setting.				all

CONFigure:UESignal:DPCH:CMODe <*Mode*>			Correlation Mode	
<Slot_No>	Description of parameters	Def. value	Def. unit	FW vers.
0 | 1	DPCCH DPCCH + DPDCH	0	–	V3.15
Description of command				Sig. State
This command defines which DPCH contributions are used for the correlation analysis.				all

CONFigure:UESignal:DPDCh:AUTO:THReshold <*THReshold*>			Threshold	
<Rate>	Description of parameters	Def. value	Def. unit	FW vers.
–25 dB to +10 dB	Power threshold for each $DPDCH_n$	–10	dB	V3.15
Description of command				Sig. State
This command defines the minimum signal strength of each DPDCH in the WCDMA signal to be detected in the automatic channelization code search. The setting is taken into account if one of the `CDPower:AUTomatic` applications is active or if the synchronization mode in the `MODulation:WCDMA...` application (command `CONF:MOD:WCDM:DPCH:CONT:CCM`) is set to `AUTomatic`.				all

DEFault:UESignal <*Enable*> Default Settings				
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.15
Description of command				Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				SOFF SON REG

Subsystem UESignal:PCONtrol (Power Control)

The subsystem *UESignal:PCONtrol* sets the parameters to control the transmitter output power of the UE and define its initial power at random access. The subsystem corresponds to the *UE Power Control* section in the *UE Signal* tab in the popup menu *Connection Control*.

DEFault:UESignal:PCONtrol <*Enable*> Default Settings				
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.15
Description of command				Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				SOFF SON REG

CONFigure:UESignal:PCONtrol:UEPower <*Power*> Max. Allowed UE Power				
<Power>	Description of parameters	Def. value	Def. unit	FW vers.
– 50 dBm to +33 dBm	Max. allowed UE power	+33.0	dBm	V3.15
Description of command				Sig. State
This command defines the maximum allowed output power of the UE transmitter.				all

CONFigure:UESignal:PCONtrol:TPOWer:VALue <*Power*> UL Target Power				
<Power>	Description of parameters	Def. value	Def. unit	FW vers.
– 50 dBm to +33 dBm	UE target power	–20	dBm	V3.40
Description of command				Sig. State
This command defines the maximum allowed output power of the UE transmitter. The setting is relevant if the TPC pattern type is set to *Closed Loop* (`CONFigure:BSSignal:TPC:PTYPe<nr> CLOP`).				all

CONFigure:UESignal:PCONtrol:TPOWer:REFerence <*Type*>			UL Target Power Reference	
<Power>	Description of parameters	Def. value	Def. unit	FW vers.
TPOWer | DPCCh	Total power DPCCH power	TPOWer	–	V3.40
Description of command				Sig. State
This command selects the UL signal contribution that is used as the *UL Target Power* (command `CONFigure:UESignal:PCONtrol:TPOWer:VALue`).				all

CONFigure:UESignal:PCONtrol:OLPC:INTerference <*Level*>			UL Interference	
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–110 dBm to –70 dBm	UL interference level	–80	dBm	V3.15
Description of command				Sig. State
This command defines the estimated UL interference level in dBm, contained in System Information Block type 7.				SOFF SON REG

CONFigure:UESignal:PCONtrol:OLPC:CVALue <*Level*>			Constant Value	
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to –10 dB	Constant offset value	–29	dB	V3.15
Description of command				Sig. State
This command defines a constant offset for the initial preamble power.				SOFF SON REG

CONFigure:UESignal:PCONtrol:OLPC:PCPich:RPOWer <*Level*>			Reported P-CPICH Power	
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–10 dBm to +50 dBm	Reported P-CPICH power	+31	dBm	V3.15
Description of command				Sig. State
This command defines the P-CPICH power reported to the UE.				SOFF SON REG

CONFigure:UESignal:PCONtrol:OLPC:DPCCh:POFFset <*Level*>			DPCCH Power Offset	
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–164.0 dB to –6.0 dB	DPCCH power offset	–80.0	dB	V3.15
Description of command				Sig. State
This command defines the DPCCH power offset. The allowed step width is 2 dB.				SOFF SON REG

Subsystem UESignal:GFACtor (Gain Factors)

The following commands configure the gain factors for the UE signal. They correspond to the *UE Gain Factors* section in the *UE Signal* tab of the *Connection Control* menu.

CONFigure:UESignal:GFACtor:RMC:UPLMode<nr> <*Beta_c*>, <*Beta_d*>				Gain Factors
<Beta_c>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 15	DPCCH gain factor	8 (<nr> = 1) 5 (<nr> = 2) 4 (<nr> = 3) 4 (<nr> = 4)	–	V3.80
<Beta_d>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 15	DPDCH gain factor	15 (all RMC data rates)	–	V3.80
Description of command				Sig. State
This command defines the gain factors for the uplink RMCs. The numeric suffix discriminates between the data rates of 12.2 kbps (<nr> = 1), 64 kbps (<nr> = 2), 144 kbps (<nr> = 3), and 384 kbps (<nr> = 4). An error is generated unless one of the gain factors is equal to 15.				all

CONFigure:UESignal:GFACtor:VOICe <*Beta_c*>, <*Beta_d*> **CONFigure:UESignal:GFACtor:VIDeo <*Beta_c*>, <*Beta_d*>**				Gain Factors
<Beta_c>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 15	DPCCH gain factor	11 (voice) / 9 (video)	–	V3.80
<Beta_d>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 15	DPDCH gain factor	15 (all call types)	–	V3.80
Description of command				Sig. State
This command defines the gain factors for the voice, video, and packet data connections. An error is generated unless one of the gain factors is equal to 15.				all

CONFigure:UESignal:GFACtor:PDATa:UPLMode<nr> <*Beta_c*>, <*Beta_d*>				Gain Factors
<Beta_c>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 15	DPCCH gain factor	9 (<nr> = 1, 5)	–	V4.30*)
<Beta_d>	Description of parameters	Def. value	Def. unit	
1 to 15	DPDCH gain factor	15 (<nr> = 1, 5)	–	
Description of command				Sig. State
This command defines the gain factors for packet data connections. The numeric suffix discriminates between the data rates of 64 kbps (<nr> = 1), 384 kbps (<nr> = 2), 16 kbps (<nr> = 3), 32 kbps (<nr> = 4), and 128 kbps (<nr> = 5). An error is generated unless one of the gain factors is equal to 15. *) The data rates corresponding to the numeric suffixes 3 to 5 are available with firmware versions V4.51 and higher.				all

CONFigure:UESignal:GFACtor:HSTMode Power Offset Parameters
<Beta_c>, <Beta_d>, <Delta_ACK>, <Delta_NACK>, <Delta_CQI>

<Beta_c>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 15	DPCCH gain factor	9	–	V3.80
<Beta_d>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 15	DPDCH gain factor	15	–	V3.80
<Delta_ACK>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 8	Power offset parameter Δ_{ACK}	5	–	V3.80
<Delta_NACK>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 8	Power offset parameter Δ_{NACK}	5	–	V3.80
<Delta_CQI>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 8	Power offset parameter Δ_{CQI}	2	–	V3.80

Description of command	Sig. State
This command defines the gain factors for HSDPA connections. An error is generated unless either <Beta_c> or <Beta_d> is equal to 15.	all

DEFault:UESignal:GFACtor *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.80

Description of command	Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the sub-system to default values. The setting *OFF* results in an error message. If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.	all

Subsystem BSSignal (WCDMA Signal)

The subsystem *BSSignal* configures the DL RF signal that the CMU generates to emulate a UTRAN cell. It corresponds to the *BS Signal* tab of the popup menu *Connection Control*.

CONFigure:BSSignal:CHANnel <*Number*> RF Channel Downlink

<*Number*>	Description of parameters	Def. value	Def. unit	FW vers.
2112.4 MHz to 2167.6 MHz (ch. no. 10562 to 10838)	Input frequency for Op. Band I (in multiples of 200 kHz)	2112.4 (ch. no. 10562)	MHz	V4.30
1932.4 MHz to 1987.6 MHz (ch. no. 9662 to 9938)	Input freq. for Op. Band II (in multiples of 200 kHz)	1932.4 (ch. no. 9662)	MHz	
1807.4 MHz to 1877.6 MHz (ch. no. 1162 to 1513)	Input freq. for Op. Band III (in multiples of 200 kHz)	1807.4 (ch. no. 1162)	MHz	
2112.4 MHz to 2152.6 MHz (ch. no. 1537 to 1783)	Input freq. for Op. Band IV (in multiples of 200 kHz)	2112.4 (ch. no. 1537)	MHz	
871.4 MHz to 891.6 MHz (ch. no. 4357 to 4458)	Input freq. for Op. Band V (in multiples of 200 kHz)	871.4 (ch. no. 4357)	MHz	
877.4 MHz to 882.6 MHz (ch. no. 4387 to 4413)	Input freq. for Op. Band VI (in multiples of 200 kHz)	877.4 (ch. no. 4387)	MHz	
2622.4 MHz to 2687.6 MHz (ch. no. 2237 to 2563)	Input freq. for Op. Band VII (in multiples of 200 kHz)	2622.4 (ch. no. 2237)	MHz	
927.4 MHz to 957.6 MHz (ch. no. 2937 to 3088)	Input freq. for Op. Band VIII (in multiples of 200 kHz)	927.4 (ch. no. 2937)	MHz	
1847.4 MHz to 1877.4 MHz (ch. no. 9237 to 9387)	Input freq. for Op. Band IX (in multiples of 200 kHz)	1847.4 (ch. no. 9237)	MHz	
2112.4 MHz to 2167.6 MHz (ch. no. 3112 to 3388)	Input freq. for Op. Band X (in multiples of 200 kHz)	2112.4 (ch. no. 3112)	MHz	V4.34
2182.4 MHz to 2197.6 MHz (ch. no. 10912 to 10988)	Input freq. for Op. Band S (in multiples of 200 kHz)	2182.4 (ch. no. 10912)	MHz	V4.50
1478.4 MHz to 1498.4 MHz (ch. no. 3712 to 3812)	Input freq. for Op. Band XI (in multiples of 200 kHz)	1478.4 (ch. no. 3712)	MHz	V4.51
730.4 MHz to 743.6 MHz (ch. no. 3837 to 3903)	Input freq. for Op. Band XII (in multiples of 200 kHz)	730.4 (ch. no. 3837)	MHz	V5.00
748.4 MHz to 753.6 MHz (ch. no. 4017 to 4043)	Input freq. for Op. Band XIII (in multiples of 200 kHz)	748.4 (ch. no. 4017)	MHz	
760.4 MHz to 765.6 MHz (ch. no. 4117 to 4143)	Input freq. for Op. Band XIV (in multiples of 200 kHz)	760.4 (ch. no. 4117)	MHz	
2192.4 MHz to 2197.6 MHz (ch. no. 10962 to 11038)	OB S 190 MHz Duplex (in multiples of 200 kHz)	2192.4 (ch. no. 10962)	MHz	V5.10
2182.4 MHz to 2187.6 MHz (ch. no. 10912 to 10938)	OB S 170 MHz Duplex (in multiples of 200 kHz)	2182.4 (ch. no. 10912)	MHz	

Description of command	Sig. State
This command defines the carrier frequency of the generated RF signal. With the command `[SENSe:]BSSignal:CHANnel:UNIT`, the default frequency unit can be changed, and UARFCN (UTRA Absolute Radio Frequency Channel Numbers) can be entered instead of frequencies. In the latter case, the assignment of channel numbers and frequencies follows 3GPP specifications. ***Note:*** *Operating bands II, IV, V, VI, VII, X to XIV, S, and S 190 MHz Duplex contain additional channels that are off the 200 kHz raster (see tables in Chapter 4). These channels can also be selected with their channel numbers or frequencies.*	all

CONFigure:BSSignal:COMBined:OCHannel <*Band*>, <*Number*>			Band and RF Channel Downlink	
<Band>	Description of parameters	Def. value	Def. unit	
OB1 to OB14 | OBS | OBS1 | OBS2	Operating band 1 to XIV, S OB S 190 MHz | 170 MHz Duplex	OB1	–	
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
2112.4 MHz to 2167.6 MHz (ch. no. 10562 to 10838)	Input frequency for Op. Band I (in multiples of 200 kHz)	2112.4 (ch. no. 10562)	MHz	V4.30
1932.4 MHz to 1987.6 MHz (ch. no. 9662 to 9938)	Input freq. for Op. Band II (in multiples of 200 kHz)	1932.4 (ch. no. 9662)	MHz	
1807.4 MHz to 1877.6 MHz (ch. no. 1162 to 1513)	Input freq. for Op. Band III (in multiples of 200 kHz)	1807.4 (ch. no. 1162)	MHz	
2112.4 MHz to 2152.6 MHz (ch. no. 1537 to 1783)	Input freq. for Op. Band IV (in multiples of 200 kHz)	2112.4 (ch. no. 1537)	MHz	
871.4 MHz to 891.6 MHz (ch. no. 4357 to 4458)	Input freq. for Op. Band V (in multiples of 200 kHz)	871.4 (ch. no. 4357)	MHz	
877.4 MHz to 882.6 MHz (ch. no. 4387 to 4413)	Input freq. for Op. Band VI (in multiples of 200 kHz)	877.4 (ch. no. 4387)	MHz	
2622.4 MHz to 2687.6 MHz (ch. no. 2237 to 2563)	Input freq. for Op. Band VII (in multiples of 200 kHz)	2622.4 (ch. no. 2237)	MHz	
927.4 MHz to 957.6 MHz (ch. no. 2937 to 3088)	Input freq. for Op. Band VIII (in multiples of 200 kHz)	927.4 (ch. no. 2937)	MHz	
1847.4 MHz to 1877.4 MHz (ch. no. 9237 to 9387)	Input freq. for Op. Band IX (in multiples of 200 kHz)	1847.4 (ch. no. 9237)	MHz	
2112.4 MHz to 2167.6 MHz (ch. no. 3112 to 3388)	Input freq. for Op. Band X (in multiples of 200 kHz)	2112.4 (ch. no. 3112)	MHz	V4.34
2182.4 MHz to 2197.6 MHz (ch. no. 10912 to 10988)	Input freq. for Op. Band S (in multiples of 200 kHz)	2182.4 (ch. no. 10912)	MHz	V4.50
1478.4 MHz to 1498.4 MHz (ch. no. 3712 to 3812)	Input freq. for Op. Band XI (in multiples of 200 kHz)	1478.4 (ch. no. 3712)	MHz	V4.51
730.4 MHz to 743.6 MHz (ch. no. 3837 to 3903)	Input freq. for Op. Band XII (in multiples of 200 kHz)	730.4 (ch. no. 3837)	MHz	V5.00
748.4 MHz to 753.6 MHz (ch. no. 4017 to 4043)	Input freq. for Op. Band XIII (in multiples of 200 kHz)	748.4 (ch. no. 4017)	MHz	
760.4 MHz to 765.6 MHz (ch. no. 4117 to 4143)	Input freq. for Op. Band XIV (in multiples of 200 kHz)	760.4 (ch. no. 4117)	MHz	
2192.4 MHz to 2197.6 MHz (ch. no. 10962 to 11038)	OB S 190 MHz Duplex (in multiples of 200 kHz)	2192.4 (ch. no. 10962)	MHz	V5.10
2182.4 MHz to 2187.6 MHz (ch. no. 10912 to 10938)	OB S 170 MHz Duplex (in multiples of 200 kHz)	2182.4 (ch. no. 10912)	MHz	

Description of command	Sig. State
This command changes the operating band and the carrier frequency of the generated RF signal. This is faster than the separate commands `CONFigure:NETWork:OBANd; CONFigure:BSSignal:CHANnel`. ***Note:*** *Operating bands II, IV, V, VI, VII, X to XIV, S, and S 190 MHz Duplex contain additional channels that are off the 200 kHz raster (see tables in Chapter 4). These channels can also be selected with their channel numbers or frequencies.*	all

UNIT:BSSignal:CHANnel <*Unit*> — Frequency Unit

<Unit>	Description of parameters	Def. value	Def. unit	FW vers.
HZ | KHZ | MHZ | GHZ | CH	Frequency unit Channel number (UARFCN)	MHz	–	V3.15

Description of command — Sig. State

This command defines whether the frequency of the BS signal is specified in frequency units or as an UARFCN. — all

Note: *Operating bands II, IV, V, VI, VII, X to XIV, S, and S 190 MHz Duplex contain additional channels that are off the 200 kHz raster. These channels must be selected with* `UNIT:BSS:CHAN CH` *and their channel numbers.*

CONFigure:BSSignal:FOFFset <*FrequencyOffset*> — Frequency Offset

<FrequencyOffset>>	Description of parameters	Def. value	Def. unit	FW vers.
–100.000 kHz to +100.000 kHz	Frequency offset	0	kHz	V3.15

Description of command — Sig. State

This command defines an offset for the RF generator frequency set with the command `CONFigure:BSSignal:CHANnel`. The offset frequency must be in multiples of 1 Hz. — all

CONFigure:BSSignal:SCODe:PRIMary <*Code*> — Primary Scrambling Code

<Code>>	Description of parameters	Def. value	Def. unit	FW vers.
#H000 to #H1FF	Primary scrambling code	#H9	–	V3.15

Description of command — Sig. State

This command defines the primary scrambling code for the downlink RF generator signal. The range of scrambling code numbers corresponds to 0 to 8192 decimal. The input of a scrambing code may be in decimal or in hexadecimal format, the latter preceded by #H (as specified in IEEE 488.2). The output is always in hexadecimal format, preceded by #H. — SOFF SON REG

CONFigure:BSSignal:LREFerence <*Reference*> — Level Reference

<Reference>	Description of parameters	Def. value	Def. unit	FW vers.
PCPich | OPOWer	Relative to P-CPICH level Relative to Output Channel Power	PCPich	–	V3.15

Description of command — Sig. State

This command qualifies whether all channel power are expressed relative to the (absolute) P-CPICH level (`CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary`) or to the total Output Channel Power (`CONFigure:BSSignal:OPOWer`). — all

CONFigure:BSSignal:OPOWer <*Level*> — Output Channel Power

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–147.0 dBm to –37.0 dBm	Output ch. power if RF 1 is used	–51.6	dBm	V3.15
–147.0 dBm to –15.0 dBm	Output ch. power if RF 2 is used	–51.6	dBm	
–100.0 dBm to +3.0 dBm	O. ch. power if RF 3 OUT is used	–51.6	dBm	

Description of command — Sig. State

This command sets the absolute output channel power of the BS signal. This level is the reference for all other physical and synchronization channel levels and can not be switched off. If option R&S CMU-U99 *(RF 1 with RF 2 Level Range)* is fitted, RF 1 takes on the level range of RF2. The output level range at the default connector RF2 is sufficient for the *Maximum Input Level* test according to standard 3GPP TS 34.121, section 6.3. — all

CONFigure:BSSignal:OCNS <*Level*>				OCNS
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | OFF	Relative OCNS level OCNS switched off	OFF	dB	V3.15
Description of command				Sig. State
This command sets the level of the Orthogonal Channel Noise Simulator relative to the P-CPICH level (see command *CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary*). The setting is ignored if the channel powers are expressed relative to the total output channel power (`CONFigure:BSSignal:LREFerence OPOWer`).				all

CONFigure:BSSignal:PHYSical:LEVel ***<P-CPICH_abs> | <P-CPICH_rel>, <P-SCH>, <S-SCH>, <P-CCPCH>, <S-CCPCH>, <PICH>, <AICH> <DPDCH>, <Power Offset>***		All Physical Channel Levels		
<P-CPICH_abs>	Description of parameters	Def. value	Def. unit	FW vers.
–147.0 dBm to –37.0 dBm* **–147.0 dBm to –15.0 dBm*** **–100.0 dBm to +3.0 dBm***	Absolute P-CPICH level if RF 1 is used Absolute P-CPICH level if RF 2 is used Abs. P-CPICH level if RF 3 OUT is used	–55.0 –55.0 –55.0	dBm dBm dBm	V3.50
<P-CPICH_rel>	Description of parameters	Def. value	Def. unit	FW vers.
–30 dB to 0 dB	Relative P-CPICH level	–	dB	V3.50
<P-SCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	P-SCH level (level reference = P-CPICH) P-SCH level (level reference = total channel power)	–5.0 –	dB dB	V3.50
<S-SCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	S-SCH level (level reference = P-CPICH) S-SCH level (level reference = total channel power)	–5.0 –	dB dB	V3.50
<P-CCPCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	P-CCPCH level (level ref. = P-CPICH) P-CCPCH level (level reference = total channel power)	–2.0 –	dB dB	V3.50
<S-CCPCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	S-CCPCH level (level ref. = P-CPICH) S-CCPCH level (level reference = total channel power)	–2.0 –	dB dB	V3.50
<PICH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	PICH level (level ref. = P-CPICH) PICH level (level reference = total channel power)	–5.0 –	dB dB	V3.50
<AICH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	AICH level (level ref. = P-CPICH) AICH level (level reference = total channel power)	–5.0 –	dB dB	V3.50

<DPDCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | –30 dB to 0 dB	DPDCH level (level ref. = P-CPICH) DPDCH level (level reference = total channel power)	–7.0 –	dB dB	V3.50
<Power Offset>	**Description of parameters**	**Def. value**	**Def. unit**	**Sig. State**
0.0 dB to 6.0 dB	DPCCH/DPDCH power offset	0.0	dB	all

Description of command

This command sets all physical channel level at once. The levels can be set relative to the P-CPICH level (in which case *<P-CPICH_abs>* is used) or relative to the total channel power (*<P-CPICH_rel>* is used), depending on the `CONFigure:BSSignal:LREFerence` setting.

Note: *The instrument checks the levels for consistence before activating the settings. This is important especially if the levels are defined relative to the total channel power and must not exceed this fixed value.*

If the PICH or AICH level is changed while the CMU is in the REG or CEST states, the cell is intermediately removed and the UE is forced to register and/or connect again. To avoid delays, it is recommended to configure the PICH or AICH levels in the SOFF or SON states. The other levels can be changed any time.

*) The reported level ranges correspond to the total output power ranges at the three RF output connectors (see command `CONFigure:BSSignal:OPOWer)`. If other channel contributions are switched on, the P-CPICH level must be reduced so that the total output power range is not exceeded. If option R&S CMU-U99 *(RF 1 with RF 2 Level Range)* is fitted, RF 1 takes on the level range of RF2.

CONFigure:BSSignal:AWGN *<Power>* AWGN Noise Pwr.

<Output Power>	Description of parameters	Def. value	Def. unit	FW vers.
See below	AWGN power (Ioc)	OFF	dBm	V3.85

Description of command — Sig. State: all

This command defines the total level of the Additional White Gaussian Noise (AWGN) interferer. The AWGN power is in a range between Ior –44.9 dB and Ior + 25.4 dB, irrespective of the physical DL WCDMA channel settings. Values outside this range are allowed for some physical channel configurations.

Note: Observe the maximum output power at the connectors; see `CONFigure:BSSignal:TOPower?`

CONFigure:BSSignal:GMTFactor *<Ratio>* Geometry Factor

<Ratio>	Description of parameters	Def. value	Def. unit	FW vers.
–25.4 dB to +44.9 dB	Ior / Ioc	–	dB	V3.85

Description of command — Sig. State: all

This command defines the ratio of the *Output Ch. Power (TX) (Ior)* (`CONFigure:BSSignal:OPOWer`) to the AWGN power (`CONFigure:BSSignal:AWGN`). Changing the geometry factor affects the output channel power but leaves the AWGN power unchanged. The numeric range quoted above holds for all physical channel configurations. Values outside this range are allowed for some configurations.

Note: Observe the maximum output power at the connectors; see `CONFigure:BSSignal:TOPower?`

CONFigure:BSSignal:TOPower? <*Sum*>			Total Output Power	
<Sum>	Description of parameters	Def. value	Def. unit	FW vers.
–147.1 dBm to +10.7 dBm	Ior + Ioc	–	dBm	V3.85
Description of command				Sig. State
This command is always a query and returns the sum of the *Output Ch. Power (TX) (Ior)* (`CONFigure:BSSignal:OPOWer`) and the *AWGN Noise Power (Ioc)* (`CONFigure:BSSignal:AWGN`).				all

Subsystem BSSignal:DCH (Dedicated Channel)

The subsystem *BSSignal:DCH* selects and configures the dedicated channel that the CMU used to set up and maintain a connection. It corresponds to the *Dedicated Channel (DCH)* section in the *BS Signal* tab of the popup menu *Connection Control*.

CONFigure:BSSignal:DCH:TYPE <*Type*>			Dedicated Channel Type	
<Type>	Description of parameters	Def. value	Def. unit	FW vers.
RMC |	Reference Measurement Channel	VOIC	–	V3.15
VOICe |	Voice Channel			
SRAB |	Signalling RAB – Cell DCH			
SRFach |	Signalling RAB – Cell FACH			V3.52
VIDeo	Video channel (for video echo tests)			V3.80
Description of command				Sig. State
This command selects the dedicated channel to be allocated between the CMU/UTRAN and the UE.				SOFF SON REG

CONFigure:BSSignal:DCH:RMC:TYPE <*Type*>			Reference Channel Type	
<Type>	Description of parameters	Def. value	Def. unit	FW vers.
RMC12 | RMC64 |	Symmetric UL/DL information bit rates	RMC12	(kbps)	V3.15
RMC144 | RMC384 |				V3.40
RMC64_144 | RMC64_384 |	Asymmetric UL/DL information bit rates			V3.50
RMC144_384 |				
BTFD |	RMC for Blind Transport Format Detection			
HS34108 |	12.2 kbps + HSDPA 34.108			V3.60
RMC12HSDPA |	12.2 kbps (+ HSDPA)			V4.30
HSPA34108 |	12.2 kbps + HSPA 34.108			
RMC12HSPA	12.2 kbps (+ HSPA)			V4.50
RMC12_64 | RMC12_144 |	Asymmetric UL/DL information bit rates			V4.50
RMC 12_384				
Description of command				Sig. State
This command sets the information bit rate and type of the generated 3GPP DL Reference Measurement Channel. The setting takes effect if an RMC is selected as a dedicated channel (`CONFigure:BSSignal:DCH:TYPE RMC`).				all

CONFigure:BSSignal:DCH:RMC:TFORmat <*Format*> DL DTCH Transport Format

<Format>	Description of parameters	Def. value	Def. unit	FW vers.
K1_95 | K4_75 | K5_15 | K5_9 | K6_7 | K7_4 | K7_95 | K10_2 | K12_2	Full list of DL DTCH transport format specified for BTFD tests (3GPP TS 34.121)	K12_2	–	V3.60

Description of command	Sig. State
This command selects the information bit rate of the generated DL Dedicated Transport Channel that serves as a RMC for Blind Transport Format Detection (BTFD) tests. The setting takes effect if an RMC for BTFD is selected (`CONFigure:BSSignal:DCH:RMC:TYPE BTFD`).	all

CONFigure:BSSignal:DCH:RMC:DLRessource <*Resources*> DL Resources in Use

<Resources>	Description of parameters	Def. value	Def. unit	FW vers.
P1000 | P0500 | P0250 | P0167 |P0125 | P0100 | P0083 | P0071 | P0063 | P0056 | P0050 | P0045 | P0042 | P0038 | P0036 | P0033 | P0031	Percentage of transp. blocks with data: 100 % (all blocks filled) 1/2, 1/4, 1/6, 1/8 of all all blocks filled 1/10, 1/12, 1/14, 1/16 filled 1/18, 1/20, 1/22, 1/24 filled 1/26, 1/28, 1/30, 1/32 filled	P1000	–	V3.50

Description of command	Sig. State
This command defines the percentage of DL RMC transport blocks that are filled with information bits.	SOFF SON REG

CONFigure:BSSignal:DCH:RMC:RLCMode <*Mode*> RLC Mode (Sym. Loop Mode 1)

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
TM | **AM**	Transparent mode Acknowledged mode	TM	–	V4.55

Description of command	Sig. State
This command selects the RLC mode. The AM is valid if a test loop mode 1 with one of the following data rates is active: 64 kbps Downlink / 12.2 kbps Uplink, 144 kbps Downlink / 12.2 kbps Uplink, 384 kbps Downlink / 12.2 kbps Uplink. See commands `CONFigure:BSSignal:DCH:RMC:TMODe` and `CONFigure:BSSignal:DCH:RMC:TYPE`.	SOFF SON REG

CONFigure:BSSignal:DCH:RMC:UCRC <*Enable*> Uplink CRC (Sym. Loop Mode 2)

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	UE sends CRC, symmetric transport block size UE doesn't send CRC, asymmetric transport block size	OFF	–	V3.15

Description of command	Sig. State
This command enables or disables the uplink CRC. The BLER can be measured with disabled CRC only.	SOFF SON REG

CONFigure:BSSignal:DCH:RMC:TMODe <*Mode*> Test Mode

<*Mode*>	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **ON |** **MODE1 |** **MODE2**	RMC connection without test mode RMC connection with test mode RMC connection with test loop mode 1 RMC connection with test loop mode 2	MODE2	–	V3.15
Description of command				Sig. State
This command selects the operating mode that the UE enters after connecting to the UTRAN/CMU. The setting takes effect if an RMC is selected as dedicated channel (`CONFigure:BSSignal:DCH:TYPE RMC`).				SOFF SON REG

CONFigure:BSSignal:DCH:RMC:SDTCh <*Sequence*> Channel Data Source DTCH

<*Sequence*>	Description of parameters	Def. value	Def. unit	FW vers.
ALL0 | **ALL1 |** **ALT |** **PR9 | PR11 | PR13 | PR15**	Bit sequence consisting of zeros Bit sequence consisting of ones 010101... bit sequence Pseudo-random bit sequences	PR9	–	V3.15
Description of command				Sig. State
This command selects a bit pattern to be transmitted as user information on the DTCH. The setting takes effect if an RMC is selected as dedicated channel (`CONFigure:BSSignal:DCH:TYPE RMC`).				SOFF SON REG

CONFigure:BSSignal:DCH:HRMC:MVERsion <*Version*> Message Versions

<*Message Version*>	Description of parameters	Def. value	Def. unit	FW vers.
R9R9 | **R9R5 |** **R5R5**	Sets both SRB and RMC message versions to R99 Sets SRB to R99 and RMC to R5 Sets both SRB and RMC message versions to R5	R9R5	–	V4.34
Description of command				Sig. State
This command defines the SRB and RMC message versions as any combination of R5 (release 5) and R99 (release 99) as specified e.g. in 3GPP TS 34.121.				all

CONFigure:BSSignal:DCH:VOICe:SOURce <*Mode*> Voice Source

<*Mode*>	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **ECHO |** **COD |** **LCOD |** **ECAL |** **DCAL**	No data looped back CMU loops back voice data after approx. 50 frames (500 ms) Codec Codec Low Encoder Cal Decoder Cal	ECHO	–	V3.40
Description of command				Sig. State
This command selects the signal path for voice data. The setting takes effect if a voice channel is selected as dedicated channel (`CONFigure:BSSignal:DCH:TYPE VOIC`).				all

CONFigure:BSSignal:DCH:VOICe:ACODer <*Mode*>				Active Coder
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
NB | **WB**	Narrow-band AMR (option R&S CMU-B52) Wide-band AMR (options R&S CMU-B52 and CMU-K46)	NB	–	V4.20
Description of command				Sig. State
This command selects the active voice coder.				SOFF SON REG

CONFigure:BSSignal:DCH:VOICe:ACSet <*ACS*>				Active Codec Set (NB AMR)
<ACS>	Description of parameters	Def. value	Def. unit	FW vers.
A | **B |** **C |** **D |** **E |** **F |** **G |** **H |** **M**	ACS with single codec mode: 12.2 kbps data rate ACS with single codec mode: 10.2 kbps data rate ACS with single codec mode: 7.95 kbps data rate ACS with single codec mode: 7.4 kbps data rate ACS with single codec mode: 6.7 kbps data rate ACS with single codec mode: 5.9 kbps data rate ACS with single codec mode: 5.15 kbps data rate ACS with single codec mode: 4.75 kbps data rate ACS with four codec modes: 12.2 kbps, 7.95 kbps, 5.9 kbps and 4.75 kbps	A	–	V3.40
Description of command				Sig. State
This command defines the Active Code Set containing the codec modes (data rates) that the CMU and the UE can use for transmission.				SOFF SON REG

CONFigure:BSSignal:DCH:VOICe:WBACset <*ACS*>				Active Codec Set (WB AMR)
<ACS>	Description of parameters	Def. value	Def. unit	FW vers.
A | **B |** **C |** **D |** **E |** **F |** **G |** **H |** **I |** **M**	ACS with single codec mode: 23.85 kbps data rate ACS with single codec mode: 23.05 kbps data rate ACS with single codec mode: 19.85 kbps data rate ACS with single codec mode: 18.25 kbps data rate ACS with single codec mode: 15.85 kbps data rate ACS with single codec mode: 14.25 kbps data rate ACS with single codec mode: 12.65 kbps data rate ACS with single codec mode: 8.85 kbps data rate ACS with single codec mode: 6.60 kbps data rate ACS with three codec modes: 12.65 kbps, 8.85 kbps, 6.60 kbps	A	–	V4.20
Description of command				Sig. State
This command defines the Active Code Set containing the codec modes (data rates) that the CMU and the UE can use for transmission.				SOFF SON REG

CONFigure:BSSignal:DCH:SRAB:SRB <*Rate*> SRB

<Rate>	Description of parameters	Def. value	Def. unit	FW vers.
K1_7 **K2_5 |** **K3_4 |** **K13_6**	1.7 kbps Signalling Radio Access Bearer 2.5 kbps Signalling Radio Access Bearer 3.4 kbps Signalling Radio Access Bearer 13.6 kbps Signalling Radio Access Bearer	K3_4	–	V3.15

Description of command	Sig. State
This command selects the data rate of the SRB in kbps. The setting takes effect if a SRAB is selected as dedicated channel (`CONFigure:BSSignal:DCH:TYPE SRAB`).	SOFF SON REG

DEFault:BSSignal:DCHannel <*Enable*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	All parameters are set to their default values All or some parameters differ from the default values	ON	–	V3.40

Description of command	Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	SOFF SON REG

[SENSe:]BSSignal:DCH:VOIce:NAMR:CURRent?
[SENSe:]BSSignal:DCH:VOIce:NAMR:TOTal? NB AMR, Codec Modes

Returned values	Value range	Def. value	Def. unit	FW vers.
Percentage of time in codec mode 4.75 kbps	0 % to 100 %	NAN	–	V4.30
Percentage of time in codec mode 5.15 kbps	0 % to 100 %	NAN		
Percentage of time in codec mode 5.9 kbps	0 % to 100 %	NAN		
Percentage of time in codec mode 6.7 kbps	0 % to 100 %	NAN		
Percentage of time in codec mode 7.4 kbps	0 % to 100 %	NAN		
Percentage of time in codec mode 7.95 kbps	0 % to 100 %	NAN		
Percentage of time in codec mode 10.2 kbps	0 % to 100 %	NAN		
Percentage of time in codec mode 12.2 kbps	0 % to 100 %	NAN		
Percentage of time for comfort noise	0 % to 100 %	NAN		
Percentage of time for no data	0 % to 100 %	NAN		

Description of command	Sig. State
This command returns the percentage of time where the narrow band codec of the UE was in one of its possible operating modes. The `CURRent` results are evaluated over the last second; the `TOTal` results over the entire current call.	CONN

[SENSe:]BSSignal:DCH:VOIce:WAMR:CURRent?
[SENSe:]BSSignal:DCH:VOIce:WAMR:TOTal?
WB AMR, Codec Modes

Returned values	Value range	Def. value	Def. unit	FW vers.
Percentage of time in codec mode 6.6 kbps	0 % to 100 %	NAN	–	V4.30
Percentage of time in codec mode 8.85 kbps	0 % to 100 %	NAN		
Percentage of time in codec mode 12.65 kbps	0 % to 100 %	NAN		
Percentage of time in codec mode 14.25 kbps	0 % to 100 %	NAN		
Percentage of time in codec mode 15.85 kbps	0 % to 100 %	NAN		
Percentage of time in codec mode 18.25 kbps	0 % to 100 %	NAN		
Percentage of time in codec mode 19.85 kbps	0 % to 100 %	NAN		
Percentage of time in codec mode 23.05 kbps	0 % to 100 %	NAN		
Percentage of time in codec mode 23.85 kbps	0 % to 100 %	NAN		
Percentage of time for comfort noise	0 % to 100 %	NAN		
Percentage of time for no data	0 % to 100 %	NAN		

Description of command	Sig. State
This command returns the percentage of time where the wide band codec of the UE was in one of its possible operating modes. The `CURRent` results are evaluated over the last second; the `TOTal` results over the entire current call.	CONN

CONFigure:BSSignal:CSWitched:CAID *<ID>*
Caller ID

<ID>	Description of parameters	Def. value	Def. unit	FW vers.
"0" to "####################"	Caller ID (string)	"764332637249279"	–	V5.02

Description of command	Sig. State
This command sets a 1 to 20-digit caller ID, to be displayed at the UE under test.	≠CEST

Subsystem BSSignal:PHYSical (Downlink Physical Channels)

The subsystem *BSSignal:PHYSical* defines the level of the individual physical channels contributing to the BS signal. It corresponds to the *Downlink Physical Channels* section in the *BS Signal* tab of the popup menu *Connection Control*.

Note: *The command `CONFigure:BSSignal:LREFerence` sets all physical channel levels at once. Using this command is preferable because it allows the instrument to check the consistence of the entire level set and avoid conflicting settings during the program sequence.*

CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary <*Level_abs*> | <*Level_rel*> P-CPICH Level

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–147.0 dBm to –37.0 dBm*	Absolute P-CPICH level if RF 1 is used	–55.0	dBm	V3.15
–147.0 dBm to –15.0 dBm*	Absolute P-CPICH level if RF 2 is used	–55.0	dBm	
–100.0 dBm to +3.0 dBm*	Abs. P-CPICH level if RF 3 OUT is used	–55.0	dBm	
<Level_rel>	Description of parameters	Def. value	Def. unit	FW vers.
–30 dB to 0 dB	Relative P-CPICH level	–	dB	V3.15

Description of command	Sig. State
This command sets the level of the Primary Common Pilot Channel in absolute units or relative to the total channel power, depending on the `CONFigure:BSSignal:LREFerence` setting. The absolute level is the reference for all other physical and synchronization channel levels and can not be switched off. *) The reported level ranges correspond to the total output power ranges at the three RF output connectors (see command `CONFigure:BSSignal:OPOWer`). If other channel contributions are switched on, the P-CPICH level must be reduced so that the total output power range is not exceeded. If option R&S CMU-U99 *(RF 1 with RF 2 Level Range)* is fitted, RF 1 takes on the level range of RF2.	all

CONFigure:BSSignal:PHYSical:LEVel:SCPICH <*Level*> S-CPICH Level

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB*	S-CPICH level	OFF	dB	V4.30
OFF	S-CPICH channel switched off			

Description of command	Sig. State
This command sets the level of the Secondary Common Pilot Channel relative to the P-CPICH level (see command *CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary*). *) The relative level must not exceed 0 dB if the channel powers are expressed relative to the total output channel power (`CONFigure:BSSignal:LREFerence OPOWer`).	all

CONFigure:BSSignal:PHYSical:CODE:SCPich <*Code*> S-CPICH Channel. Code

<Code>	Description of parameters	Def. value	Def. unit	FW vers.
2 to 255	S-CPICH Channelization Code	7	–	V4.30

Description of command	Sig. State
This command assigns a channelization code to the Secondary Common Pilot Channel.	all

CONFigure:BSSignal:PHYSical:SCODe:SCPich:SECondary <*Code*>
S-CPICH Secondary Scrambling Code

<Code>>	Description of parameters	Def. value	Def. unit	FW vers.
#H0 to #HF	Secondary scrambling code	#H0	–	V4.30

Description of command	Sig. State
This command defines the secondary scrambling code for the S-CPICH in the downlink RF generator signal. The input of a scrambing code may be in decimal or in hexadecimal format, the latter preceded by #H (as specified in IEEE 488.2). The output is always in hexadecimal format, preceded by #H.	all

CONFigure:BSSignal:PHYSical:PHASe:SCPich <*Phase*> — S-CPICH Phase

<*Phase*>	Description of parameters	Def. value	Def. unit	FW vers.
0 deg | –45 deg | –90 deg | –135 deg | –180 deg | –225 deg | –270 deg | –315 deg	S-CPICH phase	0	deg	V4.30

Description of command	Sig. State
This command defines the phase of the S-CPICH relative to the P-CPICH phase.	all

CONFigure:BSSignal:PHYSical:LEVel:SCH:PRIMary <*Level*> — P-SCH Level

<*Level*>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB*| OFF	P-SCH level P-SCH channel switched off	–5.0	dB	V3.15

Description of command	Sig. State
This command sets the level of the Primary Synchronization Channel relative to the P-CPICH level (see command *CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary*). *) The relative level must not exceed 0 dB if the channel powers are expressed relative to the total output channel power (`CONFigure:BSSignal:LREFerence OPOWer`).	all

CONFigure:BSSignal:PHYSical:LEVel:SCH:SECondary <*Level*> — S-SCH Level

<*Level*>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB* | OFF	S-SCH level S-SCH channel switched off	–5.0	dB	V3.15

Description of command	Sig. State
This command sets the level of the Secondary Synchronization Channel relative to the P-CPICH level (see command *CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary*). *) The relative level must not exceed 0 dB if the channel powers are expressed relative to the total output channel power (`CONFigure:BSSignal:LREFerence OPOWer`).	all

CONFigure:BSSignal:PHYSical:LEVel:CCPCh:PRIMary <*Level*> — P-CCPCH Level

<*Level*>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB*| OFF	P-CCPCH level P-CCPCH channel switched off	–2.0	dB	V3.15

Description of command	Sig. State
This command sets the level of the Primary Common Control Physical Channel relative to the P-CPICH level (see command *CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary*). *) The relative level must not exceed 0 dB if the channel powers are expressed relative to the total output channel power (`CONFigure:BSSignal:LREFerence OPOWer`).	all

CONFigure:BSSignal:PHYSical:LEVel:CCPCh:SECondary <*Level*> — P-CCPCH Level

<*Level*>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB* | OFF	S-CCPCH level S-CCPCH channel switched off	–2.0	dB	V3.15

Description of command	Sig. State
This command sets the level of the Secondary Common Control Physical Channel relative to the P-CPICH level (see command *CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary*). *) The relative level must not exceed 0 dB if the channel powers are expressed relative to the total output channel power (`CONFigure:BSSignal:LREFerence OPOWer`).	all

CONFigure:BSSignal:PHYSical:CODE:CCPCh:SECondary <*Code*>			S-CCPCH Channelization Code	
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
2 to 511	S-CCPCH Channelization Code	2	–	V3.80
Description of command				Sig. State
This command assigns a channelization code to the Secondary Common Control Physical Channel. The maximum code number is equal to the spreading factor minus one, which in turn depends on the slot format.				SOFF SON REG

CONFigure:BSSignal:PHYSical:LEVel:PICH <*Level*>			PICH Level	
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB* | OFF	PICH level P-SCH channel switched off	–5.0	dB	V3.15
Description of command				Sig. State
This command sets the level of the Page Indicator Channel relative to the P-CPICH level (see command *CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary*). *) The relative level must not exceed 0 dB if the channel powers are expressed relative to the total output channel power (`CONFigure:BSSignal:LREFerence OPOWer`).				SON SOFF Q: all

CONFigure:BSSignal:PHYSical:CODE:PICH <*Code*>			PICH Channelization Code	
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
2 to 255	PICH Channelization Code	3	–	V3.80
Description of command				Sig. State
This command assigns a channelization code to the Page Indicator Channel.				SOFF SON REG

CONFigure:BSSignal:PHYSical:CODE:PINDicator <*Number*>			Paging Indicators per Frame	
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
18 | 36 | 72 | 144	Paging Indicators per Frame	18	–	V4.30
Description of command				Sig. State
This command sets the number of paging indicators that the R&S CMU transmits in each PICH frame.				SOFF SON REG

CONFigure:BSSignal:PHYSical:LEVel:AICH <*Level*>			AICH Level	
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB* | OFF	AICH level AICH channel switched off	–5.0	dB	V3.15
Description of command				Sig. State
This command sets the level of the Acquisition Indicator Channel relative to the P-CPICH level (see command *CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary*). *) The relative level must not exceed 0 dB if the channel powers are expressed relative to the total output channel power (`CONFigure:BSSignal:LREFerence OPOWer`).				SON SOFF Q: all

CONFigure:BSSignal:PHYSical:CODE:AICH <*Code*>			AICH Channelization Code	
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
2 to 255	AICH Channelization Code	6	–	V3.80
Description of command				Sig. State
This command assigns a channelization code to the Acquisition Indicator Channel.				SOFF SON REG

CONFigure:BSSignal:PHYSical:LEVel:DPDCh <*Level*>			DPDCH Level	
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB* | OFF	DPDCH level DPDCH channel switched off	–7.0	dB	V3.15
Description of command				Sig. State
This command sets the level of the Dedicated Physical Data Channel relative to the P-CPICH level (see command *CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary*). The setting command is unavailable as long as a DL power control test is running (signalling state *CONN* and `CONFigure:BSSignal:DPCS:PCONtrol MODE0 | MODE1`). *) The relative level must not exceed 0 dB if the channel powers are expressed relative to the total output channel power (`CONFigure:BSSignal:LREFerence OPOWer`).				all

CONFigure:BSSignal:PHYSical:CODE:DPDCh <*Code*>			DPDCH Channelization Code	
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
2 to 511	DPDCH Channelization Code	96	–	V3.15
Description of command				Sig. State
This command assigns a channelization code to the Dedicated Physical Data Channel. The maximum code number is equal to the spreading factor minus one, which in turn depends on the slot format.				SOFF SON REG

CONFigure:BSSignal:PHYSical:LEVel:DPDCh:MINimum <*Level*> DPDCH Level Min.				
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35.0 dB to +15.0 dB	Minimum DPDCH level	–18.0	dB	V3.85
Description of command				Sig. State
This command specifies the minimum DL DPDCH power relative to the P-CPICH power.				all

CONFigure:BSSignal:PHYSical:LEVel:DPDCh:MAXimum <*Level*> DPDCH Level Max.				
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35.0 dB to +15.0 dB	Maximum DPDCH level	+7.0	dB	V3.85
Description of command				Sig. State
This command specifies the maximum DL DPDCH power relative to the P-CPICH power.				all

CONFigure:BSSignal:PHYSical:DPCH:POFFset <*Level*>				Power Offset
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 6.0 dB	DPCCH/DPDCH power offset	0.0	dB	V3.15
Description of command				Sig. State
This command sets the ratio of DPCCH to DPDCH power.				all

CONFigure:BSSignal:PHYSical:DPCH:TOFFset <*Offset*> DL DPCH Timing Offset				
<Offset>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 149	Timing offset in 256-chip periods (1/10 slot)	0	–	V3.80
Description of command				Sig. State
This command specifies an offset between the DL P-CCPCH timing and the DL DPCH timing.				SOFF SON REG

CONFigure:BSSignal:SCODe:SECondary <*Code*>				Secondary Scrambling Code
<Code>>	Description of parameters	Def. value	Def. unit	FW vers.
#H0 to #HF	Secondary scrambling code	#H0	–	V3.15
Description of command				Sig. State
This command defines the secondary scrambling code for the downlink RF generator signal. The input of a scrambing code may be in decimal or in hexadecimal format, the latter preceded by #H (as specified in IEEE 488.2). The output is always in hexadecimal format, preceded by #H.				SOFF SON REG

CONFigure:BSSignal:PHYSical:DGFChange *<Enable>*				Data Gen. during Signalling Change
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Continuous or discontinuous data stream	OFF	–	V4.10
Description of command				Sig. State
This command qualifies whether or not the data stream transferred on the Reference Measurement Channels (RMCs) is interrupted during an inter-frequency handover.				all

DEFault:BSSignal:PHYSical <*Enable*>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	All parameters are set to their default values All or some parameters differ from the default values	ON	–	V3.15
Description of command				Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the sub-system to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				SOFF SON REG

Subsystem BSSignal:TPC (Transmit Power Control)

The subsystem *BSSignal:TPC* defines the Transmit Power Control information transmitted on the DPCH. It corresponds to the *TPC Settings* section in the *BS Signal* tab of the popup menu *Connection Control*.

CONFigure:BSSignal:TPC:MODE <*Algorithm*>				TPC Algorithm
<Algorithm>	Description of parameters	Def. value	Def. unit	FW vers.
ALG1 | ALG2	TPC algorithm 1 or 2	ALG2	–	V3.15
Description of command				Sig. State
This command defines the power control algorithm used to control the UE transmit power.				all (V3.60)

CONFigure:BSSignal:TPC:SSIZE <*Step*>				TPC Step Size
<Step>	Description of parameters	Def. value	Def. unit	FW vers.
1 dB | 2 dB	TPC step size 1 dB or 2 dB	1	dB	V3.15
Description of command				Sig. State
This command defines the relative power difference of the UE between two consecutive slots if it is commanded to change its output power. ***Note:*** *This command is available if TPC algorithm 1 is used. According to the standard, 1 dB must be set for TPC algorithm 2 (see command* `CONFigure:BSSignal:TPC:MODE`*).*				all (V3.60)

CONFigure:BSSignal:TPC:PSET <*Setup*>	TPC Pattern Setup			
<Setup>	Description of parameters	Def. value	Def. unit	FW vers.
SET1 | **…** **SET5 |** **TA |** **…** **TH |** **PUP |** **PDOW |** **TULC**	Setup 1 … Setup 5 Test Step A Test Step H Test Step PhD UP Test Step PhD Down UL CM TX Test Steps	SET1	–	V3.15 V3.60 V3.80 V4.51
Description of command				Sig. State
This command the TPC pattern setup to be used. Setups no. 1 to 5 are defined by the *TPC Pattern Type* (`CONFigure:BSSignal:TPC:PTYPe<nr>`) and the single *Pattern* (`CONFigure:BSSignal:TPC:PATTern<nr>`). The test step setups TA to TH account for the requirements of the conformance test specification. The setups PUP and PDOWn are for phase discontinuity measurements according to the specification. *UL CM TX Test Steps* is a P/Slot Table measurement mode.				all

CONFigure:BSSignal:TPC:PTYPe<nr> <*Type*> Pattern Type

<Type>	Description of parameters	Def. value	Def. unit	FW vers.
ALT | **ALL0 |** **ALL1 |** **CPAT |** **SPA0 |** **SPA1 |** **SPAL |** **CLOP**	Alternating 0,1 Bit sequence consisting of zeros Bit sequence consisting of ones Continuous pattern Single pattern + All 0 Single pattern + All 1 Single pattern + Alternating Closed Loop	see below	–	V3.15, V3.40 (suffix) V3.60 (test steps) V3.40

Description of command — Sig. State

This command defines or queries the bit pattern transmitted on the Dedicated Traffic Channel. The single pattern is defined via `CONFigure:BSSignal:TPC:PATTern`; see below. The numeric suffix discriminates between the five different test setups (<nr> = 1 to 5), 8 different TPC test steps (<nr> = 6 to 13), two test steps for phase discontinuity measurements (<nr> = 14 to 15); and one test setup for *UL CM TX Test Steps* (<nr> = 16); see `CONFigure:BSSignal:TPC:PSET` on p. 6.209.

The pattern types for the TPC test steps (<nr> = 6 to 13), for the phase discontinuity measurement (<nr> = 14, 15), and for *UL CM TX Test Steps* (<nr> = 16) are fixed; the command can be used only as a query with the corresponding suffixes <nr> = 6,…, 16.

The default pattern type depends on the test setup:

<nr>	1	2	3	4	5
Pattern Type	CLOP	SPAL	SPAL	CPAT	CPAT

Test steps A to H use the following fixed pattern types:

<nr>	6	7	8	9	10	11	12	13
Pattern Type	SPAL	SPAL	SPAL	SPA1	SPA0	SPA1	SPA0	SPA1

The phase discontinuity patterns (FW V3.80 and higher) and the *UL CM TX Test Steps* pattern use the following fixed pattern types:

<nr>	14	15	16
Pattern Type	SPAL	SPAL	CLOP

Sig. State: all

CONFigure:BSSignal:TPC:PATTern<nr> <*Pattern*> Pattern

<Pattern>	Descr. of parameters	Def. value	Def. unit	FW vers.
"<3 bit to 22 bit sequence>"	Single TPC pattern	<nr> = 1: not used <nr> = 2: “1111111111” <nr> = 3: “0000000000” <nr> = 4: “1111111110000000000” <nr> = 5: “1000001001111101 1010” <nr> = 6, … 16 : query only (see below)	–	V3.15, V3.40 (suffix), V3.60 (test steps) V3.80 (phase disc.) V4.51 (UL CM TX Test)

Description of command — Sig. State

This command defines the single bit pattern that is used to construct the TPC profile; see command `CONFigure:BSSignal:TPC:PTYpe` above. The numeric suffix discriminates between the five different test setups (<nr> = 1 to 5), 8 different TPC test steps (<nr> = 6 to 13), two test steps for phase discontinuity measurements (<nr> = 14 to 15); and one test setup for *UL CM TX Test Steps* (<nr> = 16); see `CONFigure:BSSignal:TPC:PSET` on p. 6.209.

The patterns for the TPC test steps (<nr> = 6 to 13), for the phase discontinuity measurement (<nr> = 14, 15), and for *UL CM TX Test Steps* (<nr> = 16) are fixed. For these pattern, the command can be used only as a query with the corresponding suffixes <nr> = 6,…, 16.

The query for the test steps A to H returns the following pattern identifiers:

<nr>	**Returned value**	**Meaning**
6	B60P	60-bit 3GPP pattern
7	B50H	50 x 1_{bin}
8	B50L	50 x 0_{bin}
9	‘11111111111111111111’	22 x 1_{bin}
10	‘00000000000000000000’	22 x 0_{bin}
11	‘11111111111111111111’	22 x 1_{bin}
12	‘00000000000000000000’	22 x 0_{bin}
13	‘11111111111111111111’	22 x 1_{bin}

The query for the phase discontinuity patterns and the *UL CM TX Test Steps* pattern returns the following pattern identifiers:

<nr>	**Returned value**	**Meaning**
14	UP	5 x 11110000_{bin}
15	DOWN	5 x 00001111_{bin}
16	ULCM	depending on pattern type, see manual control

Sig. State: all

CONFigure:BSSignal:TPC:RPATtern ON				Repeat Pattern
Parameter	Description of parameters	Def. value	Def. unit	FW vers.
ON	Send single TPC pattern	–	–	V3.15
Description of command				Sig. State
This command has no query form. It causes a single TPC pattern (defined via `CONFigure:BSSignal:TPC:PATTern`) to be sent at the next allowed frame boundary; see description in Chapter 4. The command is executed only if one of the pattern types `SPA0, SPA1` or `SPAL` is selected (command `CONFigure:BSSignal:TPC:PTYPe`); otherwise the CMU generates the SCPI error no. –200, "Execution Error". The command has been extended as follows: • In firmware versions V3.60 and higher, the command is also used to send a TPC pattern according to test steps A to H; see `CONFigure:BSSignal:TPC:PSET`. • In firmware versions V3.80 and higher, the command is also used to send the TPC patterns PUP or PDOWn for phase discontinuity measurements.				all

CONFigure:BSSignal:TPC:PCONditions <*Mode*>				Test Step Preconditions
<Mode>	Descr. of parameters	Def. value	Def. unit	FW vers.
MANual | AUTOmatic	Preconditions ignored Preconditions valid	MANual	–	V3.80
Description of command				Sig. State
This command specifies whether the test step preconditions for test steps A to H, PhD Up/Down, and UL CM TX Test Steps are valid.				all

CONFigure:BSSignal:TPC:CURRent? <*Setup*>, <*Type*>, <*Pattern*>				Current TPC Settings
<Setup>	Description of parameters	Def. value	Def. unit	FW vers.
SET1 | … |SET5 | TA | … | TH | PUP | PDOW | TULC	Setup 1 to Setup 5 or Test Step A to Test Step H TPC pattern for phase discontinuity meas. Pattern for UL CM TX Test Steps	SET1	–	V3.60 V3.80 V4.51
<Type>	Description of parameters	Def. value	Def. unit	FW vers.
ALT | ALL0 | ALL1 | CPAT | SPA0 | SPA1 | SPAL | CLOP	Pattern type, see `CONFigure:BSSignal:TPC:PTYPe<nr>`	CLOP	–	V3.60
<Pattern>	Description of parameters	Def. value	Def. unit	FW vers.
"<3 bit to 22 bit sequence>"	Single TPC pattern; see `CONFigure:BSSignal:TPC:PATTern<nr>`	'01'	–	V3.60
Description of command				Sig. State
This command queries the current TPC setup or test step, the selected pattern type and single TPC pattern.				all

DEFault:BSSignal:TPC				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.15
Description of command				Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				all

CONFigure:BSSignal:TPC:SEGMentation *<Enable>*				Segmented TPC Patterns
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable segmented patterns	OFF	–	V5.10
Description of command				Sig. State
This command enables or disables segmentation of the TPC test patterns E, G, F, and H.				all

Subsystem BSSignal:PSWitched (Packet Switched Connections)

The subsystem *BSSignal:PSWitched* defines the parameters of the packet switched connection. It corresponds to the *Packet Switched* section in the *BS Signal* tab of the popup menu *Connection Control*.

CONFigure:BSSignal:PSWitched:DCH:TYPE *<Type>*				DCH (Dedicated Chn.) Type
<Type>	Description of parameters	Def. value	Def. unit	FW vers.
PDAT | **HSTM |** **HUTM**	Data application tests (*Packet Data),* for query only Connection for HSDPA tests *(HSDPA Test Mode)* Connection for HSUPA tests *(HSUPA Test Mode)*	–	–	V3.80 V4.50
Description of command				Sig. State
This command is always a query. It returns the packet switched connection type. `HSTM` and `HUTM` connections can be initiated from the R&S CMU, `PDATa` connections from the UE only. This means that `PDAT` cannot be used as a setting parameter; it is returned if the DCH type is queried after a packet data connection has been established.				SOFF, SON / IDLE, REG / ATT Q: all

CONFigure:BSSignal:PSWitched:DCH:PDATa:RATE <*Rate*> Radio Bearer Setup

<*Rate*>	Description of parameters	Def. value	Def. unit	FW vers.
PD64 |	Symmetric 64 kbps connection	PD64_384	–	V3.80
PD64_384 |	Asymmetric 384 kbps DL / 64 kbps UL conn.			
PD384 |	Symmetric 384 kbps connection			
HSDPa |	HSDPA connection (64 kbps uplink)			V4.30
HSD384 |	HSDPA connection (384 kbps uplink)			
HSUP |	64 kbps downlink / HSUPA			V4.50
HSU384 |	384 kbps downlink / HSUPA			
HSPA |	HSDPA /HSUPA			V4.51
PD16 |	Symmetric 16 kbps connection			
PD32_64 |	Asymmetric 64 kbps DL / 32 kbps UL conn.			
PD128 |	Symmetric 128 kbps connection			
PD128_384	Asymmetric 384 kbps DL / 128 kbps UL conn.			

Description of command	Sig. State
This command selects the data rate for the packet data connection. The setting is valid for *Packet Data* connections (initiated from the UE).	SOFF, SON / IDLE, REG / ATT Q: all

CONFigure:BSSignal:PSWitched:DCH:HSTMode:RBSetup <*Type*> Radio Bearer Setup (HSDPA)

<*Type*>	Description of parameters	Def. value	Def. unit	FW vers.
HSRB |	SRB 3.4 kbps + HSDPA	HSRB	–	V3.80
HRMC |	RMC 12.2 kbps + HSDPA			
HFDP	F-DPCH + HSDPA			V5.10

Description of command	Sig. State
This command selects the Signalling Radio Bearer that is used to set up the packet switched connection. The setting is valid for *HSDPA Test Mode* connections (initiated from the R&S CMU).	SOFF, SON / IDLE, REG / ATT Q: all

CONFigure:BSSignal:PSWitched:DCH:HSTMode:RTLoop <*Type*> RMC Test Loop (HSDPA)

<*Type*>	Description of parameters	Def. value	Def. unit	FW vers.
LM1 |	Loop Mode 1 RLC TM	LM1	–	V3.85
LM2 |	Loop Mode 2			
OFF	No test loop			

Description of command	Sig. State
This command selects the test loop for a radio bearer setup using a *RMC 12.2 kbps + HSDPA* (`CONFigure:BSSignal:PSWitched:DCH:HSTMode:RBSetup HRMC`).	SOFF, SON / IDLE, REG / ATT Q: all

CONFigure:BSSignal:PSWitched:DCH:HSTMode:UCRC <Enable>			Uplink CRC (Sym. Loop Mode 2)	
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	UE sends CRC, symmetric transport block size UE doesn't send CRC, asymmetric transport block size	OFF	–	V4.50
Description of command				Sig. State
This command enables or disables the uplink CRC for the HSDPA test mode. The BLER can be measured with disabled CRC only.				SOFF, SON / IDLE, REG / ATT Q: all

CONFigure:BSSignal:PSWitched:DCH:HTSMode:SMVersion <*Version*>			SRB Message Version	
<Message Version>	Description of parameters	Def. value	Def. unit	FW vers.
R99 | **R5**	Sets the SRB message version to R99 Sets the SRB message version to R5	R99	–	V4.34
Description of command				Sig. State
This command defines the SRB message version to either R5 (release 5) or R99 (release 99) as specified e.g. in 3GPP TS 34.121.				all

CONFigure:BSSignal:PSWitched:DCH:HUTMode:RBSetup <*Type*>			Radio Bearer Setup (HSUPA)	
<Type>	Description of parameters	Def. value	Def. unit	FW vers.
HSRB | **HRMC |** **RB25**	SRB 3.4 kbps + HSPA RMC 12.2 kbps + HSPA SRB 2.5 kbps + HSPA (β_d = 0)	HRMC	–	V4.50 V5.20A
Description of command				Sig. State
This command selects the Signalling Radio Bearer that is used to set up the packet switched connection. The setting is valid for *HSUPA Test Mode* connections (initiated from the R&S CMU).				SOFF, SON / IDLE, REG / ATT Q: all

CONFigure:BSSignal:PSWitched:DCH:HUTMode:URSSize <*Type*>				UL RLC SDU Size
<Type>	Parameters	Def. value	Def. unit	FW vers.
2936 | 5872 | 8808 | 11744 | 14680 | 17616 | 20552 | 23488 | 26424 | 29360 | 32296 | 35232	SDU size	2936	(bit)	V4.50
Description of command				Sig. State
This command sets the HSUPA UL RLC SDU size as an integer multiple of the HSDPA DL RLC SDU size of 2936 bits.				SOFF, SON / IDLE, REG / ATT Q: all

CONFigure:BSSignal:PSWitched:DCH:HUTMode:HSTLoop?			HSPA Test Loop	
Response	Description of parameters	Def. value	Def. unit	FW vers.
HTLM1	Loop Mode 1	HTLM1	–	V4.50
Description of command				Sig. State
This command is always a query and returns the HSUPA/HSDPA test loop. At present only loop mode 1 is supported.				Q: all

Subsystem BSSignal:COMPressed (Compressed Mode Settings)

The subsystem *BSSignal:COMPressed* defines the compressed mode settings for the R&S CMU and the UE. It corresponds to the *Compressed Mode Settings* section in the *BS Signal* tab of the popup menu *Connection Control*.

CONFigure:BSSignal:COMPressed:PATTern <*Type*>				Pattern Type
<Type>	Description of parameters	Def. value	Def. unit	FW vers.
UEReport | **SINGle |** **UDEFined |** **NONE |** **ULCM**	UE Report Pattern Single Pattern User-defined Pattern None (compression mode not active) UL CM TX Test Steps	UEReport	–	V3.60 V4.51
Description of command				Sig. State
This command enables the compressed mode and selects the pattern type.				all

CONFigure:BSSignal:COMPressed:UEReport:FDD <*Enable*>, <*Mode*>				FDD Measurement
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable FDD measurement	OFF	–	V3.60
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
UEReport | **RABSetup**	FDD measurement while the *UE Report* is running FDD measurement while UE is connected	RABSetup	–	V3.60
Description of command				Sig. State
This command enables and configures the FDD measurement where the UE monitors UTRA neighbor cells.				all

CONFigure:BSSignal:COMPressed:UEReport:GSM <*Enable*>, <*Mode*>				GSM Measurement
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable GSM measurement	OFF	–	V3.60
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
UEReport | **RABSetup**	GSM measurement while the *UE Report* is running GSM measurement while UE is connected	RABSetup	–	V3.60
Description of command				Sig. State
This command enables and configures the GSM measurement where the UE monitors GSM neighbor cells and measures the GSM carrier RSSI.				all

CONFigure:BSSignal:COMPressed:UEReport:IBSic <*Enable*>, <*Mode*>				GSM Initial BSIC
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable GSM Initial BSIC measurement	OFF	–	V3.60
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
UEReport | **RABSetup**	Measurement while the *UE Report* is running Measurement while UE is connected	RABSetup	–	V3.60
Description of command				Sig. State
This command enables and configures the *GSM Initial BSIC* measurement where the UE searches for the BSIC and decodes it when detecting a new GSM neighbor cell.				all

CONFigure:BSSignal:COMPressed:UEReport:RBSic <*Enable*>, <*Mode*>				GSM BSIC Reconfirmation
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable *GSM BSIC Reconf.* measurement	OFF	–	V3.60
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
UEReport | RABSetup	Measurement while the *UE Report* is running Measurement while UE is connected	RABSetup	–	V3.60
Description of command				Sig. State
This command enables and configures the *GSM BSIC Reconfirmation* measurement where the UE tracks and decodes the BSIC of a GSM cell after initial BSIC identification.				all

CONFigure:BSSignal:COMPressed:SINGle:PTYPe <*Type*>				Single Pattern – Pattern Selection
<Type>	Description of parameters	Def. value	Def. unit	FW vers.
RFA | RFB | A | B | C | D | E	Name of a single pattern	OFF	–	V3.60
Description of command				Sig. State
This command selects a single compressed mode pattern for a definite measurement purpose. Measurement with a single pattern is activated via `CONFigure:BSSignal:COMPressed:PATTern SINGle`.				all

CONFigure:BSSignal:COMPressed:SINGle:PACTivation <*Mode*>				Single Pattern Activation
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
UEReport | RABSetup	Pattern active while the *UE Report* is running Pattern active while UE is connected	RABSetup	–	V3.60
Description of command				Sig. State
This command defines for how long the single pattern selected via `CONFigure:BSSignal:COMPressed:SINGle:PTYPe` remains active.				all

CONFigure:BSSignal:COMPressed:UDEFined:PACTivation <*Mode*>				User-defined Pattern Activation
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
UEReport | RABSetup	Pattern active while the *UE Report* is running Pattern active while UE is connected	RABSetup	–	V3.60
Description of command				Sig. State
This command defines for how long the user-defined pattern remains active. Measurement with a user-defined pattern is activated via `CONFigure:BSSignal:COMPressed:PATTern UDEFined`.				all

CONFigure:BSSignal:COMPressed:UDEFined:TGPRc <*Value*>				TGPRC
<Value>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 511	No. of transmission gap patterns	0	–	V3.60
Description of command				Sig. State
This command defines the number of transmission gap patterns within the Transmission Gap Pattern Sequence (0 means that the pattern is repeated continuously).				all

CONFigure:BSSignal:COMPressed:UDEFined:TGCFn <*Value*>				TGFCN Frame No.
<*Value*>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 255	Connection Frame Number	0	(frames)	V3.60
Description of command				Sig. State
This command defines the Connection Frame Number of the first frame of the first pattern.				all

CONFigure:BSSignal:COMPressed:UDEFined:TGSN <*Value*>				TGSN Slot No.
<*Value*>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 14	TGSN slot number	2	(slots)	V3.60
Description of command				Sig. State
This command defines the slot number of the first transmission gap slot within the TGCFN.				all

CONFigure:BSSignal:COMPressed:UDEFined:TGPL <*Value*>				TGPL1
<*Value*>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 144 frames	Duration of the transmission gap pattern	3	(frames)	V3.60
Description of command				Sig. State
This command defines the duration of the transmission gap pattern *TG Pattern 1*.				all

CONFigure:BSSignal:COMPressed:UDEFined:TGAP<nr> <*Enable*>				Transmission Gap 1, 2
<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable transmission gap 2	OFF	–	V3.60
Description of command				Sig. State
This command defines the presence of the second transmission gap within the transmission gap pattern (<nr> = 2). The first transmission gap is always present; the command with numeric suffix <nr> = 1 can be used as a query only.				all

CONFigure:BSSignal:COMPressed:UDEFined:TGL<nr> <*Value*>				TGL1, TGL2
<*Value*>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 14 slots	Length of the transmission gap	2	(slots)	V3.60
Description of command				Sig. State
This command defines the length of the first and the second transmission gap (numeric suffix <nr> = 1, 2) within the transmission gap pattern. The length of the second gap is ignored if transmission gap 2 is disabled (`CONFigure:BSSignal:COMPressed:UDEFined:TGAP2 OFF`).				all

CONFigure:BSSignal:COMPressed:UDEFined:DSIR<nr> <*Value*>				DeltaSIR1, DeltaSIR2
<*Value*>	Description of parameters	Def. value	Def. unit	FW vers.
0 dB/10 to 30 dB/10	Delta in DL SIR target value	0	dB/10	V3.60
Description of command				Sig. State
This command defines the delta in DL SIR target value to be set in the UE during compressed frames due to the first and the second transmission gap (numeric suffix <nr> = 1, 2). The value must be entered as an integer number, corresponding to an integer multiple of 1/10 dB.				all

CONFigure:BSSignal:COMPressed:UDEFined:DSAFter<nr> <*Value*> DeltaSIR after 1, DeltaSIR after 2

<*Value*>	Description of parameters	Def. value	Def. unit	FW vers.
0 dB/10 to 30 dB/10	DeltaSIR after 1/2	0	dB/10	V3.60

Description of command	Sig. State
This command defines the delta in DL SIR target value to be set in the UE one frame after the compressed frames due to the first and the second transmission gap (numeric suffix <nr> = 1, 2). The value must be entered as an integer number, corresponding to an integer multiple of 1/10 dB.	all

CONFigure:BSSignal:COMPressed:UDEFined:MPURpose <*Mode*> Measurement Purpose

<*Mode*>	Description of parameters	Def. value	Def. unit	FW vers.
TDD | FDD | RSSI | IBSic | RBSic | MULTicarrier	Monitor UTRA neighbor cells, Time Division Duplex Monitor UTRA neighbor cells, Frequency Division Duplex GSM Carrier RSSI GSM Initial BSIC GSM BSIC Reconfirmation Multi Carrier	FDD	–	V3.60

Description of command	Sig. State
This command selects the measurement purpose for the user-defined compressed mode pattern.	all

CONFigure:BSSignal:COMPressed:UDEFined:TGD <*Value*> TGD

<*Value*>	Description of parameters	Def. value	Def. unit	FW vers.
15 to 270	TGD (duration between transmission gaps)	15	(slots)	V3.60

Description of command	Sig. State
This command defines the duration between the starting slots of two consecutive transmission gaps within a transmission gap pattern (270 represents undefined).	all

CONFigure:BSSignal:COMPressed:UDEFined:RPP <*Mode*> RPP

<*Mode*>	Description of parameters	Def. value	Def. unit	FW vers.
ZERO | ONE	RPP mode 0 or 1	ONE	–	V3.60

Description of command	Sig. State
This command defines the Recovery Period Power control mode.	all

CONFigure:BSSignal:COMPressed:UDEFined:ITP <*Mode*> ITP

<*Mode*>	Description of parameters	Def. value	Def. unit	FW vers.
ZERO | ONE	ITP mode 0 or 1	ONE	–	V3.60

Description of command	Sig. State
This command defines the Initial Transmit Power mode.	all

CONFigure:BSSignal:COMPressed:UDEFined:LMODe <*Mode*> UL/DL Mode

<*Mode*>	Description of parameters	Def. value	Def. unit	FW vers.
UPLink | DOWNlink | ULDL	Only uplink or only downlink compressed mode Combined uplink and downlink comp. mode	ULDL	–	V3.60

Description of command	Sig. State
This command defines whether only DL, only UL, or combined UL & DL compressed mode is used.	all

CONFigure:BSSignal:COMPressed:UDEFined:UPLink <*Mode*>			Uplink Compressed Mode	
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SF2 | HLS	SF/2 Higher Layer Scheduling	SF2	–	V3.60
Description of command				Sig. State
This command selects the method for generating the uplink compressed mode gap. The setting is not used if only downlink compressed mode is active (`CONFigure:BSSignal:COMPressed:UDEFined:LMODe DOWN`).				all

CONFigure:BSSignal:COMPressed:UDEFined:DOWNlink <*Mode*>			Downlink Compressed Mode	
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SF2	SF/2	SF2	–	V3.60
Description of command				Sig. State
This command selects the method for generating the uplink compressed mode gap. The setting is not used if only uplink compressed mode is active (`CONFigure:BSSignal:COMPressed:UDEFined:LMODe UPL`).				all

CONFigure:BSSignal:COMPressed:UDEFined:DFRame <*Type*>			Downlink Frame Type	
<Type>	Description of parameters	Def. value	Def. unit	FW vers.
A | B	Frame type	A	–	V3.60
Description of command				Sig. State
This command defines the downlink compressed frame structure.				all

DEFault:BSSignal:COMPressed <*Enable*>			Default Settings	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.60
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Subsystem BSSignal:COMPressed:ULCMtxtest (UL CM TX Test)

The following commands configure the TPC pattern that the R&S CMU uses for the *UL CM TX Test*. The *UL CM TX Test* belongs to the *Power/Slot Table* application; see …`POWer:XSLot`… commands.

CONFigure:BSSignal:COMPressed:ULCMtxtest:APATtern ON			Activate Pattern	
Parameter	Description of parameters	Def. value	Def. unit	FW vers.
ON	Send single UL CM TX Test pattern	–	–	4.51
Description of command				Sig. State
This command has no query form. It initiates an *UL CM TX Test*. Use of an UL CM TX Test pattern is activated via `CONFigure:BSSignal:COMPressed:PATTern ULCM`.				all

CONFigure:BSSignal:COMPressed:ULCMtxtest:PTYPe <Type>				Pattern Type
<Type>	Description of parameters	Def. value	Def. unit	FW vers.
PAR | **PAF |** **PB**	Pattern A (rising) Pattern A (falling) Pattern B	PAR	–	4.51
Description of command				Sig. State
This command has no query form. It initiates an *UL CM TX Test* measurement. Use of an UL CM TX Test pattern is activated via `CONFigure:BSSignal:COMPressed:PATTern ULCM`.				all

Subsystem BSSignal:DPCS (Downlink Power Control)

The subsystem *BSSignal:COMPressed* defines the downlink power control settings. It corresponds to the *Downlink Power Control Settings* section in the *BS Signal* tab of the popup menu *Connection Control*.

DEFault:BSSignal:DPCS	Default Settings			
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.85
Description of command				Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				SOFF, SON, REG Q: all

CONFigure:BSSignal:DPCS:PCONtrol <Mode>	DL Power Control			
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **MODE0 |** **MODE1**	Disable DL power control Enable DL power control mode 0 Enable DL power control mode 1	OFF	–	V3.85
Description of command				Sig. State
This command disables or enables DL power control and selects the power control mode.				all

CONFigure:BSSignal:DPCS:SSIZe <Step>	Step Size			
<Step>	Description of parameters	Def. value	Def. unit	FW vers.
S05 | S10 | S15 | S20	Step size 0.5 dB, 1.0 dB, 1.5 dB, 2.0 dB	S10	–	V3.85
Description of command				Sig. State
This command specifies the DL power control step size Δ_{TPC}.				all

CONFigure:BSSignal:DPCS:DTQuality ***<BLER>*** DTCH Target Quality				
<BLER>	Description of parameters	Def. value	Def. unit	FW vers.
P0001 | P0010 | P0020 | P0050 | P0100 | P0200 | P0500 | P1000 | P2000	DTCH target quality 0.01 %, 0.1 %, …, 20 %	P0100	–	V3.85
Description of command				Sig. State
This command specifies the target BLER for downlink power control measured on the DTCH.				SOFF, SON, REG Q: all

CONFigure:BSSignal:DPCS:FDPCh:TPCError ***<Target Rate>*** F-DPCH TPC Error Rate Target				
<Target Rate>	Description of parameters	Def. value	Def. unit	FW vers.
1 % to 10 %	Error rate target	1	%	V5.10
Description of command				Sig. State
This command selects the target *TPC error rate* that must be reached at the end of the DL power control procedure.				SOFF, SON / IDLE, REG / ATT Q: all

Subsystem NETWork (Network Parameters)

The subsystem *NETWork* configures parameters that the CMU reports to the UE. It corresponds to the *Network* tab of the popup menu *Connection Control*.

CONFigure:NETWork:OBANd <*Band*> Operating Band

<*Band*>	Description of parameters	Def. value	Def. unit	FW vers.
OB1 | OB2 | OB3 | **OB4 | OB5 | OB6|** **OB7 |** **OB8 | OB9 |** **OBS |** **OB10 |** **OB11 |** **OB12 | OB12 | OB13** **OBS1 | OBS2**	Operating Band I, II, III Operating Band IV, V, VI Operating Band VII, Operating Band VIII, IX Operating Band S Operating Band X Operating Band XI Operating Band XII, XIII, XIV Operating Band S 190 MHz | 170 MHz Duplex	OB1	–	V3.15 V3.60 V4.20 V4.10 V4.34 V4.40 V4.51 V5.00 V5.10

Description of command	Sig. State
This command selects the Operating Band of the UE. The channels and band frequencies of all operating bands are listed in Chapter 4. The band can be selected together with the uplink and downlink channels; see commands `CONFigure:UESignal:COMBined:OCHannel` and `CONFigure:BSSignal:COMBined:OCHannel`.	SOFF, SON, REG Q: all

CONFigure:NETWork:PSWitched:DOMain <*Enable*> Packet Switched Domain

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Enable packet switched connections Disable packet switched connections	ON	–	V3.80

Description of command	Sig. State
This command enables or disables packet switched connections. For speed tests and remote control tests where the time to set up the circuit switched connection is critical, it can be advantageous to disable the packet switched domain.	SOFF, SON / IDLE, REG / ATT Q: all

Subsystem NETWork:IDENtity

The subsystem *NETWork:IDENtity* sets parameters of the mobile radio network that the CMU transfers to the UE under test. The subsystem corresponds to the *Network Identity* section in the *Network* tab of the *Connection Control* menu.

CONFigure:NETWork:IDENtity:MCC <*Code*> MCC

<*Code*>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 999	Mobile Country Code	001	–	V3.15

Description of command	Sig. State
This command defines the 3-digit Mobile Country Code.	SOFF, SON Q: all

CONFigure:NETWork:IDENtity:MNC <*Code*>				MNC
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 99 | **0 to 999**	2-digit Mobile Network Code 3-digit Mobile Network Code	01	–	V3.15 V3.50
Description of command				Sig. State
This command defines the 2 or 3-digit Mobile Network Code, see `CONFigure:NETWork:IDENtity:MNC:DIGits`.				SOFF, SON Q: all

CONFigure:NETWork:IDENtity:MNC:DIGits <*Code*>				MNC: No. of Digits
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
TWO | THR	2 or 3-digit Mobile Network Code	01	–	V3.50
Description of command				Sig. State
This command defines the number of digits of the Mobile Network Code, see `CONFigure:NETWork:IDENtity:MNC`. If `TWO` is set while a three-digit MNC is active, then the MNC is reset to the default value 01.				SOFF, SON Q: all

CONFigure:NETWork:IDENtity:LAC <*Code*>				LAC
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 65533 and 65535	Location Area Code	1	–	V3.15
Description of command				Sig. State
This command defines the Location Area Code.				SOFF, SON Q: all

CONFigure:NETWork:IDENtity:URA *<ID>*				URA Identity
<ID>	Description of parameters	Def. value	Def. unit	FW vers.
<16-digit binary>	UTRAN Registration Area Identity	0000 0000 0000 0001	–	V3.15
Description of command				Sig. State
This command sets the 16-digit URA identity transmitted to the UE for random access.				SOFF SON REG

CONFigure:NETWork:IDENtity:CELL *<ID>*				URA Identity
<ID>	Description of parameters	Def. value	Def. unit	FW vers.
<28-digit binary>	Cell ID	0000 0000 0000 0000 0000 0000 0001	–	V4.10
Description of command				Sig. State
This command sets the 28-bit cell identity transmitted to the UE.				SOFF SON REG

CONFigure:NETWork:IDENtity:IMSI <*Code*>		IMSI (Default)		
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
000000000000000 to 999999999999999	International Mobile Subscriber Identity (default))	001010123456063*)	–	V3.80
Description of command				Sig. State
This command defines the 15-digit default IMSI that the R&S CMU can use before the UE is registered. *) Replaced by 001010123456789 while *Use 2G SIM* is enabled (`CONFigure:NETWork:REQuest:S2G ON`).				SOFF, SON Q: all

DEFault:NETWork:IDENtity				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.15
Description of command				Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				all

Subsystem NETWork:RAC... (Random Access Settings)

The subsystem *NETWork:RAC...* sets the parameters required for initiating a physical random access procedure of the UE. It corresponds to the *Random Access Settings* section in the *Network* tab of the popup menu *Connection Control*.

CONFigure:NETWork:RAC:TTI <*Interval*>				RACH TTI
<Interval>	Description of parameters	Def. value	Def. unit	FW vers.
T10 | T20	10 ms or 20 ms TTI	T10	–	V3.15
Description of command				Sig. State
This command selects one of the two RACH Transmission Time Intervals allowed in FDD systems.				SOFF, SON REG

CONFigure:NETWork:RAC:PREamble:MCYCles <*Cycles*>				Max. Preamble Cycles
<Cycles>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 32	Maximum number of preamble cycles	2	–	V3.15
Description of command				Sig. State
This command defines the maximum number of times the preamble cycle is repeated.				SOFF, SON REG

CONFigure:NETWork:RAC:PREamble:SSIZe <*Step*>				Step Size
<Step>	Description of parameters	Def. value	Def. unit	FW vers.
1 dB to 8 dB	Step size	3	dB	V3.15
Description of command				Sig. State
This command defines the transmit power difference between two consecutive preambles.				SOFF SON REG

CONFigure:NETWork:RAC:PREamble:TAICh <*Step*>				AICH Transmission Timing
<Step>	Description of parameters	Def. value	Def. unit	FW vers.
3 | 4	AICH transmission timing	3	(slots)	V3.15
Description of command				Sig. State
This command defines the minimum time delay between two consecutive preambles.				SOFF SON REG

CONFigure:NETWork:RAC:PREamble:MRETrans <*Step*>				Max. Retransmission
<Step>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 64	Max. no. of retransmissions	6	–	V3.15
Description of command				Sig. State
This command defines the max. number of preambles to be transmitted before a single preamble cycle is terminated.				SOFF SON REG

CONFigure:NETWork:RAC:PREamble:POFFset <*Step*>				RACH Msg. Part Power Offset
<Step>	Description of parameters	Def. value	Def. unit	FW vers.
–5 dB to +10 dB	RACH message part power offset	–5	dB	V3.15
Description of command				Sig. State
This command defines the power difference between the last preamble transmitted and the RACH message part.				SOFF SON REG

CONFigure:NETWork:RAC:DRXCycle <*Length*>				DRX Cycle Length
<Length>	Description of parameters	Def. value	Def. unit	FW vers.
6 to 9	Cycle Length, 2^6 to 2^9 frames (640 ms to 5.12 s)	8	2^n frames	V3.15
Description of command				Sig. State
This command defines the length of a Discontinuous Reception (DRX) cycle where the UE needs only to monitor one Page Indicator in one Paging Occasion.				SOFF, SON Q: all

CONFigure:NETWork:RAC:PREamble:ACK <*Mode*>				AICH Acknowledge
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
POS | NEG | OFF	Positive or negative acknowledgement No acknowledgement	POS	–	V3.60 V4.34
Description of command				Sig. State
This command defines how the CMU acknowledges PRACH preambles received from the UE.				SOFF SON REG

CONFigure:NETWork:RAC:PREamble:SUBChannel <*Channels*>				Available Subchannels
<Channels>	Description of parameters	Def. value	Def. unit	FW vers.
'<12-digit binary>'	Available subchannels	'000000000001'	–	V3.60
Description of command				Sig. State
This command defines the available subchannels associated with the PRACH. The value must be transferred as a string.				SOFF SON REG

CONFigure:NETWork:RAC:PREamble:SIGNature <*Signature*>				Available Signatures
<Signature>	Description of parameters	Def. value	Def. unit	FW vers.
'<16-digit binary>'	Available signatures	'1111111111111111'	–	V3.60
Description of command				Sig. State
This command defines the available signatures associated with the PRACH. The value must be transferred as a string.				SOFF SON REG

CONFigure:NETWork:RAC:PREamble:SINDex <*Mode*>				Available Signature – Index Select
<Signature>	Description of parameters	Def. value	Def. unit	FW vers.
ALL | FIRS	Use all Use first index only	ALL	–	V4.51
Description of command				Sig. State
This command defines whether the UE can use the full signature or the first index only.				SOFF SON REG

Subsystem NETWork:REQuest (Requested UE Data)

The subsystem *NETWork:REQuest* defines which UE data are requested and transferred to the CMU during registration and how registration is performed. It corresponds to the *Requested UE Data* section in the *Network* tab of the popup menu *Connection Control*. Disabling the check of UE data accelerates the registration process.

Note: *All* NETWork:REQuest... *settings can still be changed in the* REG *signalling state. They remain valid for the next registration(s).*

CONFigure:NETWork:REQuest:ADETach <*Enable*> Attach/Detach

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable attach/detach Disable attach/detach	ON	–	V3.85

Description of command	Sig. State
This command enables or disables the registration procedure. If registration is disabled, the UE will listen to paging messages as soon as it has detected the R&S CMU's UTRAN cell.	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:ACAPability <*Enable*> UE Radio Access Capability

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable request of radio access capability Disable request of radio access capability	ON	–	V3.15

Description of command	Sig. State
This command qualifies whether or not the CMU requests the UE's radio access capability.	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:IMEI <*Enable*> IMEI

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable request of IMEI Disable request of IMEI	OFF	–	V3.15

Description of command	Sig. State
This command qualifies whether or not the CMU requests the UE's International Mobile station Equipment Identity.	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:SRBReconfig <*Enable*> SRB Reconfiguration

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable SRB reconfiguration Disable SRB reconfiguration	OFF	–	V3.85

Description of command	Sig. State
This command enables or disables fast registration, connection setup, and connection release using a 13.6 kbps SRB.	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:RLCReestab ***<Enable>*** RLC Reestablish

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable RLC reestablish Disable RLC reestablish	ON	–	V3.85

Description of command	Sig. State
This command enables or disables the RLC re-establish procedure associated with a *SRB Reconfiguration* (`CONFigure:NETWork:REQuest:SRBReconfig ON`).	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:AUTHenticat ***<Enable>*** Authentication

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable authentication during registration Disable authentication during registration	ON	–	V3.40

Description of command	Sig. State
This command switches the authentication procedure during registration on or off. If authentication is enabled, the *Security* mode can be activated in addition; see `CONFigure:NETWork:REQuest:SECurity`.	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:SECurity ***<Enable>*** Security

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable security mode Disable security mode	ON	–	V3.40

Description of command	Sig. State
This command switches the security mode during authentication on or off. Security is always disabled if authentication is switched off; see `CONFigure:NETWork:REQuest:AUTHenticat`.	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:SKEY ***<Part 1>, <Part 2>*** Secret Key K

<Part_1>	Description of parameters	Def. value	Def. unit	FW vers.
"0000000000000000" to "FFFFFFFFFFFFFFFF",	First part of Secret Key K (string parameter)	"0001020304050607"	–	V3.50
<Part_2>	Description of parameters	Def. value	Def. unit	FW vers.
"0000000000000000" to "FFFFFFFFFFFFFFFF"	Second part of Secret Key K (string parameter)	"08090A0B0C0D0E0F"	–	V3.50

Description of command	Sig. State
This command defines the Secret Key K used for the authentication procedure including a possible integrity check. The value is ignored if authentication is switched off; see `CONFigure:NETWork:REQuest:AUTHenticat`.	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:OPC ***<Part 1>, <Part 2>*** OP_C

<Part_1>	Description of parameters	Def. value	Def. unit	FW vers.
"0000000000000000" to "FFFFFFFFFFFFFFFF",	First part of OP_C (string parameter)	"0000000000000000"	–	V5.10
<Part_2>	Description of parameters	Def. value	Def. unit	FW vers.
"0000000000000000" to "FFFFFFFFFFFFFFFF"	Second part of OP_C (string parameter)	"0000000000000000"	–	V5.10

Description of command	Sig. State
This command defines the OP_C variable used for the MILENAGE authentication procedure including a possible integrity check. The value is ignored if MILENAGE authentication is switched off; see `CONFigure:NETWork:REQuest:MILenage`.	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:MILenage ***<Enable>*** Use Milenage

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable MILENAGE authentication during registration Disable MILENAGE authentication during registration	OFF	–	V5.10

Description of command	Sig. State
This command switches the MILENAGE authentication procedure during registration on or off.	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:S2G ***<Enable>*** Use 2G SIM

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable registration with a 2G SIM Registration with a 3G USIM	OFF	–	V4.51

Description of command	Sig. State
This command enables registration of the WCDMA UE with a 2G SIM card. With firmware version V5.01 and later versions, it also overwrites the default IMSI (`CONFigure:NETWork:IDENtity:IMSI`).	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:RRCC ***<Enable>*** Keep RRC Connection

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Keep RRC connection after registration Release RRC connection after registration	OFF	–	V3.50

Description of command	Sig. State
This command qualifies whether or not an RRC connection set up during registration is released after the registration is terminated.	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:SRAB *<Enable>* Skip RAB Release

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Skip RAB release (no release while connection is set up) Do not skip RAB release	ON	–	V3.80

Description of command — Sig. State

This command enables or disables the RAB release while the connection is set up. In the default setting *(Skip RAB Release: On),* the connection setup procedure is accelerated by up to 2 s.

Sig. State: SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:RRAB *<Enable>* Release after RAB Reconfig. Failure

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Release connection after RAB reconfiguration failure Maintain connection	ON	–	V4.30

Description of command — Sig. State

This command enables or disables the release of the connection in case that an attempted reconfiguration of a RAB or physical channel (e.g. change of gain factors, HSDPA settings,…) during the connection failed. Bit no. 9 in the status reporting system indicates a RAB reconfiguration failure. If the connection is maintained to save time, it is essential to monitor this bit in order to avoid misleading measurement results.

Sig. State: SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:ATOFfset *<Frames>* Activation Time Offset

<Frames>	Description of parameters	Def. value	Def. unit	FW vers.
5 to 50 | IMMediate	Activation time offset, integer no. of frames times 8 No time offset, immediate	20	(8 frames)	V4.20

Description of command — Sig. State

This command defines the delay used by the RRC for the calculation of the activation time in peer messages.

Sig. State: SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:HACTime *<Frames>* Handover Activation Time

<Frames>	Description of parameters	Def. value	Def. unit	FW vers.
5 to 50	HO activation time, integer no. of frames times 8	15	(8 frames)	V3.50

Description of command — Sig. State

This command defines the delay time (number of WCDMA frames with a duration of 10 ms) before the UE, after receiving a HANDOVER COMMAND from the CMU, initiates the WCDMD to GSM handover.

Sig. State: SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:TTIMeout ***<Frames>*** T3212 Timeout

<Frames>	Description of parameters	Def. value	Def. unit	FW vers.
0 **1 to 255**	No periodic registration performed Value of T3212 timer	1	(decihours)	V3.60

Description of command	Sig. State
This command sets the value of the timer T3212 for the periodic location updating procedure. The unit decihours corresponds to 6 minutes or 360 seconds.	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:T31Timeout ***<Duration>*** T313 Timeout

<Duration>	Description of parameters	Def. value	Def. unit	FW vers.
0 s to 15 s	T313 timeout	3	s	V3.80

Description of command	Sig. State
This command specifies how long the UE maintains the connection if it receives no signal from the R&S CMU.	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:N31Sync ***<Indicators>*** N313

<Indicators>	Description of parameters	Def. value	Def. unit	FW vers.
1 | 2 | 4 | 10 | 20 | 50 | 100 | 200	N313	20	–	V4.30

Description of command	Sig. State
This command specifies the maximum number of successive "out of sync" indications received from L1 before the UE considers a connection release.	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:OSTimeout ***<Duration>*** Out of Sync Timeout

<Duration>	Description of parameters	Def. value	Def. unit	FW vers.
2 s to 30 s	Out of sync timeout	4	s	V3.80

Description of command	Sig. State
This command specifies how long the R&S CMU maintains the connection if it receives no signal from the UE. The *Out of Sync Timeout* must be shorter than the *Paging Timeout* (`CONFigure:NETWork:REQuest:PTIMeout`)*;* inconsistent settings are auto-corrected.	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:PTIMeout ***<Duration>*** Paging Timeout

<Duration>	Description of parameters	Def. value	Def. unit	FW vers.
2 s to 30 s | **OFF**	Paging timeout No timeout (paging for a practically unlimited period of time)	20	s	V3.80 V5.20A

Description of command	Sig. State
This command specifies the maximum duration of the paging process. The *Paging Timeout* must be larger than the *Out of Sync Timeout* (`CONFigure:NETWork:REQuest:OSTimeout`)*;* inconsistent settings are auto-corrected.	SOFF, SON, REG Q: all

DEFault:NETWork:REQuest			Default Settings	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.40
Description of command				Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the sub-system to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				SOFF, SON, REG Q: all

Subsystem NETWork:CRINfo (Cell Reselection Information)

The subsystem *NETWork:CRINfo* defines the cell reselection parameters that the R&S CMU transmits in its system information blocks SIB3 and SIB11. It corresponds to the *WCDMA/GSM Neighbor Cell List* sections in the *Network* tab of the popup menu *Connection Control*.

CONFigure:NETWork:CRINfo:QH2S *<Hysteresis>*			CPICH E_c/N_0 Qhyst2s	
<Hysteresis>	Description of parameters	Def. value	Def. unit	FW vers.
0 dB to 20 dB | OFF	Hysteresis value (integer value) Do not transmit value	0	dB	V5.01
Description of command				Sig. State
This command defines a hysteresis value, to be used for FDD cells if the quality measure for cell selection and reselection is set to CPICH Ec/No. Transmission of the hysteresis value is optional. The entered integer dB value is multiplied by 2.				SOFF, SON, REG Q: all

CONFigure:NETWork:CRINfo:INTRasearch *<Threshold>*			$S_{intrasearch}$	
<Threshold>	Description of parameters	Def. value	Def. unit	FW vers.
–16 dB to +10 dB | OFF	$S_{intrasearch}$ Do not transmit value	–16	dB	V5.01
Description of command				Sig. State
This command defines a threshold for intra frequency measurements and for the Hierarchical Cell Structure (HCS) measurement rules. Transmission of the threshold value is optional. The entered integer dB value is multiplied by 2.				SOFF, SON, REG Q: all

CONFigure:NETWork:CRINfo:INTersearch *<Threshold>*			$S_{intrasearch}$	
<Threshold>	Description of parameters	Def. value	Def. unit	FW vers.
–16 dB to +10 dB | OFF	$S_{intersearch}$ Do not transmit value	–16	dB	V5.01
Description of command				Sig. State
This command defines a threshold (in dB) for for inter-frequency measurements and for the HCS measurement rules. Transmission of the threshold value is optional. The entered integer dB value is multiplied by 2.				SOFF, SON, REG Q: all

CONFigure:NETWork:CRINfo:SHCS ***<Threshold>***				$S_{searchHCS}$
<Threshold>	Description of parameters	Def. value	Def. unit	FW vers.
–53 dB to +45 dB | OFF	$S_{searchHCS}$ Do not transmit value	OFF	dB	V5.01
Description of command				Sig. State
This command defines the limit for the cell reselection RX level value Srxlev in the serving cell. Transmission of the threshold value is optional. The entered integer dB value is multiplied by 2.				SOFF, SON, REG Q: all

CONFigure:NETWork:CRINfo:QQUalmin ***<Threshold>***				Qqualmin
<Threshold>	Description of parameters	Def. value	Def. unit	FW vers.
–24 dB to 0 dB	Qqualmin	–24	dB	V5.01
Description of command				Sig. State
Minimum required quality level in the cell. The entered integer dB value is multiplied by 2.				SOFF, SON, REG Q: all

CONFigure:NETWork:CRINfo:QRXLevmin ***<Threshold>***				Qrxlevelmin
<Threshold>	Description of parameters	Def. value	Def. unit	FW vers.
–58 dBm to –13 dBm	Qrxlevelmin	–58	dBm	V5.01
Description of command				Sig. State
Minimum required RX level in the cell. The entered integer dBm value is multiplied by 2 and 1 dB is added (resulting in an actual range of –115 dBm to –25 dBm).				SOFF, SON, REG Q: all

CONFigure:NETWork:CRINfo:T33Timeout ***<Timeout>***				T3312 Timeout
<Timeout>	Description of parameters	Def. value	Def. unit	FW vers.
0 | **1 to 31 (*2 s)**	No routing area update Timer value	0	2 s	V5.02
Description of command				Sig. State
This command defines the value of timer T3312.				≠CEST

CONFigure:NETWork:CRINfo:TRESelection ***<Timer>***				Reselection Timer
<Timer>	Description of parameters	Def. value	Def. unit	FW vers.
0 | **1 to 31**	No cell reselection Timer value	0	–	V5.02
Description of command				Sig. State
This command defines the value of the reselection timer.				≠CEST

Subsystem NETWork:NCELI (Neighbor Cell Lists)

The subsystem *NETWork:NCELI* defines the neighbor cell lists that the R&S CMU broadcasts to the registered UE. It corresponds to the *WCDMA/GSM Neighbor Cell List* sections in the *Network* tab of the popup menu *Connection Control*.

CONFigure:NETWork:NCELI:WCDMA:INTRa<nr> *<SC>, <Enable>*			WCDMA Intra Neighbor Cell List	
<SC>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 1FF	Primary scrambling code of neighbor cell <nr>	9	–	V3.60
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Broadcast neighbor cell <nr> Do not include neighbor cell <nr> in the neighbor cell list	<nr> = 1: ON <nr> > 1: OFF	–	V3.60
Description of command				Sig. State
These commands define a list of up to 32 WCDMA intra neighbor cells (<nr> = 1 to 32). A maximum of 18 neighbor cells can be enabled simultaneously.				SOFF, SON, REG Q: all

CONFigure:NETWork:NCELI:WCDMA:INTer<nr> **<*Channel*>, <*SC*>, <*Enable*>**			WCDMA Inter Neighbor Cell List	
<Channel>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 16383	RF Channel of neighbor cell <nr>	10562	–	V3.60
<SC>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 1FF	Primary scrambling code of neighbor cell <nr>	9	–	V3.60
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Broadcast neighbor cell <nr> Do not include neighbor cell <nr> in the neighbor cell list	OFF	–	V3.60
Description of command				Sig. State
These commands define a list of up to 32 WCDMA inter neighbor cells (<nr> = 1 to 32).). A maximum of 18 neighbor cells can be enabled simultaneously.				SOFF, SON, REG Q: all

CONFigure:NETWork:NCELI:GSM<nr> GSM Neighbor Cell List
<Channel>, <NCC>, <BCC>, <Band_Ind>, <Enable>

<Channel>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 1023	RF Channel of neighbor cell <nr>	36	–	V3.60
<NCC>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7	NCC of neighbor cell <nr>	0	–	V3.60
<BCC>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7	BCC of neighbor cell <nr>	0	–	V3.60
<Band_Ind>	Description of parameters	Def. value	Def. unit	FW vers.
G18 | G19	Band indicator for GSM1800 or GSM1900	G18	–	V3.60
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Broadcast neighbor cell <nr> Do not include neighbor cell <nr> in the neighbor cell list	OFF	–	V3.60

Description of command	Sig. State
These commands define a list of up to 32 GSM neighbor cells (<nr> = 1 to 32).). A maximum of 18 neighbor cells can be enabled simultaneously.	SOFF, SON, REG Q: all

CONFigure:NETWork:NCELI:GSM:CRINfo:ENABle *<Enable>* *Enable Cell Reselection Information*

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable transfer of Qoffset $1_{s,n}$ and Qrxlevelmin values	OFF	–	V5.01

Description of command	Sig. State
This command qualifies whether or not the R&S CMU transmits the cell reselection parameters *Qoffset* $1_{s,n}$ and *Qrxlevelmin* to the UE; see commands below.	SOFF, SON, REG Q: all

CONFigure:NETWork:NCELI:GSM:CRINfo:QO1Sn *<Offset>* Qoffset $1_{s,n}$

<Offset>	Description of parameters	Def. value	Def. unit	FW vers.
–50 dB to +50 dB	Qqualmin	0	dB	V5.01

Description of command	Sig. State
This command defines the level offset between two cells. The entered integer dB value is multiplied by 2.	SOFF, SON, REG Q: all

CONFigure:NETWork:NCELI:GSM:CRINfo:QRXLevmin *<Threshold>* Qrxlevelmin

<Threshold>	Description of parameters	Def. value	Def. unit	FW vers.
–58 dBm to –13 dBm	Qrxlevelmin	–58	dBm	V5.01

Description of command	Sig. State
Minimum required RX level in the cell. The entered integer dBm value is multiplied by 2 and 1 dB is added (resulting in an actual range of –115 dBm to –25 dBm).	SOFF, SON, REG Q: all

Commands for Input and Output Connectors

The commands in this section configure the input and output connectors. They correspond to the tab *RF* in the popup menu *Connect. Control*.

INPut[:STATe] <*State*> — RF Input

<State>	Description of parameters	Def. value	Def. unit	FW vers.
RF1 **RF2** **RF4**	Connector RF1 used as input Connector RF2 used as input Connector RF4 IN used as input	RF2	–	V3.15

Description of command — Sig. State

This command determines the connector to be used for RF input signals. The bidirectional connectors RF1 and RF2 can be used both as input and output connectors in the same measurement (see `OUTPut[:STATe]`). Only one input and one output may be active at the same time, a new RF input setting overwrites the previous one. — all

OUTPut[:STATe] <*State*> — RF Output

<State>	Description of parameters	Def. value	Def. unit	FW vers.
RF1 **RF2** **RF3**	Connector RF1 used as output Connector RF2 used as output Connector RF3 OUT used as output	RF2	–	V3.15

Description of command — Sig. State

This command determines the connector to be used for RF output signals. The bidirectional connectors RF1 and RF2 can be used as input and output connectors in the same measurement (see `INPut[:STATe]`).

Only one input and one output may be active at the same time, a new RF output setting overwrites the previous one. — all

[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude] <*Attenuation* >
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude] <*Attenuation* > — Ext. Att. Input

<Attenuation>	Description of parameters	Def. value	Def. unit	FW vers.
–50 dB to +50 dB	Ext. attenuation at RF <nr>, where <nr> = 1,2,4	0	dB	V3.15

Description of command — Sig. State

This command assigns an external attenuation value to one of the inputs defined before (see command `INPut:STATe)`. — all

[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude] <*Attenuation*>
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude] <*Attenuation*> — Ext. Att. Output

<Attenuation>	Description of parameters	Def. value	Def. unit	FW vers.
–50 dB to +50 dB	Ext. attenuation at RF <nr>, where <nr> = 1,2,3	0	dB	V3.15

Description of command — Sig. State

This command assigns an external attenuation value to one of the outputs defined before (see command `OUTPut:STATe`). — all

ROUTe:SPENcoder[:INPut] <*Source*>				Speech Encoder
<Source>	Description of parameters	Def. value	Def. unit	FW vers.
HANDset | **GENerator**	Handset is used as source AF generator is used as source	HAND	–	V3.50
Description of command				Sig. State
This command determines the input source that feeds the CMU speech encoder (option CMU-B52).				all

ROUTe:SPDecoder[:OUTPut] <*Destination*>				Speech Decoder
<Destination>	Description of parameters	Def. value	Def. unit	FW vers.
HANDset | **ANALyzer |** **ANA2 |** **ABOTh**	Speech decoder output routed to the handset Speech dec. output routed to primary AF analyzer Speech dec. output routed to secondary AF analyzer Speech dec. output routed to both AF analyzers	HAND	–	V3.50
Description of command				Sig. State
This command routes the CMU speech decoder output (option CMU-B52).				all

Subsystem DM:CLOCk (Synchronization)

The subsystem *DM:CLOCk* sets a system clock specific to the network. This frequency is set in the tab *Synch.* in the popup menu *Connect. Control*.

SOURce:DM:CLOCk:STATe <*Mode*>				REF OUT 2 on/off
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Switching the system clock frequency on/off	OFF	–	V3.15
Description of command				Sig. State
This command switches the system clock frequency at output *REF OUT 2* on or off.				all

SOURce:DM:CLOCk:FREQuency <*Frequency*>				REF OUT 2
<Frequency>	Description of parameters	Def. value	Def. unit	FW vers.
0.960 MHz to 30.720 MHz	System clock frequency	30.720	MHz	V3.15
Description of command				Sig. State
This command determines the system clock frequency applied to *REF OUT 2*. The frequency entered is internally rounded to one of the following discrete values: 0.960 0.991 1.024 1.059 1.097 1.138 1.181 1.229 1.280 1.335 1.396 1.463 1.536 1.617 1.706 1.807 1.920 2.048 2.194 2.363 2.560 2.793 3.072 3.413 3.840 4.388 5.120 6.144 7.680 10.240 15.360 30.720				all

Subsystem TRIGger (Trigger Mode)

The subsystem *TRIGger* defines the trigger mode. It corresponds to the *Trigger* tab of the *Connection Control* menu.

TRIGger[:SEQuence]:SOURce <*Source*> Source

<*Source*>	Description of parameters	Def. value	Def. unit	FW vers.
FRUN |	Trigger by measured timing of the analyzed input signal	SIGN	–	V3.15
EXTern |	External trigger signal via AUX3			
IFPower |	Narrow-band IF power trigger			
SIGNalling |	Internal trigger signal provided by RF generator			
SLOT	UL slot trigger			V3.80
FRAMe |	UL frame trigger			
TPC |	Trigger at the beginning of each TPC pattern			
AUTO |	Automatic trigger selection according to the meas. application			
PRE |	Preamble trigger			
PMP |	PRACH message part			
HSDPcch |	HS-DPCCH trigger			
CMODe |	Compressed mode trigger			
CTFC	Change of TFC			

Description of command

This command selects the source of the trigger event.

TRIGger[:SEQuence]:DELay <*Slot_Delay*>, <*Delay_Offset*> Slot Delay, Delay Offset

<*Slots*>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 14,	No. of slots between trigger time and measurement	0	(slots)	V3.15
–2559.75 to +2559.75	No of chips between trigger time and measurement (in multiples of ¼ chip periods)	0	(chips)	

Description of command	Sig. State
This command defines a delay time (integer number of slots plus additional delay offset) between the trigger time and the start of the measurement. The settings are ignored for free-run measurements (see command `TRIGger[:SEQuence]:SOURce`).	all

TRIGger[:SEQuence]:THReshold:IFPower <*Threshold*> Level – IF Power

<*Threshold*>	Parameter description	Def. value	Default unit	FW vers.
–47 dB to 0 dB	IF power threshold	–26	dB	V3.50

Description of command	Sig. State
This command sets the IF signal level at which the measurement is triggered. The IF power threshold is defined relative to the maximum RF input level; see `[SENSe:]LEVel:MAXimum`. The setting has effect for trigger source `IFPower` only (see `TRIG:SEQ:SOUR`).	all

TRIGger[:SEQuence]:SLOPe <*Slope*>				Slope
<Slope>	Parameter description	Def. value	Default unit	FW vers.
POSitive | NEGative	Rising edge Falling edge	POS	–	V3.50
Description of command				Sig. State
This command qualifies whether the trigger event occurs on the *Rising Edge* or on the *Falling Edge* of the trigger signal. The setting has no influence on *Free Run* measurements (see `TRIG:SEQ:SOUR`).				all

TRIGger[:SEQuence]:HOFF <*Holdoff*>				Holdoff
<Slots>	Description of parameters	Def. value	Def. unit	FW vers.
1 µs to 50 µs | OFF	Holdoff time (in 1 µs steps) No trigger holdoff	OFF	µs	V4.20
Description of command				
This command defines a holdoff time (in µs) after each trigger event during which the trigger system is locked so that the R&S generates no further trigger events. The setting is effective for *IF Power* or *External* trigger source (see command `TRIGger[:SEQuence]:SOURce`).				

DEFault:TRIGger[:SEQuence]				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.15
Description of command				Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				all

Subsystem LEVel (Input Level)

The subsystem *LEVel* controls the level in the RF input signal path. It corresponds to the table section *Analyzer Level* in the *UE Signal* tab of the *Connection Control* menu.

