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 III / I / II / IV / V / VI Signalling

R&S® CMU-K67/-K68/-K69/-K61/-K62/-K63

1150.3000.02/1115.5300.02/1115.5400.02
1157.3670.02/1157.3770.02/1157.3870.02

HSDPA 3.6 Mbps

R&S® CMU-K64

1157.3970.02

WCDMA Application Testing

R&S® CMU-K96

1157.4177.02

Printed Germany

Dear Customer,

throughout this manual, CMU-K61 to CMU-K69 and CMU-K96 is generally used as an abbreviation for the software options R&S® CMU-K61 to R&S® CMU-K69 and R&S® CMU-K96. The Universal Radio Communication Tester R&S® CMU 200 is abbreviated as CMU200.

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List of R&S Representatives

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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 CMU-B41, CMU-B17) and separate manuals for individual software and hardware options. The complete documentation is available on CD-ROM, stock no. PD 0757.7746.2x.

For an overview and order information about printed manuals refer to the beginning of the Quick Start Guide. The latest revisions of all manuals are also posted on the CMU Customer Web on GLORIS.

Operating Manual R&S CMU-K61/…/-K69/-K96 (Software Options: WCDMA UE TX Test (3GPP/FDD) WCDMA (3GPP/FDD, DL) Generator) WCDMA UE Band I…VI Signalling HSDPA 3.6 Mbps WCMDA Application Testing

The present operating manual describes the application of the WCDMA UE function groups listed above. 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 TX measurements and presents typical 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 TX measurements.

Chapter 6 Lists all remote control commands for WCDMA TX measurements. At the end of the chapter the commands are grouped together according to their function (measurement groups or configurations) and sorted in alphabetical order.

Chapter 7 Contains program examples for selected applications.

Chapter 8 Describes the HSDPA option including the HSDPA downlink generator, HSDPA signalling, and HSDPA measurements.

Chapter 9 Describes option *WCDMA Application Testing* including the *RLC BLER* measurement for evaluating the data throughput.

Chapter 10 Contains an index for the operating manual.

What's new in this Revision...

This operating manual describes versions V3.80 of the WCDMA UE software options. Compared to the version described in the last revision of the operating manual (V3.60) the new CMU-K61/.../-K69 firmware version provides numerous extensions and improvements. The new features described in this manual are listed below.

New Features	Description	Refer to...
New and extended Options		
R&S CMU-K96	WCDMA Data Application Testing including a special *RLC BLER* measurement to evaluate the BLER and throughput of data applications.	Chapter 9
R&S CMU-K64	HSDPA measurements extended; support of HSDPA in *Signalling* mode (for details see Non Signalling and Signalling sections below)	Chapter 8, → HSDPA in Signalling Mode
General Features		
Code Conflict Handling	Code conflicts in the generated DL WCDMA signals are slso checked for HSDPA channels and possibly auto-corrected (applies to *Non Signalling* and to *Signalling* mode).	Chapter 4, → Connection Control (Non Signalling) – RF Generator
Freq. dependent attenuation	Frequency-dependent input and output attenuation factors can be defined with up to 50 different interpolation points.	Chapter 4, RF Measurements → Connection Control (Non Signalling) – Frequency Dep. Attenuation
Improved output level	The output level range at RF2 has been improved to –20.1 dB, which is sufficient for the *Maximum Input Level* test according to standard 3GPP TS 34.121, section 6.3.	Chapter 4, → Connection Control (Non Signalling) – RF Generator
Non Signalling – New Measurements and Connection Control		
P/Slot (Table)	Graphical display of the measured powers or power steps.	Chapter 4, → Power Measurements
P/Slot (Table)	Extended *Measure Modes: Ref. Level Switch Off* vs. *Ref. Level Switch Auto*.	Chapter 4, → Power Measurements
Phase Discontinuity	Measurement of the change in phase between two adjacent timeslots in accordance with standard 3GPP TS 34.121.	Chapter 4, → Modulation Measurements
CDP vs- Time	Code power and gain factors for all UL channels including HSDPA channels (remote control feature).	Chapter 6, → CDP vs. Time Measurement
Automatic Resynchronization	Check of the BER within each individual received block and correction of the PN phase and its position in the block sequence.	Chapter 4, → Receiver Quality Measurements
New RX Quality results	The *Receiver Quality* measurement can provide the *UL BLER,* the *PN Discontinuity,* and the *Transport Block Delay*.	Chapter 4, → Receiver Quality Measurements
DL DPCH Timing Offset	Adjustable offset between the DL P-CCPCH timing and the DL DPCH timing.	Chapter 4, → Connection Control (Non Signalling) – RF Generator
Aux TX	Additional RF generator signal *Aux TX* and high-level signal *Aux TX Over Range*.	Chapter 4, → Connection Control (Non Signalling) – RF Generator

New Features	Description	Refer to...
CW Signal	The RF generator can generate an alternative CW signal for test purposes.	Chapter 4, → Connection Control (Non Signalling) – RF Generator
Extended trigger model	New trigger sources: *Slot, Frame, TPC, HS-DPCCH, Auto*.	Chapter 4, → Connection Control (Non Signalling) – Trigger
HSDPA Generator	New or modified parameters: – HS-SCCH UE ID – HS-SCCH Dummy UE ID – HS-SCCH Selection (fixed, cyclic, random) – Number of HS-SCCHs – Force NACK with configurable percentage of data with incorrect CRC – CQI Feedback Cycle – Edit mode for RV coding sequences	Chapter 8, → HSDPA Downlink Generator
HS-DPCCH code power	The *Code Domain Power* measurement also provides the code power and ρ-factor of the HS-DPCCH channel.	Chapter 8, → Code Domain Power
HS-DPCCH Logging	ACK/NACK messages and reported CQI values that the UE returns in a sequence of 60 consecutive HS-DPCCH subframes.	Chapter 8, → HSDPA Receiver Tests
CQI Reporting	CQI reporting accuracy measurement according to 3GPP TS 34.121.	Chapter 8, → HSDPA Receiver Tests
HSDPA ACK test	New parameter *Measure Subframes* configures the scope of a single shot measurement.	Chapter 8, → HSDPA Receiver Tests
CQI Detection Threshold	The *CQI Detection Threshold* is a general parameter which applies to all HSDPA RX tests	Chapter 8, → HSDPA Receiver Tests
Monitored H-ARQ	The *Monitored H-ARQ* is a general parameter which applies to all HSDPA RX tests	Chapter 8, → HSDPA Receiver Tests
Signalling – New Measurements and Connection Control		
P/Slot (Table)	Graphical display of the measured powers or power steps.	Chapter 4, → Power Measurements
P/Slot (Table)	Extended *Measure Modes: Ref. Level Switch Off* vs. *Ref. Level Switch Auto*.	Chapter 4, → Power Measurements
Phase Discontinuity	Measurement of the change in phase between two adjacent timeslots with special TPC pattern in accordance with standard 3GPP TS 34.121.	Chapter 4, → Modulation Measurements
PRACH Preamble	Measurement of the ability of the UE to transmit the PRACH preamble in accordance with the core requirements.	Chapter 4, → Modulation Measurements
CDP vs- Time	Code power and gain factors for all UL channels including HSDPA channels (remote control feature).	Chapter 6, → CDP vs. Time Measurement
Automatic Resynchronization	Check of the BER within each individual received block and correction of the PN phase and its position in the block sequence.	Chapter 4, → Receiver Quality Measurements
New RX Quality results	The *Receiver Quality* measurement can provide the *UL BLER,* the *PN Discontinuity,* and the *Transport Block Delay*.	Chapter 4, → Receiver Quality Measurements
Inter-band handover	The R&S CMU can change the operating band during an established connection.	Chapter 4, → Connection Control (Signalling) – Handover

New Features	Description	Refer to...
Packet switched connection	Packet switched connection scheme with variable data rates for HSDPA tests and WCDMA application testing (option R&S CMU-K96).	Chapter 4, → Connection Control (Signalling) – Connection
Video Echo	The R&S CMU can set up a circuit-switched vido call and loop back video data including audio.	Chapter 4, → Connection Control (Signalling) – Connection
Gain factors	Gain factor settings for all UL channels including HSDPA channels.	Chapter 4, → Connection Control (Signalling) – UE Signal
DL DPCH Timing Offset	Adjustable offset between the DL P-CCPCH timing and the DL DPCH timing.	Chapter 4, → Connection Control (Signalling) – BS Signal
Fixed TPC patterns	TPC patterns for phase discontinuity measurements (PhD Up/Down) according to 3GPP TS 34.121.	Chapter 4, → Connection Control (Signalling) – BS Signal
TPC test step preconditions	Initial power setting for all fixed TPC patterns	Chapter 4, → Connection Control (Signalling) – BS Signal
Channelization codes	Configuration of the channelization codes for the S-CCPCH, PICH, and AICH in the WCDMA DL signal.	Chapter 4, → Connection Control (Signalling) – BS Signal
Paging without registration, default IMSI	Optional default IMSI can speed up the paging procedure	Chapter 4, → Connection Control (Signalling) – Network
Skip RAB Release	RAB release during the connection setup can be disabled to speed up the connection setup procedure.	Chapter 4, → Connection Control (Signalling) – Network
Timeouts	New *T313 Timeout*, *Out of Sync Timeout,* and *Paging Timeout* parameters	Chapter 4, → Connection Control (Signalling) – Network
Extended trigger model	New trigger sources: *Slot, Frame, TPC, HS-DPCCH, Auto, Preamble, PRACH Msg. Part, Compressed Mode, Change of TFC.*	Chapter 4, → Connection Control (Signalling) – Trigger
TCP/IP	The IP address settings for the R&S CMU have moved to the *Setup – TCP/IP* menu (base system). The *Misc.* tab contains additional addresses for the *Message Monitor* and for *Application Testing.*	Chapter 4, → Connection Control (Signalling) – Misc.
HSDPA in Signalling mode	The HSDPA generator and many HSDPA measurements (see below) are also available in *Signalling* mode. The *Signalling* generator provides all *Non Signalling* features plus the following additional parameters: – Measurement power offset – Configurable *No. of H-ARQ Processes* for CQI channels	Chapter 8, → HSDPA in Signalling Mode
HS-DPCCH code power	The *Code Domain Power* measurement also provides the code power and ρ-factor of the HS-DPCCH channel.	Chapter 8, → Code Domain Power
HS-DPCCH Logging	ACK/NACK messages and reported CQI values that the UE returns in a sequence of 60 consecutive HS-DPCCH subframes.	Chapter 8, → HSDPA Receiver Tests
CQI Reporting	CQI reporting accuracy measurement according to 3GPP TS 34.121.	Chapter 8, → HSDPA Receiver Tests
HSDPA ACK test	New parameter *Measure Subframes* configures the scope of a single shot measurement.	Chapter 8, → HSDPA Receiver Tests

New Features	Description	Refer to...
CQI Detection Threshold	The *CQI Detection Threshold* is a general parameter which applies to all HSDPA RX tests	Chapter 8, → HSDPA Receiver Tests
Monitored H-ARQ	The *Monitored H-ARQ* is a general parameter which applies to all HSDPA RX tests	Chapter 8, → HSDPA Receiver Tests

Frequently Used Abbreviations

3GPP	*3rd Generation Partnership Project*
Abs.	*Absolute*
ACLR	*Adjacent Channel Leakage power Ratio*
ACP	*Adjacent Channel Power*
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*
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*
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*
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

3GPP TS 21.905 "Vocabulary for 3GPP Specifications" (Release 1999)
3GPP TS 25.101 "UE Radio transmission and reception (FDD)" (Release 1999)
3GPP TS 25.211 "Physical channels and mapping of transport channels onto physical channels" (Release 1999)
3GPP TS 25.212 "Multiplexing and channel coding (FDD)" (Release 1999)
3GPP TS 25.213 "Spreading and modulation (FDD)" (Release 1999)
3GPP TS 25.214 "Physical layer procedures (FDD)" (Release 1999)
3GPP TS 25.215, "Physical layer - Measurements (FDD)" (Release 1999)
3GPP TS 25.306 "UE Radio Access capabilities definition" (Release 1999)
3GPP TS 25.323 "Packet Data Convergence Protocol (PDCP) specification" (Release 1999)
3GPP TS 25.331 "RRC Protocol Specification" (Release 1999)
3GPP TS 34.108 "Common Test Environments for User Equipment (UE) Conformance Testing" (Release 1999)
3GPP TS 34.109 "Terminal logical test interface; Special conformance testing functions" (Release 1999)
3GPP TS 34.121 "Terminal Conformance Specification Radio transmission and reception (FDD)" (Release 1999)

Application Note 1GP39_0E: "W-CDMA Signal Generator Solutions by Rohde & Schwarz"
Application Note 1EF44_0E: "Measurements on 3GPP Base Station Transmitter Signals"

For more application notes and information related to our instruments please refer to http://www.rohde-schwarz.com/www/dev_center.nsf

Supplement to the Operating Manual for WCDMA UE Software Options

New Features in Version 3.85 of Options R&S® CMU-K61/…/-K69 (with Base System V3.85)

Smart Alignment, AWGN, CDP vs. Time, DL Power Control, Aux TX, Disable Attach/Detach, SRB Reconfiguration, RMC Test Loop for HSDPA

Dear CMU Customer,

The upcoming version V3.85 of the WCDMA UE software for the Universal Radio Communication Tester R&S® CMU 200 will provide a new functionality that could not yet be reported in the current revision of the operating manual, 1115.4962.12-07-.

The following pages give an introduction to the new features and describe the conditions for obtaining measurement results. Details of the implementation, the man-machine interface and the remote control commands are subject to modifications until the final release.

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Smart Alignment

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 3 to 60 slots.

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.

Smart Alignment is available in *Non Signalling* mode. With the minimum step width of 3 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.

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 *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. 8-3 6) 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. 1 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).

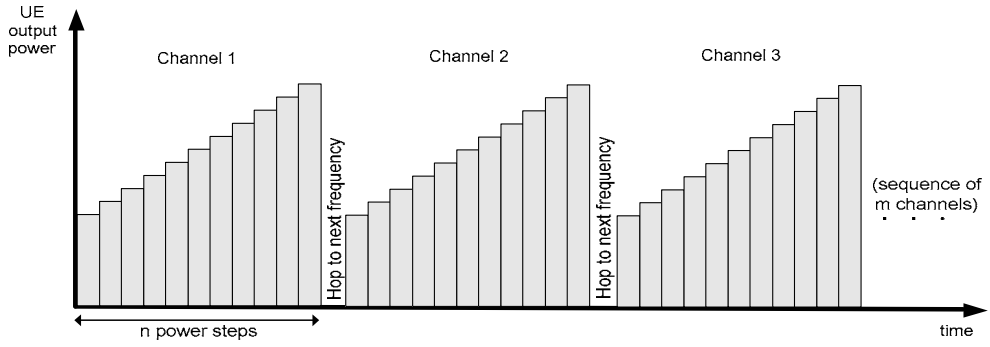
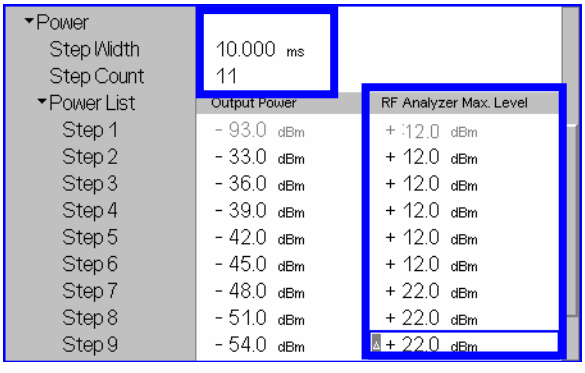


Fig. 1 TX calibration: mobile power settings

R&S CMU Settings

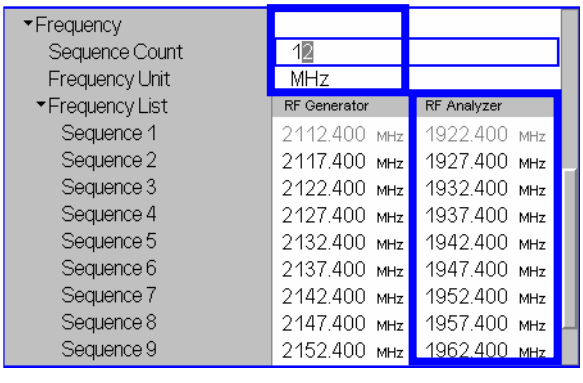
3. In the *Menu Select* menu, select the WCDMA FDD function group and the measurement menu *Non Signalling – Power – Smart Alignment*. Press *RESET* to set the instrument to a defined state. Press *ENTER CONT/HALT* to set the measurement to the *HLT* state and eliminate the *Trigger not found !* message.
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 *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 *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. 5.

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

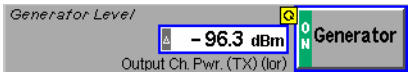
For an RX calibration the R&S CMU generates an RF test signal with definite frequencies and powers, to be compared with the power measured at the UE receiver. Both the RF generator and the *Smart Alignment* measurement must be running *(ON, RUN)* in order to generate the test signal. In addition, a suitable 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:

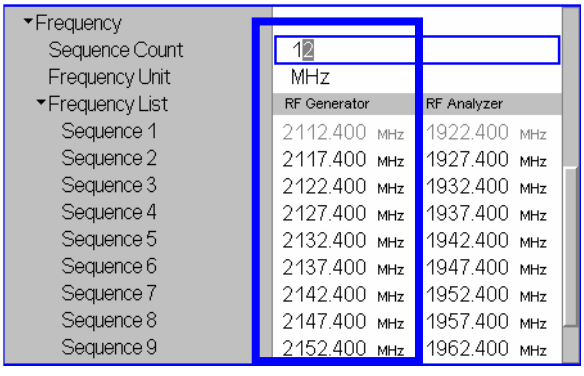


The *Output Ch. Power (TX) (Ior))* is the sum of all physical DL WCDMA channels configured in the *Generator* tab (P-CPICH, SCH, P-CCPCH, PICH, DPCH, OCNS). The AWGN does not contribute to the *Output Ch. Power (TX) (Ior);* it is normally switched off for RX calibrations (default setting).

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. 1 on p. 3.

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 *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 *Smart Alignment Configuration* on p. 7).

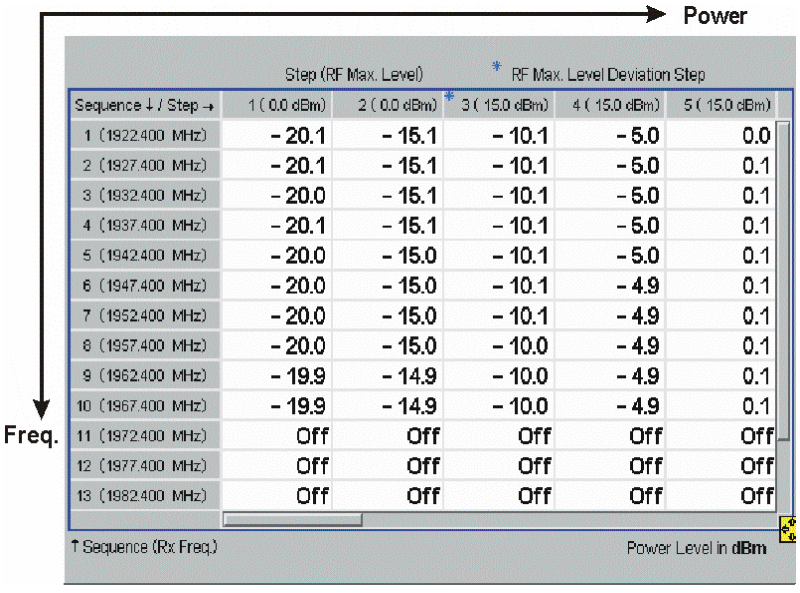


Fig. 8-2 Display of results (Power – Smart Alignment)

Power results

The *Smart Alignment* application measures the average burst power in up to 20 consecutive power steps of configurable width and at up to 16 different frequencies, so that up to 320 results are obtained in each measurement cycle. The measurement is performed with a wide-band 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.

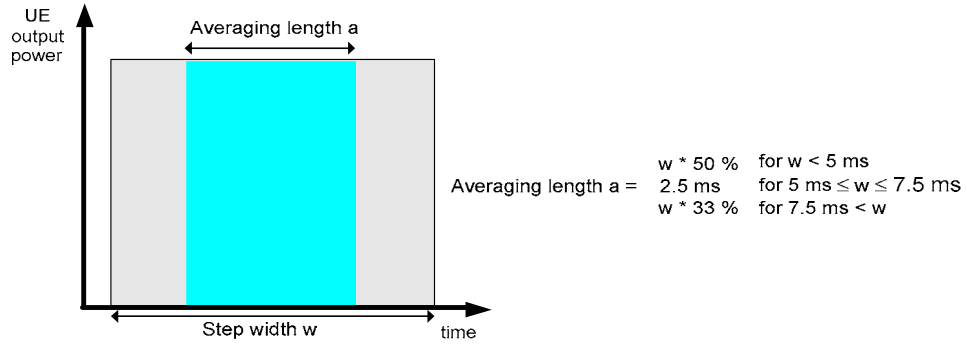


Fig. 8-3 Averaging length

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. 2.).

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?
```

Smart Alignment Configuration

The power steps and frequencies for the *Smart Alignment* measurement are defined in the *Control* tab of the *Connection Control* menu.

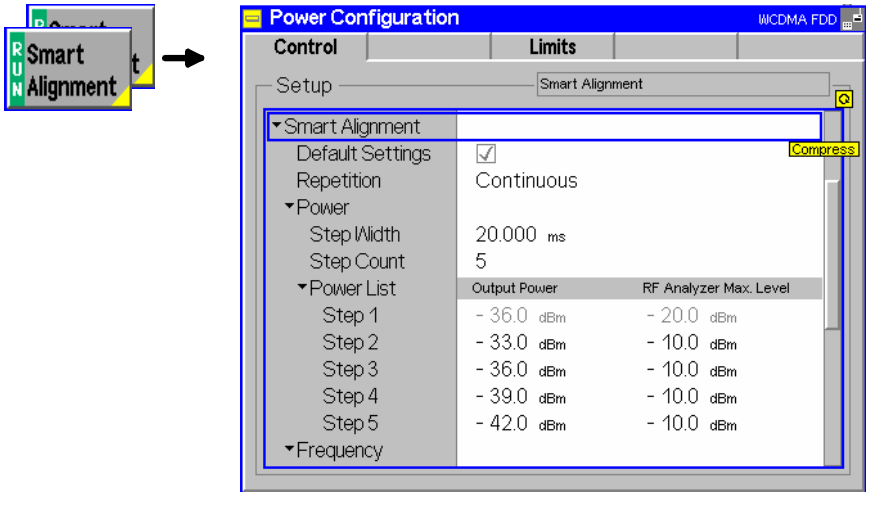


Fig. 8-5 Power Configuration – Control

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. 8-6 below. The total measurement time is equal to *T = <Step Width> * (<Step Count> + 1) * <Sequence Count>.*

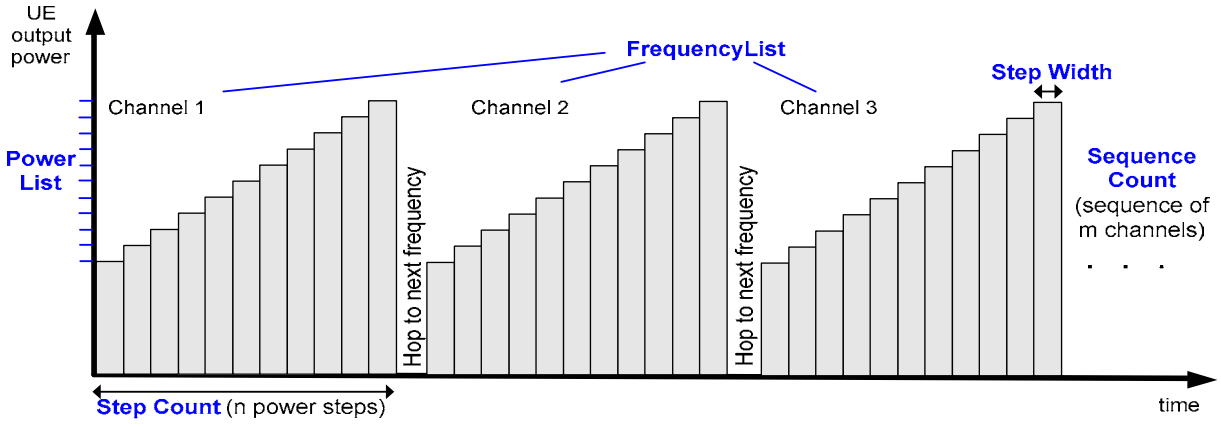


Fig. 8-6 Smart Alignment – power and frequency settings

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. 8-3 on p. 6. The minimum step width of 2 ms corresponds to 3 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 a *Smart Alignment* measurement is running.

NOTE

A reduction of the RF Analyzer Max. Level across –10 dBm (RF1), –24 dBm (RF2), or –49 dBm (RF4 IN) is likely to cause an invalid result in the following power step. A fixed (not frequency-dependent) external attenuation shifts the limits quoted above (e.g. RF2 and +14 dB external attenuation –> limit at –24 dBm + 14 dB = –10 dBm).

Remote control

```
CONFigure:POWer:SALignment:CONTrol:SWIDth
CONFigure:POWer:SALignment:CONTrol:SCOunt
CONFigure:POWer:SALignment:CONTrol:STEP<nr>
```

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). Additional channels outside the 200 kHz raster (for operating bands II, III, IV, V) must be specified with their channel frequency.

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
```

Remote Control Commands

The following sections describe the remote control commands for option R&S CMU-K47; *Smart Alignment*.

Measurement Control

The following commands control the *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 |	The parameters are set to their default values	ON	–	V3.85
OFF	Some or all parameters are not set to default			

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 |	Interrupt measurement after each statistics cycle	NONE	–	V3.85
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: The *<Repetition>* parameter has no effect on `READ:...` commands, where the measurement is always stopped after a single shot.

CONFigure:POWer:SALignment:CONTrol:SWIDth *<Step Width>* Step Width

<Step Width>	Description of parameters	Def. value	Def. unit	FW vers.
0.002 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.

CONFigure:POWer:SALignment:CONTrol:SCOunt *<Step Count>* Step Count

<Step Count>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 20	Step count	5	–	V3.85

Description of command

This command defines the number of power steps per cycle.

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.
–40.0 dBm to +53.0 dBm **–54.0 dBm to +39.0 dBm** **–77.0 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> (<nr> = 2 to 20). 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.

The powers must be multiples of 0.1 dB. The default generator powers read

$$p^{Gen}_{1,\ def} = -93\,dBm; \quad p^{Gen}_{<nr>,\ def} = -27\,dBm - 3 \cdot < nr > dB; \quad < nr > = 2\ to\ 20.$$

The default max. levels read

$$p^{An}_{1,\ def} = +\ 30\ dBm; \quad p^{An}_{<nr>,\ def} = 10 \cdot \mathrm{Int}\left(\frac{< nr > + 4}{5}\right) dBm; \quad < nr > = 2\ to\ 20.$$

CONFigure:POWer:SALignment:CONTrol:SQCount *<Sequence Count>* Sequence Count

<Step Count>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 16	Sequence count	10	–	V3.85

Description of command

This command defines the number of power step cycles per single shot measurement.

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

$$f^{Gen}_{<nr>,\,def} = 2112.4\ MHz + 5 \cdot (<nr> - 1)\ MHz; \quad <nr> = 1\ to\ 16.$$

The default analyzer frequencies read

$$f^{An}_{<nr>,\,def} = 1922.4\ MHz + 5 \cdot (<nr> - 1)\ MHz; \quad <nr> = 1\ to\ 16.$$

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.

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 in time period no. 1	NAN	dBm	V3.85
…	…			
–100 dBm to +60 dBm | OFF	Avg. power in time period no. N	NAN	dBm	

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 results is $N = 20 \cdot <Sequence\ Count>$ (`CONFigure:POWer:SALignment:CONTrol:SQCount`). OFF indicates that no result is available because the step count is below its maximum value.

AWGN Generator

The *Generator* tab of the *Connection Control* menu provides an Additive White Gaussian Noise signal, to be added to the DL WCDMA signal. The properties of the AWGN interferer comply with the requirements of the conformance test specification 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.

Generator Level – AWGN

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.

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 standard 3GPP 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
```
SOURce:RFGenerator:AWGN
SOURce:RFGenerator:GMTFactor?
SOURce:RFGenerator:TOPower?
```

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`).

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

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

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

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`).

RMC Test Loops for HSDPA

In the *BS Signal* tab of the *Connection Control* menu, it is possible to configure test loops for the HSDPA test mode. According to the conformance test specification 3GPP TS 34.121 the test loops are required for TX tests as well as for *Receiver Quality* tests.

BS Signal – Packet Switched

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) or *RMC 12.2 kbps + HSDPA*. The RMC connection can be configured with or without a test loop at the UE; see *RMC Test Loop* parameter below.

HSDPA Test Mode – 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.

Remote control

```
CONFigure:BSSignal:PSWitched:DCH:HSTMode:RBSetup HSRB | HRMC
CONFigure:BSSignal:PSWitched:DCH:HSTMode:RTLoop
                OFF | LM1 | LM2
```

CONFigure:BSSignal:PSWitched:DCH:HSTMode:RTLoop ***<Rate>***				RMC Test Loop
<Rate>	Description of parameters	Def. value	Def. unit	FW vers.
LM1 | **LM2 |** **OFF**	Loop Mode 1 RLC TM Loop Mode 2 No test loop	LM1	–	V3.85
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

Parameters for Fast Connection Setup

The list of the *Requested UE Data* in the *Network* tab of the *Connection Control* menu has been extended. The new parameters are described below.

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.

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.

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.

Remote control

```
CONFigure:NETWork:REQuest:ADETach ON | OFF
CONFigure:NETWork:REQuest:SRBReconfig ON | OFF
CONFigure:NETWork:REQuest:RLCReestab ON | OFF
```

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: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

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.)*.

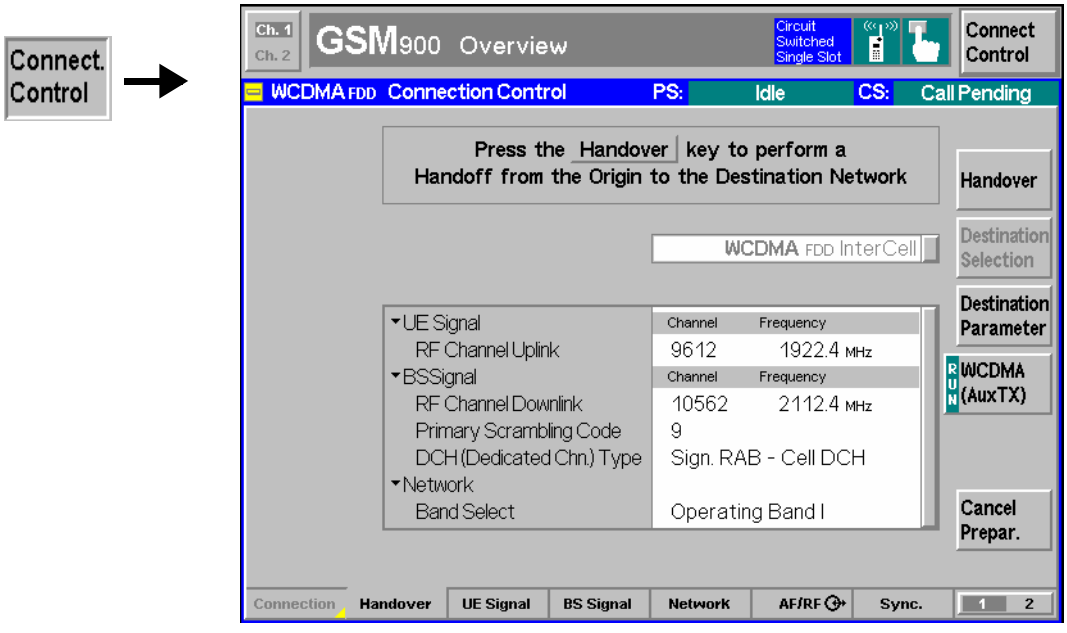


Fig. 7 Connection Control – Handover (Call Pending, WCDMA FDD InterCell handover)

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

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.

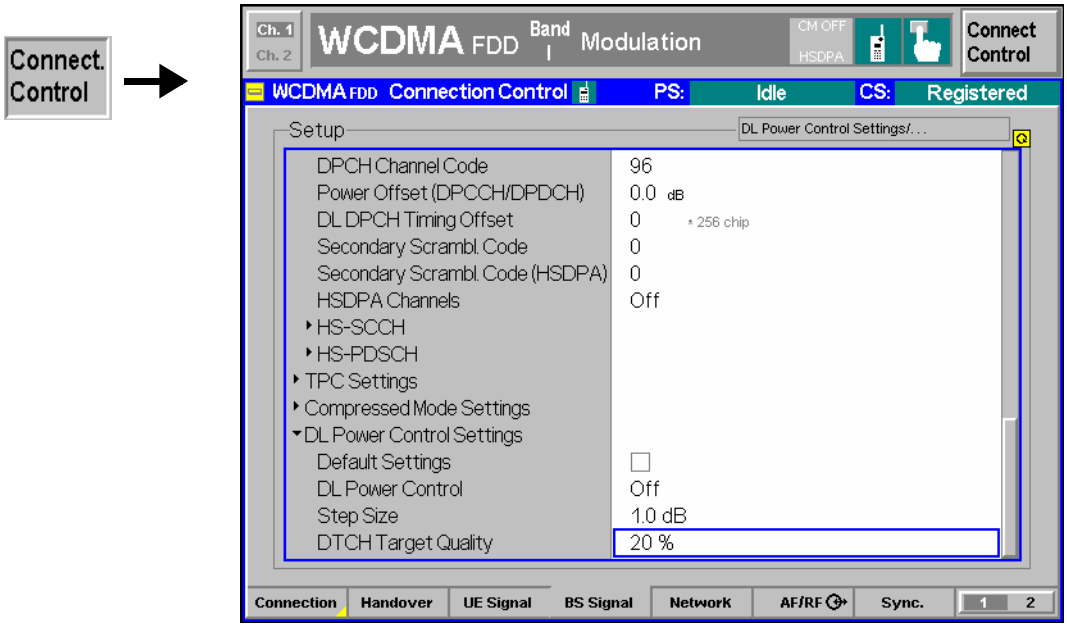


Fig. 8 Connection Control – BS Signal (DL Power Control Settings)

DL Physical Channels

The following parameters in the *DL Physical Channels* section specify 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.

DPDCH Level Min. Minimum DPDCH level during the DL power control test

DPDCH Level Max. 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.

Remote control
```
DEFault:BSSignal:DPCS ON | OFF
CONFigure:BSSignal:DPCS:PCONtrol ON | OFF
CONFigure:BSSignal:DPCS:SSIZe
CONFigure:BSSignal:DPCS:DTQuality
```

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.

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

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

CDP vs. Time Measurement

The *CDP vs. Time* measurement provides the code power and the gain factors for all UL channels. The measurement is an application of the *Code Domain Power* measurement which 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 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.

The CDP vs. Time measurement requires the hardware option U65Var04.

A program example for a CDP vs. Time measurement is reported in Chapter 7 of the operating manual.

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 (see also section *HSDPA in CDP Measurement* in Chapter 8 of the operating manual). 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. In particular 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* in Chapter 4 of the operating manual.

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 6-1 below.

NOTE

If desired the normalization can be changed using a different Power Reference Beta Fact. *(see p. 27).*

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 Chapter 4).

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 6-1 Signalled values for gain factors and channel powers

Signalled values for β_c and β_d	Quantized amplitude ratios *R*	Relative Power $P_{ch} = 20 * log(R)$	Signalled values for Δ_{ACK}, Δ_{NACK}, Δ_{CQI}	Quantized amplitude ratios *R*	Relative Power $P_{ch} = 20 * log(R)$
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	8	30/15	+6.0 dB
7	7/15	–6.6 dB	7	24/15	+4.1 dB
6	6/15	–8.0 dB	6	19/15	+2.1 dB
5	5/15	–9.5 dB	5	15/15	0 dB
4	4/15	–11.5 dB	4	12/15	–1.9 dB
3	3/15	–13.9 dB	3	9/15	–4.4 dB
2	2/15	–17.5 dB	2	8/15	–5.5 dB
1	1/15	–23.5 dB	1	6/15	–8.0 dB
0		– (Switch off)	0	5/15	–9.5 dB

The result for the different code channel powers obtained in a *CDP vs. Time* measurement in HSDPA test mode are shown below.

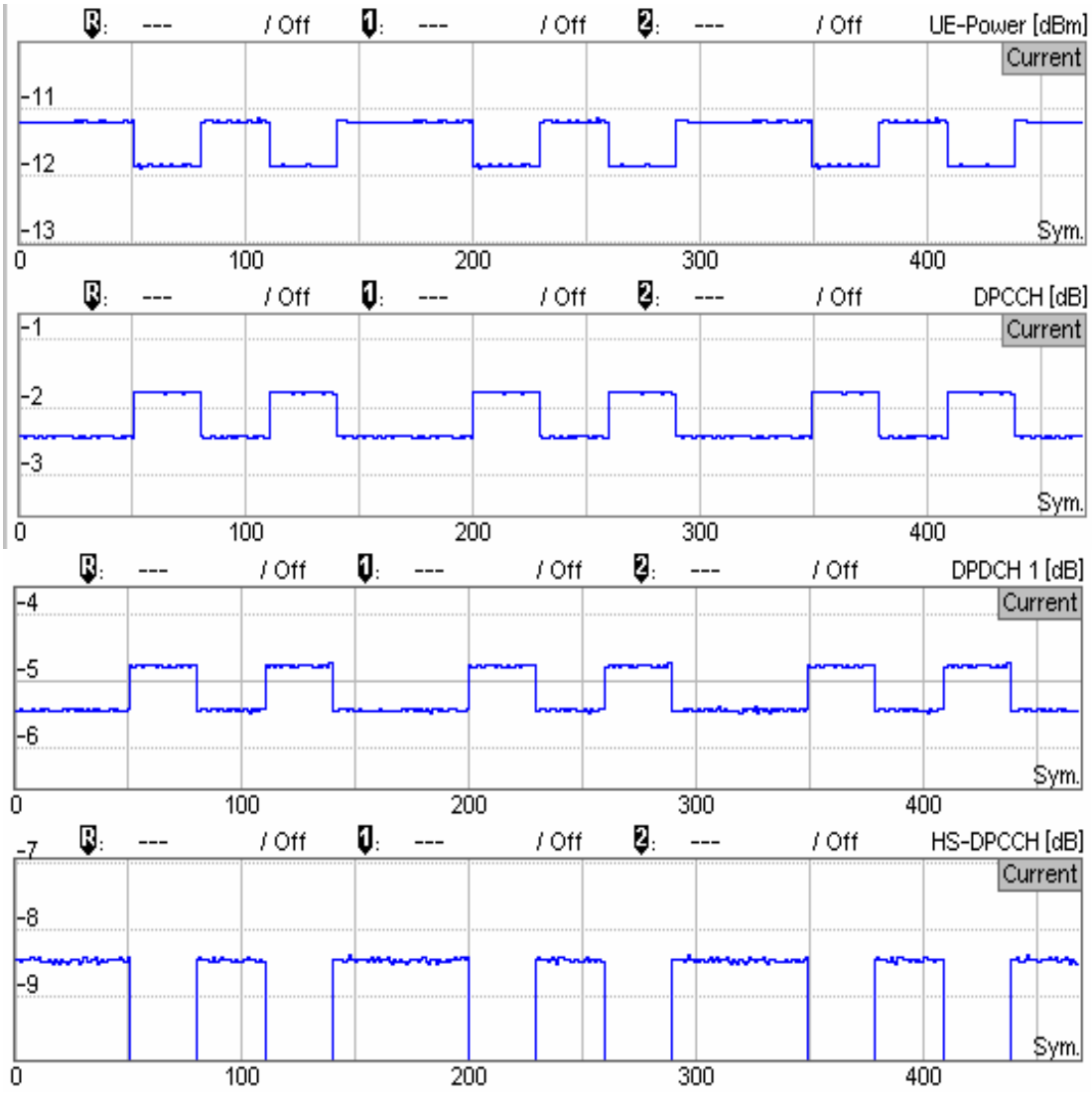


Fig. 9 CDP vs. Time – measurement example

CDP vs. Time Results

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.

Parameter lines

Upper diagram

Lower diagram

Output fields

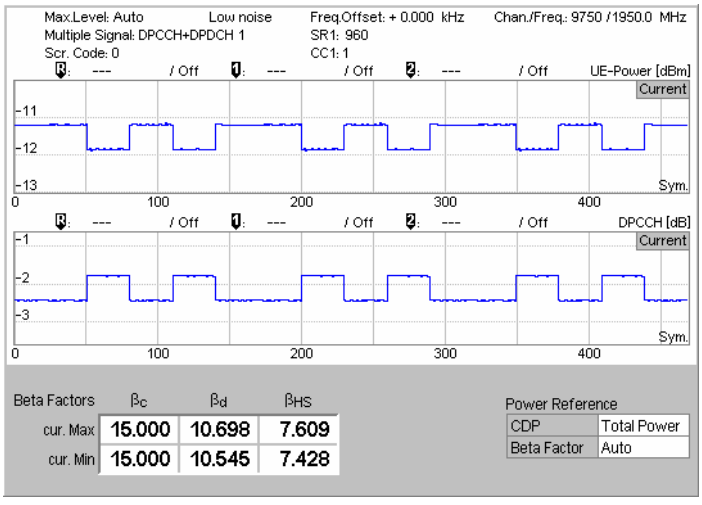


Fig. 10 Display of results (CDP vs. Time)

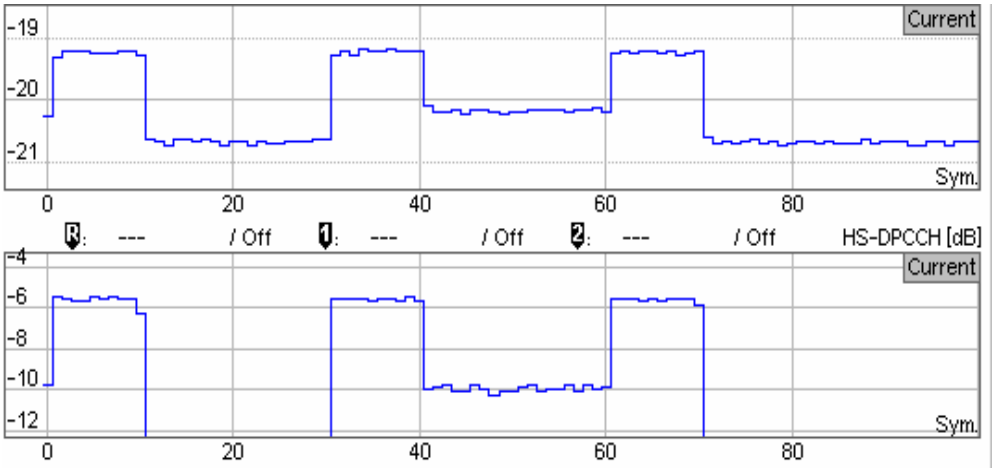
Parameter lines The test settings and results (marker values) displayed in the four parameter lines are analogous to the settings and results in the *CDP/Code Auto (CDP/Code Rho Auto)* menus; see p. 4.88 of the operating manual.

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, the DPDCHs, and the HS-DPCCH channels. The results are measured as described in section *CDP vs. Time Measurement* on p. 22. 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 *CDP vs. Time Configuration* on p. 27. Both diagrams can be scaled independently using the hotkeys associated with the *Display/Marker* softkey:

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 on p. 23.

- 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 DPDCH6; its signalled value is an integer number between 0 and 15.
- β_{hs} is the gain factor for the HS-DPCCH; it can vary between 0 and 30 (15 times the quantized amplitude ratios in Table 6-1 23).

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* on p. 4.201 of the operating manual.

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.

CDP vs. Time Configuration

The *CDP/Time* settings in the *Control* tab of the *Code Domain Power* menu define the scope of the *CDP vs. Time* measurement, scale the results and select the displayed values for the two diagrams in the measurement menus.

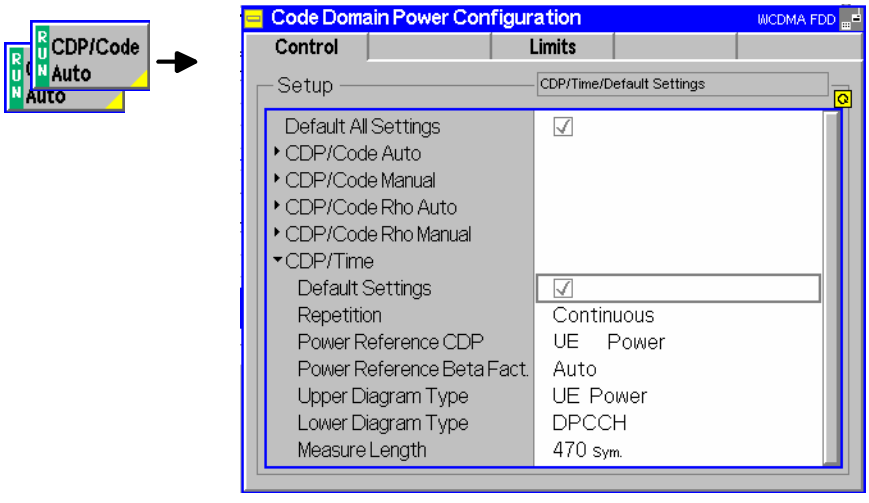


Fig. 11 Code Domain Power Configuration – Control

The *Repetition* mode is analogous for all measurement applications. The following settings 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
Results are always referenced to the UE power.

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. 23.

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
–

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. 22.

Remote control
–

Remote Control Commands

The remote control commands for the *CDP vs. Time* measurement are reported in Chapter 6 of the operating manual; see p. 6.125. 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). In remote control, gain factors are always referenced to the strongest channel (corresponding to *Power Reference Beta: Auto);* their range is within 0 and 15 (0 and 30 for the HS-DPCCH).
- Code channel powers for the *DPCCH, DPDCH 1,* and *HS-DPDCH* are always expressed relative to the *UE Power.*
- 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.

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1 Installation

This chapter describes the installation and update of the WCDMA UE software options R&S CMU-K61 to R&S CMU-K69 for the Universal Radio Communication Tester R&S CMU200.

The WCDMA UE software options provide the following functionality:

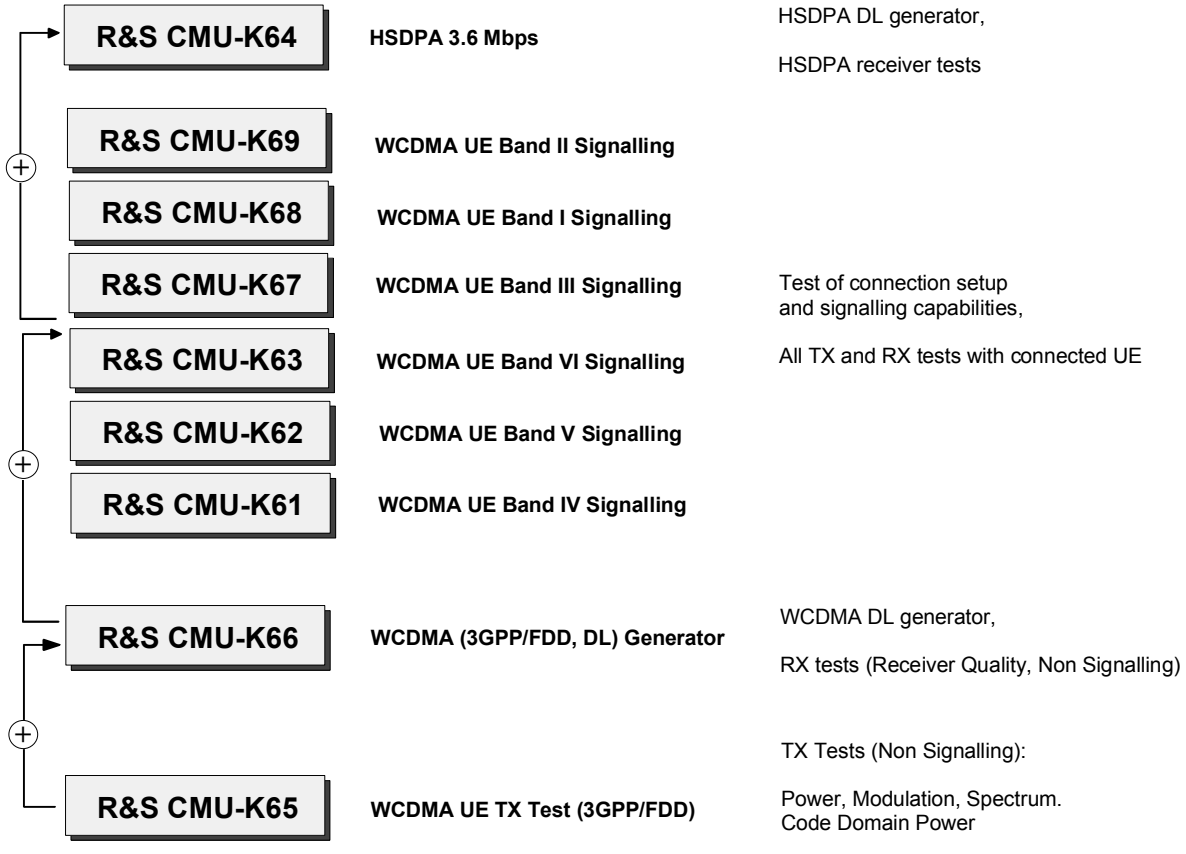


Fig. 1-1 WCDMA UE options

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:*

- 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 1.4.
- 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. 1.6).

Software Installation or Update

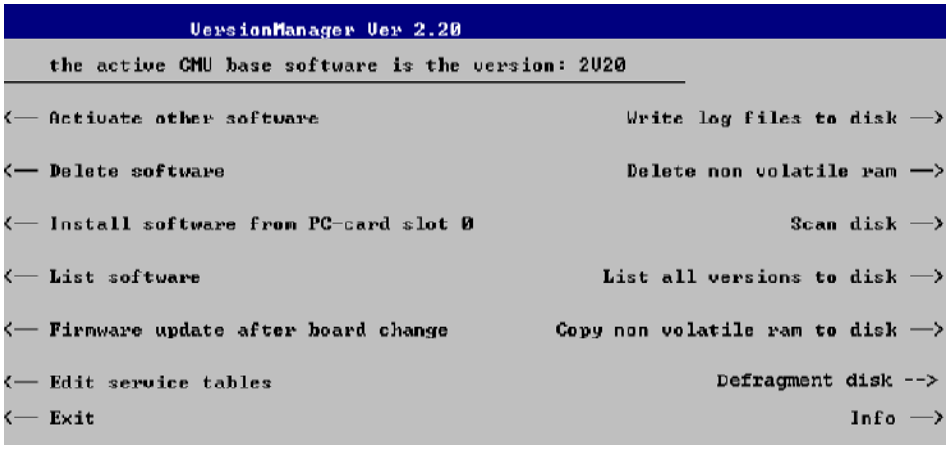
The CMU is always delivered with the latest software version available. New CMU software versions are available for download on the R&S Lotus Notes Service board. To be loaded via the PCMCIA interface, the software must be copied to one or several flash disks/memory cards or PCMCIA hard disks. An appropriate 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.

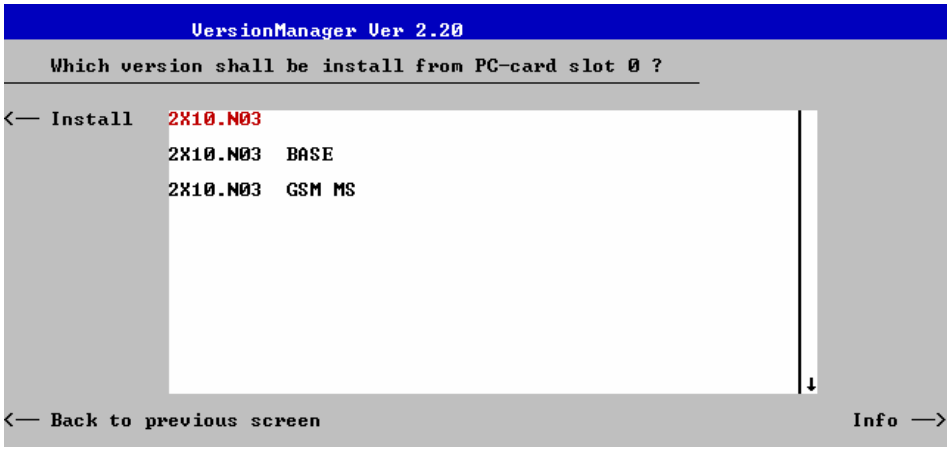
The installation is started automatically while the CMU performs its start-up procedure. To this end the *VersionManager* is called up (for a detailed description of the *VersionManager* refer to chapter 1 of the CMU operating manual or to the on-line help accessible via *Info):*



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.*

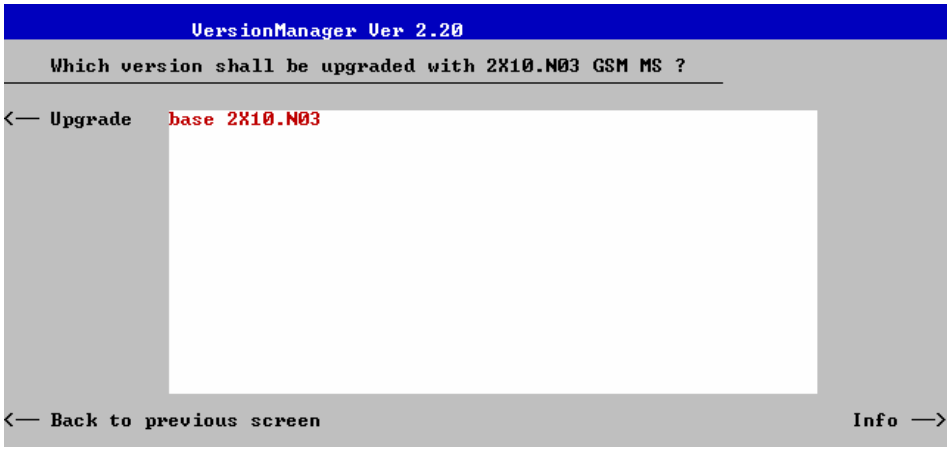
- Press left softkey no. 5 *(Install software...)* to start the installation.

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.

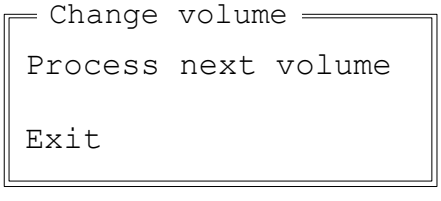
The installation is started. To be operable on your instrument, a network option must be combined with a compatible version of the CMU base software. Any base software version installed on the CMU hard disk can be combined with one or several network options to form an independent software configuration. 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 1.4. 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*.

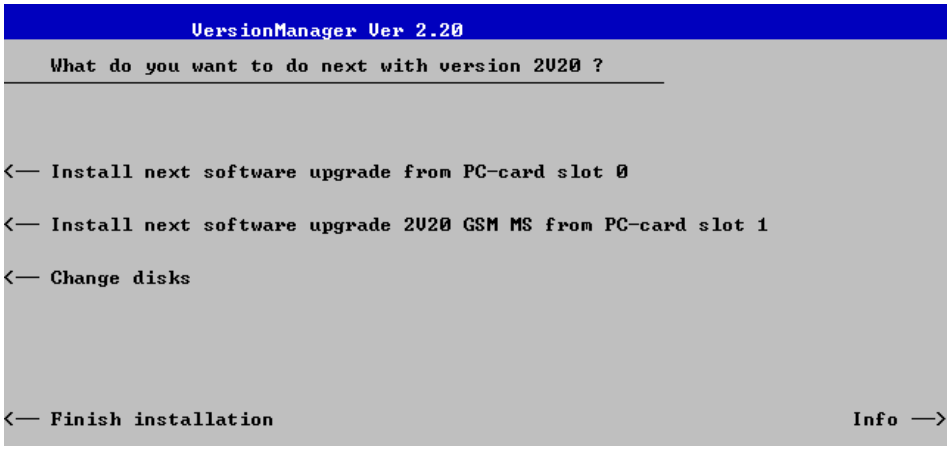
The new *WCDMA* option is added to the configuration or updates the previous *WCDMA* version of the configuration. To indicate that the storage medium must be changed the CMU issues the *Change volume* message:



- 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:



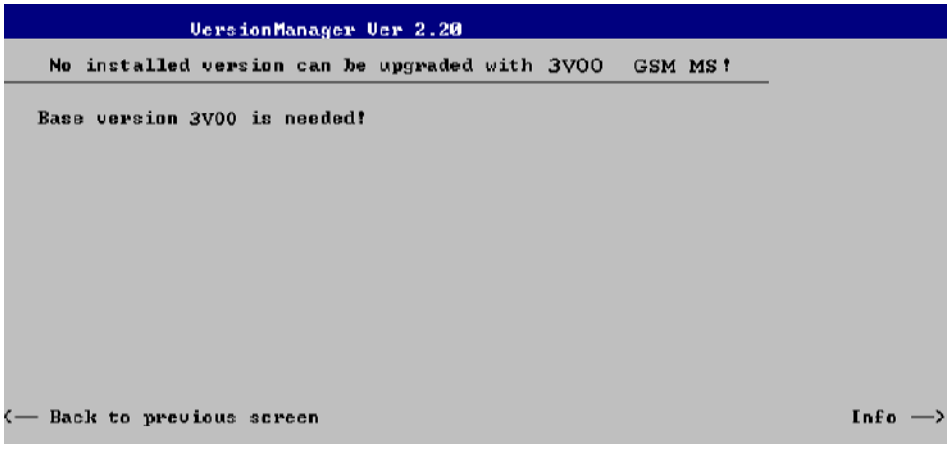
- If you wish to install or upgrade other software versions, press left softkey no 4 or 5 *(Install next software...)* or insert new storage medium into the PCMCIA slot or floppy disk drive and press *Change disks*.
- To finish the installation, remove all disks from the drive and press *Finish installation*.

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.

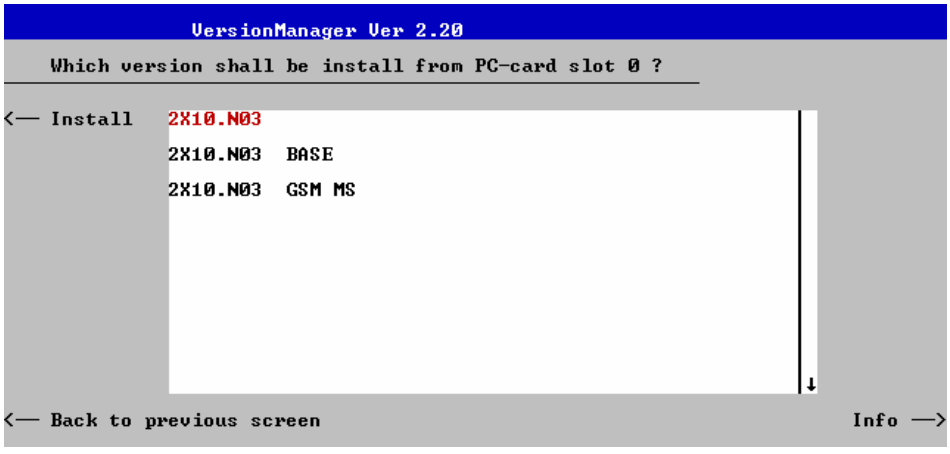
Creating a new Software Configuration

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:



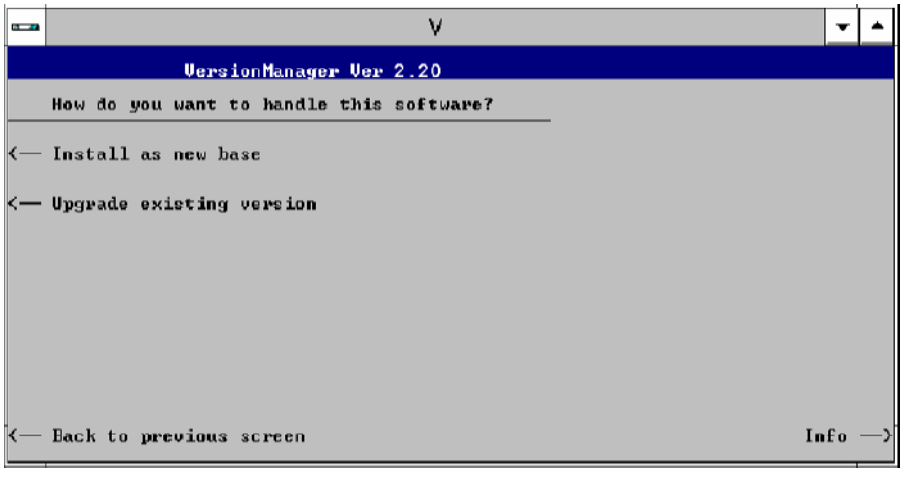
➢ Press *Back to installation* to return to the software version selection dialog.



➢ 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 3.60 to 3.69 (if available) can be run together with base system version 3.60 to 3.69 (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:

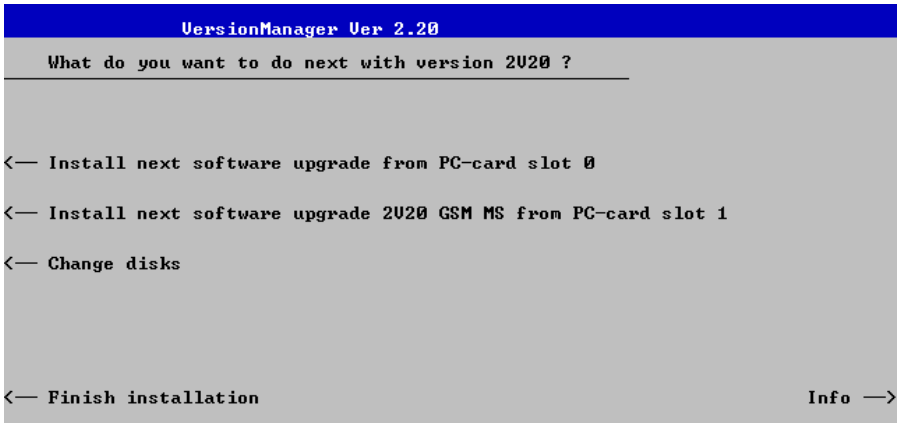


Note: *This dialog is skipped if the new base software version is not compatible with any of the existing configurations. An incompatible new base software must be installed as a new base software.*

➢ 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.*

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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.

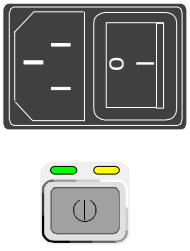
The principles of manual operation are discussed in Chapter 3. For a systematic explanation of all menus, functions and parameters refer to the reference part in Chapter 4.

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.*

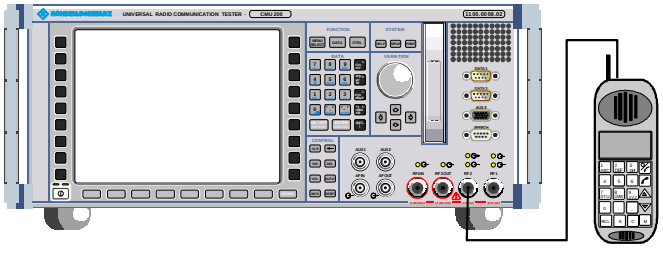
Preparing a WCDMA UE TX Test

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:

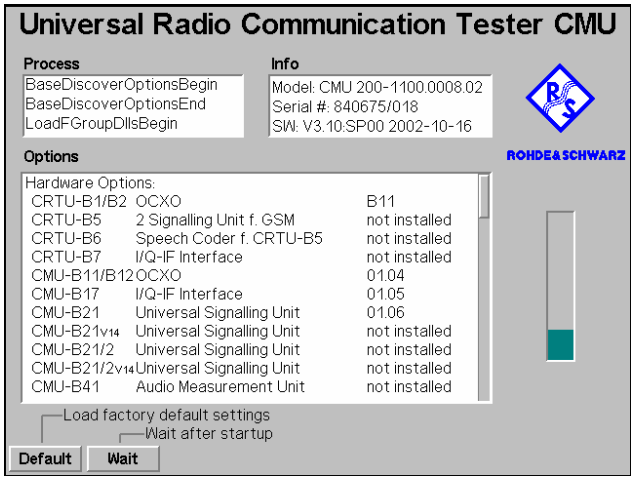
- A single QPSK-modulated signal with a chip rate of 3.84 Mcps
- An uplink WCDMA signal containing one DPCCH plus up to 6 DPDCHs, multiplexed according to 3GPP specifications.

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.*

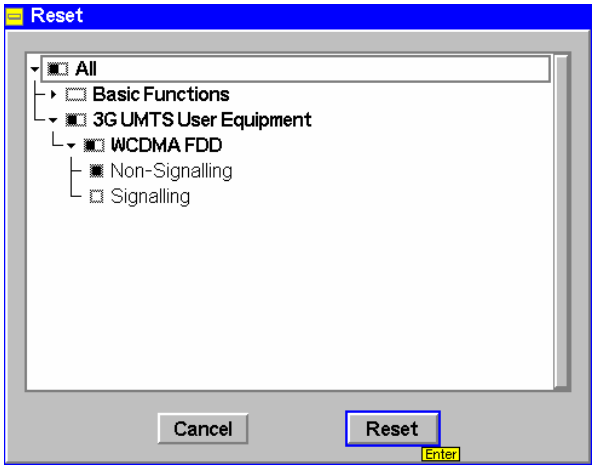


Step 3

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.

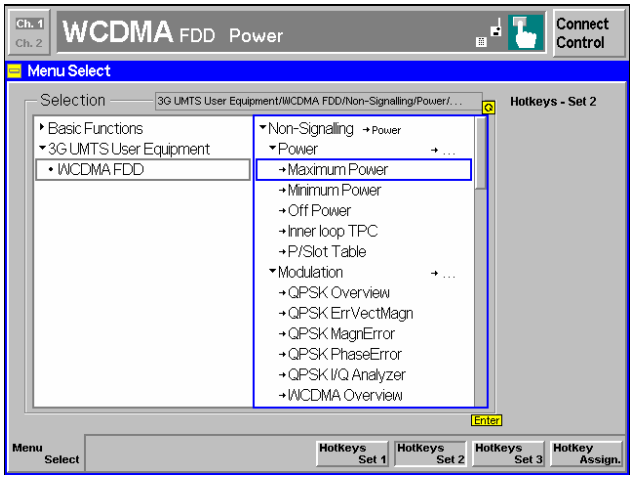


- Proceed as described in Chapter 4 of the CMU200/300 operating manual, section *Reset of Instrument Settings*, to expand the tree of function groups.
- Select the function group *WCDMA FDD Non Signalling* to be reset (the corresponding nodes must be black).
- Use the cursor keys to activate the *Reset* 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 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 is subdivided in 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

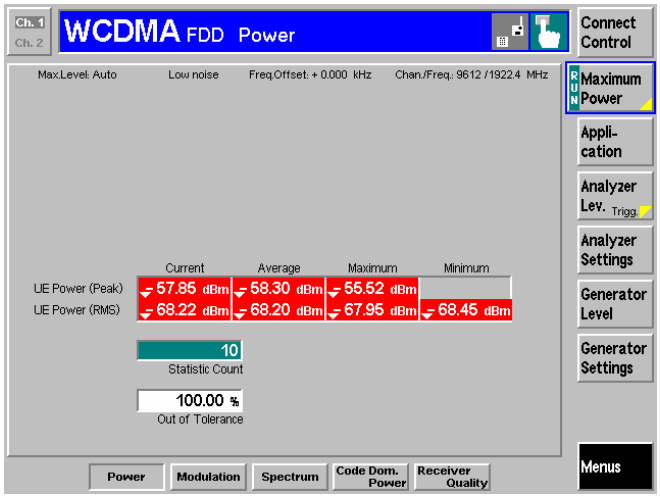
For an overview of the menu structure of the WCDMA UE function groups see Chapter 3 of the present manual.

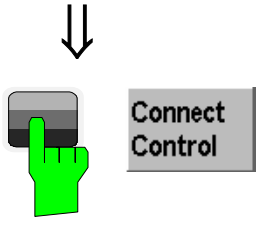
Non Signalling Measurements

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 the *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.





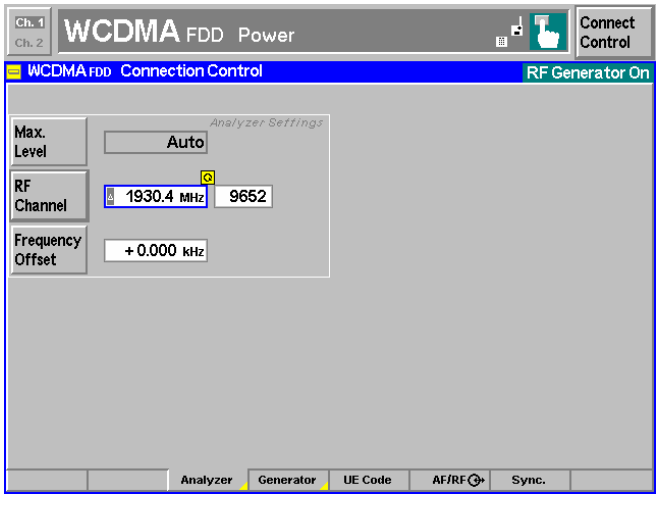
Step 1

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

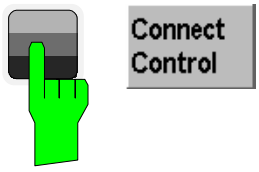
To facilitate and speed up the operation, many CMU settings are accessible from different menus. The RF analyzer settings can be accessed via the *Analyzer Level* and *Analyzer Settings* softkeys in the *Power* measurement menu as well.

☞ Chapter 4

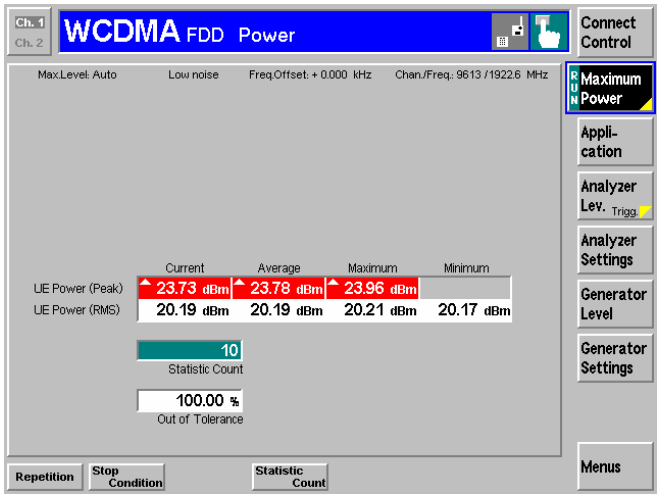
The RF *Max. Level* can also be set in all measurement menus (softkey *Analyzer Level*, hotkey *Max. Level)*.

☞ 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.



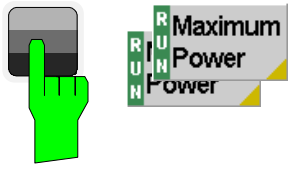
Step 3

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.

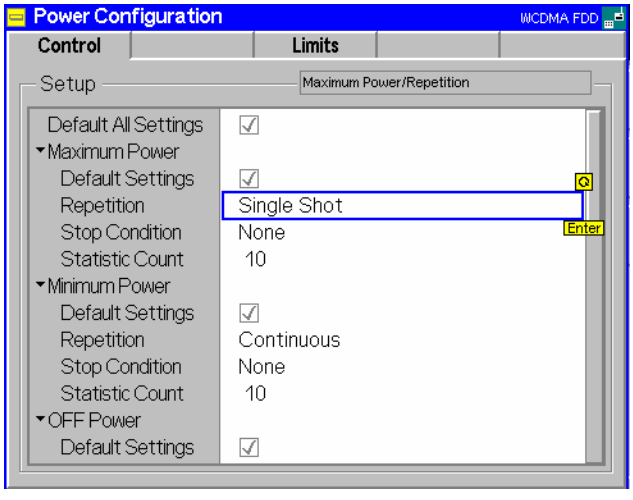
The analyzer settings from the *Connection Control* menu are displayed in a parameter line above the diagram. The *Maximum Power* softkey indicates the measurement state *RUN.* ①

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 *Single Shot* in the *Repetition* table line of the *Maximum Power* section.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

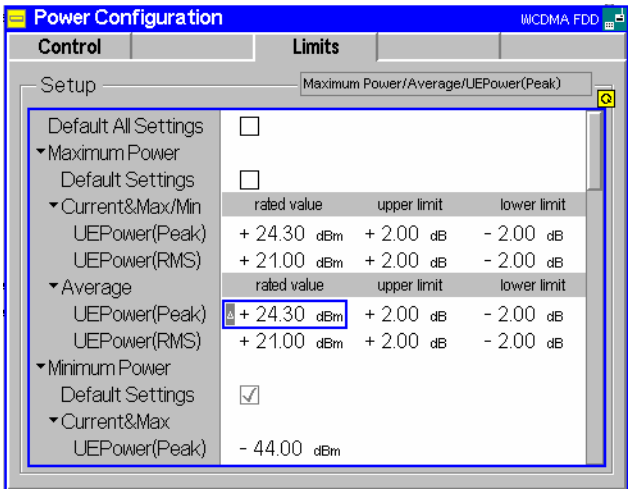
- Continued until it is explicitly stopped by the operator *(Continuous)*
- Stopped after one statistic count *(Single Shot)*

By default, a statistic count comprises 10 basis 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.

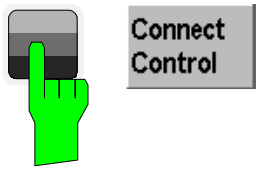
This is suitable if the limit check represents the main purpose of the measurement.



Step 5

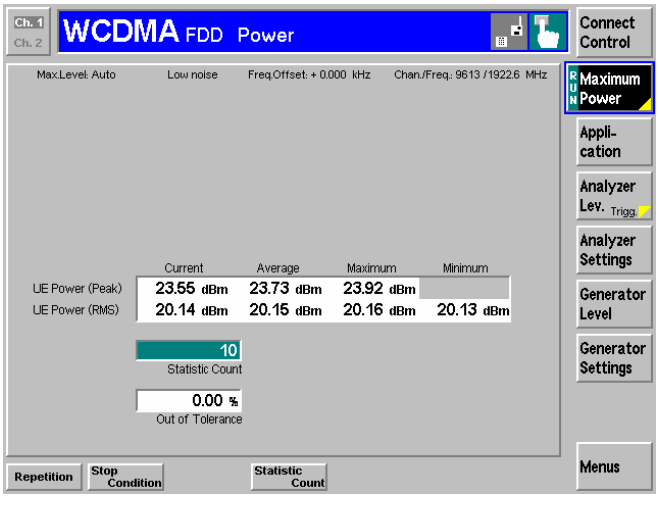
The *Limits* tab of the *Power Configuration* menu defines the rated values and the upper and lower limits for the peak and RMS power measured. ①

- 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
- Press the *ESCAPE* key to close the *Power Configuration* menu and return to the main menu.



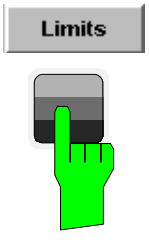
Step 6

- 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.



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

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

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.

☞ Chapter 4

③ Measurement in the HLT 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). 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.

☞ CMU200 manual

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

Out-of-tolerance power measurements

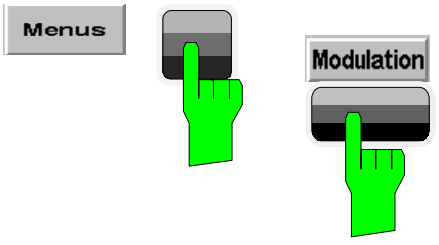
If a power measurement is out of tolerance, please first ensure that the attenuation of any cables and/or antenna couplers used is being taken into account by the CMU. As the power levels must be within a 4 dB range around the rated value, even a small attenuation can result in an out-of-tolerance measurement.

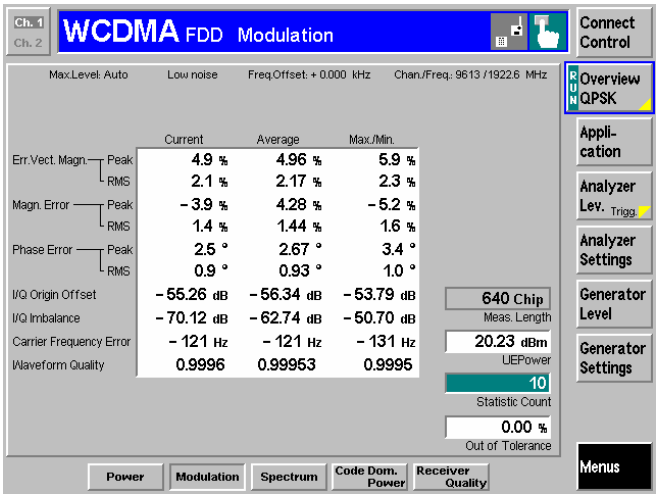
External attenuation values for each input may be entered in the *RF* ⊶ tab of the *Connect. Control* menu.

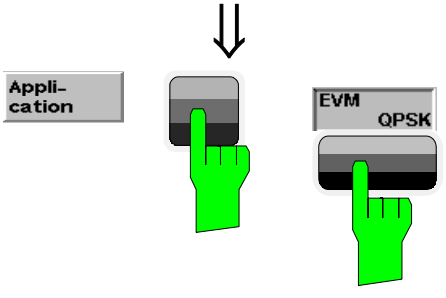
The cables, RF connections and antenna couplers must also be in good condition for satisfactory measurements. Dirty or broken RF connections can cause problems at the high frequencies used by WCDMA networks.

