ROHDE&SCHWARZ

Test and Measurement
Division

Operating Manual

Software Options:

GSM400/GT800/850/900/1800/1900-BTS for CMU-B21

R&S®CMU-K30/-K31/-K32/-K33/-K34/-K36

1115.4004.02/1115.4104.02/1115.4204.02/
1115.4304.02/1115.4404.02/1150.4207.02

Including the following software extensions:

AMR (Adaptive Multi Rate) Testing (R&S® CMU-K37)
1150.4307.02

Uplink Signalling Channels (R&S® CMU-K38)
1150.3400.02

MOC/MTC (R&S® CMU-K39)
1115.4791.02

8PSK Software Extension for CMU-K3x (R&S® CMU-K41)
1115.4604.02

Printed in Germany

Dear Customer,

throughout this manual, CMU-K30 to CMU-K41 is generally used as an abbreviation for the software options R&S® CMU-K30 to R&S® CMU-K41. The Universal Radio Communication Tester R&S® CMU 300 is abbreviated as CMU300.

Tabbed Divider Overview

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 CMU-K30 … K41
(Software Options for GSM Base Station Tests)

The present operating manual describes the application of CMU for GSM base station tests. It gives comprehensive information about the installation of the required software options and about manual and remote control of the instrument. For introduction, some typical measurement tasks are explained in detail using the functions of the graphical user interface.

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 GSM base station tests 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 GSM base station tests.
Chapter 6	Lists all remote control commands for GSM base station tests. 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 10	Contains an index for the operating manual.

What's new in this Revision...

This operating manual describes version V3.82 of the GSMxxx-BTS software options. Compared to the previous firmware version V3.65, this firmware provides the extensions listed below.

New Features	Description	Refer to...
I/Q Analyzer	Graphical analysis of the I/Q amplitudes of the measured 8PSK-modulated signal	Chapter 4, GSM Module Tests (Non Signalling) → Modulation Measurements
Demodulated Bits	Display of the demodulated bits of the measured 8PSK-modulated signal	Chapter 4, GSM Module Tests (Non Signalling) → Modulation Measurements

Frequently Used Abbreviations

Abs.	*Absolute*
AF	*Audio Frequency*
AGC	*Automatic Gain Control*
Att.	*Attenuation*
BCC	*BTS Color Code*
BCCH	*Broadcast Control Channel*
BER	*Bit Error Rate*
BLER	*Block Error Rate*
BS	*Base (Transceiver) Station*
BSIC	*Base Transceiver Station Identity Code*
BTS	*Base Transceiver Station*
CC	*Call Control*
CCH	*Control Channel*
Ch./Chan.	*Channel*
Chan.	*Channel*
Config.	*Configuration*
CRC	*Cyclic Redundancy Check*
CS	*Coding Scheme*
DBLER	*Data Block Error Rate*
Disp.	*Display*
DUT	*Device Under Test*
EFS	*Enhanced Full Rate Speech*
Err.	*Error*
Err. Vect. Magn.	*Error Vector Magnitude*
EVM	*Error Vector Magnitude*
Ext.	*Extended*
Ext. Att.	*External Attenuation*
FAC	*Final Assembly Code*
FER	*Frame Erasure Rate*
FS	*Full Rate Speech*
GMSK	*Gaussian Minimum Shift Keying*
GSM	*Global System for Mobile Communication, Groupe Spécial Mobile*
HS	*Half Rate Speech*
IF	*Intermediate Frequency*
IMEI	*International Mobile Station Equipment Identity*
Loc. Area	*Location Area (Code)*
Loc. Update	*Location Update*
Magn.	*Magnitude*
Max.	*Maximum (Level etc.)*
MCC	*Mobile Country Code*
ME	*Magnitude Error*
Meas.	*Measurement*

MM	*Mobility Management*
MNC	*Mobile Network Code*
MOC	*Mobile Originated Call*
MS	*Mobile Station*
MTC	*Mobile Terminated Call*
NB	*Normal Burst*
NCC	*PLMN Color Code*
Norm.	*Normal (burst)*
Ovw.	*Overview*
P/t	*Power versus time*
PE	*Phase Error*
Ph.	*Phase*
PIN	*Personal Identification Number*
PLMN	*Public Land Mobile Network*
Pop.	*Popup (menu)*
PRBS	*Pseudo Random Bit Sequence*
PSK	*Phase Shift Keying*
PSR	*Pseudo Random (Sequence)*
RACH	*Random Access Channel*
Ref.	*Reference*
Rel.	*Relative*
RF	*Radio Frequency*
RMS	*Root Mean Square (averaging)*
RR	*Radio Resources*
RX	*Receiver*
SACCH	*Slow Associated Control Channel*
SCH	*Synchronization Channel*
SIM	*Subscriber Identity Module*
SNR	*Serial Number*
Srch.	*(BER) Search (mode)*
SVN	*Software Version Number*
Sync./Synch.	*Synchronization*
TAC	*Type Approval Code*
TCH	*Traffic Channel*
TDMA	*Time Division Multiple Access*
Trg.	*Trigger*
TS	*Timeslot*
TSC	*Training Sequence (Code)*
TX	*Transmitter*
Vect.	*Vector*

Contents

1 Installation and First Steps

This chapter describes the installation and update of software options *GSM400/GT800/850/900/1800/1900-BTS* for the Universal Radio Communication Tester CMU300.

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 CMU manual. The hardware and software options available are shown in the *Startup* menu. The status of the software options required for GSM base station tests is indicated in the lines "CMU-K30 GSM400-BTS", "CMU-K31 GSM900-BTS", "CMU-K32 GSM1800-BTS", "CMU-K33 GSM1900-BTS", "CMU-K34 GSM850-BTS", and "CMU-K36 GSM GT800-BTS". The status of the additional options described in this manual is indicated in the lines "CMU-K37 AMR @ GSM-BTS", "CMU-K38 UL Sig. Channels @ GSM-BTS", "CMU-K39 MOC/MTC @ GSM-BTS" and "CMU-K41 8PSK (EDGE) @ GSM-BTS":

- If a version number is indicated, the CMU is ready to use the software option. 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 *Enabling Software Options* on p. 1.6.
- If *not installed* is indicated, the software must be installed via the PCMCIA interface or the floppy disk drive, see below.

Software Installation or Update

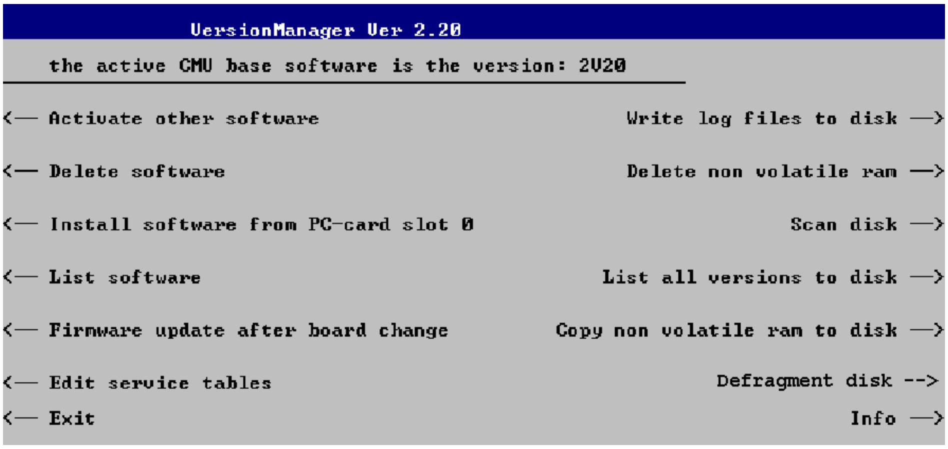
The CMU is always delivered with the latest software version available. New CMU software versions are available for download on the R&S Lotus Notes Service board. To be loaded via the PCMCIA interface, the software must be copied to one or several flash disks/memory cards or PCMCIA hard disks. An appropriate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

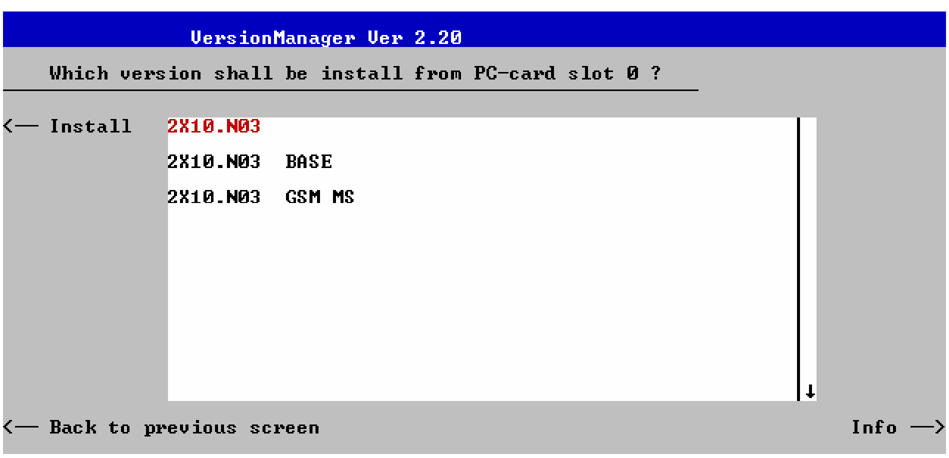
The installation is started automatically while the CMU performs its start-up procedure. To this end the *VersionManager* is called up (for a detailed description of the *VersionManager* refer to chapter 1 of the CMU operating manual or to the on-line help accessible via *Info):*



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.*

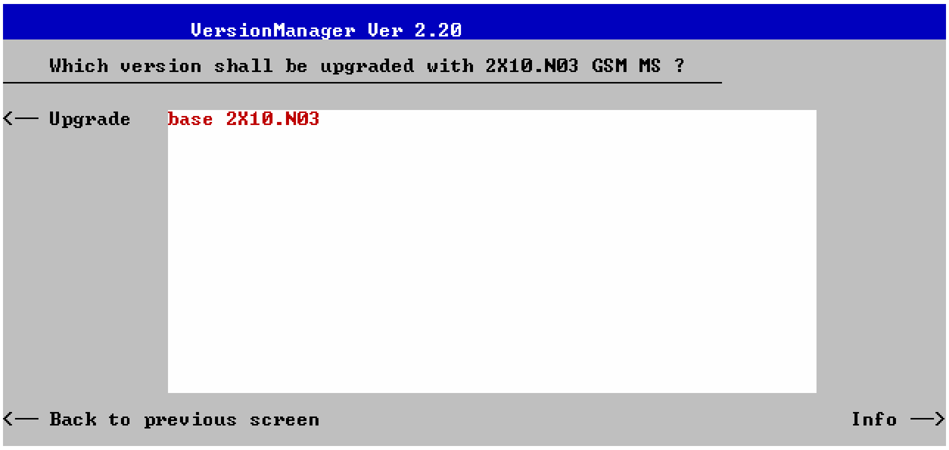
- Press left softkey no. 5 *(Install software...)* to start the installation.

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 *GSM-BTS* software version you intend to install.
- Press *Install* to start the installation.

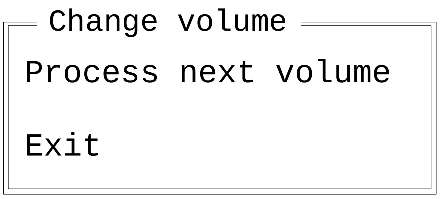
The installation is started. To be operable on your instrument, a network option must be combined with a compatible version of the CMU base software. Any base software version installed on the CMU hard disk can be combined with one or several network options to form an independent software configuration. If none of the configurations is compatible to the new *GSM-BTS* 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 *GSM-BTS* software.

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

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

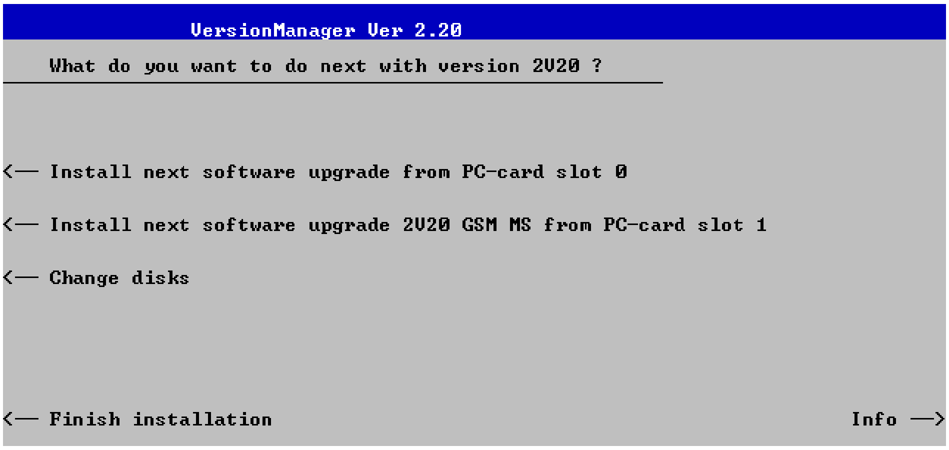


➢ Replace the current disk with the disk requested.

➢ 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*.

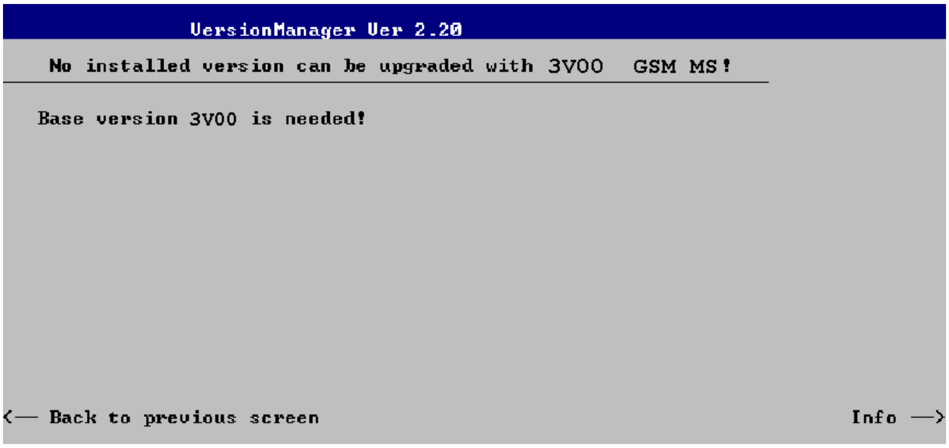
➢ To finish the installation, remove all disks from the drive and press *Finish installation*.

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.

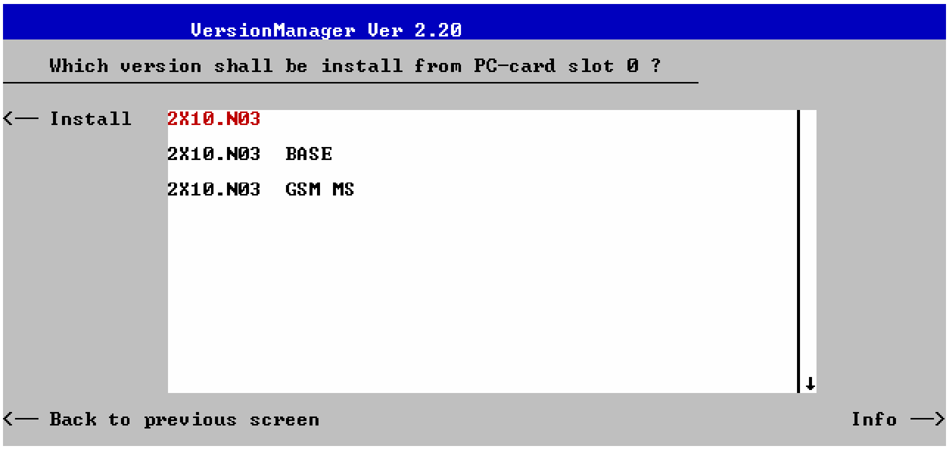
Creating a new Software Configuration

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 *GSM-BTS* software option selected in the software selection dialog (see previous section). Instead, it displays the following error message:



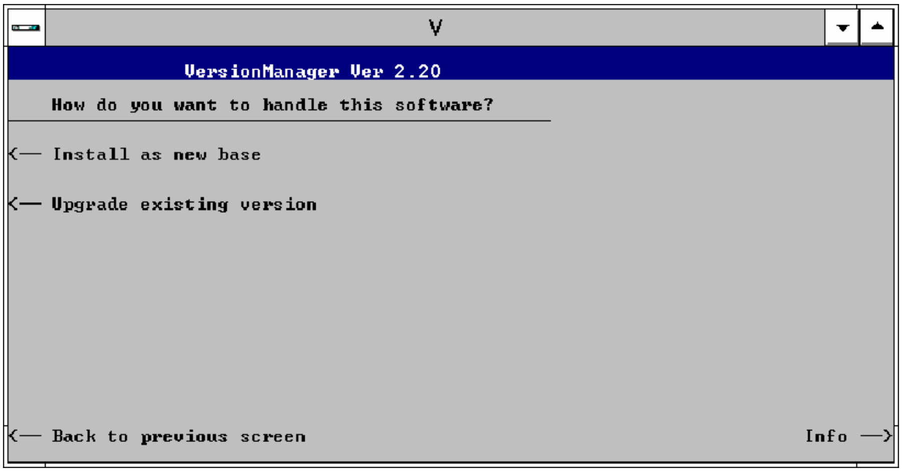
➢ Press *Back to installation* to return to the software version selection dialog.



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

Note: *In general the* GSM-BTS *firmware version number and the base software version number must be in the same range, i.e. they may differ in the last digit only. The VersionManager checks and detects all compatible versions.*

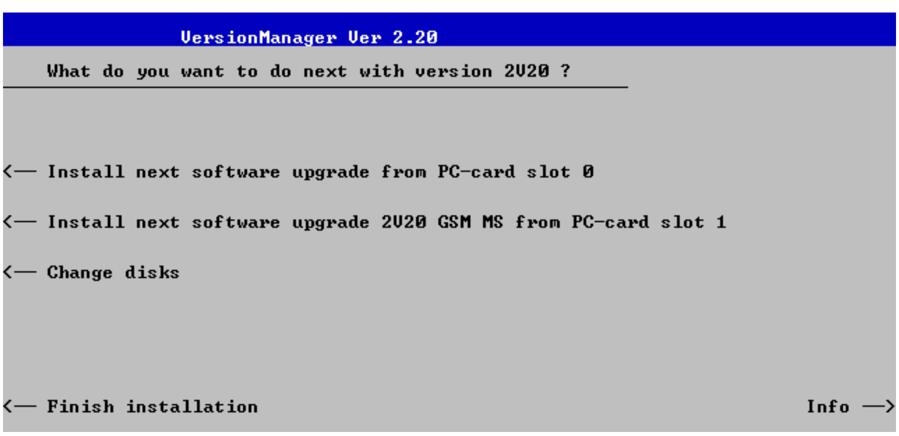
With a new base software version, it is possible to either update an existing configuration or create a new one. A dialog selecting between the two alternatives is opened:



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 *GSM-BTS* 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. 1.1 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. 1.1 ff. to install the new *GSM-BTS* 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 CMU200/300 operating manual.

Note: *The software options* GSM400/GT800/850/900/1800/1900-BTS *and the supplementary options* MOC/MTC for GSM-BTS (R&S CMU-K39), 8PSK (EDGE) for GSM-BTS (R&S CMU-K41), Uplink Signalling Channels (R&S CMU-K38), AMR Testing for GSM-BTS (R&S CMU-K37) *are part of a single software package termed* GSM BTS*, so they must be installed or updated together. However, they must be enabled and operated separately. Software installation and enabling of software options are completely independent from each other.*

Contents

2 Getting Started

The following chapter presents a sample GSM base station test with the universal radio communication tester CMU. It is intended to provide a quick overview of the function groups *GSM400/GT800/850/900/1800/1900-BTS Non Signalling* and *GSM400/GT800/850/900/1800/1900-BTS Signalling* and to lead through some basic tests that are commonly performed on GSM base stations.

Test that require additional software options, in particular transmitter tests of 8PSK-modulated signals (with option CMU-K41, EDGE for CMU-K30/-K31/-K32/-K33) and setup of a call connection from the CMU or the BTS under test (with option CMU-K39, MOC/MTC) are not described in this chapter. Nevertheless, they are described in detail in the reference parts of this manual; see chapters 4 and 6.

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. For installation instructions for the GSM400/GT800/850/900/1800/1900 software (CMU-K30/-K31/-K32/-K33) refer to chapter 1 of the present manual.

The tests reported below include:

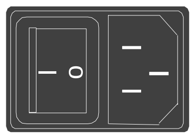
- Connection of the phone and selection of the GSM function group
- Power and modulation measurements in *Non Signalling* mode
- Selection and measurement of signalling parameters
- Receiver Quality tests

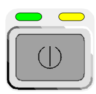
The steps to perform are explained on the left side of each double-page together with the results obtained on the CMU screen. On the right side, additional information is given. We also point out alternative settings and related measurements that could not be reported in detail.

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

Preparing a GSM Base Station Test

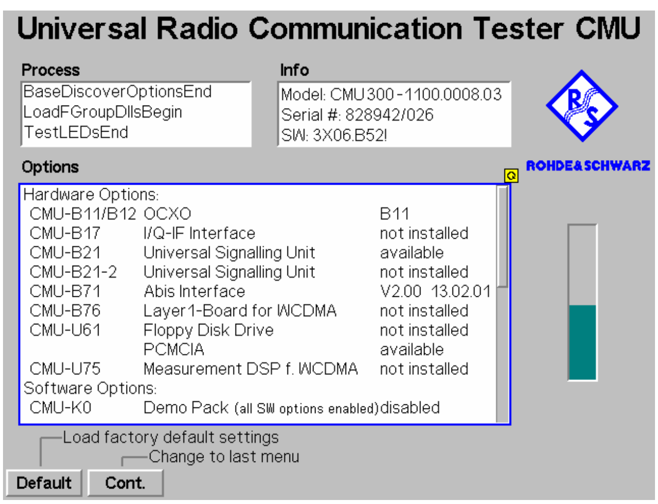
This chapter describes how to use the CMU for GSM base station tests. As a prerequisite for starting the session, the instrument must be correctly set up and connected to the AC power supply as described in chapter 1 of the operating manual for the CMU basic unit. Furthermore, the GSM software must be properly installed following the instructions given in chapter 1 of the present manual.





Step 1

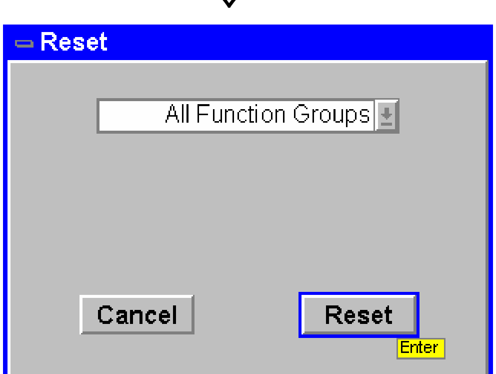
- ➢ Switch on the CMU using the mains switch at the rear. ①
- ➢ Check the operating mode of the instrument at the *ON/STANDBY* key on the front panel.② Press the *ON/STANDBY* key to switch on the CMU.



Step 2

The startup menu is displayed while the CMU performs a power-up test. ③

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



Step 3

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

The *Reset* popup menu is opened.

- ➢ Use the left and right arrow keys to toggle between the two buttons *Cancel* and *Reset*.
- ➢ Select *Reset* and press the *ENTER* key.
- ➢ In the popup window opened *(Are you sure?)*, select *Yes* to confirm the instrument reset.

The CMU indicates that it performs a general reset of all device settings and is then ready to carry out the following steps. The *Reset* popup menu is closed automatically.

Additional Information...

Alternative Settings and Measurements

... on Step 1

① **Mains switch on the rear panel**

☞ Chapter 1 of CMU manual

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

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

☞ Chapter 1 of CMU manual

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 orange LED (STANDBY) is illuminated.

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

... on Step 2

③ **Startup menu (see p. 2.2)**

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)*

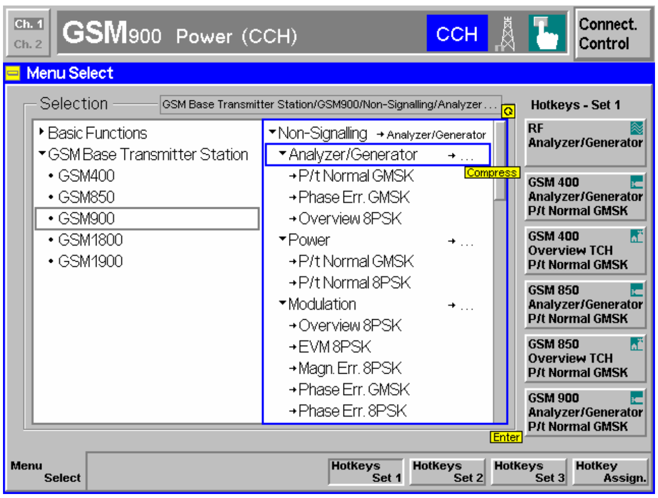
The progress of the startup test (*Startup* bar graph)

☞ Chapter 4 of CMU manual

That chapter also contains information on customizing the CMU.

Step 4

➢ Press the *Menu Select* key to open the *Menu Select* menu. ④



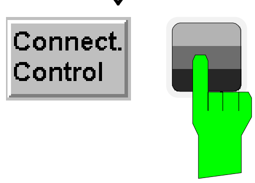
The *Menu Select* menu indicates the function groups available. If a function group is selected the corresponding modes and measurement menus are indicated.

➢ Select the appropriate *GSMxxx-BTS* function group, xxx corresponding to the GSM hyperband supported by the base station under test.

➢ Select the *Non-Signalling* mode

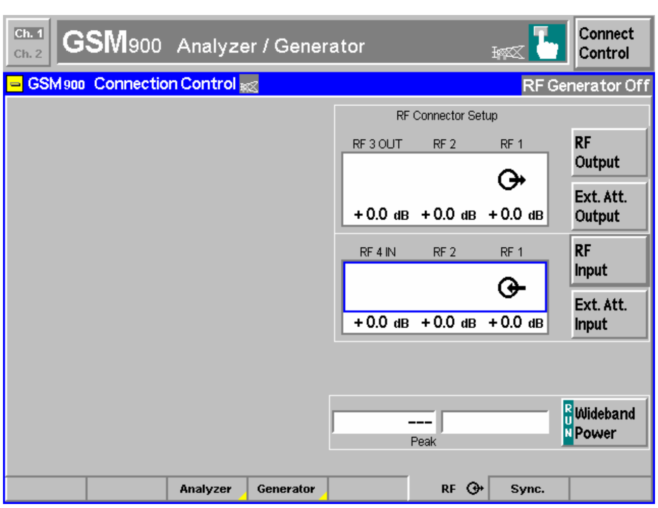
➢ Select the *Analyzer/Generator* menu.

➢ Press the *Enter* key to activate the measurement selected and open the *Analyzer/Generator* menu.



Step 5

➢ Press the *Connect. Control* softkey.



The *RF Connection Control* menu is opened. ⑤

➢ Press the *RF* hotkey to open the index card defining the signal connectors and external attenuation values.

➢ Select RF1 as output connector and as input connector. Do not define any external attenuation (all values equal to 0.0 dB).

Two yellow LEDs on the front panel indicate the input and output connectors selected.

Additional Information...

Alternative Settings and Measurements

... on Step 4

④ **Menu Select menu**

The *Menu Select* menu shows all function groups installed on your CMU. Function group *GSM400/GT800/850/900/1800/1900-BTS* is subdivided in the two measurement modes *Non Signalling* and *Signalling*, each containing a number of measurement menus.

☞ Chapter 3

☞ Chapter 4

Frequently used measurement menus can be stored together with their function group and mode and assigned to one of the eight hotkeys. When needed for the next time, they can be called up by a single keystroke.

... on Step 5

⑤ **RF connection of the base station**

The *RF Connection Control* menu configures the input and output connectors in the *GSM900-BTS Non Signalling* function group. The CMU provides two bi-directional RF connectors RF1 and RF2 differing by their permissible input and output levels. RF1 is adapted to the RF output level range of a GSM base station; it is the recommended standard connector for GSM-BTS tests (see data sheet).

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 GSM base stations off the air via antennas.

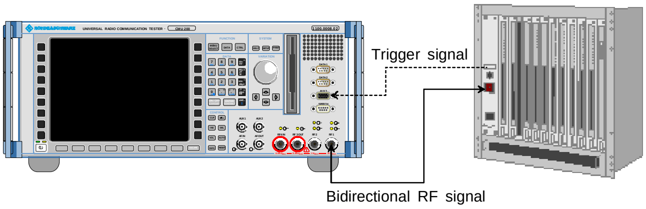
The choice of the RF inputs and outputs may also depend on the connectors of your base station.

☞ Chapter 4

Input and output connectors can be selected in the *RF* tab of the *Connect. Control* menu; see section *RF Connectors* on page 4.70 ff.

The same tab lets you report external attenuation factors for the RF inputs and outputs of the CMU. This feature can be used to compensate for a known cable loss between the CMU and the BTS under test.

⇓



Step 6

- Connect the bi-directional RF connector RF 1 of the CMU to the RF input/output of the base station. ⑥
- Provide an external trigger signal (TTL) at pin no. 6 of connector AUX 3 of the CMU (for wired synchronization only, see section *Synchronization and Signalling Parameters* on p. 2.16 ff). ⑦
- Supply the base station with the correct operating voltage and switch on.

The CMU is now ready to perform module tests on the base station (see section *Non Signalling Mode* on p. 2.8 ff). To perform synchronized measurements on the CCH or TCH from the base station, the *Menu Select* menu must be called up again to select the *Signalling* mode (see section *Signalling Mode* on p. 2.16 ff).

Additional Information...

... on Step 6

⑥ **RF connection of the base station**

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

⑦ **External trigger**

In *Signalling* measurements, the CMU is time-synchronized with the base station under test; see section *Synchronization and Signalling Parameters* on page 2.16. The time reference can be provided either by the control channel signal from the BTS fed in via the current RF connector (CCH synchronization) or by an external trigger signal with a TCH multiframe structure that is applied to pin no. 6 of the AUX 3 connector (wired synchronization, multiframe trigger).

For unsynchronized operation *(Non Signalling Mode*, see p. 2.8) or CCH synchronization, only the RF connection between the CMU and the BTS under test is needed.

Alternative Settings and Measurements

☞ Chapter 4

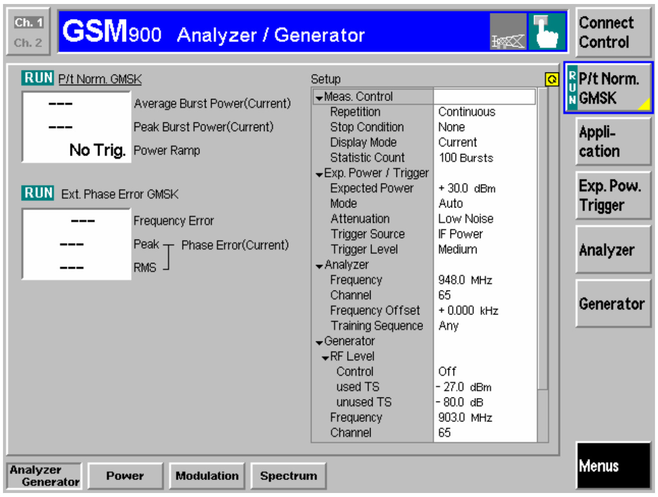
☞ Chapter 4

See section *Signalling Control (State Unsynchronized)* on p. 4.80 ff.

Non Signalling Mode

In the *Non Signalling* mode, a GSM-specific RF signal can be generated and a RF signal with GSM characteristics can be analyzed. Compared to the *Signalling* mode test times may be reduced considerably. Moreover, the measurements are not restricted to the specified channel range of the network. The most common application is module test and test of base stations in a special “test mode”.

In our example we use the GSM signal generated by the CMU itself to demonstrate the main features of the *Non Signalling* mode. This is analogous to the *RF* measurement example in the operating manual for CMU but illustrates the extended functionality of the GSM function groups.



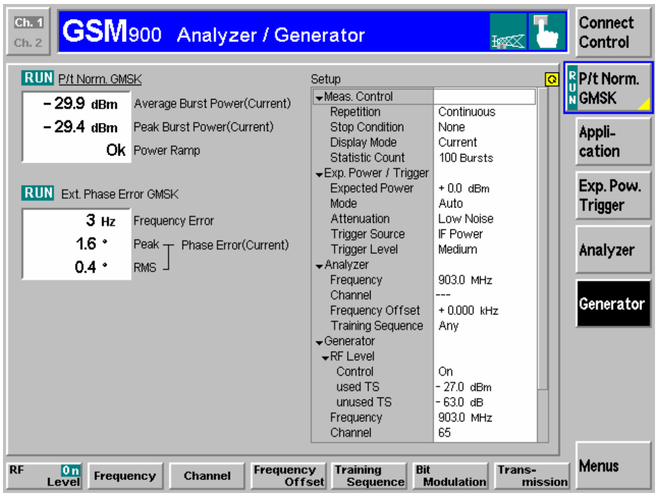
Step 1

The *Analyzer/Generator* menu displays the current measurement results for power, frequency and phase errors of the received signal are displayed. At present, there is no RF input signal so the output fields show invalid results ("---"). ①

In addition, the menu provides softkeys to configure the signals generated by the RF *Generator* of the CMU and sets the RF *Analyzer*. ②

All parameters are set to default values. They can be changed by means of the softkey/hotkey combinations or in the *Connection Control* menu. User-defined parameters will be saved to the non-volatile RAM for later sessions when the CMU is switched off.

⇓



⇓

- Proceed as outlined in section *RF Non Signalling Measurements*, chapter 2 of the CMU operating manual to connect RF3 to RF 4 using a coax cable. Open the *Connection Control* menu and perform the appropriate RF input and output settings.
- Select the *Generator* tab of the *Connection Control* menu, select the *Generator* softkey and press the *ON/OFF* key to switch on the generator.
- Select the *Analyzer* tab of the *Connection Control* menu and adapt the *RF Channel* frequency to the default generator frequency.

By default, the *Expected Power* is set to *Auto*, the CMU adapts itself to the power of the RF input signal. ③

- Close the *Connection Control* menu to observe the result in the *Analyzer/Generator* menu.

Additional Information...

Alternative Settings and Measurements

... on Step 1

② **Measurement and Generator State**

The state of the *Power* and *Modulation* measurements and of the RF generator is indicated above the output fields for the results; the generator state is shown in the *Setup* table. For ongoing measurements, the results in the output fields are constantly updated. All measured quantities refer to the current burst.

For various reasons, an output field may fail to show a valid measurement result (indication "---"):

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 above the output fields).

The current options for the measurement status are *ON* (default) and *OFF*. A third state, *HLT*, occurs after a single-shot measurement is terminated (see below).

Once selected, the *Power* or *Modulation* measurement can be switched off and on again by means of the toggle key *ON/OFF*.

Generators may also be switched on (state *ON)* and off (state *OFF)* by means of the *ON/OFF* key.

① **Analyzer/Generator menu**

☞ Chapter 4, p. 4.2 ff.

The *Analyzer/Generator* menu contains softkeys to

- Define the RF input path configuration and the trigger settings *(Exp. Pow. Trigger)*
- Set the CMU RF analyzer *(Analyzer)*, i.e. determine the RF input signal that can be measured
- Control the RF generator *(Generator)* and define the parameters of the RF output signal generated including its bit content

The settings of the three softkeys are also accessible in the *Analyzer* and *Generator* tabs of the *Connection Control* menu.

The assignment between carrier frequency and channel number is according to GSM specifications. As the CMU simulates a mobile station, the generator signal corresponds to the uplink (signal direction from the mobile station towards the base station); the signal analyzed corresponds to the downlink (signal direction from the base station towards the mobile station). The channel/frequency assignment changes accordingly.

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 generated and analyzed.

In general, the RF generator level is set to be different for the used timeslot and unused timeslots. The level of the unused timeslots is defined relative to the level in the used timeslot.

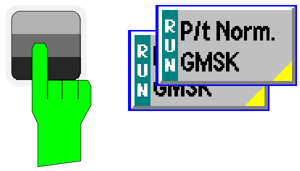
Selecting a definite training sequence (TSC) or bit modulation or transmission mode in the *Generator Modulation* panel implies that signals with these characteristics are generated.

Selecting a definite TSC in the *Analyzer Settings* panel implies that only signals with this TSC are analyzed.

③ **Expected Power**

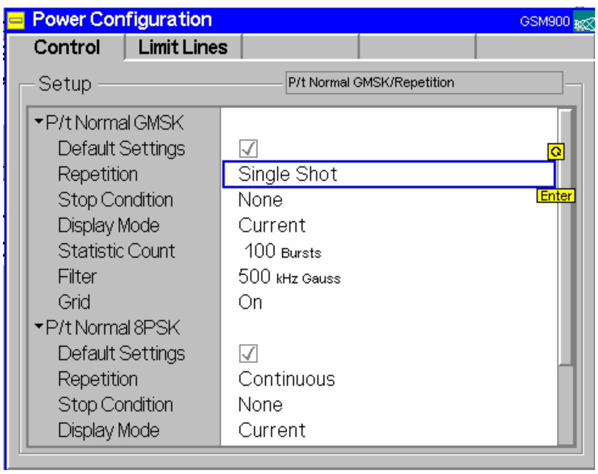
☞ Chapter 4, p. 4.61 ff.

The *Expected Power* parameter is used to adjust the RF input path to the expected power of the measured signal. This is done automatically or by entering a definite maximum input power. The permissible range of *Expected Power* depends on the RF connector and the external attenuation used.



Step 2

➢ Press the *Power GMSK* softkey twice to call up the *Power Configuration* menu.



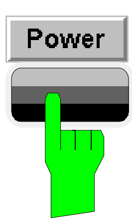
The *Power Configuration* menu defines the scope of the *Power* measurement. The settings offered in this menu are discussed in section *General Settings* in chapter 3. We pick just one example, limiting the number of bursts measured.①

➢ Press the *ON/OFF* key or the rotary knob to expand the table.

➢ Select *Single Shot* in the *Repetition* line.②

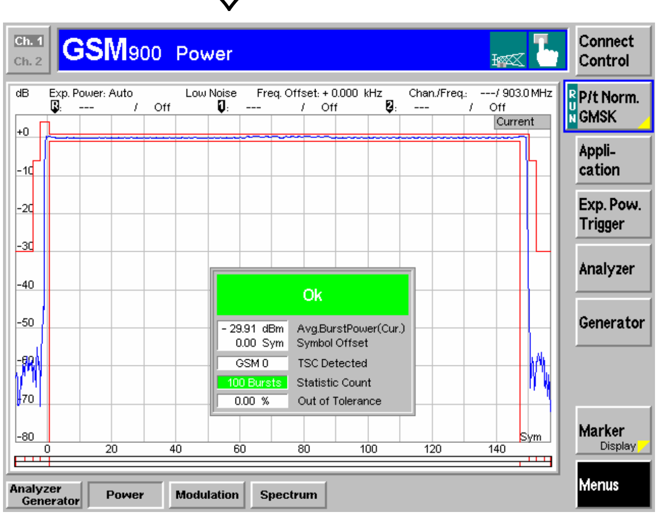
➢ Press the *ESCAPE* key or the *Power* softkey again to close the *Power Configuration* menu and return to the main menu.

The *Power* measurement is stopped after one statistic count. The status indication next to the *Power GMSK* softkey is set to *HLT*.③



Step 3

➢ Press the *Power* hotkey to switch over to the graphical menu *Power*.



The *Power* menu shows the power of the current burst as a function of time. ④

(If no measurement curve is displayed, select the *P/t Norm. GMSK* softkey and press *CONT/HALT* to initiate another single shot *Power* measurement.)

Together with the burst power, a tolerance template as specified in the GSM standard is displayed. Settings (at present, the default settings) and scalar results are displayed in two parameter lines above the diagram and in a message box positioned in the center of the diagram.

Various tools allowing to take a closer look at the measurement results are provided in the graphical measurement menu.

Additional Information...

Alternative Settings and Measurements

... on Step 2

① **Power Configuration menu**

The *Power Configuration* menu contains two tabs to define

The repetition mode, stop condition, display mode and statistic count *(Control)*

The tolerance template for the burst *(Limit Lines)*

☞ 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 and mode *GSMxxx-BTS Non Signalling*.

② **Repetition mode and Stop Condition**

If no stop condition is imposed *(Stop Condition = None),* the *Repetition* mode determines whether the measurement is

Continued until explicitly stopped by the operator *(Continuous)* or...

Stopped after one statistic count *(Single Shot)*

By default, a statistic count comprises 100 bursts. With *Stop Condition = On Limit Failure*, the measurement is stopped after the first burst which is out of tolerance.

☞ Chapter 3.

The *statistic count* is defined in the *Control* tab of the *Power Configuration* menu.

The stop condition *On Limit Failure* should be selected if the limit check represents the main purpose of the measurement.

The limits can be modified in the *Limit Lines* tab of the *Power Configuration* menu.

③ **Measurement in the HLT state**

In the *Analyzer/Generator* menu, the average and peak power of the last burst measured is indicated in the output fields *Average Burst Power* and *Peak Burst Power*.

In contrast, the modulation measurement is still running. The results for the frequency and phase errors are periodically updated.

☞ CMU manual

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

... on Step 3

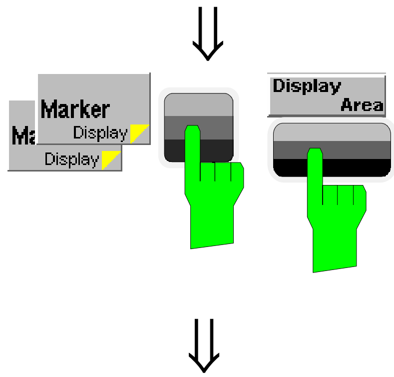
④ **Power menu**

The diagram in the *Power* menu shows a normal burst with a length of 148 bits (plus a guard period of 8.25 bits). The default tolerance template for the power ramp plotted with red lines is defined in the GSM specifications. The time scale of the diagram ranges from –10 bits to 156¾ bits covering the useful part, the rising and falling edges of the burst. The ordinate ranges from –80 dB to +10 dB, the 0-dB reference level is equal to the carrier power.

Note that settings made previously (*Power Configuration* menu) are preserved in the whole measurement group. Accordingly, the status of the measurement is still *HLT.* The diagram is fixed showing the last burst measured.

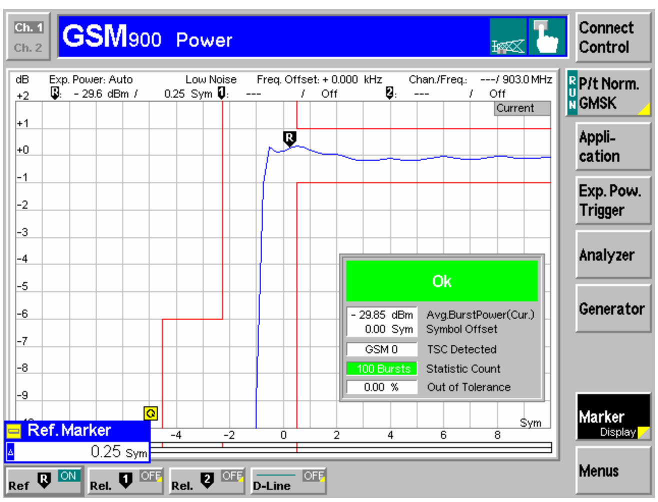
☞ Chapter 4, p. 4.8 ff.

The GSM power template is generally defined relative to the carrier power. For low signal powers, a looser absolute limit is to be applied at the beginning and the end of the power ramp (areas 1, 2, 7, and 8). This yields the distorted template that we observe in the present example.



Step 4

- Press the *Marker/Display* softkey twice to change the hotkeys displayed below the diagram.① The softkey changes to *Display/Marker.*
- Press the *Display Area* hotkey to open a window offering a list of different zoom areas.

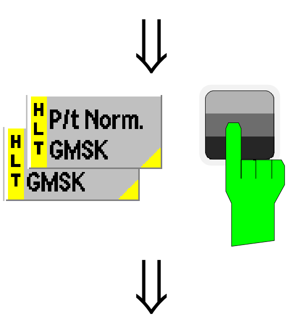


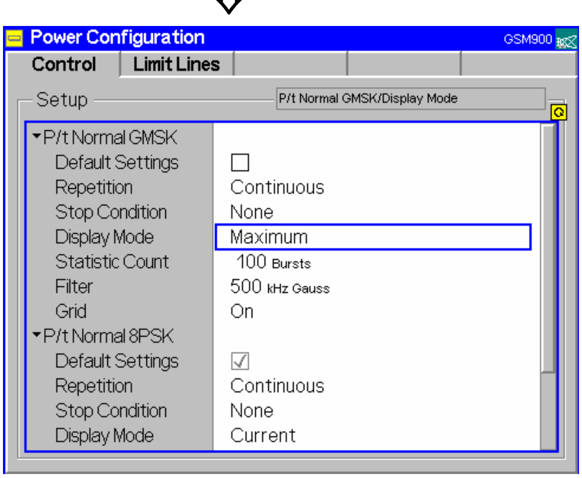
If you select *Left Upper Corner* the CMU zooms in on the left upper corner of the burst.

- Press the *Display/Marker* softkey again to toggle back to *Marker/Display* and press the *Ref R* hotkey. Enter an abscissa value (in symbols) to position a reference marker onto the trace.②

The coordinates (time and burst power) of the reference marker are displayed in the second parameter line.

For the next step we'll take advantage of the fact that the configuration menu is accessible from the graphical menu as well.





Step 5

- Press the *Power/t Norm. GMSK* softkey twice to reopen the *Power Configuration* menu.
- Select the Control tab.
- Select *Continuous* from the *Repetition* field to restart the measurement.
- From the *Display Mode* field, select *Maximum.*③
- Press *ESCAPE* or the *P/t Norm. GMSK* softkey again to close the configuration menu.

Instead of the current burst power, the diagram shows the maximum burst power measured at each time. As no stop condition is set, the measurement will be running until it is explicitly terminated.

Additional Information...

Alternative Settings and Measurements

... on Step 4

① **Softkeys and hotkeys**

To enlarge the diagram area of the graphical measurement menus the left softkey column is suppressed. 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 are also accessible via configuration menus. For example, the *Exp. Pow. Trigger* settings are 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 and test mode.

☞ Chapter 4, p. 4.9 ff.

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

The *Analyzer* softkey defines the frequency and channel of the measured signal.

The *Exp. Pow. Trigger* softkey controls the level in the RF input signal path and the trigger settings.

The *Marker/Display* softkey sets markers and scales the axes of the diagram.

② **Markers**

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

The reference marker measures the absolute level of the trace, the delta markers and measure the absolute level or (if set to relative) the distance between their position and the reference marker.

The *Marker* softkey sets markers and D-lines and determines the display area.

☞ Chapter 4, p. 4.9 ff.

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

... on Step 5

③ **Display mode**

If the measurement extends over several bursts the CMU calculates four different traces one of which can be selected in the *Display Mode* field. The purpose of the four traces is to give an overview of the range and arithmetic mean of the levels detected at any point on the time axis.

☞ Chapter 3.

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

☞ Chapter 4, p. 4.18 ff.

Out-of-tolerance power measurements

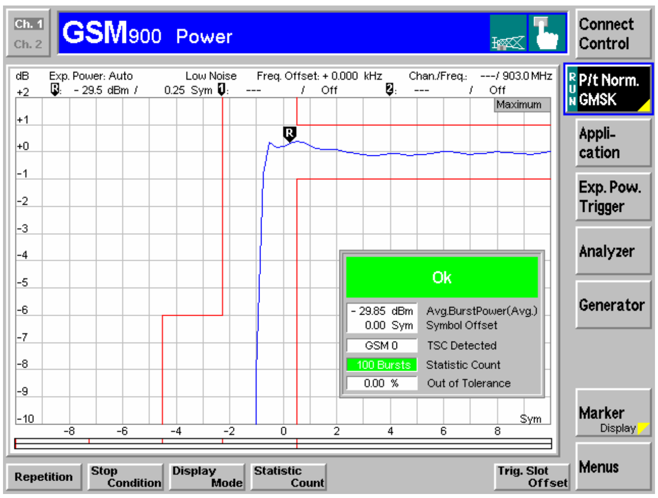
If a power measurement is out of tolerance, please ensure that the attenuation of any cables and/or antenna couplers used is being taken into account by the CMU. As many GSM power levels must be within ±2 dB of the nominal value given in the specifications, even a small attenuation can result in an out-of-tolerance measurement.

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

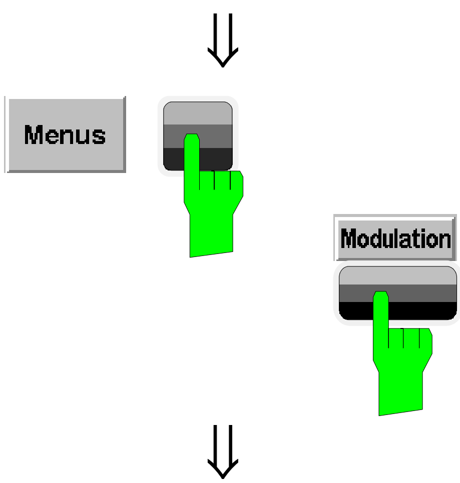
The cables, RF connections and antenna couplers must also be in good condition for satisfactory measurements. Dirty or broken RF connections can cause problems at the high frequencies used by GSM networks.

Step 6

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



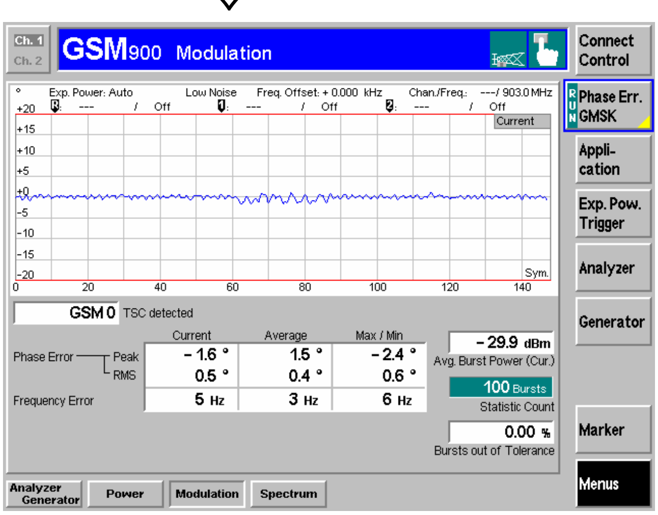
The trace is now continuously measured and updated in the display. With the display mode *Maximum,* which is indicated in the upper right corner of the diagram, trace values will be replaced only if a current measured value at a particular test point exceeds all values measured before at the same test point.



Step 7

➢ Press the *Menus* softkey to display the measurement groups available in the hotkey bar.

➢ Press the *Modulation* hotkey to open the *Modulation* menu.



The *Modulation* menu displays the results of the phase and frequency error measurement.①

The trace represents the phase error of the current burst as a function of time.②

Below, a table displays the extreme value of the phase error and the RMS phase error, and the frequency error. ③

The detected training sequence *(TSC)*, average power of the current burst and the statistic count are shown in addition.

Additional Information...

... on Step 7

① **Phase and frequency errors**

GSM specifies different modulation schemes; the basic scheme is GMSK modulation. The bits to be transmitted translate into the phase information of the RF signal. It is important that the modulation scheme is adhered to as strictly as possible. GSM specifies a peak phase error of max. 20°, a RMS-weighted phase error of max. 5° and a frequency error of max. 0.05 ppm of the transmit frequency.

The limits may be modified in the *Limits* tab of the *Modulation Configuration* menu, which is opened by pressing the selected *Ext. Phase Err. GMSK* softkey once again. The *Modulation Configuration* menu is analogous to the *Power Configuration* menu explained on the previous pages. According to the requirements of the measurements the two configuration menus differ in two points:

Phase errors are relevant within the useful part of the burst. The specified limits are symmetric with respect to the 0 deg line and valid over the whole burst. It is not necessary to discriminate between different areas (see item ② below).

The absolute value of the phase error is a measure of the quality of modulation, whereas the sign is of secondary interest. This is why the display modes *Minimum* and *Maximum* can not be selected separately, the CMU displays the extreme values instead (display mode *Minimum/Maximum*).

② **Measurement curve**

The diagram in the *Modulation* menu shows the useful part of a normal burst with a length of 148 bits, The time scale of the diagram, ranging from 0 bits to 146¾ bits, is thus shorter than in the *Power vs. Time* diagram. The ordinate is symmetric around 0 , ranging from –20 dB to +20 dB.

③ **Statistical quantities**

The table below the phase error diagram gives an overview of the phase error averaged over the current burst *(Phase Error RMS),* the extreme value of the current phase error *(Phase Error Peak)*, the current frequency error, and the statistical distribution of these three quantities. The values in the three columns are calculated as follows:

The *Current* column contains the frequency error, RMS-averaged phase error and peak (Max./Min.) phase error for the current burst.

The *Average* column contains the three quantities averaged over the last statistics cycle.

The *Maximum* column contains the extreme values of the three quantities within all bursts measured.

Alternative Settings and Measurements

☞ Chapter 4, p. 4.26 ff.