[SENSe:]LEVel:MODE <*Mode*>				Input Level – Mode
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
MANual | AUTomatic	Manual setting of max. input level Automatic setting corresponding to average power of signal applied	AUTomatic	–	V3.15
Description of command				Sig. State
This command defines the mode for setting the maximum input level.				all

[SENSe:]LEVel:MAXimum <*Level*>				Max. Level
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–0 dBm to +53 dBm **+14 dBm to +39 dBm** **–37 dBm to 0 dBm**	Maximum input level for RF1 Maximum input level for RF2 Maximum input level for RF 4 IN	+30.0 +30.0 0.0	dBm dBm dBm	V3.15
Description of command				Sig. State
This command defines the maximum input level. The value range depends on the RF input used and the external attenuation set (see command `[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]`).				all

[SENSe:]LEVel:ATTenuation <*Mode*>				Attenuation
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
NORMal | **LNOise |** **LDIStortion**	Mixer level in normal range Low noise (mixer level 10 dB higher than in normal setting) Low distortion (mixer level 10 dB lower than in normal setting)	LNOise	–	V3.15
Description of command				Sig. State
This command tunes the RF analyzer for normal setting, low noise level (full dynamic range), or low distortion (high intermodulation spacing).				all

DEFault:LEVel <*Enable*>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	All parameters are set to their default values All or some parameters differ from the default values	ON	–	V3.15
Description of command				Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				all

Subsystem MMONitor (Message Monitor)

The subsystem *MMONitor* defines the address information necessary for connecting the *WCDMA Message Analyzer* installed on a PC to the CMU. It corresponds to the *Message Monitor* section in the *Misc.* tab of the *Connection Control* menu.

CONFigure:MMONitor:LOGGing <*Enable*>				Logging
Enable	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Logging enabled Logging disabled	OFF	–	V3.40
Description of command				Sig. State
This command enables *(On)* or disables message logging.				SOFF, SON

CONFigure:MMONitor:IPADdress ***<IP Address 1>*, *<IP Address 2>*, *<IP Address 3>*, *<IP Address 4>***				IP Address
<IP Address 1>	Description of parameters	Def. value	Def. unit	
0 to 255,	First segment of IP address	192	–	
<IP Address 2>	Description of parameters	Def. value	Def. unit	
0 to 255,	Second segment of IP address	168	–	
<IP Address 3>	Description of parameters	Def. value	Def. unit	
0 to 255,	Third segment of IP address	0	–	
<IP Address 4>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 255	Fourth segment of IP address	2	–	V3.40
Description of command				Sig. State
This command sets the IP address of the CMU (equivalent to the base system command `YSTem:TCPip:PRIMary:STATic:IPADdress`).				SOFF, SON

CONFigure:MMONitor:SMASk ***<Subnet Mask 1>*, *<Subnet Mask 2>*, *<Subnet Mask 3>*, *<Subnet Mask 4>***				Subnet Mask
<Subnet Mask 1>	Description of parameters	Def. value	Def. unit	
0 to 255,	First segment of Subnet Mask	255	–	
<Subnet Mask 2>	Description of parameters	Def. value	Def. unit	
0 to 255,	Second segment of Subnet Mask	255	–	
<Subnet Mask 3>	Description of parameters	Def. value	Def. unit	
0 to 255,	Third segment of Subnet Mask	255	–	
<Subnet Mask 4>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 255	Fourth segment of Subnet Mask	0	–	V3.40
Description of command				Sig. State
This command sets the Subnet Mask of the CMU (equivalent to the base system command `YSTem:TCPip:PRIMary:STATic:SMASk`).				SOFF, SON

CONFigure:MMONitor:HOST ***<IP Address 1>*, *<IP Address 2>*, *<IP Address 3>*, *<IP Address 4>***			Host Address	
<IP Address 1>	Description of parameters	Def. value	Def. unit	
0 to 255,	First segment of IP address	192	–	
<IP Address 2>	Description of parameters	Def. value	Def. unit	
0 to 255,	Second segment of IP address	168	–	
<IP Address 3>	Description of parameters	Def. value	Def. unit	
0 to 255,	Third segment of IP address	0	–	
<IP Address 4>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 255	Fourth segment of IP address	2	–	V3.40
Description of command				Sig. State
This command sets the IP address of the host PC.				SOFF, SON

Subsystem VIPaddress (Application Testing)

The subsystem *VIPaddress* defines the address information for *WCDMA Application Testing* (option R&S CMU-K96). It corresponds to the *Application Testing* section in the *Misc.* tab of the *Connection Control* menu.

CONFigure:ATESt:VIPaddress ***<IP Address 1>*, *<IP Address 2>*, *<IP Address 3>*, *<IP Address 4>***			IP Address	
<IP Address 1>	Description of parameters	Def. value	Def. unit	
0 to 255,	First segment of IP address	192	–	
<IP Address 2>	Description of parameters	Def. value	Def. unit	
0 to 255,	Second segment of IP address	168	–	
<IP Address 3>	Description of parameters	Def. value	Def. unit	
0 to 255,	Third segment of IP address	0	–	
<IP Address 4>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 255	Fourth segment of IP address	19	–	V3.80
Description of command				Sig. State
This command sets the virtual IP address of the CMU.				SOFF, SON

CONFigure:ATESt:UEIPaddress *<IP Address 1>*, *<IP Address 2>*, *<IP Address 3>*, *<IP Address 4>*			IP Address	
<IP Address 1>	Description of parameters	Def. value	Def. unit	
0 to 255,	First segment of IP address	192	–	
<IP Address 2>	Description of parameters	Def. value	Def. unit	
0 to 255,	Second segment of IP address	168	–	
<IP Address 3>	Description of parameters	Def. value	Def. unit	
0 to 255,	Third segment of IP address	0	–	
<IP Address 4>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 255	Fourth segment of IP address	20	–	V3.80
Description of command				Sig. State
This command sets the IP address of the UE.				SOFF, SON

CONFigure:ATESt:DNS:PRIPaddress:ENABle *<Enable>*			Primary DNS IP Address Enable	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable primary DNS server address	OFF	–	V4.52
Description of command				Sig. State
This command enables the primary DNS server address for virtual testing.				SOFF, SON, REG/ATT

CONFigure:ATESt:DNS:PRIPaddress *<IP Address 1>*, *<IP Address 2>*, *<IP Address 3>*, *<IP Address 4>*			Primary DNS IP Address	
<IP Address 1>	Description of parameters	Def. value	Def. unit	
0 to 255,	First segment of IP address	192	–	
<IP Address 2>	Description of parameters	Def. value	Def. unit	
0 to 255,	Second segment of IP address	168	–	
<IP Address 3>	Description of parameters	Def. value	Def. unit	
0 to 255,	Third segment of IP address	168	–	
<IP Address 4>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 255	Fourth segment of IP address	169	–	V4.52
Description of command				Sig. State
This command sets the primary DNS server address for virtual testing.				SOFF, SON, REG/ATT

CONFigure:ATESt:DNS:SEIPaddress:ENABle *<Enable>*			Secondary DNS IP Address Enable	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable secondary DNS server address	OFF	–	V4.52
Description of command				Sig. State
This command enables the secondary DNS server address for virtual testing. To enable the secondary address, the primary DNS server address must be enabled first `CONFigure:ATESt:DNS:PRIPaddress:ENABle ON`. (				SOFF, SON, REG/ATT

CONFigure:ATESt:DNS:SEIPaddress *<IP Address 1>*, *<IP Address 2>*, *<IP Address 3>*, *<IP Address 4>*			Secondary DNS IP Address	
<IP Address 1>	Description of parameters	Def. value	Def. unit	
0 to 255,	First segment of IP address	192	–	
<IP Address 2>	Description of parameters	Def. value	Def. unit	
0 to 255,	Second segment of IP address	168	–	
<IP Address 3>	Description of parameters	Def. value	Def. unit	
0 to 255,	Third segment of IP address	168	–	
<IP Address 4>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 255	Fourth segment of IP address	168	–	V4.52
Description of command				Sig. State
This command sets the secondary DNS server address for virtual testing.				SOFF, SON, REG/ATT

Subsystem WIZard (Measurement Wizard)

The following command starts the measurement wizard; see chapter 2.

PROCedure:WIZard:ACTion *<Type>*			Measurement Wizard	
<Type>	Description of parameters	Def. value	Def. unit	FW vers.
HDMax | **HUMax |** **HSMax |** **HDMSettings**	Enable *HSDPA Max. Throughput* wizard Enable *HSUPA Max. Throughput* wizard Enable *HSDPA/HSUPA Max. Throughput* wizard Enable HSDPA wizard	–	–	V4.52 V5.01
Description of command				Sig. State
This command starts the measurement wizard. (				PEST

.

Contents

7 Remote Control – Program examples 7.1

Transmit Power Control Tests 7.1

Power Setting in Uplink Compressed Mode 7.4

CDP vs. Time Measurement with HSDPA Channels 7.7

Speed Improvement for TPC Step Measurements 7.10

7 Remote Control – Program examples

The following sections contain program examples for typical measurement tasks. To keep the syntax as short and simple as possible, the programs were written with the aid of *Winbatch*, a batch job tool organizing and simplifying the transfer of commands and data between the controller and the instrument.

In *Winbatch,* a definite secondary address is assigned to each function group and test mode. With a secondary address <n>, a complete command line reads:

```
CMUBASE: <n>;<CMU_Command>
```

where <CMU_Command> may be any of the commands (setting commands or queries) specified within the function group and mode identified by the secondary address <n>. Program sequences consisting of commands that are defined in several function groups and modes can be re-used with an exchanged secondary address.

In addition to these data transfer commands, *Winbatch* provides *WHILE, GOTO*, and *IF* statements to express conditions and define loops. With the statement

```
WHILE CMUBASE: 2;SIGN:STAT? <> REG
```

the instrument waits until it has reached the signalling state *Registered* before it executes the following commands.

For a C program assigning secondary addresses refer to chapter 7 of the CMU200 manual.

Transmit Power Control Tests

In the following example the CMU generates a sequence of Transmit Power Control commands in order to induce a power ramp of the UE transmitter output signal according to the conformance test specification 3GPP TS 34.121. The analogous test sequence in manual control is reported in Chapter 4, section *Downlink Signal (Connection Control – BS Signal).* To see which analyzer settings are necessary, it is recommended to carry out the measurement manually first. Before doing so and running the program, connect your UE to the RF 2 connector using a coax cable.

```
REM ************************************************************
REM  Instrument reset; general configurations and assignment of secondary addresses
REM ************************************************************

CMUBASE: *CLS;*OPC?
CMUBASE: *IDN?
CMUBASE: *OPT?
CMUBASE: *SEC 0
CMUBASE: SYST:NONV:DIS
CMUBASE: *CLS;*RST;*OPC?
CMUBASE: SYST:GTRM:COMP OFF
CMUBASE: TRAC:REM:MODE:DISP ON
CMUBASE: CONF:SYNC:FREQ:REF:MODE INT
CMUBASE: *CLS;SYST:REM:ADDR:SEC 1,"WCDMA19UEFDD_NSig"
CMUBASE: *STB?
CMUBASE: *CLS;SYST:REM:ADDR:SEC 2,"WCDMA19UEFDD_Sig"
CMUBASE: *STB?


REM ************************************************************
REM Select the input/output connector and set the path loss
REM ************************************************************
```

```
CMUBASE: 2;INP:STAT RF2
CMUBASE: 2;OUTP:STAT RF2
CMUBASE: 2;SENS:CORR:LOSS:INP2 0.5
CMUBASE: 2;SENS:CORR:LOSS:OUTP2 0.5

REM ************************************************************
REM  Call parameters
REM  The physical channel levels are chosen in accordance with Annex E of the
REM  conformance test specification 3 GPP TS 34.121 (see Chapter 4, section
REM  WCDMA Signal Levels for TX and RX Tests)
REM ************************************************************

CMUBASE: 2;CONF:NETW:OBAN OB1
CMUBASE: 2;CONF:BSS:DCH:TYPE RMC
CMUBASE: 2;CONF:BSS:DCH:RMC:RTYP 12.2
CMUBASE: 2;CONF:BSS:DCH:RMC:SDTC PR9
CMUBASE: 2;CONF:BSS:DCH:RMC:TMOD MODE2
CMUBASE: 2;CONF:BSS:DCH:RMC:UCRC OFF
CMUBASE: 2;CONF:BSS:DCH:SRAB:SRB K2_5
CMUBASE: 2;CONF:BSS:TPC:MODE ALG2
CMUBASE: 2;CONF:BSS:TPC:SSIZ 1
CMUBASE: 2;CONF:BSS:LREF OPOW
CMUBASE: 2;CONF:BSS:OPOW -50.60
CMUBASE: 2;CONF:BSS:PHYS:LEV:CPIC:PRIM -3.3
CMUBASE: 2;CONF:BSS:PHYS:LEV:SCH:PRIM -8.3
CMUBASE: 2;CONF:BSS:PHYS:LEV:SCH:SEC -8.3
CMUBASE: 2;CONF:BSS:PHYS:LEV:CCPC:PRIM -5.3
CMUBASE: 2;CONF:BSS:PHYS:LEV:CCPC:SEC -5.3
CMUBASE: 2;CONF:BSS:PHYS:LEV:PICH -8.3
CMUBASE: 2;CONF:BSS:PHYS:LEV:AICH -8.3
CMUBASE: 2;CONF:BSS:PHYS:LEV:DPDC -10.3
CMUBASE: 2;CONF:BSS:PHYS:CODE:DPDC 6
CMUBASE: 2;CONF:BSS:PHYS:DPCH:POFF 0.00
CMUBASE: 2;CONF:BSS:PHYS:CODE:DPDC 6
CMUBASE: 2;CONF:BSS:CHAN 10562 CH
CMUBASE: 2;CONF:BSS:SCOD:PRIM #H9
CMUBASE: 2;CONF:BSS:SCOD:SEC #H0
CMUBASE: 2;CONF:NETW:IDEN:MCC 1
CMUBASE: 2;CONF:NETW:IDEN:MNC 1
CMUBASE: 2;CONF:NETW:IDEN:LAC 1
CMUBASE: 2;CONF:NETW:REQ:SEC On
CMUBASE: 2;CONF:NETW:REQ:AUTH On
CMUBASE: 2;CONF:NETW:REQ:IMEI Off
CMUBASE: 2;CONF:UES:SCOD:SEC #H0
CMUBASE: 2;LEV:MODE AUT
CMUBASE: 2;CONF:BSS:TPC:PTYP CLOP
CMUBASE: 2;PROC:SIGN:ACT SON;*OPC?


REM ************************************************************
REM Wait for UE registration
REM ************************************************************

REPORT OFF
WHILE CMUBASE: 2;SIGN:STAT? <> REG
REPORT ON
CMUBASE: 2;SIGN:RITY?
CMUBASE: 2;SIGN:RID?
CMUBASE: 2;SENSE:SIGN:IMEI?

REM ************************************************************
```

```
REM Set up a MTC
REM ***********************************************************

CMUBASE: 2;PROC:SIGN:ACT CTM;*OPC?
REPORT OFF
WHILE CMUBASE: 2;SIGN:STAT? <> CEST
REPORT ON

REM ***********************************************************
REM Define the measurement statistics and the UE signal power
REM ***********************************************************

CMUBASE: 2;CONF:POW:XSL:CONT:REP SING,NONE,NONE

CMUBASE: 2;CONF:UES:PCON:TPOW:REF TPOW
CMUBASE: 2;CONF:UES:PCON:TPOW:VAL -10.0

REM ***********************************************************
REM Measure test steps A to H and query the results
REM ***********************************************************

FPRINT TESTPATTERN A
CMUBASE: 2;CONF:BSS:TPC:PSET TA
CMUBASE: 2;INIT:POW:XSL;*OPC?
CMUBASE: 2;CONF:BSS:TPC:RPAT ON
CMUBASE: 2;FETC:POW:XSL:ABS?
CMUBASE: 2;FETC:POW:XSL:DELT?

FPRINT TESTPATTERN B
CMUBASE: 2;CONF:BSS:TPC:PSET TB
CMUBASE: 2;INIT:POW:XSL;*OPC?
CMUBASE: 2;CONF:BSS:TPC:RPAT ON
CMUBASE: 2;FETC:POW:XSL:ABS?
CMUBASE: 2;FETC:POW:XSL:DELT?

FPRINT TESTPATTERN C
CMUBASE: 2;CONF:BSS:TPC:PSET TC
CMUBASE: 2;INIT:POW:XSL;*OPC?
CMUBASE: 2;CONF:BSS:TPC:RPAT ON
CMUBASE: 2;FETC:POW:XSL:ABS?
CMUBASE: 2;FETC:POW:XSL:DELT?

FPRINT TESTPATTERN D
CMUBASE: 2;CONF:BSS:TPC:PSET TD
CMUBASE: 2;INIT:POW:XSL;*OPC?
CMUBASE: 2;CONF:BSS:TPC:RPAT ON
CMUBASE: 2;FETC:POW:XSL:ABS?
CMUBASE: 2;FETC:POW:XSL:DELT?

FPRINT TESTPATTERN E
CMUBASE: 2;CONF:BSS:TPC:PSET TE
CMUBASE: 2;INIT:POW:XSL;*OPC?
CMUBASE: 2;CONF:BSS:TPC:RPAT ON
CMUBASE: 2;FETC:POW:XSL:ABS?
CMUBASE: 2;FETC:POW:XSL:DELT?

FPRINT TESTPATTERN F
CMUBASE: 2;CONF:BSS:TPC:PSET TF
CMUBASE: 2;INIT:POW:XSL;*OPC?
CMUBASE: 2;CONF:BSS:TPC:RPAT ON
CMUBASE: 2;FETC:POW:XSL:ABS?
CMUBASE: 2;FETC:POW:XSL:DELT?
```

```
FPRINT TESTPATTERN G
CMUBASE: 2;CONF:BSS:TPC:PSET TG
CMUBASE: 2;INIT:POW:XSL;*OPC?
CMUBASE: 2;CONF:BSS:TPC:RPAT ON
CMUBASE: 2;FETC:POW:XSL:ABS?
CMUBASE: 2;FETC:POW:XSL:DELT?

FPRINT TESTPATTERN H
CMUBASE: 2;CONF:BSS:TPC:PSET TH
CMUBASE: 2;INIT:POW:XSL;*OPC?
CMUBASE: 2;CONF:BSS:TPC:RPAT ON
CMUBASE: 2;FETC:POW:XSL:ABS?
CMUBASE: 2;FETC:POW:XSL:DELT?
```

Power Setting in Uplink Compressed Mode

In the following example the CMU performs a compressed mode test in accordance with the test specification 3GPP TS 34.121, section 5.7. For a measurement example in manual control refer to Chapter 2 of this manual.

; set up connection in remote debug mode

```
BASE15:     syst:err?
BASE15:     syst:err?

BASE15:     *OPT?
BASE15:     SYST:REM:ADDR:SEC 3,"WCDMA19UEFDD_Sig"
BASE15:     SYST:REM:ADDR:SEC? 3

BASE15:     syst:err?

BASE15: 3;  syst:err?
```

; Trigger is Default (Signalling = CM trigger is used)

```
BASE15: 3;  CONFigure:POWer:XSLot:CONTrol:MMODe CMTS
BASE15: 3;  CONFigure:POWer:XSLot:CONTrol:MMODe?

BASE15: 3;  CONFigure:BSSignal:TPC:PSET TULC
BASE15: 3;  CONFigure:BSSignal:TPC:PSET?

BASE15: 3;  CONFigure:BSSignal:TPC:PCONditions AUTO
BASE15: 3;  CONFigure:BSSignal:TPC:PCONditions?

BASE15: 3;  CONFigure:BSSignal:TPC:PSET TULC
BASE15: 3;  CONFigure:BSSignal:TPC:PSET?

BASE15: 3;  CONFigure:BSSignal:TPC:SSIZe?
BASE15: 3;  CONFigure:BSSignal:TPC:MODE?

BASE15: 3;  CONFigure:BSSignal:COMPressed:PATTern ULCM
BASE15: 3;  CONFigure:BSSignal:COMPressed:PATTern?

BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:PTYPe PAR
BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:PTYPe?
BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:PTYPe PAF
BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:PTYPe?
BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:PTYPe PB
BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:PTYPe?
```

```
BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:PTYPe PAR
BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:PTYPe?

BASE15: 3;  INITiate:POWer:XSLot;*opc?

BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:APATtern ON

BASE15: 3;  FETCh:POWer:XSLot:ABSolute?
BASE15: 3;  FETCh:POWer:XSLot:DELTa?
BASE15: 3;  CALCulate:ARRay:POWer:XSLot:DELTa:MATChing:LIMit?

BASE15: 3;  FETCh:POWer:XSLot:MAERror?
BASE15: 3;  CALCulate:POWer:XSLot:MAERror:MATChing:LIMit?

BASE15: 3;  CALCulate:POWer:XSLot:DELTa:MATChing:LIMit?

; The next line may appear to be redundant, but it has the side effect that
; the test step precondition (target power, closed loop) is reactivated
; before the start of the measurement. If this line is omitted, the
; precondition may possibly be set up only during CONF:BSS...:APAT ON
; which may produce a high time cost by forcing the measurement to
; perform a sequence of HW settings
BASE15: 3;  CONFigure:BSSignal:COMPressed:PATTern ULCM
; The next line is used to achieve the correct TPC step size of 2 dB for Test Step A
BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:PTYPe PAR
BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:PTYPe?

BASE15: 3;  INITiate:POWer:XSLot;*opc?

BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:APATtern ON

BASE15: 3;  FETCh:POWer:XSLot:ABSolute?
BASE15: 3;  FETCh:POWer:XSLot:DELTa?
BASE15: 3;  CALCulate:ARRay:POWer:XSLot:DELTa:MATChing:LIMit?

BASE15: 3;  FETCh:POWer:XSLot:MAERror?
BASE15: 3;  CALCulate:POWer:XSLot:MAERror:MATChing:LIMit?

BASE15: 3;  CALCulate:POWer:XSLot:DELTa:MATChing:LIMit?



; achieve test step precondition (closed loop):
BASE15: 3;  CONFigure:BSSignal:COMPressed:PATTern ULCM
; patch:
BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:PTYPe PAF
BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:PTYPe?

BASE15: 3;  INITiate:POWer:XSLot;*opc?

BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:APATtern ON

BASE15: 3;  FETCh:POWer:XSLot:ABSolute?
BASE15: 3;  FETCh:POWer:XSLot:DELTa?
BASE15: 3;  CALCulate:ARRay:POWer:XSLot:DELTa:MATChing:LIMit?

BASE15: 3;  FETCh:POWer:XSLot:MAERror?
BASE15: 3;  CALCulate:POWer:XSLot:MAERror:MATChing:LIMit?

BASE15: 3;  CALCulate:POWer:XSLot:DELTa:MATChing:LIMit?

; achieve test step precondition (closed loop):
```

```
BASE15: 3;  CONFigure:BSSignal:COMPressed:PATTern ULCM
; patch:
BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:PTYPe PAF
BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:PTYPe?

BASE15: 3;  INITiate:POWer:XSLot;*opc?

BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:APATtern ON

BASE15: 3;  FETCh:POWer:XSLot:ABSolute?
BASE15: 3;  FETCh:POWer:XSLot:DELTa?
BASE15: 3;  CALCulate:ARRay:POWer:XSLot:DELTa:MATChing:LIMit?

BASE15: 3;  FETCh:POWer:XSLot:MAERror?
BASE15: 3;  CALCulate:POWer:XSLot:MAERror:MATChing:LIMit?

BASE15: 3;  CALCulate:POWer:XSLot:DELTa:MATChing:LIMit?



; achieve test step precondition (closed loop):
BASE15: 3;  CONFigure:BSSignal:COMPressed:PATTern ULCM
; patch:
BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:PTYPe PB
BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:PTYPe?

BASE15: 3;  INITiate:POWer:XSLot;*opc?

BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:APATtern ON

BASE15: 3;  FETCh:POWer:XSLot:ABSolute?
BASE15: 3;  FETCh:POWer:XSLot:DELTa?
BASE15: 3;  CALCulate:ARRay:POWer:XSLot:DELTa:MATChing:LIMit?

BASE15: 3;  FETCh:POWer:XSLot:MAERror?
BASE15: 3;  CALCulate:POWer:XSLot:MAERror:MATChing:LIMit?

BASE15: 3;  CALCulate:POWer:XSLot:DELTa:MATChing:LIMit?



; achieve test step precondition (closed loop):
BASE15: 3;  CONFigure:BSSignal:COMPressed:PATTern ULCM
; patch:
BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:PTYPe PB
BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:PTYPe?

BASE15: 3;  INITiate:POWer:XSLot;*opc?

BASE15: 3;  CONFigure:BSSignal:COMPressed:ULCMtxtest:APATtern ON

BASE15: 3;  FETCh:POWer:XSLot:ABSolute?
BASE15: 3;  FETCh:POWer:XSLot:DELTa?
BASE15: 3;  CALCulate:ARRay:POWer:XSLot:DELTa:MATChing:LIMit?

BASE15: 3;  FETCh:POWer:XSLot:MAERror?
BASE15: 3;  CALCulate:POWer:XSLot:MAERror:MATChing:LIMit?

BASE15: 3;  CALCulate:POWer:XSLot:DELTa:MATChing:LIMit?
```

CDP vs. Time Measurement with HSDPA Channels

In the following example the R&S CMU sets up a packet data connection and commands the UE to *HSDPA Test* mode. In this mode it is possible to start a *CDP vs. Time* measurement and retrieve the code power and the gain factors for all UL channels including the HSDPA channels. The results are written to a common file statis.dat.

To perform the measurement as reported below, the UE must be connected to the RF 2 connector.

```
FPRINT ************************************************************
FPRINT General R&S CMU configurations
FPRINT (CMU base system commands, see R&S CMU200/300 operating manual)
FPRINT ************************************************************

CMUBASE: *IDN?
CMUBASE: *OPT?
CMUBASE: SYST:NONV:DIS
CMUBASE: *CLS;*RST;*OPC?
CMUBASE: SYST:GTRM:COMP OFF
CMUBASE: TRAC:REM:MODE:DISP ON
CMUBASE: CONF:SYNC:FREQ:REF:MODE INT
CMUBASE: *CLS;SYST:REM:ADDR:SEC 1,"WCDMA19UEFDD_NSig"
CMUBASE: *STB?
CMUBASE: *CLS;SYST:REM:ADDR:SEC 2,"WCDMA19UEFDD_Sig"
CMUBASE: *STB?

IF CMUBASE: 2;SIGN:STAT? {} SOFF goto suite
CMUBASE: 2;PROC:SIGN:ACT SOFF;*OPC?
[suite]

FPRINT ************************************************************
FPRINT Connector selection and path loss settings in WCDMA UE function group.
FPRINT ************************************************************

CMUBASE: 2;INP:STAT RF2
CMUBASE: 2;OUTP:STAT RF2
CMUBASE: 2;SENS:CORR:LOSS:INP2 0
CMUBASE: 2;SENS:CORR:LOSS:OUTP2 0

FPRINT ************************************************************
FPRINT Network settings
FPRINT ************************************************************

CMUBASE: 2;CONF:NETW:OBAN OB1
CMUBASE: 2;CONF:NETW:PSW:DOM ON
CMUBASE: 2;CONF:NETW:IDEN:MCC 1
CMUBASE: 2;CONF:NETW:IDEN:MNC 1
CMUBASE: 2;CONF:NETW:IDEN:LAC 1
CMUBASE: 2;CONF:NETW:REQ:SEC ON
CMUBASE: 2;CONF:NETW:REQ:AUTH ON
CMUBASE: 2;CONF:NETW:REQ:IMEI OFF
CMUBASE: 2;CONF:NETW:REQ:TTIM 1
CMUBASE: 2;CONF:NETW:RAC:DRXC 6

FPRINT ************************************************************
FPRINT Enter your SIM secret code (example)
FPRINT ************************************************************

CMUBASE: 2;CONF:NETW:REQ:SKEY "0001020304050607","08090A0B0C0D0E0F"
```

```
FPRINT ************************************************************
FPRINT BS Signal settings
FPRINT ************************************************************

CMUBASE: 2;CONF:BSS:DCH:TYPE RMC
CMUBASE: 2;CONF:BSS:DCH:RMC:RTYP 12.2
CMUBASE: 2;CONF:BSS:DCH:RMC:SDTC PR9
CMUBASE: 2;CONF:BSS:DCH:RMC:TMOD MODE2
CMUBASE: 2;CONF:BSS:DCH:RMC:UCRC OFF
CMUBASE: 2;CONF:BSS:DCH:SRAB:SRB K2_5
CMUBASE: 2;CONF:BSS:TPC:MODE ALG1
CMUBASE: 2;CONF:BSS:TPC:SSIZ 1
CMUBASE: 2;CONF:BSS:LREF OPOW
CMUBASE: 2;CONF:BSS:OPOW -50.60
CMUBASE: 2;CONF:BSS:HSDP:SIGN:ENAB ON
CMUBASE: 2;CONF:BSS:PHYS:LEV:CPIC:PRIM -5.33
CMUBASE: 2;CONF:BSS:PHYS:LEV:SCH:PRIM -10.23
CMUBASE: 2;CONF:BSS:PHYS:LEV:SCH:SEC -10.23
CMUBASE: 2;CONF:BSS:PHYS:LEV:CCPC:PRIM -7.23
CMUBASE: 2;CONF:BSS:PHYS:LEV:CCPC:SEC -7.23
CMUBASE: 2;CONF:BSS:PHYS:LEV:PICH -10.23
CMUBASE: 2;CONF:BSS:PHYS:LEV:AICH -10.23
CMUBASE: 2;CONF:BSS:PHYS:LEV:DPDC -12.23
CMUBASE: 2;CONF:BSS:PHYS:LEV:HSSC1 -12.23
CMUBASE: 2;CONF:BSS:PHYS:LEV:HSPD -5.23
CMUBASE: 2;CONF:BSS:PHYS:DPCH:POFF 0.00
CMUBASE: 2;CONF:BSS:PHYS:DPCH:TOFF 0
CMUBASE: 2;CONF:BSS:CHAN 10562 CH
CMUBASE: 2;CONF:BSS:SCOD:PRIM #H9
CMUBASE: 2;CONF:BSS:SCOD:SEC #H0
CMUBASE: 2;CONF:UES:SCOD:SEC #H0
CMUBASE: 2;CONF:BSS:HSDP:SSC #H0
CMUBASE: 2;CONF:BSS:TPC:PTYP1 CLOP
CMUBASE: 2;CONF:BSS:TPC:PSET SET1;*OPC?
CMUBASE: 2;LEV:MODE AUT

FPRINT ************************************************************
FPRINT Special HSDPA parameters
FPRINT ************************************************************

CMUBASE: 2;CONF:UES:GFAC:HSTM 11,15,5,5,2
CMUBASE: 2;CONF:BSS:PSW:DCH:PDAT:RATE PD64_384
CMUBASE: 2;CONF:BSS:PSW:DCH:HSTM:RBS HSRB
CMUBASE: 2;CONF:BSS:HSDS:TYPE FRCH

CMUBASE: 2;CONF:BSS:HSDS:FRCH:HSET S5QP
CMUBASE: 2;CONF:BSS:HSDS:FNAC OFF
CMUBASE: 2;CONF:BSS:HSDS:CFCY C4
CMUBASE: 2;CONF:BSS:HSDS:UEC 12

CMUBASE: 2;CONF:BSS:PHYS:HSSC:UEID #HAAAA
CMUBASE: 2;CONF:BSS:PHYS:HSSC:USUB TDU
CMUBASE: 2;CONF:BSS:PHYS:HSPD:USUB DDAT
CMUBASE: 2;CONF:BSS:PHYS:HSPD:MPOF 0.00

FPRINT ************************************************************
FPRINT Select signalling trigger before setting up the connection
FPRINT ************************************************************

CMUBASE: 2;TRIG:SOURce SIGN
```

```
FPRINT ************************************************************
FPRINT Generator on - wait for registration
FPRINT ************************************************************

CMUBASE: 2;PROC:SIGN:ACT SON;*OPC?
REPORT OFF
[reg]
PAUSE 100
IF CMUBASE: 2;SIGN:STAT? <> REG GOTO reg
REPORT ON
CMUBASE: 2;SIGN:RITY?
CMUBASE: 2;SIGN:RID?

WHILE CMUBASE: 2;SIGN:PSW:STAT? <> ATT

FPRINT ************************************************************
FPRINT Page device, MTC
FPRINT ************************************************************

33;PROC:SIGN:PSW:ACT PCON;*OPC?
REPORT OFF
WHILE CMUBASE: 2; SIGN:PSW:STAT? <> PEST
REPORT ON

FPRINT ************************************************************
FPRINT Select HS-DPCCH trigger after the connection is established
FPRINT ************************************************************

CMUBASE: 2;TRIG:SOURce HSDP

FPRINT ************************************************************
FPRINT Measurement and retrieval of results
FPRINT (with APPENDARAY command in Winbatch, all data will be written to file statis.dat)
FPRINT ************************************************************

CMUBASE: 2;READ:CDPower:TIME:CPOWer?
APPENDARRAY
APPENDNEWLINE
CMUBASE: 2;FETCh:CDPower:TIME:BFACtor?
CMUBASE: 2;FETCh:ARRay:CDPower:TIME:UEPower?
APPENDARRAY
APPENDNEWLINE
CMUBASE: 2;FETCh:ARRay:CDPower:TIME:DPCCh:CPOWer?
APPENDARRAY
APPENDNEWLINE
CMUBASE: 2;FETCh:ARRay:CDPower:TIME:DPDC1:CPOWer?
APPENDARRAY
APPENDNEWLINE
CMUBASE: 2;FETCh:ARRay:CDPower:TIME:DPDC2:CPOWer?
CMUBASE: 2;FETCh:ARRay:CDPower:TIME:DPDC3:CPOWer?
CMUBASE: 2;FETCh:ARRay:CDPower:TIME:DPDC4:CPOWer?
CMUBASE: 2;FETCh:ARRay:CDPower:TIME:DPDC5:CPOWer?
CMUBASE: 2;FETCh:ARRay:CDPower:TIME:DPDC6:CPOWer?
CMUBASE: 2;FETCh:ARRay:CDPower:TIME:HSDPcch:CPOWer?
APPENDARRAY
APPENDNEWLINE
CMUBASE: 2;FETCh:ARRay:CDPower:TIME:DPCCh:BFACtor?
CMUBASE: 2;FETCh:ARRay:CDPower:TIME:DPDC1:BFACtor?
CMUBASE: 2;FETCh:ARRay:CDPower:TIME:DPDC2:BFACtor?
CMUBASE: 2;FETCh:ARRay:CDPower:TIME:DPDC3:BFACtor?
CMUBASE: 2;FETCh:ARRay:CDPower:TIME:DPDC4:BFACtor?
CMUBASE: 2;FETCh:ARRay:CDPower:TIME:DPDC5:BFACtor?
```

```
CMUBASE: 2;FETCh:ARRay:CDPower:TIME:DPDC6:BFACtor?
CMUBASE: 2;FETCh:ARRay:CDPower:TIME:HSDPcch:BFACtor?

CMUBASE: 2;FETCh:CDPower:TIME:STATus?
CLOSEDATA

FPRINT ************************************************************
FPRINT Release Call
FPRINT ************************************************************

CMUBASE: 2; PROC:SIGN:PSW:ACT PREL;*OPC?

WHILE CMUBASE: 2;SIGN:PSW:STAT? <> ATT
```

Speed Improvement for TPC Step Measurements

The order of the different configurations and test steps has a critical impact on the speed of a TPC test sequence. For best results observe the following rules:

1. Select the test step before initiating the measurement:

   ```
   CONFigure:BSSignal:TPC:PCONditions AUTO
   CONFigure:UESignal:PCONtrol:TPOWer:VALue -10
   CONFigure:BSSignal:TPC:PSET TA
   INITiate:POWer:XSLOT
   FETCh:POWer:XSLOT:ABSolute?
   …
   ```

2. Avoid switchover from manual to automatic preconditions as far as possible, e.g. by forming groups of test steps with the same precondition types or precondition automatic → manual transitions only.

3. Avoid reconfigurations of the *TPC Algorithm* and of the *TPC Step Size,* e.g. by measuring all test steps with the same algorithm and step size in a row.

Contents

8 HSDPA and HSUPA 8.1

HSDPA Options (R&S CMU-K60/-K64) 8.1

HSDPA Measurements 8.1
HSDPA Modulation Tests 8.1
EVM & PhD with HS-DPCCH Measurement 8.2
HSDPA Receiver Quality Tests 8.7
HSDPA ACK/NACK Receiver Test 8.7
CQI Reporting Test 8.11
HS-DPCCH Logging 8.16
HSDPA Code Domain Power Tests 8.19
HSDPA in CDP/Code Measurements 8.19
HSDPA in CDP vs. Time Measurement 8.21
HS-DPCCH Time Mask 8.23
CDP Relative 8.28
CDE Relative 8.34
HSDPA Downlink Generator (Non Signalling) 8.39
HSDPA in Signalling Mode 8.50
HSDPA Downlink Signal (BS Signal) 8.50
HSDPA in Remote Control 8.66
HSDPA Downlink Generator (Non Signalling) 8.66
Fixed Reference Channel (FRCHannel) 8.73
CQI Channel (CQIChannel) 8.74
User Defined Channel (UDCHannel) 8.78
Common Measurement Groups 8.82
MODulation:EPHSdpcch 8.82
HSDPA Receiver Quality Tests 8.90
HS-DPCCH Time Mask 8.102
HS-DPCCH Time Mask (4-Slot) 8.107
CDP Relative 8.112
CDE Relative 8.122
HSDPA Downlink Signal Configuration (Signalling) 8.128
Physical HSDPA Channels 8.128
HS-DSCH Settings 8.132
Fixed Reference Channel (FRCHannel) 8.135
CQI Channel (CQIChannel) 8.136
User Defined Channel (UDCHannel) 8.142

HSUPA 5.76 Mbps (Option R&S CMU-K56) 8.148

HSUPA Measurements 8.148
HSUPA Receiver Quality Tests 8.148
HSUPA E-AGCH Measurement 8.149
HSUPA E-RGCH Measurement 8.151
HSUPA E-HICH Measurement 8.156
E-DPCCH Logging Measurement 8.159
RLC BLER Measurements 8.161
HSUPA Throughput Measurement 8.163
HSUPA Code Domain Power Tests 8.164
HSUPA in CDP/Code Measurements 8.164
HSUPA in CDP vs. Time Measurement 8.166
HSUPA Downlink Generator (Non Signalling) 8.168

HSUPA UE Settings (Non Signalling) 8.176
HSUPA in Signalling Mode 8.178
HSUPA Downlink Signal (BS Signal) 8.178
HSUPA UE Signal Parameters 8.180
Gain Factors 8.181
HSUPA in Remote Control 8.185
HSUPA Downlink Generator (Non Signalling) 8.185
E-AGCH Channel Settings 8.186
E-RGCH / E-HICH Channel Settings 8.188
HARQ Feedback (E-HICH) 8.191
Relative Grant (E-RGCH) 8.192
HSUPA UE Signal Configuration (Signalling) 8.193
Measurement Groups (Signalling) 8.194
E-DPCCH Logging Remote Commands 8.194
HSUPA E-AGCH Measurement 8.197
HSUPA E-RGCH Measurement 8.202
HSUPA E-HICH Measurement 8.206
HSUPA Throughput Measurement 8.210
HSUPA Downlink Signal Configuration (Signalling) 8.212
Physical Channel Settings 8.212
General Generator Settings 8.217
E-AGCH Channel Settings 8.218
E-RGCH / E-HICH and HARQ Feedback (E-HICH) 8.220
Relative Grant (E-RGCH) 8.221
HSUPA UE Signal Configuration (Signalling) 8.222
HSUPA Gain Factors: Remote Control 8.224

8 HSDPA and HSUPA

If equipped with the relevant options, the R&S CMU supports measurements on HSDPA and HSUPA channels.

HSDPA Options (R&S CMU-K60/-K64)

With the supplementary option R&S CMU-K64, *HSDPA 3.6 Mbps,* added to R&S CMU-K65, R&S-K66 and one of the signalling options R&S CMU-K57 to R&S CMU-K59, R&S CMU-K61 to R&S CMU-K63, or R&S CMU-K67 to R&S CMU-K69, the R&S CMU200 supports 3.6 Mbps High Speed Downlink Packet Access (HSDPA) channels. With an additional option R&S CMU-K60, *HSDPA 10 Mbps,* HSDPA channels up to 10 Mbps are supported. The HSDPA functionality is available in *Non Signalling* and in *Signalling* mode. It consists of a HSDPA downlink generator and various HSDPA-specific measurement applications.

The HSDPA gain factors and the HS-DPCCH trigger are described in Chapter 4 of this manual. For an introduction to WCDMA application testing with HSDPA connections refer to Chapter 9.

The uplink HS-DPCCH received from the UE is taken into account for the Modulation measurement.

Some measurements require special HSDPA parameter settings. For an overview refer to section Measurement Groups – Special Parameter Settings *in Chapter 3.*

HSDPA Measurements

The measurements reported in this section require the HSDPA option R&S CMU-K64. All measurements are available in *Non Signalling* and in *Signalling* mode.

HSDPA Modulation Tests

The *Modulation* menu provides the following HSDPA application:

- *EVM & PhD HS-DPCCH* provides the change in phase between any two adjacent half slots and an evaluation of the corresponding EVM and frequency error values. This application covers the *EVM and Phase Discontinuity with HS-DPCCH* conformance test (see standard 3GPP TS 34.121 V7.2.0, test procedure 5.13.1AA).

The measurement settings and results of the application are described in detail below. For general notes on HSDPA tests refer to section *HSDPA in Signalling Mode* on p. 8.50.

EVM & PhD with HS-DPCCH Measurement

EVM & PhD HS-DPCCH provides the change in phase due to the transmission of the HS-DPCCH and an evaluation of the corresponding EVM and frequency error values. This application covers the *EVM and Phase Discontinuity with HS-DPCCH* conformance test (see standard 3GPP TS 34.121 V7.2.0, test procedure 5.13.1AA).

EVM & PhD HS-DPCCH extends the *Phase Discontinuity* measurement (see chapter 4) for UL signals with a HS-DPCCH that is not slot-aligned to the UL DPCH. The timing offset between the different code channels can cause the nominal UE power to vary within a 1-slot period. The test specification stipulates a ½-slot timing offset between the HS-DPCCH and the UL DPCH so that the nominal UE power remains constant over periods of ½ slot. The EMV is defined in intervals where the nominal power of each code is constant, therefore it is measured in half slot intervals (excluding a 25 µs guard period at the beginning and at the end of each half slot) as shown below[1]. The same applies to the frequency error. The phase discontinuity is calculated for each HS-DPCCH slot boundary.

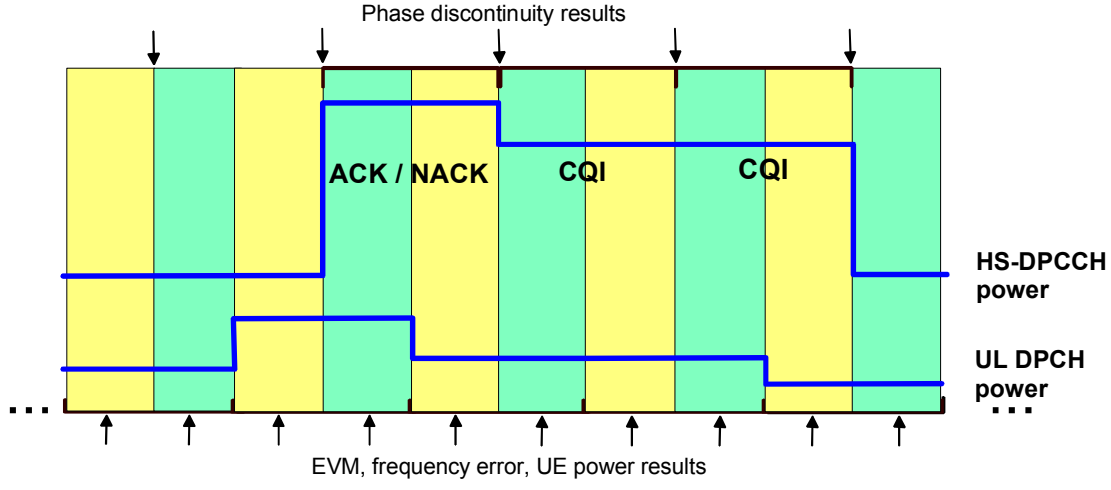


Fig. 8-1 Half slot timing offset for EVM & PhD with HS-DPCCH

The EVM & PhD HS-DPCCH *measurement is available in* Non Signalling *and in* Signalling *mode. An application example for the measurement is reported in chapter 2. For a definition of the different modulation parameters, in particular the phase error, refer to the description of the Modulation measurement in chapter 4.*

In Non Signalling mode, the HSDPA signal in the Connection Control – Generator tab must be switched On to induce the R&S CMU to measure the HS-DPCCH. In Signalling mode the HS-DPCCH is measured while the R&S CMU is in HSDPA test mode.

EVM & PhD with HS-DPCCH Measurement Results

The graphical measurement menu for the *EVM & PhD with HS-DPCCH* application contains three parameter lines, two test diagrams, and a tabular overview below:

[1] The R&S CMU measures the EVM and phase discontinuity for arbitrary timing offsets. Notice, however, that results for timing offsets ≠ ½ slot or 1 slot do not comply with the conformance test specification.

MENU SELECT →

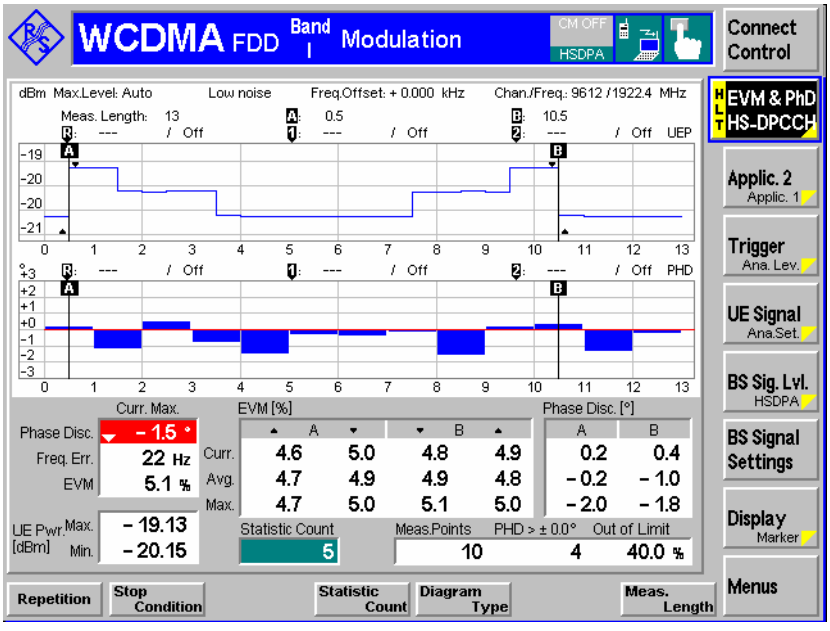


Fig. 8-2 Display of results (Modulation – EVM & PhD with HS-DPCCH)

Test settings The parameter lines show the essential test settings and the marker values.

Upper diagram: UE Power etc. In the default configuration, the upper diagram shows the current measured UE power in up to 46 consecutive slots (2*46 = 92 power steps), corresponding to the selected gain factors *(Connection Control – UE Signal – UE Gain Factors)* and TPC settings. Notice that the test specification stipulates power control algorithm 2 and an alternating TPC pattern during the test, which means that the nominal UL DPCH power remains constant.

The measured UE power is averaged as described in chapter 4, section *Power Measurements*. The number of slots measured and the marker lines A and B can be changed using the *Meas. Length* hotkey associated with the measurement control softkey. The axis scales can be changed using the *Display* softkey.

The upper diagram can also display the EVM or frequency error (switch over with *EVM & PhD HS-DPCCH – Diagram Type)*.

Remote control
`READ:ARRay:MODulation:EPHSdpcch:UEPower?` etc.

Lower diagram: Phase disc. etc. The lower diagram shows the current phase discontinuity due to the transmission of the HS-DPCCH. This means that a result is displayed between any two consecutive HS-DPCCH slots; the maximum number of results is 46.

The phase discontinuity is evaluated as described in chapter 4, section *Modulation Measurements.* The number of slots measured and the marker lines A and B can be changed using the *Meas. Length* hotkey associated with the measurement control softkey. The axis scales can be changed using the *Display* softkey.

The lower diagram can also display the EVM or frequency error (switch over with *EVM & PhD HS-DPCCH – Diagram Type)*.

Remote control
`READ:ARRay:MODulation:EPHSdpcch:PHDiscont?`
`READ:ARRay:MODulation:EPHSdpcch:EVMagnitude?`
`READ:ARRay:MODulation:EPHSdpcch:CFERror?` etc.

Limit Check

The limit check indication diagrams depends on the diagram type:

- The *UE Power* results are not limit-checked.
- The symmetric red limit lines in the *Phase Discontinuity* and the *Frequency Error* diagrams represent the tolerances for these results.
- The red limit line in the *Error Vector Magn.* diagram represents the upper limit for the *Error Vector Magn.*

All limits can be changed in the configuration menu; see section EVM & PhD with HS-DPCCH Limits on p. 8.5.

Remote control
```
CALCulate[:SCALar]:MODulation:EPHSdpcch:MATChing:LIMit?
```

Output values

Below the diagrams, the menu shows the the following results:

Curr. Max — Maximum of the measured phase discontinuity, frequency error, and EVM in the current measurement step (the maximum of the values displayed in the diagrams). For the phase discontinuity and frequency error, the result with the largest absolute value is displayed, irrespective of the sign.

UE Pwr. [dBm] — Maximum and minimum of the measured UE power values in the current measurement step (the maximum and minimum of all half slot results in across the selected measurement length).

EVM [%] — EVM in the half slots to the left and to the right of the marker lines labeled A and B.

Phase Disc. [°] — Phase discontinuity at the HS-DPCCH slot boundaries corresponding to the marker lines labeled A and B.

The R&S CMU displays the EVM and phase discontinuity results in the *Current* measurement step, the average over all results referenced to the statistics cycle, and the maximum of all results since the measurement was started. To measure the EVM and phase discontinuity according to the conformance test specification, the marker lines can be positioned to the beginning fo the first ACK/NACK slot and to the end of the second ACK/NACK slot in the measured pattern (see Fig. 8-2 above and measurement example in chapter 2). This means that specified test requirements are related to the values in the *EVM* and *Phase Disc.* tables.

Statistic Count — Number of measurement steps per statistics cycle (as defined in the *Control* tab of the configuration menu). Each measurement step yields the UE power, EVM, phase discontinuity and frequency error over the entire measurement length. The colored bar indicates the relative measurement progress in the first statistics cycle.

Meas. Points — Number of acquired phase discontinuity values at the slot boundaries A and B. In general this number is twice the number of measurement steps that the R&S CMU has performed.

PhD > <limit> — Number of phase discontinuity values with failed limit check.

Out of Limit — Percentage of phase discontinuity values with failed limit check: *PhD > <limit> / Meas. Points * 100 %.* In single shot mode this value is updated at the end of each measurement cycle only; see limit check (scalar results) below.

Remote control
```
READ[:SCALar]:MODulation:EPHSdpcch?
READ[:SCALar]:MODulation:EPHSdpcch:MPoints?
READ[:SCALar]:MODulation:EPHSdpcch:EVM?
READ[:SCALar]:MODulation:EPHSdpcch:PHD?
```

Limit Check (Scalar Results)

In general, a red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Modulation Configuration* menu, see section EVM & PhD with HS-DPCCH Limits on p. 8.5. The UE power is not limit-checked.

The limit check for the *Out of Limit* result depends on the repetition mode:

- In single shot mode, the *Out of Limit* result is updated after each measurement cycle and compared to the *Out of Limit Tolerance.* This prevents the measurement from being stopped by an *On Limit Failure* condition if many large phase discontinuity values are encountered at the beginning of the measurement cycle.
- In continuous mode, the result is continuously updated for information (although the statistics is poor at the beginning of the measurement); however, the limit check is suspended.

Remote control
`CALCulate[:SCALar]:MODulation:EPHSdpcch:MATChing:LIMit?`

EVM & PhD with HS-DPCCH Limits

The *Limits* tab of the *Modulation Configuration* menu defines the upper limits for the individual measured quantities in the *Receiver Quality* menu.

The requirements for the EVM & PhD test are specified for the 12 ms HS-DPCCH repeat pattern shown in Fig. 8-2 on page 8.3 (see standard TS 34.121, section 5.131AA.5).

- The measured EVM in the four half slots shown in the *EVM [%]* table must not exceed 17.5%.
- The absolute value of the phase discontinuity at the two HS-DPCCH slot boundaries A and B (table *Phase Disc. [°])* must not exceed 30°. Annex F.2 of TS 34.121 specifies an additional test tolerance of 6°, so that the phase discontinuity limit may be increased to ±36°.

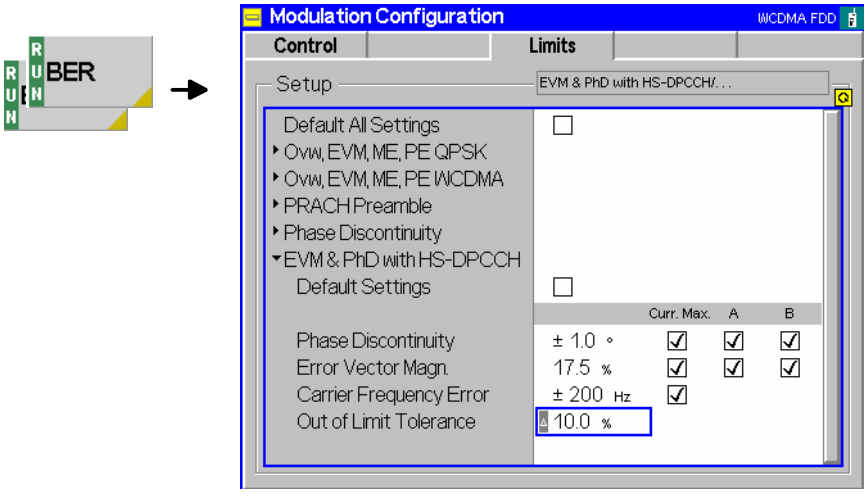


Fig. 8-3 Modulation Configuration – Limits

Default Settings

The *Default* switches overwrite all settings in the *Limits* tab with default values. The default values for the *EVM & PhD with HS-DPCCH* measurement are quoted in the command description in section *Subsystem RXQuality:HCQI:...LIMit* on p. 8.96.

Remote control
`DEFault:MODulation:EPHSdpcch:LIMit <Enable>`

EVM & PhD with HS-DPCCH

The following limits can be set for *EVM & PhD with HS-DPCCH* tests.

Phase Discontinuity Upper limit for the absolute value of the measured phase discontinuity. The limit check can be enabled for the slot boundaries A and B (requirements of the conformance test specification) and for the *Current. Max.* value (i.e. the maximum of the phase discontinuity values displayed in the test diagram).

Error Vector Magn. Upper limit for the measured EVM. The limit check can be enabled for the two half slots around the markers A and B (requirements of the conformance test specification) and for the *Current. Max.* value (i.e. the maximum of the EVM values displayed in the test diagram).

Carrier Frequency Error Upper limit for the absolute values of the measured frequency error in all measured half slots.

Out of Limit Tolerance Percentage of phase discontinuity results that may exceed the specified limit. This limit is to check the statistical aspect (e.g. 90% pass rate) of the specified minimum requirement for the phase discontinuity; it is only used in single shot mode (see *Limit Check* on p. 8.5).

Remote control

```
CONFigure:MODulation:EPHSdpcch:LIMit[:SCALar]:ASYMmetric
   [:COMBined]:VALue
CONFigure:MODulation:EPHSdpcch:LIMit[:SCALar]:SYMMetric
   [:COMBined]:VALue
CONFigure:MODulation:EPHSdpcch:LIMit[:SCALar]:ASYMmetric
   [:COMBined]:ENABle
CONFigure:MODulation:EPHSdpcch:LIMit[:SCALar]:SYMMetric
   [:COMBined]:ENABle
```

HSDPA Receiver Quality Tests

The *Receiver Quality* menu provides the following HSDPA applications:

- In the *HSDPA ACK* application, the R&S CMU transmits the HSDPA downlink signals configured in the *BS Signal* tab of the *Connection Control* menu and evaluates the demodulation of the HS-DSCH and the data throughput.
- In the *HSDPA CQI* application, the R&S CMU allocates a HSDPA CQI test channel to the UE and tests the accuracy of CQI reporting.
- The *HS-DPCCH Logging* application provides the ACK/NACK messages and reported CQI values that the UE returns in a sequence of 60 consecutive HS-DPCCH subframes (12 WCDMA frames).

The measurement settings and results of the HSDPA applications are described in detail below. For general notes on HSDPA tests refer to section *HSDPA in Signalling Mode* on p. 8.50.

NOTE

If the Receiver Quality – HSDPA ACK, HS-DPCCH Logging, HSDPA CQI measurements fail, it is recommended to increase the activation time offset (Connection Control – Network – Requested UE Data – Activation Time Offset = Immediate).

HSDPA ACK/NACK Receiver Test

The *HSDPA ACK* report menu evaluates the demodulation of the DL HS-DSCH by the UE and measures the data throughput. It is an application of the *Receiver Quality* measurement. This application is available in *Non Signalling* and in *Signalling* mode.

- To access the *HSDPA ACK* measurement menu, select the *Receiver Quality* measurement and press *Application – HSDPA ACK.*
- To configure the downlink HSDPA generator for ACK/NACK tests according to the conformance specification 3GPP TS 34.121, open the *Generator/BS Signal* tab of the *Connection Control* menu and select an appropriate reference channel *(HSPDA – Fixed Reference Channel)*.
- In *Non Signalling* mode, the HSDPA signal in the *Connection Control – Generator* tab must be switched *On* to induce the R&S CMU to measure the HS-DPCCH. In *Signalling* mode the HS-DPCCH is measured while the R&S CMU is in HSDPA test mode.

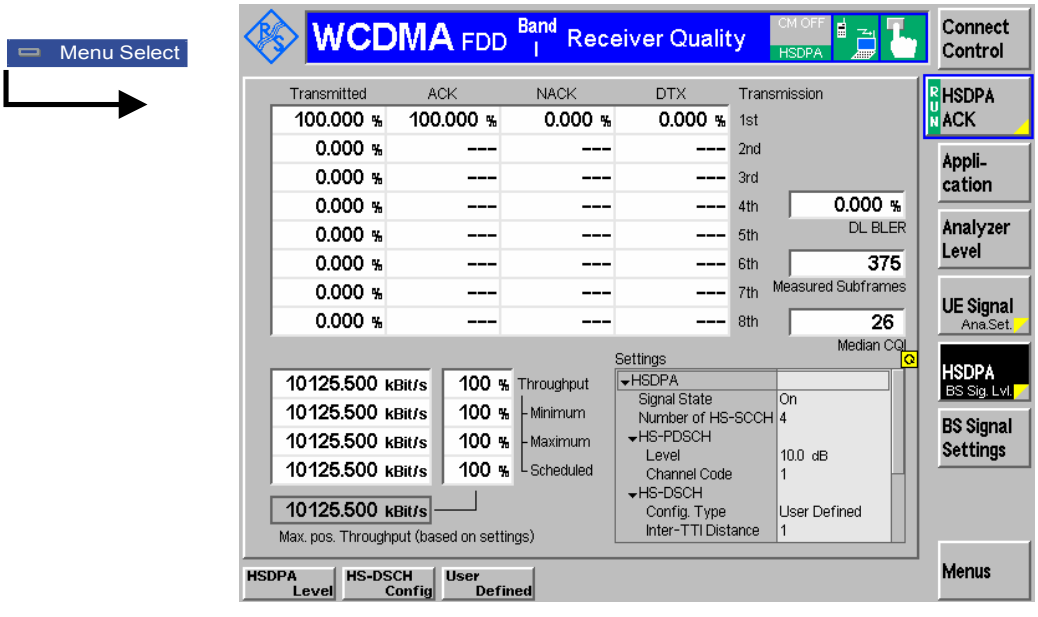


Fig. 8-4 Receiver Quality – HSDPA ACK

The *HSDPA ACK* measurement is controlled by the following softkeys and hotkeys:

HSDPA ACK

The *HSDPA ACK* softkey controls the measurement and indicates its status *(RUN | OFF | HLT)*. This softkey changes to *BER*, *HS-DPCCH Logging* etc., depending on the selected *Receiver Quality* measurement application.

The measurement status can be changed after softkey selection (pressing once) by means of the *ON/OFF* or *CONT/HLT* key.

Remote control
```
INITiate:RXQuality:HACK
ABORt:RXQuality:HACK
STOP:RXQuality:HACK
CONTinue:RXQuality:HACK
FETCh[:SCALar]:RXQuality:HACK:STATus?
```

The following hotkeys are associated with the *HSDPA ACK* softkey. Only the *Repetition* and the *Measure Subframes* parameters are specific to the *HSDPA ACK* measurement. The *Repetition* mode and the *DL/UL Timing* (Non Signalling) are described in Chapter 4; the *CQI Detect. Threshold* and the *Monitored H-ARQ* processes are valid for all HSDPA *Receiver Quality* applications.

Measure Subframes

The *Measure Subframes* hotkey selects the number of HSDPA subframes (transmission packets) to be measured per measurement cycle (single shot). The *Measured Subframes* output field in the measurement menu shows the current number of measured subframes; the result never exceeds the *Measure Subframes* value.

If a single *Monitored H-ARQ* is selected (see below), then *Measure Subframes* specifies the number of subframes for the selected H-ARQ process.

Remote control
```
CONFigure:RXQuality:HACK:CONTrol:MSUBframes
```

CQI Detect. Threshold

The *CQI Detect. Threshold* hotkey defines the uplink HS-DPCCH level threshold above which an CQI value reported by the UE will be considered for the *Median CQI* calculation.

A threshold of n dB means that the decoded CQI value is only taken into account if the ratio of the HS-DPCCH level to the sum of the DPDCH levels in the uplink signal is larger than n dB. At lower relative HS-DPCCH level, any CQI value is interpreted as DTX and rejected.

Remote control
```
CONFigure:RXQuality:CONTrol:CTHReshold
```

Monitored H-ARQ

The *Monitored H-ARQ* hotkey selects either a single H-ARQ process (numbered 0 to 7) or *All* processes to be monitored. If a single process is selected, the number should not exceed the *Number of H-ARQ Processes* defined in the *RF Generator* or *BS Signal* tab of the *Connection Control* menu.

Selecting a single process extends the measurement duration because only part of the transmitted subframes is measured (see *Measure Subframes* above). For fast production tests, it is recommended to select *All* processes.

Remote control
```
CONFigure:RXQuality:CONTrol:MHARq
```

The following softkey provides HSDPA-specific signal settings.

HSDPA BS Sig. Lev.

The *HSDPA BS Sig. Lev.* softkey provides the most important HSDPA downlink generator settings; see section *HSDPA Downlink Signal (BS Signal)* on p. *8.50*.

The remaining softkey/hotkey combinations are not specific to the *HSDPA ACK* measurement; refer to Chapter 4 for detailed information.

HSDPA ACK Measurement Results

The *HSDPA ACK* menu contains various tables to display the signal configuration and the measurement results.

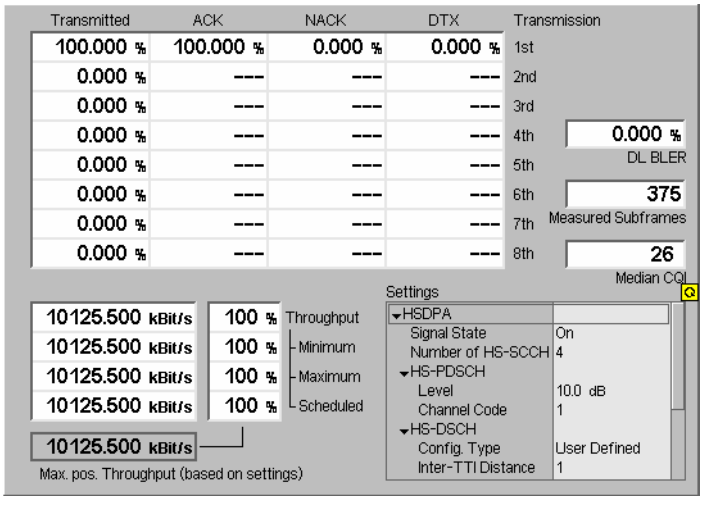


Fig. 8-5 Measurement Results – HSDPA ACK

In its lower right part the *HSDPA ACK* menu displays the generator *Settings* described in section *HSDPA Downlink Signal (BS Signal)* on p. 8.50. The remaining output tables show the results described below.

Transmitted Percentage of transmissions with the 1st to 8th redundancy version.

ACK / NACK Percentage of transmission packets (HSDPA subframes) that the UE answered with *ACK* after successful CRC check, and percentage of transmissions that the UE answered with *NACK* to indicate an unsuccessful transmission on the HS-DSCH. Values are given for the 1st to 8th redundancy version.

In response to the ACK/NACK field, the R&S CMU shows the behavior specified in standard 3GPP TS 25.101; see Table 8-1 below.

DTX Percentage of transmissions that were not answered at all and caused Discontinuous Transmission (DTX). Values are given for the 1st to 8th redundancy version. The probability of reporting DTX should be very low under the test conditions specified in standard 3GPP TS 25.101.

In response to DTX, the R&S CMU shows the behavior specified in standard 3GPP TS 25.101; see Table 8-1 below.

DL BLER Percentage of transmissions that were not acknowledged, i.e.

Downlink BLER = 1 – <Percentage of acknowledged packets>
*(<NACK packets> + <DTX packets>)/<all packets> * 100%*

The values are added over all transmissions.

Measured Subframes Total number of transmission packets (HSDPA subframes) measured.

Median CQI Median of the CQI values reported by the UE (i.e. the middle of the CQI distribution: half the reported CQIs are above and half below the median).

Throughput Information bit throughput of the HSDPA link in kBit/s. In standard 3GPP TS 25.101 the conformance requirements are specified in terms of a minimum information bit throughput. The R&S CMU provides the following results:

Throughput Current throughput, updated in regular, non-configurable averaging intervals (smaller than a single shot statistics cycle). The averaging intervals are also used for the scheduled results; see below. The throughput is closely related to the DL BLER:

Throughput / % = 100 – DL BLER / %

Minimum Minimum measured throughput in any evaluation period since the start of the measurement

Maximum Maximum measured throughput in any evaluation period since the start of the measurement

Scheduled Maximum effective throughput of the connection assuming that all blocks are acknowledged in the first transmission (in other words: including all blocks answered with ACK, NACK or DTX). In contrast to the maximum possible throughput, this value is measured. In HSDPA test mode; the scheduled throughput is expected to be equal to the maximum possible throughput; values larger than the maximum possible throughput are due to averaging effects (see below). For data application tests on HSDPA connections, the scheduled throughput generally decreases because the MAC-d PDUs carrying the user bits do not always fill the complete MAC-hs payload (see *MAC-d PDU Size* on p. 8.62). In addition, various limitations in the network and the application protocols can decrease the scheduled throughput.

Max. pos. Thr. Maximum throughput, calculated under the assumption that all transmission packets are acknowledged in the first transmission (no retransmissions necessary). The maximum possible throughput only depends on the HS-DSCH parameters selected in the *RF Generator / BS Signal* tab of the *Connection Control* menu, in particular the number of HARQ processes and the inter-TTI distance; it is a fixed value for a fixed connection.

The fixed averaging intervals for the *Throughput* and the *Scheduled* values have a variable overlap with the DL blocks. This causes the result to jitter around the average value.

Example: In Fig. 8-5 above, almost all the data is acknowledged in the third transmission, which causes an average throughput of approx. 1/3 ≈ 33 %.

Remote control

```
READ[:SCALar]:RXQuality:HACK?
FETCh[:SCALar]:RXQuality:HACK?
SAMPle[:SCALar]:RXQuality:HACK?
READ[:SCALar]:RXQuality:HACK:EXTended?
READ[:SCALar]:RXQuality:HACK:BLER?
READ[:SCALar]:RXQuality:HACK:ALL?  etc.
```

Table 8-1 R&S CMU behavior in response to ACK/NACK/DTX

HS-DPCCH ACK/NACK field state	R&S CMU behavior
ACK	New transmission using 1st redundancy and constellation version (RV)
NACK	Retransmission using the next RV (up to the maximum permitted number or RVs)
DTX	Retransmission using the RV previously transmitted to the same H-ARQ process

CQI Reporting Test

The *HSDPA CQI* report menu measures the CQI reporting accuracy under AWGN or fading conditions. It is an application of the *Receiver Quality* measurement. This application is available in *Non Signalling* and in *Signalling* mode.

- To access the *HSDPA CQI* measurement menu, select the *Receiver Quality* measurement and press *Application – HSDPA CQI*.
- To configure the downlink HSDPA generator for CQI reporting tests according to the conformance specification 3GPP TS 34.121, proceed as follows:
  - In *Non Signalling* mode, open the *Generator* tab of the *Connection Control* menu and select a CQI test channel *(Channel Settings – HSDPA Channels – HS-DSCH – Channel Configuration Type: CQI)* that you can configure in the *CQI Channel Configuration* section.
  - In *Signalling* mode, open the *BS Signal* tab of the *Connection Control* menu and select a CQI test channel *(HSDPA HS-DSCH – Channel Configuration Type: CQI)* that you can configure in the *CQI Channel Configuration* section. For general notes on HSDPA tests refer to section *HSDPA in Signalling Mode* on p. 8.50.
- To define the number of subframes measured, press *HSDPA CQI – Measure Subframes*.
- To select the propagation conditions, press *HSDPA CQI – Test Case*.
- To change the limit settings, press the measurement control softkey *HSDPA CQI* twice to open the *Receiver Quality Configuration* menu and access the *Limits* tab.

See also measurement example *CQI Reporting Test under Fading Conditions* in chapter 2.

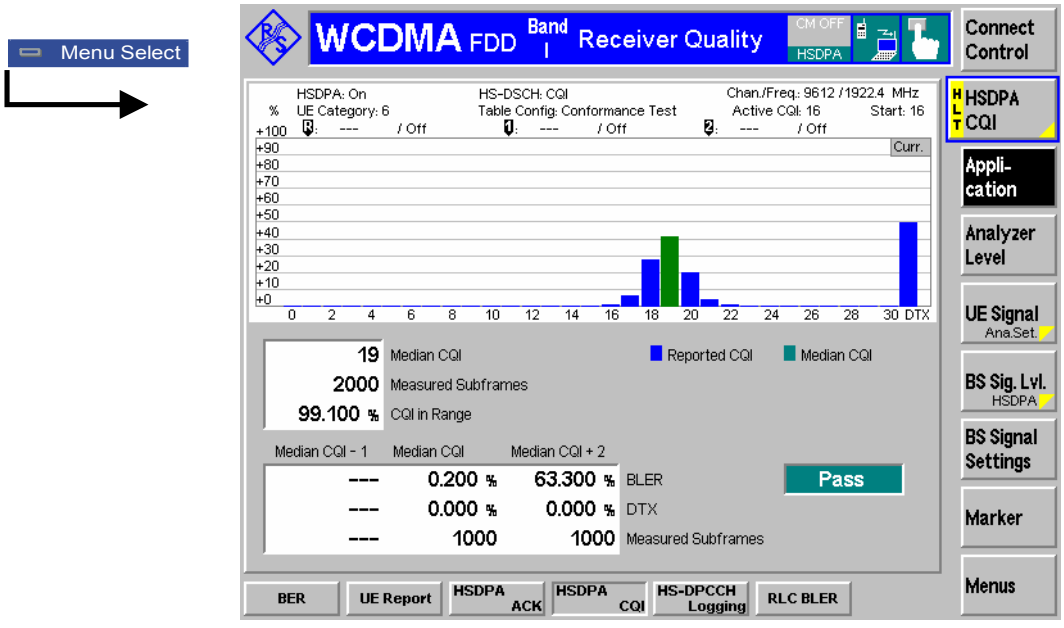


Fig. 8-6 Receiver Quality – HSDPA CQI

The *HSDPA CQI* measurement is controlled by the following softkeys and hotkeys:

HSDPA CQI

The *HSDPA CQI* softkey controls the maximum power measurement and indicates its status *(RUN | HLT)*. This softkey changes to *HSDPA ACK* or *BER*, depending on the selected *Receiver Quality* measurement application. The measurement status can be changed after softkey selection (pressing once) by means of the *CONT/HLT* key. The measurement is always performed in single shot mode.

A number of hotkeys associated with the *HSDPA CQI* softkey provides settings that are also accessible from the *Control* tab of the *Connection Control* menu.

Remote control
```
INITiate:RXQuality:HCQI
ABORt:RXQuality:HCQI
STOP:RXQuality:HCQI
CONTinue:RXQuality:HCQI
FETCh[:SCALar]:RXQuality:HCQI:STATus?
```

Test Case

The *Test Case* hotkey defines the propagation conditions for the CQI test (see also *Method of Test* on p. 8.13):

- *AWGN* selects the CQI reporting test with an Additional Gaussian White Noise (AWGN) interferer superimposed to the BS Signal (see standard 3GPP TS 34.121, section 9.3.1). The R&S CMU provides the AWGN signal, measures the distribution of the reported CQI values and calculates the BLER at three different downlink transport formats.
- *Fading* selects the CQI reporting test under fading conditions (see standard 3GPP TS 34.121, section 9.3.2). This test case requires option R&S CMU-B17 so that the baseband signals of the R&S CMU can be fed to a fading simulator (e.g. an R&S ABFS or R&S SMU; see measurement example in chapter 2). The R&S CMU measures the distribution of the reported CQI values and calculates the BLER for UE responses with two different reported CQI values.

Remote control
```
CONFigure:RXQuality:HCQI:CONTrol:TCASe
```

Measure Subframes

The *Measure Subframes* hotkey defines the scope of the CQI tests:

- *CQI* denotes the number of CQI values collected in the first stage of the CQI test (see *Method of Test* on p. 8.13) in order to calculated the CQI statistics.
- *BLER* denotes the number of subframes (filtered ACK and NACK responses) measured in the second stage in order to calculate the BLER.

The parameters are also accessible from the *Control* tab of the *Connection Control* menu.

Remote control
`CONFigure:RXQuality:HCQI:CONTrol:MSUBframes <CQI>, <BLER>`

The hotkeys *CQI Detect. Threshold* and *Monitored H-ARQ* are also associated with the *HSDPA CQI* softkey. They are valid for all HSDPA *Receiver Quality* applications (see p. 8.8).

The remaining softkey/hotkey combinations are not specific to the *HSDPA ACK* measurement; refer to Chapter 4 for detailed information.

HSDPA CQI Measurement Results

The *HSDPA CQI* menu contains two parameter lines, a bar graph and various output tables to display the signal configuration and the measurement results.

Method of Test

According to the conformance test specification 3GPP TS 34.121, section 9.3, the CQI reporting test is performed in two stages:

- In the first stage, the R&S CMU tests whether the UE reports a limited range of CQI values if it receives a HSDPA signal under fixed conditions.

  To this end the R&S CMU allocates a HSDPA CQI test channel to the UE, maintaining a Transport Format (TF) according to a fixed CQI value (the *Conf. Test Start Value)*, and records the CQI values received from the UE. After collecting a specified number of reported CQI values, the R&S CMU calculates the frequency of each value and the median CQI. In the *AWGN* test case, the UE under test is passed in this stage 1 if 1800 or more CQI values fall into the interval [median CQI – 2, median CQI + 2]. In the *Fading* test case, no limit check is performed in stage 1.
- The second stage of the CQI reporting test essentially depends on the test case.

  In the **AWGN** test case, the R&S CMU tests whether BLER versus CQI has the correct sense. Stage 2 is only attempted if the UE was passed in stage 1. The R&S CMU transmits a TF according to the median CQI and records the number of transmission packets (HSDPA subframes) that the UE answered with ACK, NACK or DTX. DTX responses are discarded; the same is true for ACK or NACK responses following an odd number of DTX responses (including 1)[2]. If the BLER of the remaining packets, defined as the ratio of NACK/(NACK + ACK) packets, is < 0.1, the test is repeated at (median CQI +2), otherwise it is repeated at (median CQI – 1). The BLER at (median CQI +2) must be >0.1, the BLER at (median CQI – 1) must be <0.1.

  In the **Fading** test case, the R&S CMU tests the BLER for UE responses with two different reported CQI values. Again, the tester transmits a TF according to the median CQI and records the number of transmission packets (HSDPA subframes) that the UE answered with ACK, NACK or DTX. DTX responses are subtracted as described above. The remaining packets are associated with the reported CQI values from the UE. The BLER of the packets with a corresponding reported CQI = (median CQI) must be below 60%, the BLER of the packets with a corresponding reported CQI = (median CQI + 3) must be below 15%.

The two test cases provide different measurement results.

[2] Note that this packet filter algorithm is enabled only if the R&S CMU is configured for CQI reporting tests *(Channel Configuration Type: CQI* and *CQI Table Index: Conformance Test)*. For correct results the *CQI Feedback Cycle* must be set to 2 ms and the *No. of H-ARQ Processes* to 2; see measurement example in chapter 2.

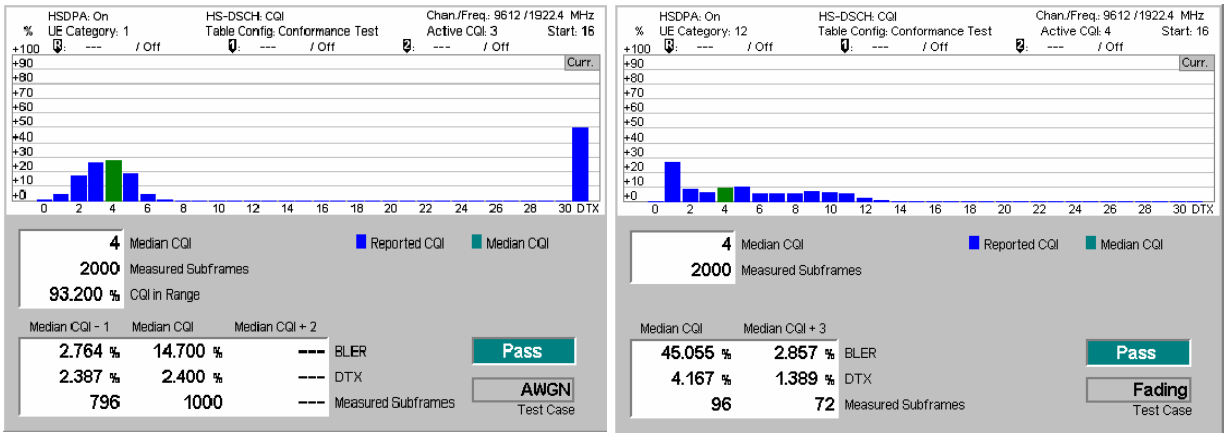


Fig. 8-7 Measurement Results – HSDPA CQI (AWGN and Fading test cases)

Parameter Lines

In the parameter lines the *HSDPA CQI* menu displays the essential generator *Settings* described in section *HSDPA Downlink Signal (BS Signal)* on p. *8.50*. In particular the *Active CQI* is the CQI defining the downlink TF during the conformance test. During the first stage of the test, this is equal to the *Conf. Test Start Value.* In the following stage, it is set according to the test case requirement; see above. This parameter can be used to monitor the progress of the CQI conformance test.

Remote control
`[SENSe:]RXQuality:HCQI:TINDex:CTAValue?`

Bar graph

The bar graph shows the relative frequency of the CQI values collected in stage 1 of the CQI reporting test (see background information on CQI *Method of Test* above). The green bar shows the median CQI.

Remote control
`READ:ARRay:RXQuality:HCQI?`
`FETCh:ARRay:RXQuality:HCQI?`
`SAMPle:ARRay:RXQuality:HCQI?`

Upper output table

Statistics of reported CQI values in stage 1.

Median CQI Middle of the CQI distribution: half the reported CQIs are above and half below the median.

Meas. Subframes Total number of transmission packets (HSDPA subframes) measured.

CQI in Range Percentage of reported CQI values in the interval [median CQI – 2, median CQI + 2] (available for AWGN test case only).

Lower output table

Statistics of reported CQI values in stage 2 of the CQI reporting test (see background information on CQI *Method of Test* above). Results obtained at the different reported CQI values are displayed in separate columns.

BLER Block error ratio, the percentage of transmission packets (HSDPA subframes) received in error, i.e. the ratio of (DTX + NACK)/(DTX + NACK + ACK) packets.

DTX Percentage of HSDPA subframes that the UE answered with DTX.

Meas. Subframes Total number of HSDPA subframes measured.

Remote control
`READ[:SCALar]:RXQuality:HCQI?`

```
FETCh[:SCALar]:RXQuality:HCQI?
SAMPle[:SCALar]:RXQuality:HCQI?
```

Limit check A red output field and an arrow pointing upwards or downwards indicates that the results for *CQI in Range* (AWGN test case only), *BLER,* and *DTX* exceed the upper or lower limit set in the *Limits* tab of the *Receiver Quality Configuration* menu, see section *HSDPA CQI Limits* on p. 8.15.

The pass/fail indication on the right side applies to the entire CQI report test including stage 1 and 2.

Remote control
```
CALCulate[:SCALar]:RXQuality:HCQI:MATChing:LIMit?
```

HSDPA CQI Limits

The *Limits* tab of the *Receiver Quality Configuration* menu defines the upper limits for the individual measured quantities in the *Receiver Quality* menu.

For the HSDPA CQI test the standard TS 34.121 specifies the following limits (see *Method of Test* on p. 8.13):

- **Stage 1 (AWGN test case only):** 1800 or more of the 2000 CQI values acquired (i.e. ≥ 90% of the values) must be in the range (Median CQI – 2) ≤ Median CQI ≤ (Median CQI + 2).
- **Stage 2:** The requirements depend on the test case:

  AWGN: If the BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 2) shall be greater than 0.1. If the HS-PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

  Fading: The BLER of the packets with a corresponding reported CQI = (median CQI) must be below 60%, the BLER of the packets with a corresponding reported CQI = (median CQI + 3) must be below 15%.

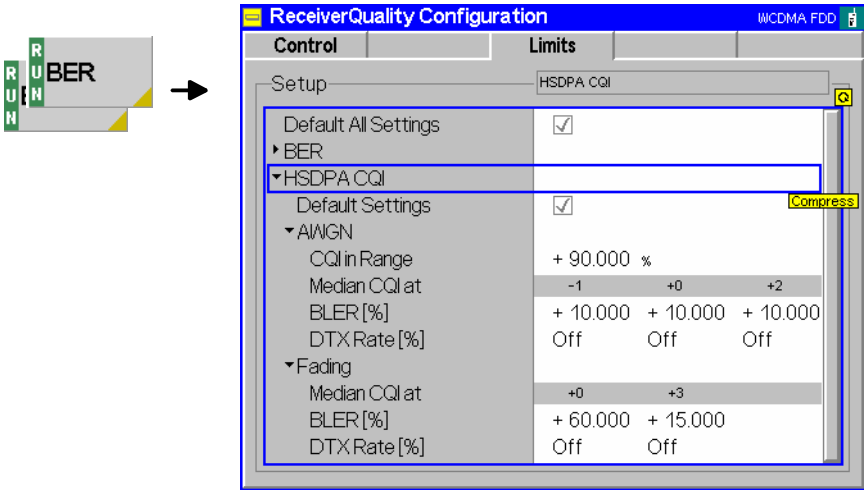


Fig. 8-8 Receiver Quality Configuration – Limits

Default Settings The *Default* switches overwrite all settings in the *Limits* tab with default values. The default values are quoted in the command description in section *Subsystem RXQuality:HCQI:...LIMit* on p. 8.96.

Remote control
```
DEFault:RXQuality:LIMit <Enable>
```

```
DEFault:RXQuality:BER:LIMit <Enable>
DEFault:RXQuality:HCQI:LIMit <Enable>
```

HSDPA CQI

The limits for the *AWGN* and *Fading* test cases can be set independently; see background information above.

CQI in Range Minimum percentage of the CQI values acquired in stage 1 that fall in the range (Median CQI – 2) ≤ Median CQI ≤ (Median CQI + 2). This limit is available for the AWGN test case only.

BLER Upper or lower BLER limits. **AWGN** test case: If the BLER at median CQI exceeds the limit, the BLER at median CQI – 1 must be below the limit. If the BLER at median CQI is below the limit, the BLER at median CQI + 2 must be above the limit.

DTX Rate Maximum percentage of HSDPA subframes that the UE answered with DTX. Off disables the limit check.

Remote control

```
CONFigure:RXQuality:HCQI:LIMit:IRCQi
CONFigure:RXQuality:HCQI:LIMit:BLER
CONFigure:RXQuality:HCQI:LIMit:DTXRate
CONFigure:RXQuality:HCQI:FADing:LIMit:BLER
CONFigure:RXQuality:HCQI:FADing:LIMit:DTXRate
```

HS-DPCCH Logging

The *HS-DPCCH Logging* application of the *Receiver Quality* measurement provides the ACK/NACK messages and reported CQI values that the UE returns in a sequence of 1000 consecutive HS-DPCCH subframes (200 WCDMA frames). This application is available in *Non Signalling* and in *Signalling* mode.

- To access the *HS-DPCCH Logging* measurement menu, select the *Receiver Quality* measurement and press *Application – HS-DPCCH Logging*.
- In *Non Signalling* mode, the HSDPA signal in the *Connection Control – Generator* tab must be switched *On* to induce the R&S CMU to measure the HS-DPCCH. In *Signalling* mode the HS-DPCCH is measured while the R&S CMU is in HSDPA test mode.

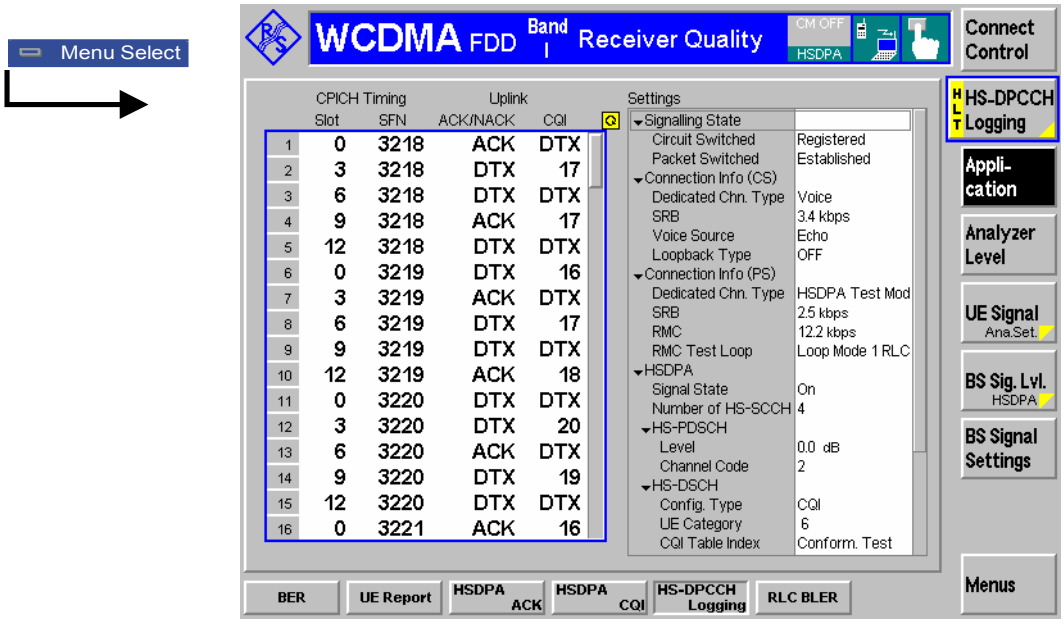


Fig. 8-9 HS-DPCCH logging menu

The *HS-DPCCH Logging* measurement is controlled by the following softkeys and hotkeys:

HS-DPCCH Logging

The *HS-DPCCH Logging* softkey controls the measurement and indicates its status *(RUN | OFF | HLT)*. This softkey changes to *BER*, *HSDPA ACK* etc., depending on the selected *Receiver Quality* measurement application.

The measurement status can be changed after softkey selection (pressing once) by means of the *ON/OFF* or *CONT/HLT* key. Besides the *Repetition* hotkey which is associated with the measurement control softkey selects the repetition mode (single shot or continuous measurement). The evaluation period (single shot) is fixed and comprises 1000 HS-DPCCH subframes.

Remote control
```
INITiate:RXQuality:HSLog
ABORt:RXQuality:HSLog
STOP:RXQuality:HSLog
CONTinue:RXQuality:HSLog
FETCh[:SCALar]:RXQuality:HSLog:STATus?
```

The following hotkeys are associated with the *HSDPA ACK* softkey.

Start SFN

Specifies the first System Frame Number (SFN) for which the returned ACK/NACK messages and reported CQI values are displayed. In the default setting *Off,* the measurement starts as soon as possible. If a number between 0 and 4095 is entered, the measurement starts in the next WCDMA frame with the specified SFN.

Remote control
```
CONFigure:RXQuality:HSLog:CONTrol:SSFN
```

Table Tree

Sets the focus on the result table or on the *Settings* table in the right half of the menu (for scrolling).

Remote control
No command, display configuration only.

HS-DPCCH Logging Measurement Results

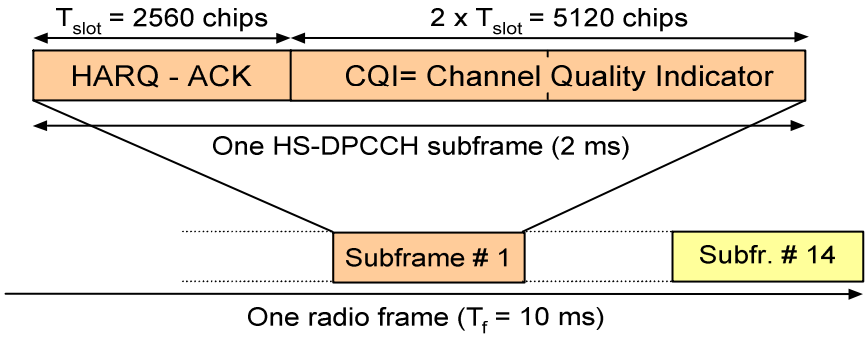
The tables in the *HS-DPCCH Logging* menu display the measurement results and the signal configuration.

The *Settings* table in the right half shows the generator settings described in section *HSDPA Downlink Generator (Non Signalling)* on p. 8.39. The output table in the left half shows the results described below.

Slot

First slot number of the received UL HS-DPCCH subframe. Each HS-DPCCH subframe contains three slots, so the first slot numbers are 0, 3, 6, 9, or 12. As the *HS-DPCCH Logging* measurement extends over 200 complete, consecutive WCDMA radio frames (1000 subframes), this slot number sequence is repeated 200 times.

The first slot of each UL HS-DPCCH subframe contains the ACK/NACK messages, the following two slots carry the CQI. The frame structure of the uplink HS-DPCCH is shown in the figure below.



SFN System Frame Number corresponding to the received UL HS-DPCCH subframe; 200 consecutive SFNs starting with the selected *Start SFN (HS-DPCCH Logging – Start SFN)*.

The SFN is sent on the DL P-CCPCH and used for paging groups and system information scheduling etc. The P-CCPCH is frame-aligned with both the DL P-CPICH and the DL HS-PDSCH. The P-CCPCH/P-CPICH timing is used as a reference for all physical DL and UL channels in the cell including the HSDPA channels. The DL DPCHs (DPCCH/DPDCHs) are transmitted with an offset to the P-CPICH timing; an additional offset separates the DL DPCCH/DPDCHs dedicated to an UE from the UL HS-DPCCH. For a detailed description of the timing relations refer to standard 3GPP TS 25.211.

ACK / NACK Response of the UE, transmitted in the first slot of the HS-DPCCH subframe: *ACK* (after successful CRC check of a received transmission packet) or *NACK* (after failed CRC check). *DTX* means that no answer was received from the UE.

CQI Reported Channel Quality Indicator in the range 0 to 30, transmitted in the second and third slots of the HS-DPCCH subframe. DTX means that no CQI was sent. The UE can use DTX independently in the ACK/NACK and CQI fields.

Remote control

```
READ[:SCALar]:RXQuality:HSLog?
FETCh[:SCALar]:RXQuality:HSLog?
SAMPle[:SCALar]:RXQuality:HSLog?
```

HSDPA Code Domain Power Tests

The *Code Domain Power* measurement provides the following HSDPA applications:

- In the *CDP/Code Manual* and *CDP/Code Rho Manual* applications, the *Code Domain Power* menu shows the power or ρ-factor of the HS-DPCCH over 1 complete slot (see section *HSDPA in CDP/Code Measurements* on p. 8.19.
- The *CDP vs. Time* application shows the code power and the measured gain factors for the HS-DPCCH. The principle of the *CDP vs. Time* measurement is desribed in Chapter 4 (see section *CDP vs. Time Measurement);* the HSDPA-specific measurement result are described below (see section *HSDPA in CDP vs. Time Measurement* on p. 8.21).
- The *HS-DPCCH Time Mask* measurement provides the code power of the UL channels over a 4-slot period; see *HS-DPCCH Time Mask* on p. 8.23.
- The *CDP Relative* measurement provides the relative code power of the UL channels over a configurable measurement length in the range between 1 and 46 slots, see *CDP Relative* on p. 8.28.
- The *CDE Relative* measurement provides the relative code domain error of the UL channels, see *CDE Relative* on p. 8.34.

For general notes on HSDPA tests refer to section *HSDPA in Signalling Mode* on p. 8.50.

HSDPA in CDP/Code Measurements

In the *CDP/Code Manual* and *CDP/Code Rho Manual* applications, the *Code Domain Power* menu shows the power or ρ-factor of the HS-DPCCH over 1 complete slot (10 consecutive 256-chip periods). A HS-DPCCH trigger is recommended for this measurement; see section *HS-DPCCH Trigger* in Chapter 4.

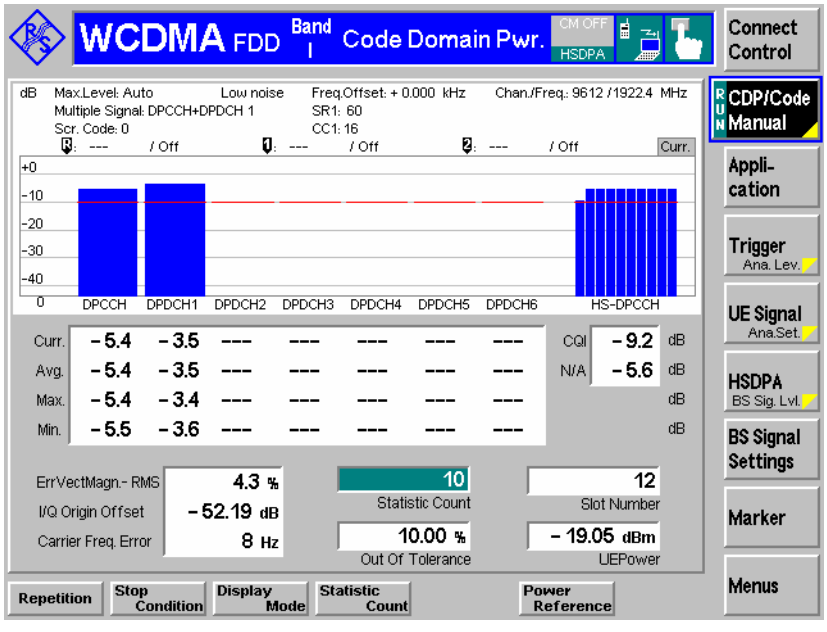


Fig. 8-10 HS-DPCCH measurement in CDP

Preparing a HS-DPCCH Test

To obtain the results shown in Fig. 8-10 above configure the R&S CMU as follows:

1. In the *Connection* tab of the *Connection Control* menu, select *Dedicated Channel: HSDPA Test Mode*.

2. In the *Network* tab of the *Connection Control* menu, enable the *Packet Switch Domain*.
3. In the *HS-DSCH* section of the *BS Signal* tab, ensure that the *UE Category* is set in accordance with your UE. If you use a *Fixed Reference Channel*, select a H-set which is compatible with your UE.
4. If you wish to control the HS-DPCCH signal level, open the *MS Signal* level and vary the *UE Gain Factors* for HSDPA Test Mode.
5. Connect your UE, wait for registration and set up a connection.
6. Open the *Code Domain Power* menu and select one of the manual applications.
7. Press *Trigger – Trigger Source: HSDPCCH*.

HS-DPCCH diagram

In the diagram the HS-DPCCH power or ρ-factor is shown to the right of the DPDCH channels. HS-DPCCH and DPDCH results are obtained with the same measurement and filter settings. The ten bars correspond to 10 consecutive 256-chip periods (1 slot). The HS-DPCCH is a fixed rate (SF = 256) channel so that each measurement interval corresponds to 1 symbol period. The displayed power or ρ-factor is averaged over the entire 256-chip period.

Owing to the properties of the HS-DPCCH trigger the measurement is not necessarily slot-aligned. If the gain factors for ACK, NACK, and CQI slots specified in the *MS Signal* tab of the *Connection Control* menu differ from each other, then the diagram possibly shows two groups of bars with different power. The *DL DPCH Timing Offset,* to be set in the *RF Generator / BS Signal* tab of the *Connection Control* menu, controls the slot alignment between the UL DPCH and the HS-DPCCH; moreover, the trigger *Slot Delay* in the *Trigger* tab can be used to select a particular 1-slot period within the HSDPA subframe. See Fig. 8-11 below and section *Trigger Offsets for TX Measurements* in Chapter 4.

The HS-DPCCH bars always show *Current* results, irrespective of the display mode indicated in the menu.

Remote control:
`READ:ARRay:CDPower:MANual:HSDPcch?`
`READ:ARRay:CDPower:RMANual:HSDPcch?` etc.
Each command returns 10 values, corresponding to the power or ρ-factor at the ten symbol periods.

The remote control commands for CDPower including the HSDPA commands are reported in Chapter 6.

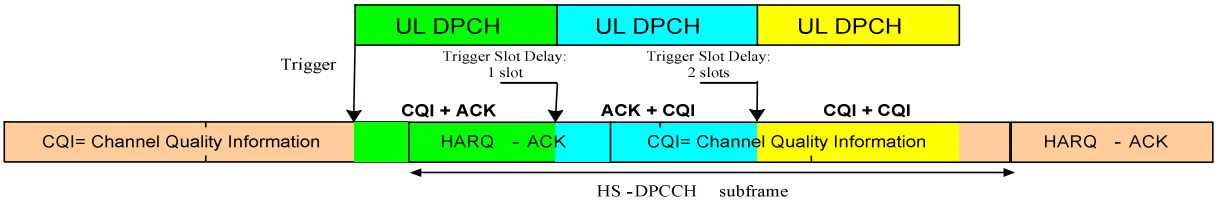


Fig. 8-11 HS-DPCCH measurement in CDP

Additional results

Below the diagram the average power or ρ-factor for all measured CQI and ACK symbols is displayed. The results are obtained from the 10 HS-DPCCH bars in the diagram which are converted into a linear power or ρ-factor, averaged, and then reconverted into a dB-value. The results are referenced to the total uplink power,

averaged over the CQI or ACK symbol periods, respectively.

$$CQI = \frac{\sum_{CQI\ symbols} \overline{P}_{CQI}}{\sum_{CQI\ symbols} \overline{P}_{total}}; \qquad ACK = \frac{\sum_{ACK\ symbols} \overline{P}_{ACK}}{\sum_{ACK\ symbols} \overline{P}_{total}}$$

In the formulas above $\overline{P}$ denotes the power averaged over the symbol period. If the diagram shows only CQI bars, the ACK result is invalid ("---").

Remote control:
```
READ[:SCALar]:CDPower:MANual:CQI?
READ[:SCALar]:CDPower:MANual:ACK?
READ[:SCALar]:CDPower:RMANual:CQI?
READ[:SCALar]:CDPower:RMANual:ACK?
```
etc.

Each command returns 1 value, corresponding to the average power or ρ-factor for the measured CQI or ACK symbols.

The remote control commands for CDPower including the HSDPA commands are reported in Chapter 6.

Limit check

A pair of horizontal red lines represent the limit lines set in the *Limits* tab of the configuration menu. In addition the *CQI* and *ACK* fields turn red if the average results exceed the tolerances.

The HS-DPCCH measurement always yields *Current* results. No limits are provided for *Average, Minimum,* and *Maximum* measurements.

Remote control
For limit definition:
```
CONFigure:CDPower:MANual:CMMax:LIMit:POINt:ASYMmetric:
  UPPer:CHANnel<nr> <CDP_Limit>,
```
where `<nr> = 8`
```
CONFigure:CDPower:MANual:CMMax:LIMit:POINt:ASYMmetric:
  LOWer:CHANnel<nr> <CDP_Limit>,
```
where `<nr> = 8`
```
CONFigure:CDPower:RMANual:CMMax:LIMit:POINt:ASYMmetric:
  UPPer:CHANnel<nr> <CD-ρ_Limit>,
```
where `<nr> = 8`
```
CONFigure:CDPower:RMANual:CMMax:LIMit:POINt:ASYMmetric:
  LOWer:CHANnel<nr> <CD-ρ_Limit>,
```
where `<nr> = 8`
For limit matching:
```
CALCulate:ARRay:CDPower:MANual:CURRent:MATChing:LIMit?
CALCulate:ARRay:CDPower:RMANual:CURRent:MATChing:LIMit?
```
The commands return the limit matching information `(NMAU | NMAL | INV | OK)` for HS-DPCCH as a last parameter. The result is `OK` only if none of the results for the ACK or CQI symbols exceeds the tolerances.

The remote control commands for CDPower:MANual and CDPower:RMANual including the HSDPA commands are reported in Chapter 6.

HSDPA in CDP vs. Time Measurement

In the *CDP / Time* menu, the code power for all UL channels is shown in two diagrams (see general description in Chapter 4, section *CDP vs. Time Measurement)*. The measured gain factors for the

individual channels are displayed below. The HS-DPCCH channel can be displayed in the upper or in the lower diagram.

Parameter lines

Upper diagram

Lower diagram

Output fields

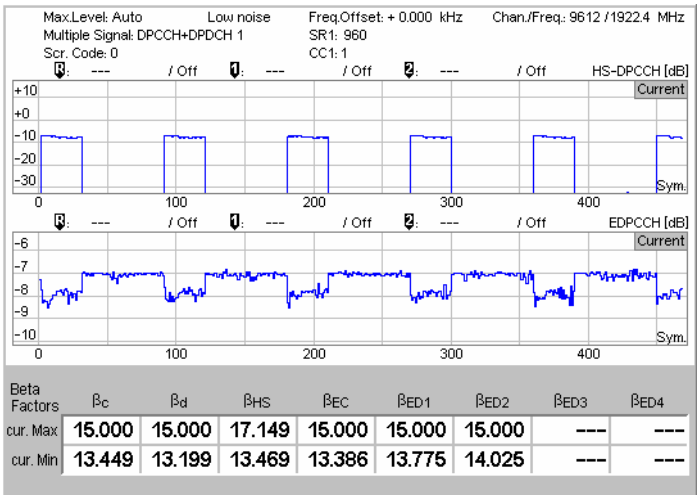


Fig. 8-12 Display of results (CDP vs. Time, HSDPA)

Diagrams

The diagrams in the *CDP vs. Time* measurement menu show the absolute *UE Power* (the sum of all UL channels in dBm) and the relative powers of the HS-DPCCH and the other UL channels. The following results and settings are related to the HS-DPCCH:

- HS-DPCCH channel selection for the upper or for the lower diagram *(CDP/Time – Diagram Type)*
- Diagram scaling *(Display/Marker – HS-DPCCH Scale X/Y)*

Remote control
`READ:ARRay:CDPower:TIME:HSDPcch:CPOWer?` etc.

The following commands retrieve the maximum and minimum code powers of all channels:
`READ[:SCALar]:CDPower:TIME:CPOWer?` etc.

Output fields

The output fields below the diagram show the minimum and maximum gain factors that the R&S CMU determined across the entire measurement range. The gain factors define the relative strength of the uplink channels (see standard TS 25.213), they are calculated and normalized as described in section *CDP vs. Time Measurement* in Chapter 4. The gain factor β_{hs} for the HS-DPCCH can vary between 5 and 30 (15 times the quantized amplitude ratios).

In *Signalling* mode the R&S CMU can also configure the gain factors. For a detailed description refer to section *Gain Factors for the UE Signal* in Chapter 4.

Remote control
`READ[:SCALar]:CDPower:TIME:BFACtor?` etc.

The following commands retrieve the gain factors across the entire measurement range:
`READ:ARRay:CDPower:TIME:HSDPcch:BFACtor?` etc.

NOTE

The remote control commands for CDPower:TIME including the HSDPA commands are reported in Chapter 6.

HS-DPCCH Time Mask

The *HS-DPCCH Time Mask* measurement provides the code power of the UL channels over a configurable measurement length in the range between 1 and 19 slots. The main purpose of this measurement is to assess the steps of the UL transmission power due to the transmission of ACK/NACK or CQI over the HS-DPCCH (HS-DPCCH test, described in the conformance test specification 3GPP TS 34.121, section 5.7A). The measurement is an application of the *Code Domain Power* measurement which is available in *Non Signalling* and in *Signalling* mode.

Measurement procedure and purpose

The measurement extends over a duration of up to 6 HSDPA subframes (18 slots) plus ½ slot before and one slot afterwards. A ½-slot delay between the UL DPCH ($DPDCH_1$ and DPCCH) and the HS-DPCCH is assumed. The R&S CMU 200 acquires a set of average code power values in each half slot. This means that a single shot measurement yields up to 38 results for the code powers in each channel.

A 25 µs period before and after any DPCCH or HS-DPCCH slot boundary is excluded from the evaluation of the mean power. Based on the mean power values, the R&S CMU assesses the power steps at the HS-DPCCH slot boundaries and performs a limit check.

In *Signalling* mode the *HS-DPCCH Time Mask* measurement can be used as well to verify to which degree of accuracy the UL code powers comply with the gain factors signalled to the UE; see section *UE Signal* in Chapter 4.

Channel detection

A channel is considered to be active if its signal power, averaged over a slot, exceeds the *Threshold* value defined in the *UE Code* or *UE Signal* tab of the *Connection Control* menu *(UE Code – DPDCH Settings – Auto Settings – Threshold* in Non Signalling mode or *UE Signal – Measurement Settings – Threshold* in Signalling mode). The R&S CMU provides no power results for inactive channels; the `READ…/FETCh…/SAMPle…` commands return `NAN` values. The following exceptions apply:

- The DPCCH is assumed to be always active. Its measured power and gain factor is always indicated (no NAN values), irrespective of the threshold.
- In Signalling mode or in Non Signalling mode with the setting *DPDCH CC Mode: Auto,* the DPDCH 1 is also assumed to be active.
- In Non Signalling mode with the setting *DPDCH CC Mode: Manual*, all DPDCHs selected manually are assumed to be active.

Measurement settings

The HS-DPCCH measurement is most conveniently performed with a HS-DPCCH trigger, which is also the *Auto* trigger source *(Connection Control – Trigger – Source: HSDPCCH)*. To obtain results according to the conformance test specification 3GPP TS 34.121, section 5.7A, configure the R&S CMU as follows:

1. To ensure a ½-slot delay between the UL DPCH and the HS-DPCCH, open the *BS Signal* tab of the *Connection Control* menu and select *Downlink Physical Channels – DL DPCH Timing Offset: = 6 * 256 chips*.
2. To ensure the right ACK/NACK and CQI pattern, expand the *HSDPA DSCH* parameter section and select a CQI feedback cycle of 4 ms. Moreover, set the *CQI Repetition Factor* and the *ACK/NACK Repetition Factor* to 1 and select *Channel Configuration Type: User Defined.* It is sufficient to keep the default settings for the user defined channel.
3. In *Signalling* mode, you can configure an appropriate set of gain factors *(Connection Control – UE Signal – UE Gain Factors)* in order to obtain an UE signal power according to the requirements of the test specification (see Table 8-2 on p. 8.26).

4. In *Non Signalling* mode, the HSDPA signal in the *Connection Control – Generator* tab must be switched *On* to induce the R&S CMU to measure the HS-DPCCH. In *Signalling* mode the HS-DPCCH is measured while the R&S CMU is in HSDPA test mode.

HS-DPCCH Time Mask Results

In the *HS-DPCCH Time Mask* menu, the code power for the UL channels and the total UE power is shown in two diagrams. The power steps are displayed below.

Parameter lines

Upper diagram

Lower diagram

Output fields

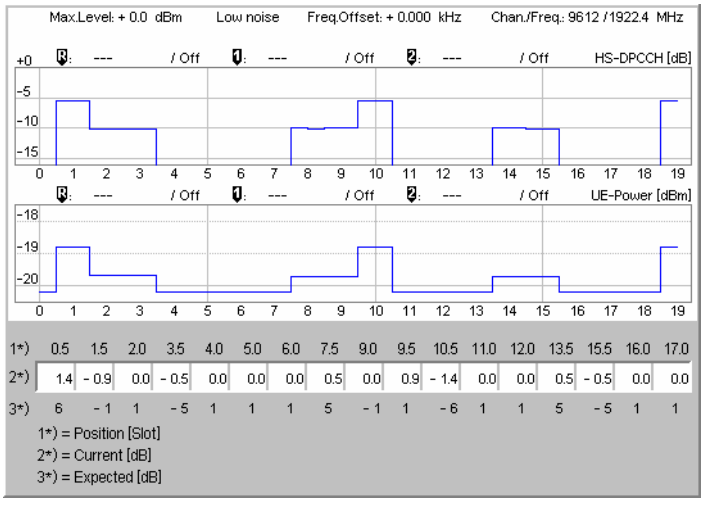


Fig. 8-13 Display of results (HS-DPCCH Time Mask)

Parameter lines The test settings and results (marker values) displayed in the four parameter lines are analogous to the settings and results in the *CDP/Code Auto (CDP/Code Rho Auto)* menus; see Chapter 4.