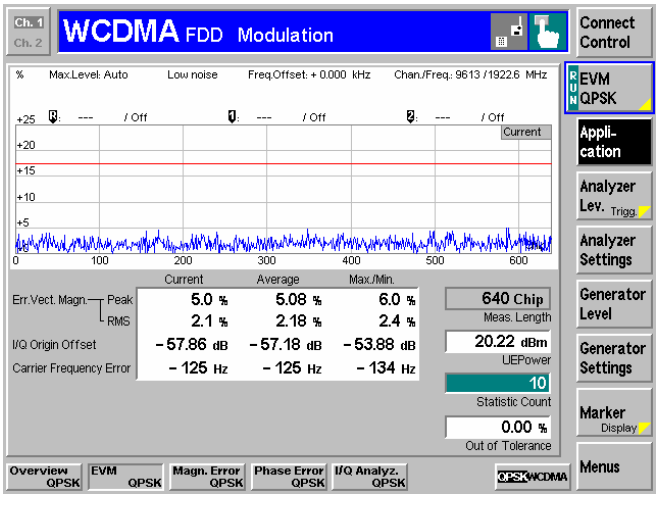
Modulation Measurements

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.

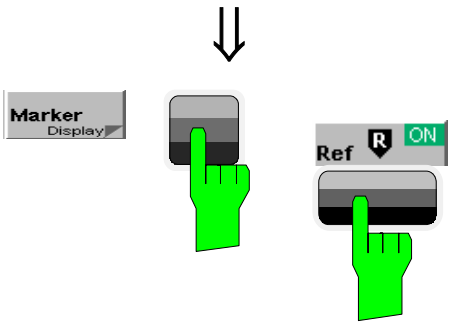
If the *Overview QPSK* measurement fails, make sure that your signal configuration is QPSK-like. A composite signal with a DPCCH plus more than one DPDCH will result in wrong results

☞ Chapter 5 of CMU200 manual

☞ Chapter 4.

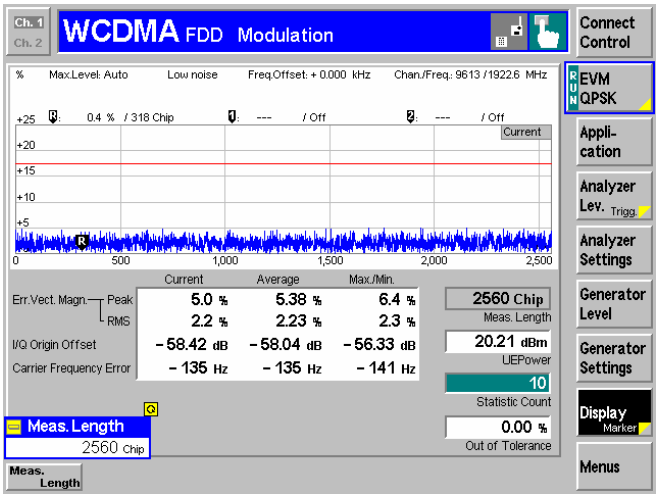
The principle of *Modulation* measurements and the measured quantities are explained at the beginning of section *Modulation Measurements.*

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

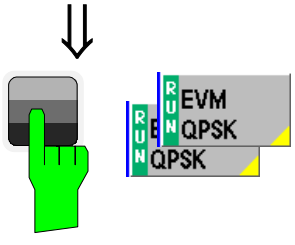


➢ Press the *Marker/Display* softkey again.

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

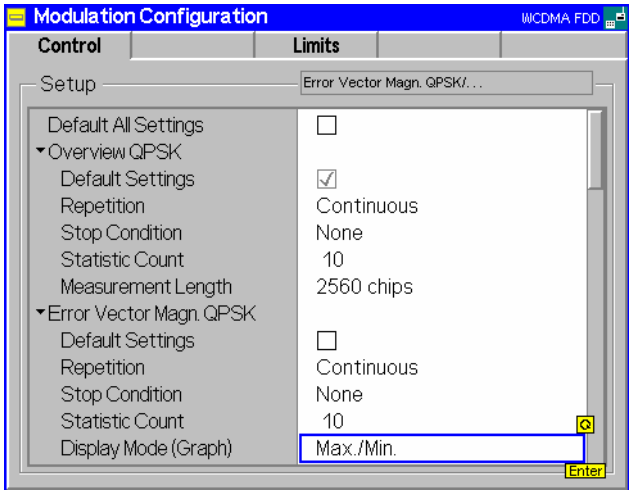
➢ Press the *Meas. Length* hotkey and change the diagram scale to 2560 bits (1 slot).

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.

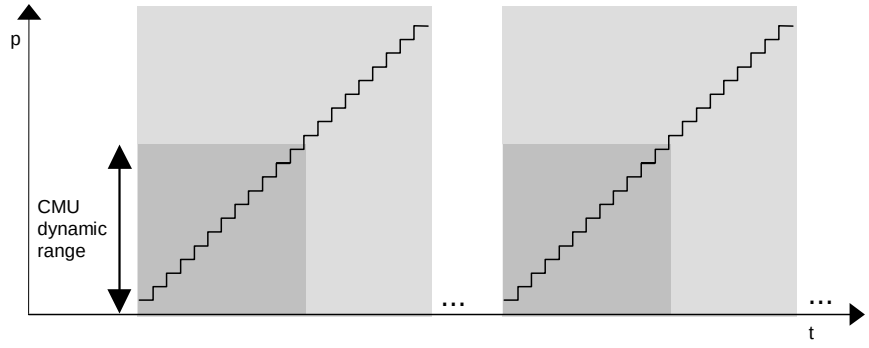
The operating principle of the other TX measurements *(Spectrum, Code Domain Power)* is analogous to the *Power* and *Modulation* measurements. For detailed information on all functions refer to Chapter 4 of this manual.

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.

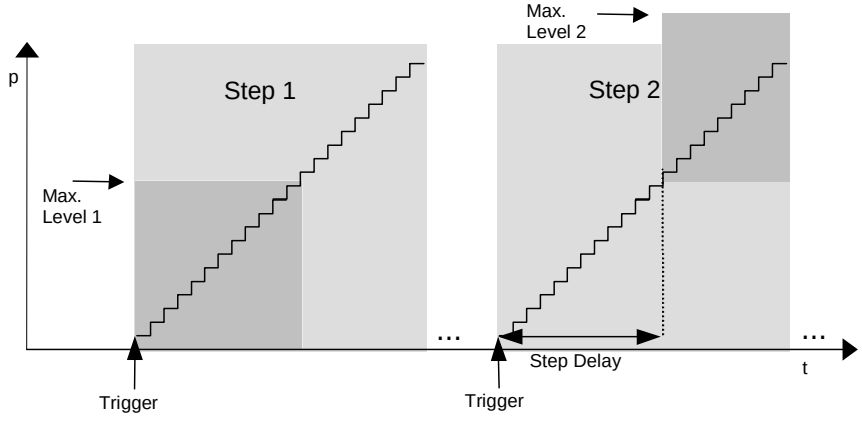
Measurement task

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)* on p. 4.163 ff.
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)* on p. 4.127 ff.).

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 1 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 *BS Signal* 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 8-2 below. A schematic test setup is shown in Fig. 8-1 below.

Table 8-2 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

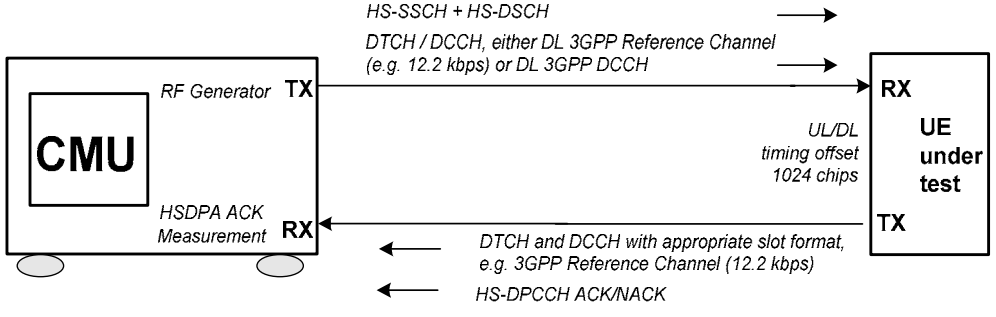


Fig. 8-1 Test setup for HSDPA ACK tests

2b. UE configuration with 3GPP DCCH

UE receiver settings

1. In the *3GPP DL DCCH Channel* section of the *BS Signal* 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. 8-1 above.

Table 8-3 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. If the title bar of the *Connection* tab does not show *Signal Off,* press the *Signal Off* softkey.
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. Return to the *Connection (Signal Off)* tab and 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.

6. 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.

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

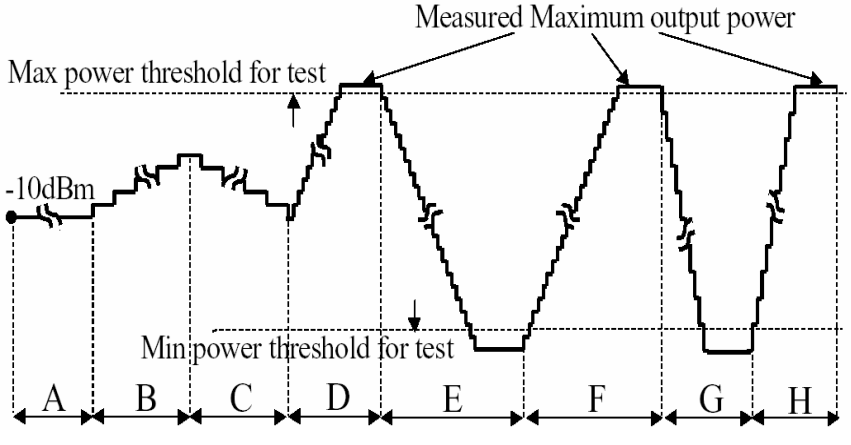
- Use *UE Signal – Openloop Power Ctrl* to define the initial power of the UE at random access (first preamble power, see p. 4.166 of the operating manual).
- Use *On/Off Time Mask – Random Access Set – Step Size* to specify the power step between two consecutive preambles.
- To select a different sequence 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 setups to account for the requirements of the conformance test specification 3GPP TS 34.121. 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 proceed as follows:

Start Conditions

1. Reset the instrument and set up a call to the UE, allocating a 3GPP Reference Measurement Channel (**Dedicated Channel: 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.*

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.

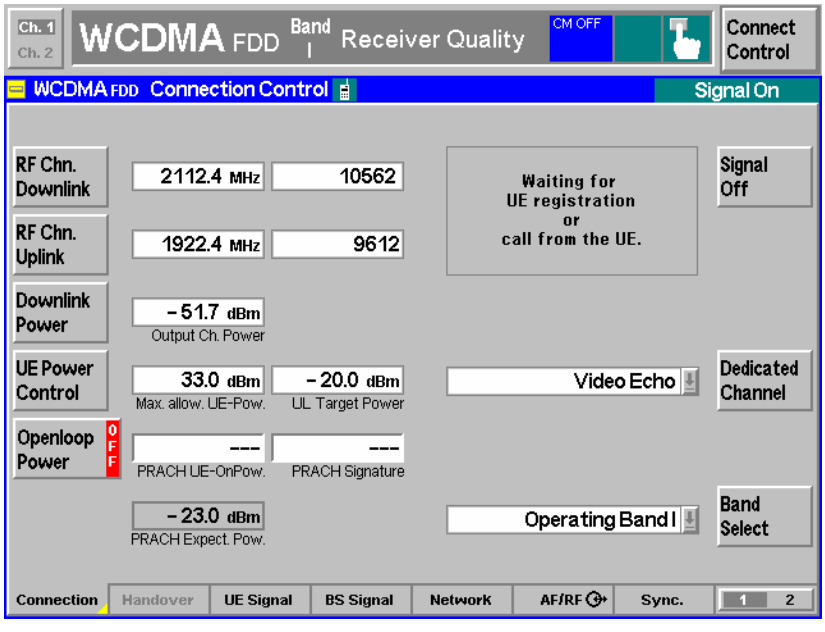


Fig. 4-2 Video echo call selection

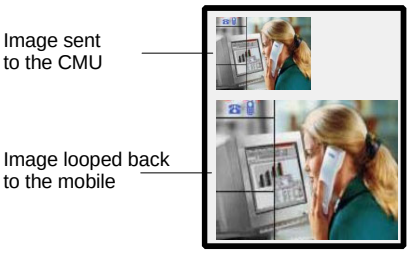
Video tests

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.

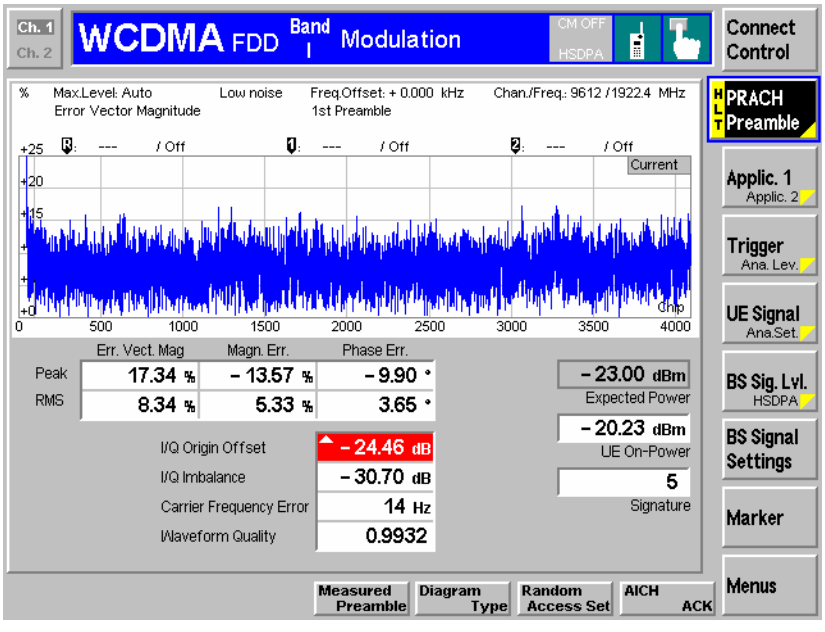
PRACH Preamble Quality Measurement

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.

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



4. Reset the *Signalling* function group. Close the *Connection Control* menu, if it is opened automatically.
5. In the *Modulation* menu, press *Trigger/Ana. Level – Trigger Source* and select *Auto* (see section *Extended Trigger Settings* in Chapter 4).
6. 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.

7. 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.

8. 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 4** and **Table 5** below.

Table 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)**
$\hat{I}_{or}$	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 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

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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 f.

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 f.

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 f.

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

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. 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.

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 *Phase Discontinuity* Change in phase between any two adjacent timeslots.	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 *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.
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 in the code domain channels (*DCP/Code Auto* or *DCP/Code Rho Auto* representation) or in 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. **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. 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.	**Code Domain Power** Measurement of the code domain power or of the rho factor in the code domain channels (*DCP/Code Auto* or *DCP/Code Rho Auto* representation) or in 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. **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 and a limit check are provided in addition. 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.

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 60 consecutive HS-DPCCH subframes (12 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 60 consecutive HS-DPCCH subframes (12 WCDMA frames). Application *RLC BLER* (with option R&S CMU-K96) 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*.

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.

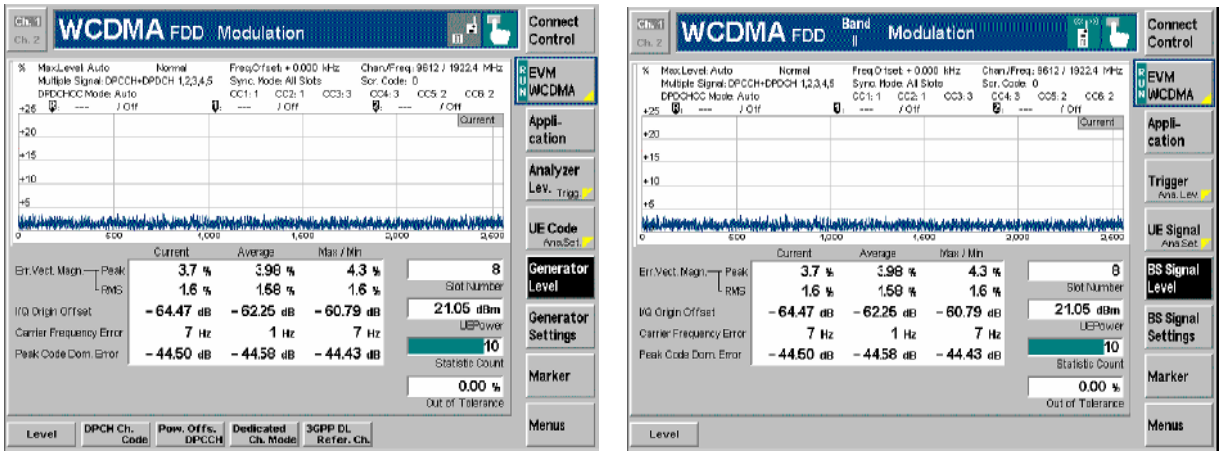

Fig. 4-1 Comparison of Non Signalling and Signalling measurement menu

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	–

Measurement	**Behavior in Signalling mode (if different from Non Signalling mode)**
Inner Loop TPC	No need to adjust the *TPC Mode* 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 Overview WCDMA EVM WCDMA Phase Error WCDMA Magn. Error 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.
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. ***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. Not available in *Non Signalling* mode.

[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.

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

$$Avg(n) = \frac{c-1}{c} Avg(n-1) + \frac{1}{c} Curr(n) \qquad (n > c)$$ (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:

$$Avg(n)_{RMS} = \sqrt{\frac{n-1}{n} \left| Avg(n-1)_{RMS} \right|^2 + \frac{1}{n} \left| Curr(n)_{RMS} \right|^2} \quad (n = 1, \ldots, c)$$ (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 prescription:

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

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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.

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. *4.21 ff. 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 *ff.*

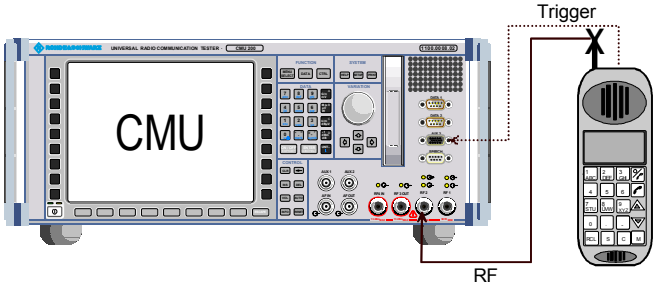
Important Note 4: P/Slot Table

The P/Slot Table measurement requires an external trigger with a correct timing; see Fig. 4-10 on p. 4.29*. 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



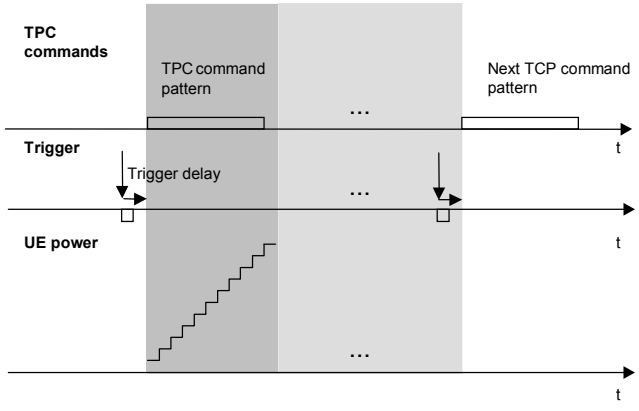
The UE receives a TPC command pattern (to be set internally or by external means) and is stimulated to perform power steps, obeying the rules described below. The CMU test settings are set to comply with the expected RF signal from the UE *(TPC command pattern, TPC Mode, Step Size).*

- 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).

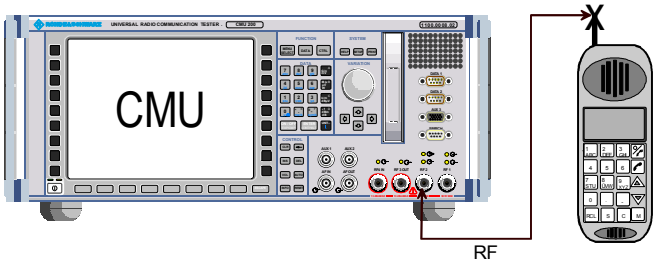


An external trigger can be set as follows:

- 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. 4.163 ff.

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. 4.163 ff. 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).*

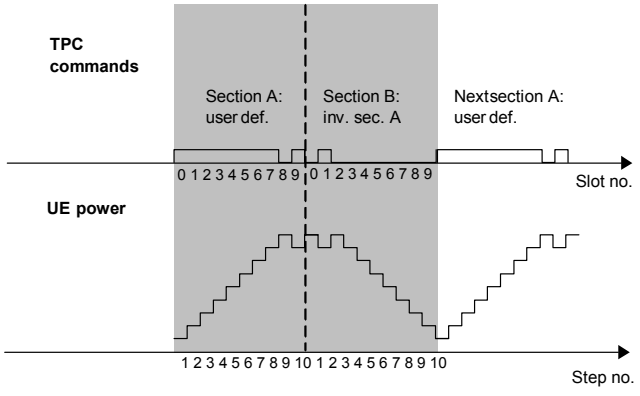
- Use of *TPC Mode = Off* at the CMU is possible but typically used in test scenario 1 where no TPC command pattern is transferred.
- *TPC Mode = Algorithm 1* or *Algorithm 2* is set at the CMU and at the UE. In contrast to scenario 1, no external trigger is required.

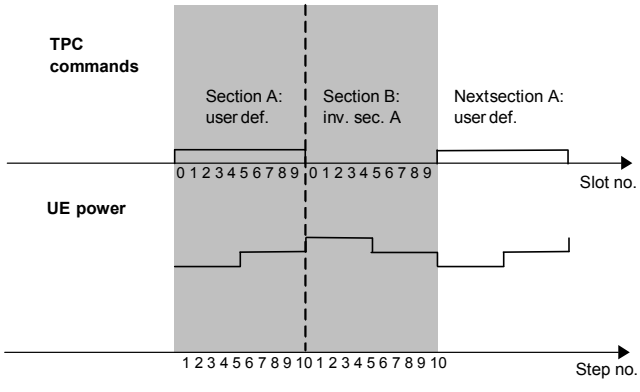
Note: *In the* Inner Loop TPC *measurement with internal trigger, the timing is exclusively determined by the TPC trigger time and the trigger delay parameters* (Slot Delay + Delay Offset). *In contrast to other measurements the CMU does not perform a correlation analysis to exactly pin down the beginning of the UL slot (see Fig. 4-66 on p. 4.154). 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. 4-9 on p. 4.28).*

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 4-19 on p. 4.146) 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).

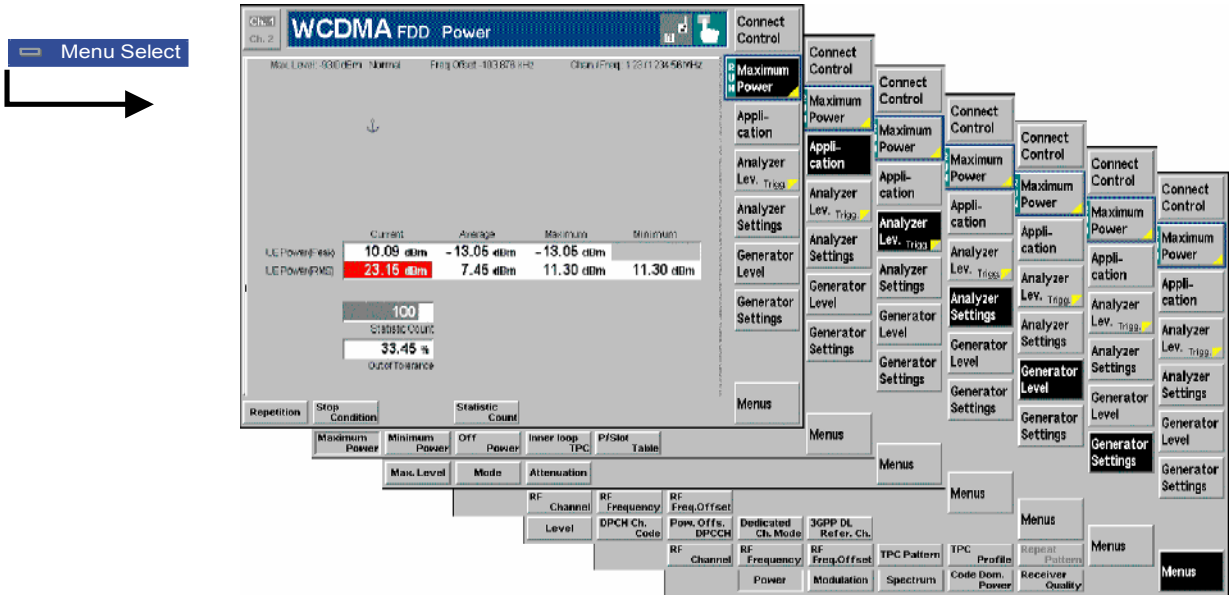


Fig. 4-1 Measurement menu Power

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 4.21 ff. 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 4.21). 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 4.21 ff.). 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. 4.21 ff.).

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. *4.122* ff.; the trigger settings in section *Trigger (Connection Control – Trigger)* on p. *4.163* ff.

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. 4.122 ff.

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 4.51 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. 4.151 ff. 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) contributing to the RF generator signal. The generator settings are described in more detail in section *Generator Settings (Connection Control – Generator)* on p. 4.127 ff.

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. 4.127 ff. *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. 4.21 ff.

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

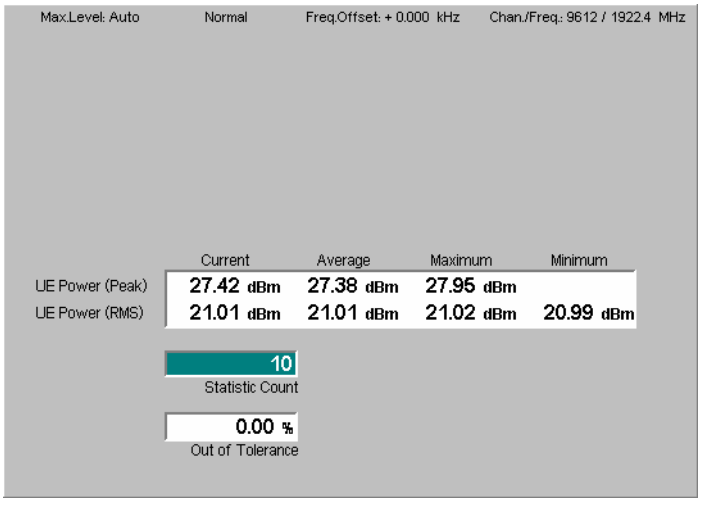


Fig. 4-2 Display of results (Maximum Power)

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. 4.8) 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. 4.21 ff. 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. 4.30 ff.

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

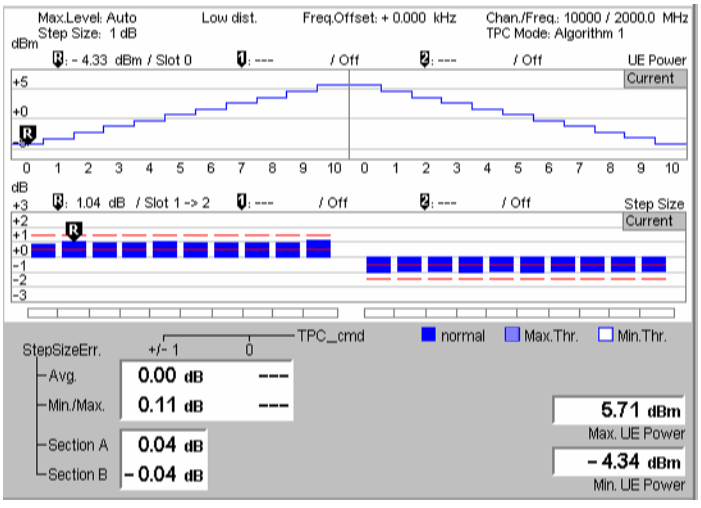


Fig. 4-3 Display of results (Inner Loop TPC)

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. 4.8) 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. 4.21 ff.):

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. 4.24). 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. 4.25, 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. 4.26) 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 ff.

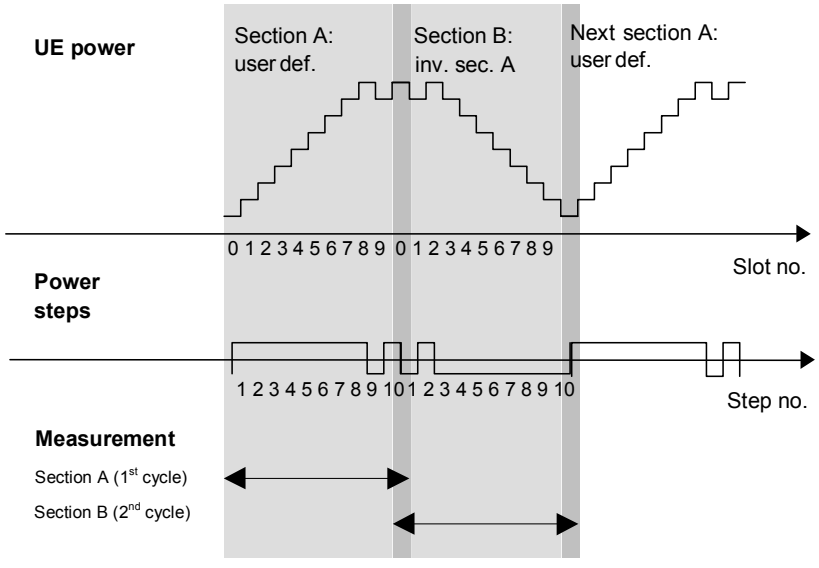


Fig. 4-4 Display of UE power and power steps

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. 4.25) is displayed in 7 or 10 consecutive slots, depending on the *Profile Length* settings (see p. 4.24). 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. 4.25). 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 ff.

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. 4.30 ff. 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. 4.25) 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. 4.25). 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. 4.21 ff.

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. 4.31. 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. 4.30 ff. 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. 4.31) 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?
```

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).

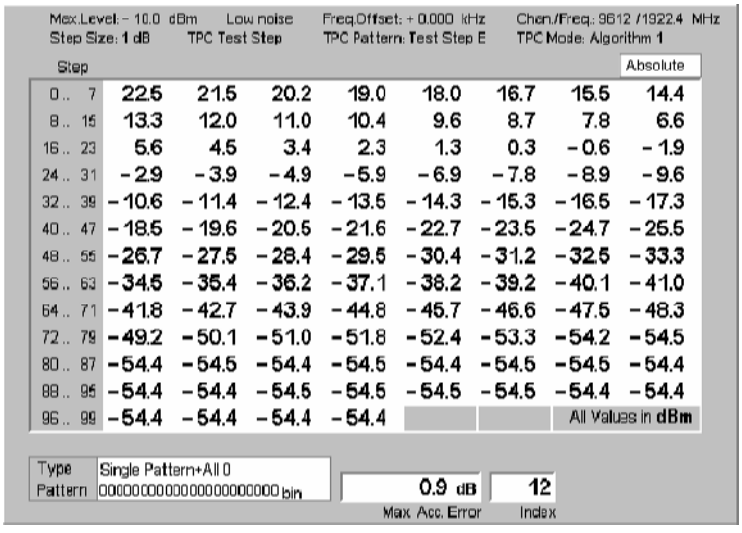


Fig. 4-5 Display of results (P/Slot Table)

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. 4.8) 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. 4.21 ff. 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. 4.21 ff.). 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. 4.29).

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. 4.27. The result in slot no. 0 is invalid if a negative trigger delay is set; see *Step Delay* parameter on p. 4.29.

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. 4-10 on p. 4.29. 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, an additional measurement mode* TPC Steps *is available. This mode makes the* P/Slot Table *measurement suitable for power ramp measurements according to the conformance test specification 3GPP TS 34.121, see measurement example in Chapter 2. The measurement mode can be activated via* P/Slot Table – Measure Mode *or in the configuration menu; see* Measure Mode *on p. 4.27.*

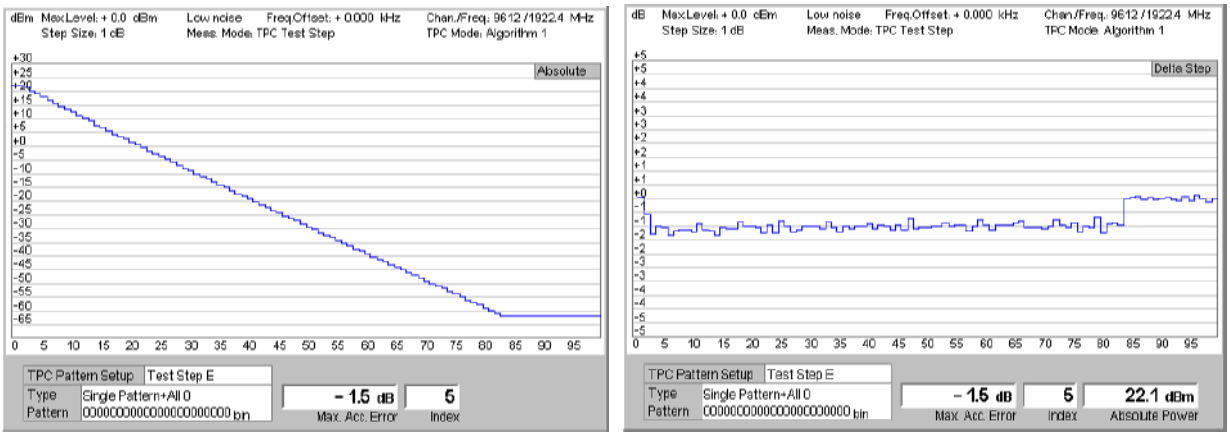
Remote control

`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. 4.30 ff.

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

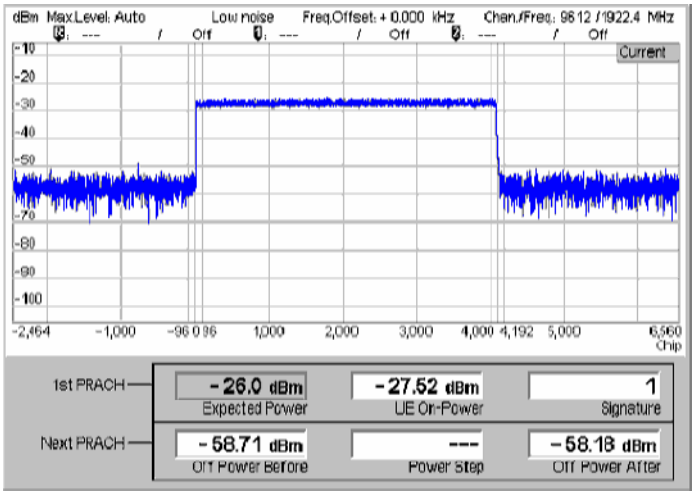


Fig. 4-6 Display of results (Inner Loop TPC)

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. 4.8) 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 n^{th} 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 n^{th} PRACH preamble
Signature	Measured signature of the n^{th} PRACH preamble

For a detailed description of the parameters above refer to section *Connection – RF Channel and Power* on p. 4.183.

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. 4-7** 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 n^{th} 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.

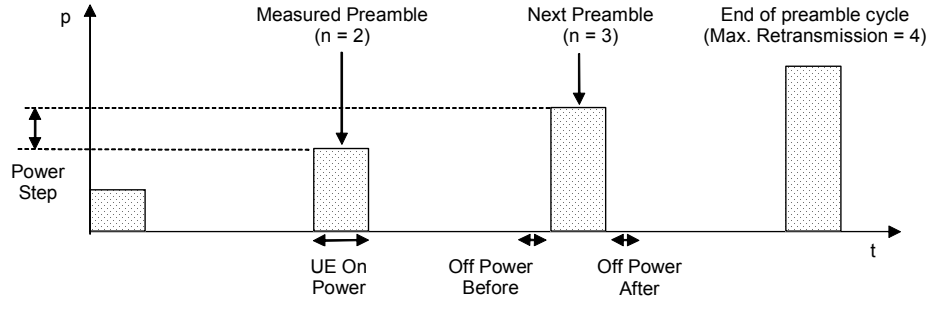


Fig. 4-7 On/Off Time Mask results

Remote control
```
READ[:SCALar]:POWer:ONOFf:CURRent?
FETCh[:SCALar]:POWer:ONOFf:CURRent?
SAMPle[:SCALar]:POWer:ONOFf:CURRent?
CALCulate[:SCALar]:POWer:ONOFf:CURRent:MATChing:LIMit?
```

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)*

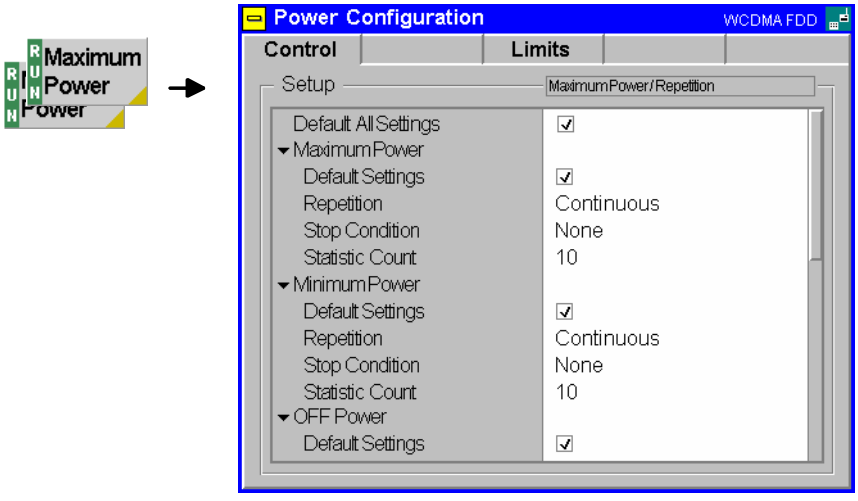


Fig. 4-8 Power Configuration – Control

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, for example 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. 4.26). 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 4-27 on p. 4.213).

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. 4.31 and in Table 4-5 on p. 4.31.*

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 ff.).

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. 4.31.

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. 4.30 ff.

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.

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. 4.26). 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 ff.

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 ff.

The sequence of TPC commands for *Algorithm 1* and *Algorithm 2* is defined in the *Step Control* section; see p. 4.26. 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..*

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 ff.

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. 4.24) *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 ff. 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 4-19* on p. *4.146*). 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

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.*

[1] Algorithm 2 is compatible with a 7-slot profile length if no power steps occur over the whole measurement length.

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 Steps Special test mode for power ramp measurements according to the conformance test specification 3GPP TS 34.121. *TPC Test Steps* is available in *Signalling* test mode only. 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.

Remote Control
`CONFigure:POWer:XSLot: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).

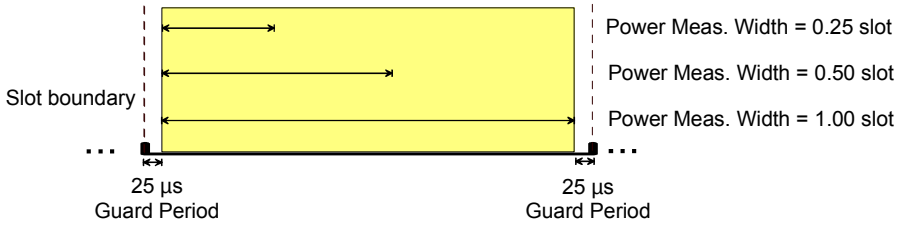


Fig. 4-9 Power measurement width

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. 4.163).

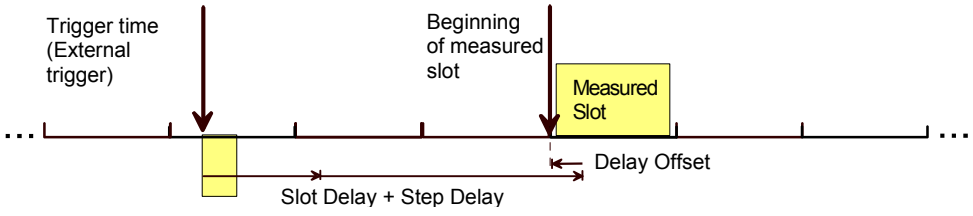


Fig. 4-10 Trigger delay and step delay for P/Slot Table measurement

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. 4-9*) 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. 4-66 on p. 4.154). 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. 4-9 on p. 4.28).*

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.

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

Step Size / dB	Max. Power Step Error after 7 Steps / dB	Max. Power Step Error after 10 Steps / dB	TPC_cmd Values	CMU Settings
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

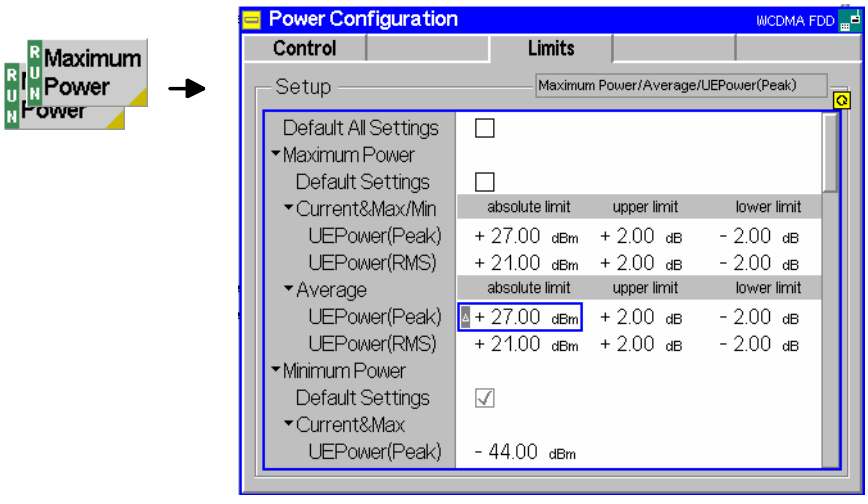


Fig. 4-11 Power Configuration – Limits

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 ff.)

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. 4.30.

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.

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
```

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.*

PRACH PowStep Maximum deviation of the measured *Power Step* (i.e. the difference between the average power of the $(n + 1)^{st}$ and the n^{th} 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. 4-14 on p. 4.39) 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. 4.41 ff.).
- 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. 4.51 ff.).

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. 4.61). 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. 4.59). This application is available in *Signalling* mode only.

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.

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 *12 below*. The modulation parameters of the conformance specification are

[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).

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 provides the not only 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 *12 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. 4-13* on page 4.37 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. 4-13* on page 4.37 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 E 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. 4-14* on p. 4.39 and *Fig. 4-15* on p. 4.40), 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. 4.90 ff.) and the varied reference signal R'.

3. **Calculate the EVM, Phase Error and Magnitude Error as a function of time**

   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:

   | *E* | = | *Z – R'* | Magnitude of the error vector, calculated at each sample in the measurement interval.

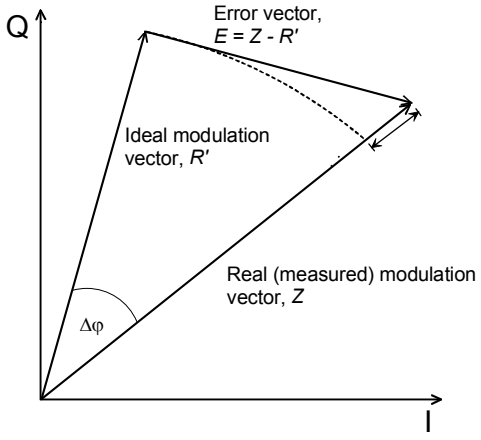


Fig. 4-12 Modulation errors in the I/Q vector diagram

$\Delta\varphi$	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:

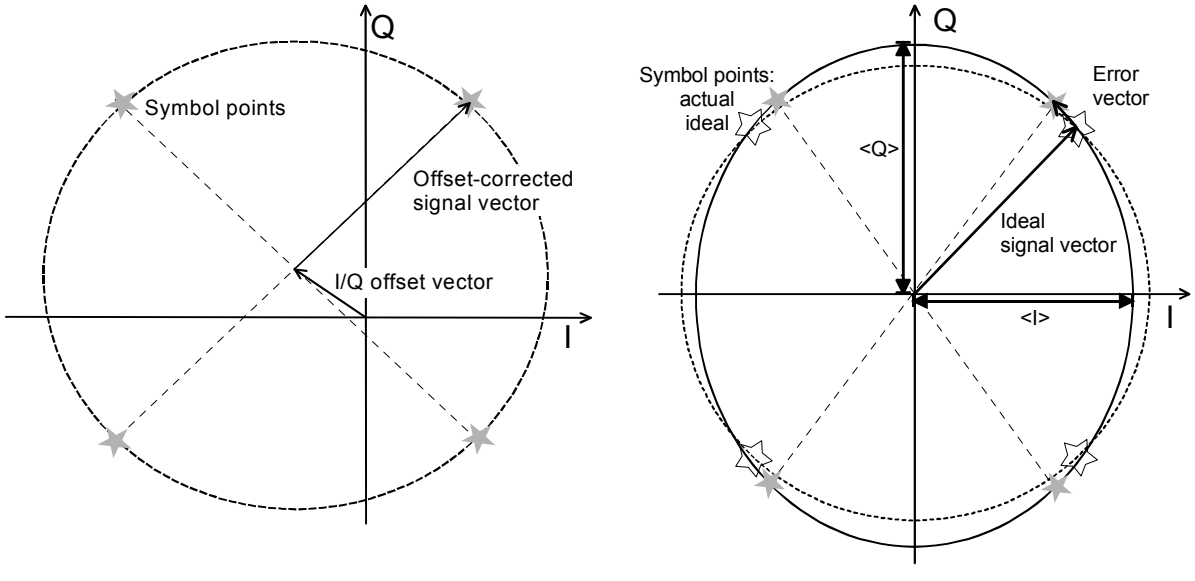


Fig. 4-13 Modulation errors in the I/Q constellation diagram

Origin offset

Fig. 4-13 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*, $|\text{Offset - corrected signal vector}|_{RMS}$ 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. 4.123 ff.), 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. 4-18* 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. 4-18* 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 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:

$$\text{I/Q Imbalance} = 20\log\frac{|<I> - <Q>|}{|<I> + <Q>|} \quad \text{(Equation 4-2).}$$

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 k^{th} sample of the ideal signal, Z_k is the k^{th} 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. 4-14* below.

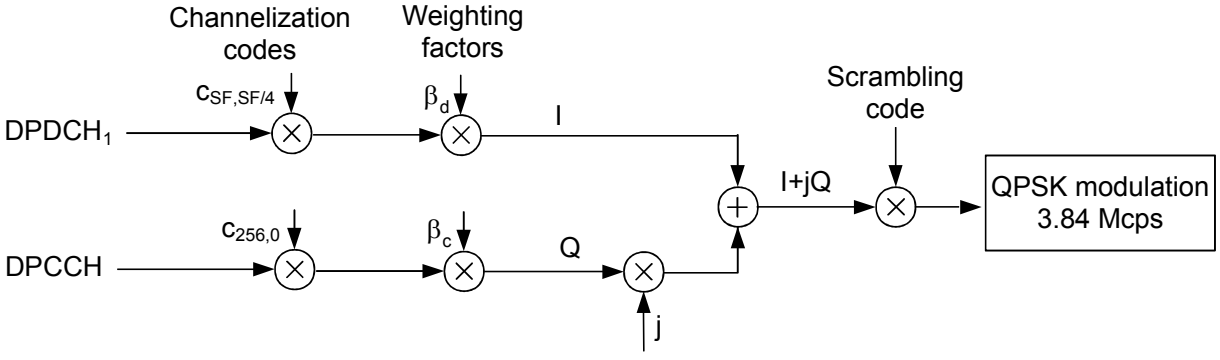


Fig. 4-14 Uplink WCDMA signal with up to 1 data channel

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. 4-14,* 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. 4-15* below.

The CMU is able to analyze standard WCDMA signals with an arbitrary number of DPDCHs and arbitrary channelization codes.

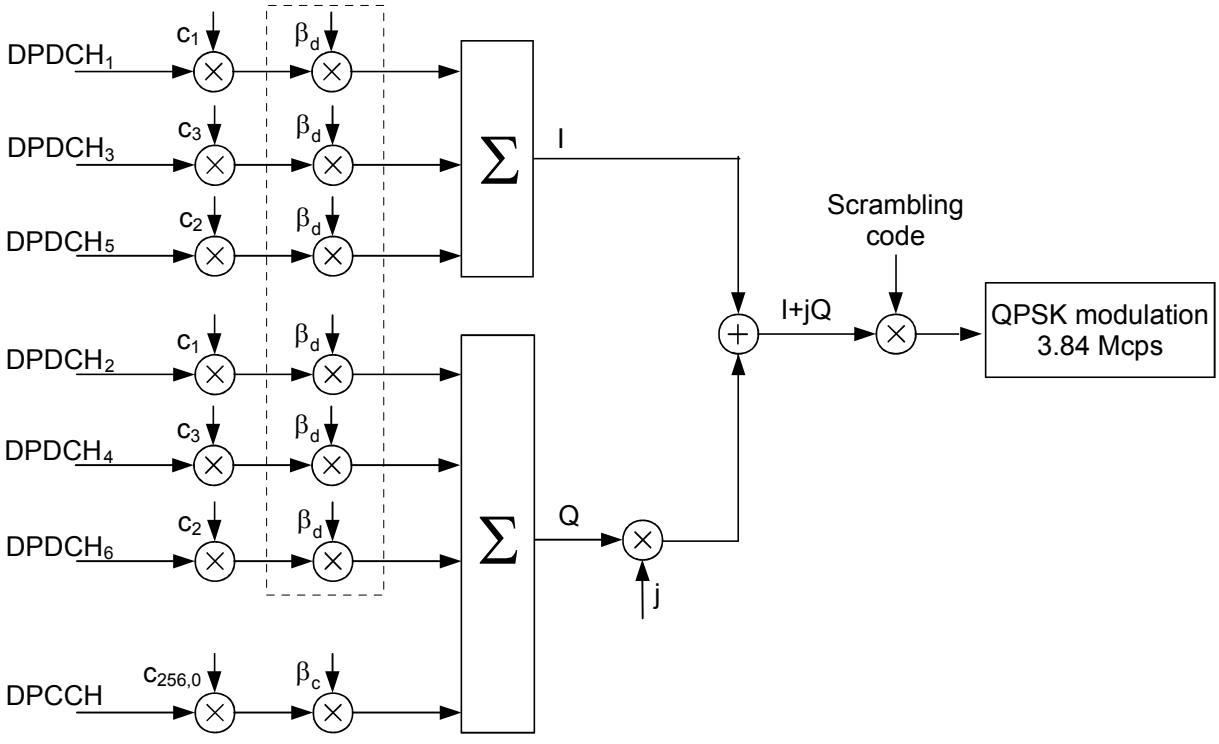


Fig. 4-15 Uplink WCDMA signal with up to 6 data channels

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.

QPSK Measurements (Modulation – QPSK)

If the QPSK signal configuration is selected (see *Application* softkey in section *Test Settings* on page 4.41 ff.), 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).

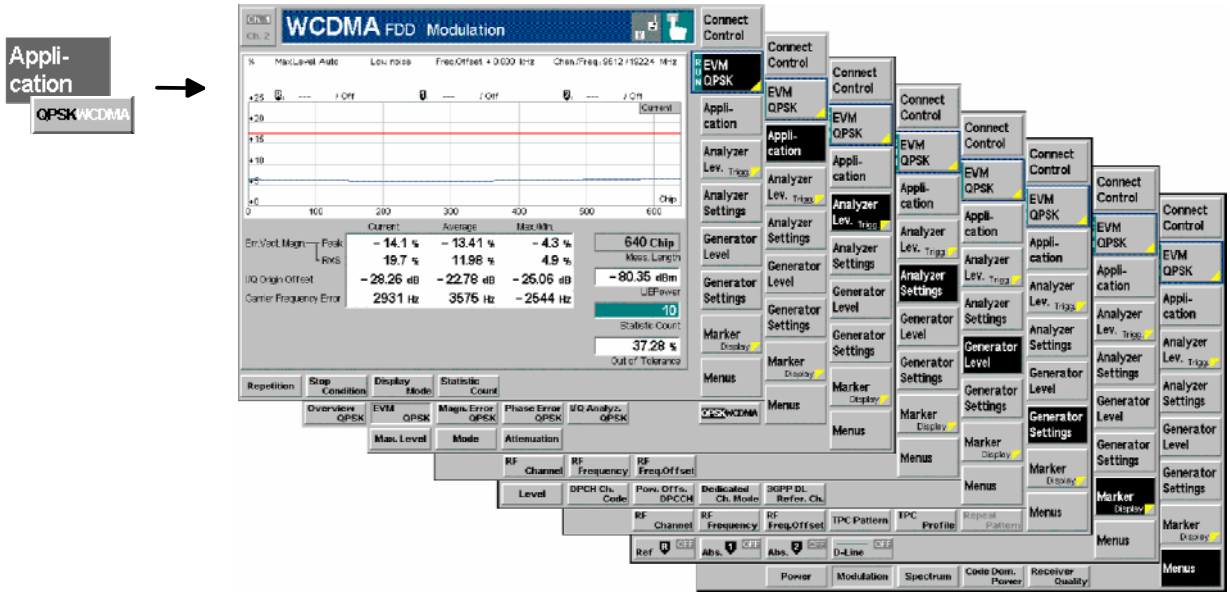


Fig. 4-16 Measurement menu Modulation – EVM QPSK

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 4.6). 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 4.61 ff.). 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 4.6); they are identical with the parameters set in the *Control t*ab of the *Modulation Configuration* menu (see page 4.61 ff.).

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. 4.61 ff.).

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 4.35.

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 4.35. 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 4.35. 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 4.35.

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 4.64 ff. 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 4.51 ff.

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 4.64 ff.

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

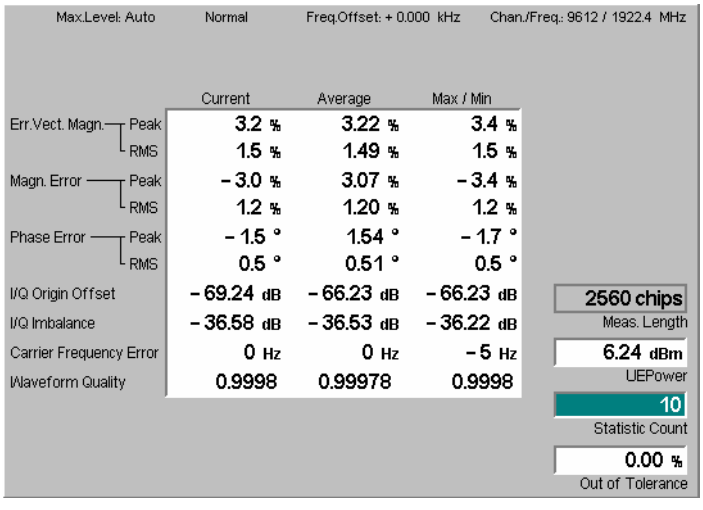


Fig. 4-17 Display of results (Modulation – Overview QPSK)

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. 4.8) 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. 4.35 ff. 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. 4.67.

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. 4.64.

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:

Parameter lines

Test diagram

Output fields and table

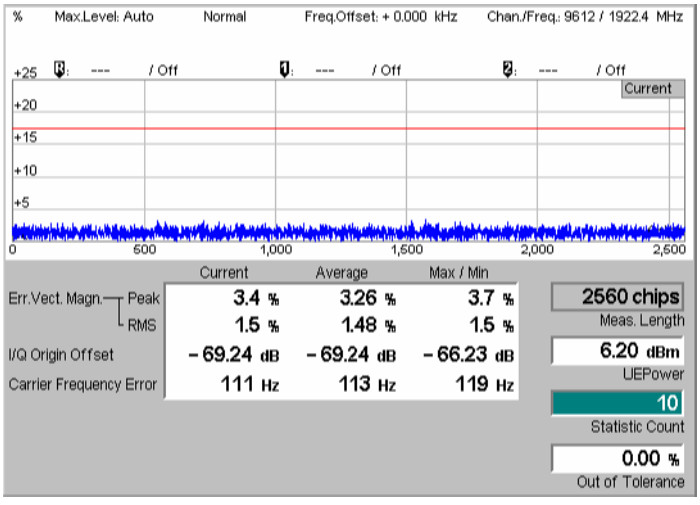


Fig. 4-18 Display of results (Modulation – EVM / Phase Error / Magn. Error QPSK)

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. 4.8) 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 4.45 ff. 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. 4.64 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. 4.67 ff.).

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 4.64 ff. 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.

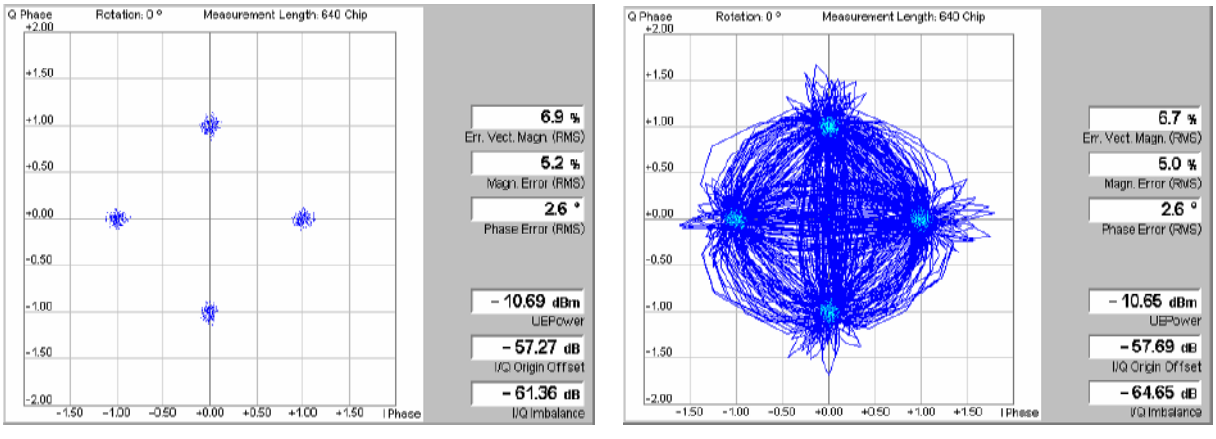


Fig. 4-19 Display of results (Modulation – I/Q Analyzer – Constellation/Vector)

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. 4.64 ff.) 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. 4.35 ff. 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. 4-12 on p. 4.37.

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. 4.64 ff.

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.

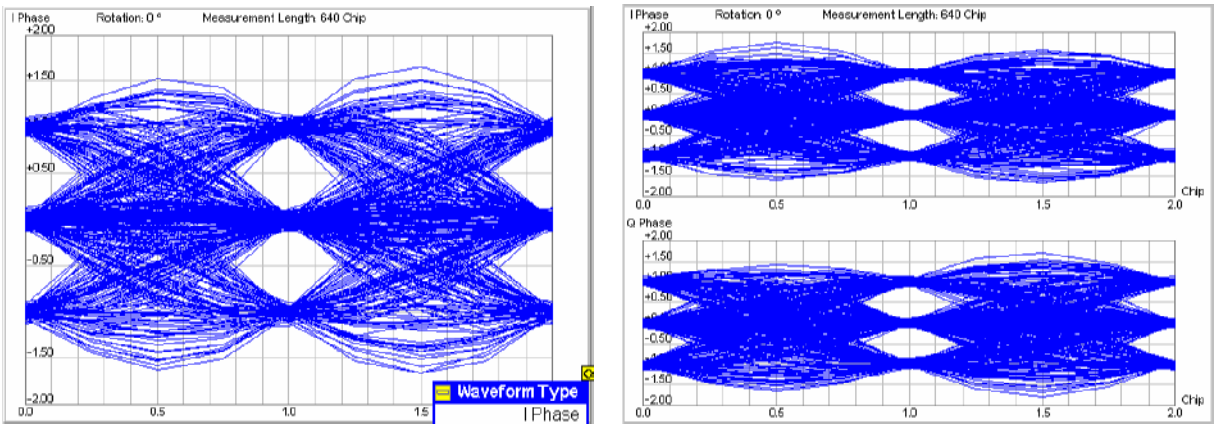


Fig. 4-20 Display of results (Modulation – I/Q Analyzer – I Phase / Q Phase)

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. 4.48 ff.

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. 4.64 ff. A rotation angle of 0° corresponds to the scenario in *Fig. 4-20* 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 4.41 ff.), 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).

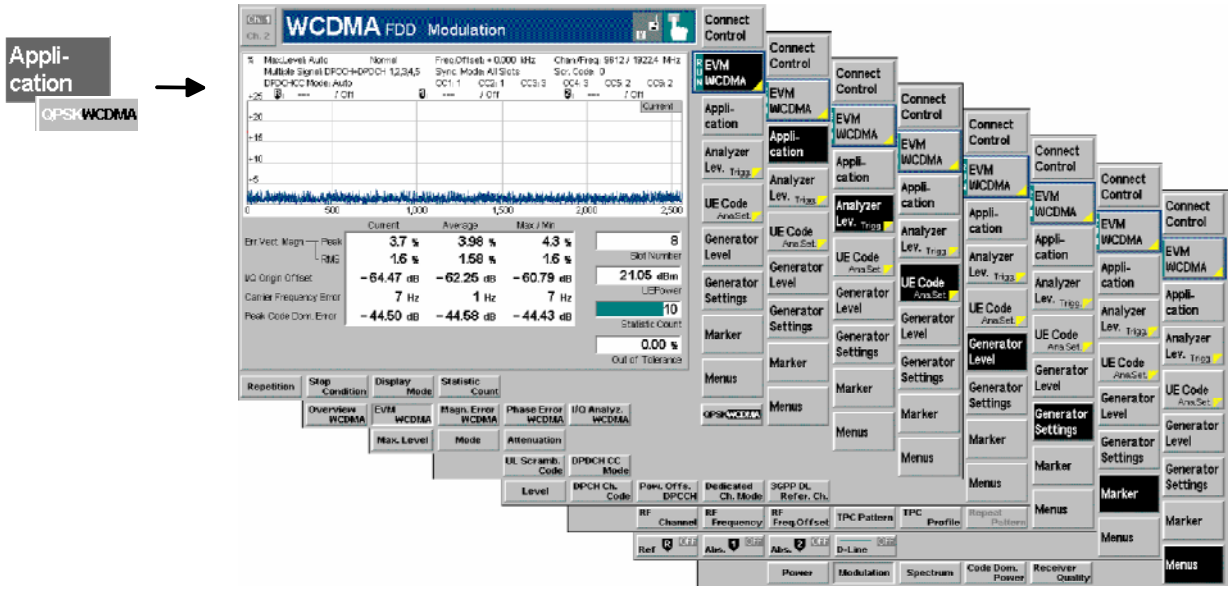


Fig. 4-21 Measurement menu Modulation – EVM WCDMA

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 4.6). 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 4.41. 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. 4.61 ff.).

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 4.35.

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 4.35. 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 4.35.

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 4.35. 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 4.64 ff.

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 4.35 ff.

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 4.51 f. Most of the *UE Code* settings are also accessible via the *UE Code* tab of the *Connection Control* menu p. 4.123 ff. 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 4.6.

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. 4-15* on p. 4.40.

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.* 4.123 ff.: 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.* 4.123 ff. 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

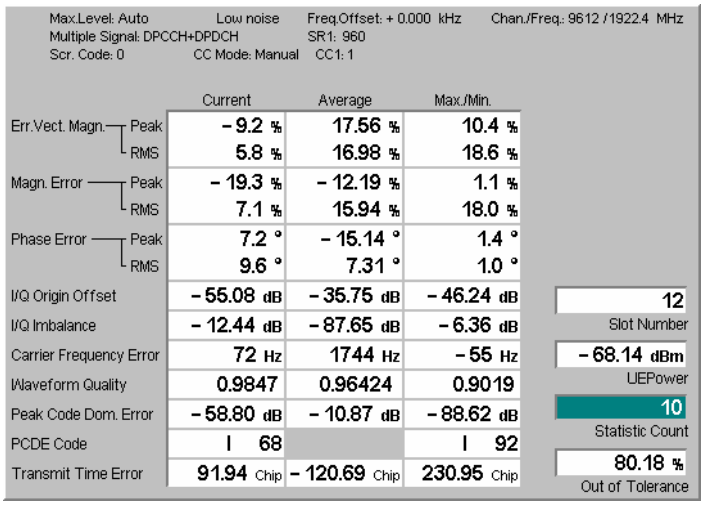


Fig. 4-22 Display of results (Modulation – Overview WCDMA)

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. 4.8) 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. 4.53) and/or the *UE Code* tab of the *Connection Control* menu; *p*. 4.123 ff.:

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. 4.35 ff. In addition to the values in the QPSK application (see section *Scalar Results (Overview)* on page 4.35 ff., 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. 4.67.

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. *4.151.*

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

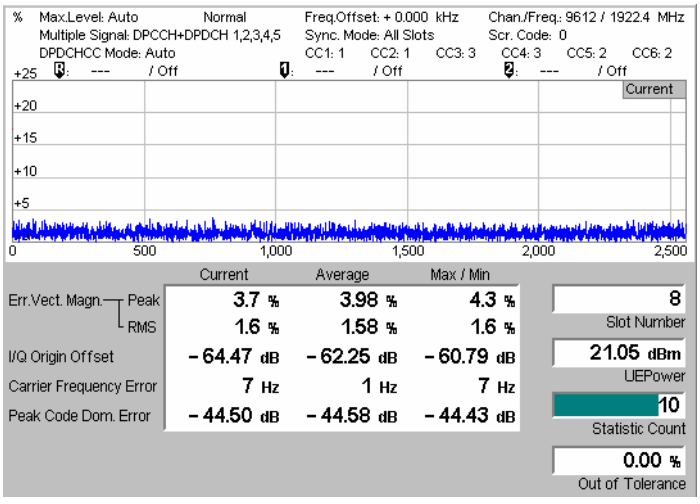


Fig. 4-23 Display of results (Modulation – EVM / Phase Error / Magn. Error WCDMA)

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 4.55 ff.

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 4.55 ff. 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 4.46 ff. The curve refers to the multiple WCDMA signal measured.

Remote control

`READ:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?` etc.

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 4.64 ff. 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.

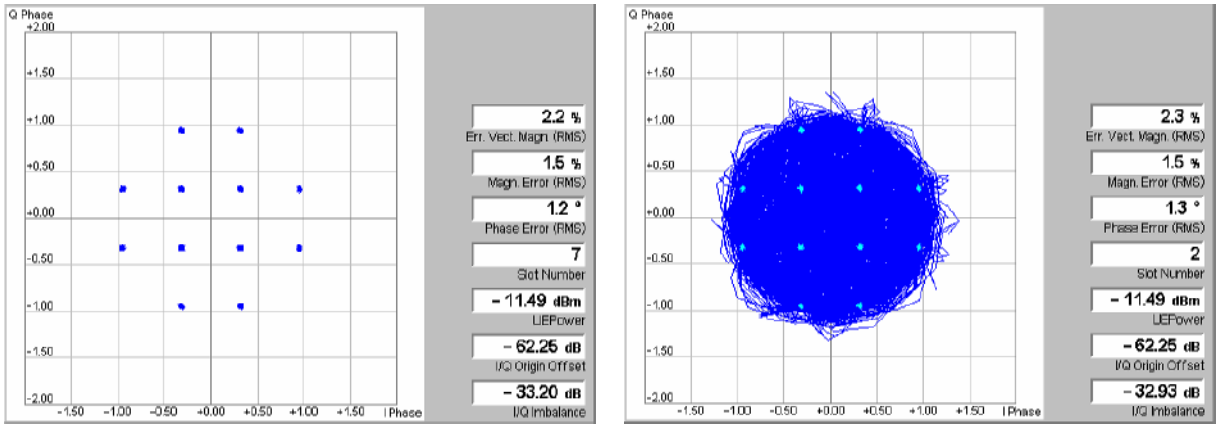


Fig. 4-24 Display of results (Modulation – I/Q Analyzer – Constellation/Vector)

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. 4.48 ff. 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. 4-24* 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.

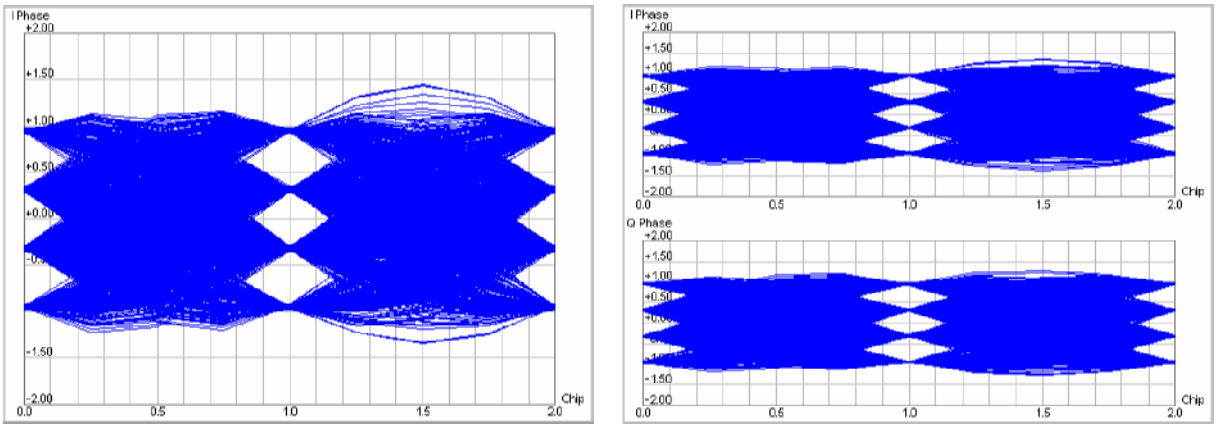


Fig. 4-25 Display of results (Modulation – I/Q Analyzer – I Phase / Q Phase)

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:

MENU SELECT →

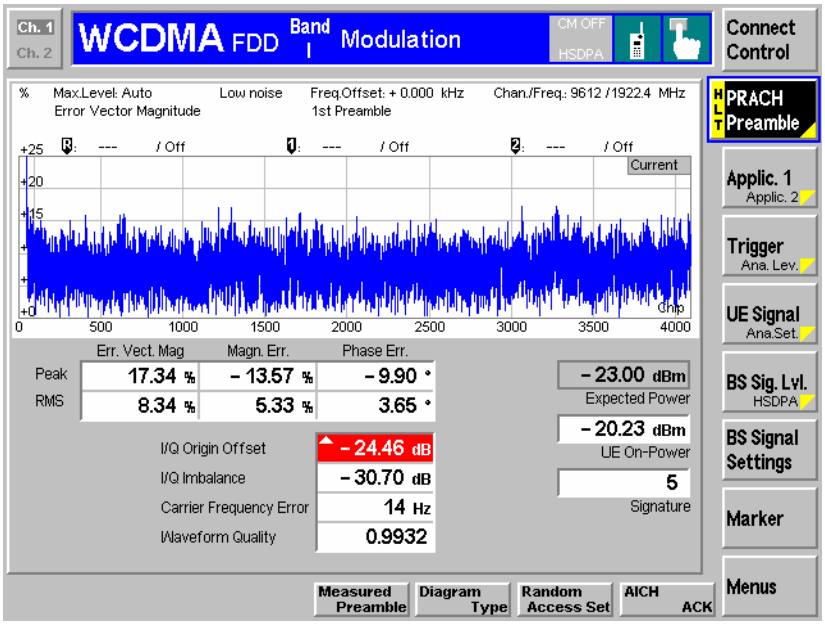


Fig. 4-26 Display of results (Modulation – PRACH Preamble Quality)

Test settings

The parameter lines show the essential test settings and the marker values. For a detailed description refer to the WCDMA UE operating manual.

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 4.64 ff.). 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 the operating manual, section *Modulation Measurements.*

The *Expected Power,* the *UE-On Power,* and the *Signature* are described in section *Connection – RF Channel and Power* on p. 4.183 ff.

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. 4.35 ff. 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:

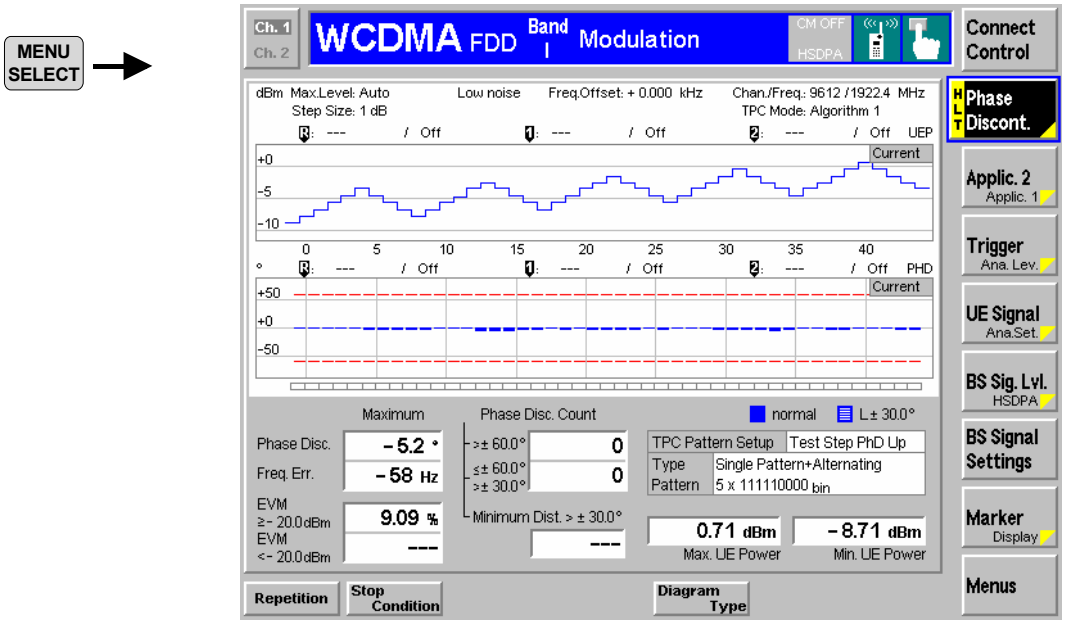


Fig. 4-27 Display of results (Modulation – Phase Discontinuity)

Test settings

The parameter lines show the essential test settings and the marker values. For a detailed description refer to the WCDMA UE operating manual.

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).*

The measured UE power is averaged as described in section *Power Measurements* on p. 4.2 ff.). 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. 4.35 ff.) 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 *Carrier Frequency Error.*
- The red limit lines in the *Error Vector Magn.* diagram represent 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. 4.67 ff.

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. 4.67 ff. 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,* for single QPSK signals only)
- 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

Besides, it influences the graphical measurement menus by adding or removing the *Grid*.

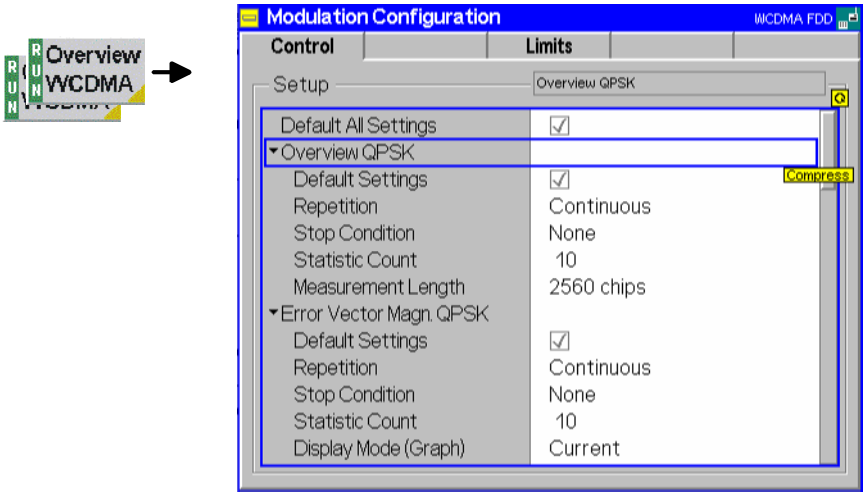


Fig. 4-28 Modulation Configuration – Control

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 4.21). 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 a time interval (number of consecutive chips) to be measured per single shot. In graphical diagrams, the *Measurement Length* is identical with the time range displayed. The following values are provided:

2560 Chips The measurement extends over the complete WCDMA slot comprising 2560 chips.

640 Chips The measurement extends over the first quarter of the WCMDA slot.

A short measurement length reduces the measurement time. The beginning of the WCDMA slot is determined by detecting the pilot bits in the DPCCH. Note that the position of the *Measurement Length* within the slot differs from the *Code Domain Power* measurement where it is influenced by the trigger settings.

Remote control
```
CONFigure:MODulation:OVERview:QPSK:CONTrol:MLENgth <No_chips>
```

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. 4.54.

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. 4.50 ff.

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. 4.48 ff.

Vector Vector diagram; see section *Representation in the I/Q Plane* on p. 4.48 ff.

I Phase Eye diagram of the I amplitude; see section *Representation of the Amplitudes vs. Time* on p. 4.50 ff.

Q Phase Eye diagram of the Q amplitude; see section *Representation of the Amplitudes vs. Time* on p. 4.50 ff.

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. 4.50 ff.

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. 4.221 ff.

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.

The Phase Discontinuity criterion only makes sense if the Static limit exceeds the Dynamic limit.