The measurement principle for phase and frequency errors is explained at the beginning of section *Measurement Menu (Modulation – GMSK).*

For configuration settings see section *Measurement Configurations (Modulation Configuration).*

As a second modulation scheme, the CMU supports 8PSK-modulated traffic channels (the so-called EDGE channels). For this measurement, option CMU-K41 is required.

☞ Chapter 4, p. 4.28 ff.

☞ Chapter 3.

This chapter gives a comprehensive description of measurement control and of the definition of statistical quantities.

☞ Chapter 4, p. 4.28 ff.

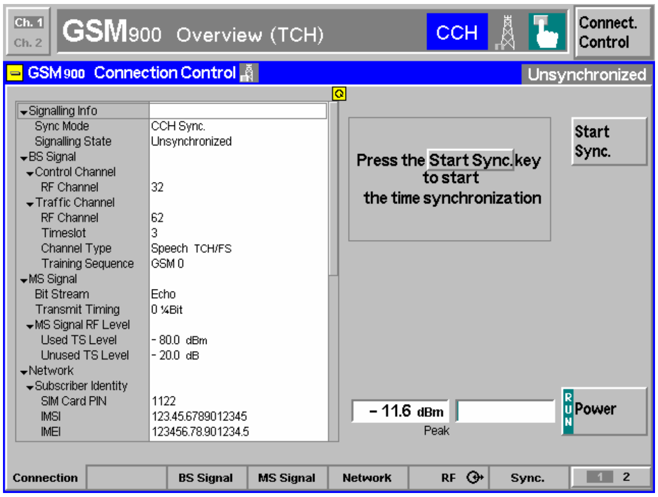
As a last measurement group in *Non Signalling* mode, the *Spectrum* measurement assesses the off-channel power due to the modulation and due to switching.

Signalling Mode

In the *Signalling* mode, the CMU receives a control channel signal from the base station to which it can synchronize. From the synchronized state (CCH Test), the CMU can initiate a location update and a call can be initiated from either the base station or the CMU (option CMU-K39 required). Measurements can be performed in the *Synchronized* state on both the CCH (control channel) and the TCH (traffic channel) and in the *Call Established* state (TCH). As an alternative to the BTS control channel, an external trigger signal can be used for synchronization.

Synchronization and Signalling Parameters

The signalling processes and configurations are controlled via the *Connection Control* popup menu. The first of several *Connection* tabs contained in the *Connection Control* popup menu is automatically displayed when the *Signalling* test mode is selected (see *Menu Select* menu on page 2.4; for the following examples, *GSM900-MS Signalling Meas*. with the *Receiver Quality* menu was selected).



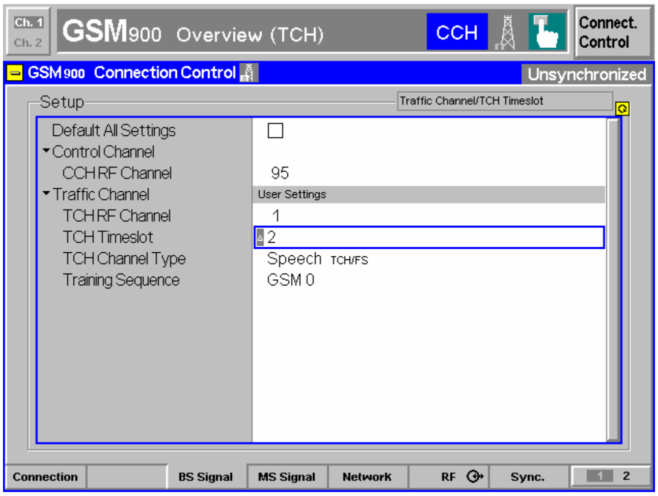
Step 1

The *Connection (Unsynchronized)* tab indicates the RF signals of the base station and initiates synchronization between the CMU and the base station.①

In addition it indicates the parameters of the TCH signal provided by the CMU and the RF connectors used. ②

Below the parameter list the *Power* softkey shows the current status of the wide-band peak power measurement, the current result *(Peak* output field*)* and its ratio to the maximum input power set in the *Connection Control* menu (analog bar). ③

⇓



- ➢ Before starting synchronization, restore the test setup described in section *Preparing a GSM Base Station Test* on p. 2.2 ff. In particular, make sure that your base station is connected to RF 1 and that RF 1 is selected as RF input/output connector.
- ➢ Select the *BS Signal* tab and adjust the *CCH RF Chan* (control channel number of the BTS), the *TCH RF Chan* (traffic channel number of the BTS), the *TCH Timeslot*, and the *TCH Ch. Type* settings to the RF output signal of the base station under test.

Additional Information...

... on Step 1

① Synchronization modes

In *Signalling* measurements, the CMU is time-synchronized with the base station under test. The time reference can be provided in different ways:

In the default mode *No Loc. Update CCH (fix)* the CMU uses the timing information transferred on the BTS control channel that is fed in via the current RF connector. After successful synchronization the CMU reaches the *CCH Test* state. The *TCH Test* state can be reached in a subsequent step.

In the *Wired Sync. (Ext. Trigger)* mode the timing information is provided by an external TTL trigger signal with a TCH multiframe structure that is applied to pin no. 6 of the AUX 3 connector (multiframe trigger, see also description of the test setup on p. 2.2). After successful synchronization the CMU reaches the *TCH Test* state. The CCH from the BTS is idle so no *CCH Test* can be performed.

② MS and BS Signals

In the *Unsynchronized* state, both the RF signal generated by the CMU (MS Signal) and by the BTS (BS Signal) can be defined:

The *MS Signal* tab configures the TCH signal transmitted from the CMU to the BTS under test, i.e. the data transmitted or retransmitted to the BTS, the timing and the levels in the used and unused timeslots. These parameters are indicated in the *MS Signal* table section of the *Signalling (Unsynchronized)* tab.

The *BS Signal* tab configures the signal transmitted from the BTS under test to the CMU, i.e. the CCH and TCH channel number, the data transmitted to the CMU on the TCH, the used timeslot and the training sequence. All these parameters are also available for editing in the *Signalling (Unsynchronized)* tab.

③ Wide-band power

The *Power* softkey has no configuration menu assigned but can be used like any other softkey controlling a measurement. In particular, it is used to switch over between the measurement states *RUN* and *OFF* (softkey selection plus *ON/OFF* key) and *RUN/HLT* (softkey selection plus *CONT/HALT* key).

Alternative Settings and Measurements

☞ Chapter 4, p. 4.80 ff.

With option CMU-K39 *(MOC/MTC),* it is possible to test the essential signalling issues and simulate the circumstances in a real GSM network. Starting from the *CCH Test* state, the CMU can initiate a location update and a call connection can be attempted from either the CMU (mobile originated call, MOC) or the base station (mobile terminated call, MTC). A large variety of network parameters are provided to configure the properties of the CMU acting as a mobile station.

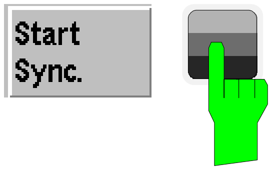
☞ Chapter 4, p. 4.80 ff.

See also description of the BS Signal tab on p. 4.130 and on the MS Signal tab on p. 4.133 ff.

All signal parameters except the CCH channel number can be set in the *TCH Test* and *CCH Test* states as well.

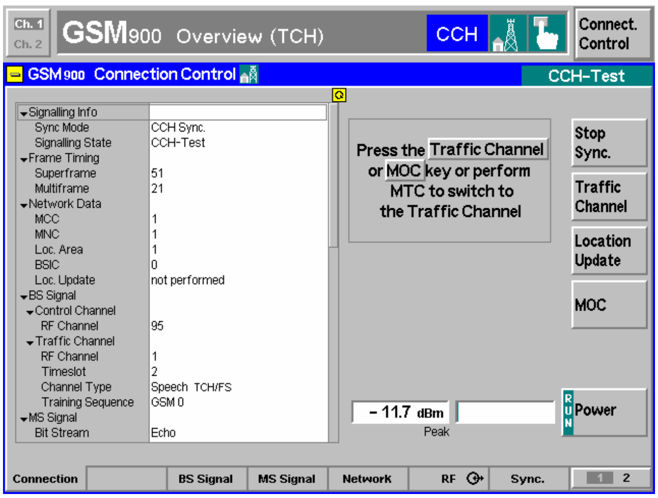
☞ Chapter 4, p. **Error! Reference source not found.**.

See also the diagrams on measurement control in chapter 5 of the CMU manual



Step 2

➢ Return to the *Connection* tab and press the *Start Sync.* softkey.

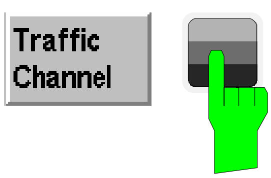


The *Signalling (Synchronizing)* tab with the header message *Searching for a control channel on RF channel...* is displayed. When the CMU has synchronized to the BS signal, the *Signalling (CCH Test)* tab is displayed. ④

The *Signalling (CCH Test)* still indicates the parameters of the BS TCH signal. Besides, it shows a list of signalling parameters *(Signalling Info).*⑤

In the CCH states, all transmitter tests *(Power, Modulation, and Spectrum)* can be performed.

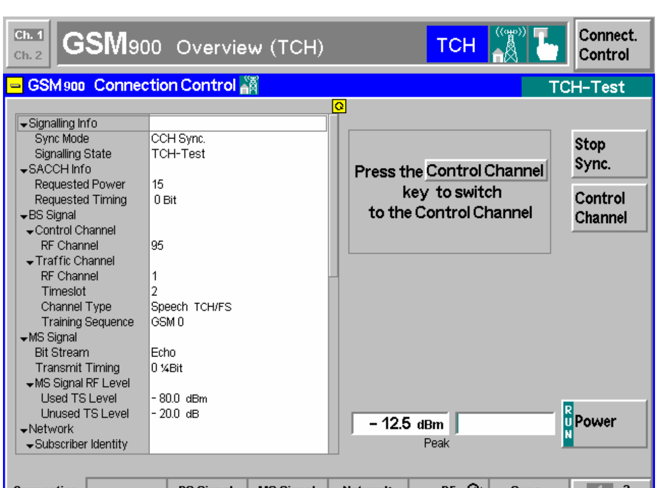
⇓



Step 3

➢ Press the *Traffic Channel* softkey.

⇓



In addition to the parameters indicated in the *CCH Test* tab the *Signalling (TCH Test)* tab shows signalling parameters that are transferred by the base station over the SACCH associated to the allocated traffic channel *(Signalling Info).*⑥

In the *TCH Test* state, all transmitter tests *(Power, Modulation, Spectrum)* and receiver tests *(Receiver Quality)* can be performed on the TCH from the base station.

➢ Press the *Escape* key to close the *Connection Control* menu and return to the *Receiver Quality* menu.

Additional Information...

Alternative Settings and Measurements

... on Step 2

④ CCH test

☞ Chapter 4, p. 4.83 ff.

In the *CCH Test* mode, the CMU is able to perform all transmitter tests *(Power, Modulation, and Spectrum)* on the CCH from the base station. This implies that the measured timeslot is always timeslot 0; the traffic channel settings are irrelevant and therefore not provided in the individual measurement menus. *Receiver Quality* tests involving data transmission between the CMU and the BTS over the traffic channel are not possible in the *CCH Test* mode.

The *Location Update* and *MOC* softkeys are only available with option CMU-K39, MOC/MTC.

⑤ Signalling info

☞ Chapter 4, p. 4.83 ff.

The *Signalling Info* table contains signalling parameters that are transferred by the base station over the control channel:

The *Frame Timing* section shows the CCH timing, expressed by the current values of the multiframe and superframe counters. A CCH multiframe consists of 51 TDMA frames; a superframe consists of 26 x 51 = 1326 TDMA frames. The multiframe counter wraps around after each complete superframe (26 multiframes), the superframe counter after 2^{12} superframes.

The *Network Data* section shows the identity codes of the mobile station/CMU and of the BTS under test. Its 3-digit Mobile Country Code (MCC) and the 2-digit Mobile Network Code (MNC) identify the CMU. The 3-digit Location Area Code and the 6-bit BTS Identity Code (BSIC) identify the BTS.

... on Step 3

⑥ TCH test

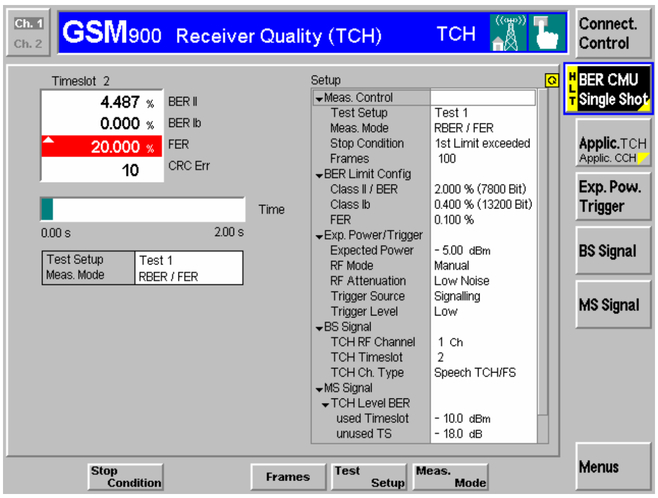
☞ Chapter 4, p. 4.85 ff.

In the *TCH Test* mode, the CMU is able to perform all transmitter tests *(Power, Modulation, and Spectrum)* on the TCH from the base station. *Receiver Quality* tests involving data transmission between the CMU and the BTS over the traffic channel must be performed in the *TCH Test* mode.

Receiver Quality Measurements

Receiver Quality measurements evaluate parameters which characterize the quality of transmission on the complete transmission path between CMU and base station. To this purpose the bits sent to the base station are looped back and retransmitted. The CMU compares the bits received with those sent and can thus calculate the percentage of faulty bits.

Note: *To perform a* Receiver Quality *measurement, the BTS under test must be set to a special test mode where the received data is retransmitted to the CMU (closed loop).*

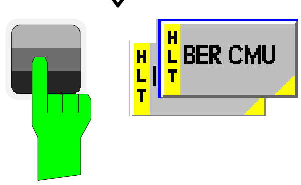


Step 1

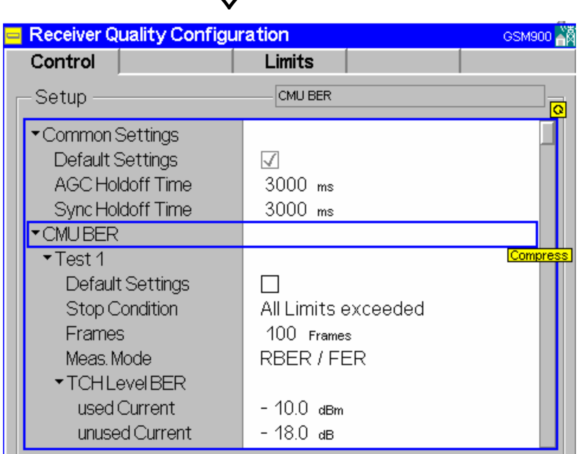
The *Receiver Quality* menu controls the receiver quality tests and displays the measurement results together with an overview of the test settings (*Setup* table).

- ➢ Press the *Applic. TCH/Applic. CCH* softkey to display all applications of the *Receiver Quality* measurement group. ①
- ➢ Press the *BER CMU Single Shot* softkey and the *Meas. Mode* hotkey and select *RBER/FER*. ②

⇓



⇓



Step 2

- ➢ Press the *BER CMU* softkey again.

The *Receiver Quality Configuration* menu is opened.

Most parameters of the *Receiver Quality Configuration* menu are equal or analogous to the ones used in *Power* or *Modulation* measurements. Major differences occur in the measurement modes available (*Control* tab, ②) and in the definition of the measurement statistics (*Statistics* tab, ③).

Additional Information...

Alternative Settings and Measurements

... on Step 1

① Applications

Within the *Receiver Quality* measurement group, the measurements *BER CMU Single Shot* (single shot bit error rate tests) and *BER CMU Average* (continuous bit error rate tests) are treated as different applications. In addition, bit error rate tests via Abis interface *(BER Abis Single Shot, BER Abis Average)* and *RACH Tests* can be performed. Applications are different measurements belonging to the same measurement group. Each application is assigned its own set of configuration parameters. Therefore, the applications within a measurement group can be configured individually and serviced in parallel.

Single shot measurements (application *BER CMU)* are further split up into different test setups. Up to ten different test setups with independent parameters can be configured.

☞ Chapter 4, p. 4.108 ff.

For a general discussion of measurement control and applications see chapters 3 and 5 of the CMU manual.

For test setups see the *Test Setup* hotkey and the different tabs in the *Receiver Quality Configuration* menu).

② Measurement Mode

A number of different quantities characterizing the quality of transmission are defined:

- Bit error rate (for class II and class Ib bits)
- Residual bit error rate (for class II and class Ib bits)
- Frame erasure rate

The type of quantities measured depends on the measurement mode *(BER, RBER/FER*, or *Burst by Burst).* In the *Burst by Burst* mode, which is specified for GSM phase II and phase II+ base stations, only bits without error protection are transmitted and the data loop in the base station is closed before the channel decoder and coder. This enhances the speed of the bit error rate test (fast BER test).

☞ Chapter 4, p. 4.117 ff.

The bit classes and measured quantities are explained at the beginning of section *Measurement Menu Receiver Quality*.

... on Step 2

③ Statistics

In the framework of sensitivity tests the basic evaluation period is equal to the frames used by the speech coder and consisting of 260 bits. Bursts and TDMA frames are irrelevant. A statistics cycle thus consists of a definite number of frames.

☞ Chapter 3 and 4.

Failed Receiver Quality Test

If a BER test fails check the following:

1. Ensure that the attenuation of any antenna coupler and/or cables used is being taken into account by the CMU. During the test the base station receiver is being tested with very low RF signal levels, and even a small attenuation can cause the CMU to show a fail indication.

2. An external signal from a real network may interfere with the signal sent from the CMU to the base station, in particular during BER tests where the output level of the CMU is reduced to as low as -104 dBm. The BER test should ideally be performed in a shielded room, however, if this is not possible, the channel(s) used for the test should be changed. If different results are obtained on neighboring channels, the problem is likely to be due to external interferences.

Contents

3 Manual Control

This chapter gives a brief survey of the operating concept and the structure of the user interface for GSM base station 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 measurements. Switchover between the different menu groups and test modes *(Signalling – Non Signalling)* 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)*. For a presentation of the CMU's control elements, menu types and dialog elements within the menus refer to chapter 3 of the operating manual for the CMU basic unit.

Menu Structure

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

- The function groups *GSM400-BTS, GSM GT800-BTS, GSM850-BTS; GSM900-BTS, GSM1800-BTS* and *GSM1900-BTS*,
- The two test modes *Signalling* and *Non Signalling*
- General configurations *(Connection Control),* configurations specific to a measured quantity *(Power Configuration, Modulation Configuration, Spectrum Configuration, Receiver Quality Configuration),* and menus displaying the results of the measurement *(Analyzer/Generator, Overview, Power (P/t Normal GMSK,P/t Normal 8PSK, P/Slot, P/t Multislot), Modulation (Phase Error GMSK, Overview 8PSK, EVM 8PSK, Phase Error 8PSK, Magnitude Error 8PSK), Spectrum (due to Modulation* and *due to Switching), Receiver Quality (BER CMU Single Shot, BER CMU Average, BER Abis Single Shot, BER Abis Average, RACH Test))*.

In a more 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 Modes

GSM 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 base stations in a special "test mode". The *Signalling* mode serves to measure the base station performance under realistic operating conditions where the CMU mimics a GSM mobile station.

Definition The term signalling denotes all actions necessary to establish, control and terminate a communication between the base station and the mobile phone. The signalling messages conveyed allow the mobile station and the network to discuss the management of issues either related to the user or concerning technical aspects of the communication.

Non Signalling Mode In the *Non Signalling* mode, the CMU generates an RF signal conforming to GSM specifications and analyzes the signal with GSM characteristics (i.e. with definite level in the designated channel and in the adjacent channels, definite phase and frequency, and bit content) retransmitted by the device under test. No signalling parameters are transferred so that test times can be reduced considerably. The test signal may be inside or outside the designated GSM channel range.

Normal burst signals are generated and analyzed. Various transmitter quality measurements (burst power versus time, average burst power, phase and frequency errors, error vector magnitude, I/Q imbalance and origin offset in the constellation diagram, adjacent channel power due to switching and due to modulation) can be performed. GMSK and 8PSK-modulated signals are supported. The measurement may be triggered by an additional external signal.

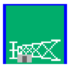
Signalling Mode

In the *Signalling* mode, the CMU receives a control channel signal from the base station to which it can synchronize. From the synchronized state (CCH Test), the CMU can initiate a location update and a call can be initiated from either the base station or the CMU (option CMU-K39 required). Measurements can be performed in the *Synchronized* state on both the CCH (control channel) and the TCH (traffic channel) and in the *Call Established* state (TCH).

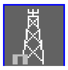
The CMU is able to configure a broad range of network parameters and to determine the parameters characterizing the base station. Measurements of the burst power versus time in one or several consecutive timeslots, the average burst power in consecutive timeslots, the modulation parameters (phase and frequency errors, I/Q imbalance and origin offset in the constellation diagram), the adjacent channel power due to switching and due to modulation, and of the bit error rate can be performed for normal bursts. GMSK and 8PSK-modulated signals are supported.

Symbols for Signalling Mode and State

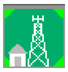
The *signalling mode* and *state* is indicated to the left of the operating mode in each main menu and graphical measurement menu (see chapter 3 of CMU operating manual). The following symbols occur in function group *GSM400/850/900/1800/1900-BTS:*



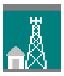
Non signalling mode



Signalling mode, Unsynchronized

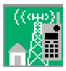


Signalling mode, Synchronizing (symbol blinks)



Signalling mode, CCH Test

Signalling mode, TCH Test



Signalling mode, Location Update in Progress / Call in Progress / Call Established / Call Release in Progress (symbol blinks for transitory states)

Configurations

The CMU offers a wide range of settings for signal generators and analyzers, the signalling procedures, and the individual measurements. Configurations can be set either for the whole function group *(Connection Control)* or for a particular measurement.

Connection Control

The *Connect. Control* softkey is located on the right side of the title bar of each main and graphical measurement menu. It opens a popup menu with several tabs controlling

- The signal generators and analyzers of the instrument *(Analyzer* and *Generator* in Non Signalling, *MS Signal* and *BS Signal* in Signalling mode)
- The CMU receiver settings and input path configuration (included in *Analyzer, MS Signal)*
- The trigger settings (included in *Analyzer, MS Signal)*
- The RF connectors to be used and the external attenuation *(RF Input/Output)*
- The reference signal and the system clock *(Sync.)*
- In *Signalling* mode, all actions changing the CMU's signalling state *(Connection)*
- In *Signalling* mode, parameters of the network and the mobile station under test *(Network)*

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

Configurations of measurements

A popup menu offering specific settings is assigned to each measurement group *(Power vs. Time, Modulation, Spectrum* and *Receiver Quality).* The following parameters can be defined:

- The repetition mode, the stop condition, the statistic count and the 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 3.5).

Configuration via hotkeys

The softkeys and associated hotkeys in the graphical measurement menus provide the most important configurations for the current measurement; see chapter 4 and chapter 3 of the CMU operating manual. Settings may via hotkeys supersede the corresponding *Connection Control* settings.

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 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 3.5), the indicated results are constantly updated. As shown in the table below, some of the measurement groups are different for the two test modes.

Table 3-1Measurement Groups in the *Signalling* and *Non Signalling* Mode

Non Signalling	**Signalling**
Analyzer/Generator Shows the basic instrument settings and the settings for the signals generated and analyzed by the instrument and presents an overview of the basic scalar power and modulation results.	**Overview** Shows the settings for attempting a connection to the mobile and presents an overview of the basic scalar power and modulation results. The receiver parameters and various signalling parameters are indicated in addition.
Power Application *P/t Norm. GMSK/8PSK* Diagram showing the trace of the measured burst power as a function of time. The peak power, statistical results and the results of the limit check are indicated in addition. Single points of the trace may be evaluated using graphical tools (markers, D-Line).	**Power** Application *P/t Norm. GMSK/8PSK* Diagram showing the trace of the measured burst power as a function of time. The peak power, statistical results and the results of the limit check are indicated in addition. Single points of the trace may be evaluated using graphical tools (markers, D-Line). Application *P/Slot* Bar graph showing the average burst power in 8 consecutive timeslots. Application *P/t Multislot* Diagram showing the trace of the measured burst power as a function of time in up to 4 consecutive timeslots. The peak power, statistical results and the results of the limit check are indicated in addition. Single points of the trace may be evaluated using graphical tools (markers, D-Line).
Modulation Application *Phase Err. GMSK* Diagram showing the phase error within the burst as a function of time. The frequency error, average and RMS phase error, statistical results and the results of the limit check are indicated in addition. Application *Overview 8PSK* Table showing a statistical evaluation of 8PSK modulation parameters. Application *EVM 8PSK* Diagram showing the error vector magnitude (EVM) within the burst as a function of time plus a statistical evaluation of 8PSK modulation parameters. Application *Magn. Error 8PSK* Diagram showing the magnitude error within the burst as a function of time plus a statistical evaluation of 8PSK modulation parameters.	**Modulation** Application *Phase Err. GMSK* Diagram showing the phase error within the burst as a function of time. The frequency error, average and RMS phase error, statistical results and the results of the limit check are indicated in addition. Application *Overview 8PSK* Table showing a statistical evaluation of 8PSK modulation parameters. Application *EVM 8PSK* Diagram showing the error vector magnitude (EVM) within the burst as a function of time plus a statistical evaluation of 8PSK modulation parameters. Application *Magn. Error 8PSK* Diagram showing the magnitude error within the burst as a function of time plus a statistical evaluation of 8PSK modulation parameters.

Non Signalling	Signalling
Application *Phase Error 8PSK* Diagram showing the phase error within the burst as a function of time plus a statistical evaluation of 8PSK modulation parameters. Application *I/W Analyzer* Graphical analysis of the I/Q amplitudes of the measured 8PSK-modulated signal.	Application *Phase Error 8PSK* Diagram showing the phase error within the burst as a function of time plus a statistical evaluation of 8PSK modulation parameters. Application *I/W Analyzer* Graphical analysis of the I/Q amplitudes of the measured 8PSK-modulated signal.
Spectrum Shows the amount of energy that spills outside the designated channel. The off-channel spectrum is caused by the modulation (spectrum due to modulation) and to the bursty nature of the RF signal (spectrum due to switching). Statistical results and the results of the limit check are indicated in addition.	**Spectrum** Shows the amount of energy that spills outside the designated channel. The off-channel spectrum is caused by the modulation (spectrum due to modulation) and to the bursty nature of the RF signal (spectrum due to switching). Statistical results and the results of the limit check are indicated in addition.
–	**Receiver Quality** Evaluates the Bit Error Rate, Frame Erasure Ratio, Residual Bit Error Rate, and Block Error Rate/Data Block Error Rate including a limit check. In the RACH test, the CMU sends a series of access bursts to the BTS and measures the relative number of bursts to which the BTS could not respond with an IMMEDIATE ASSIGNMENT message.

General Settings

A number of settings can be made in several of the configuration menus assigned to the measurement groups *Power*, *Modulation, Spectrum,* and *Receiver Quality*. In combination, these settings define the scope of the measurement, i.e. the number of bursts measured and the results displayed. The following brief overview is intended to avoid confusion of terms.

Application

Applications represent 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 graphical measurement menus.

Statistic Count

The statistic count is equal to the integer number of evaluation periods which form one measurement cycle. An evaluation period corresponds to the duration of a burst (measurement groups *Power*, *Modulation, and Spectrum)* or a speech frame (measurement group *Receiver Quality).* Together with the *stop condition,* the *repetition mode* determines when exactly the measurement is stopped.

The *statistic count* is set in the *Statistics* tab of the configuration popup menus assigned to each measurement group.

Repetition Mode

The *repetition mode* defines how many statistics cycles are measured if the measurement is not stopped by a limit failure (see stop condition *On Limit Failure* below). Two modes are available for all measurements:

Single Shot The measurement is stopped after one statistics cycle

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 *repetition mode* is set in the *Control* tab of the configuration popup-menus assigned to the three measurement groups *Power vs. Time*, *Modulation,* and *Spectrum.* In the *Receiver Quality* menu, the repetition mode can be set via the *Application* softkey*.*

Note: *In contrast to other measurement settings, the 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

For *Power vs. Time, Modulation, and Spectrum* measurements, two stop conditions can be selected:

None The measurement is performed according to its repetition mode, regardless of the measurement results,

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

For *Receiver Quality* measurements, the stop condition *None* (see above) and two further conditions can be selected:

1st Limit exceed. The measurement is stopped as soon as one of the limits is exceeded

All Limits exceed. The measurement is stopped as soon as all limits defined are exceeded. Again, 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 each measurement group.

Display Mode

In graphical measurement diagrams, the *Display Mode* defines which of the measured and calculated traces is displayed if the measurement extends over several bursts. In general, traces are evaluated at a set of fixed, equidistant test points (samples). After n bursts, n measurement results per test point have been taken. After a single shot measurement extending over c bursts, c measurement results per test point have been taken.

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

Minimum At each test point, the minimum value of all bursts measured is displayed.

Maximum At each test point, the maximum value of all bursts measured is displayed.

Max./Min. At each test point, the extreme value of all bursts 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 bursts measured is displayed; see paragraph entitled *Calculation of average quantities* below.

Note the difference in the calculation of *Average* on one hand, *Minimum, Maximum* and *Max./Min.* on the other hand, if the measurement extends over more than one statistic count (repetition mode *Continuous,* measurement time longer than one statistic count).

After evaluation of the different traces, the burst power is logarithmized and plotted in a semi-logarithmic diagram.

The *Display Mode* is set in the *Control* tab of the configuration popup-menus assigned to the measurement groups *Power, Modulation,* and *Spectrum.*

Calculation of average quantities

The *Average* traces in the *Power, Modulation,* and *Spectrum* menus are obtained as follows:

Let c be the number of bursts forming one statistics cycle (one *Statistic Count)* and assume that n bursts have been measured since the start of the measurement. In calculating the *Average* trace, the following two situations are distinguished:

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

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

The *Average* trace represents the arithmetic mean value over all n bursts measured.

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

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

Scalar quantities are averaged in analogy to *Average* traces. The formulas hold for n = 1 where the average trace becomes equal to the current trace (statistics off).

Calculation of statistical quantities

In *Power* and *Modulation* measurements the statistical functions *Average, Minimum, Maximum* and *Minimum/Maximum* are applied to a set of test points depending on two independent parameters:

- The time, i.e. the abscissa values t_i, i ranging from 1 to the total number of test points comprising the trace.
- The burst number ranging from 1 to the number n of the current burst.

The result of the statistical operations depends on the parameter range considered and – in the case of statistics functions evaluated over several parameters – on the order of evaluations. This is why the definition of statistical quantities deserves some attention and is explained in the relevant sections in chapter 4. Some particular examples are:

1. In the *Power* menu, the quantity *Average Burst Power* denotes the average power of the current burst. i.e. the arithmetical mean value of all test points t_i located in the useful part of the burst (lower area 1 in the power template in chapter 4).
2. In the *Modulation* menu quantities such as the *Frequency Error*, *Phase Error RMS, Phase Error Peak* etc. are first calculated for the current burst and entered in the *Current* column of the output table. The results in the *Minimum/Maximum* column correspond to the extreme value of the *Current* results calculated over all bursts measured. The results in the *Average* column correspond to the average of the *Current* results calculated according to the prescription in paragraph *Calculation of average quantities* above.

Contents

4 Functions and their Application

This chapter explains in detail all functions for the measurement of base stations supporting the GSM standard.

The chapter is divided in two sections corresponding to the two function groups for module tests *(GSM400/GT800/850/900/1800/1900-BTS Non Signalling)* and for tests including signalling *(GSM400/GT800/850/900/1800/1900-BTS Signalling*). Within the two sections, the discussion is structured 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 according to the following scheme:

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 CMU basic instrument; besides, a description of measurement control and the essential settings and a graphical overview of the most important menus is given at the end of chapter 3 in the present GSM 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.

GSM Module Tests (Non Signalling)

The structure of this section is based on the configuration and measurement groups defined in the function group *GSM400/GT800/850/900/1800/1900-BTS Non Signalling*, i.e. the menus of the graphical user interface. The menus are described in the following order:

1. Global settings *(Analyzer/Generator)* and display of generator signals
2. Measurement menus *(Power, Modulation* and *Spectrum):* performance of the measurements, output of measurement results, specific measurement configurations
3. Global configurations *(Connection Control)*

The most important menus within function group *GSM400/GT800/850/900/1800/1900-BTS Non Signalling* are shown in an overview at the end of chapter 3 in the present GSM manual.

Analyzer/Generator Menu

The *Analyzer/Generator* menu displays the essential results of the *P/t Norm. GMSK,* the *Ext. Phase Err. GMSK*, and the *Overview 8PSK* applications and provides access to the most important measurement settings. In particular, it configures the signals of the RF generator and defines the properties of the CMU's RF analyzer.

- The measurement control softkey *P/t Norm. GMSK* changes to *Ext. Phase Err. GMSK* or *Overview 8PSK,* depending on the application selected. This softkey controls the measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Power Configuration* or *Modulation Configuration*. The hotkeys associated to the measurement control softkey define the scope of the *Power* or *Modulation* measurement.
- The other softkeys on the right side are combined with various hotkeys (e.g. the hotkeys *Frequency, Channel, Frequency Offset,* and *Training Sequence* belong to the softkey *Analyzer Settings).* The softkey/hotkey combinations provide test settings and switch over between different measurements.

Types of settings

The purpose of the *Analyzer/Generator* menu is to provide quick access to the most common *Power* and *Modulation* measurements and to present the basic measurement results at a glance. The three measurement applications *P/t Norm. GMSK,* the *Ext. Phase Err. GMSK*, or *Overview 8PSK* can be selected with the *Application* softkey. The remaining softkeys/hotkey combinations provide two different types of settings:

- General settings are valid for all applications of function group *GSM400/GT800/850/900/1800/1900-BTS Non Signalling.* Changing general settings in any application will have an impact on all measurements and applications of the function group. All general settings are also provided in the *Connection Control* menu (see p. 4.61 ff.). Examples of general settings are the RF input power and trigger settings (softkey *Exp. Power Trigger)* and the configuration of the RF generator (softkey *Generator)*.
- Specific settings are relevant for one application only, or they can be set independently for several applications. Changing specific settings in an application will not affect the other measurements and applications of the function group. No specific settings are provided in the *Connection Control* menu (see p. 4.61 ff.). Examples of specific settings are the *Repetition* mode (to be set independently for all applications).

Measurement results

The output fields in the left half of the *Analyzer/Generator* menu show the current measurement results. The results depend on the application selected. They are described in detail in section *Measurement Results* on p. 4.6 f.

The results displayed in the *Analyzer/Generator* menu represent only a small fraction of the power and modulation results that the CMU is able to acquire. A comprehensive set of test results is displayed in the *Power* and *Modulation* measurement menus; see sections *Measurement Results* on p. 4.15 ff. and *Measurement Results* on p. 4.28 ff. In particular, the *Power* and *Modulation* menus show many quantities as functions of time

The *Analyzer/Generator* menu can be opened from the *Menu Select* menu (with associated key at the front of instrument). The hotkeys associated to the *Menus* softkey switch over between the *Analyzer/Generator* menu and the remaining measurement menus of function group *GSM400/GT800/850/900/1800/1900-BTS Non Signalling*.

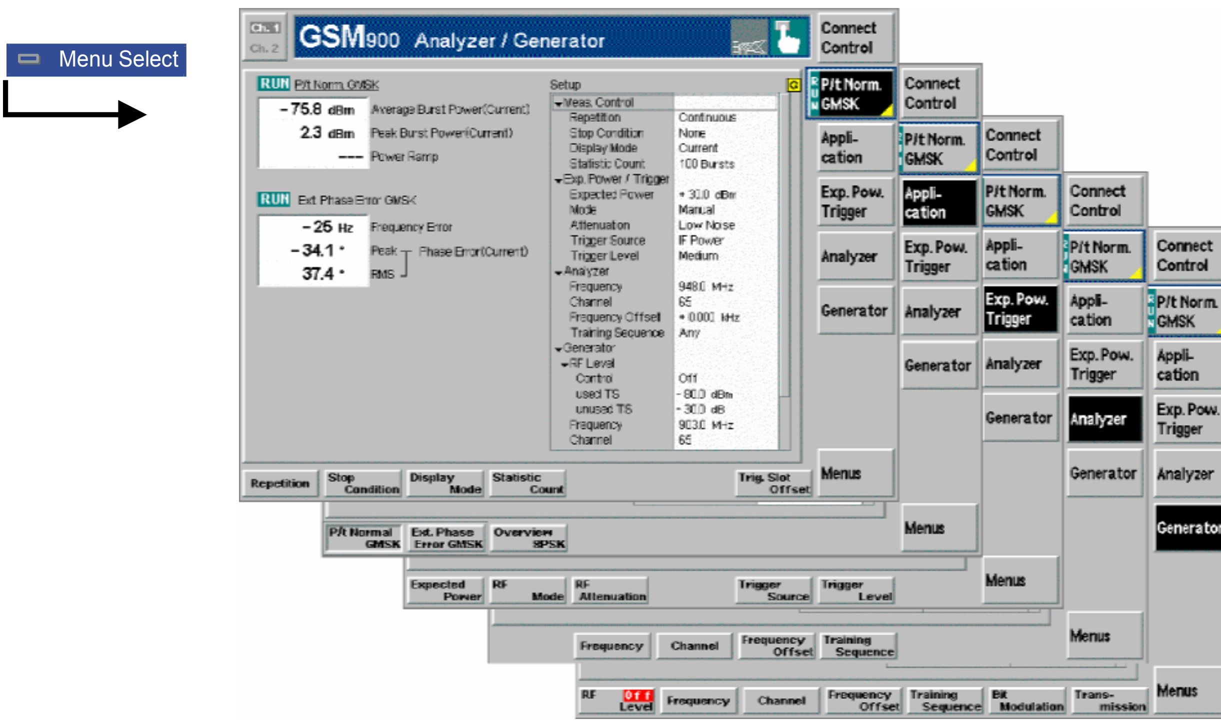


Fig. 4-1 Measurement menu Analyzer/Generator (example: P/t Norm. GMSK)

Test Settings

The settings for the *Analyzer/Generator* menu are accessible via softkey/hotkey combinations. If a softkey (located in the softkey bar on the right side of the menu) is selected and an associated hotkey (displayed across the bottom of the menu) is pressed, a popup window indicating the current setting and enabling an entry will appear.

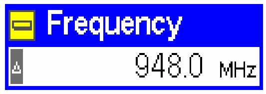
Example:

Analyzer

The *Analyzer* softkey displays a hotkey bar including the hotkey labeled *Frequency*.

Frequency

The *Frequency* hotkey opens the input window *Frequency*.



Input windows indicate the current parameter value (in this case: the current RF input frequency) or a list of the possible settings. Parameters are changed by

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

Measurement Control

Each *Analyzer/Generator* application is controlled by means of the measurement control softkey below the *Connect. Control* softkey and the associated hotkeys.

P/t Norm. GMSK

The *P/t Norm. GMSK* softkey (which changes to *Ext. Phase Err. GMSK* or *Overview 8PSK,* depending on the application selected) controls the measurement application 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 can be set independently for all three applications.

The applications *P/t Norm. GMSK* and *Ext. Phase Err. GMSK* can be run in parallel, so the results for both applications are displayed simultaneously. Switchover between these two applications does not change the course of the measurement.

The GMSK applications and the *Overview 8PSK* suspend each other. The selected measurement status of each application is stored and will be put into effect as soon as the application is activated. In particular, an application in the status *RUN* is restarted each time it is activated.

Remote control
`INITiate:POWer:NBURst:GMSK` etc.
`FETCh:POWer:NBURst:GMSK:STATus?`
`INITiate:MODulation:PERRor:GMSK` etc.
`FETCh:MODulation:PERRor:GMSK:STATus?`
`INITiate:MODulation:OVERview:EPSK` etc.
`FETCh:MODulation:OVERview:EPSK:STATus?`

Measurement configuration

The configuration menus for all *Power* and *Modulation* measurements are directly accessible from the *Analyzer/Generator* menu:

- Pressing the *P/t Norm. GMSK* softkey twice opens the popup menu *Power Configuration* (see page 4.17 ff.).
- Pressing the *Ext. Phase Err. GMSK* or the *Overview 8PSK* softkey twice opens the popup menu *Modulation Configuration* (see page 4.40 ff.).

Selecting the Application

Appli-cation

The *Application* softkey selects the measurement application. The measurement control softkey (second softkey below *Connect. Control)* indicates the current application. Some of the hotkeys associated to the different softkeys, the *Setup* table, and the results in the *Analyzer/Generator* menu also vary as a function of the application. The corresponding measurement results are explained in section *Measurement Results* on page 4.6 ff.

P/t Normal GMSK

The *P/t Normal GMSK* hotkey selects the power versus time measurement for normal burst signals. See section *Power Measurements* on p. 4.8.

Remote control
The *P/t Normal GMSK* application is selected by the keywords `:NBURst:GMSK` in the 3rd and 4th level of the `POWer` commands, e.g.
`CONFigure:POWer:NBURst:GMSK...`

Ext. Phase Err. GMSK

The *Ext. Phase Error GMSK* hotkey selects the measurement of the modulation accuracy of GMSK modulated signals. See section *Measurement Menu (Modulation – GMSK)* on p. 4.26 ff.

Remote control
The *Phase Error GMSK* application is selected by the keywords `PERRor:GMSK` in the 3rd and 4th level of the `MODulation` commands, e.g.
`CONFigure:MODulation:PERRor:GMSK...`

Overview 8PSK

The *Overview 8PSK* hotkey selects the measurement of the power and modulation accuracy of 8PSK modulated signals. See section *Measurement Menu (Modulation – 8PSK)* on page 4.30.

Remote control
The *Overview 8PSK* application is selected by the keywords `OVERview:EPSK` in the 3rd and 4th level of the `MODulation` commands, e.g.
`CONFigure:MODulation:OVERview:EPSK...`

Application-Specific Settings

As outlined in section *Analyzer/Generator Menu* on p. 4.2, some of the hotkey/softkey combinations in the *Analyzer/Generator* menu vary as a function of the application. However, all *Analyzer/Generator* settings are always identical to the corresponding settings in the *Power* and *Modulation* menus. Changes made in the *Analyzer/Generator* menu overwrite the *Power* and *Modulation* settings and vice versa.

Description of settings

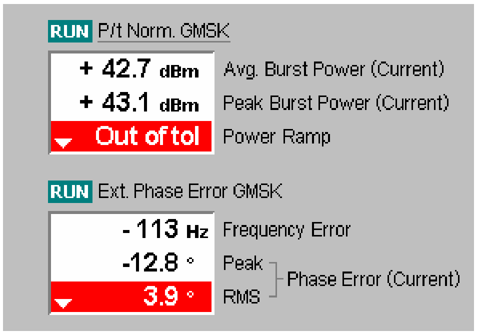
- The settings to be made in the *P/t Normal GMSK* application are described in section *P/t Normal GMSK* on p. 4.10 ff.
- The settings to be made in the *Ext. Phase Error GMSK* application are described in section *Test Settings* on p. 4.27 ff.
- The settings to be made in the *Overview 8PSK* application are described in section *Test Settings* on p. 4.32 ff.

Setup table

The *Setup* table in the right half of the *Analyzer/Generator* menu gives an overview of the measurement settings belonging to the current application. It changes when a different application is selected. The roll-key scrolls and expands the *Setup* table.

Measurement Results

The results displayed in the *Analyzer/Generator* menu depend on the selected application:



The results for the *P/t Norm. GMSK* and *Ext. Phase Error GMSK* applications are displayed simultaneously because both applications can be run in parallel. The results appear in two output fields, each containing three entries. A header line indicates the name of the application and its measurement status. The current application is underscored.

All results refer to the current burst. No comparison is made between different bursts, so the result does not depend on the statistical settings (e.g. single shot or continuous measurement).

P/t Norm. GMSK

The *P/t Norm. GMSK* output field indicates the average and peak burst power as well as the result of the limit check:

Avg. Burst Power (Current) Average power of the current burst in dBm.

Peak Burst Power (Current) Peak power of the current burst in dBm.

Power Ramp Matching of the tolerances by the current burst. The messages that may appear in the list field are self-explanatory.

The *P/t Norm. GMSK* results are also indicated in the info box in the graphical measurement menu *Power* (see section *P/t Normal GMSK* on p. 4.15 ff.).

Remote control
```
READ[:SCALar]:POWer:NBURst:GMSK?
FETCh[:SCALar]:POWer:NBURst:GMSK?
SAMPle[:SCALar]:POWer:NBURst:GMSK?
```

Ext. Phase Error GMSK

The *Ext. Phase Error GMSK* output field indicates the average (RMS) and peak phase error and the frequency error:

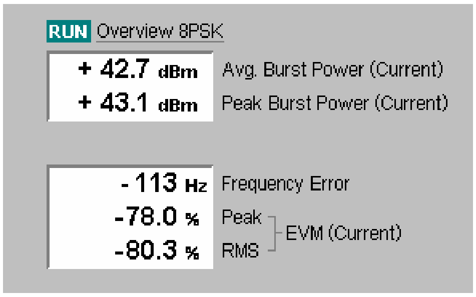
Frequency Error Frequency error of the current burst in Hz.

Peak Phase Error (Current) Extreme value of the phase error (minimum or maximum, whichever has the larger absolute value) of the current burst in degrees. The result can be positive or negative.

RMS Phase Error (Current) RMS phase error of the current burst in degrees.

The *Ext. Phase Err. GMSK* results are also indicated in the graphical measurement menu *Modulation* (see section *Measurement Results* on p. 4.28 ff.). For a detailed explanation of the quantities characterizing the GMSK modulation accuracy see section *Measurement Menu (Modulation – GMSK)* on p. 4.26 ff.

Remote control
```
READ[:SCALar]:MODulation:PERRor:GMSK?
FETCh[:SCALar]:MODulation:PERRor:GMSK?
SAMPle[:SCALar]:MODulation:PERRor:GMSK?
```



The results for the *Overview 8PSK* application appear in two output fields with two and three rows, respectively. A header line indicates the name of the application and its measurement status.

All results refer to the current burst. No comparison is made between different bursts, so the result does not depend on the statistical settings (e.g. single shot or continuous measurement).

Overview 8PSK

The *Overview 8PSK* output fields indicate the average and peak burst power, the average (RMS) and peak Error Vector Magnitude (EVM) and the frequency error:

Avg. Burst Power (Current) Average power of the current burst in dBm.

Peak Burst Power (Current) Peak power of the current burst in dBm.

Frequency Error Frequency error of the current burst in Hz.

Peak EVM (Current) Extreme value of the Error Vector Magnitude (minimum or maximum, whichever has the larger absolute value) of the current burst in degrees. The result can be positive or negative.

RMS EVM (Current) RMS-averaged EVM of the current burst in degrees. Quadratic averaging complies with the GSM standard.

The *Overview 8PSK* results are also indicated in the measurement menu *Modulation* (see section *Scalar Results (Overview)* on p. 4.34 ff.). For a detailed explanation of the quantities characterizing the 8PSK modulation accuracy see section *Measurement Menu (Modulation – 8PSK)* on p. 4.30 f.

Remote control

```
READ[:SCALar]:MODulation:OVERview:EPSK?
FETCh[:SCALar]:MODulation:OVERview:EPSK?
SAMPle[:SCALar]:MODulation:OVERview:EPSK?
```

Power Measurements

The menu group *Power* comprises the functions for measuring the power of the received RF burst signal as a function of time. The power within a burst, the averaged power and its evolution over several consecutive slots or frames can be analyzed. The measurement results are displayed in the measurement menu *Power,* the popup menu *Power Configuration* is used for configuration of the measurements.

The ***P/t Normal ...*** (burst power versus time) application measures the output power of the DUT over one burst period. The measurement curve obtained can be further processed to determine an average, minimum, or maximum result and calculate the average over the whole burst. *P/t* measurements are provided for normal bursts at GMSK or 8PSK modulation; the latter require option CMU-K41 to be installed.

In addition to the burst power measurement, a limit check with tolerances depending on the RF output power of the DUT and the modulation scheme is performed. The results are output in tabular form.

In all applications, the CMU measures at arbitrary RF input powers provided that they are within the allowed range of the RF input connectors.

Measurement Menu (*Power*)

The graphical measurement menu *Power* shows the results of the burst analysis (power measurement).

- The measurement control softkey *P/t Norm. GMSK,* which changes to *P/t Norm. 8PSK,* depending on the power measurement application and on the modulation scheme selected) controls the power measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Power Configuration*.
- The other softkeys to the right of the test diagram are combined with various hotkeys (the *hotkeys Channel, Frequency, Frequency Offset* and *Training Sequence* are associated with the softkey *Analyzer* in the example below*).* The softkey/hotkey combinations provide test settings and switch over between different measurements.

The measurement menu *Power* is opened from the main menu *Menu Select* (with the associated key at the front of the instrument) or using the *Power/t* hotkey.

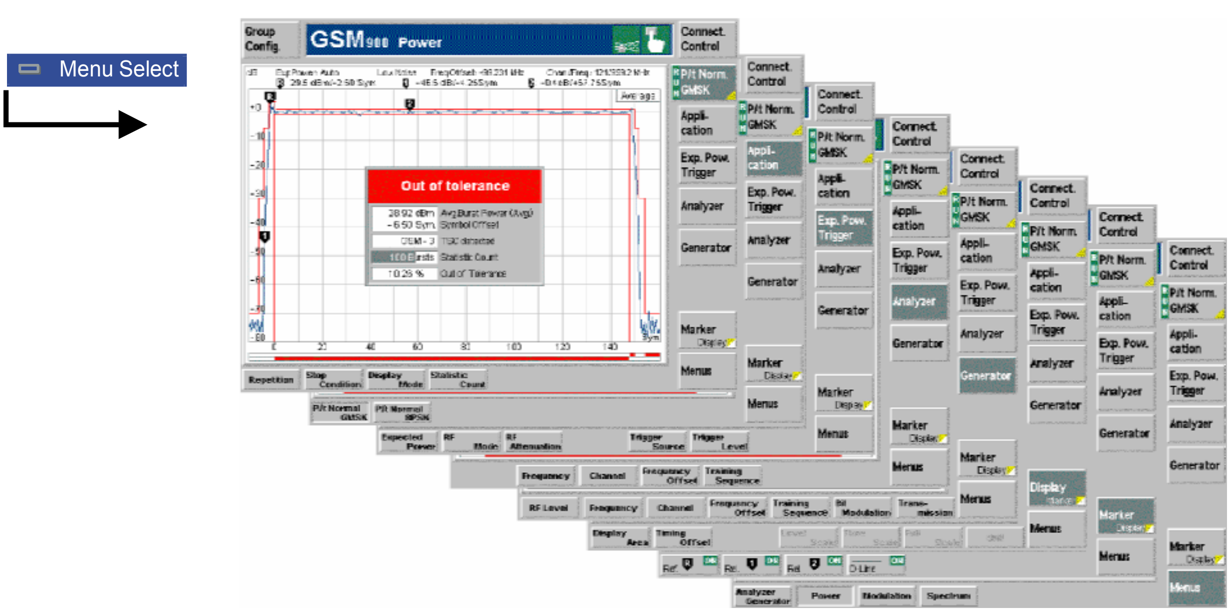


Fig. 4-2 Measurement menu Power – P/t Norm. GMSK

Test settings

The basic settings for the *Power* measurement are directly accessible from the measurement menu via softkey/hotkey combinations. The entry of values is described in section *Test Settings* on page 4.3.

Many of the basic settings are also accessible from the *Power Configuration* popup menu. They are explained in more detail in section *Measurement Configurations (Power Configuration)* on p. 4.17 ff.

a) Measurement Control

Each *Power* application is controlled by means of the measurement control softkey below the *Connect. Control* softkey and the associated hotkeys.

P/t Norm. GMSK

The *P/t Norm. GMSK* measurement control softkey (which changes to P/t Norm. 8PSK etc., depending on the application selected) controls the power measurement application 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 can be set independently for all *Power* applications.

The active *Power* application generally suspends the other applications. On switchover between different applications, the selected measurement status of each application is stored and will be put into effect as soon as the application is activated. In particular, an application in the status *RUN* is restarted each time it is activated.

Remote control

```
INITiate:POWer:<Application>
ABORt:POWer:<Application>
STOP:POWer:<Application>
CONTinue:POWer:<Application>
FETCh:POWer:<Application>:STATus?
<Application> = NBURst:GMSK | NBURst:EPSK etc.
```

Measurement configuration

Pressing the *P/t Norm. GMSK* softkey twice opens the popup menu *Power Configuration* (see page 4.17). Besides, the measurement control softkey provides hotkeys to define the scope of the measurement. All these settings are described in more detail in section *Measurement Control (Power Configuration – Control)* on page 4.18 ff.

b) Selecting the Measurement Application

Appli-cation

The Application softkey selects the power measurement application. The applications *P/t Normal <Mod_Type>* depend on the modulation scheme of the analyzed signal. The *Power* measurement menu and the measurement control softkey change with the application selected; the results are explained in section *Measurement Results* on page 4.15 ff.

P/t Normal GMSK

The *P/t Normal GMSK* hotkey selects the power versus time measurement for GMSK modulated normal burst signals (see explanation of GSM burst structure at the beginning of section *Limit lines (Power Configuration – Limit Lines)* on p. 4.21 ff.).