Diagrams The diagrams in the *HS-DPCCH Time Mask* measurement menu show the powers of the DPCCH, the DPDCH 1 and the HS-DPCCH channel relative to the total UE power, and the absolute *UE Power* (the sum of all UL channels in dBm, lower diagram). The hotkeys associated with the measurement control softkey provide the following measurement settings:

- The *Repetition* mode (single shot or continuous measurement) and *Stop Condition*
- Channel selection for the upper diagram *(Diagram Type)*
- The measurement *Mode,* adjusted for measurements at maximum UE power with TPC_cmd = 1 *(Variant 1)* or measurements below maximum UE power with TPC_cmd = 0 *(Variant 2)*
- The number of slots measured and displayed in the measurement diagrams *(Measurement Length)*

These measurement settings are also accessible from the *Control* tab of the *Connection Control* menu; see section *HS-DPCCH Time Mask Configuration* on p. 8.25. Both diagrams can be scaled independently using the hotkeys associated with the *Display/Marker* softkey:

DPCCH Scale Y and *UE Power Scale Y* define the scale span; the upper edge of the diagram is automatically adjusted according to the maximum power across the evaluation period.

Note that the HS-DPCCH slot boundaries for a half-slot UL DPCH / HS-DPCCH delay coincide with slots 0.5, 1.5, … 18.5.

Remote control
`READ:ARRay:CDPower:TMHSdpcch:UEPower?` etc.
`READ:ARRay:CDPower:TMHSdpcch:DPCCH?` etc.
`READ:ARRay:CDPower:TMHSdpcch:DPDCH?` etc.
`READ:ARRay:CDPower:TMHSdpcch:HSDPcch?` etc.

Output fields

The row of output fields below the diagrams shows the power steps from the conformance test specification:

- In a measurement according to *Variant 1* (TPC_cmd = 1), 17 power steps are measured (steps 1 to 13 from the standard, where step no. 5 contains three test points, steps no. 10 and 13 contain 2 test points).
- In a measurement according to *Variant 2* (TPC_cmd = 0), 14 power steps are measured (steps 1 to 11 from the standard, where each of the steps no. 4, 8 and 11 contain 2 test points).

The test point positions (slot numbers) are displayed above the output fields, the rounded nominal power steps, according to the selected test variant, are displayed below for comparison with the measured values.

Remote control
`READ[:SCALar]:CDPower:TMHSdpcch?` etc.

Limit Check

A red output field and an arrow pointing upwards or downwards indicates that the measurement result for one of the power steps exceeds the upper or lower limit set in the *Limits* tab of the *Code Domain Power Configuration* menu, see Fig. 8-15 on p. 8.27.

Remote control
`CALCulate[:SCALar]:CDPower:TMHSdpcch:MATChing:LIMit?`

HS-DPCCH Time Mask Configuration

The *HS-DPCCH Time Mask* settings in the *Control* tab of the *Code Domain Power* menu define the scope of the *HS-DPCCH Time Mask* measurement, scale the results and select the displayed values for the upper diagram in the measurement menus.

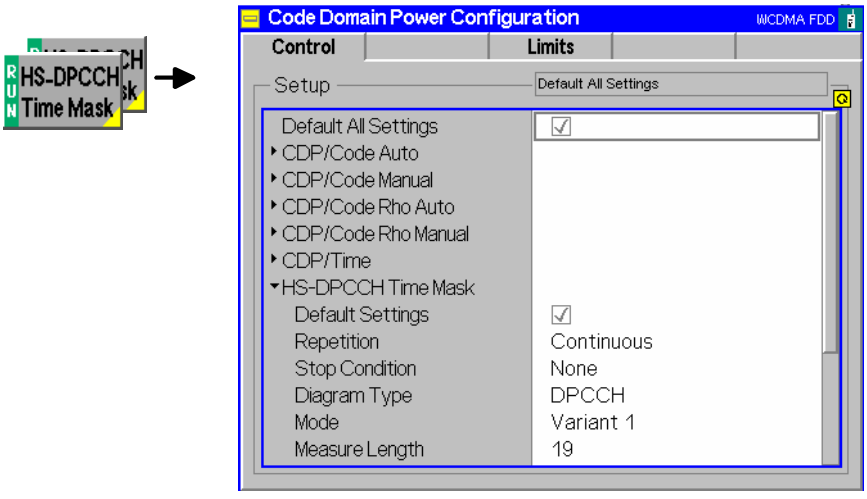


Fig. 8-14 Code Domain Power Configuration – Control

The *Repetition* mode and *Stop Condition* are analogous for all measurement applications. The following settings are *HS-DPCCH Time Mask*-specific.

Diagram Type Selects the relative powers of the *DPCCH, DPDCH 1,* and *HS-DPDCH* code channels for the upper diagram in the measurement menu.

Remote control
–

Mode Selects one of the measurement scenarios described in the conformance test specification and adjusts the number of test steps in the measurement diagram. The UE signal must be configured independently according to the selected test scenario.

Variant 1 Measurement at maximum UE power with TPC_cmd = 1

Variant 2 Measurement below maximum UE power with TPC_cmd = 0

Remote control
`CONFigure:CDPower:TMHSdpcch:CONTrol:MODE VAR1 | VAR2`

Measure Length Selects the number of slots measured and displayed in the code domain power and UE power diagrams. The position of the test steps is not affected, however, power step results beyond the measurement length are not available (invalid results).

Remote control
`CONFigure:CDPower:TMHSdpcch:CONTrol:MLENgth`

The *Step Size Limits* for the HS-DPCCH time mask measurement are in accordance with the minimum requirements (tables 5.7.A.2 and 5.7.A.3) in the conformance test specification 3GPP TS 34.121.

Test No	β_c	β_d	β_{ACK}	β_{ACK}	β_{CQI}	Power Step Size / dB	Step Size Limit /dB (TS 34.131, table 5.7.A.1)
5	15	7	8	8	7	7	±2.0
						2	±1.0
						0	±0.5
						5	±2.0
6	15	0	8	8	7	7	±2.0
						1	±0.5
						0	±0.5
						6	±2.0

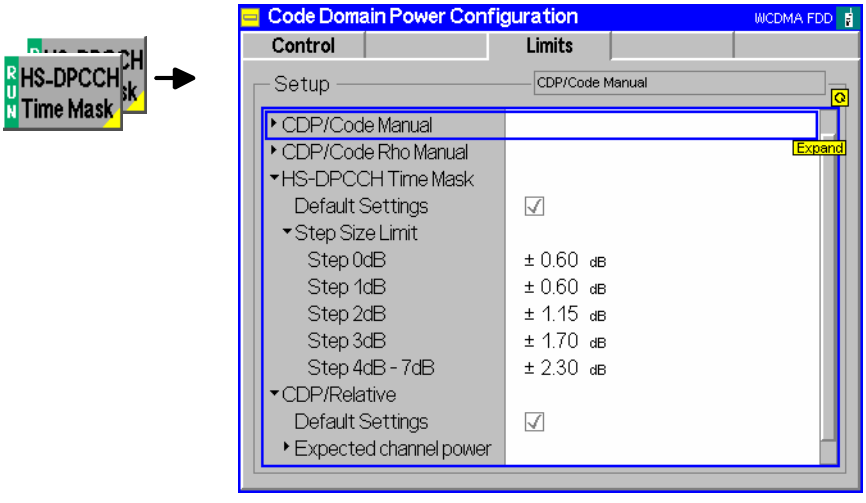


Fig. 8-15 Code Domain Power Configuration – Limits

Step Size Limit Limits for the step size, depending on the rounded nominal size of the power step. The standard specifies limits for rounded power step sizes of 0 dB, ±1 dB, ±5 dB, and ±6 dB. These limits correspond to the *Step 0 dB, Step 1 dB,* and *Step 4 dB – 7 dB* values of the R&S CMU. Additional limits are available for possible extensions of the HSDPA time mask measurement.

The limit check is performed as follows:

1. Calculation of the rounded value for the nominal power steps (depending on the test mode, *Variant 1* or *Variant 2)*.
2. Selection of the limit value and calculation of the allowed range for the measured power step: For positive rounded step sizes [rounded step size – limit value, measured step size + limit value] for zero rounded step size [–limit value, +limit value], for negative rounded step sizes [measured step size – limit value, rounded step size + limit value].
3. Measurement of the actual power step size and comparison with the allowed range.

Example: A measured value of 1.38 dB is rounded to 1 dB. The allowed step size range is: [1 dB – <Step 1 dB>, 1.38 dB + <Step 1 dB>] = [0.4 dB, 1.98 dB].

Remote control

```
CONFigure:CDPower:TMHSdpcch:SSIZe:LIMit:SCALar:SYMMetric:
COMBined:VALue
```

CDP Relative

The *CDP Relative* measurement provides the relative code power of the UL channels over a configurable measurement length in the range between 1 and 46 slots. The main purpose of this measurement is to assess the relative code domain power of the DPCCH, DPDCH, the HS-DPCCH and E-DPCH for a specific UL signal configuration (UE relative code domain power accuracy, described in the conformance test specification 3GPP TS 34.121, section 5.2C and section 5.2D). The measurement is an application of the *Code Domain Power* measurement which is available in *Non Signalling* and in *Signalling* mode.

Definition of measured quantities:

According to the Terminal Conformance Specification TS 34.121, the relative CDP accuracy of a code channel is the difference of the measured CDP ratio minus the nominal CDP ratio. The measured CDP ratio is the ratio of the measured code power to the measured total power of all active codes, expressed in dB. The nominal CDP ratio is the ratio of the nominal code power to the sum of all nominal code powers, expressed in dB.

The nominal code powers are derived from gain factors (beta factors); their sum is equal to 1 by definition. According to its definition, the relative CDP accuracy is independent of variations in the actual total power of the UE signal and of noise in the signal that falls on inactive codes.

According to the test specification, the HS-DPCCH and the HS-DPCCH + E-DPCH measurements are performed with different sets of test parameters and different limits. The R&S CMU auto-selects the measurement type:

- In *Signalling* mode, HS-DPCCH + E-DPCH (HSUPA) or HS-DPCCH (HSDPA) tests are performed depending on the current DCH type *(Connection Control – BS Signal – Packet Switched – DCH (Dedicated Chn.) Type)*.
- In *Non Signalling* mode, an E-DPCH (HSUPA) test is performed if both the HSDPA signal and the HSUPA signal in the *Connection Control – Generator* tab is *On.* If the HSUPA signal is switched off, a HS-DPCCH (HSDPA) test is performed.

The measurement procedure and necessary measurement settings also depend on the measurement type. The following paragraphs give an overview.

HSDPA test: Measurement procedure and purpose

The measurement extends over a duration of up to 15 HSDPA subframes (45 slots) plus ½ slot before and one slot afterwards. A ½-slot delay between the UL DPCH ($DPDCH_1$ and DPCCH) and the HS-DPCCH is assumed; no E-DPCH channels are expected. The R&S CMU 200 acquires a set of average code power values in each half slot. This means that a single shot measurement yields up to 92 results for the code powers in each channel.

A 25 µs period before and after any DPCCH or HS-DPCCH slot boundary is excluded from the evaluation of the relative code powers. In addition to the relative code power measurement over the entire measurement interval, the R&S CMU200 performs a limit check at four specific measurement points.

HSDPA test: Measurement settings

The HS-DPCCH measurement is most conveniently performed with a HS-DPCCH trigger, which is also the *Auto* trigger source *(Connection Control – Trigger – Source: HSDPCCH)*. To obtain results according to the conformance test specification 3GPP TS 34.121, section 5.2C, configure the R&S CMU as follows:

1. To ensure a ½-slot delay between the UL DPCH and the HS-DPCCH, open the *BS Signal* tab of the *Connection Control* menu and select *Downlink Physical Channels – DL DPCH Timing Offset: = 6 * 256 chips*.
2. To ensure the right ACK/NACK and CQI pattern, expand the *HSDPA DSCH* parameter section and select a CQI feedback cycle of 4 ms. Moreover, set the *CQI Repetition Factor* and the *ACK/NACK Repetition Factor* to 1.
3. In the *TPC Settings* section of the *Connection Control – RF Generator* or *BS*

Signal tabs of the *Connection Control* menu, select TPC algorithm 2 and a *Closed Loop* TPC pattern type to ensure that the UE output power, in time intervals where not HS-DPCCH is transmitted, is in the range (0 ± 2) dBm.

4. In *Signalling* mode, you can configure an appropriate set of gain factors *(Connection Control – UE Signal – UE Gain Factors)* in order to obtain an UE signal power according to the requirements of the test.

Note: *Depending on the values of the gain factors, a change of the "UE Signal – Measurement Settings – Threshold" value may be necessary. For subtest 1 (β_c = 2, β_D = 15, Δ_{ACK} = Δ_{NACK} = 8, Δ_{CQI} = 7), a value of –1 dB is recommended. For subtest 4 (β_c = 15, β_D = 4, Δ_{ACK} = Δ_{NACK} = 8, Δ_{CQI} = 7), a value of –20 dB is recommended.*

HSUPA test: Measurement procedure and purpose

The measurement extends over a duration of up to 46 slots (3 WCDMA frames plus 1 slot). A continuous HS-DPCCH is assumed, and the R&S CMU measures the power steps due to the discontinuous E-DPCH channels E-DPCCH, E-DPDCH1, and E-DPDCH2. The R&S CMU 200 acquires a set of average code power values in each slot. This means that a single shot measurement yields up to 46 results for the code powers in each channel.

A 25 µs period before and after each slot boundary is excluded from the evaluation of the relative code powers. In addition to the relative code power measurement over the entire measurement interval, the R&S CMU200 performs a limit check at three specific measurement points.

HSUPA test: Measurement settings

The HS-DPCCH + E-DPCH measurement is most conveniently performed with a frame trigger *(Connection Control – Trigger – Source: Frame)*. While a relative CDP measurement is running, the frame trigger events are suppressed in every second frame, so that the trigger intervals correspond to the periodicity of the expected E-DPCH signal.

To obtain results according to the conformance test specification 3GPP TS 34.121, section 5.2D, configure the R&S CMU as follows:

1. Ensure that the HS-DPCCH is transmitted continuously. In *Signalling* mode, you can select a fixed reference channel according to H-Set 1 QPSK with a CQI repetition factor of 2 and an ACK/NACK repetition factor of 3 *(Connection Control – BS Signal – HSDPA HS-DSCH…)*. Furthermore, you can select equal gain factors ΔACK = ΔNACK = ΔCQI *(Connection Control – UE Signal – UE Gain Factors…)*.
2. Select an absolute grant pattern that will cause the UE to send scheduling information every other 10 ms E-DCH TTI. In *Signalling* mode, open the *HSUPA* section in the *Connection Control – BS Signal* tab and select an AG pattern length of 2 with AG index values 10 and 0. You may use another index value instead of 10, however, the first AG index should be different from zero to avoid trigger problems. In *Non Signalling* mode, open the *Channel Settings – HSUPA Channels* section of the *Connection Control – Generator* tab and select the *Primary UE ID* values 10, 0, Off, Off.
3. Set the UE to its maximum output power using the procedure described in the conformance test specification. In the *TPC Settings* section of the *Connection Control – RF Generator* or *BS Signal* tabs of the *Connection Control* menu, select TPC algorithm 2 and a *Alternating* TPC pattern type to ensure that the UE remains at its maximum output power.

CDP Relative Results

In the *CDP Relative* menu, the total UE power and the code power for the UL channels is shown in two diagrams. The power steps are displayed below. The measurement results depend on the measurement type (HS-DPCCH or HS-DPCCH + E-DPCH measurement).

Parameter lines

Upper diagram

Lower diagram

Output fields

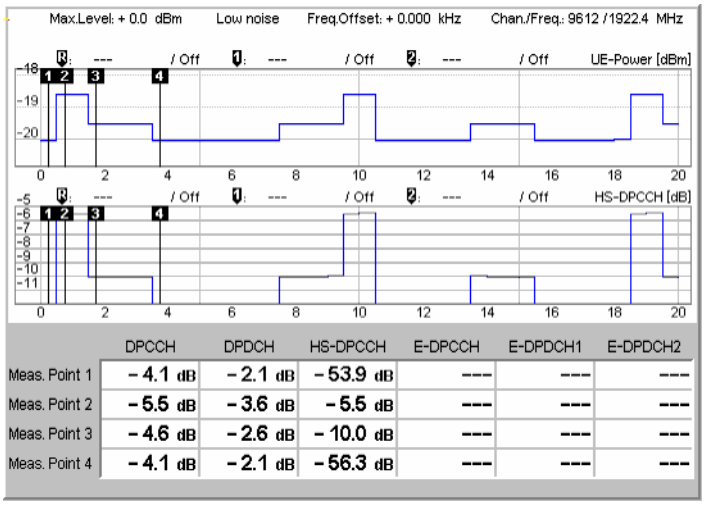


Fig. 8-16 Display of results (CDP Relative, HS-DPCCH measurement)

Parameter lines

Upper diagram

Lower diagram

Output fields

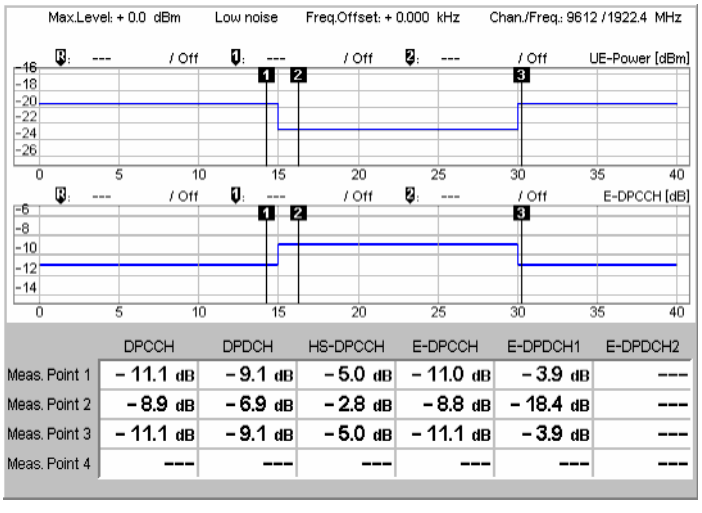


Fig. 8-17 Display of results (CDP Relative, HS-DPCCH + E-DPCH measurement)

Parameter lines The test settings and results (marker values) displayed in the four parameter lines are analogous to the settings and results in the *CDP/Code Auto (CDP/Code Rho Auto)* menus; see Chapter 4.

Diagrams The diagrams in the *CDP Relative* measurement menu show the absolute *UE Power* (the sum of all UL channels in dBm, upper diagram) and the powers of the DPCCH, the DPDCH 1, the HS-DPCCH, and the E-DPCH channels (E-DPCCH, E-DPDCH1, E-DPDCH2) relative to the total UE power. The vertical marker lines labeled 1 to 3 or 4 indicate the position of the measurement points; see below.

The hotkeys associated with the measurement control softkey provide the following measurement settings:

- The *Repetition* mode (single shot or continuous measurement) and *Stop Condition*
- Channel selection for the lower diagram *(Diagram Type)*
- The position of the measurement points *(Measure Points)* where the R&S CMU measures the relative code domain powers (displayed in the output fields below the diagram). See *Measure Points* on p. 8.32.
- The number of slots measured and displayed in the measurement diagrams *(Measurement Length)*

These measurement settings are also accessible from the *Control* tab of the *Connection Control* menu; see section *CDP Relative Configuration* on p. 8.32. Both diagrams can be scaled independently using the hotkeys associated with the *Display/Marker* softkey:

UE Power Scale Y and *DPCCH Scale Y* define the scale span; the upper edge of the diagram is automatically adjusted according to the maximum power across the evaluation period.

Remote control
`READ:ARRay:CDPower:RELative:UEPower?` etc.
`READ:ARRay:CDPower:RELative:DPCCH?` etc.
`READ:ARRay:CDPower:RELative:DPDCH?` etc.
`READ:ARRay:CDPower:RELative:HSDPcch?` etc.
`READ:ARRay:CDPower:RELative:EDPCch?` etc.
`READ:ARRay:CDPower:RELative:EDPDch<nr>?` etc.
No remote control for *Measure Points* (display configuration only).

Output fields

The output fields below the diagrams show the measured relative code domain power for the measured channels:

- In a HS-DPCCH measurement, the DPCCH, DPDCH, and HS-DPCCH power is displayed at the measurement points 1 to 4. The E-DPCH channel results (E-DPCCH, E-DPDCH1, E-DPDCH2) are invalid.
- In a HS-DPCCH + E-DPCH measurement, the power of the previous channels plus the E-DPCH channel powers are displayed at the measurement points 1 to 3. The results at point 4 are invalid.

Remote control
`READ[:SCALar]:CDPower:RELative?` etc.
`READ[:SCALar]:CDPower:RELative:HSPA?` etc.

Limit Check

A red output field and an arrow pointing upwards or downwards indicates that the measurement result for one of the relative code domain powers exceeds the upper or lower limit set in the *Limits* tab of the *Code Domain Power Configuration* menu, see Fig. 8-19 on p. 8.33.

Remote control
`CALCulate[:SCALar]:CDPower:RELative:MATChing:LIMit?`
`CALCulate[:SCALar]:CDPower:RELative:HSPA:MATChing:LIMit?`

CDP Relative Configuration

The *CDP Relative* settings in the *Control* tab of the *Code Domain Power* menu define the scope of the *CDP Relative* measurement, scale the results and select the displayed values for the lower diagram in the measurement menus.

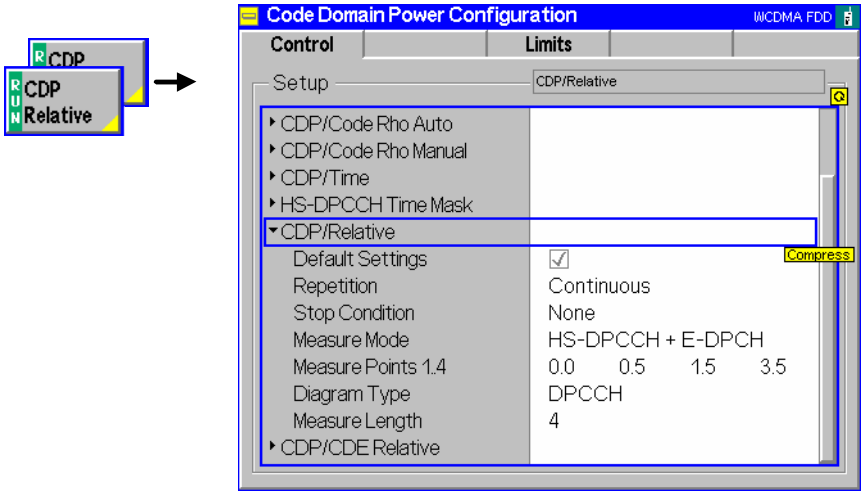


Fig. 8-18 Code Domain Power Configuration – Control

The *Repetition* mode and *Stop Condition* are analogous for all measurement applications. The following settings are *CDP Relative*-specific.

Measure Points Position of the points in the diagrams where the R&S CMU measures the relative code domain power. In *Signalling* mode, the limit check is always performed at the default positions (0.0, 0.5, 1.5, 3.5) shown in Fig. 8-16 above, irrespective of the actual positions of the measurement points. If E-DPCH channels are measured, the limit check is performed at the three alternative positions (29.0, 31.0 and 45.0).

Remote control
`CONFigure:CDPower:RELative:CONTrol[:SCALar]:MEAPoint:VALue<nr>`

Diagram Type Selects the code channels for the lower diagram in the measurement menu.

Remote control: No command, display configuration only

Measure Length Selects the number of slots measured and displayed in the UE power and code domain power diagrams. The position of the measurement points is not affected, however, relative code domain power results beyond the measurement length are not available (invalid results).

Remote control
`CONFigure:CDPower:RELative:CONTrol:MLENgth`

The limits for the relative CDP measurement are in accordance with the minimum requirements (tables 5.2.C.3 and 5.2.C.4) in the conformance test specification 3GPP TS 34.121.

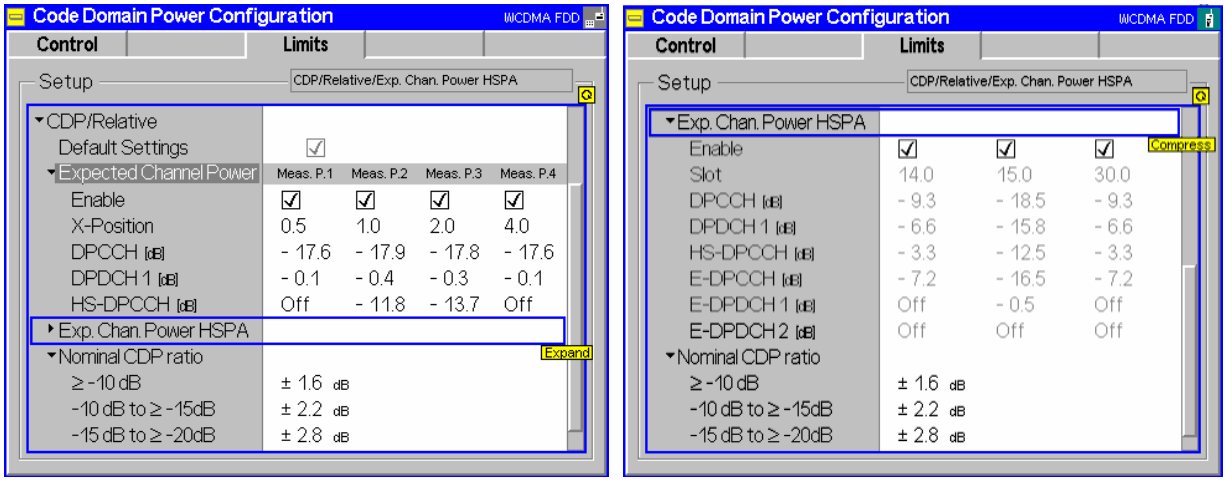


Fig. 8-19 Code Domain Power Configuration – Limits (Non Signalling and Signalling mode)

Expected Channel Power

Expected relative code domain power in dB for the measurement points 1 to 4 and for the DPCCH, DPDCH, and the HS-DPCCH. The values are used if no E-DPCH channels are measured. Possible settings depend on the test mode:

- In *Non Signalling* mode, the values can be set manually; the default configuration corresponds to subtest 1 in 3GPP TS 34.121, table C.10.1.3. Moreover it is possible to disable the limit check at each measurement point.
- In *Signalling* mode, the values are fixed; they are calculated from the gain factors that the R&S CMU transmits to the UE and the position of the measurement points. The x-positions are fixed in accordance with the conformance test specification; they do not depend on the measurement point positions defined in the *Control* tab. It is still possible to enable or disable the limit check.

Remote control

```
CONFigure:CDPower:RELative:LIMit[:SCALar]:ASYMmetric
[:COMBined]:VALue<nr>
CONFigure:CDPower:RELative:LIMit[:SCALar]:ASYMmetric
[:COMBined]:ENABle<nr>
```

Expected Chan. Power HSPA

Expected relative code domain power in dB for the measurement points 1 to 4 and for the DPCCH, DPDCH, the HS-DPCCH, and the E-DPCH channels. The values are used if E-DPCH channels are measured. The settings depend on the test mode:

- In *Non Signalling* mode, the values can be set manually; the default configuration corresponds to subtest 1 in 3GPP TS 34.121, table 5.2D.7. Moreover it is possible to disable the limit check at each measurement point.
- In *Signalling* mode, the values are fixed; they are calculated from the gain factors and the absolute grant pattern that the R&S CMU transmits to the UE and the position of the measurement points. The x-positions are fixed in accordance with the conformance test specification; they do not depend on the measurement point positions defined in the *Control* tab. It is still possible to enable or disable the limit check.

Remote control

```
CONFigure:CDPower:RELative:LIMit:HSPA[:SCALar]:ASYMmetric
[:COMBined]:VALue<nr>
CONFigure:CDPower:RELative:LIMit:HSPA[:SCALar]:ASYMmetric
[:COMBined]:ENABle<nr>
```

Nominal CDP Ratio

Limits for the relative code domain power, depending on the expected (relative) channel power displayed in the upper table. For the default channel configuration in *Non Signalling* mode and the HS-DPCCH measurement, the limits apply as follows:

- The "≥ –10 dB" limit is relevant for the DPDCH. At measurement point 1 and with default limit settings, the relative DPDCH power must be in the range from –1.7 dB to 0 dB (the maximum possible value; note, however the DPCCH limit).
- The "–10 dB to ≥–15 dB" limit is relevant for the HS-DPCCH. At measurement point 2 and with default limit settings, the relative HS-DPCCH power must be in the range from –14.0 dB to –9.6 dB.
- The "–15 dB to ≥–20 dB" limit is relevant for the DPCCH. At measurement point 1 and with default limit settings, the relative DPCCH power must be in the range from –20.4 dB to –14.8 dB.

The validity of the *Nominal CDP Ratio* limits for the HS-DPCCH + E-DPCH measurement can be read from the *Expected Chan. Power HSPA* in analogy to the previous examples.

Remote control

```
CONFigure:CDPower:RELative:LIMit[:SCALar]:SYMMetric
[:COMBined]:VALue<nr>
```

CDE Relative

The *CDE Relative* measurement provides the relative code domain error of the UL channels. The main purpose of this measurement is to assess the relative code domain error of the DPCCH, DPDCH, the HS-DPCCH and E-DPCH for a specific UL signal configuration (relative code domain error test, described in the conformance test specification 3GPP TS 34.121, section 5.13.2A and section 5.13.2B). The measurement is an application of the *Code Domain Power* measurement which is available in *Non Signalling* and in *Signalling* mode.

Definition of measured quantities:

According to the Terminal Conformance Specification TS 34.121, the relative code domain error is computed by projecting the error vector on the code domain: The relative CDE corresponds to the projection of the EVM onto a code. For a given active code channel (i.e. a channel with non-zero gain or beta factor), it is defined as the ratio of the mean power of the projection on the code to the mean power of the code in the composite reference waveform.

The minimum requirement for the relative code domain error is defined in terms of the nominal CDP ratio of a channel and its spreading factor; see *CDE Relative Configuration* on p. 8.37. The Effective Code Domain Power (ECDP) combines both quantities:

*ECDP = Nominal CDP ratio + 10 * log (SF/256)*

According to the test specification, the HS-DPCCH and the HS-DPCCH + E-DPCH measurements are performed with different sets of test parameters and different limits. The R&S CMU auto-selects the measurement type:

- In *Signalling* mode, HS-DPCCH + E-DPCH (HSUPA) or HS-DPCCH (HSDPA) tests are performed depending on the current DCH type *(Connection Control – BS Signal – Packet Switched – DCH (Dedicated Chn.) Type)*.
- In *Non Signalling* mode, an E-DPCH (HSUPA) test is performed if both the HSDPA signal and the HSUPA signal in the *Connection Control – Generator* tab is *On.* If the HSUPA signal is switched off, a HS-DPCCH (HSDPA) test is performed.

The measurement procedure and necessary measurement settings also depend on the measurement type. The following paragraphs give an overview.

HSDPA test: Measurement settings

The HS-DPCCH measurement is most conveniently performed with a HS-DPCCH trigger, which is also the *Auto* trigger source *(Connection Control – Trigger – Source: HSDPCCH)*. The relative CDE results are averaged over one slot. To obtain results according to the conformance test specification 3GPP TS 34.121, section 5.13.2A, configure the R&S CMU as follows:

1. To perform the measurement at maximum UE power, open the *TPC Settings* section of the *Connection Control – RF Generator* or *BS Signal* tabs of the *Connection Control* menu send an *All 1* TPC pattern type to the UE. Then select TPC algorithm 2 and a *Alternating* TPC pattern type to ensure that the UE remains at its maximum output power.
2. To measure at –18 dBm, select TPC algorithm 2 and a *Closed Loop* TPC pattern type with a target power of –18 dBm.
3. In *Signalling* mode, you can you can select a fixed reference channel according to H-Set 1 QPSK. You can also configure an appropriate set of gain factors *(Connection Control – UE Signal – UE Gain Factors)* in order to obtain an UE signal power according to the requirements of the test.

HSUPA test: Measurement settings

The HS-DPCCH + E-DPCH measurement is most conveniently performed with a frame trigger *(Connection Control – Trigger – Source: Frame)*. The relative CDE results are averaged over one slot. To obtain results according to the conformance test specification 3GPP TS 34.121, section 5.13.2B, configure the R&S CMU as follows:

1. Ensure that the HS-DPCCH is transmitted continuously. In *Signalling* mode, you can select a fixed reference channel according to H-Set 1 QPSK with a CQI repetition factor of 2 and an ACK/NACK repetition factor of 3 *(Connection Control – BS Signal – HSDPA HS-DSCH…)*. Furthermore, you can select equal gain factors ΔACK = ΔNACK = ΔCQI *(Connection Control – UE Signal – UE Gain Factors…)*.
2. Select a absolute grant pattern that will cause the UE to send a continuous E-DPCH. In *Signalling* mode, open the *HSUPA* section in the *Connection Control – BS Signal* tab and select an AG pattern length of 1 with *AG Index* values according to table C.11.1.3 in the test specification. In *Non Signalling* mode, open the *Channel Settings – HSUPA Channels* section of the *Connection Control – Generator* tab and select the *Primary UE ID* values *<AG Index>, Off, Off, Off*.
3. To perform the measurement at maximum UE power, open the *TPC Settings* section of the *Connection Control – RF Generator* or *BS Signal* tabs of the *Connection Control* menu send an *All 1* TPC pattern type to the UE. Then select TPC algorithm 2 and a *Alternating* TPC pattern type to ensure that the UE remains at its maximum output power.
4. To measure at –18 dBm, select TPC algorithm 2 and a *Closed Loop* TPC pattern type with a target power of –18 dBm.

CDE Relative Results

In the *CDE Relative* menu, the relative code domain error for all measured channels is displayed in a bar graph. Numeric results are displayed below .

Parameter lines

Upper diagram

Lower diagram

Output fields

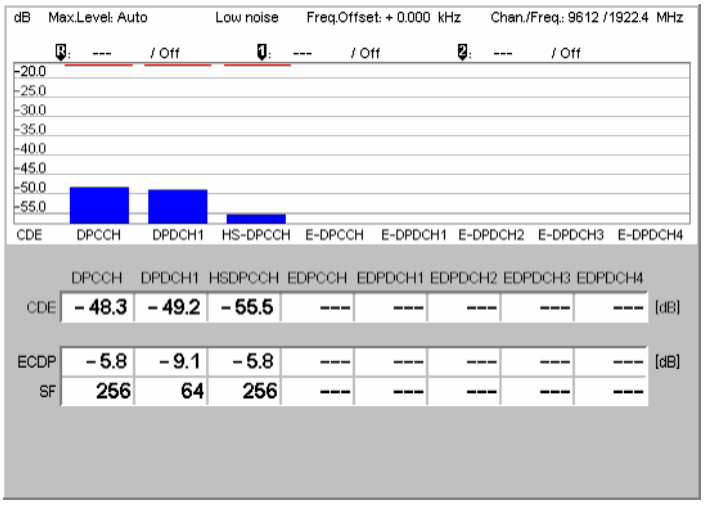


Fig. 8-20 Display of results (CDE Relative, HS-DPCCH measurement)

Parameter lines

Upper diagram

Lower diagram

Output fields

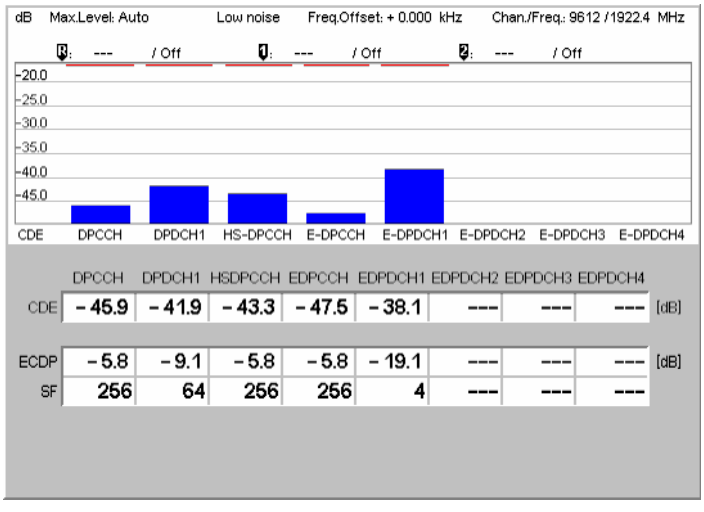


Fig. 8-21 Display of results (CDE Relative, HS-DPCCH + E-DPCH measurement)

Parameter lines The test settings and results (marker values) displayed in the four parameter lines are analogous to the settings and results in the *CDP/Code Auto (CDP/Code Rho Auto)* menus; see Chapter 4.

Diagrams The diagrams in the *CDP Relative* measurement menu show the relative code domain error of the DPCCH, the DPDCH 1, the HS-DPCCH, and the E-DPCH channels (E-DPCCH, E-DPDCH1 to E-DPDCH4). Only active channels are displayed.

Remote control

`READ:ARRay:CDPower:RELative:CDERror:UEPower?` etc.
`READ:ARRay:CDPower:RELative:CDERror:DPCCH?` etc.
`READ:ARRay:CDPower:RELative:CDERror:DPDCH?` etc.
`READ:ARRay:CDPower:RELative:CDERror:HSDPcch?` etc.

```
READ:ARRay:CDPower:RELative:CDERror:EDPCch?  etc.
READ:ARRay:CDPower:RELative:CDERror:EDPDch<nr>?  etc.
```

Output fields

The output fields below the diagrams show the following results for all active channels:

- The *CDE* is identical with the relative code domain error values in the diagram.
- ECDP is the measured Effective Code Domain Power, see section *CDE Relative* on p. 8.122.
- SF is the measured spreading factor of the code channel.

Remote control

```
READ[:SCALar]:CDPower:RELative:CDERror?  etc.
READ[:SCALar]:CDPower:RELative:CDERror:HSPA?  etc.
```

Limit Check

A red output field and an arrow pointing upwards indicates that the relative CDE result for a channel exceeds the upper limit set in the *Limits* tab of the *Code Domain Power Configuration* menu, see Fig. 8-19 on p. 8.33.

Remote control

```
CALCulate[:SCALar]:CDPower:RELative:CDERror:MATChing:LIMit?
CALCulate[:SCALar]:CDPower:RELative:CDERror:HSPA:MATChing:LIMit?
```

CDE Relative Configuration

The *Repetition* mode and *Stop Condition* settings in the *Control* tab of the *Code Domain Power* menu define the scope of the *CDE Relative* measurement. The settings are analogous for all measurement applications.

The limits for the relative CDP measurement are in accordance with the minimum requirements (tables 5.13.2A.5 and 5.13.2B.9) in the conformance test specification 3GPP TS 34.121.

Relative CDE test requirements:

A large relative code domain error indicates a poor modulation accuracy of the channel and may cause errors in the receiver. The standard stipulates small relative CDE values for code channels with large relative powers and large spreading factors (high data rates). The test requirement is stated in terms of the effective code domain power defined in section *CDE Relative* on p. 8.122:

- For EDDP values larger than –21 dB, the relative CDE must be ≤ –16 dB.
- For ECDP values between – 30 dB and –21 dB, the relative CDE must be ≤ –37 dB – ECDP.

The requirements do not apply to code channels with an ECDP value below –30 dB or with a nominal CDP below – 20 dB.

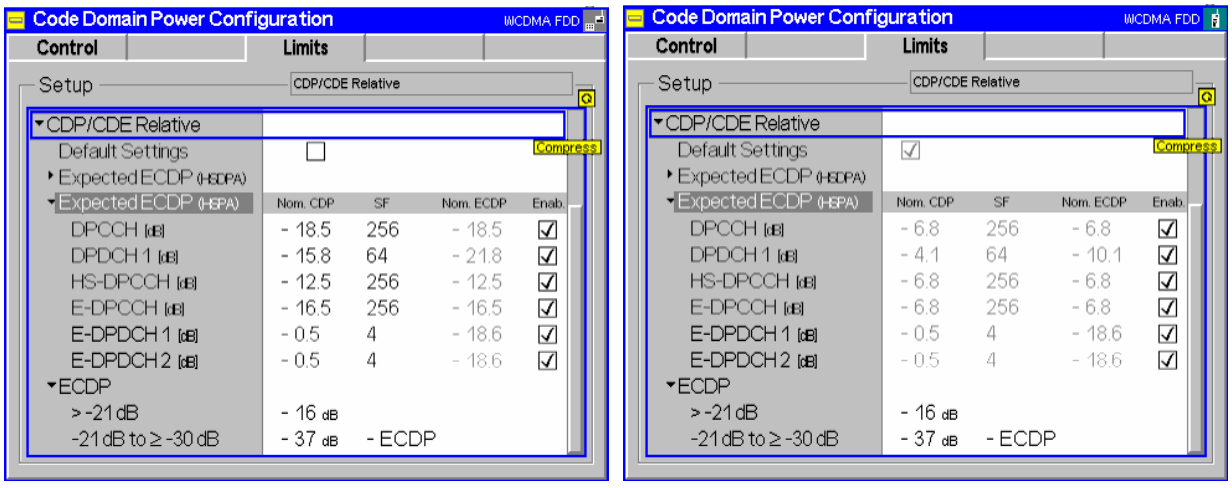


Fig. 8-22 Code Domain Error Configuration – Limits (Non Signalling and Signalling mode)

Expected ECDP (HSDPA)

Expected effective code domain power in dB for all measured channels, depending on the measurement type (HS-DPCCH (HSDPA) or HS-DPCCH + E-DPCH (HSUPA)). Possible settings depend on the test mode:

- In *Non Signalling* mode, the expected nominal CDP and SF values can be set manually; the expected nom. ECDP is calculated according to *ECDP = Nominal CDP ratio + 10 * log (SF/256).* The default configurations correspond to subtest 1 in 3GPP TS 34.121, tables 5.13.2A.4 and 5.13.2B.8, respectively. Moreover it is possible to disable the limit check at each measurement point.
- In *Signalling* mode, the values are fixed; they are calculated from the gain factors and the absolute grant pattern that the R&S CMU transmits to the UE. It is still possible to enable or disable the limit check.

Remote control

```
CONFigure:CDPower:RELative:CDERror:LIMit[:SCALar]:ASYMmetric
[:COMBined]:VALue<nr>
CONFigure:CDPower:RELative:CDERror:LIMit[:SCALar]:ASYMmetric
[:COMBined]:ENABle<nr>
```

ECDP

Limits for the relative code domain error, depending on the expected ECDP displayed in the upper table. For the default channel configurations in *Non Signalling* mode, the “≥ –21 dB” limit applies to all code channels.

Remote control

```
CONFigure:CDPower:RELative:CDERror:LIMit[:SCALar]:SYMMetric
[:COMBined]:VALue<nr>
```

HSDPA Downlink Generator (Non Signalling)

The HSDPA downlink signal is added to the WCDMA channels. In *Non Signalling* mode, both are configured in the *Generator* tab of the *Connection Control* menu. The HSDPA signal cannot be received without the WCDMA channels. In the *Generator* tab, the *HSDPA* settings are divided into several parameter groups:

- Activation of HSDPA signal *(HSDPA Signal)*
- Configuration of the downlink High Speed Shared Control Channels belonging to a single HS-SCCH set *(HS-SCCH Configuration)*
- Configuration of the High Speed (Physical) Downlink Shared Channels *(HS-(P)DSCH Configuration)*
- Configuration of he HS-DSCH as a *Fixed Reference Channel*, as a test channel *CQI* reporting tests, or as a *User Defined Channel*.

The settings are described in detail below.

Note: *The HSDPA generator has been designed with the aim of testing the receiver performance including the Hybrid ARQ (Automatic Repeat Request) functionality. The transmissions of the R&S CMU depend on the ACK/NACK messages that the UE returns after receiving a transmission packet and on the RV coding sequence. The UE must be synchronized to the generator signal, otherwise the CMU behaves as if it received only NACK messages. For an application example about the HSDPA signal refer to section* Setting up a HSDPA ACK Test *in Chapter 2.*

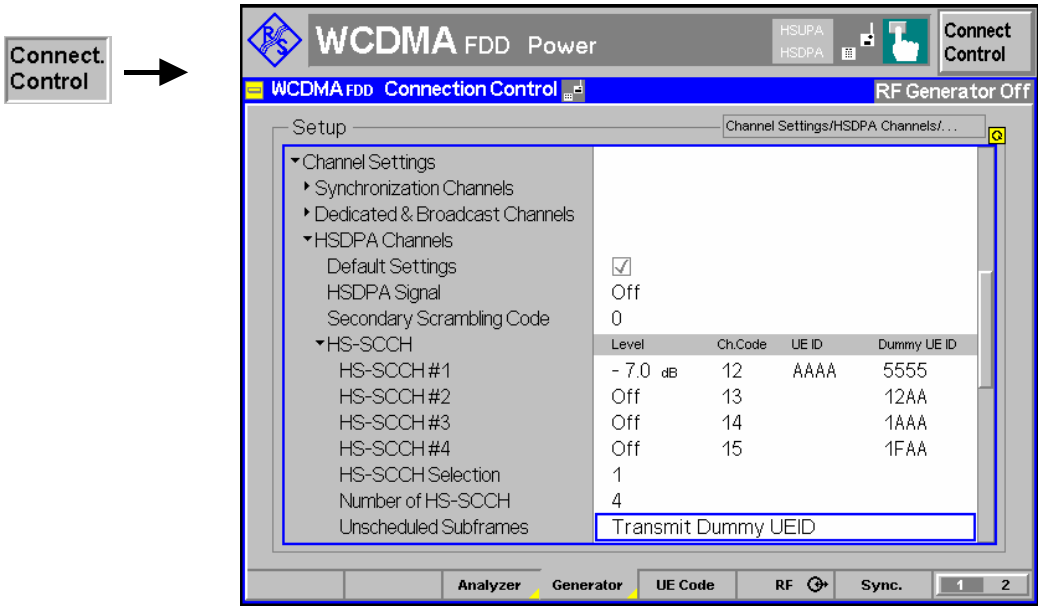


Fig. 8-23 Connection Control – Generator

The *Channel Settings – HSDPA Channels* section in the table-oriented version of the *Generator* tab provides the following settings:

Default Settings Sets all parameters in the *HSDPA* section to default values (the default values are quoted in the command description in chapter 6 of this manual).

Remote control
`DEFault:HSDPa`

HSDPA Signal

Switches the HSDPA channels in the WCDMA downlink signal *On* or *Off.*

The RF generator providing the P-SCH, S-SCH, P-CCPCH, and P-CPICH channels necessary for synchronization must be on *(Generator Level – Generator Control: On)* in order to generate the HSUPA signal. To perform HSDPA receiver tests, the UE must be able to decode the received data, so a downlink Reference Measurement Channel is necessary in addition.

Remote control
`SOURce:HSDPa:SIGNal:ENABle ON | OFF`

Secondary Scrambling Code

Selects the secondary scrambling code for the downlink HSDPA signal. The code is used for HSDPA channels only but equal for all HS-SCCHs and HS-PDSCHs; see standard 3GPP TS 25.213.

The secondary scrambling code corresponds to the index k of the codes $S_{16*i+k}^{p/s}$ in Fig. 8-27 on p. 8.52. A secondary scrambling code 0 means that the HSDPA channels are scrambled with the primary scrambling code i of the cell, to be set in the *Generator Settings* section. For more information about primary and secondary scrambling codes refer to the description of the WCDMA downlink RF generator in Chapter 4.

Remote control
`SOURce:HSDPa:SSCode`

HS-SCCHs and HS-SCCH sets

The HS-SCCH is a downlink physical channel used to carry downlink signalling information related to HS-DSCH transmission. This includes the channelization code set, the modulation scheme, the transport block size and H-ARQ related information (see standard 3GPP TS 25.212).

A HS-SCCH set is a set of 1 to 4 HS-SCCHs which is allocated to a UE. There can be multiple HS-SCCH sets in one cell, however, only a single HS-SCCH set is allocated to the UE at a given time. The UE continuously monitors all the HS-SCCHs in the allocated set.

The HS-SCCH carries a UE identity that identifies the UE for which it is carrying the information necessary for decoding the HS-PDSCH. If a UE detects that one of the monitored HS-SCCHs carries consistent control information, it starts receiving the HS-PDSCHs indicated by this control information.

HS-SCCH Configuration

For each HS-SCCH in the CMU's HS-SCCH set, the following parameters can be set:

Level Signal level of the channel relative to the *Level Reference* (P-CPICH level or total output channel power) selected in the *Generator Level* section. If it is defined relative to the P-CPICH level then the level of the HS-SCCH#k is equal to ratio of the weighting factors $G_k/G_{P\text{-}PICH}$ in Fig. 8-27 on p. 8.52. Each of the HS-SCCHs can be switched off by means of the *ON/OFF* key.

Ch. Code Channelization code (Orthogonal Variable Spreading Code, OVSC) number assigned to the HS-SCCHs. The HS-SCCH is a fixed rate (60 kbps, SF = 128) physical channel with channelization code numbers ranging from 1 to 127 (ch. code $C_{128,0}$ is barred because the channelization codes $C_{256,0}$ and $c_{256,1}$ are reserved for the P-CPICH and P-CCPCH, respectively). The channelization codes for the HS-SCCHs must be different from each other and compatible with the channelization codes for the PICH, the DPCH, and the HS-PDSCH; see background information on *PICH/DPCH channelization codes* in Chapter 4, section *Generator Settings.* The CMU checks and possibly auto-corrects incompatible

entries; see section *Code Conflict Handling for WCDMA DL Generator* in Chapter 4.

Dummy UE ID 4-digit hex number, to be sent in HS-SCCH subframes which are not allocated to the UE (unscheduled subframes), provided that *Unscheduled Subframes: Transmit Dummy ID* is active.

The HS-SCCHs no. 1 through n are generated with the selected parameters, where n is the selected *Number of HS-SCCHs*.

The following parameter is assigned to a single HS-SCCH, to be selected via *HS-SCCH Selection.*

UE ID UE identity (=H-RNTI); 16-bit value, entered as a 4-digit hex number. The UE ID identifies the UE for which data is transmitted in the corresponding HS-DSCH TTI. As the HS-SCCH set is allocated to a single UE, there is only one UE ID in the entire set. In unscheduled subframes the UE ID is not used.

Remote control
```
SOURce:HSDPa:LEVel:HSSCch<nr>
SOURce:HSDPa:PHYSical:LEVel
SOURce:HSPa:PHYSical:LEVel
SOURce:HSDPa:HSSCch:CODE<nr>
SOURce:HSDPa:HSSCch:UEID
SOURce:HSDPa:HSSCch:DUMMY:UEID<nr>
```

HS-SCCH Selection

Selection of the HS-SCCH(s) that carry the UE ID (see above). The UE ID can be assigned to a fixed HS-SCCH no. 1 to 4 or change after each subframe:

1 to 4 The UE ID is transferred on a fixed HS-SCCH.

Cyclic The UE ID is transferred on the HS-SCCH sequence 1, 2,…, n, 1, 2,…, where n is the *Number of HS-SCCHs.*

Random The HS-SCCHs for each transmission are selected at random among the active channels 1 to n *(Number of HS-SCCHs)*. This setting can be used to check whether the UE can actually detect subframes irrespective of the HS-SCCH carrying the UE ID.

The R&S CMU functionality is beyond the standard where transmission on a fixed HS-SCCH is stipulated.

An application example for *Cyclic HS-SCCH selection* is reported on p. 8.54.

Remote control
```
SOURce:HSDPa:HSSCch:SELection 1 to 4 | CYCLic | RANDom
```

Number of HS-SCCHs

The R&S CMU provides a single HS-SCCH set containing 1 to 4 High Speed Shared Control Channels *(Number of HS-SCCHs).* In the *HS-SCCH Configuration* section, the leading HS-SCCHs are active: If a number of $n\ (1 \le n \le 4)$ HS-SCCHs is selected then the channels $n+1, \ldots, 4$ are switched off.

Note: *4 is the maximum number of HS-SCCHs per HS-SCCH set. With this number of HS-SCCHs the CMU test signal can be used for HS-SCCH detection performance tests according to 3GPP TS 34.121, section 9.4.*

Remote control
```
SOURce:HSDPa:HSSCch:NUMBer
```

Unscheduled Subframes

Defines the transmission in the gaps between consecutive HS-SCCH subframes allocated to the UE (inter-TTI distance = 2 or 3; see Fig. 8-24 below). If *Transmit Dummy UE ID* is set, the HS-SCCH power is maintained and the unscheduled HS-SSCH subframes contain the *Dummy UE ID* of the HS-SCCH(s) selected for UE ID transmission.

Otherwise the CMU uses discontinuous transmission *(DTX;* the output power is switched off). This parameter has no influence on the HS-PDSCH transmission, which is controlled by means of a separate parameter; see below.

```
SOURce:HSDPa:HSSCch:USUBframes TDU | DTX
```

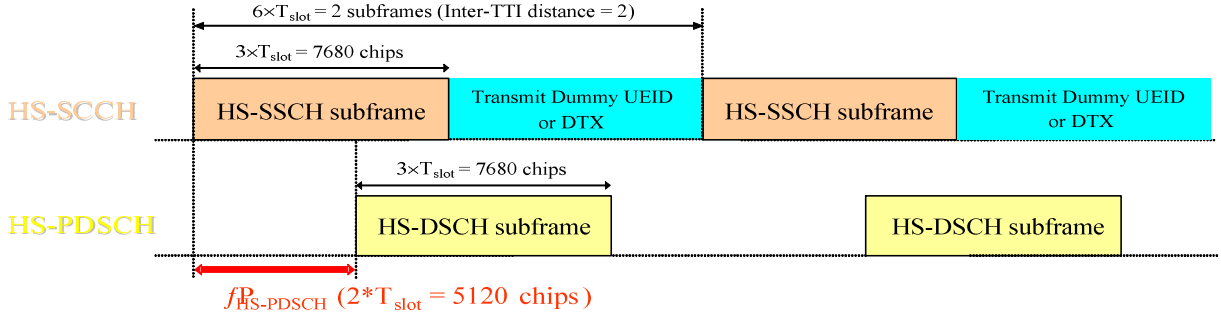


Fig. 8-24 Unscheduled Subframes (HS-SSCH)

HS-PDSCH Configuration

The High Speed Physical Downlink Shared Channel (HS-PDSCH) is a physical channel with fixed spreading factor SF=16 which is used to carry the High Speed Downlink Shared Channel (HS-DSCH). Depending on its capability, the UE can be assigned multiple channelization codes in the same HS-PDSCH subframe. The following HS-PDSCH parameters can be set:

Level (All Active Codes)

Signal level of the HS-PDSCH, summed over all active codes, relative to the *Level Reference* (P-CPICH power or total output channel power) selected in the *Generator Level* section. If it is defined relative to the P-CPICH level then the sum level is equal to ratio of the weighting factors $(G_5+G_6+\ldots)/G_{P\text{-}PICH}$ in Fig. 8-27 on p. 8.52. All HS-PDSCHs can be switched off by means of the *ON/OFF* key.

The actual HS-PDSCH level is allowed to change from one TTI to another according to the reference power adjustment Δ defined in TS 25.214 table 7A-E. The displayed HS-PDSCH shows the constant value corresponding to Δ = 0 dB. For a CQI channel configuration, the reference power adjustment is compensated for by a dynamic OCNS.

1st Used Ch. Code

Lowest numbered channelization code assigned to the HS-PDSCH (the index O in Fig. 8-27 on p. 8.52). The HS-PDSCH channelization codes are allocated contiguously starting from the first code. The number of codes is defined in the H-Sets (relevant for *HS-DSCH Configuration: Fixed Reference Channel)* or in the *User Defined Channel* settings (relevant for *HS-DSCH Configuration: User Defined).*

The HS-PDSCH is a fixed rate (SF = 16) physical channel with channelization code numbers ranging from 1 to 15 (ch. code $C_{16,0}$ is barred because the channelization codes $C_{256,0}$ and $c_{256,1}$ are reserved for the P-CPICH and P-CCPCH, respectively). The channelization codes for the HS-PDSCHs

must be compatible with the channelization codes for the PICH, the DPCH, and the HS-SCCHs. The CMU checks and possibly auto-corrects incompatible entries; see section *Code Conflict Handling for WCDMA DL Generator* in Chapter 4.

Unscheduled Subframes

Defines the transmission in the gaps between consecutive HS-DSCH subframes allocated to the mobile (inter-TTI distance = 2 or 3; see Fig. 8-25 below). If *Dummy Data* is set, the HS-DSCH power is maintained as specified in standard 3GPP TS 34.121 for CQI reporting tests; otherwise the CMU uses discontinuous transmission *(DTX;* the output power is switched off). This parameter has no influence on the HS-SSCH transmission, which is controlled by means of a separate parameter; see above.

Remote control

```
SOURce:HSDPa:LEVel:HSPDsch
SOURce:HSDPa:PHYSical:LEVel
SOURce:HSPa:PHYSical:LEVel
SOURce:HSDPa:HSPDsch:CODE
SOURce:HSDPa:HSPDsch:USUBframes DDATa | DTX
```

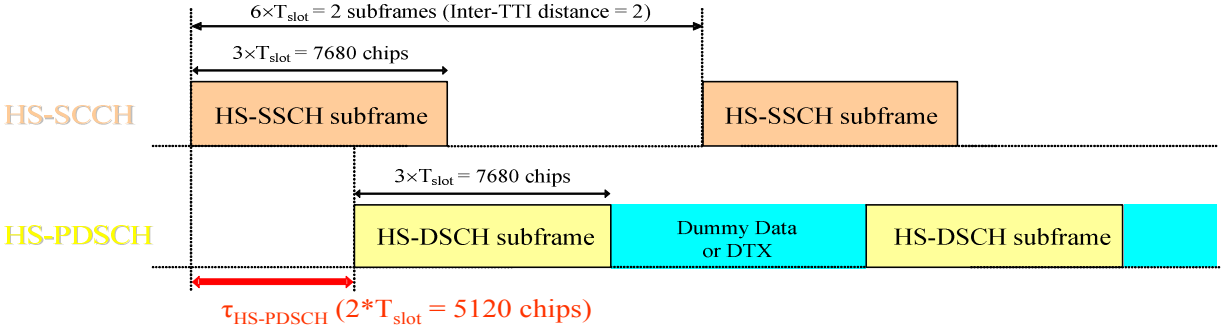


Fig. 8-25 Unscheduled Subframes (HS-PDSCH)

HS-DSCH Data Pattern

Bit pattern transmitted as user information on the HS-DSCH: Bit sequence consisting of zeros *(All 0)*, ones *(All 1)* 010101... *(Alternating)*, or pseudo-random bit sequences of variable length *(PRBS9, PRBS11, PRBS13, PRBS15).*

Remote control

```
SOURce:HSDPa:HSDSch:DSOurce
      ALL0 | ALL1 | ALT | PR9 | PR11 | PR 13 | PR15
```

Force NACK

If *Force NACK* is set to *Off,* the HS-DSCH data is sent with the correct CRC so that receiver tests can be performed as specified in 3GPP TS34.121, section 9.2.

Otherwise a selectable percentage of the HS-DSCH data is sent with an incorrect CRC so that the failed CRC check in the UE should cause a NACK in the UL. Together with the *HSDPA ACK* measurement application (see section *HSDPA ACK/NACK Receiver Test* on p. 8.7), this can be used for a first plausibility check whether the UE operates correctly. It is also possible to distinguish HS-DPCCH slots containing ACK or NACK messages is different gain factors Δ_{ACK} and Δ_{NACK} are set (see description of the *UE Signal* tab of the *Connection Control* menu in Chapter 4).

Remote control
`SOURce:HSDPa:HSDSch:FNACk ON | OFF P10 | P20 | … | P100 | OFF`

CQI Feedback Cycle

Specifies a time (in multiples of 2 ms or 1 HSDPA subframe) after which the UE will repeat the transmission of CQI symbols on the HS-DPCCH.

If the CQI feedback cycle is switched off, the UE transmits no CQI symbols (see standard 3GPP TS 25.214, section 6A). For a feedback cycle of n*2ms, CQI symbols are transmitted in every n^{th} subframe; the HS-DPCCH power in the remaining CQI slots is switched off (DTX). In particular, a feedback cycle of 2 ms means that all uplink HSDPA subframes carry CQI symbols so that no DTX periods occur (see also section *HS-DPCCH Trigger* in Chapter 4).

Remote control
`SOURce:HSDPA:HSDSch:CQIC|FC4C|Y…c|lC1e60 | OFF`

CQI Repetition Factor

Specifies the number of CQI transmissions per CQI Feedback Cycle (see standard 3GPP TS 25.214). CQI transmission is repeated in consecutive HSDPA subframes. With <CQI Repetition Factor> = <CQI Feedback Cycle> / 2ms, the CQI information is transmitted in all subframes. The UE does not support the case <CQI Repetition Factor> > <CQI Feedback Cycle> / 2ms.

Remote control
`SOURce:HSDPa:HSDSch:CRFactor 1 to 4`

ACK/NACK Repetition Factor

Specifies the number of repeated ACK/NACK transmissions (see standard 3GPP TS TS 25.214). ACK/NACK transmission is repeated in consecutive HSDPA subframes.

Remote control
`SOURce:HSDPa:HSDSch:ANRFactor 1 to 4`

UE Category

Capability category that the UE belongs to. The CQI mapping tables and the minimum requirements for the CQI test depend on the UE category; see *CQI Channel Configuration* below.

Remote control
`SOURce:HSDPa:HSDSch:UECategory 1 to 12`

HS-DSCH Channel Configuration Type

Pre-selection of the parameters used to configure the High Speed Downlink Shared Channel (HS-DSCH). The HS-DSCH is the downlink transport channel for user data and may be configured as follows:

Fixed Reference Channel	Configuration as a reference channel according to standard 3GPP TS 25.101, Annex A7. The channel type (H-Set) is selected in the *Fixed Reference Channel* section. Fixed reference channels are to be used for HS-DSCH demodulation (ACK/NACK) tests; see section *HSDPA ACK/NACK Receiver Test* on p. 8.7.
CQI	Configuration as a CQI reporting test channel using the parameters defined in the *CQI Channel Configuration* section. See also *CQI Reporting* on p. 8.11.
User Defined	User-defined transport channel parameters defined in the *User-defined Channel* section.

Remote control
`SOURce:HSDPa:HSDSch:TYPE FRCH | CQIC | UDCH`

Fixed Reference Channel

The *Fixed Reference Channel* settings take effect when the HS-DSCH is configured as a *Fixed Reference Channel;* see *HS-DSCH Configuration* parameter above.

H-Set Selection Reference channels for HSDPA conformance tests are described in terms of the H-Sets 1 to 6 defined in standard 3GPP TS 25.101, Annex A7. For the H-Sets 1, 2, 3 and 6, a QPSK and a 16QAM version is available. H-Sets 4 and 5 use QPSK modulation. The *H-Set 1 Max. Input* is defined in table 7.3 A of standard 3GPP TS 25.101. H-Set 6 requires option R&S CMU-K60, HSDPA 10 Mbps.

RV Coding Sequence Display of the redundancy and constellation version coding sequence for the selected H-Set. This parameter is for information only because the H-Set unambiguously determines the RV coding sequence.

Remote control

```
SOURce:HSDPa:FRCHannel:HSET
  S1QP | S1Q | S1M | S2QP | S2Q | S3QP | S3Q | S4QP | S5QP |
  S6QP | S6Q
SOURce:HSDPa:FRCHannel:RVCSequence?
```

CQI Channel Configuration

The *CQI Channel Configuration* settings take effect if the HS-DSCH is configured as a *CQI* reporting test channel; see *HS-DSCH Configuration* parameter above.

NOTE

Dynamic OCNS for HSDPA CQI

The HS-DSCH power is reduced by the reference power adjustment *given in TS 25.214, table 7A-7E for each CQI value and each UE category.*

When a CQI Channel Configuration is used, the OCNS is used to fill up the output channel power when the HS-DSCH power is reduced. By this means the output channel power remains constant irrespective of the transmitted CQI value.

Note: *The CQI tables contain only a subset of all possible transport formats. The R&S CMU can generate all transport formats for up to 5 physical channelization codes. All transport block sizes up to a data rate of 4.6 Mbit/s are supported for a user defined channel.*

CQI Table Index Defines whether the downlink Transport Format (TF) that the CMU uses for CQI reporting tests is fixed or variable. The TF is defined in terms of a CQI value and the UE category; refer to the CQI mapping tables in standard 3GPP TS 25.214.

If *Fixed Value* is selected, the R&S CMU uses the TF according to the CQI defined under *Fixed Value.* If *Sequence* is selected, the TF changes periodically between the *Min. CQI* and *Max. CQI* set under *Sequence.* If *Follow UL CQI* is set, the TF is adapted according to the CQI proposed/sent by the UE, with the restriction that the *Min. CQI* and *Max. CQI* values define the minimum and maximum allowed downlink CQI.

Conformance Test must be set in order to ensure that the R&S CMU uses the appropriate downlink TFs for the *HSDPA CQI* test; see section *CQI Reporting Test* on p. 8.11. The CQI during the performance test is displayed as *Active CQI.* Moreover, the inter-TTI distance is automatically set to 3 in

accordance with the requirements of the conformance test specification (standard 3GPP TS 34.121).

Generator restrictions for Follow UL CQI

In remote control the WCDMA DL generator can be used while the R&S CMU performs measurements in a function group other than WCDMA Non Signalling. While *Follow UL CQI* is active, the RF analyzer must be constantly available to receive the UL WCDMA signal. To avoid a resource conflict with the other measurements, the R&S CMU behaves in accordance with the *Task Priority Management* setting in the base system (Setup – Remote; see R&S CMU 200/300 operating manual):

- If *Task Priority Management* is enabled (releasable measurements and generators), the WCDMA generator is switched off when another function group is activated and vice versa.
- If *Task Priority Management* is disabled (persistent measurements and generators), the WCDMA generator must be switched off explicitly when another function group is activated and vice versa.

No restrictions arise in manual control where the WCDMA generator is simply suspended while another measurement is performed. The described behavior also applies to other generator settings which depend on the RF analyzer, e.g. closed loop uplink power control (see chapter 4).

Fixed Value Sets the fixed CQI value which defines the TF if the table index type is set to *Fixed.*

Sequence/ Follow CQI Sets the CQI range to be used if the table index type is set to *Sequence.* The CQI starts at *Min. CQI,* is increased by 1 for the next scheduled subframe, and restarts at *Min. CQI* after the *Max CQI* value has been reached. If the *Follow UL CQI* table index is selected, *Min. CQI* and *Max. CQI* define the range where the downlink signal is allowed to follow the proposed CQI. If the *Min. CQI* is set to be larger than the *Max. CQI,* then *Max. CQI* is the only allowed CQI value.

Example: *If Min. CQI = 15, Max. CQI = 16, then the modulation scheme (QPSK or 16QAM) changes after each scheduled subframe.*

Conf. Test Start Value CQI defining the downlink TF for the first stage of the CQI conformance test where the downlink TF is fixed and the frequency distribution of the reported CQI values is calculated.

No. of H-ARQ Processes No. of Hybrid ARQ (Automatic Repeat Request) processes for retransmission in the range 1 to 8. In *Non Signalling* mode, this parameter cannot be set.

Inter-TTI Distance Minimum distance between two consecutive Transmission Time Intervals (no. of TTIs, 1 to 3) in which the HS-DSCH is allocated to the UE. In accordance with the CQI test requirements, the Inter-TTI distance is automatically set to 3 as soon as *CQI Table Index: Conformance Test* is selected. Otherwise the inter-TTI distance depends on the UE category as described in Table 8-3 on p. 8.47.

RV Coding Sequence QPSK RV coding sequence, to be used whenever the CQI channel uses QPSK modulation (depending on the active CQI value). The R&S CMU provides the following predefined sequences:

{ 0 } (Single Transmission, if QPSK)
{ 6 } (Single Transmission, if 16QAM)
{ 0, 2, 5, 6 } (FRC, if QPSK)
{ 6, 2, 1, 5 } (FRC, if 16QAM)
{ 0, 0, 0, 0 } (Chase Combining, if QPSK)
{ 6, 6, 6, 6 } (Chase Combining, if 16QAM)
{ 6, 0, 4, 5 } (Chase Combining with constellation re-arrangement, if 16QAM)

All sequences listed above can be chosen as QPSK coding sequences. If *Edit Mode* is selected, the R&S CMU uses the RV coding sequence specified in the *Edit Mode – Sequence* field. For background information on RV coding sequences and examples refer to p. 8.64.

RV Coding Sequence 16QAM RV coding sequence for 16 QAM modulation, selected in analogy to the *RV Coding Sequence QPSK*.

Remote control

```
SOURce:HSDPa:CQIChannel:TINDex:TYPE FIX | SEQ | FULC | CONF
SOURce:HSDPa:CQIChannel:TINDex:FIXed 1 to 30
SOURce:HSDPa:CQIChannel:TINDex:SEQuence 1 to 30, 1 to 30
SOURce:HSDPa:CQIChannel:TINDex:CTSValue 1 to 30
SOURce:HSDPa:CQIChannel:TTIDistance?
SOURce:HSDPa:CQIChannel:HARQ?
SOURce:HSDPa:CQIChannel:RVCSequence:QPSK
SOURce:HSDPa:CQIChannel:RVCSequence:QAM
```

Table 8-3 Mapping between UE category and inter-TTI distance

UE Category	Inter-TTI Distance
Category 1	3
Category 2	3
Category 3	2
Category 4	2
Category 5	1
Category 6	1
Category 11	2
Category 12	1

User Defined Channel

The *User Defined Channel* settings take effect if the HS-DSCH is configured as a *User Defined* channel; see *HS-DSCH Configuration* parameter above. The parameters are analogous to the reference channel parameters; see standard 3GPP TS 25.101, Annex A7:

Inter-TTI Distance Minimum distance between two consecutive Transmission Time Intervals (no. of TTIs, 1 to 3) in which the HS-DSCH is allocated to the UE.

No. of H-ARQ Processes No. of Hybrid ARQ (Automatic Repeat Request) processes for retransmission in the range 1 to 8.

Transport Block Size Index (k_i) Value of the Transport Format and Resource Indicator (TFRI) in the range between 0 and 62; see background information on p. 8.64.

Transport Block Size Transport block size in bits calculated according to the entered *Transport Block Size Index (k_i),* the *Modulation* scheme and the *No. of Physical*

Channel Codes (see TS 25.321); no setting value.

No. of Physical Channel. Codes — Number of different HS-PDSCHs or channelization codes $C_{16,n}$ in the range 1 to 15; see Fig. 8-27 on p. 8.52.

Modulation — Modulation scheme QPSK or 16QAM. The latter increases the transport block size, see note below.

IR Buffer Size — Calculated size (no. of bits) of the virtual IR buffer used in the H-ARQ process (no setting value). The IR buffer size is given by the total buffer size divided by the number of HARQ processes. The total buffer size is fixed for each UE category; see standard TS 25.306, table 5.1a.

Memory Size Control — Implicit or explicit partitioning of the UE's soft memory buffer in the MAC-hs entity:

With implicit partitioning, the UE partitions its memory buffer equally among the HARQ processes, so the size depends on the number of processes. The *IR Buffer Size* is given by the total buffer size divided by the number of HARQ processes; this value is displayed for information. The total buffer size is fixed for each UE category; see standard TS 25.306, table 5.1a.

With explicit partitioning the memory size for each process *(IR Buffer Size (Explicit))* is set at the R&S CMU.

IR Buffer Size (Explicit) — Displays the buffer size (for *Memory Size Control: Implicit),* or sets an explicit buffer size (for *Memory Size Control: Explicit)*.

RV Coding Sequence — One of the following sequences:

{ 0 }	(Single Transmission, if QPSK)
{ 6 }	(Single Transmission, if 16QAM)
{ 0, 2, 5, 6 }	(FRC, if QPSK)
{ 6, 2, 1, 5 }	(FRC, if 16QAM)
{ 0, 0, 0, 0 }	(Chase Combining, if QPSK)
{ 6, 6, 6, 6 }	(Chase Combining, if 16QAM)
{ 6, 0, 4, 5 }	(Chase Combining with constellation re-arrangement, if 16QAM)

The sequences can be chosen irrespective of the selected modulation scheme. If *Edit Mode* is selected, the R&S CMU uses the RV coding sequence specified in the *Edit Mode – Sequence* field. For background information on RV coding sequences and examples refer to p. 8.64.

Note: *The R&S CMU can generate all transport formats for up to 5 physical channelization codes. All transport block sizes up to a data rate of 4.6 Mbit/s are supported.*

Remote control

```
SOURce:HSDPa:UDChannel:TTIDistance
SOURce:HSDPa:UDChannel:HARQ
SOURce:HSDPa:UDChannel:TBLock:SINDex
```

```
SOURce:HSDPa:UDChannel:TBLock:SIZE?
SOURce:HSDPa:UDChannel:NCODes
SOURce:HSDPa:UDChannel:MODulation
SOURce:HSDPa:UDChannel:IRBuffer?
SOURce:HSDPa:UDCHannel:MSIZe IMPL | EXPL
SOURce:HSDPa:UDCHannel:IRBuffer?
SOURce:HSDPa:UDCHannel:IRBuffer:EXPLicit
SOURce:HSDPa:UDChannel:RVCSequence
```

HSDPA in Signalling Mode

With option R&S CMU-K64, measurements on HSDPA channels are also available in *Signalling* mode. Manual and remote control is identical with the *Non Signalling* measurements.

The HSDPA generator is also available in *Signalling* mode; it is configured in the *BS Signal* tab of the *Connection Control* menu. The settings are analogous to the *Non Signalling* settings, however, the remote control command syntax has been adjusted to be in line with the other *BS Signal* commands. The new commands are listed in section *HSDPA Downlink Signal Configuration* on p. 8.66.

The R&S CMU provides a number of HSDPA-specific RX and TX measurements; see sections *HSDPA Receiver Quality Tests* on p. 8.1 and *HSDPA in CDP/Code Measurements* on p. 8.19.

Performing HSDPA Tests

In *Signalling* mode the R&S CMU maintains a connection to the UE under test and is able to transmit and receive signalling information. Compared to the *Non Signalling* tests described above, the test configuration is much easier because there is no need to configure the R&S CMU and the UE separately.

HSDPA tests are performed in a particular *HSDPA Test Mode.* To enter this mode proceed as described in section *Packet Switched Connections* in Chapter 4.

HSDPA Downlink Signal (BS Signal)

The HSDPA downlink signal is added to the WCDMA channels; both are configured in the *BS Signal* tab of the *Connection Control* menu. The HSDPA signal cannot be received without the WCDMA channels. In the *BS Signal* tab, the *HSDPA* settings are divided into several parameter groups:

- Parameters which are relevant for the connection to HSDPA test mode *(Packet Data – HSDPA Test Mode…)*. These parameters are described in section *Packet Switched Connections* in Chapter 4.
- Activation of HSDPA signal *(Downlink Physical Channels – HSDPA Channels)*
- Configuration of the downlink High Speed Shared Control Channels belonging to a single HS-SCCH set *(HS-SCCH Configuration)*
- Configuration of the High Speed (Physical) Downlink Shared Channels *(HS-(P)DSCH Configuration)*
- Configuration of the HS-DSCH as a *Fixed Reference Channel*, as a test channel for *CQI* reporting tests, or as a *User Defined Channel*.

The settings are described in detail below.

Note: *The HSDPA generator has been designed with the aim of testing the receiver performance including the Hybrid ARQ (Automatic Repeat Request) functionality. The transmissions of the R&S CMU depend on the ACK/NACK messages that the UE returns after receiving a transmission packet and on the RV coding sequence. The UE must be synchronized to the generator signal, otherwise the CMU behaves as if it received only NACK messages.*

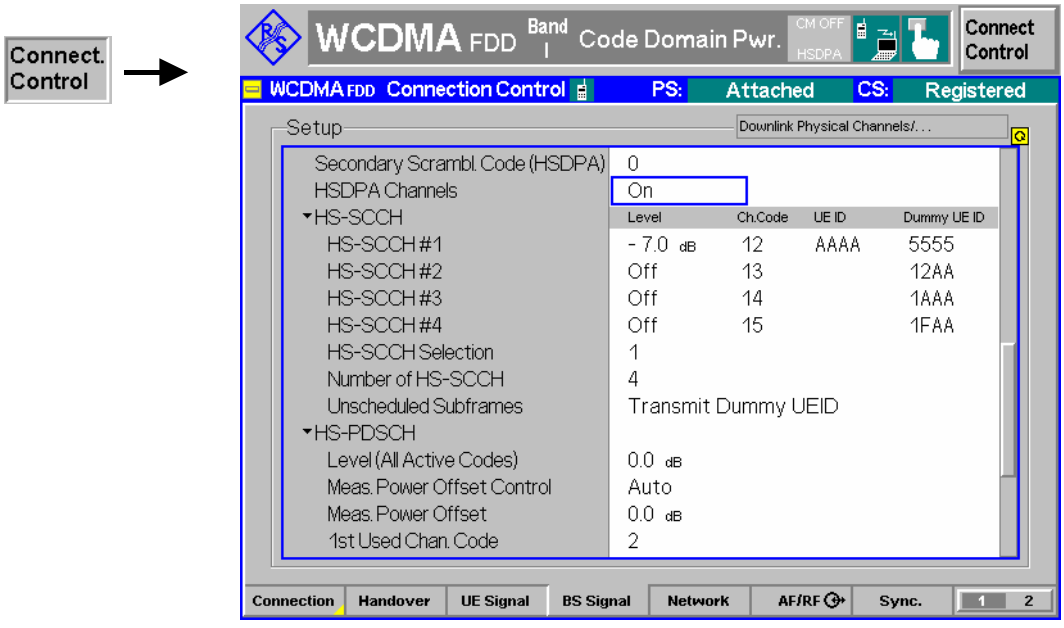


Fig. 8-26 Connection Control – BS Signal

The HSDPA signal is switched on in the *HSDPA Channels* section or automatically, if the *HSDPA Test Mode* is activated in the *Connection* tab of the *Connection Control* menu.

HSDPA Channels Switches the HSDPA channels in the WCDMA downlink signal *On* or *Off.*

The (physical) HSDPA channels can be switched on or off irrespective of the signalling state and the other WCDMA channel settings.

Remote control
`CONFigure:BSSignal:HSDPa:SIGNal:ENABle ON | OFF`

Besides the *HSDPA Channels* section in the *BS Signal* tab provides the following settings:

Secondary Scrambling Code (HSDPA) Selects the secondary scrambling code for the downlink HSDPA signal. The code is used for HDSPA channels only but equal for all HS-SCCHs and HS-PDSCHs; see standard 3GPP TS 25.213.

The secondary scrambling code corresponds to the index k of the codes $S_{16*i+k}^{p/s}$ in Fig. 8-27 on p. 8.52. A secondary scrambling code 0 means that the HSDPA channels are scrambled with the primary scrambling code i of the cell, to be set in the *Node B Settings* section. For more information about primary and secondary scrambling codes refer to the description of the WCDMA downlink RF generator in Chapter 4.

Remote control
`CONFigure:BSSignal:HSDPa:SSCode`

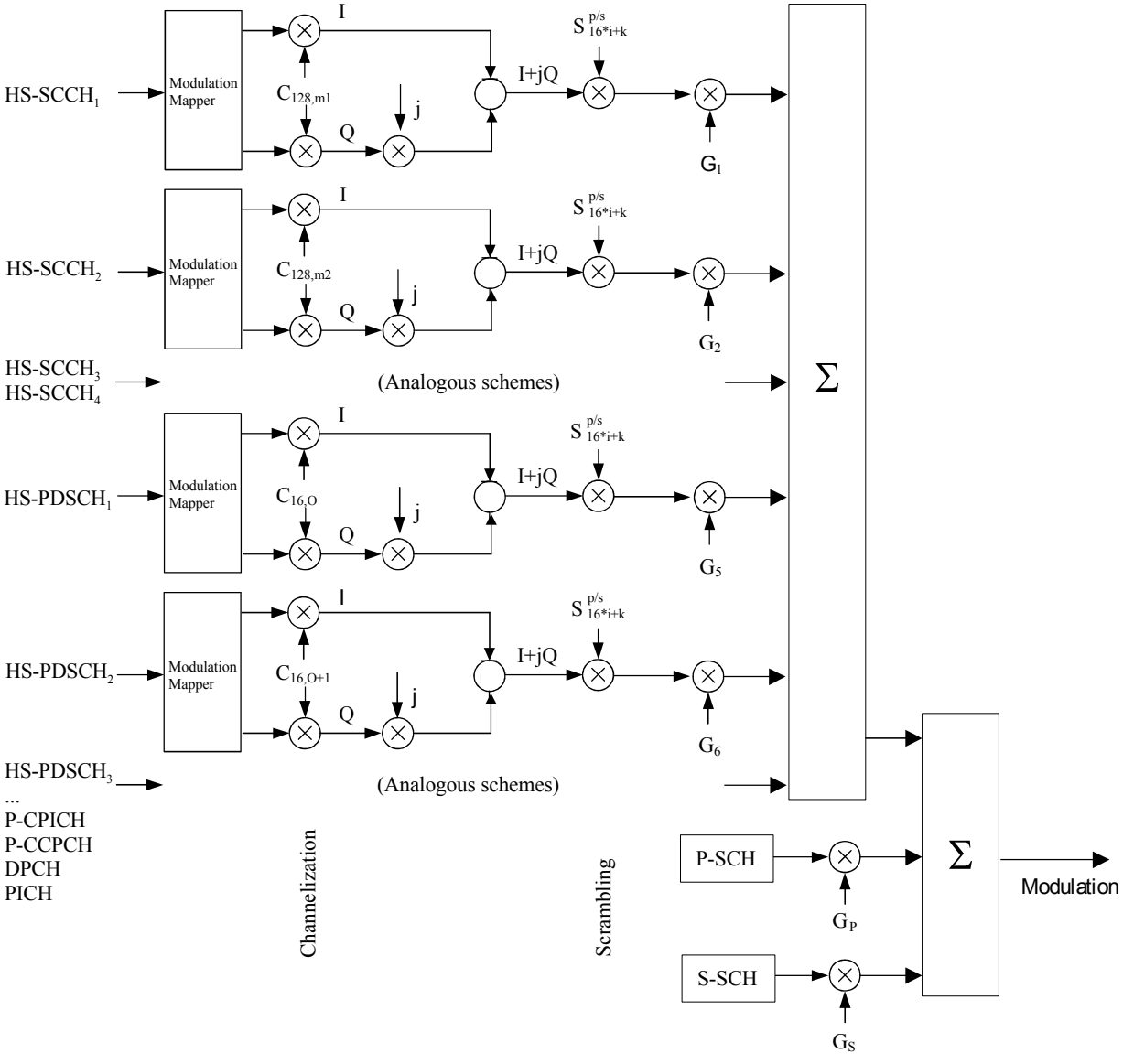


Fig. 8-27 Spreading of HSDPA channels

HS-SCCHs and HS-SCCH sets

The HS-SCCH is a downlink physical channel used to carry downlink signalling information related to HS-DSCH transmission. This includes the channelization code set, the modulation scheme, the transport block size and H-ARQ related information (see standard 3GPP TS 25.308).

A HS-SCCH set is a set of 1 to 4 HS-SCCHs which is allocated to a UE. There can be multiple HS-SCCH sets in one cell, however, only a single HS-SCCH set is allocated to the UE at a given time. The UE continuously monitors all the HS-SCCHs in the allocated set.

The HS-SCCH carries a UE identity that identifies the UE for which it is carrying the information necessary for decoding the HS-PDSCH. If a UE detects that one of the monitored HS-SCCHs carries consistent control information, it starts receiving the HS-PDSCHs indicated by this control information.

HS-SCCH Configuration

For each HS-SCCH in the CMU's HS-SCCH set, the following parameters can be set:

Level Signal level of the channel relative to the *Level Reference* (P-CPICH level or total output channel power) selected in the *Node B Settings* section. If it is defined relative to the P-CPICH

level then the level of the HS-SCCH#k is equal to ratio of the weighting factors $G_k/G_{P\text{-}PICH}$ in Fig. 8-27 on p. 8.52. Each of the HS-SCCHs can be switched off by means of the *ON/OFF* key.

Ch. Code Channelization code (Orthogonal Variable Spreading Code, OVSC) number assigned to the HS-SCCHs. The HS-SCCH is a fixed rate (60 kbps, SF = 128) physical channel with channelization code numbers ranging from 1 to 127 (ch. code $C_{128,0}$ is barred because the channelization codes $C_{256,0}$ and $c_{256,1}$ are reserved for the P-CPICH and P-CCPCH, respectively). The channelization codes for the HS-SCCHs must be different from each other and compatible with the channelization codes for the PICH, the DPCH, and the HS-PDSCH. The CMU checks and possibly auto-corrects incompatible entries; see section *Code Conflict Handling for WCDMA DL Generator* in Chapter 4.

Dummy UE ID 4-digit hex number, to be sent in HS-SCCH subframes which are not allocated to the UE (unscheduled subframes), provided that *Unscheduled Subframes: Transmit Dummy ID* is active.

The HS-SCCHs no. 1 through *n* are generated with the selected parameters, where *n* is the selected *Number of HS-SCCHs*.

The following parameter is assigned to a single HS-SCCH, to be selected via *HS-SCCH Selection.*

UE ID UE identity (=H-RNTI); 16-bit value, entered as a 4-digit hex number. The UE ID identifies the UE for which data is transmitted in the corresponding HS-DSCH TTI. As the HS-SCCH set is allocated to a single UE, there is only one UE ID in the entire set. In unscheduled subframes the UE ID is not used.

Remote control

```
CONFigure:BSSignal:PHYSical:LEVel:HSSCch<nr>
CONFigure:BSSignal:PHYSical:HSSCch:CODE<nr>
CONFigure:BSSignal:PHYSical:HSSCch:UEID
CONFigure:BSSignal:PHYSical:HSSCch:DUMMY:UEID<nr>
```

HS-SCCH Selection

Selection of the HS-SCCH(s) that carry the UE ID (see above). The UE ID can be assigned to a fixed HS-SCCH no. 1 to 4 or change after each subframe:

1 to 4 The UE ID is transferred on a fixed HS-SCCH.

Cyclic The UE ID is transferred on the HS-SCCH sequence 1, 2,…, n, 1, 2,…, where n is the *Number of HS-SCCHs.*

Random The HS-SCCHs for each transmission are selected at random among the active channels 1 to n *(Number of HS-SCCHs)*. This setting can be used as a stress test for the UE to check whether it can actually detect subframes irrespective of the HS-SCCH carrying the UE ID.

The R&S CMU functionality is beyond the standard where transmission on a fixed HS-SCCH is stipulated.

In accordance with the requirements of the standard, a change of the HS-SCCH is suspended when the UE is scheduled in two consecutive subframes. This scenario occus for an Inter TTI of 1, provided that the number of H-ARQ processes is sufficiently large. For 6 or more H-ARQ processes, the UE is continuously scheduled so there is no Cyclic *or* Random *change of the HS-SCCH.*

Example

Cyclic HS-SCCH selection on a subset of 3 HS-SCCHs

HS-SCCH configuration:	HS-SCCH #1:	–7dB
	HS-SCCH #2	OFF
	HS-SCCH #3	–7 dB
	HS-SCCH #4	OFF
	HS-SCCH Selection:	Cyclic
	Number of HS-SCCHs:	3

With an Inter TTI of 2, every second subframe carries the UE ID (see Fig. 8-28 above):

Subframe 0, frame 0	UE ID on HS-SCCH #1
Subframe 1, frame 0	UE unscheduled due to Inter TTI = 2
Subframe 2, frame 0	UE ID on HS-SCCH #2 but signal power off → UE returns DTX instead of ACK or NACK
Subframe 3, frame 0	UE unscheduled due to Inter TTI = 2
Subframe 4, frame 0	UE ID on HS-SCCH #3
Subframe 0, frame 1	UE unscheduled due to Inter TTI = 2
Subframe 1, frame 1	UE ID on HS-SCCH #1
Subframe 2, frame 1	UE unscheduled due to Inter TTI = 2
Subframe 3, frame 1	UE ID on HS-SCCH #2 but signal power off → UE returns DTX instead of ACK or NACK
Subframe 4, frame 1	UE unscheduled due to Inter TTI = 2
Subframe 0, frame 2	UE ID on HS-SCCH #3

→ The uplink HS-DPCCH contains 2/3 ACK/NACK and 1/3 DTX messages.

Remote control
```
CONFigure:BSSignal:PHYSical:HSSCch:SELection
      1 to 4 | CYCLic | RANDom
```

Number of HS-SCCHs

The R&S CMU provides a single HS-SCCH set containing 1 to 4 High Speed Shared Control Channels *(Number of HS-SCCHs).* In the *HS-SCCH Configuration* section, the leading HS-SCCHs are active: If a number of $n\ (1 \le n \le 4)$ HS-SCCHs is selected then the channels $n+1, \ldots, 4$ are switched off.

Note: *4 is the maximum number of HS-SCCHs per HS-SCCH set. With this number of HS-SCCHs the CMU test signal can be used for HS-SCCH detection performance tests according to 3GPP TS 34.121, section 9.4.*

Remote control
```
CONFigure:BSSignal:PHYSical:HSSCch:NUMBer
```

Unscheduled Subframes

Defines the transmission in the gaps between consecutive HS-SCCH subframes allocated to the UE (inter-TTI distance = 2 or 3; see Fig. 8-28 below). If *Transmit Dummy UE ID* is set, the HS-SCCH power is maintained and the unscheduled HS-SSCH subframes contain the *Dummy UE ID* of the HS-SCCH(s) selected for UE ID transmission.

Otherwise the CMU uses discontinuous transmission *(DTX;* the output power is switched off). This parameter has no influence on the HS-PDSCH transmission, which is controlled by means of a separate parameter; see below.

Remote control
```
CONFigure:BSSignal:PHYSical:HSSCch:USUBframes TDU | DTX
```

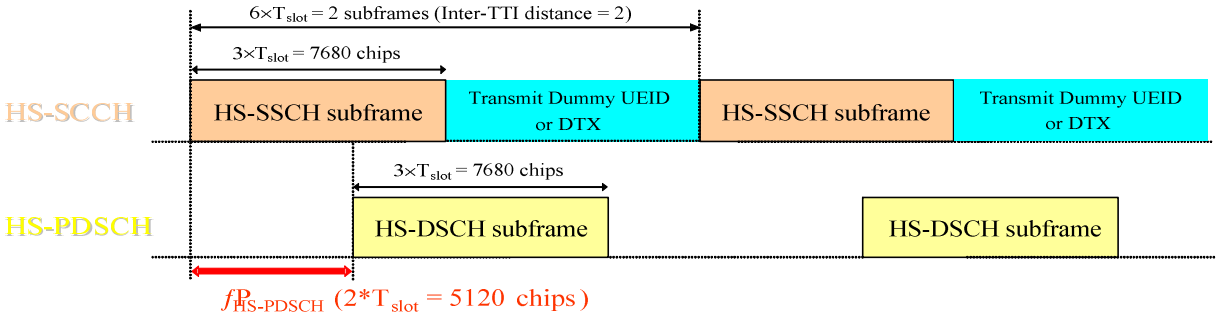


Fig. 8-28 Unscheduled Subframes (HS-SSCH)

HS-PDSCH Configuration

The High Speed Physical Downlink Shared Channel (HS-PDSCH) is a physical channel which is used to carry the High Speed Downlink Shared Channel (HS-DSCH). Depending on its capability, the UE can be assigned multiple channelization codes in the same HS-PDSCH subframe. The following HS-PDSCH parameters can be set:

Level (All Active Codes)

Signal level of the HS-PDSCH, summed over all active codes, relative to the *Level Reference* (P-CPICH power or total output channel power) selected in the *Node B Settings* section. If it is defined relative to the P-CPICH level then the sum level is equal to ratio of the weighting factors $(G_5+G_6+\ldots)/G_{P\text{-}PICH}$ in Fig. 8-27 on p. 8.52. All HS-PDSCHs can be switched off by means of the *ON/OFF* key.

The actual HS-PDSCH level is allowed to change from one TTI to another according to the reference power adjustment Δ defined in TS 25.214 table 7A-E. The displayed HS-PDSCH shows the constant value corresponding to Δ = 0 dB. For a CQI channel configuration, the reference power adjustment is compensated for by a dynamic OCNS.*Meas. Power*

Offset Control

Selects manual power offset setting (using the offset Γ below) or automatic setting. The automatic power offset value for fixed reference and user-defined channels is calculated according to

$$\Gamma = P_{HS\text{-}PDSCH} - P_{P\text{-}CPICH}$$

For CQI channels, an additional reference power adjustment is taken into account; see below. Manual setting can be used to report a wrong offset value to the UE and test its reaction, e.g. by analyzing the returned CQI values.

Meas. Power Offset

Power difference Γ between the P-CPICH and the HS-PDSCH that the UE assumes for CQI reporting; see standard 3GPP TS 25.214, section 6A. The UE measures the P-CPICH power and assumes the total received HS-PDSCH power to be

$$P_{HS\text{-}PDSCH} = P_{P\text{-}CPICH} + \Gamma + \Delta \text{ (CQI, UE Category)}.$$

The reference power adjustment Δ is also specified in the standard. In general, changing the *Measurement Power Offset* will cause an offset of the CQI values reported by the UE: The larger the offset, the higher the reported CQIs.

Examples:

In the *Follow Uplink CQI* mode *(BS Signal – HSDPA HS-DSCH – CQI Channel Configuration – CQI Table Index: Follow Uplink CQI)*, a variation of the meas. power offset will translate into a

a variation of the percentage of blocks received in error (approx. 10% NACKs at power offset 0 dB, more/less at higher/lower power offset values because the UE requests a DL transport format corresponding to larger/smaller CQI values).

According to the formula quoted above the *Level (All Active Codes)* and the *Meas. Power Offset* have an inverse effect on CQI reporting. If both parameters are set to the same value, they compensate each other, leaving the reported CQI values unchanged.

1st Used Ch. Code Lowest numbered channelization code assigned to the HS-PDSCH (the index O in Fig. 8-27 on p. 8.52). The HS-PDSCH channelization codes are allocated contiguously starting from the first code. The number of codes is defined in the H-Sets (relevant for *HS-DSCH Configuration: Fixed Reference Channel)* or in the *User Defined Channel* settings (relevant for *HS-DSCH Configuration: User Defined).*

The HS-PDSCH is a fixed rate (SF = 16) physical channel with channelization code numbers ranging from 1 to 15 (ch. code $C_{16,0}$ is barred because the channelization codes $C_{256,0}$ and $c_{256,1}$ are reserved for the P-CPICH and P-CCPCH, respectively). The channelization codes for the HS-PDSCHs must be compatible with the channelization codes for the PICH, the DPCH, and the HS-SCCHs. The CMU checks and possibly auto-corrects incompatible entries; see section *Code Conflict Handling for WCDMA DL Generator* in Chapter 4.

Unscheduled Subframes Defines the transmission in the gaps between consecutive HS-DSCH subframes allocated to the mobile (inter-TTI distance = 2 or 3; see Fig. 8-29 below). If *Dummy Data* is set, the HS-DSCH power is maintained as specified in standard 3GPP TS 34.121 for CQI reporting tests; otherwise the CMU uses discontinuous transmission *(DTX;* the output power is switched off). This parameter has no influence on the HS-SSCH transmission, which is controlled by means of a separate parameter; see above.

Remote control

```
CONFigure:BSSignal:PHYSical:LEVel:HSPDsch
CONFigure:BSSignal:PHYSical:HSPDsch:MPOControl MAN | AUTO
CONFigure:BSSignal:PHYSical:HSPDsch:MPOFfset
CONFigure:BSSignal:PHYSical:HSPDsch:CODE
CONFigure:BSSignal:PHYSical:HSPDsch:USUBframes DDATa | DTX
```

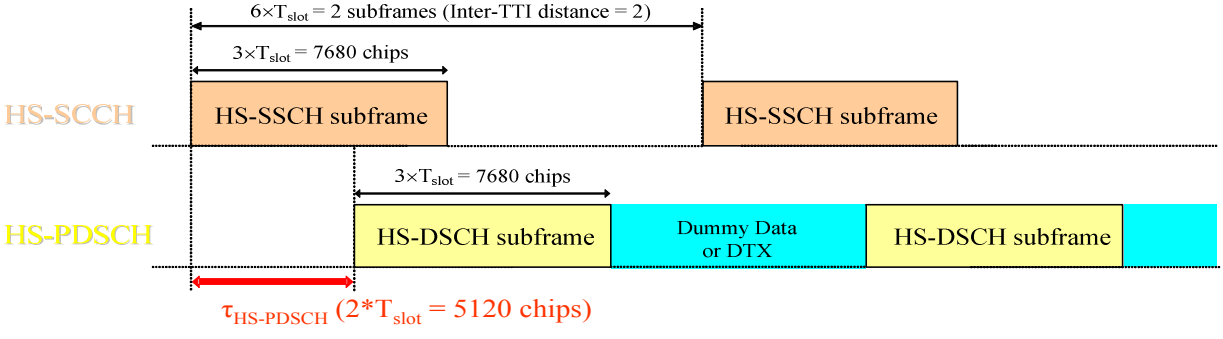


Fig. 8-29 Unscheduled Subframes (HS-PDSCH)

The *HS-DSCH* section in the *BS Signal* tab provides the following settings:

Default Settings

Sets all parameters in the *HS-DSCH* section to default values (the default values are quoted in the command description).

Remote control
```
DEFault:BSSignal:HSDSch
```

HS-DSCH Data Pattern

Bit pattern transmitted as user information on the HS-DSCH: Bit sequence consisting of zeros *(All 0)*, ones *(All 1)* 010101... *(Alternating)*, or pseudo-random bit sequences of variable length *(PRBS9, PRBS11, PRBS13, PRBS15).*

Remote control
```
CONFigure:BSSignal:HSDSch:DSOurce
      ALL0 | ALL1 | ALT | PR9 | PR11 | PR 13 | PR15
```

HS-DSCH Force NACK

If *Force NACK* is set to *Off,* the HS-DSCH data are sent with the correct CRC so that receiver tests can be performed as specified in 3GPP TS34.121, section 9.2.

Otherwise a selectable percentage of the HS-DSCH data is sent with an incorrect CRC so that the failed CRC check in the UE should cause a NACK in the UL. Together with the *HSDPA ACK* measurement application (see Fig. 15 on p. 57), this can be used for a first plausibility check whether the UE operates correctly.

Remote control
```
CONFigure:BSSignal:HSDSch:FNAck P10 | P20 | … | P100 | OFF
```

CQI Feedback Cycle

Specifies a time (in multiples of 2 ms or 1 HSDPA subframe) after which the UE will repeat the transmission of CQI symbols on the HS-DPCCH.

If the CQI feedback cycle is switched off, the UE transmits no CQI symbols (see standard 3GPP TS 25.214, section 6A). For a feedback cycle of n*2ms, CQI symbols are transmitted in every n^{th} subframe; the HS-DPCCH power in the remaining CQI slots is switched off (DTX). In particular, a feedback cycle of 2 ms means that all uplink HSDPA subframes carry CQI symbols so that no DTX periods occur (see also section *HSDPA Trigger* in Chapter 4). This parameter can be changed in all signalling states including *Connected.*

Remote control
```
CONFigure:BSSignal:HSDSch:CFCYcle C2 | C4 | … | C160 | OFF
CONFigure:BSSignal:HSDSch[:COMBined]:CANack
```

CQI Repetition Factor

Specifies the number of CQI transmissions per CQI Feedback Cycle (see standard 3GPP TS 25.214). CQI transmission is repeated in consecutive HSDPA subframes. With <CQI Repetition Factor> = <CQI Feedback Cycle> / 2ms, the CQI information is transmitted in all subframes. The UE does not support the case <CQI Repetition Factor> > <CQI Feedback Cycle> / 2ms. This parameter can be changed in all signalling states including *Connected.*

Remote control
```
CONFigure:BSSignal:HSDSch:CRFactor 1 to 4
CONFigure:BSSignal:HSDSch[:COMBined]:CANack
```

ACK/NACK Repetition Factor

Specifies the number of repeated ACK/NACK transmissions (see standard 3GPP TS TS 25.214). ACK/NACK transmission is repeated in consecutive HSDPA subframes. This parameter can be changed in all signalling states including *Connected.*

Remote control
```
CONFigure:BSSignal:HSDSch:ANRFactor 1 to 4
CONFigure:BSSignal:HSDSch[:COMBined]:CANack
```

UE Category Selection

Assignment of the *UE Category,* see below.

UE Capability Report Upon registration, the R&S CMU evaluates the capability reports received from the UE and uses the reported UE capability. The reported capability is displayed in the *UE Capability* field.

Manual Fixed, manual setting in the *UE Capability* field, must be in accordance with the actual UE category.

Remote control
```
CONFigure:BSSignal:HSDSch:UECategory:MODE UCR | MAN
```

UE Category

Capability category that the UE belongs to. The CQI mapping tables and the minimum requirements for the CQI test depend on the UE category; see *CQI Channel Configuration* below.

The conformance test specification defines many UE requirements for fixed reference channel types (H-sets) rather than for UE categories. The following mapping between UE categories and H-sets applies (3GPP 34.121, table 9.2.1.1):

Table 8-4 Mapping between HS-DSCH category and FRC

HS-DSCH category	Corresponding requirement
Category 1	H-Set 1
Category 2	H-Set 1
Category 3	H-Set 2
Category 4	H-Set 2
Category 5	H-Set 3
Category 6	H-Set 3
Category 7	H-Set 6
Category 8	H-Set 6
Category 11	H-Set 4
Category 12	H-Set 5

Remote control
```
CONFigure:BSSignal:HSDSch:UECategory 1 to 12
```

HS-DSCH Channel Configuration Type

Pre-selection of the parameters used to configure the High Speed Downlink Shared Channel (HS-DSCH). The HS-DSCH is the downlink transport channel for user data and may be configured as follows:

Fixed Reference Channel Configuration as a reference channel according to standard 3GPP TS 25.101, Annex A7. The channel type (H-Set) is selected in the *Fixed Reference Channel* section. Fixed reference channels are to be used for HS-DSCH demodulation (ACK/NACK) tests; see section *HSDPA ACK/NACK Receiver Test* on p. 8.7.

CQI Configuration as a CQI reporting test channel using the parameters defined in the *CQI Channel Configuration* section; see below.

User Defined User-defined transport channel parameters defined in

the *User-defined Channel* section.

The channel configuration type and all channel configuration settings (except *MAC-d PDU Size Control, MAC-d PDU Size)* can be changed in all signalling states including *Connected.*

Remote control
```
CONFigure:BSSignal:HSDSch:TYPE FRCH | CQIC | UDCH
```

T1 Release Timer Value in ms of the re-ordering release timer T1. T1 controls the stall avoidance in the UE reordering buffer as described in standard 3GPP TS 25.321, section 11.6.2.3. Possible values are 10 ms, 20 ms, 30 ms … 100 ms, 120 ms, 140 ms, 160 ms, 200 ms, 300 ms, 400 ms.

The value of T1 has no impact in HSDPA test mode but can be relevant for HSDPA data application tests (option R&S CMU-K96); see Chapter 9.

Remote control
```
CONFigure:BSSignal:HSDSch:T1RTimer
```

Receiver Window Size Size of the receiver window in the UE; see standard 3GPP TS 25.321, section 11.6.2.3. The receiver window size has no impact in HSDPA test mode but can be relevant for HSDPA data application tests (option R&S CMU-K96); see Chapter 9.

Remote control
```
CONFigure:BSSignal:HSDSch:RWSize
```

Fixed Reference Channel The *Fixed Reference Channel* settings take effect when the HS-DSCH is configured as a *Fixed Reference Channel;* see *HS-DSCH Configuration* parameter above.

H-Set Selection Reference channels for HSDPA conformance tests are described in terms of the H-Sets 1 to 6 defined in standard 3GPP TS 25.101, Annex A7. For the H-Sets 1, 2, 3 and 6, a QPSK and a 16QAM version is available. H-Sets 4 and 5 use QPSK modulation. H-Set 6 requires option R&S CMU-K60, HSDPA 10 Mbps. The *H-Set 1 Max. Input* is defined in table 7.3 A of standard 3GPP TS 25.101.

RV Coding Sequence Display of the redundancy and constellation version coding sequence for the selected H-Set. This parameter is for information only because the H-Set unambiguously determines the RV coding sequence.

The soft memory buffer size for each H-ARQ process within the fixed reference channels (H-Sets) is configured in accordance with the requirements of standard 3GPP TS 25.101 (explicit partitioning; see Memory Partitioning *parameter on p. 8.62). Explicit partitioning is also used for CQI channels. The memory partitioning for user defined channels may be either implicit or explicit; see* Memory Partitioning *parameter below.*

Remote control
```
CONFigure:BSSignal:HSDSch:FRCHannel:HSET
  S1QP | S1Q | S1M | S2QP | S2Q | S3QP | S3Q | S4QP | S5QP
  S6QP | S6Q
CONFigure:BSSignal:HSDSch:FRCHannel:RVCSequence?
CONFigure:HSDPa[:COMBined]:FRCHannel
```
(fast combined parameter settings)

CQI Channel Configuration

The *CQI Channel Configuration* settings take effect if the HS-DSCH is configured as a *CQI* reporting test channel; see *HS-DSCH Configuration* parameter above.

The CQI channels use explicit partitioning; see Memory Partitioning parameter on p. 8.62.

Dynamic OCNS for HSDPA CQI

The HS-DSCH power is reduced by the reference power adjustment *given in TS 25.214, table 7A-7E for each CQI value and each UE category.*

When a CQI Channel Configuration is used, the OCNS is used to fill up the output channel power when the HS-DSCH power is reduced. By this means the output channel power remains constant irrespective of the transmitted CQI value.

The CQI tables contain only a subset of all possible transport formats. The R&S CMU can generate all transport formats for up to 5 physical channelization codes. All transport block sizes up to a data rate of 4.6 Mbit/s are supported for a user defined channel.

CQI Table Index Defines whether the downlink Transport Format (TF) that the CMU uses for CQI reporting tests is fixed or variable. The TF is defined in terms of a *CQI value* and the *UE category*; refer to the CQI mapping tables in standard 3GPP TS 25.214.

If *Fixed Value* is selected, the R&S CMU uses the TF according to the CQI defined under *Fixed Value.* If *Sequence* is selected, the TF changes periodically between the *Min. CQI* and *Max. CQI* set under *Sequence.* If *Follow UL CQI* is set, the TF is adapted according to the CQI proposed/sent by the UE, with the restriction that the *Min. CQI* and *Max. CQI* values define the minimum and maximum allowed downlink CQI.

Conformance Test must be set in order to ensure that the R&S CMU uses the appropriate downlink TFs for the *HSDPA CQI* test; see section *CQI Reporting Test* on p. 8.11.

Fixed Value Sets the fixed CQI value which defines the TF if the table index type is set to *Fixed.*

Sequence/ Follow CQI Sets the CQI range to be used if the table index type is set to *Sequence.* The CQI starts at *Min. CQI,* is increased by 1 for the next scheduled subframe, and restarts at *Min. CQI* after the *Max CQI* value has been reached. If the *Follow UL CQI* table index is selected, *Min. CQI* and *Max. CQI* define the range where the downlink signal is allowed to follow the proposed CQI. If the *Min. CQI* is set to be larger than the *Max. CQI,* then *Max. CQI* is the only allowed CQI value.

***Example:** If Min. CQI = 15, Max. CQI = 16, then the modulation scheme (QPSK or 16QAM) changes after each scheduled subframe.*

Conf. Test Start Value CQI defining the downlink TF for the first stage of the CQI conformance test where the downlink TF is fixed and the frequency distribution of the reported CQI values is calculated.

No. of H-ARQ Processes No. of Hybrid ARQ (Automatic Repeat Request) processes for retransmission in the range 1 to 8.

Inter-TTI Distance Minimum distance between two consecutive Transmission Time Intervals (no. of TTIs, 1 to 3) in which the HS-DSCH is allocated to the UE. In accordance with the CQI test requirements, the Inter-TTI distance is automatically set to 3 as soon as *CQI Table Index: Conformance Test* is selected. Otherwise the inter-TTI distance depends on the UE category as described in Table 8-3 on p. 8.47.

RV Coding Sequence QPSK RV coding sequence, to be used whenever the CQI channel uses QPSK modulation (depending on the active CQI value). The R&S CMU provides the following predefined sequences:

{ 0 }	(Single Transmission, if QPSK)
{ 6 }	(Single Transmission, if 16QAM)
{ 0, 2, 5, 6 }	(FRC, if QPSK)
{ 6, 2, 1, 5 }	(FRC, if 16QAM)
{ 0, 0, 0, 0 }	(Chase Combining, if QPSK)
{ 6, 6, 6, 6 }	(Chase Combining, if 16QAM)
{ 6, 0, 4, 5 }	(Chase Combining with constellation re-arrangement, if 16QAM)

All sequences listed above can be chosen as QPSK coding sequences. If *Edit Mode* is selected, the R&S CMU uses the RV coding sequence specified in the *Edit Mode – Sequence* field. For background information on RV coding sequences and examples refer to p. 8.64.