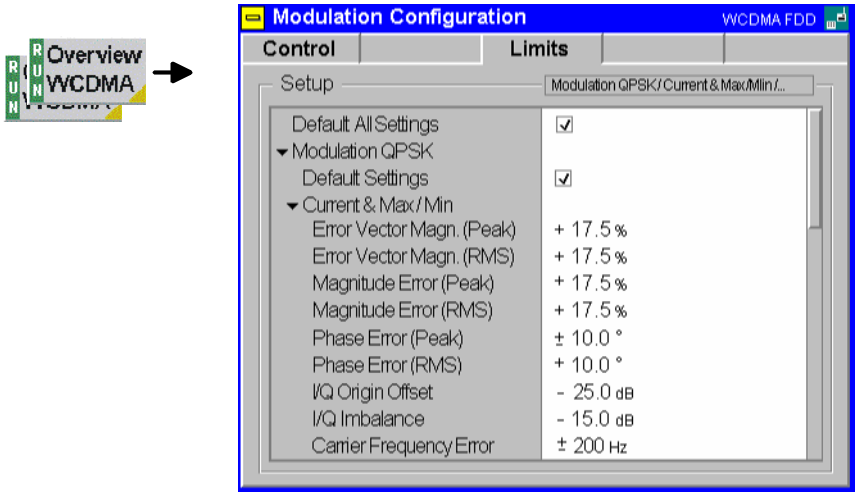


Fig. 4-29 Modulation Configuration – Limits

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. 4.35 ff.

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. 4-30 below illustrates the different quantities that can be obtained in the *Spectrum* measurement. *Fig. 4-30*

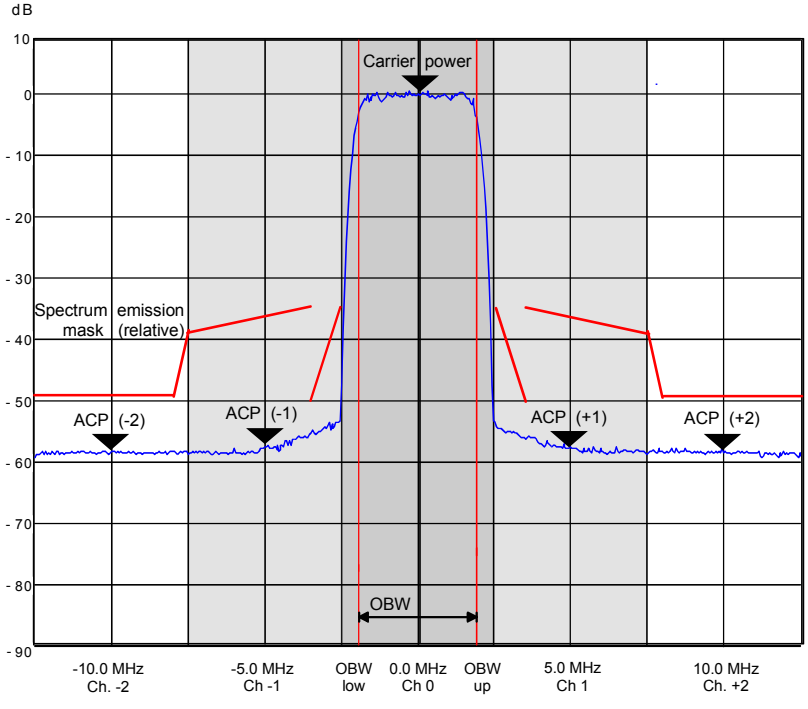


Fig. 4-30 Test parameters in the Spectrum measurement

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, 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 using 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). All measured spectrum emission values are represented relative to the 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 4-27 on p. 4.213):

- 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

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.*

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).

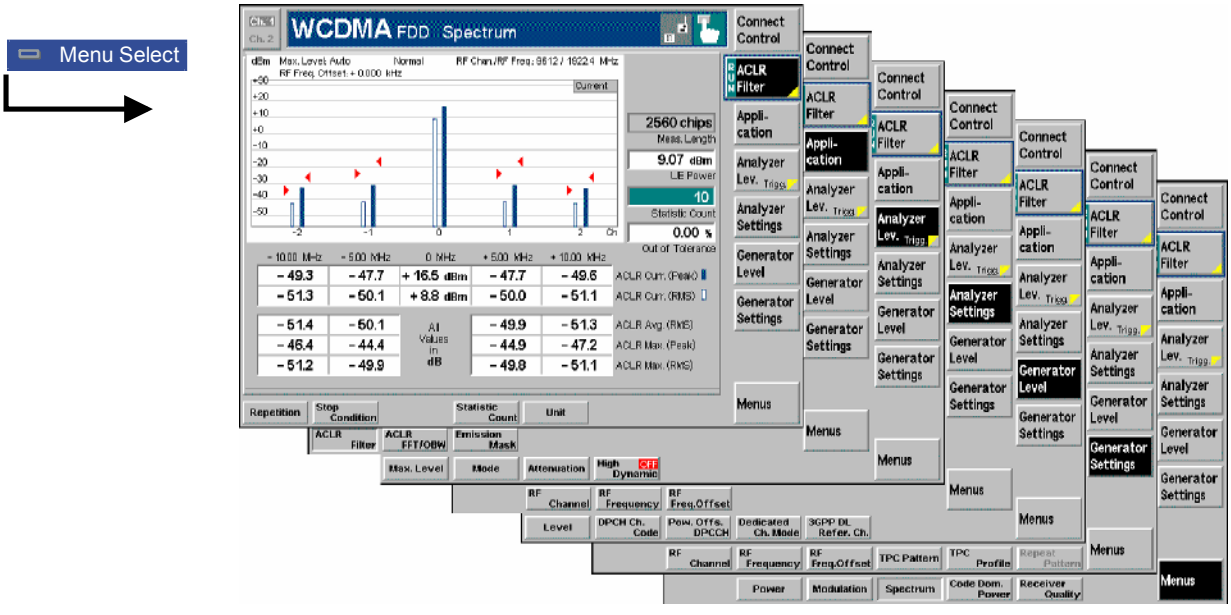


Fig. 4-31 Measurement menu Spectrum

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 4.6). 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 4.61 ff.). 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 4.6); 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 4.81 ff.). 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. 4.70.

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. 4.78 ff.).

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

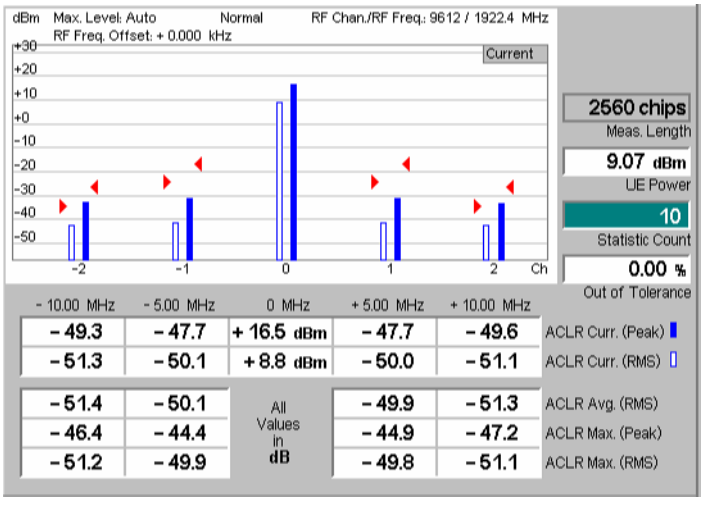


Fig. 4-32 Display of results (ACLR Filter)

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. 4.8) 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. 4.81 f.

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 *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. 4.81 f.

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. 4.86).

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. 4.82.

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. 4.82. 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.

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. 4.86.

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:

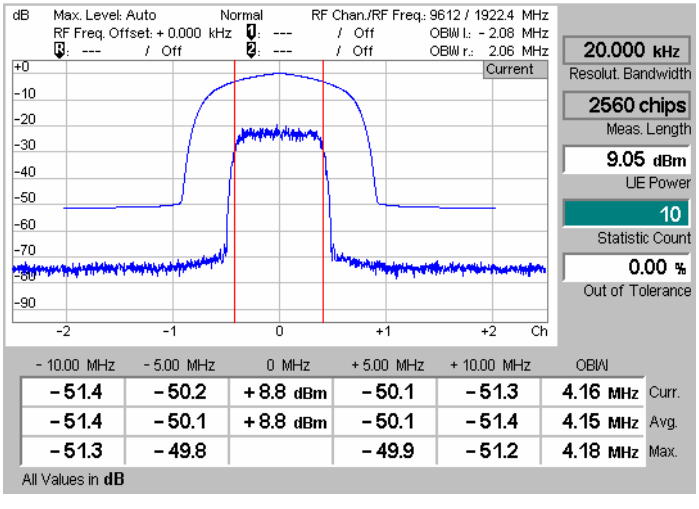


Fig. 4-33 Display of results (ACLR FFT/OBW)

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. 4.8) 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. 4.81 f.
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. 4.70. 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 upper (red) continuous curve in the test diagram shows the ACLR calculated from the FFT curve by applying a numerical RRC filter. This numerical method eliminates random effects from the FFT curve transforming it into a smooth curve for which it makes sense to perform a statistical evaluation. Therefore, the display mode (*Current, Maximum, Average*) for this curve 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. 4.81 f. The ACLR curve is normalized to the *Ref. Power* by definition, i.e. its central (0 MHz) value is 0 dB.

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 RMS-averaged power at the carrier frequency (Channel 0, central values) and in channels no. ±1 and ±2 as well as the Occupied Bandwidth (OBW). 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. 4.82.

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. 4.86.

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

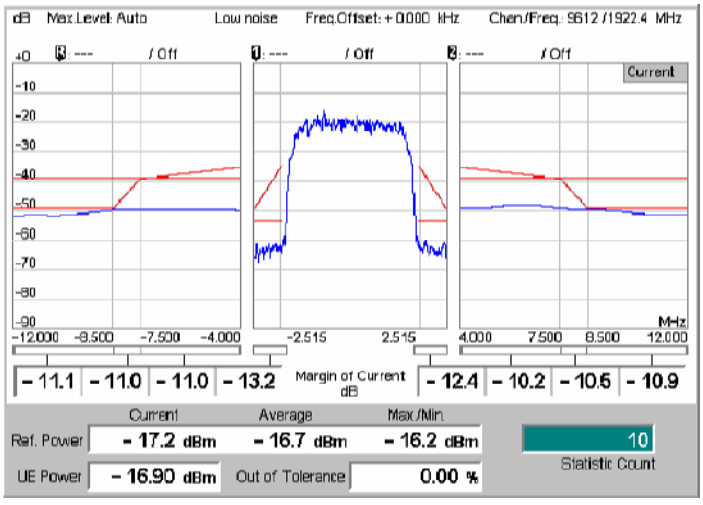


Fig. 4-34 Display of results (Spectrum Emission Mask)

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. 4.8) 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
- Left 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. 4.81 f. The curve is calculated as described in section *Spectrum Measurements* on p. 4.70. 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. 4.83 f.

Remote control
`READ:ARRay:SPECtrum:EMASk:CURRent,`
`FETCh:ARRay:SPECtrum:EMASk:CURRent,`
`SAMPle:ARRay:SPECtrum:EMASk:CURRent` etc.

Limit Check

The two bars below the diagram are divided into several sections corresponding to the fixed 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?`

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:*

$$\text{Margin} = \max_{i=1}^{N} \left[y_i - \text{limit line}(x_i) \right]$$

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.

The margin values are calculated from the displayed measurement curve so they depend on the *Display Mode* (Current, Average, Maximum).

Remote control
`READ[:SCALar]:SPECtrum:EMASk: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)*.

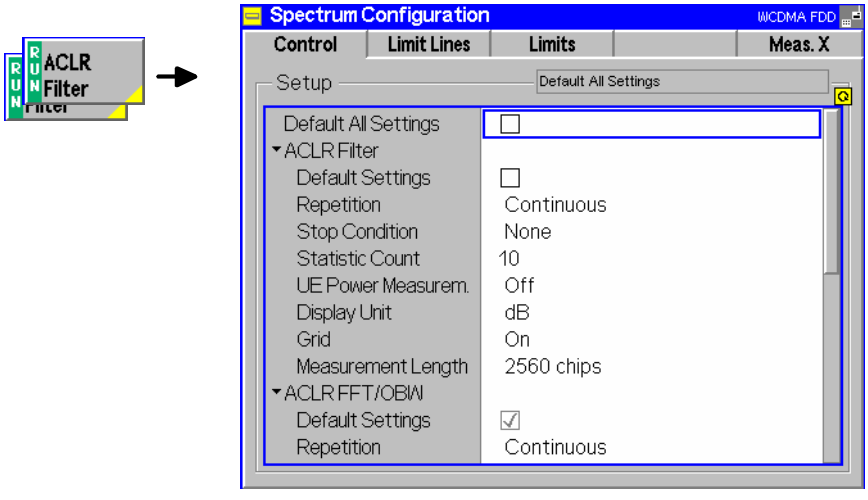


Fig. 4-35 Spectrum Configuration – Control

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 4.21). 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. 4.74 and *ACLR FFT/OBW Measurement* on p. 4.76.

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 emission (excluding spurious emissions) that are specified in terms of a spectrum emission mask and 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. 4.86. The spectrum emission mask is specified as follows:

Table 4-6 3GPP spectrum emission mask

Frequency offset from carrier Δf	Minimum requirement	Additional requirement for band II	Measurement bandwidth
2.5 MHz to 3.5 MHz	–35 dBc – 15*(Δf/MHz – 2.5) dBc	–15 dBm	30 kHz[1]
3.5 MHz to 7.5 MHz	–35 dBc – 1*(Δf/MHz – 3.5) dBc	–13 dBm	1 MHz[2]
7.5 MHz to 8.5 MHz	–39 dBc – 10*(Δf/MHz – 7.5) dBc	–13 dBm	1 MHz[2]
8.5 MHz to 12.5 MHz	–49 dBc	–13 dBm	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 dBm referenced to a 3.84 MHz filter. This implies that the absolute spectrum emissions must be:*

- *above* $-50\ \text{dBm} + 10 \cdot \log_{10}\left(\frac{1}{3.84}\right)\ \text{dBm} \approx -55.8\ \text{dBm}$ *where they are measured with a 1 MHz filter,*
- *above* $-50\ \text{dBm} + 10 \cdot \log_{10}\left(\frac{0.03}{3.84}\right)\ \text{dBm} \approx -71.1\ \text{dBm}$ *where they are measured with a 30 kHz filter.*

Signals with smaller powers always pass the entire limit check.

The complete spectrum emission mask is (for band II) shown in *Fig. 4-36 below*.

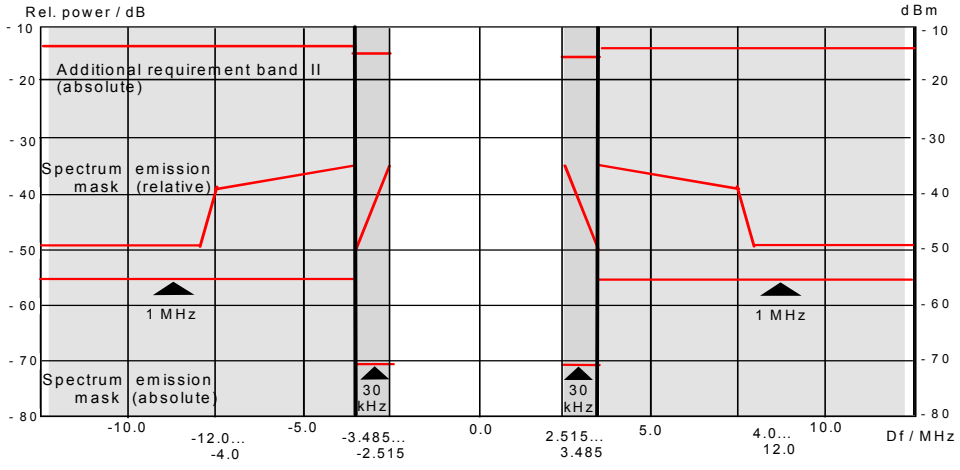


Fig. 4-36 Spectrum emission mask

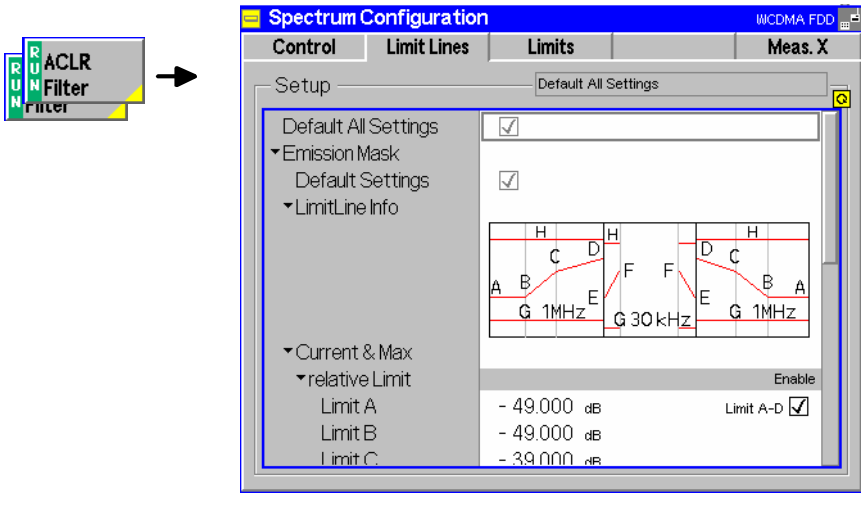


Fig. 4-37 Spectrum Configuration – Limits

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
```

Limit Line Info

The *Limit Line Info* diagram shows a preview of the spectrum emission mask that represents a simplified version of *Fig. 4-36*. According to the specification, the relative limit lines consist of several line sections with different slopes. In the CMU the line sections are defined by the coordinates of their start and end points labeled A to F. In contrast, the absolute limit lines of the CMU are defined by three values corresponding to the filter bandwidths 3.84 MHz, 1 MHz and 30 kHz (sections G).

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. 4.84.

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. 4.86 ff.

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* is defined in the 1 MHz and 30 kHz frequency domains. This limit corresponds to the *Additional requirement for band II* in *Table 4-6* and is not used in the other frequency bands. If a measurement result exceeds the absolute limit H, the domain 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. 4.83. 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.

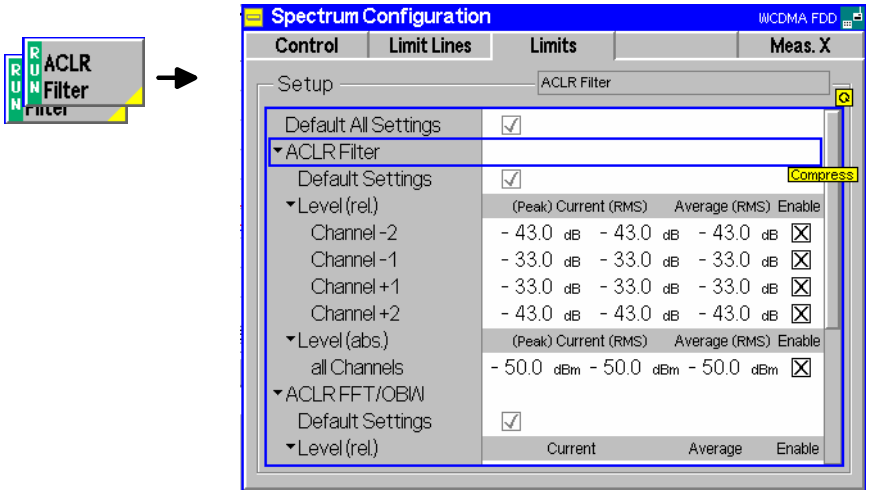


Fig. 4-38 Spectrum Configuration – Limits

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.

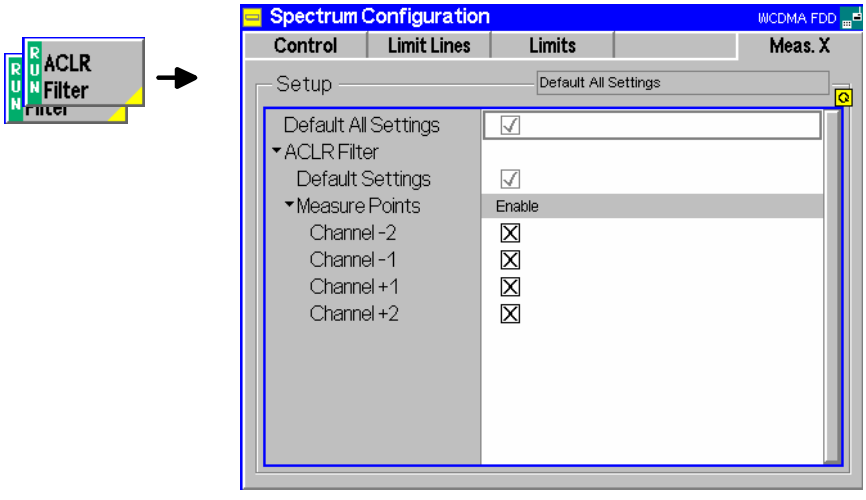


Fig. 4-39 Spectrum Configuration – Meas. X

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. 4.38), 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. 4-15* on p. 4.40. 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:

HS-DPCCH Test 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.

CD vs. Time The *CDP vs. Time* measurement is a remote control application providing the code power and the gain factors for all UL channels. For a detailed description refer to Chapter 6.

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* or *CDP/Code Rho Manual*, if one of these 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).

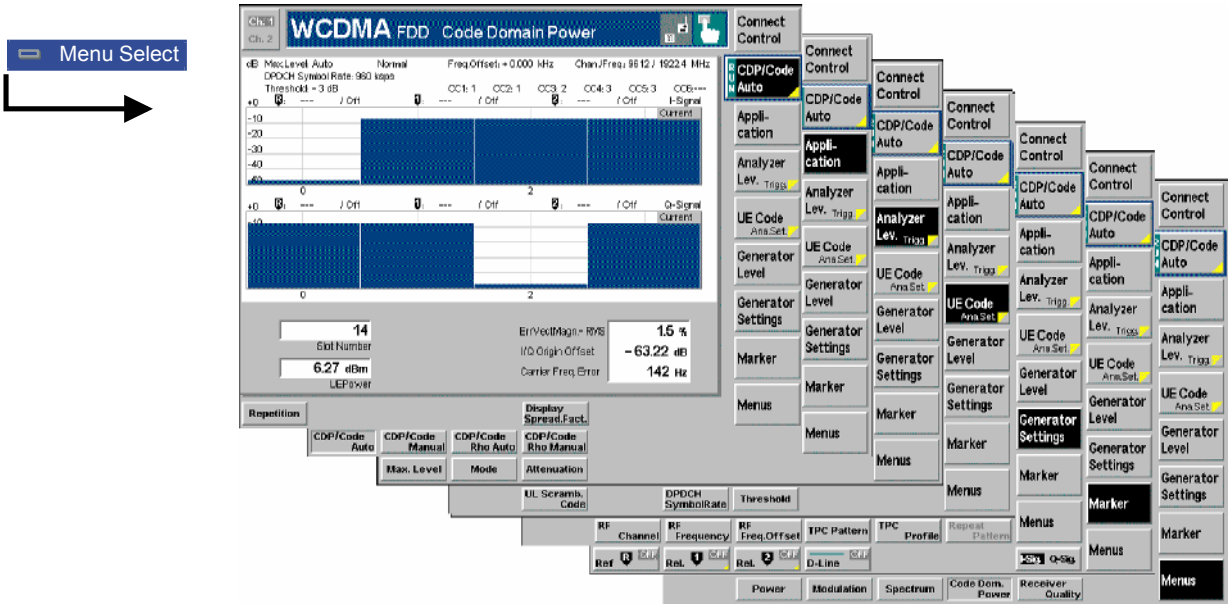


Fig. 4-40 Measurement menu Code Domain Power

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 4.6). 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 4.61 ff.). Besides, the hotkeys *Repetition, Stop Condition,* and *Statistic Count* defining the scope of the measurement are associated with the *CDP/Code Auto* softkey. The function of these hotkeys is explained in the *Power* menu section (see section *Test Settings* on page 4.6); they are identical with the parameters set in the *Control t*ab of the *Code Domain Power Configuration* menu (see section *Measurement Control (Code Domain Power Configuration – Control)* on page 4.81 ff.). The *Display Mode* hotkey, which is available in the *CDP ... Manual* applications, is also provided in the *Control* tab.

Display Spread.Fact.

The *Display Spread. Fact.* hotkey selects the number of code channels to be displayed in the *CDP/Code Auto* and *CDP/Code Rho Auto* applications.

Remote control
`CONFigure:CDPower:<CDP_Auto_Application>:CONTrol:DSFactor <Factor>`

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. 4.90.

The alternative applications call up different measurement menus containing bar graphs and various output fields; see section *Measurement Results* on p. 4.94 ff. 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. 4.99 ff.).

CDP/Code Auto

The *CDP/Code Auto* hotkey selects the measurement of 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* hotkey selects the measurement of the power in the dedicated physical channels contributing 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* hotkey selects the measurement of 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* hotkey selects the measurement of 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...`

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 4.51 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. 4.151 ff.

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 4.6.

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. 4-15* on p. 4.40.

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. 4.151 ff.

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

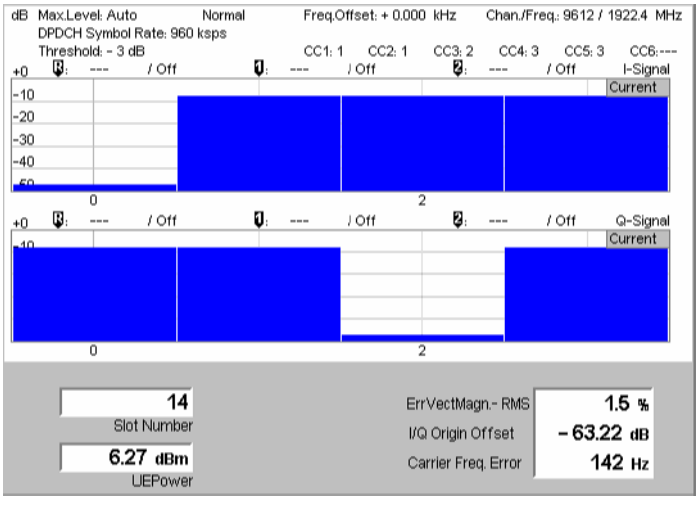


Fig. 4-41 Display of results (CDP/Code Auto)

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. 4.8) 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. 4.53) and/or in the *UE Code* tab of the *Connection Control* menu; see section *Uplink Signal (Connection Control – UE Code)* on p. *4.151* ff.:

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. 4.99 f. 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. 4-41 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. 4.35. 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:

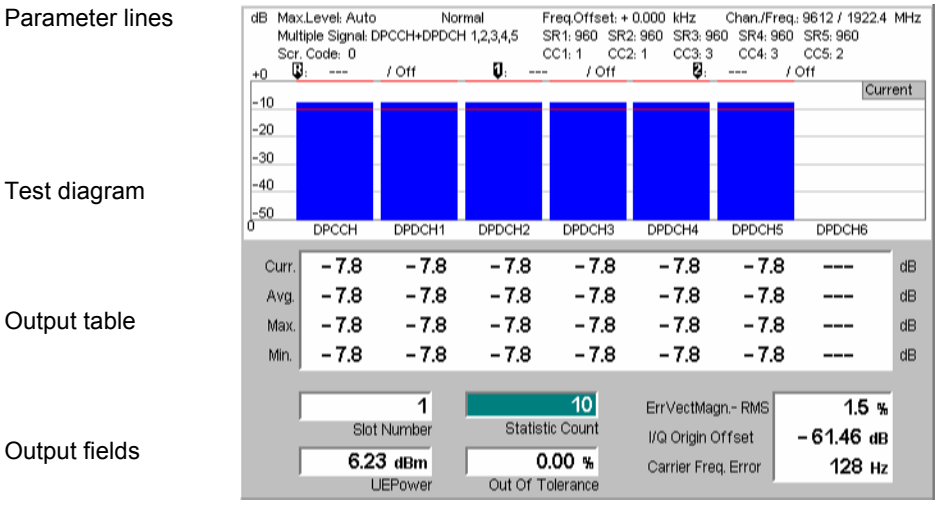


Fig. 4-42 Display of results (CDP/Code Manual)

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. 4.95.

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. 4.99 f. 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. 4.94), 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. 4.100 f.

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. 4.86.

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. 4.95. 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.

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)*
- 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)*

Besides, it influences the graphical measurement menus by adding or removing the *Grid* (for applications *CDP/Code Auto* and *CDP/Code Rho Auto)*.

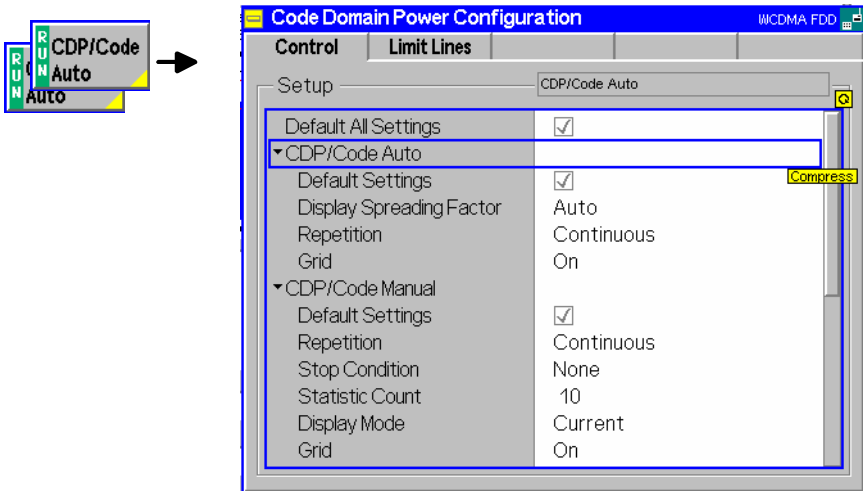


Fig. 4-43 Code Domain Power Configuration – Control

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 4.21). 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. 4.51) 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.

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. 4.90, the CD-ρ factor is equivalent to the CDP for a WCDMA signal with ideal modulation characteristics:

$$CDP_{ideal} = 10 \cdot \log_{10}\left(CD\rho_{ideal}\right) ; \qquad \text{(Equation 4)}$$

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*.

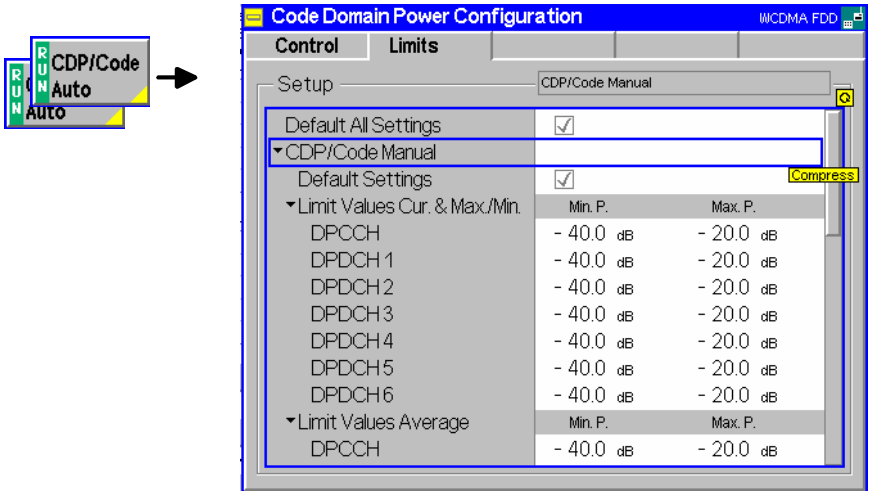


Fig. 4-44 Code Domain Power Configuration – Limits

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 4-7 below*). As a high-speed production tester the CMU uses a method of measurement that provides the BER and BLER results (plus an additional DBLER, see below) in parallel. The *WCDMA (3GPP/FDD, DL) Generator* (option CMU-K66) provides a reference measurement channel 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 4-7*.

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 4-13 on p. 4.141, i.e. a TFCI of 1 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.

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 4-7 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)

	Test loop mode 1	**Test loop mode 2**
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. 4.105 ff.

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. 4.105 ff.

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. 4.105 ff. It is generally a good approximation to the BLER; see below.

Relation between BER, BLER and DBLER

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 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:

$$\begin{aligned} BLER &= 1 - \langle \text{Probability that all bits are correct} \rangle \\ &= 1 - \langle \text{Probability that 1 bit is correct} \rangle^n = 1 - (1 - BER)^n \end{aligned}$$

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. 4-45 below*.

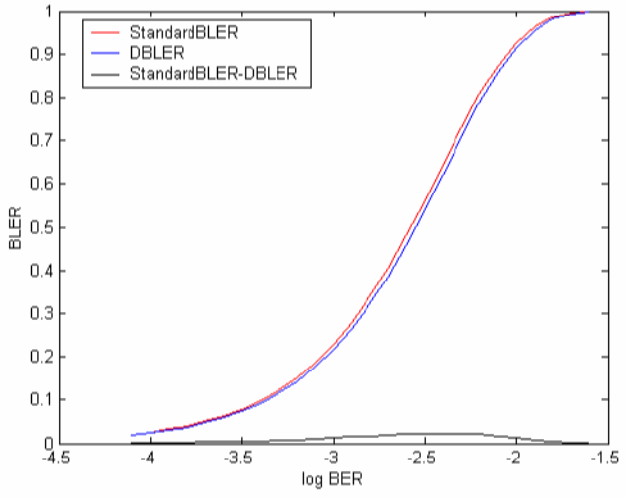


Fig. 4-45 Approximate relation between BER, BLER and DBLER

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. 4.117).

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.

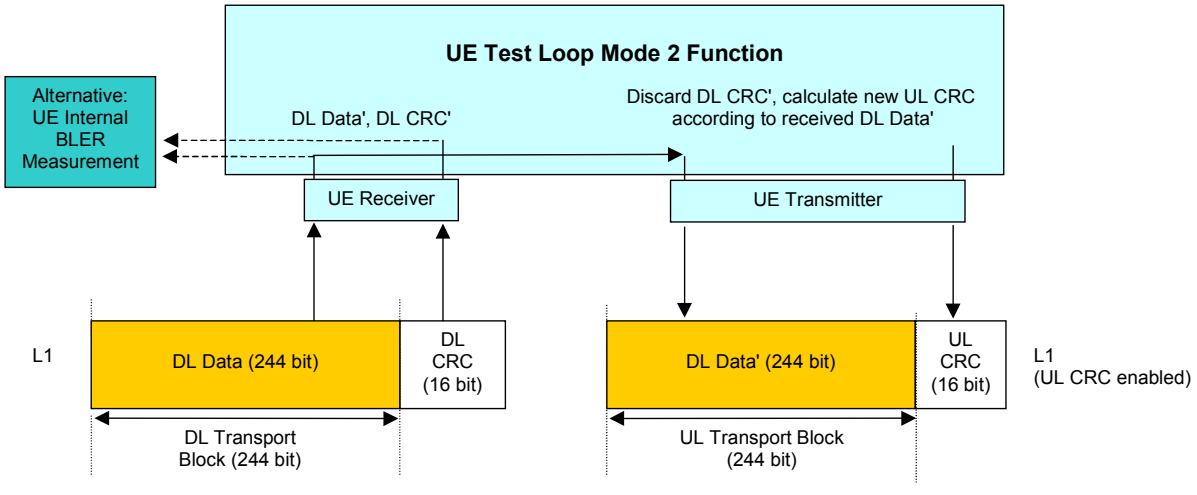


Fig. 4-46 Symmetric DL/UL transport block size for a 12.2 kbps reference meas. channel

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.

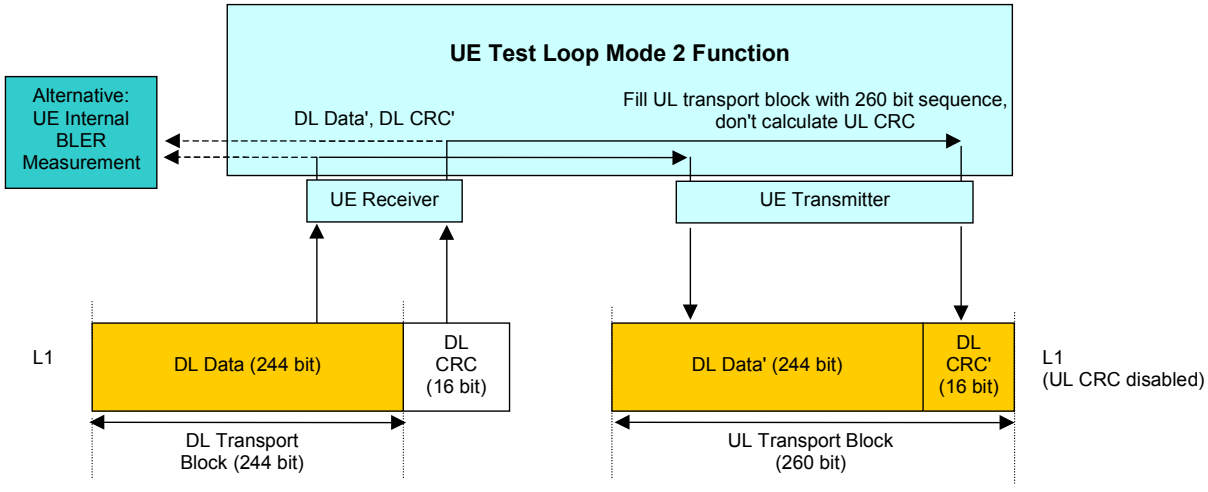


Fig. 4-47 Asymmetric DL/UL transport block size for a 12.2 kbps reference meas. channel

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.

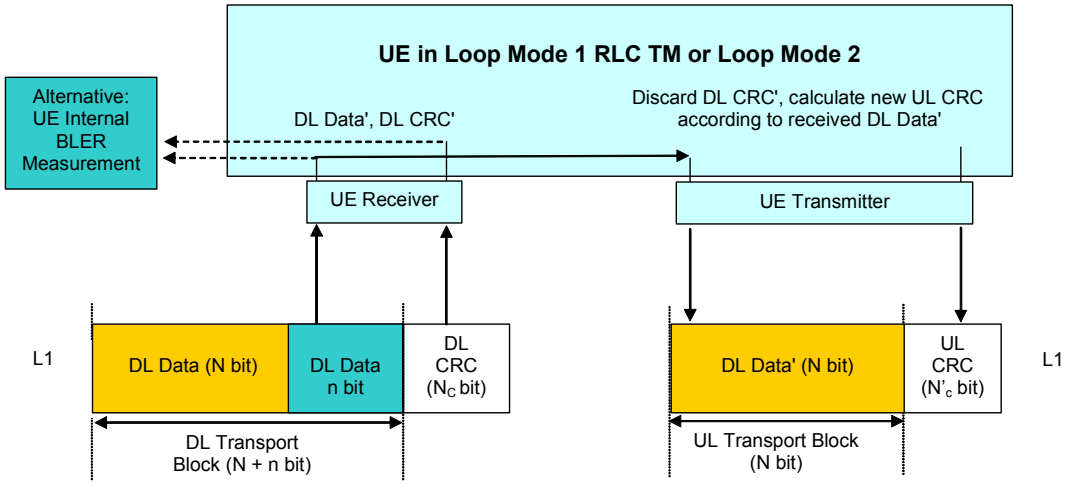


Fig. 4-48 BER and DBLER measurement with asymmetric RMCs

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. 4-49 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.*

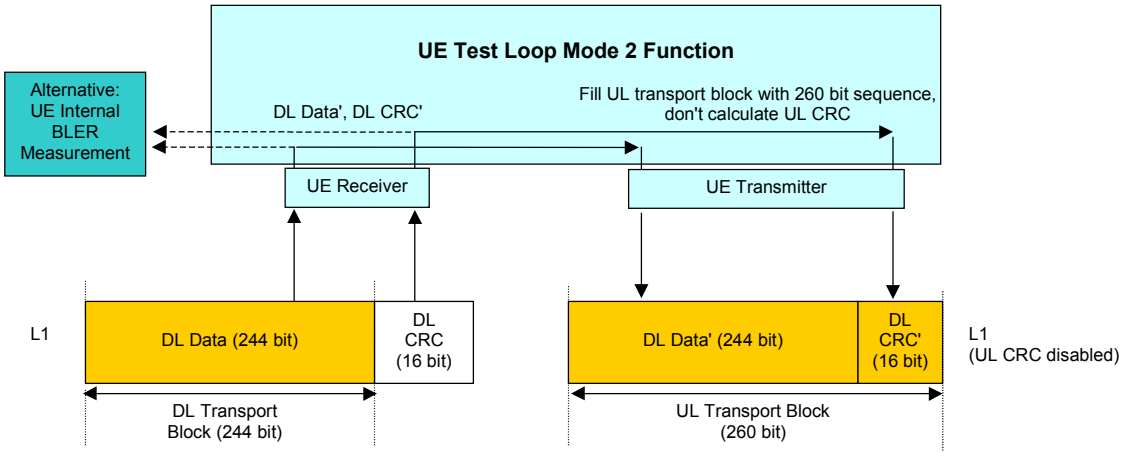


Fig. 4-49 Symmetric test scenario for UL BLER tests

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.*

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*.

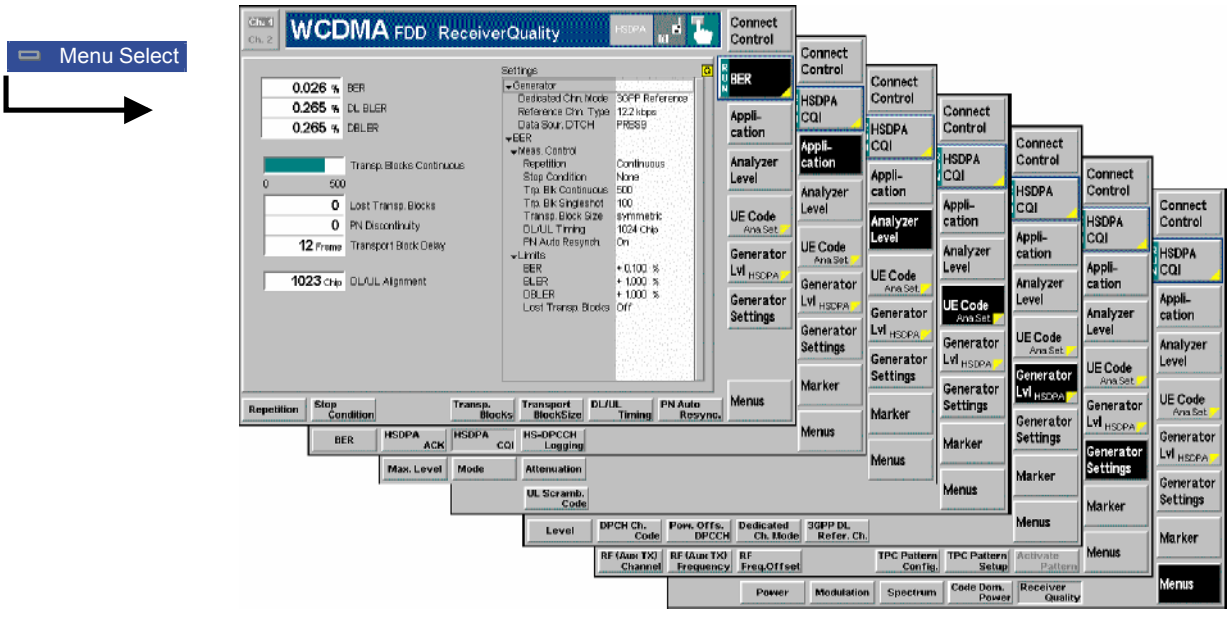


Fig. 4-50 Main menu Receiver Quality (BER, Non Signalling)

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 4.6 ff.). 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 4.116 ff.

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. 4.116 ff.).

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.

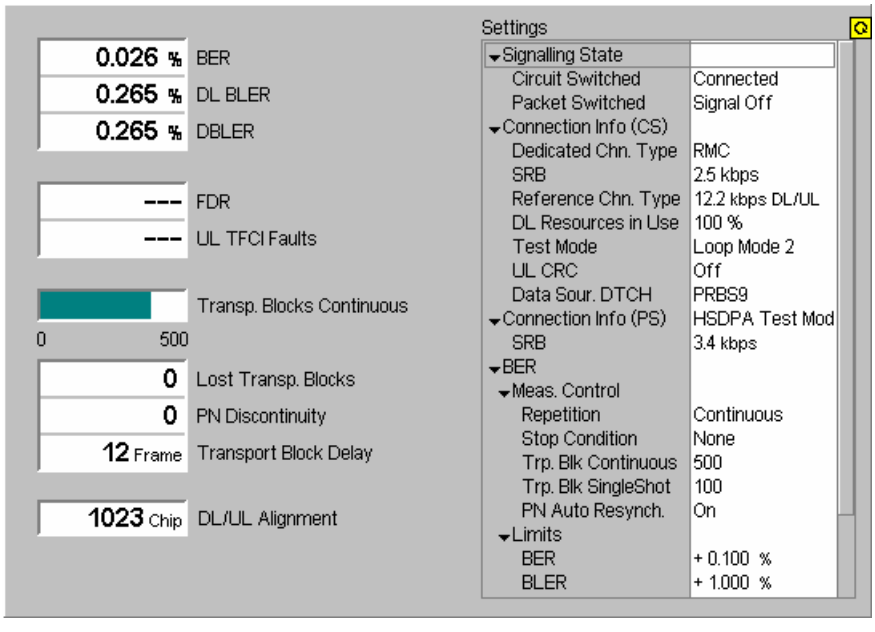


Fig. 4-51 Display of test settings and measurement results (BER, Signalling)

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.

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.

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. 4.103 ff.

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. 4.108 ff.

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. 4.118).

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. 4.116 ff.

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. 4.119 ff.

Remote Control

```
READ[:SCALar]:RXQuality:BER?
FETCh[:SCALar]:RXQuality:BER?
SAMPle[:SCALar]:RXQuality:BER?
CALCulate[:SCALar]:RXQuality:BER:MATChing:LIMit?
```

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 4.119.

The parameters depend on the current application and the measurement mode.
Remote control
See sections *Test Settings* on page 4.110 and *Upper Limits for Bit Error Rate (Receiver Quality Configuration – Limits)* on p. 4.119.

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.

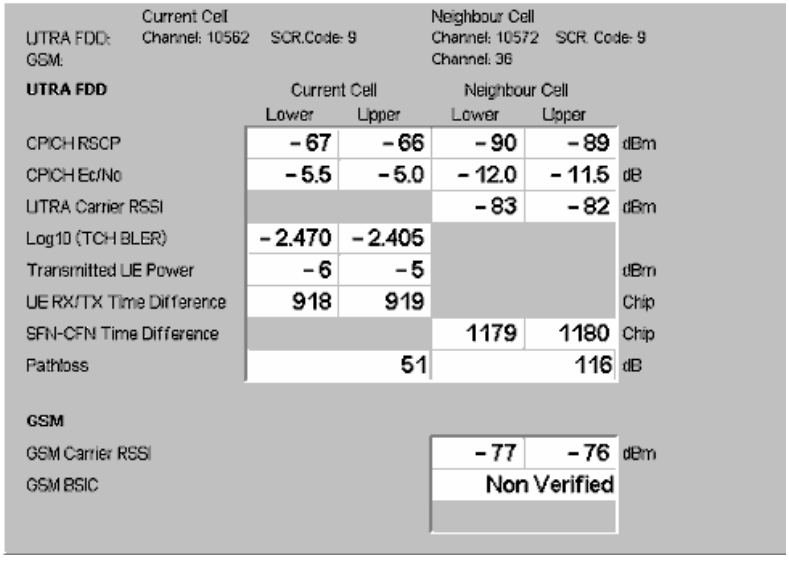


Fig. 4-52 Display of test settings and measurement results (UE Report)

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. 4.113 ff.

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. 4.116 ff.) 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. 4.2152). 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. 4.196 ff.
- 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 *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 *(UE Report,* in *Signalling* mode only)

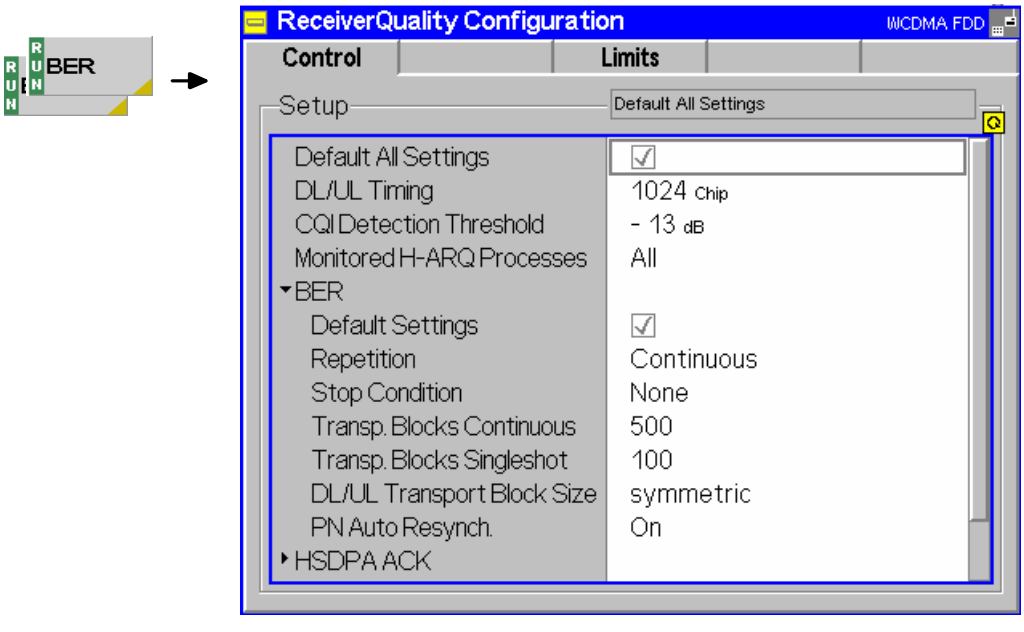


Fig. 4-53 Receiver Quality – Control (Signalling)

The *Repetition* mode and *Stop Condition* comply with the corresponding settings in the *Control* tab of the *Power Configuration* menu (see page 4.21). 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. 4.111 ff.

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>`

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.

Different numbers can be defined for single shot *BER* measurements (only one measurement cycle) and continuous measurements (measurement cycle repeated periodically).

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. 4.105 ff.

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. 4.113 ff.

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.

Remote control
```
DEFault:RXQuality:UEReport:ENABle
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. 4.127 ff.
Operating Band	One of the operating bands I to VI.
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. 4-45 on p.* 4.105.

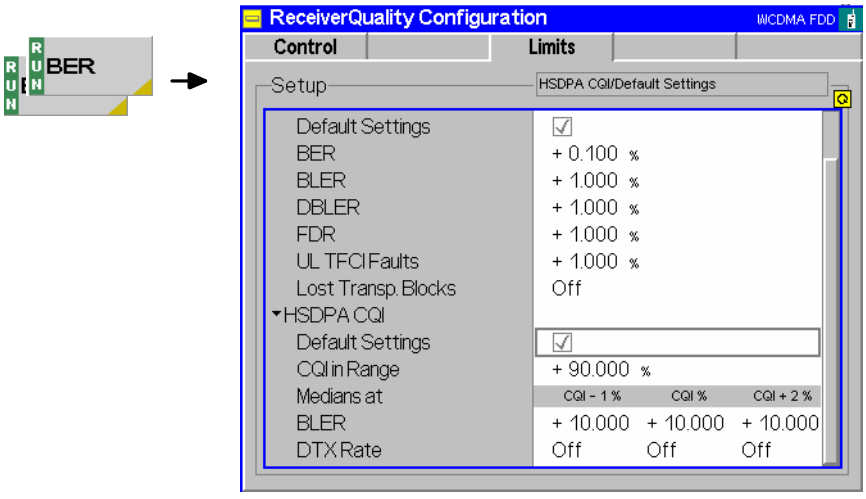


Fig. 4-54 Receiver Quality Configuration – Limits

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. 4.111 ff.). All limits are in the value range 0% to 100%.

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
```

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. 4.156 ff. 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. 4.228 ff.).

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. 4.127 ff.

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)

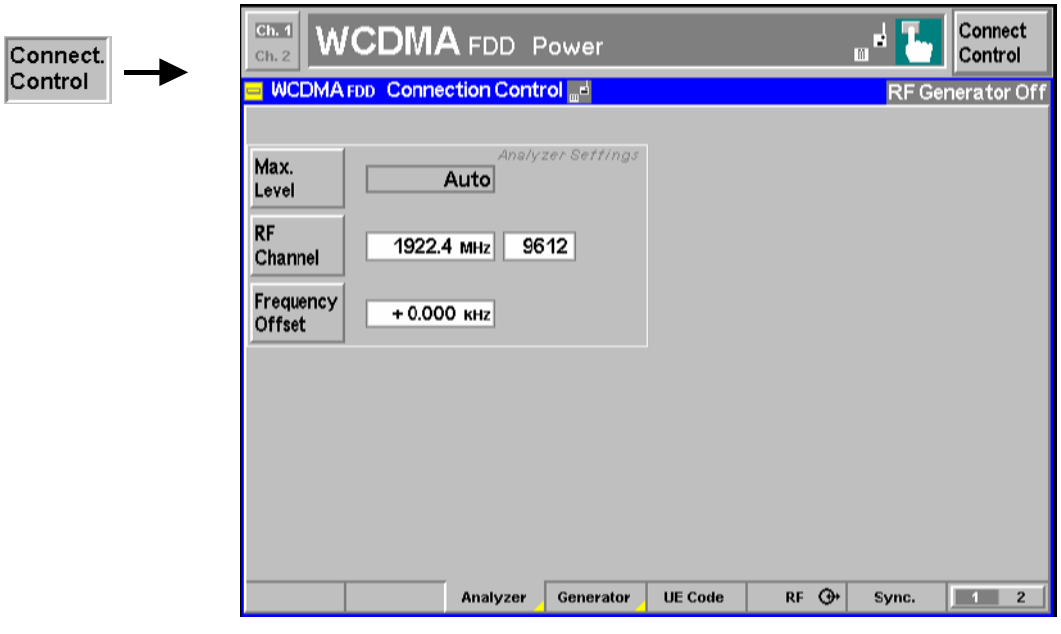


Fig. 4-55 Connection Control – Analyzer (panel)

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. 4.125.
- 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 34.121). The following relation holds for both directions of transmission (uplink and downlink) and all operating bands (I to VI):

$$N = 5 \cdot (F / MHz), \quad 0.0\ MHz \le F \le 3276.6\ MHz$$

The CMU accepts the entry of frequency **or** channel number, provided that the assignment is unambiguous, i.e. that the channel number is assigned in one of the three operating bands and that it is calculated according to the formula quoted above. If the channel number is not assigned, the channel input field shows an invalid channel result "---".

In operating bands II, III, IV, and V, additional center frequencies are specified, which are shifted by 100 kHz relative to the normal raster, see *Table 4-8 below*. These channels must be selected with their channel numbers; it is not possible to enter frequencies off the 200 kHz raster.

It is possible, however, to enter arbitrary UARFCNs or RF frequencies outside the uplink bands, provided that the frequencies are in multiples of 200 kHz and within the specified range of the RF analyzer (see data sheet). Moreover, the analyzer 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 defined as a center frequency of the analyzer.

Note: *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>`

Table 4-8 UTRA operating bands and channel numbers: Uplink

Operating Band	UL Frequency Band	Assigned Channels	Assigned Center Frequencies
I	1920 MHz to 1980 MHz	9612 to 9888	1922.4 MHz to 1977.6 MHz
II	1850 MHz to 1910 MHz	9262 to 9538, 12, 37, 62, 87, 112, 137, 162, 187, 212, 237, 262, 287	1852.4 MHz to 1907.6 MHz, 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	1710 MHz to 1785 MHz	8562 to 8913	1712.4 MHz to 1782.6 MHz
IV	1710 MHz to 1755 MHz	8562 to 8736, 1162, 1187, 1212, 1237, 1262, 1287, 1312, 1337, 1362	1712.4 MHz to 1752.6 MHz, 1712.5, 1717.5, 1722.5, 1727.5, 1732.5, 1737.5, 1742.5, 1747.5, 1752.5
V	824 MHz to 849 MHz	4132 to 4233, 782, 787, 807, 812, 837, 862	826.4 MHz to 846.6 MHz, 826.5, 827.5, 831.5, 832.5, 1 827.5, 842.5
VI	830 MHz to 840 MHz	4162 to 4188, 812, 837	832.4 MHz to 837.6 MHz, 832.5, 837.5

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)*

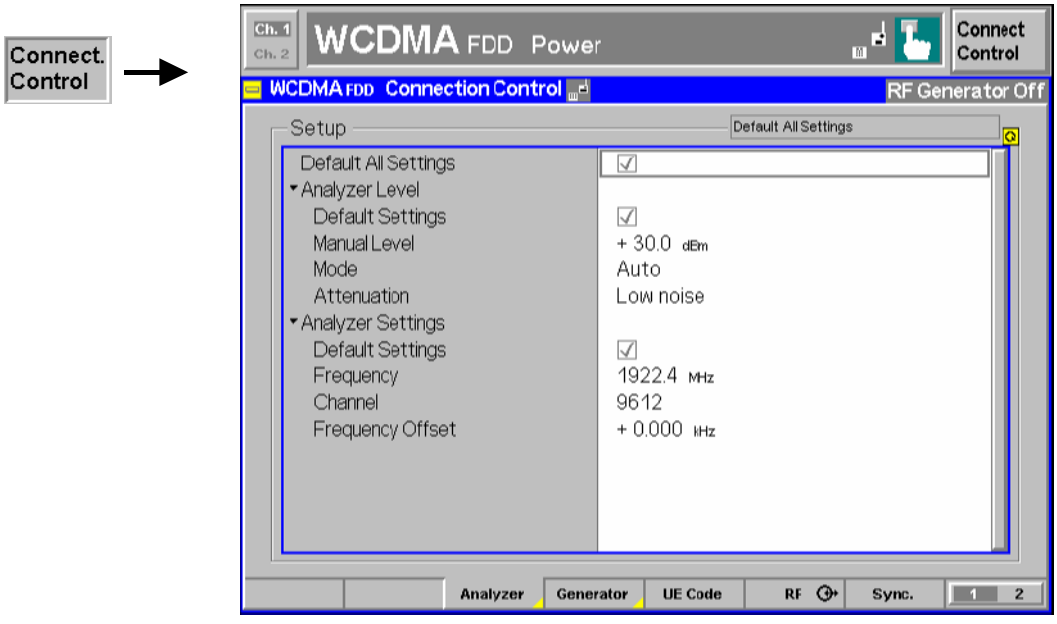


Fig. 4-56 Connection Control – Analyzer (table)

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 4.125), 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. 4.122 ff. 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 4-23 on p. 4.197).

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. *4.3 ff.* To control the *Inner Loop TPC* measurement a set of *TPC Settings* is provided at the generator; see p. 4.145.
- 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. *4.103* ff.
- 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. 4.203 ff.), 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. 4.128 ff.

The HSDPA channels that the R&S CMU provides with option R&S CMU-K64 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 4-9 below* summarizes the parameters that are relevant for this section.

Table 4-9 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 4-10 below.

Table 4-10 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 spreading code $c_{256, 0}$ Primary scrambling code Predefined symbol sequence

Channel type	Purpose	Properties
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 spreading 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 five channels (see *Fig. 4-57 below*). The real-valued P-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 4-16* on p. 4.144) 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. 4.137, 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, P-CCPCH, DPCH and PICH.

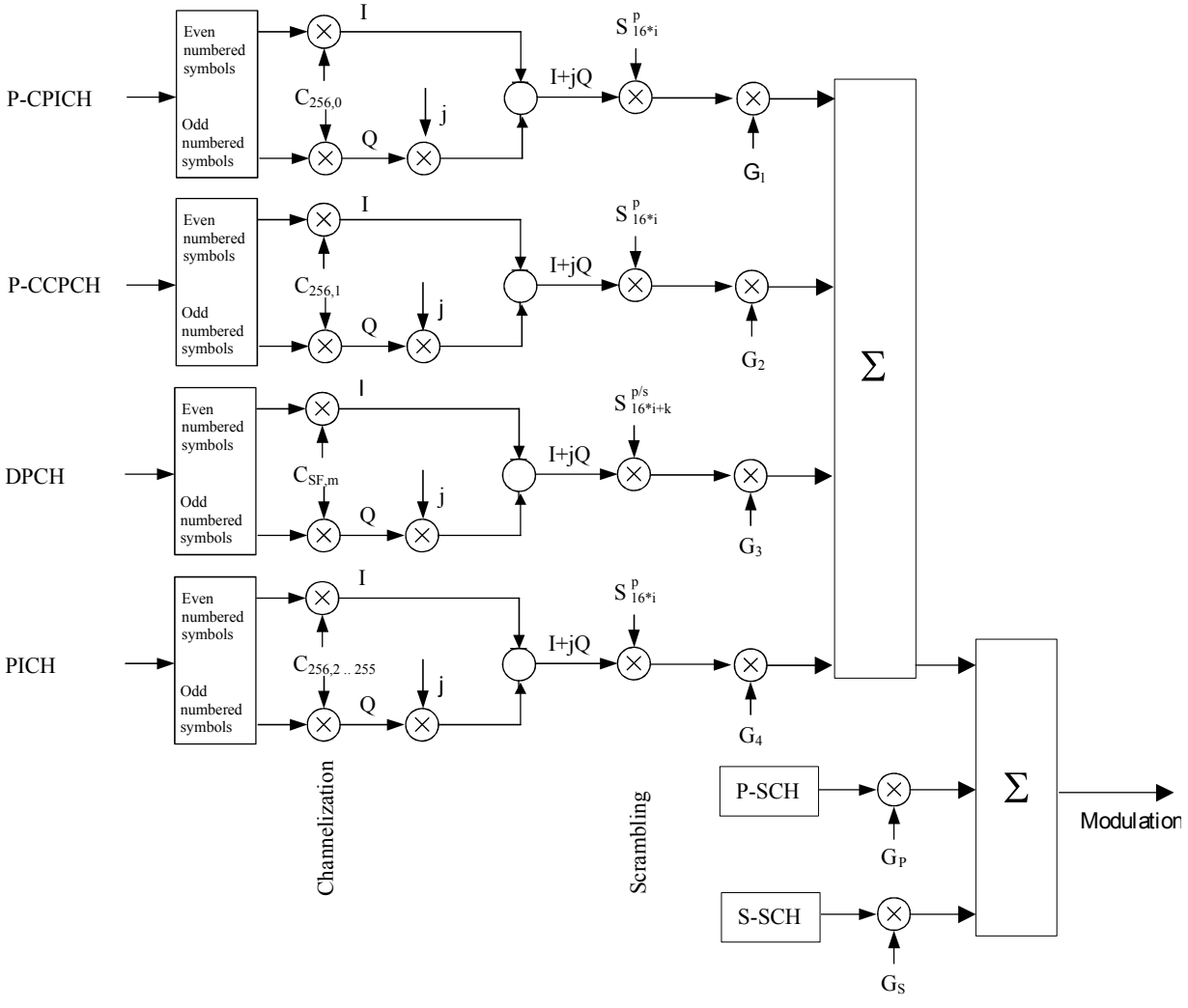


Fig. 4-57 Spreading of the downlink channels

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. 4-59* on p. 4.133).

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)

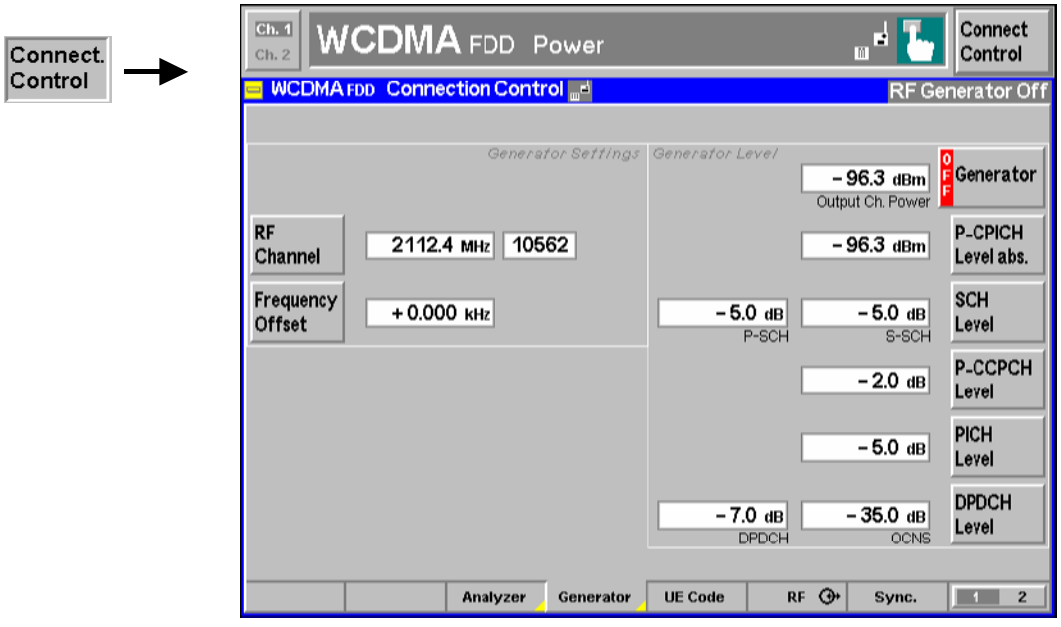


Fig. 4-58 Connection Control – Generator (panel)

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. 4.139). The output power depends on the power settings of the individual physical channels (see softkeys *P-CPICH Level abs.* ff. 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. 4.128 ff.

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. 4.137). 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. 4-57* (see p. 4.130). The *S-SCH Level* is equal to the ratio of the weighting factors G_s/G_1 in *Fig. 4-57*.

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. 4-59 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. 4.137), 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. 4-59 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. 4.137). 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. 4-57* (see p. 4.130).

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. 4-59 below*.

Remote control
`SOURce:RFGenerator:DBCHannel:LEVel:PCCPch <Level>`

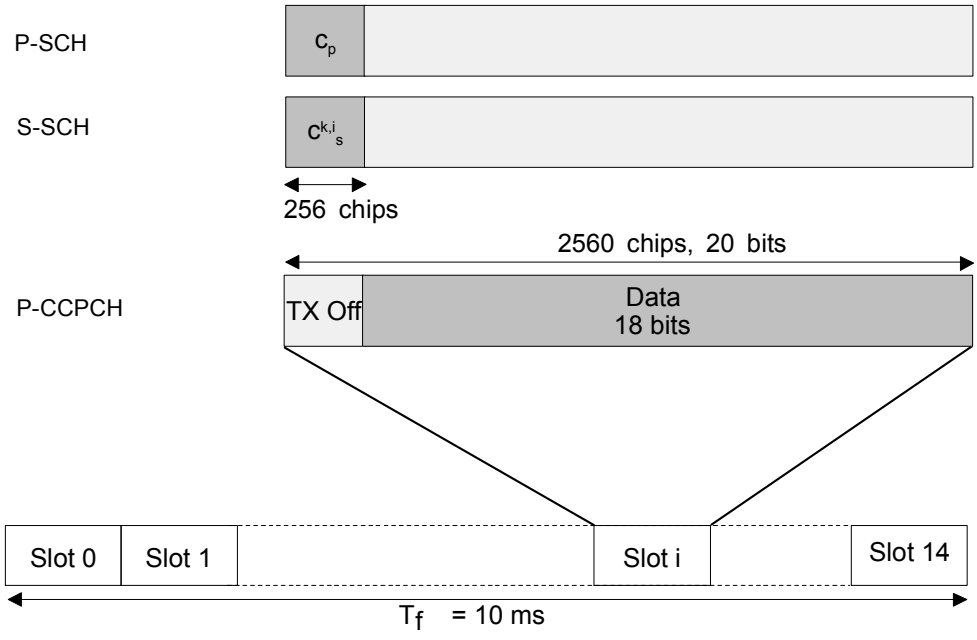


Fig. 4-59 Frame structure for the SCH and P-CCPCH

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. 4.137). 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. 4-57*.

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. 4.137). The level of the control part can be set to be different from the *DPDCH Level;* see *Power Offset* parameter on p. 4.139. 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. 4-57* (see p. 4.130). 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.

Further DPCH settings are provided in the table-oriented version of the *Generator* tab; see section *Table Oriented Version* on p. 4.135 ff. and *Fig. 4-63* on p. 4.143.

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 4-11 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.

Table 4-11 DPCH Channelization Code contributions of the OCNS signal

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

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 34.121). The following relation holds for both directions of transmission (uplink and downlink) and all operating bands (I, to VI):

$$N = 5 \cdot (F / MHz), \quad 0.0\ MHz \le F \le 3276.6\ MHz$$

The CMU accepts the entry of frequency **or** channel number, provided that the assignment is unambiguous, i.e. that the channel number is assigned in one of the three operating bands and that it is calculated according to the formula quoted above. If the channel number is not assigned, the channel input field shows an invalid channel result "---".

In operating bands II, IV, V, and VI, additional center frequencies are specified, which are shifted by 100 kHz relative to the normal raster, see *Table 4-8 above*. These channels must be selected with their channel numbers; it is not possible to enter frequencies off the 200 kHz raster.

It is possible, however, to enter arbitrary UARFCNs or RF frequencies outside the downlink bands, provided that the frequencies are in multiples of 200 kHz and within the specified range of the RF generator (see data sheet). 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 defined as a generator frequency.

Note: *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>
```

Table 4-12 UTRA operating bands and channel numbers: Downlink

Operating Band	DL Frequency Band	Assigned Channels	Assigned Center Frequencies
I	2110 MHz to 2170 MHz	10562 to 10838	2112.4 MHz to 2167.6 MHz
II	1930 MHz to 1990 MHz	9662 to 9938, 412, 437, 462, 487, 512, 537, 562, 587, 612, 637, 662, 687	1932.4 MHz to 1987.6 MHz, 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	1805 MHz to 1880 MHz	9037 to 9388	1807.4 MHz to 1877.6 MHz
IV	2110 MHz to 2155 MHz	10562 to 10736, 1462, 1487, 1512, 1537, 1562, 1587, 1612, 1637, 1662	2112.4 MHz to 2152.6 MHz, 2112.5, 2117.5, 2122.5, 2127.5, 2132.5, 2137.5, 2142.5, 2147.5, 2152.5
V	869 MHz to 894 MHz	4357 to 4458, 1007, 1012, 1032, 1037, 1062, 1087	871.4 MHz to 891.6 MHz, 871.5, 872.5, 876.5, 877.5, 1 882.5, 887.5
VI	875 MHz to 885 MHz	4387 to 4413, 1037, 1062	877.4 MHz to 882.6 MHz, 877.5, 882.5

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)*
- 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.

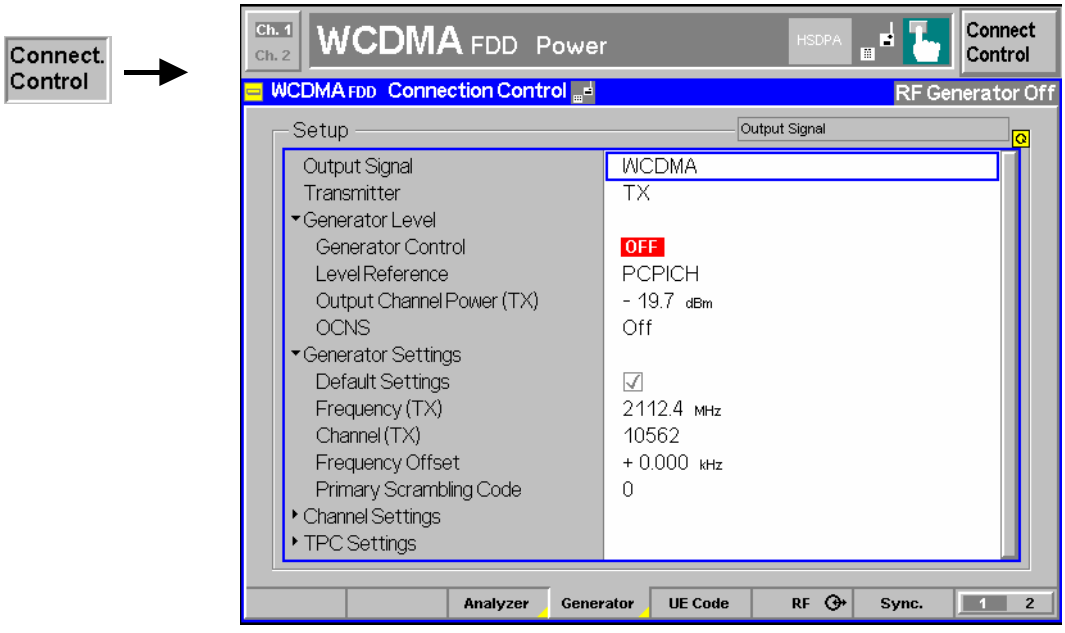


Fig. 4-60 Connection Control – Generator (table)

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 ON | OFF` 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. 4.149 ff. 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.

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. 4.133) 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.

Remote control

```
FETCh:RFGenerator:STATus?
SOURCE:RFGenerator:LREFerence PCPich | OPOWer
SOURce:RFGenerator:OPOWer <Power>
SOURce:RFGenerator:OCNS <Power>
```

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. 4.134)

Channel UARFCN (see *RF Channel* softkey description on p. 4.134)

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. 4-59* on p. 4.133.

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.

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. 4.131 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 at once (recommended command)

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/DPCH channelization codes* on p. 4.140.

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 4-16* on p. 4.144 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/DPCH channelization codes* on p. 4.140.

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. 4.166 *ff.*

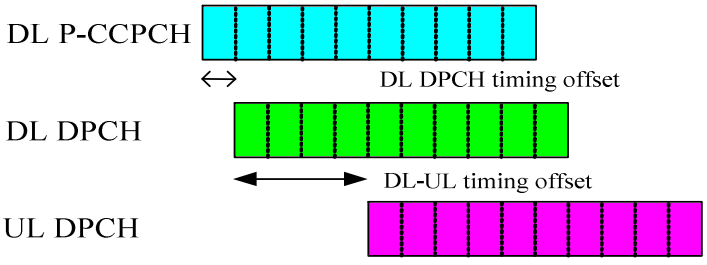


Fig. 61 DL DPCH Timing Offset

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-CCPICH. n is the *DL DPCH Timing Offset*.
- The HS-DPCCH is at a fixed ½ slot offset after the P-CCPICH. 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. 4.133).

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. 4.137. 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.