Remote control:
The *P/t Normal GMSK* application is selected by the keywords :NBURst :GMSK in the 3rd and 4th level of the POWer commands, e.g. CONFigure:POWer :NBURst:GMSK...

P/t Normal 8PSK

The *P/t Normal 8PSK* hotkey selects the power versus time measurement for 8PSK modulated normal burst signals (see explanation of GSM burst structure at the beginning of section *Limit lines (Power Configuration – Limit Lines)* on p. 4.21 ff.). This application requires option CMU-K41.

Remote control:
The *P/t Normal 8PSK* application is selected by the keywords `:NBURst:EPSK` in the 3rd and 4th level of the POWer commands, e.g. `CONFigure:POWer:NBURst:EPSK...`

Some of the following test settings depend on the application selected.

c) P/t Normal GMSK and P/t Normal 8PSK (with Option CMU-K41)

All softkeys and hotkeys in the *P/t Normal GMSK/8PSK* application are shown in *Fig. 4-2* on page 4.8.

P/t Norm. GMSK

The *P/t Norm. GMSK* measurement control softkey controls the *P/t Norm. GMSK* measurement; see detailed explanation in section *Measurement Control* on p. 4.9 ff. Besides, the measurement control softkey provides hotkeys to define the scope of the measurement. All these settings are described in more detail in section *Measurement Control (Power Configuration – Control)* on page 4.18 ff.

Repetition

The hotkey *Repetition* determines the repetition mode of the measurement *(Single Shot* or *Continuous* measurement).

Remote control
`CONFigure:POWer:NBURst:GMSK:CONTrol:REPetition`
`  **<Repetition>**,<StopCond>,<Stepmode>`

Stop Condition

The *Stop Condition* hotkey sets a stop condition for the measurement *(None* or *On Limit Failure)*.

Remote control
`CONFigure:POWer:NBURst:GMSK:CONTrol:REPetition`
`  <Repetition>,**<StopCond>**,<Stepmode>`

Display Mode

The hotkey *Display Mode* determines the display mode of the measurement curve.

Remote control
no display mode set, the four measurement curves are accessible via
`FETCh:ARRAy:POWer:NBURst:GMSK:CURRent?`
`FETCh:ARRAy:POWer:NBURst:GMSK:MINimum?`
`FETCh:ARRAy:POWer:NBURst:GMSK:MAXimum?`
`FETCh:ARRAy:POWer:NBURst:GMSK:AVERage?` etc.

Statistic Count

The *Statistic Count* hotkey defines the number of bursts per statistic cycle.

Remote control
`CONFigure:POWer:NBURst:GMSK:CONTrol:STATistics`
`  1 ... 1000 | NONE`

Trig. Slot Offset

The *Trig. Slot Offset* hotkey defines a delay time (integer number of GSM timeslots) between the trigger time and the measured timeslot. In the default setting *(Trig. Slot Offset = 0)* the measured timeslot is determined by the trigger time. By varying the *Trig. Slot Offset,* an unknown GSM signal can be analyzed timeslot by timeslot at constant trigger settings.

Remote control
`CONFigure:RFANalyzer:MCONTrol:TSOFfset 0 to 7`

Ref. Power Mode

The *Ref. Power Mode* hotkey defines whether the reference power (0-dB line) in the measurement diagram is derived from the average power of the current measurement curve *(Current),* the average power of the average curve *(Average),* or the average power of the current curve with an additional correction for the deviation due to the data modulated onto the RF signal *(Data Compens.).* See section *Measurement Control (Power Configuration – Control)* on page 4.18.

The hotkey is provided for 8PSK modulation only.

Remote control
```
CONFigure:POWer:NBURst:EPSK:CONTrol:RPMode
  CURRent | AVERage | DCOMpensated
```

Exp. Pow. Trigger

The *Exp. Power Trigger* softkey controls the level in the RF input signal path and provides the trigger settings for the *Power* measurement.

The input level and trigger settings are also provided in the *Analyzer* and *Trigger* tabs of the *Connection Control* menu. For a detailed description see sections *Table-Oriented Version* on p. 4.65 ff. and *Trigger (Connection Control – Trigger)* on p. 4.74 ff.

Expected Power

The *Expected Power* hotkey sets the maximum expected input level in dBm.

Remote control
`[SENSE:]EPOWer:VALue  <Level>`

RF Mode

The *RF Mode* hotkey determines how the input level is defined.

Manual	Manual input via *Expected Power* hotkey
Auto	Automatic setting according to the average burst power of the applied signal.

Remote control
`[SENSE:]EPOWer:MODE  MANual | AUTomatic`

RF Attenuation

The *RF Attenuation* hotkey selects a strategy for tuning the RF analyzer.

Normal	Input signal is kept unchanged
Low Noise	Enhanced mixer level. This setting ensures the full dynamic range of the CMU and is therefore recommended for *Power* and *Spectrum* measurements.
Low Distortion	Decreased mixer level. This setting ensures a high transmission reserve and is therefore recommended for *Modulation* measurements.

Remote control
`[SENSE:]EPOWer:ATTenuation  NORMal | LNOIse | LDIStortion`

Trigger Source

The *Trigger Source* hotkey determines the trigger condition.

Free Run	Trigger by TDMA timing of the incoming burst
RF Power	Trigger on power (rising edge) of incoming burst, wideband trigger at the Front End
IF Power	Narrow-band trigger
Extern	External trigger signal fed in via connector AUX3/4 (pins 6, 7 or 8)

Remote control
```
TRIGger[:SEQuence]:SOURce
          FRUN | RFPOWer | IFPOWer | EXTern
```

Trigger Level

The *Trigger Level* hotkey determines the trigger level. This softkey is enabled for trigger source *RF Power* or *IF Power* only.

Remote control
```
TRIGger[:SEQuence]:THReshold:RFPower LOW | MEDium | HIGH
TRIGger[:SEQuence]:THReshold:IFPower <Value>
```

Analyzer

The *Analyzer* softkey determines the frequency and training sequence of the RF signal analyzed. The analyzer settings are described in more detail in section *RF Analyzer Settings (Connection Control – Analyzer)* on p. 4.61.

Frequency

The *Frequency* hotkey defines the frequency of the analyzed signal in MHz.

Remote control
```
[SENSe:]RFANalyzer:FREQuency <Frequency>
```

Channel

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

Remote control
```
[SENSe:]RFANalyzer:FREQuency:UNIT CH <Frequency>
[SENSe:]RFANalyzer:FREQuency <Frequency>
```

Frequency Offset

The *Frequency Offset* hotkey defines a frequency offset relative to the signal frequency or GSM channel frequency defined with the *Frequency* or *Channel* hotkeys.

Remote control
```
[SENSe:]RFANalyzer:FOFFset <Offset>
```

Training Sequence

The *Training Sequence* hotkey defines a training sequence for the analyzed signal.

Remote control
```
[SENSe:]RFANalyzer:TSEQuence <TSC>
```

Generator

The *Generator* softkey configures the RF signal generated.

The following generator settings are described in more detail in section *Generator Settings (Connection Control – Generator)* on p. 4.67.

RF Level

The *RF Level* hotkey defines the generator level in the used timeslot and in the unused timeslots in dBm.

Remote control
```
SOURce:RFGenerator:LEVel:UTIMeslot <Level>
SOURce:RFGenerator:LEVel:UNTimeslot <Level>
```

Frequency

The *Frequency* hotkey defines the frequency of the RF generator signal in MHz.

Remote control
```
SOURce:RFGenerator:FREQuency <Frequency>
```

Channel

The *Channel* hotkey defines the GSM channel number of the generator signal.

Remote control
`SOURce:RFGenerator:FREQuency:UNIT CH`
`SOURce:RFGenerator:FREQuency <Channel>`

Frequency Offset

The *Frequency Offset* hotkey defines a frequency offset relative to the signal frequency or GSM channel frequency defined with the *Frequency* or *Channel* hotkeys.

Remote control
`SOURce:RFGenerator:FOFFset <Offset>`

Training Sequence

The *Training Sequence* hotkey selects a training sequence for the generator signal.

Remote control
`CONFigure:RFGenerator:MODulation:TSEQuence <TSC>`

Bit Modulation

The *Bit Modulation* hotkey selects a bit sequence to be modulated onto the generator signal.

Remote control
`CONFigure:RFGenerator:MODulation:BMODulation <Sequence>`

Trans-mission

The *Transmission* hotkey determines the shape of the generator signal (burst signal or continuous wave with constant level).

Remote control
`CONFigure:RFGenerator:MODulation:TRANsmission <Mode>`

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.

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 further markers which permit to measure spacings (delta marker 1 and 2).
The coordinates of the three markers are indicated in the format Ordinate value (level)/abscissa value (time) in a parameter line above the test diagram. The position of the reference marker is expressed in absolute units (level in dBm and time in bits), the delta marker by absolute or relative values (relative level in dB or time differences from the reference marker).

D-line — The D-line (display line) is a horizontal line that can be positioned on the test diagram at will to mark and read out level values.

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*. The marker can be positioned to arbitrary time values. It is switched off in the default setting *(Off).* The marker level is given by the measurement curve at the marker position.

The position of all markers can be varied using the rollkey.

Remote control
No command, screen configuration only.

Rel □

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 □ in the test diagram. The marker position (abscissa) is defined in the input field *Rel. Marker 1*. The marker can be positioned to arbitrary time values. If its position is outside the diagram area it will be invisible and its coordinates will be "<abscissa_value> / - - -". The marker is switched off in the default setting *(Off).* The marker level 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 (dBm) or relative to the reference marker.

Remote control
No command, screen configuration only.

Rel □

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 a level value and for measuring level differences. The level (ordinate) 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.

The switch *D-Line Config.* is opened by pressing *D-Line* twice and determines whether the D-line level is expressed in absolute units (in dBm, setting absolute) or relative to the *Expected Power* (in dB, setting relative).

Remote control
No command, screen configuration only.

Display Marker

The *Display/Marker* softkey zooms or shifts the graphical display. It is selected 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.

Display Area

The *Display Area* hotkey selects the displayed screen area.

It is possible to select either the complete burst (see Fig. 4-6 on p. 4.22), or zoom in to a particular area:

Full Range	Display of complete burst in the time range –10 bit to 157 bit and levels between –80 dBc and 10 dBc
Useful Part	Full time range, measurement curve magnified around the reference level
Left Upper Corner	Measurement curve magnified around the left upper corner
Rising Edge	Full level range, time axis from –10 bit to 10 bit
Right Upper Corner	Measurement curve magnified around the right upper corner
Falling Edge	Full level range, time axis from 139 bit to 157 bit

The screen setting and the measurement do not affect each other.

Remote control
No command, screen configuration only.

Timing Offset

The *Timing Offset* hotkey shifts the burst by the entered number of bits (GMSK modulation) or symbols (8PSK modulation) .

The burst is shifted relative to the time axis and the tolerance template for the burst analysis, see section *Limit lines (Power Configuration – Limit Lines)* on page 4.21. Therefore, the value of *Timing Offset* affects the result of the tolerance check.

Remote control
`CONFigure:POWer:NBURst[:GMSK]:TOFFset <Offset>`

Menus

The *Menus* softkey displays the hotkey bar for changing to the other measurement groups. The main measurement menu within each group is directly opened by pressing the associated hotkey.

Measurement Results

The measurement results depend on the application selected.

d) P/t Normal GMSK

The values shown in the measurement menu *Power*, application *P/t Normal GMSK,* can be divided into three groups:

- Settings
- Scalar measurement results (single values)
- Arrays (the measurement curve plotted as a function of time)

These values are indicated in two parameter lines, the test diagram and an info box:

Parameter line 1, 2

Test diagram

Info box

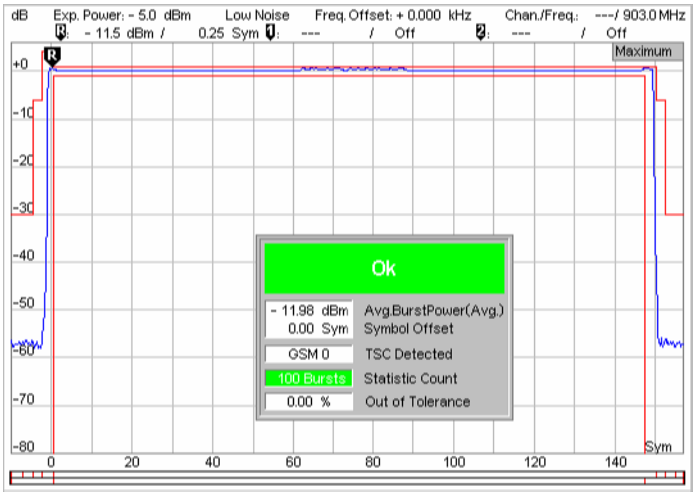


Fig. 4-3 Display of results (Power – P/t Norm. GMSK)

Settings/ scalar measurement results

Settings and scalar measurement results are indicated in the two parameter lines above the test diagram and in the info box, a popup window in the middle of the graphical screen *Power*.

1st parameter line

The first parameter line contains the following settings:

Expected Power Maximum input power as set in *Expected Power - Mode* (see section *RF Analyzer Settings (Connection Control – Analyzer)* on p. 4.61 ff.)

Attenuation Setting for the attenuation of the input level *(Normal, Low Noise, Low Distortion)* as set in *Expected Power - Attenuation* (see section *RF Analyzer Settings (Connection Control – Analyzer)* on p. 4.61 ff.)

Freq. Offset Frequency offset with respect to the nominal channel frequency

Chan./Freq. RF channel and associated frequency

2nd parameter line

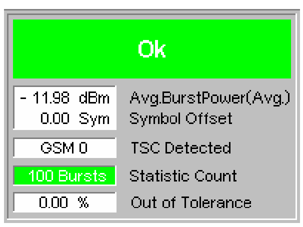
The second parameter line contains the following marker values:

Power and time of reference marker

Power and time of delta marker 1 (setting *absolute*) or difference from reference marker (setting *relative*)

Power and time of delta marker 2 (setting *absolute*) or difference from reference marker (setting *relative*)

Info box



The info box contains the following settings:

Bit Offset Shifting of the burst with respect to the time axis and the tolerance template.

Statistic Count Number of bursts per statistics cycle.

In addition, the following scalar results are indicated:

Avg Burst Power Average burst power, depending on the display mode set (see upper right corner of the diagram).

TSC detected Training sequence of the measured RF burst *(GSM – 0 to 7 | Dummy | ---)*.

Out of Tolerance Relative number of bursts that are out of the tolerances defined by the limit lines.

Burst Matching Error message if the displayed burst is out of tolerance.

Remote control

Settings are read out using the query corresponding to the setting command (setting command with appended question mark).

For scalar measurement results:

```
READ[:SCALar]:POWer:NBURst:GMSK?
CALCulate[:SCALar]:POWer:NBURst:GMSK:MATChing:LIMit?
FETCh[:SCALar]:POWer:NBURst:GMSK?
SAMPle[:SCALar]:POWer:NBURst:GMSK?
```

Traces (arrays)

The measurement result is displayed as a continuous measurement curve in the test diagram together with the limit lines, markers and the D-line, if defined. The curve is derived from 668 equidistant measurement points with a ¼ bit spacing covering a time range between –10 bit and 156 ¾ bit.
The measurement curve in the *Power* measurement menu shows the measured burst power (in dB) as a function of time (in bits). The displayed result depends on the test settings. The display mode for the measurement curve *(Minimum, Maximum, Average, Current)* is indicated in the upper right corner of the diagram.

The scale of both axes can be adjusted via the *Display Area* hotkey (see above).

Remote control

```
READ:ARRay:POWer:NBURst:GMSK...?
CALCulate[:SCALar]:POWer:NBURst:GMSK:MATChing:LIMit?
FETCh:ARRay:POWer:NBURst:GMSK...?
SAMPle:ARRay:POWer:NBURst:GMSK...?
```

e) P/t Normal 8PSK (Option CMU-K41 Required)

As shown in *Fig. 4-4* below, the *P/t Normal 8PSK* measurement results are similar to the *P/t Normal GMSK* results, however, the default limit lines differ from the GMSK limit lines (see *Fig. 4-8* on p. 4.23).

Parameter line 1, 2

Test diagram

Info box

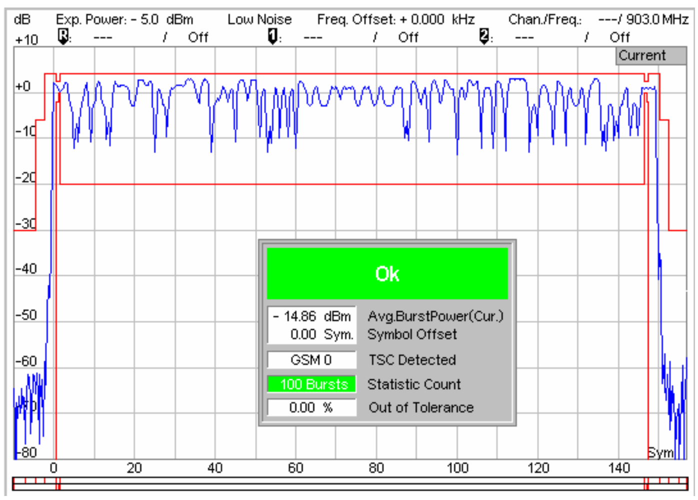


Fig. 4-4 Display of results (Power – P/t Norm. 8PSK)

Measurement Configurations (*Power* Configuration)

The popup menu *Power Configuration* contains two tabs to determine the parameters controlling the power measurement including the tolerance limits.

The popup menu *Power Configuration* is activated by pressing the measurement control softkey *P/t Norm. GMSK* or *P/t Norm. 8PSK* 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 tab *Control* controls the power measurement by determining

- The *Repetition* mode
- The *Stop Condition* for the measurement
- The type of measurement curve displayed *(Display Mode)*
- The number of bursts/evaluation periods forming a statistics cycle *(Statistic Count)*
- The measurement *Filter* for *P/t Normal GMSK* and *P/t Normal 8PSK* measurements
- The averaging prescription to obtain the reference power *(Ref. Power Mode* , for *P/t Norm. 8PSK* measurements only)

Besides, it configures the diagram by adding or removing the *Grid*.

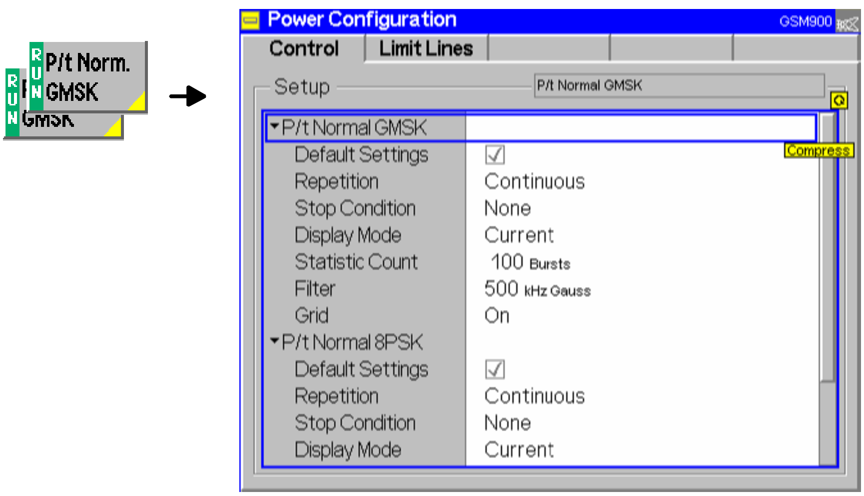


Fig. 4-5 Power Configuration – Control

The settings can be defined separately for the different applications of the *Power* measurement group. The following settings are available in several applications:

Default Settings The *Default Settings* switches assign default values to all parameters of a particular application. The default values are quoted in the command description in chapter 6 of this manual.

Remote control

```
DEFault:POWer:NBURst:GMSK:CONTrol  ON | OFF
DEFault:POWer:NBURst:EPSK:CONTrol  ON | OFF
```

Repetition The *Repetition* parameter defines how often the measurement is repeated:

Single Shot Single-shot measurement: the measurement is stopped after a statistics cycle, or after a stop condition is met. A stopped measurement is indicated by the status display *HLT* in the softkey *Power*.

For *Power* measurements, a statistics cycle corresponds to the number of bursts/evaluation periods set under *Statistic Count*. Otherwise, a statistics cycle lasts until all measurement results have been acquired (i.e. it comprises the total number of slots or frames measured).

Continuous Continuous measurement: The CMU continues the measurement until it is terminated explicitly or until the stop condition (see below) for the measurement is met. The measurement results are valid after one statistic cycle; however, the measurement is continued, and the output is continuously updated. An ongoing measurement is indicated by the status display *RUN* in the softkey *Power*.

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:NBURst:GMSK:CONTrol:REPetition CONTinuous | SINGleshot | 1 ... 10000,<StopCondition>,<Stepmode>` etc.

Stop Condition

The *Stop Condition* table row 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:NBURst:GMSK:CONTrol:REPetition <Repetition>,SOERrror | NONE, <Stepmode>` etc.

Display Mode

The *Display Mode* table row defines which of the four measured and calculated traces is displayed. The traces differ in the way the burst power *p(t)* at a fixed point in time *t* is calculated if the measurement extends over several bursts:

Current	Measured value for current burst
Minimum	Minimum over a number of bursts
Maximum	Maximum over a number of bursts
Average	Average value over a number of bursts

The number of bursts for calculation of the statistics values *Minimum, Maximum* and *Average* – and thus the result – depends on the measurement mode set (see section *Measurement Control (Power Configuration – Control)* on page 4.18). In detail, this implies:

Single shot	Display of minimum, maximum and average value from the performed statistics cycle
Continuous	Display of minimum and maximum from all bursts already measured. The **average value**, however, is calculated according to the prescription in Chapter 3, section *General Settings*.

Remote control
no display mode set explicitly, the four measurement curves are accessible via

```
FETCh:ARRAy:POWer:NBURst:GMSK:CURRent?
FETCh:ARRAy:POWer:NBURst:GMSK:MINimum?
FETCh:ARRAy:POWer:NBURst:GMSK:MAXimum?
FETCh:ARRAy:POWer:NBURst:GMSK:AVERage?
```
etc.

Statistic Count The table row *Statistic Count* defines the length of the statistics cycles in bursts.

A statistics cycle is equal to the duration of single-shot measurements *(*see section *Measurement Control (Power Configuration – Control)* on page 4.18).

Remote control
```
CONFigure:POWer:NBURst:GMSK:CONTrol:STATistics
        1 ... 1000 | NONE
```

Filter The input fields *Filter* determine which type of measurement filter is used for the P/t measurements:

500 kHz Gauss	Gauss filter with a 3-dB bandwidth of 500 kHz, recommended for GMSK modulation
600 kHz Band	Bandpass filter with a bandwidth of 600 kHz and steep edges, recommended for 8PSK modulation

Both filters are in accordance with the conformance specification GSM 11.10.

Remote control
```
CONFigure:POWer:NBURst:GMSK:FILTer G500 | B600
CONFigure:POWer:NBURst:EPSK:FILTer G500 | B600
```

Grid The *Grid* table row switches the grid on or off in the graphical test diagram. By default, the grid is switched on.

Remote control
No command, screen configuration only

The following settings are application-specific:

P/t Normal 8PSK – Ref. Power Mode The input field *Ref. Power Mode* determines how the reference power, i.e. the 0-dB line in the measurement diagram, is calculated.

Current	The reference power depends on the *Display Mode* set. It is equal to the average power of the *Current* measurement curve (display mode *Current)* or to the average power of the *Average* measurement curve (display mode *Average, Maximum, or Minimum)*.
Average	The reference power is equal to the average power of the average measurement curve.
Data Compens.	The reference power depends on the *Display Mode* set. It is equal to the data-compensated average power of the *Current* measurement curve (display mode *Current)* or to the data-compensated average power of the *Average* measurement curve (display mode *Average, Maximum, or Minimum)*.

Owing to the characteristics of 8PSK modulation, the amplitude of the RF signal varies according to the data transmitted. As a consequence, only the long term average of the power when taken over the useful part of the burst for random data represents a correct measure for the output power of the base station. This long time average (rather than the average power of the current burst) is also the correct reference level (0-dB line) for the *P/t Norm. 8PSK* measurement.

The *Average* setting ensures that a correct reference power is used, however, averaging results in a longer measurement time. In the *Data Compensated* mode, a known data sequence is used to correct the measured average power of the current burst and estimate the correct reference power. Delays due to averaging are avoided.

Remote control
```
CONFigure:POWer:NBURst:EPSK:RPMode
   CURRent | AVERage | DCOMpensated
```

Limit lines (Power Configuration – Limit Lines)

The tab *Limit Lines* defines the limit lines for the *Power* measurements (applications *P/t Norm. GMSK* and *P/t Norm. 8PSK*). The upper and lower limit lines mark a domain in the power versus time diagram that the BTS transmitter output power must not exceed (tolerance template). The GSM templates consist of several adjacent time intervals (areas) with constant limits covering the whole timeslot.

Burst structure in GSM mobile radio network:

GMSK modulation

In the GSM mobile radio network, all radio channels are divided into frames with 8 timeslots, each with a duration of 15/26 ms ≈ 577 µs. In this time mask, various bursts types can be transmitted. The GSM standard specifies the carrier power versus time for two burst types of different length:

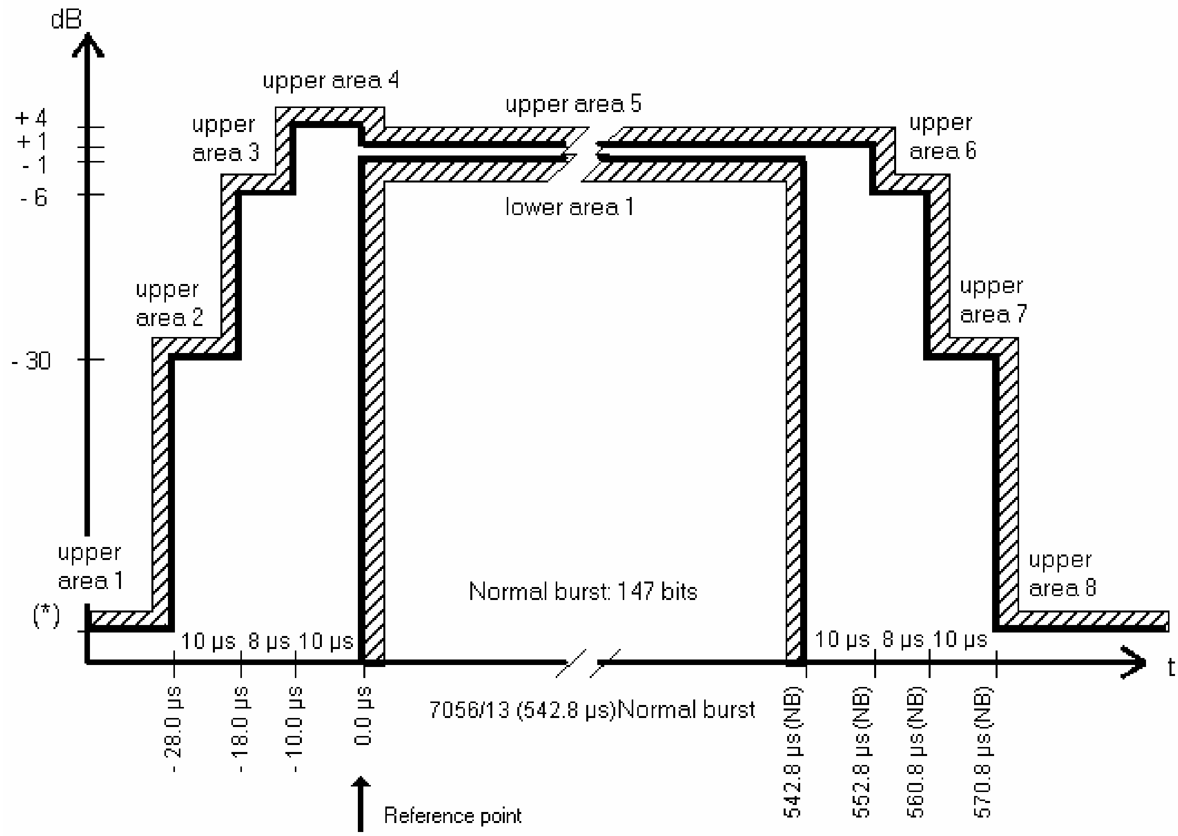
Normal burst (NB) Data transmission in the traffic channel and in the control channels except RACH. The useful part of the normal burst comprises 157 bits.

Access burst (Access Burst) Allows the mobile (MS) first access to the base station (BTS) in order to determine the timing advance. The useful part of the access burst comprises 87 bits. This burst type is not used in BTS tests.

The data transmission rate in GMSK-modulated GSM channels is 270.833 kbit/s, resulting in a bit duration of 3.69 µs/bit. The bit structure of the normal burst is shown in *Fig. 4-30*.

As a function of time, the power ramp for normal (NB) and access bursts (AB) can be divided into different areas. These areas serve as a basis for the definition of the limit lines and are shown in the following diagram *Fig. 4-6*.

Note: *The burst type analyzed in the* Non Signalling *mode is the normal burst. The reference power (0 dB line) is equal to the received transmitter carrier power, i.e. the average value of the transmitter carrier power over the useful part of the burst as received by the CMU. The burst is fitted into the tolerance template such that the transition between bit 13/14 of the training sequence corresponds to the center of the useful part of the burst. This timing reference can be modified via the* Time *softkey, see section* Test settings *on page* 4.9*.*



(*) No requirement for BTS below –30 dBc. If bursts are transmitted in a series of consecutive time slots, no requirements are specified to the power ramping in the guard times between the active slots, but the tolerance template shall be respected at the beginning and the end of the series of consecutive bursts (GSM 05.05).

Fig. 4-6 Tolerance mask (limit lines) for normal and access bursts (BTS) at GMSK modulation according to GSM specifications (GSM400/GT800/850/900/1800)

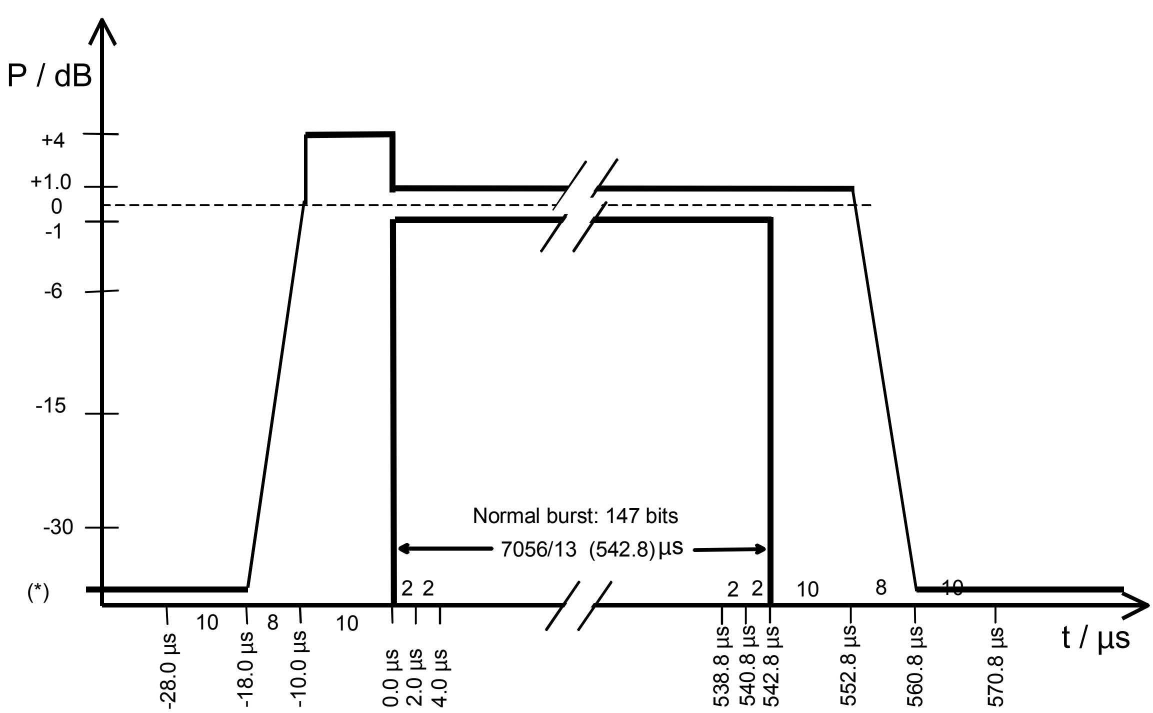


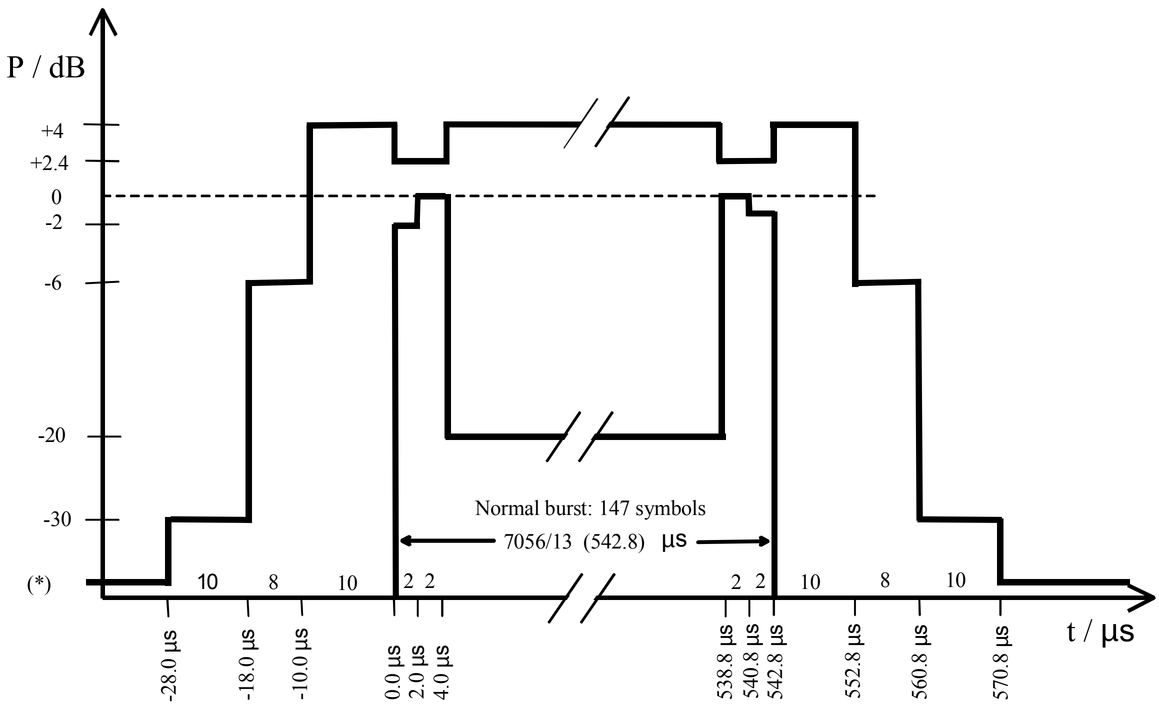
Fig. 4-7 Tolerance mask (limit lines) for normal bursts (BTS) at GMSK modulation according to GSM specifications (GSM1900)

Burst structure in GSM mobile radio network:

8PSK modulation

8PSK modulation was introduced to GSM with release 1999 (GSM 05.05 version 7.1.0). 8PSK channels (the so-called EDGE channels) are used for data transmission; only normal bursts are transmitted. The modulating symbol rate is the same as in GMSK modulation (270.833 ksymb/s), which corresponds to a bit rate of 3 x 270.833 kbit/s. The CMU uses the same time scale for both modulation schemes; a bit duration in GMSK modulation is equal to a symbol duration in 8PSK modulation.

The power template for 8PSK burst differs from the GMSK power template but is equal for all GSM bands; see *Fig. 4-8* below.



(*) No requirement for BTS below –30 dBc.

Fig. 4-8 GSM tolerance template for normal bursts (BTS) at 8PSK modulation (for all GSM bands, GSM05.05 version 8.5.0 or GSM11 .21 version 8.3.0)

The limit lines for GMSK and 8PSK modulation are set in separate table sections but in an analogous way. Note that 8PSK measurements require option CMU-K41.

The *Limit Lines* tab provides:

- A preview of the default limit lines showing the different areas *(Area Info)*
- Definition of the limit lines for the normal burst section by section *(Upper Limit Line, Lower Limit Line)*

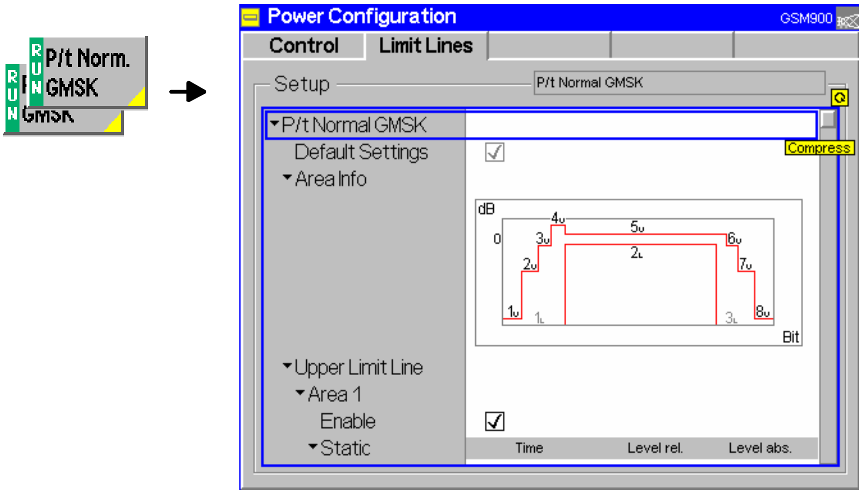


Fig. 4-9 Power Configuration – Limit Lines

Default Settings The *Default Settings* switches assign default values to all parameters of a particular modulation scheme. The default values are quoted in the command description in chapter 6 of this manual.

Remote control

```
DEFault:POWer:NBURst:GMSK:LIMit:LINE  ON | OFF
DEFault:POWer:NBURst:EPSK:LIMit:LINE  ON | OFF
```

Area Info The *Area Info* diagram represents the GSM tolerance template.

Remote control –

Upper Limit Line The table *Upper Limit Line* defines the upper limit lines for normal bursts. The normal burst can be divided into up to 16 areas *(Area 1 to Area 16)*; within an area, the limit line represents a line section with arbitrary (even infinite) slope.

The individual entries in the table field *Upper Limit Line* have the following meaning:

Area 1 etc.	Area number, by default 8 enabled areas as in *Fig. 4-6*.
Enable	Switches the limit line in the corresponding area and the limit check on or off.
Time	Start and (below) stop time of the section in bits.
Level rel. [dB]	Start and (below) stop level of the section in units relative to the carrier. This means that the reference level (0-dB line) is the carrier power averaged over the useful part of the burst.
Level abs. [dBm]	Start and (below) stop level of the section in absolute units (dBm).

The input of relative and absolute limit values is optional; both can be switched off for valid areas (setting *Off)*. If both absolute and relative limit values are specified in an area, the tolerance template and the results of the limit check refer to the **looser** criterion.

The permissible ranges for the upper and lower limit lines, i.e. of the quantities *Time, Level rel.,* and *Level abs*. vary according to the area numbers, see command description in chapter 6.

Remote control

```
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:UPPer:
AREA<nr> <StartTime>,<EndTime>,<StartRelLevel>,<EndRelLevel>,
      <StartAbsLevel>,<EndAbsLevel>,<Visibility>
```

Lower Limit Line The table *Lower Limit Line* defines the lower limit lines for normal bursts. All settings are analogous to the upper limit lines.

```
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:LOWer:
AREA<nr>  <StartTime>,<EndTime>,<StartRelLevel>,<EndRelLevel>,
         <StartAbsLevel>,<EndAbsLevel>,<Visibility>
```

Modulation Measurements

The menu group *Modulation* comprises the functions for measurement of the modulation parameters of the RF signal transmitted by the base station. The measurement results are displayed in the graphical measurement menu *Modulation,* 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 modulation scheme *(GMSK* or *8PSK* modulation) selected by means of the *Application* softkey in the *Modulation* measurement menu. For the sake of clarity, the two modulation schemes are explained separately throughout the remainder of this section.

Measurement Menu (Modulation – GMSK)

If the GMSK modulation scheme is selected (see *Application* softkey in section *Test Settings* on page 4.27 ff.), the graphical measurement menu *Modulation* displays the results of the phase and frequency error analysis.

- The measurement control softkey *Phase Err. GMSK* indicates the measurement status *(RUN* | *HLT* | *OFF)* and opens the configuration menu *Modulation Configuration* (press twice). The hotkeys associated to 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 *Test Settings* on page 4.3.

The measurement menu *Modulation* can be accessed from any other measurement menu of function group *GSMxxxx-BTS Non Signalling* 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).

Frequency and phase errors are determined as follows:

The actual phase of the signal received from the base station is recorded during the entire burst and stored. The transferred data is demodulated and the training sequence searched for. The middle of the training sequence is used for time synchronization (transition between bit 13/14).

The complete data content of the burst is then mathematically modulated using an ideal modulator. The resulting ideal phase is compared with the measured phase. From the difference between the two quantities (the phase difference trajectory), a regression line is calculated using the Mean Square Error method. The *phase error* is the difference between the phase difference trajectory and the regression line; it is calculated and plotted over the whole useful part of the burst (147 bits for NB). The average *frequency error* in the burst is equal to the derivative of the regression line with respect to time.

*Fig. 4-13*4.31*Equation 4-1*For the **tolerance check** the phase error trajectory is fitted into the tolerance template and checked for tolerance violations. According to GSM specifications, a maximum peak phase error of $\pm 20^0$, a maximum RMS phase error of $\pm 5^0$, and a frequency error of 0.05 ppm referred to the carrier frequency is allowed.

The CMU evaluates the phase error with a resolution of 4 measured values per modulating bit. This corresponds to a sampling rate of approx. 1 MHz.

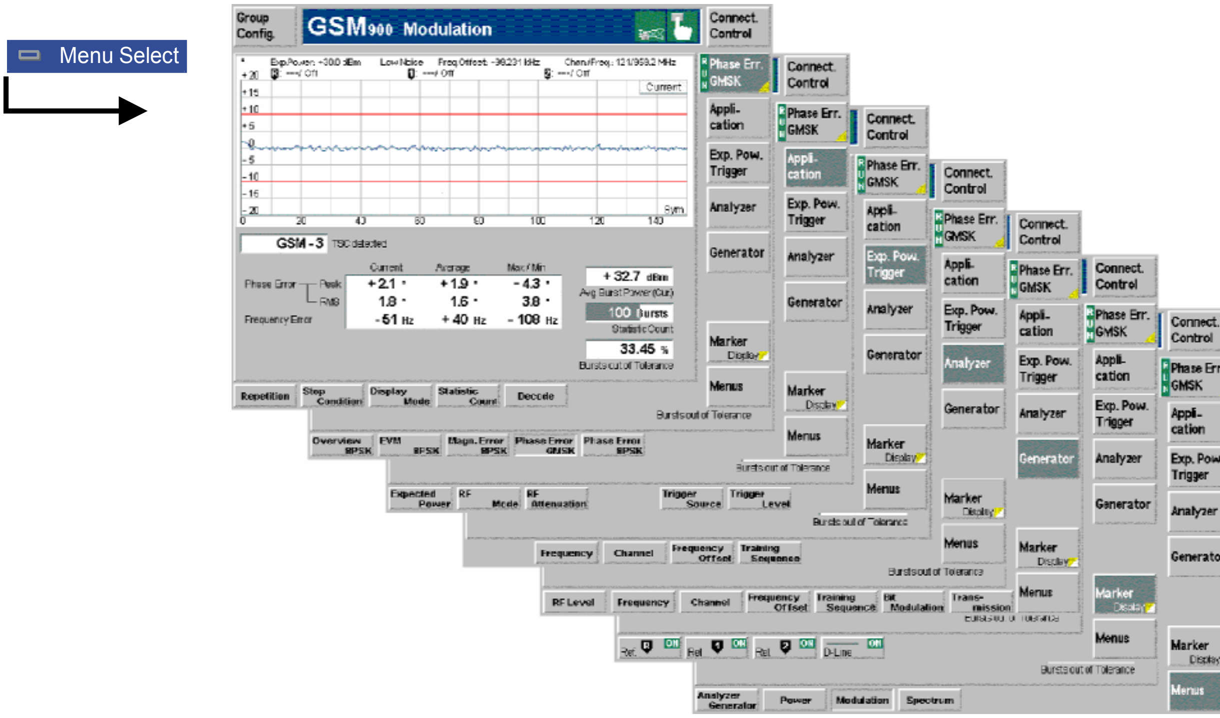


Fig. 4-10 Measurement menu Modulation – Phase Err. GMSK

Test Settings

The hotkeys associated to the measurement control softkey defining the scope of the measurement, the *Exp. Power Trigger, Analyzer, Generator* and *Marker* settings are identical with those in the *Power* menu (see section *P/t Normal GMSK and P/t Normal 8PSK (with Option CMU-K41)* on p. 4.10 ff.). The *Applications* of the *Modulation* measurement group are explained section *Test Settings* on p. 4.32 ff. The following softkeys and hotkeys differ from the *Power* measurement:

Phase Err. GMSK

The *Phase Err. GMSK* softkey controls the GMSK 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:PERRor:GMSK
ABORt:MODulation:PERRor:GMSK
STOP:MODulation:PERRor:GMSK
CONTINUE:MODulation:PERRor:GMSK
```

Measurement configuration

Pressing the *Phase Err. GMSK* softkey twice opens the popup menu *Modulation Configuration* (see page 4.40 ff.).

Decode

The *Decode* hotkey defines whether guard or tail bits are decoded or not. See section *Measurement Control (Modulation Configuration – Control)* on p. 4.40 ff.

Remote control

```
CONFigure:MODulation:PERRor:GMSK:TIME:DECode
   STANdard | GTBits
```

Measurement Results

The values shown in the measurement menu *Modulation* can be divided into three groups:

- Setting values
- Scalar measurement results (single values)
- Arrays (the phase error trajectory)

The values are indicated in a parameter line, the test diagram and a tabular overview below:

Parameter line

Test diagram

Output table

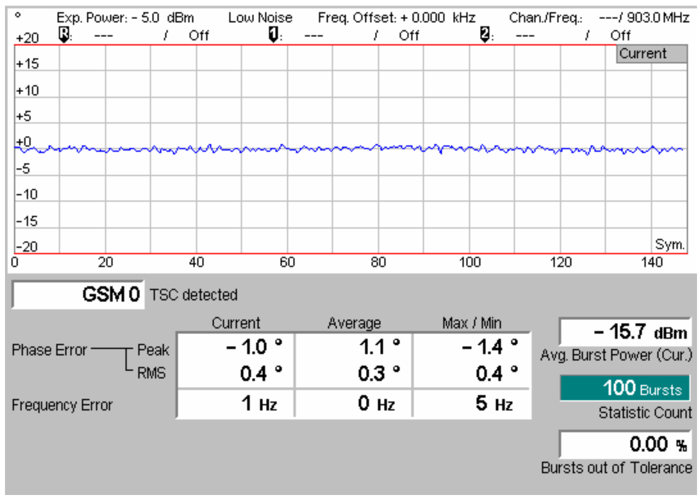


Fig. 4-11 Display of results (Modulation – Phase Err. GMSK)

Settings/ Scalar results

Scalar measurement results and settings are indicated in the parameter line above the test diagram and in the output table below.

Parameter line

The first parameter line contains the following settings:

Expected Power	Maximum input power set as in *Input Power – Expected Power* (see section *RF Analyzer Settings (Connection Control – Analyzer)* on p. 4.61 ff.)
Attenuation	Setting for the external attenuation of the input power *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal channel frequency
Chan./Freq.	RF channel and associated 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 output table contains the following scalar values:

Average Burst P.	Average burst power, depending on the display mode set (see upper right corner of the diagram)
Statistic Count	Length of statistics cycle in bursts. The colored bar indicates the relative measurement progress in the statistics cycle
Bursts out of Tolerance	Percentage of bursts that violate the tolerance limits

The following scalar values are calculated for the current burst first. From the current results the average over a statistics cycle (*Average*) and the extreme value over all bursts measured so far *(Max/Min)* is calculated:

Phase Error (Peak)	Maximum phase error
Phase Error (RMS)	Effective phase error (RMS-averaged over the burst)

Frequency Error Frequency error

Remote control

```
READ[:SCALar]:MODulation:PERRor:GMSK?
FETCh[:SCALar]:MODulation:PERRor:GMSK?
SAMPle[:SCALar]:MODulation:PERRor:GMSK?