RV Coding Sequence 16QAM RV coding sequence for 16 QAM modulation, selected in analogy to the *RV Coding Sequence QPSK*.

Remote control

```
CONFigure:BSSignal:HSDSch:CQIChannel:TINDex:TYPE
       FIX | SEQ | FULC | CONF
CONFigure:BSSignal:HSDSch:CQIChannel:TINDex:FIXed 1 to 30
CONFigure:BSSignal:HSDSch:CQIChannel:TINDex:SEQuence
       1 to 30, 1 to 30
CONFigure:BSSignal:HSDSch:CQIChannel:TINDex:CTSValue 1 to
30CONFigure:BSSignal:HSDSch:CQIChannel:TTIDistance?
CONFigure:BSSignal:HSDSch:CQIChannel:HARQ
CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QPSK
CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QAM
CONFigure:HSDPa[:COMBined]:CQIChannel
```

(fast combined parameter settings)

Edit Mode If *RV Coding Sequence: Edit Mode* is selected, then the R&S CMU uses the RV coding sequence specified in the *Sequence* field. The *Length* parameter adjusts the length of the user-defined sequence in the range between 1 and 8.

Remote control

```
CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QPSK:EMSequence<nr>
CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QAM:EMSequence<nr>
CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QPSK:EMSequence:ALL
CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QAM:EMSequence:ALL
CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QPSK:EMSequence:LENGth
CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QAM:EMSequence:LENGth
```

User Defined Channel The *User Defined Channel* settings take effect if the HS-DSCH is configured as a *User Defined* channel; see *HS-DSCH Configuration* parameter above. The parameters are analogous to the reference channel parameters; see standard

3GPP TS 25.101, Annex A7:

Inter-TTI Distance Minimum distance between two consecutive Transmission Time Intervals (no. of TTIs, 1 to 3) in which the HS-DSCH is allocated to the UE.

No. of H-ARQ Processes No. of Hybrid ARQ (Automatic Repeat Request) processes for retransmission in the range 1 to 8.

Transport Block Size Index (k_i) Value of the Transport Format and Resource Indicator (TFRI) in the range between 0 and 62; see background information below.

Transport Block Size Transport block size in bits calculated according to the entered *Transport Block Size Index (k_i),* the *Modulation* scheme and the *No. of Physical Channel Codes* (see TS 25.321); no setting value.

No. of Physical Channel. Codes Number of different HS-PDSCHs or channelization codes $C_{16,n}$ in the range 1 to 15; see Fig. 8-27 on p. 8.52.

Modulation Modulation scheme QPSK or 16QAM. The latter increases the transport block size, see note below.

IR Buffer Size Calculated size (no. of bits) of the virtual IR buffer used in the H-ARQ process (no setting value). The IR buffer size depends on the *Memory Partitioning* setting, see below. The total buffer size is fixed for each UE category; see standard TS 25.306, table 5.1a.

MAC-d PDU Size Control Selects *Manual* or *Automatic* setting of the MC-d PDU size. In manual control mode, the *MAC-d PDU Size* in bits is entered below; in *Auto* mode, the R&S CMU calculates the size such that the MAC-hs payload for the HS-DSCH is filled with MAC-hs SDUs of equal MAC-d PDU size, leaving a minimum of padding bits (see 3GPP TS 25.321, section 9.1.4). The calculated MAC-d PDU size is shown below. Manual setting is required in case the UE does not support automatic calculation.

MAC-d PDU Size Size of the MAC-hs SDUs in the MAC-hs payload for the HS-DSCH, either calculated or set manually (see *MAC-d PDU Size Control).* The MAC-d PDU size has no impact in HSDPA test mode but can be relevant for HSDPA data application tests (option R&S CMU-K96); see Chapter 9.

Memory Partitioning

Implicit or explicit partitioning of the UE's soft memory buffer in the MAC-hs entity: With *Implicit* partitioning, the UE partitions its memory buffer equally among the HARQ processes, so it depends on the number of processes. With *Explicit* partitioning the R&S CMU calculates the memory size for each process depending on the UE category and the no. of HARQ processes; see standard 3GPP TS 25.331.

The memory partitioning has no impact in HSDPA test mode but can be relevant for HSDPA data application tests (option R&S CMU-K96); see Chapter 9.

Memory Size Control (Explicit)

In the *Automatic* mode, the memory size for each process is calculated automatically, depending on the UE category and the

no. of HARQ processes, as defined in standard 3GPP TS 25.331. In *Manual* mode, the process memory size can be defined using the *Memory Size (Explicit)* item.

Memory Size (Explicit)

If the *Memory Size Control (Explicit)* is set to manual, the process memory size can be set within the range between 800 bit to 304000 bit (in steps of 800 up to 16000 bit, then in steps of 1600 up to 304000 bit).

RV Coding Sequence

One of the following sequences:

{ 0 }	(Single Transmission, if QPSK)
{ 6 }	(Single Transmission, if 16QAM)
{ 0, 2, 5, 6 }	(FRC, if QPSK)
{ 6, 2, 1, 5 }	(FRC, if 16QAM)
{ 0, 0, 0, 0 }	(Chase Combining, if QPSK)
{ 6, 6, 6, 6 }	(Chase Combining, if 16QAM)
{ 6, 0, 4, 5 }	(Chase Combining with constellation re-arrangement, if 16QAM)

The sequences can be chosen irrespective of the selected modulation scheme. If *Edit Mode* is selected, the R&S CMU uses the RV coding sequence specified in the *Edit Mode – Sequence* field. For background information on RV coding sequences and examples refer to p. 8.64.

The R&S CMU can generate all transport formats for up to 5 physical channelization codes. All transport block sizes up to a data rate of 4.6 Mbit/s are supported.

Remote control

```
CONFigure:BSSignal:HSDSch:UDCHannel:TTIDistance
CONFigure:BSSignal:HSDSch:UDCHannel:HARQ
CONFigure:BSSignal:HSDSch:UDCHannel:TBLock:SINDex
CONFigure:BSSignal:HSDSch:UDCHannel:TBLock:SIZE?
CONFigure:BSSignal:HSDSch:UDCHannel:NCODes
CONFigure:BSSignal:HSDSch:UDCHannel:MODulation
CONFigure:BSSignal:HSDSch:UDCHannel:IRBuffer?
CONFigure:BSSignal:HSDSch:UDCHannel:MDPSize:MODE AUTO | MAN
CONFigure:BSSignal:HSDSch:UDCHannel:MDPSize:MANual
CONFigure:BSSignal:HSDSch:UDCHannel:MDPSize:AUTO?
CONFigure:BSSignal:HSDSch:UDCHannel:MPARtition IMPL | EXPL
CONFigure:BSSignal:HSDSch:UDCHannel:MSIZe:MODE
CONFigure:BSSignal:HSDSch:UDCHannel:MSIZe:AUTO?
CONFigure:BSSignal:HSDSch:UDCHannel:MSIZe:MANual
CONFigure:BSSignal:HSDSch:UDCHannel:RVCSequence
CONFigure:BSSignal:HSDSch:UDCHannel:RWSize
CONFigure:HSDPa[:COMBined]:UDCHannel
```

(fast combined parameter settings)

Edit Mode

If *RV Coding Sequence: Edit Mode* is selected, then the R&S CMU uses the RV coding sequence specified in the *Sequence* field. The *Length* parameter adjusts the length of the user-defined sequence in the range between 1 and 8.

Remote control

```
CONFigure:BSSignal:HSDSch:UDCHannel:EMSequence
CONFigure:BSSignal:HSDSch:UDCHannel:EMSequence<nr>
CONFigure:BSSignal:HSDSch:UDCHannel:EMSequence:ALL
```

Transport Block Size Index (k_i)

The TFRI includes information about the dynamic part of the HS-DSCH transport format, including transport block size and modulation scheme. The TFRI also includes information about the set of physical channels (channelization codes) onto which HS-DSCH is mapped in the corresponding HS-DSCH TTI. The CMU uses the k_i value to calculate the *Transport Block Size* according to standard TS 25.321.

The same TFRI k_i can indicate different transport block sizes depending on the modulation scheme and the number of channelization codes used.

Table according to 3GPP TS 25.321, extract from QPSK section

Combination	*Mod. Scheme*	*No. of channelization codes*	$k_{0,i}$
0	*QPSK*	*1*	*1*
1		*2*	*40*
2		*3*	*63*
3		*4*	*79*
…		…	…

First step:

Modulation scheme and number of channelization codes as signalled on HS-SCCH determine value $k_{0,i}$.

Table according to 3GPP TS 25.321, 254 entries in total

Index k_t	*TB Size*	*Index k_t*	*TB Size*	*Index k_t*	*TB Size*
1	*137*	*86*	*1380*	*171*	*6324*
2	*149*	*87*	*1405*	*172*	*6438*
3	*161*	*88*	*1430*	*173*	*6554*
…	…	…	…	…	…

Second step:

Index $k_t = k_i + k_{0,i}$ determines HS-DSCH transport block size.

RV Coding Sequences

RV coding sequences define the retransmissions of the HSDPA packets. The format of the coding sequences is $\{X_{rv,0}, \ldots, X_{rv,N}\}$ where any of the X_{rv} values is a 3-bit number encoding the redundancy version (for QPSK and 16 QAM modulation) and the constellation version (for 16 QAM modulation only). N denotes the number of retransmissions and is (for real UTRANs) in the range between 0 (no transmission, as in {0}) and 3 (initial transmission and 3 retransmissions). The R&S CMU provides an *Edit Mode* with up to 7 retransmissions; see below.

According to standard 3GPP TS 25.222 the individual transmissions depend on the redundancy version parameters s and r and the constellation version parameter b where:

- s can take on the value 0 or 1 to distinguish whether systematic bits (s = 1) or non systematic bits (S = 0) are prioritized in the HARQ second rate matching stage.
- r (range 0 to 3 for QPSK, 0 to 1 for 16 QAM) changes the initial error variable in the case of puncturing and influences the repetition algorithm defined in standard 3GPP TS 25.212 (if repetition is used instead of puncturing).
- b (range 0 to 3) describes the constellation re-arrangement for 16 QAM.

The mapping between the parameters r, s, b and the X_{rv} values is shown in the tables below (example 1 and 2).

Example 1: The RV coding sequence {0,2,5,6} for a QPSK-modulated Fixed Reference Channel (FRC) denotes one initial transmission and 3 retransmissions with different redundancy version parameters r and s.

	X_{rv}	s	r
Initial transmission ⇨	0	1	0
	1	0	0
First retransmission ⇨	2	1	1
	3	0	1
	4	1	2
Second retransmission ⇨	5	0	2
Third retransmission ⇨	6	1	3
	7	0	3

Example 2: The RV coding sequence {6,0,4,5} for a 16 QAM-modulated channel denotes one initial transmission and 3 retransmissions with 4 different constellation version parameters b. The redundancy version parameters r and s are equal for all transmissions (Chase combining).

	X_{rv}	s	r	b
First retransmission ⇨	0	1	0	0
	1	0	0	0
	2	1	1	1
	3	0	1	1
Second retransmission ⇨	4	1	0	1
Third retransmission ⇨	5	1	0	2
Initial transmission ⇨	6	1	0	3
	7	1	1	0

Note: *In the edit mode described below, the R&S CMU can configure RV coding sequences with up to 8 values (corresponding to up to 7 retransmissions). Sequences with a length > 4 are not used in UTRANs but provided for test purposes.*

HSDPA in Remote Control

The following section describes the commands for the HSDPA generators (in *Non Signalling* and *Signalling* mode) and the specific HSDPA tests.

The Code Domain Power vs. Time *measurement and the* `CDPower:MANual` *and* `CDPower:RMANual` *applications also provide HSDPA-specific measurement results. These measurements are described in Chapter 6 of this manual.*

HSDPA Downlink Generator (Non Signalling)

The subsystem *HSDPa* configures the HSDPA signals generated by the CMU. It corresponds to the *HSDPA* section in the *Generator* tab of the *Connection Control* menu. HSDPA signals and measurements require option R&S®CMU-K64.

SOURce:HSDPa:SIGNal:ENABle <*Enable*>				HSDPA Signal
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	HSDPA channels switched on or off	OFF	–	V3.60
Description of command				
This command switches the HSDPA channels in the WCDMA downlink signal *On* or *Off*. The HSDPA channels can be switched on or off irrespective of the other WCDMA channel settings. To perform HSDPA receiver tests, the UE must be able to synchronize to the R&S CMU's downlink signal and decode the received data, so the WCMA generator must be switched on as well (`INITiate:RFGenerator`).				

DEFault:HSDPa <*Enable*>	Default Settings			
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.60
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the `HSDPa` subsystem (including the commands in the following sub-sections) to default values. The setting *OFF* results in an error message. If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

SOURce:HSDPa:SSCode <*Code*>				Secondary Scrambling Code
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
#H0 to #HF	Secondary scrambling code	#H0	–	V3.60
Description of command				
This command defines the secondary scrambling code for the downlink HSDPA signal. The input of a scrambling code may be in decimal or in hexadecimal format, the latter preceded by #H (as specified in IEEE 488.2). The output is always in hexadecimal format, preceded by #H.				

SOURce:HSDPa:HSSCch:NUMBer <*Number*> Number of HS-SCCHs

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 4	No. of HS-SCCHs	4	–	V3.60

Description of command

This command defines the number of HS-SCCHs within the R&S CMU's HS-SCCH set.

SOURce:HSDPa:LEVel:HSSCch<nr> <*Level*> HS-SCCH Level

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35.0 dB to +15.0 dB | OFF	Level of HS-SCCH no. <nr> (<nr> = 1 to 4) HS-SCCH switched off	–7 (<nr> = 1) OFF (<nr> > 1)	dB	V3.60

Description of command

This command defines the HS-SCCH level relative to the level reference for the DL generator signal (`SOURce:RFGenerator:LREFerence`). Use the command `SOURce:HSDPa:PHYSical:LEVel` or `SOURce:HSPa:PHYSical:LEVel` to define the HS-SCCH level together with all other physical channel levels.

SOURce:HSDPa:HSSCch:CODE<nr> <*Code*> HS-SCCH Ch. Code

<Code>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 127	Chann. code of HS-SCCH no. <nr> (<nr> = 1 to 4)	11 + <nr>	–	V3.60

Description of command

This command selects the HS-SCCH channelization code set information for HS-DSCH allocation.

SOURce:HSDPa:HSSCch:UEID<nr> <*Number*> HS-SCCH UE ID

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
#H0 to #HFFFF	UE ID of the HS-SCCH set	#HAAAA	–	V3.80

Description of command

This command selects the UE identity (=H-RNTI) to specify the UE for which data is transmitted in the corresponding HS-DSCH TTI.

SOURce:HSDPa:HSSCch:DUMMY:UEID<nr> <*Number*> HS-SCCH Dummy UE ID

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
#H0 to #HFFFF	Dummy UE ID of HS-SCCH no. <nr> (<nr> = 1 to 4)	#H5555 (<nr> = 1) #H12AA (<nr> = 2) #H1AAA (<nr> = 3) #H1FAA (<nr> = 4)	–	V3.80

Description of command

This command defines the dummy UE identities that the R&S CMU transmits in the unscheduled subframes if `CONFigure:BSSignal:PHYSical:HSSCch:USUBframes TDU` is set.

SOURce:HSDPa:HSSCch:SELection <*Number*> HS-SCCH Selection

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
SCCH1 to SCCH4 | CYCLic | RANDom	Fixed HS-SCCH channel Cyclic change of HS-SCCH channel Random selection of HS-SCCH channel	1	–	V3.80

Description of command

This command selects the HS-SCCH(s) within the R&S CMU's HS-SCCH set that carry the UE ID. In the `CYCLic` or `RANDom` mode, the HS-SCCH changes among channels 1 to n where n is defined via `SOURce:HSDPa:HSSCch:NUMBer`.

SOURce:HSDPa:HSSCch:NUMBer <*Number*> Number of HS-SCCHs

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 4	No. of HS-SCCHs	4	–	V3.80

Description of command

This command defines the number of HS-SCCHs within the R&S CMU's HS-SCCH set.

SOURce:HSDPa:HSSCch:USUBframes <*Mode*> Unscheduled Subframes

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
TDU | DTX	Transmit Dummy UEID DTX	UEID	–	V3.60

Description of command

This command defines the transmission in the gaps between consecutive HS-SCCH subframes allocated to the UE.

SOURce:HSDPa:LEVel:HSPDsch <*Level*> Level (All Active Codes)

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | OFF | ON	Sum level of HS-PDSCH HS-PDSCH switched off Switch on the HS-PDSCH that was `OFF` before, using the level defined previously	0.0	dB	V3.60

Description of command

This command defines the signal level of the HS-PDSCH, summed over all active codes, relative to the level reference for the DL generator signal (`SOURce:RFGenerator:LREFerence`). Use the command `SOURce:HSDPa:PHYSical:LEVel` or `SOURce:HSPa:PHYSical:LEVel` to define the HS-PDSCH level together with all other physical channel levels.

SOURce:HSDPa:PHYSical:LEVel HS-SCCH and HS-PDSCH Levels

<P-CPICH_abs> | <P-CPICH_rel>, <P-SCH>, <S-SCH>, <P-CCPCH>, <PICH>, <DPDCH>, <Power Offset>, <SCCH_1>, … , <SCCH_4>, <PDSCH>

<P-CPICH_abs>	Description of parameters	Def. value	Def. unit	FW vers.
–147.0 dBm to –37.0 dBm* –147.0 dBm to –20.0 dBm* –100.0 dBm to +3.0 dBm*	Absolute P-CPICH level if RF 1 is used Absolute P-CPICH level if RF 2 is used Abs. P-CPICH level if RF 3 OUT is used	–96.3 –96.3 –96.3	dBm dBm dBm	V3.50
<P-CPICH_rel>	Description of parameters	Def. value	Def. unit	FW vers.
–30 dB to 0 dB	Relative P-CPICH level	–	dB	V3.50
<P-SCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | –30 dB to 0 dB	P-SCH level (level reference = P-CPICH) P-SCH level (level reference = total channel power)	–5.0 –	dB dB	V3.50
<S-SCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | –30 dB to 0 dB	S-SCH level (level reference = P-CPICH) S-SCH level (level reference = total channel power)	–5.0 –	dB dB	V3.50
<P-CCPCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | –30 dB to 0 dB	P-CCPCH level (level ref. = P-CPICH) P-CCPCH level (level reference = total channel power)	–2.0 –	dB dB	V3.50
<PICH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | –30 dB to 0 dB	PICH level (level ref. = P-CPICH) PICH level (level reference = total channel power)	–5.0 –	dB dB	V3.50
<DPDCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | –30 dB to 0 dB	DPDCH level (level ref. = P-CPICH) DPDCH level (level reference = total channel power)	–7.0 –	dB dB	V3.50
<Power Offset>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 6.0 dB	DPCCH/DPDCH power offset	0.0	dB	V3.50
<SCCH_1>, … , <SCCH_4>	Description of parameters	Def. value	Def. unit	FW vers.
–35.0 dB to +15.0 dB | OFF | ON,	Level of HS-SCCH no. 1 to 4 HS-SCCH switched off Switch on a HS-SCCH that was `OFF` before, using the level defined previously	–7 (<nr> = 1) OFF**) (<nr> > 1)	dB	V3.60
<PDSCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | OFF | ON	Sum level of HS-PDSCH HS-PDSCH switched off Switch on the HS-PDSCH that was `OFF` before, using the level defined previously	0.0	dB	V3.60

Description of command

This command sets all physical channel levels at once, including the HSDPA channels. The WCDMA levels can be set relative to the P-CPICH level (in which case <*P-CPICH_abs*> is used) or relative to the total channel power (<*P-CPICH_rel*> is used), depending on the `SOURce:RFGenerator:LREFerence` setting.

Note: *The instrument checks the levels for consistence before activating the settings. This is important especially if the levels are defined relative to the total channel power and must not exceed this fixed value.*

*) The reported level ranges correspond to the total output power ranges at the three RF output connectors (see command `SOURce:RFGenerator:OPOWer`). If other channel contributions are switched on, the P-CPICH level must be reduced so that the total output power range is not exceeded.

**) If the channels no. 2, 3, or 4 are switched `ON`, their level is set to –7 dB.

SOURce:HSPA:PHYSical:LEVel WCDMA and HSPA Combined Channel Levels

<P-CPICH_abs> | <P-CPICH_rel>, <P-SCH>, <S-SCH>, <P-CCPCH>, <PICH>, <DPDCH>, <Power Offset>, <SCCH_1>, … , <SCCH_4>, <PDSCH>, <E-AGCH>, <E-RGCH>

<P-CPICH_abs>	Description of parameters	Def. value	Def. unit	FW vers.
–147.0 dBm to –37.0 dBm* –147.0 dBm to –20.0 dBm* –100.0 dBm to +3.0 dBm*	Absolute P-CPICH level if RF 1 is used Absolute P-CPICH level if RF 2 is used Abs. P-CPICH level if RF 3 OUT is used	–96.3 –96.3 –96.3	dBm dBm dBm	V4.20
<P-CPICH_rel>	Description of parameters	Def. value	Def. unit	
–30 dB to 0 dB	Relative P-CPICH level	–	dB	
<P-SCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB | –30 dB to 0 dB	P-SCH level (level reference = P-CPICH) P-SCH level (level reference = total channel power)	–5.0 –	dB dB	
<S-SCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB | –30 dB to 0 dB	S-SCH level (level reference = P-CPICH) S-SCH level (level reference = total channel power)	–5.0 –	dB dB	
<P-CCPCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB | –30 dB to 0 dB	P-CCPCH level (level ref. = P-CPICH) P-CCPCH level (level reference = total channel power)	–2.0 –	dB dB	
<PICH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB | –30 dB to 0 dB	PICH level (level ref. = P-CPICH) PICH level (level reference = total channel power)	–5.0 –	dB dB	
<DPDCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB | –30 dB to 0 dB	DPDCH level (level ref. = P-CPICH) DPDCH level (level reference = total channel power)	–7.0 –	dB dB	
<Power Offset>	Description of parameters	Def. value	Def. unit	
0.0 dB to 6.0 dB	DPCCH/DPDCH power offset	0.0	dB	
<SCCH_1>, … , <SCCH_4>	Description of parameters	Def. value	Def. unit	
–35.0 dB to +15.0 dB | OFF | ON,	Level of HS-SCCH no. 1 to 4 HS-SCCH switched off Switch on a HS-SCCH that was `OFF` before, using the level defined previously	–7 (<nr> = 1) OFF**) (<nr> > 1)	dB	
<PDSCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB | OFF | ON	Sum level of HS-PDSCH HS-PDSCH switched off Switch on the HS-PDSCH that was `OFF` before, using the level defined previously	0.0	dB	
<E-AGCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB | OFF	Sum level of E-AGCH HS-PDSCH switched off	–6.0	dB	
<E-RGCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB | OFF	Sum level of E-RGCH/E-HICH E-RGCH/E-HICH switched off	–6.0	dB	

Description of command

This command sets all physical channel levels at once, including the HSDPA and HSUPA channels. The WCDMA levels can be set relative to the P-CPICH level (in which case <*P-CPICH_abs*> is used) or relative to the total channel power (<*P-CPICH_rel*> is used), depending on the `SOURce:RFGenerator:LREFerence` setting.

Note: *The instrument checks the levels for consistence before activating the settings. This is important especially if the levels are defined relative to the total channel power and must not exceed this fixed value.*

*) The reported level ranges correspond to the total output power ranges at the three RF output connectors (see command `SOURce:RFGenerator:OPOWer`). If other channel contributions are switched on, the P-CPICH level must be reduced so that the total output power range is not exceeded.

**) If the channels no. 2, 3, or 4 are switched ON, their level is set to –7 dB.

SOURce:HSDPa:HSPDsch:CODE <*Code*> — First Used Ch. Code

<*Code*>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 15	First Used Ch. Code	2	–	V3.60

Description of command

This command selects the lowest numbered channelization code assigned to the HS-PDSCH.

SOURce:HSDPa:HSPDsch:USUBframes <*Mode*> — Unscheduled Subframes

<*Mode*>	Description of parameters	Def. value	Def. unit	FW vers.
DDATa | DTX	Dummy data DTX	DDAT	–	V3.60

Description of command

This command qualifies whether the CMU maintains the signal power in unscheduled HS-PDSCH subframes.

SOURce:HSDPa:HSDSch:DSOurce <*Pattern*> — HS-DSCH Data Pattern

<*Pattern*>	Description of parameters	Def. value	Def. unit	FW vers.
ALL0 | **ALL1 |** **ALT |** **PR9 | PR11 | PR13 | PR15**	Bit sequence consisting of zeros Bit sequence consisting of ones 010101... bit sequence Pseudo-random bit sequences	PR9	–	V3.60

Description of command

This command selects the bit pattern transmitted as user information on the HS-DSCH.

SOURce:HSDPa:HSDSch:FNACk <*Mode*> — Force NACK

<*Mode*>	Description of parameters	Def. value	Def. unit	FW vers.
P10 | P20 | … | P100 | **OFF**	UE sends 10%, 20%, …, 100% UL NACK No UL NACK sent	OFF	–	V3.80 V3.60

Description of command

This command specifies the percentage of data with incorrect CRC cauing NACKs in the UL.

SOURce:HSDPa:HSDSch:CFCYcle <*Period*>			CQI Feedback Cycle	
<Period>	Description of parameters	Def. value	Def. unit	FW vers.
C2 | C4 | C8 | C10 | C20 | C40 | C80 | C160 | OFF	Feedback cycle length No CQI symbols sent (DTX)	C4	ms	V3.80
Description of command				
This command specifies a time (in multiples of 2 ms or 1 HSDPA subframe) after which the UE will repeat the transmission of CQI symbols on the HS-DPCCH. **Note:** The query returns the feedback cycle length without “C”, i.e. 2 | 4 | 8… | 160 | OFF.				

SOURce:HSDPa:HSDSch:CRFactor <*Factor*>			CQI Repetition Factor	
<Factor>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 4	No. of consecutive CQI transmissions	1	–	V4.20
Description of command				
This command specifies the number of CQI transmissions per CQI Feedback Cycle (`SOURce:HSDPa:HSDSch:CFCYcle`).				

SOURce:HSDPa:HSDSch:ANRFactor <*Factor*>			ACK/NACK Repetition Factor	
<Factor>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 4	No. of consecutive ACK/NACK transmissions	1	–	V4.20
Description of command				
This command specifies the number of repeated ACK/NACK transmissions.				

SOURce:HSDPa:HSDSch:UECategory <*Number*>			UE Category	
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
1 | 2 … 12	UE Category	1	–	V3.60
Description of command				
This command selects the capability category of the UE. The setting takes effect when HS-DSCH configuration as a *CQI Channel* is selected (`SOURce:HSDPa:HSDSch:TYPE CQI`).				

SOURce:HSDPa:HSDSch:TYPE <*Channel*>			Channel Configuration Type	
<Channel>	Description of parameters	Def. value	Def. unit	FW vers.
FRCHannel | CQIChannel | UDCHannel	Fixed Reference Channel CQI User Defined	FRCH	–	V3.60
Description of command				
This command selects the HS-DSCH channel type.				

Fixed Reference Channel (FRCHannel)

The subsystem *HSDPa:FRCHannel* configures the HSDPA signal as a reference channel (H-set) according to standard 3GPP TS 25.101, Annex A7. It corresponds to the *Fixed Reference Channel* section in the *Generator* tab of the *Connection Control* menu.

SOURce:HSDPa:FRCHannel:HSET <*Set*> Fixed Reference Channel, H-Set Selection

<Set>	Description of parameters	Def. value	Def. unit	FW vers.
S1QP | S1Q | **S1M |** **S2QP | S2Q |** **S3QP | S3Q |** **S4QP | S5QP |** **S6QP | S6Q**	H-Set 1, QPSK or 16QAM modulation H-Set 1 Max. Input H-Set 2, QPSK or 16QAM modulation H-Set 3, QPSK or 16QAM modulation H-Set 4 or 5 (QPSK modulation) H-Set 6, QPSK or 16QAM modulation	S1QP	–	V3.60 V4.20

Description of command

This command selects the fixed reference channel type (H-Set). The setting takes effect when HS-DSCH configuration as a *Fixed Reference Channel* is selected (`SOURce:HSDPa:HSDSch:TYPE FRCH`).

SOURce:HSDPa:FRCHannel:RVCSequence? Fixed Reference Channel, RV Coding Sequence

Response	Description of parameters		Def. value	Def. unit	FW vers.
S0256 | **S6 |** **S6215**	{ 0, 2, 5, 6 } { 6 } { 6, 2, 1, 5 }	QPSK H-Set active H-Set 1 Max. Input active 16QAM H-Set active	S0256	–	V3.60

Description of command

This command is always a query and returns the RV coding sequence of the fixed reference channel type (H-Set). The response is for information only as it is fixed, depending on the selected H-Set (`SOURce:HSDPa:FRCHannel:HSET`).

CQI Channel (CQIChannel)

The subsystem *HSDPa:CQIChannel* configures the HSDPA signal as a CQI test channel. It corresponds to the *CQI Channel Configuration* section in the *Generator* tab of the *Connection Control* menu.

SOURce:HSDPa:CQIChannel:TINDex:TYPE <*Number*> Table Index, Type

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
FIXed | **SEQuence |** **FULCqi |** **CONF**	Fixed Sequence Follow UL CQI Conformance test (CQI reporting test)	FIX	–	V3.60

Description of command

This command selects the CQI table index type. The setting takes effect when HS-DSCH configuration as a *CQI Channel* is selected (`SOURce:HSDPa:HSDSch:TYPE CQI`).

SOURce:HSDPa:CQIChannel:TINDex:FIXed <*Number*> Table Index, Fixed

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 30	Fixed CQI	16	–	V3.60

Description of command

This command selects the fixed CQI defining the downlink Transport Format (TF). The setting takes effect when a fixed table index type (`SOURce:HSDPa:CQIChannel:TINDex:TYPE FIX`) and HS-DSCH configuration as a *CQI Channel* is selected (`SOURce:HSDPa:HSDSch:TYPE CQI`).

SOURce:HSDPa:CQIChannel:TINDex:SEQuence <*Min*>, <*Max*>				Table Index, Sequence
<Min>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 30	Min. CQI	1	–	V3.60
<Max>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 30	Max. CQI	30	–	V3.60

Description of command

This command defines a range of CQI values for variable downlink TFs. The setting takes effect when a sequential table index type (`SOURce:HSDPa:CQIChannel:TINDex:TYPE SEQ`) and HS-DSCH configuration as a *CQI Channel* is selected (`SOURce:HSDPa:HSDSch:TYPE CQI`).

SOURce:HSDPa:CQIChannel:TINDex:CTSValue <*Value*>				Table Index, Confidence Test Start Value
<Value>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 30	Start value for the CQI conformance test	16	–	V3.60

Description of command

This command selects the start value for the CQI conformance test. The setting is relevant if a HS-DSCH configuration as a *CQI Channel* is selected (`SOURce:HSDPa:HSDSch:TPYE CQI`) in order to perform a CQI Reporting test (`SOURce:HSDPa:CQIChannel:TINDex:TYPE CONF`).

SOURce:HSDPa:CQIChannel:TTIDistance?				Inter-TTI Distance
Response	Description of parameters	Def. value	Def. unit	FW vers.
1 to 3	Number of TTIs	3	–	V3.60

Description of command

This command is always a query and returns the minimum distance between two consecutive Transmission Time Intervals (TTIs) in which the HS-DSCH is allocated to the UE.

SOURce:HSDPa:CQIChannel:HARQ?				No. of H-ARQ Processes
Response	Description of parameters	Def. value	Def. unit	FW vers.
1 to 8	Number of HARQ processes	2	–	V3.60

Description of command

This command is always a query and returns the no. of Hybrid ARQ (Automatic Repeat Request) processes for retransmission.

SOURce:HSDPa:CQIChannel:RVCSequence:QPSK <*Sequence*>CQI Channel, RV Coding Sequence QPSK

<Sequence>	Description of parameters		Def. value	Def. unit	FW vers.
S0 | **S6 |** **S0256 |** **S6215 |** **S0000 |** **S6666 |** **S6045 |**	{ 0 } { 6 } { 0, 2, 5, 6 } { 6, 2, 1, 5 } { 0, 0, 0, 0 } { 6, 6, 6, 6 } { 6, 0, 4, 5 }	(Single Transmission, QPSK) (Single Transmission, 16QAM) (FRC, QPSK) (FRC, 16QAM) (Chase Combining, QPSK) (Chase Combining, 16QAM) (Chase Combining with constellation re-arrangement, 16QAM)	S0	–	V4.50
EMODe	Edit mode				

Description of command

This command selects the RV coding sequence for the QPSK-modulated CQI channel.

If `EMOD` is active an arbitrary RV coding sequence can be set; see commands `SOURce:HSDPa:CQIChannel:RVCSequence:QPSK:EMSequence<nr> and SOURce:HSDPa:CQIChannel: RVCSequence:QPSK:EMSequence:ALL`.

SOURce:HSDPa:CQIChannel:RVCSequence:QPSK:EMSequence:LENGth <*Length*> Edit Mode – Sequence Length

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 8	Number of retransmissions + 1	8	–	V4.50

Description of command

This command defines the length of the edited RV coding sequence for the QPSK modulated CQI channel. The sequence can define one initial transmission plus 1 to 7 retransmissions, so the <*Length*> parameter is equal to the number of retransmissions plus one. The setting takes effect if the edit mode is active (`SOURce:HSDPa:CQIChannel:RVCSequence:QPSK EMOD`).

SOURce:HSDPa:CQIChannel:RVCSequence:QPSK:EMSequence<nr> <*Value*> Edit Mode – Sequence

<Value>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7	Sequence value for transmission <nr> (<nr> = 1 to 8)	0	–	V4.50

Description of command

This command defines a single value of the the edited RV coding sequence for the QPSK modulated CQI channel. If the numeric suffix is larger than the sequence length defined via `SOURce:HSDPa:CQIChannel:RVCSequence:QPSK:EMSequence:LENGth`) the value is ignored. The setting takes effect if the edit mode is active (`SOURce:HSDPa:CQIChannel:RVCSequence EMOD`).

SOURce:HSDPa:CQIChannel:RVCSequence:QPSK:EMSequence:ALL Edit Mode – Sequence
<Value_1>, <Value_2>, …,<Value_8>

Parameters	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7, **…,** **0 to 7**	RV coding sequence, first value RV coding sequence, 8th value	0, …, 0	–	V4.50

Description of command

This command defines an arbitrary RV coding sequence consisting of 8 numbers. The parameter list must contain eight numbers, however, only the first n numbers (where n denotes the sequence length defined via `SOURce:HSDPa:CQIChannel:RVCSequence:QPSK:EMSequence:LENGth`) are used. The setting takes effect if the edit mode is active (`SOURce:HSDPa:CQIChannel:RVCSequence EMOD`).

SOURce:HSDPa:CQIChannel:RVCSequence:QAM <*Sequence*>CQI Channel, RV Coding Sequence 16 QAM

<Sequence>	Description of parameters		Def. value	Def. unit	FW vers.
S0 | **S6 |** **S0256 |** **S6215 |** **S0000 |** **S6666 |** **S6045 |**	{ 0 } { 6 } { 0, 2, 5, 6 } { 6, 2, 1, 5 } { 0, 0, 0, 0 } { 6, 6, 6, 6 } { 6, 0, 4, 5 }	(Single Transmission, QPSK) (Single Transmission, 16QAM) (FRC, QPSK) (FRC, 16QAM) (Chase Combining, QPSK) (Chase Combining, 16QAM) (Chase Combining with constellation re-arrangement, 16QAM)	S0	–	V4.50
EMODe	Edit mode				

Description of command

This command selects the RV coding sequence for the 16 QAM-modulated CQI channel.

If `EMOD` is active an arbitrary RV coding sequence can be set; see commands `SOURce:HSDPa:CQIChannel:RVCSequence:QAM:EMSequence<nr> and SOURce:HSDPa:CQIChannel:RVCSequence:QAM:EMSequence:ALL`.

SOURce:HSDPa:CQIChannel:RVCSequence:QAM:EMSequence:LENGth <*Length*> Edit Mode – Sequence Length

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 8	Number of retransmissions + 1	8	–	V4.50

Description of command

This command defines the length of the edited RV coding sequence for the 16 QAM modulated CQI channel. The sequence can define one initial transmission plus 1 to 7 retransmissions, so the *<Length>* parameter is equal to the number of retransmissions plus one. The setting takes effect if the edit mode is active (`SOURce:HSDPa:CQIChannel:RVCSequence:QAM EMOD`).

SOURce:HSDPa:CQIChannel:RVCSequence:QAM:EMSequence<nr> <*Value*> Edit Mode – Sequence

<Value>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7	Sequence value for transmission <nr> (<nr> = 1 to 8)	0	–	V4.50

Description of command

This command defines a single value of the the edited RV coding sequence for the 16 QAM modulated CQI channel. If the numeric suffix is larger than the sequence length defined via `SOURce:HSDPa:CQIChannel:RVCSequence:QAM:EMSequence:LENGth`) the value is ignored. The setting takes effect if the edit mode is active (`SOURce:HSDPa:CQIChannel:RVCSequence:QAM EMOD`).

SOURce:HSDPa:CQIChannel:RVCSequence:QAM:EMSequence:ALL Edit Mode – Sequence
<Value_1>, <Value_2>, …,<Value_8>

Parameters	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7, **…,** **0 to 7**	RV coding sequence, first value RV coding sequence, 8th value	0, …, 0	–	V4.50

Description of command

This command defines an arbitrary RV coding sequence consisting of 8 numbers. The parameter list must contain eight numbers, however, only the first n numbers (where n denotes the sequence length defined via `SOURce:HSDPa:CQIChannel:RVCSequence:QAM:EMSequence:LENGth`) are used. The setting takes effect if the edit mode is active (`SOURce:HSDPa:CQIChannel:RVCSequence:QAM EMOD`).

User Defined Channel (UDCHannel)

The subsystem *HSDPa:UDCHannel* configures the HSDPA signal with user-defined parameters. It corresponds to the *User Defined Channel* section in the *Generator* tab of the *Connection Control* menu.

SOURce:HSDPa:UDCHannel:TTIDistance <*TTIs*>				Inter-TTI Distance
<TTIs>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 3	Number of TTIs	3	–	V3.60
Description of command				
This command sets the minimum distance between two consecutive Transmission Time Intervals (TTIs) in which the HS-DSCH is allocated to the UE. The setting takes effect when HS-DSCH configuration as a *User Defined* channel is selected (`SOURce:HSDPa:HSDSch:TYPE UDCH`).				

SOURce:HSDPa:UDCHannel:HARQ <*Number*>				No. of H-ARQ Processes
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 8	Number of HARQ processes	2	–	V3.60
Description of command				
This command sets the no. of Hybrid ARQ (Automatic Repeat Request) processes for retransmission. The setting takes effect when HS-DSCH configuration as a *User Defined* channel is selected (`SOURce:HSDPa:HSDSch:TYPE UDCH`).				

SOURce:HSDPa:UDCHannel:TBLock:SINDex <*Number*>				Transport Block Size Index
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 62	Transport block size index (k_i)	41	–	V3.60
Description of command				
This command sets the transport block size index. The setting takes effect when HS-DSCH configuration as a *User Defined* channel is selected (`SOURce:HSDPa:HSDSch:TYPE UDCH`).				

SOURce:HSDPa:UDCHannel:TBLock:SIZE? <*Number*>				Transport Block Size
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 28800	Transport block size	INV	(bits)	V3.60
Description of command				
This command is always a query and returns the number of bits per transport block.				

SOURce:HSDPa:UDCHannel:NCODes <*Number*>				No. of Physical Channel Codes
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 15	Number of Physical Channel Codes	5	–	V3.60
Description of command				
This command sets the number of physical HS-DSCH channelization codes. The setting takes effect when HS-DSCH configuration as a *User Defined* channel is selected (`SOURce:HSDPa:HSDSch:TYPE UDCH`).				

SOURce:HSDPa:UDCHannel:MODulation <*Scheme*> Modulation

<Scheme>	Description of parameters	Def. value	Def. unit	FW vers.
QPSK | QAM16	QPSK modulation 16QAM modulation	QPSK	–	V3.60

Description of command

This command sets the modulation scheme of the user-defined HSDPA signal. The setting takes effect when HS-DSCH configuration as a *User Defined* channel is selected (`SOURce:HSDPa:HSDSch:TYPE UDCH`).

SOURce:HSDPa:UDCHannel:MSIZe <*Mode*> Memory Size Control

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
IMPL | EXPL	Implicit partitioning (by UE) Explicit partitioning	IMPL	–	V4.34

Description of command

This command selects implicit or explicit partitioning of the soft memory buffer in the MAC-hs. With explicit partitioning, the buffer size is set via `SOURce:HSDPa:UDCHannel:IRBuffer:EXPLicit`.

SOURce:HSDPa:UDCHannel:IRBuffer? <*Bits*> IR Buffer Size (Implicit)

<Bits>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 172 800	Buffer size	NAN	(bits)	V3.60

Description of command

This command is always a query and returns the size of the virtual IR buffer. The value is valid if implicit memory size control is active (`SOURce:HSDPa:UDCHannel:MSIZe IMPL`).

SOURce:HSDPa:UDCHannel:IRBuffer:EXPLicit? <*Bits*> IR Buffer Size (Explicit)

<Bits>	Description of parameters	Def. value	Def. unit	FW vers.
800 | 900 | 1000 | … | 304 000	Buffer size	800	(bits)	V4.34

Description of command

This command defines the size of the virtual IR buffer. The value is valid if explicit memory size control is active (`SOURce:HSDPa:UDCHannel:MSIZe EXPL`).

SOURce:HSDPa:UDCHannel:RVCSequence <*Sequence*> User Defined Channel, RV Coding Sequence

<*Sequence*>	Description of parameters		Def. value	Def. unit	FW vers.
S0 | **S6 |** **S0256 |** **S6215 |** **S0000 |** **S6666 |** **S6045 |**	{ 0 } { 6 } { 0, 2, 5, 6 } { 6, 2, 1, 5 } { 0, 0, 0, 0 } { 6, 6, 6, 6 } { 6, 0, 4, 5 }	(Single Transmission, QPSK) (Single Transmission, 16QAM) (FRC, QPSK) (FRC, 16QAM) (Chase Combining, QPSK) (Chase Combining, 16QAM) (Chase Combining with constellation re-arrangement, 16QAM)	S0256	–	V3.60
EMODe	Edit mode				V3.80

Description of command

This command selects the RV coding sequence of the user defined channel. The sequence can be chosed irrespective of the selected modulation scheme (`SOURce:HSDPa:UDCHannel:MODulation`). The setting takes effect when HS-DSCH configuration as a *User Defined* channel is selected (`SOURce:HSDPa:HSDSch:TYPE UDCH`)

If `EMOD` is active an arbitrary RV coding sequence can be set; see commands `SOURce:HSDPa:UDCHannel:EMSequence<nr> and SOURce:HSDPa:UDCHannel: EMSequence:ALL`.

SOURce:HSDPa:UDCHannel:EMSequence:LENGth <*Length*> Edit Mode – Sequence Length

<*Length*>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 8	Number of retransmissions + 1	8	–	V3.80

Description of command

This command defines the length of the RV coding sequence. The sequence can define one initial transmission plus 1 to 7 retransmissions, so the <*Length*> parameter is equal to the number of retransmissions plus one. The setting takes effect when HS-DSCH configuration as a *User Defined* channel is selected (`SOURce:HSDPa:TYPE UDCH`) and if the edit mode is active (`SOURce:HSDPa:UDCHannel:RVCSequence EMOD`).

SOURce:HSDPa:UDCHannel:EMSequence<nr> <*Value*> Edit Mode – Sequence

<*Value*>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7	Sequence value for transmission <nr> (<nr> = 1 to 8)	0	–	V3.80

Description of command

This command defines a single value of the RV coding sequence. If the numeric suffix is larger than the sequence length defined via `SOURce:HSDPa:UDCHannel:EMSequence:LENGth`) the value is ignored. The setting takes effect when HS-DSCH configuration as a *User Defined* channel is selected (`SOURce:HSDPa:HSDSch:TYPE UDCH`) and if the edit mode is active (`SOURce:HSDPa:UDCHannel:RVCSequence EMOD`).

SOURce:HSDPa:UDCHannel:EMSequence:ALL Edit Mode – Sequence
<Value_1>, <Value_2>, …,<Value_8>

Parameters	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7, …, 0 to 7	RV coding sequence, first value RV coding sequence, 8th value	0, …, 0	–	V3.80

Description of command

This command defines an arbitrary RV coding sequence consisting of 8 numbers. The parameter list must contain eight numbers, however, only the first n numbers (where n denotes the sequence length defined via `SOURce:HSDPa:UDCHannel:EMSequence:LENGth`) are used. The setting takes effect when HS-DSCH configuration as a *User Defined* channel is selected (`SOURce:HSDPa:HSDSch:TYPE UDCH`) and if the edit mode is active (`SOURce:HSDPa:UDCHannel:RVCSequence EMOD`).

Common Measurement Groups

The measurements reported in this section are available both in *Non Signalling* and in *Signalling* mode.

MODulation:EPHSdpcch

The subsystem `MODulation:EPHSdpcch` controls the *EVM & PhD with HS-DPCCH* measurement. The subsystem corresponds to the measurement menu *Modulation,* application *EVM & PhD with HS-DPCCH,* and the sections in the popup menu *Modulation Configuration* that are related to the *EVM & PhD with HS-DPCCH* application.

Measurement Control

The following commands control the *EVM & PhD with HS-DPCCH* measurement. They correspond to the *Phase Discont.* softkey in the measurement menu *Modulation*.

INITiate:MODulation:EPHSdpcch	Start new measurement	⇒	*RUN*
ABORt:MODulation:EPHSdpcch	Abort running measurement and switch off	⇒	*OFF*
STOP:MODulation:EPHSdpcch	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:MODulation:EPHSdpcch	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V4.30

CONFigure:MODulation:EPHSdpcch:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V4.30
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:MODulation:EPHSdpcch:STATus?			Measurement Status	
Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	V4.30
1 to 10000 | **NONE,**	Counter for current statistics cycle No counting mode set	NONE	–	
1 to 1000 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	
Description of command				
This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).				

Test Configuration

The commands of the following subsystems configure the *EVM & PhD with HS-DPCCH* measurement. They correspond to the sections in the popup menu *Modulation Configuration* that are related to the *EVM & PhD with HS-DPCCH* application.

Subsystem MODulation:EPHSdpcch:CONTrol

The subsystem *MODulation:EPHSdpcch:CONTrol* configures the scope of the measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration*.

CONFigure:MODulation:EPHSdpcch:CONTrol:STATistics <*Statistics*>			Measurement Statistics	
<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 | **NONE**	Number of evaluation periods per statistics cycle Statistics off (equivalent to 1)	10	–	V4.30
Description of command				
This command defines the number of slots forming a statistics cycle.				

CONFigure:MODulation:EPHSdpcch:CONTrol:REPetition Test Cycles
<Repetition>, <StopCond>, <Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	FW vers.
CONTinuous | SINGleshot | 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	V4.30
<StopCond>	Description of parameters	Def. value	Def. unit	FW vers.
SONerror | NONE	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	V4.30
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | NONE	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V4.30

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of `READ` commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:MODulation:EPHSdpcch:CONTrol:MLENgth *<Slots>* Measurement Length

<Slots>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 46	Number of slots per single measurement step	46	(slots)	V4.30

Description of command

This command selects the time interval to be measured.

CONFigure:MODulation:EPHSdpcch:CONTrol:SECA *<Slots>* Section A

<Slots>	Description of parameters	Def. value	Def. unit	FW vers.
0.5 | 1.5 | … 44.5	Position of section A (first marker line)	0.5	(slots)	V4.30

Description of command

This command selects the position of section A relative to the start of the measured time interval. For a half slot measurement (`CONFigure:BSSignal:PHYSical:DPCH:TOFFset 6`), the allowed positions coincide with the HS-DPCCH slot boundaries.

CONFigure:MODulation:EPHSdpcch:CONTrol:SECB *<Slots>* Section B

<Slots>	Description of parameters	Def. value	Def. unit	FW vers.
1.5 | 2.5 | … 45.5	Position of section B (second marker line)	45.5	(slots)	V4.30

Description of command

This command selects the position of section B relative to the start of the measured time interval. For a half slot measurement (`CONFigure:BSSignal:PHYSical:DPCH:TOFFset 6`), the allowed positions coincide with the HS-DPCCH slot boundaries.

DEFault:MODulation:EPHSdpcch:CONTrol <*Enable*>			Default Settings	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V4.30
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Subsystem MODulation:EPHSdpcch:...LIMit

The subsystem *MODulation:EPHSdpcch:...LIMit* defines the limits for the *EVM & PhD with HS-DPCCH* measurement. The subsystem corresponds to the *EVM & PhD with HS-DPCCH* section in the *Limits* tab of the popup menu *Modulation Configuration.*

CONFigure:MODulation:EPHSdpcch:LIMit[:SCALar]:SYMMetric [:COMBined]:VALue *<PHD>, <Freq_Err>*			Symmetric Limit Values	
<PHD>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 deg to 70.0 deg	Static phase discontinuity limit (symmetric)	30.0	deg	V4.30
<Freq_Err>	Description of parameters	Def. value	Def. unit	FW vers.
0 Hz to 4000 Hz	Frequency Error (symmetric)	200.0	Hz	V4.30
Description of command				
This command specifies the symmetric limit values for the *EVM & PhD with HS-DPCCH* measurement.				

CONFigure:MODulation:EPHSdpcch:LIMit[:SCALar]:ASYMmetric [:COMBined]:VALue *<EVM>, <Out of Limit>*			Asymmetric Limit Values	
<EVM>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to 50.0 %	EVM limit	17.5	%	V4.30
<Out of Limit>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to 100.0 %	Out of Limit Tolerance	10.0	%	V4.30
Description of command				
This command specifies the asymmetric limit values for the *EVM & PhD with HS-DPCCH* measurement.				

CONFigure:MODulation:EPHSdpcch:LIMit[:SCALar]:SYMMetric [:COMBined]:ENABle *<PHD_Curr_Max>, <PHD_A>, <PHD_B>, <Freq_Err_Curr_Max>*			Symmetric Limit Check On/Off	
For all parameters	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable limit check	ON	–	V4.30
Description of command				
This command enables or disables the symmetric limit check for the *EVM & PhD with HS-DPCCH* measurement.				

CONFigure:MODulation:EPHSdpcch:LIMit[:SCALar]:ASYMmetric [:COMBined]:ENABle *<EVM_Curr_Max>, <EVM_A>, <EVM_B>* Asymmetric Limit Check On/Off

For all parameters	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable limit check	ON	–	V4.30

Description of command

This command enables or disables the asymmetric limit check for the *EVM & PhD with HS-DPCCH* measurement.

DEFault:MODulation:EPHSdpcch:LIMit *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V4.30

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystem MODulation:EPHSdpcch...?

The subsystem *MODulation:EPHSdpcch...?* measures and returns the results and compares them with tolerance values. The subsystem corresponds to the graphical measurement menu *Modulation,* application *EVM & PhD with HS-DPCCH.*

Scalar Results: Current Max. and UE Power

READ[:SCALar]:MODulation:EPHSdpcch? Start single shot measurement and return results
FETCh[:SCALar]:MODulation:EPHSdpcch? Read measurement results (unsynchronized)
SAMPle[:SCALar]:MODulation:EPHSdpcch? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Current Max. Phase Disc.,	–180.0 deg to +180.0 deg	NAN	deg	V4.30
Current Max. Freq. Error,	–5000.0 Hz to +5000.0 Hz	NAN	Hz	
Current Max. EVM ≥ Thresh. EVM,	0.0 % to 100.0 %	NAN	%	
Max. UE Power	–100.0 dBm to +60.0 dBm	NAN	dBm	
Min. UE Power	–100.0 dBm to +60.0 dBm	NAN	dBm	

Description of command

These commands are always queries. They start a `MODulation:EPHSdpcch` measurement (`READ...`) and/or return the *Current Max.* and *UE Power* results.

Scalar Results: Statistics

READ[:SCALar]:MODulation:EPHSdpcch:MPOints? Start single shot measurement and return results
FETCh[:SCALar]:MODulation:EPHSdpcch:MPOints? Read measurement results (unsynchronized)
SAMPle[:SCALar]:MODulation:EPHSdpcch:MPOints? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Meas. Points,	0 to 2000	NAN	–	V4.30
PHD > <limit>,	0 to 2000	NAN	–	
Out of Limit	0.0 % to 100.0 %	NAN	%	

Description of command

These commands are always queries. They start a `MODulation:EPHSdpcch` measurement (`READ...`) and/or return the statistical parameters of the current measurement cycle.

Scalar Results: EVM

READ[:SCALar]:MODulation:EPHSdpcch:EVM? Start single shot measurement and return results
FETCh[:SCALar]:MODulation:EPHSdpcch:EVM? Read measurement results (unsynchronized)
SAMPle[:SCALar]:MODulation:EPHSdpcch:EVM? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
EVM Curr. A left,	0.0 % to 100.0 %	NAN	%	V4.30
EVM Curr. A right,	0.0 % to 100.0 %	NAN	%	
EVM Curr. B left,	0.0 % to 100.0 %	NAN	%	
EVM Curr. B right,	0.0 % to 100.0 %	NAN	%	
EVM Avg. (x4),	0.0 % to 100.0 %	NAN	%	
EVM Max. (x4)	0.0 % to 100.0 %	NAN	%	

Description of command

These commands are always queries. They start a `MODulation:EPHSdpcch` measurement (`READ...`) and/or return the statistical EVM results around the marker points A and B (`CONFigure:MODulation:EPHSdpcch:CONTrol:SECA, CONFigure:MODulation:EPHSdpcch:CONTrol:SECB`). A (x4) behind the returned value denotes four results A left, A right, B left, B right.

Scalar Results: Phase Disc.

READ[:SCALar]:MODulation:EPHSdpcch:PHD? Start single shot measurement and return results
FETCh[:SCALar]:MODulation:EPHSdpcch:PHD? Read measurement results (unsynchronized)
SAMPle[:SCALar]:MODulation:EPHSdpcch:PHD? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
EVM Curr. A,	–180.0 deg to +180.0 deg	NAN	deg	V4.30
EVM Curr. B,	–180.0 deg to +180.0 deg	NAN	deg	
EVM Avg. (x2),	–180.0 deg to +180.0 deg	NAN	deg	
EVM Max. (x2)	–180.0 deg to +180.0 deg	NAN	deg	

Description of command

These commands are always queries. They start a `MODulation:EPHSdpcch` measurement (`READ...`) and/or return the statistical phase discontinuity results at the marker points A and B (`CONFigure:MODulation:EPHSdpcch:CONTrol:SECA, CONFigure:MODulation:EPHSdpcch:CONTrol:SECB`). A (x2) behind the returned value denotes two results at marker A and B.

CALCulate[:SCALar]:MODulation:EPHSdpcch:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
Phase Disc. Curr. Max.,	NMAU | NMAL | INV | OK	INV	–	V4.30
Phase Disc. Curr. Sect. A,	NMAU | NMAL | INV | OK	INV	–	
Phase Disc. Curr. Sect. B,	NMAU | NMAL | INV | OK	INV	–	
Phase Disc. Avg. Sect. A,	NMAU | NMAL | INV | OK	INV	–	
Phase Disc. Avg. Sect. B,	NMAU | NMAL | INV | OK	INV	–	
Phase Disc. Max. Sect. A,	NMAU | NMAL | INV | OK	INV	–	
Phase Disc. Max. Sect. B,	NMAU | NMAL | INV | OK	INV	–	
Freq. Error. Curr. Max.,	NMAU | NMAL | INV | OK	INV	–	
EVM Curr. Max.,	NMAU | NMAL | INV | OK	INV	–	
EVM Curr. Max.,	NMAL | INV | OK	INV	–	
EVM Curr. (x4),	NMAL | INV | OK	INV	–	
EVM Avg. (x4),	NMAU | INV | OK	INV	–	
EVM Max. (x4),	NMAU | INV | OK	INV	–	
PhD out of limit*)	NMAU | INV | OK	INV	–	

Description of command

This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see commands above) are exceeded. A (x4) behind the returned value denotes four results A left, A right, B left, B right.

The following messages may be returned for all measured values:

NMAL	Result exceeds upper limit, limit check failed
NMAU	Result below lower limit, limit check failed
INV	No valid result available
OK	Limit check passed

*) This result is calculated at the end of a single shot measurement. It is not available in continuous mode.

READ:ARRay:MODulation:EPHSdpcch:UEPower? UE Power
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:EPHSdpcch:UEPower?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:EPHSdpcch:UEPower?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for UE power	–100.0 dBm to +60.0 dBm,	NAN	dBm	V4.30
...	... ,	...	...	
92th value for UE power	–100.0 dBm to +60.0 dBm	NAN	dBm	

Description of command

These commands are always queries. They return the UE power in all half slots measured.

READ:ARRay:MODulation:EPHSdpcch:EPHSdpcch? Phase discontinuity
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:EPHSdpcch:EPHSdpcch?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:EPHSdpcch:EPHSdpcch?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for phase discontinuity	–180.0 deg to +180.0 deg,	NAN	deg	V4.30
...	... ,	...	...	
46th value for phase discontinuity	–180.0 deg to +180.0 deg	NAN	deg	

Description of command

These commands are always queries. They return the phase discontinuity at all HS-DPCCH slot boundaries measured.

READ:ARRay:MODulation:EPHSdpcch:EVMagnitude? Error Vector Magnitude
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:EPHSdpcch:EVMagnitude?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:EPHSdpcch:EVMagnitude?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for EVM	0% to +100.0 %,	NAN	%	V4.30
...	... ,	...	...	
92th value for EVM	0% to +100.0 %	NAN	%	

Description of command

These commands are always queries. They return the EVM in all half slots measured.

READ:ARRay:MODulation:EPHSdpcch:CFERror? Frequency Error
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:EPHSdpcch:CFERror?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:EPHSdpcch:CFERror?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for frequency error	–5000.0 Hz to +5000.0 Hz,	NAN	kHz	V4.30
...	... ,	...	...	
92th value for frequency error	–5000.0 Hz to +5000.0 Hz	NAN	kHz	

Description of command

These commands are always queries. They return the frequency error in all half slots measured.

HSDPA Receiver Quality Tests

The following commands provide general settings for HSDPA *Receiver Quality* tests.

CONFigure:RXQuality:CONTrol:CTHReshold <Level> CQI Detect. Threshold

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–16 dB to + 16 dB	CQI detection threshold	–13	dB	V3.80

Description of command

This command defines the uplink HS-DPCCH level threshold above which an CQI value reported by the UE will be considered for the *Median CQI* calculation.

CONFigure:RXQuality:CONTrol:MHARq <*H-ARQ*> Monitored H-ARQ

<H-ARQ>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7 | ALL	Single process or all processes	ALL	–	V3.80

Description of command

This command specifies the H-ARQ processes to be monitored in the *HSDPA ACK* measurement.

Remote Control: HSDPA ACK Test (HACK)

The subsystem `RXQuality:HACK` controls the HSDPA ACK/NACK test. The subsystem corresponds to the measurement menu *Receiver Quality,* application *HSDPA ACK.*

INITiate:RXQuality:HACK	Start new measurement ⇒	*RUN*	
ABORt:RXQuality:HACK	Abort running measurement and switch off	⇒	*OFF*
STOP:RXQuality:HACK	Stop measurement ⇒	*STOP*	
CONTinue:RXQuality:HACK	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the current measurement, setting it to the status indicated in the top right column.	V3.60

CONFigure:RXQuality:HACK:EREPorting <Mode> — Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.60
SOPC |	Single operation complete			
SRSQ |	SRQ and SRSQ			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).

FETCh:RXQuality:HACK:STATus? — Measurement Status

Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.60
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop cond.			
1 to 10000 |	Counter for current statistics cycle	NONE		V4.30
NONE,	No counting mode set		–	
1 to 1 000 000 |	Counter for current measured subframe within a cycle	NONE		V3.60
NONE	Statistic count set to off		–	

Description of command

This command is always a query. It returns the status of the measurement (see chapter 5).

CONFigure:RXQuality:HACK:CONTrol:REPetition <Repetition>, <StopCond>, <Stepmode> — Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	FW vers.
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	V4.30
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 10000	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCond>	Description of parameters	Def. value	Def. unit	FW vers.
SONerror |	Stop measurement in case of error *(stop on error)*	NONE	–	V4.30
NONE	Continue measurement even in case of error			
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP |	Interrupt measurement after each statistics cycle	NONE	–	V4.30
NONE	Continue measurement according to its rep. mode			

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of `READ` commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:RXQuality:HACK:CONTrol:MSUBframes <*Subframes*>			Measure Subframes	
<Subframes>	Description of parameters	Def. value	Def. unit	FW vers.
120 to 1 000 000	Number of subframes	2000	(subframes)	V3.61

Description of command

This command specifies the number of subframes to be measured per single shot.

	Scalar Results
READ[:SCALar]:RXQuality:HACK?	Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:HACK?	Read out meas. results (unsynchronized)
SAMPle[:SCALar]:RXQuality:HACK?	Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
ACK (x4),	0.000% to 100.000%	NAN	%	V3.60
NACK (x4),	0.000% to 100.000%	NAN	%	
Transmitted (x4),	0.000% to 100.000%	NAN	%	
DTX (x4),	0.000% to 100.000%	NAN	%	
Meas. Subframes,	0 to <total number of subframes sent>	NAN	(subframes)	
Median CQI,	0 chips to 2559 chips	NAN	0 to 30	
Throughput	0 Mbit/s to 4600 kBit/s	NAN	kBit/s	

Description of command

These commands are always queries. They start an ACK/NACK receiver test (`READ…`) and/or return the measurement results (see also detailed explanation of measured values in section *HSDPA ACK Measurement Results* on p. 8.9). The following results are returned:

ACK	Percentage of HSDPA subframes answered with ACK
NACK	Percentage of HSDPA subframes answered with NACK
Transmitted	Percentage of transmissions with the 1st, 2nd, 3rd and 4th redundancy version
DTX	Percentage of HSDPA subframes not answered, caused DTX
Meas. Subframes	Total number of subframes measured
Median CQI	Median of the CQI values reported by the UE
Throughput	Information bit throughput of the HSDPA link in kbit/s.

The symbol (x4) behind a returned value means that the output string contains 4 comma-separated values, corresponding to the 1st, 2nd, 3rd, and 4th redundancy version. To retrieve results for redundancy versions 4 to 8 and statistical throughput results, use `READ[:SCALar]:RXQuality:HACK:EXTended?` etc.

Scalar Results: Extended

READ[:SCALar]:RXQuality:HACK:EXTended? Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:HACK:EXTended? Read out meas. results (unsynchronized)
SAMPle[:SCALar]:RXQuality:HACK:EXTended? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
ACK (x4),	0.000% to 100.000%	NAN	%	V4.20
NACK (x4),	0.000% to 100.000%	NAN	%	
Transmitted (x4),	0.000% to 100.000%	NAN	%	
DTX (x4),	0.000% to 100.000%	NAN	%	
Min. Throughput,	0 Mbit/s to 4600 kBit/s	NAN	kBit/s	
Max. Throughput,	0 Mbit/s to 4600 kBit/s	NAN	kBit/s	
Max. Possible Throughput,	0 Mbit/s to 4600 kBit/s	NAN	kBit/s	
Scheduled Throughput,	0 Mbit/s to 4600 kBit/s	NAN	kBit/s	
Rel. Throughput,	0.000% to 100.000%	NAN	%	
Min. Rel. Throughput,	0.000% to 100.000%	NAN	%	
Max. Rel. Throughput,	0.000% to 100.000%	NAN	%	
Scheduled Rel. Throughput	0.000% to 100.000%	NAN	%	

Description of command

These commands are always queries. They start an ACK/NACK receiver test (`READ…`) and/or return the measurement results (see also detailed explanation of measured values in section *HSDPA ACK Measurement Results* on p. 8.9). The following results are returned:

ACK	Percentage of HSDPA subframes answered with ACK
NACK	Percentage of HSDPA subframes answered with NACK
Transmitted	Percentage of transmissions with the 1st, 2nd, 3rd and 4th redundancy version
DTX	Percentage of HSDPA subframes not answered, caused DTX
Throughput	Information bit throughput of the HSDPA link in kbit/s.

The symbol (x4) behind a returned value means that the output string contains 4 comma-separated values, corresponding to the 5th, 6th, 7th, and 8th redundancy version. This command complements the basic commands `READ[:SCALar]:RXQuality:HACK` etc.

Scalar Results: DL BLER

READ[:SCALar]:RXQuality:HACK:BLER? Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:HACK:BLER? Read out meas. results (unsynchronized)
SAMPle[:SCALar]:RXQuality:HACK:BLER? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
BLER	0.000% to 100.000%	NAN	%	V4.30

Description of command

These commands are always queries. They start an ACK/NACK receiver test (`READ…`) and/or return the DL BLER result (see also detailed explanation of measured values in section *HSDPA ACK Measurement Results* on p. 8.9).

Scalar Results: All (for up to 8 H-ARQ processes)

READ[:SCALar]:RXQuality:HACK:ALL? Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:HACK:ALL? Read out meas. results (unsynchronized)
SAMPle[:SCALar]:RXQuality:HACK:ALL? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
ACK (x8),	0.000% to 100.000%	NAN	%	V4.55
NACK (x8),	0.000% to 100.000%	NAN	%	
Transmitted (x8),	0.000% to 100.000%	NAN	%	
DTX (x8),	0.000% to 100.000%	NAN	%	
Meas. Subframes,	0 to <total number of subfr. sent>	NAN	(subframes)	
Median CQI,	0 chips to 2559 chips	NAN	0 to 30	
Throughput,	0 Mbit/s to 4600 kBit/s	NAN	kBit/s	
Min. Throughput,	0 Mbit/s to 4600 kBit/s	NAN	kBit/s	
Max. Throughput,	0 Mbit/s to 4600 kBit/s	NAN	kBit/s	
Max. Possible Throughput,	0 Mbit/s to 4600 kBit/s	NAN	kBit/s	
Scheduled Throughput,	0 Mbit/s to 4600 kBit/s	NAN	kBit/s	
Rel. Throughput,	0.000% to 100.000%	NAN	%	
Min. Rel. Throughput,	0.000% to 100.000%	NAN	%	
Max. Rel. Throughput,	0.000% to 100.000%	NAN	%	
Scheduled Rel. Throughput	0.000% to 100.000%	NAN	%	

Description of command

These commands are always queries. They start an ACK/NACK receiver test (`READ…`) and/or return the measurement results (see also detailed explanation of measured values in section *HSDPA ACK Measurement Results* on p. 8.9). The following results are returned:

ACK	Percentage of HSDPA subframes answered with ACK
NACK	Percentage of HSDPA subframes answered with NACK
Transmitted	Percentage of transmissions with the 1st, 2nd, 3rd and 4th redundancy version
DTX	Percentage of HSDPA subframes not answered, caused DTX
Throughput	Information bit throughput of the HSDPA link in kbit/s

The symbol (x8) behind a returned value means that the output string contains 8 comma-separated values, corresponding to the 1st, 2nd… 8th redundancy version. This command returns all HSDPA ACK measurement results.

CQI Reporting Test

The subsystem `RXQuality:HCQI` controls the *HSDPA CQI* measurement. The subsystem corresponds to the measurement menu *Receiver Quality,* application *HSDPA CQI,* and the sections in the popup menu *Receiver Quality Configuration* that are related to the *HSDPA CQI* application.

Measurement Control

The following commands control the *HSDPA CQI* measurement. They correspond to the *HSDPA CQI* softkey in the measurement menu *Receiver Quality*.

INITiate:RXQuality:HCQI	Start new measurement	⇒	*RUN*
ABORt:RXQuality:HCQI	Abort running measurement and switch off	⇒	*OFF*
STOP:RXQuality:HCQI	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:RXQuality:HCQI	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V3.80

CONFigure:RXQuality:HCQI:EREPorting <*Mode*> — Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.80
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:RXQuality:HCQI:STATus? — Measurement Status

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.80
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
NONE	No counting mode set (single shot measurement)	NONE	–	

Description of command

This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The following commands configure the *HSDPA CQI* measurement. They correspond to the measurement-specific softkey/hotkey combinations and to the sections in the popup menu *Receiver Quality Configuration* that are related to the *HSDPA CQI* application.

CONFigure:RXQuality:HCQI:CONTrol:MSUBframes <*CQI*>, <*BLER*> — Measure Subframes

<CQI>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1 000 000	Number of collected CQI values	2000	–	V3.80
<BLER>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
1 to 1 000 000	Number of subframes for BLER calculation	1000	(subframes)	V3.80

Description of command

This command defines the scope of the CQI test.

CONFigure:RXQuality:HCQI:CONTrol:TCASe <*Propagation*>				Test Case
<Propagation>	Description of parameters	Def. value	Def. unit	FW vers.
AWGN | FADing	3GPP TS 34.121, section 9.3.1 3GPP TS 34.121, section 9.3.2	AWGN	–	V4.30
Description of command				
This command selects the CQI reporting test case.				

Subsystem RXQuality:HCQI:...LIMit

The subsystem *RXQuality:HCQI:...LIMit* defines the limits for the *HSDPA CQI* measurement. The subsystem corresponds to the *HSDPA CQI* section in the *Limits* tab of the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:HCQI:LIMit:IRCQi <*Limit*>			CQI in Range Limit (AWGN)	
<Limit>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to 100.0 %	Limit for CQI in Range	90.0	%	V3.80
Description of command				
This command specifies the minimum percentage of the CQI values in the range (Median CQI – 2) ≤ Median CQI ≤ (Median CQI + 2). The limit applies to the AWGN test case (`CONFigure:RXQuality:HCQI:CONTrol:TCASe AWGN`).				

CONFigure:RXQuality:HCQI:LIMit:BLER <*Lim_1*>, <*Lim_2*>, <*Lim_3*>			BLER Limits (AWGN)	
<Lim_1>, <Lim_2>, <Lim_3>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to 100.0 %, **0.0 % to 100.0 %,** **0.0 % to 100.0 %**	Limit for BLER at (median CQI – 1) Limit for BLER at (median CQI) Limit for BLER at (median CQI + 2)	10.0 10.0 10.0	% % %	V3.80
Description of command				
This command specifies the upper BLER limits at (median CQI – 1), (median CQI), and (median CQI + 2). The limits apply to the AWGN test case (`CONFigure:RXQuality:HCQI:CONTrol:TCASe AWGN`).				

CONFigure:RXQuality:HCQI:LIMit:DTXRate <*Lim_1*>, <*Lim_2*>, <*Lim_3*>			DTX Rate Limits (AWGN)	
<Lim_1>, <Lim_2>, <Lim_3>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to 100.0 % | OFF, **0.0 % to 100.0 % | OFF,** **0.0 % to 100.0 % | OFF**	Limit for DTX rate at (median CQI – 1) Limit for DTX rate at (median CQI) Limit for DTX rate at (median CQI + 2)	OFF OFF OFF	% % %	V3.80
Description of command				
This command specifies the maximum percentage of HSDPA subframes that the UE answered with DTX at (median CQI – 1), (median CQI), and (median CQI + 2). OFF disables the limit check. The limits apply to the AWGN test case (`CONFigure:RXQuality:HCQI:CONTrol:TCASe AWGN`).				

CONFigure:RXQuality:HCQI:LIMit:BLER <*Lim_1*>, <*Lim_2*> BLER Limits (Fading)

<*Lim_1*>, <*Lim_2*>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to 100.0 %, **0.0 % to 100.0 %,**	Limit for BLER at (median CQI) Limit for BLER at (median CQI + 3)	60.0 15.0	% %	V4.30

Description of command

This command specifies the upper BLER limits at (median CQI) and (median CQI + 3). The limits apply to the Fading test case (`CONFigure:RXQuality:HCQI:CONTrol:TCASe FADing`).

CONFigure:RXQuality:HCQI:LIMit:DTXRate <*Lim_1*>, <*Lim_2*> DTX Rate Limits (Fading)

<*Lim_1*>, <*Lim_2*>, <*Lim_3*>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to 100.0 % | OFF, **0.0 % to 100.0 % | OFF**	Limit for DTX rate at (median CQI) Limit for DTX rate at (median CQI + 3)	OFF OFF	% %	V4.30

Description of command

This command specifies the maximum percentage of HSDPA subframes that the UE answered with DTX at (median CQI) and (median CQI + 3). OFF disables the limit check. The limits apply to the Fading test case (`CONFigure:RXQuality:HCQI:CONTrol:TCASe FADing`).

DEFault:RXQuality:HCQI:LIMit <*Enable*> Default Settings

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.80

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystem RXQuality:HCQI...?

The subsystem *RXQuality:HCQI...?* measures and returns the results and compares them with tolerance values. The subsystem corresponds to the graphical measurement menu *Receiver Quality,* application *HSDPA CQI.*

				Scalar Results
READ[:SCALar]:RXQuality:HCQI?				Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:HCQI?				Read measurement results (unsynchronized)
SAMPle[:SCALar]:RXQuality:HCQI?				Read measurement results (synchronized)
Returned values, AWGN test case	Value range	Def. value	Def. unit	FW vers.
Median CQI,	0 to 30	NAN	–	V3.80
Measured Subframes (stage 1),	depending on meas. settings*)	NAN	–	
CQI in Range,	0.0 % to 100.0 %	NAN	%	
BLER at (median CQI – 1),	0.0 % to 100.0 %	NAN	%	
BLER at (median CQI),	0.0 % to 100.0 %	NAN	%	
BLER at (median CQI + 2),	0.0 % to 100.0 %	NAN	%	
DTX at (median CQI – 1),	0.0 % to 100.0 %	NAN	%	
DTX at (median CQI),	0.0 % to 100.0 %	NAN	%	
DTX at (median CQI + 2),	0.0 % to 100.0 %	NAN	%	
Meas. Subframes at (median CQI – 1),	depending on meas. settings*)	NAN	–	
Meas. Subframes at (median CQI),	depending on meas. settings*)	NAN	–	
Meas. Subframes at (median CQI + 2),	depending on meas. settings*)	NAN	–	
Pass/Fail indicator	PASS | FAIL	INV	–	
Returned values, Fading test case	Value range	Def. value	Def. unit	FW vers.
Median CQI,	0 to 30	NAN	–	V4.30
Measured Subframes (stage 1),	depending on meas. settings*)	NAN	–	
<reserved>,	NAN	NAN	–	
BLER at (median CQI),	0.0 % to 100.0 %	NAN	%	
BLER at (median CQI + 3),	0.0 % to 100.0 %	NAN	%	
<reserved>,	NAN	NAN	–	
DTX at (median CQI),	0.0 % to 100.0 %	NAN	%	
DTX at (median CQI + 3),	0.0 % to 100.0 %	NAN	%	
<reserved>,	NAN	NAN	–	
Meas. Subframes at (median CQI),	depending on meas. settings*)	NAN	–	
Meas. Subframes at (median CQI + 3),	depending on meas. settings*)	NAN	–	
<reserved>,	NAN	NAN	–	
Pass/Fail indicator	PASS | FAIL	INV	–	

Description of command

These commands are always queries. They start a `RXQuality:HCQI` measurement (`READ...`) and/or return all scalar measurement results. The output values depend on the selected test case (`CONFigure:RXQuality:HCQI:CONTrol:TCASe`).

*) See `CONFigure:RXQuality:HCQI:CONTrol:MSUBframes`.

CALCulate[:SCALar]:RXQuality:HCQI:MATChing:LIMit? Limit Matching

Returned values, AWGN test case	Value range	Def. value	Def. unit	FW vers.
CQI in Range,	NMAU | INV | OK	INV	–	V3.80
BLER at (median CQI – 1),	NMAL | INV | OK	INV	–	
BLER at (median CQI),	NMAL | NMAU | INV | OK	INV	–	
BLER at (median CQI + 2),	NMAU | INV | OK	INV	–	
DTX at (median CQI – 1),	NMAL | INV | OK	INV	–	
DTX at (median CQI),	NMAL | INV | OK	INV	–	
DTX at (median CQI + 2)	NMAL | INV | OK	INV	–	
Returned values, Fading test case	Value range	Def. value	Def. unit	FW vers.
<reserved>,	INV	INV	–	V4.30
BLER at (median CQI),	NMAL | INV | OK	INV	–	
BLER at (median CQI + 3),	NMAL | NMAU | INV | OK	INV	–	
<reserved>,	INV	INV	–	
DTX at (median CQI),	NMAL | INV | OK	INV	–	
DTX at (median CQI + 3),	NMAL | INV | OK	INV	–	
<reserved>,	INV	INV	–	

Description of command

This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see commands above) are exceeded. The output values depend on the selected test case (`CONFigure:RXQuality:HCQI:CONTrol:TCASe`).

The following messages may be returned for all measured values:

NMAL	Result exceeds upper limit, limit check failed
NMAU	Result below lower limit, limit check failed
INV	No valid result available
OK	Limit check passed

CQI Distribution(Diagram)

READ:ARRay:RXQuality:HCQI[:CURRent]? Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:RXQuality:HCQI[:CURRent]? Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:RXQuality:HCQI[:CURRent]? Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st relative frequency (CQI 0)	0% to +100.0 %,	NAN	%	V3.80
...	... ,	...	...	
31st relative frequency (CQI 30)	0% to +100.0 %,	NAN	%	
32th relative frequency (DTX)	0% to +100.0 %	NAN	%	

Description of command

These commands are always queries. They return the relative frequency of the CQI values collected in stage 1 of the CQI reporting test.

[:SENSe]:RXQuality:HCQI:TINDex:CTAValue? Active CQI

Returned values	Value range	Def. value	Def. unit	FW vers.
0 to 30	Active CQI	NAN	–	V3.80

Description of command

This command is always a query. It returns the CQI of the allocated HSDPA CQI test channel. This *Active CQI* changes during the different test stages, so that it can be used to monitor the progress of the measurement..

Remote Control: HS-DPCCH Logging (HSLog)

The subsystem `RXQuality:HSLog` controls the *HS-DPCCH Logging* application. The subsystem corresponds to the measurement menu *Receiver Quality,* application *HS-DPCCH Logging.*

INITiate:RXQuality:HSLog	Start new measurement	⇒	*RUN*
ABORt:RXQuality:HSLog	Abort running measurement and switch off	⇒	*OFF*
STOP:RXQuality:HSLog	Stop measurement	⇒	*STOP*
CONTinue:RXQuality:HSLog	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the current measurement, setting it to the status indicated in the top right column.	V3.62

CONFigure:RXQuality:HSLog:EREPorting <Mode> — Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.62
SOPC |	Single operation complete			
SRSQ |	SRQ and SRSQ			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).

FETCh:RXQuality:HSLog:STATus? — Measurement Status

Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.62
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current evaluation period	NONE	–	
NONE	Statistic count set to off			

Description of command

This command is always a query. It returns the status of the measurement (see chapter 5).

CONFigure:CDPower: HSLog:CONTrol:REPetition Test Cycles
<Repetition>, <StopCond>, <Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	FW vers.
CONTinuous | SINGleshot | 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	V4.51
<StopCond>	Description of parameters	Def. value	Def. unit	FW vers.
NONE	No stop condition (no limit check performed)	NONE	–	V4.51
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | NONE	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V4.51

Description of command

This command determines the number of statistics cycles and the stepping mode for the measurement. The <*Stop_Cond*> parameter is ignored.

Note: In the case of `READ` commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:RXQuality:HSLog:CONTrol:SSFN *<Number>* Start System Frame Number

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 4095 | OFF	Start SFN No SFN specified	OFF	–	V3.62

Description of command

This command specifies the first System Frame Number (SFN) for which the returned ACK/NACK messages and reported CQI values are displayed. In the default setting *OFF,* the measurement starts as soon as possible.

Scalar Results

READ[:SCALar]:RXQuality:HSLog? Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:HSLog? Read out meas. results (unsynchronized)
SAMPle[:SCALar]:RXQuality:HSLog? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Slot,	0 | 3 6 | 9 | 12	NAN	–	V3.62
SFN,	0 to 4095	NAN	–	
ACK/NACK,	NACK | ACK | DTX	NAN	–	
CQI,	0 to 30 | DTX	NAN	–	
… (1000 repetitions)				

Description of command

These commands are always queries. They start an *HS-DPCCH Logging* measurement (`READ…`) and/or return the measurement results (see also detailed explanation of measured values in section *HS-DPCCH Logging* on p. 8.16).

HS-DPCCH Time Mask

The subsystem `CDPower:TMHSdpcch` controls the *HS-DPCCH Time Mask* measurement. The subsystem corresponds to the measurement menu *Modulation,* application *HS-DPCCH Time Mask,* and the sections in the popup menu *Modulation Configuration* that are related to the *HS-DPCCH Time Mask* application.

Measurement Control

The following commands control the *HS-DPCCH Time Mask* measurement. They correspond to the *HS-DPCCH Time Mask* softkey in the measurement menu *Code Domain Power*.

INITiate:CDPower:TMHSdpcch	Start new measurement	⇒	*RUN*
ABORt:CDPower:TMHSdpcch	Abort running measurement and switch off	⇒	*OFF*
STOP:CDPower:TMHSdpcch	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:CDPower:TMHSdpcch	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V4.50

CONFigure:CDPower:TMHSdpcch:EREPorting <*Mode*> — Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V4.50
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:CDPower:TMHSdpcch:STATus? — Measurement Status

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V4.50
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle	NONE	–	V4.10
NONE	No counting mode set			

Description of command

This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The subsystem *CDPower:TMHSdpcch:CONTrol* defines the scope of the measurement.

CONFigure:CDPower:TMHSdpcch:CONTrol:REPetition Test Cycles
<Repetition>, <StopCond>, <Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	FW vers.
CONTinuous | SINGleshot | 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	V4.50
<StopCond>	Description of parameters	Def. value	Def. unit	FW vers.
SONerror | NONE	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	V4.50
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | NONE	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V4.50

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of `READ` commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:CDPower:TMHSdpcch:CONTrol:MODE *<Mode>* Mode

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
VAR1 | VAR2	Variant 1 (corresponding to TPC_cmd = 1) Variant 1 (corresponding to TPC_cmd = 2)	VAR1	–	V4.50

Description of command

This command selects one of the measurement modes specified in the standard .

CONFigure:CDPower:TMHSdpcch:CONTrol:MLENgth *<Slots>* Measurement Length

<Slots>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 19	Number of slots measured	19	(slots)	V4.50

Description of command

This command selects the number of slots measured. The value affects the number of power values and power steps available.

DEFault:CDPower:TMHSdpcch:CONTrol <*Enable*>			Default Settings	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V4.50
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Tolerance values – Subsystem CDPower:TMHSdpcch:LIMit

The subsystem *CDPower:TMHSdpcch:LIMit* defines tolerance values for the code domain power measurement. The subsystem corresponds to the settings in the *Limits* tab of the popup menu *Code Domain Power Configuration* that are related to the *HS-DPCCH Time Mask* application.

CONFigure:CDPower:TMHSdpcch:SSIZe:LIMit:SCALar:SYMMetric:COMBined:VALue <*Step_0 dB*>, <*Step_1 dB*>, <*Step_2 dB*>, <*Step_3 dB*>, <*Step_4 dB – 7 dB*>			Step Size Limit	
<Step_0 dB>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 5.0 dB	Step size limit for 0 dB steps, symmetric	±0.6	dB	V4.50
<Step_1>	Description of parameters	Def. value	Def. unit	
0.0 dB to 5.0 dB	Step size limit for 1 dB steps, symmetric	±0.6	dB	
<Step_2 dB>	Description of parameters	Def. value	Def. unit	
0.0 dB to 5.0 dB	Step size limit for 2 dB steps, symmetric	±1.15	dB	
<Step_3 dB>	Description of parameters	Def. value	Def. unit	
0.0 dB to 5.0 dB	Step size limit for 3 dB steps, symmetric	±1.7	dB	
<Step_4 dB – 7 dB>	Description of parameters	Def. value	Def. unit	
0.0 dB to 5.0 dB	Step size limit for 4 dB to 7 dB steps, symmetric	±2.3	dB	
Description of command				
This command defines the power step limits.				

DEFault:CDPower:TMHSdpcch:LIMit <*Enable*>			Default Settings	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V4.50
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Measured Values – Subsystem CDPower:TMHSdpcch...?

The subsystem *CDPower:TMHSdpcch...?* measures and returns the results and compares them with tolerance values.

Power Steps

READ[:SCALar]:CDPower:TMHSdpcch? Start single shot measurement and return results
FETCh[:SCALar]:CDPower:TMHSdpcch? Read measurement results (unsynchronized)
SAMPle[:SCALar]:CDPower:TMHSdpcch? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Power Step 1,	–100.0 dB to +100.0 dB	NAN	dB	V4.50
…,	…	NAN	dB	
Power Step 17	–100.0 dB to +100.0 dB	NAN	dB	

Description of command

These commands are always queries. They start a `CDPower:TMHSdpcch` measurement (`READ...`) and/or return the measured power steps at the specified test points. The number and position of the test points depends on the measurement mode (`CONFigure:CDPower:TMHSdpcch:CONTrol:MODe`); refer to the descripton of manual control.

CALCulate[:SCALar]:CDPower:TMHSdpcch:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
Power Step 1,		INV	–	V4.50
…,	For all measured values:	INV	–	
Power Step 17	NMAU | NMAL | INV | OK	INV	–	

Description of command

This command is always a query. It indicates whether and in which way the error limits for the power steps (see commands above) are exceeded.

The following messages may be returned for all power steps:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

UE Power

READ:ARRay:CDPower:TMHSdpcch:UEPower? Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:CDPower:TMHSdpcch:UEPower? Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:CDPower:TMHSdpcch:UEPower? Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for total UE power	–100 dBm to +60 dBm,	NAN	dBm	V4.50
...	... ,	...	...	
38th value for total UE power	–100 dBm to +60 dBm	NAN	dBm	

Description of command

These commands are always queries. They start a `CDPower:TMHSdpcch` measurement (`READ...`) and/or return the UE power in 38 consecutive half-slot periods, corresponding to 19 WCDMA slots. Values beyond the measurement length (`CONFigure:CDPower:TMHSdpcch:CONTrol:MODe`) are invalid (NAN).

READ:ARRay:CDPower:TMHSdpcch:DPCCh? DPCCH Channel Power
Start single shot measurement and return results ⇒ *RUN*

FETCh:ARRay:CDPower:TMHSdpcch:DPCCh?
Read measurement results (unsynchronized) ⇒ *RUN*

SAMPle:ARRay:CDPower:TMHSdpcch:DPCCh?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for DPCCH power	–100 dB to +100 dB,	NAN	dB	V4.50
...	... ,	...	...	
38th value for DPCCH power	–100 dB to +100 dB	NAN	dB	

Description of command

These commands are always queries. They start a `CDPower:TMHSdpcch` measurement (`READ...`) and/or return the measured DPCCH channel power in 38 consecutive half-slot periods, corresponding to 19 WCDMA slots. Values beyond the measurement length (`CONFigure:CDPower:TMHSdpcch:CONTrol:MODe`) are invalid (NAN).

READ:ARRay:CDPower:TMHSdpcch:DPDCh? $DPDCH_1$ Channel Power
Start single shot measurement and return results ⇒ *RUN*

FETCh:ARRay:CDPower:TMHSdpcch:DPDCh?
Read measurement results (unsynchronized) ⇒ *RUN*

SAMPle:ARRay:CDPower:TMHSdpcch:DPDCh?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for $DPDCH_1$ power,	–100 dB to +100 dB,	NAN	dB	V4.50
...	... ,	...	...	
38th value for $DPDCH_1$ power	–100 dB to +100 dB	NAN	dB	

Description of command

These commands are always queries. They start a `CDPower:TMHSdpcch` measurement (`READ...`) and/or return the measured $DPDCH_1$ channel power in 38 consecutive half-slot periods, corresponding to 19 WCDMA slots. Values beyond the measurement length (`CONFigure:CDPower:TMHSdpcch:CONTrol:MODe`) are invalid (NAN).

READ:ARRay:CDPower:TMHSdpcch:HSDPcch? HS-DPCCH Channel Power
Start single shot measurement and return results ⇒ *RUN*

FETCh:ARRay:CDPower:TMHSdpcch:HSDPcch?
Read measurement results (unsynchronized) ⇒ *RUN*

SAMPle:ARRay:CDPower:TMHSdpcch:HSDPcch?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for HS-DPCCH power,	–100 dB to +100 dB,	NAN	dB	V4.50
...	... ,	...	...	
38th value for HS-DPCCH power	–100 dB to +100 dB	NAN	dB	

Description of command

These commands are always queries. They start a `CDPower:TMHSdpcch` measurement (`READ...`) and/or return the measured HS-DPCCH channel power in 38 consecutive half-slot periods, corresponding to 19 WCDMA slots. Values beyond the measurement length (`CONFigure:CDPower:TMHSdpcch:CONTrol:MODe`) are invalid (NAN).

HS-DPCCH Time Mask (4-Slot)

The subsystem `CDPower:HTMask` controls the 4-slot *HS-DPCCH Time Mask* measurement. The subsystem corresponds to earlier versions of the conformance test specification; for an extended time mask measurement in accordance with manual control refer to section HS-DPCCH Time Mask on p. 8.102.

Measurement Control

The following commands control the *HS-DPCCH Time Mask* measurement. They correspond to the *HS-DPCCH Time Mask* softkey in the measurement menu *Code Domain Power*.

INITiate:CDPower:HTMask	Start new measurement	⇒	*RUN*
ABORt:CDPower:HTMask	Abort running measurement and switch off	⇒	*OFF*
STOP:CDPower:HTMask	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:CDPower:HTMask	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V4.10

CONFigure:CDPower:HTMask:EREPorting <*Mode*> — Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V4.10
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:CDPower:HTMask:STATus? — Measurement Status

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V4.10
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle	NONE	–	V4.10
NONE	No counting mode set			

Description of command

This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The subsystem *CDPower:HTMask:CONTrol* defines the scope of the measurement.

CONFigure:CDPower:HTMask:CONTrol:REPetition Test Cycles
<Repetition>, <StopCond>, <Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	FW vers.
CONTinuous | SINGleshot | 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	V4.10
<StopCond>	Description of parameters	Def. value	Def. unit	FW vers.
SONerror | NONE	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	V4.10
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | NONE	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V4.10

Description of command

This command determines the number of statistics cycles and the stepping mode for the measurement.

Note: In the case of `READ` commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:CDPower:HTMask:CONTrol:PREFerence *<Reference>* Power Reference

<Reference>	Description of parameters	Def. value	Def. unit	FW vers.
TPOWer | DPCCh	Channel powers referenced to the total UE power Channel powers referenced to the DPCCH power	TPOW	–	V4.10

Description of command

This command selects the power reference for the relative channel power results (DPCCH, $DPDCH_1$, HS-DPCCH).

DEFault:CDPower:HTMask:CONTrol *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V4.10

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Tolerance values – Subsystem CDPower:HTMask:LIMit

The subsystem *CDPower:HTMask:LIMit* defines tolerance values for the code domain power measurement. The subsystem corresponds to the settings in the *Limits* tab of the popup menu *Code Domain Power Configuration* that are related to the *HS-DPCCH Time Mask* application.

CONFigure:CDPower:HTMask:PSSize:LIMit:SCALar:ASYMmetric:COMBined:VALue *<Step_1>, <Step_2>, <Step_3>, <Step_4>* — Power Step Size

<Step_1>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 7.0 dB	Step size for DTX –> ACK/NACK	7.0	dB	V4.10
<Step_2>	Description of parameters	Def. value	Def. unit	
–14.0 dB to 0.0 dB	Step for ACK/NACK –> CQI (calculated, query only)	–2.0	dB	
<Step_3>	Description of parameters	Def. value	Def. unit	
0.0 dB (fixed)	Step size for CQI –> CQI (fixed, query only)	0.0	dB	
<Step_4>	Description of parameters	Def. value	Def. unit	
–7.0 dB to 0.0 dB	Step size for CQI –> DTX	–5.0	dB	

Description of command

This command defines or queries the power step sizes for the *HS-DPCCH Time Mask* measurement. The setting command is available in *Non Signalling* mode and requires two numeric parameters (example: `CONF:CDP:HTM:SIM:SCAL:ASYM:COMB:PSS 7.0, -5.0`; the query returns the four default step sizes).

Note: *The setting command is available in Non Signalling mode only. The step size for the CQI –> CQI boundary is fixed (0 dB). The step size for the ACK/NACK –> CQI boundary is calculated according to* $Step_{ACK/NACK\ –>\ CQI} = Step_{DTX\ –>\ ACK/NACK} + Step_{CQI\ –>\ DTX}$*. In Signalling mode, all power steps are caluculated according to the gain factors* β_c, β_d, β_{hs}.

CONFigure:CDPower:HTMask:SSIZe:LIMit:SCALar:ASYMmetric:COMBined:VALue *<Step_0 dB>, <Step_1 dB>, <Step_2 dB>, <Step_3 dB>, <Step_4 dB – 7 dB>* — Step Size Limit

<Step_0 dB>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 5.0 dB	Step size limit for 0 dB steps, symmetric	±0.5	dB	V4.10
<Step_1>	Description of parameters	Def. value	Def. unit	
0.0 dB to 5.0 dB	Step size limit for 1 dB steps, symmetric	±0.5	dB	
<Step_2 dB>	Description of parameters	Def. value	Def. unit	
0.0 dB to 5.0 dB	Step size limit for 2 dB steps, symmetric	±1.0	dB	
<Step_3 dB>	Description of parameters	Def. value	Def. unit	
0.0 dB to 5.0 dB	Step size limit for 3 dB steps, symmetric	±1.5	dB	
<Step_4 dB – 7 dB>	Description of parameters	Def. value	Def. unit	
0.0 dB to 5.0 dB	Step size limit for 4 dB to 7 dB steps, symmetric	±2.0	dB	

Description of command

This command defines the power step limits.

DEFault:CDPower:HTMask:LIMit *<Enable>* — Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	The parameters are set to default values	ON	–	V4.10
OFF	Some or all parameters differ from the default values			

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystem CDPower:HTMask...?

The subsystem *CDPower:HTMask...?* measures and returns the results and compares them with tolerance values.

Minimum and Maximum Code Power

READ[:SCALar]:CDPower:HTMask:TRANsitions? Start single shot measurement and return results
FETCh[:SCALar]:CDPower:HTMask:TRANsitions? Read measurement results (unsynchronized)
SAMPle[:SCALar]:CDPower:HTMask:TRANsitions? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
DTX –> ACK/NACK,	–100.0 dB to +100.0 dB	NAN	dB	V4.10
ACK/NACK –> CQI,	–100.0 dB to +100.0 dB	NAN	dB	
CQI –> CQI,	–100.0 dB to +100.0 dB	NAN	dB	
CQI –> DTX	–100.0 dB to +100.0 dB	NAN	dB	

Description of command

These commands are always queries. They start a `CDPower:HTMask` measurement (`READ...`) and/or return the measured changes in uplink transmit power (power steps) at the HS-DPCCH slot boundaries.

CALCulate[:SCALar]:CDPower:HTMask:TRANsitions:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
DTX –> ACK/NACK,	For all measured values: NMAU | NMAL | INV | OK	INV	–	V4.10
ACK/NACK –> CQI,		INV	–	
CQI –> CQI,		INV	–	
CQI –> DTX		INV	–	

Description of command

This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see commands above) are exceeded.

The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

Averaged UE Power

READ:ARRay:CDPower:HTMask:MPOWer? Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:CDPower:HTMask:MPOWer? Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:CDPower:HTMask:MPOWer? Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for averaged UE power	–100 dBm to +60 dBm,	NAN	dBm	V4.10
...	... ,	...	...	
8th value for averaged UE power	–100 dBm to +60 dBm	NAN	dBm	

Description of command

These commands are always queries. They start a `CDPower:HTMask` measurement (`READ...`) and/or return the measured UE power in 8 consecutive ½-slot periods.

UE Power

READ:ARRay:CDPower:HTMask:UEPower? Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:CDPower:HTMask:UEPower? Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:CDPower:HTMask:UEPower? Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for total UE power	–100 dBm to +60 dBm,	NAN	dBm	V4.10
...	... ,	...	...	
40th value for total UE power	–100 dBm to +60 dBm	NAN	dBm	

Description of command

These commands are always queries. They start a `CDPower:HTMask` measurement (`READ...`) and/or return the UE power in 40 consecutive 1-symbol periods, corresponding to 4 WCDMA slots.

READ:ARRay:CDPower:HTMask:DPCCh:CPOWer? DPCCH Channel Power
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:CDPower:HTMask:DPCCh:CPOWer?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:CDPower:HTMask:DPCCh:CPOWer?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for DPCCH power	–100 dB to +100 dB,	NAN	dB	V4.10
...	... ,	...	...	
40th value for DPCCH power	–100 dB to +100 dB	NAN	dB	

Description of command

These commands are always queries. They start a `CDPower:HTMask` measurement (`READ...`) and/or return the measured DPCCH channel power in 40 consecutive 1-symbol periods, corresponding to 4 WCDMA slots. The DPCCH power is expressed in dB relative to the total UE power or relative to the DPCCH power (–> 0 dB), depending on the `CONFigure:CDPower:HTMask:CONTrol:PREFerence` setting.

READ:ARRay:CDPower:HTMask:DPDCh1:CPOWer? $DPDCH_1$ Channel Power
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:CDPower:HTMask:DPDCh1:CPOWer?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:CDPower:HTMask:DPDCh1:CPOWer?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for $DPDCH_1$ power,	–100 dB to +100 dB,	NAN	dB	V4.10
...	... ,	...	...	
40th value for $DPDCH_1$ power	–100 dB to +100 dB	NAN	dB	

Description of command

These commands are always queries. They start a `CDPower:HTMask` measurement (`READ...`) and/or return the measured $DPDCH_1$ channel power in 40 consecutive 1-symbol periods, corresponding to 4 WCDMA slots. The $DPDCH_1$ power is expressed in dB relative to the total UE power or relative to the DPCCH power, depending on the `CONFigure:CDPower:HTMask:CONTrol:PREFerence` setting.

READ:ARRay:CDPower:HTMask:HSDPcch:CPOWer? HS-DPCCH Channel Power
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:CDPower:HTMask:HSDPcch:CPOWer?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:CDPower:HTMask:HSDPcch:CPOWer?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for HS-DPCCH power,	–100 dB to +100 dB,	NAN	dB	V4.10
...	... ,	...	...	
40th value for HS-DPCCH power	–100 dB to +100 dB	NAN	dB	

Description of command

These commands are always queries. They start a `CDPower:HTMask` measurement (`READ...`) and/or return the measured HS-DPCCH channel power in 40 consecutive 1-symbol periods, corresponding to 4 WCDMA slots. The HS-DPCCH power is expressed in dB relative to the total UE power or relative to the DPCCH power, depending on the `CONFigure:CDPower:HTMask:CONTrol:PREFerence` setting.

CDP Relative

The subsystem *`CDPower:RELative`* controls the *CDP Relative* measurement. The subsystem corresponds to the measurement menu *Modulation,* application *CDP Relative,* and the sections in the popup menu *Modulation Configuration* that are related to the *CDP Relative* application.

Measurement Control

The following commands control the *CDP Relative* measurement. They correspond to the *CDP Relative* softkey in the measurement menu *Code Domain Power*.

INITiate:CDPower:RELative	Start new measurement	⇒	*RUN*
ABORt:CDPower:RELative	Abort running measurement and switch off	⇒	*OFF*
STOP:CDPower:RELative	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:CDPower:RELative	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V4.50

CONFigure:CDPower:RELative:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V4.50
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:CDPower:RELative:STATus?			Measurement Status	
Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	V4.50
1 to 10000 | **NONE**	Counter for current statistics cycle No counting mode set	NONE	–	V4.10
Description of command				
This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).				

Test Configuration

The subsystem *CDPower:RELative:CONTrol* defines the scope of the measurement.

CONFigure:CDPower:RELative:CONTrol:REPetition ***<Repetition>, <StopCond>, <Stepmode>***			Test Cycles	
<Repetition>	Description of parameters	Def. value	Def. unit	FW vers.
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	V4.50
<StopCond>	Description of parameters	Def. value	Def. unit	FW vers.
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	V4.50
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V4.50
Description of command				
This command determines the number of statistics cycles and the stepping mode for the measurement. **Note:** In the case of `READ` commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.				

CONFigure:CDPower:RELative:CONTrol:MLENgth <*Slots*>			Measurement Length	
<Slots>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 46	Number of slots measured	4	(slots)	V4.50
Description of command				
This command selects the number of slots measured. The value affects the number of relative CDP power values available.				

CONFigure:CDPower:RELative:CONTrol:MEAPoint:VALue<nr> <*Position*>			Measurement Points	
<Slots>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 45.5	Position of measured point no. <nr>	See below	(slots)	V4.50
Description of command				
This command selects the position of the four measurement points (<nr> = 1 to 4). The position may be varied with a 0.5-slot increment. The default position of the measurement points is: 0.5 1.0 2.0 4.0				

DEFault:CDPower:RELative:CONTrol <*Enable*>			Default Settings	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V4.50
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Tolerance values – Subsystem CDPower:RELative:LIMit

The subsystem *CDPower:RELative:LIMit* defines tolerance values for the code domain power measurement. The subsystem corresponds to the settings in the *Limits* tab of the popup menu *Code Domain Power Configuration* that are related to the *CDP Relative* application.

Meas. point positions and expected relative channel powers (HS-DPCCH)

CONFigure:CDPower:RELative:LIMit[:SCALar]:ASYMmetric[:COMBined]:VALue<nr>
<x-Position>, <Relative DPCCH Power>, <Rel. DPDCH Power>, <Rel. HS-DPCCH Power>

<x-Position>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 45.5	Position of the measurement point (in 0.5 slot increments)	See below	(slots)	V4.50
<Relative DPCCH Power>	Description of parameters	Def. value	Def. unit	FW vers.
0 dB to –50 dB	DPCCH power relative to the total UE power	See below	dB	V4.50
<Rel. DPDCH Power>	Description of parameters	Def. value	Def. unit	FW vers.
0 dB to –50 dB dB	DPDCH power relative to the total UE power	See below	dB	V4.50
<Rel. HS-DPCCH Power>	Description of parameters	Def. value	Def. unit	FW vers.
0 dB to –50 dB dB | OFF	HS-DPCCH power rel. to the total UE power HS-DPCCH not active	See below	dB	V4.50

Description of command

This command is valid for HS-DPCCH measurements. In *Non Signalling* mode it defines the measurement points and expected relative code domain powers. The numeric suffix <nr> = 1 to 4 numbers the four measurement points. The default values correspond to the conformance test specification:

Expected Channel Power	Meas. P.1	Meas. P.2	Meas. P.3	Meas. P.4
Enable	☑	☑	☑	☑
X-Position	0.5	1.0	2.0	4.0
DPCCH [dB]	- 17.6	- 17.9	- 17.8	- 17.6
DPDCH 1 [dB]	- 0.1	- 0.4	- 0.3	- 0.1
HS-DPCCH [dB]	Off	- 11.8	- 13.7	Off

In *Signalling* mode, the x-positions are fixed, and the relative code power values are calculated from the UE gain factors; only the query form is supported.

Enable limit check (Non Signalling only)

CONFigure:CDPower:RELative:LIMit[:SCALar]:ASYMmetric[:COMBined]:ENABle<nr> ***<Enable>***

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable the limit check	ON	–	V4.50

Description of command

This command enables or disables the limit check at the four measurement points <nr> = 1 to 4.

Expected meas. points and relative channel powers (HS-DPCCH + E-DPCH)

CONFigure:CDPower:RELative:LIMit:HSPA[:SCALar]:ASYMmetric[:COMBined]:VALue<nr>
<x-Position>, <Relative DPCCH Power>, <Rel. DPDCH Power>, <Rel. HS-DPCCH Power>, <Rel. E-DPCCH Power>, <Rel. E-DPDCH1 Power>, <Rel. E-DPDCH2 Power>

<x-Position>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 46	Position of the measurement point (in 0.5 slot increments)	See below	(slots)	V4.55
<Relative DPCCH Power>	Description of parameters	Def. value	Def. unit	FW vers.
0 dB to –50 dB dB	DPCCH power relative to the total UE power	See below	dB	V4.55
<Rel. DPDCH Power>	Description of parameters	Def. value	Def. unit	FW vers.
0 dB to –50 dB dB	DPDCH power relative to the total UE power	See below	dB	V4.55
<Rel. HS-DPCCH Power>	Description of parameters	Def. value	Def. unit	FW vers.
0 dB to –50 dB dB | OFF	HS-DPCCH power rel. to the total UE power HS-DPCCH not active	See below	dB	V4.55
<Rel. E-DPCCH Power>	Description of parameters	Def. value	Def. unit	FW vers.
0 dB to –50 dB dB | OFF	E-DPCCH power rel. to the total UE power E-DPCCH not active	See below	dB	V4.55
<Rel. E-DPDCH1 Power>	Description of parameters	Def. value	Def. unit	FW vers.
0 dB to –50 dB dB | OFF	E-DPDCH1 power rel. to the total UE power E-DPDCH1 not active	See below	dB	V4.55
<Rel. E-DPDCH2 Power>	Description of parameters	Def. value	Def. unit	FW vers.
0 dB to –50 dB dB | OFF	E-DPDCH2 power rel. to the total UE power E-DPDCH2 not active	See below	dB	V4.55

Description of command

This command is valid for HS-DPCCH +E-DPCH measurements. In *Non Signalling* mode it defines the measurement points and relative code domain powers. The numeric suffix <nr> = 1 to 3 numbers the three measurement points. The default values correspond to the conformance test specification:

Exp. Chan. Power HSPA	Meas. P.1	Meas. P.2	Meas. P.3
Enable	☑	☑	☑
X-Position	0.5	1.0	2.0
DPCCH [dB]	- 9.3	- 18.5	- 9.3
DPDCH 1 [dB]	- 6.6	- 15.8	- 6.6
HS-DPCCH [dB]	- 3.3	- 12.5	- 3.3
E-DPCCH [dB]	- 7.2	- 16.5	- 7.2
E-DPDCH 1 [dB]	Off	- 0.5	Off
E-DPDCH 2 [dB]	Off	Off	Off

In *Signalling* mode, the x-positions are fixed, and the relative code power values are calculated from the UE gain factors and absolute grant values; only the query form is supported.

Enable limit check (Non Signalling only)

CONFigure:CDPower:RELative:LIMit:HSPA[:SCALar]:ASYMmetric[:COMBined]:ENABle<nr> ***<Enable>***

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable the limit check	ON	–	V4.55

Description of command

This command enables or disables the limit check at the four measurement points <nr> = 1 to 4.

CONFigure:CDPower:RELative:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue Rel. CDP Accuracy
<Limit ≥ –10 dB>, <Limit –10 dB to ≥ –15 dB>, <Limit –15 dB to ≥ –20 dB >

<Limit ≥ –10 dB>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to ±5.0 dB	Relative CDP accuracy at large CDP ratio	±1.6	dB	V4.50
<Limit –10 dB to ≥ –15 dB>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to ±5.0 dB	Relative CDP accuracy at medium CDP ratio	±2.2	dB	V4.50
<Limit –15 dB to ≥ –20 dB >	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to ±5.0 dB	Relative CDP accuracy at small CDP ratio	±2.8	dB	V4.50

Description of command

This command defines the limits for the relative code domain power, depending on the nominal CDP ratio of the code channels.

DEFault:CDPower:RELative:LIMit *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V4.50

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystem CDPower:RELative...?

The following commands start a `CDPower:RELative` measurement (`READ...`) and/or return the results and compare them with tolerance values.

Relative CDP results at the four measurement points
READ[:SCALar]:CDPower:RELative? Start single shot measurement and return results
FETCh[:SCALar]:CDPower:RELative? Read measurement results (unsynchronized)
SAMPle[:SCALar]:CDPower:RELative? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
DPCCH, meas. point 1,	–100.0 dB to +100.0 dB	NAN	dB	V4.50
…,	…	NAN	dB	
DPCCH, meas. point 4,	–100.0 dB to +100.0 dB	NAN	dB	
DPDCH, meas. point 1,	–100.0 dB to +100.0 dB	NAN	dB	
…,	…	NAN	dB	
DPDCH, meas. point 4,	–100.0 dB to +100.0 dB	NAN	dB	
HS-DPCCH, meas. point 1,	–100.0 dB to +100.0 dB	NAN	dB	
…,	…	NAN	dB	
HS-DPCCH, meas. point 4	–100.0 dB to +100.0 dB	NAN	dB	

Description of command

These commands are always queries. They start a `CDPower:RELative` measurement (`READ...`) and/or return the relative code powers at the specified test points. The commands are valid for HS-DPCCH measurements.