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), or as a physical channel. The parameters of the different channel types are defined in the table sections 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:DPDCh:MODE PHYS | TGPP | DCCH
SOURce:RFGenerator:DBCHannel:TSTate <Enable>
```

PICH/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 is always 256 whereas the spreading factors of the DPCH vary between 4 and 512, depending on the slot format (see *Table 4-16* on p. 4.144). When a PICH 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. 4.147 ff.

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. 4-62 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 4-14* and *Table 4-15 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.

To facilitate signalling of the individual TFIs, they are combined to an integer code number, the Calculated Transport Format Combination (CTFC). The CTFC is uniquely defined by the TFIs of the individual TrCHs in the transport bearer (see standard 3GPP TS 25.331). On the other hand, the individual TFIs can be resolved from the CTFC, the total number of TrCHs, and the number of TFIs for each TrCH.

For a given TrCH configuration, the CTFC list contains a definite number, say n, of distinct, integer numbers ≥ 0. These n CTFC values are mapped to a set of Transport Format Combination Index (TFCI) values comprising all integer numbers between 0 and n – 1. The one-to-one mapping between the CTFC and the TFCI values is always the same in the node B and in the UE so that CTFC and TFCI values are equivalent.

The 3GPP DL reference measurement channel contains two TrCHs, one of them carrying the DTCH, the other carrying the DCCH (see *Fig. 4-62 below*). Both channels can be configured either with the transport block size defined in the standard (see *Table 4-15 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 uses TFI = 1 for empty TrCHs and the fixed assignment between CTFC and TFCI values listed in *Table 4-13 below*. This means that TFCI = 3 identifies the standard 3GPP DL reference measurement channel with no empty transport channels.

Remote control
`SOURce:RFGenerator:RCHannel...`

Table 4-13 TFCI assignment in the CMU

TFI_1	**TFI_2**	**CTFC**	**TFCI**
1 (empty $TrCH_1$) 0 (standard $TrCH_1$) 1 (empty $TrCH_1$) 0 (standard $TrCH_1$)	0 (standard $TrCH_2$) 1 (empty $TrCH_2$) 1 (empty $TrCH_2$) 0 (standard $TrCH_2$)	1*1 + 0*2 = 1 0*1 + 1*2 = 2 1*1 + 1*2 = 3 0*1 + 0*2 = 0	0 1 2 3

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.

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. 4-62.

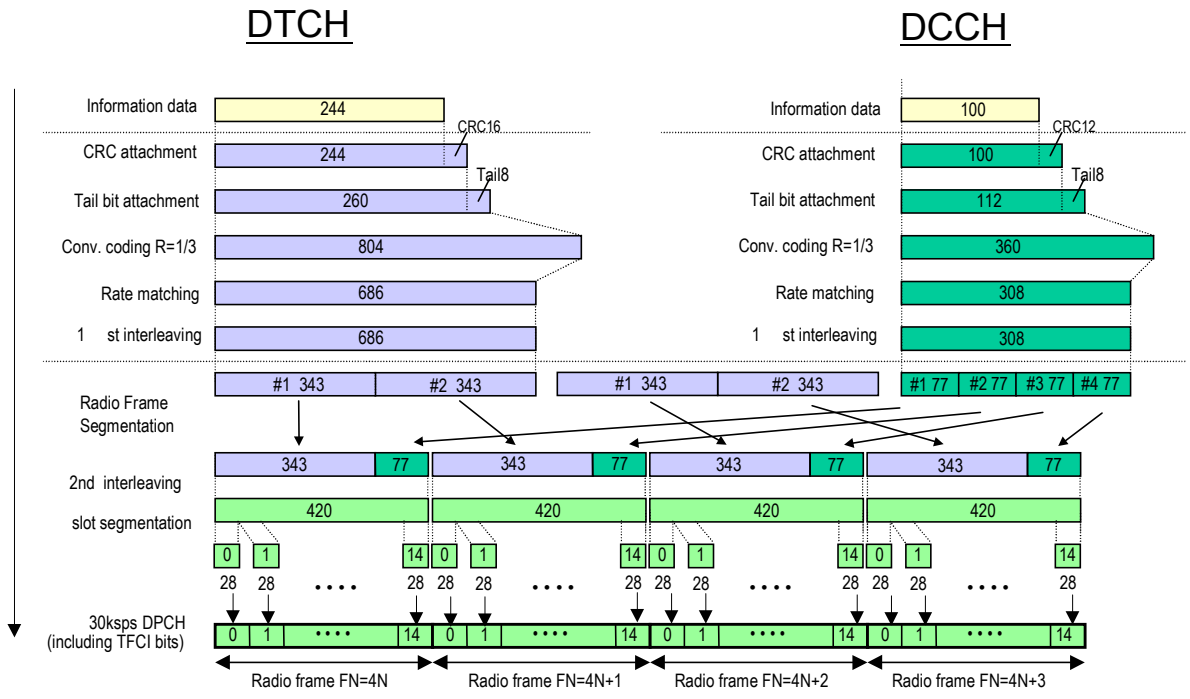


Fig. 4-62 Channel coding of DL reference measurement channel (12.2 kbps)

Table 4-14 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 4-15 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. 4.139), 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 4-16 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...`

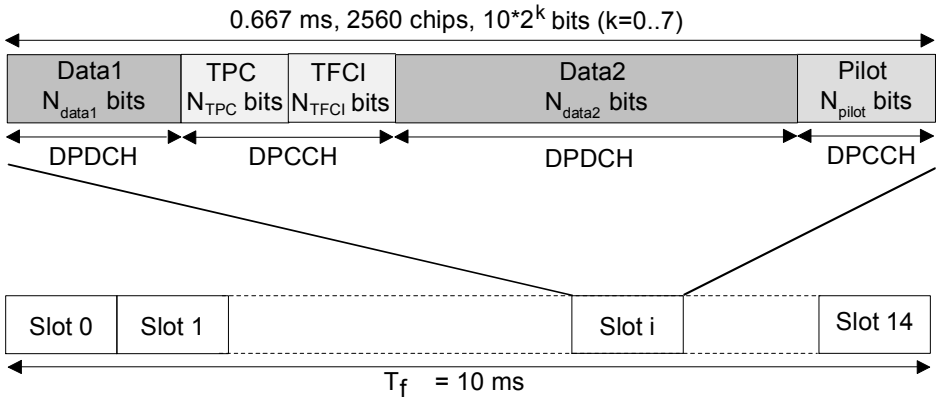


Fig. 4-63 Structure of an downlink DPCH in time domain

DPCCH Dedicated Physical Control Channel
DPDCH Dedicated Physical Data Channel
TFCI Transport Format Combination Indicator
TPC Transmit Power Control

Table 4-16 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 4-17 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 4-17 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 4-17 below.

Remote control
```
SOURce:RFGenerator:DCCH:TYPE
SOURce:RFGenerator:DCCH:TVALue
DEFault:RFGenerator:DCCH
```

Table 4-17 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 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.

TPC Pattern Setup Selects the TPC pattern setup to be used. All setups no. 01 to 05 are defined by the *TPC Pattern Type* and the single *Pattern;* see *Table 4-18* below. .

TPC Pattern Type TPC command sequence transferred to the UE. Together with the power control algorithm set at the UE, 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* ff.

The actual pattern transferred depends on the finite single *Pattern* defined below, the *TPC Pattern Type* and the *Activate Pattern* setting; see *Table 4-19* 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.

Activate Pattern Enabled for *TPC Pattern Type = Single Pattern + All 0, Single Pattern + All 1* or *Single Pattern + Alternating.* Selecting *On* terminates the running alternating bit sequence at the next matching frame boundary and replaces it by <Pattern>000..., <Pattern>111..., or <Pattern>(0)10010...; see *Table 4-19 and rules for the transfer of TPC patterns below.* The function is afterwards switched back to the *Off* state. The function can be used repeatedly to insert single patterns into the bit sequence and test the inner loop TPC.

Note: *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. 4.122 ff.), must be adapted to the expected maximum power. This can be done using autoranging. The transmitter output power must be compatible with the input level range of the CMU input connectors.*

Remote control

```
SOURce:RFGenerator:TPC:PSET<nr>
SOURce:RFGenerator:TPC:PTYPe<nr>
SOURce:RFGenerator:TPC:PATTern<nr>
DEFault:RFGenerator:TPC
SOURce:RFGenerator:TPC:RPATtern
```

Table 4-18 Default TPC Patterns: Non Signalling

Setup No.	TPC Pattern Type	Pattern	Description
1	Alternating 0, 1	0101010101 0101010101	UE maintains its power (averaged over 2 slots).
2	Continuous Pattern	1111100000 1111100000	UE periodically increases and decreases its output power in 5-slot intervals. The average UE power over 10 slots is constant irrespective of the TPC algorithm.
3	Single Pattern + All 0	1111111111 1111111111	UE increases its output power on each <Activate Pattern> event; otherwise it decreases its power up to its minimum power level.
4	Single Pattern + All 1	0000000000 0000000000	UE decreases its output power on each <Activate Pattern> event; otherwise it increases its power up to its minimum power level.
5	Single Pattern + Alternating	1111111111 0000000000	On each <Activate Pattern> event, the UE increases and decreases its output power in 10-slot intervals. The average UE power over 20 slots is constant irrespective of the TPC algorithm.

Table 4-19 Single pattern and TPC Pattern Type: Non Signalling

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*[2]
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*[2]

2 *Activate Pattern* causes a trigger event for the transmission of <Pattern>. See *Rules for the transfer of TPC patterns.*

TPC Pattern Type	Transferred pattern for a single pattern <Pattern>	Trigger events
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*[2]

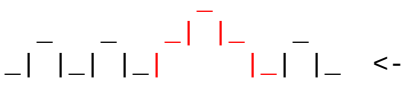
Rules for the transfer of TPC patterns:

- 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>.*

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



b) 1st and last bit in <Pattern> equal

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	P-CCPCH	PICH	DPCH	HS-SCCH	HS-DSCH
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 4-20 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.
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.
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.
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.

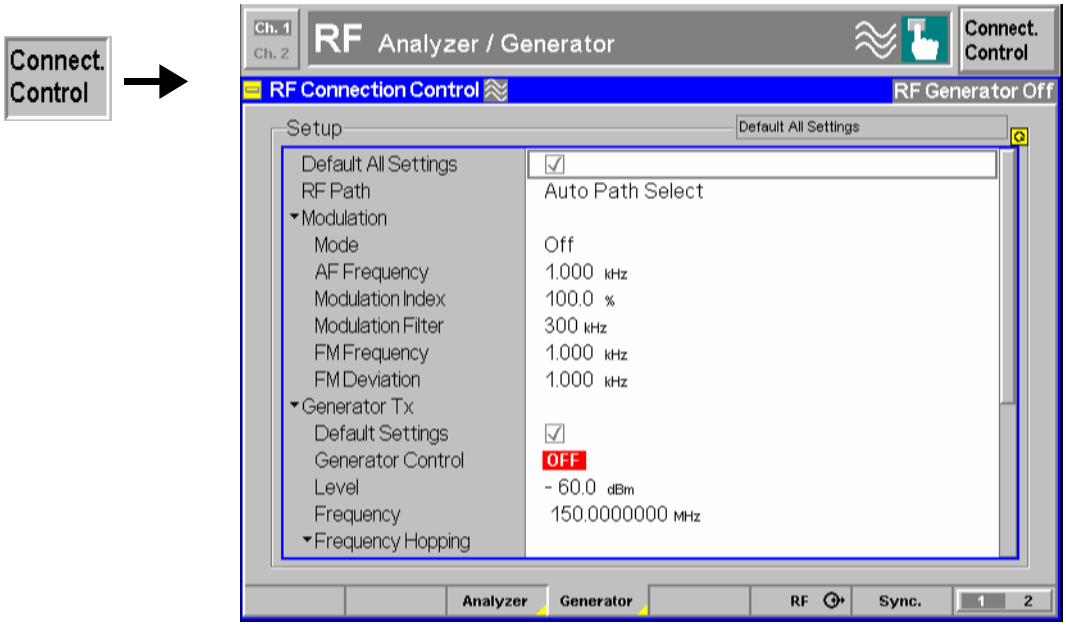


Fig. 4-1 Connection Control – RF generator settings (table)

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).*

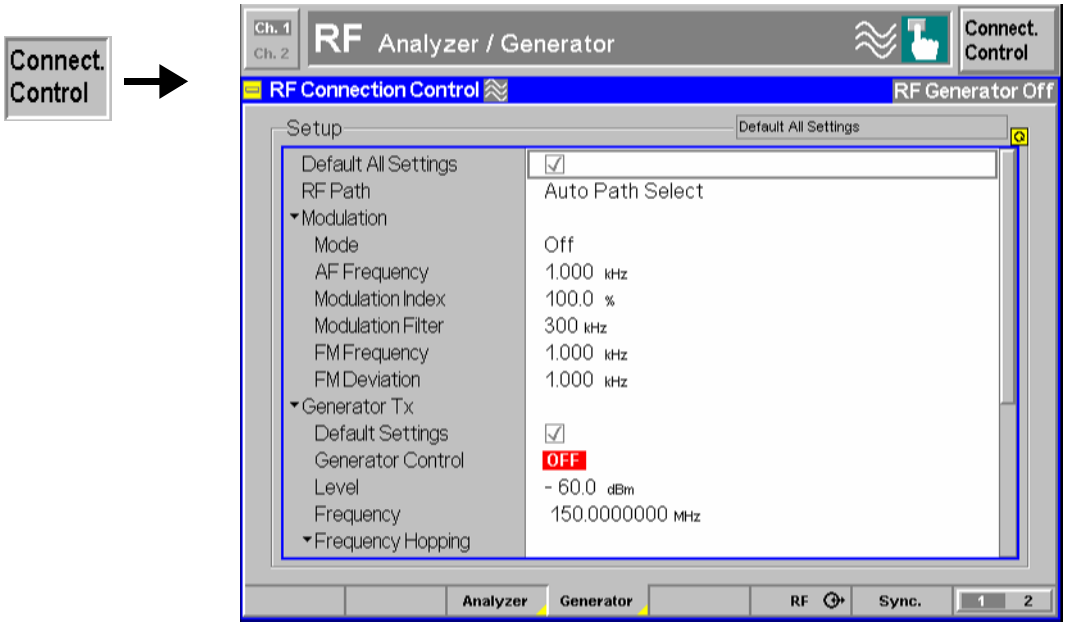


Fig. 4-2 Connection Control – RF inputs/outputs

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)*

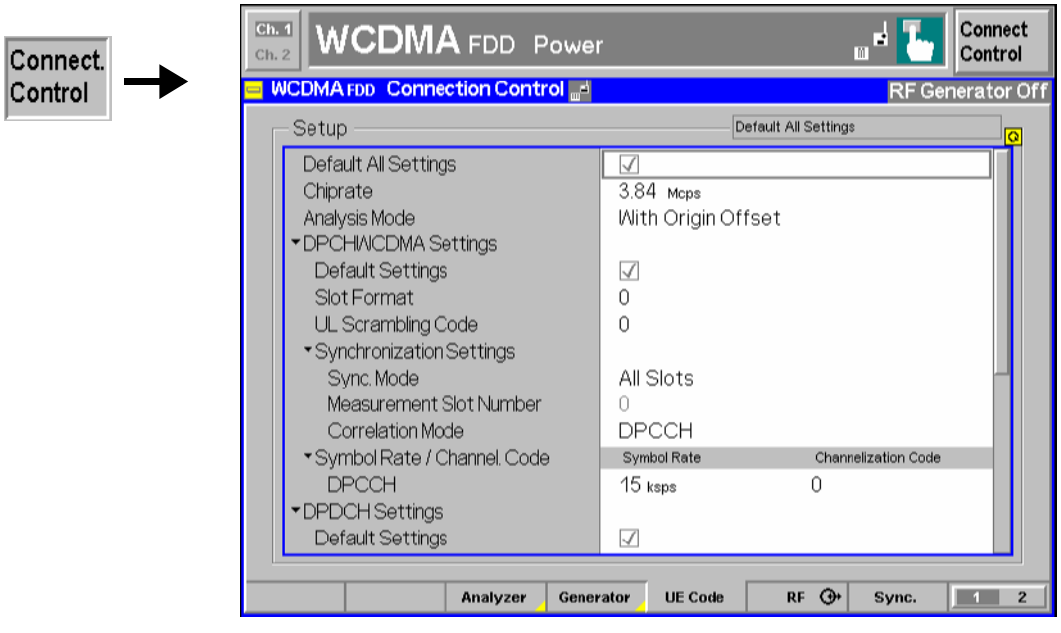


Fig. 4-64 Connection Control – RF connectors

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. *4.51* ff. and for *Code Domain Power* measurement described on p. *4.90* ff. 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:

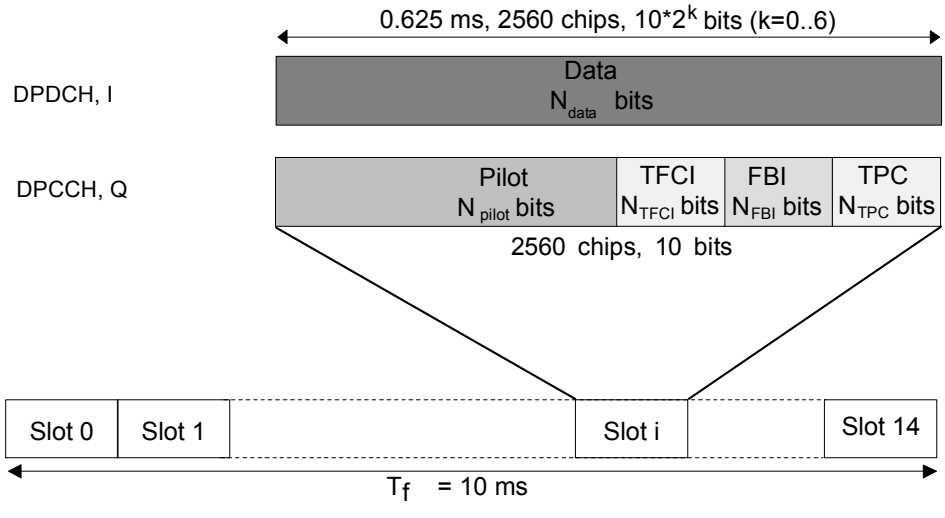


Fig. 4-65 Structure of an uplink DPCH in time domain

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 4-21 below.

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 4-21 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
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. 4-66 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.

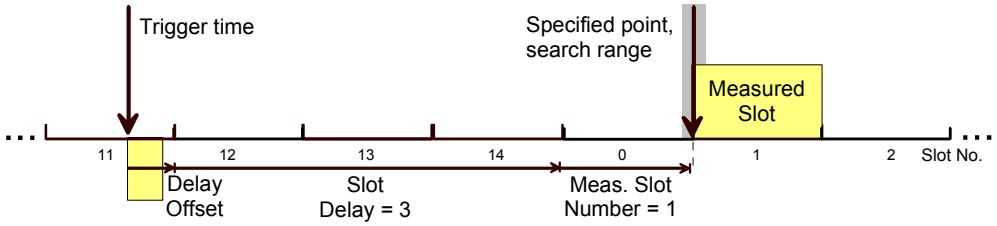


Fig. 4-66 Measured slot in Synchronous mode

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. 4-66 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. 4.163; *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 Offset = 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. *4.51* ff. 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 begin-*

ning 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. 4.51 ff.

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 set symbol rate and derives its channelization codes according to the specified properties; see section *Measurement Menu (Modulation WCDMA)* on p. 4.51 ff.

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:AUTO:SRATe <Rate>
CONFigure:UECode:DPDCh:AUTO:THReshold <THReshold>
CONFigure:UECode:DPDCh:MANual:MSIGnal <Channels>
CONFigure:UECode:DPDCh:MANual:DPDCh1:SRCCode <Channels>
```

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.

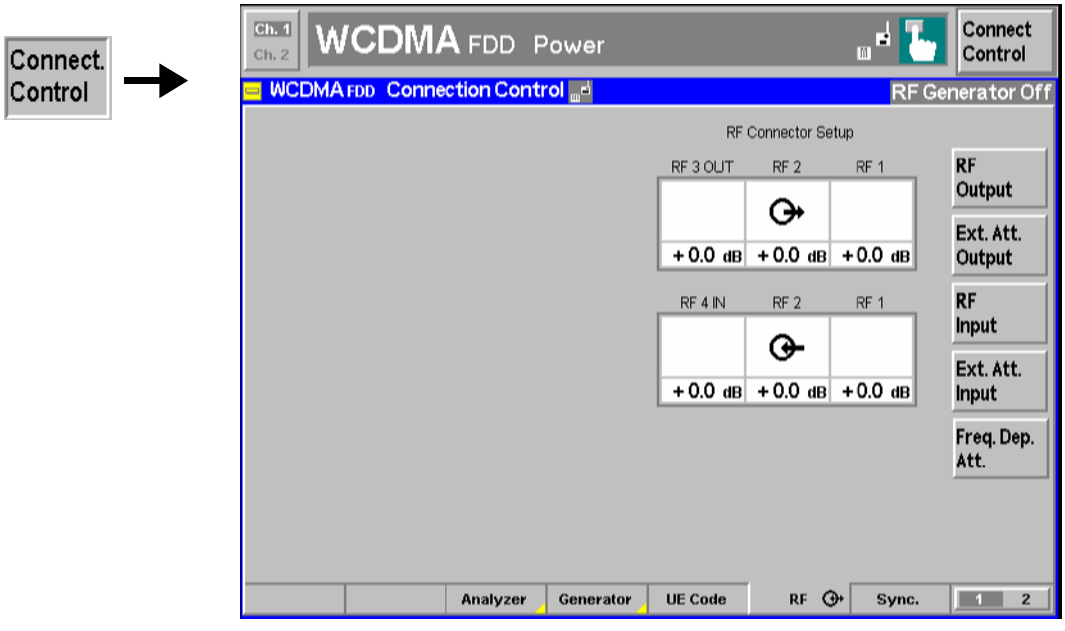


Fig. 4-67 Connection Control – RF connectors

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.*

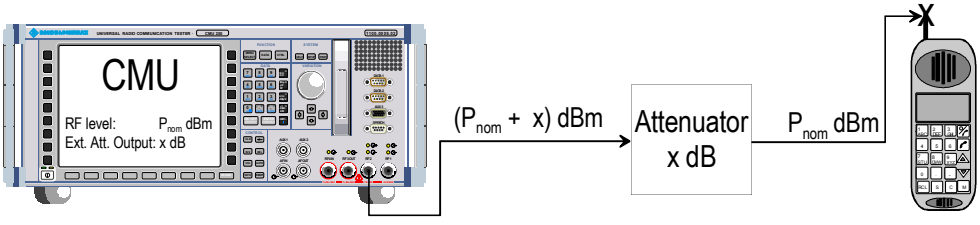
The LEDs on the front panel are only „on“ (light) if the output level is switched on.

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.

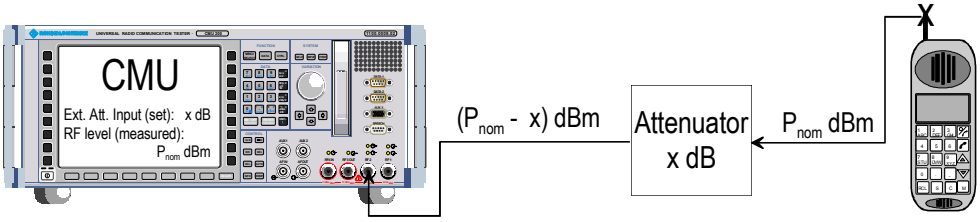
Remote control

```
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 4.125), 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. 4.158 ff.

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).

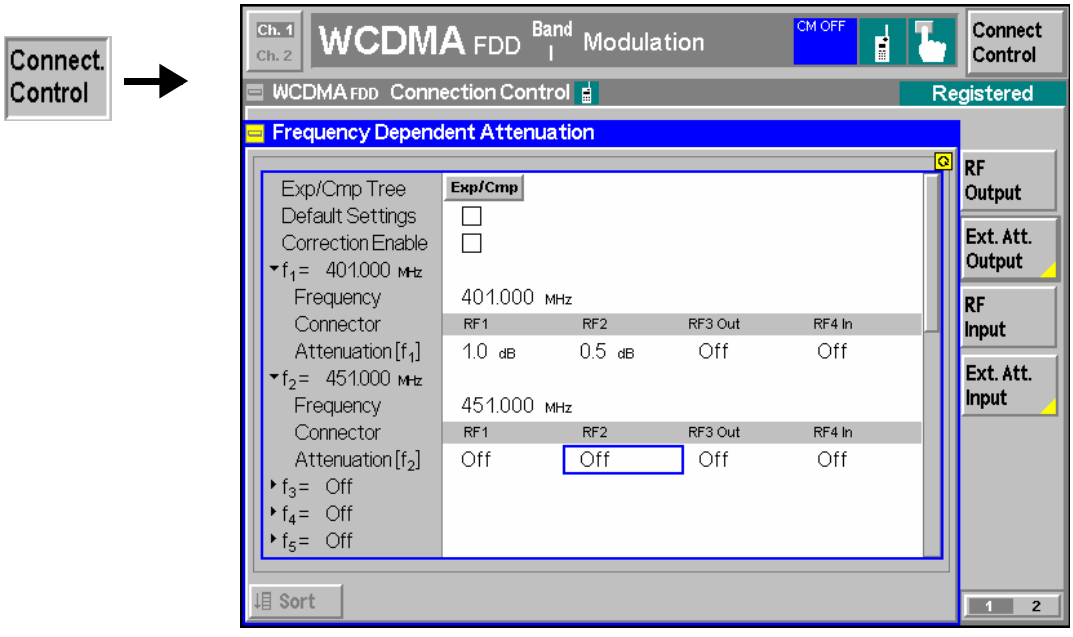


Fig. 68 Frequency-dependent attenuation

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)

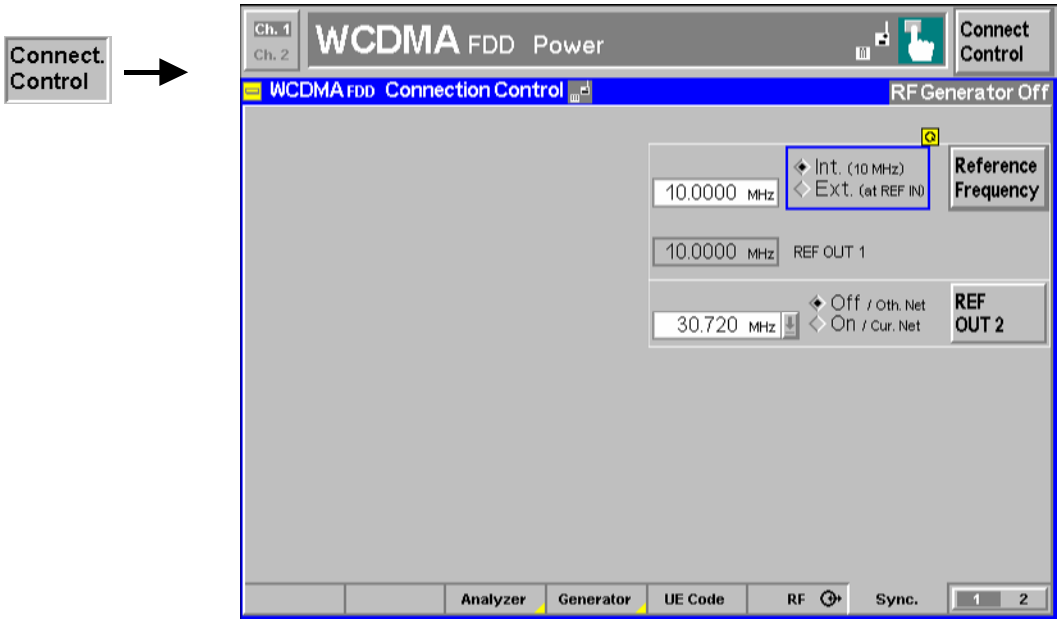


Fig. 4-69 Connection Control – Sync.

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.

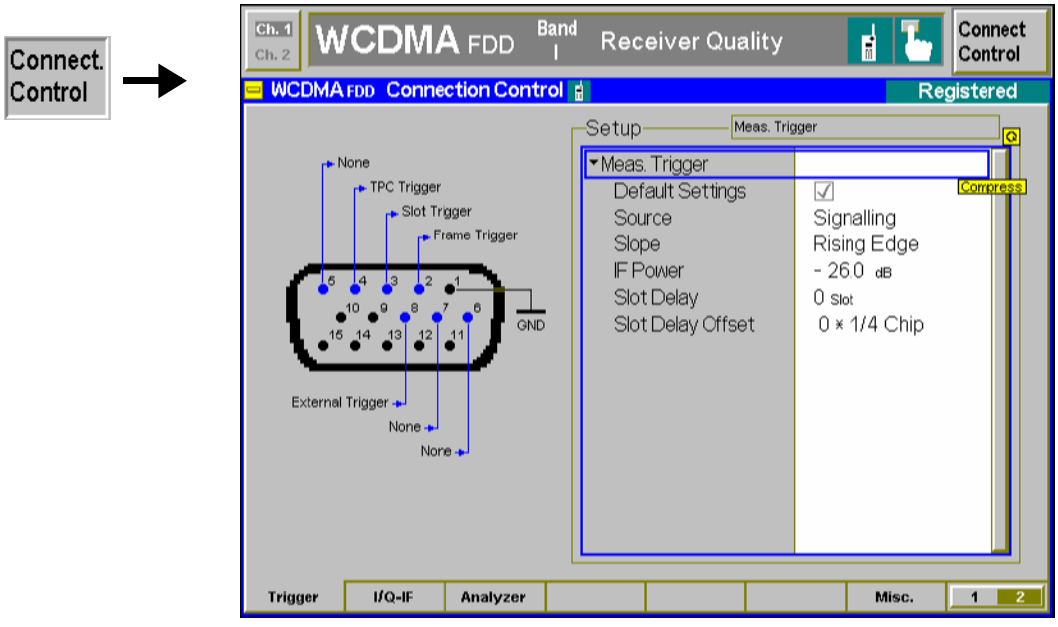


Fig. 4-70 Connection Control – Trigger

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)[3]. 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. 4-72 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. *4.3* ff.). Again, a trigger delay can be added to the frame trigger time (see *Fig. 4-72 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.

3 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. 4-72 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. *4.3* ff. 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)[4]. 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** 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 5 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. 4.166 ff. 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 4-34 on p. 4.233 gives and overview of the compatibility between the different trigger sources and WCDMA measurements.

Remote control

```
TRIGger[:SEQuence]:SOURce FRUN | EXTern | INTern | IFPower
```

4) The slot and frame trigger depends on the *DL DPCH Timing Offset;* see p. 4.138.

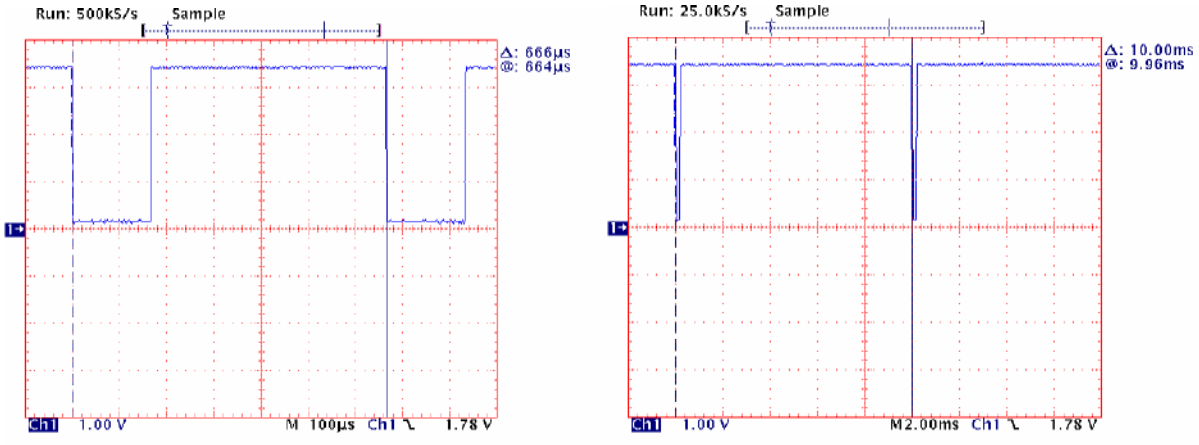


Fig. 4-71 Slot trigger and frame trigger

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. 4-72 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>`

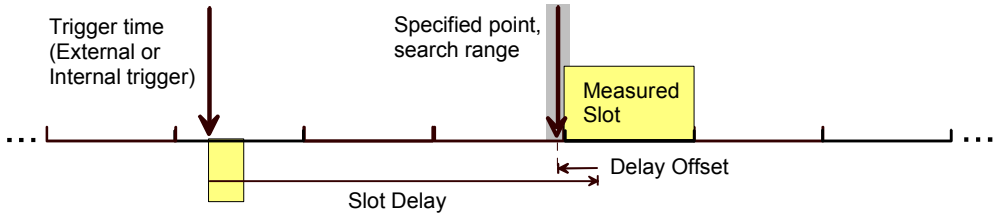


Fig. 4-72 Slot Delay and Delay Offset

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>`

Slope *Slope* 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 or *Internal* trigger source.

Remote control
`TRIGger[:SEQuence]:SLOPe POSitive | NEGative`

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. 73 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.

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).

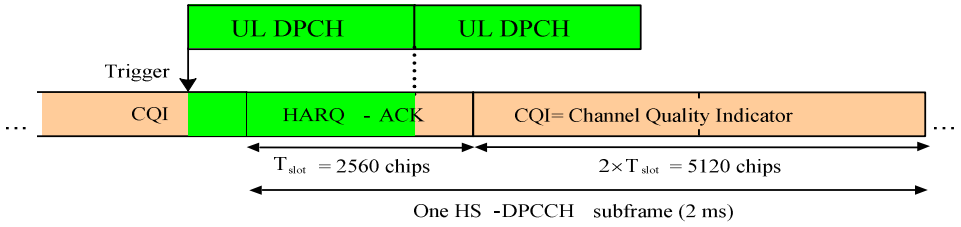


Fig. 73 HS-DPCCH trigger and HS-DPCCH timing

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. 4.168 ff.

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-CCPICH. 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. 4.138).
- The HS-DPCCH is at a fixed ½ slot offset after the P-CCPICH. 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-CCPICH 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.

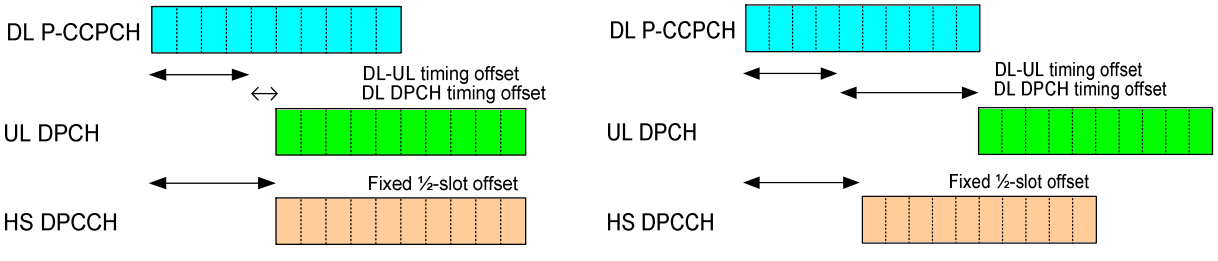


Fig. 74 HSDPA slot timing according to example 1 (left) and 2

Modification: Spectrum

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

measurement

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.

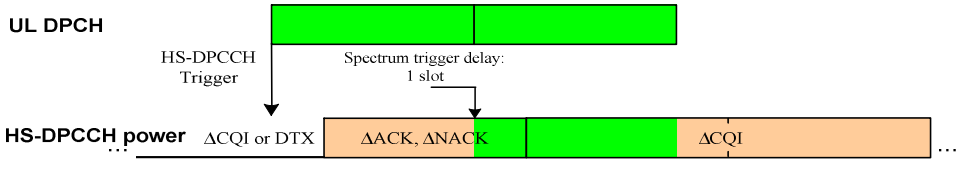
Hence, in order to ensure stable and correct results, HS-DPCCH trigger events for all *Spectrum* measurements are only generated if the HS-DPCCH power in the CQI slots following the ACK or NACK symbols is not switched off (no DTX). In addition, the measurement is delayed by one slot relative to the trigger 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.

The 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.*



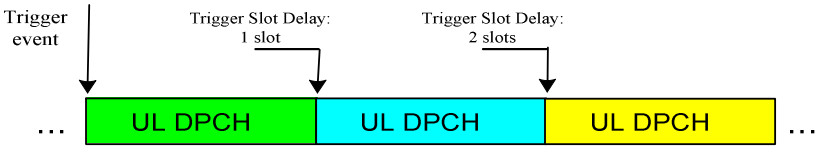
This modification is automatically enabled while a *Spectrum* measurement application is running.

Trigger Offsets for TX Measurements

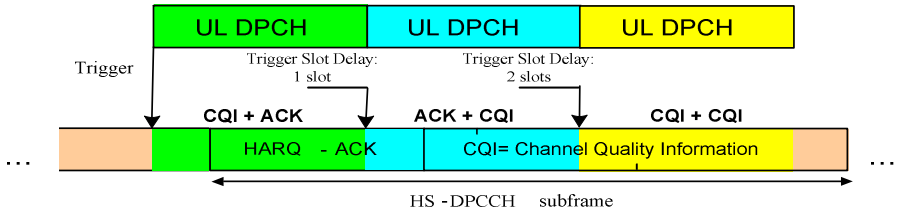
The timing of the trigger events initiating the measurement and of the trigger output signals can be modified by means of the *Slot Delay* and *Slot Delay Offset* parameters in the *Trigger* tab of the *Connection Control* menu. The impact of the *Slot Offset* is equal for all TX measurements; the impact 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 n^{th} UL slot after the trigger event. This means that measurements on non-HSDPA channels (UL DPCHs) are slot-aligned.



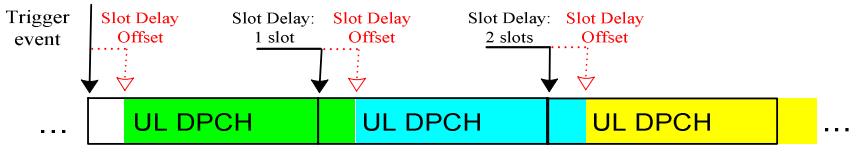
HSDPA channels have an offset relative to the UL DPCH, depending on the *DPCH Timing Offset* parameter in the *RF Generator* or *BS Signal* tab of the *Connection Control* menu (see section *HS-DPCCH Trigger* on p. 4.166 ff.).



With *DPCH Timing Offset* values of 1, 11, 21,... the HSDPA measurements are also slot-aligned.

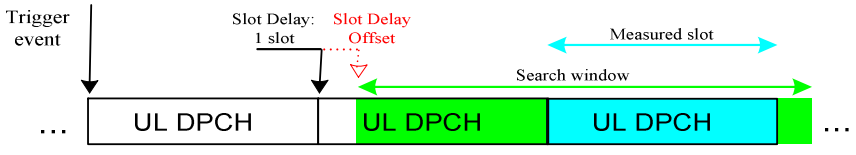
Slot Delay Offset

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.

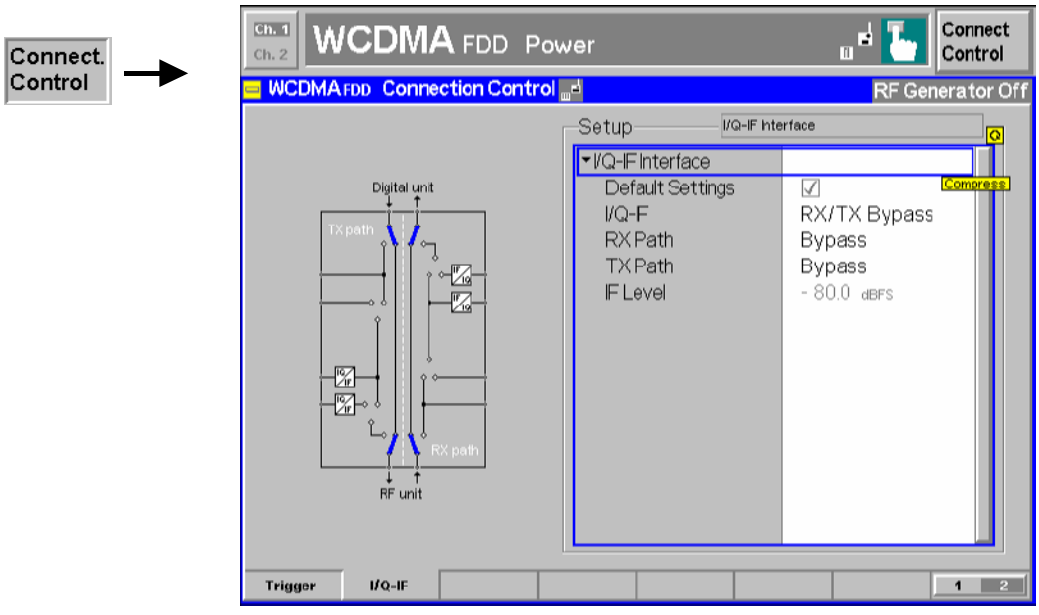


Fig. 4-75 Connection Control – I/Q-IF

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 4-22 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
```

IF Level Indicates the IF output level in the TX path relative to the maximum IF input/output level (PEP) cited in the data sheet. The value is equal to the I/Q output level in the TX path relative to the maximum I/Q input voltage cited in the data sheet. The result is in dBFS units (dB Full Scale).

Remote control `[SENSe:]IQIF:IFLevel?`

Table 4-22 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 Connections on p. *4.187 ff.*

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. 4-77* on p. 4.173.
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. 4-76* 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. 4.205) and *Test Mode* (see p. 4.207) 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:

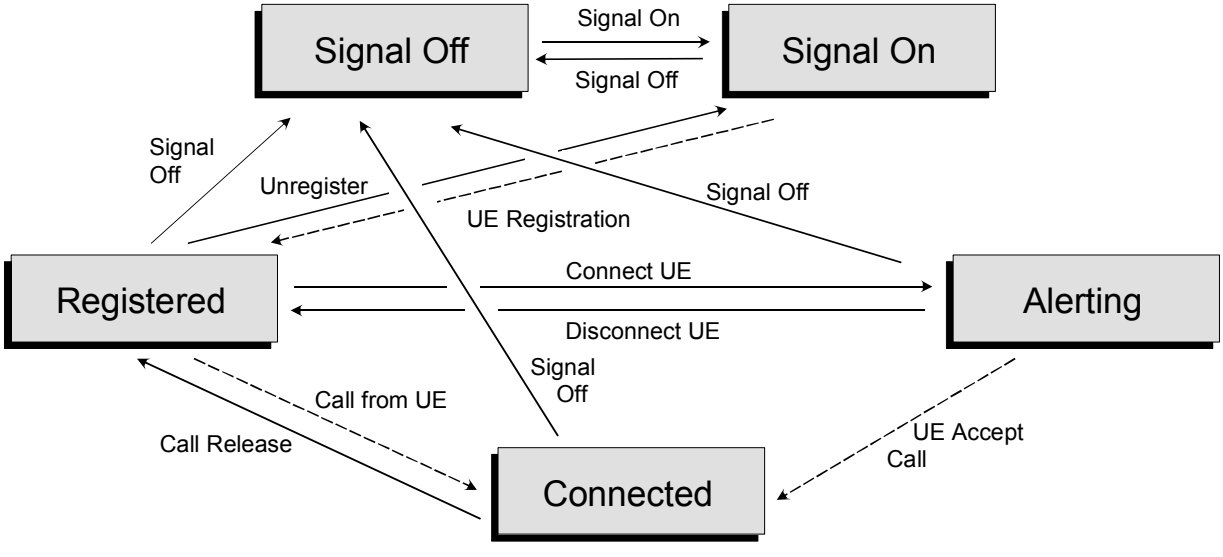


Fig. 4-76 Signalling states of the CMU: Connection with Alerting

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:

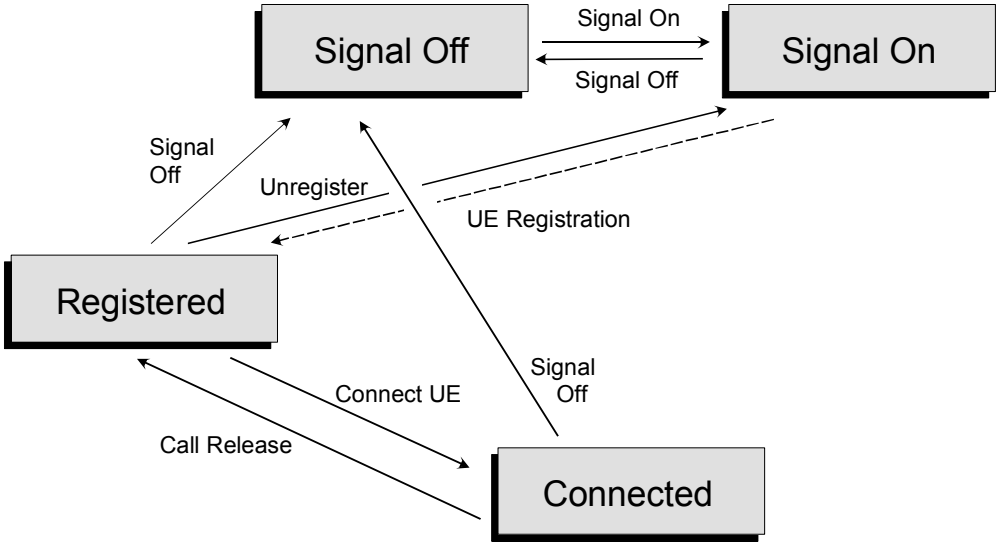


Fig. 4-77 Signalling states of the CMU: Connection without Alerting

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. 4.238 ff.

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

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. 4.183 ff. 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. 4-76*).

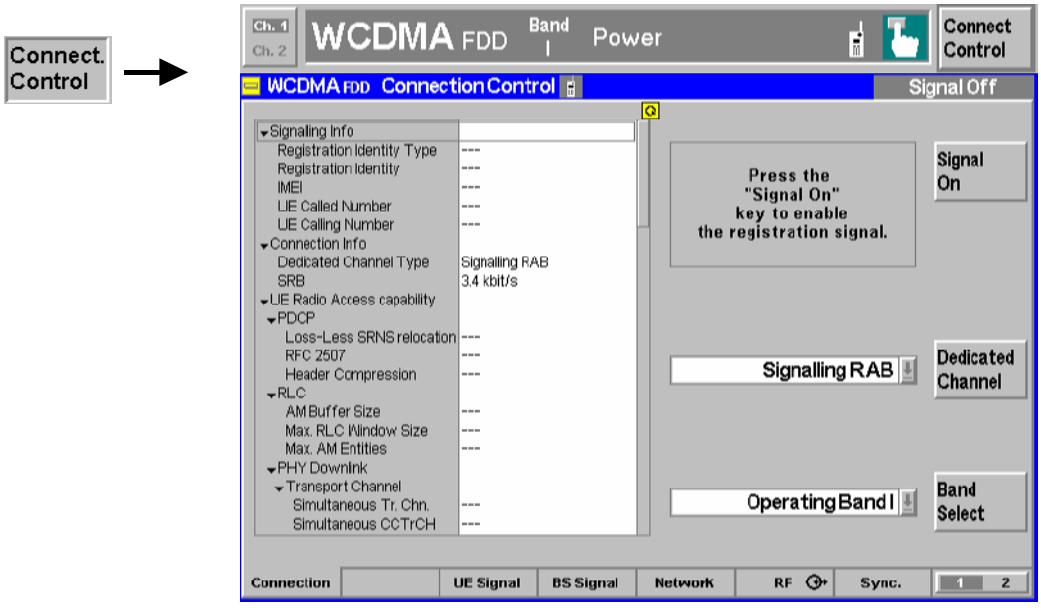


Fig. 4-78 Connection Control – Connection (Signal Off)

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. 4.179 ff. 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. 4.205.

Remote control
`CONFigure:BSSignal:DCH:TYPE RMC | VOIC | SRAB | SRF`

Band Select

The *Band Select* softkey selects the UTRA/FDD frequency band in which the UE is designed to operate:

- 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 1885 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.

All uplink and downlink channel numbers and frequencies are quoted in *Table 4-8* on p. 4.124 and in *Table 4-12* on p. 4.135, respectively.

Remote control

```
CONFigure:NETWork:OBANd
      OPB1 | OPB2 | OPB3 | OPB4 | OPB5 | OPB6
```

Connection – State Signal On

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. 4.173 ff., 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, 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. 4.203 ff.

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. 4-76*).

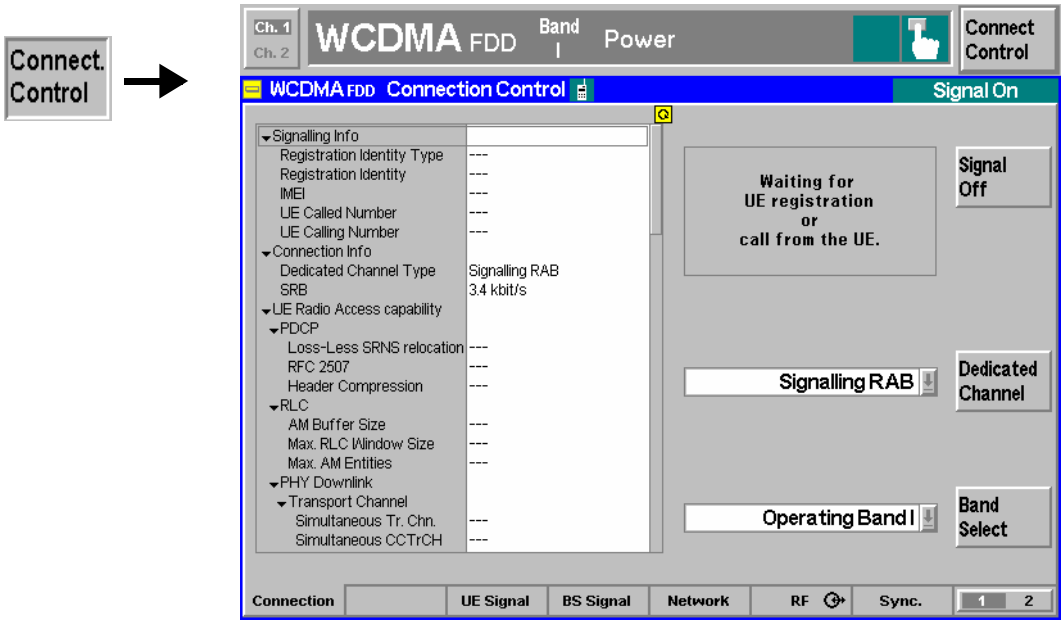


Fig. 4-79 Connection Control – Connection (Signal On)

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. 4.179 ff. 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

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. 4.173 ff., 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* -> 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* 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),* or by the *Connection (Connected)* tab if the UE initiates a connection to the CMU, see *Fig. 4-76* on page 4.172.

Note: *The parameter settings in the Requested UE Data section of the Network tab have and influence on the registration procedure; see p. 4.225. If registration fails, check whether the UE capabilities are in accordance with the Requested UE Data settings.*

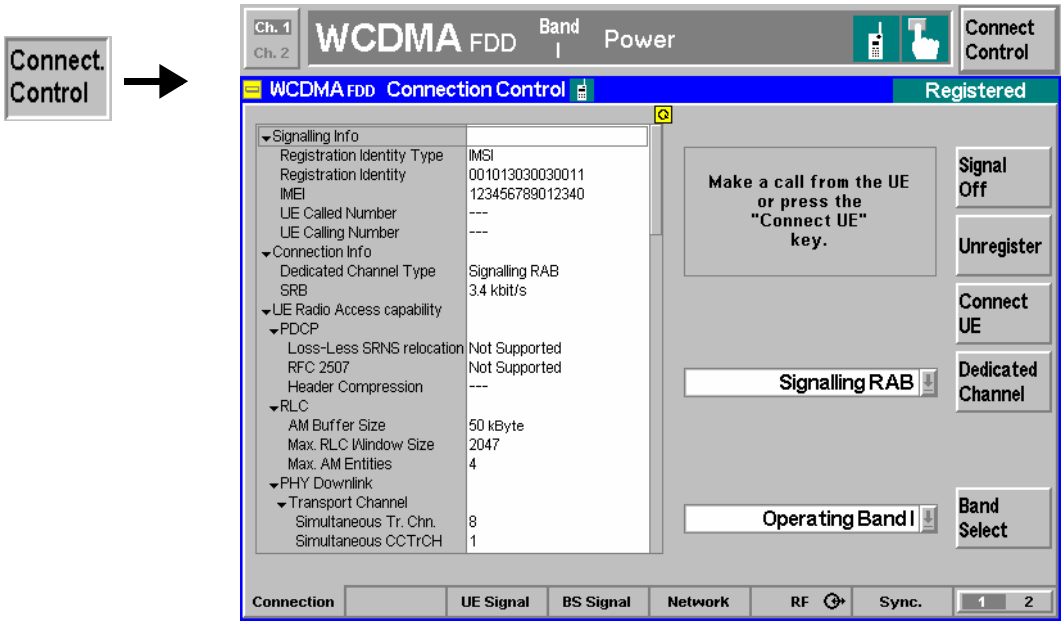


Fig. 4-80 Connection Control – Connection (Registered)

The softkey *Signal Off* is described in section *Connection – State Signal On* on page 4.175.

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. 4.179 ff. 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 The softkey *Connect UE* initiates a connection between the CMU and the UE. The CMU pages the UE 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 signalling state *Connected*.

Remote control
`PROCedure:SIGNalling:ACTion CTM`

Connection – State Alerting

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. 4.173 ff., 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* 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* 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* softkey, UE connection release), see *Fig. 4-76*.

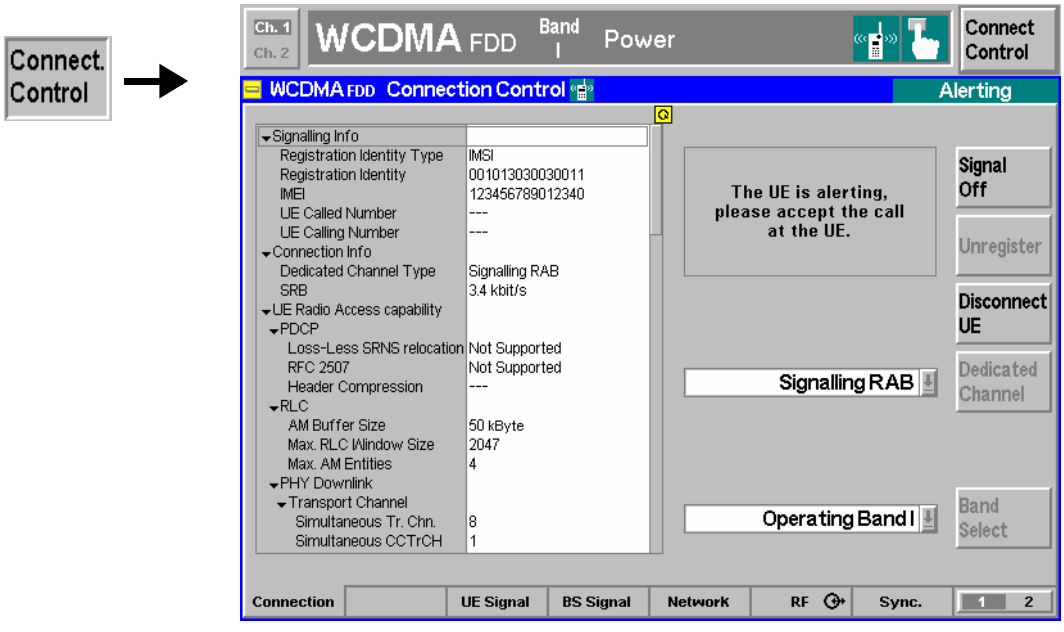


Fig. 4-81 Connection Control – Connection (Alerting)

The softkey *Signal Off* is described in section *Connection – State Signal On* on page 4.175.

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. 4.179 ff. 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 The *Disconnect UE* softkey releases the connection to the UE. The CMU changes to the signalling state *Registered*.

Remote control
`PROCedure:SIGNalling[CSWitched]:ACTion CREL`

Connection – State Connected

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. 4.173 ff., 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* –> state *Registered)*

The tab Connection *(Connected)* can be opened after a connection attempt from the CMU *(Connect UE* 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* softkey, UE connection release) see *Fig. 4-76*.

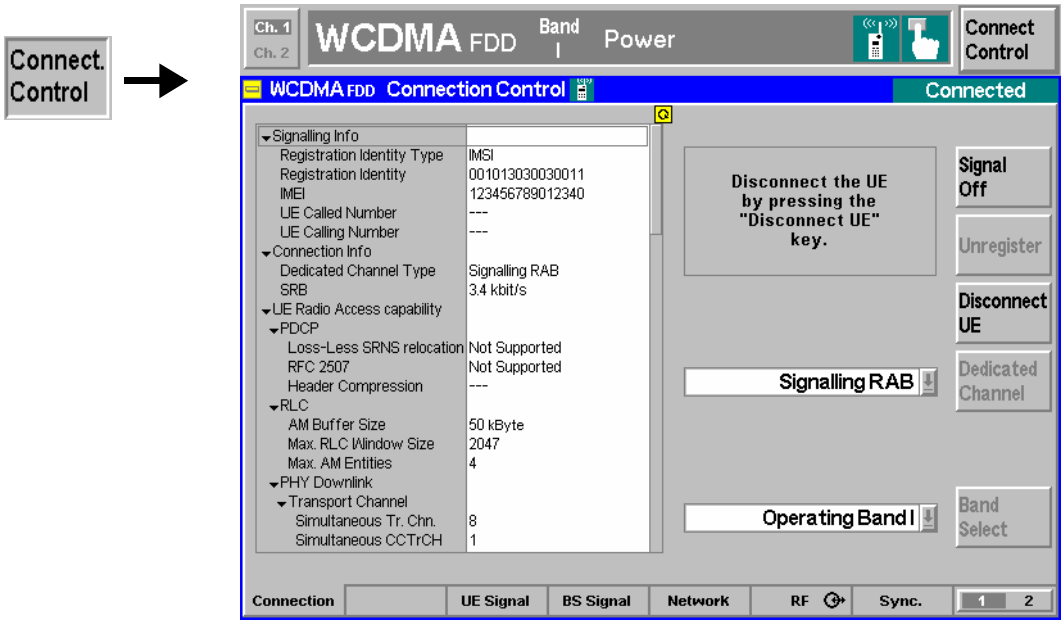


Fig. 4-82 Connection Control – Connection (Connected)

The function of the *Signal Off* softkey is described in section *Connection – State Signal Off* on page 4.173, the *Disconnect UE* softkey in section *Connection – State Alerting* on page 4.178.

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 request is enabled in the *Network* tab; see p. 4.225.

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

Remote control
```
[SENSe]:SIGNalling:RIType?
[SENSe]:SIGNalling:RIDentity?
[SENSe]:SIGNalling:IMEI?
[SENSe]:SIGNalling:DNUMber?
[SENSe]:SIGNalling:CNUMber?
```

Connection Info The *Connection Info* parameter displays the settings made to set up the connection.

Dedicated Channel Type Dedicated channel (to be) allocated between the CMU/UTRAN and the UE; see p. 4.205.

SRB Data rate of the Signalling Radio Bearer used, depending on the dedicated channel type.

Remote control
```
CONFigure:BSSignal:DCH:TYPE
CONFigure:BSSignal:DCH:RMC:RTYPE
```

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. 4.225.

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 of loss-less SRMS relocation

RFC 2507 Support of header compression according to RFC 2507

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.

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 The *Physical Downlink – Transport Channel* section describes the capacity of the UE to simultaneously process and store downlink transport channels:

Channel

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 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: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/PDSCH Codes Maximum number of DPCH/PDSCH 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.

PDSCH Support of the Physical Downlink Shared Channel (PDSCH).

Channel Estimation Pilots Support for dedicated pilots for channel estimation.

Simultaneous Reception Support of simultaneous reception of the Secondary Common Control Physical Channel and the Dedicated Physical Channel *(SCCPCH, DPCH)* and of the three channels *SCCPCH, DPCH, PDSCH.* The PDSCH part of the latter capability is only relevant if the UE supports PDSCH, as covered by the capability *PDSCH*.

SCCPCH Radio Links Maximum number of radio links on which the UE is capable of receiving SCCPCH simultaneously.

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).

PCPCH Support of the Physical Common Packet Channel (PDSCH). When CPCH is supported, then simultaneous DPCCH & SCCPCH reception is needed.

UE Power Class Indicates the UE power class as defined in 3GPP TS 25.101, *UE Radio Transmission and Reception (FDD)*.

Remote control
`[SENSe]:UECapability:PUPLink?`

RF Parameters

Tx/Rx Frequ. Separation Indicates the uplink/downlink frequency separations supported by the UE. This parameter depends on the operating band of the UE.

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.

Multi-Carrier Mode Indicates whether the UE supports multi-carrier mode.

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 Difference 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.

Remote control
`[SENSe]:UECapability:UEPosition?`

Measurement Related

The *Measurement Related* section contains parameters related to inter-frequency or inter-Radio Access Technology (RAT) measurements:

DL Compressed Mode Indicates whether the UE needs compressed mode in the downlink in order to perform inter-frequency or inter-RAT measurements.

UL Compressed Mode Indicates whether the UE needs compressed mode in the uplink in order to perform inter-frequency or inter-RAT measurements.

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.

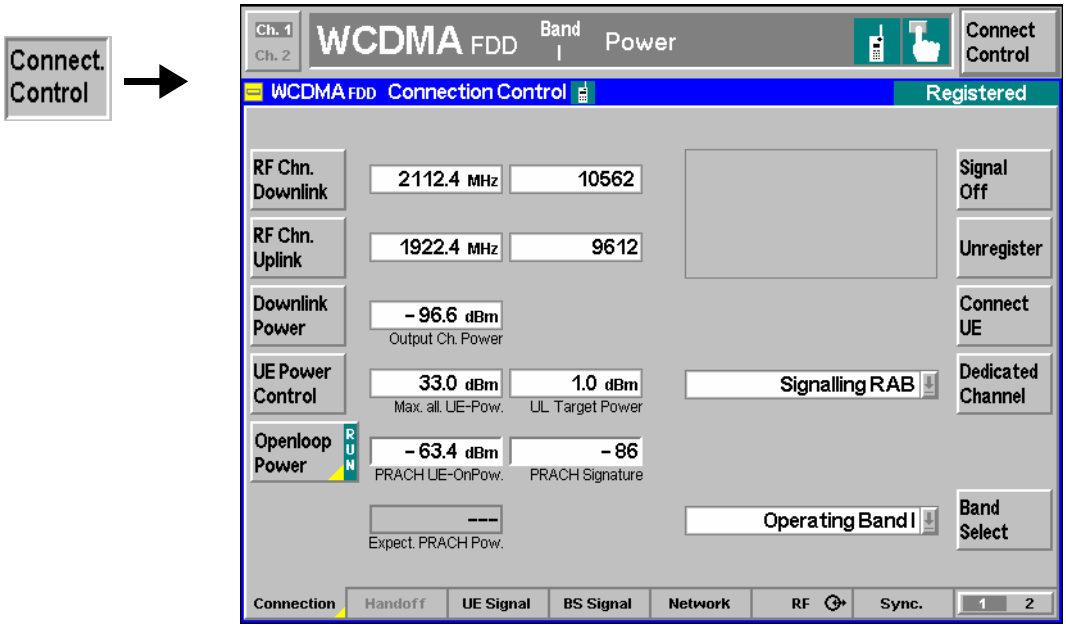


Fig. 4-83 Connection Control – Connection (RF Channel and Power)

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. 4.127 ff.

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. 4.122 ff.

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. 4.203 ff.

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. 4.196 ff.

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. 4-97 on p. 4.224. To obtain a measurement result, proceed as follows:

4. Reset the instrument and make sure that all TX measurements are turned off.
5. Open the *Connection Control* menu and press the *Signal Off* softkey in the *Connection* tab.
6. Press *Openloop Power* and the *ON/OFF* key to initiate the openloop power measurement.
7. Press *Signal On* to switch on the *BS Signal.*
8. 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.

9. 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.*
10. Return to the *Connection* tab of the *Connection Control* menu.
11. Press *Openloop Power* and *ON/OFF* to re-start the measurement or simply close and re-open the *Connection Control* menu.
12. Press *Connect to UE*.

The openloop power results are updated after the CMU has received the first PRACH preamble from the UE.

13. 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. 4.230 *ff.* 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 $P_{preamble}$ on p. 4.199).

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?
```

Packet Switched 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 tests in *Signalling* mode (see Chapter 8) and for *WCDMA Application Testing* (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 *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. 84 on p. 4.188, 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 explicitly **before** a (CS or PS) connection is set up.

➢ Open the *Network* tab of the *Connection Control* menu and select *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:

5. 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*.

6. Open the *Network* tab and select *Packet Switched Domain: On*.
7. 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 or packet data application tests.

HSDPA Test Mode

8. Open the *BS Signal* tab and open the *Packet Switched – HSDPA Test Mode* section where you can select the *Radio Bearer* that the R&S CMU uses to set up the packet switched connection.
9. Still in the *BS Signal* tab, switch the HSDPA channels in the downlink signal on *(Downlink Physical Channels – HSDPA Channels: On).*
10. 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.
11. 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.

Packet Data Application Tests

4. Open the *BS Signal* tab and open the *Packet Switched – Packet Data* section where you can select the data rate for the application tests.
5. Set up a packet switched connection from your UE. Do not attempt a call from the R&S CMU or a simultaneous circuit switched connection.

The CMU is in the signalling state *PS: Established, CS: Registered* where it is ready to perform data application tests.

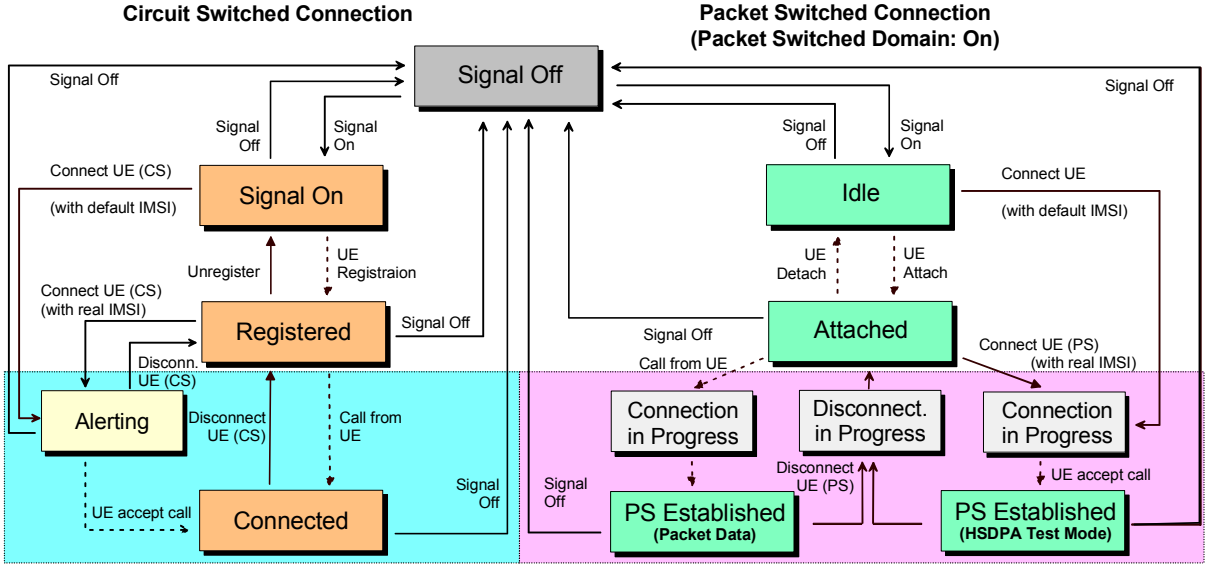


Fig. 84 Packet switched and circuit switched signalling states

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.*

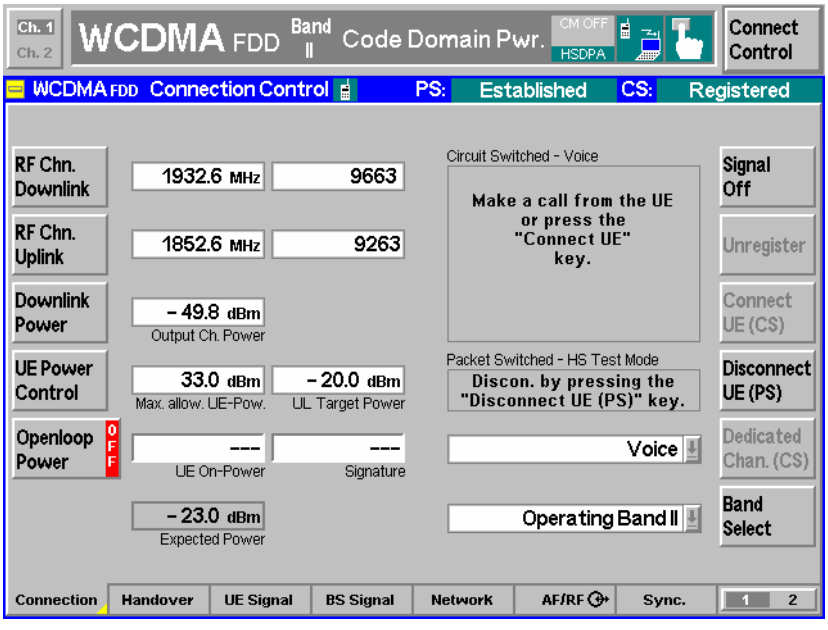
2. A CS connection (signalling state CS: Connected*) suspends the PS connection scheme; a PS connection (signalling state* PS: Established*) suspends the CS connection scheme (no multicall capability).*

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. 84 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). *HSDPA* appears on a green background if the HSDPA channels are switched on and the *PS Established (HSDPA Test Mode)* state is reached.



Remote control

```
PROCedure:SIGNalling:PSWitched:ACTion
[SENSe]:SIGNalling:PSWitched:STATe?
```

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. 4-87 on p. 4.194):

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).
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. 4-87 on p. 4.194.

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. 4.205. 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. 4.226.

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. 4.195 *ff.*

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.

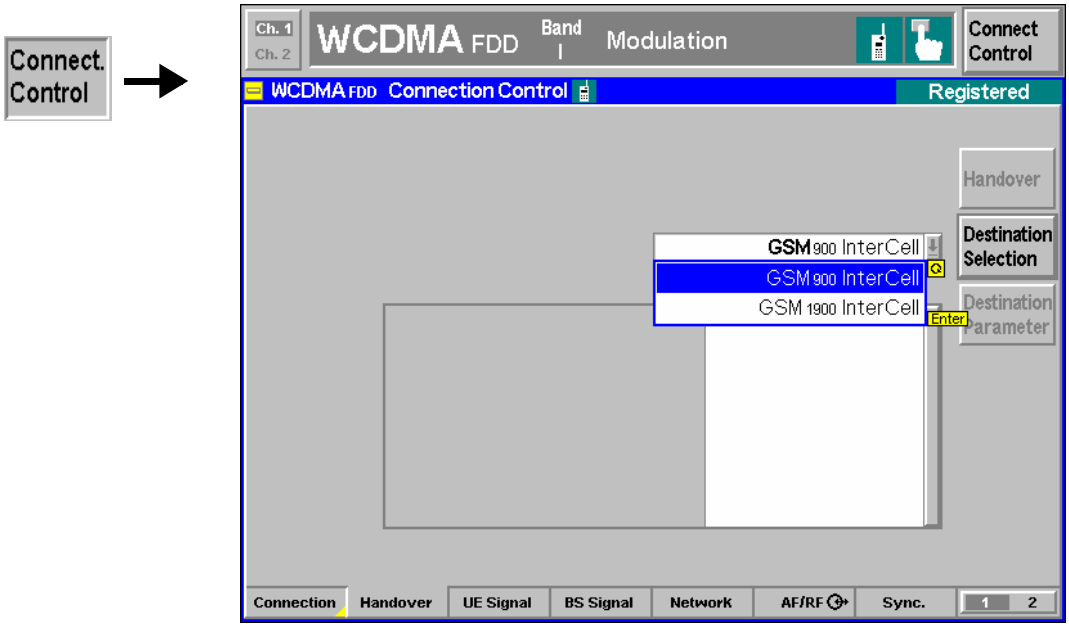


Fig. 4-85 Connection Control – Handover (destination selection)

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. 4-87 on p. 4.194.*

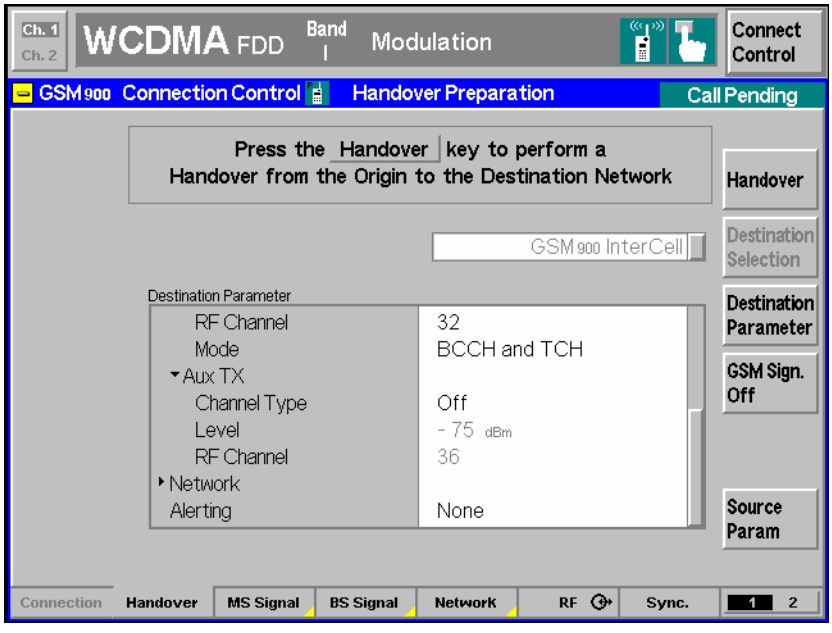


Fig. 4-86 Connection Control – Handover (Call Pending)

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 *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. 4.205) 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. 4-87 on p. 4.194). 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
```

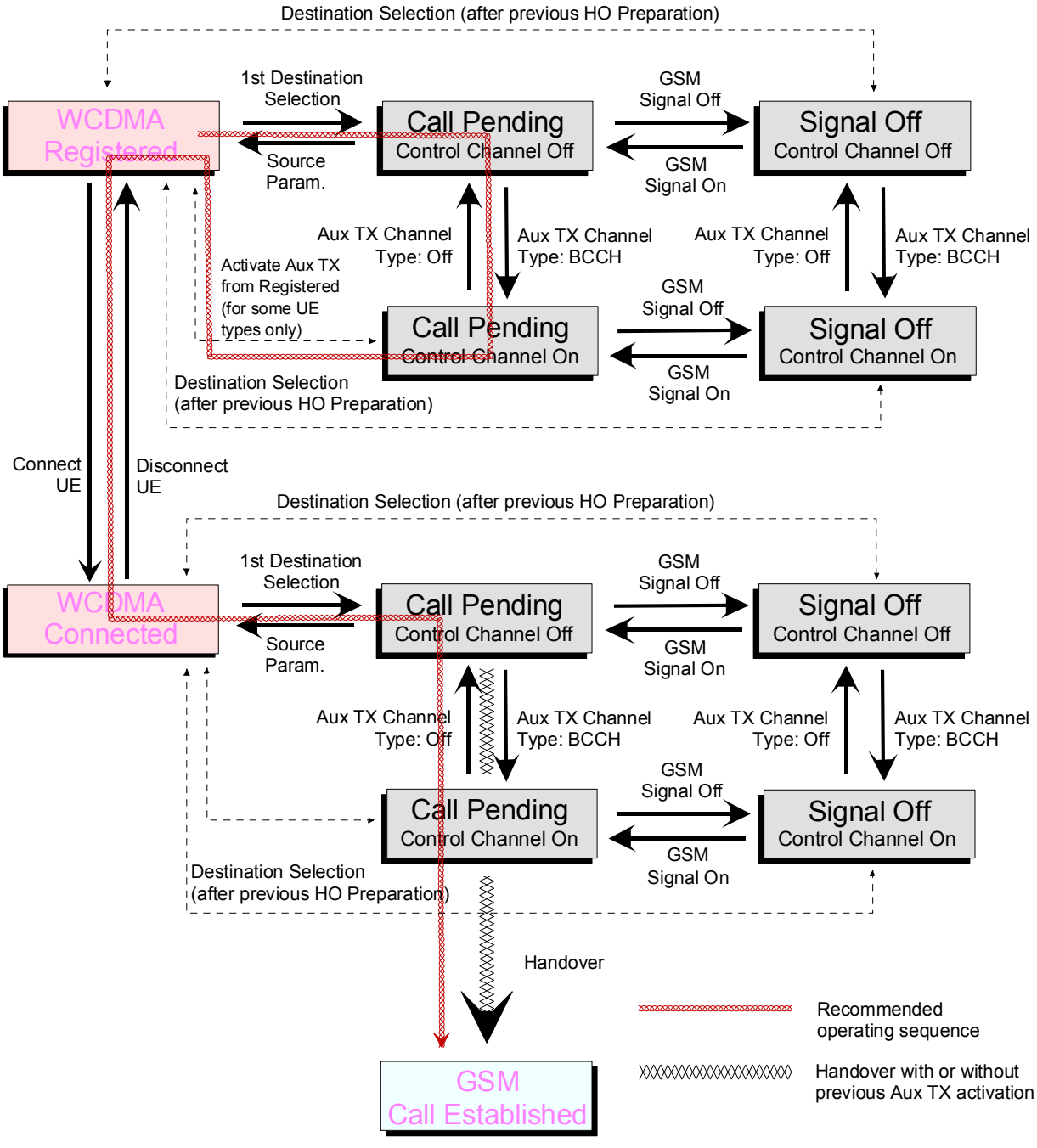


Fig. 4-87 Handover State Machine

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. 4.189.

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.

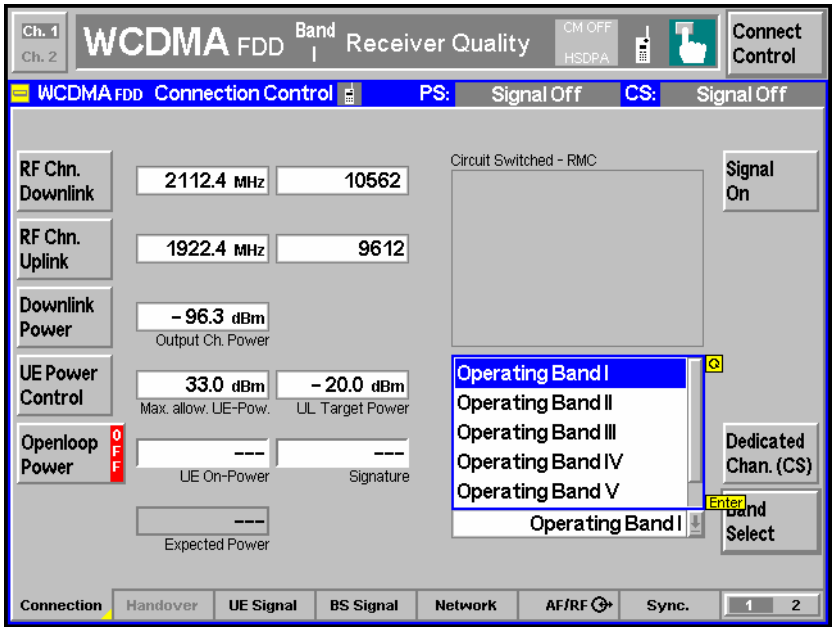


Fig. 88 Connection Control

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.