CALCulate[:SCALar]:MODulation:PERRor:GMSK:MATChing:LIMit?
```

Measurement curves (arrays)

The continuous measurement curve in the test diagram shows the phase error in the burst (in degrees) as a function of time (in bits). The display mode *(Current, Max./Min., Average)* for the measurement curve is indicated in the upper right corner of the diagram.

The scale of both axes is fixed. The measurement curve comprises the whole useful part of the normal burst (bit 0 to 146 ¾). The curve is derived from 588 equidistant measurement points with a ¼ bit spacing. The y-axis ranges from -20^0 to $+20^0$.

Due to the definition of the phase error (see shaded section on page 4.26), the phase error oscillates around the center of the diagram: The 0^0 line is equal to the regression line of the phase error trajectory calculated using the Mean Square Error method.

The two colored, horizontal lines in the test diagram mark the selected tolerance range of the phase error.

Remote control

```
READ:ARRay:MODulation:PERRor:GMSK...?
FETCh:ARRay:MODulation:PERRor:GMSK...?
SAMPle:ARRay:MODulation:PERRor:GMSK...?
```

Measurement Menu (Modulation – 8PSK)

If the 8PSK modulation scheme is selected (see *Application* softkey in section *Test Settings* on page 4.27 ff.), the graphical measurement menu *Modulation* displays quantities characterizing the 8PSK modulation accuracy.

- The measurement control softkey *Overview 8PSK* (which changes to *EVM 8PSK, Magn. Error 8PSK,* or *Phase Error 8PSK* if the corresponding application is selected) indicates the measurement status *(RUN | HLT | OFF)* and opens the configuration menu *Modulation Configuration* (press twice). The hotkeys associated to 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 *Test Settings* on page 4.3.

The measurement menu *Modulation* can be accessed from any other measurement menu of function group *GSMxxxx-BTS Non Signalling* 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).

Quantities characterizing the 8PSK modulation accuracy are determined as follows:

The actual modulation vector of the received signal from the base station is measured over the complete burst and stored. From a comparison of this measured modulation vector with the (computed) ideal signal vector, three non-redundant quantities are calculated (see *Fig. 4-12*):

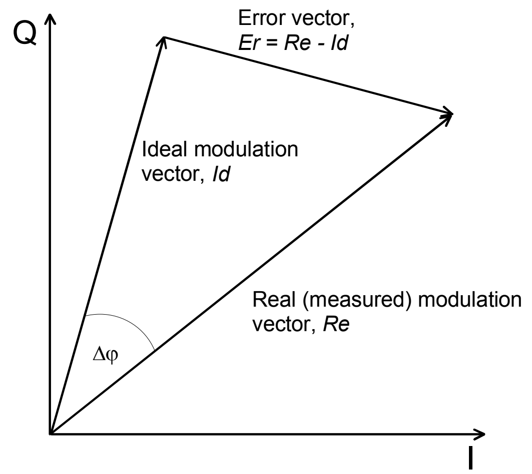
Phase error	Difference in phase between the measured and the ideal signal vector.
Magnitude error	Difference between the magnitudes of the measured and the ideal signal vector.
Error vector magnitude	Magnitude of the vector connecting the measured and the ideal signal vector. In contrast to the previous quantities, the error vector magnitude cannot be negative.

These three quantities are calculated as a function of time and displayed over the whole useful part of the burst (symbol 6 to symbol 162), each of them in a separate graphical measurement menu. In addition, the peak and RMS values of all three quantities are calculated (over the whole display range or over the first ten symbols only) and displayed.

Finally, the *Modulation* measurement provides the following scalar quantities:

95th percentile	Limit value below which 95% of the values of a measurement curve are located. The 95th percentile of a measured quantity has the same unit as the quantity itself. In the 8PSK modulation measurement, the CMU determines 95th percentiles of the Error Vector Magnitude, the Magnitude Error, and the Phase Error.
Origin offset	Origin offset in the I/Q constellation diagram reflecting a DC offset in the baseband signal (see *Fig. 4-13* on page 4.31 and *Equation 4-1*). The origin offset corresponds to an RF carrier feedthrough.
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 4.31 and *Equation 4-2*). The I/Q imbalance corresponds to an unwanted signal in the opposite sideband.
Frequency error	Difference of the measured frequency from the expected frequency.

For the **tolerance check** all three phase error curves can be fitted into a tolerance template and checked.



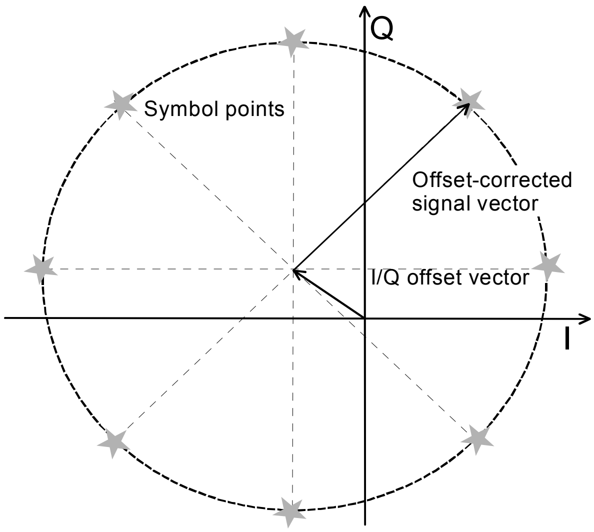
The I/Q vector diagram shows the following quantities measured in the *Modulation* menu:

| *Er* | = | *Re* – *Id* |	Error vector magnitude (EVM)
$\Delta\varphi$	Phase error
| *Re* | - | *Id* |	Magnitude error

The 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 | *Id* |.

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.*

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



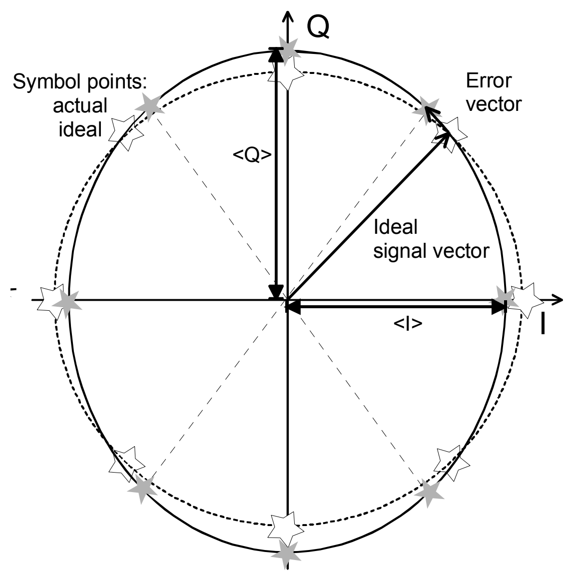


Fig. 4-13 Modulation errors in the I/Q constellation diagram

Fig. 4-13 is an idealized representation of the modulation errors where the effect 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:

$$\text{Origin Offset} = 20\log\frac{|\text{I/Q offset vector}|}{|\text{Offset-corrected signal vector}|} \qquad \text{(Equation 4-1)}$$

In *Equation 4-1*, |Offset-corrected signal vector| denotes the magnitude of the offset-corrected signal vector averaged over all constellation points. The average is evaluated according to the prescription given in the annex of standard GSM 05.05.

The I/Q imbalance in dB is equal to the difference between the estimated I and Q amplitudes of the measured signals, which are normalized and logarithmized as follows:

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

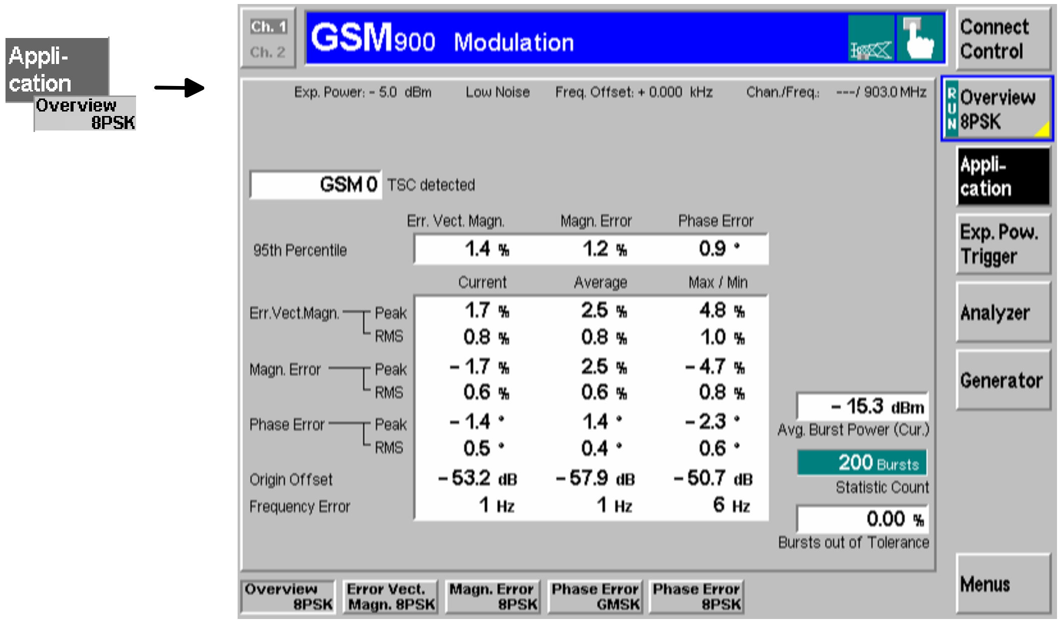


Fig. 4-14 Measurement menu Modulation – Overview 8PSK

Test Settings

The hotkeys associated to the measurement control softkey defining the scope of the measurement, the *Exp. Power Trigger, Analyzer, Generator* and *Marker* settings are identical with those in menu *Power* (see section *Test settings* on page 4.9). The *Overview 8PSK* measurement control softkey (which changes to *EVM 8PSK, Magn. Error 8PSK,* or *Phase Error 8PSK* if the corresponding application is selected) is analogous to the *Phase Err. GMSK* softkey described in section *Test Settings* on page 4.27. With 8PSK modulation, the *Application* softkey provides the following applications:

Application

The *Application* softkey selects the measurement application and the modulation scheme. Several applications of the *Modulation* menu are related to 8PSK modulated signals. The GMSK application is described in section *Test Settings* on page 4.27 f.

Overview 8PSK

The *Overview 8PSK* hotkey selects all scalar modulation results to be displayed. For an explanation of the measured quantities see section *Measurement Menu (Modulation – 8PSK)* on page 4.30.

Remote control
No explicit switchover command. All *Overview 8PSK* measurements are identified by the 3rd/4th level keywords `...OVERview:EPSK...`

EVM 8PSK

The *EVM 8PSK* hotkey selects the magnitude of the error vector to be displayed. The error vector connects the measured signal from the base station and the ideal signal vector at the symbol points, see explanation in section *Measurement Menu (Modulation – 8PSK)* on page 4.30. 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 8PSK* measurements are identified by the 3rd/4th level keywords `...EVMagnitude:EPSK...`

Phase Err. 8PSK

The *Phase Error 8PSK* 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 base station and an ideal signal waveform at the symbol points, see explanation in section *Measurement Menu (Modulation – 8PSK)* on page 4.30.

Remote control
No explicit switchover command. All *Phase Error 8PSK* measurements are identified by the 3rd/4th level keywords ...PERRor:EPSK...

Magn. Err. 8PSK

The *Magnitude Error 8PSK* 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 base station and an ideal signal waveform at the symbol points, see explanation in section *Measurement Menu (Modulation – 8PSK)*. 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 8PSK* measurements are identified by the 3rd/4th level keywords ...MERRor:EPSK...

I/Q Analyz. 8PSK

Application *I/Q Analyz. 8PSK* displays 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 p. 4.40 ff. This application is available in *Non Signalling* mode only.

Remote control
No explicit switchover command. All *I/Q Analyz 8PSK* measurements are identified by the 3rd/4th level keywords ...IQANalyzer:EPSK...

Marker

The hotkeys associated with the *Marker* softkey control the markers and the display line.

In addition to the reference markers and the relative markers described on p. **Error! Bookmark not defined.**, an additional marker controls the readout of the demodulated bits in the 8PSK-diagrams (application *EVM 8PSK, Phase Error 8PSK, Magnitude Error 8PSK)*.

On /OFF

Switches the demodulated bit marker on or off and defines its position as an integer symbol value within the displayed useful part of the burst (symbols no. 3 to 144). The symbol at the marker position is displayed in the center of the demodulated bits bar below the diagram, framed with a blue rectangle.

110 001 101 010 010 010 110 010 011 010 110 $\boxed{100}$ 100 101 110 011 011 110 010 010 000 001 101

Remote control
CONFigure:MODulation:<Application>:EPSK:DBITs
where <Application> = EVMagnitude | PERRor | MERRor

–> Peak

Sets the demodulated bit marker to the symbol with the largest of all EVM values across the burst (application *EVM 8PSK)* or to the symbol where the absolute value of the phase error (application *Phase Err. 8PSK)* or magnitude error (application *Magn. Err. 8PSK)* reaches its maximum.

This function is suitable for analyzing the correlation between large modulation errors and the transferred bit pattern.

Remote control
`READ[:SCALar]:MODulation:<Application>:EPSK:DBITs:PEAK?`
where `<Application> = EVMagnitude | PERRor | MERRor`

Measurement Results

The values shown in the *Modulation* measurement menus can be divided into three groups:

- Setting values
- Scalar measurement results (single values)
- Arrays (traces plotted as a function of time)

The measurement menu for the *Overview* application shows all scalar results but no trace. The measurement menus for the remaining three applications are analogous 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.

a) Scalar Results (Overview)

The measurement menu for the application *Overview 8PSK* shows all scalar results. Most of the values are indicated in tabular form:

Parameter line

Output fields

Output table
and additional fields

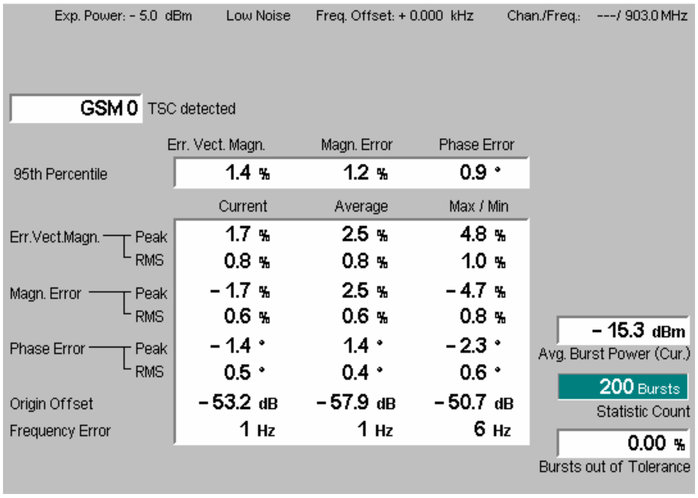


Fig. 4-15 Display of results (Modulation – Overview)

Parameter line The parameter line contains the following settings:

Exp. Power Maximum expected input power set as in *Input Power – Expected Power* (see section *RF Analyzer Settings (Connection Control –*

		Analyzer) on p. 4.61 ff.)
	Attenuation	Setting for the external attenuation of the input power *(Normal, Low Noise, Low Distortion)*,
	Freq. Offset	Frequency offset with respect to the nominal channel frequency,
	Chan./Freq.	RF channel and associated frequency.
Remote control	The settings are read out using the query corresponding to the setting command (setting command with appended question mark).	
Output fields	In the output fields in the center of the menu, the following results are displayed:	
	TSC detected	Detected training sequence of the current burst received from the base station *(GSM 0 to 7* or *Dummy* or *"---"),* see section (see section *RF Analyzer Settings (Connection Control – Analyzer)* on p. 4.61 ff.)
	95th percentile	Limit values below which 95% of the measured *Error Vector Magnitudes, Magnitude Errors,* and *Phase Errors* in the current burst are located. Owing to this definition, the 95th percentile of a measured quantity has the same unit as the quantity itself.
Output table	The scalar values in the output table are explained at the beginning of this section on page 4.30. They are first calculated for the current burst. From the current results the average referenced to a statistics cycle (*Average,* see averaging prescription in Chapter 3, section *General Settings)* and the extreme value over all bursts measured during the ongoing measurement *(Max/Min)* is calculated. Peak and RMS[1] values are taken over the whole useful part of the burst.	
	Error Vect. Magn.	Peak and effective (RMS averaged) value of the relative error vector magnitude
	Magn. Error	Peak and RMS (relative) magnitude error
	Phase Error	Peak and RMS phase error
	Origin Offset	Origin offset in the I/Q constellation diagram
	Frequency Error	Difference between measured and expected signal frequency
Additional fields	Three output fields to the right of output table indicate the following results and settings:	
	Avg. Burst Power	Average burst power, depending on the display mode set (see upper right corner of the diagram).
	Statistic Count	Length of statistics cycle in bursts. The colored bar indicates the relative measurement progress in the statistics cycle,
	Bursts out of Tolerance	Percentage of bursts that violate the tolerance 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 *Modulation* configuration menu, see p. 4.43.	

Remote control	`READ[:SCALar]:MODulation:OVERview:EPSK? etc.`
	`CALCulate[:SCALar]:MODulation:OVERview:EPSK:`
	`  MATChing:LIMit?`	

[1] To keep the results comparable, RMS averaging was chosen for both positive quantities and quantities with alternating sign. The RMS-averaged EVM is calculated according to the prescription of GSM 05.05.

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

The graphical measurement menus for the three applications *EVM 8PSK*, *Magn. Error 8PSK*, and *Phase Error 8PSK* 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

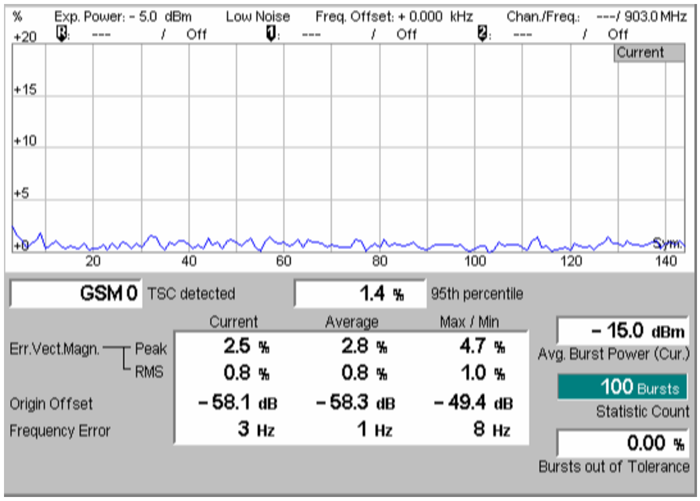


Fig. 4-16 Display of results (Modulation – EVM / Phase Error / Magn. Error)

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.

Parameter line The first parameter line contains the following settings:

Exp. Power Maximum input power as set in *Expected Power - Mode* (see section *RF Analyzer Settings (Connection Control – Analyzer)* on p. 4.61 ff.)

Attenuation Setting for the external attenuation of the input power *(Normal, Low Noise, Low Distortion)*

Freq. Offset Frequency offset with respect to the nominal channel frequency

Chan./Freq. RF channel and associated frequency

Remote control The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Output fields Below the diagram, the following results are displayed:

TSC detected Detected training sequence of the current burst received from the base station *(GSM 0 to 7* or *Dummy* or *"---"),* see section *RF Analyzer Settings (Connection Control – Analyzer)* on p. 4.61 ff.

95th percentile Limit values below which 95% of the measured *Error Vector Magnitudes, Magnitude Errors,* and *Phase Errors* in the current burst are located. Owing to this definition, the 95th percentile of a measured quantity has the same unit as the quantity itself.

Output table The output table contains the following scalar values that:

Avg. Burst Power Average burst power, depending on the display mode set (see upper right corner of the diagram)

Statistic Count Length of statistics cycle in bursts. The colored bar indicates the relative measurement progress in the statistics cycle

Bursts out of Percentage of bursts that violate the tolerance limits

Tolerance

The following scalar values are calculated for the current burst first. From the current results the average referenced to a statistics cycle (*Average,* see averaging prescription in Chapter 3, section *General Settings)* and the extreme value over all bursts measured so far *(Max/Min)* is calculated:

Err. Vect. Magn. (Peak)	Maximum EVM (application *EVM 8PSK* only)
Err. Vect. Magn. (RMS)	Effective EVM (RMS-averaged over the burst)
Magn. Error (Peak)	Maximum magnitude error (application *Magn. Err. 8PSK*)
Magn. Error (RMS)	Effective magnitude error (RMS-averaged over the burst)
Phase Error (Peak)	Maximum phase error (application *Phase Err. 8PSK* only)
Phase Error (RMS)	Effective phase error (RMS-averaged over the burst)
Origin Offset	Origin offset in the I/Q constellation diagram
Frequency Error	Difference between measured and expected signal frequency

Peak and RMS values are specific to the current application *(Phase Error, Magnitude Error* or *Error Vector Magnitude)*. For an explanation of all quantities measured refer to the beginning of this section on page 4.30.

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. 4.43.

Remote control

```
READ[:SCALar]:MODulation:EVMagnitude:EPSK?                etc.
CALCulate[:SCALar]:MODulation:EVMagnitude:EPSK
   :MATChing:LIMit?
```

Traces (arrays) The continuous trace in the test diagram shows the measured quantity as a function of time (in symbols). The display mode *(Current, Max./Min., Average)* for the trace is indicated in the upper right corner of the diagram.

The measurement curve comprises the whole useful part of the normal burst (bit 3 to 144). The curve is derived from 142 equidistant measurement points with a 1 bit spacing. The y-axis range is fixed for any of the three measured quantities (applications):

–20 deg to +20 deg	for the phase error
–20 % to +20 %	for the magnitude error
0 % to +20 %	for the error vector magnitude

Remote control

```
READ:ARRay:MODulation:EVMagnitude:EPSK:CURRent?   etc.
```

Demod. Bits It the demodulated bit marker is switched on (see marker functions on p. 4.33), then the demodulated bits in a 23-symbol range are displayed below the test diagram.

110 001 101 010 010 010 110 010 011 010 110 100 100 101 110 011 011 110 010 010 000 001 101

Each 8PSK symbol corresponds to 3 bits. The symbol at the marker position is displayed in the center of the bar, framed with a blue rectangle. Towards the edges of the burst, the bar contains invalid results (symbol numbers <3 and >144).

The result is suitable for analyzing the correlation between modulation errors and the transferred bit pattern.

Remote control

```
READ[:SCALar]:MODulation:<Application>:EPSK:DBITs
READ:ARRay:MODulation:<Application>:EPSK:DBITs?
READ[:SCALar]:MODulation:<Application>:EPSK:DBITs:PEAK?
```

etc., where `<Application> = EVMagnitude | PERRor | MERRor`

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

The *I/Q Analyz. 8PSK* application provides five different graphical menus to display and analyze the modulation vector of the received 8PSK-modulated signal. The diagram type is selected via *Display – Waveform* or in the configuration menu; see section *Measurement Control (Modulation Configuration – Control)* on p. 4.40 ff.

Representation in the I/Q Plane

The *Constellation* and the *Vector* diagram both show the basic properties of the 8PSK modulation vector in the I/Q plane. The menus display the actual test diagram and several output fields for the output power and the essential modulation parameters.

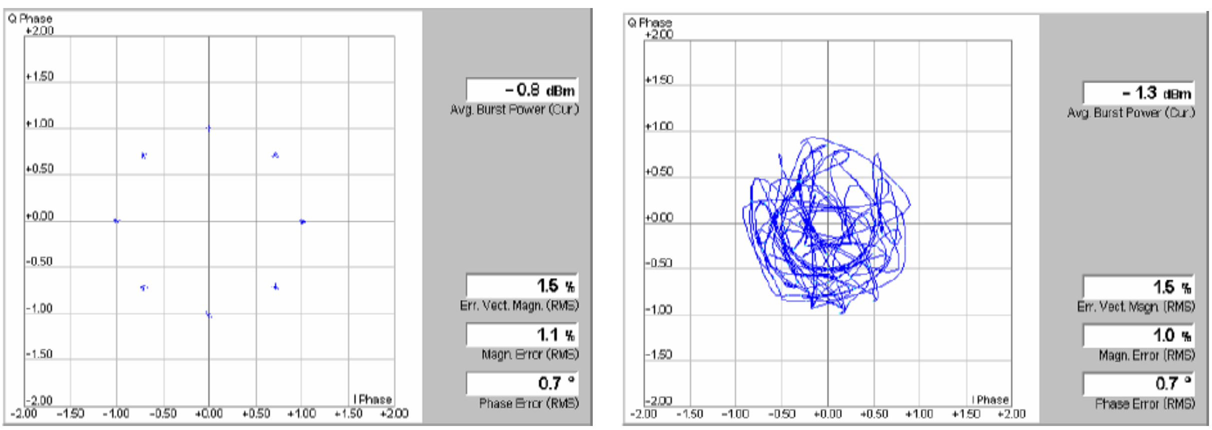


Fig. 4-17 Display of results (Modulation – I/Q Analyzer – Constellation/Vector)

Settings/ Scalar results

The scalar modulation parameters indicated in the output fields on the right side are also shown in the other *Modulation* applications; see e.g. section *Scalar Results (Overview)* on p. 4.34 ff.

Remote control
`READ[:SCALar]:MODulation:IQANalyzer:EPSK?` etc.

Diagrams

The constellation and vector diagrams trace the 8PSK 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 symbol. If the inter-symbol interference is removed by means of an appropriate I/Q filter (see p. 4.42), then the constellation diagram of an ideal 8PSK-modulated signal contains 8 constellation points with distance 1 from the origin and relative angles of $\pi/4$. Large variations of the symbol point positions in the constellation diagram indicate a poor signal quality.

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 8PSK modulation scheme allows transitions between each pair of constellation points.

A single shot measurement extends over 142 symbols within the useful part of a normal GSM burst (symbol 3 to symbol 144). The vector diagram is based on 4*142 = 568 measurement points.

Settings 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 *(Display* softkey). The appearance of the diagram is also influenced by the parameters *Rotation* (see p. 4.42) and I/Q filter (see p. 4.42).

Remote control
```
READ:ARRay:MODulation:IQANalyzer:EPSK:IPHASe?
READ:ARRay:MODulation:IQANalyzer:EPSK:QPHASe?
```
etc.

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.

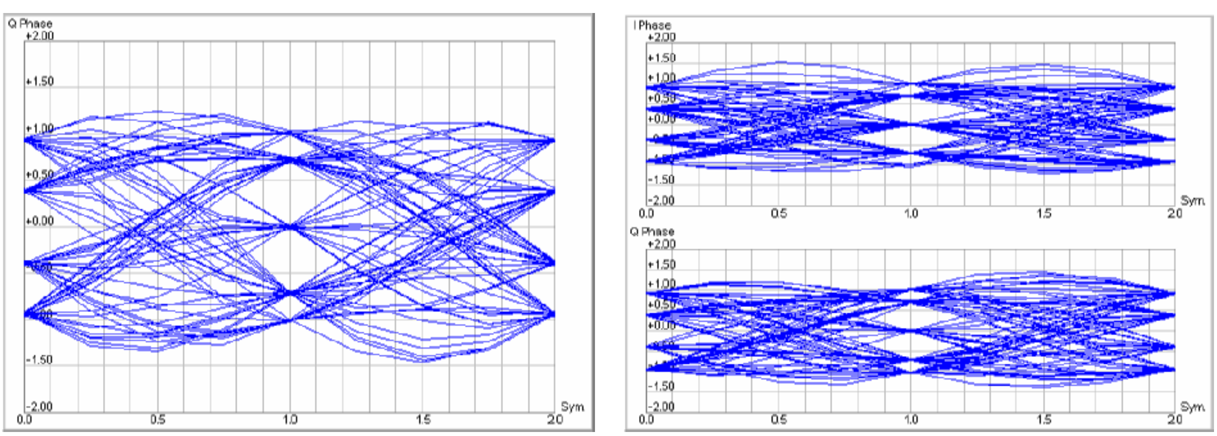


Fig. 4-18 Display of results (Modulation – I/Q Analyzer – I Phase / Q Phase)

Diagram The *I Phase,* the *Q Phase,* and the *I Phase & Q Phase* diagrams 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-symbol time interval, starting at the time of a constellation point, whereas the total duration of a single shot measurement is 142 symbols (symbols no. 3 to 144). The measurement curve restarts at the left diagram edge after each 2-symbol period so that the complete diagram contains 71 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 (=5). 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.

Settings 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 *(Display* softkey). The appearance of the diagram is also influenced by the parameters *Rotation* (see p. 4.42) and I/Q filter (see p. 4.42).

Remote control
`READ:ARRay:MODulation:IQANalyzer:EPSK:IPHASe?`
`READ:ARRay:MODulation:IQANalyzer:EPSK:QPHASe?` etc.

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 softkey *Phase Err. GMSK* (or *Overview 8PSK* etc. if one of the other applications is 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 tab *Control* controls the *Modulation* measurement by defining

- The *Repetition* mode
- The *Stop Condition* for the measurement
- The measurement curve displayed *(Display Mode*, not for application *Overview 8PSK)*
- The number of bursts/evaluation periods forming a statistics cycle *(Statistic Count)*,
- The decoding prescription for guard and tail bits *(Decode*, for GMSK modulation only)
- The averaging prescription to obtain the reference power *(Ref. Power Mode*, for *8PSK* measurements only)
- The display configuration for the *I/Q Analyzer* diagrams

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

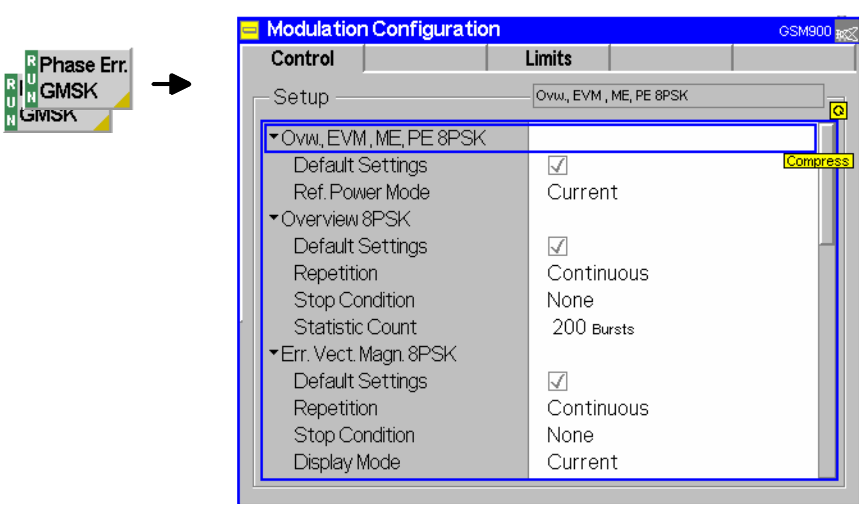


Fig. 4-19 Modulation Configuration – Control

The settings can be defined separately for the different applications of the *Modulation* measurement group. Most functions comply with those of the menu *Control* in the menu group *Power* (see page 4.18). In the remote-control commands, the keyword `POWer...` is to be replaced by `MODulation...`. The following parameters are specific to the *Modulation* measurement:

Default Settings The *Default Settings* switches assign default values to all parameters of a particular application. The default values are quoted in the command description in chapter 6 of this manual.

Remote control
`DEFault:MODulation:PERRor:GMSK:CONTrol ON | OFF etc.`

Display Mode The *Display Mode* field defines which of the measured and calculated traces is displayed. The traces differ in the way the phase error *Δ(t)* at a fixed point in time *t* is calculated if the measurement extends over several bursts:

Current	Measured value for the current burst
Max./Min.	Extreme value over a number of bursts
Average	Average value over a number of bursts

The number of bursts for the calculation of the statistic values *Minimum/Maximum* and *Average* – and thus the result – depends on the set measurement mode (see section *Measurement Control (Power Configuration – Control)* on page 4.18). In detail, this implies:

Single shot	Display of minimum, maximum and average value from the performed statistics cycle
Continuous	Display of minimum and maximum from all bursts already measured. The **average value**, however, is calculated according to the averaging prescription in Chapter 3, section *General Settings*.

In a power measurement, absolute values are determined, whereas the measured phase error can have both positive or negative sign. To assess the phase error only the magnitude (and not the sign) is relevant so that the *Modulation* menu shows extreme values instead of maxima and minima.

Remote control
No display mode set, the three traces are accessible via

```
FETCh:ARRAy:MODulation:PERRor:GMSK:CURRent?
FETCh:ARRAy:MODulation:PERRor:GMSK:MMAXimum?
FETCh:ARRAy:MODulation:PERRor:GMSK:AVERage?
```
etc.

Decode The *Decode* hotkey defines whether guard or tail bits are decoded or not (for GMSK modulation only).

Guard and tail bits are located at the beginning and the end of a normal burst (see *Fig. 4-30*), which is why they also affect the phase error at the beginning and the end of the useful information and therefore the frequency error. The CMU offers two settings:

Standard	Guard and tail bits are assumed to be in line with GSM. If the mobile station does actually not send these bits correctly, large phase errors will be measured at the beginning and end of the useful information.
Guard & Tailbits	Guard and tail bits are also decoded. This avoids excessive phase errors in the case of bursts that do not comply with the standard.

Remote control
```
CONFigure:MODulation:PERRor:GMSK:TIME:DECode
       STANdard | GTBits
```

The following parameters specify the values and appearance of the *I/Q Analyzer* diagrams.

Rotation

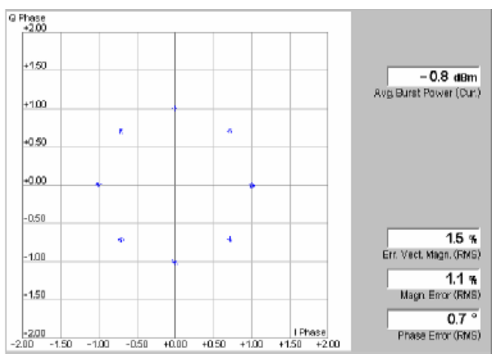
According to standard 3GPP TS 05.04 the 8PSK symbols are continuously rotated with 3π/8 radians per symbol before pulse shaping. Due to the rotation zero crossings in the vector diagram are avoided, however, the number of possible symbol point locations in the constellation diagram is doubled.

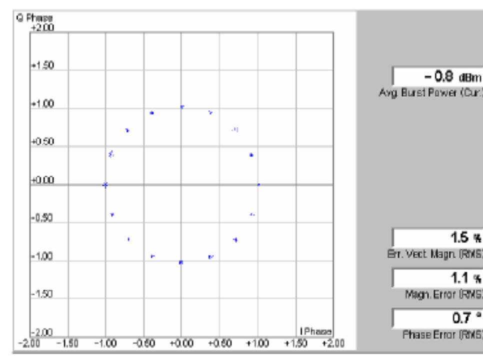
Rotation specifies whether or not the 3π/8 rotation is subtracted off before the symbols are displayed in the constellation diagram.

3π / 8 Removed The constellation points appear as if no phase rotation occurred; the constellation diagram contains 8 symbol point locations (left example below). The symbol mapping of the modulating bits into the 8 symbols is in accordance with specification 3GPP TS 05.04.

3π / 8 The phase-rotated constellation points are displayed; the constellation diagram contains 16 symbol point locations (right example below).

The *Rotation* setting is effective for the *Constellation* diagram only.





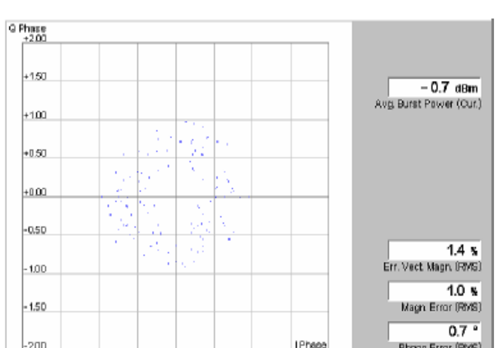
Remote control
`CONFigure:MODulation:IQANalyzer:EPSK:ROTation`
`   P38 | P38Removed`

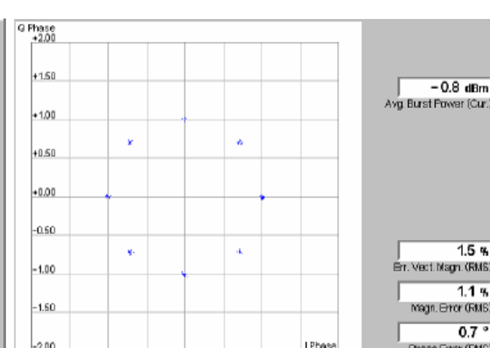
I/Q Filter

Specifies whether the I/Q data is filtered in order to eliminate the inter-symbol interference (ISI) at all constellation points.

Unfiltered No I/Q filter applied. The position of the constellation points is smeared out due to the ISI effects (left example below).

ISI Removed The constellation points appear at fixed locations (right example below).





Remote control
`CONFigure:MODulation:IQANalyzer:EPSK:IQFilter`

`ISIRemoved | UNFiltered`

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.

In addition to the zoom factor it is possible to shift the diagram in horizontal or vertical direction using the *Zoom* hotkey associated with the *Display* softkey.

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. 4.38 ff.

Vector Vector diagram; see section *Representation in the I/Q Plane* on p. 4.38 ff.

I Phase Eye diagram of the I amplitude; see section *Representation of the Amplitudes vs. Time* on p. 4.39 ff.

Q Phase Eye diagram of the Q amplitude; see section *Representation of the Amplitudes vs. Time* on p. 4.39 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. 4.39 ff.

Remote control
no command, display configuration only.

Tolerance Values (Modulation Configuration – Limits)

The tab *Limits* defines upper and lower error limits for the measured values of the phase and frequency error measurement.

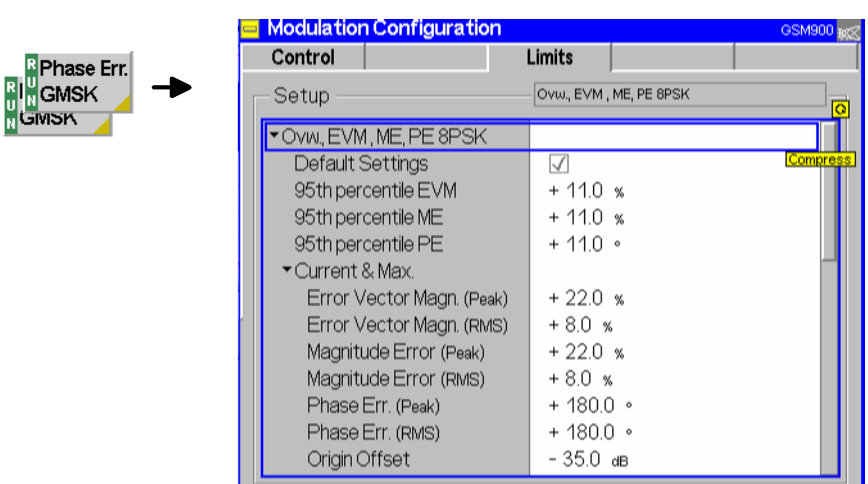


Fig. 4-20 Modulation Configuration – Limits

Default Settings

The *Default Settings* switches assign default values to all parameters of a particular application. The default values are quoted in the command description in chapter 6 of this manual.

Remote control
`DEFault:MODulation:PERRor:GMSK:CONTrol ON | OFF etc.`

Ovw., EVM, ME, PE 8PSK

The *Ovw., EVM, ME, PE 8PSK* table section defines all limits for 8PSK-modulated signals. The limits are set independently for the display modes *Current* and *Max./Min.* on one hand, *Average* on the other hand; see section *Measurement Control (Modulation Configuration – Control)* on p. 4.40 ff.

Default Settings	Overwrites all *8PSK settings* with their default values (see command description in Chapter 6)
95th percentile PE	Upper limit for the phase error below which 95% of all measured phase error values are located
95th percentile ME	Upper limit for the magnitude error below which 95% of all measured relative magnitude error values are located
95th percentile EVM	Upper limit for the relative error vector magnitude below which 95% of all measured EVM values are located
Error Vector Magn.	Upper limits for the (peak and RMS-averaged[2]) relative error vector magnitude (EVM). Both entries are positive.
Magnitude Error	Upper limits for the absolute value of the (peak and RMS) relative magnitude error. Both entries are positive; the limits for the peak magnitude error define a tolerance mask symmetric to the origin.
Phase Error	Upper limits for the absolute value of the (peak and RMS) phase error. Both entries are positive; the limits for the peak phase error define a tolerance mask symmetric to the origin.
Origin Offset	Upper limit for the origin offset in the I/Q constellation diagram.
Frequency Error	Upper limit for the difference between the measured and the expected frequency of the signal.

For an explanation of all measured quantities refer to the beginning of this section on page 4.30.

Remote control
```
CONFigure:MODulation:OEMP:EPSK:CMMAX:LIMit[:SCALar]:
         SYMMetric[:COMBined]:VALue
CONFigure:MODulation:OEMP:EPSK:AVERage:LIMit[:SCALar]:
         SYMMetric[:COMBined]:VALue
CONFigure:MODulation:OEMP:EPSK:P95Th:LIMit[:SCALar]:
         SYMMetric[:COMBined]:VALue
```

Phase Error GMSK

The table section *Phase Error GMSK* defines upper limits for the different GMSK modulation parameters. The limits depend on the display mode of the measurement curve:

Default Settings	Overwrites all *GMSK settings* with their default values (see command description in Chapter 6)
Current & Max.	Common limits for the *Current* measurement curve and for the *Minimum/Maximum* curve
Average	Limits for the *Average* measurement curve

[2] To keep the results comparable, RMS averaging was chosen for both positive quantities and quantities with alternating sign. The RMS-averaged EVM is calculated according to the prescription of GSM 05.05.

For setting of the display mode see section *Measurement Control (Modulation Configuration – Control)* on p. 4.40 ff.

The meaning of the error limits is the same for single-shot (Current & Max.) and average measurement:

Phase Err. Peak Maximum phase error

Phase Err. RMS RMS phase error (RMS-averaged over the burst)

Frequency Error Average frequency error in the burst

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). In contrast to the *Power* measurement where individual limit lines can be switched off, the *Modulation* limit check is always active.

Remote control

```
CONFigure:MODulation:PERRor:GMSK:CMMax:LIMit[:SCALar]
      :SYMMetric[:COMBined]:VALue
         <PhaseErrorPeak>,<PhaseErrorRMS>,<FrequencyError>

CCONFigure:MODulation:PERRor:GMSK:AVERage:LIMit[:SCALar]
      :SYMMetric[:COMBined]:VALue
         <PhaseErrorPeak>,<PhaseErrorRMS>,<FrequencyError>
```

Spectrum Measurements

The menu group *Spectrum* comprises the functions for measurement of the off-carrier power originating from the modulation process *(spectrum due to modulation)* and from the bursty nature of the RF signal, i.e. the power ramping up and down *(spectrum due to switching)*. The two spectra can be measured separately (applications *Modulation* and *Switching)* or together (application *Modulation & Switching).* Moreover, it is possible to analyze the power vs. time of the signal at off-carrier frequencies. 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 when the base station transmits at variable output power. The measurement is performed in the time domain (zero frequency span mode), at a series of frequency points symmetrically distributed around the nominal frequency of the designated channel (see section *Tolerance Values (Spectrum Configuration – Limit Lines)* on page 4.55 ff.).

In GSM 05.05 and GSM 11.21, the two *Spectrum* measurements are specified in detail:

- For the *spectrum due to modulation*, the power must be averaged over 50% to 90% of the useful part of the burst, excluding the training sequence, and then averaged again over a given minimum number of bursts.
- For the *spectrum due to switching*, the peak power over a minimum number of bursts must be determined.

Additional requirements concerning the measurement bandwidths are specified.

The *Spectrum* measurements for GMSK and 8PSK modulation are analogous, however, the tolerance values specified in the GSM standard vary depending on the modulation scheme.

A typical example of a burst measured at 400 kHz offset from the carrier (1st alternate channel) with a 30 kHz measurement filter is given below (Fig. 4-21). In the left example, the burst power at any time is averaged over several consecutive busts, the right example represents a peak hold measurement.

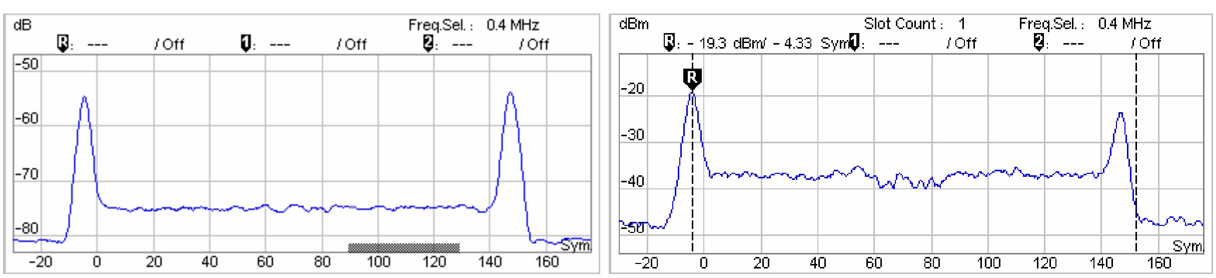


Fig. 4-21 Spectrum due to modulation and switching transients in time domain representation

Multislot Mode If the DUT operates in multislot mode, the spectrum due to *Switching* depends on the MS transmitter output power in all timeslots. The CMU provides a special multislot mode where the switching transients can be correctly measured for any multislot configuration and for any levels in the individual UL timeslots; see *Slot Count* softkey on p. 4.54.

The *Spectrum due to Modulation* measurement is performed on a slot by slot basis; the result is not influenced by multislot scenarios.

Trigger Settings In *Free Run* trigger mode (see section *Trigger (Connection Control – Trigger)* on p. 4.74 ff.), the CMU does not detect the burst edges of the measured RF signal. This mode is unsuitable for *Switching* measurements but can be used for *Modulation* measurements on continuous signals.

Measurement Menu (Spectrum)

The graphical measurement menu *Spectrum* displays the results of the adjacent channel power measurement.

- The measurement control softkey *Modulation GMSK* (which changes to *Switching GMSK, Modulation 8PSK,* or *Switching 8PSK* when the corresponding application or modulation scheme is selected) controls the measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Spectrum Configuration.* The hotkeys associated to the measurement control softkey define the scope of the *Spectrum* measurement.
- The remaining softkeys to the right of the test diagram 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. The entry of values is described in section *Test Settings* on page 4.3.

The measurement menu *Spectrum* can be accessed from any other measurement menu of function group *GSMxxxx-BTS Non Signalling* 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).

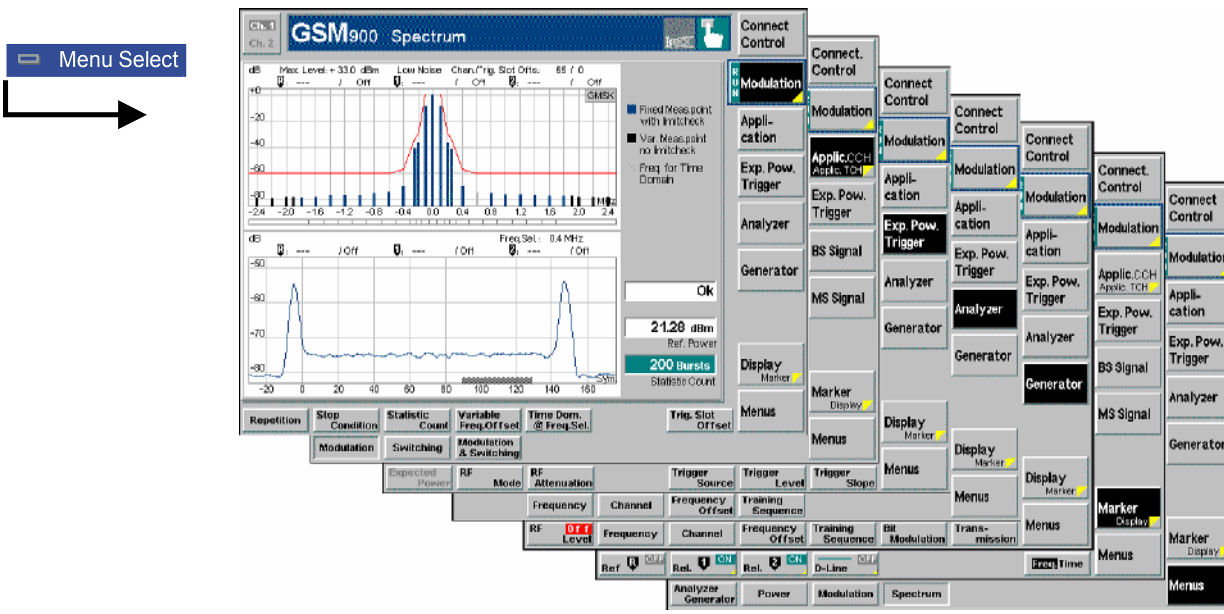


Fig. 4-22 Measurement menu Spectrum due to Modulation

Test Settings

The hotkeys associated to the measurement control softkey defining the scope of the measurement, the *Exp. Power Trigger, Analyzer, Generator* and *Marker* settings are identical with those in menu *Power* (see section *Test settings* on page 4.9; no display mode can be set in the *Spectrum* menu). The *Spectrum* measurement differs from the *Power* measurement in the *Application* softkey.

Modulation

The *Modulation* softkey controls the 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. It can be set independently for all *Spectrum* applications.

The active application generally suspends the other applications. On switchover between different applications, the selected measurement status of each application is stored and will be put into effect as soon as the application is activated. In particular, an application in the status *RUN* is restarted each time it is activated.

```
INITiate:SPECtrum:MODulation
ABORt:SPECtrum:MODulation
STOP:SPECtrum:MODulation
CONTINUE:SPECtrum:MODulation
FETCh:SPECtrum:MODulation:STATus?
```

Measurement configuration

Pressing the *Modulation GMSK* softkey twice opens the popup menu *Spectrum Configuration* (see page 4.52 ff.). Besides, the hotkeys *Repetition, Stop Condition,* and *Statistic Count* defining the scope of the measurement and the *Trig. Slot Offset* hotkey are associated to the measurement control softkey. The function of these hotkeys is explained in the *Power* menu section (see section *Test settings* on page 4.9); they are identical with the parameters set in the *Control* tab of the *Spectrum Configuration* menu (see page 4.52 ff.).

The remaining settings associated with the measurement control softkey are also accessible in the *Control* tab of the *Spectrum Configuration* menu.

Appli-cation

The Application softkey changes the type of spectrum to be measured and the modulation scheme. The two alternative spectra (applications) are displayed in separate measurement menus. When an application is selected, the corresponding measurement menu is called up and the labeling of the measurement control softkey is adapted. The configuration settings for both applications, however, are listed in a common popup menu (see p. 4.52 ff.).

Modulation

The *Modulation* hotkey selects the spectrum due to modulation measurement for GMSK or 8PSK modulated signals. In this mode, the power at the nominal frequency and the relative power at up to 11 neighboring frequencies is displayed in a single graph, see p. 4.49 ff.

Remote control
No explicit switchover command. All spectrum due to modulation measurements are identified by the 2nd to 4th level keywords `..SPECtrum:MODulation`

Switching GMSK

The *Switching GMSK* hotkey selects the spectrum due to switching measurement for GMSK or 8PSK modulated signals. In this mode, the power at the nominal frequency and the relative power at up to 4 neighboring frequencies is displayed in a single graph, see p. 4.51 ff.

Remote control
No explicit switchover command. All spectrum due to switching measurements are identified by the 2nd to 4th level keywords `...SPECtrum:SWITching`

Modulation &Switching

The *Modulation & Switching* hotkey selects the simultaneous measurement of the spectrum due to modulation and the spectrum due to switching for GMSK or 8PSK modulated signals.

Remote control
No explicit switchover command. All combined spectrum measurements are identified by the 2nd to 4th level keywords `...SPECtrum:MSWitching`

Measurement Results

The *Spectrum* measurement menu and the results depend on the type of spectrum (application) selected. The scaling of the axes is equal for the two spectra.

a) Spectrum due to Modulation

In the *Spectrum due to Modulation* measurement, the average burst power at a series of fixed frequency points around the selected RF frequency is displayed. The results and the corresponding settings are indicated in two parameter lines, the test diagrams (bar graph and time domain diagram), and three additional output fields:

Parameter lines

Frequency domain: Bar graph with legend on the right side

Time domain: diagram

Additional output fields on the right side

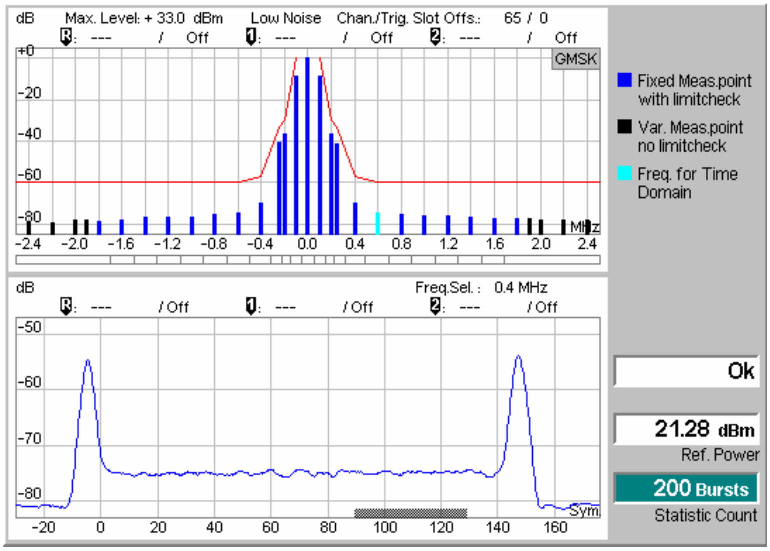


Fig. 4-23 Display of results (spectrum due to modulation)

Parameter lines The first parameter line contains the following settings:

Exp. Power Maximum input power as set in *Expected Power - Mode* (see section *RF Analyzer Settings (Connection Control – Analyzer)* on p. 4.61 ff.)

Attenuation Setting for the external attenuation of the input power *(Normal, Low Noise, Low Distortion)*

Freq. Offset Frequency offset with respect to the nominal channel frequency

Chan./Freq. RF channel and associated frequency

2nd parameter line The second parameter line contains the following marker values:

Absolute power (in dBm) and frequency offset from the carrier of reference marker

Power (in dBm) and frequency offset of delta marker 1 (setting *absolute*). With setting *relative,* the level difference from the carrier is indicated (same as the diagram units)

Power and time of delta marker 2, see delta marker 1

Output fields The output fields indicate the following settings and scalar results:

Burst Matching Error message if the displayed burst is out of tolerance.

Ref. Power Absolute value of the measured carrier output power of the MS. According to GSM specifications, the *Ref. Power* is measured with a filter bandwidth of 30 kHz so that it differs from the average burst power determined in the *Power vs. Time* menu.

Statistic Count Number of bursts per statistics cycle.

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark). The reference power and burst matching are retrieved with a single command:

```
READ[:SCALar]:SPECtrum:MODulation:<Modulation>?
FETCh[:SCALar]:SPECtrum:MODulation:<Modulation>?
SAMPle[:SCALar]:SPECtrum:MODulation:<Modulation>?
```

Response: <RefPower>,<Matching>

Bar graph The bar graph shows the current carrier output power of the BTS and the measured spectrum due to modulation at 11 non-equidistant frequencies that are symmetrically distributed around the carrier frequency. The diagram is scaled such that the x-axis indicating the frequency offset from the carrier ranges from –2 MHz to +2 MHz; the carrier output power forms the 0 dB reference level. The spectral tolerance mask defined in the *Limit Lines* tab (see p. 4.55 ff.) is indicated in addition. The measurement result at particular frequencies can be read out by means of markers. At every single frequency point, the measurement can be switched on or off in the *Meas X* tab (see p. 4.59).

Remote control

```
READ:ARRay:SPECtrum:MODulation:<Modulation>?
FETCh:ARRay:SPECtrum:MODulation:<Modulation>?
SAMPle:ARRay:SPECtrum:MODulation:<Modulation>?
```

Limit Check The upper limit lines defined in the Limit Lines tab of the configuration menu (see p. 4.55 ff.) yield the red polygonal curve in the diagram. If the limit check fails at a particular test point the corresponding section of the bar across the bottom of the diagram turns red.

Time Domain Diagram The time domain diagram shows the current BS output power at the frequency set under *Modulation – Time Dom. @ Freq. Sel.,* measured with a 30 kHz filter and averaged over consecutive bursts. The diagram is scaled such that the x-axis covers one burst length plus an appropriate margin; the carrier output power *(Ref. Power)* defines the 0 dB reference level. The diagram scale can be changed using the *Display/Marker* softkey.

The gray bars across the bottom of the diagram represent the *Averaging Areas* (A, B or both) selected in the *Control* tab of the configuration menu.

Remote control

Non Signalling:

```
READ:ARRay:SPECtrum:MODulation:TDOMain?
FETCh:ARRay:SPECtrum:MODulation:TDOMain?
SAMPle:ARRay:SPECtrum:MODulation:TDOMain?
```

Signalling

```
READ:ARRay:SPECtrum:MODulation:TCH:TDOMain?
FETCh:ARRay:SPECtrum:MODulation:TCH:TDOMain?
```