Relative CDP results at the four measurement points

READ[:SCALar]:CDPower:RELative:HSPA? Start single shot measurement and return results

FETCh[:SCALar]:CDPower:RELative:HSPA? Read measurement results (unsynchronized)

SAMPle[:SCALar]:CDPower:RELative:HSPA? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
DPCCH, meas. point 1,	–100.0 dB to +100.0 dB	NAN	dB	V4.55
…,	…	NAN	dB	
DPCCH, meas. point 4,	–100.0 dB to +100.0 dB	NAN	dB	
DPDCH, meas. point 1,	–100.0 dB to +100.0 dB	NAN	dB	
…,	…	NAN	dB	
DPDCH, meas. point 4,	–100.0 dB to +100.0 dB	NAN	dB	
HS-DPCCH, meas. point 1,	–100.0 dB to +100.0 dB	NAN	dB	
…,	…	NAN	dB	
HS-DPCCH, meas. point 4,	–100.0 dB to +100.0 dB	NAN	dB	
E-DPCCH, meas. point 1,	–100.0 dB to +100.0 dB	NAN	dB	
…,	…	NAN	dB	
E-DPCCH, meas. point 4,	–100.0 dB to +100.0 dB	NAN	dB	
E-DPDCH1, meas. point 1,	–100.0 dB to +100.0 dB	NAN	dB	
…,	…	NAN	dB	
E-DPDCH1, meas. point 4,	–100.0 dB to +100.0 dB	NAN	dB	
E-DPDCH2, meas. point 1,	–100.0 dB to +100.0 dB	NAN	dB	
…,	…	NAN	dB	
E-DPDCH2, meas. point 4	–100.0 dB to +100.0 dB	NAN	dB	

Description of command

These commands are always queries. They start a `CDPower:RELative` measurement (`READ...`) and/or return the relative code powers at the specified test points. The commands are valid for HS-DPCCH + E-DPCH measurements.

CALCulate[:SCALar]:CDPower:RELative:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
DPCCH, meas. point 1,	For all measured values: NMAU | NMAL | INV | OK	INV	–	V4.50
…,		INV	–	
DPCCH, meas. point 4,		INV	–	
DPDCH, meas. point 1,		INV	–	
…,		INV	–	
DPDCH, meas. point 4,		INV	–	
HS-DPCCH, meas. point 1,		INV	–	
…,		INV	–	
HS-DPCCH, meas. point 4		INV	–	

Description of command

This command is always a query. It is valid for HS-DPCCH measurements. The command indicates whether and in which way the error limits for the relative code powers (see commands above) are exceeded.

The following messages may be returned for all power steps:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

CALCulate[:SCALar]:CDPower:RELative:HSPA:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
DPCCH, meas. point 1,		INV	–	V4.55
…,	For all measured values:	INV	–	
DPCCH, meas. point 3,	NMAU | NMAL | INV | OK	INV	–	
DPDCH, meas. point 1,		INV	–	
…,		INV	–	
DPDCH, meas. point 3,		INV	–	
HS-DPCCH, meas. point 1,		INV	–	
…,		INV	–	
HS-DPCCH, meas. point 3,		INV	–	
E-DPCCH, meas. point 1,		INV	–	
…,		INV	–	
E-DPCCH, meas. point 3,		INV	–	
E-DPDCH1, meas. point 1,		INV	–	
…,		INV	–	
E-DPDCH1, meas. point 3,		INV	–	
E-DPDCH2, meas. point 1,		INV	–	
…,		INV	–	
E-DPDCH2, meas. point 3		INV	–	

Description of command

This command is always a query. It is valid for HS-DPCCH + E-DPCH measurements. The command indicates whether and in which way the error limits for the relative code powers (see commands above) are exceeded.

The following messages may be returned for all power steps:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

UE Power

READ:ARRay:CDPower:RELative:UEPower? Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:CDPower:RELative:UEPower? Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:CDPower:RELative:UEPower? Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for total UE power	–100 dBm to +60 dBm,	NAN	dBm	V4.50
...	... ,	...	...	
96th value for total UE power	–100 dBm to +60 dBm	NAN	dBm	

Description of command

These commands are always queries. They start a `CDPower:RELative` measurement (`READ...`) and/or return the UE power in up 96 consecutive half-slot periods, corresponding to 48 WCDMA slots. Values beyond the measurement length (`CONFigure:CDPower:RELative:CONTrol:MLENgth`) are invalid (NAN).

READ:ARRay:CDPower:RELative:DPCCh? DPCCH Channel Power
Start single shot measurement and return results ⇒ *RUN*

FETCh:ARRay:CDPower:RELative:DPCCh?
Read measurement results (unsynchronized) ⇒ *RUN*

SAMPle:ARRay:CDPower:RELative:DPCCh?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for DPCCH power	–100 dB to +100 dB,	NAN	dB	V4.50
...	... ,	...	...	
38th value for DPCCH power	–100 dB to +100 dB	NAN	dB	

Description of command

These commands are always queries. They start a `CDPower:RELative` measurement (`READ...`) and/or return the relative DPCCH channel power in 96 consecutive half-slot periods, corresponding to 48 WCDMA slots. Values beyond the measurement length (`CONFigure:CDPower:RELative:CONTrol:MLENgth`) are invalid (NAN).

READ:ARRay:CDPower:RELative:DPDCh? $DPDCH_1$ Channel Power
Start single shot measurement and return results ⇒ *RUN*

FETCh:ARRay:CDPower:RELative:DPDCh?
Read measurement results (unsynchronized) ⇒ *RUN*

SAMPle:ARRay:CDPower:RELative:DPDCh?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for $DPDCH_1$ power,	–100 dB to +100 dB,	NAN	dB	V4.50
...	... ,	...	...	
38th value for $DPDCH_1$ power	–100 dB to +100 dB	NAN	dB	

Description of command

These commands are always queries. They start a `CDPower:RELative` measurement (`READ...`) and/or return the relative $DPDCH_1$ channel power in 96 consecutive half-slot periods, corresponding to 48 WCDMA slots. Values beyond the measurement length (`CONFigure:CDPower:RELative:CONTrol:MLENgth`) are invalid (NAN).

READ:ARRay:CDPower:RELative:HSDPcch? HS-DPCCH Channel Power
Start single shot measurement and return results ⇒ *RUN*

FETCh:ARRay:CDPower:RELative:HSDPcch?
Read measurement results (unsynchronized) ⇒ *RUN*

SAMPle:ARRay:CDPower:RELative:HSDPcch?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for HS-DPCCH power,	–100 dB to +100 dB,	NAN	dB	V4.50
...	... ,	...	...	
38th value for HS-DPCCH power	–100 dB to +100 dB	NAN	dB	

Description of command

These commands are always queries. They start a `CDPower:RELative` measurement (`READ...`) and/or return the relative HS-DPCCH channel power in 96 consecutive half-slot periods, corresponding to 48 WCDMA slots. Values beyond the measurement length (`CONFigure:CDPower:RELative:CONTrol:MLENgth`) are invalid (NAN).

READ:ARRay:CDPower:RELative:EDPCch? HS-DPCCH Channel Power
Start single shot measurement and return results ⇒ *RUN*

FETCh:ARRay:CDPower:RELative:EDPCch?
Read measurement results (unsynchronized) ⇒ *RUN*

SAMPle:ARRay:CDPower:RELative:EDPCch?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for HS-DPCCH power,	–100 dB to +100 dB,	NAN	dB	V4.55
...	... ,	...	...	
38th value for HS-DPCCH power	–100 dB to +100 dB	NAN	dB	

Description of command

These commands are always queries. They start a `CDPower:RELative` measurement (`READ...`) and/or return the relative E-DPCCH channel power in 96 consecutive half-slot periods, corresponding to 48 WCDMA slots. Values beyond the measurement length (`CONFigure:CDPower:RELative:CONTrol:MLENgth`) are invalid (NAN).

READ:ARRay:CDPower:RELative:EDPDch<nr>? HS-DPCCH Channel Power
Start single shot measurement and return results ⇒ *RUN*

FETCh:ARRay:CDPower:RELative:EDPDch<nr>?
Read measurement results (unsynchronized) ⇒ *RUN*

SAMPle:ARRay:CDPower:RELative:EDPDch<nr>?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for HS-DPCCH power,	–100 dB to +100 dB,	NAN	dB	V4.55
...	... ,	...	...	
38th value for HS-DPCCH power	–100 dB to +100 dB	NAN	dB	

Description of command

These commands are always queries. They start a `CDPower:RELative` measurement (`READ...`) and/or return the relative E-DPDCH1 and E-DPDCH2 (<nr> = 1, 2) power in 96 consecutive half-slot periods, corresponding to 48 WCDMA slots. Values beyond the measurement length (`CONFigure:CDPower:RELative:CONTrol:MLENgth`) are invalid (NAN).

CDE Relative

The subsystem `CDPower:RELative:CDERror` controls the *CDE Relative* measurement. The subsystem corresponds to the measurement menu *Modulation,* application *CDE Relative,* and the sections in the popup menu *Modulation Configuration* that are related to the *CDE Relative* application.

Measurement Control

The following commands control the *CDE Relative* measurement. They correspond to the *CDE Relative* softkey in the measurement menu *Code Domain Power*.

INITiate:CDPower:RELative:CDERror	Start new measurement	⇒	*RUN*
ABORt:CDPower:RELative:CDERror	Abort running measurement and switch off	⇒	*OFF*
STOP:CDPower:RELative:CDERror	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:CDPower:RELative:CDERror	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V4.55

CONFigure:CDPower:RELative:CDERror:EREPorting <*Mode*> — Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V4.55
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:CDPower:RELative:CDERror:STATus? — Measurement Status

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V4.55
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle	NONE	–	
NONE	No counting mode set			

Description of command

This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The subsystem *CDPower:RELative:CDERror:CONTrol* defines the scope of the measurement.

CONFigure:CDPower:RELative:CDERror:CONTrol:REPetition Test Cycles
<Repetition>, <StopCond>, <Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	FW vers.
CONTinuous | SINGleshot | 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	V4.55
<StopCond>	Description of parameters	Def. value	Def. unit	FW vers.
SONerror | NONE	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	V4.55
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | NONE	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V4.55

Description of command

This command determines the number of statistics cycles and the stepping mode for the measurement.

Note: In the case of `READ` commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

DEFault:CDPower:RELative:CDERror:CONTrol *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V4.55

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Tolerance values – Subsystem CDPower:RELative:CDERror:LIMit

The subsystem *CDPower:RELative:CDERror:LIMit* defines tolerance values for the code domain power measurement. The subsystem corresponds to the settings in the *Limits* tab of the popup menu *Code Domain Power Configuration* that are related to the *CDE Relative* application.

Nominal CDP and ECDP values and spreading factors (HS-DPCCH)

CONFigure:CDPower:RELative:CDERror:LIMit:HSDP[:SCALar]:ASYMmetric[:COMBined]:VALue<nr>
<Nom. CDP>, <SF>, <Nom. ECDP>

<Nom. CDP>	Description of parameters	Def. value	Def. unit	FW vers.
–50.0 dB to 0.0 dB	Nominal code domain power	See below	–	V4.55
<SF>	Description of parameters	Def. value	Def. unit	FW vers.
2 | 4 … 256	Spreading factor for code channel	See below	dB	V4.55
<Nom EDCP>	Description of parameters	Def. value	Def. unit	FW vers.
–	Nominal ECDP (for query only)	See below	dB	V4.55

Description of command

This command is valid for HS-DPCCH measurements (`CONFigure:CDPower:RELative:CDERror:CONTrol:MODE HSDP`). In *Non Signalling* mode it defines the nominal code domain powers and spreading factors for the CDE relative measurement. The numeric suffix <nr> = 1 to 3 numbers the three code channels DPCCH, DPDCH, and HS-DPCCH, respectively. The default values correspond to the conformance test specification:

Expected ECDP (HSDPA)	Nom. CDP	SF	Nom. ECDP	Enab.
DPCCH [dB]	- 17.9	256	- 17.9	☑
DPDCH 1 [dB]	- 0.4	64	- 6.4	☑
HS-DPCCH [dB]	- 11.8	256	- 11.8	☑

In *Signalling* mode, the values are signaled (SF) or calculated from the UE gain factors; only the query form is supported.

Enable limit check (Non Signalling only)

CONFigure:CDPower:RELative:CDERror:LIMit:HSDP[:SCALar]:ASYMmetric[:COMBined]:ENABle<nr>
<Enable>

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable the limit check	ON	–	V4.55

Description of command

This command enables or disables the limit check. The numeric suffix <nr> = 1 to 3 numbers the three code channels DPCCH, DPDCH, and HS-DPCCH.

Nominal CDP and ECDP values and spreading factors (HS-DPCCH + E-DPCH)

CONFigure:CDPower:RELative:CDERror:LIMit:HSPA[:SCALar]:ASYMmetric[:COMBined]:VALue<nr>
<Nom. CDP>, <SF>, <Nom. ECDP>

<Nom. CDP>	Description of parameters	Def. value	Def. unit	FW vers.
–50.0 dB to 0.0 dB | OFF	Nominal code domain power code channel not active	See below	–	V4.55
<SF>	Description of parameters	Def. value	Def. unit	FW vers.
2 | 4 … 256	Spreading factor for code channel	See below	dB	V4.55
<Nom EDCP>	Description of parameters	Def. value	Def. unit	FW vers.
–	Nominal ECDP (for query only)	See below	dB	V4.55

Description of command

This command is valid for HS-DPCCH +E-DPCH measurements (`CONFigure:CDPower:RELative:CDERror:CONTrol:MODE HSPA`). In *Non Signalling* mode it defines the nominal code domain powers and spreading factors for the CDE relative measurement. The numeric suffix <nr> = 1 to 6 numbers the six code channels DPCCH, DPDCH, HS-DPCCH, E-DPCCH, E-DPDCH1, and E_DPDCH2, respectively. The default values correspond to the conformance test specification:

Expected ECDP (HSPA)	Nom. CDP	SF	Nom. ECDP	Enab.
DPCCH [dB]	- 18.5	256	- 18.5	☑
DPDCH 1 [dB]	- 15.8	64	- 21.8	☑
HS-DPCCH [dB]	- 12.5	256	- 12.5	☑
E-DPCCH [dB]	- 16.5	256	- 16.5	☑
E-DPDCH 1 [dB]	- 0.5	4	- 18.6	☑
E-DPDCH 2 [dB]	Off	Off	Off	☑

In *Signalling* mode, the values are signaled (SF) or calculated from the UE gain factors and absolute grant values; only the query form is supported.

Enable limit check (Non Signalling only)

CONFigure:CDPower:RELative:CDERror:LIMit:HSPA[:SCALar]:ASYMmetric[:COMBined]:ENABle<nr>
<Enable>

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable the limit check	ON	–	V4.55

Description of command

This command enables or disables the limit check. The numeric suffix <nr> = 1 to 6 numbers the six code channels DPCCH, DPDCH, HS-DPCCH, E-DPCCH, E-DPDCH1.

Rel. CDE vs. ECDP

CONFigure:CDPower:RELative:CDERror:LIMit[:SCALar]:ASYMmetric[:COMBined]:VALue
<Limit ≥ –21 dB>, <Limit –21 dB to ≥ –30 dB>

<Limit ≥ –21 dB>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to ±5.0 dB	Relative CDE at large ECDP	–16	dB	V4.55
<Limit –21 dB to ≥ –30 dB>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to ±5.0 dB	Relative CDE at medium ECDP	–37	dB	V4.55

Description of command

This command defines the limits for the relative code domain error, depending on the ECDP of the code channels.

DEFault:CDPower:RELative:CDERror:LIMit <*Enable*>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V4.55
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Measured Values – Subsystem CDPower:RELative:CDERror...?

The following commands start a `CDPower:RELative:CDERror…` measurement (`READ...`) and/or return the results and compare them with tolerance values.

				CDE, ECDP, and SF results
READ[:SCALar]:CDPower:RELative:CDERror?				Start single shot measurement and return results
FETCh[:SCALar]:CDPower:RELative:CDERror?				Read measurement results (unsynchronized)
SAMPle[:SCALar]:CDPower:RELative:CDERror?				Read measurement results (synchronized)
Returned values	Value range	Def. value	Def. unit	FW vers.
Relative CDE for DPCCH,	–100.0 dB to 0.0 dB	NAN	dB	V4.55
Relative CDE for DPDCH,	–100.0 dB to 0.0 dB	NAN	dB	
Relative CDE for HS-DPCCH,	–100.0 dB to 0.0 dB	NAN	dB	
Relative CDE for E-DPCCH,	–100.0 dB to 0.0 dB	NAN	dB	
Relative CDE for E-DPDCH1,	–100.0 dB to 0.0 dB	NAN	dB	
…,	…	NAN	dB	
Relative CDE for E-DPDCH4,	–100.0 dB to 0.0 dB	NAN	dB	
Relative ECDP for DPCCH,	–100.0 dB to 0.0 dB	NAN	dB	
…,	…			
ECDP for E-DPDCH4	–100.0 dB to 0.0 dB	NAN	dB	
SF for DPCCH,	2 to 256	NAN	–	
…,				
SF for E-DPDCH4	2 to 256	NAN	–	
Description of command				
These commands are always queries. They start a `CDPower:RELative:CDERror` measurement (`READ...`) and/or return the code domain errors, ECDP values and spreading factors for all channels.				

CALCulate[:SCALar]:CDPower:RELative:CDERror:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
Relative CDE for DPCCH,		INV	–	V4.55
Relative CDE for DPDCH,	For all measured values:	INV	–	
Relative CDE for HS-DPCCH,	NMAU | NMAL | INV | OK	INV	–	
Relative CDE for E-DPCCH,		INV	–	
Relative CDE for E-DPDCH1,		INV	–	
…,		INV	–	
Relative CDE for E-DPDCH4		INV	–	

Description of command

This command is always a query. The command indicates whether and in which way the error limits for the relative code powers (see commands above) are exceeded.

The following messages may be returned for all power steps:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

Relative Code Domain Error

READ:ARRay:CDPower:RELative:CDERror? Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:CDPower:RELative:CDERror? Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:CDPower:RELative:CDERror? Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
Relative CDE for DPCCH,	–100.0 dB to 0.0 dB	NAN	dB	V4.55
Relative CDE for DPDCH,	–100.0 dB to 0.0 dB	NAN	dB	
Relative CDE for HS-DPCCH,	–100.0 dB to 0.0 dB	NAN	dB	
Relative CDE for E-DPCCH,	–100.0 dB to 0.0 dB	NAN	dB	
Relative CDE for E-DPDCH1,	–100.0 dB to 0.0 dB	NAN	dB	
…,	…	NAN	dB	
Relative CDE for E-DPDCH4	–100.0 dB to 0.0 dB	NAN	dB	

Description of command

These commands are always queries. They start a `CDPower:RELative:CDERror` measurement (`READ...`) and/or return the relative code domain error for all channels.

HSDPA Downlink Signal Configuration (Signalling)

The commands in the following sections configure the HSDPA channels generated by the CMU. They correspond to the sections in the *BS Signal* tab of the *Connection Control* menu that are related to HSDPA channel configuration. HSDPA signals and measurements require option R&S CMU-K64.

To perform HSDPA tests, the HSDPA test mode must be activated as described in section *Packet Switched Connections* in Chapter 4.

Physical HSDPA Channels

The following commands configure the physical HSDPA channels generated by the CMU. They correspond to the *Downlink Physical Channels – HSDPA Channels* section in the *BS Signal* tab of the *Connection Control* menu.

CONFigure:BSSignal:HSDPa:SIGNal:ENABle <*Enable*>				HSDPA Signal
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	HSDPA channels switched on or off	OFF	–	V3.80
Description of command				Sig. State
This command switches the HSDPA channels in the WCDMA downlink signal *On* or *Off*. The HSDPA channels can be switched on or off irrespective of the other BS signal settings.				all

CONFigure:BSSignal:HSDPa:SSCode <*Code*>				Secondary Scrambling Code
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
#H0 to #HF	Secondary scrambling code	#H0	–	V3.80
Description of command				Sig. State
This command defines the secondary scrambling code for the downlink HSDPA generator signal. The input of a scrambling code may be in decimal or in hexadecimal format, the latter preceded by #H (as specified in IEEE 488.2). The output is always in hexadecimal format, preceded by #H.				SOFF SON REG

CONFigure:BSSignal:PHYSical:LEVel:HSSCch<nr> <*Level*>				HS-SCCH Level
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35.0 dB to +15.0 dB | OFF	Level of HS-SCCH no. <nr> (<nr> = 1 to 4) HS-SCCH switched off	–7 (<nr> = 1) OFF (<nr> > 1)	dB	V3.80
Description of command				Sig. State
This command defines the HS-SCCH level relative to the level reference for the BS signal (`CONFigure:BSSignal:LREFerence`). Use the command `CONFigure:BSSignal:HSDPA:PHYSical:LEVel` to define the HS-SCCH level together with all other physical channel levels.				all

CONFigure:BSSignal:PHYSical:HSSCch:CODE<nr> <*Code*>				HS-SCCH Ch. Code
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 127	Chann. code of HS-SCCH no. <nr> (<nr> = 1 to 4)	11 + <nr>	–	V3.80
Description of command				Sig. State
This command selects the HS-SCCH channelization code set information for HS-DSCH allocation.				SOFF SON REG

CONFigure:BSSignal:PHYSical:HSSCch:UEID <*Number*>			HS-SCCH UE ID	
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
#H0 to #HFFFF	UE ID of the HS-SCCH set	#HAAAA	–	V3.80
Description of command				Sig. State
This command selects the UE identity (=H-RNTI) to specify the UE for which data is transmitted in the corresponding HS-DSCH TTI.				SOFF SON REG

CONFigure:BSSignal:PHYSical:HSSCch:DUMMY:UEID<nr> <*Number*>			HS-SCCH Dummy UE ID	
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
#H0 to #HFFFF	Dummy UE ID of HS-SCCH no. <nr> (<nr> = 1 to 4)	#H5555 (<nr> = 1) #H12AA (<nr> = 2) #H1AAA (<nr> = 3) #H1FAA (<nr> = 4)	–	V3.80
Description of command				Sig. State
This command defines the dummy UE identities that the R&S CMU transmits in the unscheduled subframes if `CONFigure:BSSignal:PHYSical:HSSCch:USUBframes TDU` is set.				SOFF SON REG

CONFigure:BSSignal:PHYSical:HSSCch:SELection <*Number*>			HS-SCCH Selection	
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
SCCH1 to SCCH4 | CYCLic | RANDom	Fixed HS-SCCH channel Cyclic change of HS-SCCH channel Random selection of HS-SCCH channel	1	–	V3.80
Description of command				Sig. State
This command selects the HS-SCCH(s) within the R&S CMU's HS-SCCH set that carry the UE ID. In the `CYCLic` or `RANDom` mode, the HS-SCCH changes among channels 1 to n where n is defined via `CONFigure:BSSignal:PHYSical:HSSCch:NUMBer`.				SOFF SON REG

CONFigure:BSSignal:PHYSical:HSSCch:NUMBer <*Number*>			Number of HS-SCCHs	
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 4	No. of HS-SCCHs	4	–	V3.80
Description of command				Sig. State
This command defines the number of HS-SCCHs within the R&S CMU's HS-SCCH set.				SOFF SON REG

CONFigure:BSSignal:PHYSical:HSSCch:USUBframes <*Mode*>			Unscheduled Subframes	
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
TDU | DTX	Transmit Dummy UEID DTX	UEID	–	V3.80
Description of command				Sig. State
This command defines the transmission in the gaps between consecutive HS-SCCH subframes allocated to the UE.				all

CONFigure:BSSignal:PHYSical:LEVel:HSPDsch <*Level*>				Sum Level
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | OFF | ON	Sum level of HS-PDSCH HS-PDSCH switched off Switch on the HS-PDSCH that was `OFF` before, using the level defined previously	0.0	dB	V3.80
Description of command				Sig. State
This command defines the signal level of the HS-PDSCH, summed over all active codes, relative to the level reference for the BS Signal (`CONFigure:BSSignal:LREFerence`). Use the command `CONFigure:BSSignal:HSDPa:PHYSical:LEVel` to define the HS-PDSCH level together with all other physical channel levels.				all

CONFigure:BSSignal:PHYSical:HSPDsch:MPOControl <*Level*>				Meas. Power Offset Control
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
MAN | AUTO	Manual setting Automatic calculation	MAN	–	V4.20
Description of command				Sig. State
This command qualifies whether the Meas. Power Offset is set manually using `CONFigure:BSSignal:PHYSical:HSPDsch:MPOFfset` or calculated.				SOFF SON REG; Q: all

CONFigure:BSSignal:PHYSical:HSPDsch:MPOFfset <*Level*>				Meas. Power Offset
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–6.0 dB to +13.0 dB	Measured power offset	+0.0	dB	V3.80
Description of command				Sig. State
This command defines the power difference between the P-CPICH and the HS-PDSCH that the UE assumes for CQI reporting.				SOFF SON REG; Q: all

CONFigure:BSSignal:HSDPa:PHYSical:LEVel HS-SCCH and HS-PDSCH Levels
<P-CPICH_abs> | <P-CPICH_rel>, <P-SCH>, <S-SCH>, <P-CCPCH>, <S-CCPCH>, <PICH>, <AICH>, <DPDCH>, <Power Offset>, <SCCH_1>, … , <SCCH_4>, <PDSCH>

<P-CPICH_abs>	Description of parameters	Def. value	Def. unit	FW vers.
–147.0 dBm to –37.0 dBm*	Absolute P-CPICH level if RF 1 is used	–96.3	dBm	V3.80
–147.0 dBm to –20.0 dBm*	Absolute P-CPICH level if RF 2 is used	–96.3	dBm	
–100.0 dBm to +3.0 dBm*	Abs. P-CPICH level if RF 3 OUT is used	–96.3	dBm	
<P-CPICH_rel>	Description of parameters	Def. value	Def. unit	FW vers.
–30 dB to 0 dB	Relative P-CPICH level P-CPICH channel switched off	–	dB	V3.80
<P-SCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	P-SCH level (level reference = P-CPICH) P-SCH level (level reference = total channel power)	–5.0 –	dB dB	V3.80
<S-SCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	S-SCH level (level reference = P-CPICH) S-SCH level (level reference = total channel power)	–5.0 –	dB dB	V3.80
<P-CCPCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	P-CCPCH level (level ref. = P-CPICH) P-CCPCH level (level reference = total channel power)	–2.0 –	dB dB	V3.80
<S-CCPCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	S-CCPCH level (level ref. = P-CPICH) S-CCPCH level (level reference = total channel power)	–2.0 –	dB dB	V3.80
<PICH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	PICH level (level ref. = P-CPICH) PICH level (level reference = total channel power)	–5.0 –	dB dB	V3.80
<AICH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	AICH level (level ref. = P-CPICH) AICH level (level reference = total channel power)	–5.0 –	dB dB	V3.80
<DPDCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	DPDCH level (level ref. = P-CPICH) DPDCH level (level reference = total channel power)	–7.0 –	dB dB	V3.80
<Power Offset>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 6.0 dB	DPCCH/DPDCH power offset	0.0	dB	V3.80
<SCCH_1>, … , <SCCH_4>	Description of parameters	Def. value	Def. unit	FW vers.
–35.0 dB to +15.0 dB | **OFF |** **ON,**	Level of HS-SCCH no. 1 to 4 HS-SCCH switched off Switch on a HS-SCCH that was `OFF` before, using the level defined previously	–7 (<nr> = 1) OFF**) (<nr> > 1)	dB	V3.80

<PDSCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **OFF |** **ON**	Sum level of HS-PDSCH HS-PDSCH switched off Switch on the HS-PDSCH that was OFF before, using the level defined previously	0.0	dB	V3.80

Description of command

This command sets all physical channel levels at once, including the HSDPA channels. The WCDMA levels can be set relative to the P-CPICH level (in which case *<P-CPICH_abs>* is used) or relative to the total channel power (*<P-CPICH_rel>* is used), depending on the CONFigure:BSSignal:LREFerence setting.

Note: *The instrument checks the levels for consistence before activating the settings. This is important especially if the levels are defined relative to the total channel power and must not exceed this fixed value.*

*) The reported level ranges correspond to the total output power ranges at the three RF output connectors (see command CONFigure:BSSignal:OPOWer). If other channel contributions are switched on, the P-CPICH level must be reduced so that the total output power range is not exceeded.

**) If the channels no. 2, 3, or 4 are switched ON, their level is set to –7 dB.

CONFigure:BSSignal:PHYSical:HSPDsch:CODE <*Code*> First Used Ch. Code

<Code>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 15	First Used Ch. Code	2	–	V3.80

Description of command — Sig. State

This command selects the lowest numbered channelization code assigned to the HS-PDSCH. — all

CONFigure:BSSignal:PHYSical:HSPDsch:USUBframes <*Mode*> Unscheduled Subframes

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
DDATa | **DTX**	Dummy data DTX	DDAT	–	V3.80

Description of command — Sig. State

This command qualifies whether the CMU maintains the signal power in unscheduled HS-PDSCH subframes. — all

HS-DSCH Settings

The following commands configure the High Speed Downlink Shared Channel (HS-DSCH). They correspond to the *HS-DSCH* section in the *BS Signal* tab of the *Connection Control* menu.

DEFault:HSDPa:HSDSch <*Enable*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.80

Description of command — Sig. State

If used as a setting command with the parameter *ON* this command sets all parameters of the HSDSch subsystem (including the commands in the following sub-sections) to default values. The setting *OFF* results in an error message. If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*. — SON, SOFF

CONFigure:BSSignal:HSDSch:DSOurce <*Pattern*>				HS-DSCH Data Pattern
<Pattern>	Description of parameters	Def. value	Def. unit	FW vers.
ALL0 | **ALL1 |** **ALT |** **PR9 | PR11 | PR13 | PR15**	Bit sequence consisting of zeros Bit sequence consisting of ones 010101... bit sequence Pseudo-random bit sequences	PR9	–	V3.80
Description of command				Sig. State
This command selects the bit pattern transmitted as user information on the HS-DSCH.				all[3]

CONFigure:BSSignal:HSDSch:FNACk <*Mode*>				Force NACK
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
P10 | P20 | … | P100 | **OFF**	UE sends 10%, 20%, …, 100% UL NACK No UL NACK sent	OFF	–	V3.80
Description of command				Sig. State
This command specifies the percentage of data with incorrect CRC causing NACKs in the UL.				all[3]

CONFigure:BSSignal:HSDSch:CFCYcle <*Period*>				CQI Feedback Cycle
<Period>	Description of parameters	Def. value	Def. unit	FW vers.
C2 | C4 | C8 | C10 | C20 | C40 | C80 | C160 | **OFF**	Feedback cycle length No CQI symbols sent (DTX)	C4	ms	V3.80
Description of command				Sig. State
This command specifies a time (in multiples of 2 ms or 1 HSDPA subframe) after which the UE will repeat the transmission of CQI symbols on the HS-DPCCH. Use the combined command `CONFigure:BSSignal:HSDSch[:COMBined]:CANack` for a quick change of the CQI feedback cycle and repetition factors during a connection. **Note:** The query returns the feedback cycle length without “C”, i.e. 2 | 4 | 8… | 160 | OFF.				all

CONFigure:BSSignal:HSDSch:CRFactor <*Factor*>				CQI Repetition Factor
<Factor>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 4	No. of consecutive CQI transmissions	1	–	V4.20
Description of command				Sig. State
This command specifies the number of CQI transmissions per CQI Feedback Cycle (`CONFigure:BSSignal:HSDSch :CFCYcle`). Use the combined command `CONFigure:BSSignal:HSDSch[:COMBined]:CANack` for a quick change of the CQI feedback cycle and repetition factors during a connection.				all

CONFigure:BSSignal:HSDSch:ANRFactor <*Factor*>				ACK/NACK Repetition Factor
<Factor>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 4	No. of consecutive ACK/NACK transmissions	1	–	V4.20
Description of command				Sig. State
This command specifies the number of repeated ACK/NACK transmissions. Use the combined command `CONFigure:BSSignal:HSDSch[:COMBined]:CANack` for a quick change of the CQI feedback cycle and repetition factors during a connection.				all

[3] Unrestricted in HSDPA test mode, <CONN (CS) and <PEST (PS) in packet data test mode.

CONFigure:BSSignal:HSDSch[:COMBined]:CANack *<Period>, <CQI_Factor>, <ACK_Factor>* — CQI Feedback Cycle and Rep. Factors

<Period>	Description of parameters	Def. value	Def. unit	FW vers.
C2 | C4 | C8 | C10 | C20 | C40 | C80 | C160 | OFF,	Feedback cycle length (query: without C) No CQI symbols sent (DTX)	C4	ms	V4.20
<CQI_Factor>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
1 to 4,	No. of consecutive CQI transmissions	1	–	V4.20
<ACK_Factor>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
1 to 4	No. of consecutive CQI transmissions	1	–	V4.20

Description of command	Sig. State
This command defines the CQI feedback cycle and the CQI and ACK/NACK repetition factors. During a connection (signalling state CONN) it is more efficient to change the parameters with a single command rather than reconfiguring the radio bearer repeatedly.	all

CONFigure:BSSignal:HSDSch:UECategory:MODE <*Number*> — UE Category Selection

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
UCR | MAN	From UE Capability reports Manual setting	UCR	–	V4.20

Description of command	Sig. State
This command defines how the capability category of the UE is set. In manual setting, the UE category is defined via `CONFigure:BSSignal:HSDSch:UECategory`.	SOFF SON REG

CONFigure:BSSignal:HSDSch:UECategory <*Number*> — UE Category

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
1 | 2 … 12	UE Category	1	–	V3.80

Description of command	Sig. State
This command selects the capability category of the UE.	SOFF SON REG

CONFigure:BSSignal:HSDSch:T1RTimer <*Number*> — T1 Release Timer

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
10 ms | 20 ms | 30 ms … 100 ms | 120 ms | 140 ms | 160 ms | 200 ms | 300 ms | 400 ms	T1 re-ordering release timer	50	ms	V4.20

Description of command	Sig. State
This command sets the value of the T1 release timer.	SOFF SON REG

CONFigure:BSSignal:HSDSch:RWSize <*Bits*>				Receiver Window Size
<Bits>	Description of parameters	Def. value	Def. unit	FW vers.
1 | 8 | 16 | 32 | 64 | 128| 256 | 512 | 768 | 1024 | 1536 | 2047 | 2560 | 3072 | 3584 | 4095	Window size	2047	(bits)	V4.22
Description of command				Sig. State
This command specifies the size of the receiver window in the UE for all channel types.				SOFF SON REG

CONFigure:BSSignal:HSDSch:TYPE <*Channel*>				Channel Configuration Type
<Channel>	Description of parameters	Def. value	Def. unit	FW vers.
FRCHannel | **CQIChannel |** **UDCHannel**	Fixed Reference Channel CQI User Defined	FRCH	–	V3.80
Description of command				Sig. State
This command selects the HS-DSCH channel type.				all[4]

Fixed Reference Channel (FRCHannel)

The subsystem *BSSignal:HSDSch:FRCHannel* configures the HSDPA signal as a reference channel (H-set) according to standard 3GPP TS 25.101, Annex A7. It corresponds to the *Fixed Reference Channel* section in the *Generator* tab of the *Connection Control* menu.

CONFigure:BSSignal:HSDSch:FRCHannel:HSET <*Set*>				Fixed Reference Channel, H-Set Selection
<Set>	Description of parameters	Def. value	Def. unit	FW vers.
S1QP | S1Q | **S1M |** **S2QP | S2Q |** **S3QP | S3Q |** **S4QP | S5QP |** **S6QP | S6Q**	H-Set 1, QPSK or 16QAM modulation H-Set 1 Max. Input H-Set 2, QPSK or 16QAM modulation H-Set 3, QPSK or 16QAM modulation H-Set 4 or 5 (QPSK modulation) H-Set 6, QPSK or 16QAM modulation	S1QP	–	V3.80 V4.20
Description of command				Sig. State
This command selects the fixed reference channel type (H-Set). The setting takes effect when HS-DSCH configuration as a *Fixed Reference Channel* is selected (`CONFigure:BSSignal:HSDSch:TYPE FRCH`).				all[4]

CONFigure:BSSignal:HSDSch:FRCHannel:RVCSequence? Fixed Reference Channel, RV Coding Sequence					
Response	Description of parameters		Def. value	Def. unit	FW vers.
S0256 | **S6 |** **S6215**	{ 0, 2, 5, 6 } { 6 } { 6, 2, 1, 5 }	QPSK H-Set active H-Set 1 Max. Input active 16QAM H-Set active	S0256	–	V3.80
Description of command					Sig. State
This command is always a query and returns the RV coding sequence of the fixed reference channel type (H-Set). The response is for information only as it is fixed, depending on the selected H-Set (`CONFigure:BSSignal:HSDSch:FRCHannel:HSET`).					all

[4] Unrestricted in HSDPA test mode, <CONN (CS) and <PEST (PS) in packet data test mode.

CONFigure:HSDPA[:COMBined]:FRCHannel <*Set*> Fixed Reference Channel, combined parameters ***<Beta_c>*, *<Beta_d>*, *<Delta_ACK>*, *<Delta_NACK>*, *<Delta_CQI>*, *<Period>*, *<CQI_Factor>*, *<ACK_Factor>*, *<Set>***				
<Beta_c>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 15	DPCCH gain factor	9	–	V4.20
<Beta_d>	Description of parameters	Def. value	Def. unit	
1 to 15	DPDCH gain factor	15	–	
<Delta_ACK>	Description of parameters	Def. value	Def. unit	
0 to 8	Power offset parameter Δ_{ACK}	5	–	
<Delta_NACK>	Description of parameters	Def. value	Def. unit	
0 to 8	Power offset parameter Δ_{NACK}	5	–	
<Delta_CQI>	Description of parameters	Def. value	Def. unit	
0 to 8	Power offset parameter Δ_{CQI}	2	–	
<Period>	Description of parameters	Def. value	Def. unit	
C2 | C4 | C8 | C10 | C20 | C40 | C80 | C160 | OFF,	Feedback cycle length (query: without C) No CQI symbols sent (DTX)	C4	ms	
<CQI_Factor>	Description of parameters	Def. value	Def. unit	
1 to 4,	No. of consecutive CQI transmissions	1	–	
<ACK_Factor>	Description of parameters	Def. value	Def. unit	
1 to 4	No. of consecutive CQI transmissions	1	–	
<Set>	Description of parameters	Def. value	Def. unit	
S1QP | S1Q | S1M | S2QP | S2Q | S3QP | S3Q | S4QP | S5QP | S6QP | S6Q	H-Set 1, QPSK or 16QAM modulation H-Set 1 Max. Input H-Set 2, QPSK or 16QAM modulation H-Set 3, QPSK or 16QAM modulation H-Set 4 or 5 (QPSK modulation) H-Set 6, QPSK or 16QAM modulation	S1QP	–	
Description of command				Sig. State
This command performs a fast combined channel configuration for the fixed reference channel.				all[5]

CQI Channel (CQIChannel)

The subsystem *BSSignal:HSDSch:CQIChannel* configures the HSDPA signal as a CQI test channel. It corresponds to the *CQI Channel Configuration* section in the *BS Signal* tab of the *Connection Control* menu.

CONFigure:BSSignal:HSDSch:CQIChannel:TINDex:TYPE <*Type*> Table Index, Type				
<Type>	Description of parameters	Def. value	Def. unit	FW vers.
FIXed | SEQuence | FULCqi | CONF	Fixed Sequence Follow UL CQI Conformance test (CQI reporting test)	FIX	–	V3.80
Description of command				Sig. State
This command selects the CQI table index type. The setting takes effect when HS-DSCH configuration as a *CQI Channel* is selected (`CONFigure:BSSignal:HSDSch:TYPE CQI`).				all[5]

[5] Unrestricted in HSDPA test mode, <CONN (CS) and <PEST (PS) in packet data test mode.

CONFigure:BSSignal:HSDSch:CQIChannel:TINDex:FIXed <*Number*>				Table Index, Fixed
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 30	Fixed CQI	16	–	V3.80
Description of command				Sig. State
This command selects the fixed CQI defining the downlink Transport Format (TF). The setting takes effect when a fixed table index type (`CONFigure:BSSignal:HSDSch:CQIChannel:TINDex:TYPE FIX`) and HS-DSCH configuration as a *CQI Channel* is selected (`CONFigure:BSSignal:HSDSch:TYPE CQI`).				all[6]

CONFigure:BSSignal:HSDSch:CQIChannel:TINDex:SEQuence <*Min*>, <*Max*>				Table Index, Sequence
<Min>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 30	Min. CQI	1	–	V3.80
<Max>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 30	Max. CQI	30	–	V3.80
Description of command				Sig. State
This command defines a range of CQI values for variable downlink TFs. The setting takes effect when a sequential table index type (`CONFigure:BSSignal:HSDSch:CQIChannel:TINDex:TYPE SEQ`) and HS-DSCH configuration as a *CQI Channel* is selected (`CONFigure:BSSignal:HSDSch:TYPE CQI`).				all[6]

CONFigure:BSSignal:HSDSch:CQIChannel:TINDex:CTSValue <*Value*>				Confidence Test Start Value
<Value>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 30	Start value for the CQI conformance test	16	–	V3.80
Description of command				Sig. State
This command selects the start value for the CQI conformance test. The setting is relevant if a HS-DSCH configuration as a *CQI Channel* is selected (`CONFigure:BSSignal:HSDSch:TPYE CQI`) in order to perform a CQI Reporting test (`CONFigure:BSSignal:HSDSch:CQIChannel:TINDex:TYPE CONF`).				all[6]

CONFigure:BSSignal:HSDSch:CQIChannel:TTIDistance?				Inter-TTI Distance
Response	Description of parameters	Def. value	Def. unit	FW vers.
1 to 3	Number of TTIs	3	–	V3.80
Description of command				Sig. State
This command is always a query and returns the minimum distance between two consecutive Transmission Time Intervals (TTIs) in which the HS-DSCH is allocated to the UE.				all

CONFigure:BSSignal:HSDSch:CQIChannel:HARQ <*Number*>				No. of H-ARQ Processes
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 8	Number of HARQ processes	2	–	V3.80
Description of command				Sig. State
This command defines the no. of Hybrid ARQ (Automatic Repeat Request) processes for retransmission.				all[6]

[6] Unrestricted in HSDPA test mode, <CONN (CS) and <PEST (PS) in packet data test mode.

CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QPSK <*Sequence*> CQI Channel, RV Coding Sequence QPSK

<*Sequence*>	Description of parameters		Def. value	Def. unit	FW vers.
S0 | **S6 |** **S0256 |** **S6215 |** **S0000 |** **S6666 |** **S6045 |**	{ 0 } { 6 } { 0, 2, 5, 6 } { 6, 2, 1, 5 } { 0, 0, 0, 0 } { 6, 6, 6, 6 } { 6, 0, 4, 5 }	(Single Transmission, QPSK) (Single Transmission, 16QAM) (FRC, QPSK) (FRC, 16QAM) (Chase Combining, QPSK) (Chase Combining, 16QAM) (Chase Combining with constellation re-arrangement, 16QAM)	S0	–	V4.50
EMODe	Edit mode				

Description of command

This command selects the RV coding sequence for the QPSK-modulated CQI channel.

If `EMOD` is active an arbitrary RV coding sequence can be set; see commands `CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QPSK:EMSequence<nr> and CONFigure:BSSignal:HSDSch:CQIChannel: RVCSequence:QPSK:EMSequence:ALL`.

CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QPSK:EMSequence:LENGth <*Length*> Edit Mode – Sequence Length

<*Length*>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 8	Number of retransmissions + 1	8	–	V4.50

Description of command

This command defines the length of the edited RV coding sequence for the QPSK modulated CQI channel. The sequence can define one initial transmission plus 1 to 7 retransmissions, so the <*Length*> parameter is equal to the number of retransmissions plus one. The setting takes effect if the edit mode is active (`CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QPSK EMOD`).

CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QPSK:EMSequence<nr> <*Value*> Edit Mode – Sequence

<*Value*>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7	Sequence value for transmission <nr> (<nr> = 1 to 8)	0	–	V4.50

Description of command

This command defines a single value of the the edited RV coding sequence for the QPSK modulated CQI channel. If the numeric suffix is larger than the sequence length defined via `CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QPSK:EMSequence:LENGth`) the value is ignored. The setting takes effect if the edit mode is active (`CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence EMOD`).

CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QPSK:EMSequence:ALL Edit Mode – Sequence ***<Value_1>, <Value_2>, …,<Value_8>***

Parameters	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7, …, 0 to 7	RV coding sequence, first value RV coding sequence, 8th value	0, …, 0	–	V4.50

Description of command

This command defines an arbitrary RV coding sequence consisting of 8 numbers. The parameter list must contain eight numbers, however, only the first n numbers (where n denotes the sequence length defined via `CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QPSK:EMSequence:LENGth`) are used. The setting takes effect if the edit mode is active (`CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence EMOD`).

CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QAM ***<Sequence>*** CQI Channel, RV Coding Sequence 16 QAM

<Sequence>	Description of parameters		Def. value	Def. unit	FW vers.
S0 |	{ 0 }	(Single Transmission, QPSK)	S0	–	V4.50
S6 |	{ 6 }	(Single Transmission, 16QAM)			
S0256 |	{ 0, 2, 5, 6 }	(FRC, QPSK)			
S6215 |	{ 6, 2, 1, 5 }	(FRC, 16QAM)			
S0000 |	{ 0, 0, 0, 0 }	(Chase Combining, QPSK)			
S6666 |	{ 6, 6, 6, 6 }	(Chase Combining, 16QAM)			
S6045 |	{ 6, 0, 4, 5 }	(Chase Combining with constellation re-arrangement, 16QAM)			
EMODe	Edit mode				

Description of command

This command selects the RV coding sequence for the 16 QAM-modulated CQI channel.

If `EMOD` is active an arbitrary RV coding sequence can be set; see commands `CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QAM:EMSequence<nr>` and `CONFigure:BSSignal:HSDSch:CQIChannel: RVCSequence:QAM:EMSequence:ALL`.

CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QAM:EMSequence:LENGth ***<Length>*** Edit Mode – Sequence Length

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 8	Number of retransmissions + 1	8	–	V4.50

Description of command

This command defines the length of the edited RV coding sequence for the 16 QAM modulated CQI channel. The sequence can define one initial transmission plus 1 to 7 retransmissions, so the *<Length>* parameter is equal to the number of retransmissions plus one. The setting takes effect if the edit mode is active (`CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QAM EMOD`).

CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QAM:EMSequence<nr> <*Value*> Edit Mode – Sequence

<Value>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7	Sequence value for transmission <nr> (<nr> = 1 to 8)	0	–	V4.50

Description of command

This command defines a single value of the the edited RV coding sequence for the 16 QAM modulated CQI channel. If the numeric suffix is larger than the sequence length defined via `CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QAM:EMSequence:LENGth`) the value is ignored. The setting takes effect if the edit mode is active (`CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QAM EMOD`).

CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QAM:EMSequence:ALL Edit Mode – Sequence ***<Value_1>, <Value_2>, …,<Value_8>***

Parameters	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7, **…,** **0 to 7**	RV coding sequence, first value RV coding sequence, 8th value	0, …, 0	–	V4.50

Description of command

This command defines an arbitrary RV coding sequence consisting of 8 numbers. The parameter list must contain eight numbers, however, only the first n numbers (where n denotes the sequence length defined via `CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QAM:EMSequence:LENGth`) are used. The setting takes effect if the edit mode is active (`CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QAM EMOD`).

CONFigure:HSDPA[:COMBined]:CQIChannel <*Set*> CQI Channel, combined parameters
<*Beta_c*>, <*Beta_d*>, <*Delta_ACK*>, <*Delta_NACK*>, <*Delta_CQI*>, <*Period*>, <*CQI_Factor*>, <*ACK_Factor*>, <*CQI_Type*>, <*CQI_Number*>, <*CQI_Min*>, <*CQI_Max*>, <*CQI_Start_Value*>, <*HARQ_Number*>

<Beta_c>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 15	DPCCH gain factor	9	–	V4.20
<Beta_d>	Description of parameters	Def. value	Def. unit	
1 to 15	DPDCH gain factor	15	–	
<Delta_ACK>	Description of parameters	Def. value	Def. unit	
0 to 8	Power offset parameter Δ_{ACK}	5	–	
<Delta_NACK>	Description of parameters	Def. value	Def. unit	
0 to 8	Power offset parameter Δ_{NACK}	5	–	
<Delta_CQI>	Description of parameters	Def. value	Def. unit	
0 to 8	Power offset parameter Δ_{CQI}	2	–	
<Period>	Description of parameters	Def. value	Def. unit	
C2 | C4 | C8 | C10 | C20 | C40 | C80 | C160 | OFF,	Feedback cycle length (query: without C) No CQI symbols sent (DTX)	C4	ms	
<CQI_Factor>	Description of parameters	Def. value	Def. unit	
1 to 4,	No. of consecutive CQI transmissions	1	–	
<ACK_Factor>	Description of parameters	Def. value	Def. unit	
1 to 4	No. of consecutive CQI transmissions	1	–	
<CQI_Type>	Description of parameters	Def. value	Def. unit	
FIXed | **SEQuence |** **FULCqi |** **CONF**	Fixed Sequence Follow UL CQI Conformance test (CQI reporting test)	FIX	–	
<CQI_Number>	Description of parameters	Def. value	Def. unit	
1 to 30	Fixed CQI	16	–	
<CQI_Min>	Description of parameters	Def. value	Def. unit	
1 to 30	Min. CQI	1	–	
<CQI_Max>	Description of parameters	Def. value	Def. unit	
1 to 30	Max. CQI	30	–	
<CQI_Start_Value>	Description of parameters	Def. value	Def. unit	
1 to 30	Start value for the CQI conformance test	16	–	
<HARQ_Number>	Description of parameters	Def. value	Def. unit	
1 to 8	Number of HARQ processes	2	–	

Description of command	Sig. State
This command performs a fast combined channel configuration for the CQI channel.	all[7]

[7] Unrestricted in HSDPA test mode, <CONN (CS) and <PEST (PS) in packet data test mode.

User Defined Channel (UDCHannel)

The subsystem *BSSignal:HSDSch:UDCHannel* configures the HSDPA signal with user-defined parameters. It corresponds to the *User Defined Channel* section in the *BS Signal* tab of the *Connection Control* menu.

CONFigure:BSSignal:HSDSch:UDCHannel:TTIDistance <*TTIs*>				Inter-TTI Distance
<TTIs>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 3	Number of TTIs	3	–	V3.80
Description of command				Sig. State
This command sets the minimum distance between two consecutive Transmission Time Intervals (TTIs) in which the HS-DSCH is allocated to the UE. The setting takes effect when HS-DSCH configuration as a *User Defined* channel is selected (`CONFigure:BSSignal:HSDSch:TYPE UDCH`).				all[8]

CONFigure:BSSignal:HSDSch:UDCHannel:HARQ <*Number*>				No. of H-ARQ Processes
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 8	Number of HARQ processes	2	–	V3.80
Description of command				Sig. State
This command sets the no. of Hybrid ARQ (Automatic Repeat Request) processes for retransmission. The setting takes effect when HS-DSCH configuration as a *User Defined* channel is selected (`CONFigure:BSSignal:HSDSch:TYPE UDCH`).				all[8]

CONFigure:BSSignal:HSDSch:UDCHannel:TBLock:SINDex <*Number*>				Transport Block Size Index
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 62	Transport block size index (k_i)	41	–	V3.80
Description of command				Sig. State
This command sets the transport block size index. The setting takes effect when HS-DSCH configuration as a *User Defined* channel is selected (`CONFigure:BSSignal:HSDSch:TYPE UDCH`).				all[8]

CONFigure:BSSignal:HSDSch:UDCHannel:TBLock:SIZE? <*Number*>				Transport Block Size
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 28800	Transport block size	INV	(bits)	V3.80
Description of command				Sig. State
This command is always a query and returns the number of bits per transport block.				all

CONFigure:BSSignal:HSDSch:UDCHannel:NCODes <*Number*>				No. of Physical Channel Codes
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 15	Number of Physical Channel Codes	5	–	V3.80
Description of command				Sig. State
This command sets the number of physical HS-DSCH channelization codes. The setting takes effect when HS-DSCH configuration as a *User Defined* channel is selected (`CONFigure:BSSignal:HSDSch:TYPE UDCH`).				all[8]

[8] Unrestricted in HSDPA test mode, <CONN (CS) and <PEST (PS) in packet data test mode.

CONFigure:BSSignal:HSDSch:UDCHannel:MODulation <*Scheme*>				Modulation
<Scheme>	Description of parameters	Def. value	Def. unit	FW vers.
QPSK | QAM16	QPSK modulation 16QAM modulation	QPSK	–	V3.80
Description of command				Sig. State
This command sets the modulation scheme of the user-defined HSDPA signal. The setting takes effect when HS-DSCH configuration as a *User Defined* channel is selected (`CONFigure:BSSignal:HSDSch:TYPE UDCH`).				all[9]

CONFigure:BSSignal:HSDSch:UDCHannel:IRBuffer? <*Bits*>				IR Buffer Size
<Bits>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 172800	Buffer size	NAN	(bits)	V3.80
Description of command				Sig. State
This command is always a query and returns the size of the virtual IR buffer used in the H-ARQ process.				all

CONFigure:BSSignal:HSDSch:UDCHannel:MDPSize:MODE <*Mode*>				MAC-d PDU Size Control
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
AUTO | MAN	Automatic adjustment of MAC-d PDU size Manual setting	AUTO	–	V4.20
Description of command				Sig. State
This command selects automatic or manual setting of the MAC-d PDU size.				SOFF SON REG

CONFigure:BSSignal:HSDSch:UDCHannel:MDPSize:MANual <*Bits*>				MAC-d PDU Size, manual
<Bits>	Description of parameters	Def. value	Def. unit	FW vers.
112 | 120 … 5000	MAC-d PDU size	NAN	(bits)	V4.20
Description of command				Sig. State
This command defines the MAC-d PDU size for manual setting (`CONFigure:BSSignal:HSDSch:UDCHannel:MDPSize:MODE MAN`).				SOFF SON REG

CONFigure:BSSignal:HSDSch:UDCHannel:MDPSize:AUTO? <*Bits*>				MAC-d PDU Size, automatic
<Bits>	Description of parameters	Def. value	Def. unit	FW vers.
112 | 120 … 5000	MAC-d PDU size	NAN	(bits)	V4.20
Description of command				Sig. State
This command is always a query and returns the MAC-d PDU size that the R&S CMU determined automatically (`CONFigure:BSSignal:HSDSch:UDCHannel:MDPSize:MODE AUTO`).				all

CONFigure:BSSignal:HSDSch:UDCHannel:MPARtition <*Mode*>				Memory Partitioning
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
IMPL | EXPL	Implicit partitioning (by UE) Explicit partitioning (signaled by R&S CMU)	IMPL	–	V4.20
Description of command				Sig. State
This command selects implicit or explicit partitioning of the soft memory buffer in the MAC-hs.				all[9]

[9] Unrestricted in HSDPA test mode, <CONN (CS) and <PEST (PS) in packet data test mode.

CONFigure:BSSignal:HSDSch:UDCHannel:MSIZe:MODE Memory Size Control (Explicit)
<Mode>

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
MANual | **AUTOmatic |** **DEFault**	The explicit memory size is defined manually The explicit memory size is determined automatically The explicit memory size control mode is set to default	AUTO	–	V4.32

Description of command

This command specifies how the explicit memory size for the UE's soft memory buffer in the MAC-hs entity is determined.

If used as a query, the command returns the currently set memory size control mode.

CONFigure:BSSignal:HSDSch:UDCHannel:MSIZe:AUTO? Memory Size Settings

<Memory Size>	Description of parameters	Def. value	Def. unit	FW vers.
800 ... 304000	Automatic explicit memory size	14400	bit	V4.32

Description of command

This command is always a query and returns the value of the memory size when the explicit memory size control is set to *Auto* for the UE's soft memory buffer in the MAC-hs entity.

CONFigure:BSSignal:HSDSch:UDCHannel:MSIZe:MANual <*Size*> Memory Size (Explicit)

<Size>	Description of parameters	Def. value	Def. unit	FW vers.
800 | 1600 | **2400 | ... | 304000 |**	Memory size (in steps of 800 up tp 16000 bit, then in steps of 1600 up to 304000)	800	bit	V4.32
MINimum | **MAXimum |** **DEFault**	Memory size set to minimum (800 bit) Memory size set to maximum (304000 bit) Memory size set to default value			

Description of command

This command sets the explicit memory size for the UE's soft memory buffer in the MAC-hs entity. This setting only becomes effective when `CONFigure:BSSignal:HSDSch:UDCHannel:MSIZe:MODE` is set to *MANual*.

If used as a query, the command returns the currently set memory size.

CONFigure:BSSignal:HSDSch:UDCHannel:RWSize <*Bits*> Receiver Window Size

<Bits>	Description of parameters	Def. value	Def. unit	FW vers.
1 | 8 | 16 | 32 | 64 | 128| 256 | 512 | 768 | 1024 | 1536 | 2047 | 2560 | 3072 | 3584 | 4095	Window size	2047	(bits)	V4.20

Description of command	Sig. State
This command specifies the size of the receiver window in the UE for user-defined channels. Use `CONFigure:BSSignal:HSDSch:RWSize` to specify the receiver window size for all channel types.	SOFF SON REG

CONFigure:BSSignal:HSDSch:UDCHannel:RVCSequence <*Sequence*> RV Coding Sequence

<*Sequence*>	Description of parameters		Def. value	Def. unit	FW vers.
S0 | **S6 |** **S0256 |** **S6215 |** **S0000 |** **S6666 |** **S6045 |**	{ 0 } { 6 } { 0, 2, 5, 6 } { 6, 2, 1, 5 } { 0, 0, 0, 0 } { 6, 6, 6, 6 } { 6, 0, 4, 5 }	(Single Transmission, QPSK) (Single Transmission, 16QAM) (FRC, QPSK) (FRC, 16QAM) (Chase Combining, QPSK) (Chase Combining, 16QAM) (Chase Combining with constellation re-arrangement, 16QAM)	S0256	–	V3.80
EMODe	Edit mode				

Description of command	Sig. State
This command selects the RV coding sequence of the user defined channel. The setting takes effect when HS-DSCH configuration as a *User Defined* channel is selected (`CONFigure:BSSignal:HSDSch:TYPE UDCH`). If EMOD is active an arbitrary RV coding sequence can be set; see commands `CONFigure:BSSignal:HSDSch:UDCHannel:EMSequence<nr>` and `CONFigure:BSSignal:HSDSch:UDCHannel:EMSequence:ALL`.	all[10]

CONFigure:BSSignal:HSDSch:UDCHannel:EMSequence:LENGth <*Length*> Edit Mode – Sequence Length

<*Length*>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 8	Number of retransmissions + 1	8	–	V3.80

Description of command	Sig. State
This command defines the length of the RV coding sequence. The sequence can define one initial transmission plus 1 to 7 retransmissions, so the <*Length*> parameter is equal to the number of retransmissions plus one. The setting takes effect when HS-DSCH configuration as a *User Defined* channel is selected (`CONFigure:BSSignal:HSDSch:TYPE UDCH`) and if the edit mode is active (`CONFigure:BSSignal:HSDSch:UDCHannel:RVCSequence EMOD`).	all[10]

CONFigure:BSSignal:HSDSch:UDCHannel:EMSequence<nr> <*Value*> Edit Mode – Sequence

<*Value*>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7	Sequence value for transmission <nr> (<nr> = 1 to 8)	0	–	V3.80

Description of command	Sig. State
This command defines a single value of the RV coding sequence. If the numeric suffix is larger than the sequence length defined via `CONFigure:BSSignal:HSDSch:UDCHannel:EMSequence :LENGth`) the value is ignored. The setting takes effect when HS-DSCH configuration as a *User Defined* channel is selected (`CONFigure:BSSignal:HSDSch:TYPE UDCH`) and if the edit mode is active (`CONFigure:BSSignal:HSDSch:UDCHannel:RVCSequence EMOD`).	all[11]

[10] Unrestricted in HSDPA test mode, <CONN (CS) and <PEST (PS) in packet data test mode.
[11] Unrestricted in HSDPA test mode, <CONN (CS) and <PEST (PS) in packet data test mode.

CONFigure:BSSignal:HSDSch:UDCHannel:EMSequence:ALL Edit Mode – Sequence
<Value_1>, <Value_2>, …,<Value_8>

Parameters	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7, …, 0 to 7	RV coding sequence, first value … RV coding sequence, 8th value	0, …, 0	–	V3.80

Description of command	Sig. State
This command defines an arbitrary RV coding sequence consisting of 8 numbers. The parameter list must contain eight numbers, however, only the first n numbers (where n denotes the sequence length defined via `CONFigure:BSSignal:HSDSch:UDCHannel:EMSequence:LENGth`) are used. The setting takes effect when HS-DSCH configuration as a *User Defined* channel is selected (`CONFigure:BSSignal:HSDSch:TYPE UDCH`) and if the edit mode is active (`CONFigure:BSSignal:HSDSch:UDCHannel:RVCSequence EMOD`).	all[11]

CONFigure:HSDPA[:COMBined]:UDCHannel <*Set*> User Defined Channel, combined parameters ***<Beta_c>, <Beta_d>, <Delta_ACK>, <Delta_NACK>, <Delta_CQI>, <Period>, <CQI_Factor>, <ACK_Factor>, <Inter TTI>, <HARQ_Number>, <TP Size>, <Phys_Codes>, <Mod_Scheme>, <Mem_Part>***				
<Beta_c>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 15	DPCCH gain factor	9	–	V4.20
<Beta_d>	Description of parameters	Def. value	Def. unit	
1 to 15	DPDCH gain factor	15	–	
<Delta_ACK>	Description of parameters	Def. value	Def. unit	
0 to 8	Power offset parameter Δ_{ACK}	5	–	
<Delta_NACK>	Description of parameters	Def. value	Def. unit	
0 to 8	Power offset parameter Δ_{NACK}	5	–	
<Delta_CQI>	Description of parameters	Def. value	Def. unit	
0 to 8	Power offset parameter Δ_{CQI}	2	–	
<Period>	Description of parameters	Def. value	Def. unit	
C2 | C4 | C8 | C10 | C20 | C40 | C80 | C160 | OFF,	Feedback cycle length (query: without C) No CQI symbols sent (DTX)	C4	ms	
<CQI_Factor>	Description of parameters	Def. value	Def. unit	
1 to 4,	No. of consecutive CQI transmissions	1	–	
<ACK_Factor>	Description of parameters	Def. value	Def. unit	
1 to 4	No. of consecutive CQI transmissions	1	–	
<Inter TTI>	Description of parameters	Def. value	Def. unit	
1 to 3	Number of TTIs	3	–	
<HARQ_Number>	Description of parameters	Def. value	Def. unit	
1 to 8	Number of HARQ processes	2	–	
<TP Size>	Description of parameters	Def. value	Def. unit	
0 to 62	Transport block size index (k_i)	41	–	
<Phys_Codes>	Description of parameters	Def. value	Def. unit	
1 to 15	Number of Physical Channel Codes	5	–	
<Mod_Scheme>	Description of parameters	Def. value	Def. unit	
QPSK | QAM16	QPSK modulation 16QAM modulation	QPSK	–	
<Mem_Part>	Description of parameters	Def. value	Def. unit	
IMPL | EXPL	Implicit partitioning (by UE) Explicit partitioning (signaled by R&S CMU	IMPL	–	
Description of command				Sig. State
This command performs a fast combined channel configuration for the user defined channel.				all[12]

[12] Unrestricted in HSDPA test mode, <CONN (CS) and <PEST (PS) in packet data test mode.

HSUPA 5.76 Mbps (Option R&S CMU-K56)

With the supplementary option R&S CMU-K56 added to R&S CMU-K65 and R&S-K66, the R&S CMU200 supports 5.76 Mbps High Speed Uplink Packet Access (HSUPA) channels. The HSUPA functionality is available in *Non Signalling* and in *Signalling* mode. It consists of a HSUPA downlink generator and various HSUPA-specific measurement applications.

HSUPA TX Measurements

The R&S CMU supports all TX measurements on HSUPA channels. CDP Measurements with special HSUPA functionality are described below.

The HSUPA gain factors are described in Chapter 4 of this manual. For an introduction to WCDMA application testing with HSUPA connections refer to Chapter 9. The gain factors allow for a power ratio up to 20 dB between the UL HSUPA channels and the DPCCH. An excess E-DPCCH/DPCCH or E-DPDCH/DPCCH power ratio may prevent proper synchronization of the R&S CMU to the UL WCDMA signal, which typically results in EVM values >70%. The setting Connection Control – UE Code – DPCH WCDMA Settings – Synchronization Settings – Correlation Mode – DPCCH+DPDCH usually solves this problem.

***Exception:** At present, no CDP and Modulation WCDMA measurement results can be obtained if the UL signal is configured as follows: E-DPDCH/DPCCH power ratio > 12 dB, no DPDCH active, E-DPDCH spreading factor 2. Measurements that do not rely upon a DPCCH synchronization (e.g. Power, Spectrum…) can be performed without restriction.*

Typical HSUPA Test Settings for* Signalling *measurements

Many of the HSUPA measurements in Signalling *mode require a specific configuration of the connection scheme, the* BS Signal *and* UE Signal *settings. For an example refer to Chapter 2, section* Maximum Output Power with HS-DPCCH and E-DCH.

HSUPA Measurements

The measurements reported in this section are especially designed for HSUPA channels and require the HSUPA option R&S CMU-K56. The *E-DPCCH Logging* measurement is available in *Non Signalling* and in *Signalling* mode; the remaining measurements require the *Signalling* mode.

HSUPA Receiver Quality Tests

The *Receiver Quality* measurement covers the following uplink HSUPA applications, to be performed in HSUPA test mode:

- In the *HSUPA E-AGCH* application, the R&S CMU counts the received E-TFCI values from the UE and compares them to the expected E-TFCIs, corresponding to the absolute grant sequence sent on the E-AGCH; see section *HSUPA E-AGCH Measurement* on p. 8.149.
- In the *HSUPA E-RGCH* application, the R&S CMU records the received E-TFCI values from the UE and compares them to the expected E-TFCIs, corresponding to a relative grant sequence sent on the E-RGCH; see section *HSUPA E-AGCH Measurement* on p. 8.149.
- The purpose of the *HSUPA E-HICH* measurement is to test the detection of the E-DCH HARQ Indicator Channel (E-HICH). The R&S CMU transmits a selectable ACK/NACK pattern on the DL E-

HICH and counts the number of correct and false responses of the UE; see section *HSUPA E-HICH Measurement* on p. 8.156.

- The *E-DPCCH Logging* application of the *Receiver Quality* measurement provides the decoded E-DPCCH information from the UE in 1000 consecutive Transmission Time Intervals (TTIs); see section *E-DPCCH Logging Measurement* on p. 8.159.
- The *HSUPA Throughput* application provides CRC-based block error rate and throughput tests on HSUPA channels; see section *HSUPA Throughput Measurement* on p. 8.163.

In addition, the R&S CMU provides RLC throughput / BLER measurements on HSUPA channels. A packet data connection for WCDMA application tests must be established as described in Chapter 4, section *Packet Switched Connections*, and an external server is needed. See section RLC BLER Measurements on p. 8.161.

For general notes on HSUPA tests refer to section *HSUPA in Signalling Mode* on p. 8.178.

HSUPA E-AGCH Measurement

In the *HSUPA E-AGCH* measurement, the R&S CMU counts the received E-TFCI values from the UE and compares them to the expected E-TFCIs, corresponding to the absolute grant sequence sent on E-AGCH. The measurement has been designed for the *Demodulation of E-AGCH* test described in the conformance test specification 3GPP TS 34.121. The *HSUPA E-AGCH* measurement is a *Receiver Quality* application which is available in *Signalling* mode.

The *HSUPA E-AGCH* application provides two measurement types:

"*General Histogram*" shows a histogram of the received E-TFCI values:

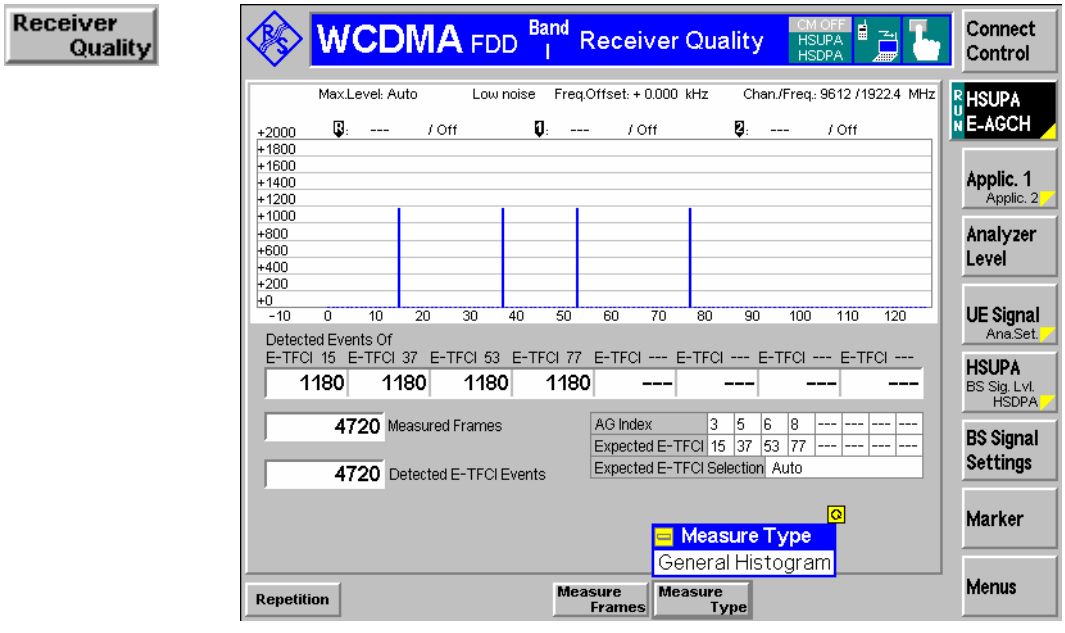


Fig. 8-30 “General Histogram” measurement type

"*Missed Detection*" correlates the received E-TFCI values with expected E-TFCI values:

The R&S CMU provides two alternative methods for determining the expected E-TFCI values:

- Automatic calculation by the R&S CMU according to the parameters of the connection.
- Manual setting, e.g. according to the values quoted in the conformance test specification.

In general, the R&S CMU can automatically determine the correct E-TFCI values. Situations where the automatic detection may fail (e.g. a UE transmitting close to its maximum transmitter output power or additional relative grants) do not correspond to the specified conditions for the E-AGCH conformance test. However, it is still possible to perform the E-AGCH measurement in these situations using manual E-TFCI setting.

The expected E-TFCI values are related to the AG pattern of the generator (set in *BS Signal)*. Their number is the same as the AG pattern length. Each AG value is mapped to an expected E-TFCI value. If a received E-TFCI doesn't match the expected E-TFCI, a missed detection is counted. The "missed detection" type can be used for the E-AGCH conformance test described in standard 3GPP TS 34.121.

Note: *The values in the AG pattern used for the E-AGCH conformance test must be unique. This means that all Expected E-TFCI Values must be different from each other.*

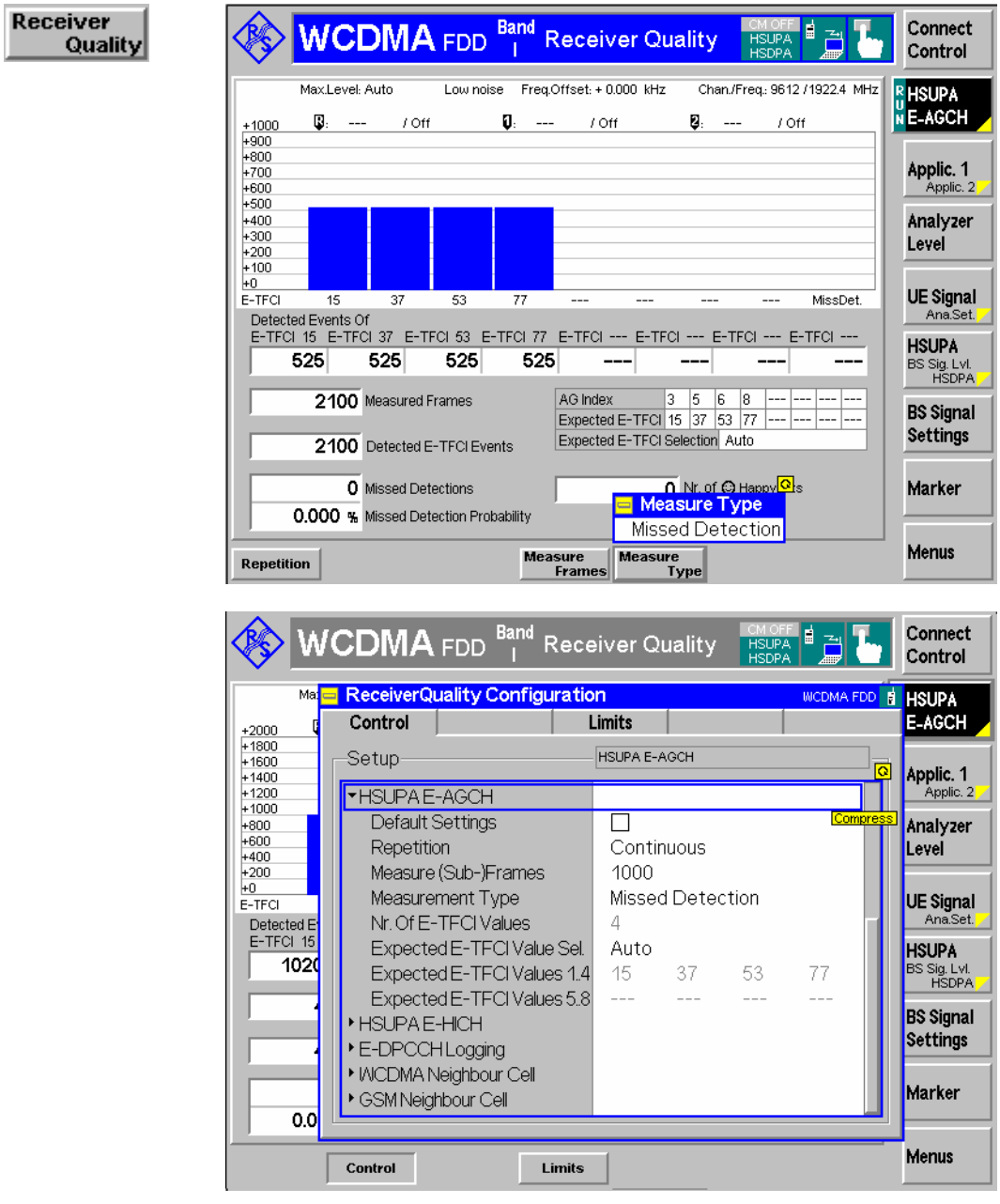


Fig. 8-31 “Missed Detection” measurement type

Remote control `CONFigure:RXQuality:EAGCh:…`

HSUPA E-AGCH Measurement Results

The HSUPA E-AGCH results depend on the measurement type.

General Histogram

The diagram in the *General Histogram* view shows the distribution of all detected E-TFCIs (range 0 to 127), irrespective of the *Expected E-TFCI Values* and the happy bit setting. The statistics for the 8 most frequently detected E-TFCIs is displayed below the diagram.

Detected Events of E-TFCI — Table of up to 8 most frequently detected E-TFCI values and their count. If a periodic AG pattern of length n is used, the expected ideal result is as follows: The first n detected E-TFCIs are equal to the n *Expected E-TFCI Values*. Each of the values is detected *Detected E-TFCI Events / n* times. No additional E-TFCIs are detected.

Measured Subframe — Number of measured TTIs. Ideally, one E-TFCI value is detected per TTI, so the number of measured TTIs corresponds to the sum of the expected E-TFCI counts in the diagram.

Detected E-TFCI Events — Sum of all E-TFCI events in the histogram; ideally equal to the *Measured Subframe* count. A smaller number of E-TFCI events indicates transmission errors.

Missed Detection

The *Missed Detection* diagram shows a subset of the bars in the *General Histogram* view, corresponding to the eight *Expected E-TFCI Values* from the *Receiver Quality Configuration* menu. For all values in this view, only TTIs with sufficiently filled UE RLC transmit buffer (happy bit value: unhappy) are counted. In addition to the statistical values in the *General Histogram* view (referenced to the subset of *Expected E-TFCI Values)*, the following E-AGCH conformance test results are displayed:

Missed Detections — Number of TTIs where the R&S CMU did not detect the expected E-TFCI value although the happy bit was not set (unhappy).

Missed Det. Probability — Ratio of the number of *Missed Detections* to the *Detected E-TFCI Events.*

No. of Happy Bits — Number of TTIs which were discarded because the happy bit was set.

Remote control

```
READ[:SCALar]:RXQuality:EAGCh:MDETection?
READ:ARRay:RXQuality:EAGCh:MDETection?
READ[:SCALar]:RXQuality:EAGCh:GENeral
READ:ARRay:RXQuality:EAGCh:GENeral?
CALCulate[:SCALar]:RXQuality:EAGCh:MDETection:MATChing:LIMit?
```

HSUPA E-RGCH Measurement

In the *HSUPA E-RGCH* measurement, the R&S CMU transmits a sequence of relative grant values on the E-RGCH and compares the received E-TFCI values from the UE to the expected E-TFCIs, corresponding to the relative grant sequence sent. The measurement has been designed for the *Detection of E-DCH Relative Grant Channel* test described in the conformance test specification 3GPP TS 34.121, section 10.3.1 (single link performance, 10 ms and 2 ms TTI). The *HSUPA E-RGCH* measurement is a *Receiver Quality* application which is available in *Signalling* mode.

According to the test specification, the E-RGCH detection must be tested using alternating “DOWN / UP” relative grant values for each H-ARQ process (“Missed UP/DOWN Test”) and using “DTX” values

("Missed HOLD Test"). The R&S CMU automatically activates the sub-test and calculates the test results depending on the selected sequence of relative grant values.

The measurement procedure and necessary measurement settings also depend on the measurement type. The following paragraphs give an overview.

Measurement procedure and purpose

The E-RGCH measurement starts at a specific E-TFCI operating point of the UE, corresponding to the first absolute grant (AG) index in the R&S CMU's *AG Pattern*. In a "Missed UP/DOWN Test", the first relative grant value is always DOWN. The UE is allowed to use E-TFCI values in a range of *Expected E-TFCI* values around the initial operating point. If the UE receives all relative grant values correctly, an alternating or "DTX" relative grant sequence will ensure that it always operates in the vicinity of the initial operating point.

If relative grant values are received in error, the operating point can shift outside the *Expected E-TFCI* range. If this happens, the R&S CMU200 will automatically re-adjust the initial operating point in order to continue the measurement. See section *HSUPA E-RGCH Test Settings* on p. 8.154.

Measurement settings

After a preset of the R&S CMU200 and selection of the E-RGCH measurement, a series of message boxes will advise you to adjust the following settings:

1. To ensure that the UE always transmits new data, select *Connection Control – UE Signal – HSUPA – RAB H-ARQ Profile – Max. Number of Retransmissions: 0.*
2. Switch on the HSUPA channels including the E-RGCH: *Connection Control – BS Signal – Downlink Physical Channels – HSUPA Channels: On* and *E-RGCH/E-HICH – E-RGCH Active: On*.
3. Open the *BS Signal – HSUPA – E-RGCH / E-HICH – Relative Grant (E-RGCH)* section and select a suitable relative grant pattern. For the "Missed UP/DOWN test", select the *Alternating H-ARQ Cycle* mode. For the "Missed HOLD" test, select an *All DTX* mode.
4. To be consistent with the test specification, switch off the E-HICH power: *HARQ Feedback (E-HICH) – Mode: All DTX*.

A few more settings are recommended:

5. Select *Connection Control – BS Signal – HSUPA: RLC PDU Size: 112.*

A low PDU size ensures that every "UP" or "DOWN" relative grant value will actually result in an E-TFCI change. The value of 112 is consistent with the test specification.

6. Select *Connection Control – BS Signal – HSUPA – E-AGCH – AG Pattern – AG Index* and set the first index value to 5.

An AG index value of 5 will ensure consistency with the test specification (for TTI = 10 ms) when the R&S CMU initializes or re-adjusts the operating point of the UE.

HSUPA E-RGCH Measurement Results

During a HSUPA E-RGCH measurement, the R&S CMU collects and displays either the *Missed UP / DOWN Test* or the *Missed HOLD Test* results.

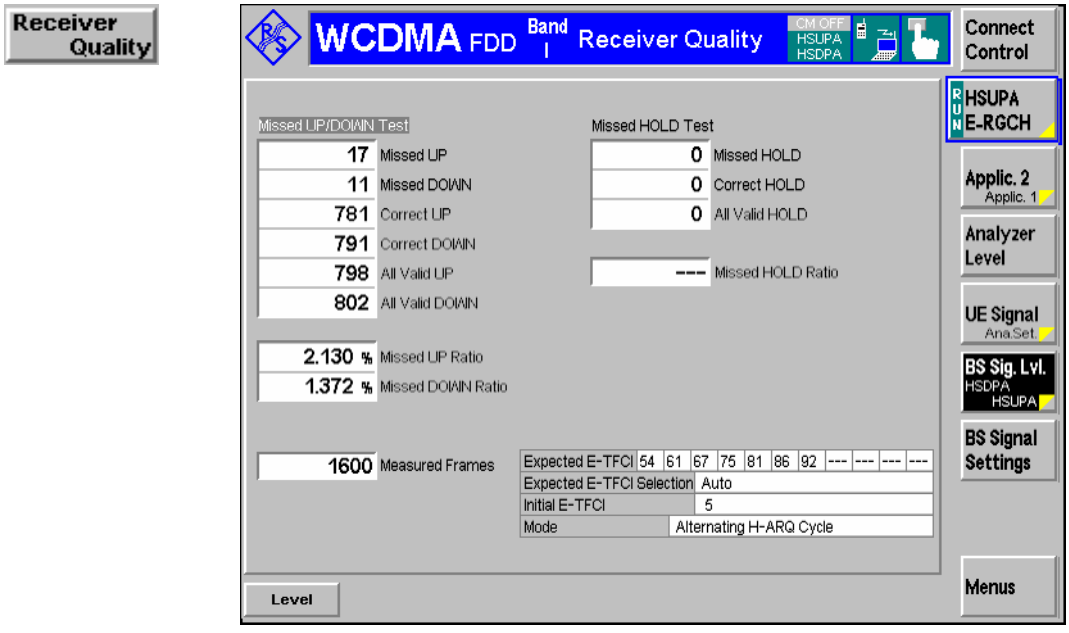


Fig. 8-32 HSUPA E-RGCH measurement results

Missed UP/DOWN Test

Up and down detections of the UE that the R&S CMU collected during a "Missed UP/DOWN" test.

Missed UP / DOWN Number of UP or DOWN relative grant values that the UE received in error.

Correct UP / DOWN Number of UP or DOWN relative grant values that the UE received correctly.

All Valid UP / DOWN Sum of the missed and the correct UP or DOWN events.

Missed UP / DOWN Ratio Missed UP or DOWN events / All Valid UP or DOWN events

Note: *In accordance with the test specification TS 34.121, the measurement only evaluates TTIs with happy bit = unhappy. This ensures that the UE transmits at its maximum data rate.*

Missed HOLD Test

HOLD ("DTX") detections of the UE that the R&S CMU collected during a "Missed HOLD" test. The results are analogous to the *Missed UP/DOWN Test* results.

Remote control

`READ[:SCALar]:RXQuality:ERGCh?`

Limit check

A red output field and an arrow pointing upwards indicates that the *Missed UP / DOWN / HOLD Ratio* exceed the limits defined in the *Limits* tab of the *Receiver Quality Configuration* menu, see section *HSUPA E-RGCH Test Settings* on p. 8.154.

Remote control
`CALCulate[:SCALar]:RXQuality:ERGCh:MATChing:LIMit?`

Settings

The statistical settings *(Measured Frames)* and the operating range of the UE are displayed in the lower part of the measurement diagram; see section *HSUPA E-RGCH Test Settings* on p. 8.154.

HSUPA E-RGCH Test Settings

Many of the test parameters can be set in the *Connection Control* menu. Refer to the *Measurement Settings* paragraph in section *HSUPA E-RGCH Measurement* on p. 8.151.

The operating range of the UE is configured in the *Control* tab of the *Receiver Quality Configuration* dialog.

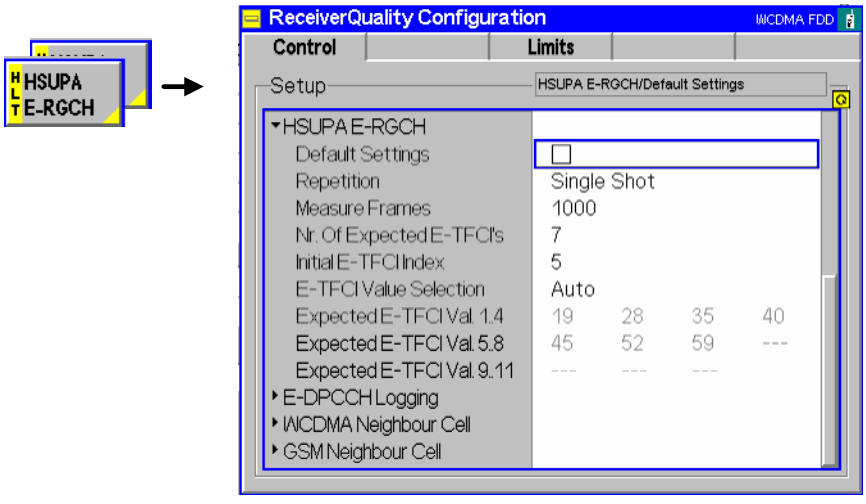


Fig. 8-33 HSUPA E-RGCH settings (Control)

The *Repetition* mode and *Stop Condition* are analogous for all measurement applications. The following settings are *HSUPA E-RGCH*-specific.

Measure (Sub)Frames

Number of relative grant values that the R&S CMU transmits per measurement cycle (one value per TTI, i.e. per WCDMA frame / subframe for a 10 ms / 2 ms TTI).

- For the “Missed UP/DOWN” test, “Measure Subframes” denotes the sum of the UP and DOWN values.
- For the “Missed HOLD” test, “Measure Subframes” denotes the number of “DTX” values.

Remote control
`CONFigure:RXQuality:ERGCh:CONTrol:MSUBframes`

No. of Expected E-TFCIs

Number of valid E-TFCI values in the *Expected E-TFCI* table below. If the operating point of the UE is shifted outside the E-TFCI range, the initial operating point is re-adjusted.

Remote control
`CONFigure:RXQuality:ERGCh:CONTrol:ETFCi:NEXPected`

Initial E-TFCI Index

Position of the initial operating point in the *Expected E-TFCI* table below.

Remote control
`CONFigure:RXQuality:ERGCh:CONTrol:ETFCi:INITial`

E-TFCI Value Selection

Switches between automatic and manual *Expected E-TFCI* settings:

Auto The *Expected E-TFCI* table is calculated, depending on the current DL and UL signal configuration. The measurement starts at the *Initial E-TFCI* position. With compatible settings (see

section *HSUPA E-RGCH Measurement* on p. 8.151), the calculated E-TFCI values are all different and in ascending order. This mode is recommended unless a special UE configuration is used, where the calculated values need to be corrected manually.

Manual Manual setting of the *Expected E-TFCI* values. The values must correspond to the R&S CMU and UE configuration. The measurement can be started only if the initial operating point is set in accordance with the first *AG Index,* and if the E-TFCI values are all different and in ascending order.

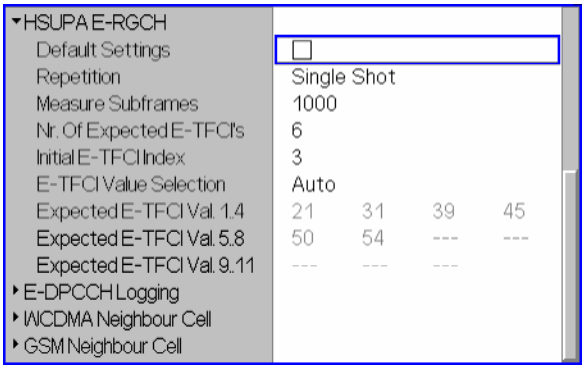
Note: *The RLC PDU Size (Connection Control – BS Signal – HSUPA: RLC PDU Size) is a critical parameter for the dependence between E-TFCI values and relative grants. A small RLC PDU Size generally ensures that every UP or DOWN relative grant value actually changes the E-TFCI at the UE.*

Remote control
`CONFigure:RXQuality:ERGCh:CONTrol:ETFCi:MODE`

Expected E-TFCI E-TFCI values expected from the UE, either defined manually or calculated by the R&S CMU. If several of the calculated E-TFCI values are equal, the table shows invalid results. With a first *AG Index: 5* and *RLC PDU Size: 112* and a 10 ms TTI, the calculated values correspond to the values in 3GPP TS 34.121, Table 10.3.1.1.4.2.1 (see Fig. 8-33 on p. 8.154).

Ambiguous E-TFCI for 2 ms TTI:

For HSUPA TTI = 2ms, the conformance test specification stipulates an operation range containing an *ambiguous E-TFCI* (see 3GPP TS 34.121 Table 10.3.1.2.4.2.1). It is not possible to directly specify an *ambiguous E-TFCI* value in the E-RGCH measurement control settings. Select the *Nr. of Expected E-TFCIs* and the *Initial E-TFCI Index* as shown below.



With these settings, the HSUPA E-RGCH measurement operates as described in the conformance test specification. According to 3GPP 34.121 the operating point should be re-adjusted when the operating point is shifted into the range of *ambiguous E-TFCI* values. The R&S CMU re-adjusts the operating point when the operating point is shifted out of the operating table. With the above settings, this is equivalent to the requirement of the test specification.

Note that the automatically calculated *Expected E-TFCI* values in the figure above are based on the 3GPP TS 34.121 settings, namely TTI = 2 ms, AG value = 4, RLC PDU size = 112 bits.

Remote control
```
CONFigure:RXQuality:ERGCh:CONTrol:ETFCi:AUTO<nr>
CONFigure:RXQuality:ERGCh:CONTrol:ETFCi:MANual<nr>
```

The *Limits* tab of the *Receiver Quality Configuration* menu defines upper limit for the missed DOWN / UP / HOLD ratios.

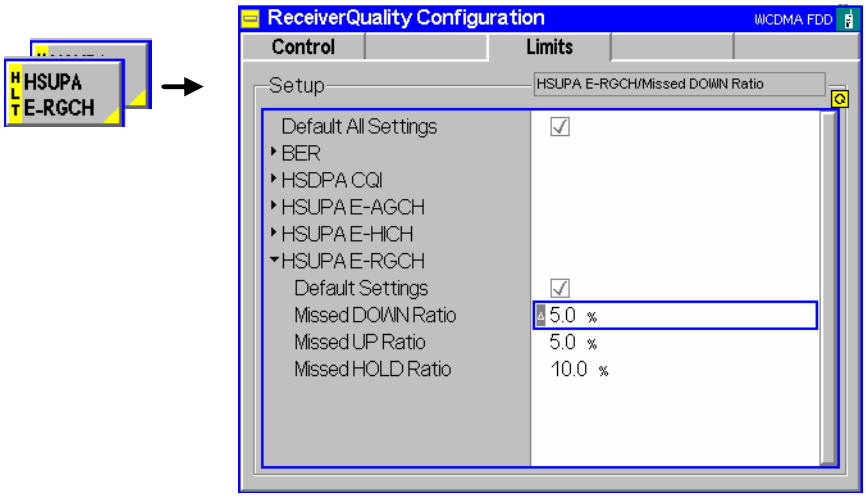


Fig. 8-34 HSUPA E-RGCH settings (Limits)

Remote control
```
CONFigure:RXQuality:ERGCh:LIMit[:SCALar]
      :ASYMmetric[:COMBined]:VALue
```

HSUPA E-HICH Measurement

The purpose of the *HSUPA E-HICH* measurement is to test the detection of the E-DCH HARQ Indicator Channel (E-HICH). The R&S CMU transmits a selectable ACK/NACK pattern on the DL E-HICH and counts the number of correct and false responses of the UE. The evaluation is based on the Retransmission Sequence Number (RSN) that the UE transmits on the UL E-DPCCH:

- After receiving an ACK value, the UE is expected to indicate the transmission of a new data block (no retransmission)
- After receiving a NACK or DTX value, the UE is expected to indicate a retransmission.

In response of a received NACK or DTX value each block can be retransmitted several times until the maximum number of retransmissions is reached. After this limit, the UE will send new data, irrespective of the received HARQ indicator value. The first new data block after a complete retransmission cycle is not counted as a test sample.

The *HSUPA E-HICH* measurement is suitable for the *Detection of E-DCH HARQ ACK Indicator Channel* test described in the conformance test specification 3GPP TS 34.121, section 10.2. The measurement is a *Receiver Quality* application which is available in *Signalling* mode.

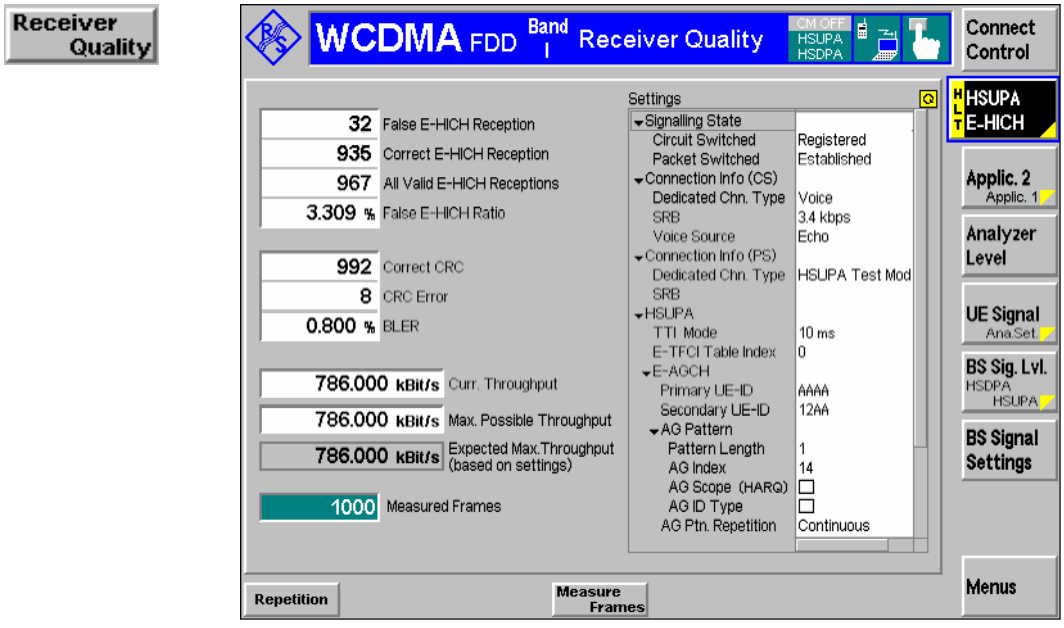


Fig. 8-35 HSUPA E-HICH measurement

HSUPA E-HICH Measurement Results

The results of the *HSUPA E-HICH* measurement appear in three groups of output fields in the left half of the measurement menu (see Fig. 8-35 above).

E-HICH Reception

The upper group of ouput fields is based on the evaluation of the RSN field of the E-DPCCH and shows the following values:

False E-HICH Reception Number of transmissions that the UE received incorrectly. Two classes of events contribute to the *False E-HICH Reception:*

1. The R&S CMU sends an ACK but the UE retransmits data (the “missed ACK” events from the conformance test specification).
2. The R&S CMU sends a NACK or DTX but the UE sends new data, although the maximum number of retransmissions is not reached yet (the “false ACK” events from the conformance test specification).

Correct E-HICH Rec. Number of transmissions that the UE received correctly.

All Valid E-HICH Rec. The sum of the previous two numbers. The first new data block after a complete retransmission cycle is not counted as a test sample. Therefore, the number of valid E-HICH receptions is possibly lower than the total number of *Measured Frames* displayed below.

Example: With an all NACK pattern transmitted to the UE and a maximum number of 7 retransmissions (8 transmissions in total), the ratio <All Valid E-HICH Receptions> to <Measured Subframes> is approximately 7/8.

False E-HICH Ratio Ratio of *False E-HICH Reception* to *All Valid E-HICH Receptions.*

CRC Errors The results of this and the following group of output fields are based on a CRC analysis of the E-DPDCH re-transmitted by the UE under test.

Correct CRC Number of transmissions with correct CRC.

CRC Errors Number of transmissions with incorrect CRC.

BLER Block error rate; the ratio of <CRC Errors> / (<Correct CRC> + <CRC Errors>).

Throughput The lower group of output fields shows the following values:

Curr. Throughput Data throughput on layer 1 level: The number of E-DPDCH data bits (without CRC bits) transmitted per unit of time that the R&S CMU could receive correctly. Transmissions with failed CRC check do not contribute to the current throughput. With good transmission conditions, the *Current Throughput* is equal to the maximum possible throughput (no CRC errors).

The R&S CMU calculates the current throughput from the number of received packets per unit of time times the number of user data bits in each packet, depending on the E-TFCI values received on the E-DPDCH.

Max. Poss. Throughput Maximum current throughput for HSUPA, in case that all bits are received correctly (no CRC errors). The maximum possible throughput is calculated in L1 by means of the measured E-TFCI.

Expected Max. Throughput (based on settings)
Maximum throughput for HSUPA, in case that the UE sends at the maximum data rate (depending on the current settings), and that no CRC errors occur. This value is greater or equal to the measured “Max. Poss. Throughput”. The maximum throughput for HSUPA with a 10 ms TTI is 2000.000 kbit/s.

Measured Frames Total number of subframes (transmission packets) measured. This number can exceed the value *All Valid E-HICH Receptions;* see above.

Remote control
```
READ[:SCALar]:RXQuality:EHICh?  etc.
READ[:SCALar]:RXQuality:EHICh:BLER?  etc.
CALCulate[:SCALar]:RXQuality:EHICh:MATChing:LIMit?
READ[:SCALar]:RXQuality:EHICh:EMTHroughput?  etc.
```

HSUPA E-HICH Test Settings

Many of the test parameters can be set in the *Connection Control* menu. In particular, the transmitted ACK/NACK pattern is selected in the *HSUPA – E-RGCH/E-HICH – HARQ Feedback (E-HICH)* section of the *BS Signal* tab (see *HARQ Feedback (E-HICH)* on p. 8.173). An *All ACK* and *All DTX* pattern is required for the E-HICH test according to the conformance test specification.

The measurement scope and the limit for the false E-HICH ratio can be set in the *Receiver Quality Configuration* menu:

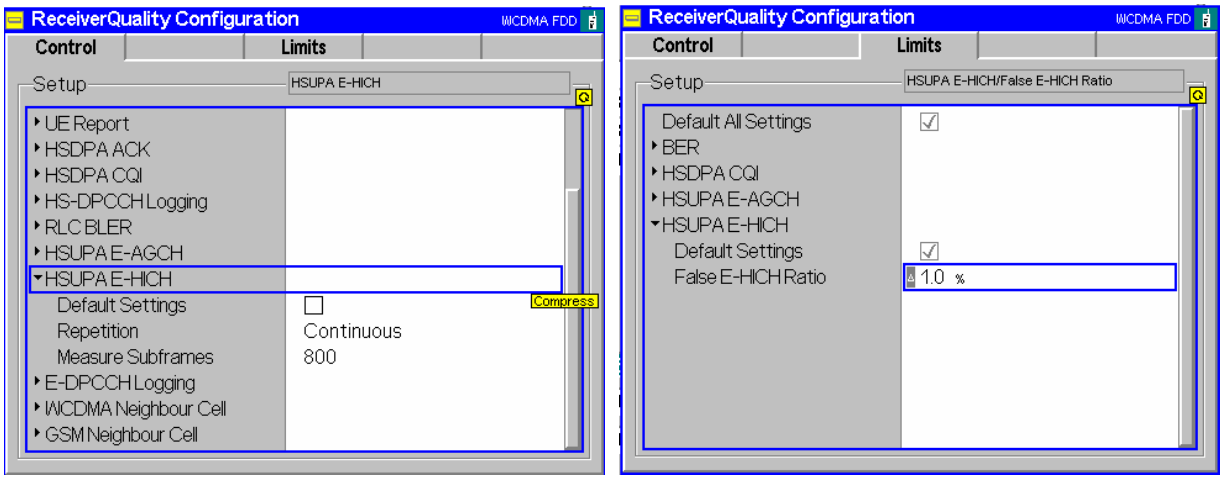


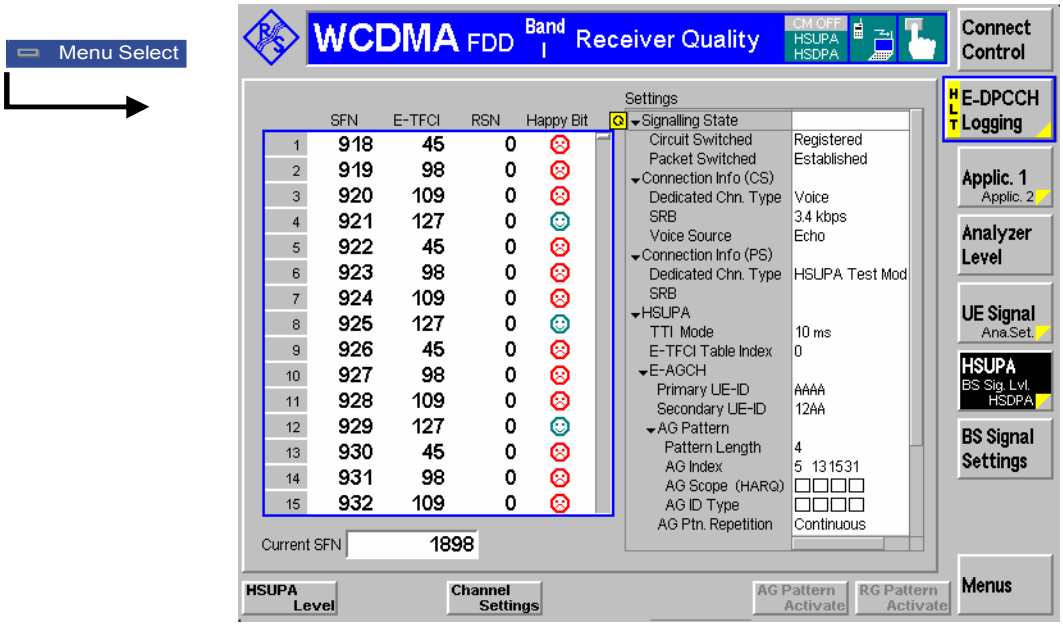
Fig. 8-36 HSUPA E-HICH settings

E-DPCCH Logging Measurement

The *E-DPCCH Logging* application of the *Receiver Quality* measurement provides the decoded E-DPCCH information from the UE in 1000 consecutive Transmission Time Intervals (TTIs). This application is available in *Non Signalling* and in *Signalling* mode.

The *E-DPCCH Logging* measurement is similar to the *HS-DPCCH Logging* measurement described on p. 8.16.

- To access the *E-DPCCH Logging* measurement menu, select the *Receiver Quality* measurement and press *Application – E-DPCCH Logging*.
- In *Non Signalling* mode, the HSDPA signal in the *Connection Control – Generator* tab must be switched *On* to induce the R&S CMU to measure the E-DPCCH. In *Signalling* mode the HS-DPCCH is measured while the R&S CMU is in HSUPA test mode.



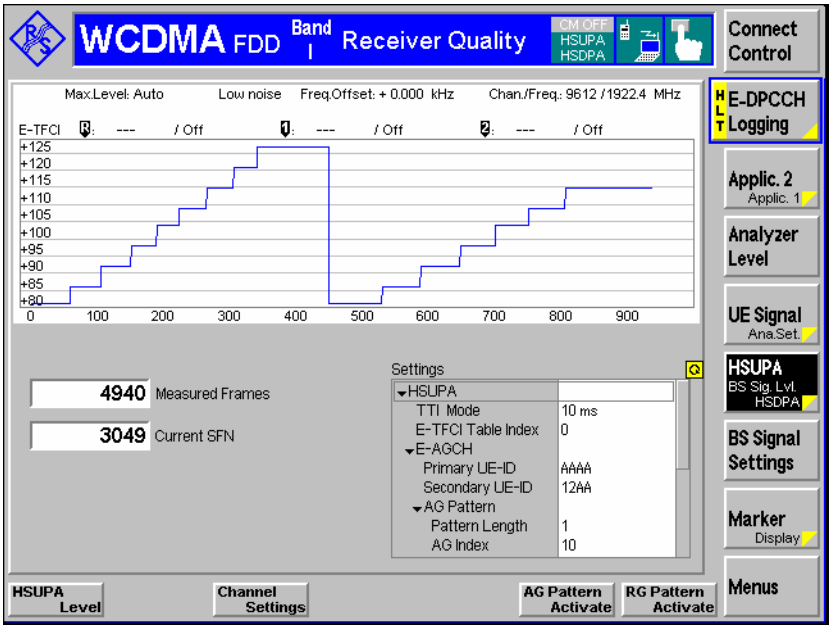


Fig. 8-37 *E-DPCCH Logging* measurement (Table & Info Tree and Diagram)

The following hotkeys are associated with the *E-DPCCH* measurement control softkey:.

Start SFN

Specifies the first System Frame Number (SFN) for which the E-DPCCH information is displayed. In the default setting *Off,* the measurement starts as soon as possible. If a number between 0 and 4095 is entered, the measurement starts in the next WCDMA frame with the specified SFN.

The *Current SFN* is displayed from the start of the measurement. It can be used to monitor the time until the *Start SFN* is reached and the result table if filled.

Remote control
`CONFigure:RXQuality:HSULog:CONTrol:SSFN`

Select View

Switches between the two diagram types shown above. The trace shows the decoded E-TFCI vs the slow number.

Remote control
No command, display configuration only.

Table Tree

Sets the focus on the result table or on the *Settings* table in the right half of the menu (for scrolling).

Remote control
No command, display configuration only.

For a statistical evaluation of the E-DPCCH information, in particular of the decoded E-TFCI values, use the *HSUPA E-AGCH Measurement* described on p. 8.149.

RLC BLER Measurements

The R&S CMU provides RLC throughput / BLER measurements on HSUPA channels. A packet data connection for WCDMA application tests must be established as described in the operating manual, and an external server is needed.
RLC throughput measurements on HSUPA channels require options R&S CMU-K96, *WCDMA Application Testing,* and R&S CMU-K56, *HSUPA 5.75 Mbps*. The data traffic is monitored using the *RLC BLER* application of the *Receiver Quality* menu.

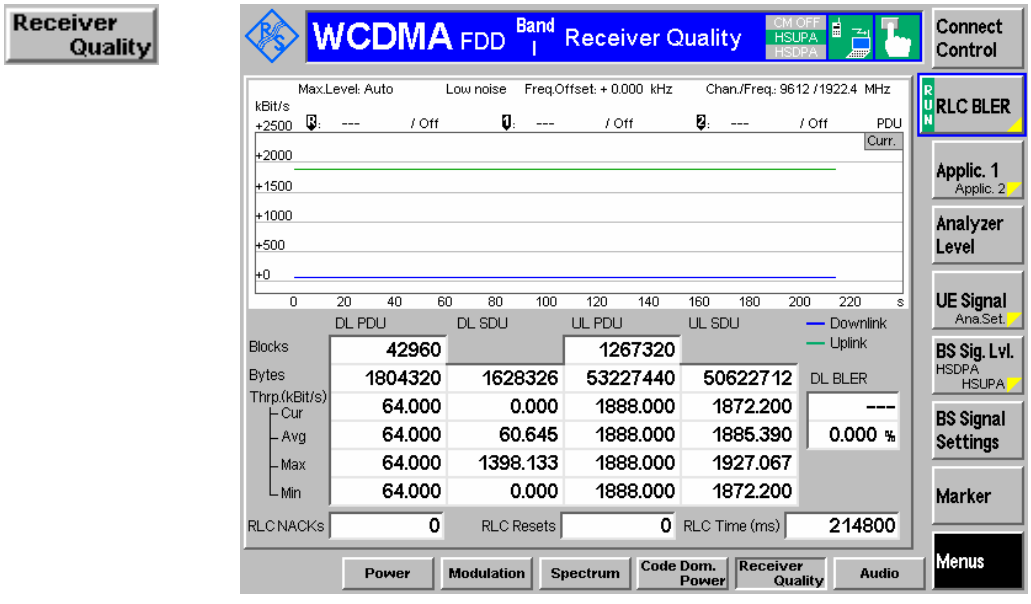


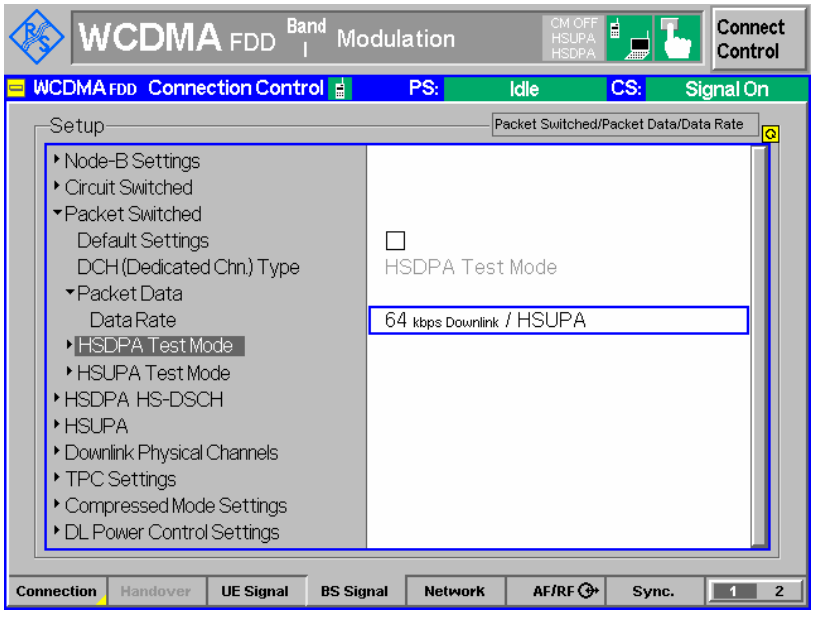
Fig. 8-38 RLC BLER measurement on HSUPA channels

Remote control: The commands for the RLC BLER test (`…RXQuality:RLCBler…`) are described in chapter 9 of the WCDMA UE operating manual.