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
```

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. 4.201 ff.

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.

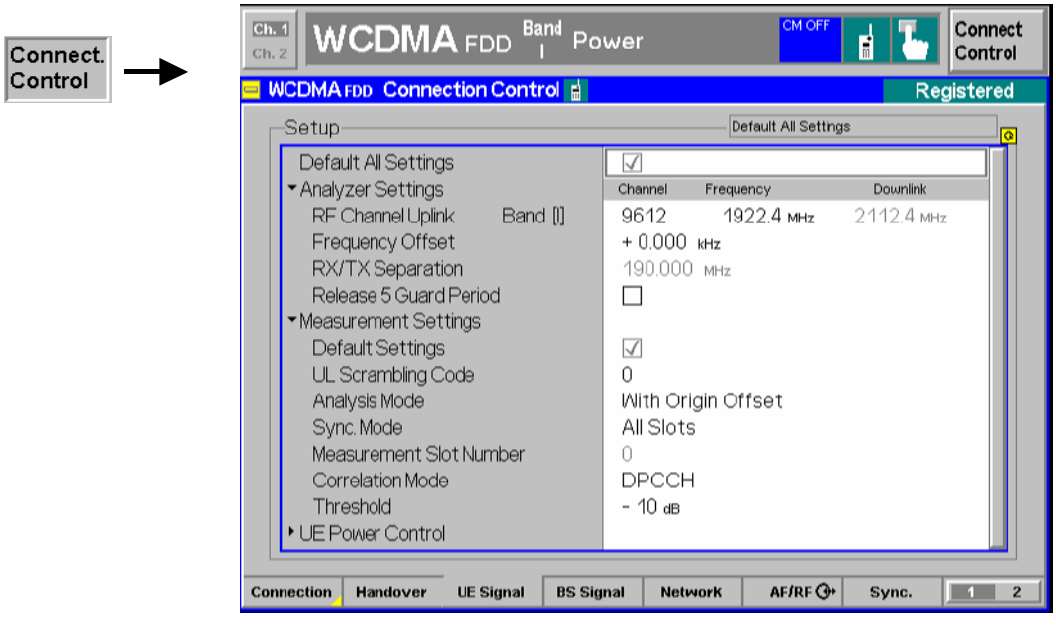


Fig. 4-89 Connection Control – UE Signal

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

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. 4.122 ff. They can be changed in all signalling 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 4-23 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:CHANnel <Unit>
UNIT:UESignal:CHANnel <CHANnel>CONFigure:UESignal:FOFFset
<Offset>
CONFigure:UESignal:GPERiod
```

Table 4-23 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. *4.39*. 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. 4.152.

The following synchronization settings are described in detail in section *Uplink Signal (Connection Control – UE Code)* on p. 4.151 ff. 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 4-24 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*.

UL Target Power — Fixed output power of the UE transmitter. The value is used if the *TPC Pattern Type* (see p. 4.211) 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.* 4.205*)* 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 DUT.
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 Type* 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 4-24 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. 4-97 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. 4.203 ff.). 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. 4.185). 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 0 and 15.
- βd is the common gain factor for the data channels DPDCH1 to DPDCH6; its signalled value is an integer number between 0 and 15.
- 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. 90 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.

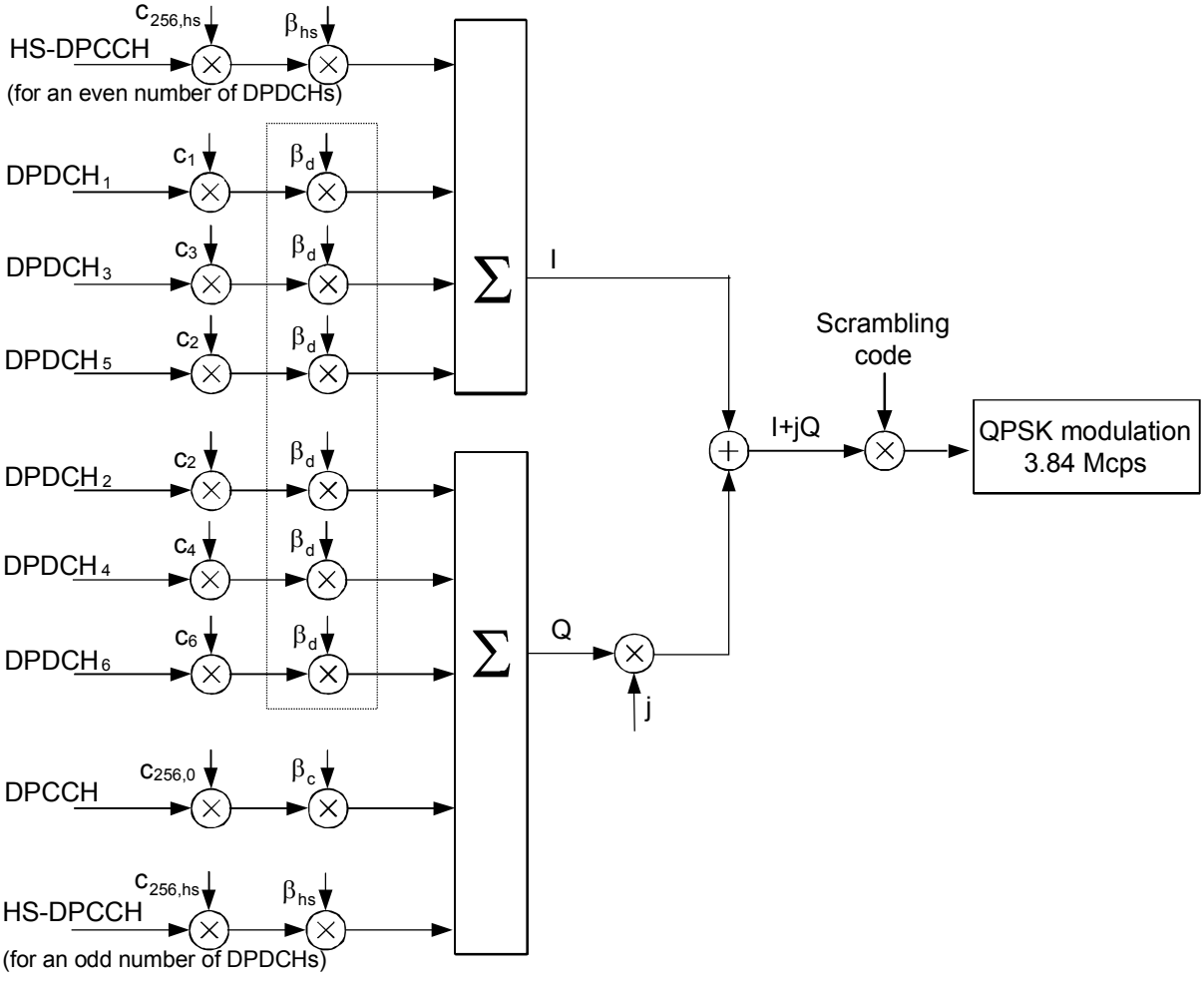


Fig. 90 Spreading of the uplink channels and gain factors

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.

Use the CDP vs. Time measurement (see Chapter 6) to verify to which degree of accuracy the actual gain factors of the UL channels comply with the gain factors signalled to the UE.

Connect. Control

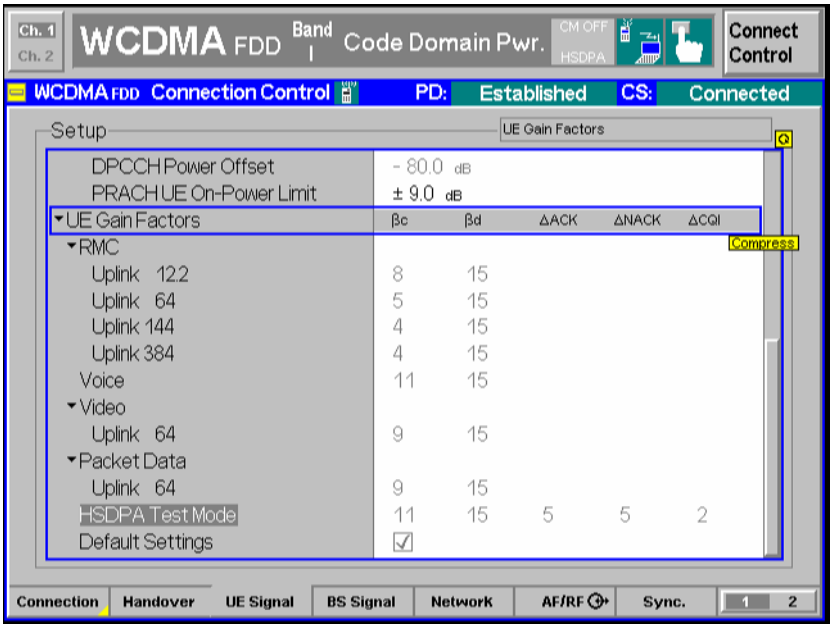


Fig. 4-91 Connection Control – UE Signal

The gain factors for the different *Dedicated Channel* types are set in the *UE Gain Factors* section of the *UE Signal* tab.

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. 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 during 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
```

HSDPA 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.

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)*
- 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. 4.215 ff.

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.

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, 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. 4.127 ff. Parameters involving 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.

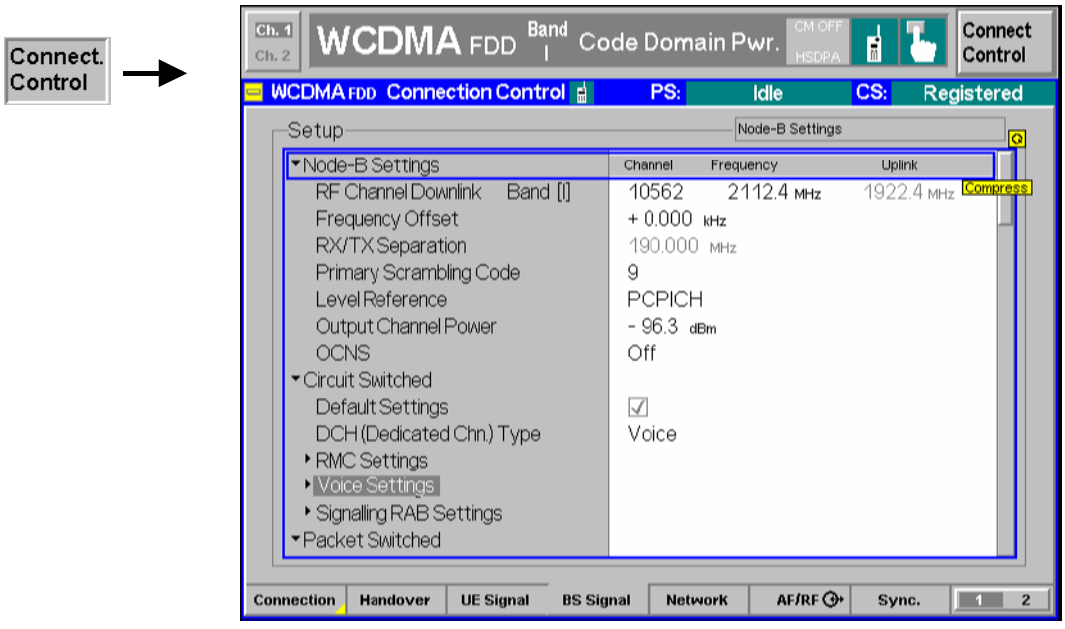


Fig. 4-92 Connection Control – BS Signal

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
`DEFault:BSSignal`

Node B Settings 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. 4.127 ff. 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).

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.*

OCNS Level of the Orthogonal Channel Noise Simulator (OCNS, see description on p. 4.133) 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 to-

tal output channel power and the individual physical channel contributions.

Remote control

```
UNIT:BSSignal:CHANnel <Unit>
CONFigure:BSSignal:CHANnel <UARFCN>
CONFigure:BSSignal:FOFFset <Offset>
CONFigure:BSSignal:SCODe:PRIMary
CONFigure:BSSignal:LREFerence <Reference>
CONFigure:BSSignal:OPOWer <Abs_Power>
CONFigure:BSSignal:OCNS <Rel_Power>
```

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 connection 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. 4.190 *ff.*

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. 4.140 ff.

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 4-14* and *Table 4-15*.

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. 4.108 Selecting this RMC channel type enables *DL DTCH Transport Format;* see below.

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. 4.105).

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 larger 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. 4.198) can be defined relative to the constant DOCCH power.*

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 1 and section *Test Loops for BER, BLER and DBLER Tests* on p. 4.242 f.). 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 4-25 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).*

Remote control

```
CONFigure:BSSignal:DCH:RMC:RTYPE <Rate>
CONFigure:BSSignal:DCH:RMC:TFORmat <Rate>
CONFigure:BSSignal:DCH:RMC:UCRC <Enable>
CONFigure:BSSignal:DCH:RMC:TMODe OFF  | ON | MODE2
CONFigure:BSSignal:DCH:RMC:SDTCh <Sequence>
```

Table 4-25 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.

Off Nothing is looped back.

Codec 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.

Codec 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 – AMR *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 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 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 M 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). 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
```

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
```

Packet Switched

The parameters in the *Packet Switched* section specify how the packet switched connection is set up.

DCH (Dedicated Chn.)

Type Packet switched connection for HSDPA tests *(HSDPA Test Mode)* or data application tests (option R&S CMU-K96, *Packet Data)*. This parameter is displayed for information after the connection is established (no setting value). The DCH type is implicitly determined by the connection procedure; see Fig. 84 on p. 4.188.

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) or RMC 12.2 kbps + HSDPA.

Packet Data – Data Rate Data rate for the packet data connection (initiated from the UE). The R&S CMU supports symmetric 64 kbps connections and faster, asymmetric 384 kbps Downlink / 64 kbps Uplink connections.

For a description of the HSDPA channel configuration refer to Chapter 8 of this manual.

Remote control
```
CONFigure:BSSignal:PSWitched:DCH:TYPE
CONFigure:BSSignal:PSWitched:DCH:HSTMode:RBSetup HSRB | HRMC
CONFigure:BSSignal:PSWitched:DCH:PDATa:RATE
```

Downlink Physical Channels

The *Downlink Physical Channels* section defines the level of the P-CPICH, P-SCH, S-SCH, P-CCPCH, the PICH and the DPDCH (see section *Panel Oriented Version* on p. 4.131 ff.).

Note: *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. 4.128 ff.*

In addition to the signal levels the section defines the channelization codes for the PICH and the DPCH as well as the DPCCH/DPDCH power offset, the *DL DPCH Timing Offset* (see p. 4.138), and the secondary scrambling code of the DPDCH (see p. 4.137 f.) 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. 4.147 ff.

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 4-16* on p. 4.144) 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. 4.206). 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. 4.147 ff.

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. 4.147 ff.

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.

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
```

TPC Settings

The *TPC Settings* section defines the uplink Transmit Power Control (TPC) parameters transferred to the UE. The following two parameters can be changed in all signalling states including *Connected:*

TPC Algorithm — Power control algorithm 1 or 2 used to control the UE transmit power. See background information below.

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*.

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.*

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.

TPC 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 4-26 below.* In addition a series of fixed test setups labeled test steps A to H are available; see below.

TPC Pattern Type — TPC command sequence transferred to the UE. Together with the power control algorithm, the TPC profile determines the power steps of the UE transmitter between consecutive slots.

Note: Closed Loop pattern type

In addition to the pattern types provided in Non Signalling mode (see Table 4-19 *on p. 4.146), a* Closed Loop *pattern type is available in Signalling mode.* Closed Loop *means that 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. 4.198). Closed Loop is suspended if a* Min. Power, Max. Power *or* Spectrum *measurement is switched on, see* Table 4-27 *below.*

Pattern — TPC command sequence of finite length (single pattern) used to construct the pattern transferred to the UE; see *TPC Profile* above.

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 4-19 *and* rules for the transfer of TPC patterns *on p. 4.145.* The function can be used repeatedly to insert single patterns into the bit sequence.

If a *Precondition* is set *(Test Step Precondition: Auto* and test step A to H, PhD Up/Down), 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.
3. If *Activate Pattern* is pressed repeatedly the precondition is set again before the bit sequence is transmitted.

For more information refer to p. 4.145.

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
```

The default patterns are inspired by the conformance test specification 3GPP TS 34.121.

Table 4-26 Default TPC Patterns: Signalling

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 increases 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 4-27 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.

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 5^{th} slot is +1 (–1). Otherwise TPC_cmd for the 5^{th} 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.

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:

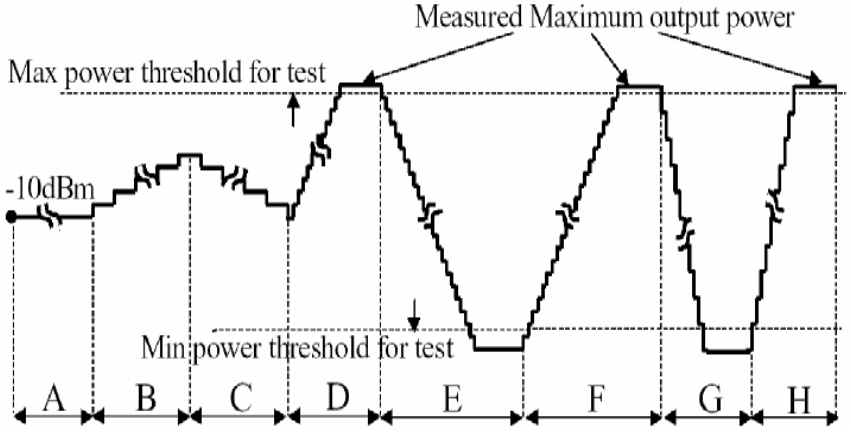


Fig. 4-93 Fixed test steps

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 Step Preconditions

Specifies whether the test step preconditions are valid.

Manual The preconditions for test steps A to H, PhD Up/Down 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; see description of *Activate Pattern* above. This setting is recommendable especially if a particular test step is repeated several times.

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. 4-93 above).

Test Steps A, B, C Precondition *Closed Loop:* The UE is commanded to the *UL Target Power* before *Activate Pattern* is executed.

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 preconditions *Closed Loop* for the fixed TPC patterns have 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.

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.*

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. 4.113 ff. All compressed mode settings can still be changed while a connection is established.

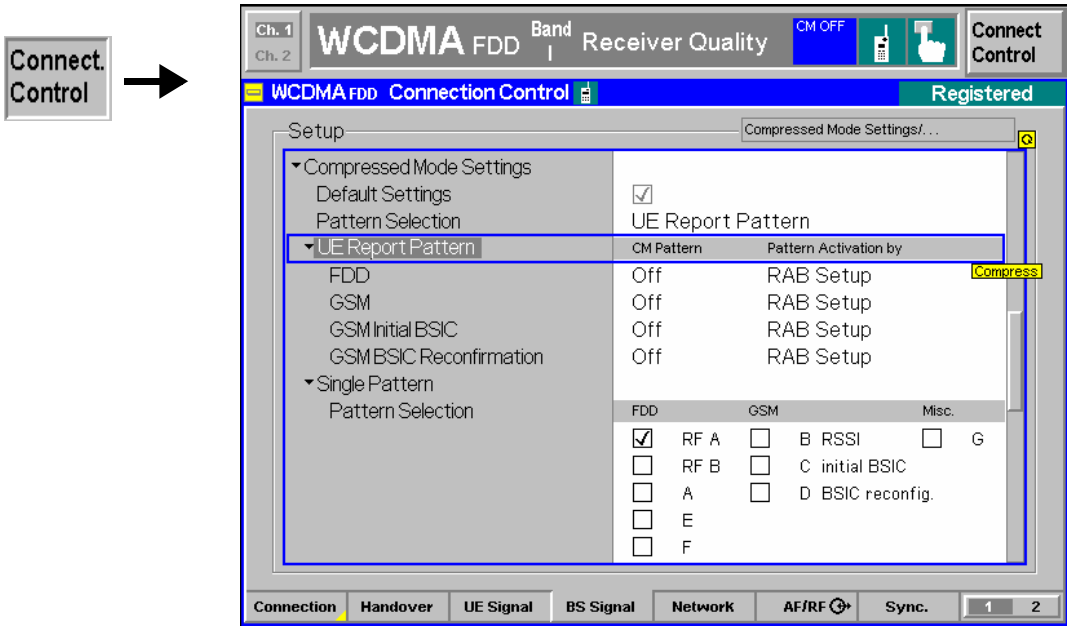


Fig. 4-94 Connection Control – BS Signal (Compressed Mode Settings)

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.

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 measurements.

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. 4.113) and terminates the measurement when the *UE Report* measurement is switched off.

Note: *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 4-28 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 pattern consists of two parts *TG Pattern 1* and *TG Pattern2* (see the *TG Pattern Info* figure in the menu). As shown in Fig. 4-95 on p. 4.218 the two parts can be of different length. The entire pattern is repeated a definite number of times to form a periodic transmission gap pattern sequence.

The meaning of the compressed mode parameters is described in Table 4-29 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. 4.236 ff. and Fig. 100 .*

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 4-28 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
F	FDD	3GPP TS 34.121 Tab. C.5.1 Set 2
G	FDD (not specified in standard)	3GPP TS 34.121 Tab. C.5.2 Set 3

Table 4-29 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
TGPL2	0 frames to 144 frames	3	Duration of transmission gap pattern 2
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)*
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 4-28 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)

Parameter	Values	Default Value	Meaning
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 | Puncturing	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

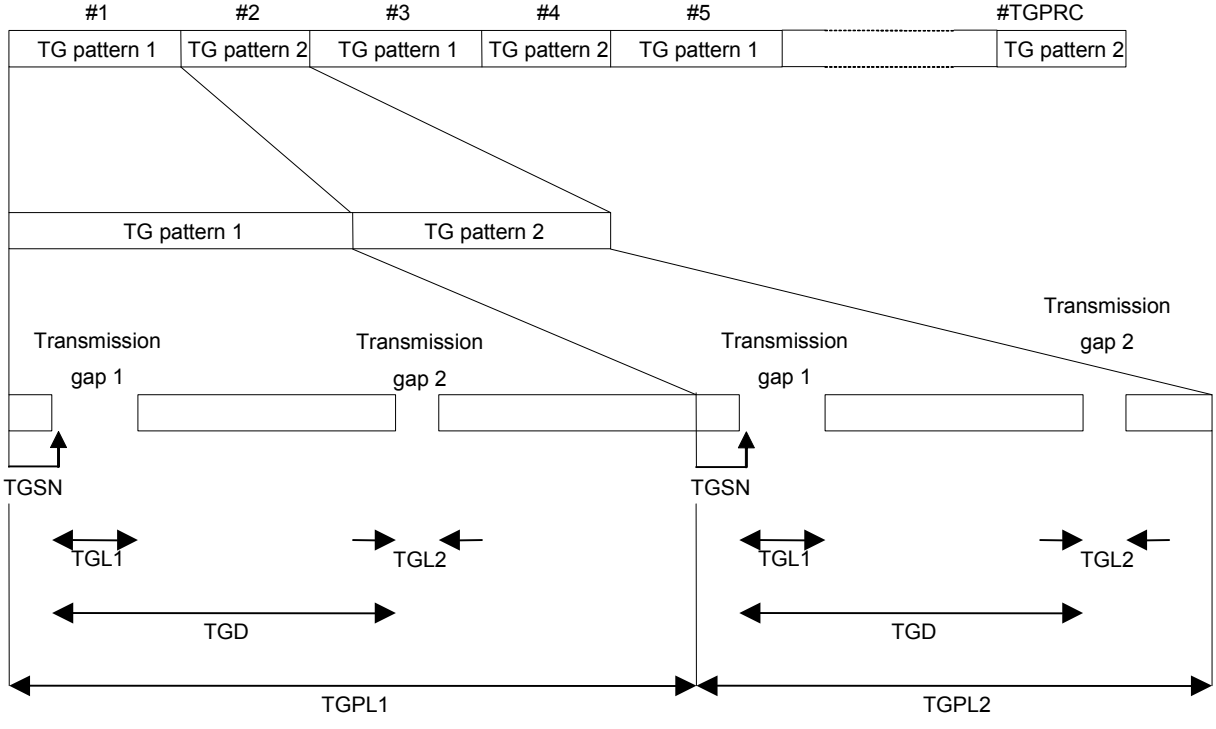


Fig. 4-95 Transmission gap pattern sequence

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 following section 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.

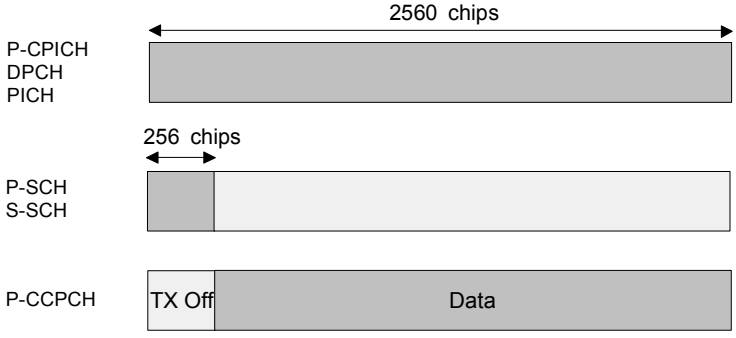
General Considerations

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. 4.133. 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. 4-59 on p. 4.133 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

The level of control channels that are only active while the connection is set up (AICH, S-CCPCH) do not contribute to the *Output Channel Power*. Their levels can be calculated in analogy to the other physical channel levels.

In the following tables, the downlink physical channels from standard 3GPP TS 34.121, annex E.2 and E.3, 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.

Table 4-30 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	–3.3 dB	⇨ <I_{or}> – 3.3 dB
P-CCPCH	–5.3 dB	–2 dB
SCH	–5.3 dB (set P-SCH and S-SCH to –8.3 dB)	–2 dB (set P-SCH and S-SCH to –5 dB)
PICH	–8.3 dB	–5 dB
S-CCPCH	–10.3 dB	–7 dB
OCNS	⇨ Turned off	Turned off

Table 4-31 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 4-32 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 4-33 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}	⇨ –93.1 dBm /3.84 MHz	⇨ –93.1 dBm /3.84 MHz
P-CPICH	–2.9 dB	–96 dBm / 3.84 MHz
P-CCPCH	–4.9 dB	–2 dB
SCH	–4.9 dB (set both SCHs to –7.9 dB)	–2 dB (set both SCHs to –5 dB)
PICH	–7.9 dB	–5 dB
OCNS	Turned off automatically	Turned off

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. 4.173.
- 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).*
- 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.

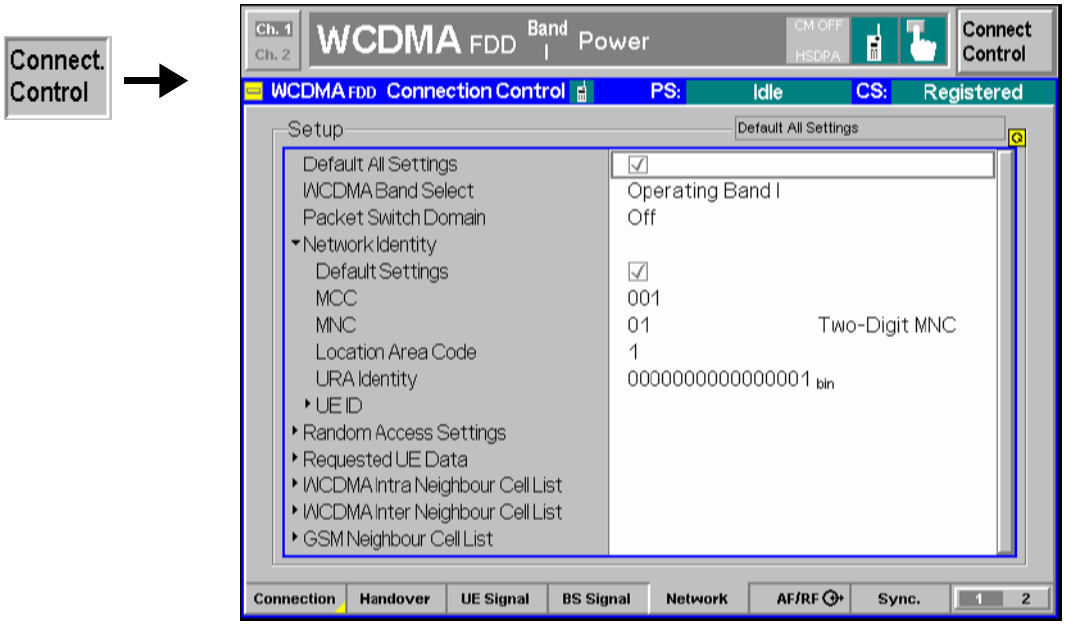


Fig. 4-96 Connection Control – Network parameters

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. 4.175 ff.

Remote control
```
CONFigure:NETWork:OBANd
      OPB1 | OPB2 | OPB3 | OPB4 | OPB5 | OPB6
```

Packet Switched Domain

Includes the information for the packet data domain in System Information Block 1 (if set to *On)*. This information makes it easier for some UEs to register. In particular, *Packet Switch Domain* must be enabled if the device initiates a combined attach.

Remote control
```
CONFigure:NETWork:PSWitched:DOMain
```

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).

The *Network Support* 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

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>
```

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.

  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 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. 4-97 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: 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. 4-97 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
```

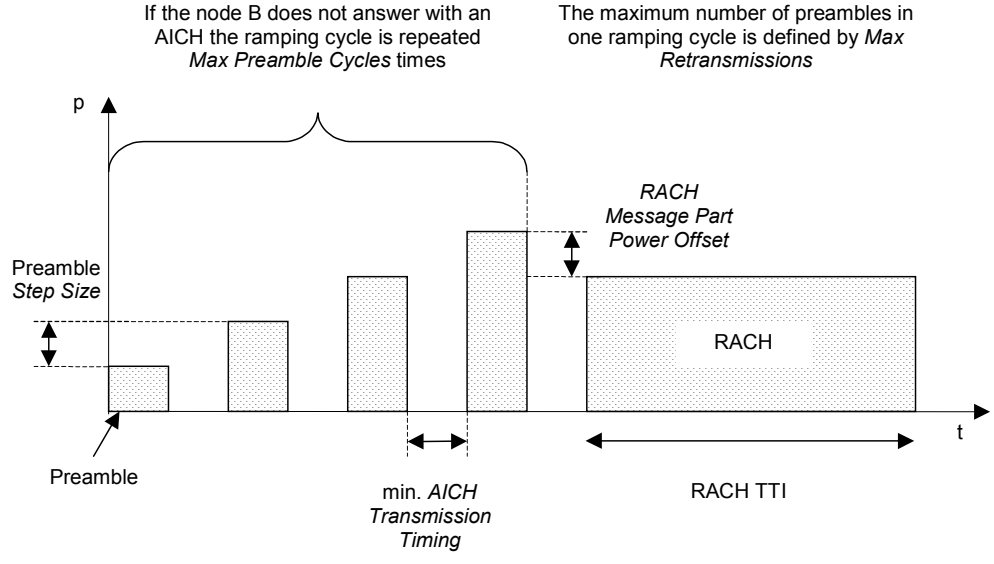


Fig. 4-97 Connection Control – random access settings[5]

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 The CMU can acknowledge the preambles so that the UE can be registered and a connection can be set up.

Negative The 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 re-initiate 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.

Remote control
`CONFigure:NETWork:RAC:PREamble:ACK POS | NEG`

Available Subchannels

12-digit binary value to define the available subchannels associated with the PRACH. A subchannel i corresponds to PRACH transmission in the frames where the System Frame Number mod 12 is equal to i (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. 4.19 ff.).

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 consist of 256 repetitions of a 16-bit Hadamard code (3GPP TS 25.213).

Remote control
`CONFigure:NETWork:RAC:PREamble:SIGNature <Channels>`

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. 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.

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.

UE Radio Access Capability Enable *(On)* or disable *(Off)* request of radio access capability. This information is displayed in the Connection tab; see p. 4.180.

IMEI Enable *(On)* or disable *(Off)* request of the International Mobile station Equipment Identity. This information is displayed in the *Connection* tab; see p. 4.179 ff.

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. 4.205).*

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.

Handover Activation Time 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 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. 4.189 ff. 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.

Note: *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.*

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.

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.

Remote control

```
CONFigure:NETWork:REQuest:ACAPability ON | OFF
CONFigure:NETWork:REQuest:IMEI 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:RRCC ON | OFF
CONFigure:NETWork:REQuest:SRAB ON | OFF
CONFigure:NETWork:REQuest:HACTime <Frames>
CONFigure:NETWork:REQuest:TTIMeout <Decihours>
CONFigure:NETWork:REQuest:T313 0 s to 15 s
CONFigure:NETWork:REQuest:OSTimeout 2 s to 30 s
CONFigure:NETWork:REQuest:PTIMeout 2 s to 30 s
```

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 broadcasts 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 only 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 broadcasts 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 only enabled cells.

Remote control

```
CONFigure:NETWork:NCELl:GSM<nr>
      <Channel>, <NCC>, <BCC>, <Band>, <Enable>
```

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.

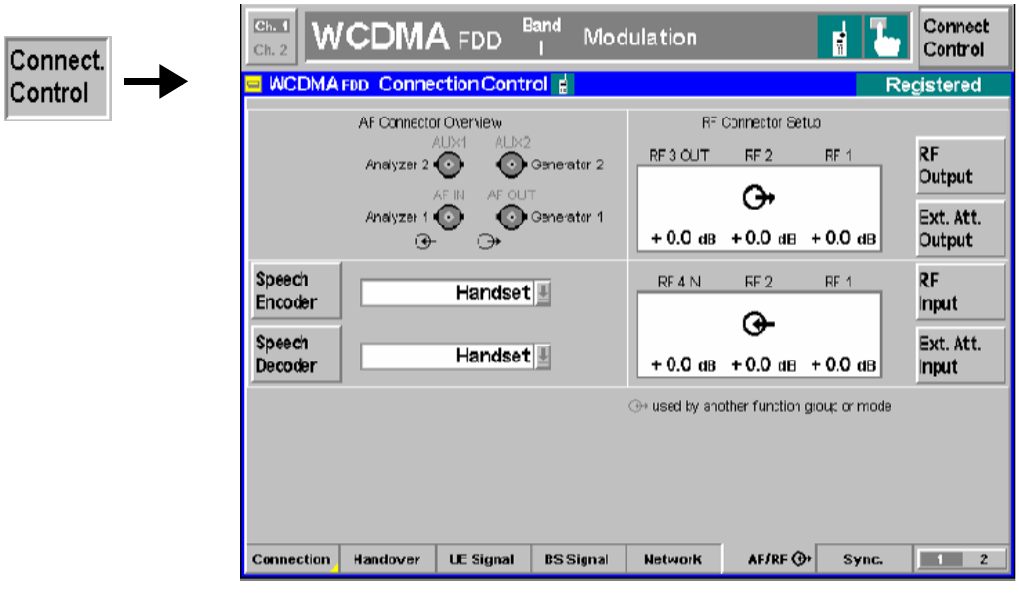


Fig. 4-98 Connection Control – AF/RF connectors

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. 4.156 ff.

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. 4.161 ff.

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 4.163 f. 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. 4.235 ff.

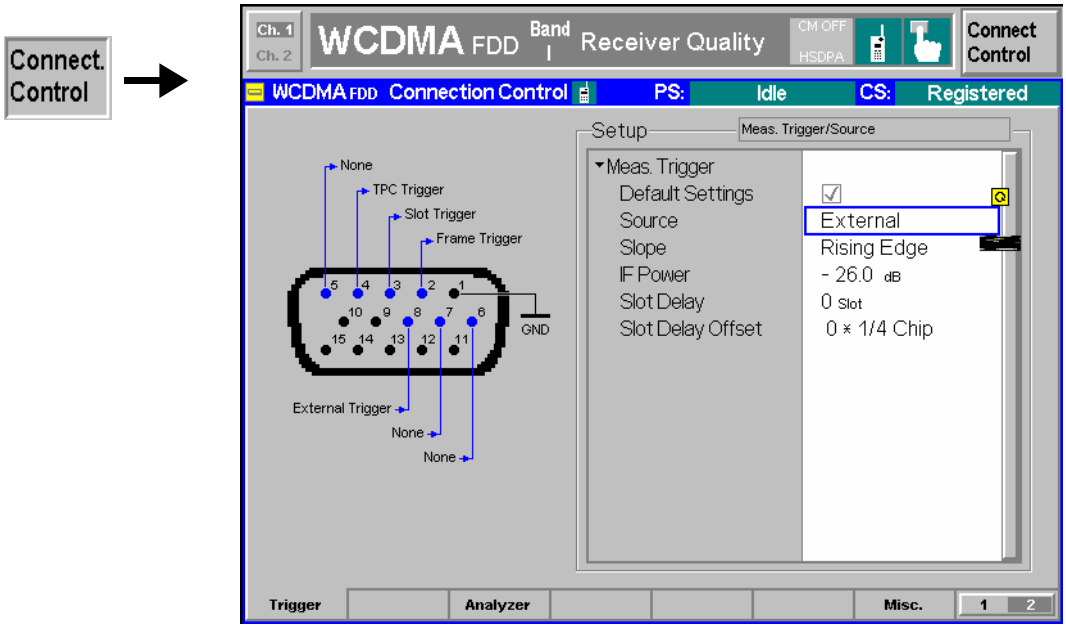


Fig. 4-99 Connection Control – AF/RF connectors

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. 4.163 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. 4.201 ff.) 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 4-34 on p. 4.233 gives and overview of the compatibility between the different trigger sources and WCDMA measurements.

Legend for Table 4-34

—	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 4-34 *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. *4.168 ff.*

Table 4-34 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 (Signalling only)	Change of TFC (Signalling 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**	–	–
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**	–	–
Spectrum	☑	☑	–	☑	☑	**Auto**	☑	–	☑	–	**Auto (CM)**	☑
CDP (Synchronized)	–	☑	–	☑ (⇨ Frame)	☑ (⇨ Frame)	–	**Auto**	–	☑	–	**Auto (CM)**	☑

Measurement application	Free Run	External	IF Power	Internal (Non Signalling)	Signalling (Signalling)	Slot	Frame	TPC	HSDPCCH	Preamble (Sig. only)	Compressed Mode (Signalling only)	Change of TFC (Signalling only)
CDP (All Slots)	–	☑	–	☑ (⇨ Frame)	☑ (⇨ Frame)	**Auto**	☑	–	☑	–	–	☑
CDP (HS-DPCCH)	–	☑	–	–	–	–	–	–	☑	–	–	–
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. 4.221 ff. 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. 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. 100 on p. 4.236. 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).*

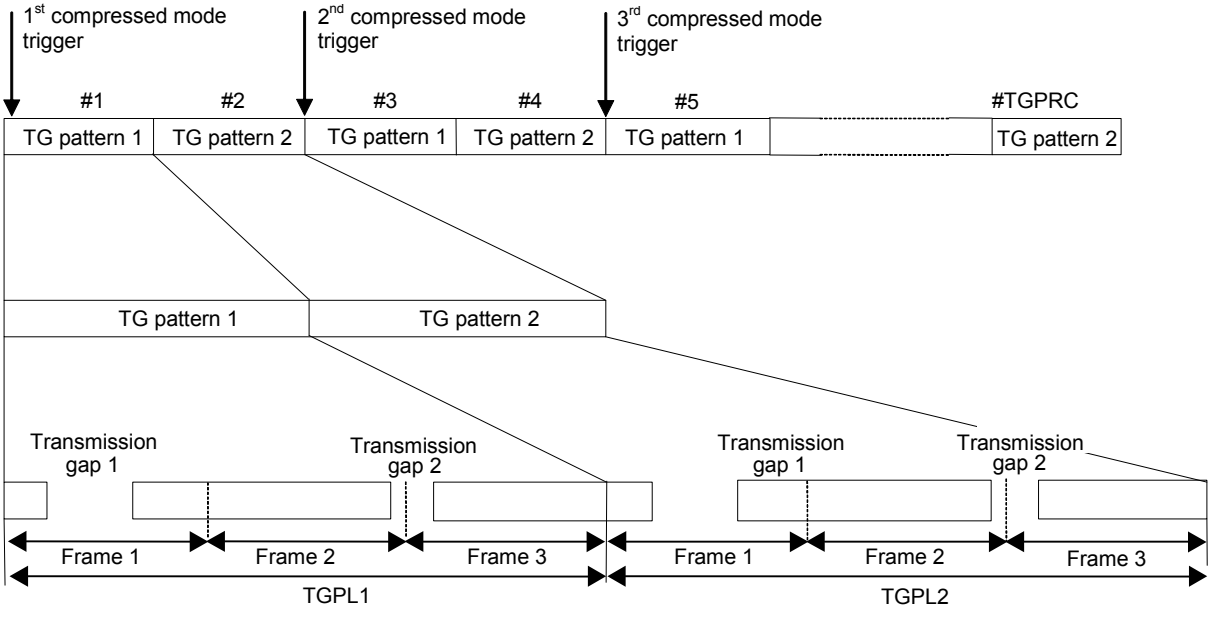


Fig. 100 Compressed mode trigger events (TGPL1 = TGPL2 = 3 frames)

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.

Monitoring the compressed mode

The compressed mode can be activated for the entire connection; see section *Compressed Mode Configuration* on p. 4.215. 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:

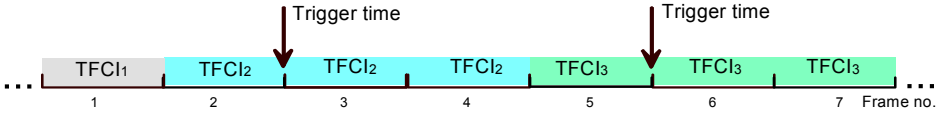


Fig. 4-101 Change of TFCI trigger timing

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. 4.169 ff.

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)*

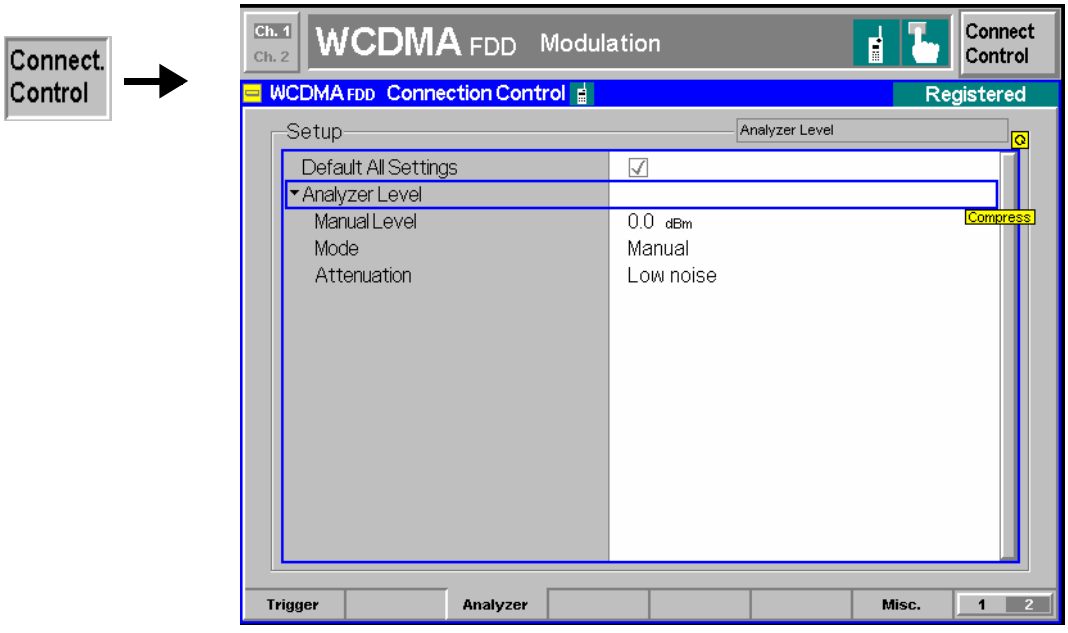


Fig. 4-102 Connection Control – Analyzer

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. 4.122 ff.

*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) address used for WCDMA data application tests.

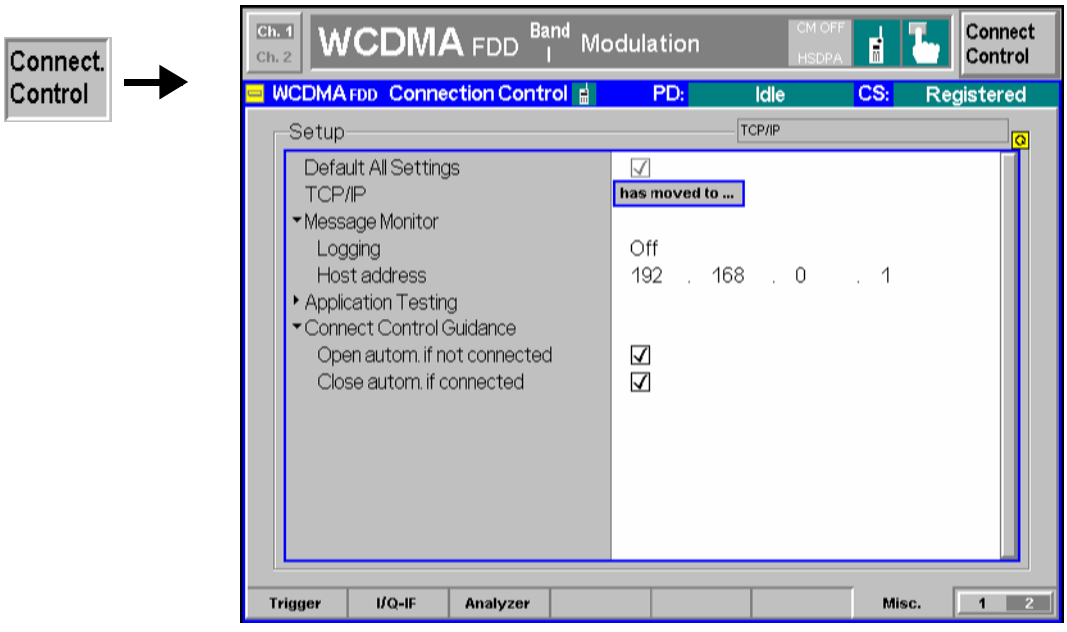


Fig. 4-103 Connection Control – Misc

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). This option requires a packet data connection and is described in Chapter 9 of this manual.

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>
```