```
SAMPle:ARRay:SPECtrum:MODulation:TCH:TDOMain?
READ:ARRay:SPECtrum:MODulation:CCH:TDOMain?
FETCh:ARRay:SPECtrum:MODulation:CCH:TDOMain?
SAMPle:ARRay:SPECtrum:MODulation:CCH:TDOMain?
```

b) Spectrum due to Switching

In the *Spectrum due to Switching* measurement, the maximum level at a series of fixed frequency points around the selected RF frequency is displayed. The results and the corresponding settings are indicated in two parameter lines, the test diagrams (bar graph and time domain diagram), and three additional output fields:

Parameter lines

Frequency domain: Bar graph with legend on the right side

Time domain: diagram

Additional output fields on the right side

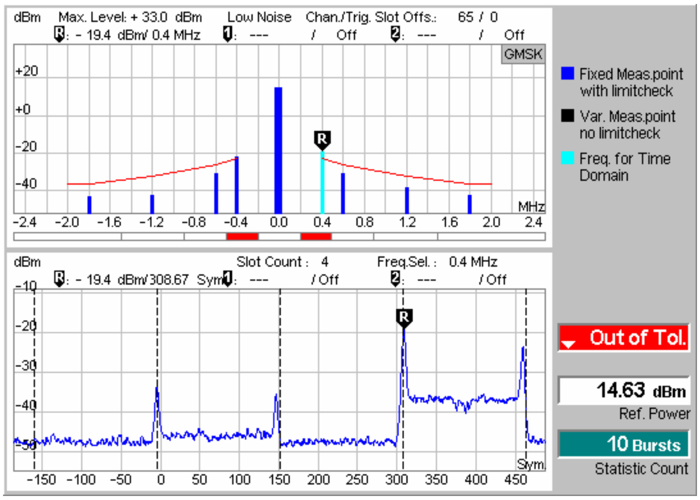


Fig. 4-24 Display of results (spectrum due to switching)

The two parameter lines and the output fields are identical with the *due to Modulation* menu, see above. Note that, according to GSM specifications, the *Ref. Power* is measured with a filter bandwidth of 300 kHz so that it slightly differs from the average burst power determined in the *Power* menu.

Bar graph The bar graph shows the current carrier output power of the BTS and the measured spectrum due to switching at 4 non-equidistant frequencies that are symmetrically distributed around the carrier frequency. The diagram is scaled such that the x-axis indicating the frequency offset from the carrier ranges from –2 MHz to +2 MHz; the y-axis is in relative power units (dBc). The spectral tolerance mask defined in the *Limit Lines* tab (see *Fig. 4-27* on p. 4.57) is indicated in addition. The measurement result at particular frequencies can be read out by means of markers. At every single frequency point, the measurement can be switched on or off in the *Meas X* tab (see p. 4.59).

Limit Check The upper limit lines defined in the *Limit Lines* tab of the configuration menu (see p. 4.55 ff.) yield the red polygonal curve in the diagram. If the limit check fails at a particular test point the corresponding section of the bar across the bottom of the diagram turns red.

Remote control

```
READ:ARRay:SPECtrum:SWITching?
FETCh:ARRay:SPECtrum:SWITching?
SAMPle:ARRay:SPECtrum:SWITching?
```

Time Domain Diagram The time domain diagram shows the current BS output power at the frequency set under *Modulation – Time Dom. @ Freq. Sel.,* measured with a 30 kHz filter, a 100 kHz video filter and in peak hold mode.

The diagram is scaled such that the x-axis covers the number of burst lengths selected in the configuration menu *(Spectrum Configuration – Control – Switching – Slot Count)* plus an appropriate margin. The carrier output power *(Ref. Power)* defines the 0 dB reference level. The diagram scale can be changed using the *Display/Marker* softkey.

Remote control

Non Signalling:	`READ:ARRay:SPECtrum:SWITching:TDOMain?`
	`FETCh:ARRay:SPECtrum:SWITching:TDOMain?`
	`SAMPle:ARRay:SPECtrum:SWITching:TDOMain?`

Signalling	`READ:ARRay:SPECtrum:SWITching:TCH:TDOMain?`
	`FETCh:ARRay:SPECtrum:SWITching:TCH:TDOMain?`
	`SAMPle:ARRay:SPECtrum:SWITching:TCH:TDOMain?`
	`READ:ARRay:SPECtrum:SWITching:CCH:TDOMain?`
	`FETCh:ARRay:SPECtrum:SWITching:CCH:TDOMain?`
	`SAMPle:ARRay:SPECtrum:SWITching:CCH:TDOMain?`

c) Application Modulation & Switching

In the *Modulation & Switching* application, both spectra are measured in a single measurement shot. The measurement menu contains two diagrams corresponding to the frequency domain bar graphs in the *Modulation* and *Switching* applications. *Modulation & Switching* can be used if both spectra but no power vs. time results are needed.

In remote control, *Modulation & Switching* is identified by the 2nd to 4th level keywords `...SPECtrum:MSWitching...` The combined `MSWitching` measurement takes longer than a single `MODulation` or `SWITching` measurement, however, all results can be retrieved with a single command.

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 *Modulation GMSK/8PSK* or *Switching GMSK/8PSK*, depending on the selected application and modulation scheme). 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

- A parameter to improve the dynamic range of the measurement *(Noise Correction)*
- The *Repetition* mode
- The *Stop Condition* for the measurement
- The number of bursts/evaluation periods forming a statistics cycle *(Statistic Count)*
- The frequency and averaging areas for the time domain diagram *(Time Dom @ Freq., Averaging Areas)*
- The analyzer settings and number of slots for *Spectrum due to Switching (Cont. Stat. Mode, Slot Count)*

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

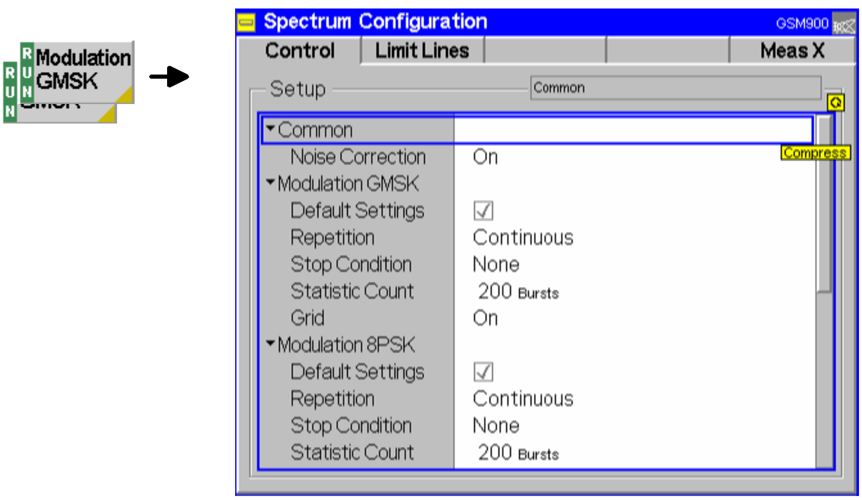


Fig. 4-25 Spectrum Configuration – Control

Noise Correction The *Noise Correction* field switches the noise corrections for all spectrum measurements on or off. The noise correction improves the dynamic range but slightly reduces the speed of the measurement.

Remote control `CONFigure:SPECtrum[:COMMon]:NOISe:CORRection ON | OFF`

All remaining settings can be defined separately for the two applications *due to Modulation* and *due to Switching* and for the two modulation schemes *GMSK* and *8PSK*. They comply with those of the menu *Control* in the menu group *Power* (see page 4.18). In the remote-control commands, the keyword `POWer` is to be replaced by `SPECtrum:MODulation` or `SPECtrum:SWITching`.

The following settings are specific to the time domain diagrams:

Time D. @ Freq. *Time D. @ Freq.* selects the measurement frequency for the time domain (power vs. time) diagrams in the *Modulation* and *Switching* applications. The frequency is defined relative to the carrier frequency *(Analyzer – Frequency).* All fixed and variable frequencies defined and enabled in the *Meas X* tab are available as time domain frequencies.

Remote control

Non Signalling: `CONFigure:SPECtrum:MODulation:TDFSelect`
`CONFigure:SPECtrum:SWITching:TDFSelect`

Signalling: `CONFigure:SPECtrum:MODulation:TCH:TDFSelect`

CONFigure:SPECtrum:SWITching:TCH:TDFSelect
CONFigure:SPECtrum:MODulation:CCH:TDFSelect
CONFigure:SPECtrum:SWITching:CCH:TDFSelect

Averaging Areas *Averaging Areas* selects one or two 40-bit sections of the burst which are measured and averaged in order to calculate the *Modulation* results. In accordance with the test specification the areas A and B do not overlap with the training sequence. Area A is located before, area B after the training sequence. The selected area(s) are indicated with a gray bar in the time domain diagram.

This setting has no impact on the *Switching* measurement.

Remote control
Non Signalling: CONFigure:SPECtrum:MODulation:AVGareas
Signalling: CONFigure:SPECtrum:MODulation:TCH:AVGareas
CONFigure:SPECtrum:MODulation:CCH:AVGareas

Cont. Stat. Mode *Cont. Stat. Mode* defines the analyzer settings for the *Spectrum due to Switching* measurement:

F. Dom. & T. Dom.
Peak Hold The results in the frequency and time domain diagram reflect the maximum signal power since the start of the measurement. The old results are only cleared when a new measurement is started.

F. Dom.: Stat. Count / T. Dom.:
Current The results in the frequency domain diagram are equal to the peak value over the last n bursts where n is the selected *Statistic Count* (moving window). If a *Statistic Count* larger than 100 is selected, then the peak value is taken over the last 100 bursts. The time domain measurement always represents the current burst.

Both settings are equivalent for single shot measurements.

Remote control
Non Signalling: CONFigure:SPECtrum:SWITching:CSMode PHOL | SCO
Signalling: CONFigure:SPECtrum:SWITching:TCH:CSMode PHOL | SCO
CONFigure:SPECtrum:SWITching:CCH:CSMode PHOL | SCO

Slot Count *Slot Count* defines the number of timeslots which are considered for the *Spectrum due to Switching* measurement:

1 The CMU measures the peak power in a fixed timeslot. The measured timeslot (MTS) is given by the trigger time plus the trigger slot offset (the *Trig. Slot Offset* softkey is associated with the measurement control softkey; it is described in the operating manual). A measurement cycle with *Statistic Count* = *n* extends over n (not necessarily consecutive) TDMA frames, where only the fixed timeslot, including the burst edges, is measured.

1 < n ≤ 8 The CMU measures the peak power in the MTS (see definition above), the MTS – 1, and the n–2 timeslots MTS + 1, MTS + 2, …, MTS + n – 2. The carrier output power (central bar in the *Spectrum due to Switching* diagram) is measured in the MTS; whereas the off-carrier powers represent the maximum power over all measured timeslots; see Fig. 4-24 on p. 4.51. A measurement cycle with *Statistic Count* = *n* extends over n TDMA frames.

The single slot measurement *(Slot Count: 1)* is faster and is correct if the DUT operates in single slot mode. By increasing the slot count it is possible to obtain the correct *Spectrum due to Switching* for any multislot configuration and for any levels in the individual UL timeslots. The measured off-carrier power does not depend on the *Measured Timeslot,* however, the *Measured Timeslot* has an influence on the measured carrier output power and thus on the limit lines. The *Measured Timeslot* can be changed in order to select the highest BS output power as a reference for the tolerance template, in close analogy to single slot mode.

Remote control
```
Non Signalling:  CONFigure:SPECtrum:MODulation:NOSLots 1 to 8
Signalling:      CONFigure:SPECtrum:MODulation:TCH:NOSLots 1 to 8
                 CONFigure:SPECtrum:MODulation:CCH:NOSLots 1 to 8
```

Tolerance Values (Spectrum Configuration – Limit Lines)

The tab *Limit Lines* defines upper limits for the output spectrum around the RF carrier frequency. All relative limit values are referred to the actual carrier output power of the base station. The tab provides the following settings:

- Selection of the template according to the modulation type *(Limit Selection)*
- Definition of the limit lines for *Spectrum due to Modulation* and *Spectrum due to Switching*

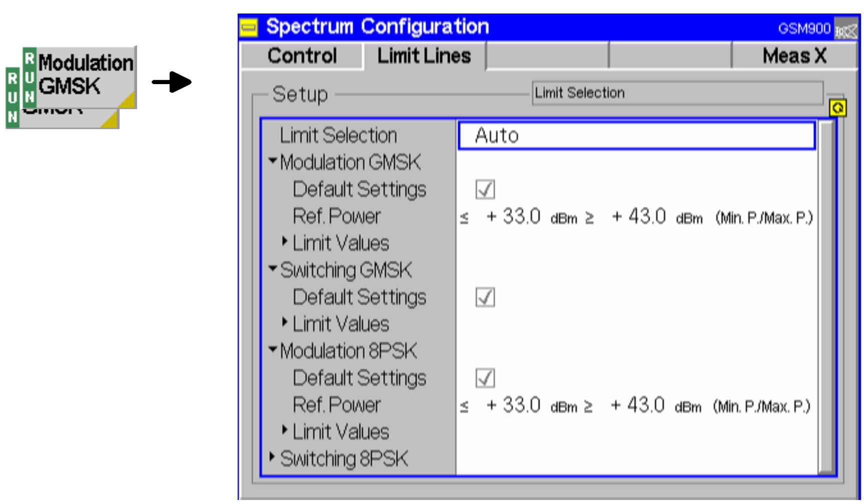


Fig. 4-26 Spectrum Configuration – Limit Lines

Limit Selection Selects the limit line template to be applied.

Auto The R&S CMU 300 uses the GMSK template. After detecting the first 8PSK modulated burst it uses the 8PSK template until the end of the measurement. Occasional GMSK modulated bursts within the 8PSK burst sequence will not disturb the limit lines.

GMSK The GMSK template is used irrespective of the actual modulation scheme of the received signal.

8PSK The 8PSK template is used irrespective of the actual modulation scheme of the received signal.

Remote control
Non Signalling: `CONFigure:SPECtrum:LIMit:LINE:SELect GMSK | EPSK | AUTO`
Signalling: `CONFigure:SPECtrum:TCH:LIMit:LINE:SELect GMSK | EPSK | AUTO`

a) Spectrum due to Modulation

The limit lines for the *spectrum due to modulation* as specified in standards GSM 05.05 and GSM 11.21 depend on both the frequency and (for frequencies that differ from the carrier frequency by more than 400 kHz) on the output power of the base station. The following values apply to all GSM bands:

Table 4-1 GSM tolerances for spectrum due to modulation

Frequency offset / [MHz]	**Relative power at a BTS output power ≤ 33 dBm (in dBc)**	**Relative power at a BTS output power ≥ 43 dBm (in dBc)**
0.1	+0.5	+0.5
0.2	–30	–30
0.25	–33	–33
0.4	–60 (GMSK modulation) –56 (8PSK modulation)	–60 (GMSK modulation) –56 (8PSK modulation)
0.6	–60	–70
1.0	–60	–70
1.2	–63	–73
1.4	–63	–73
1.6	–63	–73
<1.8	–63	–73

Between the frequency points in the table, the limits are determined by linear interpolation. Analogously, in the frequency range above 400 kHz from the carrier and for output powers between 33 dBm and 43 dBm, the limit depends linearly on the output power. The resulting spectral mask is shown below (*Fig. 4-27*).

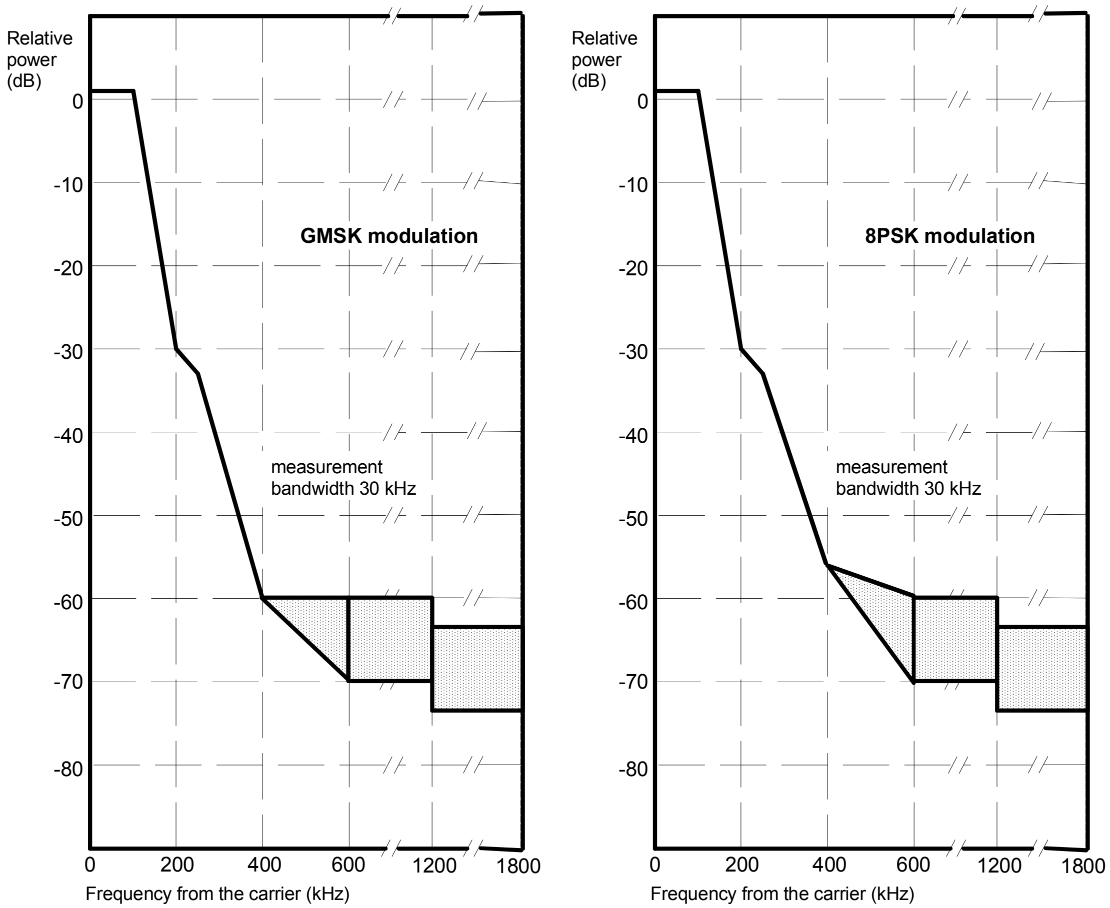


Fig. 4-27 Spectral mask as specified for GSM base stations

Slightly different limit lines are specified for micro and pico BTSs. Moreover, according to GSM 05.05 and 11.21, exceptions to the limit lines are allowed up to a level of –36 dBm and in a limited number of bands of limited width.

Default Settings The *Default Settings* switches assign default values to all parameters of a particular application. The default values are quoted in the command description in chapter 6 of this manual.

Remote Control
`DEFault:SPECtrum:MODulation:GMSK:LIMit:LINE ON|OFF` etc.

Ref. Power The *Ref. Power* line indicates the BTS carrier output power domain (33 dBm to 43 dBm according to the GSM standard) where the limit lines are to be determined by linear interpolation. Below *Min. P.*, the lower limit line applies, above *Max. P.*, the upper limit line applies. The *Ref. Power* domain can be modified.

Remote Control
```
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric
          [:COMBined]:RPOWer <Min_Power>,<Max_Power>
```

Limit Values The *Limit Values* table section defines upper limits for the power at eleven fixed, GSM-specific frequency offsets:

Lvl. rel. Upper limit for the RF power referred to the actual BTS carrier output power, valid for output powers below the *Ref. Power* domain *(Min. P.)* and for output powers above the *Ref. Power* domain *(Max. P.)*. Inside the *Ref. Power* domain, *Lvl. rel.* is determined by linear interpolation.

Level abs. Alternative absolute power limits, to be applied if the relative limits *Lvl. rel.* are tighter

Enable Switches the limit check at the frequency on and off.

Remote Control

```
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric
         [:COMBined]:FREQuency<nr>
           <Min_Rel>,<Max_Rel>,<Abs>,<Enable> etc.
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric
         [:COMBined]:FREQuency<nr>:ENABle ON | OFF  etc.
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric
         [:COMBined]:FREQuency<nr>:VALue  etc.
           <Min_Rel>,<Max_Rel>,<Abs>
```

b) Spectrum due to Switching

The limit lines for the *spectrum due to switching* as specified in standard GSM 05.05 and 11.21 cover offset frequencies between 0.4 and 1.8 MHz and do not depend on the output power of the base station. Different limit lines are defined for the individual GSM bands:

Table 4-2 GSM tolerances for spectrum due to switching

Frequency offset / [MHz]	**Maximum power relative to carrier / [dBc]**	
	GSM 400/850/900	**GSM 1800 /1900**
0.4	–57 (GMSK modulation) –52 (8PSK modulation)	–50
0.6	–67 (GMSK modulation) –62 (8PSK modulation)	–58
1.2	–74	–66
1.8	–74	–66

The minimum absolute limit is –36 dBm for all frequencies and GSM bands.

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 spectrum types are provided.

Remote Control

`DEFault:SPECtrum:SWITching:GMSK:LIMit:LINE ON|OFF` etc.

Limit Values The *Limit Values* table section defines upper limits for the power at four fixed, GSM-specific frequency offsets:

Lvl. rel. [dBc] Upper limit for the RF power referred to the actual BTS carrier output power

Level abs.[dB] Absolute limit for the RF power, to be applied if the relative limits *Lvl. rel.* are tighter

Enable Switches the limit check at the frequency on and off

If both a relative and an absolute limit at a frequency is defined, the limit check corresponds to the looser criterion (the higher of the two values).

Remote Control
```
CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE:SYMMetric
          [:COMBined]:FREQuency<nr>
            <Min_Rel>,<Max_Rel>,<Abs>,<Enable> etc.
CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE:SYMMetric
          [:COMBined]:ENABle ON | OFF   etc.
```

Selection of Measurement Points (Modulation Configuration – Meas X)

The tab *Meas X* defines at which frequencies a *Spectrum* measurement is performed.

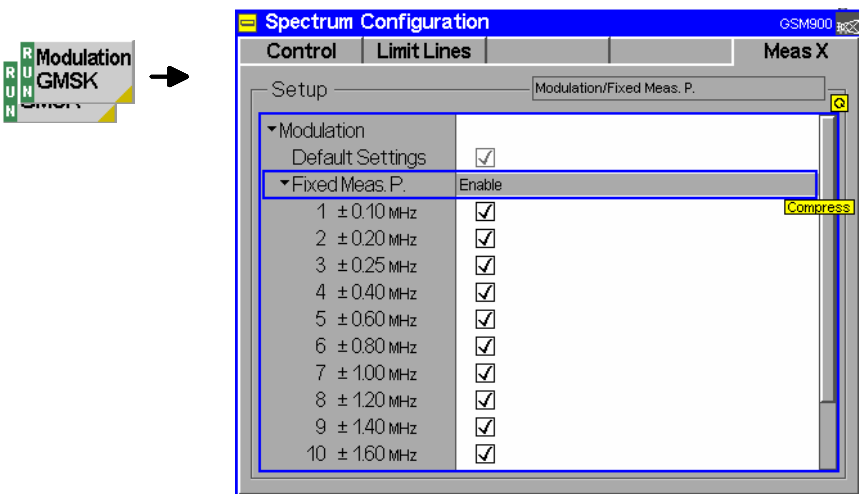


Fig. 4-28 Spectrum Configuration – Meas X

All settings can be defined separately for the two applications *due to Modulation* and *due to Switching*.

Default Settings The *Default Settings* switches assign default values to all parameters of a particular application. The default values are quoted in the command description in chapter 6 of this manual.

Remote Control
–

Fixed Meas. Points The *Fixed Meas. Points* table section enables (*Enable* box checked) or disables the spectrum measurement at fixed frequency points. All frequencies listed in *Table 4-1* (spectrum due to modulation) and *Table 4-2* (spectrum due to switching) can be selected.

Remote Control
```
CONFigure:SPECtrum:MODulation:MPOint<nr>:ENABle   ON|OFF
CONFigure:SPECtrum:SWITching:MPOint<nr>:ENABle  ON|OFF
```
etc.

Variable Meas. Points

Variable Meas. Points enables the spectrum measurement at additional frequencies. By default the additional points are switched *Off.* Setting a frequency enables the measurement at the variable measurement point. No limit check is performed. In the diagrams, black bars denote the results at variable measurement points.

A reduction of the measurement points enhances the measurement speed. To be selected as the frequency for the time domain measurement, a measurement point must be enabled.

Remote control

Non Sig.: `CONFigure:SPECtrum:MODulation:CONTrol:VMPoint<nr>`
`CONFigure:SPECtrum:SWITching:CONTrol:VMPoint<nr>`

Signalling: `CONFigure:SPECtrum:MODulation:TCH:CONTrol:VMPoint<nr>`
`CONFigure:SPECtrum:MODulation:CCH:CONTrol:VMPoint<nr>`
`CONFigure:SPECtrum:SWITching:TCH:CONTrol:VMPoint<nr>`
`CONFigure:SPECtrum:SWITching:CCH:CONTrol:VMPoint<nr>`

Connection Control

The popup menu *Connection Control* contains four tabs to configure the inputs and outputs of the CMU and the respective signals in the function group *GSM400/GT800/850/900/1800/1900-BTS Non Signalling.*

The menu group is activated via the softkey *Connect. Control* to the right of the header of each measurement menu. The individual tabs *(Analyzer, Generator, RF* and *Sync.)* are linked to each other via the hotkey bar at the lower edge of the screen.

RF Analyzer Settings (Connection Control – Analyzer)

The *Analyzer* tab determines the maximum expected input power *(Expected Power)* of the RF analyzer, defines the frequency *(RF Channel, Frequency Offset)* and the *Training Sequence* of the analyzed RF input signal and configures the RF input path as well as the trigger settings. Besides it controls the wideband peak power measurement *(Power)* and indicates the result.

The CMU provides a softkey-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.

Softkey-Oriented Version

The softkey-oriented version of the *Analyzer* tab determines

- The maximum input level that the CMU can measure *(Expected Power)*
- The frequency *(RF Channel, Frequency Offset)* and the *Training Sequence* of the analyzed RF input signal.

Besides it controls the wideband peak power measurement *(Power)* and indicates the result. All setting values of this menu are also displayed in the main menu *Analyzer/Generator* (see page 4.2).

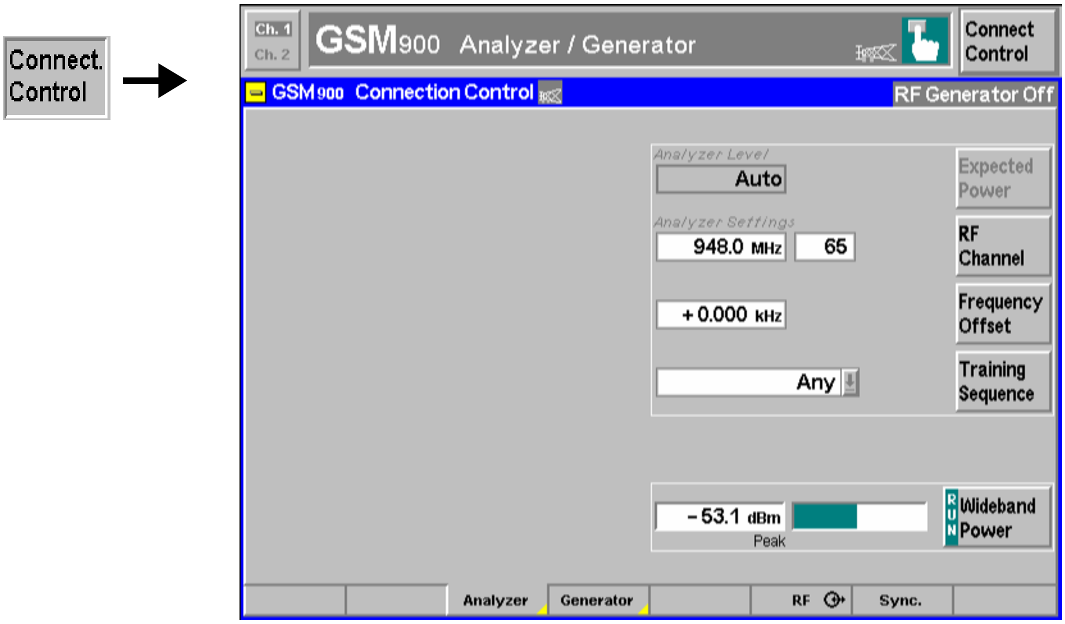


Fig. 4-29 Connection Control – Analyzer (softkey)

Expected Power

The *Expected Power* softkey adjusts the RF input signal path of the CMU to the maximum expected power of the measured signal (overload level). This level corresponds to the maximum peak envelope power (PEP) of the GSM signal that the CMU is able to measure. For GSM signals, the PEP is very close to the average burst power (low crest factor), however, it is appropriate to allow for a display margin of a few dB. Input levels exceeding the *Expected Power* 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 *Expected Power* softkey depends on the way the input level is set:

- In manual mode, the input level is indicated in the input field to the left of the softkey. This field can be activated and the level can be changed by pressing the *Expected Power* softkey. Note the remarks on external output attenuation on p. 4.68.
- If autoranging is selected, *Auto* is indicated in the input field to the right of the softkey. *Expected Power* 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:]EPOWer:VALue <Power>
[SENSe:]EPOWer:MODE <Power>
```

RF Channel

The *RF Channel* softkey defines the channel number and frequency of the measured signal. The assignment between channel numbers and frequencies is defined in the GSM specification for both directions of transmission (uplink and downlink). Therefore, it is sufficient to enter only one value (frequency **or** channel number), the CMU will automatically determine the other one.

The following tables contain the channel assignment in downlink direction (i.e. from base station to CMU). Compared to the uplink, all channel frequencies are shifted by a constant frequency offset depending only on the GSM band (duplex spacing; see *Table 4-4* on p. 4.68). Channel numbers which are not listed in the tables are not assigned.

Table 4-3 GSM channels in downlink direction

Frequency / [MHz]	Channel	GSM400 Band
0.2 ↓ 460.4	--- ↓ ---	–
460.6 ↓ 467.4	259 ↓ 293	GSM 450 band
467.6 ↓ 488.8	--- ↓ ---	
489.0 ↓ 495.8	306 ↓ 340	GSM 480 band
496.0 ↓ 2700	--- ↓ ---	–

Frequency / [MHz]	Channel	GSM900 Band
0.2 ↓ 921	--- ↓ ---	–
921.2 ↓ 925	955 ↓ 974	R-GSM band (European railway netw.)
925.2 ↓ 934.8 935.0	975 ↓ 1023 0	E-GSM band (extended GSM)
935.2 ↓ 959.8	1 ↓ 124	P-GSM-Band (primary GSM)
960 ↓ 2700	--- ↓ ---	–

Frequency / [MHz]	Channel	GSM1800 Band
0.2 ↓ 1805	--- ↓ ---	–
1805.2 ↓ 1879.8	512 ↓ 885	GSM 1800 band
1880 ↓ 2700	--- ↓ ---	–

Frequency / [MHz]	Channel	GSM1900 Band
0.2 ↓ 1930	--- ↓ ---	–
1930.2 ↓ 1989.8	512 ↓ 810	GSM 1900 band
1990 ↓ 2700	--- ↓ ---	–

Frequency / [MHz]	Channel	GSM850 Band
0.2 ↓ 869.0	--- ↓ ---	–
869.2 ↓ 893.8	128 ↓ 251	GSM 850 band
893.0 ↓ 2700	--- ↓ ---	–

Frequency / [MHz]	Channel	GSM GT800 Band
0.2 ↓ 849.8	--- ↓ ---	–
851.0 ↓ 866.0	350 ↓ 425	GSM GT 800 band
866.2 ↓ 2700	--- ↓ ---	–

According to the channel width of the GSM bands, the RF frequency can be set in multiples of 200 kHz. It can be modified by an additional *frequency offset* entered in the input field below.

Remote control

```
[SENSe:]RFANalyzer:FREQuency <Frequency>
```

Frequency Offset

The Frequency Offset softkey defines an offset for the frequency set under RF Channel. This enables fine tuning of the frequency measured by the CMU.

Remote control

```
[SENSe:]RFANalyzer:FOFFset <Offset>
```

Training Sequence

The Training Sequence softkey defines a training sequence for the measured signal.

The training sequence is located in the middle of the symmetrical normal burst and is used for synchronization and to assess the transmission conditions in the RF channel.

TB	Useful Information	F	Training sequence	F	Useful Information	TB	GP

TB	Tail bits (end or start bit)	Bits 0 to 2, 145 to 147
Useful information		Bits 3 to 59, 88 to 144
F	Flag Bit, Stealing Flag	Bits 60, 87
Training sequence		Bits 61 to 86
GP	Guard Period, transmission-free time of 8.25 bit periods	

Fig. 4-30 Bit structure of a GSM normal burst

Here the training sequence is used to distinguish different burst types: If a definite training sequence is specified, the CMU exclusively analyzes bursts with this training sequence. The following settings are provided:

GSM 0 to 7	GSM standard training sequences
Dummy	GSM-specific dummy burst
Off	Training sequence not detected, measurement of all bursts regardless of their training sequence
Any	Automatic detection of the training sequences. The signal is analyzed if one of the sequences defined in the GSM standard (GSM 0 to GSM 7 or Dummy) could be found.

GSM training sequences

The 8 training sequences *GSM 0 to GSM 7* are specified in the GSM standard and read as follows:

TSC	**Bit pattern (Bits No. 61 to 86)**																									
0	0	0	1	0	0	1	0	1	1	1	0	0	0	0	1	0	0	0	1	0	0	1	0	1	1	1
1	0	0	1	0	1	1	0	1	1	1	0	1	1	1	1	0	0	0	1	0	1	1	0	1	1	1
2	0	1	0	0	0	0	1	1	1	0	1	1	1	0	1	0	0	1	0	0	0	0	1	1	1	0
3	0	1	0	0	0	1	1	1	1	0	1	1	0	1	0	0	0	1	0	0	0	1	1	1	1	0
4	0	0	0	1	1	0	1	0	1	1	1	0	0	1	0	0	0	0	0	1	1	0	1	0	1	1
5	0	1	0	0	1	1	1	0	1	0	1	1	0	0	0	0	0	1	0	0	1	1	1	0	1	0
6	1	0	1	0	0	1	1	1	1	1	0	1	1	0	0	0	1	0	1	0	0	1	1	1	1	1
7	1	1	1	0	1	1	1	1	0	0	0	1	0	0	1	0	1	1	1	0	1	1	1	1	0	0

where

TSC	training sequence code for numbering the sequences
Bit pattern	26-bit training sequence

Remote control `[SENSe:]RFANalyzer:TSEQuence <Sequence>`

Wideband Power

The *Wideband Power* softkey controls the wideband power measurement and indicates its status *(RUN | HLT | OFF)*. The status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The measurement result is in units of dBm. The analog bar to the left of the softkey shows the measured power relative to the *Expected Power:* The display range is between *Expected Power – 10 dB* and *Expected Power + 10 dB*.

The wideband power measurement is performed at the RF Frontend of the CMU and yields the peak power of the input signal inside a wide frequency range. For GMSK modulated GSM signals, the result of the wideband power measurement is usually slightly higher than the result of the *Power* measurement which is obtained with different filter characteristics. The main purpose of the wideband power measurement is to indicate whether an input signal is available and whether it is advisable to change the *Expected Power* settings.

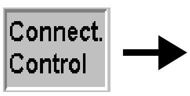
Note: *An additional quick and precise power measurement is available in remote control (keyword `NPOWer`).*

Remote control
```
INITiate:WPOWer
FETCh:WPOWer:STATus?
READ[:SCALar]:WPOWer?
FETCh[:SCALar]:WPOWer?
SAMPle[:SCALar]:WPOWer?
```

Table-Oriented Version

The table-oriented version of the *Analyzer* tab controls:

- The maximum expected input power *(Expected Power – Manual)* and the way it is defined *(Mode)*
- An external input attenuation or gain *(Attenuation)*
- All *Analyzer Settings* described in section Softkey-Oriented Version on p. 4.61 ff.



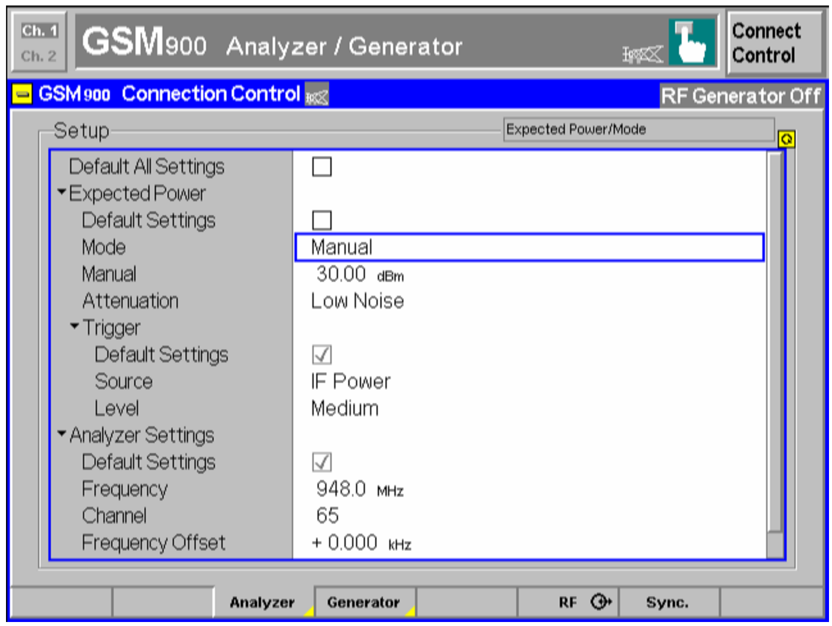


Fig. 4-31 Connection Control – Analyzer (table)

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). Additional default switches are provided for the individual sections of the *Analyzer* tab.

Remote control
```
DEFault:EPOWer ON | OFF
```

Expected Power – Mode

The *Expected Power* table section determines the maximum input power that can be measured. The maximum input power is displayed next to the softkey *Expected Power* in the main menu *Analyzer/Generator* (see page 4.2) and in the parameter lines above the graphical measurement menus. Two alternative *Modes* for defining this value are provided:

Manual	Manual input of maximum expected input power
Auto	Automatic setting of maximum input power (autoranging) according to average burst power of applied signal

Remote control
```
[SENSe:]EPOWer:MODE MANual | AUTomatic
```

Expected Power – Manual

The maximum expected input power can be entered in the *Manual* input field. Input powers exceeding the maximum expected power can not be measured; the corresponding measurement result fields indicate "– – –".

External input attenuation

The range of *Expected Power* 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)* on p. 4.70 ff.), 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 *Expected Power* 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 Expected Power
Re-edit	Expected Power is entered once again
Cancel	The last valid input value is maintained

When switching over to another input, the current value of *Expected Power* is automatically adapted, if required:

- Towards lower values to the maximum permissible value of the new input,
- Towards upper values to the minimum value of the new input.

Note: *A maximum input power can be entered even if automatic level setting (autoranging) is selected. This power is used as initial value for the autoranging procedure; it also ensures safe switchover to manual setting.*

Remote control
`[SENSe:]EPOWer:VALue <Power>`

Expected Power – Attenuation

The *Attenuation* parameter 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

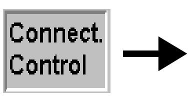
Remote control
`[SENSe:]EPOWer:ATTenuation <Mode>`

Generator Settings (Connection Control – Generator)

The *Generator* tab controls and configures the RF generator. It defines.

- The level for the used and unused timeslot (measurement control softkey *Generator*)
- The generator frequency *(RF Channel, Frequency Offset)*
- A *Training Sequence* and a *Bit Modulation* sequence for the generated RF signals
- The *Transmission* mode (continuous or burst signal, effective for GMSK-modulated signals only)

The CMU provides a softkey-oriented version of the *Generator* tab and a table-oriented version. The *Generator* hotkey toggles between the two versions if it is pressed repeatedly. Both versions provide the same settings.



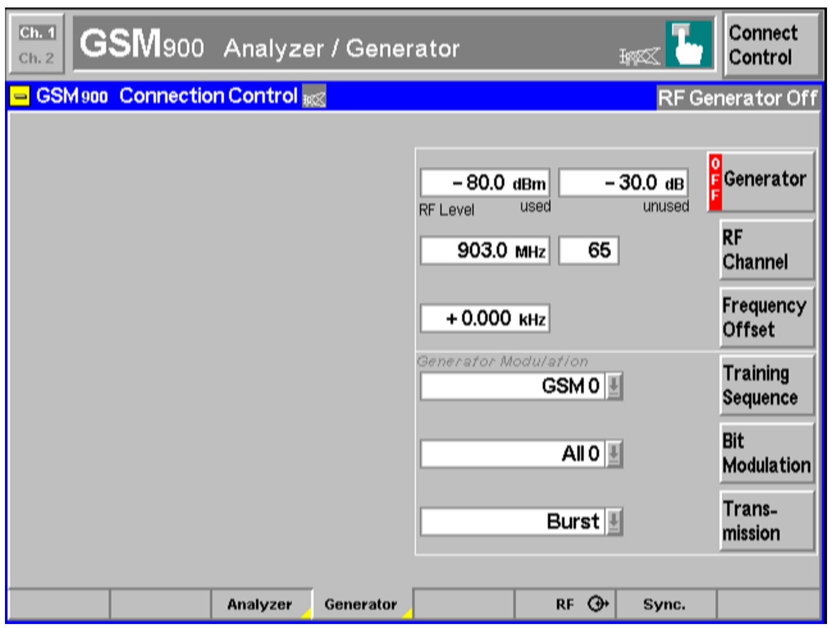


Fig. 4-32 Connection Control – Generator

Generator

The *Generator* softkey defines the generator level and 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.

For the generator level, a distinction is made between the used timeslot (selected and used for later measurements) and the remaining, unused timeslots. This feature is useful for many tests specified for GSM mobile phones. E.g. the adjacent time slot level is set to a higher value than the used time slot level in order to test whether the base station receiver can quickly adapt to fast level changes.

Remote control
```
INITiate:RFGenerator
ABORt:RFGenerator
FETCh:RFGenerator:STATus?
```

Used

The level is indicated as absolute value (in dBm).

Remote control
```
SOURce:RFGenerator:LEVel:UTIMeslot <Level>
```

Unused

The level is indicated relative to the level in the used timeslot (in dB). The absolute level in the unused timeslots, i.e. the sum of numerical values set under *used* and *unused* must lie within the permissible range for the RF Outputs. This condition further restricts the permissible level for the unused timeslots.

External output attenuation

If an external output attenuation or gain is known and reported to the instrument (see softkey *Ext. Att. Output*) the RF generator level is adjusted to maintain the commanded power after the attenuation or gain. As a consequence, all levels indicated are referred to the input of the DUT and no longer correspond to the actual level at the output connectors of the CMU (see section *RF Connectors (Connection Control – RF)* on page 4.70). The default value for the generator power is 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.

Error messages

If the level defined for *RF Level* is too high or too low, a window will appear with the error message *"<RF_Level> is out of range. <Permissible max. value> is limit.*" and three fields:

Accept	Permissible max. value is accepted as generator *RF Level*
Re-edit	The *RF Level* is entered once again
Cancel	The last valid input is maintained

When a different output is selected, the current value of *RF Level* is automatically adapted, if required:

- Towards lower values to the maximum permissible value of the new output
- Towards higher values to the minimum value of the new output

Remote control
```
SOURce:RFGenerator:LEVel:UNTimeslot <Level>
```

RF Channel

The *RF Channel* softkey defines the channel number or the frequency of the generated RF signal.

The assignment of channel numbers and frequencies is unambiguously defined in the GSM specification for both directions of transmission. Therefore, it is sufficient to enter only one value (frequency **or** channel number), the other one is automatically determined by the CMU.

The following tables contain the channel assignment in uplink direction (i.e. from CMU to base station). Compared to the downlink, all channel frequencies are shifted by a constant frequency offset depending only on the GSM band (duplex spacing, see *Table 4-3* on p. 4.62): Channel numbers which are not listed in the tables are not assigned.

Table 4-4 GSM channels in uplink direction

Frequency / [MHz]	Channel	GSM400 Band
0.2 ↓ 450.4	--- ↓ ---	–
450.6 ↓ 457.4	259 ↓ 293	GSM 450 band
457.6 ↓ 478.8	--- ↓ ---	
479.0 ↓ 485.8	306 ↓ 340	GSM 480 band

Frequency / [MHz]	Channel	GSM900 Band
0.2 ↓ 876	--- ↓ ---	–
876.2 ↓ 880	955 ↓ 974	R-GSM band (European railway netw.)
880.2 ↓ 889.8 890.0	975 ↓ 1023 0	E-GSM band (extended GSM)
890.2 ↓ 914.8	1 ↓ 124	P-GSM-Band (primary GSM)

Frequency / [MHz]	Channel	GSM400 Band
486.0 ↓ 2700	--- ↓ ---	–

Frequency / [MHz]	Channel	GSM900 Band
915 ↓ 2700	↓ ---	–

Frequency / [MHz]	Channel	GSM1800 Band
0.2 ↓ 1710	--- ↓ ---	–
1710.2 ↓ 1784.8	512 ↓ 885	GSM 1800 band
1785 ↓ 2700	--- ↓ ---	–

Frequency / [MHz]	Channel	GSM1900 Band
0.2 ↓ 1850	--- ↓ ---	–
1850.2 ↓ 1909.8	512 ↓ 810	GSM 1900 band
1910 ↓ 2700	--- ↓ ---	–

Frequency / [MHz]	Channel	GSM850 Band
0.2 ↓ 824.0	--- ↓ ---	–
824.2 ↓ 848.8	128 ↓ 251	GSM 850 band
849.0 ↓ 2700	--- ↓ ---	–

Frequency / [MHz]	Channel	GSM GT800 Band
0.2 ↓ 805.8	--- ↓ ---	–
806.0 ↓ 821.0	350 ↓ 425	GSM GT 800 band
821.2 ↓ 2700	--- ↓ ---	–

According to the channel width of the GSM bands, the RF frequency can be set in multiples of 200 kHz. It can be modified by an additional *frequency offset* entered in the input field below.

Remote control
`SOURce:RFGenerator:FREQuency <Number>`

Frequency Offset

The *Freq. Offset* softkey defines a frequency offset shifting the frequency set under RF Channel. This enables fine tuning of the RF frequency generated by the CMU.

Remote control
`SOURce:RFGenerator:FOFFset <Offset>`

Training Sequence

The *Training Sequence* softkey defines the training sequence that is modulated on the RF carrier signal. The following settings are possible:

GSM 0 to 7	GSM standard training sequences
All 0	Training sequence consisting of zeros
Dummy	GSM-specific dummy burst

The 8 GSM standard training sequences are listed on p. 4.64.

Remote control
```
CONFigure:RFGenerator:MODulation:TSEQuence
                        GSM0 | ... | GSM7 | DUMMy
```

Bit Modulation

The *Bit Modulation* softkey defines a bit sequence that is modulated onto the RF carrier signal. The following types of modulation sequence can be selected:

Off	No signal superimposed, "empty" carrier
All 0	Modulation sequence consisting of zeros
PRBS	Pseudo random bit sequence
Dummy Bursts	Fixed bit sequences (Dummy Bursts) with selectable training sequence
8PSK All 0	Modulation sequence consisting of zeros, 8PSK modulation
8PSK PRBS	Pseudo-random bit sequence, 8PSK modulation

Remote control

```
CONFigure:RFGenerator:MODulation:BMODulation
  OFF | PRBS | DUMMy | ALL0 | EALL0 | EPRBs
```

Trans-mission

The softkey *Transmission* determines the shape of the generated RF signal. The RF generator generates either a burst or a continuous signal, i.e. a carrier with a constant level. The setting is valid for GMSK-modulated signals only.

Remote control

```
CONFigure:RFGenerator:MODulation:TRANsmission
                       BURSt | CONTinuous
```

RF Connectors (Connection Control – RF)

The *RF* tab configures the connectors for RF signals. This includes the setting 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)*

The tab also controls the wideband peak power measurement *(Wideband Power)* and indicates the result. The name and function of the AF connectors is indicated in addition.

Connect. Control →

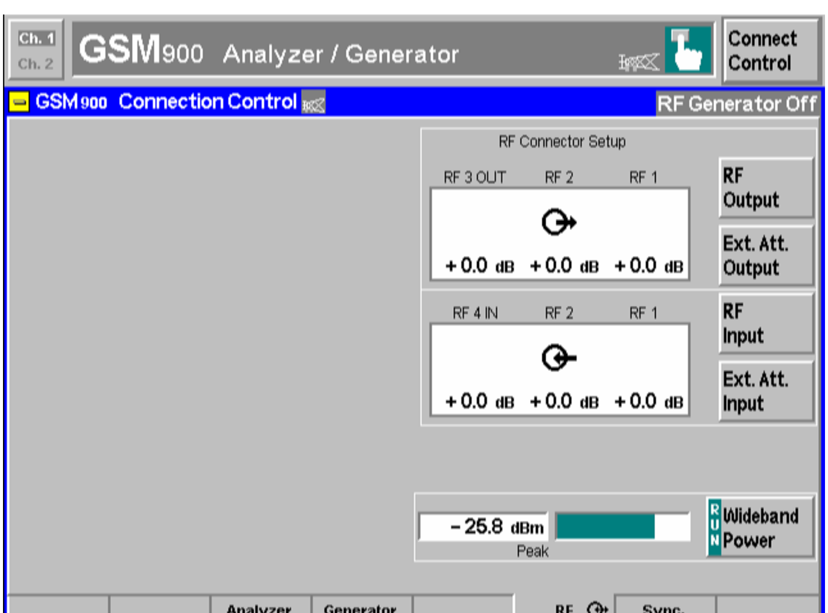


Fig. 4-33 Connection Control – RF connectors

The *Wideband Power* measurement is explained on p. 4.64.

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: *It is possible to combine any pair of input and output connectors. The bidirectional connectors RF 1 and RF 2 can be selected as RF inputs and outputs at the same time.*

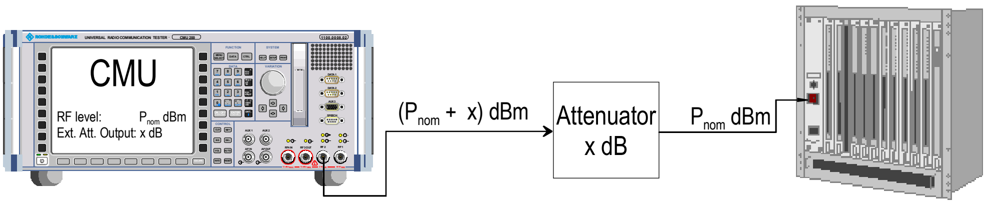
The LEDs on the front panel are only „on“ (light) if the output level is switched on.

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 if, 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.



Remote control
`[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]`
`SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]`

RF Input

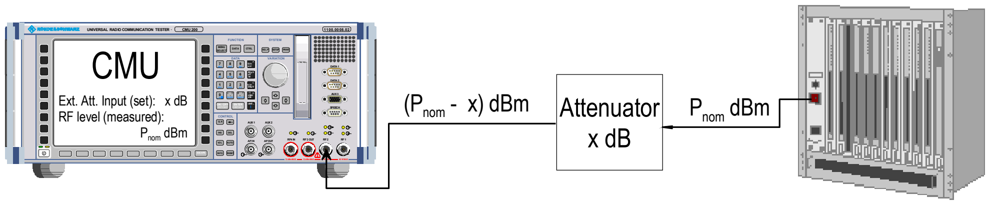
The *RF Input* softkey determines which of the three connectors RF 1, RF 2 and RF 4 IN is to be used as RF input connector. A symbol indicates the selected input. It is possible to combine any pair of input and output connectors.

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)* on page 4.70), 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.*

Remote control
`[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]`
`SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude]`

Reference Frequency (Connection Control – Sync.)

The *Sync.* tab defines the reference signals for synchronization. This includes

- The internal or external *Reference Frequency*
- Configuration of the network-specific system clock *(REF OUT 2)*

Connect. Control →

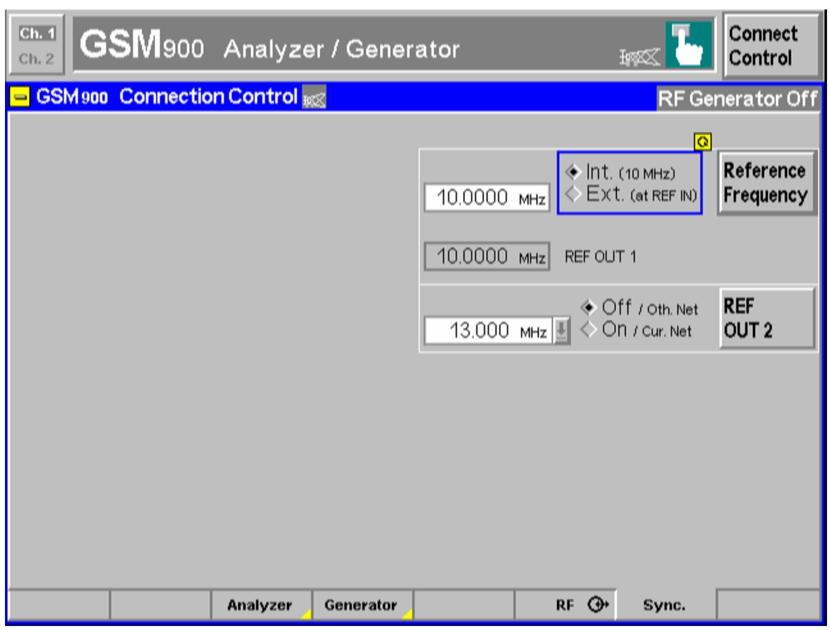


Fig. 4-34 Connection Control – Sync.