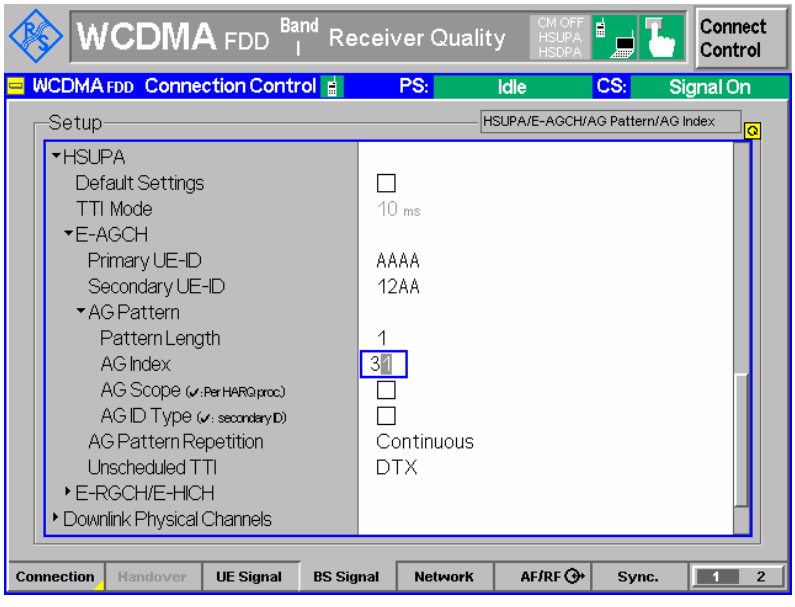
For HSUPA RLC BLER measurements, the CMU default settings can be used with additional BS signal parameter settings described below.

BS signal settings

5. In the *BS Signal* tab of the *Connection Control* menu set the packet switched *Data Rate* to 64kbps/HSUPA.



6. Change the *AG Index* in order to influence the HSUPA throughput. In order to reach the maximum UL data rate, an AG Index of 31 should be used.



Remote control:

```
CONFigure:BSSignal:PSWitched:DCH:PDATa:RATE HSUP
CONFigure:BSSignal:HSUPa:EAGCh:AGPattern:LENGth 1
CONFigure:BSSignal:HSUPa:EAGCh:AGPattern:INDex1 31
```

HSUPA Throughput Measurement

The *Receiver Quality – HSUPA Throughput* application provides CRC-based block error rate and throughput tests on HSUPA channels. The measurement requires the HARQ feedback mode *React on UL CRC*. *HSUPA Throughput* is a *Non Signalling* application.

Test procedure

1. From the *Menu Select* dialog, access the *WCDMA FDD – Non Signalling – Receiver Quality* dialog.
2. Open the *Connection Control – Generator* tab and select *Generator Level – Generator Control: On*. Check the basic RF settings in the *Generator Level* and *Generator Settings* sections.
3. Still in the *Generator* tab, select *Channel Settings – HSUPA Channels – HSUPA Signal: On*.
4. Select *Channel Settings – HSUPA Channels – E-RGCH / E-HICH – HARQ Feedback (E-HICH) – Mode: React on UL CRC*.
5. Open the *UE Code* tab and expand the *HSUPA* parameter section. Check whether the parameters are set in accordance with your UE configuration.
6. Close the *Connection Control* dialog and return to the *Receiver Quality* measurement dialog.
7. Connect your UE to the RF 2 connector and switch on.
8. Select *Application – HSUPA Throughput* and observe the measurement results in the dialog.

The results of the *HSUPA Throughput* measurement are displayed in the measurement dialog.

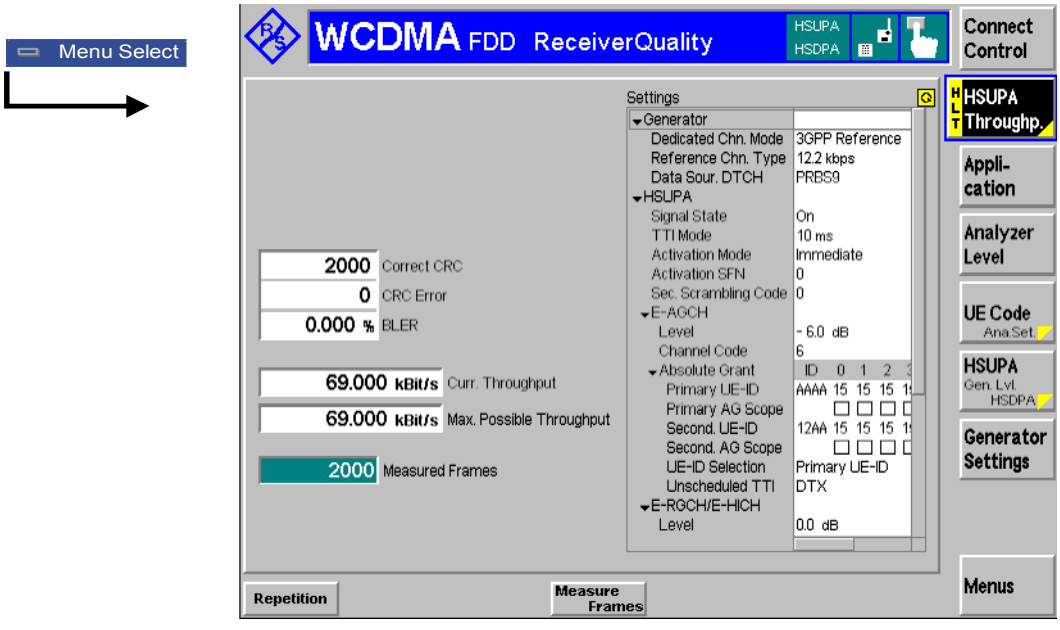


Fig. 8-39 HSUPA Throughput test results

All results are based on a CRC analysis of the E-DPDCH re-transmitted by the UE under test.

CRC Errors	*Correct CRC*	Number of transmissions with correct CRC.
	CRC Errors	Number of transmissions with incorrect CRC.
	BLER	Block error rate; the ratio of <CRC Errors> / (<Correct CRC> + <CRC Errors>).

Throughput	*Curr. Throughput*	Data throughput on layer 1 level: The number of E-DPDCH data bits (without CRC bits) transmitted per unit of time that the R&S CMU could receive correctly. Transmissions with failed CRC check do not contribute to the current throughput. With good transmission conditions, the *Current Throughput* is equal to the maximum possible throughput (no CRC errors). The R&S CMU calculates the current throughput from the number of received packets per unit of time times the number of user data bits in each packet, depending on the E-TFCI values received on the E-DPDCH.
	Max. Poss. Throughput	Maximum current throughput for HSUPA, in case that all bits are received correctly (no CRC errors). The maximum possible throughput is calculated in L1 by means of the measured E-TFCI.
	Measured Frames	Total number of subframes (transmission packets) measured.

Remote control `READ[:SCALar]:RXQuality:HSUPa:THRoughput?` etc.

HSUPA Code Domain Power Tests

The *Code Domain Power* measurement covers the uplink HSUPA channels:

- In the *CDP/Code Manual* and *CDP/Code Rho Manual* applications, the *Code Domain Power* menu shows the power or ρ-factor of the E-DPCCH and the E-DPDCH$_1$ to E-DPDCH$_4$ over 1 complete slot (see section *HSUPA in CDP/Code Measurements* on p. 8.164.
- The *CDP vs. Time* application shows the code power and the measured gain factors for the E-DPCCH and the E-DPDCH$_1$ to E-DPDCH$_4$. The principle of the *CDP vs. Time* measurement is described in Chapter 4 (see section *CDP vs. Time Measurement);* the HSUPA-specific measurement result are described below (see section *HSDPA in CDP vs. Time Measurement* on p. 8.21).
- The *CDP Relative* measurement also provides the relative code power of the E-DPCH over a configurable measurement length in the range between 1 and 46 slots, see *CDP Relative* on p. 8.28.
- The *CDE Relative* measurement also provides the relative code domain error of the E-DPCH, see *CDE Relative* on p. 8.34.

For general notes on HSUPA tests refer to section *HSUPA in Signalling Mode* on p. 8.178.

HSUPA in CDP/Code Measurements

In the *CDP/Code Manual* and *CDP/Code Rho Manual* applications, the *Code Domain Power* menu shows the power or ρ-factor of the UL HSUPA channels. As soon as the HSUPA DL generator is switched on, the UL HSUPA channels (E-DPCCH and E-DPDCH1 to E-DPDCH4) replace the DPDCH2 to DPDCH6. The frame timing of the UL HSUPA channels is the same as the DPCCH frame timing, therefore no particular trigger settings are required (for an overview of the trigger settings refer to table *Trigger settings for WCDMA TX measurements* in Chapter 4).

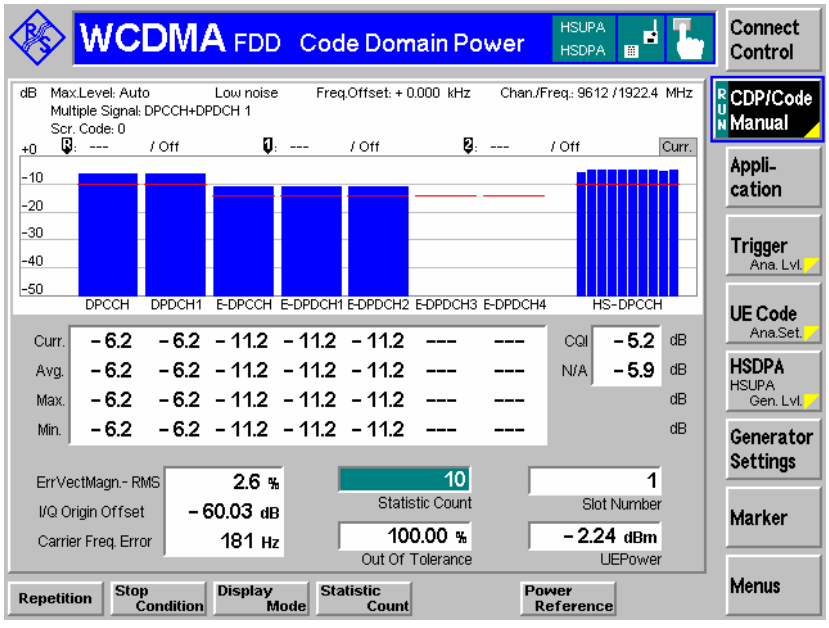


Fig. 8-40 UL HSUPA channels in CDP

Preparing a HSUPA CDP Test

To obtain the results shown in Fig. 8-40 above configure the R&S CMU as follows:

1. Open the *Menu Select* menu and select *WCDMA FDD – Non Signalling – Code Domain Power – DCP Manual.*
2. Press *Connect. Control.* In the *Generator* tab of the *Connection Control* menu, select *Generator Level – Generator Control: On* and *Channel Settings – HSUPA Channels – HSUPA Signal: On*.
3. Press *1/2* to access the second level of the *Connection Control* menu. In the *Trigger* tab, select *Meas. Trigger – Source: Auto.*
4. Press *Connect. Control* again to close the *Connection Control* menu and observe the code power of the UL HSUPA channels.

CDP diagram

In the diagram the E-DPCCH and E-DPDCH powers or ρ-factors are shown to the right of the DPCCH and DPDCH1 channels. DPCCH/DPDCH and E-DPCCH/E-DPDCH results are obtained with the same measurement and filter settings. Furthermore the *Display Mode* of both channel types is the same.

The diagram may contain additional HS-DPCCH results, if the HSDPA option R&S CMU-K64 is available.

Remote control:

```
READ:ARRay:CDPower:MANual:CURRent?
READ:ARRay:CDPower:RMANual:CURRent? etc.
```

NOTE

The remote control commands for CDPower including the HSUPA commands are reported in Chapter 6.

Limit check

A pair of horizontal red lines represent the limit lines set in the *Limits* tab of the configuration menu. In addition the output fields below the diagram turn red if the statistical results exceed the tolerances.

The limit lines for DPCCH/DPDCH and E-DPCCH/E-DPDCH channels can be set independently.

Remote control
For limit definition:
`CONFigure:CDPower:MANual:CMMax:LIMit:POINt:ASYMmetric:`
`UPPer:CHANnel<nr>` *<CDP_Limit>*, where `<nr> = 9 to 13`
`CONFigure:CDPower:MANual:CMMax:LIMit:POINt:ASYMmetric:`
`LOWer:CHANnel<nr>` *<CDP_Limit>*, where `<nr> = 9 to 13`
`CONFigure:CDPower:RMANual:CMMax:LIMit:POINt:ASYMmetric:`
`UPPer:CHANnel<nr>` *<CD-ρ_Limit>*, where `<nr> = 9 to 13`
`CONFigure:CDPower:RMANual:CMMax:LIMit:POINt:ASYMmetric:`
`LOWer:CHANnel<nr>` *<CD-ρ_Limit>*, where `<nr> = 9 to 13`
For limit matching:
`CALCulate:ARRay:CDPower:MANual:CURRent:MATChing:LIMit?`
`CALCulate:ARRay:CDPower:RMANual:CURRent:MATChing:LIMit?`
The commands return the limit matching information `(NMAU | NMAL | INV | OK)` for E-DPCCH and E-DPDCH1 to E-DPDCH4 as parameters no. 3 to 7.

The remote control commands for CDPower including the HSUPA commands are reported in Chapter 6.

HSUPA in CDP vs. Time Measurement

In the *CDP / Time* menu, the code power for all UL channels is shown in two diagrams (see general description in Chapter 4, section *CDP vs. Time Measurement)*. The measured gain factors for the individual channels are displayed below. The E-DPCCH and E-DPDCH channels can be displayed in the upper or in the lower diagram.

Parameter lines

Upper diagram

Lower diagram

Output fields

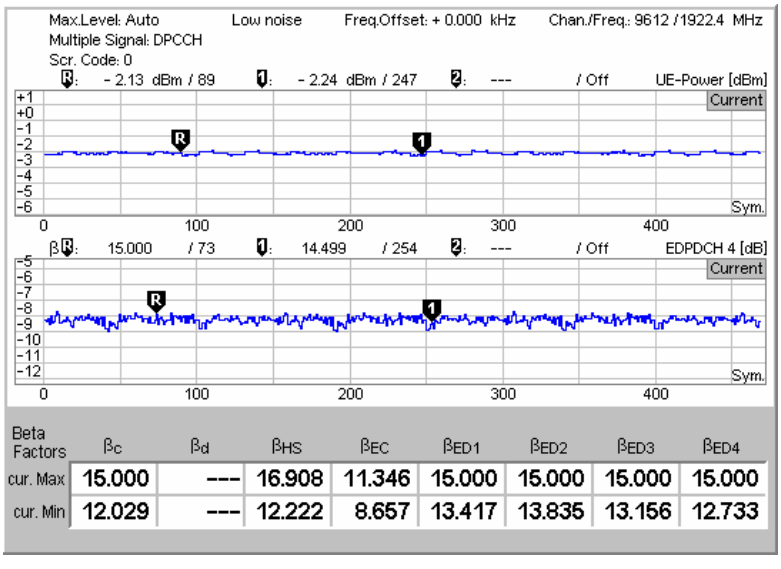


Fig. 8-41 Display of results (CDP vs. Time, HSUPA)

Diagrams

The diagrams in the *CDP vs. Time* measurement menu show the absolute *UE Power* (the sum of all UL channels in dBm) and the relative powers of the E-DPCCH, the E-DPDCHs and the other UL channels. The following results and settings are related to the HSUPA channels:

- HSUPA channel selection for the upper or for the lower diagram *(CDP/Time – Diagram Type)*
- Diagram scaling (e.g. *Display/Marker – E-DPDCH4 Scale X/Y)*

Remote control
`READ:ARRay:CDPower:TIME:EDPCch:CPOWer?` etc.
`READ:ARRay:CDPower:TIME:EDPDch<nr>:CPOWer? (<nr> = 1 to 4)`

The following commands retrieve the maximum and minimum code powers of all channels:
`READ[:SCALar]:CDPower:TIME:CPOWer?` etc.

Output fields

The output fields below the diagram show the minimum and maximum gain factors that the R&S CMU determined across the entire measurement range. The gain factors define the relative strength of the uplink channels (see standard TS 25.213), they are calculated and normalized as described in section *CDP vs. Time Measurement* in Chapter 4. The gain factor β_{ec} for the E-DPCCH can vary between 5 and 30 (15 times the quantized amplitude ratios). The gain factors $\beta_{ed,\,k}$ for the four E-DPDCHs can vary between 5 and 168.

Remote control
`READ[:SCALar]:CDPower:TIME:BFACtor?` etc.

The following commands retrieve the gain factors across the entire measurement range:
`READ:ARRay:CDPower:TIME:EDPCch:BFACtor?` etc.

The remote control commands for CDPower:TIME including the HSUPA commands are reported in Chapter 6.

HSUPA Downlink Generator (Non Signalling)

With option R&S CMU-K56, *HSUPA 5.76 Mbps*, a HSUPA downlink signal can be added to the DL WCDMA channels. In *Non Signalling* mode, both are configured in the *Generator* tab of the *Connection Control* menu. The HSUPA signal cannot be generated and received without the WCDMA channels. In the *Generator* tab, the *HSUPA* settings are divided into several parameter groups:

- Activation of HSUPA signal *(HSUPA Signal)*
- Common settings for the downlink HSUPA channels (E-AGCH, the E-RGCH, and the E-HICH) for a serving cell link
- Configuration of the Enhanced DCH Absolute Grant Channel *(E-AGCH)*
- Configuration of the Enhanced DCH Relative Grant Channel *(E-RGCH)*
- Configuration of the Enhanced DCH Hybrid ARQ Indicator Channel *(E-HICH)*

The settings are described in detail below.

Serving cell link

According to standard 3GPP TS 25.211, the configuration of the downlink HSUPA channels transmitted to a UE depends on whether the transmitting cell is the serving cell for the UE or a non-serving cell. The R&S CMU supports a serving cell radio link set; everything that is explained below applies to a serving cell link.

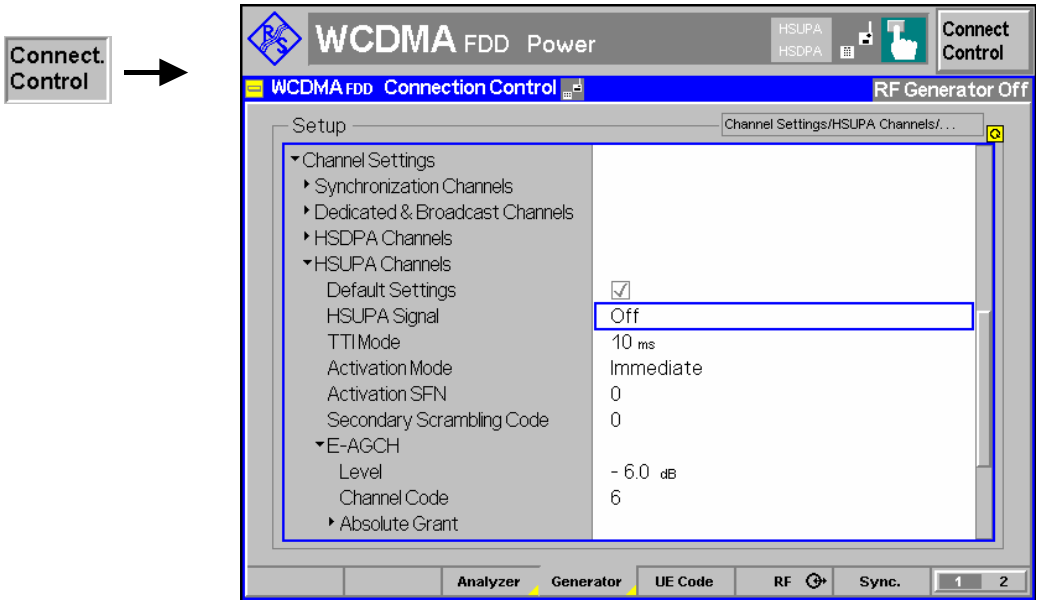


Fig. 8-42 Connection Control – Generator

The *Channel Settings – HSUPA Channels* section in the table-oriented version of the *Generator* tab provides the following settings:

Default Settings Sets all parameters in the *HSUPA* section to default values.

Remote control

–

HSUPA Signal

Switches the HSUPA channels in the WCDMA downlink signal *On* or *Off.*

The RF generator providing the P-SCH, S-SCH, P-CCPCH, and P-CPICH channels necessary for synchronization must be on *(Generator Level – Generator Control: On)* in order to generate the HSUPA signal. Instead of switching off the HSUPA signal altogether, it is possible to switch off each of the individual channels; see *Level* settings below.

Remote control
```
SOURce:HSUPA:SIGNal:ENABle ON | OFF
```

TTI Mode

Transmission Time Interval for the E-DCH. The standard (3GPP TS 25.321) allows TTIs of 2 ms (1 HSUPA subframe comprising 3 slots) or 10 ms duration (1 WCDMA frame comprising 15 slots). The measurement length for many HSUPA measurements is adjusted to the selected TTI.

The TTI duration also has an impact on the number of HARQ processes (4 for 10 ms TTI, 8 for 2 ms TTI) and on the structure of the downlink HSUPA channels; see below.

Remote control
```
SOURce:HSUPa:TTIMode M2 | M10
```

Activation Mode
Activation SFN

Start time of the HSUPA generator and of all HSUPA settings, including the sequence of absolute grants transmitted on the E-AGCH. Changes of the HSUPA signal always take effect at the beginning of the E-AGCH / E-RGCH / E-HICH frames. The timing relations of these HSUPA frames relative to the P-CCPCH is according to standard 3GPP TS 25.211.

Immediate All changes of the HSUPA signal configuration take effect as quickly as possible (within the next frame).

SFN Changes of the HSUPA signal configuration take effect in the next WCDMA frame with the *Activation SFN.* The System Frame Number (SFN) is transmitted over the P-CCPCH. The start of the HSUPA generator is also delayed until the *Activation SFN*.

Remote control
```
SOURce:HSUPa:AMODe IMMediate | SFN
SOURce:HSUPa:ASFN 0 to 4095
```

Secondary Scrambling Code

Selects the secondary scrambling code for the downlink HSUPA signal. The code is used for HSUPA channels only but equal for the E-AGCH, the E-RGCH, and the E-HICH; see standard 3GPP TS 25.213.

The secondary scrambling code corresponds to the index k of the codes $S_{16*i+k}^{p/s}$ in Fig. 8-43 below. A secondary scrambling code 0 means that the HSUPA channels are scrambled with the primary scrambling code i of the cell, to be set in the *Generator Settings* section. For more information about primary and secondary scrambling codes refer to the description of the WCDMA downlink RF generator in Chapter 4.

Remote control
```
SOURce:HSUPA:SSCode
```

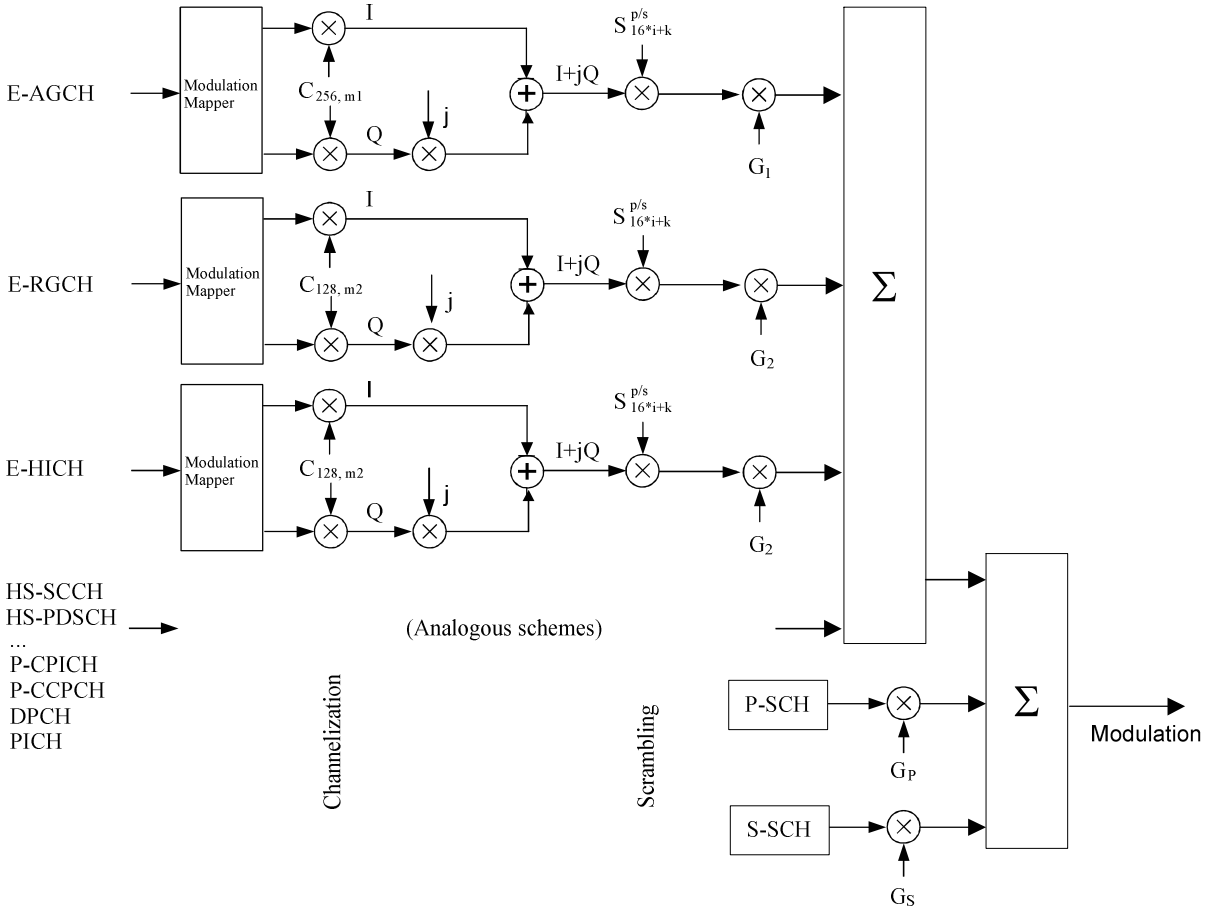


Fig. 8-43 Spreading of HSUPA channels

The following settings are specific to the E-AGCH, the E-RGCH, and the E-HICH.

E-AGCH Configuration

The Enhanced DCH Absolute Grant Channel *(E-AGCH)* is a downlink physical channel carrying the uplink E-DCH absolute grant allocation for a UE or a group of UEs. The E-AGCH is QPSK-modulated and only used for the serving radio link set.

Level Signal level of the channel relative to the *Level Reference* (P-CPICH level or total output channel power) selected in the *Generator Level* section. If it is defined relative to the P-CPICH level then the level of the E-AGCH is equal to ratio of the weighting factors $G_1/G_{P\text{-}CPICH}$ in Fig. 8-43 above. The E-AGCH can be switched off by means of the *ON/OFF* key.

Channel. Code Channelization code (Orthogonal Variable Spreading Code, OVSC) number assigned to the E-AGCH. The E-AGCH is a fixed rate (30 kbps, SF = 256) physical channel with channelization code numbers ranging from 2 to 255 (ch. codes $C_{256,0}$ and $c_{256,1}$ are barred because they are reserved for the P-CPICH and P-CCPCH, respectively). The E-AGCH channelization code must be compatible with the channelization codes for the other downlink channels (PICH, the DPCH, E-AGCHs, HS-PDSCHs); see background information on *PICH/DPCH channelization codes* in Chapter 4, section *Generator Settings.* The CMU checks and possibly auto-corrects incompatible entries; see section *Code Conflict Handling for WCDMA DL Generator* in Chapter 4.

Remote control

```
SOURce:HSUPa:EAGCh:LEVel <Level>
SOURce:HSUPa:PHYSical:LEVel
SOURce:HSPa:PHYSical:LEVel
SOURce:HSUPa:EAGCh:CCODe <Code>
```

E-AGCH – Absolute Grant

The Absolute Grant transmitted on the E-AGCH defines the maximum amount of uplink (E-DCH) resources the UE may use (see standard 3GPP TS 25.321). It is signalled to the UE by the serving cell. Up to two UE identities (E-RNTIs), one primary and one secondary, can be allocated to a UE at a time. The absolute grant is configured as follows:

Primary UE-ID Primary E-RNTI (E-DCH Radio Network Temporary Identifier); 16 bit value, entered as a 4-digit hex number. The primary UE-ID is a temporary identifier for the addressed UE. The primary absolute grants are 5-bit values (range 0 to 31 decimal). Each value controls one HARQ process, so there are four values for a 10 ms TTI, eight values for a 2 ms TTI. In addition, each absolute grant value can be set to *Off* (equivalent to *INACTIVE)* in order to deactivate the HARQ process or to switch the UE to its secondary E-RNTI. The absolute grant values indicate the maximum E-DCH traffic to pilot ratio (E-DPDCH/DPCCH) that the UE is allowed to use in the next transmission.

Prim. AG Scope The Absolute Grant Scope (AGS) flag defines which H-ARQ processes the absolute grant values should apply to. Each absolute grant value for a given UE-ID can be assigned an independent AGS value. If AGS is off (unselected), the corresponding absolute grant value is valid for all HARQ processes *(All HARQ processes)* so that the absolute grants for all processes are continuously updated. If it is on (selected), the absolute grant value applies to one HARQ process only *(Per HARQ process)*.

Secondary UE-ID Secondary E-RNTI; 16 bit value, entered as a 4-digit hex number in analogy to the primary UE-ID. The secondary UE-ID can (but doesn't have to) be used in addition to the primary UE-ID. If it is used (see *UE-ID Selection* below) the secondary absolute grant automatically replaces the primary absolute grant if the latter is set to *INACTIVE*. In the network, secondary UE-IDs are typically used to define groups of UEs which are always active. These UEs are assigned a limited, common secondary grant, to be used as soon as the individual primary absolute grants become inactive.

Sec. AG Scope Analogous to the *Primary AG Scope,* but for the absolute grant values associated with the secondary UE ID.

UE-ID Selection Defines whether absolute grant messages with the *Secondary UE-ID* are used. If *Primary UE-ID* is set, the secondary absolute grant values are ignored, otherwise, primary and secondary absolute grants are transmitted in alternating order; see background information on absolute grant transmission below.

Unscheduled TTI Defines the transmission of the R&S CMU in inactive Transmission Time Intervals (TTIs). Unscheduled TTIs occur if the R&S CMU transmits an absolute grant value *Off*. The duration of the TTI is either 2 ms (1 HSUPA subframe comprising 3 slots) or 10 ms (1 WCDMA frame comprising 15 slots), depending on the *TTI Mode*. If *Transmit Dummy UE-ID* is set, the E-AGCH power is maintained and the unscheduled TTIs contain a UE-ID which is different from the specified

primary or secondary UE-ID.

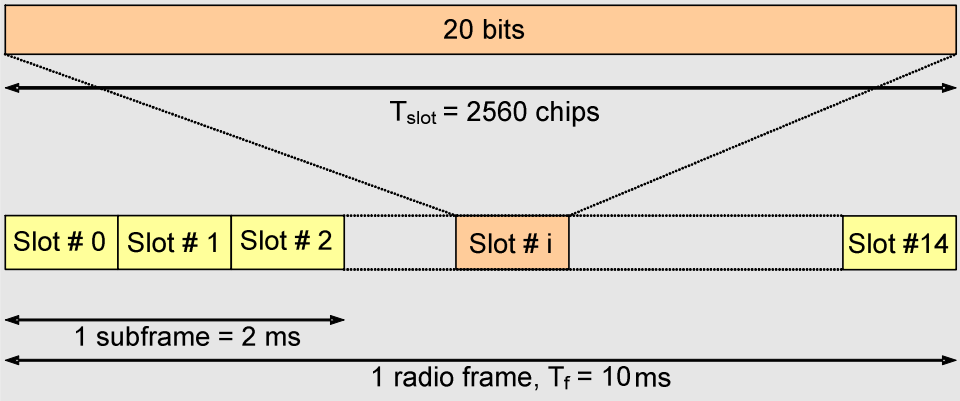
Otherwise the CMU uses discontinuous transmission *(DTX;* the output power is switched off). This parameter has no influence on the E-RGCH/E-HICH transmission.

Remote control

```
SOURce:HSUPa:EAGCh:UEID:PRIMary <ID>
SOURce:HSUPa:EAGCh:GRANts:PRIMary
SOURce:HSUPa:EAGCh:AGS:PRIMary ON |OFF
SOURce:HSUPa:EAGCh:UEID:SECondary <ID>
SOURce:HSUPa:EAGCh:GRANts:SECondary
SOURce:HSUPa:EAGCh:AGS:SECondary ON |OFF
SOURce:HSUPa:EAGCh:UEID:SELection PRIMary | PSECondary
SOURce:HSUPa:EAGCh:UTTI DTX | TDUeid
```

E-AGCH Transmission

The E-AGCH is a fixed rate (SF = 256) channel carrying 20 bits in each slot.



With a 2 ms Transmission Time Interval (TTI), 60 bits are transmitted per E-AGCH subframe. With a 10 ms TTI, this 60 bit sequence is repeated in all five subframes of a WCDMA radio frame. The 60 bit sequence contains the UE-ID with the absolute grant value and AGS information for the scheduled TTI.

Absolute Grant	ID	0	1	2	3	4	5	6	7
Primary UE-ID	AAAA	14	Off	16	17				
Primary AG Scope		☐	☐	☐	☐				
Secondary UE-ID	12AA	15	10	15	15				
Secondary AG Scope		☑	☑	☑	☑				
UE-ID Selection	Primary + Secondary UE-ID								
Unscheduled TTI	Transmit Dummy UE-ID								

The R&S CMU steps through the *Absolute Grant* table, sending a new combination of (UE-ID, Absolute Grant, AGS) values after every TTI. If both the primary and the secondary UE-ID is used, then both table rows are used in alternating order. To simulate what occurs in real networks if the primary UE-ID is INACTIVE, the rows are interchanged wherever the primary UE-ID is set to *Off*. With this rule it is also possible to configure absolute grant sequences with mixed primary and secondary UE-IDs. In the example above the following sequence is periodically repeated:
(AAAA, 14, Off), (12AA, 10, On), (AAAA, 16, Off), (AAAA, 17, Off),
(12AA, 15, On), (Dummy UE-ID, -, Off), (12AA, 15, On), (12AA, 15, On),

E-RGCH / E-HICH Configuration

The Enhanced DCH Relative Grant Channel *(E-RGCH)* is a dedicated downlink physical channel carrying the uplink E-DCH relative grant for a UE. The Enhanced DCH Hybrid ARQ Indicator Channel *(E-HICH)* is a dedicated downlink physical channel carrying the uplink E-DCH hybrid ARQ acknowledgement indicator. Both

channels are fixed-rate channels using the same channelization code. The E-RGCH and E-HICH are separated by specific orthogonal signature sequences.

Level Level of the E-RGCH and the E-HICH relative to the *Level Reference* (P-CPICH level or total output channel power) selected in the *Generator Level* section. The levels of the E-RGCH and the E-HICH are equal, therefore the sum level is approx. 3 dB above the selected level. If it is defined relative to the P-CPICH level then the sum level of the E-RGCH / E-HICH is equal to the ratio of the weighting factors $2*G_2/G_{P\text{-}CPICH}$ in Fig. 8-43 above. The E-RGCH and E-HICH can be switched off by means of the *ON/OFF* key.

If *Allow other Signatures* is selected, then the sum level is equally distributed among 12 channels so that the individual levels are approx. 10.8 dB below the sum level.

Channel. Code Channelization code (Orthogonal Variable Spreading Code, OVSC) number assigned to the E-RGCH and the E-HICH. The E-RGCH / E-HICH is a fixed rate (SF = 128) physical channel with channelization code numbers ranging from 1 to 127 (ch. code $C_{128,0}$ is barred because the codes $C_{256,0}$ and $c_{256,1}$ are reserved for the P-CPICH and P-CCPCH, respectively). The E-RGCH / E-HICH channelization code must be compatible with the channelization codes for the other downlink channels (PICH, the DPCH, E-AGCHs, HS-PDSCHs); see background information on *PICH/DPCH channelization codes* in Chapter 4, section *Generator Settings.* The CMU checks and possibly auto-corrects incompatible entries; see section *Code Conflict Handling for WCDMA DL Generator* in Chapter 4.

Allow other Signatures Allowing other signatures causes the R&S CMU to generate an additional set of 10 channels with equal channelization code but different signatures. The individual E-RGCH and E-HICH levels are reduced, see above. The additional channels simulate control channels allocated to other UEs.

Remote control

```
SOURce:HSUPa:ERGHich:LEVel <Level>
SOURce:HSUPa:PHYSical:LEVel
SOURce:HSPa:PHYSical:LEVel
SOURce:HSUPa:ERGHich:CCODe <Code>
SOURce:HSUPa:ERGHich:ASIGnatures ON | OFF
```

HARQ Feedback (E-HICH)

The *HARQ Feedback (E-HICH)* section provides specific E-HICH channel settings. The HARQ feedback information is defined with the aid of predefined, regular sequences and arbitrary, user-defined patterns. The selected sequence can be started immediately or delayed; see *Activation Mode* on p. 8.169.

Mode Type of the HARQ acknowledgement indicator sequence transmitted on the E-HICH; see Table 8-5 below.

Pattern HARQ acknowledgement indicator sequence of finite length (single pattern) used to construct the pattern transferred to the UE; see *Mode* above. The pattern consists of up to 64 ternary values (0 or 1 or -, corresponding to NACK, ACK or DTX).

Signature E-HICH signature sequence used to separate the E-HICH channel from the E-RGCH and E-HICH/E-RGCH control channels allocated to other UEs. The value is equal to the *Sequence index I* defined in standard 3GPP TS 25.211; it must be different from the E-RGCH signature. The signature is auto-

corrected if it is set to the E-RGCH signature value (signature conflict handling, see *Code Conflict Handling* in Chapter 4).

With a 10 ms TTI the E-HICH is transmitted for 12 slots per frame. During the remaining slots the E-HICH is switched off (DTX).

Remote control

```
SOURce:HSUPa:EHICh:MODe <Mode>
SOURce:HSUPa:EHICh:PATTern <Pattern>
SOURce:HSUPa:EHICh:SIGNature 0 to 39
```

Table 8-5 HARQ feedback (E-HICH) patterns (Non Signalling and Signalling modes)

HARQ Feedback Pattern Type	**Transferred pattern for a single pattern <Pattern>**
Alternating 1,0	101010...
All NACK	000000... (irrespective of <Pattern>)
All ACK	111111... (irrespective of <Pattern>)
All DTX	---------… (irrespective of <Pattern>)
Continuous Pattern	<Pattern><Pattern><Pattern><Pattern>...
Single Pattern + All ACK	<Pattern>111...
Single Pattern + All NACK	<Pattern>000...
Single Pattern + All DTX	<Pattern>---...
Single Pattern + Alternating	<Pattern>1010...
React on UL CRC[13]	1 (ACK), if the R&S CMU detects a correct UL CRC 0 (NACK), if the R&S CMU detects an UL CRC error DTX, if the R&S CMU does not detect the E-DPCCH (“React on UL CRC” not possible)

Relative Grant (E-RGCH)

The *Relative Grant (E-RGCH)* section provides specific E-RGCH channel settings. The relative grant information is defined with the aid of predefined, regular sequences and arbitrary, user-defined patterns. The selected sequence can be started immediately or delayed; see *Activation Mode* on p. 8.169.

Mode Type of the relative grant sequence transmitted on the E-RGCH; see Table 8-6 below.

Pattern Relative grant sequence of finite length (single pattern) used to construct the pattern transferred to the UE; see *Mode* above. The pattern consists of up to 64 ternary values (0 or 1 or -, corresponding to Down, Up or DTX).

Signature E-RGCH signature sequence used to separate the E-RGCH channel from the E-HICH and E-HICH/E-RGCH control channels allocated to other UEs. The value is equal to the *Sequence index I* defined in standard 3GPP TS 25.211; it must be different from the E-HICH signature. The signature is auto-corrected if it is set to the E-RGCH signature value (signature conflict handling, see *Code Conflict Handling* in Chapter 4).

Fill up Frame with Dummies With a 10 ms TTI the E-RGCH is transmitted for 12 slots per frame. During the remaining slots it is possible to switch the E-RGCH off (DTX) or to continue sending in order to maintain the

[13] The *React on UL CRC* mode is based on a CRC analysis of the E-DPDCH transmissions from the UE under test. In *Non Signaling* mode, the *HSUPA* parameters in the *UE Code* tab of the *Connection Control* menu must be set correctly to use the *React on UL CRC* mode; see section *HSUPA UE Settings (Non Signalling)* on p. 8.176.

E-RGCH power. This setting has no effect for 2 ms TTIs.

Remote control

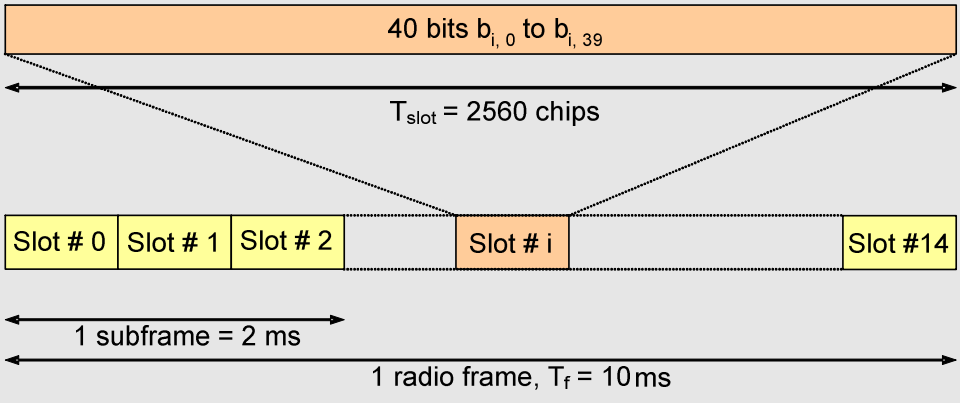
```
SOURce:HSUPa:ERGCh:MODe <Mode>
SOURce:HSUPa:ERGCh:PATTern <Pattern>
SOURce:HSUPa:ERGCh:SIGNature 0 to 39
SOURce:HSUPa:ERGCh:FDUMmies ON | OFF
```

Table 8-6 Relative grant (E-RGCH) patterns (Non Signalling and Signalling modes)

Relative Grant Pattern Type	Transferred pattern for a single pattern <Pattern>
Alternating 1,0 (TTI)	101010...
Alternating H-ARQ Cycle[14]	11110000… (for 10 ms TTI) 1111111100000000… (for 2 ms TTI)
All Down	000000... (irrespective of <Pattern>)
All Up	111111... (irrespective of <Pattern>)
All DTX	---------… (irrespective of <Pattern>)
Continuous Pattern	<Pattern><Pattern><Pattern><Pattern>...
Single Pattern + All DTX	<Pattern>---...
Single Pattern + All Up	<Pattern>111...
Single Pattern + All Down	<Pattern>000...
Single Pattern + Alternating	<Pattern>1010...

E-RGCH / E-HICH Transmission

Both the E-RGCH and the E-HICH are fixed rate (SF = 128) channels carrying 40 bits in each slot.



The bit sequence $b_{i,0}$ to $b_{i,39}$ for each slot no. i is calculated from the relative grant values (E-RGCH) or HARQ acknowledgement indicators (E-HICH) and the predefined 40-bit signature sequences following the procedure outlined in standard 3GPP TS 25.211. The relative grant values and HARQ acknowledgement indicators are ternary values, to be entered in the *Relative Grant (E-RGCH)* and *HARQ Feedback (E-HICH)* sections, respectively.

With a 2 ms Transmission Time Interval (TTI), each relative grant value and each HARQ acknowledgement indicator is transmitted for a 3 slot duration. With a 10 ms TTI, both values are transmitted for a 12 slot duration.

[14] The *Alternating H-ARQ Cycle* pattern ensures an alternating 1010… pattern for every H-ARQ cycle. If it is used for a *HSUPA E-RGCH Measurement* (see p. 8.151) it is inverted (00001111…. etc.) to ensure a measurement process according to the conformance test specification.

HSUPA UE Settings (Non Signalling)

Parameters which characterize the uplink HSUPA signal are located in the *HSUPA* section in the *UE Code* tab.

The gain factor *Δ E-DPCCH* must be set in accordance with the UE configuration to decode the E-DPCCH correctly (e.g. for E-DPCCH logging). The R&S CMU must know the remaining parameters to decode the E-DPDCH, e.g. in order to generate HARQ feedback information according to the UL CRC *(Generator – Channel Settings – HSUPA Channels – E-RGCH / E-HICH – HARQ Feedback (E-HICH) – Mode: React on UL CRC)*.

For other features, especially all HSUPA measurements which don't require decoding of the E-DPCCH or E-DPDCH, the settings are not relevant.

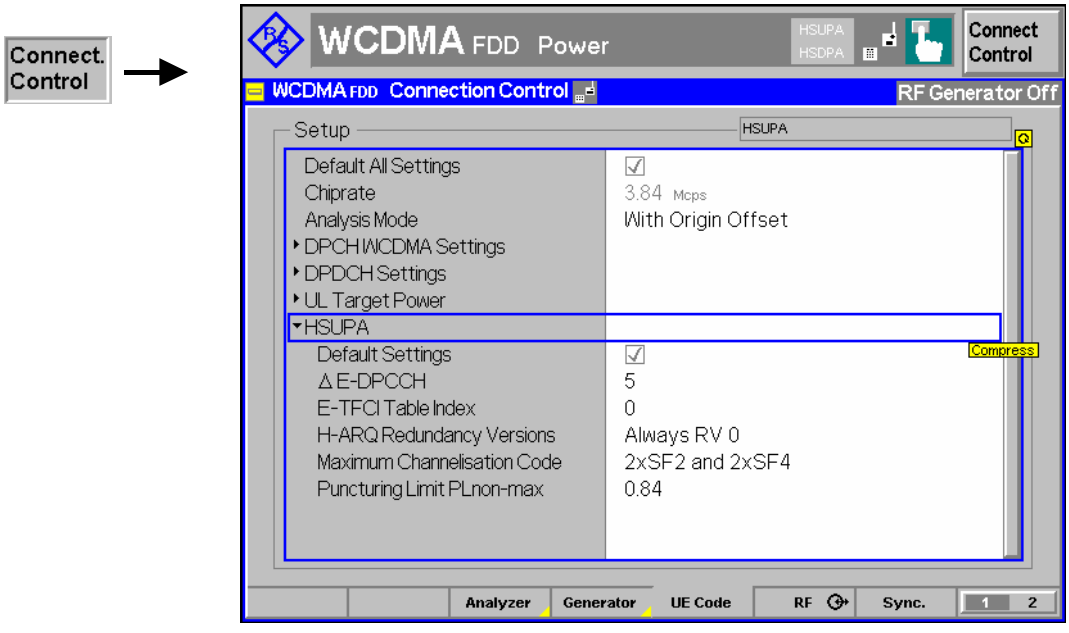


Fig. 8-44 HSUPA-specific UE signal parameters (Non Signalling)

In *Signaling* mode, the R&S CMU signals the *HSUPA* parameters to the UE under test using a *Radiobearer Setup* message; see section *HSUPA UE Signal Parameters* on p. 8.180.

HSUPA Parameters for the uplink HSUPA signal:

Δ E-DPCCH Gain factor for the uplink E-DPCCH

E-TFCI Table Index E-TFCI table index in the E-DCH information. This value indicates which of the standardized E-TFCI transport block size tables shall be used.

H-ARQ Redundancy Versions HARQ Incremental Redundancy Version configuration: Use always redundancy version 0 or use table.

Maximum Channelization Code The maximum channelization code (and thus the maximum data rate) for the E-DCH transmission. The maximum channelization code should also contain the limitation due to the UE category. Avoid values that exceed the capabilitiy of your UE under test.

Puncturing Limit $PL_{non\text{-}max}$ A PL value limits the amount of puncturing that can be applied in order to minimize the number of physical channels. The allowed

puncturing in % is actually equal to (1-PL)*100.

Remote control:
```
DEFault:UECode:HSUPa
CONFigure:UECode:HSUPa:DELTa:EDPCch
CONFigure:UECode:HSUPa:ETFCi:TINDex
CONFigure:UECode:HSUPa:HRVersion
CONFigure:UECode:HSUPa:CCODe:MAXimum
CONFigure:UECode:HSUPa:PLPLnonmax
```

HSUPA in Signalling Mode

With option R&S CMU-K56, measurements on HSUPA channels are also available in *Signalling* mode. Manual and remote control is identical with the *Non Signalling* measurements.

The HSUPA generator is also available in *Signalling* mode; it is configured in the *BS Signal* tab of the *Connection Control* menu. The settings are analogous to the *Non Signalling* settings, however, the remote control command syntax has been adjusted to be in line with the other *BS Signal* commands. The new commands are listed in section *HSUPA Downlink Signal Configuration (Signalling)* on p. 8.212..

The R&S CMU provides a number of HSUPA-specific RX and TX measurements; see sections *HSUPA Receiver Quality Tests* on p. 8.148 and *HSUPA Code Domain Power Tests* on p. 8.164.

Performing HSUPA Tests

In *Signalling* mode the R&S CMU maintains a connection to the UE under test and is able to transmit and receive signalling information. Compared to the *Non Signalling* tests described above, the test configuration is much easier because there is no need to configure the R&S CMU and the UE separately.

HSUPA tests are performed in a particular *HSUPA Test Mode.* To enter this mode proceed as described in section *Packet Switched Connections* in Chapter 4.

HSUPA Downlink Signal (BS Signal)

The parameters for the HSUPA DL channels E-AGCH, E-RGCH and E-HICH generated by the CMU can be set in the *BS Signal* tab of the *Connection Control* menu. The parameters are grouped as follows:

- Parameters which are relevant for the connection to HSUPA test mode *(Packet Data – HSUPA Test Mode…)*. These parameters are described in section *Packet Switched Connections* in Chapter 4.
- Channel levels and channelization codes can be set in the *Downlink Physical Channels* section, subsections *E-AGCH* and *E-RGCH/E-HICH*.

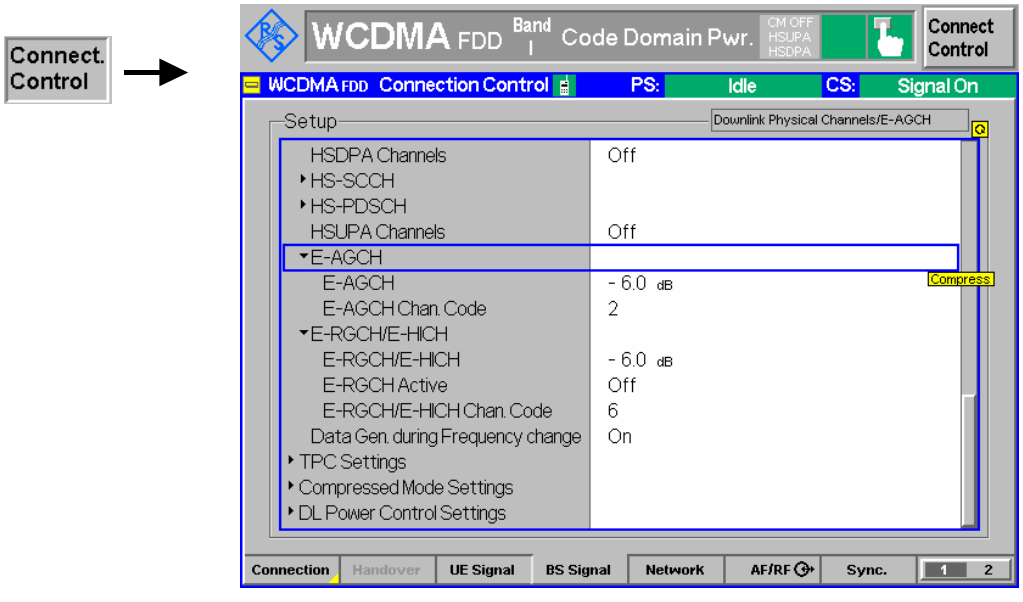


Fig. 8-45 HSUPA channel levels and codes

Remote control:
```
CONFigure:BSSignal:PHYSical:EAGCh:LEVel
CONFigure:BSSignal:PHYSical:EAGCh:CCODe
CONFigure:BSSignal:PHYSical:ERGHich:LEVel
```

```
CONFigure:BSSignal:PHYSical:ERGHich:ERGactive
CONFigure:BSSignal:PHYSical:ERGHich:CCODe
CONFigure:BSSignal:HSUPa:PHYSical:LEVel
CONFigure:BSSignal:HSPa:PHYSical:LEVel
```

- Further HSUPA-specific parameters are located in the *HSUPA* section of the *BS Signal* tab. For example, the AG pattern transmitted on the E-AGCH can be specified in the *HSUPA – E-AGCH – AG Pattern* section:

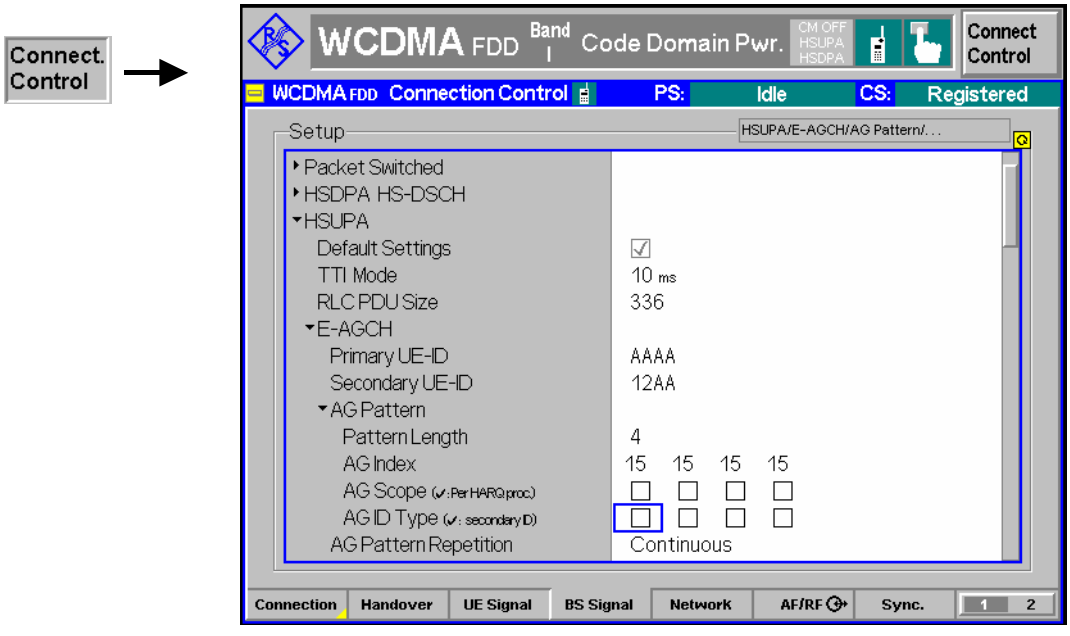


Fig. 8-46 AG pattern setting

The following paragraphs describe extensions of the *BS Signal – HSUPA* settings compared to *Non Signalling* mode.

Note: *The* AG Pattern *and the* E-RGCH/E-HICH *settings can still be changed during a connection. Moreover, it is still possible to switch the E-RGCH on or off* (Downlink Physical Channels – E-RGCH/E-HICH – E-RGCH Active).

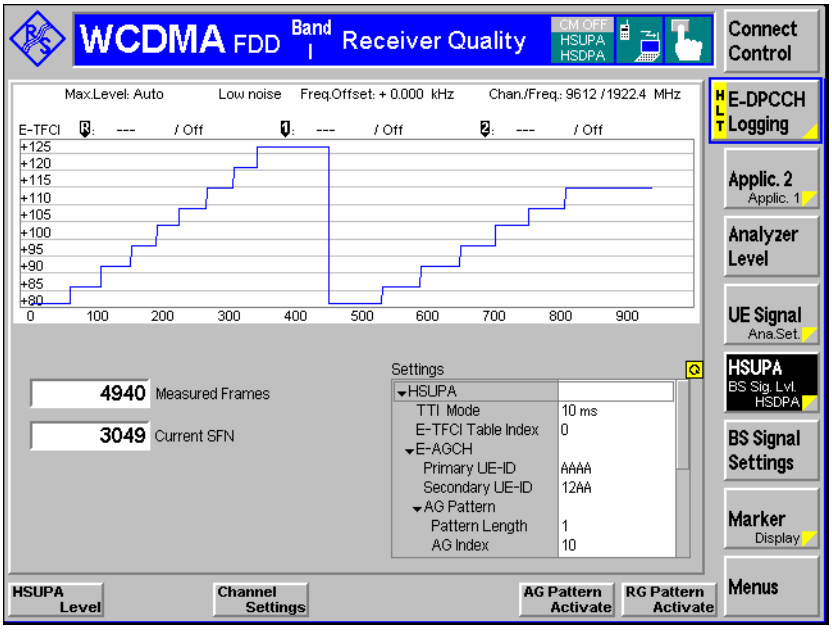
Pattern length

In *Signalling* mode, the R&S CMU can transmit AG and RG patterns of configurable length. The number of *AG Scope* and *ID Type* values is adjusted to the selected length.

Single pattern transmission

With *AG Pattern Repetition: Once,* the selected pattern is no longer periodically repeated but transmitted once whenever the *Execute* button is pressed. With an AG pattern containing a single value, it is possible to reset the E-TFCI of the UE to a definite value whenever needed.

A similar mechanism is provided for the RG pattern, if *Mode: Single Pattern + All DTX* is selected. A single transmitted RG value induces an E-TFCI change according to the RG command UP or DOWN. In the following example, an RG value UP is sent to the UE several times. After 8 single RG transmissions, the E-TFCI is reset using a single AG pattern.



In *Signalling* mode, the R&S CMU does not support the E-RGCH pattern types *Single Pattern + All Ack, Single Pattern + All NACK, Single Pattern + Alternating.* The pattern type *Alternating H-ARQ Cycle* is supported instead; see Table 8-6 on p. 8.175.

Fig. 8-47 Repeated single AG and RG pattern transmission

Remote control:

```
CONFigure:BSSignal:HSUPa:TTIMode
CONFigure:BSSignal:HSUPa:RPDSize
CONFigure:BSSignal:HSUPa:EAGCh:UEID:PRIMary
CONFigure:BSSignal:HSUPa:EAGCh:UEID:SECondary
CONFigure:BSSignal:HSUPa:EAGCh:AGPattern:LENGth
CONFigure:BSSignal:HSUPa:EAGCh:AGPattern:INDex<nr>
CONFigure:BSSignal:HSUPa:EAGCh:AGPattern:SCOPe<nr>
CONFigure:BSSignal:HSUPa:EAGCh:AGPattern:IDTYpe<nr>
CONFigure:BSSignal:HSUPa:EAGCh:APATtern
CONFigure:BSSignal:HSUPa:EAGCh:APRepetition
CONFigure:BSSignal:HSUPa:EAGCh:UTTI

CONFigure:BSSignal:HSUPa:ERGHich:FDUMmies
CONFigure:BSSignal:HSUPa:EHICh:MODE
CONFigure:BSSignal:HSUPa:EHICh:SIGNature
CONFigure:BSSignal:HSUPa:ERGCh:MODE
CONFigure:BSSignal:HSUPa:ERGCh:PATTern:LENGth
CONFigure:BSSignal:HSUPa:ERGCh:PATTern:VALue<nr>
CONFigure:BSSignal:HSUPa:ERGCh:SIGNature
CONFigure:BSSignal:HSUPa:ERGCh:APATtern
```

HSUPA UE Signal Parameters

HSUPA-specific parameters which are signalled to the UE and influence the UE uplink signal are located in the *HSUPA* section in the *UE Signal* tab.

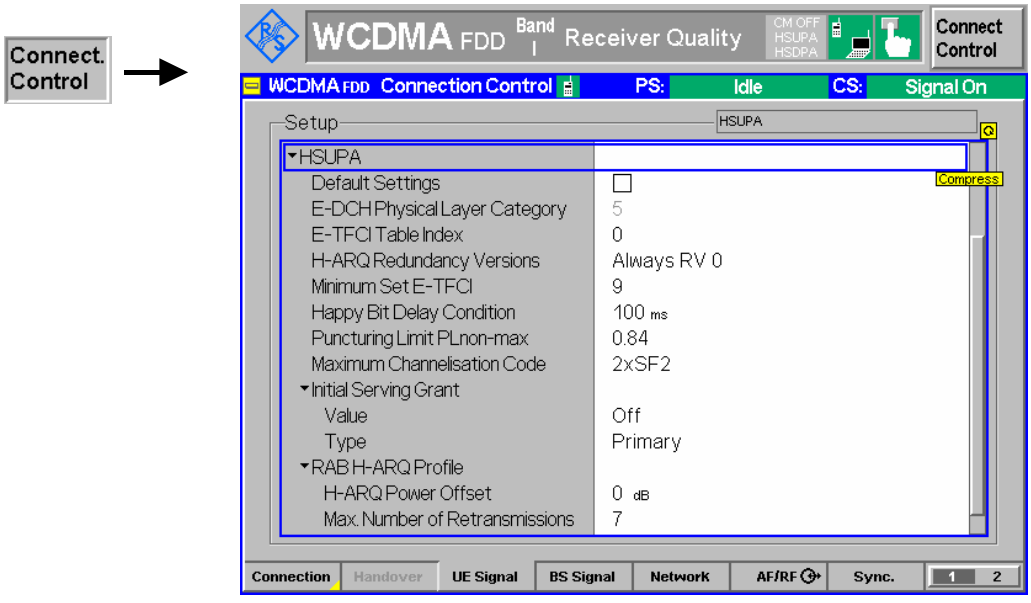


Fig. 8-48 HSUPA-specific signalling parameters

The *E-DCH Physical Layer Category* is grayed because it is signalled by the UE in the *RRC Connection Setup Complete* message. This parameter influences the upper limit of the *Maximum Channelization Code* parameter and the HSUPA TTI mode *(BS Signal – HSUPA – TTI Mode)*. A 10 ms TTI mode is compatible with all E-DCH physical layer categories; a 2 ms TTI mode with a subset of categories only.

The lower limit of the *Maximum Channelization Code* is determined such that transmission of an E-TFCI on the E-DPDCH wich contains one complete RLC PDU is still guaranteed.

All *HSUPA* parameters except the *E-DCH Physical Layer Category* are signalled to the UE in the *Radiobearer Setup* message. The names of the parameters are similar to the corresponding elements of the *Radiobearer Setup* message, see standard 3GPP TS 25.331.

Note: *The parameters in the* Radiobearer Setup *message except the* Initial Serving Grant *and* RAB H-ARQ Profile *settings can still be changed during a connection.*

Remote control:

```
DEFault:UESignal:HSUPa
CONFigure:UESignal:HSUPa:EPLCategory?
CONFigure:UESignal:HSUPa:ETFCi:TINDex
CONFigure:UESignal:HSUPa:HRVersion
CONFigure:UESignal:HSUPa:ETFCi:MSET
CONFigure:UESignal:HSUPa:HBDCondition
CONFigure:UESignal:HSUPa:PLPLnonmax
CONFigure:UESignal:HSUPa:CCODe:MAXimum

CONFigure:UESignal:HSUPa:ISGRant:VALue
CONFigure:UESignal:HSUPa:ISGRant:TYPE

CONFigure:UESignal:HSUPa:HARQ:POFFset
CONFigure:UESignal:HSUPa:HARQ:MRETransmis
```

Gain Factors

The gain factors for the uplink HSUPA channels E-DPCCH and E-DPDCH are controlled by the parameter Δ E-DPCCH and a configurable set of reference E-TFCIs. They can be set in section *HSUPA – HSUPA Gain Factors* in the *UE Signal* tab of the *Connection Control* menu.

Note: *All gain values can still be changed during a connection.*

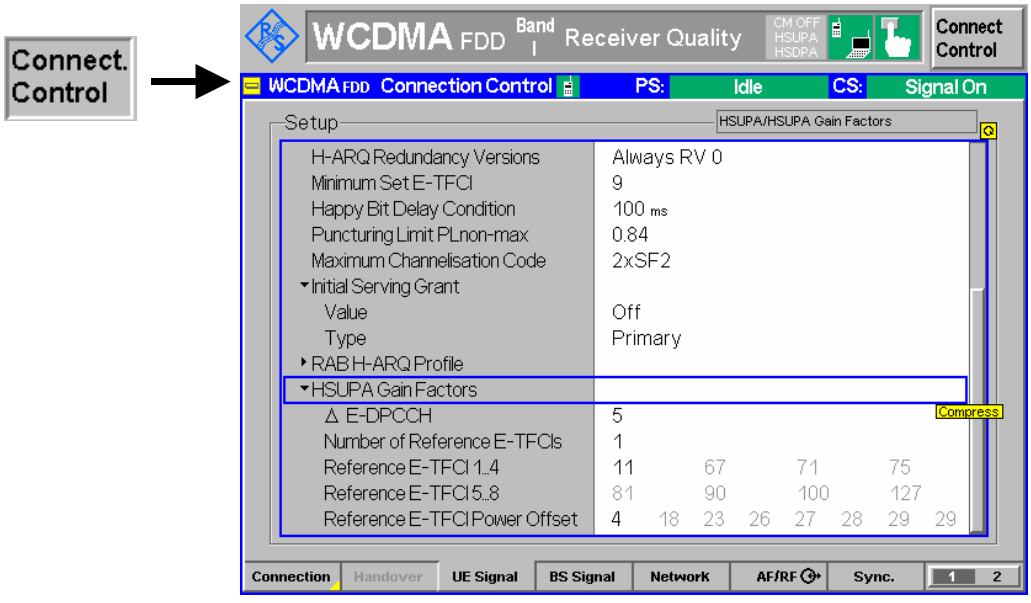


Fig. 8-49 HSUPA gain factors

HSUPA Gain Factors

Δ E-DPCCH Signaled value of the E-DPCCH gain factor. According to standard 3GPP TS 25.213, the signaled value is converted into a quantized amplitude ratio A_{ec}; see Table 8-7 below. The UE uses the quantized values to calculate the E-DPCCH gain factor β_{ec}; see standard 3GPP TS 25.214, subclause 5.1.2.5B.

Number of Reference E-TFCIs Number of reference E-TFCIs used to calculate the E-TFCI-dependent E-DPDCH gain factors. For each reference E-TFCI, a reference gain factor $\beta_{ed,\ ref}$ is signaled to the UE. The UE calculates the gain factors for all E-TFCIs and H-ARQ processes using the reference gain factors, the H-ARQ Power Offset $\Delta harq$ defined in the *RAB H-ARQ Profile* section, and the interpolation formulas from 3GPP TS 25.214, subclause 5.1.2.5B.2.

Reference E-TFCI Reference E-TFCI values

Reference E-TFCI Power Offset Signaled values of the E-DPDCH gain factors assigned to the reference E-TFCIs. The signaled values are converted into quantized amplitude ratios A_{ed}; see Table 8-8 below. The UE uses the quantized values to calculate the reference gain factors $\beta_{ed,\ ref}$.

Remote control:

```
CONFigure:UESignal:HSUPa:GFACtor:EDPCch
CONFigure:UESignal:HSUPa:GFACtor:ETFCi:NREFerence
CONFigure:UESignal:HSUPa:GFACtor:ETFCi:REFerence<nr>
CONFigure:UESignal:HSUPa:GFACtor:ETFCi:POFFset<nr>
```

Table 8-7: Calculation of quantized E-DPCCH gain factors

Signalled values for Δ E-DPCCH	Quantized amplitude ratios $A_{ec} = \beta_{ec} / \beta_c$
8	30/15
7	24/15
6	19/15
5	15/15

Signalled values for Δ E-DPCCH	Quantized amplitude ratios $A_{ec} = \beta_{ec} / \beta_c$
4	12/15
3	9/15
2	8/15
1	6/15
0	5/15

Table 8-8: Calculation of quantized E-DPDCH gain factors

Signalled values for Δ E-DPDCH	Quantized amplitude ratios $A_{ed} = \square_{ed} / \square_c$
29	168/15
28	150/15
27	134/15
26	119/15
25	106/15
24	95/15
23	84/15
22	75/15
21	67/15
20	60/15
19	53/15
18	47/15
17	42/15
16	38/15
15	34/15
14	30/15
13	27/15
12	14/15
11	21/15
10	19/15
9	17/15
8	15/15
7	13/15
6	12/15
5	11/15
4	9/15
3	8/15
2	7/15
1	6/15
0	5/15

The gain factors for DPCCH and DPDCH, β_c and β_d, as well as the gain factors for HS-DPCCH, ΔACK, ΔNACK and ΔCQI are set in section *UE Gain Factors* of the *UE signal* tab.

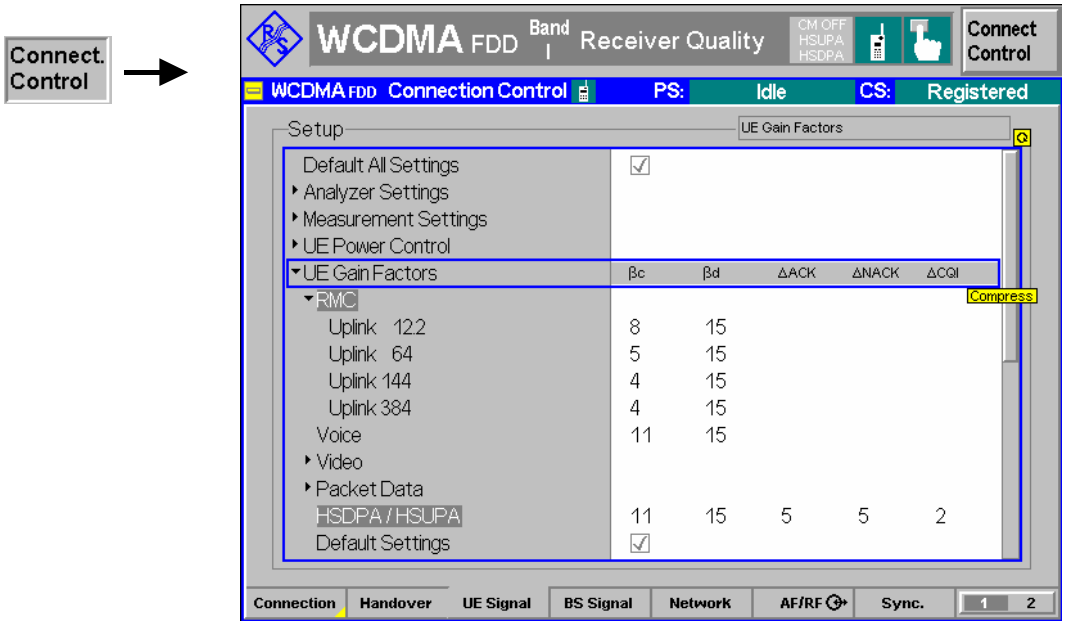


Fig. 8-50 UE gain factors

If an RMC with no additional HSDPA or HSUPA channels is active, the gain factors β_c and β_d are set in the corresponding line of the *RMC* section. The *HSDPA / HSUPA* gain factors (including the HS-DPCCH gain factors ΔACK, ΔNACK and ΔCQ)I are used if a HSDPA / HSUPA connection is set up. It is possible to reconfigure all gain factors during a connection.

HSUPA in Remote Control

The following section lists the commands for the HSUPA generators (in *Non Signalling* and *Signalling* mode) and the specific HSUPA tests.

HSUPA Downlink Generator (Non Signalling)

The subsystem *HSUPa* configures the downlink HSUPA signal generated by the CMU. It corresponds to the *HSUPA* section in the *Generator* tab of the *Connection Control* menu. HSUPA signals and measurements require option R&S®CMU-K56.

SOURce:HSUPa:SIGNal:ENABle <*Enable*>				HSUPA Signal
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	HSUPA channels switched on or off	OFF	–	V4.20
Description of command				
This command switches the HSUPA channels in the WCDMA downlink signal *On* or *Off*. To activate the HSUPA channels the WCMA generator must be switched on as well (`INITiate:RFGenerator`).				

SOURce:HSUPa:TTIMode <*TTI*>				TTI Mode
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
M2 | M10	2 ms or 10 ms TTI	M10	–	V4.55
Description of command				
This command defines the duration of the Transmission Time Interval (TTI).				

SOURce:HSUPa:AMODe <*Start*>				Activation Mode
<Start>	Description of parameters	Def. value	Def. unit	FW vers.
IMMediate | SFN	Immediate activation Activation at specified System Frame Number	IMMediate	–	V4.20
Description of command				
This command defines the start time of the HSUPA generator or HSUPA settings. The System Frame number for SFN activation is defined via `SOURce:HSUPa:SFN`.				

SOURce:HSUPa:ASFN <*SFN*>				Activation SFN
<SFN>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 4095	System Frame Number	0	–	V4.20
Description of command				
This command defines the System Frame Number (SFN) where HSUPA settings take effect.				

SOURce:HSUPa:SSCode <*Code*>				Secondary Scrambling Code
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
#H0 to #HF	Secondary scrambling code	#H0	–	V4.20
Description of command				
This command defines the secondary scrambling code for the downlink HSUPA signal. The input of a scrambling code may be in decimal or in hexadecimal format, the latter preceded by #H (as specified in IEEE 488.2). The output is always in hexadecimal format, preceded by #H.				

E-AGCH Channel Settings

The subsystem *HSUPa:EAGCh* configures the Enhanced DCH Absolute Grant Channel in the generated HSUPA downlink signal. It corresponds to the *E-AGCH* section in the *Generator* tab of the *Connection Control* menu.

SOURce:HSUPa:EAGCh:LEVel <*Level*>				E-AGCH Level
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35.0 dB to +15.0 dB | OFF	Level of E-AGCH E-AGCH switched off	–6	dB	V4.20
Description of command				
This command defines the E-AGCH level relative to the level reference for the DL generator signal (`SOURce:RFGenerator:LREFerence`). Use the command `SOURce:HSUPa:PHYSical:LEVel` or `SOURce:HSPa:PHYSical:LEVel` to define the E-AGCH level together with all other physical channel levels.				

SOURce:HSUPa:EAGCh:CCODe <*Code*>				E-AGCH Channel. Code
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
2 to 255	Chann. code of E-AGCH	6	–	V4.20
Description of command				
This command selects the channelization code (Orthogonal Variable Spreading Code, OVSC) number assigned to the E-AGCH.				

SOURce:HSUPa:EAGCh:UEID:PRIMary <*Number*>				E-AGCH UE-ID, primary
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
#H0 to #HFFFF	Primary UE-ID	#HAAAA	–	V4.20
Description of command				
This command selects the primary E-RNTI (E-DCH Radio Network Temporary Identifier) transmitted on the E-AGCH.				

SOURce:HSUPa:EAGCh:GRANts:PRIMary<nr> <*Grant_nr*>				Absolute Grant, primary
<Grant_nr>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 31 | OFF	Absolute grant value HARQ process INACTIVE	15	–	V4.20
Description of command				
This command selects the primary absolute grants. Each value controls one HARQ process, so there are four values (<nr> = 1 to 4) for a 10 ms TTI, eight values (<nr> = 1 to 8) for a 2 ms TTI (see `SOURce:HSUPa:TTIMode`).				

SOURce:HSUPa:EAGCh:AGS:PRIMary AGS (Absolute Grant Scope), primary
<Enable_1>, … <Enable_8>

<Enable_nr>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Per HARQ process All HARQ processes	OFF	–	V4.30

Description of command

This command specifies which HARQ processes the absolute grant values should apply to. Each value is associated with one HARQ process, so there are four values (<nr> = 1 to 4) for a 10 ms TTI, eight values (<nr> = 1 to 8) for a 2 ms TTI (see `SOURce:HSUPa:TTIMode`). Use `SOURce:HSUPa:EAGCh:AGS:HARQ:PRIMary<nr>` to select a single primary AGS value.

SOURce:HSUPa:EAGCh:AGS:HARQ:PRIMary<nr> *<Enable>* AGS (Absolute Grant Scope), primary

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Per HARQ process All HARQ processes	OFF	–	V4.30

Description of command

This command specifies which HARQ processes the absolute grant values should apply to. Each value is associated with one HARQ process, so there are four values (<nr> = 1 to 4) for a 10 ms TTI, eight values (<nr> = 1 to 8) for a 2 ms TTI (see `SOURce:HSUPa:TTIMode`). Use `SOURce:HSUPa:EAGCh:AGS:PRIMary` to define all primary AGS values.

SOURce:HSUPa:EAGCh:UEID:SECondary *<Number>* E-AGCH UE-ID, secondary

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
#H0 to #HFFFF	Secondary UE-ID	#H12AA	–	V4.20

Description of command

This command selects the secondary E-RNTI (E-DCH Radio Network Temporary Identifier) transmitted on the E-AGCH.

SOURce:HSUPa:EAGCh:GRANts:SECondary<nr> *<Grant_nr>* Absolute Grant, secondary

<Grant_nr>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 31 | **OFF**	Absolute grant value HARQ process INACTIVE	15	–	V4.20

Description of command

This command selects the secondary absolute grants. Each value controls one HARQ process, so there are four values (<nr> = 1 to 4) for a 10 ms TTI, eight values (<nr> = 1 to 8) for a 2 ms TTI (see `SOURce:HSUPa:TTIMode`).

SOURce:HSUPa:EAGCh:AGS:SECondary *<Enable>* AGS (Absolute Grant Scope), secondary
<Enable_1>, … <Enable_8>

<Enable_nr>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Per HARQ process All HARQ processes	OFF	–	V4.30

Description of command

This command specifies which HARQ processes the absolute grant values should apply to. Each value is associated with one HARQ process, so there are four values (<nr> = 1 to 4) for a 10 ms TTI, eight values (<nr> = 1 to 8) for a 2 ms TTI (see `SOURce:HSUPa:TTIMode`). Use `SOURce:HSUPa:EAGCh:AGS:HARQ:SECondary<nr>` to select a single secondary AGS value.

SOURce:HSUPa:EAGCh:AGS:HARQ:SECondary<nr> <*Enable*> AGS (Absolute Grant Scope), secondary

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Per HARQ process All HARQ processes	OFF	–	V4.30

Description of command

This command specifies which HARQ processes the absolute grant values should apply to. Each value is associated with one HARQ process, so there are four values (<nr> = 1 to 4) for a 10 ms TTI, eight values (<nr> = 1 to 8) for a 2 ms TTI (see `SOURce:HSUPa:TTIMode`). Use `SOURce:HSUPa:EAGCh:AGS:SECondary` to define all secondary AGS values.

SOURce:HSUPa:EAGCh:UEID:SELection <*Prim_Sec*> UE-ID Selection

<*Prim_Sec*>	Description of parameters	Def. value	Def. unit	FW vers.
PRIMary | PSECondary	Primary UE-ID Primary + Secondary UE-ID	PRIMary	–	V4.20

Description of command

This command defines whether absolute grant messages with the *Secondary UE-ID* (`SOURce:HSUPa:EAGCh:UEID:SECondary`) are used.

SOURce:HSUPa:EAGCh:UTTI <*Transmit*> Unscheduled TTI

<*Transmit*>	Description of parameters	Def. value	Def. unit	FW vers.
DTX | TDUeid	DTX Transmit Dummy UE-ID	DTX	–	V4.20

Description of command

This command defines the transmission of the R&S CMU in inactive Transmission Time Intervals (TTIs).

E-RGCH / E-HICH Channel Settings

The subsystem *HSUPa:ERGHich* provides common settings for the Enhanced DCH Relative Grant Channel (E-RGCH) and the Enhanced DCH Hybrid ARQ Indicator Channel (E-HICH) in the generated HSUPA downlink signal. It corresponds to the *E-RGCH / E-HICH* section in the *Generator* tab of the *Connection Control* menu.

SOURce:HSUPa:ERGHich:LEVel <*Level*> E-RGCH / E-HICH Level

<*Level*>	Description of parameters	Def. value	Def. unit	FW vers.
–35.0 dB to +12.0 dB	Level of E-RGCH / E-HICH	–6	dB	V4.20

Description of command

This command defines the E-RGCH / E-HICH level relative to the level reference for the DL generator signal (`SOURce:RFGenerator:LREFerence`). Use the command `SOURce:HSUPa:PHYSical:LEVel` or `SOURce:HSPa:PHYSical:LEVel` to define the E-RGCH / E-HICH level together with all other physical channel levels.

SOURce:HSUPa:ERGHich:CCODe <*Code*>			E-RGCH / E-HICH Channel. Code	
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 127	Chann. code of E-RGCH / E-HICH	1	–	V4.20
Description of command				
This command selects the channelization code (Orthogonal Variable Spreading Code, OVSC) number assigned to the E-RGCH / E-HICH.				

SOURce:HSUPa:ERGHich:ASIGnatures <*Enable*>			Allow other Signatures	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Add 10 additional channels with different signatures Generate a single E-RGCH / E-HICH channel	OFF	–	V4.20
Description of command				
This command specifies whether the R&S CMU generates an additional set of 10 channels with equal channelization code but different signatures.				

SOURce:HSUPa:PHYSical:LEVel Combined WCDMA and HSUPA Levels
<P-CPICH_abs> | <P-CPICH_rel>, <P-SCH>, <S-SCH>, <P-CCPCH>, <PICH>, <DPDCH>, <Power Offset>, <E-AGCH>, <E-RGCH>

<P-CPICH_abs>	Description of parameters	Def. value	Def. unit	FW vers.
–147.0 dBm to –37.0 dBm*	Absolute P-CPICH level if RF 1 is used	–96.3	dBm	V4.20
–147.0 dBm to –20.0 dBm*	Absolute P-CPICH level if RF 2 is used	–96.3	dBm	
–100.0 dBm to +3.0 dBm*	Abs. P-CPICH level if RF 3 OUT is used	–96.3	dBm	
<P-CPICH_rel>	Description of parameters	Def. value	Def. unit	
–30 dB to 0 dB	Relative P-CPICH level	–	dB	
<P-SCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB |	P-SCH level (level reference = P-CPICH)	–5.0	dB	
–30 dB to 0 dB	P-SCH level (level reference = total channel power)	–	dB	
<S-SCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB |	S-SCH level (level reference = P-CPICH)	–5.0	dB	
–30 dB to 0 dB	S-SCH level (level reference = total channel power)	–	dB	
<P-CCPCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB |	P-CCPCH level (level ref. = P-CPICH)	–2.0	dB	
–30 dB to 0 dB	P-CCPCH level (level reference = total channel power)	–	dB	
<PICH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB |	PICH level (level ref. = P-CPICH)	–5.0	dB	
–30 dB to 0 dB	PICH level (level reference = total channel power)	–	dB	
<DPDCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB |	DPDCH level (level ref. = P-CPICH)	–7.0	dB	
–30 dB to 0 dB	DPDCH level (level reference = total channel power)	–	dB	
<Power Offset>	Description of parameters	Def. value	Def. unit	
0.0 dB to 6.0 dB	DPCCH/DPDCH power offset	0.0	dB	
<E-AGCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB |	Sum level of E-AGCH	–6.0	dB	
OFF	HS-PDSCH switched off			
<E-RGCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +12 dB |	Sum level of E-RGCH/E-HICH	–6.0	dB	
OFF	E-RGCH/E-HICH switched off			

Description of command

This command sets all physical channel levels at once, including the HSUPA channels (`SOURce:HSUPA:PHYSical:LEVel` sets the DL HSDPA in addition). The WCDMA levels can be set relative to the P-CPICH level (in which case *<P-CPICH_abs>* is used) or relative to the total channel power (*<P-CPICH_rel>* is used), depending on the *`SOURce:RFGenerator:LREFerence`* setting.

Note: *The instrument checks the levels for consistence before activating the settings. This is important especially if the levels are defined relative to the total channel power and must not exceed this fixed value.*

*) The reported level ranges correspond to the total output power ranges at the three RF output connectors (see command *`SOURce:RFGenerator:OPOWer`*). If other channel contributions are switched on, the P-CPICH level must be reduced so that the total output power range is not exceeded.

**) If the channels no. 2, 3, or 4 are switched `ON`, their level is set to –7 dB.

HARQ Feedback (E-HICH)

The subsystem *HSUPa:EHICh* provides specific E-RGCH channel settings and defines the HARQ feedback information. It corresponds to the *HARQ Feedback (E-HICH)* section in the *Generator* tab of the *Connection Control* menu.

SOURce:HSUPa:EHICh:MODE <*Profile*> Mode

<Profile>	Description of parameters	Def. value	Def. unit	FW vers.
ALTernating |	Alternating 0,1	AACK	–	V4.20
AACK |	All ACK			
ANACk |	All NACK			
ADTX |	All DTX			
CPATtern |	Continuous Pattern			
SAACk |	Single pattern + All ACK			
SANack |	Single pattern + All NACK			
SADTx |	Single pattern + All DTX			
SALT |	Single pattern + Alternating			
ULCRc	React on UL CRC			V5.01

Description of command

This command defines the HARQ feedback information transmitted on the E-HICH.

SOURce:HSUPa:EHICh:PATTern <*Pattern*> Pattern

<Pattern>	Description of parameters	Def. value	Def. unit	FW vers.
"<1 to 64 digits>"	Single pattern (1 or 0 or – values)	„0”	–	V4.20

Description of command

This command defines the single pattern that is used to construct the HARQ feedback sequence; see command `SOURce:HSUPa:EHICh:MODE` above. Each digit corresponds to a ternary value (1 for ACK, 0 for NACK, – for DTX, e.g. ‘100-111’).

SOURce:HSUPa:EHICh:SIGNature <*Signature*> Signature (E-HICH)

<Signature>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 39	E-HICH signature	1	–	V4.20

Description of command

This command selects the signature sequence used to separate the E-HICH channel from the E-RGCH. The value must be different from the E-RGCH signature (`SOURce:HSUPa:ERGCh:SIGNature`).

Relative Grant (E-RGCH)

The subsystem *HSUPa:ERGCh* provides specific E-RGCH channel settings and defines the relative grant information. It corresponds to the *Relative Grant (E-RGCH)* section in the *Generator* tab of the *Connection Control* menu.

SOURce:HSUPa:ERGCh:MODE <*Profile*> — Mode

<*Profile*>	Description of parameters	Def. value	Def. unit	FW vers.
ALTernating |	Alternating 0,1	ALT	–	V4.20
AUP |	All UP			
ADOWn |	All DOWN			
ADTX |	All DTX			
CPATtern |	Continuous Pattern			
SAUP |	Single pattern + All UP			
SADown |	Single pattern + All DOWN			
SADTx |	Single pattern + All DTX			
SALT	Single pattern + Alternating			

Description of command

This command defines the relative grant information transmitted on the E-RGCH.

SOURce:HSUPa:ERGCh:PATTern <*Pattern*> — Pattern

<*Pattern*>	Description of parameters	Def. value	Def. unit	FW vers.
"<1 to 64 digits>"	Single pattern (1 or 0 or – values)	„0"	–	V4.20

Description of command

This command defines the single pattern that is used to construct the relative grant sequence; see command `SOURce:HSUPa:ERGCh:MODE` above. Each digit corresponds to a ternary value (1 for UP, 0 for DOWN, – for DTX, e.g. '100-111').

SOURce:HSUPa:ERGCh:SIGNature <*Signature*> — Signature (E-RGCH)

<*Signature*>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 39	E-RGCH signature	0	–	V4.20

Description of command

This command selects the signature sequence used to separate the E-RGCH channel from the E-HICH. The value must be different from the E-HICH signature (`SOURce:HSUPa:EHICh:SIGNature`).

SOURce:HSUPa:ERGCh:FDUMmies <*Enable*> — Fill up Frame with Dummies

<*Signature*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Continuous E-RGCH signal DTX in 3 slots per frame (10 ms TTI only)	ON	–	V4.20

Description of command

This command defines the transmission in the 3 slots per frame where the E-RGCH is not active. This setting has no effect for 2 ms TTIs (`SOURce:HSUPa:TTIMode M2`).

HSUPA UE Signal Configuration (Signalling)

The following commands define HSUPA-specific parameters which characterize the UE uplink signal.

DEFault:UECode:HSUPa <*Enable*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V5.01

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the `UECode:HSUPa` subsystem (including the commands in the following sub-sections) to default values. The setting *OFF* results in an error message.

If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

CONFigure:UECode:HSUPa:DELTa:EDPCch <*Δ E-DPCCH*> Gain Factor Δ E-DPCCH

<Δ E-DPCCH>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 8	Δ E-DPCCH gain factor	5	–	V5.01

Description of command

This command defines the gain factor for the uplink E-DPCCH.

CONFigure:UECode:HSUPa:ETFCI:TINDex <*E-TFCI*> E-TFCI Table Index

<E-TFCI>	Description of parameters	Def. value	Def. unit	FW vers.
0 | 1	E-TFCI table index	0	–	V5.01

Description of command

This command defines the E-TFCI table index in the E-DCH information. This value indicates which of the standardized E-TFCI transport block size tables shall be used.

CONFigure:UECode:HSUPa:HRVersion <*Versions*> H-ARQ Redundancy Versions

<Versions>	Description of parameters	Def. value	Def. unit	FW vers.
RVA | RVT	Always redundancy version index 0 Redundancy version table	RVA	–	V5.01

Description of command

This command defines the HARQ Incremental Redundancy Version configuration.

CONFigure:UECode:HSUPa:CCODe:MAXimum <*Codes*>			Maximum Channelization Code	
<Codes>	Description of parameters	Def. value	Def. unit	FW vers.
SF256 | SF128 | SF64 | SF32 | SF16 | SF8 | SF4 | SF44 | SF22 | SF24	SF256 | … | … | SF 4 | 2xSF4 | 2xSF2 | 2xSF2 and 2xSF4	SF24*)	–	V5.01
Description of command				
This command defines the maximum channelization codes (and thus the maximum data rates) for the E-DCH transmission. *) The upper limit of the maximum channelization code parameter depends on the *E-DCH Physical Layer Category* of the UE, to be requensted via `CONFigure:UECode:HSUPa:EPLCategory?`. The default value SF24 is valid for appropriate E-DCH physical layer categories only.				

CONFigure:UECode:HSUPa:PLPLnonmax <*Limit*>			Puncturing Limit $PL_{non-max}$	
<Limit>	Description of parameters	Def. value	Def. unit	FW vers.
0.44 to 1.00	Puncturing limit	0.84	–	V5.01
Description of command				
This command defines the puncturing limit $PL_{non-max}$. A PL value limits the amount of puncturing that can be applied in order to minimize the number of physical channels. The allowed puncturing in % is actually equal to (1-PL)*100. The value of $PL_{non-max}$ is used to determine the combination of spreading factor and the number of codes that are used for transmitting the E-DCH with a certain data rate.				

Measurement Groups (Signalling)

The measurements reported in this section are available in *Signalling* mode.

E-DPCCH Logging Remote Commands

The subsystem `RXQuality:HSULog` controls the E-DPCCH Logging test. The subsystem corresponds to the measurement menu *Receiver Quality,* application *E-DPCCH Logging,* and the sections in the popup menu *Receiver Quality Configuration* that are related to the *E-DPCCH Logging* application.

INITiate:RXQuality:HSULog	Start new measurement	⇒	*RUN*
ABORt:RXQuality:HSULog	Abort running measurement and switch off	⇒	*OFF*
STOP:RXQuality:HSULog	Stop measurement	⇒	*STOP*
CONTinue:RXQuality:HSULog	Next measurement step (only *stepping mode*)	⇒	*RUN*
Description of command			FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.			V4.50

CONFigure:RXQuality:HSULog:EREPorting <Mode> — Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SRSQ No reporting	OFF	–	V4.50

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of R&S CMU manual).

FETCh:RXQuality:HSULog:STATus? — Measurement Status

Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop cond.	OFF	–	V4.50
1 to 10000 | **NONE**	Counter for current statistics cycle No counting mode set	NONE	–	

Description of command

This command is always a query. It returns the status of the measurement (see chapter 5 of R&S CMU operating manual).

E-DPCCH Logging Configuration

The following commands define the scope of the E-DPCCH Logging test, the E-TFCI values, and the limits. The subsystem corresponds to the sections in the popup menu *Receiver Quality Configuration* that are related to the *E-DPCCH Logging* application.

CONFigure:RXQuality:HSULog:CONTrol:REPetition <Repetition>, <StopCond>, <Stepmode> — Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	FW vers.
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	V4.50
<StopCond>	Description of parameters	Def. value	Def. unit	FW vers.
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	V4.50
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V4.50

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of `READ` commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:RXQuality:HSULog:CONTrol:SSFN <*Number*>			Start System Frame Number	
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 4095 | OFF	Start SFN No SFN specified	OFF	–	V4.50
Description of command				
This command specifies the first System Frame Number (SFN) for which the returned ACK/NACK messages and reported CQI values are displayed. In the default setting *OFF,* the measurement starts as soon as possible.				

E-DPCCH Logging Results

The following commands query the results of the E-DPCCH Logging test.

				Measurement Results
READ[:SCALar]:RXQuality:HSULog?	Start single shot measurement and return results			
FETCh[:SCALar]:RXQuality:HSULog?	Read out meas. results (unsynchronized)			
SAMPle[:SCALar]:RXQuality:HSULog?	Read out measurement results (synchronized)			
Returned values	Value range	Def. value	Def. unit	FW vers.
SFN, **E-TFCI,** **RSN,** **Happy Bit,** **… (1000 repetitions)**	0 to 4095 0 to 127 0 to 3 U | H	NAN NAN NAN NAN	– – – –	V4.50
Description of command				
These commands are always queries. They start an E-DPCCH Logging test (`READ…`) and/or return all measurement results.				

			Current System Frame Number	
FETCh[:SCALar]:RXQuality:HSULog:CSFN?	Read out meas. results (unsynchronized)			
Returned values	Value range	Def. value	Def. unit	FW vers.
SFN	0 to 4095	NAN	–	V4.50
Description of command				
This command is always a query. It returns the current SFN for a E-DPCCH Logging test in the RUN or RDY state.				

			Current Measured Subframes	
FETCh[:SCALar]:RXQuality:HSULog:MSUBframes?	Read out meas. results (unsynchronized)			
Returned values	Value range	Def. value	Def. unit	FW vers.
Subrames	0 to 1000	NAN	–	V4.51
Description of command				
This command is always a query. It returns the current number of subframes measured while the E-DPCCH Logging test is in the RUN or RDY state.				

HSUPA E-AGCH Measurement

The subsystem `RXQuality:EAGCh` controls the HSUPA E-AGCH test. The subsystem corresponds to the measurement menu *Receiver Quality,* application *HSUPA E-AGCH,* and the sections in the popup menu *Receiver Quality Configuration* that are related to the *HSUPA E-AGCH* application.

INITiate:RXQuality:EAGCh	Start new measurement	⇒	*RUN*
ABORt:RXQuality:EAGCh	Abort running measurement and switch off	⇒	*OFF*
STOP:RXQuality:EAGCh	Stop measurement	⇒	*STOP*
CONTinue:RXQuality:EAGCh	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V4.50

CONFigure:RXQuality:EAGCh:EREPorting <Mode> — Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V4.50
SOPC |	Single operation complete			
SRSQ |	SRQ and SRSQ			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of R&S CMU manual).

FETCh:RXQuality:EAGCh:STATus? — Measurement Status

Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V4.50
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop cond.			
1 to 10000 |	Counter for current statistics cycle	NONE		
NONE,	No counting mode set		–	
1 to 1000 000 |	Counter for current measured subframe within a cycle	NONE		
NONE	Statistic count set to off		–	

Description of command

This command is always a query. It returns the status of the measurement (see chapter 5 of R&S CMU operating manual).

HSUPA E-AGCH Configuration

The following commands define the scope of the HSUPA E-AGCH test, the E-TFCI values, and the limits. The subsystem corresponds to the sections in the popup menu *Receiver Quality Configuration* that are related to the *HSUPA E-AGCH* application.

DEFault: RXQuality:EAGCh:CONTrol <*Enable*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V4.50

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the `CONFigure:RXQuality:EAGCh:CONTrol…` subsystem (including the commands in the following sub-sections) to default values. The setting *OFF* results in an error message.

If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

CONFigure:RXQuality:EAGCh:CONTrol:REPetition <Repetition>, <StopCond>, <Stepmode> Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	FW vers.
CONTinuous | SINGleshot | 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	V4.50
<StopCond>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
SONerror | NONE	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	V4.50
<Stepmode>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
STEP | NONE	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V4.50

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of `READ` commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:RXQuality:EAGCh:CONTrol:MSUBframes <*Subframes*> Measure Subframes

<Subframes>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1 000 000	Number of subframes	1000	(subframes)	V4.50

Description of command

This command specifies the number of subframes to be measured per single shot.

CONFigure:RXQuality:EAGCh:CONTrol:MTYPe <*Type*> Measure Type

<Type>	Description of parameters	Def. value	Def. unit	FW vers.
MDET | GEN	Missed detection General histogram	GEN	–	V4.55

Description of command

This command selects the E-AGCH measurement type.

CONFigure:RXQuality:EAGCh:CONTrol:ETFCi:VALue<nr> <*E-TFCI*> Expected E-TFCI Values

<E-TFCI>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 127	Expected E-TFCI <nr> where <nr> = 1 to 8	See below	–	V4.50

Description of command

This command specifies the expected E-TFCI values no. 1 to 8. Use `CONFigure:BSSignal:HSUPa:EAGCh:AGPattern:LENGth` to define the number of values used. For a 10 ms TTI, the maximum number of values is 4. The default values are as follows:

<nr>	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
E-TFCI	28	67	81	85	90	95	100	105

CONFigure:RXQuality:EAGCh:CONTrol:ETFCi:AUTO<nr>? Calculated E-TFCI Values

Response	Description of parameters	Def. value	Def. unit	FW vers.
0 to 127	Calculated E-TFCI <nr> where <nr> = 1 to 8	–	–	V4.51

Description of command

This command queries the automatically calculated E-TFCI values no. 1 to 8 (`CONFigure:RXQuality:EAGCh:CONTrol:ETFCi:MODE AUTO`). Use `CONFigure:BSSignal:HSUPa:EAGCh:AGPattern:LENGth` to define the number of values used. For a 10 ms TTI, the maximum number of values is 4.

CONFigure:RXQuality:EAGCh:CONTrol:ETFCi:MODE <Mode> Value Selection

Response	Description of parameters	Def. value	Def. unit	FW vers.
AUTO | MANual	Automatic E-TFCI calculation Manual setting	AUTO	–	V4.51

Description of command

This command selects automatic E-TFCI calculation or manual E-TFCI setting (**`CONFigure:RXQuality:EAGCh:CONTrol:ETFCi:VALue<nr>`**).

DEFault: RXQuality:EAGCh:LIMit <*Enable*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V4.50

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the `CONFigure:RXQuality:EAGCh:LIMit…` subsystem (including the commands in the following sub-sections) to default values. The setting *OFF* results in an error message.

If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

CONFigure:RXQuality:EAGCh:LIMit:SCALar:ASYMmetric:COMBined:VALue <*Limit*> Limit

<Limit>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to 100.0 %	Upper limit for *Missed Detection Probability*	1.0	%	V4.50

Description of command

This command specifies the limit for the *HSUPA E-AGCH* measurement.

HSUPA E-AGCH Results

The following commands query the results of the HSUPA E-AGCH test.

Scalar Results: Missed Detection

READ[:SCALar]:RXQuality:EAGCh:MDETection? Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:EAGCh:MDETection? Read out meas. results (unsynchronized)
SAMPle[:SCALar]:RXQuality:EAGCh:MDETection? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
E-TFCI no. 1,	0 to 127	NAN	–	V4.50
…	…	…		
E-TFCI no. 8,	0 to 127	NAN	–	
Det. Events of				
E-TFCI no. 1,	0 to <number of (sub)frames sent>	NAN	–	
…	…	…		
E-TFCI no. 8,	0 to <number of (sub)frames sent>	NAN	–	
Meas. Subframes,	0 to <total number of (sub)frames sent>	NAN	–	
Det. E-TFCI Events,	0 to <total number of (sub)frames sent>	NAN	–	
Missed Detections,	0 to <total number of (sub)frames sent>	NAN	–	
Missed Detection Prob.,	0.000% to 100.000%	NAN	%	
No. of Happy Bits	0 to <total number of (sub)frames sent>	NAN	–	

Description of command

These commands are always queries. They start an HSUPA E-AGCH test (`READ…`) and/or return the measurement results for the *Missed Detection* measurement type (see also detailed explanation of measured values in section *HSUPA E-AGCH Measurement Results* on p. 8.151).

E-TFCI Results: Missed Detection

READ:ARRay:RXQuality:EAGCh:MDETection? Start single shot measurement and return results
FETCh:ARRay:RXQuality:EAGCh:MDETection? Read out meas. results (unsynchronized)
SAMPle:ARRay:RXQuality:EAGCh:MDETection? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
E-TFCI no. 1,	0 to <total no. of (sub)frames sent>	0	–	V4.50
…	…	…	…	
E-TFCI no. 8,	0 to <total no. of (sub)frames sent>	0	–	
Missed Detections	0 to <total no. of (sub)frames sent>			

Description of command

These commands are always queries. They start an HSUPA E-AGCH test (`READ…`) and/or return the detected E-TFCI events no. 1 to 8, as defined via `CONFigure:RXQuality:EAGCh:CONTrol:ETFCi:VALue<nr>` (see also detailed explanation of measured values in section *HSUPA E-AGCH Measurement Results* on p. 8.151). If no errors (missed detections) occur and n E-TFCI values are enabled, the first n results equal to <total no. of subframes sent> / n; the remaining results are zero.

Scalar Results: Extended

READ[:SCALar]:RXQuality:EAGCh:GENeral? Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:EAGCh:GENeral? Read out meas. results (unsynchronized)
SAMPle[:SCALar]:RXQuality:EAGCh:GENeral? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
E-TFCI no. 1,	0 to 127	NAN	–	V4.50
…	…	…		
E-TFCI no. 8,	0 to 127	NAN	–	
Det. Events of				
E-TFCI no. 1,	0 to <number of (sub)frames sent>	NAN	–	
…	…	…		
E-TFCI no. 8,	0 to <number of (sub)frames sent>	NAN	–	
Meas. Subframes,	0 to <total number of (sub)frames sent>	NAN	–	
Det. E-TFCI Events	0 to <total number of (sub)frames sent>	NAN	–	

Description of command

These commands are always queries. They start an HSUPA E-AGCH test (`READ…`) and/or return the measurement results for the *General Histogram* measurement type (see also detailed explanation of measured values in section *HSUPA E-AGCH Measurement Results* on p. 8.151).

Scalar Results: Extended

READ:ARRay:RXQuality:EAGCh:GENeral? Start single shot measurement and return results
FETCh:ARRay:RXQuality:EAGCh:GENeral? Read out meas. results (unsynchronized)
SAMPle:ARRay:RXQuality:EAGCh:GENeral? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
E-TFCI = 0,	0 to <total no. of (sub)frames sent>	NAN	0	V4.50
…	…	…	…	
E-TFCI = 127	0 to <total no. of (sub)frames sent>	NAN	0	

Description of command

These commands are always queries. They start an HSUPA E-AGCH test (`READ…`) and/or return the measurement results for the *General Histogram* measurement type (see also detailed explanation of measured values in section *HSUPA E-AGCH Measurement Results* on p. 8.151). E-TFCI = n denotes the number of detected E-TFCI events with a value of n.

CALCulate[:SCALar]: RXQuality:EAGCh:MDETection:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
Missed Detection Probability	NMAL | INV | OK	INV	–	V4.50

Description of command

This command is always a query. It indicates whether and in which way the limits for the HSUPA E-AGCH test are exceeded. The following messages may be returned for all measured values:

NMAL	Result exceeds upper limit, DUT failed
INV	No valid result available
OK	DUT passed limit check

Additional commands:
The *No. of E-TFCI Values* is coupled to the *AG Pattern Length,* to be set in the *BS Signal* tab of the *Connection Control* menu.
See command `CONFigure:BSSignal:HSUPa:EAGCh:AGPattern:LENGth` on p. 8.218.

HSUPA E-RGCH Measurement

The subsystem `RXQuality:ERGCh` controls the HSUPA E-RGCH test. The subsystem corresponds to the measurement menu *Receiver Quality,* application *HSUPA E-RGCH,* and the sections in the popup menu *Receiver Quality Configuration* that are related to the *HSUPA E-RGCH* application.

INITiate:RXQuality:ERGCh	Start new measurement	⇒	*RUN*
ABORt:RXQuality:ERGCh	Abort running measurement and switch off	⇒	*OFF*
STOP:RXQuality:ERGCh	Stop measurement	⇒	*STOP*
CONTinue:RXQuality:ERGCh	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V4.55

CONFigure:RXQuality:ERGCh:EREPorting <Mode> — Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V4.55
SOPC |	Single operation complete			
SRSQ |	SRQ and SRSQ			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of R&S CMU manual).

FETCh:RXQuality:ERGCh:STATus? — Measurement Status

Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V4.55
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop cond.			
1 to 10000 |	Counter for current statistics cycle	NONE		
NONE,	No counting mode set		–	
1 to 1000 000 |	Counter for current measured subframe within a cycle	NONE		
NONE	Statistic count set to off		–	

Description of command

This command is always a query. It returns the status of the measurement (see chapter 5 of R&S CMU operating manual).

HSUPA E-RGCH Configuration

The following commands define the scope of the HSUPA E-RGCH test, the E-TFCI values, and the limits. The subsystem corresponds to the sections in the popup menu *Receiver Quality Configuration* that are related to the *HSUPA E-RGCH* application.

DEFault: RXQuality:ERGCh:CONTrol <*Enable*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V4.55

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the `CONFigure:RXQuality:ERGCh:CONTrol…` subsystem (including the commands in the following sub-sections) to default values. The setting *OFF* results in an error message.

If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

CONFigure:RXQuality:ERGCh:CONTrol:REPetition <Repetition>, <StopCond>, <Stepmode> Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	FW vers.
CONTinuous | SINGleshot | 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	V4.55
<StopCond>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
SONerror | NONE	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	V4.55
<Stepmode>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
STEP | NONE	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V4.55

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of `READ` commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:RXQuality:ERGCh:CONTrol:MSUBframes <*Subframes*> Measure Subframes

<Subframes>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1 000 000	Number of subframes	1000	(subframes)	V4.55

Description of command

This command specifies the number of subframes to be measured per single shot.

CONFigure:RXQuality:ERGCh:CONTrol:ETFCi:NEXPected <*Number*> No. of Expected E-TFCIs

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
3 to 11	No. of Expected E-TFCIs	7	–	V4.55

Description of command

Number of valid E-TFCI values. If the operating point of the UE is shifted outside the E-TFCI range, the initial operating point is re-adjusted.

CONFigure:RXQuality:ERGCh:CONTrol:ETFCi:INITial <*Number*> Initial E-TFCI

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
2 to 10	Initial E-TFCIs	5	–	V4.55

Description of command

Position of the initial operating point in the *Expected E-TFCI* range. The position must not exceed the number of valid E-TFCI values (`CONFigure:RXQuality:ERGCh:CONTrol:ETFCi:NEXPected`) minus 1.

CONFigure:RXQuality:ERGCh:CONTrol:ETFCi:MODE <Mode> E-TFCI Value Selection

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
AUTO | MANual	Automatic E-TFCI calculation Manual setting	AUTO	–	V4.55

Description of command

This command selects automatic E-TFCI calculation or manual E-TFCI setting (`CONFigure:RXQuality:ERGCh:CONTrol:ETFCi:MANual<nr>`).

CONFigure:RXQuality:ERGCh:CONTrol:ETFCi:MANual<nr> <*E-TFCI*> Expected E-TFCI

<E-TFCI>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 127	Expected E-TFCI <nr> where <nr> = 1 to 11	See below	–	V4.55

Description of command

This command specifies the expected E-TFCI values no. 1 to 11. Use `CONFigure:RXQuality:ERGCh :CONTrol:ETFCi:NEXPected` to define the number of values used. The default values are as follows:

<nr>	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8, 9, 10, 11**
E-TFCI	19	28	35	40	45	52	59	NAN

CONFigure:RXQuality:ERGCh:CONTrol:ETFCi:AUTO<nr>? Calculated E-TFCI Values

Response	Description of parameters	Def. value	Def. unit	FW vers.
0 to 127	Calculated E-TFCI <nr> where <nr> = 1 to 11	–	–	V4.55

Description of command

This command queries the automatically calculated E-TFCI values no. 1 to 11 (`CONFigure:RXQuality :ERGCh:CONTrol:ETFCi:MODE AUTO`). Use `CONFigure:RXQuality:ERGCh:CONTrol:ETFCi :NEXPected` to define the number of valid E-TFCIs.