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>
```

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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 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.

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).
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.

Measurement Object	Applications	Functionality
	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	
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 (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. The bit assignment in the corresponding two status registers is identical.

Table 5-4 Meaning of the bits used in the `STATus:OPERation:CMU:SUM1|2:CMU<nr>` sub-register assigned to the WCDMA function groups

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**
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.

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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 are listed in Chapter 8 of this manual.

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 dBm to +53 dBm **–54 dBm to +39 dBm** **–77 dBm to 0 dBm**	Maximum input level for RF 1 Maximum input level for RF 2 Maximum input level for RF 4 IN	+30.0 +30.0 0.0	dBm dBm dBm	V3.00
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.				

[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	–	V3.00
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 | **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 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 200 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 meets the 3GPP specifications. ***Note:*** *Operating bands II, IV, V, and VI contain additional channels that are off the 200 kHz raster. These channels must be selected with `UNIT:RFAN:FREQ CH` and their 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	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. Frequency units must be used to select input signals that are outside the designated channel range. ***Note:*** *Operating bands II, IV, V, and VI contain additional channels that are off the 200 kHz raster. These channels must be selected with `UNIT:RFAN:FREQ CH` and their channel numbers.*				

[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				Sig. State
This command enables or disables the guard period for RF signal evaluation according to release 5 of the 3 GPP FDD standard.				all

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.

DEFault:RFGenerator <*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 `RFGenerator` 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)*.

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 Over range Aux TX 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 200 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 meets the 3GPP specification.

Note: *Operating band II contains additional channels that are off the 200 kHz raster. These channels must be selected with* `UNIT:RFG:FREQ CH` *and their 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	MHz	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.

Note: *Operating band II contains additional channels that are off the 200 kHz raster. These channels must be selected with* `UNIT:RFG:FREQ CH` *and their channel numbers.*

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.
–147.1 dBm to –37.1 dBm	Output ch. power if RF 1 is used	–51.6	dBm	V3.15
–147.1 dBm to –20.1 dBm	Output ch. power if RF 2 is used	–51.6	dBm	
–100.1 dBm to +2.9 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.

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 –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	–	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.

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:AUXTxFREQuency`, 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, and VI contain additional channels that are off the 200 kHz raster. These channels must be selected with `UNIT:RFG:AUXT:FREQ CH` and their channel numbers.*

UNIT:RFGenerator:AUXTxFREQuency <*Unit*>			Frequency Unit	
<Unit>	Description of parameters	Def. value	Def. unit	FW vers.
HZ | KHZ | MHZ | GHZ | CH	Frequency unit | Channel number	MHz	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 band II contains additional channels that are off the 200 kHz raster. These channels must be selected with `UNIT:RFG:FREQ CH` and their channel numbers.

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 –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	
<*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.

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	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.

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	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.

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	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.

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 | PHYS | DCCH	3GPP DL reference channel Physical channel 3GPP DCCH (DL SRB according to 3GPP TS 34.108)	TGPP	–	V3.05 V3.60

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. 6.12 ff.), as a physical channel (see section *Subsystem RFGenerator:PCHannel (Physical Channel)* on p. 6.13 ff.), or as a 3GPP DL DCCH (see section *Subsystem RFGenerator:DCCH (3GPP DCCH)* on p. 6.13 ff.).

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: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:PSET <*Setup*>				TPC Pattern Setup
<Setup>	Description of parameters	Def. value	Def. unit	FW vers.
SET1 | **SET2 |** **SET3 |** **SET4 |** **SET5**	Setup 1 Setup 1 Setup 1 Setup 1 Setup 1	SET1	–	V3.40
Description of command				Sig. State
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>`).				all

SOURce:RFGenerator:TPC:PTYPe<nr> <*Profile*> Pattern Type

<Profile>	Description of parameters	Def. value	Def. unit	FW vers.
ALT **ALL0 |** **ALL1 |** **CPAT |** **SPA0 |** **SPA1 |** **SPAL**	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	see below	–	V3.05, V3.40 (suffix)

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	ALT	CPAT	SPA0	SPA1	SPAL

SOURce:RFGenerator:TPC:PATTern<nr> <*Pattern*> Pattern

<Pattern>	Description of parameters	Def. value	Def. unit	FW vers.
"<3 bit to 22 bit sequence>"	Single TPC pattern	<nr> = 1: “0101010101010101010” <nr> = 1: “11111000001111100000” <nr> = 1: “11111111111111111111” <nr> = 1: “00000000000000000000” <nr> = 1: “11111111110000000000”	–	V3.07, V3.40 (suffix)

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 <nr> = 1 to 5 discriminates between the five different test setups; see `SOURce:RFGenerator:TPC:PSET`.

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	Sig. State
This command has no query form. It causes a single TPC pattern (defined via `CONFigure: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 `CONFigure:RFGenerator:TPC:PTYPe`); otherwise the CMU generates the SCPI error no. –200, “Execution Error”.	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: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 | **1 |** **2 |** **3 |** **4 |** **5 |** **6**	DPCCH only DPCCH + DPDCH1 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	1	–	V3.00

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)*.

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, **–2559.75 to** **+2559.75**	No. of slots between trigger time and measurement No of chips between trigger time and measurement (in multiples of ¼ chip periods)	0 0	(slots) (chips)	– V3.05

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 | **NEGative**	Rising edge Falling edge	POS	–	V3.50

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`).

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:LEVel? <*TX Level*> IF Level

<*TX Level*>	Description of parameters	Def. value	Def. unit	FW vers.
< 0 dB	IF level	NAN	dBFS	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.

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. 6.36 ff.

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 |	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.

Test Cycles

CONFigure:POWer:MAXimum:CONTrol:REPetition <*Repetition*>,<*StopCond*>,<*Stepmode*>
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 |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	
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	
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	–	V3.00
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:POWer:MAXimum:TPControl <*Mode*> Power Control
CONFigure:POWer:MINimum:TPControl <*Mode*>

<*Mode*>	Desciption of parameters	Def. value	Def. unit	FW vers.
AUTO |	Automatic setting of max. and min. power	AUTO	–	V3.40
MANual	Manual setting; select appropriate TPC pattern			

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 Settings
DEFault:POWer:OFF:LIMit

<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>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar | ARRay,	Scalar values only (incl. limit matching) Scalar measured values and arrays	ARRay	–	≥3.0

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 | **PSTA |** **PSTE**	Power steps measured Absolute power steps measured Power step errors measured	PST	–	V3.05

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.

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)*.

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 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	

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				

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 | **SOFF |** **SAUTo**	TPC Test Steps Ref. Level Switch Off Ref. Level Switch Auto	STAN	–	V3.60 V3.80

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 command 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)*.				

CONFigure:POWer:XSLot:STEP:DELTa:LIMit[:SCALar]: 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 Dep. and Accumulated Limits		
<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.				

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.

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)*.

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.

*) 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	

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	

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. 6.112), 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

<*Length*>	Description of parameters	Def. value	Def. unit	FW vers.
640 | 2560	Number of chip periods measured	640 (QPSK) 2560 (WCDMA)	(chips) (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.

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 | **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* 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

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
640 | 2560	Number of chip periods measured	640 (QPSK) 2560 (WCDMA)	(chips) (chips)	V3.00

Description of command

This command selects the time interval to be measured (QPSK signals only). 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. 6.53 ff) 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,	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	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.

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 of a slot (see commands `CONFigure:MODulation:EVMagnitude: QPSK:CONTrol:MLENgth`), then the start value must be in the range between 0 chips and 639 chips, the maximum number of samples is 640.

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 raster. The number n of measured values for QPSK signals is equal to the measurement length set via `CONFigure:MODulation:EVMagnitude:QPSK:CONTrol:MLENgth`. 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 2560.

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

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
640 | 2560	Number of chip periods measured	640 (QPSK) 2560 (WCDMA)	(chips) (chips)	V3.00

Description of command

This command selects the time interval to be measured (QPSK signals only). 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. 6.53 ff) 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,	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	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.

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 of a slot (see command `CONFigure:MODulation:MERRor :QPSK:CONTrol:MLENgth`), then the start value must be in the range between 0 chips and 639 chips, the maximum number of samples is 640.

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 raster. The number n of measured values is equal to the measurement length set via `CONFigure:MODulation:MERRor: QPSK:CONTrol:MLENgth`. 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 2560.

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

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
640 | 2560	Number of chip periods measured	640 (QPSK) 2560 (WCDMA)	(chips) (chips)	V3.00

Description of command

This command selects the time interval to be measured (QPSK signals only). 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. 6.53 ff) 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,	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	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.

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 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 chips, the maximum number of samples is 640.

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 raster. The number n of measured values is equal to the measurement length set via `CONFigure:MODulation:PERRor:QPSK :CONTrol:MLENgth`. 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 2560.

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

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
640 | 2560	Number of chip periods measured	640 (QPSK) 2560 (WCDMA)	(chips) (chips)	V3.15

Description of command

This command selects the time interval to be measured (QPSK signals only). 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 Settings
DEFault:MODulation:IQANalyzer: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	–	V3.15

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 Definition of Subarrays
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}
CONFigure:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}

<Mode>	Description of parameters	Def. value	Def. unit	
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<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).

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:QPSK

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 <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	–	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.

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 [:COMBined]:VALue ***<Static_PHD>, <Dynamic_PHD>, <EVM>, <Threshold_EVM>, <Freq_Err>*** — Limit Values

<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 [:COMBined]:ENABle ***<PHD>, <EVM>, <Thresh_EVM>, <Freq_Err>*** — Limit Values

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	Hz	V3.80
...	... ,	...	...	
46th value for frequency error	–5000.0 Hz to +5000.0 Hz	NAN	Hz	

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. 6.86)	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: NMAL | INV | OK	INV	–	V3.80
...				
46th value for EVM	(see description on p. 6.86)	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. 6.86)	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*>
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*> Relative Limits

<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 | **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: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	NAN	dBm	V3.00
Carrier Power (RMS): Current,	dBm	NAN	dBm	
ACLR (Peak): Current (x4),	–100.0 dBm to +60.0 dBm	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 (Current),	–100.0 dB to 0.0 dB	NAN	dBm	
Out of Tolerance	–100.0 dBm to +60.0 dBm 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).

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,	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	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.

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` and `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 ACLR at fixed, equidistant test points with a 20 kHz raster. The number n of measured values for the RRC-filtered FFT curve (waveform spectrum, keyword `WFSPectrum`, n = 1013, frequency range from –10.12 MHz to + 10.12 MHz) is smaller than the number of values for the raw FFT curve (waveform signal spectrum, keyword `WFSSpectrum`, n = 1250, frequency range from –12.50 MHz to + 12.48 MHz).

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:RELative:CMAX:LIMit:LINE:
SYMmetric:[COMBined]:VALue <*Limit*> Relative Limit Lines
CONFigure:SPECtrum:EMASk:RELative:AVERage:LIMit:LINE:
SYMmetric:[COMBined]:VALue <*Limit*>

<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)`. The limit is only valid for band II.

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	nth 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 contains 1340 values and is divided into three domains with different sampling intervals:

- The values no. 1 to 321 correspond to test points that are separated by 25 MHz and cover the frequency range between –12.000 MHz and –4.000 from the carrier.
- The values no. 322 to 1019 correspond to test points that are separated by 10 MHz and cover the frequency range between –3.485 MHz and +3.485 from the carrier.
- The values no. 1020 to 1340 correspond to test points that are separated by 25 MHz 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*).

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

This command is always a query. It indicates whether and in which way the error 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. 6.107 ff.

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	NAN	dB	V3.60
... ,	...	...	...	
–100.0 dB to 0.0 dB	Margin for 8th limit line area	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*).

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. 6.50.*

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. 6.116). 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. 6.114) 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.

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 | 2 | 3 | 4 | 5 | 6 | 7 | 8	Channel number for DPCCH Channel number for DPDCH1 to DPDCH6 Channel number for HS-DPCCH	–	–	V3.00 V3.80
<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 | 2 | 3 | 4 | 5 | 6 | 7 | 8	Channel number for DPCCH Channel number for DPDCH1 to DPDCH6 Channel number for HS-DPCCH	–	–	V3.00 V3.80
<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	
1 | 2 | 3 | 4 | 5 | 6 | 7	Channel number for DPCCH Channel number for DPDCH1 to DPDCH6	–	–	
<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	FW vers.
0.0000 to 1.0000	Upper limit for CD-ρ	1.000	–	V3.00

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	
1 | 2 | 3 | 4 | 5 | 6 | 7	Channel number for DPCCH Channel number for DPDCH1 to DPDCH6	–	–	
<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**	**FW vers.**
0.0000 to 1.0000	Lower limit for CD-ρ	0.1000	–	V3.00

Description of command

This command defines lower limits for the *Average* results.

DEFault:CDPower:MANual:LIMit <*Enable*>
DEFault:CDPower:RMANual: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)*.

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?
READ[:SCALar]:CDPower:RMANual?

Scalar Results (DPCCH/DPDCH):
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*).

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	

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 and must be controlled by means of the `CDPOWer:TIME` commands reported below.

- The code power is measured on the DPCCH, on all DPDCHs (DPDCH1 to DPDCH6, if present), and the HS-DPCCH channels (of 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.

The CDP vs. Time *measurement requires option U65Var04.*

A program example for a CDP vs. Time measurement is reported in Chapter 7 of the operating manual.

Measurement procedure and purpose

The measurement extends over a duration of 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 (see also section *HSDPA in CDP Measurement* in Chapter 8). This means that a single shot measurement yields 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, including the HS-DPCCH, for an extended period of time. It 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* 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 Signal* tab of the Connection Control menu *(UE Signal – Measurement Settings – Threshold).* The R&S 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 DPDCH1 is also assumed to be active.
- In *Non Signalling* mode with the setting *DPDCH CC Mode: Manual*, all DPDCHs slected 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.

The signalled values for the gain factors and the corresponding power ratios are listed in Table 6-1 below.

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 Chapter 4).

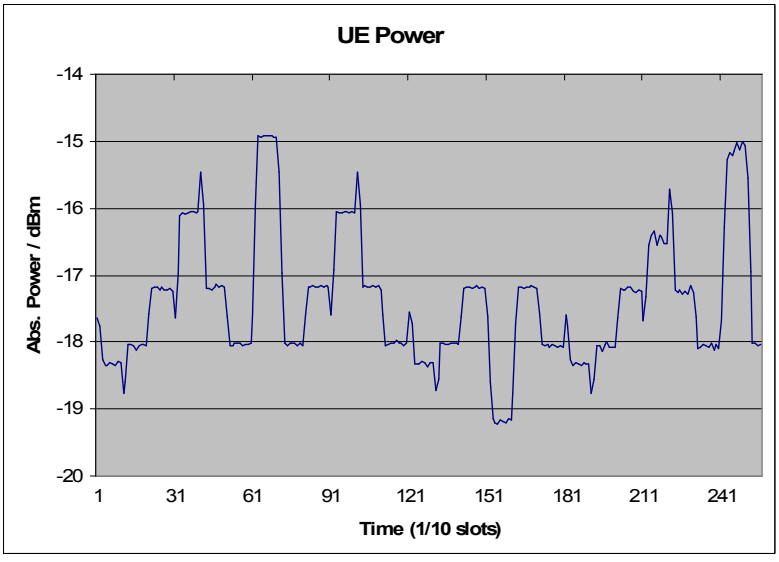
In *Signalling* mode, the measurement can be performed for all *Dedicated Channel* types. The UL gain factors must be set before a connection is established. The *Change of TFC* trigger requires a *Dedicated Channel* type where the UE actually changes the Transport Format Combination, e.g. a *Voice* call.

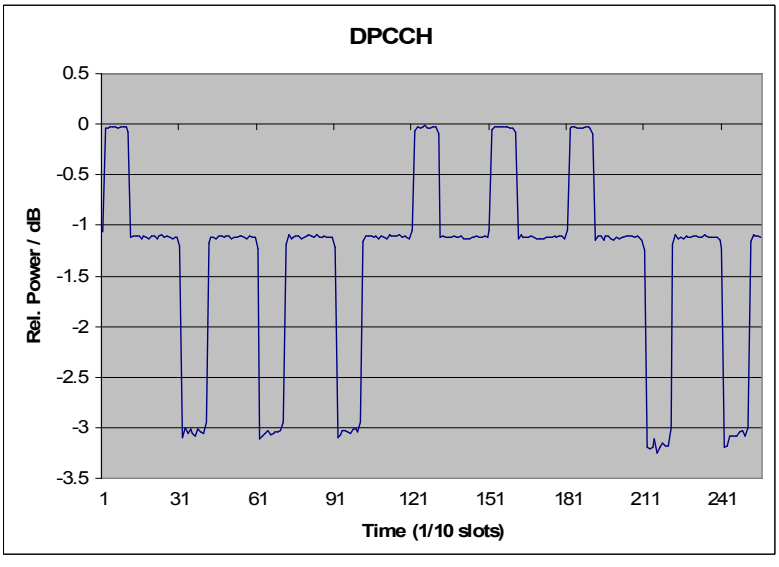
Table 6-1 Signalled values for gain factors and channel powers

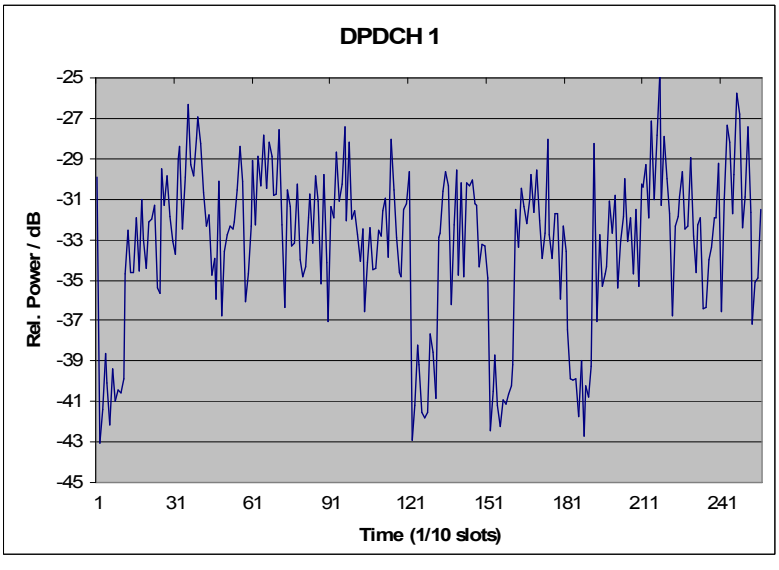
Signalled values for β_c and β_d	Quantized amplitude ratios *R*	Relative Power $P_{ch} = 20 * log(R)$	Signalled values for Δ_{ACK}, Δ_{NACK}, Δ_{CQI}	Quantized amplitude ratios *R*	Relative Power $P_{ch} = 20 * log(R)$
15	15/15	0 dB	–	–	–
14	14/15	–0.6 dB	–	–	–
13	13/15	–1.2 dB	–	–	–
12	12/15	–1.9 dB	–	–	–
11	11/15	–2.7 dB	–	–	–
10	10/15	–3.5 dB	–	–	–
9	9/15	–4.4 dB	–	–	–
8	8/15	–5.5 dB	8	30/15	+6.0 dB
7	7/15	–6.6 dB	7	24/15	+4.1 dB
6	6/15	–8.0 dB	6	19/15	+2.1 dB
5	5/15	–9.5 dB	5	15/15	0 dB
4	4/15	–11.5 dB	4	12/15	–1.9 dB
3	3/15	–13.9 dB	3	9/15	–4.4 dB
2	2/15	–17.5 dB	2	8/15	–5.5 dB
1	1/15	–23.5 dB	1	6/15	–8.0 dB
0		– (Switch off)	0	5/15	–9.5 dB

Example for CDP vs. Time Measurement Results

The result for the different code channel powers obtained in a *CDP vs. Time* measurement in HSDPA test mode are shown below.


UE Power
-14
-15
-16
-17
-18
-19
-20
Abs. Power / dBm
1
31
61
91
121
151
181
211
241
Time (1/10 slots)


DPCCH
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
Rel. Power / dB
1
31
61
91
121
151
181
211
241
Time (1/10 slots)


DPDCH 1
-25
-27
-29
-31
-33
-35
-37
-39
-41
-43
-45
Rel. Power / dB
1
31
61
91
121
151
181
211
241
Time (1/10 slots)

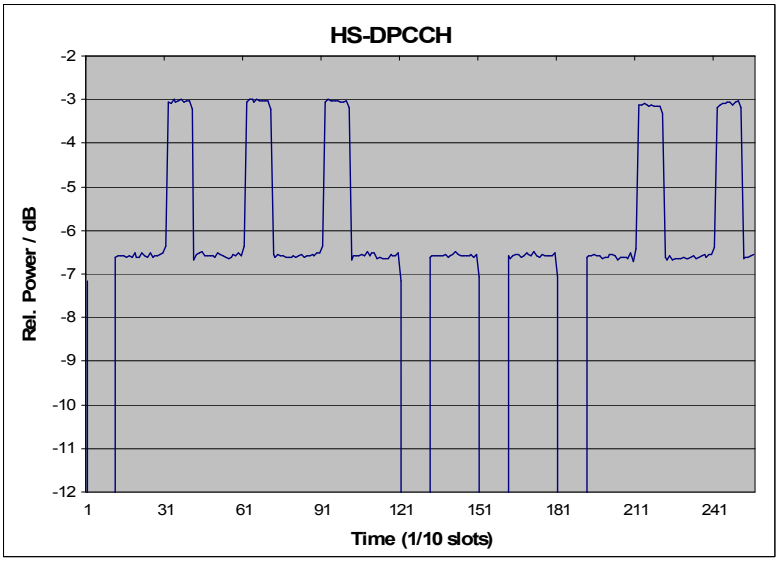


Fig. 6-1 CDP vs. Time – measurement example

CDPower:TIME

The subsystem `CDPower:TIME` controls the *CDP vs. Time* measurement. The subsystem has no equivalent in manual control.

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 |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	V3.80
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	–	V3.80
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	–	V3.80
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. 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.

DEFault:CDPower:TIME:CONTrol *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	The parameters are set to default values	ON	–	V3.80
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: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	
DPDCH 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	

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?`

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 to 15	NAN	–	
DPDCH Gain Factor (Min),	0 to 15	NAN	–	
DPDCH$_1$ Gain Factor (Max),	0 to 15	NAN	–	
DPDCH$_1$ Gain Factor (Min),	0 to 15	NAN	–	
…	…	…	…	
DPDCH$_6$ Gain Factor (Max),	0 to 15	NAN	–	
DPDCH$_6$ Gain Factor (Min),	0 to 15	NAN	–	
HS-DPCCH Gain Factor (Max),	0 to 30	NAN	–	
HS-DPCCH Gain Factor (Min)	0 to 30	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 HS-DPCCH gain factors can be larger than 15.

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 256-chip 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 in 470 consecutive 256-chip periods.

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:DPDCH<nr>:BFACtor? Start single shot meas. and return results⇒ *RUN*
FETCh:ARRay:CDPower:TIME:DPDCH<nr>:BFACtor? Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:CDPower:TIME:DPDCH<nr>:BFACtor? Read meas. results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for gain factor	0 to 15,	NAN	–	V3.80
...	... ,	...	...	
470th value for gain factor	0 to 15	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 256-chip 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 to 30	NAN	–	V3.80
...	... ,	...	...	
470th value for gain factor	0 to 30	NAN	–	

Description of command

These commands are always queries. They return the gain factor for the HS-DPCCH in 470 consecutive 256-chip periods. The gain factor can be larger than 15 if the HS-DPCCH is stronger than the strongest DPCCH or DPDCH.

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 ,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	V3.07
<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:** *In the case of 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)*.

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.*

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 and 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	

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 | ARIThmetical | MINimum | MAXimum,	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<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.

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 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 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	NMAU | 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 commands above) are exceeded. OK is returned if none of the scalar results (see `READ[:SCALar]:POWer:ONOFf:CURRent?`) exceeds the limits.

The following messages may be returned for all measured values:

NMAU	Result below lower limit	*not matching, underflow*
NMAL	Upper limit exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerances	

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 | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	V3.80
<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.

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),	0.0 % 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*

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

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 |	All information elements are displayed	ON	–	V3.40
OFF	At least one information element is switched off			

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)*.

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`.

[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 | **9662 to 9938 |** **9037 to 9388 |** **1462 to 1662 (step 25), 10562 to 10763** **1007 to 1087 (step variable), 4357 to 4458** **4387 to 4413, 1037, 1062**	UARFCN for Op. Band I UARFCN for Op. Band II UARFCN for Op. Band III UARFCN for Op. Band IV UARFCN for Op. Band V UARFCN for Op. Band VI	10572 9673 9048 10537 4368 4398	–	V3.60
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 **OB4 | OB5 | OB6**	Operating Band I, II, III Operating Band IV, V, VI	OB1	–	V3.60
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
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?`				See below
`*)` A `CTM` is only allowed in `REG` state and can lead to the `ALER` or to the `CEST` state, see Fig. 6-1 *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.

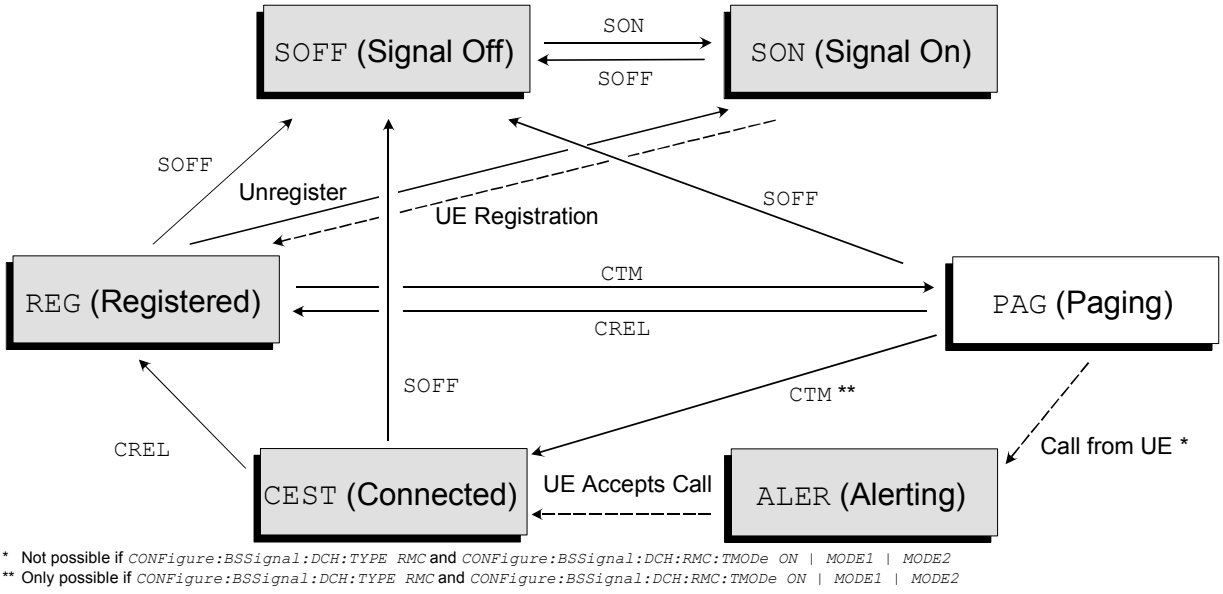


Fig. 6-1 Signalling states of the CMU and transitions

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 | **SON |** **REG |** **PAG |** **ALER |** **CEST |** **CPEN |** **FPEN**	Signal for synchronization switched off *(Signal Off)* Signal for synchronization switched on *(Signal On)* Synchronization of CMU and registration performed *(Registered)* CMU is sending paging messages to attempt a connection Mobile is ringing *(Alerting)* Call to mobile set up *(Connected)* Call pending Fallback pending	SOFF	–	V3.15
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

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. 2 below and query CONFigure:BSSignal:PSWitched:DCH:TYPE?).				See parameter desciption

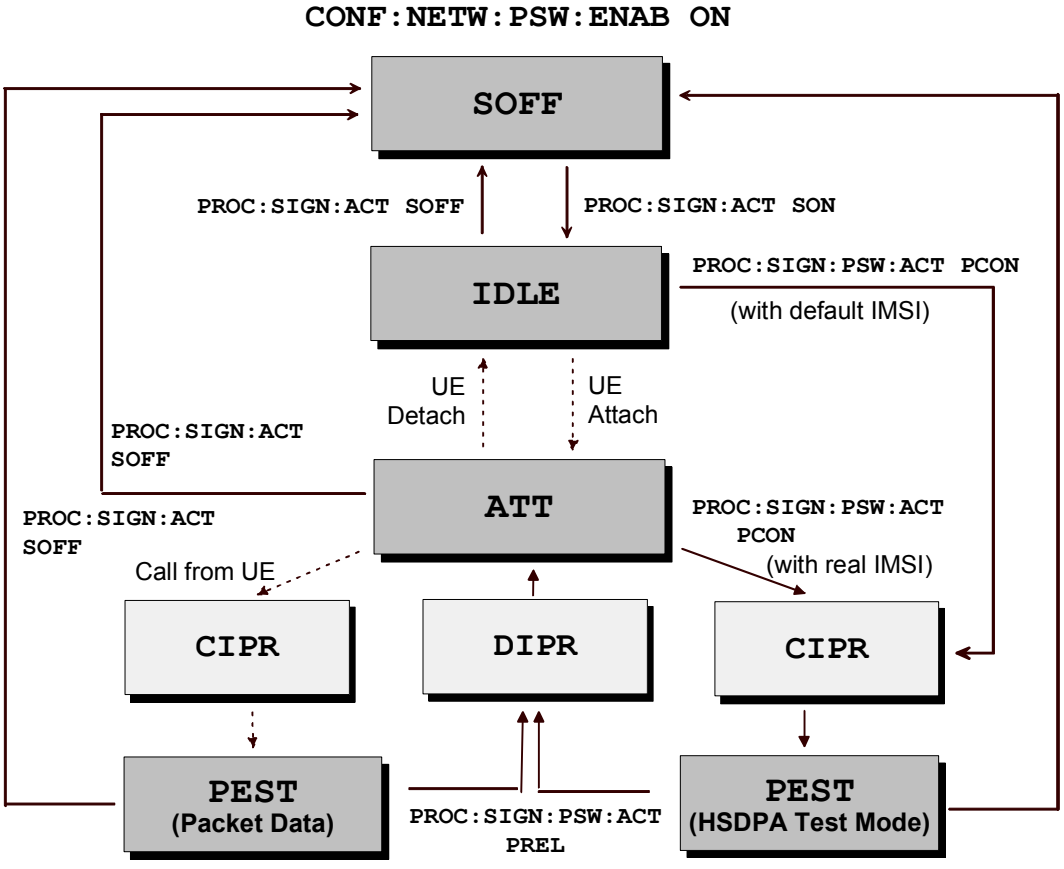


Fig. 2 Packet switched signalling states

[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

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 |	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).

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,	PRACH UE-On Power	NAN	dBm	V3.40
0 to 15,	PRACH signature	NAN	–	
–100 dBm to +60 dBm	Expected PRACH power	NAN	dBm	

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*.

STATus:HANDover:TARGet:LIST?			Destination List	
Response	Description of parameters	Def. value	Def. unit	FW vers.
"GSM400MsDualBand", **"GSM850MsDualBand",** **"GSM900MsDualBand",** **"GSM1800MsDualBand",** **"GSM1900MsDualBand"**	Target list (4 entries at maximum): All installed and enabled GSM networks except the current 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.				REG CONN

CONFigure:HANDover:TARGet <*Target*>			Destination Selection	
<Target>	Description of parameters	Def. value	Def. unit	FW vers.
"GSM400MsDualBand" | **"GSM850MsDualBand" |** **"GSM900MsDualBand" |** **"GSM1800MsDualBand" |** **"GSM1900MsDualBand"** **NONE**	Possible target networks No handover	NONE	–	V3.50
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

CONFigure: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

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 | **SUPP | NSUP |** **512 | 1024 | 2048 |** **4096 | 8192**	Support of loss-less SRNS relocation Support of RFC 2507 Header Compression	NAN, NAN, NAN	– – –	V3.15
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 | 500 | 1000, **2047 | 4095,** **3 | 4 | 5 | 6 | 8 | 16 | 30**	AM Buffer Size Max. RLC Window Size Max. AM Entities	NAN, NAN, NAN	– – –	V3.15
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		
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/PDSCH 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		
NSUP | SUPP,	PDSCH,	NAN		
NSUP | SUPP,	Channel Estimation Pilots,	NAN		
	Simult. Reception			
NSUP | SUPP,	SCCPCH/DPCH,	NAN		
NSUP | SUPP,	SCCPCH/DPCH/PDSCH,	NAN		
1	SCCPCH radio links	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
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		
NSUP | SUPP,	Ph. Channel FDD PCPCH,	NAN		
1 | 2 |3 | 4	UE Power Class	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.
	TX/RX frequency separation			V3.15
0 (134.8 ... 245.2 MHz) |	For Operating Band I	NAN,	–	
1 (174.8 ... 205.2 MHz) |	For Operating Band II	NAN,	–	
2 (190.0 MHz)	For Operating Band III	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:MMODe? Multi Mode

Return	Description of parameters	Def. value	Def. unit	FW vers.
FDD |	Frequency Division Duplex	NAN	–	V3.15
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:MRATe?				Multi RAT
Return	Description of parameters	Def. value	Def. unit	FW vers.
NSUP | SUPP, **NSUP | SUPP**	GSM support Multi-carrier mode support	NAN, NAN	–	V3.15
Description of command				Sig. State
This command is always a query. It returns 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 **NBASed | UEBased | BOTH | NONE** **NSUP | SUPP** **NSUP | SUPP** **NSUP | SUPP** **NSUP | SUPP**	<Standalone Loc. Method> <Network Assisted GPS> <GPS Reference Time> <IPDL> <OTDOA UE Based Method> <Rx/Tx Time Difference>	NAN NAN NAN NAN NAN NAN	–	V3.15
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.
NSUP | SUPP **NSUP | SUPP**	<DL Compressed Mode> <UL Compressed Mode>	NAN NAN	–	V3.15
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.				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	V3.15
1852.4 MHz to 1907.6 MHz (ch. no. 9262 to 9538) |	Input freq. for Op. Band II (in multiples of 200 kHz)	1852.6 (ch. no. 9263)	MHz	
1712.4 MHz to 1782.6 MHz (ch. no. 8562 to 8913)	Input freq. for Op. Band III (in multiples of 200 kHz)	1712.6 (ch. no. 8563)	MHz	
1712.4 MHz to 1752.6 MHz (ch. no. 8562 to 8763) |	Input freq. for Op. Band IV (in multiples of 200 kHz)	1712.6 (ch. no. 8563)	MHz	V3.60
826.4 MHz to 846.6 MHz (ch. no. 4132 to 4233) |	Input freq. for Op. Band V (in multiples of 200 kHz)	826.6 (ch. no. 4133)	MHz	
832.4 MHz to 837.6 MHz (ch. no. 4162 to 4188)	Input freq. for Op. Band VI (in multiples of 200 kHz)	832.6 (ch. no. 4163)	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, and VI contain additional channels that are off the 200 kHz raster (see tables in Chapter 4). These channels must be selected with `UNIT:UES:CHAN CH` and their channel numbers.*

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 band II contains 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:UPLink`).				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.
0 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.
0 to 15	DPDCH gain factor	15 (all RMC data rates)	–	V3.80
Description of command				
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).				

CONFigure:UESignal:GFACtor:VOICe <*Beta_c*>, <*Beta_d*>
CONFigure:UESignal:GFACtor:VIDeo <*Beta_c*>, <*Beta_d*>
CONFigure:UESignal:GFACtor:PDATa <*Beta_c*>, <*Beta_d*>

Gain Factors

<Beta_c>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 15	DPCCH gain factor	11 (voice) 9 (video) 9 (packet data)	–	V3.80
<Beta_d>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
0 to 15	DPDCH gain factor	15 (all call types)	–	V3.80

Description of command

This command defines the gain factors for the voice, video, and packet data connections.

CONFigure:UESignal:GFACtor:HSTMode <*Beta_c*>, <*Beta_d*>, <*Delta_ACK*>, <*Delta_NACK*>, <*Delta_CQI*>

Power Offset Parameters

<Beta_c>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 15	DPCCH gain factor	9	–	V3.80
<Beta_d>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
0 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

This command defines the gain factors for the voice, video, and packet data connections.

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

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 (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	V3.15
1932.4 MHz to 1987.6 MHz (ch. no. 9662 to 9938)	Input freq. for Op. Band II (in multiples of 200 kHz)	1932.6 (ch. no. 9663)	MHz	
1807.4 MHz to 1877.6 MHz (ch. no. 9037 to 9388)	Input freq. for Op. Band III (in multiples of 200 kHz)	1807.6 (ch. no. 9038)	MHz	
2112.4 MHz to 2152.6 MHz (ch. no. 10562 to 10763)	Input freq. for Op. Band IV (in multiples of 200 kHz)	2112.6 (ch. no. 10563)	MHz	V3.60
871.4 MHz to 891.6 MHz (ch. no. 4357 to 4458)	Input freq. for Op. Band V (in multiples of 200 kHz)	871.6 (ch. no. 4358)	MHz	
877.4 MHz to 882.6 MHz (ch. no. 4162 to 4413)	Input freq. for Op. Band VI (in multiples of 200 kHz)	877.6 (ch. no. 4388)	MHz	

Description of command — Sig. State

This command defines the carrier frequency of the RF signal analyzed. 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. — all

Note: *Operating bands II, IV, V, and VI contain additional channels that are off the 200 kHz raster (see tables in Chapter 4). These channels must be selected with `UNIT:BSS:CHAN CH` and their channel numbers.*

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 band II contains 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.
–147.1 dBm to –37.1 dBm **–147.1 dBm to –20.1 dBm** **–100.1 dBm to +2.9 dBm**	Output ch. power if RF 1 is used Output ch. power if RF 2 is used O. ch. power if RF 3 OUT is used	–51.6 –51.6 –51.6	dBm dBm dBm	V3.15
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 All Physical Channel Levels
<P-CPICH_abs>* | *<P-CPICH_rel>*, *<P-SCH>*, *<S-SCH>*, *<P-CCPCH>*, *<S-CCPCH>*, *<PICH>*, *<AICH>* *<DPDCH>*, *<Power Offset>

<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	–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.

DEFault:BSSignal<*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)*.	SOFF SON REG

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 | **VOICe |** **SRAB |** **SRFach |** **VIDeo**	Reference Measurement Channel Voice Channel Signalling RAB – Cell DCH Signalling RAB – Cell FACH Video channel (for video echo tests)	VOIC	–	V3.15 V3.52 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 <*Bit_Rate*>				Reference Channel Type
<Bit_Rate>	Description of parameters	Def. value	Def. unit	FW vers.
RMC12 | RMC64 | **RMC144 | RMC64_144 |** **RMC384 | RMC64_384 |** **RMC144_384 |** **BTFD**	Symmetric UL/DL information bit rates Asymmetric UL/DL information bit rates RMC for Blind Transport Format Detection	RMC12	(kbps)	V3.15 V3.40 V3.50 V3.60
Description of command				Sig. State
This command sets the information bit rate of the generated 3GPP DL Reference Measurement Channel. The setting takes effect if an RMC is selected as 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: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	–	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: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 50 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:ACSet <*ACS*> Active Codec Set

<*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: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

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 –20.0 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. — all

*) 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:PHYSical:LEVel:SCH:PRIMary <*Level*> — P-SCH Level

<*Level*>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB*	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*). — all

*) 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`).

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*	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*). — all

*) 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`).

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*	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*	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*	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:LEVel:AICH <*Level*>				AICH Level
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB*	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 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: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

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 |** **PDOWn**	Setup 1 … Setup 5 Test Step A Test Step H Test Step PhD UP Test Step PhD Down	SET1	–	V3.15 V3.60 V3.80
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.				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), and two test steps for phase discontinuity measurements (<nr> = 14 to 15); see `CONFigure:BSSignal:TPC:PSET` on p. 6.185. — all

The pattern types for the TPC test steps (<nr> = 6 to 13) and for the phase discontinuity measurement (<nr> = 14, 15) are fixed; the command can be used only as a query with the corresponding suffixes <nr> = 6,…, 15.

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
Pattern Type	SPAL

The phase discontinuity patterns (FW V3.80 and higher) use the following fixed pattern types:

<nr>	14	15
Pattern Type	SPAL	SPAL

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: “11111111110000000000” <nr> = 5: “10000010011111011010” <nr> = 6, … 15 : query only (see below)	–	V3.15, V3.40 (suffix), V3.60 (test steps) V3.80 (phase disc.)

Description of command — Sig. State: all

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), and two test steps for phase discontinuity measurements (<nr> = 14 to 15); see `CONFigure:BSSignal:TPC:PSET` on p. 6.185.

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}

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: all

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.

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 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	Setup 1 to Setup 5 or Test Step A to Test Step H TPC pattern for phase discontinuity meas.	SET1	–	V3.60 V3.80
<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

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.
HSTM | PDATa	Connection for HSDPA tests *(HSDPA Test Mode)* Data application tests (*Packet Data)*	PDATa	–	V3.80
Description of command				Sig. State
This command is always a query. It returns the packet switched connection type. `HSTM` connections are initiated from the R&S CMU, `PDATa` connections from the UE.				SOFF, SON / IDLE, REG / ATT Q: all

CONFigure:BSSignal:PSWitched:DCH:HSTMode:RBSetup <*Rate*>				Radio Bearer Setup
<Rate>	Description of parameters	Def. value	Def. unit	FW vers.
HSRB | HRMC	SRB 3.4 kbps + HSDPA RMC 12.2 kbps + HSDPA	HSRB	–	V3.80
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:PDATa:RATE <*Rate*>				Radio Bearer Setup
<Rate>	Description of parameters	Def. value	Def. unit	FW vers.
PD64 | PD64_384	Symmetric 64 kbps connection Asymmetric 384 kbps DL / 64 kbps UL connection	PD64_384	–	V3.80
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

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	UE Report Pattern Single Pattern User-defined Pattern None (compression mode not active)	UEReport	–	V3.60
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 | F | G	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<nr> <*Value*>				TGL1, TGL2
<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 first and the second transmission gap pattern (numeric suffix <nr> = 1, 2).				all

CONFigure:BSSignal:COMPressed:UDEFined:PATTern2 <*Enable*>				TG Pattern 2 Enable
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable transmission gap pattern 2	OFF	–	V3.60
Description of command				Sig. State
This command defines the presence of the second transmission gap pattern. The first transmission gap pattern is always present.				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 | PUNC	SF/2 Puncturing	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 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**	Operating Band I, II, III Operating Band IV, V, VI	OB1	–	V3.15 V3.60
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.				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	OFF	–	V3.80
Description of command				Sig. State
This command enables or disables packet switched connections.				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 *<Interval>*				URA Identity
<Interval>	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: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.				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:RAC: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 (128 ms to 512 ms)	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	Positive or negative acknowledgement	POS	–	V3.60
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 <*Channels*>			Available Signatures	
<Channels>	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

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: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: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: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.				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	OFF	(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.				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	OFF	(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:T313 ***<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: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	Paging timeout	20	s	V3.80
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: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).				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).				SOFF, SON, REG Q: all

CONFigure:NETWork:NCELI:GSM<nr> ***<Channel>, <NCC>, <BCC>, <Band_Ind>, <Enable>***				GSM Neighbor Cell List
<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).				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* > Ext. Att. Input
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude] <*Attenuation* >

<*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*> Ext. Att. Output
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude] <*Attenuation*>

<*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, –2559.75 to +2559.75	No. of slots between trigger time and measurement No of chips between trigger time and measurement (in multiples of ¼ chip periods)	0 0	(slots) (chips)	V3.15

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 ***Error! Reference source not found.***).	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

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	Maximum input level for RF1	+30.0	dBm	V3.15
+14 dBm to +39 dBm	Maximum input level for RF2	+30.0	dBm	
–37 dBm to 0 dBm	Maximum input level for RF 4 IN	0.0	dBm	

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 |	Mixer level in normal range	LNOise	–	V3.15
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	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 |	All parameters are set to their default values	ON	–	V3.15
OFF	All or some parameters differ from the default values			

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

List of Commands

In the following, all remote-control commands of the WCDMA UE function groups are listed in alphabetical order. with their parameters and page numbers. They are arranged alphabetically according to the **second** keyword of the command so that related commands belong to the same group. The commands for the two test modes *Non Signalling* and *Signalling* are listed separately.

Table 6-1 Remote-control commands: Measurements (available in Non Sign. and Signalling)

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
Code Domain Power – Automatic			
INITiate:CDPower:AUTomatic	–	no query	6.112
ABORt:CDPower:AUTomatic	–	no query	6.112
STOP:CDPower:AUTomatic	–	no query	6.112
CONTinue:CDPower:AUTomatic	–	no query	6.112
DEFault:CDPower:AUTomatic:CONTrol	ON | OFF	with query	6.115
CONFigure:CDPower:AUTomatic:CONTrol:DSFactor	AUTO | 4 | 8 | 16 | 32 | 64 | 128 | 256	with query	6.114
CONFigure:CDPower:AUTomatic:CONTrol:DSFactor:AUTMode?	<Response>	with query	6.114
CONFigure:CDPower:AUTomatic:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, STEP | NONE	with query	6.114
CONFigure:CDPower:AUTomatic:CONTrol:RMODe	SCALar | ARRay	with query	6.113
CONFigure:CDPower:AUTomatic:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.113
READ:ARRay:CDPower:AUTomatic:ISIGnal:CURRent?	–100.0 dB to 0.0 dB	query only	6.116
FETCh:ARRay:CDPower:AUTomatic:ISIGnal:CURRent?	–100.0 dB to 0.0 dB	query only	6.116
SAMPle:ARRay:CDPower:AUTomatic:ISIGnal:CURRent?	–100.0 dB to 0.0 dB	query only	6.116
READ:ARRay:CDPower:AUTomatic:QSIGnal:CURRent?	–100.0 dB to 0.0 dB	query only	6.116
FETCh:ARRay:CDPower:AUTomatic:QSIGnal:CURRent?	–100.0 dB to 0.0 dB	query only	6.116
SAMPle:ARRay:CDPower:AUTomatic:QSIGnal:CURRent?	–100.0 dB to 0.0 dB	query only	6.116
FETCh:CDPower:AUTomatic:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.113
READ[:SCALar]:CDPower:AUTomatic?	<Result>	query only	6.115
FETCh[:SCALar]:CDPower:AUTomatic?	<Result>	query only	6.115
SAMPle[:SCALar]:CDPower:AUTomatic?	<Result>	query only	6.115
Code Domain Power – Manual			
INITiate:CDPower:MANual	–	no query	6.117
ABORt:CDPower:MANual	–	no query	6.117
STOP:CDPower:MANual	–	no query	6.117
CONTinue:CDPower:MANual	–	no query	6.117
READ[:SCALar]:CDPower:MANual:ACK?	<Result>	query only	6.122
FETCh[:SCALar]:CDPower:MANual:ACK?	<Result>	query only	6.122
SAMPle[:SCALar]:CDPower:MANual:ACK?	<Result>	query only	6.122
CONFigure:CDPower:MANual:AVERage:LIMit:POINt:ASYMmetric:LOWer:CHANnel<nr>	<CDP_Limit>	with query	6.121

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
CONFigure:CDPower:MANual:AVERage:LIMit:POINt:ASYMmetric: UPPer:CHANnel<nr>	<CDP_Limit>	with query	6.120
CALCulate:ARRay:CDPower:MANual:AVERage:MATChing:LIMit?	NMAU| NMAL | INV | OK	query only	6.124
READ:ARRay:CDPower:MANual:AVERage?	–100.0 dB to 0.0 dB	query only	6.123
FETCh:ARRay:CDPower:MANual:AVERage?	–100.0 dB to 0.0 dB	query only	6.123
SAMPle:ARRay:CDPower:MANual:AVERage?	–100.0 dB to 0.0 dB	query only	6.123
CONFigure:CDPower:MANual:CMMax:LIMit:POINt:ASYMmetric: LOWer:CHANnel<nr>	<CDP_Limit>	with query	6.120
CONFigure:CDPower:MANual:CMMax:LIMit:POINt:ASYMmetric: UPPer:CHANnel<nr>	<CDP_Limit>	with query	6.120
DEFault:CDPower:MANual:CONTrol	ON | OFF	with query	6.119
CONFigure:CDPower:MANual:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.119
CONFigure:CDPower:MANual:CONTrol:RMODe	SCALar | ARRay	with query	6.118
CONFigure:CDPower:MANual:CONTrol:STATistics	1 to 1000 | NONE	with query	6.118
READ[:SCALar]:CDPower:MANual:CQI?	<Result>	query only	6.122
FETCh[:SCALar]:CDPower:MANual:CQI?	<Result>	query only	6.122
SAMPle[:SCALar]:CDPower:MANual:CQI?	<Result>	query only	6.122
CALCulate:ARRay:CDPower:MANual:CURRent:MATChing:LIMit?	NMAU| NMAL | INV | OK	query only	6.124
READ:ARRay:CDPower:MANual:CURRent?	–100.0 dB to 0.0 dB	query only	6.123
FETCh:ARRay:CDPower:MANual:CURRent?	–100.0 dB to 0.0 dB	query only	6.123
SAMPle:ARRay:CDPower:MANual:CURRent?	–100.0 dB to 0.0 dB	query only	6.123
CONFigure:CDPower:MANual:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.117
READ:ARRay:CDPower:MANual:HSDPcch?	–100.0 dB to 0.0 dB	query only	6.124
FETCh:ARRay:CDPower:MANual:HSDPcch?	–100.0 dB to 0.0 dB	query only	6.124
SAMPle:ARRay:CDPower:MANual:HSDPcch?	–100.0 dB to 0.0 dB	query only	6.124
DEFault:CDPower:MANual:LIMit	ON | OFF	with query	6.121
CALCulate:ARRay:CDPower:MANual:MAXimum:MATChing:LIMit?	NMAU| NMAL | INV | OK	query only	6.124
READ:ARRay:CDPower:MANual:MAXimum?	–100.0 dB to 0.0 dB	query only	6.123
FETCh:ARRay:CDPower:MANual:MAXimum?	–100.0 dB to 0.0 dB	query only	6.123
SAMPle:ARRay:CDPower:MANual:MAXimum?	–100.0 dB to 0.0 dB	query only	6.123
CALCulate:ARRay:CDPower:MANual:MINimum:MATChing:LIMit?	NMAU| NMAL | INV | OK	query only	6.124
READ:ARRay:CDPower:MANual:MINimum?	–100.0 dB to 0.0 dB	query only	6.123
FETCh:ARRay:CDPower:MANual:MINimum?	–100.0 dB to 0.0 dB	query only	6.123
SAMPle:ARRay:CDPower:MANual:MINimum?	–100.0 dB to 0.0 dB	query only	6.123
FETCh:CDPower:MANual:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.118
READ[:SCALar]:CDPower:MANual?	<Result>	query only	6.121
FETCh[:SCALar]:CDPower:MANual?	<Result>	query only	6.121
SAMPle[:SCALar]:CDPower:MANual?	<Result>	query only	6.121
Code Domain Rho – Automatic			

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
INITiate:CDPower:RAUTomatic	–	no query	6.112
ABORt:CDPower:RAUTomatic	–	no query	6.112
STOP:CDPower:RAUTomatic	–	no query	6.112
CONTinue:CDPower:RAUTomatic	–	no query	6.112
DEFault:CDPower:RAUTomatic:CONTrol	ON | OFF	with query	6.115
CONFigure:CDPower:RAUTomatic:CONTrol:DSFactor	AUTO | 4 | 8 | 16 | 32 | 64 | 128 | 256	with query	6.114
CONFigure:CDPower:RAUTomatic:CONTrol:DSFactor:AUTMode?	<Response>	with query	6.114
CONFigure:CDPower:RAUTomatic:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, STEP | NONE	with query	6.114
CONFigure:CDPower:RAUTomatic:CONTrol:RMODe	SCALar | ARRay	with query	6.113
CONFigure:CDPower:RAUTomatic:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.113
READ:ARRay:CDPower:RAUTomatic:ISIGnal:CURRent?	0.0000 to 1.0000	query only	6.116
FETCh:ARRay:CDPower:RAUTomatic:ISIGnal:CURRent?	0.0000 to 1.0000	query only	6.116
SAMPle:ARRay:CDPower:RAUTomatic:ISIGnal:CURRent?	0.0000 to 1.0000	query only	6.116
READ:ARRay:CDPower:RAUTomatic:QSIGnal:CURRent?	0.0000 to 1.0000	query only	6.116
FETCh:ARRay:CDPower:RAUTomatic:QSIGnal:CURRent?	0.0000 to 1.0000	query only	6.116
SAMPle:ARRay:CDPower:RAUTomatic:QSIGnal:CURRent?	0.0000 to 1.0000	query only	6.116
FETCh:CDPower:RAUTomatic:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.113
READ[:SCALar]:CDPower:RAUTomatic?	<Result>	query only	6.115
FETCh[:SCALar]:CDPower:RAUTomatic?	<Result>	query only	6.115
SAMPle[:SCALar]:CDPower:RAUTomatic?	<Result>	query only	6.115
Code Domain Rho – Manual			
INITiate:CDPower:RMANual	–	no query	6.117
ABORt:CDPower:RMANual	–	no query	6.117
STOP:CDPower:RMANual	–	no query	6.117
CONTinue:CDPower:RMANual	–	no query	6.117
READ[:SCALar]:CDPower:RMANual:ACK?	<Result>	query only	6.122
FETCh[:SCALar]:CDPower:RMANual:ACK?	<Result>	query only	6.122
SAMPle[:SCALar]:CDPower:RMANual:ACK?	<Result>	query only	6.122
CONFigure:CDPower:RMANual:AVERage:LIMit:POINt:ASYMmetric: LOWer:CHANnel<nr>	<CD-□_Limit>	with query	6.121
CONFigure:CDPower:RMANual:AVERage:LIMit:POINt:ASYMmetric: UPPer:CHANnel<nr>	<CD-□_Limit>	with query	6.120
CALCulate:ARRay:CDPower:RMANual:AVERage:MATChing:LIMit?	NMAU| NMAL | INV | OK	query only	6.124
READ:ARRay:CDPower:RMANual:AVERage?	0.0000 to 1.0000	query only	6.123
FETCh:ARRay:CDPower:RMANual:AVERage?	0.0000 to 1.0000	query only	6.123
SAMPle:ARRay:CDPower:RMANual:AVERage?	0.0000 to 1.0000	query only	6.123
CONFigure:CDPower:RMANual:CMMax:LIMit:POINt:ASYMmetric: LOWer:CHANnel<nr>	<CD-□_Limit>	with query	6.120
CONFigure:CDPower:RMANual:CMMax:LIMit:POINt:ASYMmetric:	<CD-□_Limit>	with query	6.120

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
UPPer:CHANnel<nr>			
DEFault:CDPower:RMANual:CONTrol	ON | OFF	with query	6.119
CONFigure:CDPower:RMANual:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.119
CONFigure:CDPower:RMANual:CONTrol:RMODe	SCALar | ARRay	with query	6.118
CONFigure:CDPower:RMANual:CONTrol:STATistics	1 to 1000 | NONE	with query	6.118
READ[:SCALar]:CDPower:RMANual:CQI?	<Result>	query only	6.122
FETCh[:SCALar]:CDPower:RMANual:CQI?	<Result>	query only	6.122
SAMPle[:SCALar]:CDPower:RMANual:CQI?	<Result>	query only	6.122
CALCulate:ARRay:CDPower:RMANual:CURRent:MATChing:LIMit?	NMAU| NMAL | INV | OK	query only	6.124
READ:ARRay:CDPower:RMANual:CURRent?	0.0000 to 1.0000	query only	6.123
FETCh:ARRay:CDPower:RMANual:CURRent?	0.0000 to 1.0000	query only	6.123
SAMPle:ARRay:CDPower:RMANual:CURRent?	0.0000 to 1.0000	query only	6.123
CONFigure:CDPower:RMANual:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.117
READ:ARRay:CDPower:RMANual:HSDPcch?	0.0000 to 1.0000	query only	6.124
FETCh:ARRay:CDPower:RMANual:HSDPcch?	0.0000 to 1.0000	query only	6.124
SAMPle:ARRay:CDPower:RMANual:HSDPcch?	0.0000 to 1.0000	query only	6.124
DEFault:CDPower:RMANual:LIMit	ON | OFF	with query	6.121
CALCulate:ARRay:CDPower:RMANual:MAXimum:MATChing:LIMit?	NMAU| NMAL | INV | OK	query only	6.124
READ:ARRay:CDPower:RMANual:MAXimum?	0.0000 to 1.0000	query only	6.123
FETCh:ARRay:CDPower:RMANual:MAXimum?	0.0000 to 1.0000	query only	6.123
SAMPle:ARRay:CDPower:RMANual:MAXimum?	0.0000 to 1.0000	query only	6.123
CALCulate:ARRay:CDPower:RMANual:MINimum:MATChing:LIMit?	NMAU| NMAL | INV | OK	query only	6.124
READ:ARRay:CDPower:RMANual:MINimum?	0.0000 to 1.0000	query only	6.123
FETCh:ARRay:CDPower:RMANual:MINimum?	0.0000 to 1.0000	query only	6.123
SAMPle:ARRay:CDPower:RMANual:MINimum?	0.0000 to 1.0000	query only	6.123
FETCh:CDPower:RMANual:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.118
READ[:SCALar]:CDPower:RMANual?	<Result>	query only	6.121
FETCh[:SCALar]:CDPower:RMANual?	<Result>	query only	6.121
SAMPle[:SCALar]:CDPower:RMANual?	<Result>	query only	6.121
Code Domain Power vs. Time			
INITiate:CDPower:TIME	–	no query	6.128
ABORt:CDPower:TIME	–	no query	6.128
STOP:CDPower:TIME	–	no query	6.128
CONTinue:CDPower:TIME	–	no query	6.128
READ[:SCALar]:CDPower:TIME:BFACtor?	<Result>	query only	6.130
FETCh[:SCALar]:CDPower:TIME:BFACtor?	<Result>	query only	6.130
SAMPle[:SCALar]:CDPower:TIME:BFACtor?	<Result>	query only	6.130
DEFault:CDPower:TIME:CONTrol	ON | OFF	with query	6.129

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
CONFigure:CDPower:TIME:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.129
READ[:SCALar]:CDPower:TIME:CPOWer?	<Result>	query only	6.130
FETCh[:SCALar]:CDPower:TIME:CPOWer?	<Result>	query only	6.130
SAMPle[:SCALar]:CDPower:TIME:CPOWer?	<Result>	query only	6.130
READ:ARRay:CDPower:TIME:DPCCH:BFACtor?	0 to 1	query only	6.131
FETCh:ARRay:CDPower:TIME:DPCCH:BFACtor?	00 to 1	query only	6.131
SAMPle:ARRay:CDPower:TIME:DPCCH:BFACtor?	0 to 1	query only	6.131
READ:ARRay:CDPower:TIME:DPCCH:CPOWer?	–100.0 dB to 0.0 dB	query only	6.131
FETCh:ARRay:CDPower:TIME:DPCCH:CPOWer?	0–100.0 dB to 0.0 dB	query only	6.131
SAMPle:ARRay:CDPower:TIME:DPCCH:CPOWer?	–100.0 dB to 0.0 dB	query only	6.131
READ:ARRay:CDPower:TIME:DPDCH<nr>:BFACtor?	00 to 1	query only	6.131
FETCh:ARRay:CDPower:TIME:DPDCH<nr>:BFACtor?	00 to 1	query only	6.131
SAMPle:ARRay:CDPower:TIME:DPDCH<nr>:BFACtor?	0 to 1	query only	6.131
READ:ARRay:CDPower:TIME:DPDCH<nr>:CPOWer?	0–100.0 dB to 0.0 dB	query only	6.131
FETCh:ARRay:CDPower:TIME:DPDCH<nr>:CPOWer?	0–100.0 dB to 0.0 dB	query only	6.131
SAMPle:ARRay:CDPower:TIME:DPDCH<nr>:CPOWer?	–100.0 dB to 0.0 dB	query only	6.131
CONFigure:CDPower:TIME:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.128
READ:ARRay:CDPower:TIME:HSDPcch:BFACtor?	0 to 30	query only	6.132
FETCh:ARRay:CDPower:TIME:HSDPcch:BFACtor?	00 to 30	query only	6.132
SAMPle:ARRay:CDPower:TIME:HSDPcch:BFACtor?	0 to 30	query only	6.132
READ:ARRay:CDPower:TIME:HSDPcch:CPOWer?	–100.0 dB to 0.0 dB	query only	6.131
FETCh:ARRay:CDPower:TIME:HSDPcch:CPOWer?	0–100.0 dB to 0.0 dB	query only	6.131
SAMPle:ARRay:CDPower:TIME:HSDPcch:CPOWer?	–100.0 dB to 0.0 dB	query only	6.131
FETCh:CDPower:TIME:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, NONE	query only	6.129
READ:ARRay:CDPower:TIME:UEPower?	–100 dBm to +60 dBm	query only	6.131
FETCh:ARRay:CDPower:TIME:UEPower?	–100 dBm to +60 dBm	query only	6.131
SAMPle:ARRay:CDPower:TIME:UEPower?	–100 dBm to +60 dBm	query only	6.131
Modulation Measurements - EVM			
INITiate:MODulation:EVMagnitude:QPSK	–	no query	6.57
ABORt:MODulation:EVMagnitude:QPSK	–	no query	6.57
STOP:MODulation:EVMagnitude:QPSK	–	no query	6.57
CONTinue:MODulation:EVMagnitude:QPSK	–	no query	6.57
CONFigure:SUBarrays:MODulation:EVMagnitude:QPSK	ALL | ARIThmetical | MINimum | QPSK,<Start>,<Samples>{ ,<Start>,<Samples>}	with query	6.60
READ:ARRay:MODulation:EVMagnitude:QPSK:AVERage?	0.0% to 100.0%	query only	6.62
FETCh:ARRay:MODulation:EVMagnitude:QPSK:AVERage?	0.0% to 100.0%	query only	6.62
SAMPle:ARRay:MODulation:EVMagnitude:QPSK:AVERage?	0.0% to 100.0%	query only	6.62

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
READ:SUBarrays:MODulation:EVMagnitude:QPSK:AVERage?	0.0% to 100.0%	query only	6.63
FETCh:SUBarrays:MODulation:EVMagnitude:QPSK:AVERage?	0.0% to 100.0%	query only	6.63
SAMPle:SUBarrays:MODulation:EVMagnitude:QPSK:AVERage?	0.0% to 100.0%	query only	6.63
DEFault:MODulation:EVMagnitude:QPSK:CONTrol	ON | OFF	with query	6.59
CONFigure:MODulation:EVMagnitude:QPSK:CONTrol:MLENgth	640 | 2560	with query	6.59
CONFigure:MODulation:EVMagnitude:QPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.59
CONFigure:MODulation:EVMagnitude:QPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.58
CONFigure:MODulation:EVMagnitude:QPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.58
READ:ARRay:MODulation:EVMagnitude:QPSK:CURRent?	0.0% to 100.0%	query only	6.62
FETCh:ARRay:MODulation:EVMagnitude:QPSK:CURRent?	0.0% to 100.0%	query only	6.62
SAMPle:ARRay:MODulation:EVMagnitude:QPSK:CURRent?	0.0% to 100.0%	query only	6.62
READ:SUBarrays:MODulation:EVMagnitude:QPSK:CURRent?	0.0% to 100.0%	query only	6.63
FETCh:SUBarrays:MODulation:EVMagnitude:QPSK:CURRent?	0.0% to 100.0%	query only	6.63
SAMPle:SUBarrays:MODulation:EVMagnitude:QPSK:CURRent?	0.0% to 100.0%	query only	6.63
CONFigure:MODulation:EVMagnitude:QPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.57
CALCulate[:SCALar]:MODulation:EVMagnitude:QPSK:MATChing:LIMit?	<Result>	query only	6.61
READ:ARRay:MODulation:EVMagnitude:QPSK:MMAX?	0.0% to 100.0%	query only	6.62
FETCh:ARRay:MODulation:EVMagnitude:QPSK:MMAX?	0.0% to 100.0%	query only	6.62
SAMPle:ARRay:MODulation:EVMagnitude:QPSK:MMAX?	0.0% to 100.0%	query only	6.62
READ:SUBarrays:MODulation:EVMagnitude:QPSK:MMAX?	0.0% to 100.0%	query only	6.63
FETCh:SUBarrays:MODulation:EVMagnitude:QPSK:MMAX?	0.0% to 100.0%	query only	6.63
SAMPle:SUBarrays:MODulation:EVMagnitude:QPSK:MMAX?	0.0% to 100.0%	query only	6.63
FETCh:MODulation:EVMagnitude:QPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.58
READ[:SCALar]:MODulation:EVMagnitude:QPSK?	<Result>	query only	6.61
FETCh[:SCALar]:MODulation:EVMagnitude:QPSK?	<Result>	query only	6.61
SAMPle[:SCALar]:MODulation:EVMagnitude:QPSK?	<Result>	query only	6.61
INITiate:MODulation:EVMagnitude:WCDMa:DPCH	–	no query	6.57
ABORt:MODulation:EVMagnitude:WCDMa:DPCH	–	no query	6.57
STOP:MODulation:EVMagnitude:WCDMa:DPCH	–	no query	6.57
CONTinue:MODulation:EVMagnitude:WCDMa:DPCH	–	no query	6.57
CONFigure:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.60
READ:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?	0.0% to 100.0%	query only	6.62
FETCh:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?	0.0% to 100.0%	query only	6.62
SAMPle:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?	0.0% to 100.0%	query only	6.62
READ:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?	0.0% to 100.0%	query only	6.63
FETCh:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?	0.0% to 100.0%	query only	6.63

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
SAMPle:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?	0.0% to 100.0%	query only	6.63
DEFault:MODulation:EVMagnitude:WCDMa:DPCH:CONTrol	ON | OFF	with query	6.59
CONFigure:MODulation:EVMagnitude:WCDMa:DPCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.59
CONFigure:MODulation:EVMagnitude:WCDMa:DPCH:CONTrol:RMODe	SCALar | ARRay	with query	6.58
CONFigure:MODulation:EVMagnitude:WCDMa:DPCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.58
READ:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?	0.0% to 100.0%	query only	6.62
FETCh:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?	0.0% to 100.0%	query only	6.62
SAMPle:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?	0.0% to 100.0%	query only	6.62
READ:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?	0.0% to 100.0%	query only	6.63
FETCh:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?	0.0% to 100.0%	query only	6.63
SAMPle:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?	0.0% to 100.0%	query only	6.63
CONFigure:MODulation:EVMagnitude:WCDMa:DPCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.57
CALCulate[:SCALar]:MODulation:EVMagnitude:WCDMa:DPCH:MATChing:LIMit?	<Result>	query only	6.61
READ:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?	0.0% to 100.0%	query only	6.62
FETCh:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?	0.0% to 100.0%	query only	6.62
SAMPle:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?	0.0% to 100.0%	query only	6.62
READ:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?	0.0% to 100.0%	query only	6.63
FETCh:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?	0.0% to 100.0%	query only	6.63
SAMPle:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?	0.0% to 100.0%	query only	6.63
FETCh:MODulation:EVMagnitude:WCDMa:DPCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.58
READ[:SCALar]:MODulation:EVMagnitude:WCDMa:DPCH?	<Result>	query only	6.61
FETCh[:SCALar]:MODulation:EVMagnitude:WCDMa:DPCH?	<Result>	query only	6.61
SAMPle[:SCALar]:MODulation:EVMagnitude:WCDMa:DPCH?	<Result>	query only	6.61
Modulation Measurements – I/Q Analyzer			
INITiate:MODulation:IQANalyzer:QPSK	–	no query	6.78
ABORt:MODulation:IQANalyzer:QPSK	–	no query	6.78
STOP:MODulation:IQANalyzer:QPSK	–	no query	6.78
CONTinue:MODulation:IQANalyzer:QPSK	–	no query	6.78
CONFigure:SUBarrays:MODulation:IQANalyzer:QPSK	ALL | ARIThmetical | MINimum | QPSK,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.80
DEFault:MODulation:IQANalyzer:QPSK:CONTrol	ON | OFF	with query	6.80
CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:MLENgth	640 | 2560	with query	6.79
CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, STEP | NONE	with query	6.79
CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.79

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:ROTation	0 | 45	with query	6.79
CONFigure:MODulation:IQANalyzer:QPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.78
READ:ARRay:MODulation:IQANalyzer:QPSK:IPHase?	–2.0 to +2.0	query only	6.81
FETCh:ARRay:MODulation:IQANalyzer:QPSK:IPHase?	–2.0 to +2.0	query only	6.81
SAMPle:ARRay:MODulation:IQANalyzer:QPSK:IPHase?	–2.0 to +2.0	query only	6.81
READ:SUBarrays:MODulation:IQANalyzer:QPSK:IPHase?	–2.0 to +2.0	query only	6.82
FETCh:SUBarrays:MODulation:IQANalyzer:QPSK:IPHase?	–2.0 to +2.0	query only	6.82
SAMPle:SUBarrays:MODulation:IQANalyzer:QPSK:IPHase?	–2.0 to +2.0	query only	6.82
READ:ARRay:MODulation:IQANalyzer:QPSK:QPHase?	–2.0 to +2.0	query only	6.81
FETCh:ARRay:MODulation:IQANalyzer:QPSK:QPHase?	–2.0 to +2.0	query only	6.81
SAMPle:ARRay:MODulation:IQANalyzer:QPSK:QPHase?	–2.0 to +2.0	query only	6.81
READ:SUBarrays:MODulation:IQANalyzer:QPSK:QPHase?	–2.0 to +2.0	query only	6.82
FETCh:SUBarrays:MODulation:IQANalyzer:QPSK:QPHase?	–2.0 to +2.0	query only	6.82
SAMPle:SUBarrays:MODulation:IQANalyzer:QPSK:QPHase?	–2.0 to +2.0	query only	6.82
FETCh:MODulation:IQANalyzer:QPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.78
READ[:SCALar]:MODulation:IQANalyzer:QPSK?	<Result>	query only	6.81
FETCh[:SCALar]:MODulation:IQANalyzer:QPSK?	<Result>	query only	6.81
SAMPle[:SCALar]:MODulation:IQANalyzer:QPSK?	<Result>	query only	6.81
INITiate:MODulation:IQANalyzer:WCDMa:DPCH	–	no query	6.78
ABORt:MODulation:IQANalyzer:WCDMa:DPCH	–	no query	6.78
STOP:MODulation:IQANalyzer:WCDMa:DPCH	–	no query	6.78
CONTinue:MODulation:IQANalyzer:WCDMa:DPCH	–	no query	6.78
CONFigure:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.80
DEFault:MODulation:IQANalyzer:WCDMa:DPCH:CONTrol	ON | OFF	with query	6.80
CONFigure:MODulation:IQANalyzer:WCDMa:DPCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, STEP | NONE	with query	6.79
CONFigure:MODulation:IQANalyzer:WCDMa:DPCH:CONTrol:RMODe	SCALar | ARRay	with query	6.79
CONFigure:MODulation:IQANalyzer:WCDMa:DPCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.78
READ:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:IPHase?	–2.0 to +2.0	query only	6.81
FETCh:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:IPHase?	–2.0 to +2.0	query only	6.81
SAMPle:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:IPHase?	–2.0 to +2.0	query only	6.81
READ:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:IPHase?	–2.0 to +2.0	query only	6.82
FETCh:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:IPHase?	–2.0 to +2.0	query only	6.82
SAMPle:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:IPHase?	–2.0 to +2.0	query only	6.82
READ:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?	–2.0 to +2.0	query only	6.81
FETCh:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?	–2.0 to +2.0	query only	6.81
SAMPle:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?	–2.0 to +2.0	query only	6.81

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
READ:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?	–2.0 to +2.0	query only	6.82
FETCh:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?	–2.0 to +2.0	query only	6.82
SAMPle:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?	–2.0 to +2.0	query only	6.82
FETCh:MODulation:IQANalyzer:WCDMa:DPCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.78
READ[:SCALar]:MODulation:IQANalyzer:WCDMa:DPCH?	<Result>	query only	6.81
FETCh[:SCALar]:MODulation:IQANalyzer:WCDMa:DPCH?	<Result>	query only	6.81
SAMPle[:SCALar]:MODulation:IQANalyzer:WCDMa:DPCH?	<Result>	query only	6.81
Modulation Measurements – Modulation Error			
INITiate:MODulation:MERRor:QPSK	–	no query	6.64
ABORt:MODulation:MERRor:QPSK	–	no query	6.64
STOP:MODulation:MERRor:QPSK	–	no query	6.64
CONTinue:MODulation:MERRor:QPSK	–	no query	6.64
CONFigure:SUBarrays:MODulation:MERRor:QPSK	ALL | ARIThmetical | MINimum | QPSK,<Start>,<Samples>{ ,<Start>,<Samples>}	with query	6.67
READ:ARRay:MODulation:MERRor:QPSK:AVERage?	–100.0% to +100.0%	query only	6.69
FETCh:ARRay:MODulation:MERRor:QPSK:AVERage?	–100.0% to +100.0%	query only	6.69
SAMPle:ARRay:MODulation:MERRor:QPSK:AVERage?	–100.0% to +100.0%	query only	6.69
READ:SUBarrays:MODulation:MERRor:QPSK:AVERage?	–100.0% to +100.0%	query only	6.70
FETCh:SUBarrays:MODulation:MERRor:QPSK:AVERage?	–100.0% to +100.0%	query only	6.70
SAMPle:SUBarrays:MODulation:MERRor:QPSK:AVERage?	–100.0% to +100.0%	query only	6.70
DEFault:MODulation:MERRor:QPSK:CONTrol	ON | OFF	with query	6.66
CONFigure:MODulation:MERRor:QPSK:CONTrol:MLENgth	640 | 2560	with query	6.66
CONFigure:MODulation:MERRor:QPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.66
CONFigure:MODulation:MERRor:QPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.65
CONFigure:MODulation:MERRor:QPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.65
READ:ARRay:MODulation:MERRor:QPSK:CURRent?	–100.0% to +100.0%	query only	6.69
FETCh:ARRay:MODulation:MERRor:QPSK:CURRent?	–100.0% to +100.0%	query only	6.69
SAMPle:ARRay:MODulation:MERRor:QPSK:CURRent?	–100.0% to +100.0%	query only	6.69
READ:SUBarrays:MODulation:MERRor:QPSK:CURRent?	–100.0% to +100.0%	query only	6.70
FETCh:SUBarrays:MODulation:MERRor:QPSK:CURRent?	–100.0% to +100.0%	query only	6.70
SAMPle:SUBarrays:MODulation:MERRor:QPSK:CURRent?	–100.0% to +100.0%	query only	6.70
CONFigure:MODulation:MERRor:QPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.64
CALCulate[:SCALar]:MODulation:MERRor:QPSK:MATChing:LIMit?	<Result>	query only	6.68
READ:ARRay:MODulation:MERRor:QPSK:MMAX?	–100.0% to +100.0%	query only	6.69
FETCh:ARRay:MODulation:MERRor:QPSK:MMAX?	–100.0% to +100.0%	query only	6.69
SAMPle:ARRay:MODulation:MERRor:QPSK:MMAX?	–100.0% to +100.0%	query only	6.69
READ:SUBarrays:MODulation:MERRor:QPSK:MMAX?	–100.0% to +100.0%	query only	6.70

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
FETCh:SUBarrays:MODulation:MERRor:QPSK:MMAX?	–100.0% to +100.0%	query only	6.70
SAMPle:SUBarrays:MODulation:MERRor:QPSK:MMAX?	–100.0% to +100.0%	query only	6.70
FETCh:MODulation:MERRor:QPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.65
READ[:SCALar]:MODulation:MERRor:QPSK?	<Result>	query only	6.68
FETCh[:SCALar]:MODulation:MERRor:QPSK?	<Result>	query only	6.68
SAMPle[:SCALar]:MODulation:MERRor:QPSK?	<Result>	query only	6.68
INITiate:MODulation:MERRor:WCDMa:DPCH	–	no query	6.64
ABORt:MODulation:MERRor:WCDMa:DPCH	–	no query	6.64
STOP:MODulation:MERRor:WCDMa:DPCH	–	no query	6.64
CONTinue:MODulation:MERRor:WCDMa:DPCH	–	no query	6.64
CONFigure:SUBarrays:MODulation:MERRor:WCDMa:DPCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.67
READ:ARRay:MODulation:MERRor:WCDMa:DPCH:AVERage?	–100.0% to +100.0%	query only	6.69
FETCh:ARRay:MODulation:MERRor:WCDMa:DPCH:AVERage?	–100.0% to +100.0%	query only	6.69
SAMPle:ARRay:MODulation:MERRor:WCDMa:DPCH:AVERage?	–100.0% to +100.0%	query only	6.69
READ:SUBarrays:MODulation:MERRor:WCDMa:DPCH:AVERage?	–100.0% to +100.0%	query only	6.70
FETCh:SUBarrays:MODulation:MERRor:WCDMa:DPCH:AVERage?	–100.0% to +100.0%	query only	6.70
SAMPle:SUBarrays:MODulation:MERRor:WCDMa:DPCH:AVERage?	–100.0% to +100.0%	query only	6.70
DEFault:MODulation:MERRor:WCDMa:DPCH:CONTrol	ON | OFF	with query	6.66
CONFigure:MODulation:MERRor:WCDMa:DPCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.66
CONFigure:MODulation:MERRor:WCDMa:DPCH:CONTrol:RMODe	SCALar | ARRay	with query	6.65
CONFigure:MODulation:MERRor:WCDMa:DPCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.65
READ:ARRay:MODulation:MERRor:WCDMa:DPCH:CURRent?	–100.0% to +100.0%	query only	6.69
FETCh:ARRay:MODulation:MERRor:WCDMa:DPCH:CURRent?	–100.0% to +100.0%	query only	6.69
SAMPle:ARRay:MODulation:MERRor:WCDMa:DPCH:CURRent?	–100.0% to +100.0%	query only	6.69
READ:SUBarrays:MODulation:MERRor:WCDMa:DPCH:CURRent?	–100.0% to +100.0%	query only	6.70
FETCh:SUBarrays:MODulation:MERRor:WCDMa:DPCH:CURRent?	–100.0% to +100.0%	query only	6.70
SAMPle:SUBarrays:MODulation:MERRor:WCDMa:DPCH:CURRent?	–100.0% to +100.0%	query only	6.70
CONFigure:MODulation:MERRor:WCDMa:DPCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.64
CALCulate[:SCALar]:MODulation:MERRor:WCDMa:DPCH:MATChing:LIMit?	<Result>	query only	6.68
READ:ARRay:MODulation:MERRor:WCDMa:DPCH:MMAX?	–100.0% to +100.0%	query only	6.69
FETCh:ARRay:MODulation:MERRor:WCDMa:DPCH:MMAX?	–100.0% to +100.0%	query only	6.69
SAMPle:ARRay:MODulation:MERRor:WCDMa:DPCH:MMAX?	–100.0% to +100.0%	query only	6.69
READ:SUBarrays:MODulation:MERRor:WCDMa:DPCH:MMAX?	–100.0% to +100.0%	query only	6.70
FETCh:SUBarrays:MODulation:MERRor:WCDMa:DPCH:MMAX?	–100.0% to +100.0%	query only	6.70
SAMPle:SUBarrays:MODulation:MERRor:WCDMa:DPCH:MMAX?	–100.0% to +100.0%	query only	6.70

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
FETCh:MODulation:MERRor:WCDMa:DPCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.65
READ[:SCALar]:MODulation:MERRor:WCDMa:DPCH?	<Result>	query only	6.68
FETCh[:SCALar]:MODulation:MERRor:WCDMa:DPCH?	<Result>	query only	6.68
SAMPle[:SCALar]:MODulation:MERRor:WCDMa:DPCH?	<Result>	query only	6.68
Modulation Measurements – General Settings			
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>	with query	6.54
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>	with query	6.53
DEFault:MODulation:OEMP:QPSK:LIMit	ON | OFF	with query	6.54
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>	with query	6.54
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>	with query	6.53
DEFault:MODulation:OEMP:WCDMa:DPCH:LIMit	ON | OFF	with query	6.54
Modulation Measurements - Overview			
INITiate:MODulation:OVERview:QPSK	–	no query	6.51
ABORt:MODulation:OVERview:QPSK	–	no query	6.51

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
STOP:MODulation:OVERview:QPSK	–	no query	6.51
CONTinue:MODulation:OVERview:QPSK	–	no query	6.51
DEFault:MODulation:OVERview:QPSK:CONTrol	ON | OFF	with query	6.53
CONFigure:MODulation:OVERview:QPSK:CONTrol:MLENgth	640 | 2560	with query	6.52
CONFigure:MODulation:OVERview:QPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.52
CONFigure:MODulation:OVERview:QPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.52
CONFigure:MODulation:OVERview:QPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.51
CALCulate[:SCALar]:MODulation:OVERview:QPSK:MATChing:LIMit?	<Result>	query only	6.56
FETCh:MODulation:OVERview:QPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.51
READ[:SCALar]:MODulation:OVERview:QPSK?	<Result>	query only	6.55
FETCh[:SCALar]:MODulation:OVERview:QPSK?	<Result>	query only	6.55
SAMPle[:SCALar]:MODulation:OVERview:QPSK?	<Result>	query only	6.55
INITiate:MODulation:OVERview:WCDMa:DPCH	–	no query	6.51
ABORt:MODulation:OVERview:WCDMa:DPCH	–	no query	6.51
STOP:MODulation:OVERview:WCDMa:DPCH	–	no query	6.51
CONTinue:MODulation:OVERview:WCDMa:DPCH	–	no query	6.51
READ[:SCALar]:MODulation:OVERview:WCDMa:DPCH:CMMax:PCDE?	<Result>	query only	6.56
FETCh[:SCALar]:MODulation:OVERview:WCDMa:DPCH:CMMax:PCDE?	<Result>	query only	6.56
SAMPle[:SCALar]:MODulation:OVERview:WCDMa:DPCH:CMMax: PCDE?	<Result>	query only	6.56
DEFault:MODulation:OVERview:WCDMa:DPCH:CONTrol	ON | OFF	with query	6.53
CONFigure:MODulation:OVERview:WCDMa:DPCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.52
CONFigure:MODulation:OVERview:WCDMa:DPCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.52
CONFigure:MODulation:OVERview:WCDMa:DPCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.51
CALCulate[:SCALar]:MODulation:OVERview:WCDMa:DPCH:MATChing: LIMit?	<Result>	query only	6.56
FETCh:MODulation:OVERview:WCDMa:DPCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.51
READ[:SCALar]:MODulation:OVERview:WCDMa:DPCH?	<Result>	query only	6.55
FETCh[:SCALar]:MODulation:OVERview:WCDMa:DPCH?	<Result>	query only	6.55
SAMPle[:SCALar]:MODulation:OVERview:WCDMa:DPCH?	<Result>	query only	6.55
Modulation Measurements – Phase Error			
INITiate:MODulation:PERRor:QPSK	–	no query	6.71
ABORt:MODulation:PERRor:QPSK	–	no query	6.71
STOP:MODulation:PERRor:QPSK	–	no query	6.71
CONTinue:MODulation:PERRor:QPSK	–	no query	6.71
CONFigure:SUBarrays:MODulation:PERRor:QPSK	ALL | ARIThmetical | MINimum |	with query	6.74

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
	QPSK,<Start>,<Samples>{ ,<Start>,<Samples>}		
READ:ARRay:MODulation:PERRor:QPSK:AVERage?	–180.0 deg to +180.0 deg	query only	6.76
FETCh:ARRay:MODulation:PERRor:QPSK:AVERage?	–180.0 deg to +180.0 deg	query only	6.76
SAMPle:ARRay:MODulation:PERRor:QPSK:AVERage?	–180.0 deg to +180.0 deg	query only	6.76
READ:SUBarrays:MODulation:PERRor:QPSK:AVERage?	–180.0 deg to +180.0 deg	query only	6.77
FETCh:SUBarrays:MODulation:PERRor:QPSK:AVERage?	–180.0 deg to +180.0 deg	query only	6.77
SAMPle:SUBarrays:MODulation:PERRor:QPSK:AVERage?	–180.0 deg to +180.0 deg	query only	6.77
DEFault:MODulation:PERRor:QPSK:CONTrol	ON | OFF	with query	6.73
CONFigure:MODulation:PERRor:QPSK:CONTrol:MLENgth	640 | 2560	with query	6.73
CONFigure:MODulation:PERRor:QPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.73
CONFigure:MODulation:PERRor:QPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.72
CONFigure:MODulation:PERRor:QPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.72
READ:ARRay:MODulation:PERRor:QPSK:CURRent?	–180.0 deg to +180.0 deg	query only	6.76
FETCh:ARRay:MODulation:PERRor:QPSK:CURRent?	–180.0 deg to +180.0 deg	query only	6.76
SAMPle:ARRay:MODulation:PERRor:QPSK:CURRent?	–180.0 deg to +180.0 deg	query only	6.76
READ:SUBarrays:MODulation:PERRor:QPSK:CURRent?	–180.0 deg to +180.0 deg	query only	6.77
FETCh:SUBarrays:MODulation:PERRor:QPSK:CURRent?	–180.0 deg to +180.0 deg	query only	6.77
SAMPle:SUBarrays:MODulation:PERRor:QPSK:CURRent?	–180.0 deg to +180.0 deg	query only	6.77
CONFigure:MODulation:PERRor:QPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.71
CALCulate[:SCALar]:MODulation:PERRor:QPSK:MATChing:LIMit?	<Result>	query only	6.75
READ:ARRay:MODulation:PERRor:QPSK:MMAX?	–180.0 deg to +180.0 deg	query only	6.76
FETCh:ARRay:MODulation:PERRor:QPSK:MMAX?	–180.0 deg to +180.0 deg	query only	6.76
SAMPle:ARRay:MODulation:PERRor:QPSK:MMAX?	–180.0 deg to +180.0 deg	query only	6.76
READ:SUBarrays:MODulation:PERRor:QPSK:MMAX?	–180.0 deg to +180.0 deg	query only	6.77
FETCh:SUBarrays:MODulation:PERRor:QPSK:MMAX?	–180.0 deg to +180.0 deg	query only	6.77
SAMPle:SUBarrays:MODulation:PERRor:QPSK:MMAX?	–180.0 deg to +180.0 deg	query only	6.77
FETCh:MODulation:PERRor:QPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.72
READ[:SCALar]:MODulation:PERRor:QPSK?	<Result>	query only	6.75
FETCh[:SCALar]:MODulation:PERRor:QPSK?	<Result>	query only	6.75
SAMPle[:SCALar]:MODulation:PERRor:QPSK?	<Result>	query only	6.75
INITiate:MODulation:PERRor:WCDMa:DPCH	–	no query	6.71
ABORt:MODulation:PERRor:WCDMa:DPCH	–	no query	6.71
STOP:MODulation:PERRor:WCDMa:DPCH	–	no query	6.71
CONTinue:MODulation:PERRor:WCDMa:DPCH	–	no query	6.71
CONFigure:SUBarrays:MODulation:PERRor:WCDMa:DPCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.74

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
READ:ARRay:MODulation:PERRor:WCDMa:DPCH:AVERage?	–180.0 deg to +180.0 deg	query only	6.76
FETCh:ARRay:MODulation:PERRor:WCDMa:DPCH:AVERage?	–180.0 deg to +180.0 deg	query only	6.76
SAMPle:ARRay:MODulation:PERRor:WCDMa:DPCH:AVERage?	–180.0 deg to +180.0 deg	query only	6.76
READ:SUBarrays:MODulation:PERRor:WCDMa:DPCH:AVERage?	–180.0 deg to +180.0 deg	query only	6.77
FETCh:SUBarrays:MODulation:PERRor:WCDMa:DPCH:AVERage?	–180.0 deg to +180.0 deg	query only	6.77
SAMPle:SUBarrays:MODulation:PERRor:WCDMa:DPCH:AVERage?	–180.0 deg to +180.0 deg	query only	6.77
DEFault:MODulation:PERRor:WCDMa:DPCH:CONTrol	ON | OFF	with query	6.73
CONFigure:MODulation:PERRor:WCDMa:DPCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.73
CONFigure:MODulation:PERRor:WCDMa:DPCH:CONTrol:RMODe	SCALar | ARRay	with query	6.72
CONFigure:MODulation:PERRor:WCDMa:DPCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.72
READ:ARRay:MODulation:PERRor:WCDMa:DPCH:CURRent?	–180.0 deg to +180.0 deg	query only	6.76
FETCh:ARRay:MODulation:PERRor:WCDMa:DPCH:CURRent?	–180.0 deg to +180.0 deg	query only	6.76
SAMPle:ARRay:MODulation:PERRor:WCDMa:DPCH:CURRent?	–180.0 deg to +180.0 deg	query only	6.76
READ:SUBarrays:MODulation:PERRor:WCDMa:DPCH:CURRent?	–180.0 deg to +180.0 deg	query only	6.77
FETCh:SUBarrays:MODulation:PERRor:WCDMa:DPCH:CURRent?	–180.0 deg to +180.0 deg	query only	6.77
SAMPle:SUBarrays:MODulation:PERRor:WCDMa:DPCH:CURRent?	–180.0 deg to +180.0 deg	query only	6.77
CONFigure:MODulation:PERRor:WCDMa:DPCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.71
CALCulate[:SCALar]:MODulation:PERRor:WCDMa:DPCH:MATChing:LIMit?	<Result>	query only	6.75
READ:ARRay:MODulation:PERRor:WCDMa:DPCH:MMAX?	–180.0 deg to +180.0 deg	query only	6.76
FETCh:ARRay:MODulation:PERRor:WCDMa:DPCH:MMAX?	–180.0 deg to +180.0 deg	query only	6.76
SAMPle:ARRay:MODulation:PERRor:WCDMa:DPCH:MMAX?	–180.0 deg to +180.0 deg	query only	6.76
READ:SUBarrays:MODulation:PERRor:WCDMa:DPCH:MMAX?	–180.0 deg to +180.0 deg	query only	6.77
FETCh:SUBarrays:MODulation:PERRor:WCDMa:DPCH:MMAX?	–180.0 deg to +180.0 deg	query only	6.77
SAMPle:SUBarrays:MODulation:PERRor:WCDMa:DPCH:MMAX?	–180.0 deg to +180.0 deg	query only	6.77
FETCh:MODulation:PERRor:WCDMa:DPCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.72
READ[:SCALar]:MODulation:PERRor:WCDMa:DPCH?	<Result>	query only	6.75
FETCh[:SCALar]:MODulation:PERRor:WCDMa:DPCH?	<Result>	query only	6.75
SAMPle[:SCALar]:MODulation:PERRor:WCDMa:DPCH?	<Result>	query only	6.75
Modulation Measurements – Phase Discontinuity			
INITiate:MODulation:PHDiscont	–	no query	6.82
ABORt:MODulation:PHDiscont	–	no query	6.82
STOP:MODulation:PHDiscont	–	no query	6.82
CONTinue:MODulation:PHDiscont	–	no query	6.82
CALCulate:ARRay:MODulation:PHDiscont:CFERror:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.89
READ:ARRay:MODulation:PHDiscont:CFERror?	–5000.0 Hz to +5000.0 Hz	query only	6.87
FETCh:ARRay:MODulation:PHDiscont:CFERror?	–5000.0 Hz to +5000.0 Hz	query only	6.87
SAMPle:ARRay:MODulation:PHDiscont:CFERror?	–5000.0 Hz to +5000.0 Hz	query only	6.87

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
DEFault:MODulation:PHDiscont:CONTrol	ON | OFF	with query	6.84
CONFigure:MODulation:PHDiscont:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.84
CALCulate[:SCALar]:MODulation:PHDiscont:CURRent:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.86
CONFigure:MODulation:PHDiscont:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.83
CALCulate:ARRay:MODulation:PHDiscont:EVMagnitude:CONDition:LIMit?	NORM | THR | INV	query only	6.88
CALCulate:ARRay:MODulation:PHDiscont:EVMagnitude:MATChing:LIMit?	NMAL | INV | OK	query only	6.88
READ:ARRay:MODulation:PHDiscont:EVMagnitude?	0% to 100.0%	query only	6.87
FETCh:ARRay:MODulation:PHDiscont:EVMagnitude?	0% to 100.0%	query only	6.87
SAMPle:ARRay:MODulation:PHDiscont:EVMagnitude?	0% to 100.0%	query only	6.87
CONFigure:MODulation:PHDiscont:LIMit[:SCALar]:SYMMetric[:COMBined]:ENABle	<Static_PHD>, <Dynamic_PHD>, <EVM>, <Thresh_EVM>, <Freq_Err>	with query	6.85
CONFigure:MODulation:PHDiscont:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue	<Static_PHD>, <Dynamic_PHD>, <EVM>, <Thresh_EVM>, <Freq_Err>	with query	6.85
CALCulate:ARRay:MODulation:PHDiscont:PHDiscont:CONDition:LIMit?	STAT | DYN | INV	query only	6.88
CALCulate:ARRay:MODulation:PHDiscont:PHDiscont:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.87
READ:ARRay:MODulation:PHDiscont:PHDiscont?	–180.0 deg to +180.0 deg	query only	6.87
FETCh:ARRay:MODulation:PHDiscont:PHDiscont?	–180.0 deg to +180.0 deg	query only	6.87
SAMPle:ARRay:MODulation:PHDiscont:PHDiscont?	–180.0 deg to +180.0 deg	query only	6.87
FETCh:MODulation:PHDiscont:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.83
READ:ARRay:MODulation:PHDiscont:UEPower?	–100.0 dBm to +60.0 dBm	query only	6.86
FETCh:ARRay:MODulation:PHDiscont:UEPower?	–100.0 dBm to +60.0 dBm	query only	6.86
SAMPle:ARRay:MODulation:PHDiscont:UEPower?	–100.0 dBm to +60.0 dBm	query only	6.86
READ[:SCALar]:MODulation:PHDiscont?	<Result>	query only	6.86
FETCh[:SCALar]:MODulation:PHDiscont?	<Result>	query only	6.86
SAMPle[:SCALar]:MODulation:PHDiscont?	<Result>	query only	6.86
Modulation Measurements – PRACH Preamble (Signalling only !)			
INITiate:MODulation:PRACh	–	no query	6.147
ABORt:MODulation:PRACh	–	no query	6.147
STOP:MODulation:PRACh	–	no query	6.147
CONTinue:MODulation:PRACh	–	no query	6.147
DEFault:MODulation:PRACh:CONTrol	ON | OFF	with query	6.148
CONFigure:MODulation:PRACh:CONTrol:MPReamble	MP1 to MP5	with query	6.148
CALCulate[:SCALar]:MODulation:PRACh:CURRent:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.150
CONFigure:MODulation:PRACh:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.147
CONFigure:SUBarrays:MODulation:PRACh:EVMagnitude	ALL | ARIThmetical |	with query	6.149

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
	MINimum | QPSK,<Start>,<Samples>{ ,<Start>,<Samples>}		
READ:ARRay:MODulation:PRACh:EVMagnitude?	0% to 100%	query only	6.151
FETCh:ARRay:MODulation:PRACh:EVMagnitude?	0% to 100%	query only	6.151
SAMPle:ARRay:MODulation:PRACh:EVMagnitude?	0% to 100%	query only	6.151
READ:SUBarrays:MODulation:PRACh:EVMagnitude?	0% to 100%	query only	6.152
FETCh:SUBarrays:MODulation:PRACh:EVMagnitude?	0% to 100%	query only	6.152
SAMPle:SUBarrays:MODulation:PRACh:EVMagnitude?	0% to 100%	query only	6.152
CONFigure:MODulation:PRACh: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>	with query	6.149
CONFigure:SUBarrays:MODulation:PRACh:MERRor	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.149
READ:ARRay:MODulation:PRACh:MERRor?	0% to 100%	query only	6.151
FETCh:ARRay:MODulation:PRACh:MERRor?	0% to 100%	query only	6.151
SAMPle:ARRay:MODulation:PRACh:MERRor?	0% to 100%	query only	6.151
READ:SUBarrays:MODulation:PRACh:MERRor?	0% to 100%	query only	6.153
FETCh:SUBarrays:MODulation:PRACh:MERRor?	0% to 100%	query only	6.153
SAMPle:SUBarrays:MODulation:PRACh:MERRor?	0% to 100%	query only	6.153
CONFigure:SUBarrays:MODulation:PRACh:PERRor	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.149
READ:ARRay:MODulation:PRACh:PERRor?	–180.0 deg to +180.0 deg	query only	6.151
FETCh:ARRay:MODulation:PRACh:PERRor?	–180.0 deg to +180.0 deg	query only	6.151
SAMPle:ARRay:MODulation:PRACh:PERRor?	–180.0 deg to +180.0 deg	query only	6.151
READ:SUBarrays:MODulation:PRACh:PERRor?	–180.0 deg to +180.0 deg	query only	6.152
FETCh:SUBarrays:MODulation:PRACh:PERRor?	–180.0 deg to +180.0 deg	query only	6.152
SAMPle:SUBarrays:MODulation:PRACh:PERRor?	–180.0 deg to +180.0 deg	query only	6.152
FETCh:MODulation:PRACh:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.148
READ[:SCALar]:MODulation:PRACh?	<Result>	query only	6.150
FETCh[:SCALar]:MODulation:PRACh?	<Result>	query only	6.150
SAMPle[:SCALar]:MODulation:PRACh?	<Result>	query only	6.150
CONFigure:MODulation:WCDMa:DPCH:CONTrol:CCMode	MANual | AUTomatic	with query	6.50
Narrow-Band Power			
INITiate:NPOWer	–	no query	6.138

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
ABORt:NPOWer	–	no query	6.138
STOP:NPOWer	–	no query	6.138
CONTinue:NPOWer	–	no query	6.138
CONFigure:NPOWer:CONTrol	1 to 1000 | NONE,CONTinuous | SINGleshot | 1 ... 10000, SONerror | NONE,STEP | NONE	with query	6.140
CONFigure:NPOWer:CONTrol:REPetition	CONTinuous | SINGleshot | 1 ... 10000, SONerror | NONE,STEP | NONE	with query	6.141
CONFigure:NPOWer:CONTrol:STATistics	1 to 1000 | NONE	with query	6.140
CONFigure:NPOWer:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.139
FETCh:NPOWer:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE, 1 to 1000 | NONE	query only	6.139
READ[:SCALar]:NPOWer?	–30 dBm to +30 dBm	query only	6.141
FETCh[:SCALar]:NPOWer?	–30 dBm to +30 dBm	query only	6.141
SAMPle[:SCALar]:NPOWer?	–30 dBm to +30 dBm	query only	6.141
Power Measurements – Inner Loop Transmit Power Control			
DEFault:POWer:CONTrol	ON | OFF	with query	6.30
INITiate:POWer:ILTPc	–	no query	6.36
ABORt:POWer:ILTPc	–	no query	6.36
STOP:POWer:ILTPc	–	no query	6.36
CONTinue:POWer:ILTPc	–	no query	6.36
DEFault:POWer:ILTPc:CONTrol	ON | OFF	with query	6.39
CONFigure:POWer:ILTPc:CONTrol:BSECtion	ON | OFF	with query	6.38
CONFigure:POWer:ILTPc:CONTrol:PLENgth	<ProfileLength>	with query, Sig. only	6.38
CONFigure:POWer:ILTPc:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.37
CONFigure:POWer:ILTPc:CONTrol:RMODe	SCALar | ARRay	with query	6.37
CONFigure:POWer:ILTPc:CONTrol:SANalysis	ON | OFF	with query	6.38
CONFigure:POWer:ILTPc:CONTrol:TPCControl	<ProfileLength>, <StepSize>, <TPCMode>	with query, NS only	6.38
CONFigure:POWer:ILTPc:CONTrol:TPCProfile:ALG<nr>	ON | OFF	with query	6.39
CALCulate[:SCALar]:POWer:ILTPc:CURRent:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.41
READ[:SCALar]:POWer:ILTPc:CURRent?	<Result>	query only	6.41
FETCh[:SCALar]:POWer:ILTPc:CURRent?	<Result>	query only	6.41
SAMPle[:SCALar]:POWer:ILTPc:CURRent?	<Result>	query only	6.41
CONFigure:POWer:ILTPc:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.36
DEFault:POWer:ILTPc:LIMit	ON | OFF	with query	6.40
FETCh:POWer:ILTPc:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.36

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
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>	with query	6.40
CALCulate:ARRay:POWer:ILTPc:STEP:CURRent:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.42
READ:ARRay:POWer:ILTPc:STEP:CURRent?	–100.0 dB to +100.0 dB	query only	6.42
FETCh:ARRay:POWer:ILTPc:STEP:CURRent?	–100.0 dB to +100.0 dB	query only	6.42
SAMPle:ARRay:POWer:ILTPc:STEP:CURRent?	–100.0 dB to +100.0 dB	query only	6.42
CONFigure:POWer:ILTPc:THReshold:CURRent:LIMit[:SCALar]:ASYMmetric[:COMBined]:VALue	<MaxThreshold>,<MinThreshold>	with query	6.39
CALCulate:ARRay:POWer:ILTPc:THReshold:CURRent:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.43
READ:ARRay:POWer:ILTPc:UEPower:CURRent?	–100.0 dBm to +60.0 dBm	query only	6.42
FETCh:ARRay:POWer:ILTPc:UEPower:CURRent?	–100.0 dBm to +60.0 dBm	query only	6.42
SAMPle:ARRay:POWer:ILTPc:UEPower:CURRent?	–100.0 dBm to +60.0 dBm	query only	6.42
DEFault:POWer:LIMit	ON | OFF	with query	6.33
Power Measurements – Max. Power			
INITiate:POWer:MAXimum	–	no query	6.27
ABORt:POWer:MAXimum	–	no query	6.27
STOP:POWer:MAXimum	–	no query	6.27
CONTinue:POWer:MAXimum	–	no query	6.27
CONFigure:POWer:MAXimum:AVERage:LIMit[:SCALar]:ASYMmetric:LOWer:VALue	<Lower_Limit_Peak>,<Lower_Limit_RMS>	with query	6.31
CONFigure:POWer:MAXimum:AVERage:LIMit[:SCALar]:ASYMmetric:RVALue	<Rated_Value_Peak>,<Rated_Value_RMS>	with query	6.32
CONFigure:POWer:MAXimum:AVERage:LIMit[:SCALar]:ASYMmetric:UPPer:VALue	<Upper_Limit_Peak>,<Upper_Limit_RMS>	with query	6.31
CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:LOWer:VALue	<Lower_Limit_Peak>,<Lower_Limit_RMS>	with query	6.31
CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:RVALue	<Rated_Value_Peak>,<Rated_Value_RMS>	with query	6.31
CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:UPPer:VALue	<Upper_Limit_Peak>,<Upper_Limit_RMS>	with query	6.30
DEFault:POWer:MAXimum:CONTrol	ON | OFF	with query	6.30
CONFigure:POWer:MAXimum:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.29
CONFigure:POWer:MAXimum:CONTrol:STATistics	1 to 1000 | NONE	with query	6.29
CONFigure:POWer:MAXimum:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.28
DEFault:POWer:MAXimum:LIMit	ON | OFF	with query	6.32
CALCulate[:SCALar]:POWer:MAXimum:MATChing:LIMit?	Evaluation periodPwCurrRMS, LeakPowRMS	query only	6.35
FETCh:POWer:MAXimum:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.28

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
CONFigure:POWer:MAXimum:TPControl	AUTO | MANual	with query	6.29
READ[:SCALar]:POWer:MAXimum?	<Result>	query only	6.34
FETCh[:SCALar]:POWer:MAXimum?	<Result>	query only	6.34
SAMPle[:SCALar]:POWer:MAXimum?	AvgEvaluation periodPower, PeakEvaluation periodPower, Evaluation periodsOutOfTol, Evaluation periodMatching	query only	6.34
Power Measurements – Min. Power			
INITiate:POWer:MINimum	–	no query	6.27
ABORt:POWer:MINimum	–	no query	6.27
STOP:POWer:MINimum	–	no query	6.27
CONTinue:POWer:MINimum	–	no query	6.27
CONFigure:POWer:MINimum:AVERage:LIMit[:SCALar]:SYMmetric [:COMBined]:VALue	<Upper_Limit_Peak>,<Upper_Limit_RMS>	with query	6.33
CONFigure:POWer:MINimum:CMAX:LIMit[:SCALar]:SYMmetric [:COMBined]:VALue	<Upper_Limit_Peak>,<Upper_Limit_RMS>	with query	6.32
DEFault:POWer:MINimum:CONTrol	ON | OFF	with query	6.30
CONFigure:POWer:MINimum:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.29
CONFigure:POWer:MINimum:CONTrol:STATistics	1 to 1000 | NONE	with query	6.29
CONFigure:POWer:MINimum:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.28
DEFault:POWer:MINimum:LIMit	ON | OFF	with query	6.33
CALCulate[:SCALar]:POWer:MINimum:MATChing:LIMit?	Evaluation periodPwCurrRMS, LeakPowRMS	query only	6.35
FETCh:POWer:MINimum:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.28
CONFigure:POWer:MINimum:TPControl	AUTO | MANual	with query	6.29
READ[:SCALar]:POWer:MINimum?	<Result>	query only	6.34
FETCh[:SCALar]:POWer:MINimum?	<Result>	query only	6.34
SAMPle[:SCALar]:POWer:MINimum?	AvgEvaluation periodPower, PeakEvaluation periodPower, Evaluation periodsOutOfTol, Evaluation periodMatching	query only	6.34
Power Measurements – OFF Power			
INITiate:POWer:OFF	–	no query	6.27
ABORt:POWer:OFF	–	no query	6.27
STOP:POWer:OFF	–	no query	6.27
CONTinue:POWer:OFF	–	no query	6.27
CONFigure:POWer:OFF:AVERage:LIMit[:SCALar]:SYMmetric [:COMBined]:VALue	<Upper_Limit_Peak>,<Upper_Limit_RMS>	with query	6.33
CONFigure:POWer:OFF:CMAX:LIMit[:SCALar]:SYMmetric	<Upper_Limit_Peak>,<Upp	with query	6.32

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
[:COMBined]:VALue	er_Limit_RMS>		
DEFault:POWer:OFF:CONTrol	ON | OFF	with query	6.30
CONFigure:POWer:OFF:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.29
CONFigure:POWer:OFF:CONTrol:STATistics	1 to 1000 | NONE	with query	6.29
CONFigure:POWer:OFF:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.28
DEFault:POWer:OFF:LIMit	ON | OFF	with query	6.33
CALCulate[:SCALar]:POWer:OFF:MATChing:LIMit?	Evaluation periodPwCurrRMS, LeakPowRMS	query only	6.35
FETCh:POWer:OFF:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.28
READ[:SCALar]:POWer:OFF?	<Result>	query only	6.34
FETCh[:SCALar]:POWer:OFF?	<Result>	query only	6.34
SAMPle[:SCALar]:POWer:OFF?	AvgEvaluation periodPower, PeakEvaluation periodPower, Evaluation periodsOutOfTol, Evaluation periodMatching	query only	6.34
INITiate:POWer:ONOFf	–	no query	6.142
ABORt:POWer:ONOFf	–	no query	6.142
STOP:POWer:ONOFf	–	no query	6.142
CONTinue:POWer:ONOFf	–	no query	6.142
Power Measurements – ON/OFF Time Mask (Signalling only !)			
CONFigure:POWer:ONOFf:CONTrol:MITem	MIOO | MIOS	with query	6.143
CONFigure:POWer:ONOFf:CONTrol:MPReamble	MP1 | MP2 | MP3 | MP4 | MP5	with query	6.143
CONFigure:SUBarrays:POWer:ONOFf:CURRent	ALL | ARIThmetical | MINimum | QPSK,<Start>,<Samples>{ ,<Start>,<Samples>}	with query	6.145
CONFigure:POWer:ONOFf:CURRent:LIMit	<Open Loop>, <Max Power Limit>, <Max Power Rated>, <Off Power>, <PRACH Power Step>	with query	6.144
CALCulate[:SCALar]:POWer:ONOFf:CURRent:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.146
READ[:SCALar]:POWer:ONOFf:CURRent?	<Result>	query only	6.145
FETCh[:SCALar]:POWer:ONOFf:CURRent?	<Result>	query only	6.145
SAMPle[:SCALar]:POWer:ONOFf:CURRent?	<Result>	query only	6.145
SAMPle:ARRay:POWer:ONOFf:CURRent?	–100.0 dBm to +60.0 dBm	query only	6.146
READ:SUBarrays:POWer:ONOFf:CURRent?	0.0% to 100.0%	query only	6.146
FETCh:SUBarrays:POWer:ONOFf:CURRent?	0.0% to 100.0%	query only	6.146
SAMPle:SUBarrays:POWer:ONOFf:CURRent?	0.0% to 100.0%	query only	6.146
CONFigure:POWer:ONOFf:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.142
DEFault:POWer:ONOFf:LIMit	ON | OFF	with query	6.144

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
FETCh:POWer:ONOFf:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.143
Power Measurements – Power vs. Slot			
INITiate:POWer:XSLot	–	no query	6.43
ABORt:POWer:XSLot	–	no query	6.43
STOP:POWer:XSLot	–	no query	6.43
CONTinue:POWer:XSLot	–	no query	6.43
READ[:SCALar]:POWer:XSLot:ABSolute?	<Result>	query only; Sig. only	6.48
FETCh[:SCALar]:POWer:XSLot:ABSolute?	<Result>	query only; Sig. only	6.48
SAMPle[:SCALar]:POWer:XSLot:ABSolute?	<Result>	query only; Sig. only	6.48
DEFault:POWer:XSLot:CONTrol	ON | OFF	with query	6.46
CONFigure:POWer:XSLot:CONTrol:MMODe	SOFF | TSTeps | SAUTo	with query; Sig. only	6.45
CONFigure:POWer:XSLot:CONTrol:PMWidth	0.25 | 0.50 | 1.00	with query	6.45
CONFigure:POWer:XSLot:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 1000, SONerror | NONE, STEP | NONE	with query	6.44
CONFigure:POWer:XSLot:CONTrol:SCOunt	1 to 100	with query	6.45
CONFigure:POWer:XSLot:CONTrol:SDELay	1 to 100	with query	6.45
CONFigure:POWer:XSLot:CONTrol:SWIDth	1 to 15	with query	6.45
READ[:SCALar]:POWer:XSLot:CURRent?	<Result>	query only, NS only	6.47
FETCh[:SCALar]:POWer:XSLot:CURRent?	<Result>	query only, NS only	6.47
SAMPle[:SCALar]:POWer:XSLot:CURRent?	<Result>	query only, NS only	6.47
CALCulate[:SCALar]:POWer:XSLot:DELTa:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only; Sig. only	6.48
CALCulate:ARRay:POWer:XSLot:DELTa:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only; Sig. only	6.49
READ[:SCALar]:POWer:XSLot:DELTa?	<Result>	query only; Sig. only	6.48
FETCh[:SCALar]:POWer:XSLot:DELTa?	<Result>	query only; Sig. only	6.48
SAMPle[:SCALar]:POWer:XSLot:DELTa?	<Result>	query only; Sig. only	6.48
CONFigure:POWer:XSLot:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.43
DEFault:POWer:XSLot:LIMit	ON | OFF	with query; Sig. only	6.47
CALCulate[:SCALar]:POWer:XSLot:MAERror:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only; Sig. only	6.49
READ[:SCALar]:POWer:XSLot:MAERror?	<Result>	query only; Sig. only	6.48
FETCh[:SCALar]:POWer:XSLot:MAERror?	<Result>	query only;	6.48

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
		Sig. only	
SAMPle[:SCALar]:POWer:XSLot:MAERror?	<Result>	query only; Sig. only	6.48
FETCh:POWer:XSLot:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 1000 | NONE	query only	6.44
CONFigure:POWer:XSLot:STEP:DELTa:LIMit:ENABle	<Step Enable>, <Accu Enable>	with query; Sig. only	6.47
CONFigure:POWer:XSLot:STEP:DELTa:LIMit[:SCALar]: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>	with query; Sig. only	6.46
CONFigure:POWer:XSLot:THReshold:DELTa:LIMit[:SCALar]: ASYMmetric[:COMBined]:VALue	<MaxThreshold>,<MinThreshold>	with query; Sig. only	6.46
Receiver Quality Measurements – BER			
INITiate:RXQuality:BER	–	no query	6.133
ABORt:RXQuality:BER	–	no query	6.133
STOP:RXQuality:BER	–	no query	6.133
CONTinue:RXQuality:BER	–	no query	6.133
CONFigure:RXQuality:BER:BTFD:CURRent:LIMit[:SCALar]: ASYMmetric:UPPer:VALue	0 % to 100 %	with query, Sig. only	6.136
DEFault:RXQuality:BER:CONTrol	ON | OFF	with query	6.135
CONFigure:RXQuality:BER:CONTrol:ARESynch	ON | OFF	with query	6.135
CONFigure:RXQuality:BER:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 1000, SONerror | NONE, STEP | NONE	with query	6.134
CONFigure:RXQuality:BER:CONTrol:TBLocks	1 to 50000	with query	6.135
CONFigure:RXQuality:BER:CONTrol:TBSize		with query, NS only	6.135
CONFigure:RXQuality:BER:CURRent:LIMit[:SCALar]:ASYMmetric: UPPer:VALue	0 % to 100 %, 0 % to 100 %	with query	6.136
CONFigure:RXQuality:BER:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.133
DEFault:RXQuality:BER:LIMit	ON | OFF	with query	6.137
CALCulate[:SCALar]:RXQuality:BER:MATChing:LIMit?	<Result>	query only	6.138
FETCh:RXQuality:BER:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 1000 | NONE	query only	6.134
CONFigure:RXQuality:BER:TBLocks:CURRent:LIMit[:SCALar]: ASYMmetric:UPPer:VALue	0 to <total no. of blocks sent> | OFF	with query	6.136
READ[:SCALar]:RXQuality:BER?	<Result>	query only	6.137
FETCh[:SCALar]:RXQuality:BER?	<Result>	query only	6.137
SAMPle[:SCALar]:RXQuality:BER?	<Result>	query only	6.137
CONFigure:RXQuality:CONTrol:Timing	876 to 1172	with query, NS only	6.133
Receiver Quality Measurements – UE Reports			
INITiate:RXQuality:UEReport	–	no query	6.154

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
ABORt:RXQuality:UEReport	–	no query	6.154
DEFault:RXQuality:UEReport:CONTrol	ON | OFF	with query	6.154
CONFigure:RXQuality:UEReport:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.154
CONFigure:RXQuality:UEReport:NCELl:GSM:ARFCn	<Channel>	with query	6.158
CONFigure:RXQuality:UEReport:NCELl:GSM:BCC	0 to 7	with query	6.158
CONFigure:RXQuality:UEReport:NCELl:GSM:BINDincator	G18 | G19	with query	6.158
CONFigure:RXQuality:UEReport:NCELl:GSM:NCC	0 to 7	with query	6.157
CONFigure:RXQuality:UEReport:NCELl:WCDMa:CHANnel	2112.4 MHz to 2167.6 MHz | 1932.4 MHz to 1987.6 MHz | 1807.4 MHz to 1877.6	with query	6.157
CONFigure:RXQuality:UEReport:NCELl:WCDMa:CPICh:PRIMary	<Level_abs> | <Level_rel>	with query	6.157
CONFigure:RXQuality:UEReport:NCELl:WCDMa:OBANd	OB1 | OB2 | OB3 | OB4 | OB5 | OB6	with query	6.157
CONFigure:RXQuality:UEReport:NCELl:WCDMa:SCODe:PRIMary	000 to 1FF	with query	6.157
FETCh:RXQuality:UEReport:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 1000 | NONE	query only	6.154
CONFigure:RXQuality:UEReport<nr>:NCELl:ENABle	ON | OFF	with query	6.156
[SENSe:]RXQuality:UEReport<nr>:NCELl?	<Result>	with query	6.156
CONFigure:RXQuality:UEReport<nr>[:CCELl]:ENABle	ON | OFF	with query	6.155
[SENSe:]RXQuality:UEReport<nr>[:CCELl]?	<Result>	with query	6.155
Spectrum Measurements – Spectrum Emission Mask			
CONFigure:SPECtrum:CONTrol:HDYNamic	ON | OFF	with query	6.93
INITiate:SPECtrum:EMASk	–	no query	6.105
ABORt:SPECtrum:EMASk	–	no query	6.105
STOP:SPECtrum:EMASk	–	no query	6.105
CONTinue:SPECtrum:EMASk	–	no query	6.105
CONFigure:SPECtrum:EMASk:ABSolute:AVERage:LIMit:LINE:SYMmetric:[COMBined]:ENABle	<Limit>	with query	6.108
CONFigure:SPECtrum:EMASk:ABSolute:AVERage:LIMit:LINE:SYMmetric:[COMBined]:VALue	<Limit>	with query	6.108
CONFigure:SPECtrum:EMASk:ABSolute:CMAX:LIMit:LINE:SYMmetric:[COMBined]:ENABle	<Limit>	with query	6.108
CONFigure:SPECtrum:EMASk:ABSolute:CMAX:LIMit:LINE:SYMmetric:[COMBined]:VALue	<Limit>	with query	6.108
CONFigure:SPECtrum:EMASk:ADDition:AVERage:LIMit:LINE:SYMmetric:[COMBined]:ENABle	<Limit>	with query	6.109
CONFigure:SPECtrum:EMASk:ADDition:AVERage:LIMit:LINE:SYMmetric:[COMBined]:VALue	<Limit_1MHz>, <Limit_30kHz>	with query	6.108
CONFigure:SPECtrum:EMASk:ADDition:CMAX:LIMit:LINE:SYMmetric:[COMBined]:ENABle	<Limit>	with query	6.109
CONFigure:SPECtrum:EMASk:ADDition:CMAX:LIMit:LINE:SYMmetric:[COMBined]:VALue	<Limit_1MHz>, <Limit_30kHz>	with query	6.108
READ[:SCALar]:SPECtrum:EMASk:AVERage:MARGin?	–100.0 dB to 0.0 dB	query only	6.111
FETCh[:SCALar]:SPECtrum:EMASk:AVERage:MARGin?	–100.0 dB to 0.0 dB	query only	6.111

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
SAMPle[:SCALar]:SPECtrum:EMASk:AVERage:MARGin?	–100.0 dB to 0.0 dB	query only	6.111
CALCulate:ARRay:SPECtrum:EMASk:AVERage:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.110
READ:ARRay:SPECtrum:EMASk:AVERage?	–100.0 dB to 0.0 dB	query only	6.110
FETCh:ARRay:SPECtrum:EMASk:AVERage?	–100.0 dB to 0.0 dB	query only	6.110
SAMPle:ARRay:SPECtrum:EMASk:AVERage?	–100.0 dB to 0.0 dB	query only	6.110
DEFault:SPECtrum:EMASk:CONTrol	ON | OFF	with query	6.107
CONFigure:SPECtrum:EMASk:CONTrol:MLENgth	320 | 640 | 1280 | 2560	with query	6.107
CONFigure:SPECtrum:EMASk:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.106
CONFigure:SPECtrum:EMASk:CONTrol:RMODe	SCALar | ARRay	with query	6.106
CONFigure:SPECtrum:EMASk:CONTrol:STATistics	1 to 1000 | NONE	with query	6.106
READ[:SCALar]:SPECtrum:EMASk:CURRent:MARGin?	–100.0 dB to 0.0 dB	query only	6.111
FETCh[:SCALar]:SPECtrum:EMASk:CURRent:MARGin?	–100.0 dB to 0.0 dB	query only	6.111
SAMPle[:SCALar]:SPECtrum:EMASk:CURRent:MARGin?	–100.0 dB to 0.0 dB	query only	6.111
CALCulate:ARRay:SPECtrum:EMASk:CURRent:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.110
READ:ARRay:SPECtrum:EMASk:CURRent?	–100.0 dB to 0.0 dB	query only	6.110
FETCh:ARRay:SPECtrum:EMASk:CURRent?	–100.0 dB to 0.0 dB	query only	6.110
SAMPle:ARRay:SPECtrum:EMASk:CURRent?	–100.0 dB to 0.0 dB	query only	6.110
CONFigure:SPECtrum:EMASk:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.105
DEFault:SPECtrum:EMASk:LIMit:LINE	ON | OFF	with query	6.109
READ[:SCALar]:SPECtrum:EMASk:MAXimum:MARGin?	–100.0 dB to 0.0 dB	query only	6.111
FETCh[:SCALar]:SPECtrum:EMASk:MAXimum:MARGin?	–100.0 dB to 0.0 dB	query only	6.111
SAMPle[:SCALar]:SPECtrum:EMASk:MAXimum:MARGin?	–100.0 dB to 0.0 dB	query only	6.111
CALCulate:ARRay:SPECtrum:EMASk:MAXimum:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.110
READ:ARRay:SPECtrum:EMASk:MAXimum?	–100.0 dB to 0.0 dB	query only	6.110
FETCh:ARRay:SPECtrum:EMASk:MAXimum?	–100.0 dB to 0.0 dB	query only	6.110
SAMPle:ARRay:SPECtrum:EMASk:MAXimum?	–100.0 dB to 0.0 dB	query only	6.110
CONFigure:SPECtrum:EMASk:RELative:AVERage:LIMit:LINE:SYMmetric:[COMBined]:ENABle	<Limit>	with query	6.108
CONFigure:SPECtrum:EMASk:RELative:AVERage:LIMit:LINE:SYMmetric:[COMBined]:ENABle	<Limit>	with query	6.108
CONFigure:SPECtrum:EMASk:RELative:AVERage:LIMit:LINE:SYMmetric:[COMBined]:VALue	<Limit>	with query	6.107
CONFigure:SPECtrum:EMASk:RELative:CMAX:LIMit:LINE:SYMmetric:[COMBined]:ENABle	<Limit>	with query	6.108
CONFigure:SPECtrum:EMASk:RELative:CMAX:LIMit:LINE:SYMmetric:[COMBined]:ENABle	<Limit>	with query	6.108
CONFigure:SPECtrum:EMASk:RELative:CMAX:LIMit:LINE:SYMmetric:[COMBined]:VALue	<Limit>	with query	6.107
FETCh:SPECtrum:EMASk:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.105
READ[:SCALar]:SPECtrum:EMASk?	<Result>	query only	6.109

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
FETCh[:SCALar]:SPECtrum:EMASk?	<Result>	query only	6.109
SAMPle[:SCALar]:SPECtrum:EMASk?	<Result>	query only	6.109
Spectrum Measurements – ACLR OBW			
INITiate:SPECtrum:MFFT	–	no query	6.97
ABORt:SPECtrum:MFFT	–	no query	6.97
STOP:SPECtrum:MFFT	–	no query	6.97
CONTinue:SPECtrum:MFFT	–	no query	6.97
CONFigure:SPECtrum:MFFT:ABSolute:AVERage:LIMit[:SCALar]: ASYMmetric:UPPer:VALue	<ACLR_Limit>	with query	6.100
CONFigure:SPECtrum:MFFT:ABSolute:CMAX:LIMit[:SCALar]: ASYMmetric:UPPer:VALue	<ACLR_Limit>	with query	6.100
CONFigure:SPECtrum:MFFT:ABSolute:LIMit[:SCALar]: ASYMmetric:UPPer:Enable <Enable>	<ACLR_Limit	with query	6.100
READ[:SCALar]:SPECtrum:MFFT:ABSolute?	<Result>	query only	6.102
FETCh[:SCALar]:SPECtrum:MFFT:ABSolute?	<Result>	query only	6.102
SAMPle[:SCALar]:SPECtrum:MFFT:ABSolute?	<Result>	query only	6.102
DEFault:SPECtrum:MFFT:CONTrol	ON | OFF	with query	6.99
CONFigure:SPECtrum:MFFT:CONTrol:MLENgth	320 | 640 | 1280 | 2560	with query	6.99
CONFigure:SPECtrum:MFFT:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.98
CONFigure:SPECtrum:MFFT:CONTrol:RMODe	SCALar | ARRay	with query	6.98
CONFigure:SPECtrum:MFFT:CONTrol:STATistics	1 to 1000 | NONE	with query	6.98
CONFigure:SPECtrum:MFFT:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.97
DEFault:SPECtrum:MFFT:LIMit	ON | OFF	with query	6.100
CALCulate[:SCALar]:SPECtrum:MFFT:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.103
CONFigure:SPECtrum:MFFT:OBW:AVERage:LIMit[:SCALar]: ASYMmetric:UPPer:VALue	<OBW_Limit>	with query	6.100
CONFigure:SPECtrum:MFFT:OBW:CMAX:LIMit[:SCALar]: ASYMmetric:UPPer:VALue	<OBW_Limit>	with query	6.100
CONFigure:SPECtrum:MFFT:OBW:LIMit[:SCALar]:ASYMmetric: UPPer:Enable	ON | OFF	with query	6.100
CONFigure:SPECtrum:MFFT:RELative:AVERage:LIMit[:SCALar]: ASYMmetric:UPPer:CHANnel<nr>:VALue	<ACLR_Limit>	with query	6.99
CONFigure:SPECtrum:MFFT:RELative:CMAX:LIMit[:SCALar]: ASYMmetric:UPPer:CHANnel<nr>:VALue	<ACLR_Limit>	with query	6.99
CONFigure:SPECtrum:MFFT:RELative:LIMit[:SCALar]:ASYMmetric: UPPer:CHANnel<nr>:Enable	ON | OFF	with query	6.99
READ[:SCALar]:SPECtrum:MFFT:RELative?	<Result>	query only	6.102
FETCh[:SCALar]:SPECtrum:MFFT:RELative?	<Result>	query only	6.102
SAMPle[:SCALar]:SPECtrum:MFFT:RELative?	<Result>	query only	6.102
FETCh:SPECtrum:MFFT:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.97
CONFigure:SUBarrays:SPECtrum:MFFT:WFSPectrum	ALL | ARIThmetical | MINimum |	with query	6.101

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
	QPSK,<Start>,<Samples>{ ,<Start>,<Samples>}		
READ:ARRay:SPECtrum:MFFT:WFSPectrum:AVERage?	–100.0 dB to 0.0 dB	query only	6.103
FETCh:ARRay:SPECtrum:MFFT:WFSPectrum:AVERage?	–100.0 dB to 0.0 dB	query only	6.103
SAMPle:ARRay:SPECtrum:MFFT:WFSPectrum:AVERage?	–100.0 dB to 0.0 dB	query only	6.103
READ:SUBarrays:SPECtrum:MFFT:WFSPectrum:AVERage?	–100.0 dB to 0.0 dB	query only	6.104
FETCh:SUBarrays:SPECtrum:MFFT:WFSPectrum:AVERage?	–100.0 dB to 0.0 dB	query only	6.104
SAMPle:SUBarrays:SPECtrum:MFFT:WFSPectrum:AVERage?	–100.0 dB to 0.0 dB	query only	6.104
READ:ARRay:SPECtrum:MFFT:WFSPectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.103
FETCh:ARRay:SPECtrum:MFFT:WFSPectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.103
SAMPle:ARRay:SPECtrum:MFFT:WFSPectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.103
READ:SUBarrays:SPECtrum:MFFT:WFSPectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.104
FETCh:SUBarrays:SPECtrum:MFFT:WFSPectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.104
SAMPle:SUBarrays:SPECtrum:MFFT:WFSPectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.104
READ:ARRay:SPECtrum:MFFT:WFSPectrum:MAXimum?	–100.0 dB to 0.0 dB	query only	6.103
FETCh:ARRay:SPECtrum:MFFT:WFSPectrum:MAXimum?	–100.0 dB to 0.0 dB	query only	6.103
SAMPle:ARRay:SPECtrum:MFFT:WFSPectrum:MAXimum?	–100.0 dB to 0.0 dB	query only	6.103
READ:SUBarrays:SPECtrum:MFFT:WFSPectrum:MAXimum?	–100.0 dB to 0.0 dB	query only	6.104
FETCh:SUBarrays:SPECtrum:MFFT:WFSPectrum:MAXimum?	–100.0 dB to 0.0 dB	query only	6.104
SAMPle:SUBarrays:SPECtrum:MFFT:WFSPectrum:MAXimum?	–100.0 dB to 0.0 dB	query only	6.104
CONFigure:SUBarrays:SPECtrum:MFFT:WFSSpectrum	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.101
READ:ARRay:SPECtrum:MFFT:WFSSpectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.103
FETCh:ARRay:SPECtrum:MFFT:WFSSpectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.103
SAMPle:ARRay:SPECtrum:MFFT:WFSSpectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.103
READ:SUBarrays:SPECtrum:MFFT:WFSSpectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.104
FETCh:SUBarrays:SPECtrum:MFFT:WFSSpectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.104
SAMPle:SUBarrays:SPECtrum:MFFT:WFSSpectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.104
Spectrum Measurements – ACLR Filter			
INITiate:SPECtrum:MFILter	–	no query	6.90
ABORt:SPECtrum:MFILter	–	no query	6.90
STOP:SPECtrum:MFILter	–	no query	6.90
CONTinue:SPECtrum:MFILter	–	no query	6.90
CONFigure:SPECtrum:MFILter:ABSolute:LIMit[:SCALar]:ASYMmetric: UPPer:Enable	ON | OFF	with query	6.94
READ[:SCALar]:SPECtrum:MFILter:ABSolute?	<Result>	query only	6.95
FETCh[:SCALar]:SPECtrum:MFILter:ABSolute?	<Result>	query only	6.95
SAMPle[:SCALar]:SPECtrum:MFILter:ABSolute?	<Result>	query only	6.95
CONFigure:SPECtrum:MFILter:APEak:CURRent:LIMit[:SCALar]: ASYMmetric:UPPer:VALue	<ACLR_Limit>	with query	6.94
CONFigure:SPECtrum:MFILter:ARMS:AVERage:LIMit[:SCALar]:	<ACLR_Limit>	with query	6.94

Command (Measurements, Non Sig. and Signalling)	Parameters	Remark	Page
ASYMmetric:UPPer:VALue			
CONFigure:SPECtrum:MFILter:ARMS:CURRent:LIMit[:SCALar]: ASYMmetric:UPPer:VALue	<ACLR_Limit>	with query	6.94
DEFault:SPECtrum:MFILter:CONTrol	ON | OFF	with query	6.92
CONFigure:SPECtrum:MFILter:CONTrol:MLENgth	320 | 640 | 1280 | 2560	with query	6.92
CONFigure:SPECtrum:MFILter:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.92
CONFigure:SPECtrum:MFILter:CONTrol:STATistics	1 to 1000 | NONE	with query	6.91
CONFigure:SPECtrum:MFILter:CONTrol:UEPMeasure	ON | OFF	with query	6.92
CONFigure:SPECtrum:MFILter:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.90
DEFault:SPECtrum:MFILter:LIMit	ON | OFF	with query	6.94
CALCulate[:SCALar]:SPECtrum:MFILter:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.96
DEFault:SPECtrum:MFILter:MEASx	ON | OFF	with query	6.95
CONFigure:SPECtrum:MFILter:MEASx:CHANnel<nr>:ENABle <Enable>	ON | OFF	with query	6.94
CONFigure:SPECtrum:MFILter:RELative:LIMit[:SCALar]:ASYMmetric: UPPer:CHANnel<nr>:ENABle	ON | OFF	with query	6.93
READ[:SCALar]:SPECtrum:MFILter:RELative?	<Result>	query only	6.95
FETCh[:SCALar]:SPECtrum:MFILter:RELative?	<Result>	query only	6.95
SAMPle[:SCALar]:SPECtrum:MFILter:RELative?	<Result>	query only	6.95
CONFigure:SPECtrum:MFILter:RPEak:CURRent:LIMit[:SCALar]: ASYMmetric:UPPer:CHANnel<nr>:VALue	<ACLR_Limit>	with query	6.93
CONFigure:SPECtrum:MFILter:RRMS:AVERage:LIMit[:SCALar]: ASYMmetric:UPPer:CHANnel<nr>:VALue	<ACLR_Limit>	with query	6.93
CONFigure:SPECtrum:MFILter:RRMS:CURRent:LIMit[:SCALar]: ASYMmetric:UPPer:CHANnel<nr>:VALue	<ACLR_Limit>	with query	6.93
FETCh:SPECtrum:MFILter:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.91

Table 6-2 Remote-control commands: General settings (available in Non Sign. and Signalling)

Command (General settings, Non Sign. and Sign.)	Parameters	Remark	Page
MMEMory			
DEFault:IQIF	ON | OFF	with query	6.26
[SENSe:]:IQIF:LEVel?	< 0 dB	with query	6.26
CONFigure:IQIF:RXPath	BYP | BYIQ | XOIO | IOIO | IOXO	with query	6.25
CONFigure:IQIF:RXTXcombined	BYP | BYIQ | XOIO | IOIO | IOXO | FPAT | UDEF	with query	6.25
CONFigure:IQIF:TXPath	BYP | BYIQ | XOIO | IOIO | IOXO	with query	6.26
MMEMory			
MMEMory:RECall:CURRent	<FileName> [,<msus>]	no query	6.24
MMEMory:SAVE:CURRent	<FileName> [,<msus>]	no query	6.23
Options Query			
SYSTem:OPTions:INFO:CURRent?		query only	6.24
System Reset			
SYSTem:RESet:CURRent		no query	6.24

Table 6-3 Remote-control commands: Connection Control (available in Non Signalling)

Command (Connection Control, Non Signalling)	Parameters	Remark	Page
Inputs and Outputs			
[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]	–50 dB to +90 dB	with query	6.19
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude]	–50 dB to +90 dB	with query	6.19
[SENSe:]CORRection:LOSS:OUTPut<nr>:AUXTx:OLEVel[:MAGNitude]	–50 dB to 90 dB	with query	6.20
SOURce:CORRection:LOSS:OUTPut<nr>:AUXTx:OLEVel[:MAGNitude]	–50 dB to 90 dB	with query	6.20
[SENSe:]CORRection:LOSS:OUTPut<nr>:AUXTx[:MAGNitude]	–50 dB to 90 dB	with query	6.20
SOURce:CORRection:LOSS:OUTPut<nr>:AUXTx[:MAGNitude]	–50 dB to 90 dB	with query	6.20
[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]	–50 dB to +90 dB	with query	6.19
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]	–50 dB to +90 dB	with query	6.19
SOURce:DM:CLOCk:FREQuency	0.960 MHz to 30.720 MHz	with query	6.21
SOURce:DM:CLOCk:STATe	ON | OFF	with query	6.21
INPut[:STATe]	RF1 | RF2 | RF4	with query	6.19
OUTPut[:STATe]	RF1 | RF2 | RF3	with query	6.19
OUTPut:AUXTx:OLEVel[:STATe]	ON | OFF	with query	6.20
OUTPut:AUXTx[:STATe]	ON | OFF	with query	6.20
Input Level			
DEFault:LEVel	ON | OFF	with query	6.2
[SENSe:]LEVel:ATTenuation	NORMal | LNOise | LDIStortion	with query	6.2
[SENSe:]LEVel:MAXimum	<Level>	with query	6.2
[SENSe:]LEVel:MODE	MANual | AUTO	with query	6.1
RF Analyzer Settings			
[SENSe:]RFANalyzer:FOFFset	–100 kHz to +100 kHz	with query	6.3
[SENSe:]RFANalyzer:FREQuency	15 MHz to 2700 MHz	with query	6.3
UNIT:RFANalyzer:FREQuency	HZ | KHZ | MHZ | GHZ | CH	with query	6.3
[SENSe:]RFANalyzer:GPERiod	ON | OFF	with query	6.3
RF Generator Settings			
INITiate:RFGenerator	–	no query	6.4
ABORt:RFGenerator	–	no query	6.4
DEFault:RFGenerator	ON | OFF	with query	6.4
SOURce:RFGenerator:AUXTx:FREQuency	350 MHz to 550 MHz | 700 MHz to 1100 MHz | 1400 MHz to 2200 MHz	with query	6.8
UNIT:RFGenerator:AUXTx:FREQuency	HZ | KHZ | MHZ | GHZ | CH	with query	6.8
DEFault:RFGenerator:DBCHannel	ON | OFF	with query	6.11
SOURce:RFGenerator:DBCHannel:DPCH:TOFFset	0 to 149	with query	6.11
SOURce:RFGenerator:DBCHannel:DPDCh:CODE	2 to 511	with query	6.10
SOURce:RFGenerator:DBCHannel:DPDCh:MODE	TGPP | PHYS | DCCH	with query	6.11
SOURce:RFGenerator:DBCHannel:LEVel:DPDCh	–35 dB to +15 dB | OFF	with query	6.10

Command (Connection Control, Non Signalling)	Parameters	Remark	Page
SOURce:RFGenerator:DBCHannel:LEVel:PCCPch	–35 dB to +15 dB | OFF	with query	6.10
SOURce:RFGenerator:DBCHannel:LEVel:PICH	–35 dB to +15 dB | OFF	with query	6.10
SOURce:RFGenerator:DBCHannel:PICH:CODE	2 to 255	with query	6.11
SOURce:RFGenerator:DBCHannel:POFFset	0.0 dB to 6.0 dB	with query	6.11
SOURce:RFGenerator:DBCHannel:TSTate	ON | DTX	with query	6.11
DEFault:RFGenerator:DCCH	ON | OFF	with query	6.14
SOURce:RFGenerator:DCCH:TVALue	0 | 1	with query	6.14
SOURce:RFGenerator:DCCH:TYPE	K1_7 | K2_5 | K3_4 | K13_6	with query	6.13
SOURce:RFGenerator:FOFFset	–100 kHz to 100 kHz	with query	6.5
SOURce:RFGenerator:FREQuency	10 MHz to 2700 MHz	with query	6.5
UNIT:RFGenerator:FREQuency	HZ | KHZ | MHZ | GHZ | CH	with query	6.5
SOURce:RFGenerator:LREFerence	PCPich | OPOWer	with query	6.6
SOURce:RFGenerator:OCNS	–35 dB to +15 dB | OFF	with query	6.6
SOURce:RFGenerator:OPOWer	<Level>	with query	6.6
SOURce:RFGenerator:OUTPut	WCDMa | CW	with query	6.4
DEFault:RFGenerator:PCHannel	ON | OFF	with query	6.13
SOURce:RFGenerator:PCHannel:DSOurce	ALL0 | ALL1 | ALT | PR9 | PR11 | PR13 | PR15	with query	6.13
SOURce:RFGenerator:PCHannel:SFORmat	0 to 16	with query	6.13
SOURce:RFGenerator:PHYSical:LEVel	<P-CPICH_rel> | <P-CPICH_abs>, <P-SCH>, <S-SCH>, <P-CCPCH>, <PICH>, <DPCH>, <P-SCH>, <Power Offset>	with query	6.7
DEFault:RFGenerator:RCHannel	ON | OFF	with query	6.12
SOURce:RFGenerator:RCHannel:SDCCh	PREDefined	query only	6.12
SOURce:RFGenerator:RCHannel:SDTCh	ALL0 | ALL1 | ALT | PR9 | PR11 | PR13 | PR15	with query	6.12
SOURce:RFGenerator:RCHannel:TVALue	0 to 3	with query	6.12
SOURce:RFGenerator:RCHannel:TYPE	12.2 | 64 | 144 | 384	with query	6.12
SOURce:RFGenerator:SCHannel:LEVel:PCPich	<Level_abs> | <Level_rel>	with query	6.9
SOURce:RFGenerator:SCHannel:LEVel:PSCH	–35 dB to +15 dB | OFF	with query	6.9
SOURce:RFGenerator:SCHannel:LEVel:SSCH	–35 dB to +15 dB | OFF	with query	6.9
SOURce:RFGenerator:SCODe:PRIMary	000 to 1FF	with query	6.5
SOURce:RFGenerator:SCODe:SECondary	0 to F	with query	6.5
FETCh:RFGenerator:STATus?	OFF | RUN | ERR	query only	6.4
DEFault:RFGenerator:TPC	ON | OFF	with query	6.15
SOURce:RFGenerator:TPC:PATTern<nr>	3 bits to 22 bits	with query	6.15
SOURce:RFGenerator:TPC:PTYPe	ALL0 | ALL1 | ALT | PR9 | PR11 | PR13 | PR15	with query	6.14
SOURce:RFGenerator:TPC:PTYPe<nr>	ALL0 | ALL1 | ALT | PR9 | PR11 | PR13 | PR15	with query	6.15
SOURce:RFGenerator:TPC:RPATtern	ON	with query	6.15
SOURce:RFGenerator:TRANsmitter	WCDMa | CW	with query	6.4

Command (Connection Control, Non Signalling)	Parameters	Remark	Page
Trigger			
DEFault:TRIGger[:SEQuence]	ON | OFF	with query	6.22
TRIGger[:SEQuence]:DELay	0 to 14, –2559.75 to +2559.75	with query	6.22
TRIGger[:SEQuence]:SLOPe	POSitive | NEGative	with query	6.22
TRIGger[:SEQuence]:SOURce	FRUN | EXTern | INTern | IFPower | SLOT | FRAMe | TPC | HSDPcch | AUTO	with query	6.21
TRIGger[:SEQuence]:THReshold:IFPower	<Threshold>	with query	6.22
UE Code			
CONFigure:UECode:AMODe	WOOF | WIOF	with query	6.16
DEFault:UECode:DPCH	ON | OFF	with query	6.17
CONFigure:UECode:DPCH:CMODe	0 | 1	with query	6.17
CONFigure:UECode:DPCH:SCODe	0 to FFFFFF	with query	6.16
CONFigure:UECode:DPCH:SFORmat	0 to 5	with query	6.16
CONFigure:UECode:DPCH:SNUMber	0 to 14	with query	6.17
CONFigure:UECode:DPCH:SYMode	ASL | SYNC	with query	6.16
DEFault:UECode:DPDCh	ON | OFF	with query	6.18
CONFigure:UECode:DPDCh:AUTO:SRATe	15 | 30 | 60 | 120 | 240 | 480 | 960	with query	6.17
CONFigure:UECode:DPDCh:AUTO:THReshold	–25 dB to +10 dB	with query	6.17
CONFigure:UECode:DPDCh:MANual:DPDCh1:SRCCode	<Rate>,<Code>	with query	6.18
CONFigure:UECode:DPDCh:MANual:MSIGnal	0 to 6	with query	6.18

Table 6-4 Remote-control commands: Connection Control (available in Signalling)

Command (Connection Control, Signalling)	Parameter	Remark	Page
Application Testing			
CONFigure:ATESt:UEIPaddress	1 to 255, 1 to 255, 1 to 255, 1 to 255	with query	6.211
CONFigure:ATESt:VIPaddress	1 to 255, 1 to 255, 1 to 255, 1 to 255	with query	6.210
BSSignal – Base Station Signal			
DEFault:BSSignal	ON | OFF	with query	6.177
CONFigure:BSSignal:CHANnel	2112.4 MHz to 2167.6 MHz | 1932.4 MHz to 1987.6 MHz | 1807.4 MHz to 1877.6	with query	6.174
UNIT:BSSignal:CHANnel	HZ | KHZ | MHZ | GHZ | CH	with query	6.174
DEFault:BSSignal:COMPressed	ON | OFF	with query	6.194
CONFigure:BSSignal:COMPressed:PATTern	UEReport | SINGle | UDEFined | NONE	with query	6.189
CONFigure:BSSignal:COMPressed:SINGle:PACTivation	UEReport | RABSetup	with query	6.191
CONFigure:BSSignal:COMPressed:SINGle:PTYPe	RFA |RFB | A | B | C | D | E | F | G	with query	6.191
CONFigure:BSSignal:COMPressed:UDEFined:DFRame	A | B	with query	6.194
CONFigure:BSSignal:COMPressed:UDEFined:DOWNlink	SF2 | PUNC	with query	6.194
CONFigure:BSSignal:COMPressed:UDEFined:DSAFter<nr>	0 dB/10 to 30 dB/10	with query	6.193
CONFigure:BSSignal:COMPressed:UDEFined:DSIR<nr>	0 dB/10 to 30 dB/10	with query	6.192
CONFigure:BSSignal:COMPressed:UDEFined:ITP	ZERO | ONE	with query	6.193
CONFigure:BSSignal:COMPressed:UDEFined:LMODe	UPLink | DOWNlink | ULDL	with query	6.193
CONFigure:BSSignal:COMPressed:UDEFined:MPURpose	TDD | FDD | RSSI | IBSic | RBSic | MULTicarrier	with query	6.193
CONFigure:BSSignal:COMPressed:UDEFined:PACTivation	UEReport | RABSetup	with query	6.191
CONFigure:BSSignal:COMPressed:UDEFined:PATTern2	ON |OFF	with query	6.192
CONFigure:BSSignal:COMPressed:UDEFined:RPP	ZERO | ONE	with query	6.193
CONFigure:BSSignal:COMPressed:UDEFined:TGAP<nr>	ON |OFF	with query	6.192
CONFigure:BSSignal:COMPressed:UDEFined:TGCFn	0 to 255	with query	6.191
CONFigure:BSSignal:COMPressed:UDEFined:TGD	15 to 270	with query	6.193
CONFigure:BSSignal:COMPressed:UDEFined:TGL<nr>	1 to 14	with query	6.192
CONFigure:BSSignal:COMPressed:UDEFined:TGPL<nr>	1 to 144	with query	6.192
CONFigure:BSSignal:COMPressed:UDEFined:TGPRc	0 to 511	with query	6.191
CONFigure:BSSignal:COMPressed:UDEFined:TGSN	0 to 14	with query	6.191
CONFigure:BSSignal:COMPressed:UDEFined:UPLink	SF2 | HLS	with query	6.194
CONFigure:BSSignal:COMPressed:UEReport:FDD	ON | OFF, UEReport | RABSetup	with query	6.190
CONFigure:BSSignal:COMPressed:UEReport:GSM	ON | OFF, UEReport | RABSetup	with query	6.190
CONFigure:BSSignal:COMPressed:UEReport:IBSic	ON | OFF, UEReport | RABSetup	with query	6.190
CONFigure:BSSignal:COMPressed:UEReport:RBSic	ON | OFF, UEReport | RABSetup	with query	6.190
CONFigure:BSSignal:DCH:RMC: SDTCh	ALL0 | ALL1 | ALT | PR9 | PR11 | PR13 | PR152	with query	6.179
CONFigure:BSSignal:DCH:RMC:DLRessource		with query	6.179
CONFigure:BSSignal:DCH:RMC:TFORmat	K1_95 | K4_75 | K5_15 | K5_9 | K6_7 | K7_4 | K7_95 | K10_2 | K12_2	with query	6.178
CONFigure:BSSignal:DCH:RMC:TMODe	ON | OFF | MODE2	with query	6.179

Command (Connection Control, Signalling)	Parameter	Remark	Page
CONFigure:BSSignal:DCH:RMC:TYPE	RMC12 | RMC64 | RMC144 | RMC64_144 | RMC384 | RMC64_384 | RMC144_384 | BTFD	with query	6.178
CONFigure:BSSignal:DCH:RMC:UCRC	ON | OFF	with query	6.179
CONFigure:BSSignal:DCH:SRAB:SRB	K1_7 | K2_5 | K3_4 | K13_6	with query	6.180
CONFigure:BSSignal:DCH:TYPE	SRAB | SRF | RMC | VOIC | VIDeo	with query	6.178
CONFigure:BSSignal:DCH:VOICe:ACSet	A to H, M	with query	6.180
CONFigure:BSSignal:DCH:VOICe:SOURce	ECHO | OFF | COD | LCOD | ECAL | DCAL	with query	6.180
DEFault:BSSignal:DCHannel	ON | OFF	with query	6.180
CONFigure:BSSignal:FOFFset	–100 kHz to 100 kHz	with query	6.174
CONFigure:BSSignal:LREFerence	PCPich | OPOWer	with query	6.175
CONFigure:BSSignal:OCNS	–35 dB to +15 dB | OFF	with query	6.175
CONFigure:BSSignal:OPOWer	<Level>	with query	6.175
CONFigure:BSSignal:P HYSical:CODE:AICH	2 to 255	with query	6.183
DEFault:BSSignal:PHYSical	ON | OFF	with query	6.184
CONFigure:BSSignal:PHYSical:CODE:CCPCh:SECondary	2 to 511	with query	6.182
CONFigure:BSSignal:PHYSical:CODE:DPDCh	2 to 511	with query	6.183
CONFigure:BSSignal:PHYSical:CODE:PICH	2 to 255	with query	6.182
CONFigure:BSSignal:PHYSical:DPCH:POFFset	0.0 dB to 6.0 dB	with query	6.183
CONFigure:BSSignal:PHYSical:DPCH:TOFFset	0 to 149	with query	6.184
CONFigure:BSSignal:PHYSical:LEVel	<P-CPICH_rel> | <P-CPICH_abs>, <P-SCH>, <S-SCH>, <P-CCPCH>, <S-CCPCH>, <PICH>, <AICH>, <DPCH>, <P-SCH>, <Power Offset>	with query	6.176
CONFigure:BSSignal:PHYSical:LEVel:AICH	–35 dB to +15 dB | OFF	with query	6.183
CONFigure:BSSignal:PHYSical:LEVel:CCPCh:PRIMary	–35 dB to +15 dB | OFF	with query	6.182
CONFigure:BSSignal:PHYSical:LEVel:CCPCh:SECondary	–35 dB to +15 dB | OFF	with query	6.182
CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary	<Level_abs> | <Level_rel>	with query	6.181
CONFigure:BSSignal:PHYSical:LEVel:DPDCh	–35 dB to +15 dB | OFF	with query	6.183
CONFigure:BSSignal:PHYSical:LEVel:PICH	–35 dB to +15 dB | OFF	with query	6.182
CONFigure:BSSignal:PHYSical:LEVel:SCH:PRIMary	–35 dB to +15 dB | OFF	with query	6.181
CONFigure:BSSignal:PHYSical:LEVel:SCH:SECondary	–35 dB to +15 dB | OFF	with query	6.181
CONFigure:BSSignal:PSWitched:DCH:TYPE?	HSTM | PDATa	with query	6.189
CONFigure:BSSignal:PSWitched:DCH:HSTMode:RBSetup	HSRB | HRMC	with query	6.189
CONFigure:BSSignal:PSWitched:DCH:PDATa:RATE	PD64_384 | PD64	with query	6.189
CONFigure:BSSignal:SCODe:PRIMary	000 to 1FF	with query	6.175
CONFigure:BSSignal:SCODe:SECondary	0 to F	with query	6.184
DEFault:BSSignal:TPC	ON | OFF	with query	6.188
CONFigure:BSSignal:TPC:CURRent?	<Setup>, <Type>, <Pattern>	with query	6.188
CONFigure:BSSignal:TPC:MODE	ALG1 | ALG2	with query	6.184
CONFigure:BSSignal:TPC:PATTern<nr>	3 bits to 22 bits	with query	6.187
CONFigure:BSSignal:TPC:PCONdition	MANual | AUTOmatic	with query	6.188

Command (Connection Control, Signalling)	Parameter	Remark	Page
CONFigure:BSSignal:TPC:PSET	SET1 | SET2 | SET3 | SET4 | SET5 | TA | TB | | TC | TD | TE | TF | TG | TH | PUP | PDOWn	with query	6.185
CONFigure:BSSignal:TPC:PTYPe<nr>	ALL0 | ALL1 | ALT | SPA0 | SPA1| SPAL | CLOP	with query	6.186
CONFigure:BSSignal:TPC:RPATtern	ON	with query	6.187
CONFigure:BSSignal:TPC:SSIZE	1 dB | 2 dB	with query	6.185
RF Signal Inputs and Outputs			
[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]	-50 dB to 50 dB	with query	6.205
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude]	-50 dB to 50 dB	with query	6.205
[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]	-50 dB to 50 dB	with query	6.205
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]	-50 dB to 50 dB	with query	6.205
SOURce:DM:CLOCk:FREQuency	1.2190 MHz to 39.000 MHz	with query	6.206
SOURce:DM:CLOCk:STATe	ON | OFF	with query	6.206
INPut[:STATe]	RF1 | RF2 | RF4	with query	6.204
OUTPut[:STATe]	RF1 | RF2 | RF3	with query	6.205
Handover			
CONFigure:HANDover:TARGet	<Target>	with query	6.164
STATus:HANDover:TARGet:LIST?	<List>	query only	6.164
CONFigure:HANDover:TARGetPREPare	ON | OFF	with query	6.164
LEVel – Analyzer Level			
[SENSe:]LEVel:ATTenuation	NORMal | LNOise | LDIStortion	with query	6.208
DEFault:LEVel:DEFault	ON | OFF	with query	6.208
[SENSe:]LEVel:MAXimum	<Level>	with query	6.208
[SENSe:]LEVel:MODE	MANual | PCLevel | AUTomatic	with query	6.208
Message Recorder			
CONFigure:MMONitor:IPADdress	1 to 255, 1 to 255, 1 to 255, 1 to 255	with query	6.209
CONFigure:MMONitor:IPADdress	1 to 255, 1 to 255, 1 to 255, 1 to 255	with query	6.210
CONFigure:MMONitor:LOGGing	ON | OFF	with query	6.209
CONFigure:MMONitor:SMASk	1 to 255, 1 to 255, 1 to 255, 1 to 255	with query	6.209
NETWork – Network Parameters			
DEFault:NETWork:IDENtity	ON | OFF	with query	6.197
CONFigure:NETWork:IDENtity:IMSI	000000000000000 to 999999999999999	with query	6.196
CONFigure:NETWork:IDENtity:LAC	1 to 65533 and 65535	with query	6.196
CONFigure:NETWork:IDENtity:MCC	0 to 999	with query	6.195
CONFigure:NETWork:IDENtity:MNC	0 to 99 | 0 to 999	with query	6.196
CONFigure:NETWork:IDENtity:MNC:DIGits	TWO | THR	with query	6.196
CONFigure:NETWork:IDENtity:URA	<16-digit binary>	with query	6.196
CONFigure:NETWork:NCELl:GSM<nr>	<Channel>, <NCC>, <BCC>, <Band_Ind>, <Enable>	with query	6.204
CONFigure:NETWork:NCELl:WCDMA:INTer<nr>	<Channel>, <SC>, <Enable>	with query	6.203
CONFigure:NETWork:NCELl:WCDMA:INTRa<nr>	<SC>, <Enable>	with query	6.203

Command (Connection Control, Signalling)	Parameter	Remark	Page
CONFigure:NETWork:OBANd	OB1 | OB2 | OB3 | OB4 | OB5 | OB6	with query	6.195
CONFigure:NETWork:PSWitched:DOMain	ON | OFF	with query	6.195
CONFigure:NETWork:RAC:DRXCycle	6 to 9	with query	6.198
CONFigure:NETWork:RAC:PREamble:ACK	1 to 8	with query	6.198
CONFigure:NETWork:RAC:PREamble:MCYCles	1 to 32	with query	6.197
CONFigure:NETWork:RAC:PREamble:MRETrans	1 to 8	with query	6.198
CONFigure:NETWork:RAC:PREamble:RAC:POFFset	1 to 8	with query	6.198
CONFigure:NETWork:RAC:PREamble:SIGNature	<16-digit binary>	with query	6.199
CONFigure:NETWork:RAC:PREamble:SSIZe	1 to 8	with query	6.197
CONFigure:NETWork:RAC:PREamble:SUBChannel	'<12-digit binary>'	with query	6.198
CONFigure:NETWork:RAC:PREamble:TAICh	1 to 8	with query	6.197
CONFigure:NETWork:RAC:TTI	T10 | T20	with query	6.197
DEFault:NETWork:REQuest	ON | OFF	with query	6.203
CONFigure:NETWork:REQuest:ACAPability	ON | OFF	with query	6.200
CONFigure:NETWork:REQuest:AUTHenticat	ON | OFF	with query	6.200
CONFigure:NETWork:REQuest:HACTime	5 to 50 (frames)	with query	6.201
CONFigure:NETWork:REQuest:IMEI	ON | OFF	with query	6.200
CONFigure:NETWork:REQuest:OSTimeout	2 s to 30 s	with query	6.202
CONFigure:NETWork:REQuest:PTIMeout	2 s to 30 s	with query	6.202
CONFigure:NETWork:REQuest:RRCC	ON | OFF	with query	6.201
CONFigure:NETWork:REQuest:SECurity	ON | OFF	with query	6.200
CONFigure:NETWork:REQuest:SKEY	<Part_1>, <Part_2>	with query	6.201
CONFigure:NETWork:REQuest:SRAB	ON | OFF	with query	6.201
CONFigure:NETWork:REQuest:T313	0 s to 15 s	with query	6.202
CONFigure:NETWork:REQuest:TTIMeout	0 to 255 (decihours)	with query	6.202
Open Loop Power Measurement			
INITiate:OLP	–	no query	6.162
ABORt:OLP	–	no query	6.162
CONFigure:OLP:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue	<Limit>	with query	6.163
CALCulate[:SCALar]:OLP:MATChing:LIMit?	<Result>	query only	6.163
FETCh:OLP:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 1000 | NONE	query only	6.163
READ[:SCALar]:OLP?	<Result>	query only	6.163
FETCh[:SCALar]:OLP?	<Result>	query only	6.163
SIGNalling – Connection Control			
PROCedure:SIGNalling:ACTion	SOFF | SON | CTMobile | UNRegister | CRELease	no query	6.159
[SENSe:]SIGNalling:CNUMber?	<max. 129 digits>	query only	6.162
[SENSe:]SIGNalling:DNUMber?	<max. 129 digits>	query only	6.162
[SENSe:]SIGNalling:IMEI?	<max. 18 digits>	query only	6.162
PROCedure:SIGNalling:PSWitched:ACTion	SOFF | SON | CTMobile | UNRegister |	no query	6.160

Command (Connection Control, Signalling)	Parameter	Remark	Page
	CRELease		
[SENSe:]SIGNalling:PSWitched:STATe?	SOFF | IDLE | ATT | CIPR | PEST | DIPR	query only	6.161
[SENSe:]SIGNalling:RIDentity?	<max. 18 digits>	query only	6.162
[SENSe:]SIGNalling:RIType?	UNKN | IMSI | IMEI | IMSISV | TMSI	query only	6.161
[SENSe:]SIGNalling:STATe?	SOFF | SON | REG | PAG | ALER | CEST	query only	6.160
Speech Codec			
ROUTe:SPDecoder:OUTPut	HANDset | ANALyzer | ANA2 | ABOTh	with query	6.205
ROUTe:SPENcoder[:INPut]	HANDset | GENerator	with query	6.205
TRIGger – Trigger Settings			
DEFault:TRIGger[:SEQuence]	ON | OFF	with query	6.207
TRIGger[:SEQuence]:DELay	0 to 14, –2559.75 to +2559.75	with query	6.207
TRIGger[:SEQuence]:SLOPe	POSitive | NEGative	with query	6.207
TRIGger[:SEQuence]:SOURce	FRUN | EXTern | SIGNalling | IFPower| SLOT FRAMe | TPC | AUTO | PRE | PMP | HSDPcch | CMODe | CTFC	with query	6.206
TRIGger[:SEQuence]:THReshold:IFPower	<Threshold>	with query	6.207
UECapability – UE Radio Access Capabilities			
[SENSe:]UECapability:MMODe?	FDD | TDD | FTDD	query only	6.166
[SENSe:]UECapability:MRATe?	<GSM Support>, <Multi-carrier mode>	query only	6.167
[SENSe:]UECapability:MRELated?	<DL Compressed Mode>, <UL Compressed Mode>	query only	6.167
[SENSe:]UECapability:PDCP?	<SRNS relocation>,<RFC 2507>,<Header Compression>	query only	6.165
[SENSe:]UECapability:PDOwnlink?	<Simult. Tr. Channel>, <Simult. CCTr. Channel>, <TTITransportBlocks>, <Number of TFC>, <Number of TF>, <Turbo Decoding>, <Received Bits All>, <Received Bits Convolutionally Coded>, <Received Bits Turbo coded>, <PhyChannelFDD DPCH/PDSCH codes>, <PhyChannelFDD PhysicalChannelBits>, <PhyChannelFDD SF512>, <PhyChannelFDD PDSCH>, <PhyChannelFDD ChannelEstimation Pilots>, <Simult. Reception SCCPCH/DPCH>, <Simult. Reception SCCPCH/DPCH/PDSCH>, <Simult. Reception SCCPCH radio links>	query only	6.165
[SENSe:]UECapability:PUPLink?	<Simult. Tr. Channel>, <Simult. CCTr. Channel>, <TTITransportBlocks>, <Number of TFC>, <Number of TF>, <Turbo Encoding>, <Transmitted Bits All>, <Transmitted Bits Convolutionally Coded>, <Transmitted Bits Turbo Coded>, <PhyChannelFDD DPDCH Bits per 10ms>, <Phys. Channel FDD PCPCH>, <Phys. Channel FDD UE Power Class>	query only	6.166
[SENSe:]UECapability:RFParameters?	<Tx/RX Freq. Separation>	query only	6.166
[SENSe:]UECapability:RLC?	<AM Buffer Size>,<Max. RLC Window Size>,<Max. AM Entities>	query only	6.165
[SENSe:]UECapability:UEPosition?	<Standalone Loc. Method>, <NetworkAssisted GPS>, <GPS Reference Time>, <IPDL>, <OTDOA UE	query only	6.167

Command (Connection Control, Signalling)	Parameter	Remark	Page
	Based Method>, <Rx/Tx Time Difference>		
UESignal – UE Signal			
DEFault:UESIGnal	ON | OFF	with query	6.170
CONFigure:UESignal:AMODe	WOOFfset | WIOFfset	with query	6.169
CONFigure:UESignal:CHANnel	1922.4 MHz to 1977.6 MHz | 1852.4 MHz to 1907.6 MHz | 1712.4 MHz to 1782.6 MHz	with query	6.168
UNIT:UESignal:CHANnel	HZ | KHZ | MHZ | GHZ | CH	with query	6.168
DEFault:UESIgnal:CSETtings	ON | OFF	with query	6.169
CONFigure:UESignal:DPCH:CMODe	0 | 1	with query	6.170
CONFigure:UESignal:DPCH:SNUMber	0 to 14	with query	6.170
CONFigure:UESignal:DPCH:SYMode	ASL | SYNC	with query	6.169
CONFigure:UESignal:DPDCh:AUTO:THReshold	–25 dB to +10 dB	with query	6.170
CONFigure:UESignal:FOFFset	–100 kHz to 100 kHz	with query	6.168
DEFault:UESignal:GFACtor	ON | OFF	with query	6.173
CONFigure:UESignal:GFACtor:HSTMode	0 to 15, 0 to 15, 0 to 8, 0 to 8, 0 to 8	with query	6.173
CONFigure:UESignal:GFACtor:PDATa	0 to 15, 0 to 15	with query	6.173
CONFigure:UESignal:GFACtor:RMC:UPLMode<nr>	0 to 15, 0 to 15	with query	6.172
CONFigure:UESignal:GFACtor:VIDeo	0 to 15, 0 to 15	with query	6.173
CONFigure:UESignal:GFACtor:VOICe	0 to 15, 0 to 15	with query	6.173
CONFigure:UESignal:GPERiod	ON | OFF	with query	6.169
DEFault:UESignal:PCONtrol	ON | OFF	with query	6.171
CONFigure:UESignal:PCONtrol:OLPC:CVALue	–35 dB to –10 dB	with query	6.172
CONFigure:UESignal:PCONtrol:OLPC:DPCCh:POFFset	–164.0 dB to –6.0	with query	6.172
CONFigure:UESignal:PCONtrol:OLPC:INTerference	–110 dB to –70 dB	with query	6.171
CONFigure:UESignal:PCONtrol:OLPC:PCPich:RPOWer	–10 dBm to +50 dBm	with query	6.172
CONFigure:UESignal:PCONtrol:TPOWer:REFerence	TPOWer | DPCCh	with query	6.171
CONFigure:UESignal:PCONtrol:TPOWer:VALue	– 50 dBm to +33 dBm	with query	6.171
CONFigure:UESignal:PCONtrol:UEPower	– 50 dBm to +33 dBm	with query	6.171
CONFigure:UESignal:SCODe:SECondary	#H0 to #HFFFFFF	with query	6.169

Table 6-5 Remote-control commands, alphabetical list (Non Signalling)

Command (Non Signalling, alphabetical)	Page
[SENSe:]:IQIF:LEVel?	6.26
[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]	6.19
[SENSe:]CORRection:LOSS:OUTPut<nr>:AUXTx:OLEVel[:MAGNitude]	6.20
[SENSe:]CORRection:LOSS:OUTPut<nr>:AUXTx[:MAGNitude]	6.20
[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]	6.19
[SENSe:]LEVel:ATTenuation	6.2
[SENSe:]LEVel:MAXimum	6.2
[SENSe:]LEVel:MODE	6.1
[SENSe:]RFANalyzer:FOFFset	6.3
[SENSe:]RFANalyzer:FREQuency	6.3
[SENSe:]RFANalyzer:GPERiod	6.3
[SENSe:]RXQuality:UEReport<nr>:NCELI?	6.156
[SENSe:]RXQuality:UEReport<nr>[:CCELI]?	6.155
ABORt:CDPower:AUTomatic	6.112
ABORt:CDPower:MANual	6.117
ABORt:CDPower:RAUTomatic	6.112
ABORt:CDPower:RMANual	6.117
ABORt:CDPower:TIME	6.128
ABORt:MODulation:EVMagnitude:QPSK	6.57
ABORt:MODulation:EVMagnitude:WCDMa:DPCH	6.57
ABORt:MODulation:IQANalyzer:QPSK	6.78
ABORt:MODulation:IQANalyzer:WCDMa:DPCH	6.78
ABORt:MODulation:MERRor:QPSK	6.64
ABORt:MODulation:MERRor:WCDMa:DPCH	6.64
ABORt:MODulation:OVERview:QPSK	6.51
ABORt:MODulation:OVERview:WCDMa:DPCH	6.51
ABORt:MODulation:PERRor:QPSK	6.71
ABORt:MODulation:PERRor:WCDMa:DPCH	6.71
ABORt:MODulation:PHDiscont	6.82
ABORt:NPOWer	6.138
ABORt:POWer:ILTPc	6.36
ABORt:POWer:MAXimum	6.27
ABORt:POWer:MINimum	6.27
ABORt:POWer:OFF	6.27
ABORt:POWer:XSLot	6.43
ABORt:RFGenerator	6.4
ABORt:RXQuality:BER	6.133
ABORt:RXQuality:UEReport	6.154
ABORt:SPECtrum:EMASk	6.105
ABORt:SPECtrum:MFFT	6.97
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CALCulate:ARRay:CDPower:MANual:AVERage:MATChing:LIMit?	6.124
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CALCulate:ARRay:CDPower:MANual:MINimum:MATChing:LIMit?	6.124
CALCulate:ARRay:CDPower:RMANual:AVERage:MATChing:LIMit?	6.124
CALCulate:ARRay:CDPower:RMANual:CURRent:MATChing:LIMit?	6.124
CALCulate:ARRay:CDPower:RMANual:MAXimum:MATChing:LIMit?	6.124
CALCulate:ARRay:CDPower:RMANual:MINimum:MATChing:LIMit?	6.124
CALCulate:ARRay:MODulation:PHDiscont:CFERror:MATChing:LIMit?	6.89
CALCulate:ARRay:MODulation:PHDiscont:EVMagnitude:CONDition:LIMit?	6.88
CALCulate:ARRay:MODulation:PHDiscont:EVMagnitude:MATChing:LIMit?	6.88
CALCulate:ARRay:MODulation:PHDiscont:PHDiscont:CONDition:LIMit?	6.88
CALCulate:ARRay:MODulation:PHDiscont:PHDiscont:MATChing:LIMit?	6.87
CALCulate:ARRay:POWer:ILTPc:STEP:CURRent:MATChing:LIMit?	6.42

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CALCulate:ARRay:SPECtrum:EMASk:AVERage:MATChing:LIMit?	6.110
CALCulate:ARRay:SPECtrum:EMASk:CURRent:MATChing:LIMit?	6.110
CALCulate:ARRay:SPECtrum:EMASk:MAXimum:MATChing:LIMit?	6.110
CALCulate[:SCALar]:MODulation:EVMagnitude:QPSK:MATChing:LIMit?	6.61
CALCulate[:SCALar]:MODulation:EVMagnitude:WCDMa:DPCH:MATChing:LIMit?	6.61
CALCulate[:SCALar]:MODulation:MERRor:QPSK:MATChing:LIMit?	6.68
CALCulate[:SCALar]:MODulation:MERRor:WCDMa:DPCH:MATChing:LIMit?	6.68
CALCulate[:SCALar]:MODulation:OVERview:QPSK:MATChing:LIMit?	6.56
CALCulate[:SCALar]:MODulation:OVERview:WCDMa:DPCH:MATChing:LIMit?	6.56
CALCulate[:SCALar]:MODulation:PERRor:QPSK:MATChing:LIMit?	6.75
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CALCulate[:SCALar]:MODulation:PHDiscont:CURRent:MATChing:LIMit?	6.86
CALCulate[:SCALar]:POWer:ILTPc:CURRent:MATChing:LIMit?	6.41
CALCulate[:SCALar]:POWer:MAXimum:MATChing:LIMit?	6.35
CALCulate[:SCALar]:POWer:MINimum:MATChing:LIMit?	6.35
CALCulate[:SCALar]:POWer:OFF:MATChing:LIMit?	6.35
CALCulate[:SCALar]:RXQuality:BER:MATChing:LIMit?	6.138
CALCulate[:SCALar]:SPECtrum:MFFT:MATChing:LIMit?	6.103
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CONFigure:CDPower:MANual:AVERage:LIMit:POINt:ASYMmetric:UPPer:CHANnel<nr>	6.120
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CONFigure:CDPower:RMANual:CMMax:LIMit:POINt:ASYMmetric:LOWer:CHANnel<nr>	6.120
CONFigure:CDPower:RMANual:CMMax:LIMit:POINt:ASYMmetric:UPPer:CHANnel<nr>	6.120
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CONFigure:POWer:MAXimum:AVERage:LIMit[:SCALar]:ASYMmetric:RVALue	6.32
CONFigure:POWer:MAXimum:AVERage:LIMit[:SCALar]:ASYMmetric:UPPer:VALue	6.31
CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:LOWer:VALue	6.31
CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:RVALue	6.31
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STOP:POWer:MAXimum	6.27
STOP:POWer:MINimum	6.27
STOP:POWer:OFF	6.27
STOP:POWer:ONOFf	6.142
STOP:POWer:XSLot	6.43
STOP:RXQuality:BER	6.133
STOP:SPECtrum:EMASk	6.105
STOP:SPECtrum:MFFT	6.97
STOP:SPECtrum:MFILter	6.90
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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 ********************************************************

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 -4.42
CMUBASE: 2;CONF:BSS:PHYS:LEV:SCH:PRIM -9.42
CMUBASE: 2;CONF:BSS:PHYS:LEV:SCH:SEC -9.42
CMUBASE: 2;CONF:BSS:PHYS:LEV:CCPC:PRIM -6.42
CMUBASE: 2;CONF:BSS:PHYS:LEV:CCPC:SEC -6.42
CMUBASE: 2;CONF:BSS:PHYS:LEV:PICH -9.42
CMUBASE: 2;CONF:BSS:PHYS:LEV:AICH -9.42
CMUBASE: 2;CONF:BSS:PHYS:LEV:DPDC -11.42
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?
```