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 next 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. *With external synchronization selected, the header cyclically displays a warning if no synchronization has been performed e.g. because of 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 or REF OUT 2 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 network is GSM900) 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:

39.000 MHz,	19.500 MHz,	13.000 MHz,	9.750 MHz,	7.800 MHz,	6.500 MHz,	5.571 MHz,
4.875 MHz,	4.333 MHz,	3.900 MHz,	3.545 MHz,	3.250 MHz,	3.000 MHz,	2.786 MHz,
2.600 MHz,	2.438 MHz,	2.294 MHz,	2.166 MHz,	2.053 MHz,	1.950 MHz,	1.857 MHz,
1.773 MHz,	1.696 MHz,	1.625 MHz,	1.560 MHz,	1.500 MHz,	1.444 MHz,	1.393 MHz,
1.349 MHz,	1.300 MHz,	1.258 MHz,	1.219 MHz			

(The values are calculated according to the formula $F_{out} = 39.000\ MHz / n$ where $n = 1, ..., 32$.)

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 / 2* again switches back to the first group of tabs described above.

The *Trigger* tab defines the trigger condition for the measurement and the input for the external trigger signal.

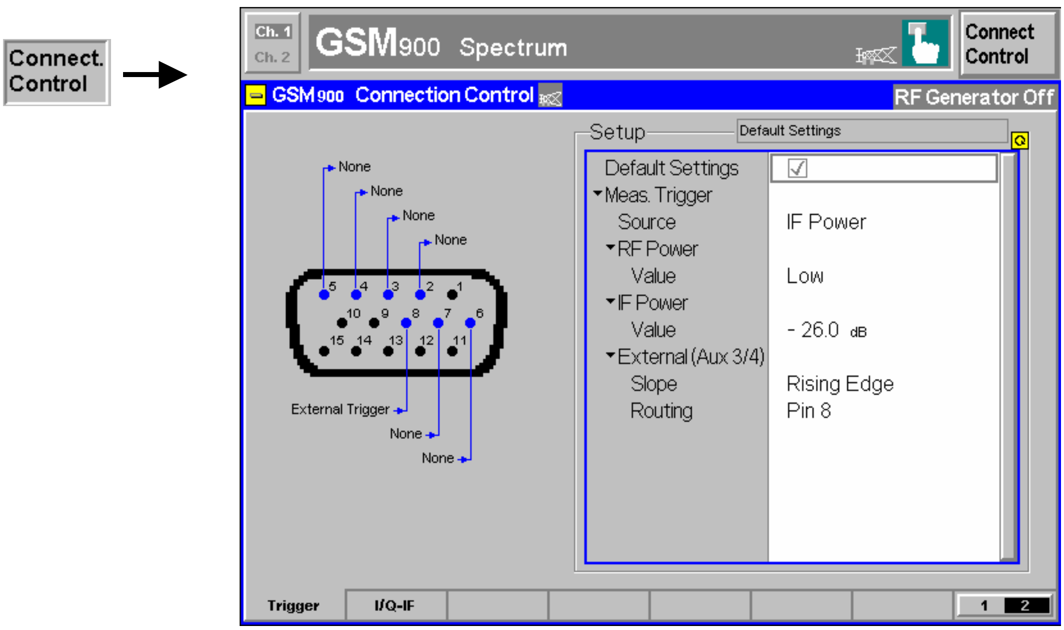


Fig. 4-35 Connection Control – Trigger

Default Settings The *Default Settings* checkbox assigns the default setting to all functions in the *Trigger* tab (the default values are quoted in the command description in chapter 6 of this manual).

Remote control `TRIGger[:SEQuence]:DEFault ON | OFF`

Meas. Trigger – Source *Source* selects the source for the trigger event:

Free Run Trigger by the GSM input signal: The CMU detects the burst; the exact timing is given by the training sequence. This setting may slow down the measurements.

RF Power The measurement is triggered by the level of the incoming burst (rising or falling edge; see *Slope* setting below), the trigger level is specified via the *Level* parameters. Wideband power trigger on the RF Front End.

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.

Extern External trigger signal fed in via connector AUX 3 or AUX 4; see *Ext. Trigger ...* setting below. The measurement is triggered by the rising or falling edge of the external trigger signal; see *Slope* setting below.

For the *Free Run, RF Power* and *IF Power* settings the input signal must be a burst signal. The external trigger can be selected for all *Non Signalling* measurements. In contrast, *Signalling* measurements must be triggered by the signal from the signalling unit or from the base station.

RF Power trigger signals have a small dynamic range which may not be sufficient for triggering. It is recommended to trigger by the *IF Power* instead.

Note: *If no measurement result can be obtained the trigger mode may not fit to the trigger signal applied. Check the trigger mode and signal.*

Remote control
`TRIGger[:SEQuence]:SOURce FRUN | EXTern | RFPower | IFPower`

RF Power / IF Power

…Value

The *Value* parameters define the trigger thresholds if the measurement is triggered by the *RF Power* or *IF Power* (see *Source* function above) respectively. Both thresholds are defined relative to the expected power set in the *Analyzer* tab. The *Level* settings have no influence on *Free Run* or *External* trigger measurements.

Note: *The trigger levels are always relative to the **current** expected power. If the expected power is set manually* (Mode = Manual)*, the current input level is constant and equal to the setting value. In autoranging mode* (Mode = Auto)*, the current maximum input level is dynamically adapted to the measured RF input level; the trigger levels change accordingly.*

The ***RF Power*** trigger threshold is the RF input signal level *(Wideband Power*, see p. 4.64) beyond which the trigger condition is satisfied and a measurement is initiated.

Low Low trigger threshold, equal to approx. the *Expected Power* –26 dB

Medium Medium trigger threshold, equal to approx. the *Expected Power* –16 dB

High High trigger threshold, equal to approx. the *Expected Power* –6 dB

The ***IF Power*** trigger threshold is the IF trigger signal level beyond which the trigger condition is satisfied and a measurement is initiated. The *IF Power* input value defines the trigger threshold relative to the expected power:

IF power trigger threshold = <Expected Power> + <IF Power>

Remote control
```
TRIGger[:SEQuence]:THReshold:RFPower LOW | MEDium | HIGH
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, which may be either an *RF Power,* an *IF Power* or an *External* trigger signal. The setting has no influence on *Free Run* measurements.

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

Ext. Trigger (AUX 3/4) – Routing

Ext. Trigger (AUX 3/4) – Routing qualifies whether the external trigger signal is fed in at *Pin 6, Pin 7,* or *Pin 8* of the AUX 3 connector. The setting only has effect if the trigger source is an *External* signal.

The CMU can be ordered with the auxiliary connector AUX 4 on the rear panel configured as an external trigger input. In this case the *Ext. Trigger...* pin selection refers to AUX 4; the front panel connector AUX 3 is disconnected.

Remote control
`TRIGger[:SEQuence]:SOURce:EXTernal PIN6 | PIN7 | PIN8`

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.

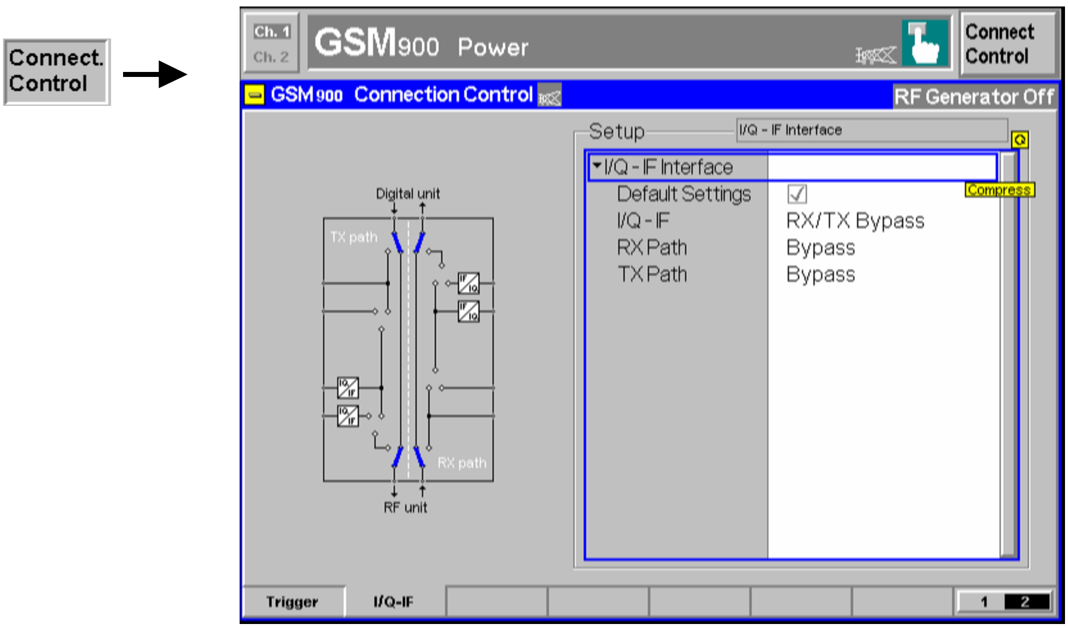


Fig. 4-36 Connection Control – I/Q-IF

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 4-5 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
```

RX 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
```

Table 4-5 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

GSM BTS Tests (Signalling)

The structure of this section is based on the configuration and measurement groups defined in function group *GSM400/GT800/850/900/1800/1900-BTS Signalling*, i.e. on the menus of the graphical user interface. The menus are described in the following order:

- Synchronization to the base station *(Connection Control – Connection)*
- Overview of measurements and global settings *(Overview)*

1. Measurement menus *(Power, Modulation, Spectrum, Receiver Quality):* Purpose of the measurements and relation to the test specifications and conformance requirements, description of measurement results, specific measurement configurations

- Global configurations *(Connection Control)*

The most important menus within function group *GSM400/GT800/850/900/1800/1900-BTS Signalling* are shown in an overview at the end of chapter 3 in the present GSM manual.

A lot of menus and controls are identical in the two test modes *Signalling* and *Non Signalling*. In this chapter, these menus will only be presented with a summary explanation; the detailed description can be found in the section *GSM400/GT800/850/900/1800/1900-BTS Non Signalling*.

Synchronizing the CMU and BTS (Popup Menu Connection Control – Connection)

The menu group *Connection Control* controls the signalling procedures (call setup and release, services, signalling parameters) and configures the inputs and outputs with the external attenuation values and the reference frequency.

The term signalling summarizes all procedures that are necessary for call setup and release and for control of a connection in the mobile radio network. In the case of the GSM base station measurements, the following main signalling states are distinguished:

Unsynchronized	No synchronization with the base station signals. As no hardware resources are available in this state, no measurements can be performed. To carry out measurements which do not require synchronization use the *Non Signalling* mode.
CCH Test	Synchronization to the base station succeeded, control channel test on timeslot 0 of the BTS signal.
TCH Test	Synchronization to the base station succeeded, traffic channel test.
Call Established	Call to base station succeeded, traffic channel test

These main signalling states are reached via intermediate signalling states. In the intermediate states, no measurements can be performed. The following intermediate states are defined:

Synchronizing	The BTS transmits a GSM control channel signal to which the CMU can synchronize.
Location Update	A location update is being performed (substate *Location Update in Progress*) or an error occurred during a location update (substate *Location Update Failed*)
Call	A call to the base station (MOC) or from the base station (MTC) is being set up (substate *Call in Progress*) or an error occurred during call setup (substate *Call Failed*)
Call Release	A call release is being performed (substate *Call Release in Progress*) or an error occurred while the call connection was released (substate *Call Release Failed*)

A number of control commands which can be initiated both by the CMU *(Mobile Originated Call, MOC)* and by the base station *(Mobile Terminated Call, MTC)* switch over between these states (see *Fig. 4-37*; processes initiated by the base station or automatic processes are indicated by dashed lines).

The CMU provides different synchronization modes to better meet the requirements of different test cases. The synchronization mode is selected and configured before the synchronization is started; it will have an impact both on the *Synchronizing* state and on the test mode reached after successful synchronization. For more information see *Sync. Mode* softkey on page 4.80.

Many applications within the function group *GSM400/GT800/850/900/1800/1900-BTS Signalling* are only possible in a particular signalling state (for example, as EDGE channels are exclusively used for data transfer, all 8PSK measurements must be performed in the TCH Test mode, whereas the corresponding measurement configurations may be defined in any signalling state). Therefore, the menus and their functionality vary according to the signalling states. For reference see the *Status* field in the command tables in Chapter 6.

As the *Signalling* measurements require a synchronization between the CMU and the BTS, the corresponding menus (*Connection Control – Connection)* appear immediately after the function group and mode *GSM400/GT800/850/900/1800/1900-BTS Signalling* 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.

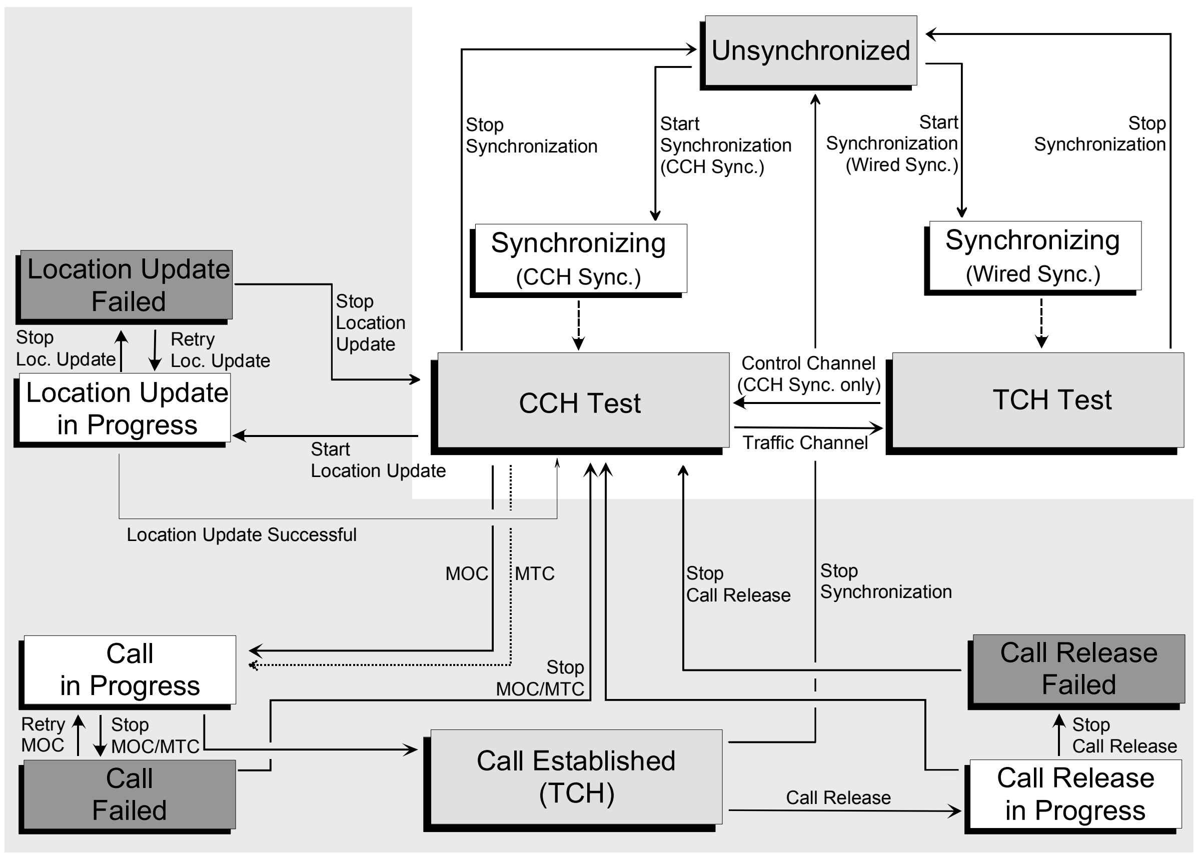


Fig. 4-37 Signalling states of the CMU

Note: *The* Call Established (TCH) *state and all other states in the shaded area in Fig. 4-37 are available with option CMU-K39, MOC/MTC only.*

Measurements on 8PSK-modulated channels can be performed with option CMU-K41 and in the TCH Test *and* Call Established (TCH) *signalling states only.*

Some test settings may not be available in all signalling states. For reference see the Sig. State *field in the command description in chapter 6 of this manual.*

Each of the signalling states in *Fig. 4-37* is assigned a different *Connection* tab in the *Connection Control* menu. When *the CCH Test* signalling state is reached, the corresponding menu is opened automatically (exception: see softkey *Open Pop. autom.*).

In the following the *Connection Control – Connection* tabs displayed during the call setup are described. The other tabs of the *Connection Control* menu provide general measurement settings; they are described in section *Connection Control* on page 4.124 ff.

Connection Control (State Unsynchronized)

The *Connection (Unsynchronized)* tab shows an overview of the most important signalling and measurement parameters in *Signalling* mode (table in the left half of the menu). Besides it contains softkeys to perform the following actions:

- Activate the synchronization process between the CMU and the base station under test *(Start Sync.)*.
- Control the wide band peak-power measurement and show the result *(Power).*

Connect. Control →

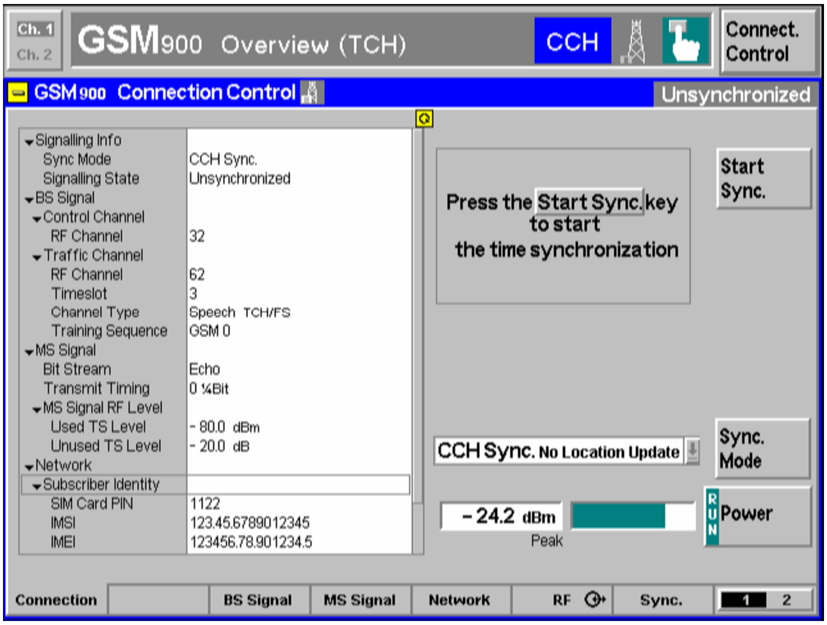


Fig. 4-38 Connection Control – Connection (Unsynchronized)

The information displayed in the table in the left half of the menu is also available in the other signalling states; for a description refer to section *Traffic Channel Test* on p. 4.85 ff.

Start Sync.

The *Start Sync.* softkey initiates the synchronization process.

On pressing this softkey, the CMU changes to the signalling state *Synchronizing*. Synchronization (and thus the *Synchronizing* state) depends on the *synchronization mode*, see below.

Remote control `PROCedure:SIGNalling:ACTion SRUN`

Sync. Mode

The *Sync. Mode* softkey selects the synchronization mode.

The synchronization mode defines which type of signal is to provide the timing information. As shown in the table below, the synchronization mode governs the softkey *CCH RF Chan. / Training sequence*, the *Synchronizing* tab, (see section *Connection Control (State Synchronizing)* on page 4.81) and determines which test mode will be active after a successful synchronization. The following modes are provided:

CCH Sync. No Loc. Update The timing information is provided by a control channel signal from the BTS under test received via the current RF connector. The channel number of the CCH signal can be set by means of the *CCH RF Chan.* softkey.

Wired Sync. (Ext. Trigger) The timing information is provided by an external trigger signal (high-pulse or low-pulse TTL) fed in via connector AUX3 (pin no. 6). The training sequence of the BTS traffic channel signal can be set by means of the *Training Sequence* softkey.

Wired synchronization is a means of circumventing CCH synchronization if no *CCH Test* is desired or possible and no call to the BTS needs to be established. The CMU synchronizes to the SACCH (frame no. 13) of a traffic channel multiframe consisting of 26 TDMA frames (26-multiframe trigger). No control channel signal from the base station is needed. In general wired synchronization is faster than CCH synchronization. Moreover, it is suitable in all test scenarios where the presence of a control channel could possibly impair the measurement.

In addition to the training sequence (GSM0 to GSM7) of the SACCH frames, the CMU exploits information such as the rising or falling edge of the TTL trigger signal for synchronization purposes. These trigger parameters are set in the *External Trigger Input* panel; see below.

Sync. Mode	CCH RF Chan. / TSC	Synchronizing Menu Message	Test Mode after Sync.
CCH Sync. No Loc. Update	CCH RF Chan.	"Searching for a Control Channel..."	CCH Test
Wired Sync. (External Trigger)	Training Sequence	"Waiting for external trigger"	TCH Test

Remote control `CONFigure:SIGNalling:SMODe NUBCch | NUETrg`

Power

The *Power* softkey controls the wide-band power measurement and indicates its state *(RUN* **|** *OFF* **|** *HLT)*.

The state can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The measurement result is in units of dBm. The analog bar to the right of the softkey shows the measured power relative to the expected level from the BTS, i.e. the nominal output power. The display range is between *Nominal Power – 10 dB* and *Nominal Power + 10 dB*.

The wideband power measurement is performed at the Front End of the CMU and yields the peak power of the input signal inside a wide frequency range. For GMSK modulated GSM signals, the result of the wideband power measurement is usually slightly higher than the result of the *Power* measurement which is obtained with different filter characteristics. The main purpose of the wideband power measurement is to indicate whether an input signal is available and whether it is in the expected range.

Note: *An additional quick and precise power measurement is available in remote control (keyword `NPOWer`).*

Remote control

```
INITiate:WPOWer
FETCh:WPOWer:STATus?
READ[:SCALar]:WPOWer?
FETCh[:SCALar]:WPOWer?
SAMPle[:SCALar]:WPOWer?
```

Connection Control (State Synchronizing)

The *Connection (Synchronizing)* tab shows an overview of the most important signalling and measurement parameters in *Signalling* mode (table in the left half of the menu) and displays a comment on the current synchronization process (message box). Besides it contains softkeys to perform the following actions:

- Stop the synchronization process between the CMU and the base station under test *(Stop Sync.)*.
- Control the wide band peak-power measurement and show the result *(Power).*

Depending on the synchronization mode (synchronization by means of the CCH from the base station or wired synchronization, see *Sync. Mode* parameter on p. 4.80), the *Synchronizing* tab occurs in two different versions:

Connect. Control →

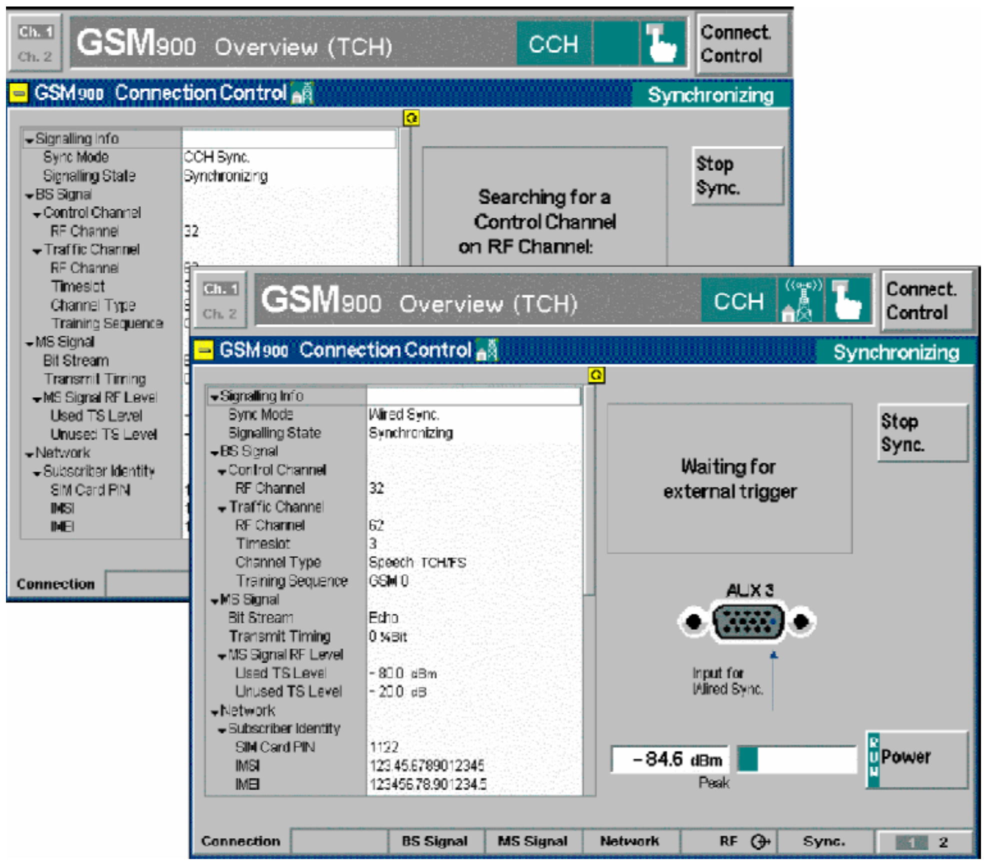


Fig. 4-39 Connection Control – Connection (Synchronizing)

The information displayed in the table in the left half of the menu is also available in the other signalling states; for a description refer to section *Traffic Channel Test* on p. 4.85 ff. The *Power* softkey is described in section *Connection Control (State Unsynchronized)* on page 4.80. Note that, if wired synchronization is selected, the input connector for the signal *(AUX3)* with the appropriate input pin (pin no. 6) is displayed in addition.

Stop Sync.

The *Stop Sync.* softkey stops the synchronization process.

The CMU returns to the signalling state *Unsynchronized,* see p. 4.80.

Remote control `PROCedure:SIGNalling:ACTion SSTP`

Connection Control in the CCH Test State

The *Connection (CCH Test)* tab shows an overview of the most important signalling and measurement parameters in *Signalling* mode (table in the left half of the menu) and displays a comment on the next signalling processes available (message box). Besides it contains softkeys to perform the following actions:

- Release of the synchronization *(Stop Sync. –>* state *Unsynchronized)*
- Switchover to traffic channel test *(Traffic Channel –>* state *TCH Test)*
- Initiating a location update *(Location Update –>* state *Location Update*, with option CMU-K39 only)
- Establishing a call to the base station *(MOC –>* state *Call Established*, with option CMU-K39 only)
- Control the wide band peak-power measurement and show the result *(Power)*.

Note: *If the synchronization is lost during operation (because of a low signal level etc.) the warning Synchronization Lost ! will appear.*

At the same time, bit 2 is set in the STATus:OPERation register. Prior to further operation, confirm the reception of the message by pressing the Accept *button.*

The *CCH Test* tab can not be accessed with wired synchronization.

Connect. Control →

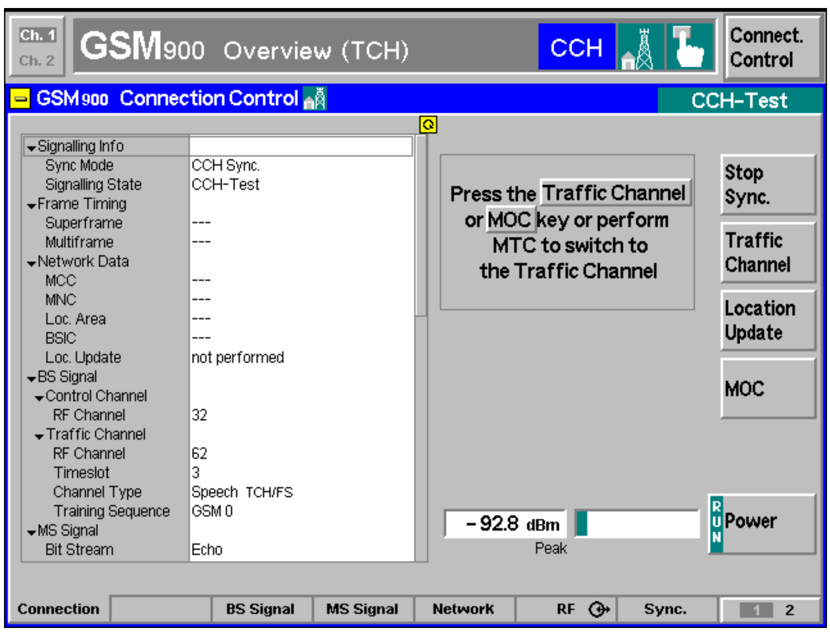


Fig. 4-40 Connection Control – Connection (CCH Test)

The *Power* softkey is described in section *Connection Control (State Unsynchronized)* on page 4.80.

Stop Sync.

The *Stop Sync.* softkey stops the synchronization process.

The CMU returns to the signalling state *Unsynchronized*.

Remote control `PROCedure:SIGNalling:ACTion SSTP`

Traffic Channel

The softkey *Traffic Channel* switches over to the *TCH Test* tab.

In the *TCH Test,* the CMU performs measurements on the traffic channel, see section *Traffic Channel Test* on page 4.85.

Remote control `PROCedure:SIGNalling:ACTion TCH`

Location Update

The softkey *Location Update* initiates a location update of the CMU to the base station.
The *Location Update* tab is called up, see section *Location Update* on page 4.124. This softkey is available with option CMU-K39 only.

Remote control `PROCedure:SIGNalling:ACTion LUP`

MOC

The softkey *MOC* sets up a call from the CMU to the base station (Mobile Originated Call).

The *Call in progress* tab is called up, see section *Call in Progress (with Option CMU-K39 only)* on page 4.125. This softkey is available with option CMU-K39 only.

Remote control `PROCedure:SIGNalling:ACTion MOC`

The table in the left half of the menu shows an overview of the most important signalling and measurement parameters in *Signalling* mode. Some of the parameters depend on the configuration of the BTS under test; the remaining ones are set in the *BS Signal, MS Signal, Network, RF* ⟶, and *Sync*. tabs of the *Connection Control* menu. The roll-key scrolls up and down in the table.

Most of the information displayed in the table is also available in the other signalling states; for a description refer to section *Traffic Channel Test* on p. 4.85 ff. The following parameters are transferred over the control channel so they are specific to the *CCH Test* signalling state:

Frame Timing The table section *Frame Timing* indicates the number of superframes (containing 26 x 51 = 1326 TDMA frames) and multiframes (containing 51 TDMA frames for control channels) transmitted via the CCH. The numbers are output values which are continuously updated. The multiframe counter repeats after each complete superframe (26 multiframes); the superframe conter after 2^{12} superframes.

Remote control
```
[SENSe:]INFO:FTIMing:MULTiframe?
[SENSe:]INFO:FTIMing:SUPerframe?
```

Network Data The table section *Network Data* indicates parameters to identify the CMU/mobile station and the network.

MCC	3-digit Mobile Country Code
MNC	2-digit Mobile Network Code
Loc. Area	3-digit Location Area Code of the base station
BSIC	6 bit Base Transceiver Station Identity Code = NCC (PLMN Color Code) + BCC (BTS Color Code)
Loc. Update	Indicates whether a location update has been performed successfully since the CMU left the signalling state *Unsynchronized.*

Remote control `[SENSe:]INFO:NWData:...?`

Traffic Channel Test

The *Connection (TCH Test)* tab shows an overview of the most important signalling and measurement parameters in *Signalling* mode (table in the left half of the menu) and displays a comment on the next signalling processes available (message box). Besides it contains softkeys to perform the following actions:

- Release of the synchronization (Stop Sync. –> state Unsynchronized)
- Switchover to control channel test (Control Channel –> state CCH Test)
- Control the wide band peak-power measurement and show the result (Power)

Note: *If the synchronization is lost during operation (because of a low signal level etc.) the warning Synchronization Lost ! will appear.*

At the same time, bit 2 is set in the STATus:OPERation register. Prior to further operation, confirm the reception of the message by pressing the Accept *button.*

Connect. Control →

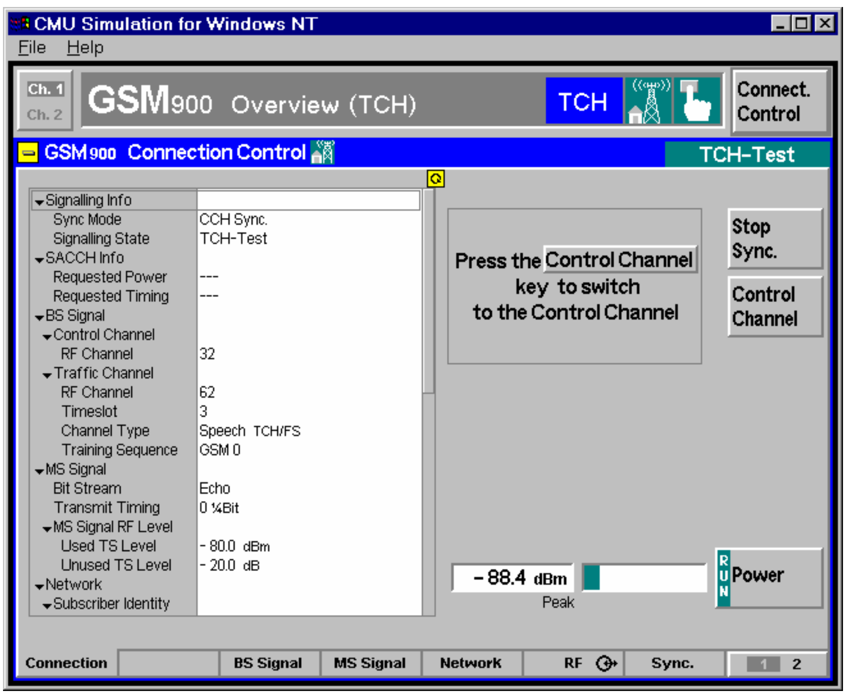


Fig. 4-41 Connection Control – Connection (CCH Test)

The *Power* softkey is described in section *Connection Control (State Unsynchronized)* on page 4.80.

Stop Sync.

The *Stop Sync.* softkey stops the synchronization process.

The CMU returns to the signalling state *Unsynchronized*.

Remote control `PROCedure:SIGNalling:ACTion SSTP`

Control Channel

The softkey *Control Channel* switches back to the *CCH Test* tab.

This softkey is not available for wired synchronization; see *Fig. 4-37* on page 4.79.

Remote control `PROCedure:SIGNalling:ACTion CCH`

The table in the left half of the menu shows an overview of the most important signalling and measurement parameters in *Signalling* mode. Some of the parameters depend on the configuration of the BTS under test; the remaining ones are set in the *BS Signal, MS Signal, Network, RF* ⊙→, and *Sync.* tabs of the *Connection Control* menu. The roll-key scrolls up and down in the table.

Signalling Info

The table section *Signalling Info* indicates the synchronization mode and the current signalling state.

Sync. Mode — Synchronization mode set via the *Sync. Mode* softkey; see p. 4.80. For wired synchronization, additional control parameters for the synchronization process are displayed. These parameters are set in the *Sync.* tab of the *Connection Control* menu; see page 4.141 ff.

Signalling State — Current signalling state. The signalling state is also indicated in the title bar of the *Connection Control* menu and in the title bar of all measurement menus.

The *Signalling Info* section is available in all but the transitory signalling states.

Remote control

```
CONFigure:SIGNalling:SMODe? <Mode>
[:SENSe]:SIGNalling:STATe?
```

SACCH Info

The table section *SACCH Info* indicates signalling information that is transferred by the base station via the SACCH (Slow Associated Control Channel) associated to the allocated traffic channel. The parameters depend on the configuration of the BTS under test.

Requested Power — Power control level and (in brackets) corresponding maximum output power requested by the BTS from the mobile phone (CMU).

Requested Timing — Timing advance requested by the BTS.

The *SACCH Info* section is available in the *TCH Test* and *Call Established* states. It is not available for wired synchronization for lack of valid frame numbers.

Remote control

```
[SENSe:]INFO:SACChinfo:REQuested:POWer?
[SENSe:]INFO:SACChinfo:REQuested:TIMing?
```

BS Signal

The table section *BS Signal* indicates the parameters of the control and traffic channel signal provided by the BTS under test. The BS signal is configured in the *BS Signal* tab (see page 4.130 ff.).

Control Channel — GSM *RF Channel* number of the BTS control channel.

Traffic Channel — GSM *RF Channel* number, used *Timeslot*, *Channel Type* (see *TCH Chan. Type* on p. 4.131), and *Training Sequence* of the BTS traffic channel.

The *BS Signal* section is available in all but the transitory signalling states.

Remote control

```
CONFigure:BSSignal...
```

MS Signal

The table section *MS Signal* indicates the parameters of the MS traffic channel signal provided by the CMU. These parameters are set in the *MS Signal* tab (see page 4.133 ff.).

Bit Stream	Data transmitted on the traffic channel
Transmit Timing	Timing offset between reception and transmission at the CMU
RF Level	Absolute level in the used TCH timeslot and relative level in the unused timeslots

The *MS Signal* section is available in all but the transitory signalling states.

Remote control `CONFigure:MSSignal...`

Network

The table section *Network* indicates parameters to control the setup of a call between the CMU and the BTS under test. These parameters are set in the *Network* tab (see page 4.138 ff.). Setting up a call requires option CMU-K39, *MOC/MTC*.

The *Network* section is available in all but the transitory signalling states.

Remote control `CONFigure:NETWork...`

Overview

The *Overview* menu displays the essential results of the *P/t Norm. GMSK,* the *Phase Err. GMSK*, and the *Overview 8PSK* applications and provides access to the most important measurement settings. In particular, it configures the GSM uplink signal that the CMU transmits in order to set up a connection *(MS Signal)* and defines the properties of the downlink signal expected from the BTS under test *(BS Signal)*. The *Overview* menu is analogous to the *Analyzer/Generator* menu described on p. 4.2 ff.

- The measurement control softkey (measurement control softkey) *P/t Norm. GMSK* changes to *Ext. Phase Err. GMSK* or *Overview 8PSK,* depending on the application selected. This softkey controls the measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Power Configuration* or *Modulation Configuration*. The hotkeys associated to the measurement control softkey define the scope of the *Power* or *Modulation* measurement.
- The other softkeys on the right side are combined with various hotkeys (see *Fig. 4-42 below*). The softkey/hotkey combinations provide test settings and switch over between different measurements.

Note: *Measurements on 8PSK-modulated channels can be performed with option CMU-K41 and in the* TCH Test *and* Call Established (TCH) *signalling states only. Application* Overview 8PSK *is not available in the other signalling states. In contrast the* P/t Norm GMSK *and* Phase Error GMSK *applications can be configured separately for* TCH Tests *(including* Call Established) *and* CCH Tests.

Some test settings may not be available in all signalling states. For reference see the Sig. State *field in the command description in chapter 6 of this manual.*

The main menu *Overview* is opened by selecting the function group in the *Menu Select* menu (with associated key at the front of the instrument) and after closing the configuration menu *Connection Control - Connection* (using the *Escape* key or automatically after establishing a connection). The hotkeys associated to the *Menus* softkey switch over between the *Overview* menu and the remaining measurement menus of function group *GSM400/GT800/850/900/1800/1900-BTS Signalling*.

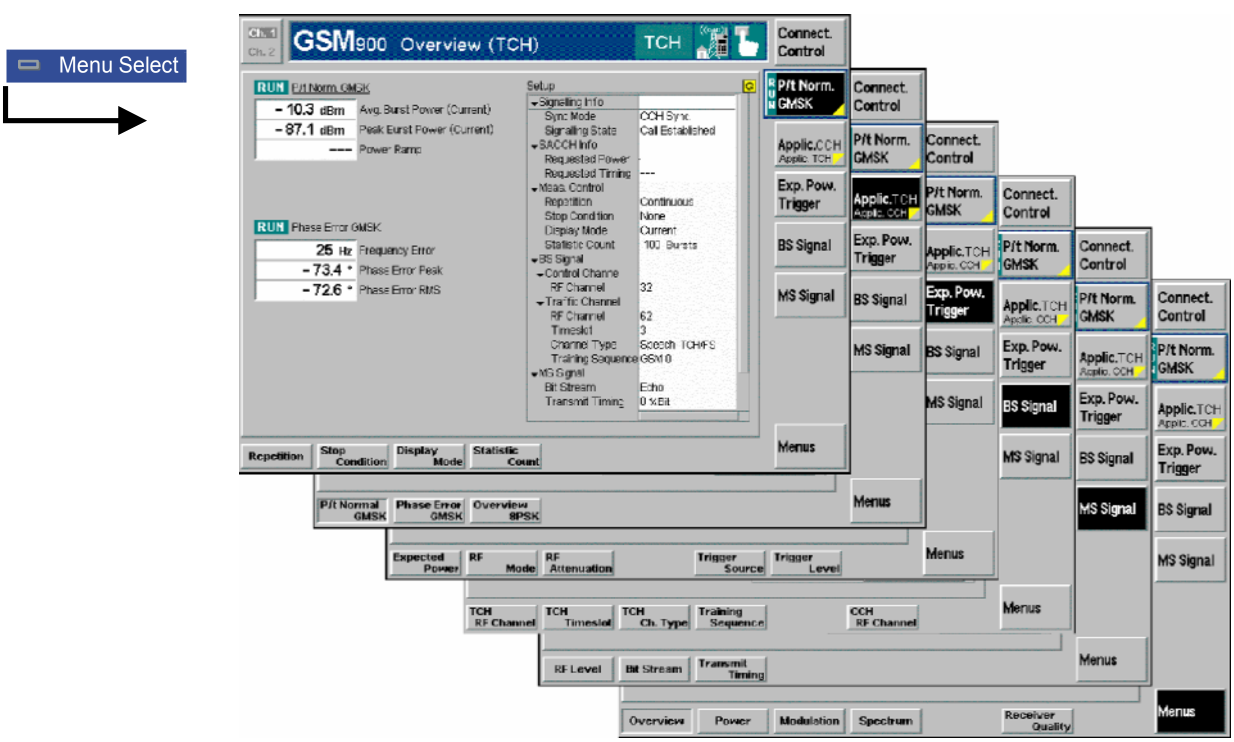


Fig. 4-42 Function overview – Overview

Test Settings

The settings for the *Overview* menu are accessible via softkey/hotkey combinations. The function of the measurement control softkeys *P/t Norm. GMSK, Phase Err. GMSK*, and *Overview 8PSK* is analogous to the measurement control softkeys in the *Analyzer/Generator* menu; see section *Measurement Control* on p. 4.4. The same holds for the selection of the application; see section *Selecting the Application* on p. 4.5.

The *Overview* menu provides a number of general or application-specific settings. All of these settings are always identical to the corresponding settings in the *Power* and *Modulation* menus. Changes made in the *Overview* menu overwrite the *Power* and *Modulation* settings and vice versa.

Description of settings

- The settings to be made in the *P/t Normal GMSK* application are described in section *Test Settings* on p. 4.91 ff.
- The settings associated to the measurement control softkey and the *Analyzer Level* settings to be made in the *Phase Error GMSK* and in the *Overview 8PSK* application are identical with the corresponding settings in the *Analyzer/Generator* menu. The *MS Signal* and *BS Signal* settings are described in section *Test Settings* on p. 4.91 ff.

Setup table

The *Setup* table in the right half of the *Overview* menu gives an overview of the measurement settings belonging to the current application. It changes when a different application is selected. The roll-key scrolls and expands the *Setup* table.

Measurement Results

The measurement results and their relation to the three measurement applications are analogous to the results in the *Analyzer/Generator* menu; see section *Measurement Results* on p. 4.6 f. The results in the *Overview* menu represent only a small fraction of the power and modulation results that the CMU is able to acquire. A comprehensive set of test results is displayed in the *Power* and *Modulation* measurement menus. More information about the measurement results is to be found in the documentation on these measurement menus:

Panel *Power*	Burst power	*Power* menu, p. 4.90 ff.
Panel *Modulation*	Modulation (phase and frequency error)	*Modulation* menu, p. 4.104 ff.

Note that the results of the *Power* and *Modulation* measurements depend on the modulation scheme selected (GMSK or 8PSK modulation, if option CMU-K41 is available). This is analogous to the *Analyzer/Generator* menu in *Non Signalling* mode (see p. 4.2 ff.).

Power Measurements

The menu group *Power* contains the functions for measurement of the received signal power as a function of time (burst analysis). The popup menu *Power Configuration* is used for configuration of the measurements; the measurement results are displayed in the graphical measurement menu *Power*.

Most settings of this menu do not depend on the signalling state and correspond to those of the menu *Power* in the operating mode *GSM400/GT800/850/900/1800/1900-BTS Non Signalling* (for a detailed description see p. 4.8 ff.). However, two additional applications *P/Slot* and *P/t Multislot* are available in *Signalling* mode.

P/Slot

The *P/Slot* application measures the average burst power in all eight timeslots of a TDMA frame. The average is taken over a section of the useful part of the burst; it is not correlated to the training sequence. The result is displayed in a bar graph (all eight timeslots of a single TDMA frame).

The *P/Slot* complements the *P/t* measurement where a large number of bursts can be measured but the output of the average burst power is restricted to current, average, minimum or maximum values within a statistics cycle (see *Display Mode* setting below). *P/Slot* returns **all** values; this application is suitable whenever the behavior or the stability of the average burst power in consecutive timeslots is to be monitored over an extended time range in R&D.

In all applications, the CMU measures at arbitrary RF input levels provided that they are within the allowed range of the RF input connectors.

P/t Multislot

The *P/t Multislot* application measures the output power of the DUT over up to 653 symbol periods, corresponding to 4 timeslots plus an appropriate display margin. This measurement is particularly suited to BTS configurations where several timeslots are active at different transmit powers (no C0 carrier configuration).

The multislot measurement curve can be further processed to determine an average, minimum, or maximum result and calculate the average power over each burst measured. *P/t Multislot* measurements are provided for normal bursts at GMSK and 8PSK modulation. In addition to the burst power measurement, a limit check with tolerances depending on the RF output power of the DUT and the modulation scheme is performed; see section *P/t Multislot* on p. 4.99 ff.

Measurement Menu (Power)

The graphical measurement menu *Power* displays the results of the power measurement.

- The measurement control softkey *P/t Norm. GMSK* (which changes to *P/Slot, P/t Norm. 8PSK* or *P/t Multislot,* depending on the power measurement application and on the modulation scheme selected) controls the power measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Power Configuration*. The hotkeys associated to 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 Expected Power, Mode, Attenuation,* and *Display Area* are associated with the softkey *Input Level).* The softkey/hotkey combinations provide test settings and switch over between different measurements.

The measurement menu *Power* is opened from the main menu *Menu Select* (with the associated key at the front of the instrument) or using the hotkey *Power/t*.

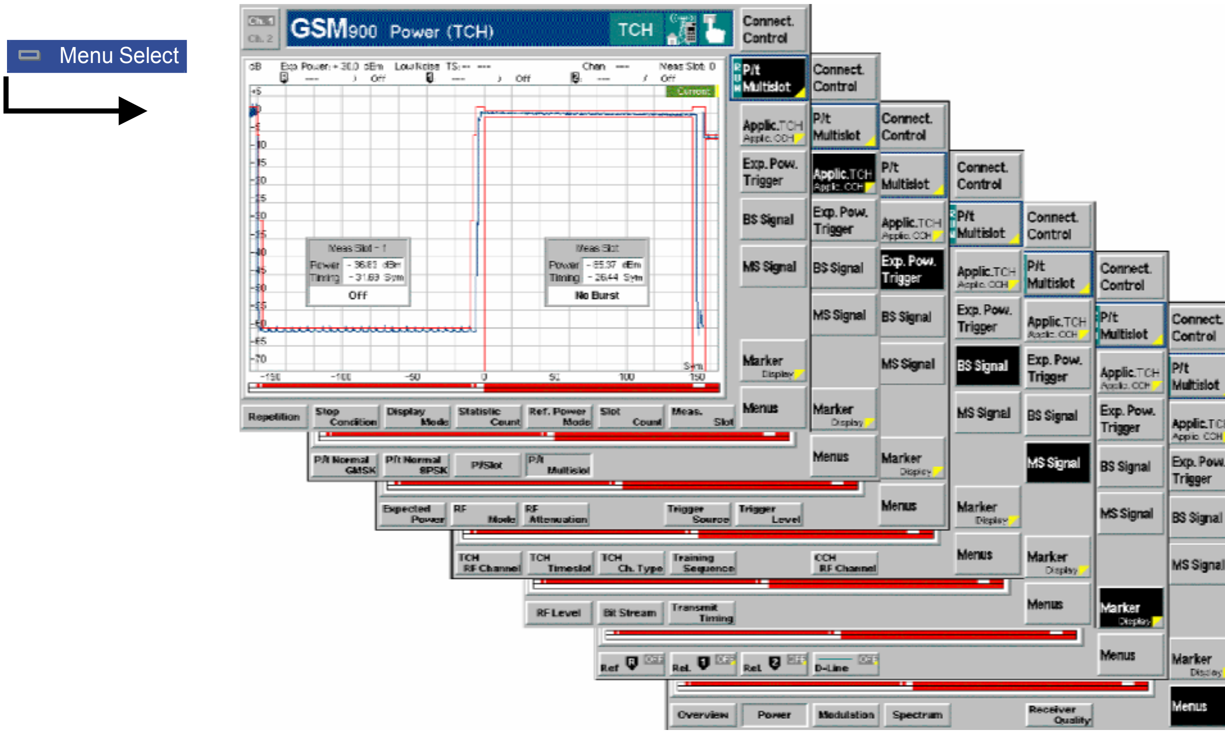


Fig. 4-43 Measurement menu Power – P/t Normal GMSK

Test Settings

The *P/t Norm. GMSK* measurement control softkey (which changes to *P/Slot etc.,* depending on the power measurement application and modulation scheme selected) is analogous to the measurement control softkey of the *Power* menu in *Non Signalling* mode. The same applies to the *Exp. Pow. Trigger* and *Marker/Display* test settings and to the *Menus* softkey. For a detailed description of these functions refer to p. 4.8 ff.

The following softkey/hotkey combinations differ from the *Non Signalling* mode:

P/t Multislot

The *P/t Multislot* measurement control softkey controls the *P/t Multislot* measurement; see detailed explanation in section *Measurement Control* on p. 4.4. Besides, the measurement control softkey provides hotkeys to define the scope of the measurement. All these settings are described in more detail in section *Measurement Control (Power Configuration – Control)* on page 4.18 ff.

Slot Count

The hotkey *Slot Count* defines an integer number of timeslots to be measured. The actual measured time range is larger than the integer number of slots because it comprises an additional display margin; for details see remote control command description. The *Meas. Slot* hotkey defines the position of the measurement range within the TDMA frame*;* see *Fig. 4-44* on p. 4.92*.*

The display range is adapted to the *Slot Count* settings by default but can be modified by means of the *Display Marker – Time Scale* and *Display Marker – Default Scale* hotkeys. Changing the *Slot Count* overrides the *Time Scale* settings and restores the default display range.

Remote control
```
CONFigure:POWer:MSLot:TCH:SCOunt
CONFigure:POWer:MSLot:CCH:SCOunt
```

Meas Slot

The hotkey *Meas. Slot* determines the timeslot that is measured in all *Multislot* configurations. In the graphical display, this measured timeslot is marked by *Meas. Slot*.

- If *Slot Count* is equal to 1, then the measurement extends over the *Meas. Slot* plus an appropriate display margin.
- If *Slot Count* is equal to 2, then the timeslot preceding the *Meas. Slot (Meas. Slot –1)* and the *Meas. Slot* are measured.
- If *Slot Count* is equal to 3 (4), then *Meas. Slot – 1, Meas. Slot* and the next timeslot (the two next timeslots, *Meas. Slot + 1* and *Meas. Slot + 2)* are measured.

The beginning of the *Meas. Slot* defines the origin (symbol no. 0) of the time axis. The *Meas. Slot* is also the reference for the *Timing* measurement; it must be active to obtain valid measurement results.

The relation between the *Meas. Slot*, the *Slot Count* and the measured time range for a signal with three active timeslots is shown in *Fig. 4-44 below*.

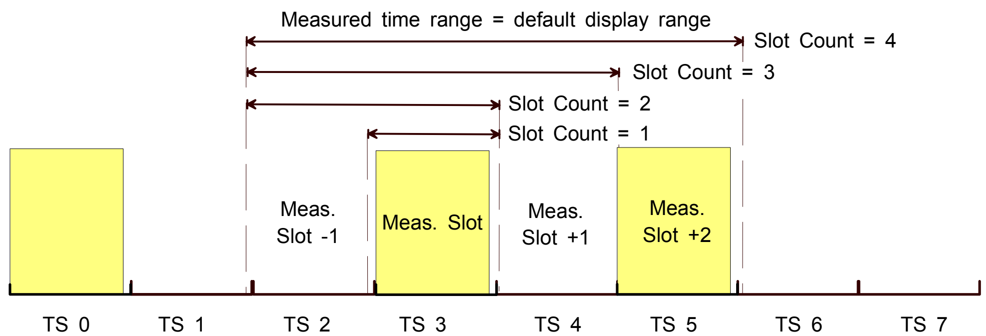


Fig. 4-44 Meas. slot and slot count (for Meas. Slot = 3)

The display range is adapted to the *Slot Count* and *Meas. Slot* settings by default but can be modified by means of the *Display Marker – Time Scale* and *Display Marker – Default Scale* hotkeys.

Remote control
```
CONFigure:POWer:MSLot:CCH:MESlot <slot>
CONFigure:POWer:MSLot:TCH:MESlot <slot>
```

Application

The *Application* softkey selects the power measurement application.

The applications *P/t Normal <Mod_Type>* depend on the modulation scheme of the analyzed signal. In the *P/t Multislot* application, the modulation in each measured slot can be defined separately. The *P/Slot* menu is available for GMSK modulation only.

Note: *Measurements on 8PSK-modulated channels can be performed with option CMU-K41 and in the* TCH Test *and* Call Established (TCH) *signalling states only. Application* Overview 8PSK *is not available in the other signalling states.*

The *Power* measurement menu and the measurement control softkey change with the application selected; the results are explained in section *Measurement Results* on page 4.96 ff.

P/t Normal GMSK

The *P/t Normal GMSK* hotkey selects the power versus time measurement for GMSK modulated normal burst signals (see explanation of GSM burst structure at the beginning of section *Limit lines (Power Configuration – Limit Lines)* on page 4.21).

Remote control
The *P/t Normal GMSK* application is selected by the keywords `:NBURst:GMSK` in the 3rd and 4th level of the `POWer` commands, e.g. `CONFigure:POWer:NBURst :GMSK...`

P/t Normal 8PSK

The *P/t Normal 8PSK* hotkey selects the power versus time measurement for 8PSK modulated normal burst signals (see explanation of GSM burst structure at the beginning of section *Limit lines (Power Configuration – Limit Lines)* on page 4.21).

Remote control:
The *P/t Normal 8PSK* application is selected by the keywords `:NBURst:EPSK` in the 3rd and 4th level of the `POWer` commands, e.g. `CONFigure:POWer :NBURst:EPSK...`

P/Slot

The *P/Slot* hotkey selects the power versus slot measurement with graphical display. In this application, the average burst power in all eight timeslots of a TDMA frame is measured and displayed in a bar graph (with GMSK modulation only).

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

P/t Multislot

The *P/t Multislot* hotkey selects the power versus time measurement for multislot configurations (see *Fig. 4-50* on p. 4.103).

Remote control:
The *P/t Multislot* application is selected by the 3rd level keyword `:MSLot` in the POWer commands, e.g. `CONFigure:POWer:MSLot...`

Exp. Pow. Trigger

The *Exp. Power Trigger* softkey controls the level in the RF input signal path and provides the trigger settings for the *Power* measurement. See also section *Input Path (Connection Control – Analyzer)* on p. 4.144 ff.

Difference from *Non Signalling* mode (p. *4.9* ff.):

In the mode *GSM400/GT800/850/900/1800/1900-BTS Signalling*, *Free Run*, *RF Power, IF Power*, and *Signalling* are available as trigger modes. This implies that the measurement is triggered by the signal from the base station or the signalling unit. Triggering by an additional external signal is not possible.

BS Signal

The *BS Signal* softkey configures the CMU analyzer according to the RF signals expected from the base station. See also section *Signals of the Base Station (Connection Control – BS Signal)* on p. 4.130 ff..

TCH RF Channel

The *TCH RF Channel* hotkey defines the GSM channel number used for the BTS traffic channel.

Remote control
`CONFigure:BSSignal:TCH:CHANnel <ChannelNo>`

TCH Timeslot

The *TCH Timeslot* hotkey sets the timeslot number of the TCH that the BS uses for a connection to the mobile station/CMU. The *TCH Timeslot* is always active.

Remote control
`CONFigure:BSSignal:TCH:TIMeslot <TimeslotNo>`

TCH CH Type

The *TCH Chan. Type* hotkey defines the coding scheme and the transmission rate in the BTS traffic channel.

Remote control
`CONFigure:BSSignal:TCH:CHTYpe <Type>`

Training Sequence

The *Training Sequence* hotkey defines the training sequence transmitted on the BTS traffic channel.

Remote control
`CONFigure:BSSignal:TCH:TSEQuence <TSC>`

CCH RF Channel

The *CCH RF Channel* hotkey defines the GSM channel number assigned to the BTS control channel.

Remote control
`CONFigure:BSSignal:CCH:CHANnel <ChannelNo>`

MS Signal

The *MS Signal* softkey configures the signals of the CMU (which simulates a mobile station transmitting a traffic channel signal) and the transmission parameters. See also section *Signals of the CMU (Connection Control – MS Signal)* on p. 4.133 ff.

RF Level

The *RF Level* hotkey defines the level of the traffic channel RF signal transmitted by the CMU in the used timeslot and in the unused timeslots.

Remote control
`CONFigure:MSSignal:LEVel:UTIMeslot <Level>`
`CONFigure:MSSignal:LEVel:UNTimeslot <Level>`

Bit Stream

The *Bit Stream* hotkey defines the data transmitted on the traffic channel.

Remote control
`CONFigure:MSSignal:BITStream <Mode>`

Transmit Timing

The *Transmit Timing* hotkey defines a timing offset for the transmitted TCH signal. The value is entered in multiples of ¼ bit.

Remote control
`CONFigure:MSSignal:TXTiming <Mode>`

Display Marker

The *Display/Marker* softkey zooms or shifts the graphical display. It is selected by pressing the *Marker/Display* softkey twice. If pressed once again, the selected *Display/Marker* softkey changes back to the *Marker/Display* softkey, see section *Test Settings* on p. 4.9 ff.

The Display Area and Timing Offset hotkeys configure the graphical diagram in the P/t Normal GMSK application; they are described in section *Test Settings* on p. 4.9 ff. The following hotkeys configure the diagram in the P/t Multislot application:

Info Box

The hotkey *Info Box* switches the info boxes for all displayed timeslots on or off. For a description of the info boxes see section *P/t Multislot* on p. 4.99 ff.

Remote control
No command, display configuration only

Modulation View

The hotkey *Modulation View* defines the expected modulation scheme in all four timeslots that can be measured and adjusts the power/time template. To obtain a valid measurement result, the actual modulation in all measured slots (see *Fig. 4-44* on p. 4.92) must be compatible with the *Modulation View* settings. See section *Measurement Control (Power Configuration – Control)* on p. 4.101 ff.

Remote control
`CONFigure:POWer:MSLot:CCH:MVIew`
`CONFigure:POWer:MSLot:TCH:MVIew`

Level Scale

The *Level Scale* hotkey defines a maximum RF level in dBm *(Max)* and a level range in dB *(Span)* that will be displayed in the graphical diagram and thus determines the scale of the y axis.

Remote control
No command, display configuration only

Time Scale

The *Time Scale* hotkey defines the start time *(Start)* and the total time interval *(Span)* that will be displayed in the graphical diagram and thus determines the scale of the x axis.

Both values are expressed in symbol periods. 1 symbol corresponds to approx. 3.69 µs so that 1 timeslot comprises 156 ¼ symbols. *Start* is expressed relative to symbol 0 of the measured timeslot (see *Fig. 4-44* on p. 4.92). *Time Scale* only configures the diagram; it does not affect the number of timeslots actually measured but is modified as this number is changed (see *Slot Count* hotkey on p. 4.91).

Remote control
No command, display configuration only

Default Scale

The *Default Scale* hotkey sets a default *Level Scale* and a default *Time Scale*, the latter corresponding to the number of timeslots measured (see *Slot Count* hotkey on p. 4.91) plus an appropriate display margin.

Remote control
No command, display configuration only

Measurement Results

The measurement results depend on the application selected.

a) P/t Normal GMSK

The values represented in the measurement menu *Power*, application *P/t Normal GMSK,* can be divided into three groups:

- Settings
- Scalar measurement results (single values)
- Arrays (the measurement curve plotted as a function of time)

The measurement results are indicated in two parameter lines, the test diagram and an info box:

Parameter line 1 / 2

Test diagram

Info box

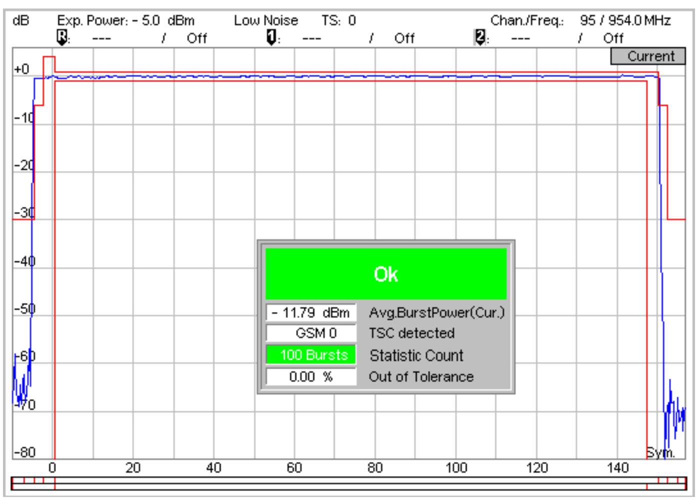


Fig. 4-45 Display of results (Power – P/t Norm. GMSK)

Settings/ scalar results

Scalar measurement results and settings are indicated in the two parameter lines above the test diagram and in the info box, which is a popup window in the middle of the graphical screen *Power*.

1st parameter line

The first parameter line contains the following settings:

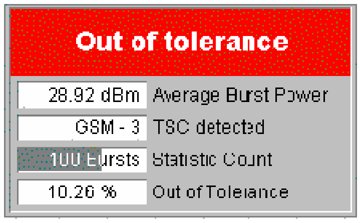
Expected Power	Maximum expected input power as set in *Input Power – Expected Power* (p. 4.144)
Attenuation	Setting for the attenuation of the input power *(Normal, Low Noise, Low Distortion)*
Timeslot	TCH timeslot number as set via the *TCH RF Chan./TCH TS* softkey or the *Connection Control* menu
Chan./Freq	RF channel and associated frequency

2nd parameter line

The second parameter line contains the following marker values:

□	Power and time of reference marker
□	Power and time of delta marker 1 (setting *absolute*) and/or difference from reference marker (setting *relative*)
□	Power and time of delta marker 2 (setting *absolute*) and/or difference from reference marker (setting *relative*)

Info-Box



The info box contains the following settings:

Statistic Count Number of bursts per measurement cycle

In addition, it indicates the results for the scalar measured values:

Avg Burst Power Average burst power, depending on the display mode set (see upper right corner of the diagram).

TSC detected Training sequence of the measured signal

Out of Tolerance Relative share of measured bursts that are out of the tolerances defined by the limit lines

Burst Matching Error message if the displayed burst is out of tolerance. The message depends on the selected display mode

Remote control

Settings are read out using the query corresponding to the setting command (setting command with appended question mark).

For scalar measurement results:

`READ[:SCALar]:POWer:NBURst:GMSK:CCH?`
`READ[:SCALar]:POWer:NBURst:GMSK:TCH?` etc.
`CALCulate:POWer:NBURst:GMSK:CCH:MATChing:LIMit?`
`CALCulate:POWer:NBURst:GMSK:TCH:MATChing:LIMit?`

Measurement curves (arrays)

The measurement result is displayed as a continuous measurement curve in the test diagram together with the limit lines, markers and the D-line, if defined. The curve is derived from 668 equidistant measurement points with a ¼ bit spacing covering a time range between –10 bit and 156 ¾ bit.

The measurement curve in the *Power* measurement menu shows the measured burst power (in dB) as a function of time (in bits). The displayed result depends on the test settings. The display mode for the measurement curve *(Minimum, Maximum, Average, Current)* is indicated in the upper right corner of the diagram. The scale of both axes can be adjusted via the *Display Area* hotkey (see above).

If a traffic channel is measured (mode *TCH Test*), the carrier is typically off in the two timeslots before and after the measured burst. Both the rising and falling edge of the burst are visible.

Conversely, in the *CCH* analysis, timeslot 0 is measured and timeslot 1 may be occupied as well. In this scenario no limit lines are specified and the limit check is switched off for the rising and falling edge of the burst.

Remote control