DEFault: RXQuality:ERGCh:LIMit <*Enable*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V4.55

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the `CONFigure:RXQuality:ERGCh:LIMit…` subsystem (including the commands in the following sub-sections) to default values. The setting *OFF* results in an error message.

If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

CONFigure:RXQuality:ERGCh:LIMit[:SCALar]:ASYMmetric[:COMBined]:VALue <DOWN>, <UP>, <HOLD>				Limits
<DOWN>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to 100.0 %	Missed DOWN Ratio	5.0	%	V4.55
<UP>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to 100.0 %	Missed UP Ratio	5.0	%	V4.55
<HOLD>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to 100.0 %	Missed HOLD Ratio	10.0	%	V4.55
Description of command				
This command specifies the limits for the *HSUPA E-RGCH* measurement.				

HSUPA E-RGCH Results

The following commands query the results of the HSUPA E-RGCH test.

	Scalar Results: Missed Detection
READ[:SCALar]:RXQuality:ERGCh?	Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:ERGCh?	Read out meas. results (unsynchronized)
SAMPle[:SCALar]:RXQuality:ERGCh?	Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Missed UP,	0 to <number of (sub)frames sent>	NAN	–	V4.55
Missed DOWN,	0 to <number of (sub)frames sent>	NAN	–	
Correct UP,	0 to <number of (sub)frames sent>	NAN	–	
Correct DOWN,	0 to <number of (sub)frames sent>	NAN	–	
All Valid UP,	0 to <number of (sub)frames sent>	NAN	–	
All Valid DOWN,	0 to <number of (sub)frames sent>	NAN	–	
Missed UP Ratio,	0.000% to 100.000%	NAN	%	
Missed DOWN Ratio,	0.000% to 100.000%	NAN	%	
Missed HOLD,	0 to <number of (sub)frames sent>	NAN	–	
Correct HOLD,	0 to <number of (sub)frames sent>	NAN	–	
All Valid HOLD,	0 to <number of (sub)frames sent>	NAN	–	
Missed HOLD Ratio,	0.000% to 100.000%	NAN	%	
Measured Subframes	0 to <total number of (sub)frames sent>	NAN	–	
Description of command				
These commands are always queries. They start an HSUPA E-RGCH test (READ…) and/or return the measurement results for the *Missed Detection* measurement type (see also detailed explanation of measured values in section *HSUPA E-AGCH Measurement Results* on p. 8.151).				

CALCulate[:SCALar]: RXQuality:ERGCh:MATChing:LIMit?				Limit Matching
Returned values	Value range	Def. value	Def. unit	FW vers.
Missed DOWN Ratio **Missed UP Ratio** **Missed HOLD Ratio**	For all results: NMAL | INV | OK	INV	–	V4.55
Description of command				
This command is always a query. It indicates whether and in which way the limits for the HSUPA E-RGCH test are exceeded. The following messages may be returned for all measured values: NMAL – Result exceeds upper limit, DUT failed INV – No valid result available OK – DUT passed limit check				

HSUPA E-HICH Measurement

The subsystem `RXQuality:EHICh` controls the HSUPA E-HICH test. The subsystem corresponds to the measurement menu *Receiver Quality,* application *HSUPA E-HICH,* and the sections in the popup menu *Receiver Quality Configuration* that are related to the *HSUPA E-HICH* application.

INITiate:RXQuality:EHICh	Start new measurement	⇒	*RUN*
ABORt:RXQuality:EHICh	Abort running measurement and switch off	⇒	*OFF*
STOP:RXQuality:EHICh	Stop measurement	⇒	*STOP*
CONTinue:RXQuality:EHICh	Next measurement step (only *stepping mode*)	⇒	*RUN*
Description of command			FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.			V4.50

CONFigure:RXQuality:EHICh:EREPorting <Mode>				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SRSQ No reporting	OFF	–	V4.50
Description of command				
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of R&S CMU manual).				

FETCh:RXQuality:EHICh:STATus?			Measurement Status	
Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop cond.	OFF	–	V4.50
1 to 10000 | **NONE,**	Counter for current statistics cycle No counting mode set	NONE	–	
1 to 1 000 000 | **NONE**	Counter for current measured subframe within a cycle Statistic count set to off	NONE	–	
Description of command				
This command is always a query. It returns the status of the measurement (see chapter 5 of R&S CMU operating manual).				

HSUPA E-HICH Configuration

The following commands define the scope of the HSUPA E-HICH test, the E-TFCI values, and the limits. The subsystem corresponds to the sections in the popup menu *Receiver Quality Configuration* that are related to the *HSUPA E-HICH* application.

DEFault: RXQuality:EHICh:CONTrol <*Enable*>			Default Settings	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V4.50
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the `CONFigure:RXQuality:EHICh:CONTrol…` subsystem (including the commands in the following sub-sections) to default values. The setting *OFF* results in an error message. If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

CONFigure:RXQuality:EHICh:CONTrol:REPetition Test Cycles
<Repetition>, <StopCond>, <Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	FW vers.
CONTinuous | SINGleshot | 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	V4.50
<StopCond>	Description of parameters	Def. value	Def. unit	FW vers.
SONerror | NONE	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	V4.50
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | NONE	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V4.50

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of `READ` commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:RXQuality:EHICh:CONTrol:MSUBframes <*Subframes*> Measure Subframes

<Subframes>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000000	Number of subframes	1000	(subframes)	V4.50

Description of command

This command specifies the number of subframes to be measured per single shot.

DEFault: RXQuality:EHICh:LIMit <*Enable*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V4.50

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the `CONFigure:RXQuality:EHICh:LIMit…` subsystem (including the commands in the following sub-sections) to default values. The setting *OFF* results in an error message.

If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

CONFigure:RXQuality:EHICh:LIMit:SCALar:ASYMmetric:COMBined:VALue <*Limit*> Limit

<Limit>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to 100.0 %	Upper limit for *False E-HICH Ratio*	1.0	%	V4.50

Description of command

This command specifies the limit for the *HSUPA E-HICH* measurement.

HSUPA E-HICH Results

The following commands query the results of the HSUPA E-HICH test.

Scalar Results: Missed Detection, Throughput

READ[:SCALar]:RXQuality:EHICh? Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:EHICh? Read out meas. results (unsynchronized)
SAMPle[:SCALar]:RXQuality:EHICh? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
False E-HICH Reception,	0 to <total number of subframes sent>	NAN	(subframes)	V4.50
Correct E-HICH Rec.,	0 to <total number of subframes sent>	NAN	–	
All Valid E-HICH Rec.,	0 to <total number of subframes sent>	NAN	–	
False E-HICH Ratio,	0.000% to 100.000%	NAN	%	
Measured Subframes,	0 to <total number of subframes sent>	NAN	–	
Curr. Throughput,	0 to 2000.000 kbps (10 ms TTI)	NAN	kbps	
Max. Poss. Throughput	0 to 2000.000 kbps (10 ms TTI)	NAN	kbps	

Description of command

These commands are always queries. They start an HSUPA E-HICH test (READ…) and/or return the measurement results for the *Missed Detection* measurement type (see also detailed explanation of measured values in section *HSUPA E-HICH Measurement Results* on p. 8.157).

Scalar Results: CRC Errors

READ[:SCALar]:RXQuality:EHICh:BLER? Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:EHICh:BLER? Read out meas. results (unsynchronized)
SAMPle[:SCALar]:RXQuality:EHICh:BLER? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Correct CRC	0 to <total number of subframes sent>	NAN	(subframes)	V4.51
CRC Error	0 to <total number of subframes sent>	NAN	–	
BLER	0 to 1	NAN	–	

Description of command

These commands are always queries. They start an HSUPA E-HICH test (READ…) and/or return the measurement results for the CRC errors (see also detailed explanation of measured values in *HSUPA E-HICH Measurement Results* on p. 8.157).

CALCulate[:SCALar]: RXQuality:EHICh:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
False E-HICH Ratio	NMAL | INV | OK	INV	–	V4.50

Description of command

This command is always a query. It indicates whether and in which way the limits for the HSUPA E-HICH test are exceeded. The following messages may be returned for all measured values:

NMAL	Result exceeds upper limit, DUT failed
INV	No valid result available
OK	DUT passed limit check

Expected Max. Throughput (based on settings)

READ[:SCALar]:RXQuality:EHICh:EMTHroughput? Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:EHICh:EMTHroughput? Read out meas. results (unsynchronized)
SAMPle[:SCALar]:RXQuality:EHICh:EMTHroughput? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Exp. Max. Throughput	0 to 2000.000 kbps (10 ms TTI)	NAN	kbps	V4.55

Description of command

These commands are always queries. They start an HSUPA E-HICH test (READ…) and/or return the expected max. throughput (based on settings) result.

HSUPA Throughput Measurement

The following new commands control the *HSUPA Throughput* measurement.

INITiate:RXQuality:HSUPa:THRoughput	Start new measurement	⇒ *RUN*
ABORt:RXQuality:HSUPa:THRoughput	Abort running measurement and switch off	⇒ *OFF*
STOP:RXQuality:HSUPa:THRoughput	Stop measurement	⇒ *STOP*
CONTinue:RXQuality:HSUPa:THRoughput	Next measurement step (only *stepping mode*)	⇒ *RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V5.02

CONFigure:RXQuality:HSUPa:THRoughput:EREPorting <Mode> — Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V5.02
SOPC |	Single operation complete			
SRSQ |	SRQ and SRSQ			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of R&S CMU manual).

FETCh:RXQuality:HSUPa:THRoughput:STATus? — Measurement Status

Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V5.02
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop cond.			
1 to 10000 |	Counter for current statistics cycle	NONE		
NONE,	No counting mode set		–	
1 to 1000 000 |	Counter for current measured subframe within a cycle	NONE		
NONE	Statistic count set to off		–	

Description of command

This command is always a query. It returns the status of the measurement (see chapter 5 of R&S CMU operating manual).

HSUPA Throughput Configuration

The following commands define the scope of the *HSUPA Throughput* measurement. The subsystem corresponds to the sections in the popup menu *Receiver Quality Configuration* that are related to the *HSUPA Throughput* application.

DEFault: RXQuality:HSUPa:THRoughput:CONTrol <*Enable*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V5.02

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the `CONFigure:RXQuality:HSUPa:THRoughput:CONTrol…` subsystem to default values. The setting *OFF* results in an error message.

If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

CONFigure:RXQuality:HSUPa:THRoughput:CONTrol:REPetition <Repetition>, <StopCond>, <Stepmode> Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	FW vers.
CONTinuous | SINGleshot | 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	V5.02
<StopCond>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
SONerror | NONE	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	V5.02
<Stepmode>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
STEP | NONE	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V5.02

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of `READ` commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:RXQuality:HSUPa:THRoughput:CONTrol:MSUBframes <*Subframes*> Measure Subframes

<Subframes>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1 000 000	Number of subframes	1000	(subframes)	V5.02

Description of command

This command specifies the number of subframes to be measured per single shot.

HSUPA Throughput Results

The following commands query the results of the *HSUPA Throughput* measurement.

	Scalar Results: Missed Detection, Throughput
READ[:SCALar]:RXQuality:HSUPa:THRoughput?	Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:HSUPa:THRoughput?	Read out meas. results (unsynchronized)
SAMPle[:SCALar]:RXQuality:HSUPa:THRoughput?	Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Correct CRC	0 to <total number of subframes sent>	NAN	(subframes)	V5.02
CRC Error	0 to <total number of subframes sent>	NAN	–	
BLER	0 to 1	NAN	–	
Curr. Throughput,	0 to 2000.000 kbps (10 ms TTI)	NAN	kbps	
Max. Poss. Throughput,	0 to 2000.000 kbps (10 ms TTI)	NAN	kbps	
Measured Subframes	0 to <total number of subframes sent>	NAN	–	

Description of command

These commands are always queries. They start a *HSUPA Throughput* measurement (`READ…`) and/or return the measurement results (see also detailed explanation of measured values in section *HSUPA Throughput Measurement* on p. 8.163).

HSUPA Downlink Signal Configuration (Signalling)

The commands in the following sections configure the HSUPA channels generated by the CMU. They correspond to the sections in the *BS Signal* tab of the *Connection Control* menu that are related to HSUPA channel configuration. HSUPA signals and measurements require option R&S CMU-K56.

To perform HSUPA tests, the HSUPA test mode must be activated as described in section *Packet Switched Connections* in Chapter 4.

Physical Channel Settings

The following commands define the properties of the physical HSUPA downlink channels.

CONFigure:BSSignal:PHYSical:EAGCh:LEVel <*Level*>				E-AGCH Level
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35.0 dB to +12.0 dB	E-AGCH level	–6.0	dB	V4.50
Description of command				Sig. State
This command sets the level of the Access Grant Channel relative to the P-CPICH level. Use the command `CONFigure:BSSignal:HSDPa:PHYSical:LEVel` or `CONFigure:BSSignal:HSPa:PHYSical:LEVel` to define the E-AGCH level together with all other physical channel levels. *) The relative level must not exceed 0 dB if the channel powers are expressed relative to the total output channel power (`CONFigure:BSSignal:LREFerence OPOWer`).				all

CONFigure:BSSignal:PHYSical:EAGCh:CCODe <*Code*>			E-AGCH Channelization Code	
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
2 to 255	Channelization code of E-AGCH	2	–	V4.50
Description of command				Sig. State
This command selects the channelization code (Orthogonal Variable Spreading Code, OVSC) number assigned to the E-AGCH.				SOFF SON REG

CONFigure:BSSignal:PHYSical:ERGHich:LEVel <*Level*>			E-RGCH / E-HICH Level	
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35.0 dB to +12.0 dB | OFF	Level of E-RGCH / E-HICH E-RGCH / E-HICH switched off	–6.0	dB	V4.50
Description of command				Sig. State
This command sets the level of the E-RGCH / E-HICH relative to the P-CPICH level. Use the command `CONFigure:BSSignal:HSDPa:PHYSical:LEVel` or `CONFigure:BSSignal:HSPa:PHYSical:LEVel` to define the HS-SCCH level together with all other physical channel levels. *) The relative level must not exceed 0 dB if the channel powers are expressed relative to the total output channel power (`CONFigure:BSSignal:LREFerence OPOWer`).				all

CONFigure:BSSignal:PHYSical:ERGHich:ERGactive <*Enable*>			E-RGCH Active	
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	E-RGCH active or switched off	OFF	–	V4.50
Description of command				Sig. State
This command switches the E-RGCH on or off.				all

CONFigure:BSSignal:PHYSical:ERGHich:CCODe <*Code*>			E-RGCH / E-HICH Channelization Code	
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 127	Channelization code of E-RGCH / E-HICH	6	–	V4.50
Description of command				Sig. State
This command selects the channelization code (Orthogonal Variable Spreading Code, OVSC) number assigned to the E-RGCH / E-HICH.				SOFF SON REG

CONFigure:BSSignal:HSPA:PHYSical:LEVel WCDMA and HSPA Combined Channel Levels
<P-CPICH_abs> | <P-CPICH_rel>, <P-SCH>, <S-SCH>, <P-CCPCH>, <PICH>, <DPDCH>, <Power Offset>, <SCCH_1>, … , <SCCH_4>, <PDSCH>, <E-AGCH>, <E-RGCH>

<P-CPICH_abs>	Description of parameters	Def. value	Def. unit	FW vers.
–147.0 dBm to –37.0 dBm*	Absolute P-CPICH level if RF 1 is used	–96.3	dBm	V4.50
–147.0 dBm to –20.0 dBm*	Absolute P-CPICH level if RF 2 is used	–96.3	dBm	
–100.0 dBm to +3.0 dBm*	Abs. P-CPICH level if RF 3 OUT is used	–96.3	dBm	
<P-CPICH_rel>	Description of parameters	Def. value	Def. unit	
–30 dB to 0 dB	Relative P-CPICH level	–	dB	
<P-SCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB |	P-SCH level (level reference = P-CPICH)	–5.0	dB	
–30 dB to 0 dB	P-SCH level (level reference = total channel power)	–	dB	
<S-SCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB |	S-SCH level (level reference = P-CPICH)	–5.0	dB	
–30 dB to 0 dB	S-SCH level (level reference = total channel power)	–	dB	
<P-CCPCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB |	P-CCPCH level (level ref. = P-CPICH)	–2.0	dB	
–30 dB to 0 dB	P-CCPCH level (level reference = total channel power)	–	dB	
<S-CCPCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB |	S-CCPCH level (level ref. = P-CPICH)	–2.0	dB	
–30 dB to 0 dB	S-CCPCH level (level reference = total channel power)	–	dB	
<PICH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB |	PICH level (level ref. = P-CPICH)	–5.0	dB	
–30 dB to 0 dB	PICH level (level reference = total channel power)	–	dB	

<AICH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB | –30 dB to 0 dB	AICH level (level ref. = P-CPICH) AICH level (level reference = total channel power)	–5.0 –	dB dB	
<DPDCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB | –30 dB to 0 dB	DPDCH level (level ref. = P-CPICH) DPDCH level (level reference = total channel power)	–7.0 –	dB dB	
<Power Offset>	Description of parameters	Def. value	Def. unit	
0.0 dB to 6.0 dB	DPCCH/DPDCH power offset	0.0	dB	
<SCCH_1>, … , <SCCH_4>	Description of parameters	Def. value	Def. unit	
–35.0 dB to +15.0 dB | OFF | ON,	Level of HS-SCCH no. 1 to 4 HS-SCCH switched off Switch on a HS-SCCH that was OFF before, using the level defined previously	–7 (<nr> = 1) OFF**) (<nr> > 1)	dB	
<PDSCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB | OFF | ON	Sum level of HS-PDSCH HS-PDSCH switched off Switch on the HS-PDSCH that was OFF before, using the level defined previously	0.0	dB	
<E-AGCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB	Sum level of E-AGCH	–6.0	dB	
<E-RGCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB | OFF	Sum level of E-RGCH/E-HICH E-RGCH/E-HICH switched off	–6.0	dB	

Description of command

This command sets all physical channel levels at once, including the HSDPA and HSUPA channels. The WCDMA levels can be set relative to the P-CPICH level (in which case *<P-CPICH_abs>* is used) or relative to the total channel power (*<P-CPICH_rel>* is used), depending on the CONFigure:BSSignal:LREFerence setting.

Note: *The instrument checks the levels for consistence before activating the settings. This is important especially if the levels are defined relative to the total channel power and must not exceed this fixed value.*

*) The reported level ranges correspond to the total output power ranges at the three RF output connectors (see command *CONFigure:BSSignal:OPOWer*). If other channel contributions are switched on, the P-CPICH level must be reduced so that the total output power range is not exceeded.

**) If the channels no. 2, 3, or 4 are switched ON, their level is set to –7 dB.

CONFigure:BSSignal:HSUPa:PHYSical:LEVel Combined WCDMA and HSUPA Levels
<P-CPICH_abs> | <P-CPICH_rel>, <P-SCH>, <S-SCH>, <P-CCPCH>, <PICH>, <DPDCH>, <Power Offset>, <E-AGCH>, <E-RGCH>

<P-CPICH_abs>	Description of parameters	Def. value	Def. unit	FW vers.
–147.0 dBm to –37.0 dBm*	Absolute P-CPICH level if RF 1 is used	–96.3	dBm	V4.20
–147.0 dBm to –20.0 dBm*	Absolute P-CPICH level if RF 2 is used	–96.3	dBm	
–100.0 dBm to +3.0 dBm*	Abs. P-CPICH level if RF 3 OUT is used	–96.3	dBm	
<P-CPICH_rel>	Description of parameters	Def. value	Def. unit	
–30 dB to 0 dB	Relative P-CPICH level	–	dB	
<P-SCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB |	P-SCH level (level reference = P-CPICH)	–5.0	dB	
–30 dB to 0 dB	P-SCH level (level reference = total channel power)	–	dB	
<S-SCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB |	S-SCH level (level reference = P-CPICH)	–5.0	dB	
–30 dB to 0 dB	S-SCH level (level reference = total channel power)	–	dB	
<P-CCPCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB |	P-CCPCH level (level ref. = P-CPICH)	–2.0	dB	
–30 dB to 0 dB	P-CCPCH level (level reference = total channel power)	–	dB	
<S-CCPCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB |	S-CCPCH level (level ref. = P-CPICH)	–2.0	dB	
–30 dB to 0 dB	S-CCPCH level (level reference = total channel power)	–	dB	
<PICH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB |	PICH level (level ref. = P-CPICH)	–5.0	dB	
–30 dB to 0 dB	PICH level (level reference = total channel power)	–	dB	
<AICH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB |	AICH level (level ref. = P-CPICH)	–5.0	dB	
–30 dB to 0 dB	AICH level (level reference = total channel power)	–	dB	
<DPDCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB |	DPDCH level (level ref. = P-CPICH)	–7.0	dB	
–30 dB to 0 dB	DPDCH level (level reference = total channel power)	–	dB	
<Power Offset>	Description of parameters	Def. value	Def. unit	
0.0 dB to 6.0 dB	DPCCH/DPDCH power offset	0.0	dB	
<E-AGCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +15 dB	Sum level of E-AGCH	–6.0	dB	
<E-RGCH>	Description of parameters	Def. value	Def. unit	
–35 dB to +12 dB |	Sum level of E-RGCH/E-HICH	–6.0	dB	
OFF	E-RGCH/E-HICH switched off			

Description of command

This command sets all physical channel levels at once, including the HSUPA channels (SOURce:HSUPA:PHYSical:LEVel sets the DL HSDPA in addition). The WCDMA levels can be set relative to the P-CPICH level (in which case *<P-CPICH_abs>* is used) or relative to the total channel power (*<P-CPICH_rel>* is used), depending on the CONFigure:BSSignal:LREFerence OPOWer setting.

Note: *The instrument checks the levels for consistence before activating the settings. This is important especially if the levels are defined relative to the total channel power and must not exceed this fixed value.*

*) The reported level ranges correspond to the total output power ranges at the three RF output connectors (see command *CONFigure:BSSignal:OPOWer*). If other channel contributions are switched on, the P-CPICH level must be reduced so that the total output power range is not exceeded.

**) If the channels no. 2, 3, or 4 are switched ON, their level is set to –7 dB.

General Generator Settings

The following commands provide general HSUPA downlink channel settings.

DEFault:BSSignal:HSUPa <*Enable*> — Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V4.50

Description of command — Sig. State

If used as a setting command with the parameter *ON* this command sets all parameters of the BSSignal:HSUPa subsystem (including the commands in the following sub-sections) to default values. The setting *OFF* results in an error message.

If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Sig. State: SOFF SON REG

CONFigure:BSSignal:HSUPa:TTIMode <*TTI*> — TTI Mode

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
M2 | M10	2 ms or 10 ms TTI	M10	–	V4.55

Description of command — Sig. State

This command defines the duration of the Transmission Time Interval (TTI).

Sig. State: SOFF SON REG

CONFigure:BSSignal:HSUPa:RPDSize <*TTI*> — RLC PDU Size

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
112 | 120 | … | 5000	RLC PDU Size	336	–	V4.50

Description of command — Sig. State

This command selects the RLC PDU size that the R&S CMU signals to the UE in order to configure its UL RLC PDU size. Uplink signals with specific RLC PDU size are used in various conformance tests; see standard 3GPP TS 34.121.

Sig. State: SOFF SON REG

E-AGCH Channel Settings

The subsystem *HSUPa:EAGCh* configures the Enhanced DCH Absolute Grant Channel in the generated HSUPA downlink signal. It corresponds to the *E-AGCH* section in the *BS Signal* tab of the *Connection Control* menu.

CONFigure:BSSignal:HSUPa:EAGCh:UEID:PRIMary <*Number*>			E-AGCH UE-ID, primary	
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
#H0 to #HFFFF	Primary UE-ID	#HAAAA	–	V4.50
Description of command				Sig. State
This command selects the primary E-RNTI (E-DCH Radio Network Temporary Identifier) transmitted on the E-AGCH.				SOFF SON REG

CONFigure:BSSignal:HSUPa:EAGCh:UEID:SECondary <*Number*>			E-AGCH UE-ID, secondary	
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
#H0 to #HFFFF	Secondary UE-ID	#H12AA	–	V4.50
Description of command				Sig. State
This command selects the secondary E-RNTI (E-DCH Radio Network Temporary Identifier) transmitted on the E-AGCH.				SOFF SON REG

CONFigure:BSSignal:HSUPa:EAGCh:AGPattern:LENGth <*Values*>			AG Pattern Length	
<Values>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 8	Number of AG indices	1	–	V4.50
Description of command				Sig. State
This command specifies the number of AG indices in the AG pattern transmitted on the E-AGCH. Each index value controls one HARQ process, so the maximum number is 4 for 10 ms TTI, 8 for 2 ms TTI. This value also defines the *No. of E-TFCI Values* for the *Receiver Quality – HSUPA E-AGCH* measurement.				all

CONFigure:BSSignal:HSUPa:EAGCh:AGPattern:INDex<nr> <*Grant_nr*>			AG Value	
<Grant_nr>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 31 | OFF	Absolute grant value HARQ process INACTIVE	10	–	V4.50
Description of command				Sig. State
This command selects the primary absolute grants. Each value controls one HARQ process, so there are up to four values (<nr> = 1 to 4) for a 10 ms TTI, up to eight values (<nr> = 1 to 8) for a 2 ms TTI (see `CONFigure:BSSignal:HSUPa:TTIMode`). The actual number of values used is defined by the AG pattern length (`CONFigure:BSSignal:HSUPa:EAGCh:AGPattern:LENGth`).				all

CONFigure:BSSignal:HSUPa:EAGCh:AGPattern:SCOPe<nr> <*Enable*> AG Scope (per HARQ process)

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Per HARQ process All HARQ processes	OFF	–	V4.50

Description of command — Sig. State

This command specifies which HARQ processes the absolute grant values should apply to. There are up to four values (<nr> = 1 to 4) for a 10 ms TTI, up to eight values (<nr> = 1 to 8) for a 2 ms TTI (see `CONFigure:BSSignal:HSUPa:TTIMode`). The actual number of used values is defined by the AG pattern length (`CONFigure:BSSignal:HSUPa:EAGCh:AGPattern:LENGth`).

Use `CONFigure:BSSignal:HSUPa:EAGCh:AGPattern:INDex<nr>` to define all AG values.

Sig. State: all

CONFigure:BSSignal:HSUPa:EAGCh:AGPattern:IDTYpe<nr> <*Enable*> AG ID Type

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Secondary absolute grants Primary absolute grants	OFF	–	V4.50

Description of command — Sig. State

This command specifies whether the AG values are primary or secondary absolute grants. There are up to four values (<nr> = 1 to 4) for a 10 ms TTI, up to eight values (<nr> = 1 to 8) for a 2 ms TTI (see `CONFigure:BSSignal:HSUPa:TTIMode`). The actual number of used values is defined by the AG pattern length (`CONFigure:BSSignal:HSUPa:EAGCh:AGPattern:LENGth`).

Use `CONFigure:BSSignal:HSUPa:EAGCh:AGPattern:INDex<nr>` to define all AG values.

Sig. State: all

CONFigure:BSSignal:HSUPa:EAGCh:APRepetition <*Transmit*> AG Pattern Repetition

<Transmit>	Description of parameters	Def. value	Def. unit	FW vers.
CONTinuous | ONCE	Repeat AG pattern continuously Send AG pattern once	CONT	–	V4.50

Description of command — Sig. State

This command specifies whether the AG pattern is continuously repeated (e.g. to perform a HSUPA E-AGCH test; see section *HSUPA E-AGCH Measurement* on p. 8.149).

Sig. State: all

CONFigure:BSSignal: HSUPa:EAGCh:APATtern ON Activate Pattern

Parameter	Description of parameters	Def. value	Def. unit	FW vers.
ON	Send single AG pattern	–	–	4.51

Description of command — Sig. State

This command has no query form. It causes a single AG pattern (defined via the `CONFigure:BSSignal:HSUPa:EAGCh:AGPattern` commands) to be sent. The command is executed only if the AG pattern repetition mode `ONCE` is active (command `CONFigure:BSSignal:HSUPa:EAGCh:APRepetition ONCE`); otherwise the R&S CMU generates the SCPI error no. –200, “Execution Error”.

Sig. State: all

CONFigure:BSSignal:HSUPa:EAGCh:UTTI <*Transmit*> Unscheduled TTI

<Transmit>	Description of parameters	Def. value	Def. unit	FW vers.
DTX | TDUeid	DTX Transmit Dummy UE-ID	DTX	–	V4.50

Description of command — Sig. State

This command defines the transmission of the R&S CMU in inactive Transmission Time Intervals (TTIs).

Sig. State: all

E-RGCH / E-HICH and HARQ Feedback (E-HICH)

The subsystem *HSUPa:ERGHich* provides common E-RGCH and E-HICH channel settings. The subsystem *HSUPa:EHICh* provides specific E-RGCH channel settings and defines the HARQ feedback information. It corresponds to the *HARQ Feedback (E-HICH)* section in the *BS SIgnal* tab of the *Connection Control* menu.

CONFigure:BSSignal:HSUPa:ERGHich:FDUMmies <*Enable*>				Fill up Frame with Dummies
<Signature>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Continuous E-RGCH signal DTX in 3 slots per frame (10 ms TTI only)	OFF	–	V4.50
Description of command				Sig. State
This command defines the transmission in the 3 slots per frame where the E-RGCH is not active. This setting has no effect for 2 ms TTIs (`CONFigure:BSSignal:HSUPa:TTIMode M2`).				SOFF SON REG

CONFigure:BSSignal:HSUPa:EHICh:MODE <*Profile*>				Mode
<Profile>	Description of parameters	Def. value	Def. unit	FW vers.
ULCRc | **ALTernating |** **AACK |** **ANACk |** **ADTX**	React on UL CRC Alternating 0,1 All ACK All NACK All DTX	ULCRc	–	V4.50
Description of command				Sig. State
This command defines the HARQ feedback information transmitted on the E-HICH.				SOFF SON REG

CONFigure:BSSignal:HSUPa:EHICh:SIGNature <*Signature*>				Signature (E-HICH)
<Signature>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 39	E-HICH signature	1	–	V4.50
Description of command				Sig. State
This command selects the signature sequence used to separate the E-HICH channel from the E-RGCH. The value must be different from the E-RGCH signature (`CONFigure:BSSignal:HSUPa:ERGCh:SIGNature`).				SOFF SON REG

Relative Grant (E-RGCH)

The subsystem *HSUPa:ERGCh* provides specific E-RGCH channel settings and defines the relative grant information. It corresponds to the *Relative Grant (E-RGCH)* section in the *BS Signal* tab of the *Connection Control* menu.

CONFigure:BSSignal:HSUPa:ERGCh:MODE <*Profile*> — Mode

<Profile>	Description of parameters	Def. value	Def. unit	FW vers.
ALTernating |	Alternating (TTI)	ALT	–	V4.50
AUP |	All Up			
ADOWn |	All Down			
ADTX |	All DTX			
CPATtern |	Continuous Pattern			
SADTx	Single pattern + All DTX			
AHQCycle	Alternating H-ARQ Cycle			V4.55

Description of command	Sig. State
This command defines the relative grant sequence transmitted on the E-RGCH.	SOFF SON REG

CONFigure:BSSignal: HSUPa:ERGCh:APATtern ON — Activate Pattern

Parameter	Description of parameters	Def. value	Def. unit	FW vers.
ON	Send single RG pattern	–	–	4.51

Description of command	Sig. State
This command has no query form. It causes a single RG pattern (defined via the `CONFigure:BSSignal:HSUPa:ERGCh:PATTern` commands) to be sent. The command is executed only if the RG pattern mode `SADTx` is active (command `CONFigure:BSSignal:HSUPa:ERGCh:MODE SADTx`); otherwise the R&S CMU generates the SCPI error no. –200, "Execution Error".	all

CONFigure:BSSignal:HSUPa:ERGCh:PATTern:LENGth <*Pattern*> — Pattern Length

<Pattern>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 8	Length of the relative grant pattern	1	–	V4.50

Description of command	Sig. State
This command defines the length of the pattern that is used to construct the relative grant sequence; see command `CONFigure:BSSignal:HSUPa:ERGCh:MODE` above. The maximum length is 4 for a 10 ms TTI, 8 for a 2 ms TTI (see `CONFigure:BSSignal:HSUPa:TTIMode`).	SOFF SON REG

CONFigure:BSSignal:HSUPa:ERGCh:PATTern:VALue<nr> <*Pattern*> — Pattern (E-RGCH)

<Pattern>	Description of parameters	Def. value	Def. unit	FW vers.
UP | DOWN | DTX	Relative grant value	„0"	–	V4.50

Description of command	Sig. State
This command defines the single pattern that is used to construct the relative grant sequence; see command `CONFigure:BSSignal:HSUPa:ERGCh:MODE` above. The single pattern contains up to 8 values (<nr> = 1 to 8). Values beyond the pattern length (`CONFigure:BSSignal:HSUPa:ERGCh:PATTern:LENGth`) are not used.	SOFF SON REG

CONFigure:BSSignal:HSUPa:ERGCh:SIGNature <*Signature*>				Signature (E-RGCH)
<Signature>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 39	E-RGCH signature	0	–	V4.50
Description of command				Sig. State
This command selects the signature sequence used to separate the E-RGCH channel from the E-HICH. The value must be different from the E-HICH signature (`CONFigure:BSSignal:HSUPa:EHICh:SIGNature`).				SOFF SON REG

HSUPA UE Signal Configuration (Signalling)

The following commands define HSUPA-specific parameters which are signalled to the UE and influence the UE uplink signal.

DEFault:UESignal:HSUPa <*Enable*>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V4.50
Description of command				Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the `UESignal:HSUPa` subsystem (including the commands in the following sub-sections) to default values. The setting *OFF* results in an error message. If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				SOFF SON REG

CONFigure:UESignal:HSUPa:EPLCategory?				E-DCH Physical Layer Category
Return	Description of parameters	Def. value	Def. unit	FW vers.
1 to 6	E-DCH physical layer category	–	–	V4.50
Description of command				Sig. State
This command is always a query. It returns the UE E-DPDCH physical layer category signalled by the UE.				≠ SOFF SON

CONFigure:UESignal:HSUPa:ETFCI:TINDex <*E-TFCI*>				E-TFCI Table Index
<E-TFCI>	Description of parameters	Def. value	Def. unit	FW vers.
0 | 1	E-TFCI table index	0	–	V4.50
Description of command				Sig. State
This command defines the E-TFCI table index in the E-DCH information. This value indicates which of the standardized E-TFCI transport block size tables shall be used.				all

CONFigure:UESignal:HSUPa:ETFCI:MSET <*E-TFCI*>				Minimum Set E-TFCI
<E-TFCI>	Description of parameters	Def. value	Def. unit	FW vers.
1 | 127	Minimum set E-TFCI	9	–	V4.50
Description of command				Sig. State
This command defines the minimum set E-TFCI for the E-DCH.				all

CONFigure:UESignal:HSUPa:HRVersion <*Versions*>			H-ARQ Redundancy Versions	
<Versions>	Description of parameters	Def. value	Def. unit	FW vers.
RVA | RVT	Always redundancy version index 0 Redundancy version table	RVA	–	V4.50
Description of command				Sig. State
This command defines the HARQ Incremental Redundancy Version configuration.				all

CONFigure:UESignal:HSUPa:HBDCondition <*Delay*>			Happy Bit Delay Condition	
<Delay>	Description of parameters	Def. value	Def. unit	FW vers.
M2 | M10 | M20 | M50 | M100 | M200 | M500 | M1000	Delay condition of 2 ms | 10 ms | … … | 1000 ms	M100	–	V4.50
Description of command				Sig. State
This command defines the Happy Bit Delay Condition. This value is compared to the time needed to transmit the E-DCH buffer contents with current transmission parameters; if the transmission time is longer than the delay condition, the happy bit may be set to “unhappy” (see standard 3GPP TS 25.321).				all

CONFigure:UESignal:HSUPa:PLPLnonmax <*Limit*>			Puncturing Limit $PL_{non\text{-}max}$	
<Limit>	Description of parameters	Def. value	Def. unit	FW vers.
0.44 to 1.00	Puncturing limit	0.84	–	V4.50
Description of command				Sig. State
This command defines the puncturing limit $PL_{non\text{-}max}$. A PL value limits the amount of puncturing that can be applied in order to minimize the number of physical channels. The allowed puncturing in % is actually equal to (1-PL)*100. The value of $PL_{non\text{-}max}$ is used to determine the combination of spreading factor and the number of codes that are used for transmitting the E-DCH with a certain data rate.				all

CONFigure:UESignal:HSUPa:CCODe:MAXimum <*Codes*>			Maximum Channelization Code	
<Codes>	Description of parameters	Def. value	Def. unit	FW vers.
SF256 | SF128 | SF64 | SF32 | SF16 | SF8 | SF4 | SF44 | SF22 | SF24	SF256 | … | … | SF 4 | 2xSF4 | 2xSF2 | 2xSF2 and 2xSF4	SF24*)	–	V4.50
Description of command				Sig. State
This command defines the maximum channelization codes (and thus the maximum data rates) for the E-DCH transmission. *) The upper limit of the maximum channelization code parameter depends on the *E-DCH Physical Layer Category* of the UE, to be requensted via `CONFigure:UESignal:HSUPa:EPLCategory?`. **The default value SF24 is valid for appropriate E-DCH physical layer categories only.**				all

CONFigure:UESignal:HSUPa:ISGRant:VALue <*Value*>			Initial Serving Grant – Value	
<Value>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 37 | ZG | OFF	Serving grant value Zero grant	OFF	–	V4.50
Description of command				Sig. State
This command defines the initial serving grant value signaled to the UE. The serving grant state variable indicates the maximum E-DPDCH to DPCCH power ratio that the UE is allowed to use for scheduled data in the following transmission.				SOFF SON REG

CONFigure:UESignal:HSUPa:ISGRant:TYPE <*Type*>			Initial Serving Grant – Type	
<Type>	Description of parameters	Def. value	Def. unit	FW vers.
PRI | SEC	Primary Secondary	PRI	–	V4.50
Description of command				Sig. State
This command defines the Primary_Grant_Available. This state variable indicates whether the UE's serving grant is only affected by Primary Absolute Grants and Relative Grants or by Secondary Absolute Grants.				SOFF SON REG

CONFigure:UESignal:HSUPa:HARQ:POFFset <*Power*>			H-ARQ Power Offset	
<Power>	Description of parameters	Def. value	Def. unit	FW vers.
0 dB | 1 dB … | 6 dB	H-ARQ power offset value in dB	0	dB	V4.50
Description of command				Sig. State
This command defines the H-ARQ power offset value Δ_{harq} defined in standard 3GPP TS 25.213. This parameter is used to define H-ARQ-dependent gain factors for the E-DCDCH; see section *Gain Factors* on p. 8.181.				SOFF SON REG

CONFigure:UESignal:HSUPa:HARQ:MRETransmis <*Retrans*>			Max. Number of Retransmissions	
<Retrans>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 15	Max. number of retransmissions	7	dB	V4.50
Description of command				Sig. State
This command defines how often the HARQ entity in the UE may re-transmit failed blocks. The max. number of retransmissions is equal to the maximum number of transmissions – 1.				SOFF SON REG

HSUPA Gain Factors: Remote Control

The following commands configure the HSUPA gain factors.

CONFigure:UESignal:HSUPa:GFACtor:EDPCch <*Δ E-DPCCH*>			Gain Factor Δ E-DPCCH	
<Δ E-DPCCH>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 8	Δ E-DPCCH gain factor	5	–	V4.50
Description of command				Sig. State
This command defines the signaled value for the gain factor for the uplink E-DPCCH.				all

CONFigure:UESignal:HSUPa:GFACtor:ETFCi:NREFerence <*Number*>			Number of Reference E-TFCIs	
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 8	Number of Reference E-TFCIs	1	–	V4.50
Description of command				Sig. State
This command defines the number of reference E-TFCIs used to calculate the E-TFCI-dependent E-DPDCH gain factors.				all

CONFigure:UESignal:HSUPa:GFACtor:ETFCi:REFerence<nr> <*E-TFCI*>			Reference E-TFCI	
<E-TFCI>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 127	E-TFCIs <nr> where <nr> = 1 to 8	See below	–	V4.50
Description of command				Sig. State
This command defines the reference E-TFCIs used to calculate the E-TFCI-dependent E-DPDCH gain factors. The default values are as follows:				all

<nr>	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
E-TFCI	11	67	71	75	81	90	100	127

CONFigure:UESignal:HSUPa:GFACtor:ETFCi:POFFset<nr> <*E-TFCI*>			Reference E-TFCI Power Offset	
<E-TFCI>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 29	Gain factor <nr> where <nr> = 1 to 8	See below	–	V4.50
Description of command				Sig. State
This command defines the signaled gain factors $\beta_{ed,\ ref}$ used to calculate the E-TFCI-dependent E-DPDCH gain factors. The default values are as follows:				all

<nr>	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
E-TFCI	4	18	23	26	27	28	29	29

Contents

9 Optional Extensions of the WCDMA UE Software 9.1

WCDMA Application Testing 9.1

System Requirements 9.1

Putting into Operation 9.2
Basic IP Test Environment 9.2
Establishing an Ethernet Connection 9.2
Application Tests with HSDPA Connections 9.4
Reconfiguration of HSDPA Parameters during the Connection 9.5
Application Tests with HSUPA Connections 9.5
Multi-Call Application Test Scenarios 9.6

R&S CMU Configuration for WCDMA Application Tests 9.6

Application Examples 9.8

Sending a Ping 9.8
Internal FTP Server 9.9
IP Connection with external PC 9.11

RLC BLER 9.12

RLC BLER Measurement Results 9.14
Remote Control: RLC BLER (RLCBler) 9.17

R&S Smart Alignment 9.22

Test Procedures 9.22

Example for TX Calibration 9.22
Example for RX Calibration 9.24

TX Calibration Results 9.25

R&S Smart Alignment Configuration 9.27

Remote Control Commands 9.30

Measurement Control 9.30
Subsystem POWer:SALignment:CONTrol 9.31
Subsystem POWer:SALignment? 9.35

Assisted GPS 9.36

Control of Measurement 9.37

Transmitted A-GPS Data 9.38

A-GPS Test Results 9.44

9 Optional Extensions of the WCDMA UE Software

This chapter describes additional software options providing an extended measurement functionality for WCDMA UEs:

- Option R&S CMU-K96, *WCDMA Application Testing,* allows the R&S CMU200 to be integrated in a TCP/IP network in order to test and monitor IP-based, packet switched data applications. See section *Optional Extensions of the WCDMA UE Software* on p. 9.1.
- Option R&S CMU-K47, *R&S Smart Alignment,* provides fast UE transmitter and receiver adjustments (TX and RX calibrations) over a wide range of channels and powers. See section *R&S Smart Alignment* on p. 9.22.
- Option R&S CMU-K90, *Assisted GPS,* allows you to exchange GPS assistance data with the UE under test. See section *Assisted GPS* on p. 9.36.

WCDMA Application Testing

WCDMA Application Testing (option R&S CMU-K96) allows the R&S CMU200 to be integrated in a TCP/IP network in order to test and monitor IP-based, packet switched data applications that a WCDMA UE services under realistic operating conditions. The option is used together with the WCDMA UE test options of the R&S CMU200 Universal Radio Communication Tester.

The software provides a special RX measurement *(Receiver Quality – RLC BLER;* see section *RLC BLER* on p. 9.12) which evaluates the downlink BLER and the data throughput for the tested applications. Moreover, the R&S CMU can perform all TX and RX tests (except RX tests relying on a special RMC) while a packet data application is running.

This chapter describes the system requirements, the installation of option R&S CMU-K96, and some basic application examples.

System Requirements

The system requirements for the external PC(s) solely depend on the server applications installed. Option R&S CMU-K96 places no additional requirements on the PC performance.

The R&S CMU hardware and software requirements are listed in the separate installation instructions supplied with the option, stock no. 1157.4219.00. In particular, the R&S CMU200 must have the following software options installed and enabled:

- One of the WCDMA UE software options R&S CMU-K61…K63, R&S CMU-K61…K63, or K67…K69, V3.80 or higher
- Option R&S CMU-K96
- Options R&S CMU-K64 and R&S CMU-K60 (for application tests with HSDPA connections; see p. 9.4)
- Options R&S CMU-K56 (for application tests with HSUPA connections; see p. 9.5)

To make full use of the data application test features, the R&S CMU must be equipped with an Ethernet connector, to be mounted on the rear panel of the instrument. Your Rohde & Schwarz service representative will install the connector and label it *ETHERNET USU* when you purchase the option for an older R&S CMU unit.

Putting into Operation

After it is installed and enabled on the R&S CMU200, option R&S CMU-K96 requires the following preparations:

- Integrate the R&S CMU in your IP test environment assigning the appropriate IP addresses; see section *Basic IP Test Environment* on p. 9.2.
- Configure the R&S CMU for WCDMA application testing and establish a packet switched connection with the WCDMA UE; see section *R&S CMU Configuration for WCDMA Application Tests* on p. 9.6.

Basic IP Test Environment

The packet switched connection scheme provides a basic IP connection between a UE and the R&S CMU200 (base station). With a mobile supporting a data connection via a cable to a PC, a typical test setup looks as follows:

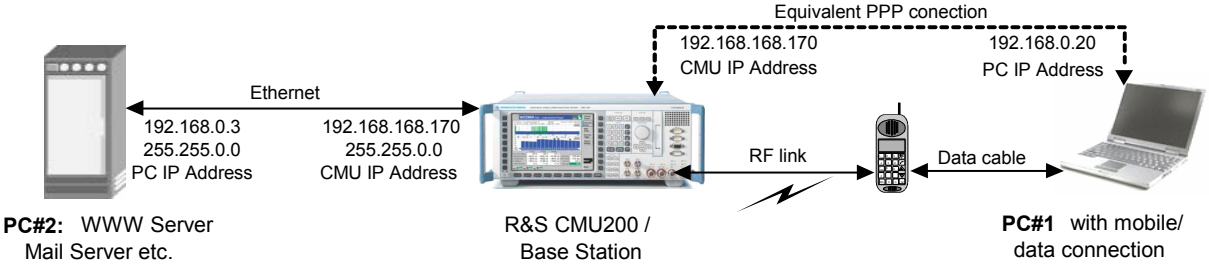


Fig. 9-1 Test setup for data application testing

The RF link between the mobile and the CMU/base station plus the data cable link to PC#1 are equivalent to a point-to-point connection between the R&S CMU and the PC#1. The R&S CMU 200 is equipped with an internal FTP server that can be addressed using the CMU's IP address set in the *TCP/IP* tab of the *Setup* menu. With this feature, it is possible to directly address the CMU, e.g. to:

- Send a ping to the internal FTP server (see p. 9.8).
- Transfer data from and to the internal server using FTP (see p. 9.9).

Alternatively, it is possible to connect the R&S CMU200 to a second external PC#2 using the *ETHERNET USU* connector at the rear panel. With this extended test setup, the CMU can be used as an IP interface to the mobile, e.g. to:

- Analyze IP traffic from the mobile at PC#2.
- Open an FTP session between PC#1 and an external FTP server running on PC#2, avoiding the restrictions of the CMU's internal FTP server (see p. 9.11).
- Configure PC#2 as a web server and test web applications.

Establishing an Ethernet Connection

The R&S CMU is directly connected to the PC#2 using the *ETHERNET USU* connector on the rear panel of the instrument (see section *System Requirements* on p. 9.1) and a cross-over network cable. There is no need to configure the PC's IP address at the R&S CMU: The PC address 192.168.0.3 in Fig. 9-1 above is just an example, intended for the simple application examples described below.

ATTENTION !

It is recommended to connect the R&S CMU to a stand alone host (laptop or desktop PC). Connection via a public or company network is possible provided that an external router with appropriate configuration is connected to the R/S CMU200's Ethernet connector. The router's purpose is to perform the NAT (Network Address Translation) between the local subnet based on the subnet mask 255.255.0.0 (see below) and the external subnet that hosts the TCP/IP based content server.

Direct connection to a public or company network is not possible !

To set up a connection between the CMU and the PC#2…

1. Establish a direct (dedicated) connection between the PC and the R&S CMU 200 using a cross-over network cable. Connect the cable between the network port labeled *ETHERNET USU* on the rear panel of the R&S CMU 200 and the network connector on the PC.
2. If desired, open the *SETUP – Option* tab and change the default (static) *IP Address* of the R&S CMU200.

The TCP/IP information is not changed after a reset of the R&S CMU base system or the WCDMA FDD Signalling function groups.

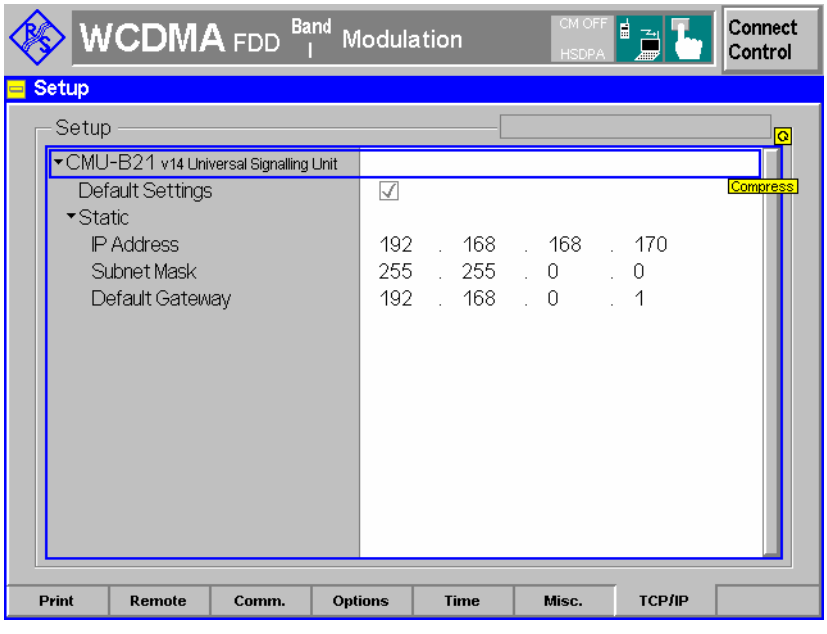


Fig. 9-2 IP address settings for the R&S CMU

For a quick test of the Ethernet connection between PC#2 and the R&S CMU200 you can send a ping to the R&S CMU: Open the command prompt and enter the following command line:

```
ping -w 4000 -l 512 192.168.168.170 -t
```

(see also section Sending a Ping on p. 9.8*). The R&S CMU should respond within 4000 ms.*

Virtual IP Address

In addition to the IP address described above the R&S CMU uses a Virtual IP Address *with the default value 192.168.0.19. This address is for internal use only and not relevant for WCDMA application tests. To avoid connection errors in case that another device in the subnet is assigned the same address, the virtual IP address can be changed in the* Misc. *tab of the connection control menu.*

Remote Control The IP address information for the R&S CMU is set in the base system:

```
SYSTem:TCPip:PRIMary:STATic:IPADdress <IP1>, <IP2>, <IP3>, <IP4>
SYSTem:TCPip:PRIMary:STATic:SMASk <SM1>, <SM2>, <SM3>, <SM4>
SYSTem:TCPip:PRIMary:STATic:DGATeway <GW1>, <GW2>, <GW3>, <GW4>
```

The virtual IP address is defined in function group WCDMA19UEFDD_Sig (see Chapter 6):

```
CONFigure:ATESt:VIPaddress <IP1>, <IP2>, <IP3>, <IP4>
```

Application Tests with HSDPA Connections

If option R&S CMU-K64, *HSDPA 3.6 Mbps,* is installed, the R&S CMU is also capable of performing WCDMA application tests on 3.6 Mbps High Speed Downlink Packet Access (HSDPA) channels. Option R&S CMU-K60, *HSDPA 10 Mbps,* provides higher data rates. The HSDPA connection is controlled in the *Connection Control* menu, in particular in the *BS Signal* tab. HSDPA application tests require a packet data connection (with *Connection Control – BS Signal Packet Switched – Packet Data – Data Rate: HSDPA / <data rate> uplink* or *HSDPA / HSUPA;* see *Packet Data Connections* in Chapter 4), however, the DL signal parameters for the HSDPA test mode *(Connection Control – BS Signal – HSDPA HS-DSCH* and *Connection Control – BS Signal – Downlink Physical Channels)* are also used for application tests.

The following HSDPA parameters in the *BS Signal* tab have no impact on the HSDPA test mode but can be relevant for HSDPA application tests:

- *T1 Release Timer* (re-ordering release timer)
- MAC-hs-related parameters for the user-defined HS-DSCH channel: *MAC-d PDU Size Control, MAC-d PDU Size, Memory Partitioning, Receiver Window Size*

For details refer to the reference information in Chapter 8.

Application tests with option R&S CMU-B56 Var 14 and Var 54

The signalling units can only handle a limited number of MAC-d PDUs per unit of time. The rate of transmitted MAC-d PDUs is closely linked to the data rate. The performance of the 3GPP Signalling Unit R&S CMU-B56 Var 14 is sufficient for all measurements in HSDPA test mode (see Chapter 8), however, it restricts the data rates for data application tests.

The allowed data rates can be calculated according to the following simple rule:

*Data rate[kbps] < C * <MAC-d PDU size>[bit] (equation 1)*

The factor C is a value between 2 (for data rates around 2400 kbps) and 3 (for data rates around 900 kbps). C is an approximately linear function of the data rate. Equation 1 holds if the average rate of transmitted PDUs shows no strong variations, and if no retransmissions are required (BLER = 0).

To obtain high data rates, simply adjust the MAC-d PDU size according to equation 1 (Connection Control – HSDPA HS-DSCH – User Defined Channel – MAC-d PDU Size). If

the selected MAC-d PDU size is too small, the test can become unstable, and you may have to terminate the session.

Example: *To test applications at a DL data rate of 2400 kbps, use a minimum MAC-d PDU size of 2400/2 = 1200.*

No data rate limits have been encountered for the upgraded signalling unit R&S CMU-B56 Var 54.

Reconfiguration of HSDPA Parameters during the Connection

The R&S CMU supports a reconfiguration of many HSDPA parameters while a data end-to-end connection is established. The following list gives an overview. For a detailed description of the parameters refer to chapter 8.

General HS-DSCH Parameters
CQI Feedback Cycle
CQI Repetition Factor
ACK/NACK Repetition Factor
T1 Release Timer
Receiving Window Size
Channel Configuration Type

The following reconfigurable parameters depend on the channel configuration type (*Connection Control – BS Signal – HSDPA HS-DSCH – Channel Configuration Type).*

Fixed Reference Channel
H-Set Selection

CQI Channel
CQI Table Index
Fixed Value

User Defined Channel
The reconfiguration requires manual setting of the MAC-d PDU Size Control (*Connection Control – BS Signal – HSDPA HS-DSCH – User Defined – MAC-d PDU Size Control: Manual).* The following parameters may be changed:

Inter TTI Distance
No Of HARQ Processes
No of Physical Channel Codes
Modulation
Memory Partitioning
Transport Block Size Index (k_i)

Application Tests with HSUPA Connections

If option R&S CMU-K56, *HSUPA 5.76 Mbps,* is installed, the R&S CMU is also capable of performing WCDMA application tests on 5.76 Mbps High Speed Uplink Packet Access (HSUPA) channels. The HSUPA connection is controlled in the *Connection Control* menu, in particular in the *BS Signal* tab. HSUPA application tests require a packet data connection (with *Connection Control – BS Signal – Packet Switched – Packet Data – Data Rate: <data rate> downlink HSUPA* or *HSDPA / HSUPA;* see *Packet Data Connections* in Chapter 4), however, the downlink signal parameters for the HSUPA test mode *(Connection Control – BS Signal – HSUPA* and *Connection Control – BS Signal – Downlink Physical Channels)* are also used for application tests.

The R&S CMU also supports RLC throughput and BLER tests on HSUPA channels. For details refer to the reference information in Chapter 8.

Application tests with option R&S CMU-B56 Var 14 and Var 54

Application tests on HSUPA channels can be performed with signalling units R&S CMU-B56 Var 14 and Var 54. To avoid limitations at high data rates, it is recommended to use the upgraded signalling unit R&S CMU-B56 Var 54.

Multi-Call Application Test Scenarios

The R&S CMU supports a circuit-switched (CS) voice call (12.2 kbps AMR) in parallel to the packet switched connection for application tests. This is an example of a real multi-call scenario where the UE services two user applications simultaneously. You can test both connections in parallel, e.g. send an SMS while you perform an FTP upload or download. Note that a connection to HSDPA or HSUPA test mode with parallel CS connection is supported, too (see section *Packet Data Connections* in Chapter 4).

To establish a multi-call connection, proceed as follows:

1. Set up a voice call to/from the UE.
2. Establish the packed data connection from the UE.

When the packet data connection is released, the voice call is still active.

The R&S CMU supports the following packet data rates for multi-call connections *(BS Signal – Packet Switched – Packet Data – Data Rate)*:

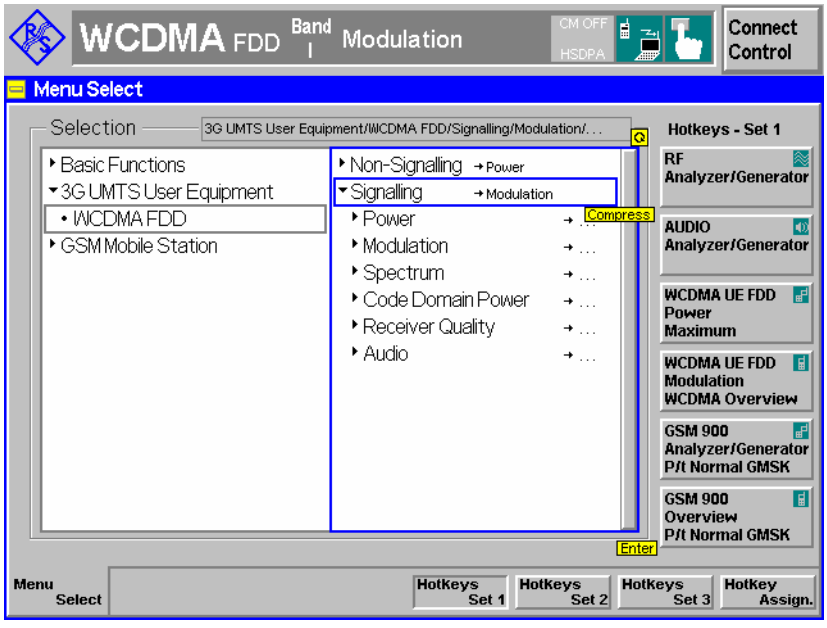
- 16 kbps Downlink/Uplink
- 64 kbps Downlink / 32 kbps Uplink
- 64 kbps Downlink/Uplink
- 128 kbps Downlink/Uplink
- 384 kbps Downlink / 64 kbps Uplink
- 384 kbps Downlink / 128 kbps Uplink
- 384 kbps Downlink/Uplink
- HSDPA / 384 kbps Uplink
- HSDPA / 64 kbps Uplink
- 64 kbps Downlink / HSUPA
- 384 kbps Downlink / HSUPA
- HSDPA / HSUPA

R&S CMU Configuration for WCDMA Application Tests

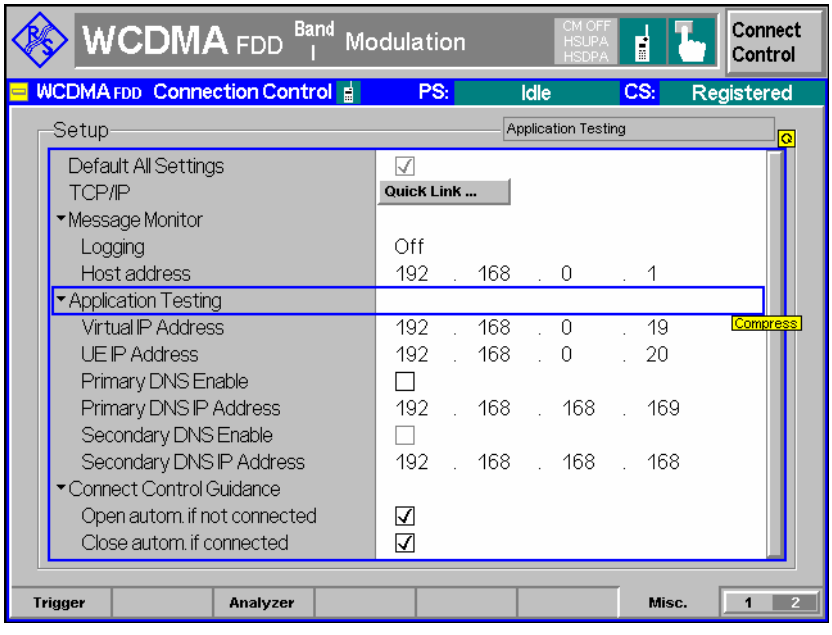
The R&S CMU provides a special packet switched connection scheme for WCDMA application tests (see section *Packet Data Connections* in Chapter 4). A packet switched connection can be established using the *Connection Control* menu after the WCDMA *Signalling* function group is loaded.

To configure the R&S CMU for WCDMA application tests…

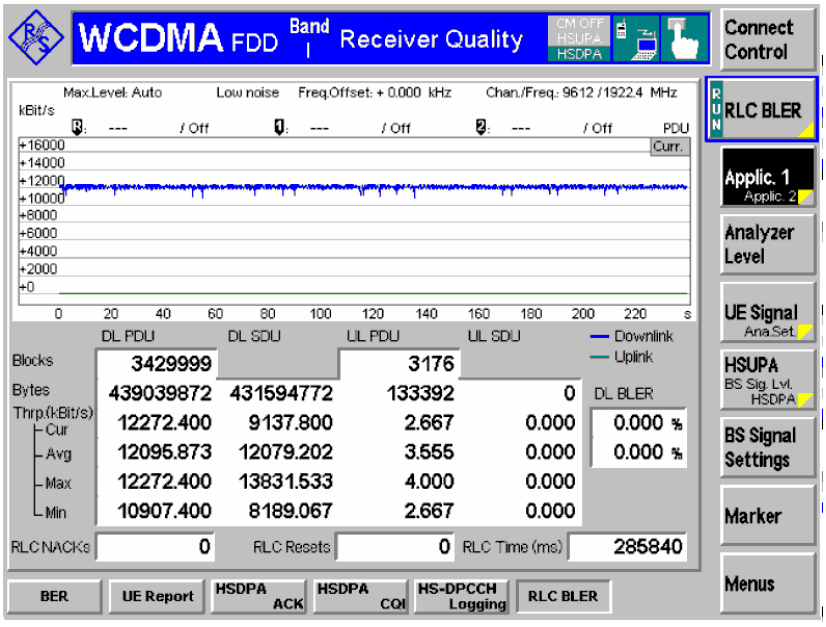
1. Start up the R&S CMU. In the *Menu Select* menu, select *WCDMA FDD* and the *Signalling* mode. Press *Enter* to access the *WCDMA FDD Signalling* measurements and automatically open the *Connection Control* menu.



3. Make sure that your WCDMA software is in a well-defined state: Press the *RESET* key on the front panel of the instrument and confirm the *Reset* of all *WCDMA FDD Signalling* parameters.
4. If you wish to change the IP address of the R&S CMU, you can do this in the *Setup* menu; see Fig. 9-2 on p. 9.3.
5. Open the *Misc.* tab in the second level of the *Connection Control* menu and adjust the *UE IP Address,* if so desired. In general you don't have to change the *Virtual IP Address* (see p. 9.4).



6. Proceed as described in section *Packet Data Connections* in Chapter 4 to activate packet data services and set up a PS connection from the UE.
7. After the R&S CMU has entered the *PS: Established* state, close the *Connection Control* menu (if it is not closed automatically) and access one of the R&S CMU's measurement menus, e.g *Receiver Quality – RLC BLER*.



8. Start an application (see section *Application Examples* below) and monitor the *Downlink BLER* and the *Throughput* in the measurement menu.

Remote Control The following commands define the virtual and the UE IP address (see Chapter 6):

```
CONFigure:ATESt:VIPaddress <IP1>, <IP2>, <IP3>, <IP4>
CONFigure:ATESt:UEIPaddress <IP1>, <IP2>, <IP3>, <IP4>
```

Application Examples

This section describes basic application examples that the R&S CMU can perform with a test setup according to Fig. 9-1 on p. 9.2.

Sending a Ping

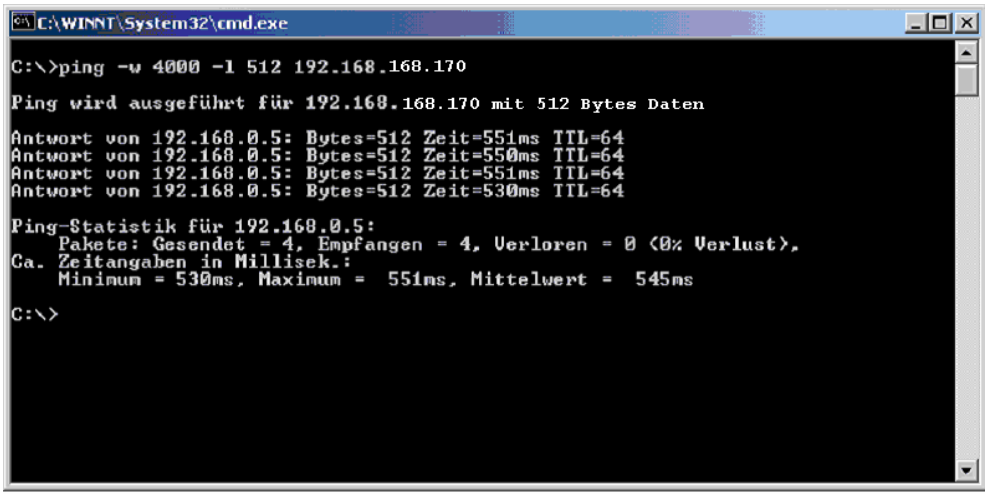
This application requires a point-to-point connection between the CMU and the PC#1 (right-hand side of Fig. 9-1). No additional PC#2 is required. Ping is an application with equal traffic in the uplink and the downlink.

Command Line To send a ping from PC#1 to the CMU use the following command line syntax:

```
ping -w 4000 -l 512 192.168.168.170 -t
```

where:	–w	number of milliseconds to wait for response
	–l	byte length of echo request
	192.168.168.170	example (default) CMU *IP Address (Setup – TCP/IP)*
	–t	if present, continues sending echo packets

Example



Internal FTP Server

This application requires a point-to-point connection between the CMU and the PC#1 (right-hand side of Fig. 9-1). No additional PC#2 is required. The connection allows to directly test the upload and download speed, e.g. at different asymmetrical data rates.

FTP Server Characteristics

The internal FTP server of the CMU has a size of 20 Mbyte and can be addressed using the *Virtual IP Address;* to be set in the *Connection Control – Misc.* tab. The server contains several files of different size to test the download without previous upload. Files transferred to the server must not exceed 20 Mbyte in size; they are automatically deleted when the R&S CMU is restarted.

Command Line

Anonymous FTP access to the internal server is allowed using the username ‘ftp’ with password ‘ftp’.

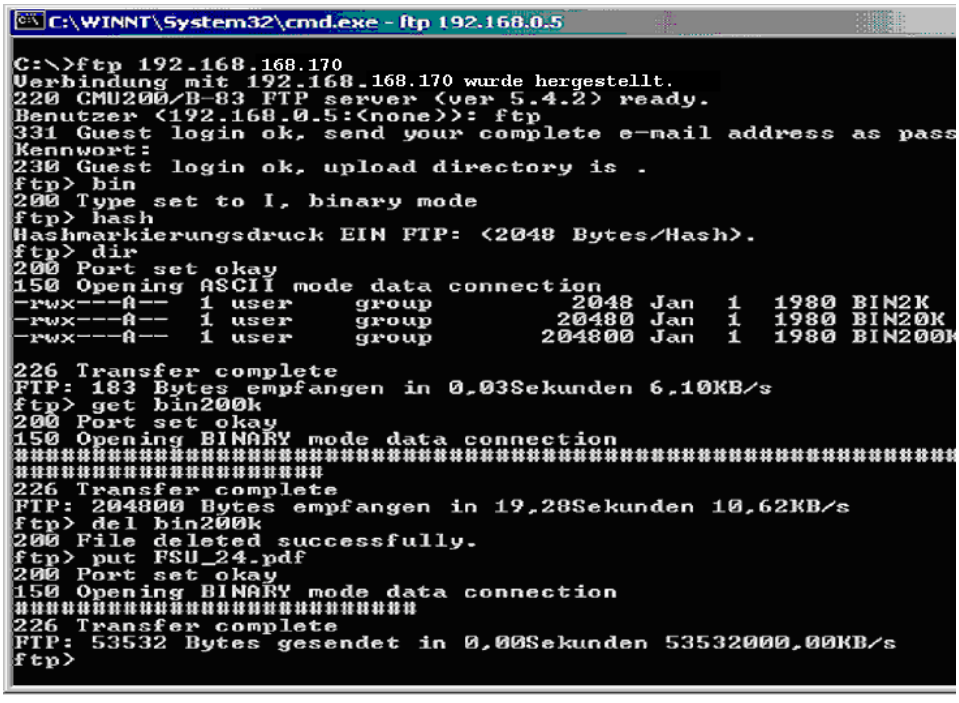
To connect to the server use the following command line syntax:

```
ftp://ftp.192.168.168.170
user:       ftp
password:   ftp
```

Use the following commands:

dir	show files
hash	displays progress
get bin200k	download a file
quit	close the FTP session

Example

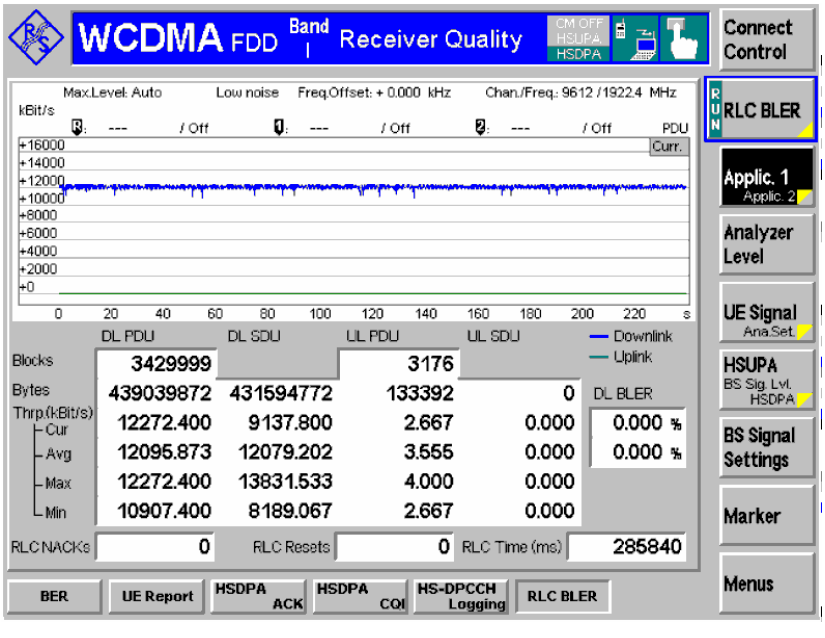


Data Traffic

The data traffic to and (indirectly) from the CMU can be observed in the *Code Domain Power* menu:

- When a file is transferred from the PC#1 to the internal FTP server (FTP upload), the bar graphs in the *Code Domain Power* menu show active uplink DPDCH channels.
- When a file is transferred from the internal FTP server to the PC#1 (FTP download), the bar graphs in the *Code Domain Power* menu show temporary activity in the uplink DPCCH channels, which is due to the exchange of signalling messages. The downlink channels are not visualized in the *Code Domain Power* menu.

The *DL BLER* and the *(DL) Throughput* are displayed in the *Receiver Quality – RLC BLER* menu.



IP Connection with external PC

With an additional second PC#2 (left-hand side of Fig. 9-1 on p. 9.2) connected through the Ethernet connection, the CMU can be used as an IP interface to the mobile. Assuming that the Ethernet PC address of PC#2 is 192.168.0.3 and the CMU Ethernet IP address is 192.168.168.170, enter the following commands on the PC #2:

```
route delete 192.168.0.0
route add 192.168.0.0 mask 255.255.0.0 192.168.168.170
```

The two PCs PC#1 and PC#2 should now be able to see each other and use network services and applications such as Ping, FTP, and HTTP.

E.g., with an FTP server running on PC#2, it is possible to open an FTP session from PC#1 using the command line:

```
ftp://ftp.192.168.0.3
```

RLC BLER

The *RLC BLER* application of the *Receiver Quality* measurement provides the total and the useful data throughput in the downlink and in the uplink and the downlink Block Error Rate. Part of the downlink blocks (RLC Protocol Data Units, PDUs) can be sent with an incorrect CRC in order to increase the BLER.

1. To access the *RLC BLER* measurement menu, select the *Receiver Quality* measurement in *Signalling* mode and press *Application – RLC BLER.*

The RLC BLER measurement requires a packet data connection initiated from the MS. The UE must operate in RLC acknowledged mode so that the R&S CMU can count the RLC blocks that the UE received correctly.

2. To establish a packet data connection, ensure that the packet switched domain is enabled *(Connection Control – Network – Packet Switch Domain: On)* and initiate a packet data connection from your UE. See also Chapter 4, section *Packet Switched Connections.*

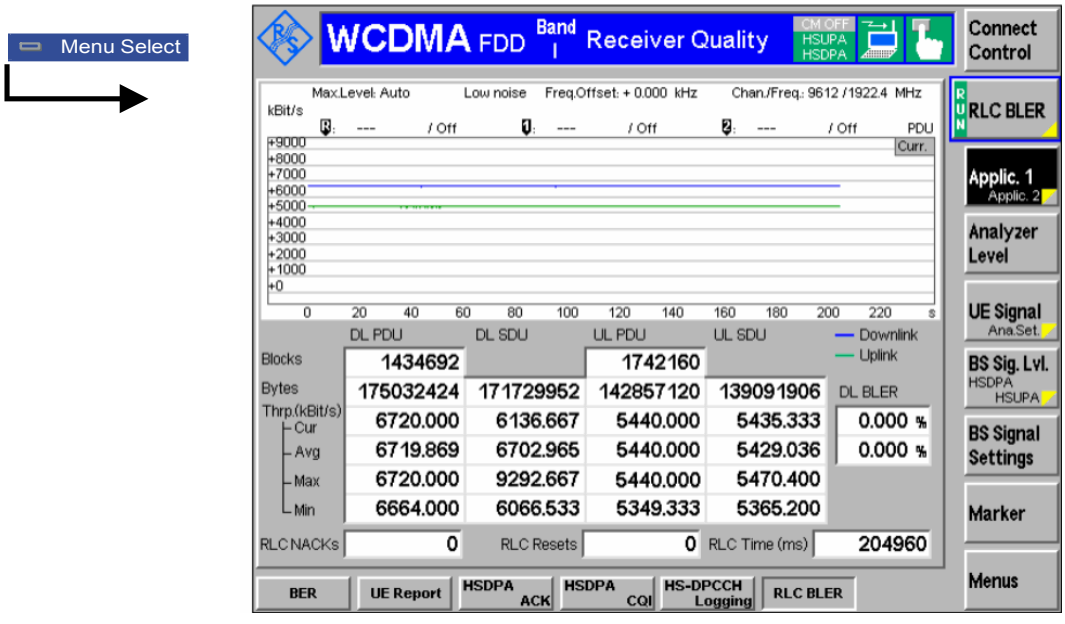


Fig. 9-3 RLC BLER menu

The *RLC BLER* measurement is controlled by the following softkeys and hotkeys:

RLC BLER

The *RLC BLER* softkey controls the measurement and indicates its status *(RUN | OFF | HLT)*. This softkey changes to *BER, RLC BLER* etc., depending on the selected *Receiver Quality* measurement application.

The measurement status can be changed after softkey selection (pressing once) by means of the *ON/OFF* or *CONT/HLT* key. Pressing the *RLC BLER* softkey twice opens the *Receiver Quality Configuration* menu to select further test settings, in particular concerning the measurement statistics.

Remote control

```
INITiate:RXQuality:RLCBler
ABORt:RXQuality:RLCBler
STOP:RXQuality:RLCBler
CONTinue:RXQuality:RLCBler
FETCh[:SCALar]:RXQuality:RLCBler:STATus?
```

The following hotkeys are associated with the *RLC BLER* softkey.

Repetition

Defines whether the measurement is performed in single shot mode or continuously. A single shot comprises the *Update Time.*

Remote control
`CONFigure:RXQuality:RLCBler:CONTrol:REPetition`

Diagram Type

Diagram Type selects the total *(PDU)* throughput or useful *(SDU)* throughput for display in the diagram. See section *RLC BLER Measurement Results* on p. 9.14.

Remote control
No command, display configuration only

Force DL NACK

Percentage of RLC blocks that are sent with an incorrect CRC in the DL and should cause a *NACK* in the UL. The incorrect CRC is only used in the first transmission; all retransmitted blocks are sent with a correct CRC.

Consequently, with a *Force DL NACK* value of x % and a perfect connection (no block errors for retransmitted blocks, no additional effects), the measured *DL BLER* is expected to be approx. 50 %. This can be verified e.g. with an FTP connection. Higher protocols may have an additional impact and further increase the measured BLER.

Due to the variable number of unacknowledged blocks in the moving evaluation window the BLER result for perfect reception can slightly vary around the expected value.

Remote control
`CONFigure:RXQuality:RLCBler:CONTrol:FNACk`

Update Time

Evaluation and update period of the current UL and DL throughputs and the current DL BLER. The throughputs and the BLER are statistical quantities, so the R&S CMU must collect data over some period of time to obtain meaningful results. See also *Window Size* below.

Remote control
`CONFigure:RXQuality:RLCBler:CONTrol:UTIMe`

Window Size

Width of the throughput diagram in the *Receiver Quality – RLC BLER* menu. The window size equals to the duration of a single shot measurement (one statistics cycle); it is internally rounded up to the next integer multiple of the *Update Time*. As a consequence the number of results in the diagram equals to the integer number following the ratio <window size> / <update time>.

The average *(Avg)* throughput and BLER results are averaged over a moving time window; its width is equal to the *Window Size.*

Remote control
`CONFigure:RXQuality:RLCBler:CONTrol:WSIZe`

RLC BLER Measurement Results

The results in the *RLC BLER* menu are displayed in a parameter line, a diagram, and various output tables. Fig. 9-4 below shows an FTP download through a 384 kBit/s connection.

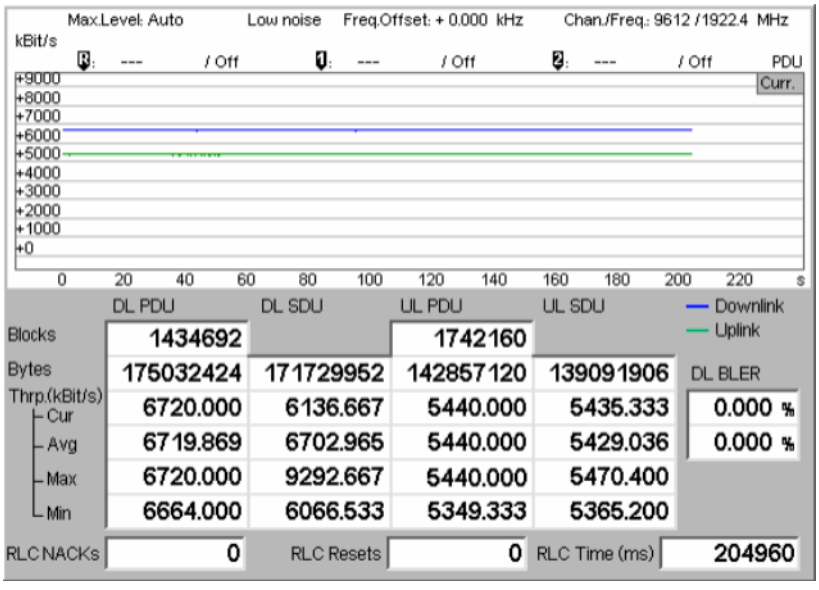


Fig. 9-4 RLC BLER – measurement results

Test Settings (parameter line)

The essential analyzer settings (as set via the *Analyzer Level* softkey and the *Analyzer Settings* softkey) are indicated in a parameter line across the top of the measurement menu:

Max. Level	Maximum expected input level in dBm
Attenuation	Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset relative to the nominal WCDMA channel frequency
Chan./Freq.	RF channel measured and associated nominal carrier frequency

Throughput Diagram

The diagram shows the current PDU or SDU throughput over the duration of a single shot measurement. Downlink and uplink throughputs are drawn with different colors as explained in the legend below the diagram. The following settings configure the diagram:

- *Diagram Type* (see p. 9.13) selects either PDU or SDU throughputs for display (see below).
- *Update Time* defines the time between two consecutive values and (together with the *Window Size* the maximum number of results displayed)
- *Window Size* defines the diagram width.

In a single shot measurement, the curves have reached the right diagram edge when the measurement is completed. In a continuous measurement the x-axis is free to move so that always the latest results appear in the diagram.

Remote control
`READ:ARRay:RXQuality:RLCBler:DL:PDU[:CURRent]?` etc.

Throughput table

The throughput table is divided into two downlink and two uplink columns. The downlink columns give an overview of the data traffic from the R&S CMU to the UE. This includes all blocks sent including retransmissions. The results in the uplink columns reflect all blocks that the R&S CMU could receive and take into account for the throughput calculation.

Blocks Number of RLC PDUs that the R&S CMU transmitted (DL PDUs) or received (UL PDUs) since the beginning of the measurement.

Bytes Number of bytes that the R&S CMU transmitted (UL) or received (DL) since the beginning of the measurement. In acknowledged mode, both the PDUs and the SDUs comprise an integer number of bytes. The PDU and SDU bytes are counted separately; the SDU bytes are a subset of the PDU bytes, so their number is always smaller. For high data rates and lengthy *Continuous* measurements the no. of bytes can exceed the maximum memory size, in which case the counters are reset.

Throughput Measured data rates of the connection in kBit/s, calculated from the size of a block times the number of transmitted (PDU) or acknowledged (SDU) blocks per unit of time. The PDU throughput corresponds to the nominal data rate of the connection; the SDU throughput is a measure for the useful data rate; see background information below. If it is averaged over a sufficient period of time, the SDU throughput is always smaller than the PDU throughput.

The SDU throughput tends to jitter because the SDUs are not necessarily acknowledged immediately, which causes variable overlaps of the acknowledgement status reports from the UE and the evaluation periods for a single result *(Update Time)*. The jitter increases as the update time is reduced. The PDU throughput is jitter-free because it is measured byte-wise on RLC level.

The nominal data rate for the packet data connection (i.e. the expected maximum PDU throughput) can be selected in the BS Signal tab of the Connection Control menu.
Via Remote control:
`CONFigure:BSSignal:PSWitched:DCH:PDATa:RATE`

Remote control
`READ[:SCALar]:RXQuality:RLCBler?` etc.
The DL and UL PDU/SDU results can be queried separately; e.g.
`READ[:SCALar]:RXQuality:RLCBler:DL:PDU?`

PDU and SDU Throughput

According to standard 3GPP TS 25.322, an RLC PDU in acknowledged mode (AMD PDU) consists of a header, the data octets, and a last octet containing padding or a piggybacked status PDU. The header is further divided into the first two mandatory octets containing the sequence number and further optional octets containing the 7- or 11-bit length indicators (LIs).

- The *PDU throughput* corresponds to the nominal data rate of the connection according to standard 3GPP TS 34.108 (QoS specification). All RLC PDU octets with the exception of the first two header octets contribute to the PDU throughput. The PDU throughput also counts RLC control PDUs and retransmissions so that it is not correlated to the measured BLER. The measured DL PDU throughput corresponds to all RLC PDUs sent (no matter whether they could be correctly received by the UE); the UL throughput corresponds to all RLC PDUs received (no matter whether the UE sent more PDUs).

- The *SDU throughput* is a measure for the useful data rate of the connection. Only the data octets contribute to the SDU throughput. RLC control PDUs and retransmissions are discarded for the SDU throughput; therefore the throughput decreases as the BLER increases.

The throughput can also decrease due to the properties of the connection and the data application. E.g. video streaming applications generally cause a variable throughput, whereas an FTP file transfer is serviced at the maximum throughput allowed by the server/network infrastructure and the data rate of the packet data channel.

Example: For a 384 kBit/s DL connection, 12 RLC PDUs are transmitted per WCDMA frame; each of the PDUs contains 42 octets. The nominal PDU throughput (QoS) is calculated as 12 * (42 – 2) * 8 / 10 ms = 384 kBit/s. The maximum SDU throughput is approx. 381 kBit/s, a typical data rate for an FTP file transfer is approx. 46 kbytes/s = 368 kBit/s.

Table 9-1 Data rates at different levels

	FTP data	FTP signalling	IP/TCP header	PDCP header	RLC LI / padding	RLC control PDUs	RLC retrans - missions	RLC header	MAC, MAC-hs header
Transport block	X	X	X	X	X	X	X	X	X
RLC PDU	X	X	X	X	X	X	X	X	
PDU Throughput	X	X	X	X	X	X	X		
SDU Throughput	X	X	X	X					
IP traffic	X	X	X						
User Data	X								

DL BLER Percentage of transmitted RLC blocks that the UE did not acknowledge:

Downlink BLER = 1 – <No. of acknowledged blocks>/<Total no. of blocks sent>

The BLER results for *Single Shot* and *Continuous* measurements are averaged as described above for the *Throughput*.

RLC NACKs Number of RLC blocks that the UE did not acknowledge. These blocks contribute to the DL BLER:

*<RLC NACKs> = <DL BLER> * <No. of DL PDU Blocks>*

RLC Resets Number of RLC reset procedures that the R&S CMU had to perform, e.g. because it could not receive any blocks from the UE for an extended period of time. A small number of RLC resets indicates a good radio link quality.

RLC Time Time elapsed since the start of the current measurement cycle. In single shot measurements the RLC time is reset after each *Window Size*. In continuous measurements, the RLC time increases continuously (until a possible overflow of the results, which causes a re-start of the measurement).

Remote control

```
READ[:SCALar]:RXQuality:RLCBler?
FETCh[:SCALar]:RXQuality:RLCBler?
SAMPle[:SCALar]:RXQuality:RLCBler?
```

Remote Control: RLC BLER (RLCBler)

The subsystem `RXQuality:RLCBler` controls the *RLC BLER* application. The subsystem corresponds to the measurement menu *Receiver Quality,* application *RLC BLER,* and the sections in the popup menu *Receiver Quality Configuration* that are related to this application.

INITiate:RXQuality:RLCBler	Start new measurement	⇒	*RUN*
ABORt:RXQuality:RLCBler	Abort running measurement and switch off	⇒	*OFF*
STOP:RXQuality:RLCBler	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:RXQuality:RLCBler	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V3.80

CONFigure:RXQuality:RLCBler:EREPorting <*Mode*> — Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.80
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:RXQuality:RLCBler:STATus? — Measurement Status

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.80
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE	No counting mode set	NONE	–	

Description of command

This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The subsystem *RXQuality:RLCBler:CONTrol* defines the scope of the measurement and further control parameters. The settings are accessible in the *Control* tab of the *Connection Control* menu

CONFigure:RXQuality:RLCBler:CONTrol:REPetition Test Cycles
<Repetition>, <StopCond>, <Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	FW vers.
CONTinuous | SINGleshot | 1 to 10000	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	V3.80
<StopCond>	Description of parameters	Def. value	Def. unit	FW vers.
SONerror | NONE	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	V3.80
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | NONE	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.80

Description of command

This command determines the number of statistics cycles and the stepping mode for the measurement. The <*Stop_Cond*> parameter is ignored.

Note: For `READ` commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:RXQuality:RLCBler:CONTrol:FNACk *<Percent>* Force DL NACK

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
0.0% to 100.0%	Force DL NACK	0.0	%	V3.80

Description of command

This command specifies the percentage of RLC blocks that are sent with an incorrect CRC and should cause a *NACK* in the UL.

CONFigure:RXQuality:RLCBler:CONTrol:UTIMe *<Time>* Update Time

<Time>	Description of parameters	Def. value	Def. unit	FW vers.
240 ms to 2400 ms (80 ms steps)	Update time (time per single shot)	240	ms	V4.20

Description of command

This command specifies the evaluation and update period of the current UL and DL throughputs and the current DL BLER.

CONFigure:RXQuality:RLCBler:CONTrol:WSIZe *<Time>* Window Size

<Time>	Description of parameters	Def. value	Def. unit	FW vers.
10 s to 240 s (1 s steps)	Update time (time per single shot)	240	s	V4.20

Description of command

This command specifies the width of the throughput diagram in the *Receiver Quality – RLC BLER* menu. The window size equals to the duration of a single shot measurement; it is internally rounded to the next integer multiple of the Update Time (`CONFigure:RXQuality:RLCBler:CONTrol:UTIMe`).

Measured Values – Subsystem RXQuality:RLCBler...?

The subsystem *RXQuality:RLCBler...?* returns the results of the measurement.

Measurement results, tables

READ[:SCALar]:RXQuality:RLCBler? Start single shot measurement and return results

FETCh[:SCALar]:RXQuality:RLCBler? Read measurement results (unsynchronized)

SAMPle[:SCALar]:RXQuality:RLCBler? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
DL PDU – Blocks,	depending on meas. duration and throughput	NAN	–	V4.20
DL PDU – Bytes,	depending on meas. duration and throughput	NAN	–	
DL PDU – Thrp. Curr.,	0 to <max. throughput of packet data channel>	NAN	kbps	
DL PDU – Thrp. Avg..,	0 to <max. throughput of packet data channel>	NAN	kbps	
DL PDU – Thrp. Max.,	0 to <max. throughput of packet data channel>	NAN	kbps	
DL PDU – Thrp. Min.,	0 to <max. throughput of packet data channel>	NAN	kbps	
UL PDU – Blocks,	depending on meas. duration and throughput	NAN	–	
UL PDU – Bytes,	depending on meas. duration and throughput	NAN	–	
UL PDU – Thrp. Curr.,	0 to <max. throughput of packet data channel>	NAN	kbps	
UL PDU – Thrp. Avg..,	0 to <max. throughput of packet data channel>	NAN	kbps	
UL PDU – Thrp. Max.,	0 to <max. throughput of packet data channel>	NAN	kbps	
UL PDU – Thrp. Min.,	0 to <max. throughput of packet data channel>	NAN	kbps	
DL SDU – Bytes,	depending on meas. duration and throughput	NAN	–	
DL SDU – Thrp. Curr.,	0 to <max. throughput> + jitter	NAN	kbps	
DL SDU – Thrp. Avg..,	0 to <max. throughput> + jitter	NAN	kbps	
DL SDU – Thrp. Max.,	0 to <max. throughput> + jitter	NAN	kbps	
DL SDU – Thrp. Min.,	0 to <max. throughput> + jitter	NAN	kbps	
UL SDU – Bytes,	depending on meas. duration and throughput	NAN	–	
UL SDU – Thrp. Curr.,	0 to <max. throughput> + jitter	NAN	kbps	
UL SDU – Thrp. Avg..,	0 to <max. throughput> + jitter	NAN	kbps	
UL SDU – Thrp. Max.,	0 to <max. throughput> + jitter	NAN	kbps	
UL SDU – Thrp. Min.,	0 to <max. throughput> + jitter	NAN	kbps	
DL BLER – Curr.,	0 % to 100 %	NAN	%	
DL BLER – Avg.,	0 % to 100 %	NAN	%	
RLC NACKs	depending on meas. duration and link quality	NAN	–	
RLC Resets	depending on meas. duration and link quality	NAN	–	
RLC Time	0 to <Window Size>	NAN	–	

Description of command

These commands are always queries. They start a `RXQuality:RLCBler` measurement (`READ...`) and/or return the measurement results (a simpler version of the commands is already available in FW version V3.80). The results for UL/DL PDUs, and UL/DL SDUs can be retrieved separately; see commands below.

For a numeric example of the measurement results see Fig. 9-4 on p. 9.14.

Measurement results, DL PDUs

READ[:SCALar]:RXQuality:RLCBler:DL:PDU? Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:RLCBler:DL:PDU? Read measurement results (unsynchronized)
SAMPle[:SCALar]:RXQuality:RLCBler:DL:PDU? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
DL PDU – Blocks,	depending on meas. duration and throughput	NAN	–	V4.20
DL PDU – Bytes,	depending on meas. duration and throughput	NAN	–	
DL PDU – Thrp. Curr.,	0 to <max. throughput of packet data channel>	NAN	kbps	
DL PDU – Thrp. Avg..,	0 to <max. throughput of packet data channel>	NAN	kbps	
DL PDU – Thrp. Max.,	0 to <max. throughput of packet data channel>	NAN	kbps	
DL PDU – Thrp. Min.	0 to <max. throughput of packet data channel>	NAN	kbps	

Description of command

These commands are always queries. They start a `RXQuality:RLCBler` measurement (`READ...`) and/or return the DL PDU measurement results.

Measurement results, UL PDUs

READ[:SCALar]:RXQuality:RLCBler:UL:PDU? Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:RLCBler:UL:PDU? Read measurement results (unsynchronized)
SAMPle[:SCALar]:RXQuality:RLCBler:UL:PDU? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
UL PDU – Blocks,	depending on meas. duration and throughput	NAN	–	V4.20
UL PDU – Bytes,	depending on meas. duration and throughput	NAN	–	
UL PDU – Thrp. Curr.,	0 to <max. throughput of packet data channel>	NAN	kbps	
UL PDU – Thrp. Avg..,	0 to <max. throughput of packet data channel>	NAN	kbps	
UL PDU – Thrp. Max.,	0 to <max. throughput of packet data channel>	NAN	kbps	
UL PDU – Thrp. Min.	0 to <max. throughput of packet data channel>	NAN	kbps	

Description of command

These commands are always queries. They start a `RXQuality:RLCBler` measurement (`READ...`) and/or return the UL PDU measurement results.

Measurement results, DL SDUs

READ[:SCALar]:RXQuality:RLCBler:DL:SDU? Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:RLCBler:DL:SDU? Read measurement results (unsynchronized)
SAMPle[:SCALar]:RXQuality:RLCBler:DL:SDU? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
DL SDU – Bytes,	depending on meas. duration and throughput	NAN	–	V4.20
DL SDU – Thrp. Curr.,	0 to <max. throughput> + jitter	NAN	kbps	
DL SDU – Thrp. Avg..,	0 to <max. throughput> + jitter	NAN	kbps	
DL SDU – Thrp. Max.,	0 to <max. throughput> + jitter	NAN	kbps	
DL SDU – Thrp. Min.	0 to <max. throughput> + jitter	NAN	kbps	

Description of command

These commands are always queries. They start a `RXQuality:RLCBler` measurement (`READ...`) and/or return the DL SDU measurement results.

Measurement results, UL SDUs

READ[:SCALar]:RXQuality:RLCBler:UL:SDU? Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:RLCBler:UL:SDU? Read measurement results (unsynchronized)
SAMPle[:SCALar]:RXQuality:RLCBler:UL:SDU? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
UL SDU – Bytes,	depending on meas. duration and throughput	NAN	–	V4.20
UL SDU – Thrp. Curr.,	0 to <max. throughput> + jitter	NAN	kbps	
UL SDU – Thrp. Avg..,	0 to <max. throughput> + jitter	NAN	kbps	
UL SDU – Thrp. Max.,	0 to <max. throughput> + jitter	NAN	kbps	
UL SDU – Thrp. Min.	0 to <max. throughput> + jitter	NAN	kbps	

Description of command

These commands are always queries. They start a `RXQuality:RLCBler` measurement (`READ...`) and/or return the UL SDU measurement results.

Measurement results, curves

READ:ARRay:RXQuality:RLCBler:DL:PDU[:CURRent]? Start single shot measurement and return results
READ:ARRay:RXQuality:RLCBler:UL:PDU[:CURRent]?
READ:ARRay:RXQuality:RLCBler:DL:SDU[:CURRent]?
READ:ARRay:RXQuality:RLCBler:UL:SDU[:CURRent]?

Returned values	Value range	Def. value	Def. unit	FW vers.
Throughput Curr. [1],	0 to <max. throughput of packet data channel>*)	NAN	kbps	V4.20
…	…	…	…	
Throughput Curr. [n]	0 to <max. throughput of packet data channel>*)	NAN	kbps	

Description of command

These commands are always queries. They start a `RXQuality:RLCBler` measurement and return the current throughput results over the duration of a single shot measurement (window size), specified by means of `CONFigure:RXQuality :RLCBler:CONTrol:WSIZe`. The current results are updated after each update time interval (`CONFigure:RXQuality :RLCBler:CONTrol:UTIMe)`. The number n is the integer number following the ratio <window size> / <update time>.

Example: With a default update time of 240 ms and a window size of 240 s, the commands return 1000 results (n = 1000), which is the maximum array length. The minimum array length (for a 10 s window size and a 2400 ms update time) is 5.

*) The SDU results can exceed the maximum throughput (jitter).

R&S Smart Alignment

R&S Smart Alignment (option R&S CMU-K47) is a supplementary software option extending the WCDMA UE network test options. The option has been designed for fast UE transmitter and receiver adjustments (TX and RX calibrations) over a wide range of channels and powers. To enable parallel UE transmitter and receiver tests, the R&S CMU can simultaneously change its generator and analyzer settings after equal time periods (step widths) of 0.75 slots to 60 slots.

R&S Smart Alignment is an application of the *Power* measurement group. All test settings can be defined in the *Control* tab of the *Power Configuration* menu.

- For a TX calibration, the analyzer frequency and maximum input power of the R&S CMU is set in accordance with the expected TX frequencies and powers of the UE under test. The R&S CMU provides a table of measured average powers, to be compared with the nominal transmitter output powers of the UE.
- For an RX calibration the R&S CMU generates an RF test signal with definite frequencies and powers, to be compared with the power measured at the UE receiver.

R&S Smart Alignment is available in *Non Signalling* mode. With a step width of 2 ms (3 WCDMA slots), it is possible to perform the entire test procedure for the UE transmit and receive power adjustment at 320 different level/frequency pairs in approx. 2/3 s.

R&S Smart Alignment is also available for GSM-MS and CDMA2000 measurements. For details refer to the relevant manuals.

Test Procedures

The *Power* menu provides all test settings for option *R&S Smart Alignment* and displays the TX calibration results. To achieve maximum speed the TX and RX calibrations are configured in the same menu and preferably performed in parallel, however, it is also possible to switch off the RF generator while carrying out a TX calibration. The following examples show how to perform an TX calibration and an RX calibration separately.

Example for TX Calibration

For a TX calibration the R&S CMU measures the UE output power in a series of configurable time periods. The measurement must be performed with an *External, Internal, IF Power, Slot, Frame, TPC,* or *Auto* trigger. The *Auto* trigger setting corresponds to *IF Power* trigger. A trigger delay has an impact on the TX calibration measurement (see Fig. 9-7 on p. 9.26) but does not affect the generator signal.

Measurement task Verify the transmitter output power of a WCDMA UE in the output power range between 0 dBm and + 20 dBm and over the entire uplink frequency range of operating band I (1922.4 MHz to 1977.6 MHz). Use a time period of 10 ms for each single power measurement.

UE Configuration

1. Stimulate the UE transmitter to change its power periodically as shown in Fig. 9-5 below. Start power: 0 dBm; increment: 2 dBm; DTX during one time period after the UE has reached +20 dBm (each 12th time period).
2. Ensure that the UE changes its frequency after each sequence of power steps, using the 12 different uplink channels no 9612 (1922.4 MHz), 9637 (1927.4 MHz) … 9887 (1977.4 MHz).

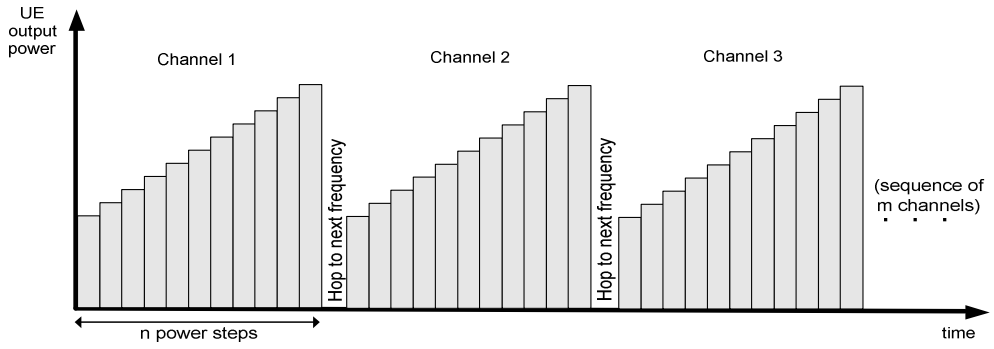
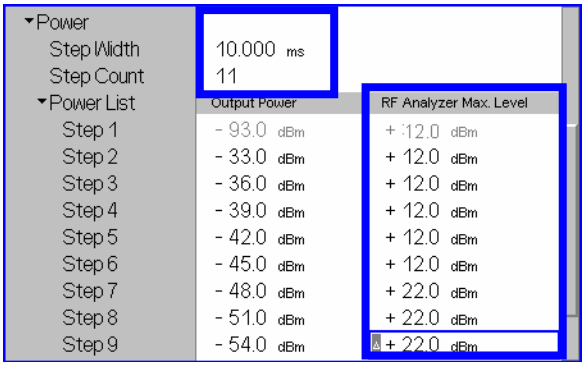


Fig. 9-5 TX calibration: mobile power settings

R&S CMU Settings

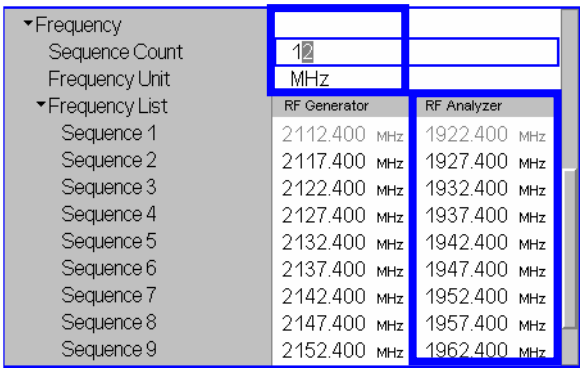
3. In the *Menu Select* menu, select the WCDMA FDD function group and the measurement menu *Non Signalling – Power – R&S Smart Alignment*. Press *RESET* to set the instrument to a defined state. Press *ENTER CONT/HALT* to set the measurement to the *HLT* state and eliminate the *Trigger not found !* message.
4. Press *Analyzer Lvl. – Max. Level* and select +12 dBm to adjust the RF analyzer to the initial input level from the UE, allowing for an appropriate margin.
5. Press the measurement control softkey *R&S Smart Alignment* twice to open the *Power Configuration* menu. In the *Control* tab, expand the *Smart Alignment* section and define the *Step Width,* the *Step Count,* and then the list of *RF Analyzer Max. Levels* in accordance with the 11 power steps of your UE signal.

For a total dynamic range of 20 dB, two different *RF Analyzer Max. Level* settings are sufficient, e.g.:



The first, non-editable *RF Analyzer Max. Level* is given by the common *Max. Level* defined in step 4.

6. Expand the *Frequency* section, select a *Sequence Count* of 12, and verify that the *RF Analyzer* frequencies are in accordance with the frequency sequence of your UE.



The first, non-editable *RF Analyzer* frequency is given by the common analyzer frequency defined via *Analyzer Settings – RF Frequency*.

7. Press *Smart Alignment* again to close the Power Configuration menu.
8. Press *Analyzer Lvl. / Trigger* twice and select *Trigger Source – IF Power*.
9. Start the *R&S Smart Alignment* measurement *(Smart Alignment – ENTER CONT/HALT)*, connect the UE to the RF2 connector of the CMU and switch on.

The measurement starts as soon as the R&S CMU detects the first power step of the UE signal. The results for all power steps and frequencies are displayed in the output table; see section *TX Calibration Results* on p. 9.25.

Define an external input attenuation (Connection Control – Ext. Att. Input *for RF2* or *Frequency Dependent Attenuation) to compensate for a known attenuation in the signal path from the UE antenna connector to the R&S CMU input.*

Example for RX Calibration

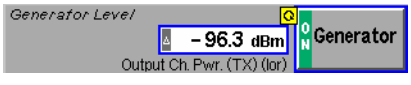
For an RX calibration the R&S CMU generates an RF test signal with definite frequencies and powers, to be compared with the power measured at the UE receiver. Both the RF generator and the *R&S Smart Alignment* measurement must be running *(ON, RUN)* in order to generate the test signal. In addition, a suitable trigger configuration *(IF Power, RF Power, …)* is needed.

Measurement task

Verify the receiver power adjustment of a WCDMA UE in the power range between –50 dBm and –30.0 dBm and over the entire downlink frequency range of operating band I (2112.4 MHz to 2167.6 MHz). Use a time period of 1 WCDMA frame for each single power measurement.

Test signal configuration

1. In the *Menu Select* menu, select the WCDMA FDD function group and the measurement menu *Non Signalling – Power – Smart Alignment*. Press *RESET* to set the instrument to a defined state. Verify that the measurement is switched on *(RUN)*.
2. Press *Analyzer Lvl. / Trigger* twice and select *Trigger Source – IF Power*.
3. Open the *Generator* tab of the *Connection Control* menu. In the *Generator Level* panel, switch the generator on and select an initial *Output Ch. Power (TX) (Ior)* of –50 dBm:

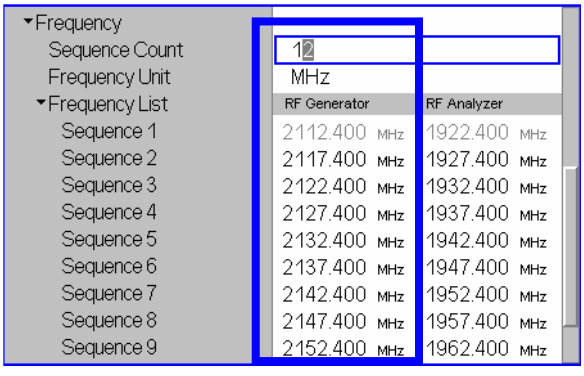


The *Output Ch. Power (TX) (Ior))* is the sum of all physical DL WCDMA channels configured in the *Generator* tab (P-CPICH, SCH, P-CCPCH, PICH, DPCH, OCNS). The AWGN does not contribute to the *Output Ch. Power (TX) (Ior);* it is normally switched off for RX calibrations (default setting).

4. Close the Connection Control menu.
5. Press the measurement control softkey *Smart Alignment* twice to open the *Power Configuration* menu. In the *Control* tab, expand the *Smart Alignment* section and define the *Step Width,* the *Step Count,* and then the list of *Output Powers* as shown below:

The first, non-editable *Output Power* is given by the *Output Ch. Power (TX)* defined in step 3.

6. Expand the *Frequency* section, select a *Sequence Count* of 12, and verify that the *RF Generator* frequencies cover the entire operating band I.



The first, non-editable *RF Generator* frequency is given by the common generator frequency defined via *Generator Settings – RF (TX) Frequency*. The generated power step sequence is analogous to Fig. 9-5 on p. 9.23.

7. Connect the UE to the RF2 connector of the R&S CMU and switch it on.

After the UE has received the entire power step sequence you can perform the receiver calibration by comparing the RF generator powers to the received power spectral density $\hat{I}_{or}$ measured by the UE.

Define an external output attenuation (Connection Control – Ext. Att. Output for RF2) to increase the RF generator level in order to compensate for a known attenuation in the signal path from the R&S CMU output to the mobile receiver input.

TX Calibration Results

While the *R&S Smart Alignment* application is running, the table in the *Power* menu shows a sequence of UL signal powers measured according to the analyzer settings in the *Power Configuration* menu (see section *R&S Smart Alignment Configuration* on p. 9.27).

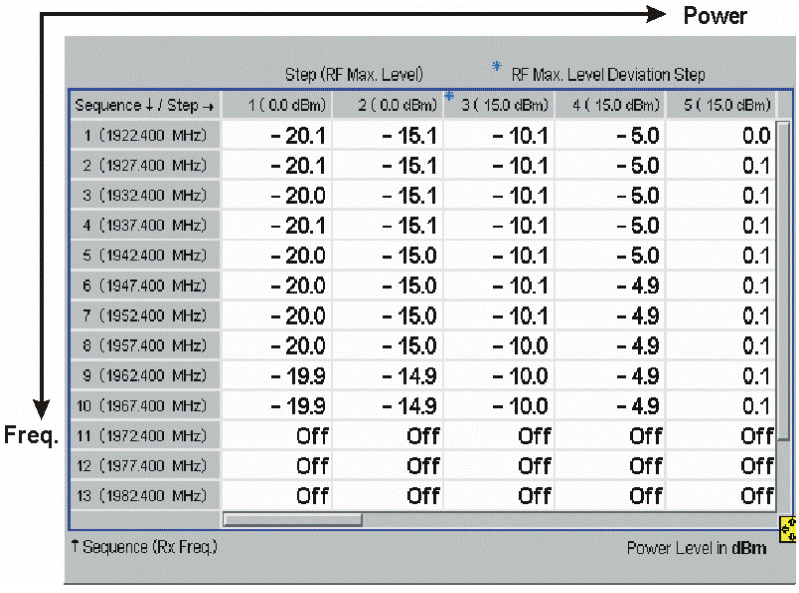


Fig. 9-6 Display of results (Power – R&S Smart Alignment)

Power results

The *R&S Smart Alignment* application measures the average burst power in up to 100 consecutive power steps of configurable width and at up to 100 different frequencies. The total number of values per measurement cycle is limited to 899. The measurement is performed with a selectable resolution filter. The average is taken over the central section of the power step unless the start of the measurement is shifted using a trigger delay. The averaging length depends on the step width as shown below.