CDP vs. Time Measurement with HSDPA Channels

In the following example the R&S CMU sets up a 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.

The *CDP vs. Time* measurement is not available in manual control. To perform the measurement as reported below, the UE must be connected to the RF 2 connector.

```
REM ************************************************************
REM General R&S CMU configurations
REM (CMU base system commands, see R&S CMU200/300 operating manual)
REM ************************************************************

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?

REM ************************************************************
REM Connector selection and path loss settings in WCDMA UE function group.
REM ************************************************************

CMUBASE: 2;INP:STAT RF2
CMUBASE: 2;OUTP:STAT RF2
CMUBASE: 2;SENS:CORR:LOSS:INP2 0
CMUBASE: 2;SENS:CORR:LOSS:OUTP2 0

REM ************************************************************
REM Call parameters
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 ALG1
CMUBASE: 2;CONF:BSS:TPC:SSIZ 1
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:SKEY "4147494C454E5420","544543484E4F0000"
CMUBASE: 2;CONF:BSS:LREF OPOW
CMUBASE: 2;CONF:BSS:OPOW -50.60
CMUBASE: 2;CONF:BSS:PHYS:LEV:CPIC:PRIM -4.42
CMUBASE: 2;CONF:BSS:PHYS:LEV:SCH:PRIM -9.42
CMUBASE: 2;CONF:BSS:PHYS:LEV:SCH:SEC -9.42
CMUBASE: 2;CONF:BSS:PHYS:LEV:CCPC:PRIM -6.42
CMUBASE: 2;CONF:BSS:PHYS:LEV:CCPC:SEC -6.42
CMUBASE: 2;CONF:BSS:PHYS:LEV:PICH -9.42
CMUBASE: 2;CONF:BSS:PHYS:LEV:AICH -9.42
CMUBASE: 2;CONF:BSS:PHYS:LEV:DPDC -11.42
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:UES:SCOD:SEC #H0
CMUBASE: 2;LEV:MODE AUT
CMUBASE: 2;CONF:BSS:TPC:PTYP1 CLOP
CMUBASE: 2;CONF:BSS:TPC:PSET SET1;*opc?

REM ***********************************************************
REM Special HSDPA parameters, test mode selection
REM ***********************************************************

CMUBASE: 2;CONFigure:NETWork:PSWitched:DOMain ON
CMUBASE: 2;CONFigure:BSSignal:DCH:TYPE HSTM
CMUBASE: 2;CONFigure:BSSignal:HSDPa:SIGNal:ENABle ON
CMUBASE: 2;CONFigure:BSSignal:HSDSch:TYPE FRCHannel
CMUBASE: 2;CONFigure:BSSignal:HSDSch:FRCHannel:HSET S5QP

REM ***********************************************************
REM Generator on - wait for registration
REM ***********************************************************

CMUBASE: 2;PROC:SIGN:ACT SON;*OPC?
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 MTC
REM ***********************************************************

CMUBASE: 2;PROC:SIGN:ACT CTM;*OPC?
REPORT OFF
WHILE CMUBASE: 2;SIGN:STAT? <> CEST
REPORT ON
```

```
REM ********************************************************
REM Measurement and retrieval of results
REM (with APPENDARAY command in Winbatch, all data will be written to file statis.dat)
REM ********************************************************

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
```

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.

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8 HSDPA 3.6 Mbps (Option R&S CMU-K64)

With the supplementary option R&S CMU-K64 added to R&S CMU-K65, R&S-K66 and one of the signalling options R&S CMU-K61 to R&S CMU-K63 or R&S CMU-K67 to R&S CMU-K69, the R&S CMU200 provides 3.6 Mbps High Speed Downlink Packet Access (HSDPA) channels. 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.

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 are available both in *Non Signalling* and in *Signalling* mode.

The Code Domain Power vs. Time *measurement provides the code power and ρ-factor of HSDPA channels. This measurement is a remote control feature and therefore decribed in Chapter 6 of this manual.*

HSDPA Receiver Tests

The *Receiver Quality* menu has been extended to include several new 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. 8.24 ff.

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)*.

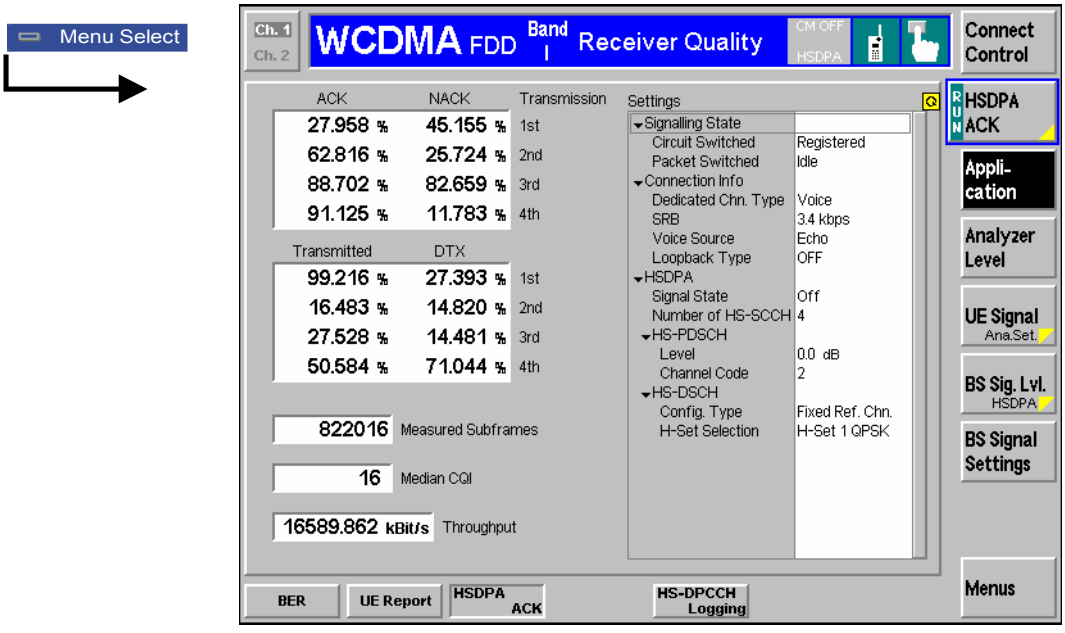


Fig. 8-1 Receiver Quality – HSDPA ACK

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. The measurement is always performed in single shot mode.

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 *Measure Subframes* parameter is specific to the *HSDPA ACK* measurement; 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. *8.24* ff.

The remaining softkey/hotkey combinations are not specific to the *HSDPA ACK* measurement; refer to Chapter 4 of the operating manual for detailed information.

HSDPA ACK Measurement Results

The *HSDPA ACK* menu contains various tables to display the signal configuration and the measurement results.

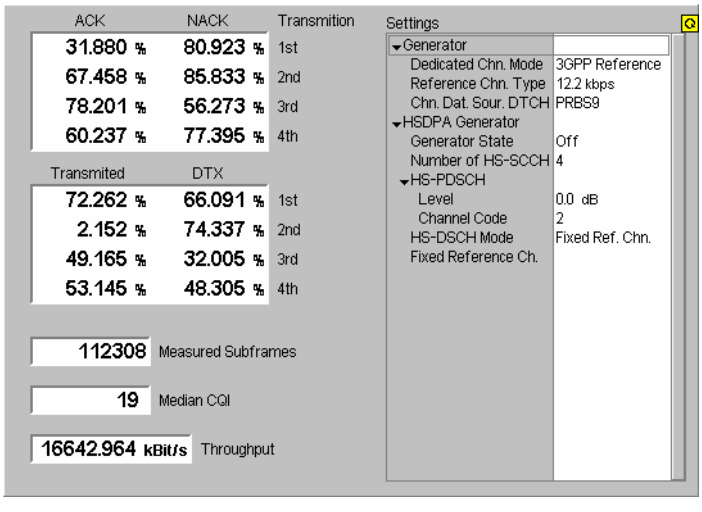


Fig. 8-2 Measurement Results – HSDPA ACK

In its right half the *HSDPA ACK* menu displays the generator *Settings* described in section *HSDPA Downlink Signal (BS Signal)* on p. *8.24* ff. The output tables to the left show the results described below.

ACK / NACK The upper table shows the percentage of transmission packets (HSDPA subframes) that the UE answered with *ACK* after successful CRC check, and the percentage of transmissions that the UE answered with *NACK* to indicate an unsuccessful transmission on the HS-DSCH. Values are given for the 1st, 2nd, 3rd, and 4th 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.

Transmitted Percentage of transmissions with the 1st, 2nd, 3rd and 4th redundancy version.

DTX Percentage of transmissions that were not answered at all and caused Discontinuous Transmission (DTX). Values are given for the 1st, 2nd, 3rd, and 4th 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.

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.

Remote control
```
READ[:SCALar]:RXQuality:HACK?
FETCh[:SCALar]:RXQuality:HACK?
SAMPle[:SCALar]:RXQuality:HACK?
```

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. 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. 8.24 ff.
- To define the number of subframes measured, press *HSDPA CQI – Measure Subframes*.
- 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.

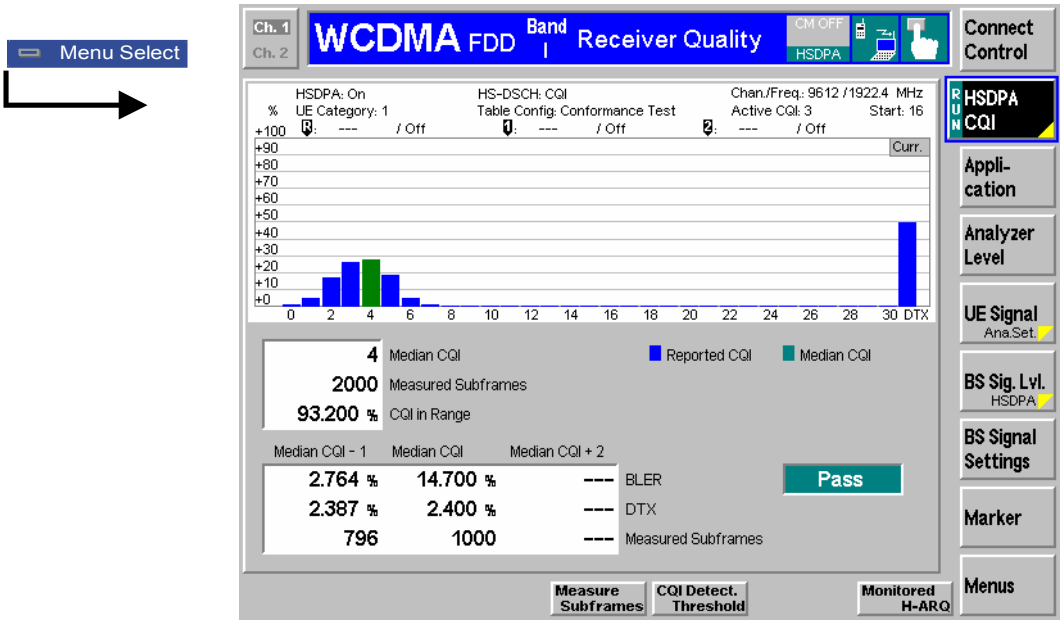


Fig. 8-17 Receiver Quality – HSDPA CQI

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 | OFF | 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 *ON/OFF* or *CONT/HLT* key.

Remote control

```
INITiate:RXQuality:HCQI
ABORt:RXQuality:HCQI
STOP:RXQuality:HCQI
CONTinue:RXQuality:HCQI
FETCh[:SCALar]:RXQuality:HCQI:STATus?
```

Measure Subframes

The *Measure Subframes* hotkey defines the scope of the CQI test:

- *CQI* denotes the number of CQI values collected in the first stage of the CQI test (see *Error! Unknown switch* ***argument.*** on p. 8.6 ff.) in order to calculated the CQI statistics.
- *BLER* denotes the number of subframes measured in the second stage in order to calculate the BLER at (median CQI – 1), median CQI, and (median CQI +2).

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. 8.2).

The remaining softkey/hotkey combinations are not specific to the *HSDPA ACK* measurement; refer to Chapter 4 of the operating manual 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, the median CQI, and the number of CQI values which fall into the interval [median CQI – 2, median CQI + 2]. The UE under test is passed in this stage 1 if 1800 or more CQI values fall into this interval.
- In the second stage, the R&S CMU tests whether BLER versus CQI has the correct sense.

  If the UE is passed in stage 1, the R&S 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. If the BLER, defined as the ratio of (DTX + NACK)/(DTX + 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.

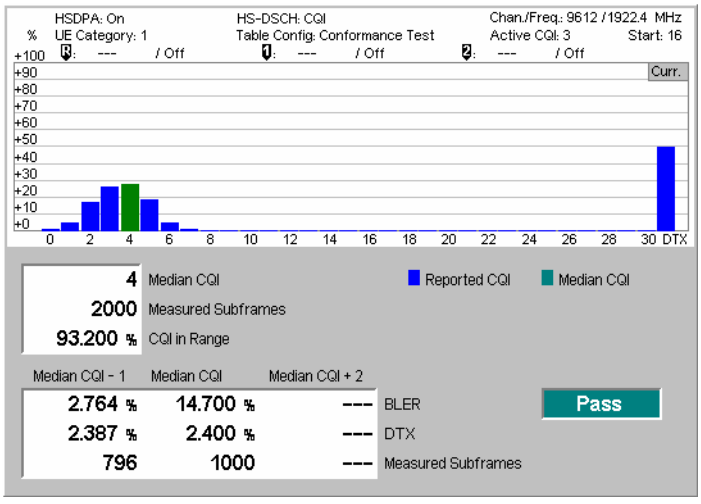


Fig. 8-18 Measurement Results – HSDPA CQI

In the parameter lines the *HSDPA CQI* menu displays the essential generator *Settings* described in section *HSDPA Downlink Signal (BS Signal)* on p. *8.24* ff. The remaining display elements show the results described below.

Parameter Lines The three parameter lines above the diagram show the essential test configuration and the marker values. 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 stages, it is set equal to median of the reported CQI values (median CQI), to median CQI – 1, and to median CQI + 2. 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].

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). The results obtained at median CQI –1, at median CQI, and at median CQI + 2 are in three 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, BLER,* and *DTX* exceed the upper or lower limit set in the *Limits* tab of the *Receiver Quality Configuration* menu, see p. *HSDPA CQI Limits* on p. 8.8 ff.

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. 8.6 ff.):

- **Stage 1:** 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:** 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.

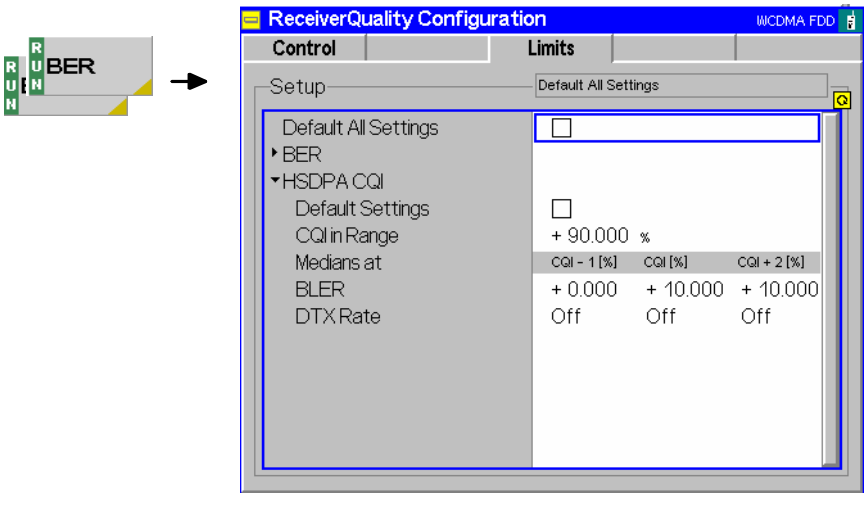


Fig. 8-3 Receiver Quality Configuration – Limits

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>
```

HSDPA CQI

The following limits can be set for *HSDPA CQI* tests.

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).

The following limits are specified separately for the transport formats indicated by the (median CQI – 1), the median CQI, and the (median CQI + 2):

BLER Upper or lower BLER limits. 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
```

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 60 consecutive HS-DPCCH subframes (12 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*.