```
READ:ARRay:POWer:NBURst:GMSK:CCH...
READ:ARRay:POWer:NBURst:GMSK:TCH...
```

b) P/t Normal 8PSK (Option CMU-K41 Required)

As shown in *Fig. 4-46* below, the *P/t Normal 8PSK* measurement results are similar to the *P/t Normal GMSK* results, however, the default limit lines differ from the GMSK limit lines.

Parameter line 1, 2

Test diagram

Info box

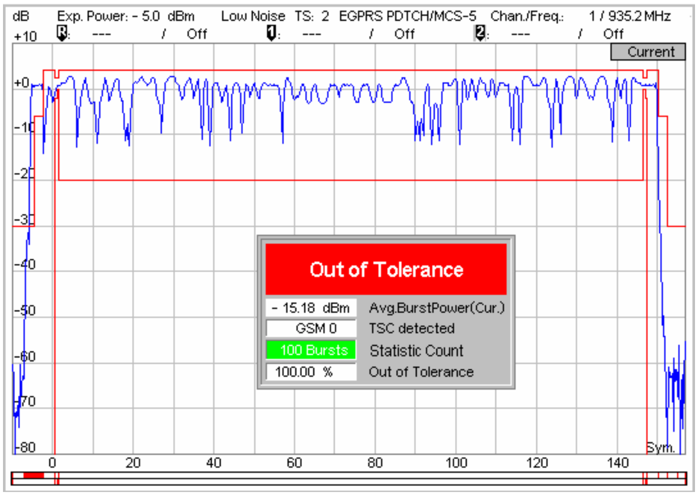


Fig. 4-46 Display of results (Power – P/t Norm. 8PSK)

c) P/Slot (GMSK Modulation only)

The results displayed in the measurement menu *Power*, application *P/Slot,* can be divided into two groups:

- Settings
- Measurement results, i.e. the average burst power in all eight slots of a TDMA frame

The measurement results are indicated in a parameter line, the test diagram and a table:

Parameter line

Test diagram

Slot table

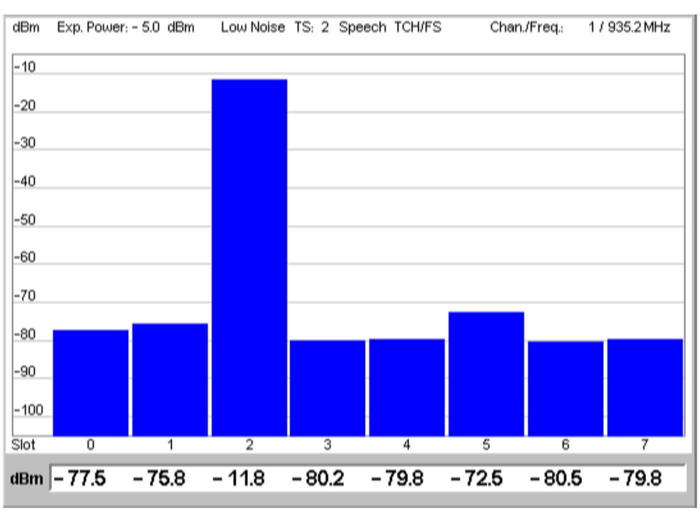


Fig. 4-47 Display of results (Power – P/Slot)

Settings The essential settings are indicated in a parameter line above the test diagram. The line is identical to the first parameter line of the test diagram in the *P/t Normal GMSK* application.

Results

The *P/Slot* application measures the average burst power in all eight time slots of a TDMA frame. The average is taken over a section of the useful part of the burst; it is not correlated to the training sequence. The time slots are numbered 0 to 7.

The eight values are shown in a bar graph and in a tabular overview below. No limit check is performed.

Remote control

```
READ[:SCALar]:POWer:SLOT:GMSK:TCH?
FETCh[:SCALar]:POWer:SLOT:GMSK:TCH?
SAMPle[:SCALar]:POWer:SLOT:GMSK:TCH?
```

d) P/t Multislot

As shown in *Fig. 4-48* below, the *P/t Multislot* measurement results are similar to the *P/t Normal GMSK* results. The following differences occur:

- The first parameter line shows the *Meas. Slot*, see p. 4.92.
- The info boxes, the diagram and the limit lines differ from the single-slot configuration, see below.

Parameter line 1, 2

Test diagram

Info boxes

Limit Check

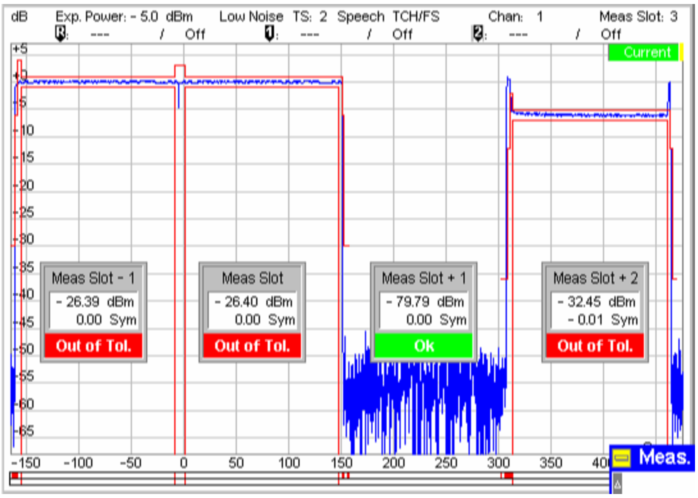
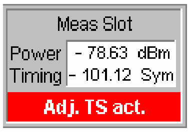


Fig. 4-48 Display of results (Power – P/t Multislot)

Info boxes



The info boxes show the following properties of the individual timeslots:

Power Average burst power in dBm. The *Power* result depends on the display mode as indicated in the upper right corner of the diagram.

Timing Timing advance error of the burst in symbol periods

Below the two measurement results, an error message is displayed e.g. if the burst is out of tolerance. The error messages are self-explanatory. An info box is provided for each timeslot displayed (1 to 4; see *Slot Count* hotkey on p. 4.91). The boxes can be suppressed altogether by means of the *Display/Marker – Info Box* hotkey.

Remote control
Settings are retrieved using the query corresponding to the setting command (setting command with appended question mark).

For scalar measurement results:

```
READ[:SCALar]:POWer:<Channel>:MSLot?  <Channel> = CCH | TCH
CALCulate[:SCALar]:POWer:<Channel>:MSLot
   :LIMit:MATChing?
FETCh[:SCALar]:POWer:<Channel>:MSLot?
SAMPle[:SCALar]:POWer:<Channel>:MSLot?
```

Measurement curves (arrays)

The measurement result is displayed together with the limit lines, markers and the D-line (if defined) as a continuous measurement curve in the test diagram. The curve is derived from equidistant measurement points with a ¼ symbol spacing the number of which depends on the number of timeslots measured (see *Slot Count* hotkey on p. 4.91, for details see remote control command description).

The measurement curve in the *Power* measurement menu shows the measured burst power (in dB) as a function of time (in symbol periods). The displayed result depends on various test settings. The display mode for the measurement curve *(Minimum, Maximum, Average, Current)* is indicated in the upper right corner of the diagram.

The scale of both axes can be adjusted via the hotkeys associated to the *Display/Marker* softkey (see section *Test Settings* on p. 4.91 ff.).

Remote control
`READ:ARRay:POWer:<Channel>:MSLot...?` etc.

Limit Check

The result of the limit check is visualized in two colored bars below the diagram. In each area of the burst, the upper (lower) bar turns red if the result exceeds (falls below) the power/time template defined in the *Limit Lines* tab of the *Power Configuration* menu.

Remote control

```
CALCulate[:SCALar]:POWer:<Channel>:MSLot:LIMit:MATChing?
CALCulate:ARRay:POWer:<Channel>:MSLot:LIMit:MATChing...?
CALCulate:ARRay:POWer:<Channel>:MSLot:AREA:LIMit:MATChing...?
```

Measurement Configurations (*Power* Configuration)

The popup menu *Power Configuration* contains two tabs to determine the parameters of the power measurement and provide graphical tools for evaluation of the measurement results.

The popup menu *Power Configuration* is activated by pressing the softkey *P/t Norm. GMSK* at the top right in the graphical measurement menu *Power* twice. It is possible to change between the tabs by pressing the associated hotkeys.

Note: *Measurements on 8PSK-modulated channels can be performed with option CMU-K41 and in the* TCH Test *and* Call Established (TCH) *signalling states only. The* P/t Normal GMSK *and* P/t Multislot *applications can be configured separately for* TCH Tests *(including* Call Established) *and* CCH Tests.

Measurement Control (Power Configuration – Control)

The tab *Control* controls the power measurement by determining

- The *Repetition* mode
- The *Stop Condition* for the measurement
- the signal generator (Peak Power Source).
- The type of measurement curve displayed *(Display Mode)*
- The number of bursts/evaluation periods forming a statistics cycle *(Statistic Count)*
- The measurement *Filter* for *P/t Normal GMSK* and *P/t Normal 8PSK* measurements
- The averaging prescription to obtain the reference power *(Ref. Power Mode* , for *P/t Norm. 8PSK* measurements only)
- The expected modulation *(Modulation View)*, the number of slots measured *(Slot Count)* and the *Info Box* in the *P/t Multislot* application

Besides, it configures the diagram by adding or removing the *Grid*.

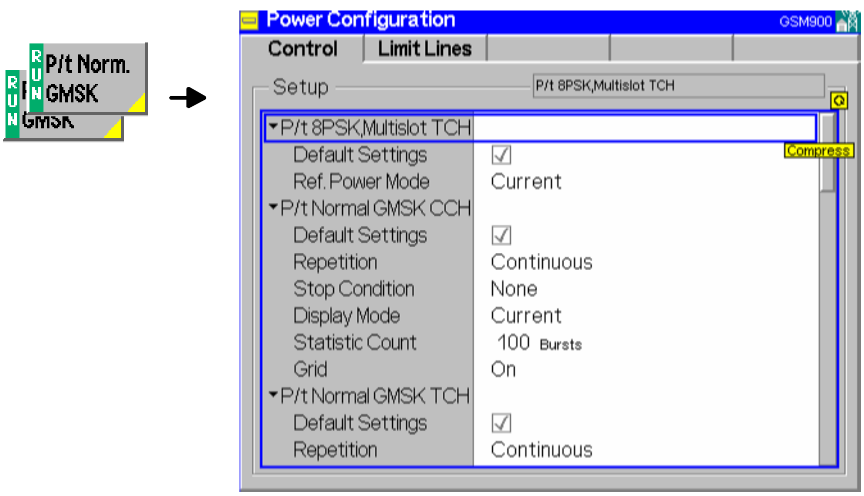


Fig. 4-49 Power Configuration – Control

Most of the functions of this menu are described in the section *GSM400/GT800/850/900/1800/1900-BTS Non Signalling* on page 4.18 ff. The following *P/t Multislot* settings are not provided in *Non Signalling* mode.

P/t Multislot – Modulation View

The *Modulation View* section defines the expected modulation scheme in all four timeslots that can be measured and adjusts the power/time template. To obtain a valid measurement result, the actual modulation in all measured slots must be compatible with the *Modulation View* settings. Otherwise, the CMU displays a warning: *"Signal does not match configuration!"*

The following settings are provided for all slots:

GMSK	GMSK modulation expected; the GMSK power/time template is used
8PSK	8PSK modulation expected; the 8PSK power/time template is used
ANY	Arbitrary modulation scheme; the CMU determines the modulation of the measured burst and uses the appropriate template. Valid results are obtained with both GMSK and 8PSK modulation.
OFF	No signal expected: timeslot must be inactive to obtain a valid result

The *Modulation View* settings are ignored for all slots that are not measured.

Remote control
`CONFigure:POWer:MSLot:MVIew`

P/t Multislot – Slot Count

The *Slot Count* defines an integer number of timeslots to be measured in the P/t Multislot application. The actual time range measured is larger than the integer number of slots because it comprises an additional display margin; for details see remote control command description.

Remote control
`CONFigure:POWer:MSLot:SCOunt`

P/t Multislot – Info Box

The *Info Box* parameter switches the info boxes for all displayed timeslots on or off.

Remote control
No command, display configuration only

Limit Lines (Power Configuration – Limit Lines)

The tab *Limit Lines* defines the limit lines for the burst power vs. time measurements (applications *P/t Normal GMSK*, *P/t Norm. 8PSK,* and *P/t Multislot*). The upper and lower limit lines mark a domain in the power versus time diagram that the BTS transmitter output power must not exceed (tolerance template). The GSM templates consist of several adjacent time intervals (areas) with constant limits covering the whole timeslot.

The limit lines for single slot measurements are explained in section *Limit Lines (Power Configuration – Limit Lines)* on p. 4.21 ff.

The tab enables

- An overview of the default limit lines and areas *(Area Info)*
- Definition of the limit lines for the normal bursts section by section *(Upper Limit Line/Lower Limit Line)*

As far as single slot measurements are concerned the functions of this menu are described in the section *GSM400/GT800/850/900/1800/1900-BTS Non Signalling* on page 4.21 ff. The limit lines for multislot configurations are based on the single-slot limit lines:

Multislot configurations

According to GSM 11.10, the power/time template for multislot configurations coincides with the template for a single GSM burst except in the guard period between every two consecutive active timeslots, where the output power shall not exceed the level allowed for the useful part of the first timeslot or the level allowed for the useful part of the second timeslot plus a multislot guard level of 3 dB, whichever is the highest. The template for two consecutive 8PSK modulated timeslots with the same output power is shown in *Fig. 4-50 below*.

Note: *The CMU treats the areas where the* ***lower*** *limit lines are switched on as the useful part of the burst; the remaining areas form the guard period. The tester calculates the multislot tolerance template from the single-slot limit lines and the* Multislot Guard *level (see below) and normalizes it to the average RF carrier power in the useful part of the* Meas. Timeslot. *This implies that the tolerance template is changed if the useful part of the burst is extended by enabling an additional lower limit area.*

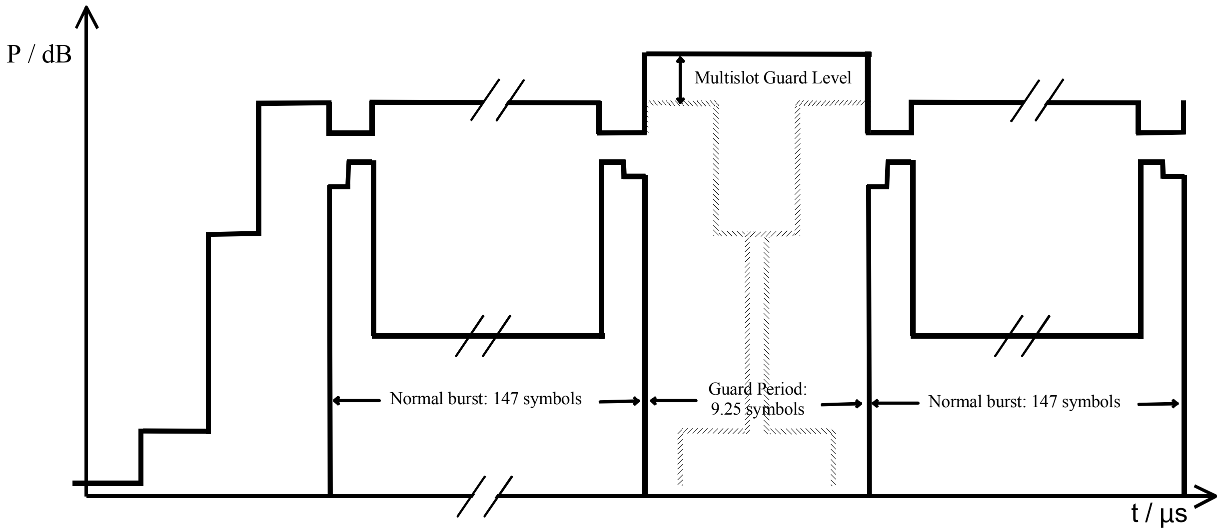


Fig. 4-50 GSM power/time template for multislot configurations

The *Limit Lines* tab provides:

- A preview of the default limit lines showing the different areas *(Area Info)*
- Definition of the limit lines for the normal burst area by area *(Upper Limit Line, Lower Limit Line)*

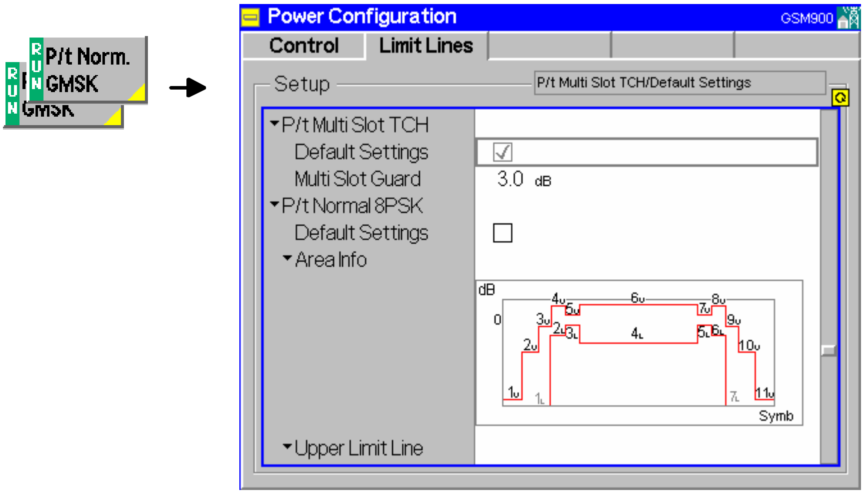


Fig. 4-51 Power Configuration – Limit Lines

In addition to the upper and lower limit line settings described on page 4.21 ff. the tab provides the following multislot configurations:

P/t Multislot – Multislot Guard

The *Multislot Guard* parameter defines the level in dB by which the upper limit line in the guard period between two consecutive bursts is raised (see *Fig. 4-50* on p. 4.103): The upper limit line in the guard period equals the upper limit line in the useful part of the first timeslot or the upper limit line in the useful part of the second timeslot plus *Multislot Guard*, whichever is the highest. No lower limit line is defined during the guard period.

Remote control

```
CONFigure:POWer:CCH:MSLot:LIMit:LINE:GLEVel <Level>
CONFigure:POWer:TCH:MSLot:LIMit:LINE:GLEVel <Level>
```

Modulation Measurements

The menu group *Modulation* contains the functions for measurement of the modulation parameters, i.e. the frequency and phase error in the burst and matching of the respective tolerance limits. The popup menu *Modulation Configuration* is used for configuration of the measurements; the measurement results are displayed in the graphical measurement menu *Modulation*.

Apart from few exceptions (which also apply to the menu *Power*), the menu group *Modulation* does not differ from the corresponding menu group in the measurement mode *GSM400/GT800/850/900/1800/1900-BTS Non Signalling* (see p. 4.26 ff.):

1. The expected traffic channel, timeslot numbers, and the channel type of the BTS signal can be set via the *BS Signal softkey* in the *Modulation* menu. The *MS Signal* softkey set the properties of the traffic channel signal generated by the CMU (see section *Test Settings* on p. 4.91 ff.).
2. In addition to the expected power, the attenuation, and the RF channel, the first parameter line also indicates the timeslot number of the base station signal.
3. Only *Free Run, RF Power* and *IF Power,* and *Signalling* are available as trigger setting. This implies that the measurement is triggered by the RF signal of the base station; triggering by an additional external signal (parameter *External*) is not possible.

Note: *Measurements on 8PSK-modulated channels can be performed with option CMU-K41 and in the* TCH Test *and i*Call Established (TCH) *signalling states only. The* Phase Error GMSK *application can be configured separately for* TCH Tests *(including* Call Established) *and* CCH Tests.

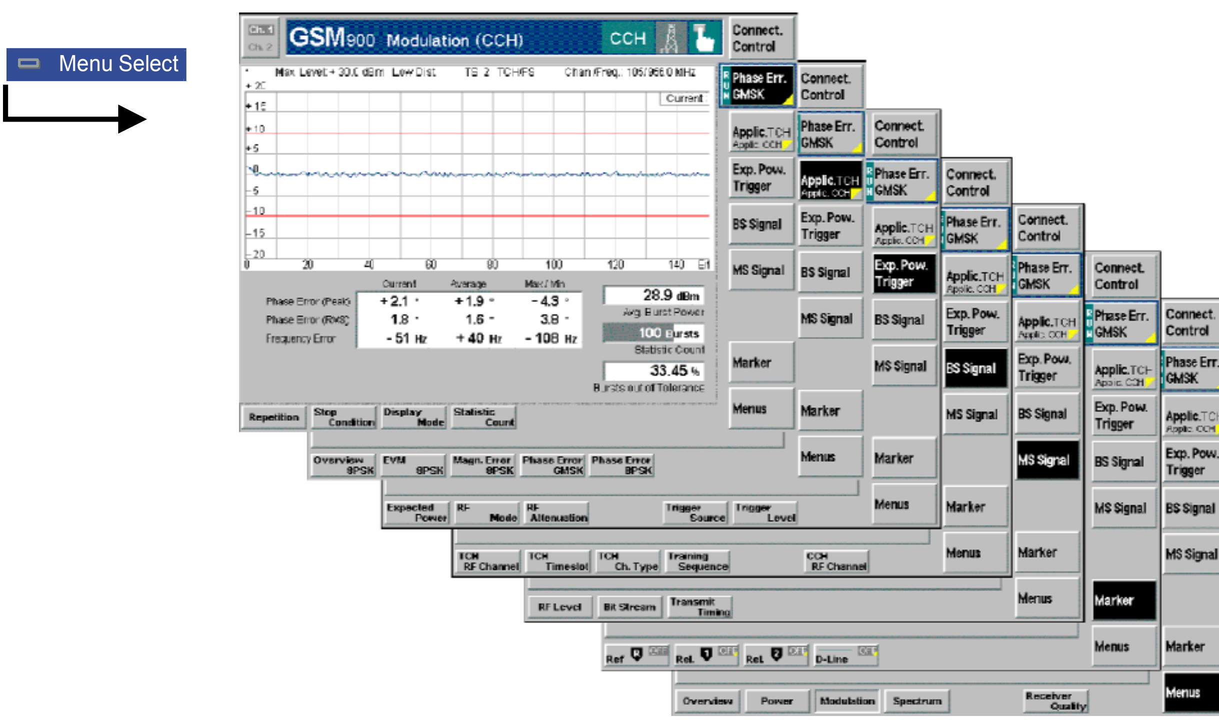


Fig. 4-52 Measurement menu Modulation – Phase Err. GMSK

Test Settings

The selections and test settings provided by the *Phase Err. GMSK, Applic. Exp. Pow. Trigger, Marker* and *Menus* softkeys are identical with those in the *Non Signalling* mode (see section *Test Settings* on page 4.27). The *BS Signal* and *MS Signal* softkeys are equal to the softkeys of the same name in the *Power* menu (see page 4.91).

Measurement Results

The values shown in the measurement menu *Modulation* can be divided into three groups:

- Setting values
- Scalar measurement results (single values)
- Arrays (the trace plotted as a function of time)

The values are indicated in two parameter lines, the test diagram and a tabular overview below:

Parameter line

Test diagram

Output table

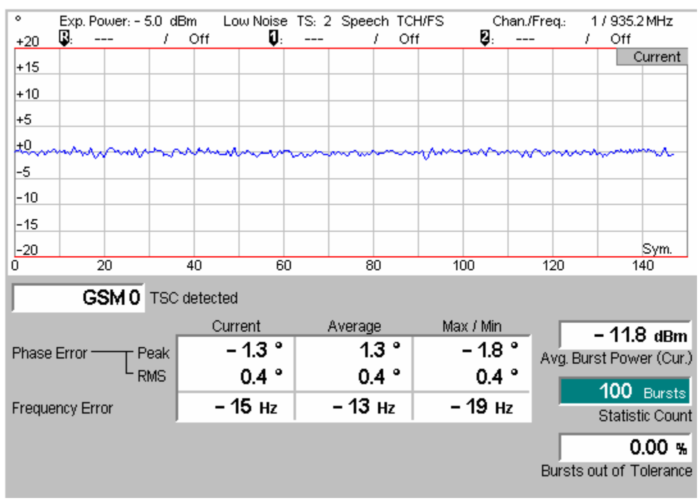


Fig. 4-53 Display of results (modulation menu)

In contrast to the *Non Signalling* mode (see p. 4.28 ff.) the first parameter line contains also the timeslot of the base station signal. Besides the representation and interpretation of the results are identical.

Measurement Configurations (Modulation Configuration)

The popup menu *Modulation Configuration* contains two tabs to define the parameters of the phase and frequency error measurement including the error tolerances.

The popup menu *Modulation Configuration* is activated by pressing the measurement control softkey *(Phase Err. GMSK* etc.) in the top right of the graphical measurement menu *Modulation* twice. By pressing the associated hotkeys, it is possible to change between the tabs.

The functions of the *Modulation Configuration* menus are described in section *GSM400/GT800/850/900/1800/1900-BTS Non Signalling*, see p. 4.40 ff.

Spectrum Measurements

The menu group *Spectrum* contains the functions for measurement of the off-carrier power, which is due to the modulation and the bursty nature of the RF signal. The popup menu *Spectrum Configuration* is used for configuration of the measurements; the measurement results are displayed in the graphical measurement menu *Spectrum*.

Apart from few exceptions (which also apply to the menu *Power*), the menu group *Spectrum* does not differ from the corresponding menu group in the measurement mode *GSM400/GT800/850/900/1800/1900-BTS Non Signalling* (see p. 4.46 ff.):

4. The expected traffic channel, timeslot numbers, and the channel type of the BTS signal can be set via the *BS Signal softkey* in the *Spectrum* menu. The *MS Signal* softkey set the properties of the traffic channel signal generated by the CMU (see section *Test Settings* on p. 4.91 ff.).

1. In addition to the expected power, the attenuation, and the RF channel, the first parameter line also indicates the timeslot number of the base station signal.

2. Only *Free Run, RF Power* and *IF Power,* and *Signalling* are available as trigger setting. This implies that the measurement is triggered by the signal of the base station; triggering by an additional external signal (parameter *External*) is not possible.

Note: *Measurements on 8PSK-modulated channels can be performed with option CMU-K41 and in the* TCH Test *and* Call Established (TCH) *signalling states only.* GMSK *measurements can be configured separately for* TCH Tests *(including* Call Established) *and* CCH Tests.

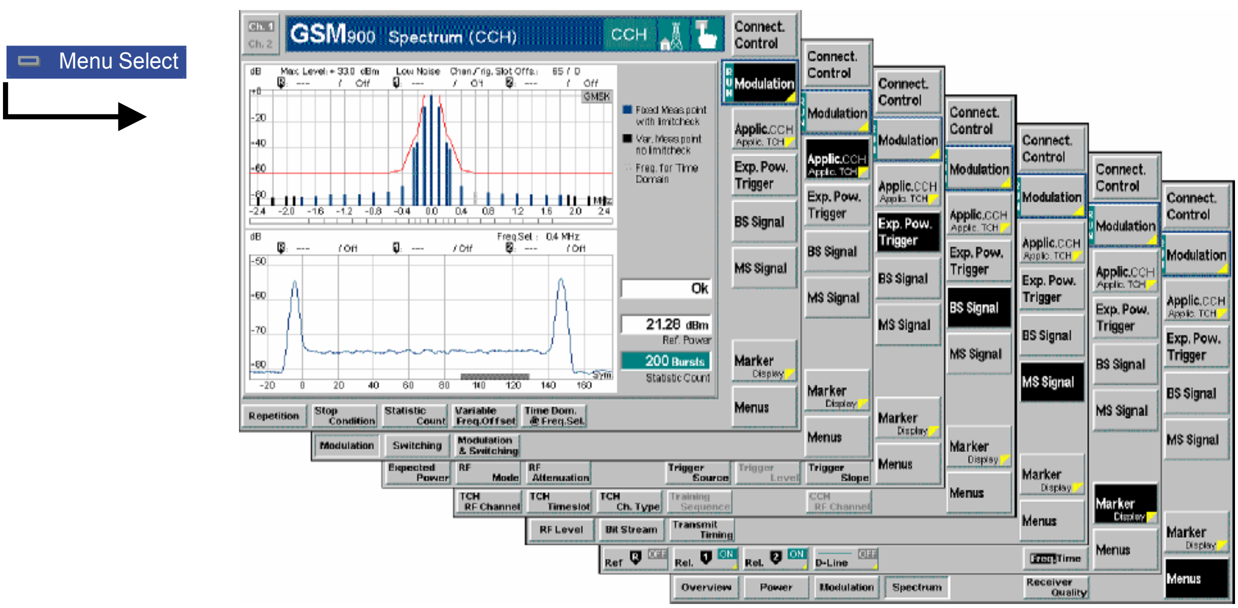


Fig. 4-54 Measurement menu Spectrum (application due to Modulation)

Test Settings

The selections and test settings provided by the *Modulation GMSK, Applic., Exp. Pow. Trigger, Marker* and *Menus* softkeys are identical with those in the *Non Signalling* mode (see section *Test Settings* on page 4.27). The *BS Signal* and *MS Signal* softkeys are equal to the softkeys of the same name in the *Power* menu (see page 4.91).

Measurement Results

The *Spectrum* measurement menu and the results depend on the type of spectrum (application) selected. The scaling of both axes is equal for the two spectra.

In contrast to the *Non Signalling* mode (see p. 4.49 ff.) the first parameter line also contains the timeslot of the base station signal. Besides the interpretation of the results is identical.

Measurement Configurations (Spectrum Configuration)

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 *Modulation* or *Switching* or *Modulation & Switching*, depending on the selected application). By pressing the associated hotkeys, it is possible to change between the tabs.

The functions of the *Spectrum Configuration* menu are described in section *GSM400/GT800/850/900/1800/1900-BTS Non Signalling*, see p. 4.51 ff.

Receiver Quality Measurements

The menu group *Receiver Quality* tests the transmission performance on the complete signal path from the CMU to the device under test (base station) and back. To this end the base station is set to test loop operation where it returns the received data back to the tester. The measurement is especially suitable to assess the sensitivity of the base station receiver at low RF power levels.

The popup menu *Receiver Quality Configuration* is used for configuration of the measurements; the measurement results are directly indicated in the main menu *Receiver Quality*.

Receiver Quality measurements are performed on the traffic channel (GMSK or 8PSK modulation) with synchronization between the CMU and the base station (signalling state *TCH Test)*. This is why they are not available in the mode *GSM400/GT800/850/900/1800/1900-BTS Non Signalling*.

Principle of the measurement

The sensitivity measurement is based on the comparison of the output bit stream transmitted by the CMU with the bit stream received and decoded by the device under test (base station). A pseudo random bit sequence must be used; see *Bit Stream BER* softkey on p. 4.116.

To this end, the base station must be set to return the received data to the CMU in loop back mode. Several different principles are used:

- In the **RF (CMU)** mode, the BTS is set to close its RF loop, which can be done either directly after demodulating the received RF signal or after the channel decoder. The received data is looped back on the RF channel; a cyclic redundancy check (CRC) excludes bit errors on the return path from the BTS to the CMU. The benefit of this measurement principle is that, besides the ordinary RF coax cable, no extra cabling is needed and that the bit error rate can be measured on 8PSK, GPRS and EGPRS channels as well.
- In the **Abis** mode (see below), the BTS decodes the data received and generates a Pulse Code Modulation (PCM) signal that is directly applied to the CMU's Abis interface. This by-passes all voice processing stages in the return path from the BTS under test to the CMU so that bit errors in the return path are largely excluded.
- In the **RACH Test** mode, the CMU sends a series of access bursts to the BTS and measures the relative number of bursts to which the BTS could not respond with an IMMEDIATE ASSIGNMENT message. The number of bursts sent and the time between two consecutive bursts can be modified to test the BTS's ability to quickly respond to the messages transmitted on the mobiles' Random Access Channels. The measurement result is indicated as a frame erasure ratio (FER).

The quality of the base station transmitter can be tested separately in the *Power* and *Modulation* measurements.

Bit classes

In the GSM system, the speech coder combines the speech information into data blocks with a length of 260 bits, the so-called frames. Within one frame, the bits are divided into bit classes:

- The 78 *class II bits* have no error protection which is why they quickly produce transmission errors.
- The 132 *class Ib bits* are partly protected against errors during channel coding (by added guard bits).

The 50 most important *class Ia bits* are well protected. The base station itself recognizes erroneous class Ia bits and clears the complete frame if no correction is possible

Definition of measured quantities

The Bit Error Rate *(BER)* is the ratio of erroneous bits to the total number of transferred bits in percent. The CMU outputs the bit error rate according to bit classes:

BER II = Erroneous class II bits / total number of class II bits * 100%

BER Ib = Erroneous class Ib bits / total number of class Ib bits * 100%

The Frame erasure ratio *(FER)* is the ratio of frames identified as erroneous to the total number of transferred frames in percent:

FER = Erroneous frames / total number of frames * 100%

In the *RACH Test,* a different definition is applied: The FER is equal to the relative number of access bursts to which the BTS did not respond with an IMMEDIATE ASSIGNMENT message:

FER (RACH) = Access bursts without IMMEDIATE ASSIGNMENT / total number of access bursts * 100%

The Residual Bit Error Rate *(Residual Bit Error Rate)* characterizes the quality of transmission of the valid frames (not erased, therefore residual). It corresponds to the ratio of the erroneous bits to the total number of transferred bits in percent, the numerator and denominator referring only to the **valid frames** *(residual frames, RF)*:

RBER II = Erroneous class II bits (RF) / total number of class II bits (RF) * 100%
RBER Ib = Erroneous class Ib bits (RF) / total number of class Ib bits (RF) * 100%

The Data Block Error Rate (DBLER) is the ratio of data blocks that contain bit errors in their data field to the total number of transferred blocks in percent:

DBLER = Blocks with erroneous data fields / total number of blocks * 100%

BER/DBLER mode

The BER/DBLER measurement assesses the receiver quality for packet data traffic channels (PDTCHs). For a detailed explanation of this mode see section *BER Tests of PDTCHs* on p. 4.110 ff.

Note: *For packet switched channels one of the packet data coding schemes CS1 to CS4 or MCS1 to MCS9 must be used (see TCH Chan. Type parameter on p. 4.131).*

Burst by Burst mode (fast BER)

In the *Burst by Burst* mode, the CMU transmits only bits without error protection (class II bits); no guard bits are used. The signal loop in the BTS under test is closed before the channel coding and decoding stages (see *Fig. 4-55*), so raw bits are measured and the bit error rate is evaluated on a burst by burst basis. This increases the number of bits measured per unit of time and thus considerably enhances the measurement speed.

Note: *The* Burst by Burst *bit error rate test is specified for GSM phase II and phase II+ equipment. Not all base stations support this test mode. If a BTS does not support the* Burst by Burst *bit error rate test, the measurement fails (like for very low signal levels) and an error message*

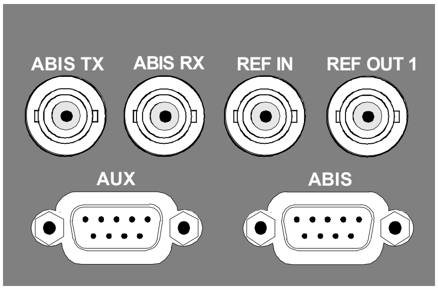
Too many errors. Measurement halted !

is generated.

Abis BER tests

In the Abis mode, the BTS decodes the data received and generates a Pulse Code Modulation (PCM) signal that is directly applied to the CMU's Abis interface. Two alternative connectors can be used as an input to the CMU's Abis interface:

- The 75 Ω BNC connector ABIS RX on the rear panel.
- The 120 Ω symmetric 9-contact SUB-D connector ABIS on the rear panel.



Which connector is used depends on the Abis output connector of the base station under test. The CMU output connector ABIS TX is intended for future extensions. The pin assignment of the symmetric (balanced) Abis connector is described in Chapter 8 of the CMU200/300 operating manual.

Abis BER tests require option CMU-B71, *Abis Interface Unit for CMU*, to be fitted.

Fig. 4-55 below illustrates the signal paths for the RF (CMU) and the Abis measurement. In the *Receiver Quality* menu, the *CMU Abis* hotkey switches over between the RF *(CMU)* and the *Abis* mode.

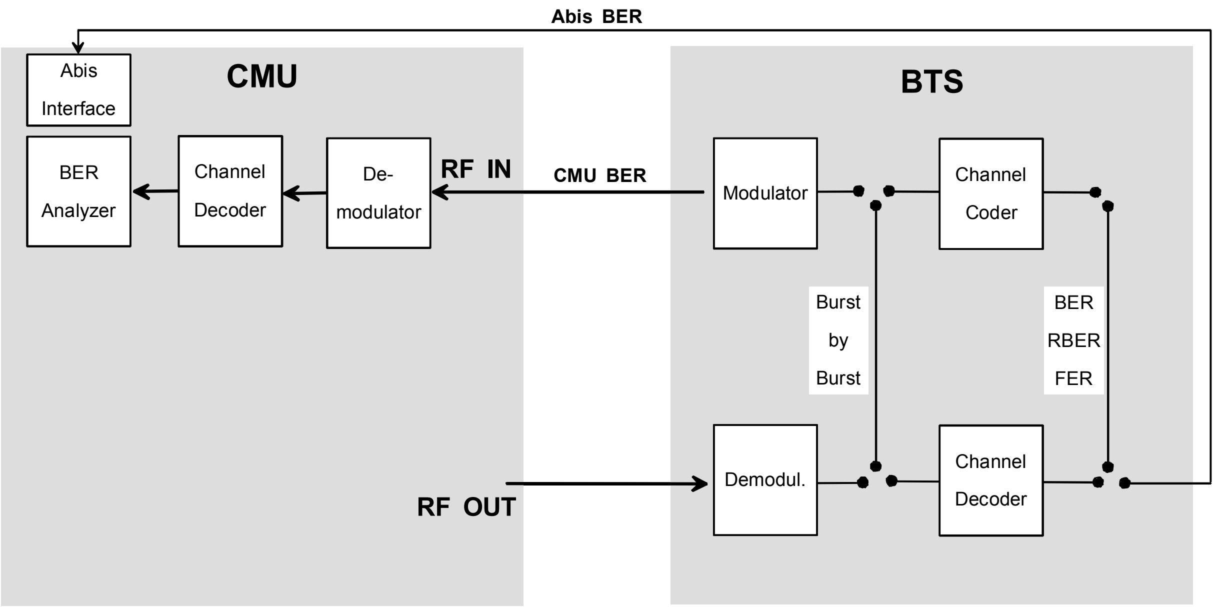


Fig. 4-55 Signal paths for BER measurements

BER Tests of PDTCHs

For packet-switched data traffic channels (PDTCHs), the bit error rate test is modified in such a way that the BTS loops back the received data packets on a block by block basis and measures the BER and the Data Block Error Rate (DBLER). The PDTCHs (CS1 to CS4 for GPRS or MCS1 to MCS9 for EGPRS) can be selected by means of the *TCH Chan. Type* parameter in the *BS Signal* tab of the *Connection Control* menu (see description on p. 4.131).

The test setup is the same as for BER CMU tests on circuit-switched speech or data channels: The test is performed on the traffic channel with synchronization between the CMU and the base station, i.e. the CMU must be in the *TCH Test* state. No signalling functionality is required because the RLC/MAC layer is not involved. To obtain the BER and DBLER results, the measurement mode *BER/DBLER* must be selected.

Principle of the measurement

Like any other *Receiver Quality* measurement, the PDTCH BER test is based on the comparison of the output signal generated by the CMU with the signal received and decoded by the device under test (base station). To this end, the base station is set to return the received signal to the CMU in loop back mode. In the case of packet data channels, the BTS loops back the packet data after demodulation and channel decoding (see BER/RBER/FER loop in *Fig. 4-55 above*). The PDTCH BER test can not be done via Abis interface.

Frame structure

The CMU provides a GPRS or EGPRS signal with a 52-multiframe structure as shown in *Fig. 56 below*. Each 52-multiframe contains 12 blocks of 4 consecutive frames (B0 to B12), 2 idle frames (X) and 2 frames used for the Packet Timing Advance Control Channel (X). All blocks in the signal are coded and modulated with the same coding and puncturing scheme. For EGPRS channels, all data blocks are punctured with scheme P1.

The base station returns the data bits of the received blocks using the original coding and puncturing scheme. This means that the loopback is done on a block by block basis. The coding and puncturing scheme is set with a command on the test interface of the BTS. The modulation and coding schemes MCS7, MCS8 and MCS9 carry 2 RLC/MAC frames which are coded separately.

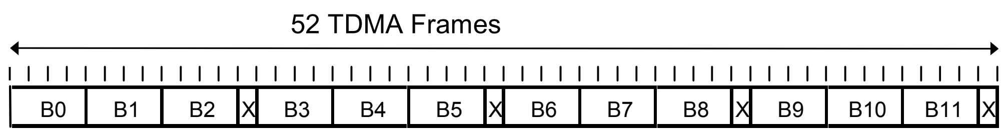


Fig. 56 52-multiframe for PDCH

Block structure

Any GPRS/EGPRS radio block is divided into the header information including the Uplink State Flag (USF) and the data bits. The CMU uses a fixed uplink header and ignores the downlink header received from the BTS. This means that only the data bits of a radio block contribute to the BER and DBLER calculation.

On the other hand, the BTS returns the received data even if the block check sequence indicates that the block was not decoded correctly. In this case the BTS calculates a new block check sequence for the received data. The same timeslot used for uplink and downlink, however, the downlink signal is delayed by 3 timeslot periods.

Definition of measured quantities

The Bit Error Rate *(BER)* is the ratio of erroneous data bits to the total number of transferred data bits in percent.

BER = Erroneous bits / total number of bits * 100%

The Data Block Error Rate *(DBLER)* is the ratio of blocks that contain bit errors in their data field to the total number of transferred blocks in percent:

DBLER = Erroneous blocks / total number of blocks * 100%

This Data Block Error Rate is not exactly the BLER that is defined in the GSM recommendations (GSM 11.10), because the possibility of an error in the header is not taken into account. But if the probability for an error in the data field, which depends on the used coding scheme, is much higher than the probability for an error in the header, the calculated Block Error Rate is a good approximation to the BLER.

Difference between DBLER and BLER

The difference between the BLER defined in GSM 11.10 and the DBLER measured by the CMU varies from one coding scheme to another. For coding scheme CS-4, where no additional effects due to channel coding occur, the difference is determined by the difference of the data field size compared to the complete RLC block size. For other coding schemes, there are additional effects originating from the different channel coding of the header and data fields and from differences in the bit error rate of header and data bits after the channel decoder. A comparison of the two coding schemes CS-4 and CS-1 is shown in *Fig. 57 below*.

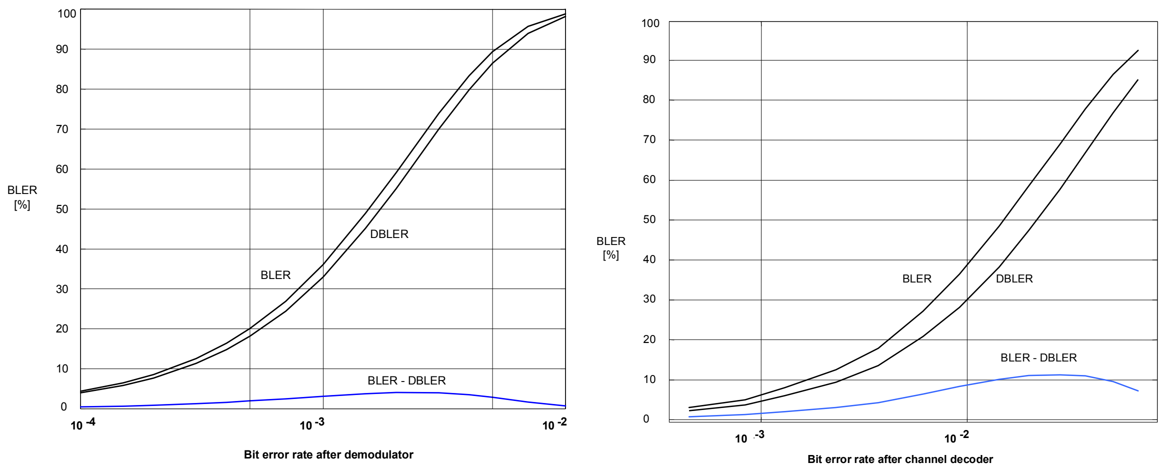


Fig. 57 Comparison between BLER and DBLER: CS-4 (left diagram) and CS-1

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 CMU Single Shot* (which changes to *BER CMU Average etc.* if the corresponding applications are selected) indicates the status of the *Receiver Quality* measurement *(RUN | HLT | OFF)* and (if pressed twice) opens the configuration menu *Receiver Quality Configuration*.
- The softkeys *Applic., Exp. Pow. Trigger, BS Signal, MS Signal,* and *Menus* to the right of the test diagram are combined with various hotkeys. If a softkey is selected and an associated hotkey pressed, a popup window will appear, which indicates a setting or enables an entry (see section *Test Settings* on page 4.9).
- 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 *GSM400/GT800/850/900/1800/1900-BTS Signalling* using the hotkey *Receiver Quality*.

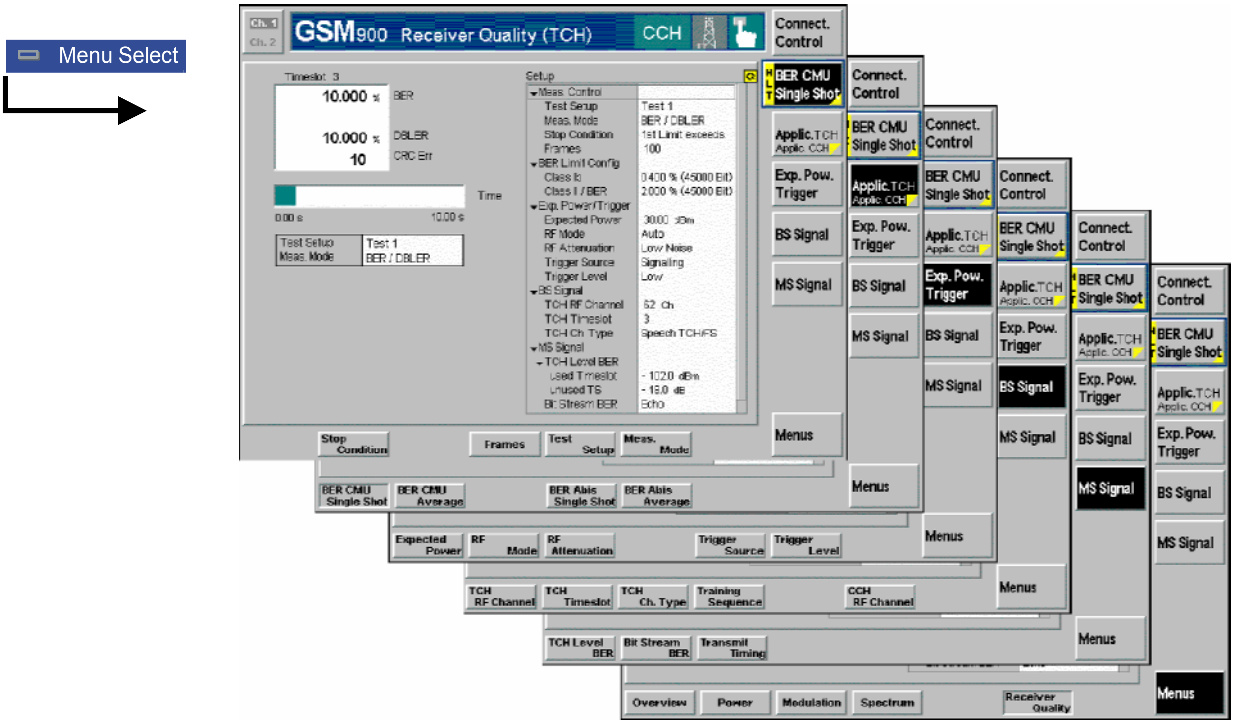


Fig. 4-58 Main menu Receiver Quality

Test Settings

The *Exp. Pow. Trigger, BS Signal* and *Menu* settings are identical with those in the *Power* menu (see section *Test Settings* on page 4.91). The following softkey/hotkey combinations differ from the *Power* measurement:

BER CMU Single Shot

The *BER CMU Single Shot* softkey controls the receiver quality measurement in the BER application 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 *Receiver Quality* measurement, however, a running measurement is restarted.

Remote control