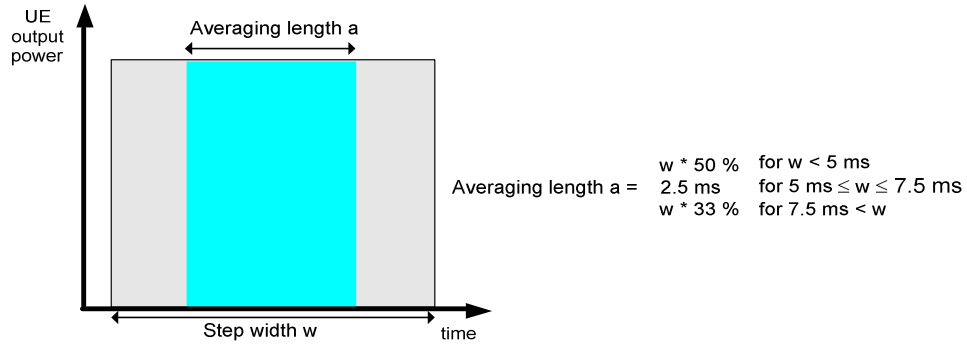


Fig. 9-7 Averaging length

The table size depends on the RF analyzer settings:

- Each table row contains a series of different power steps at constant frequency. The number of columns is equal to the *Step Count* defined in the configuration menu.
- Each table column contains a definite power step at different frequencies. The number of rows is equal to the *Sequence Count* defined in the configuration menu. A blue asterisk on top of a column indicates a change of the RF max. level setting[1].

The measurement results are obtained row by row. The time period after the last power step in each series of power steps is skipped; it provides the necessary settling time after the UE transmitter hops to the next frequency.

[1] The level uncertainty of the RF analyzer quoted in the data sheet is valid irrespective of a change of the RF max. level. At constant RF max. level settings, the relative power steps can be measured much more accurately, so it is advantageous to avoid frequent changes of the RF max. level (see also *TX Calibration* on p. 9.22.).

In continuous measurements, the results are only updated after a new set of valid results is available. "---" indicates an invalid result, e.g. due to an overflow, which can be avoided by adjusting the maximum expected input level *(Analyzer Level – Max. Level* and max. level settings in the configuration menu). *Off* indicates that no result is available because the step count or sequence count is below its maximum value.

For more than 5 power steps or more than 13 different measured frequencies, the table can be scrolled using the cursor keys. No limit check is performed.

Remote control
```
READ[:SCALar]:POWer:SALignment?
FETCh[:SCALar]:POWer:SALignment?
SAMPle[:SCALar]:POWer:SALignment?
```

R&S Smart Alignment Configuration

The power steps and frequencies for the *R&S Smart Alignment* measurement are defined in the *Control* tab of the *Power Configuration* menu.

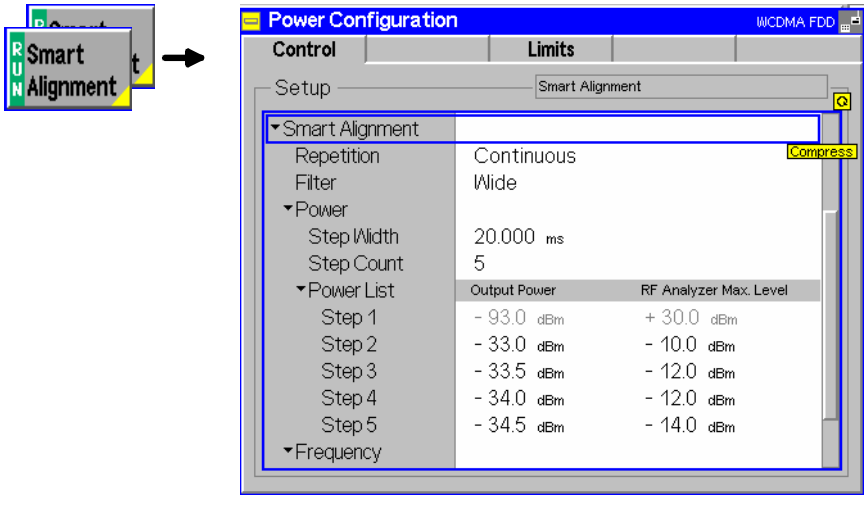


Fig. 9-8 Power Configuration – Control

Smart Alignment – Repetition

The *Repetition* parameter defines how often the measurement is repeated:

Single Shot The measurement is stopped *(HLT)* after the entire frequency list has been measured.

Continuous The measurement is repeated until it is terminated explicitly using the *ON/OFF* key. In the measurement menu, the results are only updated after a new set of valid results is available.

Remote control
```
CONFigure:POWer:SALignment:CONTrol:REPetition
  CONTinuous | SINGleshot | 1 ... 10000, NONE, <Stepmode>
```

The parameters for TX and RX calibration are located in common sections. The meaning of the power and frequency settings for a typical sequence of test steps is described in Fig. 9-9 below. The total measurement time is equal to *T = <Step Width> * (<Step Count> + 1) * <Sequence Count>.*

NOTE *The product (<Step Count> + 1) * <Sequence Count> must be smaller than 899.*

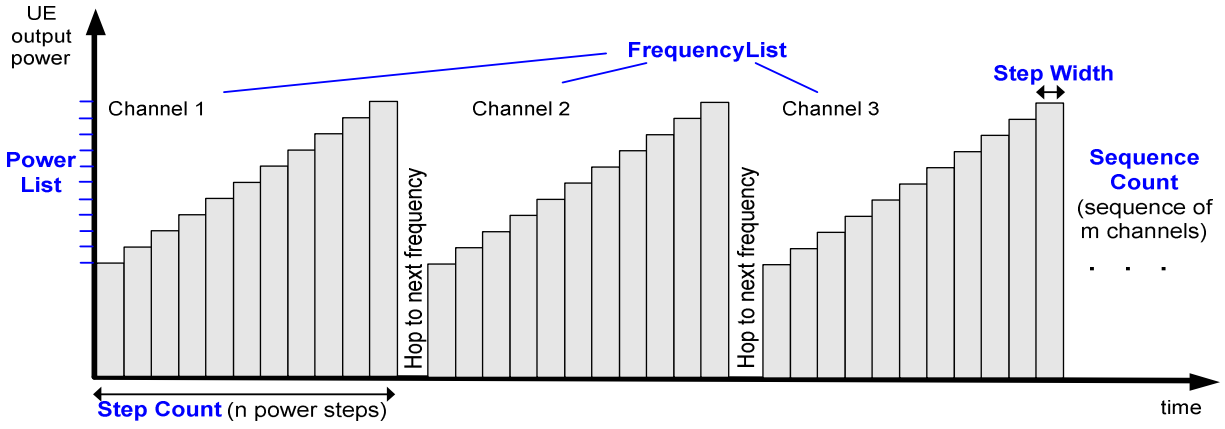


Fig. 9-9 R&S Smart Alignment – power and frequency settings

Smart Alignment – Filter

Selects a 30 KHz or a wideband IF filter with a 5 MHz bandwidth. The filter can only be changed while the *Smart Alignment* measurement is *OFF*.

Remote control

```
CONFigure:POWer:SALignment:CONTrol:FILTer WIDE | F30K
```

Smart Alignment – Power

The *Power* section provides the settings for a single power step cycle at fixed frequency.

Step Width Duration of each TX or RX power step. The step width has an impact on the averaging length for the TX calibration measurement; see Fig. 9-7 on p. 9.26. The minimum step width of 0.5 ms corresponds to 0.75 WCDMA slots.

Step Count Number of power steps per cycle. The length of the power list is automatically adjusted to the step count.

Power List Total RF generator power *(Output Power)* for each power step and expected Max. Level from the UE. The first, non-editable values are given by the common total generator output power *(Generator Lvl. – Level)* and the common maximum RF level *(Analyzer Lvl. – Max. Level)*, respectively. Autoranging is disabled while an *R&S Smart Alignment* measurement is running; it is re-enabled after the measurement is stopped.

NOTE

The smallest RF Max. Level *of the analyzer is –9 dBm (RF1), –23 dBm (RF2), and –48 dBm (RF4 IN). Smaller* RF Max. Levels *can be achieved using a negative external input attenuation (external gain, corresponding to an amplifier for the input signal).* ***Example:*** *A fixed (not frequency-dependent) external gain of –12 dB shifts the minimum* RF Max. Level *for RF2 to –23 dBm – 12 dB = –35 dBm).*

A manual RF Max. Level *setting below one of the limits quoted above is auto-corrected when the* R&S Smart Alignment *measurement is started. The* RF Max. Level *setting remains at the limit after the* R&S Smart Alignment *measurement is stopped.*

Remote control

```
CONFigure:POWer:SALignment:CONTrol:SWIDth
CONFigure:POWer:SALignment:CONTrol:SCOunt
CONFigure:POWer:SALignment:CONTrol:STEP<nr>
```

```
CONFigure:POWer:SALignment:CONTrol:STEP:OPOWer
CONFigure:POWer:SALignment:CONTrol:STEP:MLEVel
```

Smart Alignment – Frequency

The *Frequency* section defines the frequencies of the repeated power step cycles. The frequencies can be set in multiples of 1 kHz; they don't have to coincide with WCDMA channel frequencies.

Sequence Count Number of power step cycles per single shot measurement. The length of the frequency list is automatically adjusted to the sequence count.

Frequency Unit Entry of RF frequencies in MHz or channel numbers (UARFCNs). With channel numbers, it is possible to specify all UARFCNs within the normal 200 kHz channel raster (UARFCN = 5 * f / MHz) as well as additional channels outside the 200 kHz raster (for operating bands II, III, IV, V, X, S). See description of RF channel settings and WCDMA operating bands in Chapter 4.

Frequency List RF frequency or channel for the generated DL signal *(RF Generator)* and expected RF frequency or channel from the UE *(RF Analyzer)*. The first, non-editable values are given by the common generator frequency *(Generator Set. – RF Frequency)* and the common analyzer frequency *(Analyzer Settings – RF Frequency)*, respectively.

The generator and analyzer frequencies in the table must be either all greater than 1200.1 MHz or all smaller than 1200.1 MHz.

Remote control

```
CONFigure:POWer:SALignment:CONTrol:SQCOunt
CONFigure:POWer:SALignment:CONTrol:SQUence:UNIT
CONFigure:POWer:SALignment:CONTrol:SQUence
CONFigure:POWer:SALignment:CONTrol:SQUence:RFGenerator
CONFigure:POWer:SALignment:CONTrol:SQUence:RFANalyzer
```

Remote Control Commands

The following sections describe the remote control commands for option R&S CMU-K47; *R&S Smart Alignment*.

Measurement Control

The following commands control the *R&S Smart Alignment* measurement. They correspond to the measurement control softkey *Smart Alignment* in the *Power* menu.

Note: *The `POWer:SALignment…` measurement must be performed with an External, Internal, IF Power, Slot, Frame, TPC, or Auto trigger (see `TRIGger[:SEQuence]:SOURce`).*

INITiate:POWer:SALignment	Start new measurement	⇒ *RUN*
ABORt:POWer:SALignment	Abort running measurement and switch off	⇒ *OFF*
STOP:POWer:SALignment	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:POWer:SALignment	Next measurement step (only *stepping mode*)	⇒ *RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V3.85

CONFigure:POWer:SALignment:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.85
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU operating manual).

FETCh[:SCALar]:POWer:SALignment:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.85
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE	No counting mode set	NONE	–	

Description of command

This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of the CMU 200/300 manual).

Subsystem POWer:SALignment:CONTrol

The subsystem *POWer:SALignment:CONTrol* defines the scope of the measurement, the generated and the measured power steps and frequencies. The settings are located in the *Control* tab of the *Power Configuration* menu.

DEFault:POWer:SALignment:CONTrol <Enable> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to their default values Some or all parameters are not set to default	ON	–	V3.85

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.

CONFigure:POWer:SALignment:CONTrol:REPetition <*Repetition*>,<*StopCondition*>,<*Stepmode*>

Test Cycle

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous |	Continuous measurement (continuous, until STOP or ABORT)	SING	–	
SINGleshot |	Single measurement (single shot, until Status = RDY)			
1 to 10000,	Multiple measurement (counting, until Status = STEP | RDY)			
<StopCond>	Description of parameters	Def. value	Def. unit	
NONE,	No limit check, no stop condition available	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.85

Description of command

This command determines the number of statistics cycles and the stepping mode for the measurement.

Note: The <*Repetition*> parameter has no effect on `READ:`... commands, where the measurement is always stopped after a single shot.

CONFigure:POWer:SALignment:CONTrol:FILTer *<Bandwidth Filter>*

Filter

<Filter>	Description of parameters	Def. value	Def. unit	FW vers.
WIDE | **F30K**	Bandwidth filter set to 5 MHz Bandwidth filter set to 30 kHz	WIDE	–	V4.32

Description of command

If used as a setting command, this defines the bandwidth filter for the R&S Smart Alignment calibration measurements. If used as a query the command returns the currently set filter.

CONFigure:POWer:SALignment:CONTrol:SWIDth <*Step Width*> Step Width

<*Step Width*>	Description of parameters	Def. value	Def. unit	FW vers.
0.0005 s to 0.040 s	Step width	0.020	s	V3.85

Description of command

This command defines the duration of each TX or RX power step. In firmware versions < V4.31, the minimum step width is 0.002 s.

CONFigure:POWer:SALignment:CONTrol:SCOunt <*Step Count*> Step Count

<*Step Count*>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 100*)	Step count	5	–	V3.85

Description of command

This command defines the number of power steps per cycle. In firmware versions < V4.31, the maximum step count is 20.

**) The product (<Step Count> + 1) * <Sequence Count> must be smaller than 899.*

CONFigure:POWer:SALignment:CONTrol:STEP<nr> Power List
<Output Power>, <Max. Level>

<*Output Power*>	Description of parameters	Def. value	Def. unit	FW vers.
–147.1 dBm to –37.1 dBm **–147.1 dBm to –20.1 dBm** **–100.1 dBm to +2.9 dBm**	Output power <nr> if RF 1 is used Output power <nr> if RF 2 is used Output power <nr> if RF 3 OUT is used	See below	dBm	V3.85
<*Max. Level*>	Description of parameters	Def. value	Def. unit	FW vers.
–9.0 dBm to +53.0 dBm **–23.0 dBm to +39.0 dBm** **–48.0 dBm to 0.0 dBm**	Maximum input level <nr> for RF 1 Maximum input level <nr> for RF 2 Maximum input level <nr> for RF 4 IN	See below	dBm	V3.85

Description of command

This command defines a pair of generator power and max. level values numbered by the numeric suffix <nr>. The first power pair (<nr> = 1) is given by the common generator power and maximum input level (`SOURce:RFGenerator:OPOWer, [SENSe:]LEVel:MAXimum`) and can be queried only. Powers with a numeric suffix that exceeds the step count (`CONFigure:POWer:SALignment:CONTrol:SCOunt`) are configurable but not measured. Note that the maximum input levels are modified if an external attenuation is set.

The powers must be multiples of 0.1 dB. The default generator powers read

$$p^{Gen}_{1,\,def} = -93\,dBm; \quad p^{Gen}_{<nr>,\,def} = -27\,dBm - 3 \cdot < nr > dB; \quad < nr > = 2\ to\ 100.$$

The default max. levels read

$$p^{An}_{1,\,def} = +\ 30\ dBm; \quad p^{An}_{<nr>,\,def} = 10 \cdot \mathrm{Int}\left(\frac{< nr > + 4}{5}\right) dBm; \quad < nr > = 2\ to\ 100.$$

CONFigure:POWer:SALignment:CONTrol:STEP:OPOWer Power List, Output Powers
<Output Power 1>, <Output Power 2>… <Output Power 100>

<Output Power <nr>>	Description of parameters	Def. value	Def. unit	FW vers.
–147.1 dBm to –37.1 dBm **–147.1 dBm to –20.1 dBm** **–100.1 dBm to +2.9 dBm**	Output power for step <nr> and RF 1 Output power for step <nr> and RF 2 Output power for step <nr> and RF 3 OUT	See below	dBm	V4.31

Description of command

This command defines all generator power values in the *Power List*. The first power value (<nr> = 1) is given by the common generator power (`SOURce:RFGenerator:OPOWer`) and can be queried only. Powers beyond the selected step count (`CONFigure:POWer:SALignment:CONTrol:SCOunt`) are configurable but not measured.

The powers must be multiples of 0.1 dB. The default generator powers read

$$p^{Gen}_{1,\,def} = -93\,dBm; \quad p^{Gen}_{<nr>,\,def} = -27\,dBm - 3 \cdot < nr > dB; \quad < nr > = 2\ to\ 100.$$

CONFigure:POWer:SALignment:CONTrol:STEP:MLEVel Power List, Max. Levels
<Max. Level 1>, <Max. Level 2>… <Max. Level 100>

<Max. Level <nr>>	Description of parameters	Def. value	Def. unit	FW vers.
–9.0 dBm to +53.0 dBm **–23.0 dBm to +39.0 dBm** **–48.0 dBm to 0.0 dBm**	Max. input level for step <nr> and RF 1 Max. input level for step <nr> and RF 2 Max. input level for step <nr> and RF 3 OUT	See below	dBm	V4.31

Description of command

This command defines all max. level values in the *Power List*. The first max. level value (<nr> = 1) is given by the common maximum input level (`[SENSe:]LEVel:MAXimum`) and can be queried only. Max. levels beyond the selected step count (`CONFigure:POWer:SALignment:CONTrol:SCOunt`) are configurable but not measured. Note that the maximum input levels are modified if an external attenuation is set.

The default max. levels read

$$p^{An}_{1,\,def} = +\ 30\ dBm; \quad p^{An}_{<nr>,\,def} = 10 \cdot \mathrm{Int}\left(\frac{< nr > + 4}{5}\right) dBm; \quad < nr > = 2\ to\ 100.$$

CONFigure:POWer:SALignment:CONTrol:SQCount <*Sequence Count*> Sequence Count

<Sequence Count>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 100*)	Sequence count	10	–	V3.85

Description of command

This command defines the number of power step cycles per single shot measurement. In FW versions <V4.25, the maximum sequence count is 16.

*) The product *(<Step Count> + 1) * <Sequence Count>* must be smaller than 899.

CONFigure:POWer:SALignment:CONTrol:SQUence:UNIT *<Frequency Unit>* Frequency Unit

<Step Count>	Description of parameters	Def. value	Def. unit	FW vers.
MHZ | CH	Entry of frequencies in MHz Entry of channel numbers (UARFCNs)	MHZ	–	V3.85

Description of command

This command defines the unit for the values in the frequency list (`CONFigure:POWer:SALignment:CONTrol:SQUence`). With channel numbers it is possible to specify all UARFCNs within the normal 200 kHz channel raster (UARFCN = 5 * f / MHz).

CONFigure:POWer:SALignment:CONTrol:SQUence<nr> Frequency List
<Generator Freq.>, <Analyzer Freq.>

<Generator Freq.>	Description of parameters	Def. value	Def. unit	FW vers.
10.000 MHz to 2700.000 MHz,	Generator frequency <nr>	See below	MHz	V3.85
<Analyzer Freq.>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
15.000 MHz to 2700.000 MHz	Analyzer frequency <nr>	See below	MHz	V3.85

Description of command

This command defines a pair of generator and analyzer frequencies numbered by the numeric suffix <nr> (<nr> = 2 to 16). The first frequency pair (<nr> = 1) is given by the common generator and analyzer frequencies (`SOURce:RFGenerator:FREQuency, [SENSe:]RFANalyzer:FREQuency`) and can be queried only. Frequencies with a numeric suffix that exceeds the sequence count (`CONFigure:POWer:SALignment:CONTrol:SQCount`) are configurable but not measured.

The frequencies must be multiples of 1 kHz. The default generator frequencies read

$$f^{Gen}_{<nr>,\,def} = 2112.4\ MHz + 5 \cdot (<nr> - 1)\ MHz; \quad <nr> = 1\ to\ 100.$$

The default analyzer frequencies read

$$f^{An}_{<nr>,\,def} = 1922.4\ MHz + 5 \cdot (<nr> - 1)\ MHz; \quad <nr> = 1\ to\ 100.$$

CONFigure:POWer:SALignment:CONTrol:SQUence:RFGenerator Frequency List, RF Generator
Generator Freq.>, <Generator Freq. 2>… <Generator Freq. 100>

<Generator Freq. <nr>>	Description of parameters	Def. value	Def. unit	FW vers.
10.000 MHz to 2700.000 MHz,	Generator frequency <nr>	See below	MHz	V4.31

Description of command

This command defines all generator frequencies in the *Frequency List*. The first frequency (<nr> = 1) is given by the common generator frequency (`SOURce:RFGenerator:FREQuency`) and can be queried only. Frequencies beyond the sequence count (`CONFigure:POWer:SALignment:CONTrol:SQCount`) are configurable but not measured.

The frequencies must be multiples of 1 kHz. The default generator frequencies read

$$f^{Gen}_{<nr>,\,def} = 2112.4\ MHz + 5 \cdot (<nr> - 1)\ MHz; \quad <nr> = 1\ to\ 100.$$

CONFigure:POWer:SALignment:CONTrol:SQUence:RFANalyzer Frequency List, RF Analyzer
<Analyzer Freq.>, < Analyzer Freq. 2>… < Analyzer Freq. 100>

<Generator Freq.<nr>>	Description of parameters	Def. value	Def. unit	FW vers.
15.000 MHz to 2700.000 MHz,	Analyzer frequency <nr>	See below	MHz	V4.31

Description of command

This command defines all analyzer frequencies in the *Frequency List*. The first frequency (<nr> = 1) is given by the common analyzer frequency (`[SENSe:]RFANalyzer:FREQuency`) and can be queried only. Frequencies beyond the sequence count (`CONFigure:POWer:SALignment:CONTrol:SQCount`) are configurable but not measured.

The frequencies must be multiples of 1 kHz. The default analyzer frequencies read

$$f^{An}_{<nr>,\,def} = 1922.4\ MHz + 5 \cdot (<nr> - 1)\ MHz; \quad <nr> = 1\ to\ 100.$$

Subsystem POWer:SALignment?

The subsystem *POWer:SALignment* measures power versus slot and returns the results. The subsystem corresponds to the output table in the *Smart Alignment* measurement menu.

R&S Smart Alignment Results
READ[:SCALar]:POWer:SALignment? Start single shot measurement and return results
FETCh[:SCALar]:POWer:SALignment? Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:SALignment? Read out measurement results (synchronized)

Returned Values	Description of parameters	Def. value	Def. unit	FW vers.
–100 dBm to +60 dBm | OFF	Avg. power for power step 1, frequency 1	NAN	dBm	V3.85
…	…			
–100 dBm to +60 dBm | OFF	Avg. power for power step m, frequency 1	NAN	dBm	
…	…			
–100 dBm to +60 dBm | OFF	Avg. power for power step 1, frequency n			
…	…			
–100 dBm to +60 dBm | OFF	Avg. power for power step m, frequency n			

Description of command

These commands are always queries. They start a measurement (`READ…`) and/or return the average power in all time periods. The number of valid results depends on the step count m (`CONFigure:POWer:SALignment:CONTrol:SCOunt`) and the sequence count n (`CONFigure:POWer:SALignment :CONTrol:SQCount`) but cannot exceed the maximum value of 899. OFF indicates that no result is available because the step count is below its maximum value.

Note: If the step count m is smaller than 20, the R&S still returns 20 results for each frequency. The values for unused power steps are invalid (NAN).

Assisted GPS

With option R&S CMU-K90, *Assisted GPS,* the R&S® CMU can exchange GPS assistance data with the UE under test. The transfer of Assisted GPS (A-GPS) information is most conveniently organized by the *A-GPS Control Application* (refer to the separate operating manual, stock no. 1200.9341.12), however, the WCDMA UE firmware application provides a set of remote control commands that allow you to directly send or retrieve A-GPS data.

A-GPS tests require a voice call, a video or an RMC connection. The R&S CMU200 communicates with the UE under test using RRC messages which are transmitted over the Signaling Radio Bearer (SRB) of the active connection.

- To send GPS assistance data to the UE and start/stop a measurement, the R&S CMU200 sends a MEASUREMENT CONTROL request to the UE.
- To read the current position data of the UE, the R&S CMU200 reads its MEASUREMENT REPORT response(s).

The exchanged A-GPS messages are written to the message log; they may be monitored and analyzed e.g. using the *Message Analyzer and Recorder*, R&S CMU-Z46.

The structure of the A-GPS commands corresponds to the command structure for an ordinary WCDMA measurement. The following table gives an overview of the essential steps; the complete command set is described in the following sections.

SCPI Command	**Action**
`CONFigure:AGPS:CONTrol:REPetition`	Define the scope of the measurement: (repeated) single shot / continuous
`CONFigure:AGPS:CONTrol:MEAControl`	Define basic measurement control parameters
`CONFigure:AGPS:ADATa…`	Define the assistance data to be sent to the UE
`INITiate:AGPS` `ABORt:AGPS`	Send assistance data to the UE, start measurement Stop measurement
`FETCh:AGPS:STATus?`	Monitor the status of the (single shot or continuous) measurement
`FETCh[:SCALar]:AGPS?`	Read the last set of position data that the R&S CMU200 received from the UE. Single shot: Wait until measurement status is `RDY`, then read results once Repeated single shot: Poll the R&S CMU constantly to retrieve consecutive sets of results Continuous: Poll the R&S CMU constantly to retrieve consecutive sets of results, stop measurement explicitly using `ABORT:AGPS`.

Control of Measurement

The following commands control the A-GPS measurement.

INITiate:AGPS	Start new measurement	⇒	*RUN*
ABORt:AGPS	Abort running measurement and switch off	⇒	*OFF*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V5.10

CONFigure:AGPS:EREPorting <*Mode*> — Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V5.10
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:AGPS:STATus? — Measurement Status

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V5.10
RUN |	Running (after `INITiate`)			
ERR |	*OFF* (could not be started)			
RDY,	(Repeated) single shot measurement finished			
		NONE	–	
1 to 10000 |	Counter for repeated single shot measurement			
NONE	Single shot without repetition, no “counting” mode			

Description of command

This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

CONFigure:AGPS:CONTrol:REPetition — Test Mode
<Repetition>, <StopCond>, <Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	
SINGleshot	Single shot measurement (until `Status = RDY`)			
1 to 10000,	Repeated single shot measurement (counting mode)			
<StopCond>	Description of parameters	Def. value	Def. unit	
NONE,	Continue measurement if limits are exceeded	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
NONE	Continue measurement according to its rep. mode	NONE	–	V5.10

Description of command

This command selects either a continuous or a single shot measurement.

FETCh:AGPS:USESsmessages				Use SS Messages
Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF | ON	Disable or enable the use of SS messages	OFF	–	V5.10

Description of command

This command enables or disables the exchange of SS messages to allow the R&S CMU200 to obtain position data from the UE. If *Use SS Messages* is enabled, the A-GPS measurement is initialized as follows:

1. R&S CMU200 sends an *SS Register* message to the UE to ask for permission to obtain position data *(LcsNotification)*.
2. The UE displays the request from the R&S CMU200, which the user may either grant or decline.
3. The UE responds with an *SS Release Complete* message.
4. If the message contains the element *LcsNotificationGranted,* the R&S CMU200 starts the A-GPS measurement.

Use SS Messages requires a voice call or video call.

CONFigure:AGPS:MEAControl				Measurement Control
Parameter ranges	Description of parameters	Def. value	Def. unit	FW vers.
UEASsisted | UEBased,	A-GPS mode	UEBased	–	V5.10
250 | 500 | 1000 | 2000 | 3000, 4000, 6000, 8000, 12000, 16000, 20000, 24000, 28000, 32000, 64000,	Reporting interval (for continuous mode), time between consecutive meas. reports from the UE*)	2000	ms	
1 to 1806628,	Horizontal accuracy	51	m	
1 to 990,	Vertical accuracy	102	m	
0 to 300 000,	Max. response time	20 000	ms	
TRUE | FALSe	Allow *Additional Assistance Data Request* of the UE	TRUE	–	V5.20A

Description of command

This command defines basic assistance and measurement control parameters for an A-GPS test. For a detailed description of the parameters refer to the manual for the *A-GPS Control Application*, stock no. 1200.9341.12. If the *Additional Assistance Data Request* of the UE is enabled, the UE may request additional A-GPS data, in case the initial data set is not sufficient for an accurate position calculation.

*) In single shot mode, the reporting interval is the maximum time between measurement initiation and the response from the UE under test.

PROCedure:AGPS:UEPosition:RESet	Reset UE Position
Description of command	FW vers.
This command has no query form. It sends a *Reset UE Positioning Stored Information* message to the UE and thus command the UE to reset the already acquired positioning information in preparation for subsequent test procedures.	V5.10

Transmitted A-GPS Data

The following commands define or query the assistance data that the R&S® CMU sends to the UE under test. Each command contains some or all parameters (fields) of a specific A-GPS information element (IE). For a description of A-GPS IEs, refer to standard 3GPP TS 25.331 and to the document IS-GPS-200D: "Navstar GPS Space Segment/Navigation User Interface" quoted therein.

CONFigure:AGPS:ADATa:DELete Delete all Assistance Data

Description of command	FW vers.
This command has no query form. It deletes all previously defined A-GPS data so that the remaining `CONFigure:AGPS:ADATa…?` commands return OFF values.	V5.10

CONFigure:AGPS:ADATa:REFTime <*GPS week*>, <*TOW*> Reference Time

Parameter ranges	Description of parameters	Def. value	Def. unit	FW vers.
0 to 1023	GPS week number, binary	OFF	–	V5.10
0 msec to (6.048*10^8–1) msec	GPS Time of week, rounded down to the nearest millisecond unit	OFF	msec	

Description of command

This command defines satellite-independent parameters of the *UE positioning GPS reference time* IE. The GPS week number is defined as a modulo 1024 binary representation of the GPS week number since January 6th, 1980; see standard IS-GPS-200D.

CONFigure:AGPS:ADATa:REFTime:SAT<nr> Reference Time, Satellites
<Sat ID>, <TLM Message>, <TLM Reserved>,. <Alert>, <Anti-Spoof>

Parameter ranges	Description of parameters	Def. value	Def. unit	FW vers.
1 to 64 | OFF	SV ID number, identifies the satellite	OFF	–	V5.10
0 to 16383 | OFF,	14-bit TLM Message element, in decimal form	OFF	–	
0 to 3 | OFF,	Two reserved bits in TLM word, in decimal form	OFF	–	
ON | OFF,	Indicates the SV URA might be worse than indicated	OFF	–	
ON | OFF	Indicates whether anti-spoofing mode is on or off	OFF	–	

Description of command

This command defines satellite-specific parameters of the *UE Positioning GPS Reference Time* IE. The suffix <nr> = 1 to 9 numbers the satellites. All parameters are declared optional. If set to *OFF,* they are not sent to the UE.

CONFigure:AGPS:ADATa:RUEPosition Reference UE Position
<Latitude sign>, <Degrees of Latitude>, <Degrees of Longitude>, <Altitude Direction>, <Altitude>, <Uncertainty Semi-Major>, <Uncertainty Semi-Minor>, <Orientation of Major Axis>, <Uncertainty Altitude>, <Confidence>

Parameter ranges	Description of parameters	Def. value	Def. unit	FW vers.
NORTh | SOUTh,	Latitude sign	OFF	–	V5.10
0 deg to 90 deg,	Degrees of Latitude	OFF	deg	
–180 deg to +180 deg,	Degrees of Longitude	OFF	deg	
HEIGht | DEPTh,	Altitude Direction	OFF	–	
0 m to 32767 m,	Altitude	OFF	m	
0 m to 1806628 m,	Uncertainty Semi-Major, code k	OFF	m	
0 m to 1806628 m,	Uncertainty Semi-Minor, code k	OFF	m	
0 deg to 179 deg,	Orientation of Major Axis	OFF	deg	
0 m to 991 m,	Uncertainty Altitude	OFF	m	
0% to 100 %	Confidence	OFF	%	

Description of command

This command defines information elements of the *UE Positioning Reference UE Position* IE. The parameters describe an ellipsoid point with altitude and uncertainty ellipsoid.

The numeric input values correspond to conventional ellipsoid parameters in units of m and deg. Conversion to signaled values is described in standard 3GPP TS 25.331, section 10.3.8.4c.

CONFigure:AGPS:ADATa:REFTime:NAVModel<nr> Navigation Model, Satellites
***<Sat ID>*, …**

Parameter ranges	Description of parameters	Def. value	Def. unit	FW
1 to 64	SV ID number, identifies the satellite	OFF	–	V5.10
1 to 3,	C/A or P on L2, code(s) on L2 channel (1: P code on, 2: C/A code on, 3: both codes on)	OFF	–	
0 to 15,	User Range Accuracy (URA) index	OFF	–	
0 to 63,	Health indication of transmitting satellite (SV)	OFF	–	
0 to 1023,	Issue of data, clock	OFF	–	
ON,	L2 P Data Flag, indicates if data stream on P-code was commanded off	OFF	–	
0 to 2^{23}–1,	Reserved bits of subframe 1, field no. 1	OFF	–	
0 to 2^{23}–1,	Reserved bits of subframe 1, field no. 2	OFF	–	
0 to 2^{23}–1,	Reserved bits of subframe 1, field no. 3	OFF	–	
0 to 2^{23}–1,	Reserved bits of subframe 1, field no. 4	OFF	–	
n*2^{-31}, n∈[–128, +127],	T_{GD}, estimated group delay, differential	OFF	s	
n*2^{4}, n∈[0, 37799],	t_{oc}, parameters for apparent clock correction	OFF	s	
n*2^{-55}, n∈[–128, +127],	af_2, parameter for apparent clock correction	OFF	1/s	
n*2^{-43}, n∈[–2^{15}, 2^{15}–1],	af_1, parameter for apparent clock correction	OFF	–	
n*2^{-31}, n∈[–2^{21}, 2^{21}–1),	af_0, parameter for apparent clock correction	OFF	s	
n*2^{-5}, n∈[–2^{15}, 2^{15}–1],	C_{rs}, amplitude of the sine harmonic correction to the orbit radius	OFF	m	
n*2^{-43}, n∈[–2^{15}, 2^{15}–1],	Δn, mean motion difference from computed value (semi-circles per second)	OFF	s.-c./s	
n*2^{-31}, n∈[–2^{31}, 2^{31}–1],	M_0, mean anomaly at ref. time (semi-circles)	OFF	s.-c.	
n*2^{-29}, n∈[–2^{15}, 2^{15}–1],	C_{uc}, amplitude of the cosine harmonic correction term to the argument of latitude	OFF	rad	
n*2^{-33}, n∈[0, 2^{32}–1],	e, eccentricity (total value must not exceed 0.03)	OFF	–	
n*2^{-29}, n∈[–2^{15}, 2^{15}–1],	C_{us}, amplitude of the sine harmonic correction term to the argument of latitude	OFF	rad	
n*2^{-19}, n∈[0, 2^{32}–1],	Square root of semi-major axis	OFF	$m^{1/2}$	
n*2^{4}, n∈[0, 37799],	t_{oe}, reference time ephemeris	OFF		
0 or 1,	Curve-fit interval used to determine ephemeris parameters (0 for 4 hours, 1 for >4 hours)	OFF	–	
n*900, n∈[0, 31]	AODO, Age of Data Offset	OFF	s	
n*2^{-29}, n∈[–2^{15}, 2^{15}–1],	C_{ic}, amplitude of the cosine harmonic correction term to the angle of inclination	OFF	rad	
n*2^{-31}, n∈[–2^{31}, 2^{31}–1],	$OMEGA_0$, longitude of ascending node of orbit plane at weekly epoch (semi-circles)	OFF	s.-c.	
n*2^{-29}, n∈[–2^{15}, 2^{15}–1],	C_{is}, amplitude of the sine harmonic correction term to the angle of inclination	OFF	rad	
n*2^{-31}, n∈[–2^{31}, 2^{31}–1],	i_0, inclination angle at ref. time (semi-circles)	OFF	s.-c.	
n*2^{-5}, n∈[–2^{15}, 2^{15}–1],	C_{rc}, amplitude of the cosine harmonic correction term to the orbit radius	OFF	m	
n*2^{-31}, n∈[–2^{31}, 2^{31}–1],	ω, argument of pedigree (semi-circles)	OFF	s.-c.	
n*2^{-43}, n∈[–2^{23}, 2^{23}–1],	Rate of right ascension (semi-circles/sec)	OFF	s.-c./s	
n*2^{-43}, n∈[–2^{13}, 2^{13}–1]	Rate of inclination angle (semi-circles/sec)	OFF	s.-c./s	

Description of command

This command defines satellite-specific parameters of the *UE positioning GPS navigation model* IE. The suffix <nr> = 1 to 9 numbers the satellites.

The navigation model parameters comprise the satellite ID and the GPS ephemeris and clock correction parameters described in standards 3GPP TS 25.331, section 10.3.7.91a, and IS-GPS-200D. In the latter document, many of the numeric parameters are defined as signed or unsigned bit strings of length k, with a scale factor (increment) of 2^m. In the table above, the explicit parameter ranges are expressed as:

$n*2^m$, $n \in [0, 2^k-1]$ for unsigned k-bit integers with scale factor 2^m
$n*2^m$, $n \in [-2^{(k-1)}, 2^{(k-1)}-1]$ for signed k-bit integers with scale factor 2^m

All entries are automatically rounded to the closest integer multiple of 2^m.

Note: *The satellite status is automatically set to NS_NN (new satellite, new navigation model). This means that all navigation model parameters are mandatory according to standard 3GPP TS 25.331.*

CONFigure:AGPS:ADATa:REFTime:IONModel Ionospheric Model
<Alpha 0> … <Alpha 3>, <Beta 0> … <Beta 3>

Parameter ranges	Description of parameters	Def. value	Def. unit	FW
$n*2^{-30}$, $n \in [-128, +127]$,	α_0	OFF	s	V5.10
$n*2^{-27}$, $n \in [-128, +127]$,	α_1	OFF	s / semi-circle	
$n*2^{-24}$, $n \in [-128, +127]$,	α_2	OFF	s / semi-circle^2	
$n*2^{-24}$, $n \in [-128, +127]$,	α_3	OFF	s / semi-circle^3	
$n*2^{+11}$, $n \in [-128, +127]$,	β_0	OFF	s	
$n*2^{+14}$, $n \in [-128, +127]$,	β_1	OFF	s / semi-circle	
$n*2^{+16}$, $n \in [-128, +127]$,	β_2	OFF	s / semi-circle^2	
$n*2^{+16}$, $n \in [-128, +127]$	β_3	OFF	s / semi-circle^3	

Description of command

This command defines the parameters of the *UE positioning GPS ionospheric model* IE.

The ionospheric parameters are used to model the propagation delay of the GPS signal through the ionosphere. α_0 … α_3 are the coefficients of a cubic equation representing the amplitude of the vertical delay. β_0 … β_3 are the coefficients of a cubic equation representing the phase of the vertical delay. In standard IS-GPS-200D, the parameters are defined as signed bit strings of length k (= 8), with a scale factor (increment) of 2^m. In the table above, the explicit parameter ranges are expressed as $n*2^m$, $n \in [-2^{(k-1)}, 2^{(k-1)}-1]$. All entries are automatically rounded to the closest integer multiple of 2^m.

CONFigure:AGPS:ADATa:REFTime:UTCModel UTC Model
<A1>, <A 0>, …

Parameter ranges	Description of parameters	Def. value	Def. unit	FW
$n*2^{-50}$, $n \in [-2^{23}, 2^{23}-1]$,	A_1, first-order term of polynomial	OFF	s/s	V5.10
$n*2^{-30}$, $n \in [-2^{31}, 2^{31}-1]$,	A_0, constant term of polynomial	OFF	s	
$n*2^{-12}$, $n \in [0, 255]$,	t_{ot}, reference time for UTC data	OFF	s	
$n \in [0, +255]$,	WN_t, UTC reference week number	OFF	weeks	
$n \in [-128, +127]$,	Δt_{LS}, delta time due to leap seconds	OFF	s	
$n \in [0, +255]$,	WN_{LSF}, week number when the leap second becomes effective	OFF	weeks	
$n \in [0, +255]$,	DN, day number at the end of which the leap second becomes effective	OFF	days	
$n \in [-128, +127]$	Δt_{LSF}, delta time due to leap seconds	OFF	s	

Description of command

This command defines the parameters needed to relate GPS time to Universal Time Coordinate (UTC).

In standard IS-GPS-200D, the numeric parameters are defined as signed or unsigned bit strings of length k, with a scale factor (increment) of 2^m. In the table above, the explicit parameter ranges are expressed as:

$n*2^m$, $n \in [0, 2^k-1]$ for unsigned k-bit integers with scale factor 2^m
$n*2^m$, $n \in [-2^{(k-1)}, 2^{(k-1)}-1]$ for signed k-bit integers with scale factor 2^m

The factor $2^0 = 1$ is omitted. All entries are automatically rounded to the closest integer multiple of 2^m.

CONFigure:AGPS:ADATa:ALManac <*Number of the week*> Almanac

Parameter ranges	Description of parameters	Def. value	Def. unit	FW vers.
0 to 255 | OFF	GPS number of the week, modulo 256 (almanac reference week)	OFF	–	V5.10

Description of command

This command defines or queries satellite-independent parameters of the *UE positioning GPS almanac* IE. This IE contains a reduced-precision subset of the ephemeris and clock correction parameters.

CONFigure:AGPS:ADATa:ALMan<nr> Almanac, Satellites
<Sat ID>, …

Parameter ranges	Description of parameters	Def. value	Def. unit	FW vers.
1 to 64	SV ID number, identifies the satellite	OFF	–	V5.10
$n*2^{-21}$, $n \in [0, 2^{16}-1]$,	e, eccentricity	OFF	–	
$n*2^{+12}$, $n \in [0, 147]$,	t_{oa}, almanac reference time	OFF	s	
$n*2^{-19}$, $n \in [-2^{15}, 2^{15}-1]$,	δi, correction to inclination (semi-circles)	OFF	s.-c.	
$n*2^{-38}$, $n \in [-2^{15}, 2^{15}-1]$,	OMEGADOT, rate of right ascension (semi-c./s)	OFF	s.-c./s	
0 to 511,	SV Health, health indication of SV to which almanac data belongs	OFF	–	
$n*2^{-11}$, $n \in [0, 2^{24}-1]$,	$A^{1/2}$, square root of the semi-major axis	OFF	$m^{1/2}$	
$n*2^{-23}$, $n \in [-2^{23}, 2^{23}-1]$,	$OMEGA_0$, longitude of ascending node of orbit plane at weekly epoch ()	OFF	s.-c.	
$n*2^{-23}$, $n \in [-2^{23}, 2^{23}-1]$,	M_0, mean anomaly at reference time	OFF	s.-c.	
$n*2^{-23}$, $n \in [-2^{23}, 2^{23}-1]$,	ω, argument of perigree	OFF	s.-c.	
$n*2^{-20}$, $n \in [-2^{10}, 2^{10}-1]$,	af_0, parameter for apparent clock correction	OFF	s	
$n*2^{-38}$, $n \in [-2^{10}, 2^{10}-1]$	af_1, parameter for apparent clock correction	OFF	s/s	

Description of command

This command defines or queries satellite-specific parameters of the *UE positioning GPS almanac* IE IE. The suffix <nr> = 1 to 9 numbers the satellites.

The almanac contains a reduced-precision subset of the ephemeris and clock correction parameters. In standard IS-GPS-200D, the numeric parameters (except the satellite ID) are defined as signed or unsigned bit strings of length k, with a scale factor (increment) of 2^m. In the table above, the explicit parameter ranges are expressed as:

$n*2^m$, $n \in [0, 2^k-1]$ for unsigned k-bit integers with scale factor 2^m
$n*2^m$, $n \in [-2^{(k-1)}, 2^{(k-1)}-1]$ for signed k-bit integers with scale factor 2^m

All entries are automatically rounded to the closest integer multiple of 2^m.

Some of the almanac parameters are not in the parameter list because they are set to constant values:

DataID is set to 2 because this denotes the NAV data structure (all other ids are for future use)

SV Global Health (the SV health of all satellites, optional element in TS25.331) is not used. SV health of each transmitting satellite is already contained in almanac data and navigation data.

CONFigure:AGPS:ADATa:ACQassist <*GPS TOW*> Acquisition Assistance

Parameters	Description of parameters	Def. value	Def. unit	FW vers.
0 to $6.048*10^8 - 1$	GPS Time of Week (TOW), rounded to the nearest millisecond unit	OFF	ms	V5.10

Description of command

This command defines or queries satellite-independent parameters of the *UE positioning GPS acquisition assistance* IE. This IE contains parameters that enable fast acquisition of the GPS signals in UE-assisted GPS positioning.

CONFigure:AGPS:ADATa:ACQassist<nr> Acquisition Assistance, Satellites
<*Sat ID*>, …

Parameters	Description of parameters	Def. value	Def. unit	FW vers.
1 to 64 | OFF	SV ID number, identifies the satellite	OFF	–	V5.10
–5120 to 5117.5,	Doppler, constant term (increment 2.5 Hz)	OFF	Hz	
–0.966 .. 0.483 | OFF,	Doppler, 1st order term (increment 0.023 Hz/s)	OFF	Hz/s	
0 to 4 | OFF,	Doppler uncertainty (0 for A12_5, 1 for A25, 2 for A50, 3 for A100, 4 for A200)	OFF	–	
0 to 1022,	Code phase, no. of GPS chips	OFF	–	
0 to 19,	Integer code phase, in units of C/A period	OFF	–	
0 to 3,	GPS bit number modulo 4	OFF	–	
0 to 15,	Code phase search window (0 for A1023, 1 for A1, 2 for A2 … 15 for A192)	OFF	–	
0 to 360 | OFF,	Azimuth of satellite (increment 11.25 deg)	OFF	deg	
0 to 90 | OFF	Elevation of satellite (increment 11.25 deg)	OFF	deg	

Description of command

This command defines or queries satellite-specific parameters of the *UE positioning GPS acquisition assistance* IE. The suffix <nr> = 1 to 9 numbers the satellites. This IE contains parameters that enable fast acquisition of the GPS signals in UE-assisted GPS positioning. Parameters declared optional that are set to *OFF* are not sent to the UE.

Parameters for fine time assistance are not used and not supported by the R&S CMU.

A-GPS Test Results

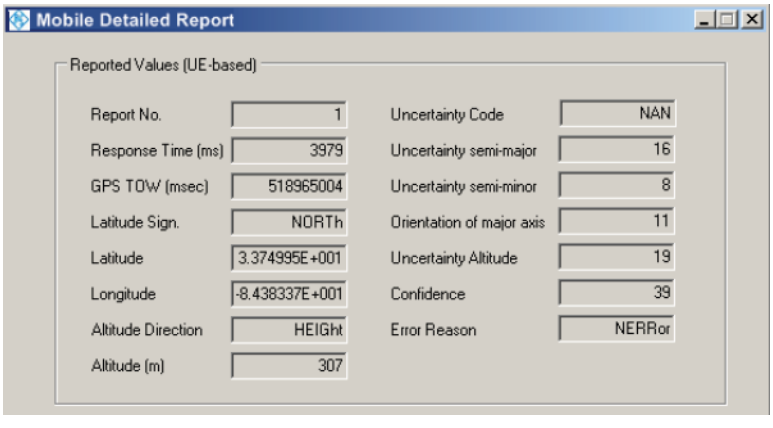
The following command queries the results of an A-GPS test. The results depend on the A-GPS mode (UE-assisted or UE-based), to be defined via `CONFigure:AGPS:MEAControl`.

FETCh[:SCALar]:AGPS? Test Results, UE-based Mode

Parameter ranges	Description of parameters	Def. unit*)	FW vers.
1 | 2 | 3 …,	Test count (determined by the R&S CMU, is always 1 for single shot measurements)	ms	V5.10
– 300 000 to 300 000,	Response time (Time to First Fix, TTFF) measured in the R&S CMU; see Fig. **10** on p. 9.48	ms (int)	
0 to 6.048*10^8-1	GPS Time of Week (TOW); indicates when the test was performed	ms (int)	
NORTh | SOUTh,	Latitude sign	–	
0.0 deg to +90.0 deg,	Degrees of latitude	deg	
–180.0 deg to 180.0 deg,	Degrees of longitude	deg	
0 m to 1806628 m	Uncertainty code	m (int)	
HEIGht | DEPTh,	Altitude direction	–	
0 m to 32767 m	Altitude	m (int)	
0 m to 1806628 m	Uncertainty semi-major	m (int)	
0 m to 1806628 m	Uncertainty semi-minor	m (int)	
0 deg to 179 deg	Orientation of major axis	deg (int)	
0 m to 990 m	Uncertainty altitude	m (int)	
0 % to 100 %	Confidence	% (int)	
No Error | Not Enough GPS Satellites | Assistance Data Missing | Undefined Error | Max.Response Time Exceeded	Error reason	–	
Boolean	Almanac requested	–	
Boolean	UTC model requested	–	
Boolean	Ionospheric model requested	–	
Boolean	Navigation model requested	–	
Boolean	Reference position requested	–	
Boolean	Reference time requested	–	
Boolean	Acquisition Assistance requested	–	

Description of command

This command queries the results of an A-GPS test performed in UE-based mode. The results are displayed in the *UE Detailed Report* dialog of the control application. The Boolean results after the error reason are only present for *Error reason: Assistance Data Missing*.



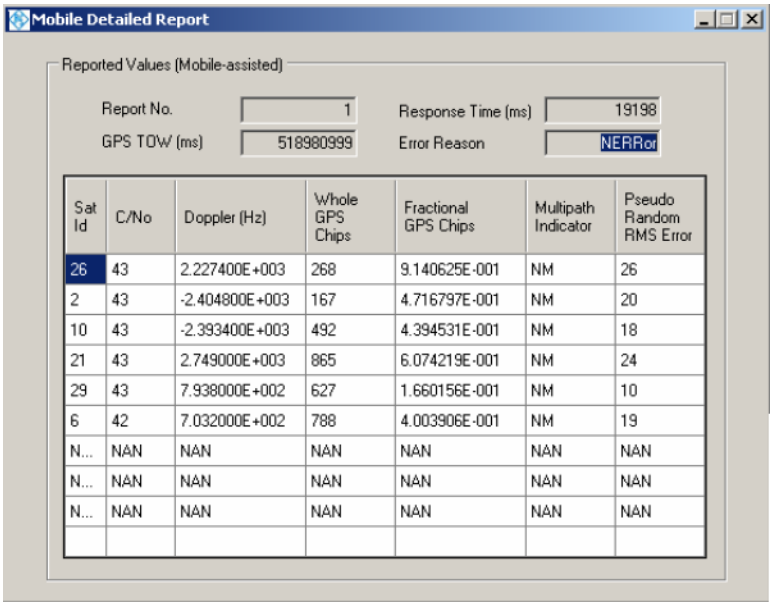
Note: The position estimate can be reported in different formats. Depending on the UE, some of the results will be unavailable.

*) Numeric results with (int) after the default unit are rounded to the next integer value.

FETCh[:SCALar]:AGPS?		Test Results, UE-assisted Mode	
Parameter ranges: general	Description of parameters	Def. unit**)	FW vers.
1 | 2 | 3 …,	Test count (determined by the R&S CMU, is always 1 for single shot measurements)	ms	V5.10
– 300 000 to 300 000,	Response time (Time to First Fix, TTFF) measured in the R&S CMU; see Fig. **10** on p. 9.48	ms (int)	
0 to 6.048*10^8-1	GPS Time of Week (TOW); indicates when the test was performed	ms (int)	
Parameter ranges: satellites 1 to 9*)	Description of parameters	Def. unit**)	FW vers.
1 to 64	SV ID No, identifies the satellite	ms	V5.10
C/N$_0$	Estimated carrier-to-noise ratio of the received signal from a particular satellite	– (int) –	
-32768 Hz to 32768 Hz,	Estimated Doppler shift of the satellite signal	Hz (int)	
0 to 1022,	Whole GPS chips	– (int)	
0 to 2^{10} – 1,	Fractional GPS chips	– (int)	
NM | LOW | MEDium |HIGH	Multipath indicator (NM for “not measured, LOW for MP error < 5 m, MEDium for 5 m < MP error <43 m, HIGH for MP error > 43 m)	–	
0 to 63	Pseudorange error	– (int)	
Parameter ranges: general	Description of parameters	Def. unit**)	FW vers.
No Error | Not Enough GPS Satellites | Assistance Data Missing | Undefined Error | Max.Response Time Exceeded	Error reason	–	V5.10
Boolean	Almanac requested	–	
Boolean	UTC model requested	–	
Boolean	Ionospheric model requested	–	
Boolean	Navigation model requested	–	
Boolean	Reference position requested	–	
Boolean	Reference time requested	–	
Boolean	Acqusition Assistance requested	–	

Description of command

This command queries the results of an A-GPS test performed in UE-assisted mode. The results are displayed in the *UE Detailed Report* dialog of the control application. The Boolean results after the error reason are only present for *Error reason: Assistance Data Missing*.



Sat Id	C/No	Doppler (Hz)	Whole GPS Chips	Fractional GPS Chips	Multipath Indicator	Pseudo Random RMS Error
26	43	2.227400E+003	268	9.140625E-001	NM	26
2	43	-2.404800E+003	167	4.716797E-001	NM	20
10	43	-2.393400E+003	492	4.394531E-001	NM	18
21	43	2.749000E+003	865	6.074219E-001	NM	24
29	43	7.938000E+002	627	1.660156E-001	NM	10
6	42	7.032000E+002	788	4.003906E-001	NM	19
N...	NAN	NAN	NAN	NAN	NAN	NAN
N...	NAN	NAN	NAN	NAN	NAN	NAN
N...	NAN	NAN	NAN	NAN	NAN	NAN

*) The satellite-specific results are repeated 9 times for satellites 1 to 9.

**) Numeric results with (int) after the default unit are rounded to the next integer value.

Response Time measurement

According to the 3GPP standard, the response time or Time to First Fix (TTFF) is defined as the time between the receipt of the (last) MEASUREMENT CONTROL request by the UE and the start of transmission of its MEASUREMENT REPORT response.

The R&S CMU measures this time indirectly as the time between the receipt of the RLC Ack for the (last) MEASUREMENT CONTROL request and receipt of the complete MEASUREMENT REPORT indication from the UE. As shown in the figure below, this method compensates for possible propagation delays between the R&S CMU and the UE under test.

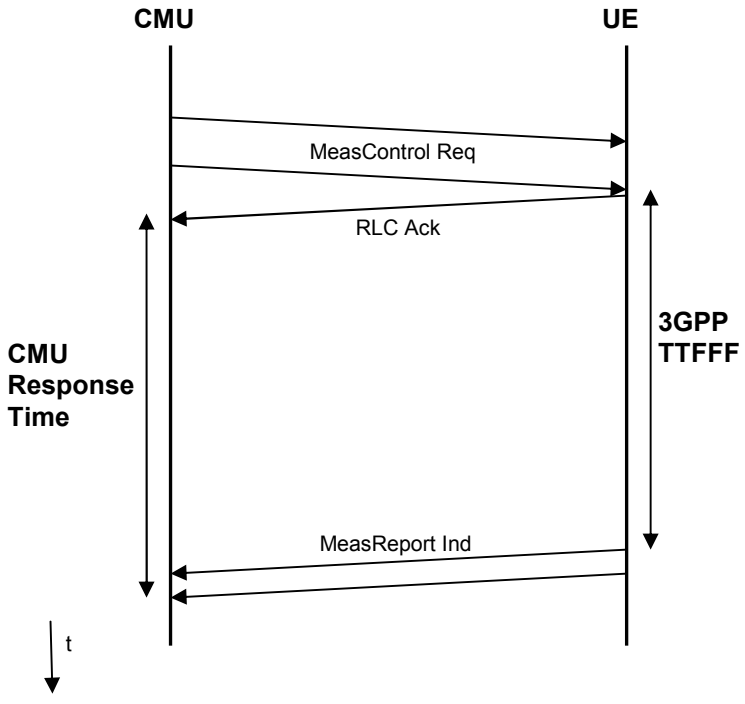


Fig. 10: Response time measurement

Error Messages

In case of an error during operation, the CMU displays a yellow notice box with a message describing the error and one or several buttons to close the box and continue operation. Many error messages are defined in the SCPI standard and not related to a particular function group. These SCPI error messages are listed in chapter 9 of the CMU operating manual. The notice boxes listed below are specific to the *WCDMA UE TX Test (3GPP/FDD)* function group.

Table 9-1: WCDMA-specific error messages

Message	**Explanation**
Reference frequency not locked	The synchronization to an external reference signal fed in via REF IN failed; see *Reference Frequency* softkey in the *Synch.* tab of the *Connection Control* menu.
Scrambling code or slot format does not match input signal	The CMU is unable to correctly detect the beginning of a slot because the analyzed signal does not conform to the *Scrambling Code* or the *Slot Format* set in the *UE Code* tab of the *Connection Control* menu. The error may occur in all measurements with channel decoding, e.g. in the *Modulation...WCDMA* applications or in a *Code Domain Power* measurement. If the error occurs, the measurement results are very likely to be wrong.

Index

1

1st Used Ch. Code 8.42, 8.56

3

3GPP DL DCCH Channel 4.166, 6.16
3GPP Reference Channel 4.162, 4.240

A

Abs. 1 ..... 4.10
Abs. Power Step 4.29
Absolute Grant 8.186
Absolute marker 4.10
ACK message 4.188
ACK/NACK Repetition Factor 8.44, 8.57, 8.73, 8.133
ACLR 4.75
ACLR FFT/OBW 4.78
  limits 4.96
ACLR Filter 4.77, 4.78
  limits 4.95
Activate Pattern
  AG 8.219
  RG 8.221
  UL CM TX Test 6.220
Activate Pattern (TPC) 4.248
Activation Mode 8.169, 8.185
Activation SFN 8.169, 8.185
Activation Time Offset 4.276, 6.231
Active Code Set 4.244
Active Codec Set 6.201
Active Coder 6.201
Active CQI 8.14, 8.99
Additional RF Generator 4.169
Address (primary/secondary) 5.1
Adjacent Channel Leakage power Ratio 4.75
Adjacent channel power 4.75
AF Connector Overview, Signalling 4.280
AG Pattern Length 8.218
AG Pattern Repetition 8.219
AG Scope 8.219
AG Value 8.218
AICH Acknowledge 4.273, 6.227
AICH Channelization Code 4.246, 6.207
AICH Level 4.246, 6.206
AICH Transmission Timing 4.272, 6.226
Alerting 4.194
Alerting (for handover) 4.223
Algorithm 1 ..... 4.29
Algorithm 1/2 ..... 4.247
Algorithm 2 ..... 4.29
All Physical Channel Levels 6.7, 6.196
Allow other Signatures 8.173, 8.189
AM Buffer Size 4.204
Analysis Mode 4.172, 4.230, 6.20, 6.188
Analyzer menu 4.288
Analyzer Level 4.8, 4.145
  remote control 6.241, 6.242, 6.243
  Signalling 4.289
Analyzer Settings 4.146
  Power 4.9
  Signalling 4.229
Application 2.13, 3.9
  Code Domain Power 4.104, 6.124
  Modulation – QPSK 4.47, 6.59
  Modulation – WCDMA 4.57, 6.59
  Power 4.8, 4.129, 6.33
  Spectrum 4.78, 6.100
Attach/Detach 4.274, 6.228
Attached 4.212
Attenuation 6.2, 6.241
  external 4.171, 4.178
  frequency-dependent 4.179
  input level 4.146
Audio Generator and Analyzer 4.279
Audio measurements 4.142
Authentication 4.274, 6.229
Auto Settings 4.175
Automatic Resynchronization 4.139
Autoranging 4.145, 6.1
Aux TX 4.156
  for handover 4.222
Aux TX Over Range 4.156, 4.170
Aux TX signal 4.169
Available Signature – Index Select 4.273, 6.227
Available Signatures 4.273, 6.227
Available Subchannels 4.273, 6.227
Averaging 3.11
AWGN Noise Pwr. 4.157, 6.8, 6.197

B

Bad DUT 4.138, 6.147
Band Indicator, UE Report 4.140, 6.173
Band Select 4.197
Bandwidth Filter (Smart Alignment) 9.31
Bar graph
  Code Domain Power 4.107, 6.1288.22, 8.166
  HS-DPCCH Time Mask 8.24
  Spectrum 4.80
BCC 4.140, 6.172
Benefits Batt. Consum. Opt. 4.207, 6.184
BER 4.128
  hotkey 4.129
  remote control 6.144
Bit error rate ..... see BER
Bit Error Rate 4.119
Blind handover 4.220
Blind Transport Format Detection 4.123
Block Error Rate 4.119
Braces 5.11
BS Signal
  menu 4.236
  remote control 6.193
BTFD 4.123

C

Call from UE 4.194
Caller ID 4.244, 6.203
CDE Relative 8.34
  remote control 8.122
CDP 4.98
CDP Relative 8.28
  remote control 8.112
CDP vs. Time 4.98, 4.99
CDP/Code Auto 4.103, 4.104
CDP/Code Manual 4.104
  limits 4.116
CDP/Code Rho Auto 4.104
CDP/Code Rho Manual 4.104
  limits 4.117

CDP/Time 4.104
CD-ρ 4.98
Cell Identity 4.270
Cell Reselection Information 4.278
CELL_PCH/URA_PCH 4.207
Change of TFC trigger 4.282
Channel Configuration Type 8.44, 8.58, 8.73, 8.135
Channel Data Source DCCH 6.14
Channel Data Source DTCH 4.242, 6.14, 6.200
Channel Settings 4.158
  Signalling 4.230
Channelization code 4.44
  E-AGCH 8.170, 8.186, 8.213
  E-RGCH/E-HICH 8.173, 8.189, 8.213
Channelization Code Mode 4.70, 6.59
Chip rate 4.172
CMU-B41 (option) 4.279
CMU-B52 (option) 4.279, 6.238
CMU-B68/CMU-U68 ..... 4.118
CMU-B96 ..... 4.169
CMU-K47 (option) 4.3, 9.22
CMU-K66 ..... 4.118
Code conflict handling 4.167
Code Domain Power 4.98
  remote control 6.124, 6.129
Code Domain Power Configuration 4.113
  remote control 6.125, 6.130
Codec 4.243
Codec Modes 4.244
Command
  order 5.1, 5.10
  structure 5.1
  tables (description) 5.10
Common channel 4.148
Compressed Mode Settings 4.255, 6.216
Compressed Mode trigger 4.282
Conf. Test Start Value (CQI) 8.46, 8.60, 8.75, 8.137
Confidence BER 4.124
Confidence Settings 4.137
Configuration of measurements 3.3
Connect UE 2.2, 2.24, 4.194
Connect UE (CS) 4.200
Connect. Control Guidance 4.290
Connected 4.194
Connection
  accelerate 2.25
  R&S CMU – PC (Ethernet) 9.2
  remote control 6.174
Connection (Alerting) 4.201
Connection (Connected) 4.202
Connection (Registered) 4.199
Connection (Signal Off) 4.196
Connection (Signal On) 4.198
Connection Control 3.3
  Non Signalling 4.143
  remote control 6.1
  Signalling 4.194
Connection in Progress 4.213
Connection Info 4.203
Connectors (RF) 2.3
Constant Value 4.232, 6.190
Continuous 5.5
Continuous measurement 4.26
Control
  Code Domain Power 4.113, 6.125, 6.130
  EVM 8.83
  Inner 6.43, 6.155
  Modulation 4.69, 6.61
  P/Slot Table 6.50
  Phase 6.94
  Power 4.25, 6.34
  PRACH 6.161
  Spectrum 4.87, 6.101, 6.108, 6.116
Control (generator) 4.157
Convolutionally Coded 4.205, 4.205
Correct E-HICH Reception 8.157
Correlated power 4.98
Correlation Mode 4.175, 4.230, 6.21, 6.188
Counting 5.5
CPICH E_c/I_0 ..... 4.133
CPICH E_c/N_0 Qhyst2s 4.278, 6.233
CPICH RSCP 4.133
CQI Channel Configuration 8.45, 8.60
  remote control 8.74, 8.136
CQI Detect. Threshold 8.8, 8.90
CQI Feedback Cycle 8.44, 8.57, 8.73, 8.133
CQI message 4.188
CQI Repetition Factor 8.44, 8.57, 8.73, 8.133
CQI Reporting Test 8.11, 8.94
  measurement example 2.40
CQI Table Index 8.45, 8.60
CRC 4.119
Crest factor 2.7, 4.2
CTM Text Telephony (TTY) 4.203, 6.178
Current results 3.11
Curve 5.5
  Modulation 4.52, 6.72, 6.79, 6.86
  Modulation (Constellation, Vector) 4.54
  Modulation (I/Q Phase) 4.55
  Modulation, I/Q Analyzer 6.92
  Spectrum 4.82, 4.85, 6.113, 6.120, 6.121
Cyclic redundancy check 4.119

D

Data Block Error Rate 4.119
Data Pattern (HS-DSCH) 8.43, 8.57, 8.72, 8.133
Data Rate, packet data 4.217
Data Source 4.164, 6.15
DBLER 4.119
DCCH Channel Type 4.166, 6.16
DCH (Dedicated Chn.) Type 4.217, 6.213
Decoder Cal 4.243
Dedicated & Broadcast Channels 4.159, 6.11
Dedicated channel 4.148
Dedicated Channel 4.197
Dedicated Channel (DCH), remote control 6.198
Dedicated Channel Mode 4.160, 6.13
Dedicated Channel Type 4.239, 6.198
Dedicated Channels, Signalling 4.239
Dedicated Physical Channel 4.173
Default Settings ..... See command tables in Ch. 6
  Power – Limits 4.37
  UE Report 6.168
Delay, trigger 4.186
Delay offset 4.187
Delay Offset 6.27, 6.239
Delta marker 4.49
DeltaSIR after 1, DeltaSIR after 2 ..... 4.257, 6.219
DeltaSIR1, DeltaSIR2 ..... 4.257, 6.218
Destination Parameter 4.222
Destination Selection 4.221, 6.180
Diagram
  CDP Relative 8.30, 8.36
  Inner Loop TPC 4.13, 4.14
Diagram Type
  PHDisc 4.72
  PRACH Preamble 4.72
Diagram Type (RLC BLER) 9.13
Disconnect UE (CS) 4.201
Disconnection in Progress 4.213
Display mode 3.10

Power/Slot Table 4.32
Display Mode
Code Domain Power 4.114
Modulation 4.70
Spectrum 4.89
Display Spreading Factor 4.114, 6.126
automatic detection 6.126
Display Unit 4.88
Display/Marker 4.10, 4.49
DL Compressed Mode 6.183
DL DPCH Timing Offset 6.13, 6.208
DL DTCH Transport Format 4.241, 6.199
DL Physical Channel 4.164
DL Power Control 4.260, 4.261, 6.221
DL Power Control Settings 4.261
DL Resources in Use 4.241, 6.199
DL/UL Alignment 4.131
DL/UL Timing 6.144
DL/UL Timing 4.137
DL/UL transport blocks
asymmetric 4.121
symmetric 4.120
D-Line 4.49
Doppler shift 4.144
Downlink Compressed Mode 4.258, 6.220
Downlink Frame Type 4.258, 6.220
Downlink Physical Channels
remote control 6.203
Signalling 4.245
Downlink Power 4.209
Downlink Power Control Settings 6.221
DPCCH 4.44, 4.58
DPCCH Power Offset 4.233, 6.190
DPCH 4.149
DPCH Channelization Code 4.159
DPCH Codes 4.205
DPCH Phase Reference 4.160, 6.13
DPCH structure 4.173
DPCH WCDMA Settings 4.173
remote control 6.20
DPDCH 4.44, 4.58
DPDCH bits per 10 ms 4.205
DPDCH CC Mode 4.59, 6.59
DPDCH Channelization Code 6.12, 6.207
DPDCH Level 4.153, 6.12, 6.207
Minimum/Maximum 4.261
DPDCH Level Max. 6.207
DPDCH Level Min. 6.207
DPDCH Settings 4.175
remote control 6.21
DPDCH Symbol Rate 4.176, 6.21
Spectrum 4.106
DRX Cycle Length 4.271, 6.226
DTCH Target Quality 4.262, 6.222
Dummy UE ID 8.41, 8.53
Dynamic range 4.146

E

E-AGCH 8.170, 8.186, 8.218
Channel Code 8.170, 8.186
Level 8.170, 8.186
E-AGCH Channelization Code 8.213
E-AGCH Level 8.212
E-AGCH UE-ID 8.186, 8.218
ECDE (CDE Relative) 8.38
E-DCH Physical Layer Category 8.222
Edit Mode – Sequence 8.76
Edit Mode (RV Coding Sequence) 8.61, 8.63
E-DPCCH Logging 8.159
Emission Mask 4.78
Enable Cell Reselection Information 4.279, 6.236
Enable software 1.7
Encoder Cal 4.243
E-RGCH Active 8.213
E-RGCH/E-HICH
Channel Code 8.173, 8.189, 8.213
Level 8.173, 8.188, 8.213
Error messages 1
Error vector magnitude ..... See EVM
E-TFCI Table Index 8.176, 8.193, 8.222
E-TFCI Value Selection 8.154, 8.204
ETHERNET USU connector 9.1
EVM 4.41
EVM & PhD with HS-DPCCH 8.2, 8.82
Limits 8.5
measurement example 2.38
EVM QPSK 4.47
EVM WCDMA 4.57
EVM with HS-DPCCH
measurement example 2.35
Expected channel power (CDP Relative) 8.33
Expected ECDP 8.38
Expected E-TFCI 8.155, 8.204
Expected E-TFCI Values 8.199
Ext. Att. Input 4.178, 6.24, 6.237
Ext. Att. Output 4.171, 4.178, 6.24, 6.25, 6.237
External attenuation 4.171, 4.178, 6.24
frequency-dependent 4.179

F

False E-HICH Reception 8.157
Fast connection 2.25
Fast Fourier Transform 4.76
FBI 4.173
FDD Measurement 4.255, 6.216
F-DPCH TPC Error Rate Target 6.222
FDR 4.123
FFT 4.76
Fill up Frame with Dummies 8.174, 8.192, 8.220
First Used Ch. Code 8.72, 8.132
Fixed (CQI table index) 8.74, 8.137
Fixed Reference Channel 8.45, 8.59
remote control 8.73, 8.135
Fixed Value (CQI table index) 8.46, 8.60
Fixed Value (CQI) 8.46, 8.60
Force DL NACK 9.13, 9.18
Force NACK 8.43, 8.57, 8.72, 8.133
Fractional DPCH 4.161
Frame trigger 4.185
Freq. Dep. Att. 4.179
Frequency
Aux Tx generator 4.170, 6.9
RF generator 4.170
Frequency List 9.29, 9.34
RX Calibration 9.29
Frequency Offset 4.144, 4.155, 6.3, 6.5, 6.187, 6.195
Frequency Unit 6.3, 6.5, 6.187, 6.195, 9.29, 9.34
Aux TX 6.9
Frequency-dependent external attenuation 4.179
FTP server (internal) 9.9
Function group 5.1
WCDMA UE Signalling (3GPP/FDD) 3.6
WCDMA UE TX Test (3GPP/FDD) 4.1

G

Gain 4.178
Gain factor 4.44, 4.235, 6.191
General Histogram 8.151
Generator 4.147, 4.151

Generator Level (Power) 4.9
Generator Settings 4.158
remote control 6.4
Generator Settings (Power) 4.9
Geometry Factor 4.157, 6.8, 6.197
Getting Started 2.1
GPS Reference Time 4.206
Grid 4.27
GSM 4.206
GSM BSIC 4.134
GSM BSIC Reconfirmation 4.255, 6.217
GSM Carrier RSSI 4.134
GSM Initial BSIC 4.255, 6.216
GSM Measurement 4.255, 6.216
GSM Neighbor Cell List 4.279, 6.236
GSM Sig. Off 6.180
GSM Sig. On 6.180
GSM Sign. Off 4.223
GSM Sign. On 4.223

H

Handover 4.220
inter-frequency 4.228, 4.237
remote control 6.179
Handover (softkey) 4.224
Handover Activation Time 4.276, 6.231
Handover to GAN 4.206
Happy bit 8.151
Happy Bit Delay Condition 8.223
H-ARQ Power Offset 8.224
H-ARQ Redundancy Versions 8.176, 8.193, 8.223
Header compression 4.204
High Dynamic (Range) 4.79, 6.103
HLT state 2.11
Holdoff (trigger) 4.187, 6.28, 6.240
Host address 4.291, 6.243
Hotkey 2.15
Hotkeys 3.3
HPSK modulation 4.40
HSDPA
measurements 8.1
option R&S CMU-K64 ..... 8.1
UE capabilities 4.207, 6.184
HSDPA ACK 8.7
CMU and UE configuration 2.20
softkey 8.8
HSDPA Channels 8.51
HSDPA CQI 8.11
Limits 8.15
results 8.13
softkey 8.12
HSDPA Gen. Lev. 8.9
HSDPA generator 8.39
remote control 8.66, 8.128, 8.212
Signalling 8.50
HSDPA Signal 8.40, 8.66, 8.128
HSDPA Test Mode 4.217
HS-DPCCH Logging 8.16
softkey 8.17
HS-DPCCH Time Mask 4.98, 8.23
remote control 8.102
remote control (4-slot) 8.107
HS-DPCCH trigger 4.187
for Spectrum measurement 4.189
H-Set Selection 8.45, 8.59, 8.74, 8.135
HSPA Test Loop 4.219, 6.215
HS-SCCH 8.40, 8.52
HS-SCCH Ch. Code 8.40, 8.53, 8.67, 8.128
HS-SCCH Dummy UE ID 8.41, 8.53, 8.67, 8.129
HS-SCCH Level 8.40, 8.52, 8.67, 8.128
HS-SCCH Selection 8.41, 8.53, 8.68, 8.129
HS-SCCH Set 8.40, 8.52
HS-SCCH UE ID 8.41, 8.53, 8.67, 8.129
HSUPA
measurements 8.148
option R&S CMU-K56 ..... 8.148
UE capabilities 4.208, 6.184
HSUPA E-AGCH 8.149
HSUPA E-RGCH 8.151
HSUPA generator 8.168, 8.185
HSUPA Signal 8.169, 8.185
HSUPA Test Mode 4.217
HSUPA Throughput 8.149, 8.163

I

I/Q Analyz. QPSK 4.48
I/Q Analyz. WCDMA 4.58
I/Q imbalance 4.43
I/Q origin offset 4.43
I/Q-IF 4.191, 6.31
Non Signalling 4.191, 4.288
I/Q-IF Interface, remote control 6.31
I/Q-IF Level Attenuation 4.192
Identity 4.202
Idle 4.212
IF Level 6.32
IF Level Attenuation 6.32
IF Power 6.27, 6.239
IF Power (trigger) 4.186
IMEI 4.202, 6.177, 6.228
IMSI (Default) 4.271, 6.225
Info 6.30
Initial E-TFCI 8.204
Initial E-TFCI Index 8.154
Initial Serving Grant 8.224
Inner Loop TPC 4.2, 6.42
hotkey 4.8
limits 4.38
test scenarios 4.4
Input level, remote control 6.1
Input Level, measurement menus 4.8
Input/output 4.177
Inputs/outputs, Signalling 4.279
Installation 1.1
Inter-frequency handover 4.228, 4.237
Intermodulation 4.146
Inter-RAT PS Handover 4.206
Inter-TTI Distance
CQI 8.46, 8.61, 8.75, 8.137
user-defined 8.47, 8.62, 8.78, 8.142
INV 5.11
IP address 6.242
PC 9.2
IP test environment (CMU-K96) 9.2
IPDL 4.206
IQ/IF Level rms 4.192
IR Buffer Size 8.48, 8.48, 8.62, 8.79, 8.143
IR Buffer Size (Explicit) 8.48, 8.79
ITP 4.258, 6.219

K

Keep RRC Connection 4.275, 6.230

L

LAC 4.270, 6.224
Leakage power ..... See ACLR, See OFF power
Level
E-AGCH 8.170, 8.186, 8.212

E-RGCH/E-HICH ... 8.173, 8.188, 8.213
FFT OBW ... 6.110
Level (abs.)
FFT ... 6.110
MFILter ... 6.104
Level (All Active Codes) ... 8.42, 8.68
Level (rel.)
FFT ... 6.109
MFILter ... 6.103
Level (rel.) enable
FFT ... 6.109, 6.110
MFILter ... 6.103, 6.104
Level (trigger) ... 4.186
Level Reference ... 4.157, 4.239, 6.6, 6.195
Limit
check ... 5.6
HSUPA E-AGCH ... 8.199
HSUPA E-HICH ... 8.208
HSUPA E-RGCH ... 8.205
lines ... 5.6
Openloop power ... 6.178
Limit enable
P/Slot ... 6.53
Limit Line Info ... 4.92
Limit line margins ... 6.122, 6.123
Limit Lines, Spectrum ... 4.89, 6.117
Limits
Code Domain Power ... 4.115, 6.131, 8.104
Code Domain Power Average ... 6.132, 6.133
Code Domain Power Current &Max/Min ... 6.132
EVM & PhD with HS-DPCCH ... 8.85
HSDPA CQI ... 8.96
Inner Loop TPC ... 6.45, 6.156
Modulation ... 4.72, 6.63
Modulation Current &Max/Min ... 6.63, 6.64
P/Slot ... 6.53
P/Slot Table ... 6.52
Phase Discontinuity ... 6.95
Power ... 6.38
Power ... 4.35, 6.36
PRACH Preamble ... 6.161
Spectrum ... 4.94, 6.103, 6.109
Limits (Receiver Quality)
remote control ... 6.148
Signalling ... 4.132, 4.137, 4.141
Literal ... 5.10
Local to Remote ... 6.174
Location Area Code ... 4.270
Log 10(TCH BLER) ... 4.133
Loop back mode ... 4.118
Loop Mode 1 RLC TM ... 4.242
Loop Mode 2 ... 4.242
Loss-less SRMS relocation ... 4.203
Lost Transport Blocks ... 4.131
Low distortion ... 4.146
Low noise ... 4.146

M

MAC-d PDU Size ... 8.62, 8.143
MAC-d PDU Size Control ... 8.62, 8.143
Magnitude error ... 4.42
Magnitude Error QPSK ... 4.47
Magnitude Error WCDMA ... 4.57
Mains switch ... 2.2
Manual control ... 3.1
Manual Settings ... 4.176
Marker ... 2.15, 4.9, 4.48
Marker/Display ... 4.9, 4.48
Max. Allowed UE Power ... 4.231, 6.189
Max. AM Entities ... 4.204
Max. Level ... 4.144, 4.145, 6.2, 6.241
Max. Number of Retransmissions ... 8.224
Max. Power Limit ... 4.39, 6.156
Max. Preamble Cycles ... 4.272, 6.225
Max. Retransmission ... 4.272, 6.226
Max. RLC Window Size ... 4.204
Max. ROHC context sessions ... 4.204
Max. Threshold ... 4.38, 6.45
P/Slot ... 6.52
Max./Min ... 3.13
Maximum ... 3.13
Maximum Channelization Code ... 8.176, 8.194, 8.223
Maximum Power ... 6.33
hotkey ... 4.8
limits ... 4.37
softkey ... 4.7
MCC ... 4.270, 6.223
Meas. Power Offset ... 8.55, 8.130
Meas. Power Offset Control ... 8.55, 8.130
Meas. Slot Number ... 4.175, 4.230
Meas. X ... 4.97, 6.104
Measure Mode: Inner Loop TPC ... 6.45
Measure Points ... 4.97
Measure points enable ... 6.104
Measure Subframes ... 8.8, 8.198
HSDPA CQI ... 8.13, 8.95
Measure Type (E-AGCH) ... 8.198
Measured Item ... 4.34, 6.155
Measured Preamble ... 4.34, 4.71, 6.155
Measured Subframe ... 8.151
Measurement control ... 5.3
Measurement groups ... 3.4
Measurement Length
EVM & PhD with HS-DPCCH ... 8.84
Modulation ... 4.69, 6.62, 6.69, 6.76, 6.83, 6.89
Phase Discontinuity ... 6.94
Spectrum ... 4.88, 6.102, 6.109, 6.117
Measurement mode: Power/Slot Table ... 4.31, 6.51
Measurement Purpose ... 4.257, 6.219
Measurement Related ... 4.207, 6.183
Measurement Slot Number ... 6.21, 6.188
Measurement wizard ... 2.51, 6.245
Median CQI ... 8.14
Memory Partitioning ... 8.62, 8.143
Memory Size: user-defined ... 8.63
Memory Size (explicit) ... 8.144
Memory Size Control ... 8.48, 8.79
user-defined ... 8.62
Menu Select ... 2.4, 2.24
Menu structure ... 3.1
Menus ... 4.10
Message analyzer ... 4.291
Message box ... 4.196
Message Monitor ... 4.291
Min. Test Time ... 4.138, 6.147
Min. Threshold ... 4.38, 6.45
P/Slot ... 6.52
Minimum ... 3.13
Minimum Power ... 4.2, 4.7, 6.33
hotkey ... 4.8
limits ... 4.37
Minimum Set E-TFCI ... 8.222
Misc. ... 4.289
Missed Detection ... 8.151
Missed detection probability ... 8.151
Missed DOWN ... 8.153
Missed HOLD ... 8.153
Missed UP ... 8.153
MNC ... 4.270
Mobile Country Code (MCC) ... 4.270
Mobile Network Code (MNC) ... 4.270
Mode ... 4.145, 6.1

HARQ Feedback 8.173, 8.220
relative grant 8.174
Modulation, HSDPA 8.48, 8.62, 8.79, 8.143
Modulation Configuration 4.68
remote control 6.61, 6.68, 6.75, 6.82, 6.89
Modulation measurement 4.40
remote control 6.59, 6.67, 6.74, 6.81, 6.88
Modulation measurement example 2.12
Modulation QPSK (limits) 4.73
Modulation WCDMA (limits) 4.74
Monitored H-ARQ 8.8, 8.90
Multi Mode 4.206, 6.182
Multi RAT 4.206, 6.183
Multi-call application tests 9.6
Multiple Settings 6.22
Multiple Signal 4.58, 4.60, 4.176
Spectrum 4.105

N

n 6.106
N313 ..... 4.277, 6.232
NAN 5.11
NAP router 9.3
NB AMR 4.244
NB AMR, Codec Modes 4.203, 6.202
NCC 4.140, 6.172
Need for DL Compressed Mode 4.207
Need for UL Compressed Mode 4.207
Network, menu 4.268
Remote Control 6.223
Network Assisted GPS 4.206
Network Identity 4.270, 6.223
UE ID 4.271
No. of Expected E-TFCIs 8.154, 8.203
No. of H-ARQ Processes
CQI 8.46, 8.61, 8.75, 8.137
user-defined 8.47, 8.62, 8.78, 8.142
No. of Physical Channel Codes 8.78, 8.142
Node B 2.7
Node B Settings 4.239
Nominal CDP ratio (CDP Relative) 8.34
Non Signalling 3.1
Normal (attenuation) 4.146
Notation (remote control) 5.9
Notice boxes 1
NPOWer (fast power measurement) 6.151
Number of HS-SCCHs 8.41, 8.54, 8.67, 8.68, 8.129
Number of Reference E-TFCIs 8.182, 8.225
Number of TF 4.204, 4.205
Number of TFC 4.204, 4.205

O

OBW 4.75
OBW Line Display 4.89
Occupied Bandwidth 4.75
OCNS 4.157, 6.6, 6.196
OFF Power 4.2, 4.7, 6.33
hotkey 4.8
limits 4.37
Off Power Limit 4.39, 6.156
OLPC, remote control 6.189
On Limit Failure 4.27
On/Off Time Mask 4.2
hotkey 4.8
limits 4.39
measurement example 2.26
remote control 6.154
OP_c 4.274
OPC 6.230
Open Loop Limit 4.39, 6.156
Open Loop Power Control 4.232
Openloop power 4.3
Openloop Power 4.209
Operating Band 6.223
UE Report 4.140, 6.171
Operating concept 3.1
OPERation status register 5.7
Option
CMU-B41 ..... 4.279
CMU-B52 ..... 4.279, 6.238
CMU-B68/CMU-U68 ..... 4.118
CMU-K47 ..... 4.3, 9.22
CMU-K66 ..... 4.118
R&S CMU-K56 ..... 8.148
R&S CMU-K64 ..... 8.1
Options (Setup), remote control 6.30
OTDOA UE based method 4.206
Out of Limit Tolerance 8.6
Out of Sync Timeout 4.277, 6.232
Out of Tolerance
CDPower:MANual 6.137
HSUPA E-AGCH 8.201
HSUPA E-HICH 8.209
HSUPA E-RGCH 8.206
Max. Acc. Error 6.58
MODulation
EPHSdpcch 8.88
EVMagnitude 6.71
MERRor 6.78
OVERview 6.66
PERRor 6.85
PHDiscont 6.96
Openloop power 6.179
POWer 6.41
ILTPc 6.47, 6.48, 6.49
ONOFf 6.158
XSLot 6.57
PRACH Preamble Quality 6.163
RXQuality:HCQI 8.99
SPECtrum 6.121
MFFT 6.113
Out-of-tolerance measurement, Power 2.11
Output ch. power (generator) 4.151
Output Chan. Power, generator 4.170
Output Channel Power 4.157, 4.239, 6.6, 6.195
Output Signal (RF generator) 4.156
Output Signal (RF Generator) 6.4
Overview QPSK 4.46, 4.47
Overview WCDMA 4.57

P

P/Slot Table 4.2
application example 2.16
hotkey 4.8
limits 4.39
Packet Switched 6.213
Packet switched connections 4.212
Packet Switched Domain 4.270, 6.223
Paging Indicators per Frame 4.245, 6.206
Paging State 4.195
Paging Timeout 4.277, 6.232
Parameter (SCPI command) 5.10
Parameter line
Modulation 4.50
On/Off Time Mask 4.22
Power 4.11, 4.13, 4.18
RLC BLER 9.14
Partial reset 6.30
Pathloss 4.133

Pattern 6.18, 6.211
HARQ Feedback 8.173, 8.191, 8.192, 8.221
relative grant 8.174
Pattern (TPC) 4.249
Pattern Length, HARQ Feedback 8.221
Pattern Type 6.17, 6.210, 6.216
UL CM TX Test 6.221
P-CCPCH 4.149
P-CCPCH Level 4.152, 6.12, 6.205
P-CPICH 4.149
P-CPICH Level 6.10, 6.204
P-CPICH Level abs. 4.152
P-CPICH Power, UE Report 4.140, 6.172
PDCP 4.203, 6.181
PDU throughput 9.15
Peak Envelope Power 2.7, 4.2
PEP (Peak Envelope Power) 4.2
Phase discontinuity, measurement example 2.33
Phase Discontinuity 4.40, 4.66, 6.93
Phase Discontinuity (limits) 4.74
Phase error 4.42
Phase Error QPSK 4.47
Phase Error WCDMA 4.57
Physical channel, remote control 6.15
Physical Channel Bits 4.205
Physical Channel FDD 4.205, 6.181, 6.182
Physical Downlink 4.204, 4.205, 6.181
Physical Uplink 4.205, 6.182
PICH 4.149
PICH Channelization Code 4.159, 6.13, 6.206
PICH Level 4.153, 6.12, 6.206
Pilot Pattern 4.173
Ping 9.8
PN Auto Resynch. 4.139, 6.146
PN Discontinuity 4.131
Power (wideband), remote control 6.151
Power Class 4.206
Power configuration 4.25
remote control 6.34
Power Configuration, remote control 6.43, 6.94, 8.83
Power control 4.2, 4.247
Power Control 6.35
Power List 9.28, 9.32
R&S Smart Alignment 9.28
Power Mea. Width 6.51
Power Meas. Width 4.33
Power measurements 4.2, 6.33
example 2.6
Power Offset 4.160, 6.13, 6.208
Power offset parameter 4.235, 6.192
Power Reference (CDP Manual) 4.114
Power results 4.11
Power Step 4.15, 4.28
Inner Loop TPC 6.48
Power Step Error 4.15, 4.29
Power switch 2.3
Power/Slot measurement (control), remote control 6.49
PRACH Msg. Part trigger 4.282
PRACH PowStep 4.39, 6.156
PRACH Preamble (limits) 4.74
PRACH preamble quality, measurement example 2.33
PRACH Preamble Quality 4.40, 4.64, 6.160
PRACH Signature 4.209
PRACH UE-On Pow. 4.209
Preamble trigger 4.282
Primary DNS IP Address 6.244
Primary DNS IP Address Enable 6.244
Primary scrambling code 4.158
Primary Scrambling Code 6.5, 6.195
UE Report 4.140, 6.172
Primary UE-ID 8.171
Profile Length 4.28, 6.44
Program examples 7.1
PS Established 4.213
P-SCH 4.149
P-SCH Level 4.152, 6.10, 6.205
Puncturing Limit PL non-max 8.176, 8.194, 8.223

Q

Qoffset $1_{s,n}$ 4.279, 6.236
QPSK WCDMA 4.48
Qqualmin 4.278, 6.234
Qrxlevelmin 4.278, 4.279, 6.234, 6.236

R

R&S CMU-K56 (option) 8.148
R&S CMU-K64 (option) 8.1
R&S CMU-K92 (option) 9.1
R&S Smart Alignment 4.3, 9.22
RACH Msg. Part Power Offset 4.272, 6.226
RACH TTI 4.271, 6.225
Radio Access Capability 4.203, 6.180
Radio Bearer Setup 6.214
HSUPA 4.218, 6.215
Random Access Settings 4.271, 6.225
Rated values (power) 6.37
Recall current 6.30
Received Bits (Tr. Blocks) 4.204
Receiver Quality
CMU and UE configuration 2.17
remote control 6.144
Receiver Quality (control) 4.136
Receiver Quality Configuration 4.136
remote control (HSDPA CQI) 8.95
Receiver Quality measurements 4.118
statistical 4.124
Receiver Window Size 8.59, 8.135, 8.144
REF OUT 2 ..... 4.183, 6.26, 6.238
Ref. Lev. Switch Auto 4.31
Ref. Lev. Switch Off 4.31
Ref. Level I/Q (@ 50 Ω) 4.192
Ref. Level IF 4.192
Ref. R 4.9, 4.48
Reference, UL Target Power 4.231, 6.23, 6.190
Reference channel, remote control 6.14
Reference Channel Type 4.240, 6.14, 6.198
Reference E-TFCI 8.182, 8.225
Reference E-TFCI Power Offset 8.182, 8.225
Reference Frequency 4.182, 6.26
remote control (Sig) 6.238
Signalling 4.281
Reference marker 4.9, 4.48
Reference Measurement Channel 4.240
Reference part 4.1
Registered 4.194
Registration Identity 4.202, 6.177
Registration Identity Type 4.202, 6.177
Rel. 1 ..... 4.10, 4.49
Rel. 2 ..... 4.49
Release 5 Guard Period 4.146, 4.229, 6.3, 6.187
Release 6 ..... 4.175, 6.21
Release after RAB Reconfig. Failure 4.276, 6.231
Release Indicator 4.207, 6.184
Remote control
basics 5.1
commands 6.1
notation 5.9
Program examples 7.1
R&S Smart Alignment 9.30
Repetition
A-GPS 9.37

CDE Relative 8.123
CDP Relative 8.113
CDP vs. Time 6.139, 9.18
Code Domain Power 6.126, 6.131
EVM & PhD with HS-DPCCH 8.84
HSDPA ACK/NACK 8.91
HS-DPCCH Time Mask 8.101, 8.103, 8.108
Inner Loop TPC 6.43
Modulation 6.61, 6.69, 6.76, 6.83, 6.89
Phase Discontinuity 6.94
Power 4.26, 6.35
Spectrum 6.102, 6.108, 6.116
Repetition (R&S Smart Alignment) 9.27, 9.31
Repetition (RLC BLER) 9.13
Repetition mode 3.10, 5.5
Reported P-CPICH Power 4.233, 6.190
Reporting Interval 4.139, 6.168
Requested UE Data 4.273, 6.227
Requirements (system, R&S CMU-K96) 9.1
Reselection Timer 4.278, 6.234
Resolution Bandwidth 4.82
Result
CDPower
AUTomatic 6.127
HTMask 8.110
MANual 6.133
TIME 6.140
TMHSdpcch 8.105
Code Domain Power 4.106
Inner Loop TPC 4.13
MODulation
EPHSdpcch 8.87
EVMagnitude 6.71
IQANalyzer 6.91
MERRor 6.78
OVERview 6.65
PERRor 6.85
PHDiscont 6.96
PRACh 6.163
Modulation QPSK 4.50
Modulation WCDMA 4.60
On/Off Time Mask 4.22
P/Slot Table 4.18
Power 4.11
POWer 6.40
ILTPc 6.47
ONOFf 6.157
Receiver Quality 4.129
RXQuality:HCQI 8.98
RXQuality:RLCBler 9.19
Spectrum 4.79
SPECtrum
EMASk 6.120
MFFT 6.112
MFILter 6.105
Result (Receiver Quality) 6.149
Result Mode
Code Domain Power 6.125, 6.130
Inner Loop TPC 6.43
Modulation 6.68, 6.75, 6.82, 6.89
Spectrum 6.108, 6.116
Result Window 4.138, 6.147
Results (R&S Smart Alignment) 9.25
Reverse Decompression 4.204
RF Analyzer 4.143
remote control 6.3
RF Channel 4.144, 4.155, 4.228, 4.237, 6.3, 6.5
UE Report 4.140, 6.172
RF Channel Downlink 6.193
UE Report 4.140, 6.171
RF Channel Uplink 6.185
RF Chn. Downlink 4.209
RF Chn. Uplink 4.209
RF connector 2.2
RF connectors 2.3
RF generator, remote control 6.4
RF Generator 4.147, 6.4
RF Input 4.178, 6.24, 6.237
RF Output 4.177, 6.24, 6.25, 6.237
RF Parameters 4.206, 6.182
RFC 2507 ..... 4.203
RFC 3095 ..... 4.204
RFC 3095 context relocation 4.204
RLC 4.204, 6.181
RLC BLER 9.12
remote control 9.17
softkey 9.12
RLC Mode (Sym. Loop Mode 1) 6.199
RLC NACKs 9.16
RLC PDU 9.15
RLC PDU Size 8.217
RLC Reestablish 4.275, 6.229
RLC Resets 9.16
RLC Time 9.16
RMC, BER with asymmetric RMC 4.122
RMC Message Versions 6.200
RMC Settings 4.240
RMC Test Loop 4.218, 6.214
Rotation 4.71, 6.90
Route (CMU as a router) 9.11
Router (NAP) 9.3
RPP 4.258, 6.219
RRC Connection 4.275
RV Coding Sequence 8.45
CQI 8.46, 8.61
RX Path 4.192, 6.31
Rx/Tx Time Difference 4.207

S

Save
current 6.29
SCCPCH Channelization Code 6.206
S-CCPCH Channelization Code 4.246
S-CCPCH Level 4.246
SCH 4.149
SCH Level 4.152
SCPI conformity 5.2
SCPI standard 5.2
S-CPICH 4.149
S-CPICH Channel Code 4.159, 6.11, 6.204
S-CPICH Level 4.159, 6.11, 6.204
S-CPICH Phase 4.159, 6.11, 6.205
S-CPICH Secondary Scrambling Code 4.159, 6.11, 6.204
Scrambling Code 4.44, 4.174, 6.20, 6.187
Modulation 4.59
Scrambling code (downlink) 4.158
SDU throughput 9.16
Secondary address 5.7
Secondary DNS IP Address 6.245
Secondary scrambling code 4.160
Secondary Scrambling Code 6.5, 6.208
HSDPA 8.40, 8.51, 8.66, 8.128
HSUPA 8.169, 8.186
Secondary UE-ID 8.171
Second-level keyword 5.1
Secret Key K 4.274, 6.229
Section A 8.84
Section B Analysis 4.29, 6.44
Security 4.206, 4.274, 6.229
Sequence (CQI table index) 8.75, 8.137
Sequence Count 9.29, 9.33
Sequence/Follow CQI 8.46, 8.60

Settings (Receiver Quality) ... 4.132
SF 512 ... 4.205
SFN-CFN Time Diff. ... 4.133
SFN-SFN Time Difference ... 4.207
Signal Off ... 4.194, 4.199, 4.212
Signal On ... 4.194, 4.197
Signalling ... 3.1, 3.2, 4.194
  measurement example ... 2.24
Signalling Info ... 4.202
Signalling RAB Settings ... 4.244
Signalling State ... 6.175, 6.177
Signalling states ... 4.194, 4.212, 6.174, 6.176
Signature
  E-HICH ... 8.173, 8.191, 8.220
  E-RGCH ... 8.174, 8.192, 8.222
Signature conflict handling ... 4.168, 8.174
Simultaneous CCTrCH ... 4.204, 4.205
Simultaneous Tr. Chn. ... 4.204, 4.205
Single Pattern (compressed mode) ... 4.256, 6.217
Single Shot ... 5.5
Single shot measurement ... 4.26
$S_{intersearch}$ ... 4.278
$S_{intrasearch}$ ... 4.278, 6.233
Skip RAB Release ... 4.276, 6.231
Slope ... 6.27, 6.240
Slope (trigger) ... 4.186
Slot Delay ... 4.186, 6.27, 6.239
Slot Delay Offset ... 4.190
Slot Format ... 4.164, 4.173, 6.15
Slot Format (UE) ... 6.20
Slot Offset ... 4.190
Slot trigger ... 4.185
Smart alignment ... 4.3, 9.22
Smart Alignment, remote control ... 9.30
SMS ... 4.212
Softkey ... 2.15, 3.3
Software (enable) ... 1.7
Source ... 6.27, 6.239
  trigger ... 4.184
Source Param. ... 4.225
Special character ... 5.11
Spectrum Configuration ... 4.87
  remote control ... 6.101, 6.108, 6.116
Spectrum Emission Mask ... 4.75
Spectrum measurements ... 4.75
  remote control ... 6.100
Spectrum trigger (HS-DPCCH) ... 4.189
Speech codec ... 4.243
Speech codec low ... 4.243
Speech Decoder ... 4.280, 6.238
Speech Encoder ... 4.280, 6.238
Spreading factor ... 4.44
Square brackets ... 5.11
SRB ... 6.202
SRB Message Version ... 4.218, 6.215
SRB Reconfiguration ... 4.275, 6.228
S-SCH ... 4.149
S-SCH Level ... 6.10, 6.205
$S_{searchHCS}$ ... 4.278, 6.234
Standalone Loc. Method ... 4.206
Standby mode ... 2.3
Start SFN ... 8.17, 8.160
Start System Frame Number ... 8.101, 8.196
Startup menu ... 1.2, 2.4
Statistic Count ... 3.9, 5.5
  Code Domain Power ... 6.130
  EVM & PhD with HS-DPCCH ... 8.83
  Modulation ... 6.61, 6.68, 6.75, 6.82
  Modulation – Overview ... 6.61, 6.68, 6.75, 6.82
  Power ... 4.27, 6.35
  Spectrum ... 6.101, 6.108, 6.116
Statistical evaluation ... 3.13
  remote control ... 5.4
Statistics cycle ... 3.9
Status indication ... 2.9, 2.11
Status reporting system ... 5.7
STATus_OPERation register ... 5.7
Step Analysis ... 4.29, 6.44
Step Control ... 4.31, 6.45
Step Count ... 4.33, 6.51, 9.28, 9.32
Step Delay ... 4.33, 6.52
Step individual ... 4.38, 6.46
Step section A/B ... 6.46
Step Section A/B ... 4.38
Step Size ... 4.28, 4.261, 4.272, 6.44, 6.221, 6.226
Step Size Limit ... 8.27
Step Width ... 4.33, 6.52, 9.28, 9.32
Stepping mode
  CDE Relative ... 8.123
  CDP Relative ... 8.113
  CDP vs. Time ... 6.139, 9.18
  Code Domain Power ... 6.126, 6.131
  EVM & PhD with HS-DPCCH ... 8.84
  HSDPA ACK/NACK ... 8.91
  HS-DPCCH Time Mask ... 8.101, 8.103, 8.108
  Inner Loop TPC ... 6.43
  Modulation ... 6.61, 6.69, 6.76, 6.83, 6.89
  Phase Discontinuity ... 6.94
  Power ... 6.35
  Spectrum ... 6.102, 6.108, 6.116
Stop Condition ... 3.10
  CDE Relative ... 8.123
  CDP Relative ... 8.113
  CDP vs. Time ... 6.139, 9.18
  Code Domain Power ... 6.126, 6.131
  EVM & PhD with HS-DPCCH ... 8.84
  HSDPA ACK/NACK ... 8.91
  HS-DPCCH Time Mask ... 8.101, 8.103, 8.108
  Inner Loop TPC ... 6.43
  Modulation ... 6.61, 6.69, 6.76, 6.83, 6.89
  Phase Discontinuity ... 6.94
  Power ... 4.27, 6.35
  Receiver Quality ... 4.138
  Spectrum ... 6.102, 6.108, 6.116
Subarrays
  Modulation ... 6.70, 6.77, 6.84
  On/Off Time Mask ... 6.156
Subnet mask ... 6.242
Sum Level ... 8.55, 8.130
Support of Band ... 4.206
Sym. Rate Chan. Code, Spectrum ... 4.106
Symbol rate ... 4.59
Symbol Rate, Modulation ... 4.59
Symbol Rate/Channel. Code ... 4.176
Symbol Rate/Channel. Code DPCCH ... 4.175, 6.22
Symbols (test mode) ... 3.2
Sync. (Connection Control) ... 4.182
Sync. Mode ... 4.174, 4.230, 6.20, 6.188
Synchronization
  internal/external ... 4.182
  remote control ... 6.26
Synchronization Channels ... 4.158
  remote control ... 6.9, 6.10
System clock ... 4.182

T

T1 Release Timer ... 8.59, 8.134
T313 Timeout ... 4.277, 6.232
T3212 Timeout ... 4.276, 6.232
T3312 Timeout ... 4.278, 6.234
Table Tree ... 8.17, 8.160

Target test time 4.126
TCH BLER 4.133
Test Case, HSDPA CQI 8.12, 8.96
Test Loop 4.242, 6.200
Test loops for BER 4.120
Test mode 2.6
Test Mode 3.1, 4.242, 6.200
Test Procedure
  RX Calibration: 9.24
  TX Calibration 9.22
Test Step Preconditions 4.252, 6.19, 6.212
TFCI 4.165, 4.173
TFCI Faults 4.124
TFCI State 4.160, 6.13
TFCI Value
  DCCH 4.166, 6.16
  RMC 4.162, 6.14
TGD 4.258, 6.219
TGFCN Frame No. 4.257, 6.218
TGL1, TGL2 ..... 4.257, 6.218
TGPL1 ..... 4.257
TGPL1 ..... 6.218
TGPRC 4.257, 6.217
TGSN Slot No. 4.257, 6.218
Threshold 4.176, 4.231, 6.22, 6.188
  Spectrum 4.106
Throughput, HSDPA ACK 8.10
Tolerance values
  Modulation 4.72
  Power 4.35
  Spectrum 4.94
Tolerance values (Code Domain Power) 4.115
Total Output Power 4.157, 4.239, 6.8, 6.198
TPC 4.173
TPC (Max./Min. Power) 4.27
TPC Algorithm 4.248, 6.16, 6.209
TPC command 4.29, 4.247
TPC Mode 4.28, 6.44
TPC Pattern Setup 4.248, 6.17, 6.209
TPC Pattern Type 4.248
TPC Settings 4.166
  remote control 6.16, 6.209
  Signalling 4.247
TPC Step Size 4.248, 6.17, 6.209
TPC Test Step 4.31
TPC trigger 4.185
TPC_cmd 4.29, 4.247
Transmission Gap 2 ..... 4.257, 6.218
Transmission reserve 4.146
Transmit Power Control, measurement example 2.28
Transmit Time Error 4.61
Transmitted Bits (Tr. Blocks) 4.205
Transmitted UE Power 4.133
Transmitter (RF generator) 4.156, 4.170, 6.4
Transp. Blocks Continuous 4.138
Transp. Blocks Single Shot 4.138
Transport Block Delay 4.131
Transport Block Size 6.146, 8.48, 8.62, 8.78, 8.142
Transport Block Size Index 8.47, 8.62, 8.78, 8.142
Transport Blocks 6.146
Transport Blocks (Receiver Quality) 4.138
Transport channel 4.162, 4.240
Transport Channel 4.204, 4.205
Trigger
  Non Signalling 4.184
  remote control 6.27
  remote control (Sig) 6.239
  Signalling 4.281
Trigger condition (R&S Smart Alignment) 9.22
Trigger Level 4.186
Trigger settings and measurements 4.284
Trigger Source 4.184
TTI Mode 8.169, 8.185, 8.217
TTI Transport Blocks 4.204, 4.205
Turbo Coded 4.205, 4.205
Turbo Decoding 4.204, 4.205
TX Path 4.192, 6.32
Tx/Rx Frequ. Separation 4.206, 6.182
Type (CQI table index) 8.74, 8.136

U

UARFCN 2.7, 4.144, 4.155, 4.228, 4.237
UE connection 2.2, 2.24
UE Called Number 4.203, 6.177
UE Calling Number 4.203, 6.177
UE Category 8.44, 8.58, 8.73, 8.134
UE Category Selection 8.58, 8.134
UE Code 4.58
  Code Domain Power 4.105
  Connection Control 4.171
  Power 4.9
  remote control 6.20, 6.185
UE Dialled Number 4.203
UE IP address 6.244
UE Originated Call 4.194
UE P. / Error 4.10
UE Position 4.206, 6.183
UE Power 4.12
  Inner Loop TPC 6.48, 6.158
UE Power Control 4.231
UE Power Measurem 4.88
UE Power Measurement 6.102
UE Radio Access Capability 4.203, 4.275, 6.180, 6.228
UE Report
  enable 4.139, 6.168, 6.169
  hotkey 4.129
  neighbor cell parameters 6.170
  results 6.179
    current cell 4.133, 6.169
    neighbor cell 4.133, 6.170
UE Report Pattern (compressed mode) 4.255
UE RX/TX Time Difference 4.133
UE Signal menu 4.227
UE Terminating Call 4.194
UE-ID Selection 8.171, 8.188
UL CM Test Step 4.31
  measurement example 2.29
UL CM TX Test Pattern (compressed mode) 4.257
UL Compressed Mode 6.183
UL Interference 4.232, 6.190
UL RLC SDU Size 4.219, 6.215
UL Scramb. Code
  Modulation 4.59
  Spectrum 4.105
UL Scrambling Code 4.230
UL Target Power 4.176, 4.231, 6.23, 6.189
  Reference 4.231
UL Target Power Reference 6.23, 6.190
UL TFCI Faults 4.124
UL/DL Mode 4.258, 6.219
UL/DL Transport Block Size 4.139
Unregister 4.200
Unscheduled Subframes
  HS-PDSCH 8.43, 8.56, 8.72, 8.132
  HS-SCCH 8.42, 8.54, 8.68, 8.129
Unscheduled TTI 8.171, 8.188, 8.219
Update Time 9.13, 9.18
Uplink Compressed Mode 4.258, 6.220
Uplink CRC (Sym. Loop Mode 2) 4.218, 6.199, 6.215
Uplink WCDMA signal 4.44
Upper/lower case characters 5.11

URA Identity 4.270, 6.224
Use 2G SIM 4.274, 6.230
Use Milenage 4.274
User defined Channel (HSDPA) 8.47, 8.61
remote control 8.78, 8.142
User-defined Pattern (compressed mode) 4.256, 6.217
UTRA 4.144, 4.155, 4.228, 4.237
UTRA Carrier RSSI 4.133
UTRA FDD/TDD 4.206, 6.182
UTRAN to GERAN NACC 4.206

V

Video Echo
measurement example 2.32
Virtual IP address 6.243
Virtual IP Address 9.4
Voice Settings 4.243
Voice Source 4.243, 4.244, 6.200

W

Waveform quality 4.43
Waveform Type 4.71
WB AMR 4.244
WB AMR, Codec Modes 4.203, 6.203
WCDMA (Aux TX) 6.180
WCDMA Application Testing 9.1
HSDPA 9.4
HSUPA 9.5
multi call 9.6
WCDMA Band Select 4.269
WCDMA Inter Neighbor Cell List 4.279, 6.235
WCDMA Intra Neighbor Cell List 4.278, 6.235
Winbatch 7.1
Window Size 9.13, 9.18
With Origin Offset 4.172
Without Origin Offset 4.172
Wrong Decision 4.137, 6.147

Z

Zoom 4.71

Δ

Δ E-DPCCH 8.176, 8.182, 8.193, 8.224

Δ

Δ_{ACK} 4.101, 4.233
ΔCQI 4.233
Δ_{NACK} 4.101, 4.233

β

β_c 4.112, 4.233
β_d 4.112, 4.233

ρ

ρ factor 4.43