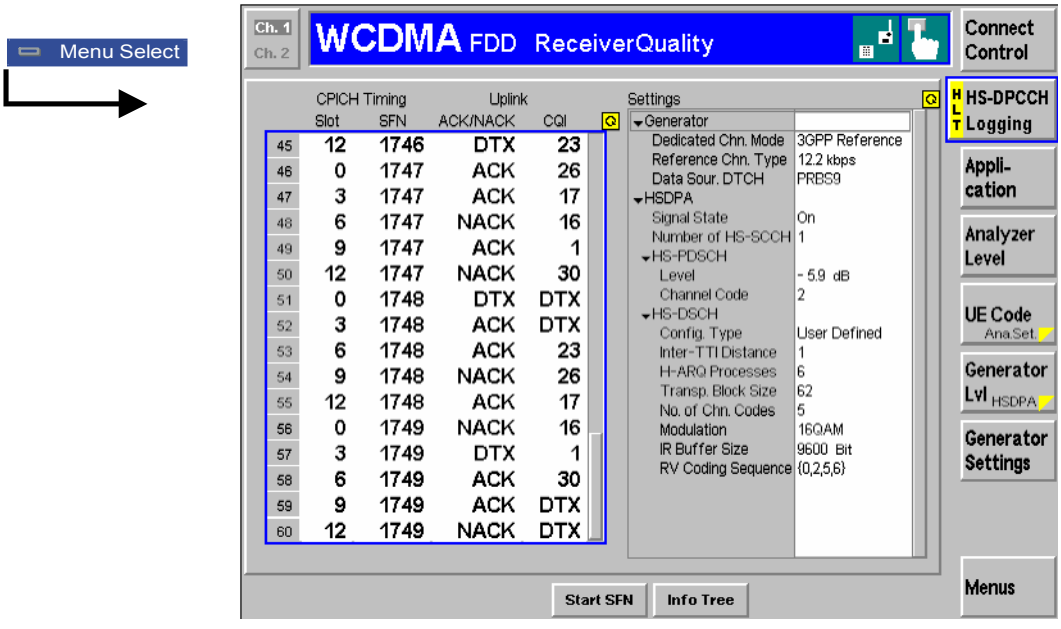


Fig. 8-4 HS-DPCCH logging menu

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. The measurement is always performed in single shot mode, one evaluation period comprises 60 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
```

Info Tree

Displays or hides the *Settings* table in the right half of the menu.

Remote control
No command, display configuration only.

HS-DPCCH Logging Measurement Results

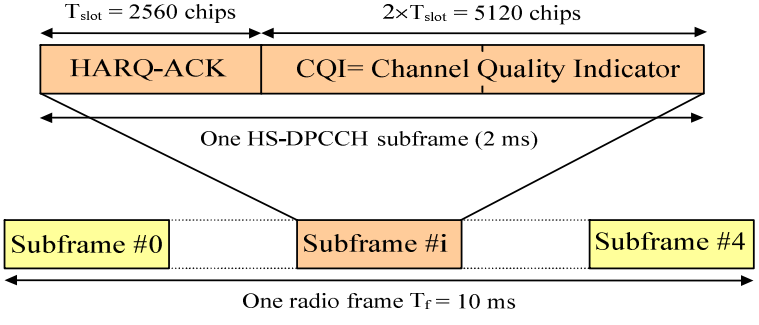
The tables in the *HS-DPCCH Logging* menu display the measurement results and the signal configuration.

The *Settings* table in the right half shows the generator settings described in section *HSDPA Downlink Generator* in Chapter 8 of the operating manual. 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 12 complete, consecutive WCDMA radio frames (60 subframes), this slot number sequence is repeated 12 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; 12 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 in CDP Measurement

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.

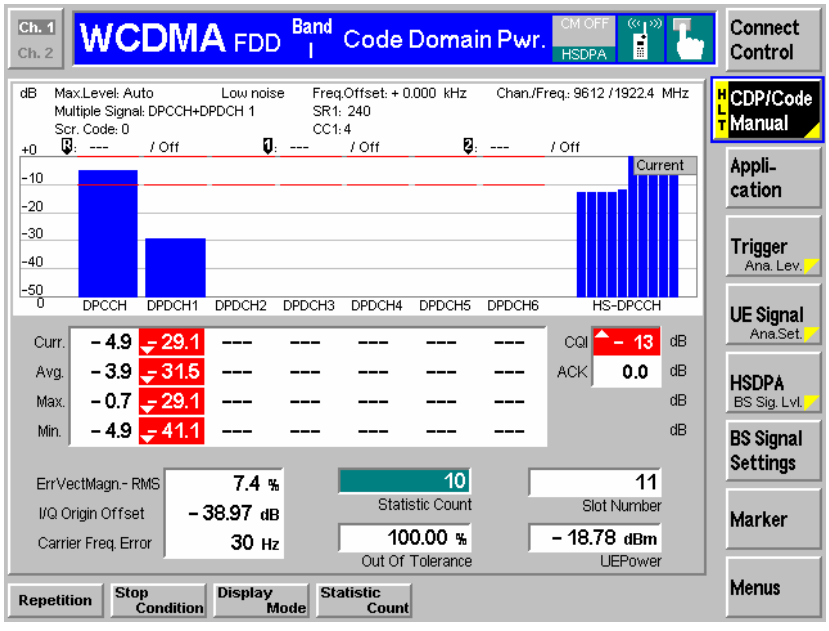


Fig. 8-5 HS-DPCCH measurement in CDP

Preparing a HS-DPCCH Test

To obtain the results shown in Fig. 20 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. 8-6 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.

NOTE

The remote control commands for CDPower including the HSDPA commands are reported in Chapter 6.

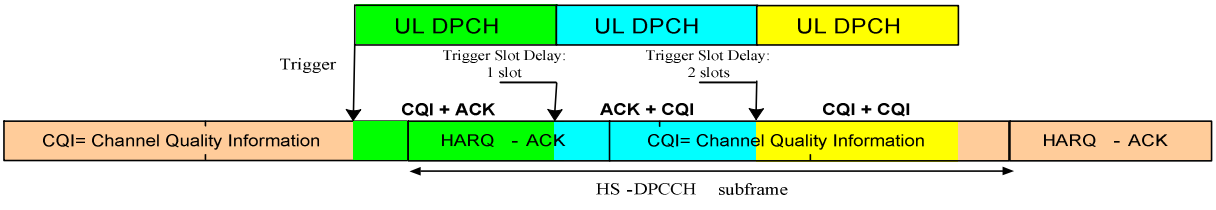


Fig. 8-6 HS-DPCCH measurement in CDP

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 including the HSDPA commands are reported in Chapter 6.

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.*

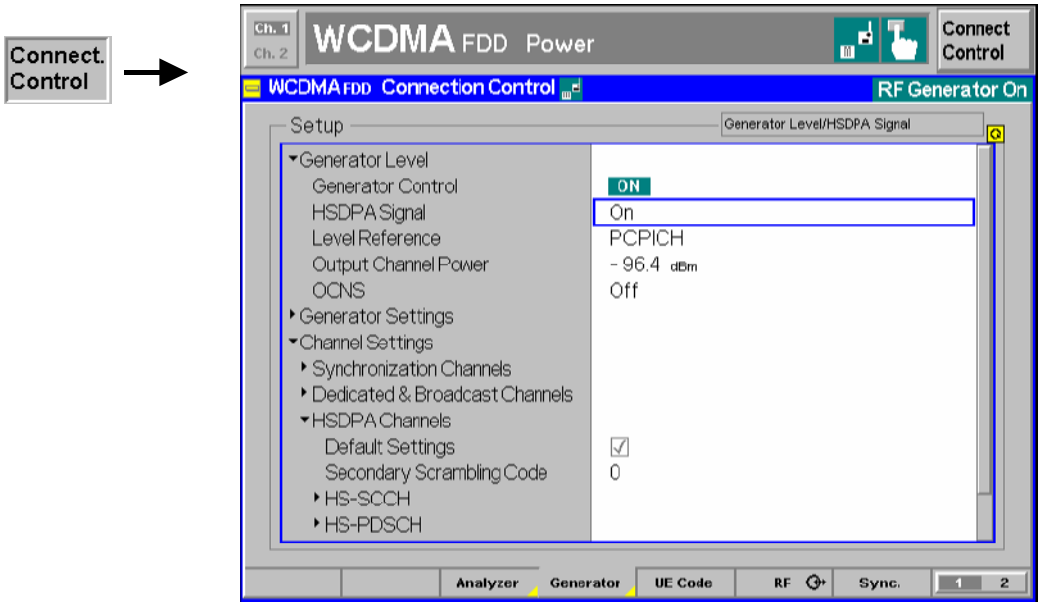


Fig. 8-7 Connection Control – Generator

The HSDPA signal is switched on in the *Generator Level* section.

HSDPA Signal 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 *(Generator Level – Generator Control: On)*, providing the necessary channels for synchronization (P-SCH, S-SCH, P-CCPCH, P-CPICH) and a downlink Reference Measurement Channel.

Remote control
`SOURce:HSDPa:SIGNal:ENABle ON | OFF`

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.

Remote control
`DEFault:HSDPa`

Secondary Scrambling Code 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. 8-11 on p. 8.26. 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`

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)*. If a number of $n\ (1 \le n \le 4)$ HS-SCCHs is selected then the channels $n+1, \ldots, 4$ in the *HS-SCCH Configuration* section are switched off.

Note: *4 is equal to 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.*

Remote control
`SOURce:HSDPa:HSSCch:NUMBer`

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 *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. 8-11 on p. 8.26. 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: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. 8.28.

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 $(1 \leq n \leq 4)$ 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. 8-8 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`

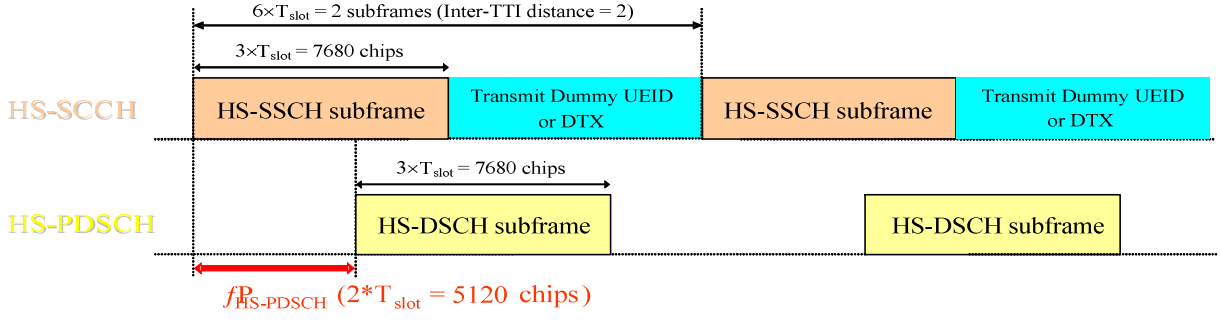


Fig. 8-8 Unscheduled Subframes (HS-SSCH)

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:

Sum Level 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. 8-11 on p. 8.26. All HS-PDSCHs can be switched off by means of the *ON/OFF* key.

The reference power adjustment Δ defined in TS 25.214 table 7A-E is not considered for the sum level.

1st Used Ch. Code Lowest numbered channelization code assigned to the HS-PDSCH (the index O in Fig. 8-11 on p. 8.26). 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. 8-9 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:HSDPa:HSPDsch:CODE
SOURce:HSDPa:HSPDsch:USUBframes DDATa | DTX
```

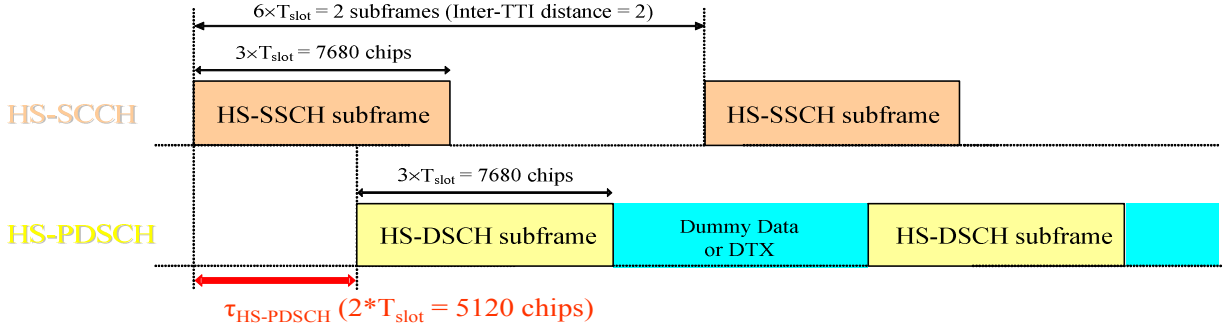


Fig. 8-9 Unscheduled Subframes (HS-PDSCH)

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 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 section *HSDPA*

ACK/NACK Receiver Test on p. 8.1 ff.), 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 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
`OURce:BSSignal:HSDSch:CFCYcle D2 | D4 | … | D160 | OFF`

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. 8.1 ff.

CQI Configuration as a CQI reporting test channel using the parameters defined in the *CQI Channel Configuration* section. *CQI Reporting* on p. 8.4 ff.

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 5 defined in standard 3GPP TS 25.101, Annex A7. For the H-Sets 1, 2 and 3, 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 7.3A 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.

Remote control

```
SOURce:HSDPa:FRCHannel:HSET
  S1QP | S1Q | S1M | S2QP | S2Q | S3QP | S3Q | S4QP | S5QP
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.

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. 8.4 ff.

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.

CQI Channel Configuration – **Remaining Parameters**

The remaining parameters are defined by the active DL CQI and can not be set separately. If a different signal configuration is needed, the *User Defined Channel* must be used.

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.*

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.

RV Coding Sequence QPSK — One of the following QPSK sequences defined in standard 3GPP TS 25.101:
{ 0 } (Single Transmission)
{ 0, 2, 5, 6 } (Fixed Reference Channel)
{ 0, 0, 0, 0 } (Chase Combining)

RV Coding Sequence 16QAM — One of the following 16QAM sequences defined in standard 3GPP TS 25.101:
{ 6 } (Single Transmission)
{ 6, 2, 1, 5 } (Fixed Reference Channel)
{ 6, 6, 6, 6 } (Chase Combining)
{ 6, 0, 4, 5 } (Chase Combining with constellation re-arrangement)

The RV Coding Sequences have an impact on the retransmissions of the generator. The coding sequences are displayed in separate lines to underscore the current modulation scheme.

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?
```

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. 8.35.

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. 8-11 on p. 8.26.

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.

RV Coding Sequence

One of the following sequences (see also background information below):

{ 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 (up to 3 sequences). For background information on RV coding sequences and examples refer to p. 8.35.

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:RVCSequence
```

HSDPA in Signalling Mode

With option R&S CMU-K64, *Receiver Quality* measurements on HSDPA channels *(HSDPA ACK, HS-DPCCH Logging)* are also available in *Signalling* mode. Manual and remote control is identical with the *Non Signalling* measurements described in Chapter 8 of the operating manual.

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 Signal Configuration* on p. 8.37 ff.

In addition to the HSDPA generator, the R&S CMU provides a number of HSDPA-specific RX and TX measurements; see sections *HSDPA Receiver Tests* on p. 8.1 ff. and *HSDPA in CDP Measurement* on p. 8.12 ff. HSDPA results are also available in the *CDP vs. Time* measurement described in Chapter 6 (remote control application).

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 in the operating manual, 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:

- 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.*

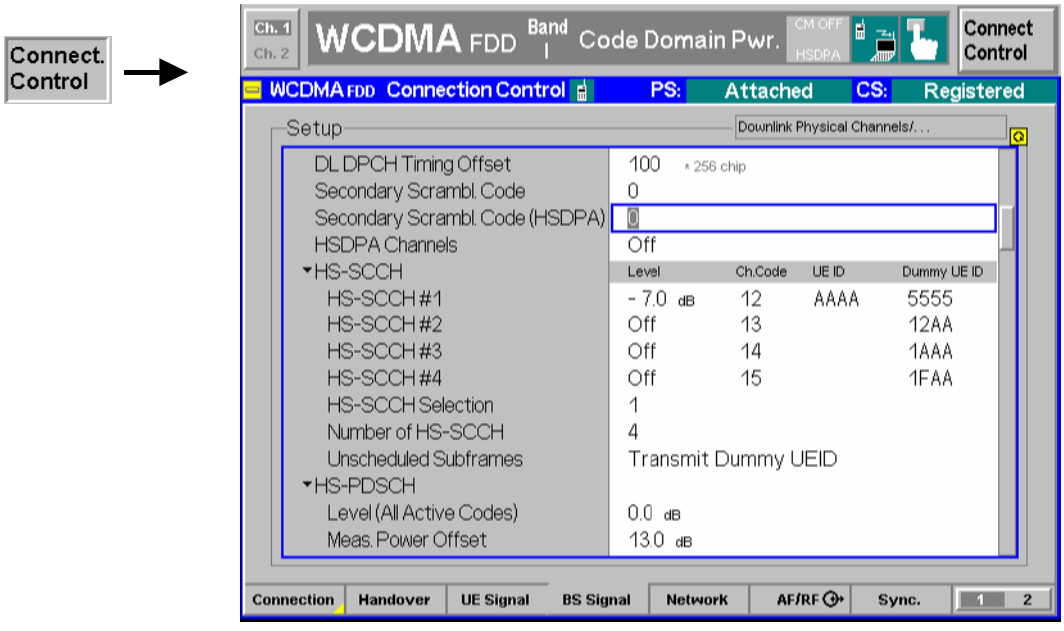


Fig. 8-10 Connection Control – Generator

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. 8-11 on p. 8.26. 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`

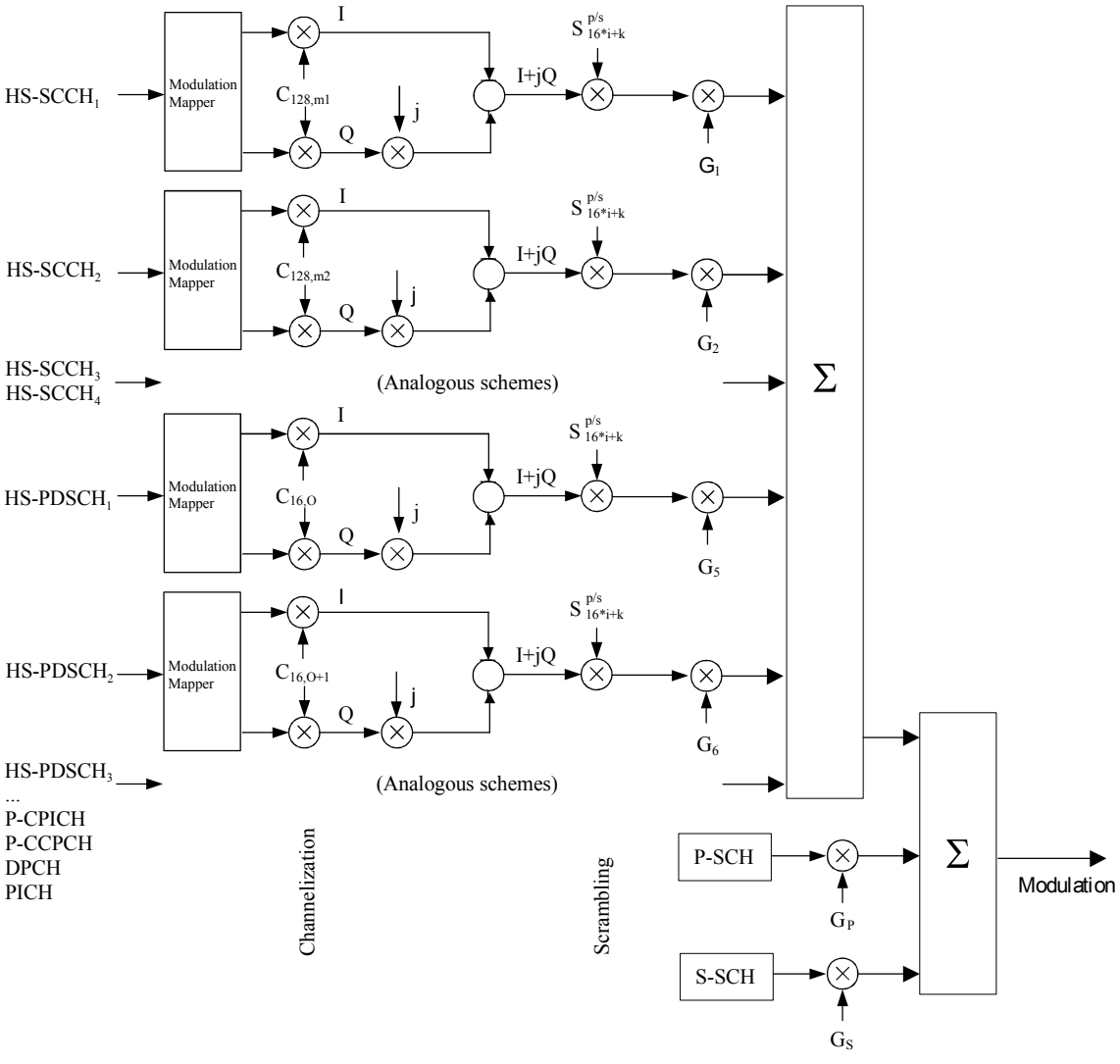


Fig. 8-11 Spreading of HSDPA channels

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. 8-11 on p. 8.26. 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. 8-12** 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. 8-12 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
```

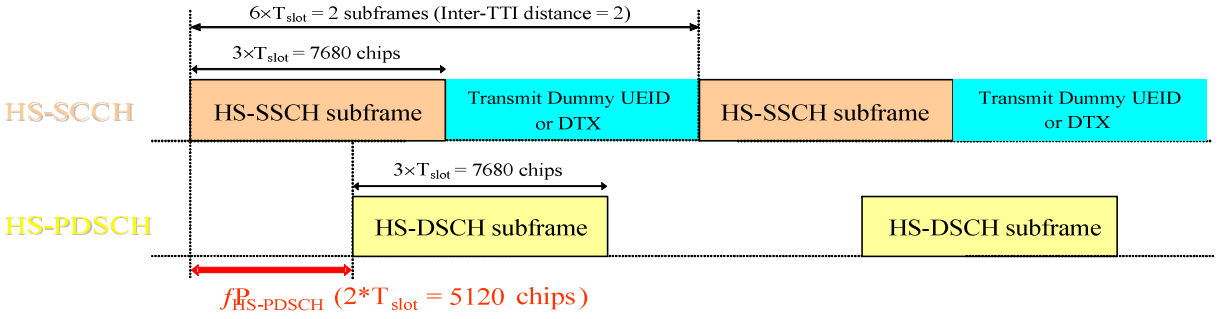


Fig. 8-12 Unscheduled Subframes (HS-SSCH)

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. 8-11 on p. 8.26. All HS-PDSCHs can be switched off by means of the *ON/OFF* key.

The reference power adjustment Δ defined in TS 25.214 table 7A-E is not considered for the sum level. See also examples for the *Meas. Power Offset* below.*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

$$P_{HS\text{-}PDSCH} = P_{P\text{-}CPICH} + \Gamma + \Delta\ (CQI,\ UE\ Category).$$

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. 8-11 on p. 8.26). 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. 8-13 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:LEVel:MPOFfset
CONFigure:BSSignal:PHYSical:HSPDsch:CODE
CONFigure:BSSignal:PHYSical:HSPDsch:USUBframes DDATa | DTX
```

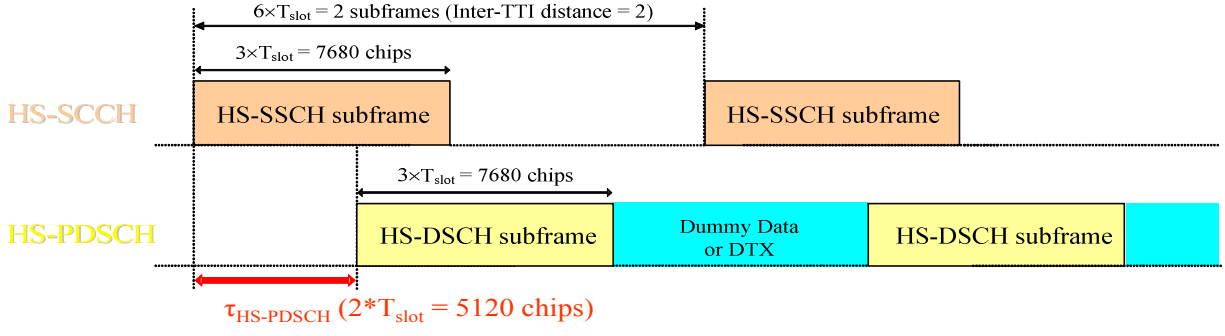


Fig. 8-13 Unscheduled Subframes (HS-PDSCH)

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 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).

Remote control
```
CONFigure:BSSignal:HSDSch:CFCYcle D2 | D4 | … | D160 | OFF
```

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 8-2 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. 8.1 ff.

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.

Remote control

```
CONFigure:BSSignal: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 5 defined in standard 3GPP TS 25.101, Annex A7. For the H-Sets 1, 2 and 3, 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 7.3A 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 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). In contrast the H-ARQ buffer sizes for CQI and user defined channels are equal (implicit partitioning).

Remote control

```
CONFigure:BSSignal:HSDSch:FRCHannel:HSET
  S1QP | S1Q | S1M | S2QP | S2Q | S3QP | S3Q | S4QP | S5QP
CONFigure:BSSignal:HSDSch: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.

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. 8.4 ff.

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.

CQI Channel Configuration – **Remaining Parameters**

The remaining parameters are defined by the active DL CQI and can not be set separately. If a different signal configuration is needed, the *User Defined Channel* must be used.

***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.*

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.

RV Coding Sequence QPSK One of the following QPSK sequences defined in standard 3GPP TS 25.101:

{ 0 } (Single Transmission)
{ 0, 2, 5, 6 } (Fixed Reference Channel)
{ 0, 0, 0, 0 } (Chase Combining)

RV Coding Sequence 16QAM One of the following 16QAM sequences defined in standard 3GPP TS 25.101:

{ 6 } (Single Transmission)
{ 6, 2, 1, 5 } (Fixed Reference Channel)
{ 6, 6, 6, 6 } (Chase Combining)
{ 6, 0, 4, 5 } (Chase Combining with constellation re-arrangement)

The RV Coding Sequences have an impact on the retransmissions of the generator. The coding sequences are displayed in separate lines to underscore the current modulation scheme.

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?
```

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. 8-11 on p. 8.26.

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 (implicit partitioning). The total buffer size is fixed for each UE category; see standard TS 25.306, table 5.1a.

RV Coding Sequence — One of the following sequences (see also background information below):

{ 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 (up to 3 sequences).

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

```
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:RVCSequence
```

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.

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	o	0
	1	0	o	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.*

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
```

HSDPA in Remote Control

The following section lists 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 measuremnents 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` 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*> 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	V3.60

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` 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: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)	4	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.				

SOURce:HSDPa:HSDSch:UECategory <*Number*>			UE Category	
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
1 | 2 | 3 | 4 | 5 | 6 | 11 | 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**	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)	S1QP	–	V3.60
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:CQICannel:RVCSequence:QPSK?			RV Coding Sequence QPSK		
<QPSK>	Description of parameters		Def. value	Def. unit	FW vers.
S0 | **S0256 |** **S0000**	{ 0 } { 0, 2, 5, 6 } { 0, 0, 0, 0 }	(Single Transmission, QPSK) (FRC, QPSK) (Chase Combining, QPSK)	INV	–	V3.60
Description of command					
This command is always a query and returns the RV coding sequence of a QPSK-modulated CQI channel.					

SOURce:HSDPa:CQICannel:RVCSequence:QAM?			RV Coding Sequence 16QAM		
<16QAM>	Description of parameters		Def. value	Def. unit	FW vers.
S6 | **S6215 |** **S6666 |** **S6045**	{ 6 } { 6, 2, 1, 5 } { 6, 6, 6, 6 } { 6, 0, 4, 5 }	(Single Transmission, 16QAM) (FRC, 16QAM) (Chase Combining, 16QAM) (Chase Combining with constellation re-arrangement, 16QAM)	INV	–	V3.60
Description of command					
This command is always a query and returns the RV coding sequence of a 16QAM-modulated CQI channel.					

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:IRBuffer? <*Bits*>				IR Buffer Size
<Bits>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 172800	Buffer size	NAN	(bits)	V3.60
Description of command				
This command is always a query and returns the size of the virtual IR buffer used in the H-ARQ process.				

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 } (Single Transmission, QPSK) { 6 } (Single Transmission, 16QAM) { 0, 2, 5, 6 } (FRC, QPSK) { 6, 2, 1, 5 } (FRC, 16QAM) { 0, 0, 0, 0 } (Chase Combining, QPSK) { 6, 6, 6, 6 } (Chase Combining, 16QAM) { 6, 0, 4, 5 } (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 must be compatible with 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 `CONFigure:HSDPa:UDCHannel:EMSequence<nr> and CONFigure:HSDPa:UDCHannel:EMSequence:ALL`.				

CONFigure: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 (`CONFigure:HSDPa:TYPE UDCH`) and if the edit mode is active (`SOURce:HSDPa:UDCHannel:RVCSequence EMOD`).				

CONFigure: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 `CONFigure: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`).				

CONFigure:HSDPa:UDCHannel:EMSequence:ALL ***<Value_1>, <Value_2>, …,<Value_8>***			Edit Mode – Sequence	
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 `CONFigure: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.

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 | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SRSQ No reporting	OFF	–	V3.60
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 | **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	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).

CONFigure:RXQuality:HACK:CONTrol:MSUBframes <*Subframes*> Measure Subframes

<Subframes>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000000	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 Chapter 8). 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.

Remote Control: 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 1000000	Number of collected CQI values	2000	–	V3.80
<BLER>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000000	Number of subframes for BLER calculation	1000	(subframes)	V3.80
Description of command				
This command defines the scope of the CQI test.				

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	
<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).				

CONFigure:RXQuality:HCQI:LIMit:BLER <*Lim_1*>, <*Lim_2*>, <*Lim_3*>			BLER Limits	
<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 or lower BLER limits at (median CQI – 1), (median CQI), and (median CQI + 2).				

CONFigure:RXQuality:HCQI:LIMit:DTXRate <*Lim_1*>, <*Lim_2*>, <*Lim_3*>			DTX Rate Limits	
<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.				

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	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	–	

Description of command

These commands are always queries. They start a `RXQuality:HCQI` measurement (`READ...`) and/or return all scalar measurement results.

*) See CONFigure:RXQuality:HCQI:CONTrol:MSUBframes.

CALCulate[:SCALar]:RXQuality:HCQI:MATChing:LIMit? Limit Matching

Returned values	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	–	

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

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 value for UE power (CQI 0)	0% to +100.0 %,	NAN	%	V3.80
...	... ,	...	...	
31st value for UE power (CQI 30)	0% to +100.0 %,	NAN	%	
32th value for UE power (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 | **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	–	V3.62
NONE	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).

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 and 4095	NAN	–	
ACK/NACK,	NACK | ACK | DTX	NAN	–	
CQI,	0 to 30 | DTX	NAN	–	
… (60 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. 8.10 ff.).

HSDPA 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: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

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

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)	4	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.				SOFF SON REG

CONFigure:BSSignal:HSDSch:UECategory <*Number*>			UE Category	
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
1 | 2 | 3 | 4 | 5 | 6 | 11 | 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: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.				SOFF SON REG

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**	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)	S1QP	–	V3.80
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`).				SOFF SON REG

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

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 <*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	–	V3.80
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

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

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

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				
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`).				

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.				SOFF SON REG

CONFigure:BSSignal:HSDSch:CQICannel:RVCSequence:QPSK?			RV Coding Sequence QPSK		
<QPSK>	Description of parameters		Def. value	Def. unit	FW vers.
S0 | S0256 | S0000	{ 0 } (Single Transmission, QPSK) { 0, 2, 5, 6 } (FRC, QPSK) { 0, 0, 0, 0 } (Chase Combining, QPSK)		INV	–	V3.80
Description of command					Sig. State
This command is always a query and returns the RV coding sequence of a QPSK-modulated CQI channel.					all

CONFigure:BSSignal:HSDSch:CQICannel:RVCSequence:QAM?			RV Coding Sequence 16QAM		
<16QAM>	Description of parameters		Def. value	Def. unit	FW vers.
S6 | S6215 | S6666 | S6045	{ 6 } (Single Transmission, 16QAM) { 6, 2, 1, 5 } (FRC, 16QAM) { 6, 6, 6, 6 } (Chase Combining, 16QAM) { 6, 0, 4, 5 } (Chase Combining with constellation re-arrangement, 16QAM)		INV	–	V3.80
Description of command					Sig. State
This command is always a query and returns the RV coding sequence of a 16QAM-modulated CQI channel.					all

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

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`).				SON, SOFF

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

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

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

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: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 |** **EMODe**	{ 0 } QPSK) { 6 } 16QAM) { 0, 2, 5, 6 } { 6, 2, 1, 5 } { 0, 0, 0, 0 } QPSK) { 6, 6, 6, 6 } 16QAM) { 6, 0, 4, 5 } constellation Edit mode	(Single Transmission, (Single Transmission, (FRC, QPSK) (FRC, 16QAM) (Chase Combining, (Chase Combining, (Chase Combining with re-arrangement, 16QAM)	S0256	–	V3.80

Description of command	Sig. State
This command selects the RV coding sequence of the user defined channel. The sequence must be compatible with the selected modulation scheme (`CONFigure:BSSignal:HSDSch:UDCHannel:MODulation`). 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

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

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

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

Remote Control: List of Commands

In the following, all remote-control commands of the WCDMA UE function groups are listed in alphabetical order. with their parameters and page numbers. They are arranged alphabetically according to the **second** keyword of the command so that related commands belong to the same group. The commands for the two test modes *Non Signalling* and *Signalling* are listed separately.

Table 8-3 Remote-control commands: Measurements (available in Non Sign. and Signalling)

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
Receiver Quality – General Configurations			
CONFigure:RXQuality:CONTrol:CTHReshold	–16 dB to +16 dB	with query	8.48
CONFigure:RXQuality:CONTrol:MHARq	1 to 7 | ALL	with query	8.48
Receiver Quality – HSDPC ACK			
INITiate:RXQuality:HACK	–	no query	8.48
ABORt:RXQuality:HACK	–	no query	8.48
STOP:RXQuality:HACK	–	no query	8.48
CONTinue:RXQuality:HACK	–	no query	8.48
CONFigure:RXQuality:HACK:CONTrol:MSUBframes	1 to 1000000	with query	8.49
CONFigure:RXQuality:HACK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	8.48
FETCh:RXQuality:HACK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 1000 | NONE	query only	8.49
READ[:SCALar]:RXQuality:HACK?	<Result>	query only	8.49
FETCh[:SCALar]:RXQuality:HACK?	<Result>	query only	8.49
SAMPle[:SCALar]:RXQuality:HACK?	<Result>	query only	8.49
Receiver Quality – CQI Reporting			
INITiate:RXQuality:HCQI	–	no query	8.50
ABORt:RXQuality:HCQI	–	no query	8.50
STOP:RXQuality:HCQI	–	no query	8.50
CONTinue:RXQuality:HCQI	–	no query	8.50
CONFigure:RXQuality:HCQI:CONTrol:MSUBframes	1 to 1000000, 1 to 1000000	with query	8.51
CONFigure:RXQuality:HCQI:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	8.50
DEFault:RXQuality:HCQI:LIMit	ON | OFF	with query	8.52
CONFigure:RXQuality:HCQI:LIMit:BLER	<Lim_1>; <Lim_2>, <Lim_3>	with query	8.51
CONFigure:RXQuality:HCQI:LIMit:DTXRate	<Lim_1>; <Lim_2>, <Lim_3>	with query	8.51
CONFigure:RXQuality:HCQI:LIMit:IRCQi	<Value>	with query	8.51
CALCulate[:SCALar]:RXQuality:HCQI:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	8.53
FETCh:RXQuality:HCQI:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	8.50
[:SENSe]:RXQuality:HCQI:TINDex:CTAValue?	0 to 30	query only	8.54
READ[:SCALar]:RXQuality:HCQI?	<Result>	query only	8.53

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
FETCh[:SCALar]:RXQuality:HCQI?	<Result>	query only	8.53
SAMPle[:SCALar]:RXQuality:HCQI?	<Result>	query only	8.53
READ:ARRay:RXQuality:HCQI[:CURRent]?	–100.0 dBm to +60.0 dBm	query only	8.54
FETCh:ARRay:RXQuality:HCQI[:CURRent]?	–100.0 dBm to +60.0 dBm	query only	8.54
SAMPle:ARRay:RXQuality:HCQI[:CURRent]?	–100.0 dBm to +60.0 dBm	query only	8.54
Receiver Quality – HS-DPCCH Logging			
INITiate:RXQuality:HSLog	–	no query	8.54
ABORt:RXQuality:HSLog	–	no query	8.54
STOP:RXQuality:HSLog	–	no query	8.54
CONTinue:RXQuality:HSLog	–	no query	8.54
CONFigure:RXQuality:HSLog:CONTrol:SSFN	1 to 1000000	with query	8.55
CONFigure:RXQuality:HSLog:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	8.54
FETCh:RXQuality:HSLog:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 1000 | NONE	query only	8.55
READ[:SCALar]:RXQuality:HSLog?	<Result>	query only	8.55
FETCh[:SCALar]:RXQuality:HSLog?	<Result>	query only	8.55
SAMPle[:SCALar]:RXQuality:HSLog?	<Result>	query only	8.55

Table 8-4 Remote-control commands: Connection Control (available in Non Signalling)

Command (Connection Control, Non Signalling)	Parameter	Remark	Page
DEFault:HSDPa	ON | OFF	with query	8.37
SOURce:HSDPa:CQIChannel:HARQ?	1 to 8	query only	8.44
SOURce:HSDPa:CQIChannel:RVCSequence:QAM	S6 | S6215 | S6666 | S6045	query only	8.44
SOURce:HSDPa:CQIChannel:RVCSequence:QPSK?	S0 | S0256 | S0000	query only	8.44
SOURce:HSDPa:CQIChannel:TINDex:CTSValue	1 to 30	with query	8.44
SOURce:HSDPa:CQIChannel:TINDex:FIXed	1 to 30	with query	8.43
SOURce:HSDPa:CQIChannel:TINDex:SEQuence	1 to 30, 1 to 30	with query	8.43
SOURce:HSDPa:CQIChannel:TINDex:TYPE	FIXed | SEQuence | FULCqi | CONF	with query	8.43
SOURce:HSDPa:CQIChannel:TTIDistance?	1 to 3	query only	8.44
SOURce:HSDPa:FRCHannel:HSET	S1QP | S1Q | S1M | S2QP | S2Q | S3QP | S3Q | S4QP | S5QP	with query	8.42
SOURce:HSDPa:FRCHannel:RVCSequence?	<Response>	query only	8.43
DEFault:HSDPa:HSDSch	ON | OFF	with query	8.60
SOURce:HSDPa:HSDSch:CFCYcle	C2|C4|C8|C10|C20 |C40|C80 | C160 | OFF	with query	8.42
SOURce:HSDPa:HSDSch:DSOurce	ALL0 | ALL1 | ALT | PR9 | PR11 | PR13 | PR15	with query	8.41
SOURce:HSDPa:HSDSch:FNACk	P10 | P20 | … | P100 | OFF	with query	8.41

Command (Connection Control, Non Signalling)	Parameter	Remark	Page
SOURce:HSDPa:HSDSch:TPYE	FRCHannel | CQIChannel | UDCHannel	with query	8.42
SOURce:HSDPa:HSDSch:UECategory	1 | 2 | 3 | 4 | 5 | 6 | 11 | 12	with query	8.42
SOURce:HSDPa:HSPDsch:CODE	0 to 15	with query	8.41
SOURce:HSDPa:HSPDsch:USUBframes	DDATa | DTX	with query	8.41
SOURce:HSDPa:HSSCch:CODE<nr>	1 to 127	with query	8.38
SOURce:HSDPa:HSSCch:DUMMY:UEID<nr>	#H0 to #HFFFF	with query	8.38
SOURce:HSDPa:HSSCch:NUMBer	1 to 4	with query	8.38
SOURce:HSDPa:HSSCch:NUMBer	1 to 4	with query	8.39
SOURce:HSDPa:HSSCch:SELection	1 to 4	with query	8.39
SOURce:HSDPa:HSSCch:UEID<nr>	#H0 to #HFFFF	with query	8.38
SOURce:HSDPa:HSSCch:USUBframes	TDU | DTX	with query	8.39
SOURce:HSDPa:LEVel:HSPDsch	–35.0 dB to +15 dB | OFF | ON	with query	8.39
SOURce:HSDPa:LEVel:HSSCch<nr>	–35.0 dB to +15 dB | OFF | ON	with query	8.38
SOURce:HSDPa:PHYSical:LEVel	<P-CPICH_rel> | <P-CPICH_abs>, <P-SCH>, <S-SCH>, <P-CCPCH>, <PICH>, <DPCH>, <P-SCH>, <Power Offset>, <SCCH_1>, … , <SCCH_4>, <PDSCH>	with query	8.40
SOURce:HSDPa:SIGNal:ENABle	ON | OFF	with query	8.37
SOURce:HSDPa:SSCode	#H0 to #HF	with query	8.37
CONFigure:HSDPa:UDCHannel:EMSequence:ALL	0 to 7, 0 to 7, …	with query	8.47
CONFigure:HSDPa:UDCHannel:EMSequence<nr>	1 to 8	with query	8.46
CONFigure:HSDPa:UDCHannel:EMSequence<nr>	0 to 7	with query	8.47
SOURce:HSDPa:UDCHannel:HARQ	1 to 8	with query	8.45
SOURce:HSDPa:UDCHannel:IRBuffer	0 to 172800	with query	8.46
SOURce:HSDPa:UDCHannel:MODulation	QPSK | QAM16	with query	8.45
SOURce:HSDPa:UDCHannel:NCODes	1 to 15	with query	8.45
SOURce:HSDPa:UDCHannel:RVCSequence	S0 | S6 | S0256 | S6215 | S0000 | S6666 | S6045 | EMODe	with query	8.46
SOURce:HSDPa:UDCHannel:TBLock:SINDex	0 to 62	with query	8.45
SOURce:HSDPa:UDCHannel:TBLock:SIZE?	0 to 28800	query only	8.45
SOURce:HSDPa:UDCHannel:TTIDistance	1 to 3	with query	8.45

Table 8-5 Remote-control commands: Connection Control (available in Signalling)

Command (Connection Control, Signalling)	Parameter	Remark	Page
CONFigure:BSSignal:HSDPa:PHYSical:LEVel	<P-CPICH_rel> | <P-CPICH_abs>, <P-SCH>, <S-SCH>, <P-CCPCH>, <S-CCPCH>, <PICH>, <AICH>, <DPCH>, <P-SCH>, <Power Offset>, <SCCH_1>, … , <SCCH_4>, <PDSCH>	with query	8.59
CONFigure:BSSignal:HSDPa:SIGNal:ENABle	ON | OFF	with query	8.56
CONFigure:BSSignal:HSDPa:SSCode	#H0 to #HF	with query	8.56
CONFigure:BSSignal:HSDSch:CFCYcle	C2|C4|C8|C10|C20 |C40|C80 C160 | OFF	with query	8.61
CONFigure:BSSignal:HSDSch:CQIChannel:HARQ?	1 to 8	query only	8.63
CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QAM	S6 | S6215 | S6666 | S6045	query only	8.64
CONFigure:BSSignal:HSDSch:CQIChannel:RVCSequence:QPSK?	S0 | S0256 | S0000	query only	8.64
CONFigure:BSSignal:HSDSch:CQIChannel:TINDex:CTSValue	1 to 30	with query	8.63
CONFigure:BSSignal:HSDSch:CQIChannel:TINDex:FIXed	1 to 30	with query	8.63
CONFigure:BSSignal:HSDSch:CQIChannel:TINDex:SEQuence	1 to 30, 1 to 30	with query	8.63
CONFigure:BSSignal:HSDSch:CQIChannel:TINDex:TYPE	FIXed | SEQuence | FULC | CONFqi	with query	8.62
CONFigure:BSSignal:HSDSch:CQIChannel:TTIDistance?	1 to 3	query only	8.63
CONFigure:BSSignal:HSDSch:DSOurce	ALL0 | ALL1 | ALT | PR9 | PR11 | PR13 | PR15	with query	8.61
CONFigure:BSSignal:HSDSch:FNACk	P10 | P20 | … | P100 | OFF	with query	8.61
CONFigure:BSSignal:HSDSch:FRCHannel:HSET	S1QP | S1Q | S1M | S2QP | S2Q | S3QP | S3Q | S4QP | S5QP	with query	8.62
CONFigure:BSSignal:HSDSch:FRCHannel:RVCSequence?	<Response>	query only	8.62
CONFigure:BSSignal:HSDSch:TPYE	FRCHannel | CQIChannel | UDCHannel	with query	8.61
CONFigure:BSSignal:HSDSch:UDCHannel:EMSequence:ALL	0 to 7, 0 to 7, …	with query	8.67
CONFigure:BSSignal:HSDSch:UDCHannel:EMSequence<nr>	1 to 8	with query	8.66
CONFigure:BSSignal:HSDSch:UDCHannel:EMSequence<nr>	0 to 7	with query	8.66
CONFigure:BSSignal:HSDSch:UDCHannel:HARQ	1 to 8	with query	8.64
CONFigure:BSSignal:HSDSch:UDCHannel:IRBuffer?	0 to 172800	query only	8.65
CONFigure:BSSignal:HSDSch:UDCHannel:MODulation	QPSK | QAM16	with query	8.65
CONFigure:BSSignal:HSDSch:UDCHannel:NCODes	1 to 15	with query	8.65
CONFigure:BSSignal:HSDSch:UDCHannel:RVCSequence	S0 | S6 | S0256 | S6215 | S0000 | S6666 | S6045 | EMODe	with query	8.66
CONFigure:BSSignal:HSDSch:UDCHannel:TBLock:SINDex	0 to 62	with query	8.65
CONFigure:BSSignal:HSDSch:UDCHannel:TBLock:SIZE?	0 to 28800	query only	8.65
CONFigure:BSSignal:HSDSch:UDCHannel:TTIDistance	1 to 3	with query	8.64
CONFigure:BSSignal:HSDSch:UECategory	1 | 2 | 3 | 4 | 5 | 6 | 11 | 12	with query	8.61
CONFigure:BSSignal:PHYSical:HSPDsch:CODE	0 to 15	with query	8.60
CONFigure:BSSignal:PHYSical:HSPDsch:MPOFfset	–35.0 dB to +15 dB	with query	8.58

Command (Connection Control, Signalling)	Parameter	Remark	Page
CONFigure:BSSignal:PHYSical:HSPDsch:USUBframes	DDATa | DTX	with query	8.60
CONFigure:BSSignal:PHYSical:HSSCch:CODE<nr>	1 to 127	with query	8.57
CONFigure:BSSignal:PHYSical:HSSCch:DUMMY:UEID<nr>	#H0 to #HFFFF	with query	8.57
CONFigure:BSSignal:PHYSical:HSSCch:NUMBer	1 to 4	with query	8.57
CONFigure:BSSignal:PHYSical:HSSCch:SELection	1 to 4	with query	8.57
CONFigure:BSSignal:PHYSical:HSSCch:UEID	#H0 to #HFFFF	with query	8.57
CONFigure:BSSignal:PHYSical:HSSCch:USUBframes	TDU | DTX	with query	8.58
CONFigure:BSSignal:PHYSical:LEVel:HSPDsch	–35.0 dB to +15 dB | OFF | ON	with query	8.58
CONFigure:BSSignal:PHYSical:LEVel:HSSCch<nr>	–35.0 dB to +15 dB | OFF | ON	with query	8.56

The following tables list the HSDPA commands described in this chapter in alphabetical order.

Table 8-6 Remote-control commands, alphabetical list (Non Signalling)

Command (Non Signalling, alphabetical)	*Page*
ABORt:RXQuality:HACK	*8.26*
CONFigure:RXQuality:HACK:CTHReshold	*8.26*
CONFigure:RXQuality:HACK:EREPorting	*8.26*
CONTinue:RXQuality:HACK	*8.26*
DEFault:HSDPa	*8.17*
FETCh:RXQuality:HACK:STATus?	*8.26*
FETCh[:SCALar]:RXQuality:HACK?	*8.27*
INITiate:RXQuality:HACK	*8.26*
READ[:SCALar]:RXQuality:HACK?	*8.27*
SAMPle[:SCALar]:RXQuality:HACK?	*8.27*
SOURce:HSDPa:CQIChannel:HARQ?	*8.23*
SOURce:HSDPa:CQIChannel:RVCSequence:QAM	*8.24*
SOURce:HSDPa:CQIChannel:RVCSequence:QPSK?	*8.23*
SOURce:HSDPa:CQIChannel:TINDex:CTACqui?	*8.23*
SOURce:HSDPa:CQIChannel:TINDex:CTSValue	*8.23*
SOURce:HSDPa:CQIChannel:TINDex:FIXed	*8.22*
SOURce:HSDPa:CQIChannel:TINDex:SEQuence	*8.22*
SOURce:HSDPa:CQIChannel:TINDex:TYPE	*8.22*
SOURce:HSDPa:CQIChannel:TTIDistance?	*8.23*
SOURce:HSDPa:CQIChannel:UECategory	*8.22*
SOURce:HSDPa:FRCHannel:HSET	*8.21*
SOURce:HSDPa:FRCHannel:RVCSequence?	*8.21*
SOURce:HSDPa:HSDSch:DSOurce	*8.20*
SOURce:HSDPa:HSDSch:FNACk	*8.20*
SOURce:HSDPa:HSDSch:TPYE	*8.21*
SOURce:HSDPa:HSPDsch:CODE	*8.20*
SOURce:HSDPa:HSPDsch:USUBframes	*8.20*
SOURce:HSDPa:HSSCch:CODE<nr>	*8.18*
SOURce:HSDPa:HSSCch:NUMBer	*8.17*
SOURce:HSDPa:HSSCch:UEID<nr>	*8.18*
SOURce:HSDPa:HSSCch:USUBframes	*8.18*
SOURce:HSDPa:LEVel:HSPDsch	*8.18*
SOURce:HSDPa:LEVel:HSSCch<nr>	*8.18*

Command (Non Signalling, alphabetical)	Page
SOURce:HSDPa:PHYSical:LEVel	8.19
SOURce:HSDPa:SIGNal:ENABle	8.17
SOURce:HSDPa:SSCode	8.17
SOURce:HSDPa:UDCHannel:HARQ	8.24
SOURce:HSDPa:UDCHannel:IRBuffer	8.25
SOURce:HSDPa:UDCHannel:MODulation	8.25
SOURce:HSDPa:UDCHannel:NCODes	8.25
SOURce:HSDPa:UDCHannel:RVCSequence	8.25
SOURce:HSDPa:UDCHannel:TBLock:SINDex	8.24
SOURce:HSDPa:UDCHannel:TBLock:SIZE?	8.24
SOURce:HSDPa:UDCHannel:TTIDistance	8.24
STOP:RXQuality:HACK	8.26

Table 8-7 Remote-control commands, alphabetical list (Signalling)

Command (Signalling, alphabetical)	Page
ABORt:RXQuality:HACK	8.48
ABORt:RXQuality:HCQI	8.50
ABORt:RXQuality:HSLog	8.54
CALCulate[:SCALar]:RXQuality:HCQI:MATChing:LIMit?	8.53
CONFigure:HSDPa:UDCHannel:EMSequence:ALL	8.47
CONFigure:HSDPa:UDCHannel:EMSequence<nr>	8.46
CONFigure:HSDPa:UDCHannel:EMSequence<nr>	8.47
CONFigure:RXQuality:CONTrol:CTHReshold	8.48
CONFigure:RXQuality:CONTrol:MHARq	8.48
CONFigure:RXQuality:HACK:CONTrol:MSUBframes	8.49
CONFigure:RXQuality:HACK:EREPorting	8.48
CONFigure:RXQuality:HCQI:CONTrol:MSUBframes	8.51
CONFigure:RXQuality:HCQI:EREPorting	8.50
CONFigure:RXQuality:HCQI:LIMit:BLER	8.51
CONFigure:RXQuality:HCQI:LIMit:DTXRate	8.51
CONFigure:RXQuality:HCQI:LIMit:IRCQi	8.51
CONFigure:RXQuality:HSLog:CONTrol:SSFN	8.55
CONFigure:RXQuality:HSLog:EREPorting	8.54
CONTinue:RXQuality:HACK	8.48
CONTinue:RXQuality:HCQI	8.50
CONTinue:RXQuality:HSLog	8.54
DEFault:HSDPa	8.37
DEFault:HSDPa:HSDSch	8.60
DEFault:RXQuality:HCQI:LIMit	8.52
FETCh:ARRay:RXQuality:HCQI[:CURRent]?	8.54
FETCh:RXQuality:HACK:STATus?	8.49
FETCh:RXQuality:HCQI:STATus?	8.50
FETCh:RXQuality:HSLog:STATus?	8.55
FETCh[:SCALar]:RXQuality:HACK?	8.49
FETCh[:SCALar]:RXQuality:HCQI?	8.53
FETCh[:SCALar]:RXQuality:HSLog?	8.55
INITiate:RXQuality:HACK	8.48
INITiate:RXQuality:HCQI	8.50
INITiate:RXQuality:HSLog	8.54
READ:ARRay:RXQuality:HCQI[:CURRent]?	8.54
READ[:SCALar]:RXQuality:HACK?	8.49
READ[:SCALar]:RXQuality:HCQI?	8.53
READ[:SCALar]:RXQuality:HSLog?	8.55

Command (Signalling, alphabetical)	*Page*
SAMPle:ARRay:RXQuality:HCQI[:CURRent]?	*8.54*
SAMPle[:SCALar]:RXQuality:HACK?	*8.49*
SAMPle[:SCALar]:RXQuality:HCQI?	*8.53*
SAMPle[:SCALar]:RXQuality:HSLog?	*8.55*
[:SENSe]:RXQuality:HCQI:TINDex:CTAValue?	*8.54*
SOURce:HSDPa:CQIChannel:HARQ?	*8.44*
SOURce:HSDPa:CQIChannel:RVCSequence:QAM	*8.44*
SOURce:HSDPa:CQIChannel:RVCSequence:QPSK?	*8.44*
SOURce:HSDPa:CQIChannel:TINDex:CTSValue	*8.44*
SOURce:HSDPa:CQIChannel:TINDex:FIXed	*8.43*
SOURce:HSDPa:CQIChannel:TINDex:SEQuence	*8.43*
SOURce:HSDPa:CQIChannel:TINDex:TYPE	*8.43*
SOURce:HSDPa:CQIChannel:TTIDistance?	*8.44*
SOURce:HSDPa:FRCHannel:HSET	*8.42*
SOURce:HSDPa:FRCHannel:RVCSequence?	*8.43*
SOURce:HSDPa:HSDSch:CFCYcle	*8.42*
SOURce:HSDPa:HSDSch:DSOurce	*8.41*
SOURce:HSDPa:HSDSch:FNACk	*8.41*
SOURce:HSDPa:HSDSch:TPYE	*8.42*
SOURce:HSDPa:HSDSch:UECategory	*8.42*
SOURce:HSDPa:HSPDsch:CODE	*8.41*
SOURce:HSDPa:HSPDsch:USUBframes	*8.41*
SOURce:HSDPa:HSSCch:CODE<nr>	*8.38*
SOURce:HSDPa:HSSCch:DUMMY:UEID<nr>	*8.38*
SOURce:HSDPa:HSSCch:NUMBer	*8.38*
SOURce:HSDPa:HSSCch:NUMBer	*8.39*
SOURce:HSDPa:HSSCch:SELection	*8.39*
SOURce:HSDPa:HSSCch:UEID<nr>	*8.38*
SOURce:HSDPa:HSSCch:USUBframes	*8.39*
SOURce:HSDPa:LEVel:HSPDsch	*8.39*
SOURce:HSDPa:LEVel:HSSCch<nr>	*8.38*
SOURce:HSDPa:PHYSical:LEVel	*8.40*
SOURce:HSDPa:SIGNal:ENABle	*8.37*
SOURce:HSDPa:SSCode	*8.37*
SOURce:HSDPa:UDCHannel:HARQ	*8.45*
SOURce:HSDPa:UDCHannel:IRBuffer	*8.46*
SOURce:HSDPa:UDCHannel:MODulation	*8.45*
SOURce:HSDPa:UDCHannel:NCODes	*8.45*
SOURce:HSDPa:UDCHannel:RVCSequence	*8.46*
SOURce:HSDPa:UDCHannel:TBLock:SINDex	*8.45*
SOURce:HSDPa:UDCHannel:TBLock:SIZE?	*8.45*
SOURce:HSDPa:UDCHannel:TTIDistance	*8.45*
STOP:RXQuality:HACK	*8.48*
STOP:RXQuality:HCQI	*8.50*
STOP:RXQuality:HSLog	*8.54*

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9 WCDMA Application Testing

WCDMA Application Testing (option R&S CMU-K92) 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. 9.9 ff.) 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-K92, 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 or K67…K69, V3.80 or higher
- Option R&S CMU-K96

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. 9.1 ff.
- 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. 9.4 ff.

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:

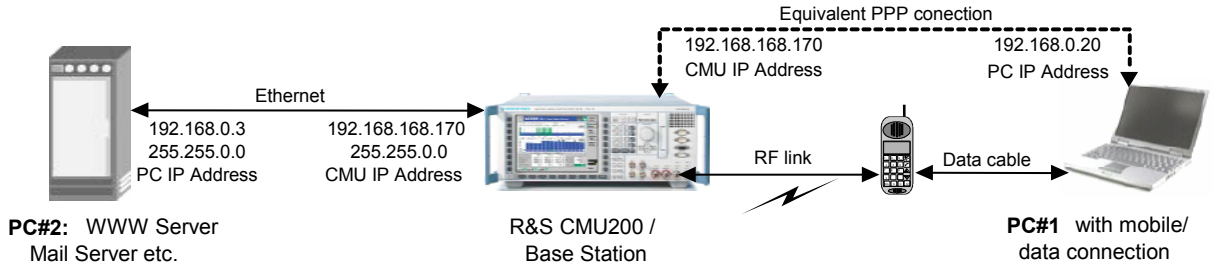


Fig. 9-1 Test setup for data application testing

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. 9.6).
- Transfer data from and to the internal server using FTP (see p. 9.6).

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. 9.8).
- 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 ff.) 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.

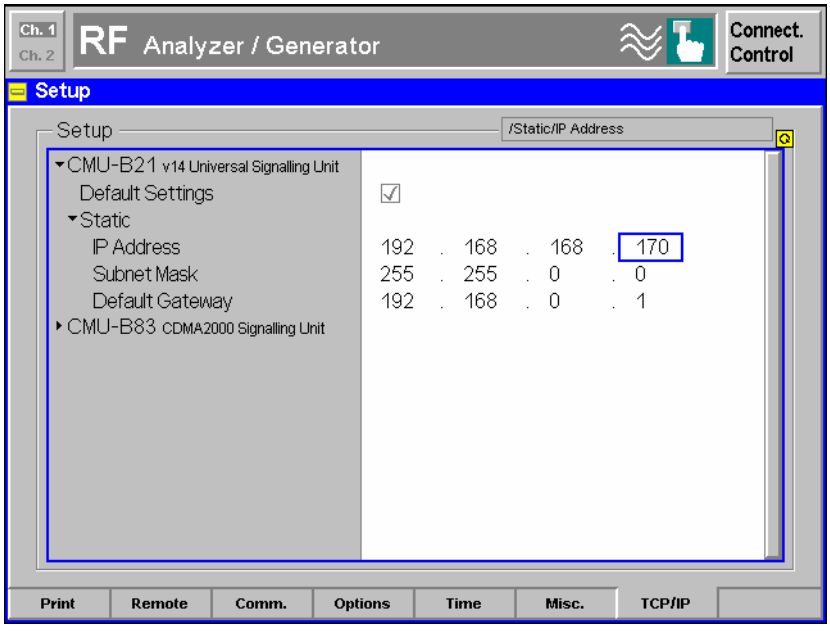


Fig. 9-2 IP address settings for the R&S CMU

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. 9.6 ff.). 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):

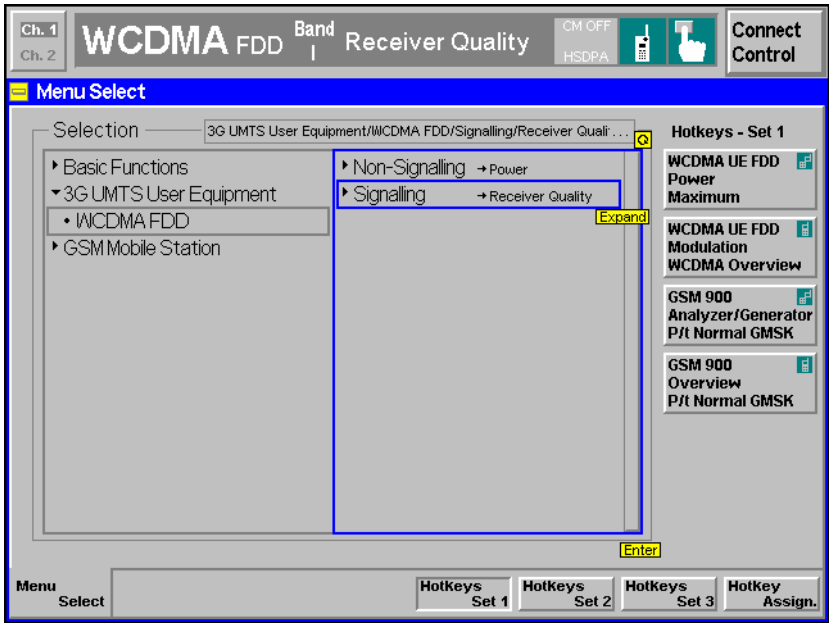
```
CONFigure:ATESt:VIPaddress <IP1>, <IP2>, <IP3>, <IP4>
```

R&S CMU Configuration for WCDMA Application Tests

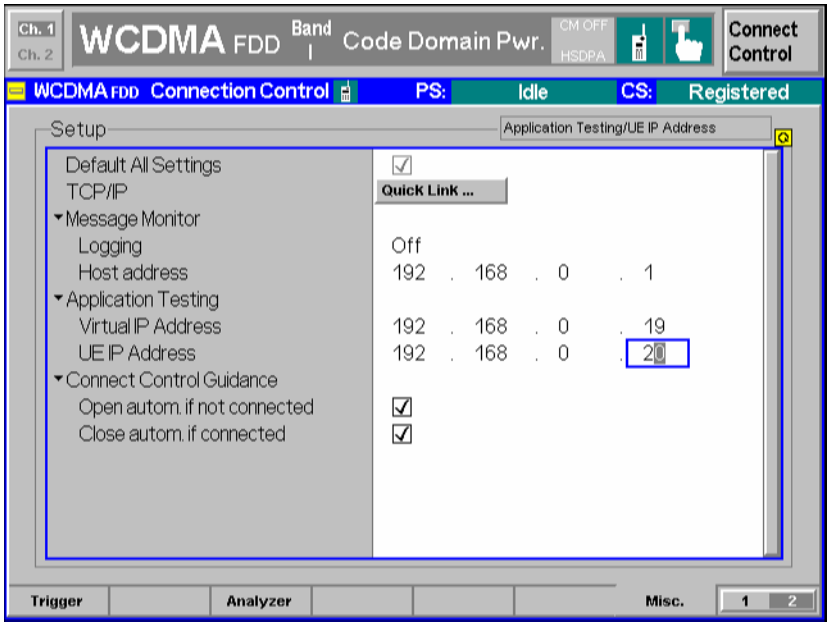
The R&S CMU provides a special packet switched connection scheme for WCDMA application tests (see section *Packet Data Connections* in Chapter 4). A packet switched connection can be established using the *Connection Control* menu after the WCDMA *Signalling* function group is loaded.

To configure the R&S CMU for WCDMA application tests…

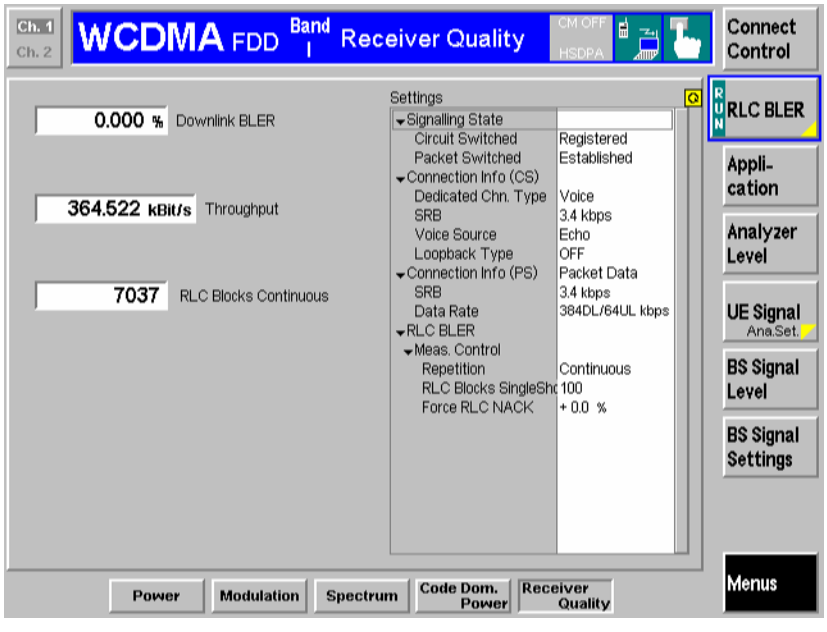
1. Start up the R&S CMU. In the *Menu Select* menu, select *WCDMA FDD* and the *Signalling* mode. Press *Enter* to access the *WCDMA FDD Signalling* measurements and automatically open the *Connection Control* menu.



2. 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.
3. 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.
4. 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. 9.3).



5. 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.
6. 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*.



7. 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.

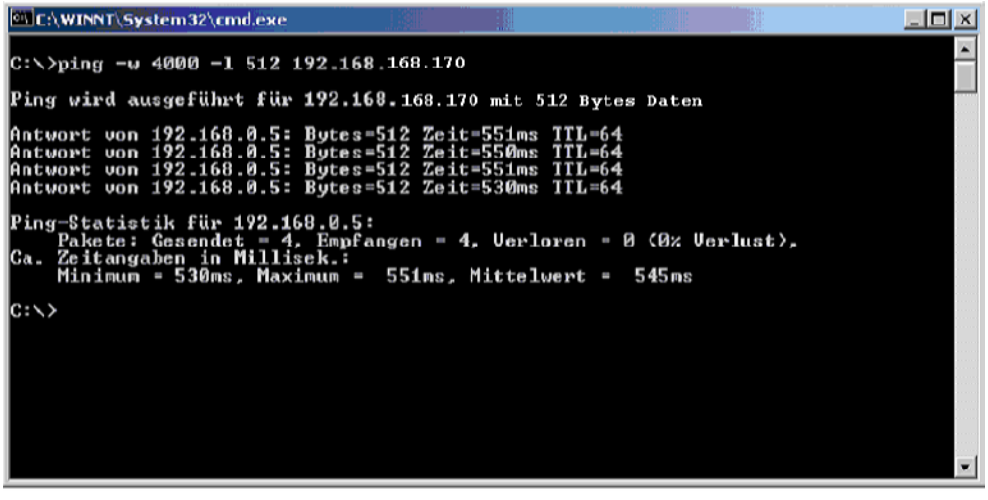
Command Line

➢ 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.

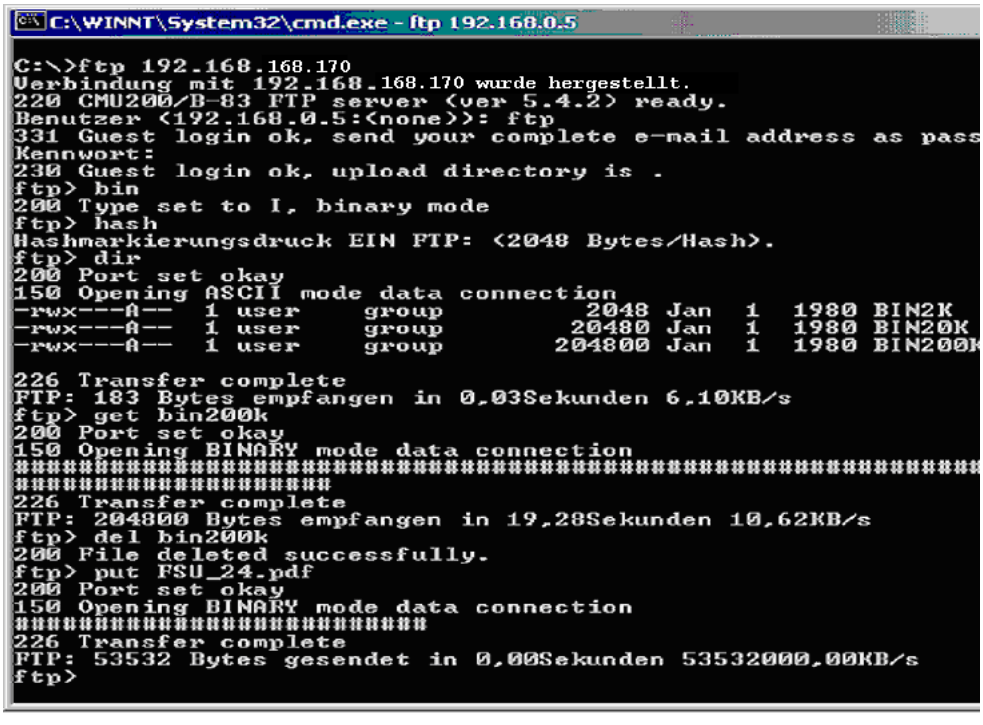
Command Line

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

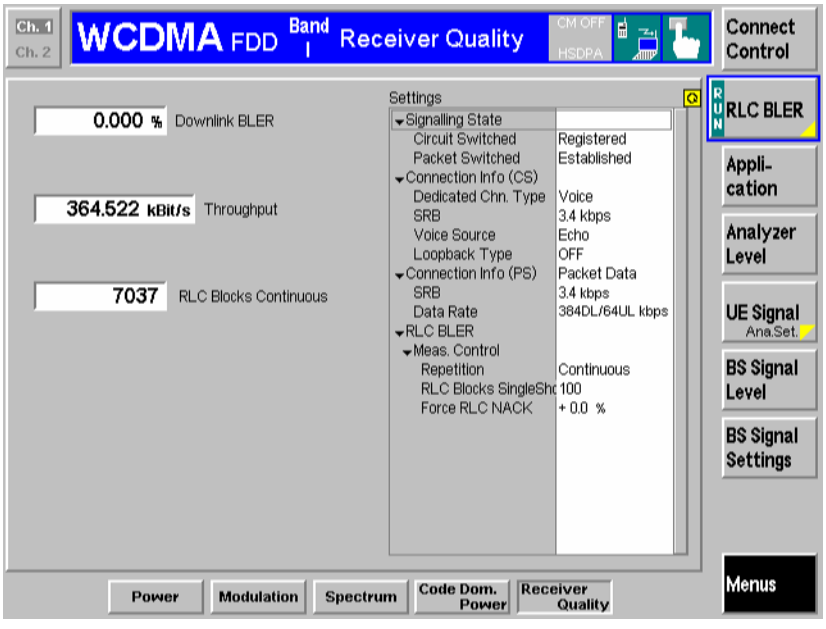


Data Traffic

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 data throughput and the downlink Block Error Rate for a configurable number of RLC blocks sent to the UE. Part of the blocks can be sent with an incorrect CRC in order to aim at a definite BLER.

- 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 acknowledge mode so that the R&S CMU can count the RLC blocks that the UE received correctly.

- To establish a packet data connection, select *Connection Control – Network – Packet Switch Domain: On* and initiate a packet data connection from your UE.

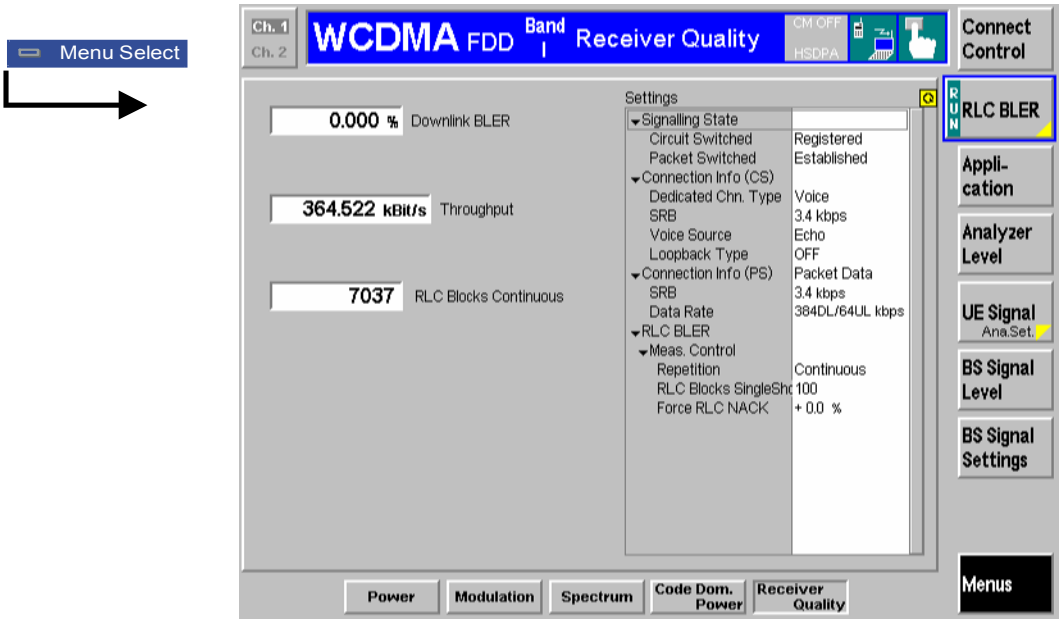


Fig. 9-3 RLC BLER menu

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 number of blocks defined via *RLC Blocks*.

Remote control
`CONFigure:RXQuality:RLCBler:CONTrol:REPetition`

RLC Blocks

Specifies the number of RLC blocks that the R&S CMU transmits and evaluates per single shot measurement. If a *Single Shot* measurement is active *(Repetition: Single Slot)*, the number of *RLC Blocks* is displayed below the *RLC Blocks Single Shot* progress bar in the measurement menu.

Remote control
`CONFigure:RXQuality:RLCBler:CONTrol:RLCBlocks`

Force RLC NACK

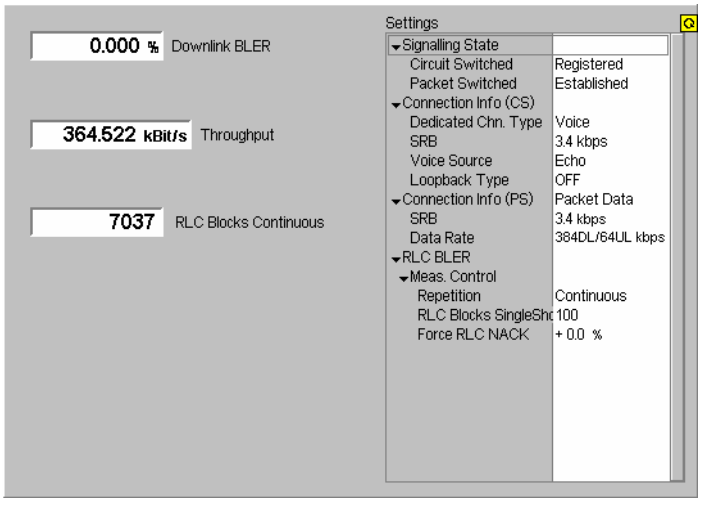
Percentage of RLC blocks that are sent with an incorrect CRC and should cause a *NACK* in the UL. These RLC blocks should also contribute to the RLC BLER: Under perfect conditions the measured *Downlink BLER* is expected to be equal to the *Force RLC NACK* value.

Due to the variable number of unacknowledged blocks in the moving evaluation time interval the BLER result for perfect reception can slightly vary around the *Force RLC NACK* value.

Remote control
`CONFigure:RXQuality:RLCBler:CONTrol:FNACk`

RLC BLER Measurement Results

The tables in the *RLC BLER* menu display the measurement results and the measurement settings.



The *Settings* table in the right half shows the properties of the current connection and the *RLC BLER* test settings. The output table in the left half shows the results described below. No limit check is performed for any of the results.

Downlink 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 rounded as

described below for the *Throughput*.

Throughput

Useful data rate of the current connection in kbps, calculated from the size of a block (RLC size) times the number of acknowledged blocks per unit of time:

- For *Single Shot* measurements the data rate is averaged over the entire measurement duration.
- For *Continuous* measurements the data rate is averaged over a moving time interval of 240 ms (only the blocks acknowledged in the last 240 ms contribute to the throughput).

RLC blocks that the UE received in error do not contribute to the 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.

The data rate for the packet data connection can be selected in the BS Signal *tab of the* Connection Control *menu.*
Via Remote control:
`CONFigure:BSSignal:PDATa:DRATe PD64 | PD64_384`

RLC Blocks Continuous

Number of RLC blocks per single shot as defined via *RLC Blocks* and progress of the measurement within the single shot.

RLC Blocks Single Shot

Total number of RLC blocks sent since the measurement was started *(ON/OFF)* or continued *(CONT/HLT)*.

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.

CONFigure:RXQuality:RLCBler: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	–	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:RXQuality:RLCBler:CONTrol:RLCBlocks ***<Number>***				RLC Blocks
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 50000	Number of RLC blocks per single shot	100	(blocks)	V3.80

Description of command

This command specifies the number of RLC blocks that the R&S CMU transmits per single shot measurement.

CONFigure:RXQuality:RLCBler:CONTrol:FNACk ***<Percent>***				Force RLC NACK
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
0.0% to 100.0%	Force RLC 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.

Measured Values – Subsystem RXQuality:RLCBler...?

The subsystem *RXQuality:RLCBler...?* returns the results of the measurement.

				Measurement results
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.
Downlink BLER, **Throughput**	0 to 1 0 to <max. throughput of packet data channel>	NAN NAN	– kbps	V3.80
Description of command				
These commands are always queries. They start a `RXQuality:RLCBler` measurement (`READ...`) and/or return the measurement results.				

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.

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