```
INITiate:RXQuality:BER
ABORt:RXQuality:BER
STOP:RXQuality:BER
CONTinue:RXQuality:BER
```

Measurement configuration

Pressing the *BER* softkey twice opens the popup menu *Receiver Quality Configuration* (see section *Measurement Configurations (Receiver Quality Configuration)* on p. 4.119 ff.). Besides, the following hotkeys defining the scope of the measurement are associated to the *BER* softkey:

Stop Condition

The *Stop Condition* hotkey sets a stop condition for the measurement *(None* or *1st Limit Exceeded* or *All Limits Exceeded;* see section *Measurement Control (Receiver Quality Configuration – Control)* on page 4.119)

Remote control

```
CONFigure:RXQuality:BER<nr>:CONTrol:REPetition
                                   <StopCondition>,<Stepmode>
```

Frames

The hotkey *Frames* determines the number of frames to be sent in a *BER ... Single Shot* measurement. It is not available in the *BER ... Average* and *RACH Test* applications; see section *Measurement Control (Receiver Quality Configuration – Control)* on page 4.119.

Remote control
`CONFigure:RXQuality:BER<nr>:CONTrol <Mode>,<FramesToSend>`

Average

The hotkey *Average* determines the number of frames to be averaged in a *BER Average* measurement. It is not available in the *BER* and *RACH Test* applications; see section *Measurement Control (Receiver Quality Configuration – Control)* on page 4.119.

Remote control
–

Bursts to Send

The hotkey *Bursts to Send* determines the number of access bursts to be sent to the BTS in a *RACH Test*. It is not available in the other applications; see section *Measurement Control (Receiver Quality Configuration – Control)* on page 4.119.

Remote control
`CONFigure:RXQuality:RACHtest:CONTrol:BTSend`

Repeat Time

The hotkey *Repeat Time* determines the time between two consecutive access bursts sent in a *RACH Test*. It is not available in the other applications; see section *Measurement Control (Receiver Quality Configuration – Control)* on page 4.119.

Remote control
`CONFigure:RXQuality:RACHtest:CONTrol:RTIMe`

Test Setup

The *Test Setup* hotkey selects one of a maximum of ten test setups. Test setups are BER configuration files defined in the *Receiver Quality Configuration* menu (see section *Measurement Control (Receiver Quality Configuration – Control)* on page 4.119). The hotkey is not available in *BER ... Average* and *RACH Test* applications.

Remote control
`CONFigure:RXQuality:BER:TSETup <TestSetup>`

The test setup number is denoted by a numeric suffix in the BER commands `(...RXQuality:BER<nr>:...)`.

Meas. Mode

The *Meas. Mode* hotkey selects the quantities to be measured. For a list of measurement modes and corresponding measurement results see section *Measurement Results* on p. 4.117 ff.

Remote control
`CONFigure:RXQuality:BER<nr>:CONTrol <Mode>,<FramesToSend>`

Application

The *Application* softkey selects the measurement application. The results for the three alternative 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. 4.119 ff.).

The measurement principle for the different applications is described in section *Receiver Quality Measurements* on p. 4.108 ff.

BER CMU Single Shot

The *BER CMU Single Shot* hotkey selects a single shot *Receiver Quality* measurement via the RF interface. The measurement is stopped after one statistics cycle, i.e. after the number of evaluation periods (frames) set with the *Frames* hotkey or if a stop condition is met. A measurement that has been stopped is indicated by the status display *HLT* in the associated softkey.

Single shot should always be used if only a single measurement result is required under fixed conditions.

Remote control
No explicit switchover command. All CMU single shot measurements are identified by the 2nd/3rd level keywords `...RXQuality:BER...`

BER CMU Average

The *BER CMU Average* hotkey selects a continuous *Receiver Quality* measurement via the RF interface. The measurement runs until it is stopped explicitly, or until the stop condition is met. A continuous average over the selected number of evaluation periods (frames) is calculated. An ongoing measurement is indicated by the status display *RUN* in the associated softkey.

Remote control
Not supported

BER Abis Single Shot

The *BER Abis Single Shot* hotkey selects a single shot *Receiver Quality* measurement via the Abis interface. The measurement is stopped after one statistics cycle, i.e. after the number of evaluation periods (frames) set with the *Frames* hotkey or if a stop condition is met. A measurement that has been stopped is indicated by the status display *HLT* in the associated softkey.

Single shot should always be used if only a single measurement result is required under fixed conditions.

Remote control
No explicit switchover command. All Abis single shot measurements are identified by the 2nd/3rd level keywords `...RXQuality:ABIS:BER...`

BER Abis Average

The *BER Abis Average* hotkey selects a continuous *Receiver Quality* measurement via the Abis interface. The measurement runs until it is stopped explicitly, or until the stop condition is met. A continuous average over the selected number of evaluation periods (frames) is calculated. An ongoing measurement is indicated by the status display *RUN* in the associated softkey.

Remote control
Not supported

RACH Test

The *RACH Test* hotkey selects the Random Access Channel test. In the *RACH Test*, the CMU sends access bursts to the base station and measures the frame erasure ratio, i.e. the relative number of access bursts to which the BTS did not respond with an IMMEDIATE ASSIGNMENT message.

Remote control
No explicit switchover command. All CMU average measurements are identified by the 2nd/3rd level keywords `...RXQuality:RACHtest...`

MS Signal

The *MS Signal* softkey configures the signals of the CMU (which simulates a mobile station transmitting a traffic channel signal) and the transmission parameters. The *TCH Level BER* and *Bit Stream BER* settings remain valid for the duration of the *Receiver Quality* measurement only, see section *Measurement Control (Receiver Quality Configuration – Control)* on page 4.119. Moreover, *TCH Level BER* is replaced by the *RACH Level* if the application *RACH Test* is selected.

TCH Level BER

The *TCH Level BER* hotkey defines the level of the traffic channel RF signal transmitted by the CMU in the used timeslot and in the unused timeslots. The unused TS level is expressed in units relative to the level in the used timeslot. Note that the sensitivity specifications defined in GSM 11.21 must be met when the two timeslots adjacent to the used timeslot are detecting GSM signals at 50 dB above the used timeslot level. This is why the default value for the unused TS level is higher than the default used TS level.

The *TCH Level BER* is valid in the applications *BER ... Single Shot* and *BER ... Average.*

Remote control
```
CONFigure:RXQuality:<Application>:CONTrol:TCH:LEVel:
  UTIMeslot  <Level>
CONFigure:RXQuality:<Application>:CONTrol:TCH:LEVel:
  UNTimeslot <Level>
```

RACH Level

The *RACH Level* hotkey defines the level of the control channel RF signal transmitted by the CMU in the used timeslot and in the unused timeslots if the application *RACH Test* is selected. The unused TS level is expressed in units relative to the level in the used timeslot.

Remote control
```
CONFigure:RXQuality:RACHtest:CONTrol:CCH:LEVel:
  UTIMeslot  <Level>
CONFigure:RXQuality:RACHtest:CONTrol:CCH:LEVel:
  UNTimeslot <Level>
```

Bit Stream BER

The *Bit Stream BER* hotkey defines the data transmitted on the traffic channel. In contrast to all transmitter tests, *Receiver Quality* measurements can be performed with pseudo random bit sequences only.

Remote control
```
CONFigure:RXQuality:CONTrol:BITStream <Mode>
```

Transmit Timing

The *Transmit Timing* hotkey defines a timing offset for the transmitted TCH signal. The value is entered in multiples of ¼ bit.

Remote control
```
CONFigure:MSSignal:TXTiming <Mode>
```

Measurement Results

The values shown in the measurement menu *Receiver Quality* can be divided into two groups:

- Measurement results and the progress of the measurement are reported in the upper left half of the menu.
- The configurations of the current measurement are shown in the table below *(Setup)*.

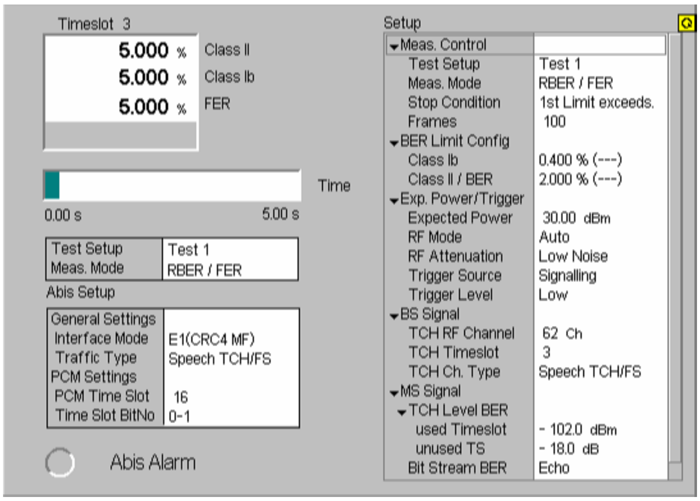


Fig. 4-59 Display of measurement results (Receiver Quality)

The measurement results in the left upper table to depend on the selected measurement mode (see definitions at the beginning of section *Receiver Quality Measurements* on page 4.108).

Note: For Abis BER measurements (applications *BER Abis Single Shot* or *BER Abis Average)*, no CRC Error is available.

RBER/FER When the residual bit error rate *(Applic. = BER CMU Single Shot, BER CMU Average, BER Abis Single Shot, BER Abis Average; Meas. Mode = RBER/FER)* is measured the following is displayed:

Class II Residual bit error rate for class II bits (unprotected bits)

Class Ib Residual bit error rate for class Ib bits (partly protected bits)

FER Frame erasure ratio: relative number of invalid and therefore erased frames

CRC Error Result of *cyclic redundancy check.* Number of frames erased on the signal path from the device under test to the CMU

NOTE

In some specific measurements, not all results may be available. E.g. the AMR full rate speech codec does not provide any Class II bits; the output field shows invalid results "– – –". The AMR results are described in section AMR Bit Error Rate Test on p. *4.152 ff..*

BER When the bit error rate *(Applic. = BER CMU Single Shot, BER CMU Average, BER Abis Single Shot, BER Abis Average; Meas. Mode = BER)* is measured the following is displayed:

Class II Bit error rate for class II bits (unprotected bits)

Class Ib Bit error rate for class Ib bits (partly protected bits)

CRC Error Result of *cyclic redundancy check:* number of frames erased on the signal path from the device under test to the CMU

Burst by Burst In a *Burst by Burst* measurement (fast BER, *Applic. = BER CMU Single Shot, BER CMU Average; Measurement Mode = Burst by Burst),* the following is displayed:

BER	Bit error rate for class II bits (unprotected bits, no other bits are transmitted)
CRC Error	Result of *cyclic redundancy check:* number of frames erased on the signal path from the device under test to the CMU

BER/DBLER In a *Data Block Error Rate* measurement (*Applic. = BER CMU Single Shot, BER CMU Average; Measurement Mode = BER/DBLER),* the following is displayed:

BER	Bit error rate for class II bits (unprotected bits, no other bits are transmitted)
DBLER	Data block error rate: relative number of erroneous blocks.
CRC Error	Result of *cyclic redundancy check:* number of frames erased on the signal path from the device under test to the CMU

RACH Test The following results are provided in application *RACH Test (Applic. = RACH Test):*

FER	Frame erasure ratio: relative number of invalid and therefore erased frames
Access Bursts Sent	Current number of access bursts sent (progress of the measurement)

A *Time* progress bar below the table indicates the relative measurement progress:

- In a *single shot* measurement (Application *BER CMU Single Shot, BER Abis Single Shot)*, the ratio between the current measurement time and the total measurement time which is indicated at the right end of the bar.
- In a *continuous* measurement (Application *BER CMU Average, BER Abis Average)*, the ratio between the frames measured in the current averaging period (single shot sub-measurement) and the total number of frames to be averaged.
- In a *RACH Test*, the ratio between the time elapsed for the measurement and the total measurement time (= the product of the *Bursts to Send* times the *Repeat Time)*.

Remote Control

```
READ[:SCALar]:RXQuality:<Application>?
FETCh[:SCALar]:RXQuality:<Application>?
SAMPle[:SCALar]:RXQuality:<Application>?
```

Limit Check A red background in the output field and an arrow pointing upwards indicates that the measurement result exceeds the upper limit set in the *Limits* tab of the *Receiver Quality Configuration* menu, see p. 4.122 ff.

Remote Control

```
CALCulate:RXQuality:<Application>:MATChing:LIMit?
```

Setup The *Setup* table in the right half of the *Receiver Quality* menu gives an overview of the configuration of the current *Receiver Quality* measurement. All parameters can be set via softkey/hotkey combinations (see p. 4.113 ff.) or the configuration menus (see p. 4.119 ff.) and are explained there in detail. Some of the parameters depend on the selected application and measurement mode:

Meas. Control	Measurement mode and name of the test setup selected (one out of max. 10, for single shot measurements (Application *BER)* only), *Stop Condition* and scope of the measurement (no. of *Frames* to send per single shot meas. or number of frame to *Average);* see section *Measurement Control (Receiver Quality Configuration – Control)* on p. 4.119 ff.
BER Limit Config.	Upper limits for the measured bit error rates, residual bit error rates, or frame erasure ratio; see section *Upper Limits for Bit Error Rate (Receiver Quality Configuration – Limits)* on p. 4.122 ff.
Exp. Power/ Trigger	Input path configuration and trigger settings
BS Signal	Expected properties of the RF signal from the BTS
MS Signal	Absolute signal level (in dBm) in the used timeslots and relative level in the unused timeslots at which the bit error rate is measured, transmitted bit pattern and transmit timing.

Remote control See section *Measurement Configurations (Receiver Quality Configuration)* below.

Measurement Configurations (*Receiver Quality Configuration*)

The popup menu *Receiver Quality Configuration* contains two tabs to determine the parameters for the bit error rate measurement.

The popup menu *Receiver Quality Configuration* is activated by pressing the softkey *BER CMU* at the top right in the main menu *Receiver Quality* twice (this softkey reads *BER CMU*, *BER CMU Average,* depending on the selected application). It is possible to change between the tabs by pressing the associated hotkeys.

Measurement Control (*Receiver Quality Configuration* – Control)

The tab *Control* controls the *Receiver Quality* measurement by determining

- *Holdoff Times* for automatic gain control and synchronization
- For single shot (Application *BER ... Single Shot)* and continuous (Application *BER ... Average)* measurements, the *Stop Condition,* and the *Meas. Mode*. In the single shot applications these parameters can be entered and stored independently for up to 10 test setups.
- For all *Receiver Quality* applications, the signal level at which the bit error rate is measured *(TCH BER Level)*. In the single shot applications this level can be entered and stored independently for up to 10 test setups.
- The scope of measurement, i.e. the number of frames/access bursts to be sent in a *BER... Single Shot* or *RACH Test* and the frames to be averaged in a *BER ... Average* test.

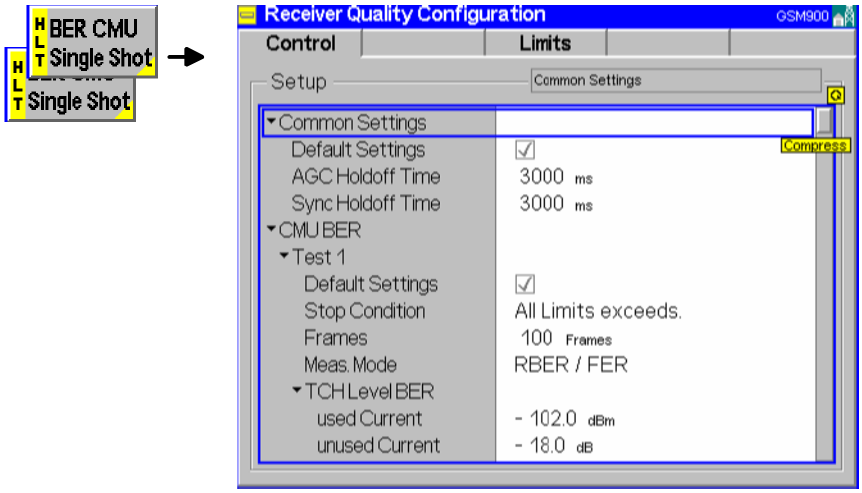


Fig. 4-60 Receiver Quality – Control

Default Settings The *Default* switches overwrite all settings in the *Control* tab belonging to a particular application with default values.

Remote control `DEFault:RXQuality:BER<nr>:CONTrol ON | OFF`

Common Settings The *Holdoff Times* necessary for the adjustment of the R&S CMU to the conditions of the *Receiver Quality* measurement are valid for all applications:

AGC Holdoff Time Time for which the R&S CMU analyzer can adjust itself to the new RF level at the beginning of the receiver quality measurement *(automatic gain control).* The *AGC Holdoff Time* is also applied if the RF level changes during the receiver quality measurement. Reducing the *AGC Holdoff Time* can accelerate the measurement.

Sync. Holdoff Time Maximum time for which the signalling unit of the CMU attempts synchronizing to the bit stream after the *Receiver Quality* measurement is started. If no synchronization can be achieved during the *Sync. Holdoff Time,* the measurement is halted *(HLT)* and a notice box is displayed.

Remote control `CONFigure:RXQuality:CONTrol:HTIMe <AGCTime>,<SynchTime>`

BER CMU Test Setup The *Test Setup* table section defines up to 10 user-specific configuration files for single shot sensitivity measurements. The applications are numbered from 1 to 10 and can be called up via the *Test Setup* hotkey associated to the *Application* softkey. They differ from each other in the default settings for the signal power of the CMU and the criteria for analysis.

Remote control `CONFigure:RXQuality:BER:TSETup <Testsetup>`

Test Name The *Test Name* parameters assign a name to each of the 10 test setups (application *CMU BER* only). In the *Test Setup* hotkey, the individual test setups are referenced with their *Test Name*.

Remote control –

Stop Condition

The *Stop Condition* parameter defines a stop condition for the (single shot or continuous) measurement:

NONE	Continue measurement even in case of error
1st Limit exceeded	Stop measurement on first error (tolerance exceeded)
All Limits exceeded	Stop measurement if all tolerances are exceeded

Remote control

```
CONFigure:RXQuality:<Application>:CONTrol:REPetition
          ALIMits | FLIMit | NONE,<StepMode>
```

Frames (Single Shot)

The parameter *Frames* defines the statistic count (= the number of frames to be sent in a single shot measurement). A low value permits to limit the scope of measurement and accelerate the measurement. The default setting depends on the test setup.

Remote control

```
CONFigure:RXQuality:BER<nr>:CONTrol <Mode>,<FramesToSend>
```

Average (Average)

The parameter *Average* defines the number of frames to be averaged in a *BER CMU Average* measurement.

Remote control

–

Bursts to Send (RACH Test)

The parameter *Bursts to Send* defines the total number of access bursts to be sent in a *RACH Test*.

Remote control

```
CONFigure:RXQuality:RACHtest:CONTrol:BTSend
```

Repeat Time (RACH Test)

The parameter *Repeat Time* defines the time (in ms) elapsed between two consecutive access bursts that the CMU sends to the base station during a *RACH Test*. The total measurement time for the RACH test is equal to the *Repeat Time* times the number of *Bursts to Send;* see above.

A short *Repeat Time* accelerates the *RACH Test* and tests the ability of the BTS to quickly respond to CHANNEL REQUEST messages from different mobiles transmitted over the RACH.

Remote control

```
CONFigure:RXQuality:RACHtest:CONTrol:RTIMe
```

Meas. Mode

The *Meas. Mode* parameter determines which quantities are measured and displayed in the upper table of the *Receiver Quality* menu (not for RACH Test).

RBER/FER	Residual bit error rate (separately for class II and class Ib bits) and frame erasure ratio
BER	Bit error rate (separately for class II and class Ib bits)
Burst by Burst	Accelerated measurement, only class II bits are transmitted
BER/DBLER	Measurement of the bit error rate and the data block error rate (DBLER) on packet-switched data traffic channels; see description in section *BER Tests of PDTCHs* on p. 4.110 ff.

All measured quantities are defined at the beginning of the section *Receiver Quality* on page 4.108.

Remote control

```
CONFigure:RXQuality:BER<nr>:CONTrol
          RFER | BER | BBB | BDBL,<FramesToSend>
```

TCH BER Level

The *TCH BER Level* parameter defines the level in the traffic channel by means of the following specifications (single or continuous measurements):

used Current Absolute level in the used timeslot of the traffic channel, valid during the Receiver Quality measurement only,

unused Current Level in the unused timeslots of the traffic channel relative to the level in the used timeslot.

The level in the used timeslot is specified in dBm. The permissible value range depends on the selected RF output of the CMU and the external attenuation set.

The level in the unused timeslots is specified relative to the level in the used timeslot in the unit dB.

The actual level in the unused timeslots must also lie within the permissible range for the RF outputs. This condition may place an additional restriction on the permissible maximum level for the unused timeslots.

Remote control

```
CONFigure:RXQuality:<Application>:CONTrol:TCH:
         LEVel:UTIMeslot <Level>
CONFigure:RXQuality:<Application>:CONTrol:TCH:
         LEVel:UNTimeslot <Level>
```

Upper Limits for Bit Error Rate (*Receiver Quality Configuration* – Limits)

The *Limits* tab defines an upper pass/fail limit for the individual measured quantities in the sensitivity menu. This is done separately for the max. 10 single shot test setups and for the *BER ... Average* and *RACH Test* modes.

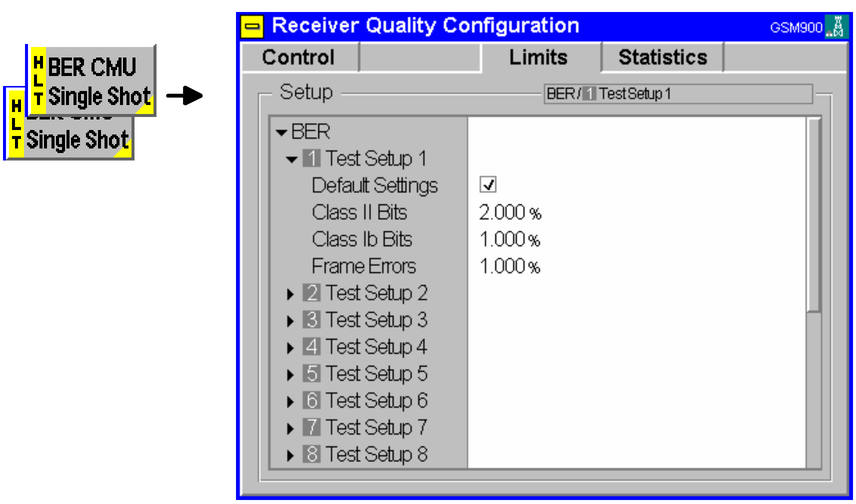


Fig. 4-61 Receiver Quality Configuration – Limits

Default Settings The *Default Settings* switch applies default values to all parameters concerning the corresponding table range or BER application.

Remote control –

Test Setup 1 etc. The upper limits for the measured quantities can be set independently for each single shot test setup and for continuous measurements. The measured quantities are defined at the beginning of section *Receiver Quality* on page 4.108; they are selected via the *Meas. Mode (*bit error rates in mode *BER,* residual bit error rates and frame erasure ratio in mode *RBER/FER).*

Class II Bits Upper limit of (residual) bit error rate for class II bits (unprotected bits) in the value range 0% ... 100%.

Class Ib Bits	Upper limit of (residual) bit error rate for class Ib bits (partly protected bits) in the value range 0% ... 100%.
Frame Errors	Upper limit for frame erasure ratio, relative number of invalid and therefore erased frames in the value range 0% ... 100%.
DBLER	Upper limit for data block error rate, relative number of blocks that contain bit errors in their data field in the value range 0% ... 100%.
FER	Upper limit for frame erasure ratio for the *RACH Test*, relative number of access burst to which the BTS did not respond with an IMMEDIATE ASSIGNMENT message in the value range 0% ... 100%.

The default settings for the upper limits reflect the importance of the measured quantities for evaluation of the transmission and received-signal quality (in the case of unprotected bits, a higher error rate is expected and accepted than in the case of protected bits, etc.).

Remote control

```
CONFigure:RXQuality:<Application>:LIMit:CLII <Error>
CONFigure:RXQuality:<Application>:LIMit:CLIB <Error>
CONFigure:RXQuality:<Application>:LIMit:FERRors <Error>
```

Connection Control (Contd.)

The menu group *Connection Control* controls the signalling procedures (synchronization, call setup and release, services, signalling parameters) and determines the inputs and outputs with the external attenuation values and the reference frequency.

As most *Signalling* measurements are performed in the *CCH Test* or *TCH Test* state or with an existing call connection to the BTS *(Call Established),* the *Connection* menus (*Connection Control – Connection)* are opened immediately after selection of the function group *GSM400/GT800/850/900/1800/1900-BTS Signalling* in the *Menu Select* menu*.* Besides, all the menus of the *Connection Control* group can be accessed any time by pressing the softkey *Connect. Control* 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. By pressing the *Escape* key, the active *Connection Control* menu is closed and the CMU changes to the measurement mode.

The tabs *Connection Control – Connection* displayed during synchronization are described at the beginning of section *GSM Measurements with Signalling* on p. 4.80 ff. The remaining tabs of the *Connection Control* menu are described below.

Location Update (with Option CMU-K39 only)

The *Connection (Location Update)* tab shows layer 3 messages sent and received by the CMU (table in the left half of the menu) and displays a comment on the current location update process (message box). Besides it contains softkeys to perform the following actions:

- Stop the current location update process of the CMU *(Stop Loc. Update)* or re-initiate a location update if the previous attempt failed *(Retry Loc. Update)*.
- Control the wide band peak-power measurement and show the result *(Power).*

A location update is always initiated from the CMU while it is in the signalling state *CCH Test*. The *Location Update* tab is thus opened via the *Location Update* softkey in the *Connection (CCH Test)* tab. It is closed automatically after a successful location update or by pressing the *ESCAPE* key or the *Connection Control* softkey. The info table in the *Connection (CCH Test)* tab indicates whether or not a location update was performed in the current measurement session.

Connect. Control →

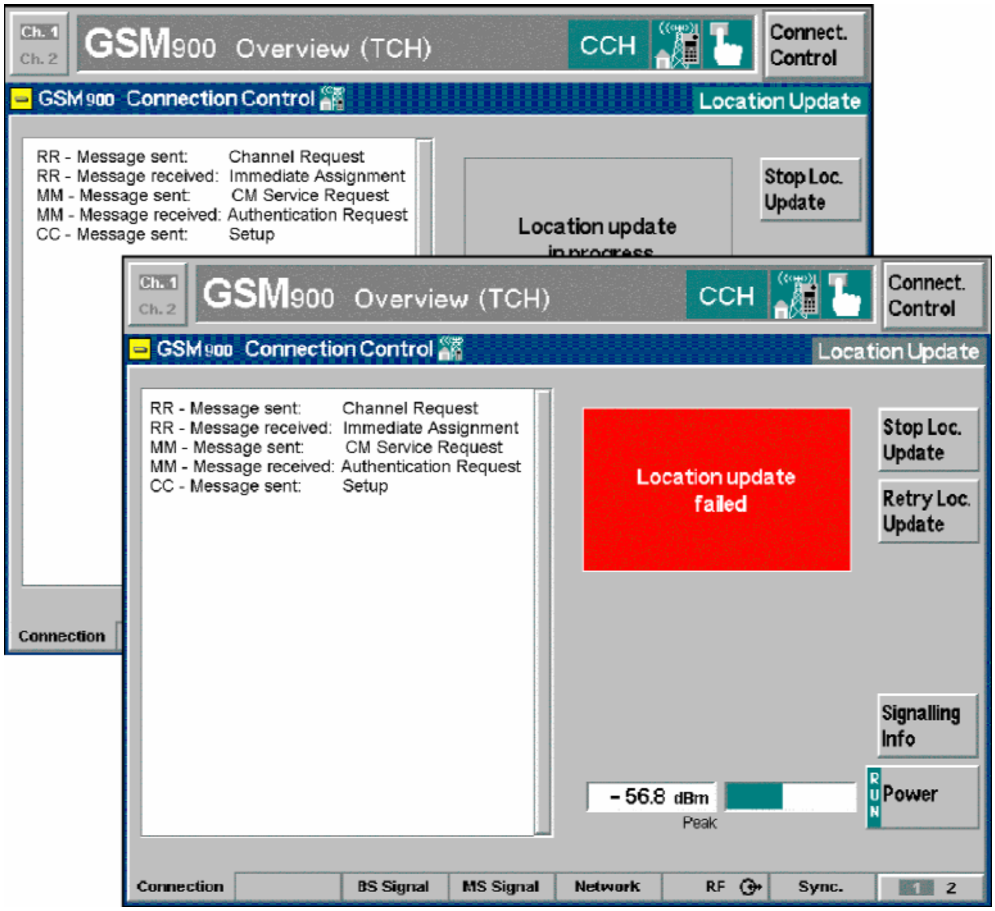


Fig. 4-43 Connection Control – Connection (Location Update)

The *Power* softkey is described in section *Connection Control (State Unsynchronized)* on page 4.80.

Message box The message box indicates whether the CMU is in the signalling state *Location Update in Progress* or *Location Update Failed*. In the signalling state *Location Update Failed*, an additional softkey *(Retry Loc. Update)* allows to re-initiate a location update.

Stop Loc. Update

The *Stop Loc. Update* softkey stops the current location update process.

The CMU returns to the signalling state *Unsynchronized.*

Remote control `PROCedure:SIGNalling:ACTion SLUP`

Retry Loc. Update

The *Retry Loc. Update* softkey initiates a new location update.

This softkey is available in the *Location Update Failed* state only. The CMU changes to the signalling state *Location Update in Progress.*

Remote control `PROCedure:SIGNalling:ACTion RLUP`

Signalling Info

The *Signalling Info* softkey activates the output table (for scrolling etc.).

In the output table all Radio Resources *(RR)* and Mobility Management *(MM)* messages sent and received by the CMU are displayed.

Remote control –

Call in Progress (with Option CMU-K39 only)

The *Connection (Call in Progress)* tab shows layer 3 messages sent and received by the CMU (table in the left half of the menu) and displays a comment on the current call attempt (message box). Besides it contains softkeys to perform the following actions:

- Stop the current Mobile Originated Call or Mobile Terminated Call *(Stop MOC/Stop MTC)* or re-initiate a call if the previous attempt failed *(Retry MOC)*.
- Control the wide band peak-power measurement and show the result *(Power).*

In the *CCH Test* signalling state, a call can be set up from either the CMU/mobile station *(Mobile Originated Call, MOC)* or from the base station *(Mobile Terminated Call, MTC)*. The *Call in Progress* tab is thus opened via the *MOC* softkey in the *Connection (CCH Test)* tab or automatically as soon as the CMU receives a call from the base station. It is closed automatically after successful call setup or by pressing the *ESCAPE* key or the *Connection Control* softkey. After a successful call setup, the CMU changes to the signalling state *Call Established*.

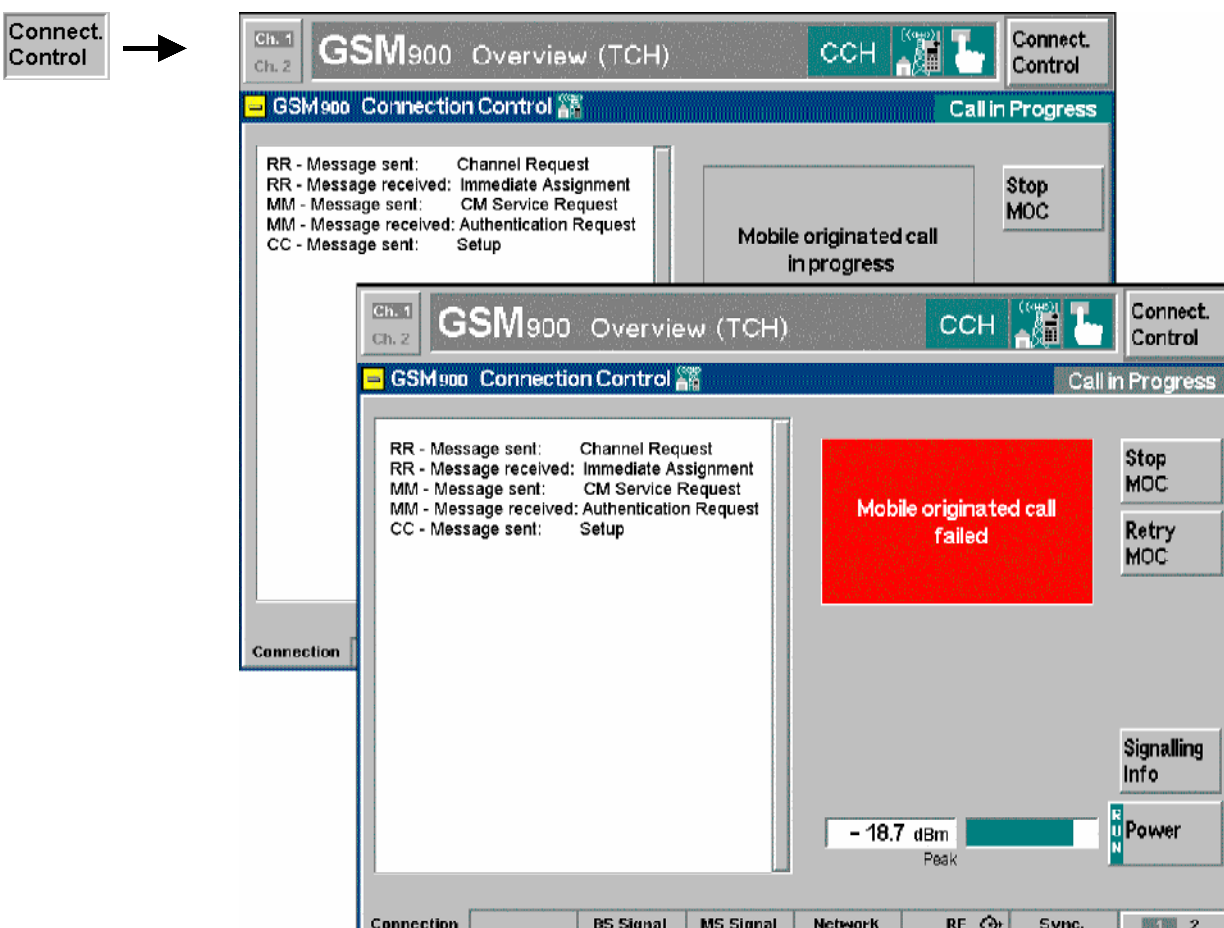


Fig. 4-44 Connection Control – Connection (Call in Progress)

The *Power* softkey is described in section *Connection Control (State Unsynchronized)* on page 4.80.

Message box The message box indicates whether the CMU is in the signalling state *Call in Progress* or *Call Failed*. In the *Call Failed* state an additional softkey *(Retry MTC/MOC)* allows to re-initiate a call setup.

Stop MOC

The *Stop MOC/Stop MTC* softkey stops the call process.

The CMU returns to the signalling state *CCH Test.*

Remote control `PROCedure:SIGNalling:ACTion SMOC`

Retry MOC

The *Retry MOC/Retry MTC* softkey initiates a new call.

This softkey is available in the *Call Failed* state only. The CMU changes to the signalling state *Call in Progress.*

Remote control `PROCedure:SIGNalling:ACTion RMOC`

Signalling Info

The *Signalling Info* softkey activates the output table (for scrolling etc.).

In the output table all Radio Resources *(RR),* Mobility Management *(MM),* and Call Control *(CC)* messages sent and received by the CMU are displayed.

Remote control –

Call Release (with Option CMU-K39 only)

The *Connection (Call Release)* tab shows layer 3 messages sent and received by the CMU (table in the left half of the menu) and displays a comment on the current call release attempt (message box). Besides it contains softkeys to perform the following actions:

- Stop the current call release procedure *(Stop Call Release)* or re-initiate a call release if the previous attempt failed *(Retry Call Release)*.
- Control the wide band peak-power measurement and show the result *(Power).*

An established call can be released by either CMU/mobile station while it is in the signalling state *Call Established* or by the base station. The *Call Release* tab is thus opened via the *Call Release* softkey in the *Connection (Call Established)* tab or automatically as soon as the base station releases the call. It is closed automatically after successful call release or by pressing the *ESCAPE* key or the *Connection Control* softkey. After a successful call release, the CMU changes to the signalling state *CCH Test*.

Connect. Control →

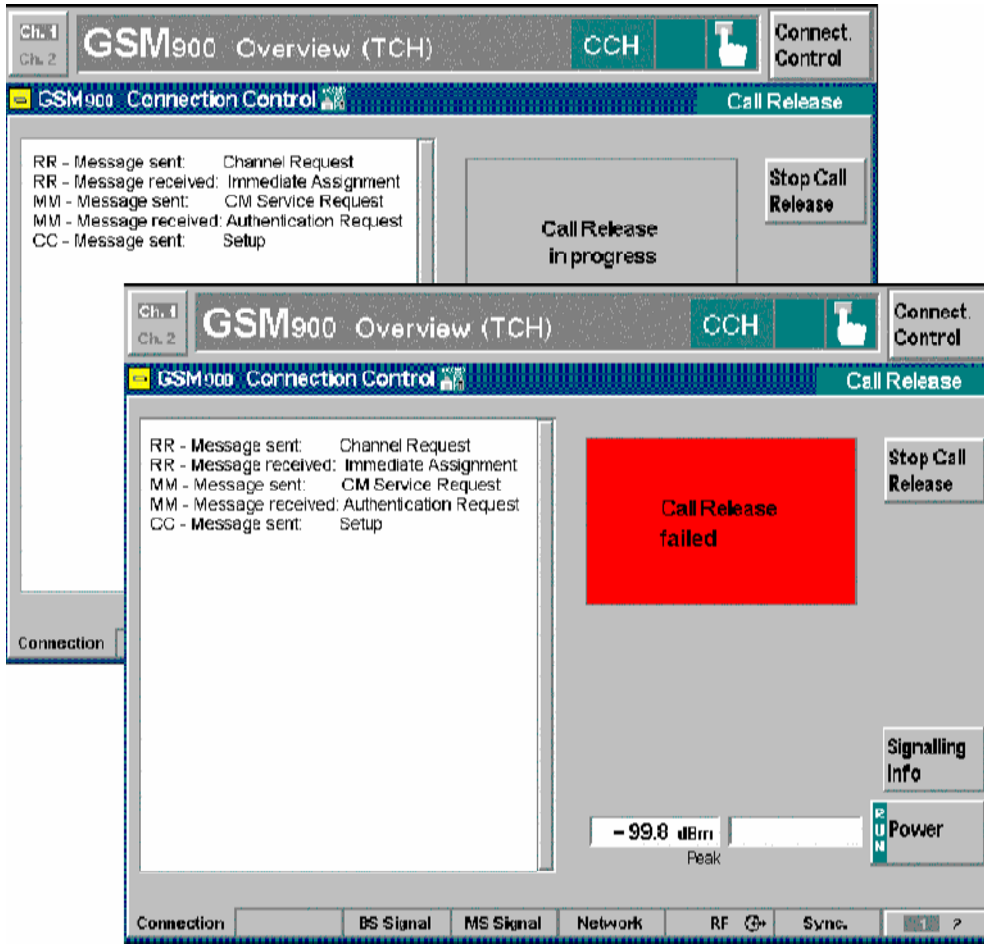


Fig. 4-45 Connection Control – Connection (Call Release)

The *Power* softkey is described in section *Connection Control (State Unsynchronized)* on page 4.80.

Message box — The message box indicates whether the CMU is in the signalling state *Call Release in Progress* or *Call Release Failed*. In the signalling state *Call Failed*, an additional softkey *(Retry Call Release)* allows to re-initiate a call release.

Stop Call Release

The *Stop Call Release*softkeys stop the call release process.

The CMU returns to the signalling state *CCH Test.*

Remote control `PROCedure:SIGNalling:ACTion SRC`

Signalling Info

The *Signalling Info* softkey activates the output table (for scrolling etc.).

In the output table all Radio Resources *(RR),* Mobility Management *(MM),* and Call Control *(CC)* messages sent and received by the CMU are displayed.

Remote control –

Call Established (TCH) (with Option CMU-K39 only)

The *Connection (Call Established)* tab shows an overview of the most important signalling and measurement parameters in *Signalling* mode (table in the left half of the menu) and displays a comment on the current synchronization process (message box). Besides it contains softkeys to perform the following actions:

- Stop the synchronization process between the CMU and the base station under test *(Stop Sync.)* or release the call *(Call Release)*.
- Control the wide band peak-power measurement and show the result *(Power).*

The main purpose of the *Call Established* state is to test the signalling properties of the BTS. All TCH measurements are also provided in the *TCH Test* state.

Connect. Control →

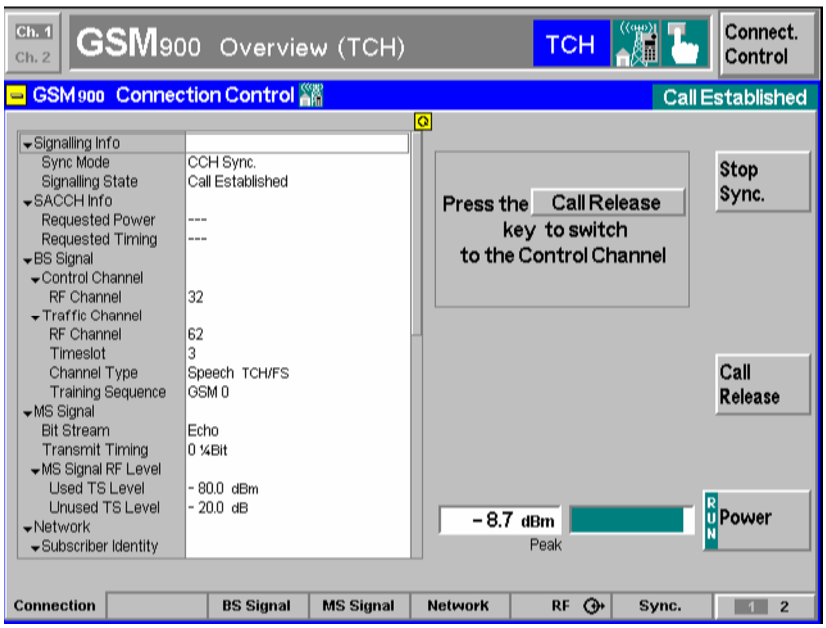


Fig. 4-46 Connection Control – Connection (Call Established)

The information displayed in the table in the left half of the menu is also available in the other signalling states; for a description refer to section *Traffic Channel Test* on p. 4.85 ff. The *Power* softkey is described in section *Connection Control (State Unsynchronized)* on page 4.80.

Stop Sync.

The *Stop Sync.* softkey stops the synchronization process. The CMU returns to the signalling state *Unsynchronized,* see p. 4.80.

Remote control `PROCedure:SIGNalling:ACTion SSTP`

Call Release

The *Call Release* softkey releases the call. The CMU changes to the signalling state *Call Release,* see p. 4.127.

Remote control `PROCedure:SIGNalling:ACTion CREL`

Signals of the Base Station (Connection Control – BS Signal)

The *BS Signal* tab configures the CMU analyzer according to the RF signals expected from the base station. It provides the following settings:

- Channel number of the BTS control channel *(CCH RF Channel)*
- Channel number (TCH RF Channel), Timeslot, TCH Channel Type, and Training Sequence, and Puncturing Scheme of the BTS traffic channel

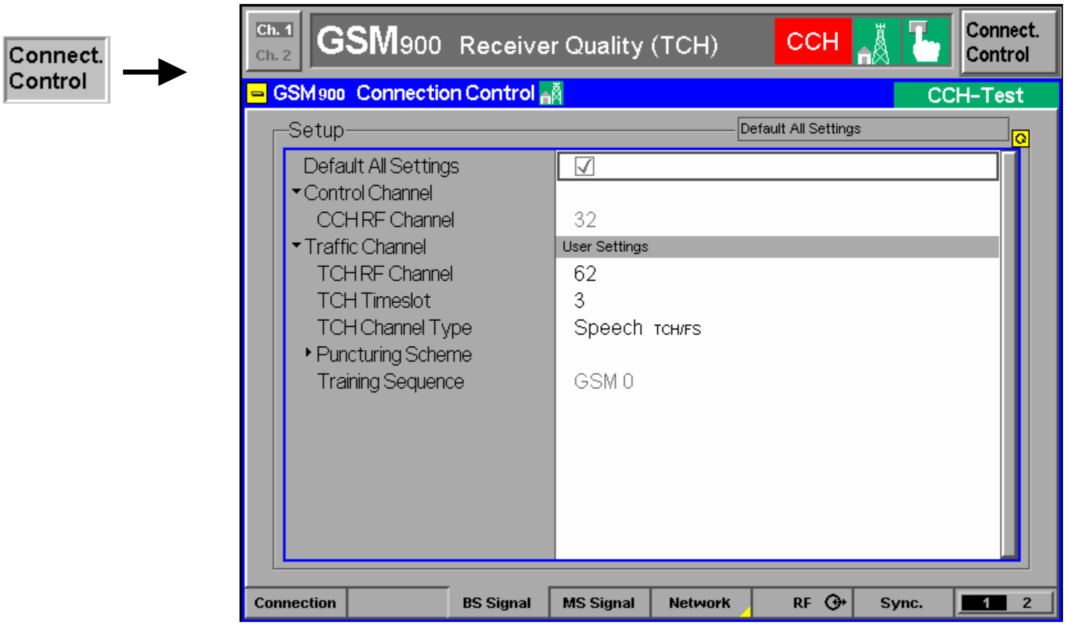


Fig. 4-62 Connection Control – BS Signal

Default Settings The *Default All Settings* switch assigns default values to all parameters of the *BS Signal* tab.

Remote control `DEFault:BSSignal <Mode>`

Control Channel The section *Control Channel* defines the BTS control channel (C0 carrier) used for synchronization.

CCH RF Channel GSM channel number assigned to the control channel. For an overview of GSM channels see section *Control of Input and Output Signals* on page 4.61 ff.

CCH RF Chan. is available in the synchronization mode *CCH Sync. No Loc. Update.* In the synchronization mode *Wired Sync. (External Trigger), CCH RF Chan.* is disabled (grayed) but the *Training Sequence* parameter described below can be selected (see *Sync. Mode* softkey on p. 4.80).

Remote control `CONFigure:BSSignal:CCH:CHANnel <ChannelNo>`

Traffic Channel The section *Traffic Channel* defines the BTS traffic channel.

TCH RF Channel GSM channel number assigned to the traffic channel. For an overview of GSM channels see section *Control of Input and Output Signals* on page 4.61 ff.

TCH Timeslot Timeslot number of the TCH used to transfer signalling information. The TCH timeslot is always active.

Remote control `CONFigure:BSSignal:TCH:CHANnel <ChannelNo>`
`CONFigure:BSSignal:TCH:TIMeslot <TimeslotNo>`

Traffic Channel – TCH CH Type

The *TCH Chan. Type* parameter defines the coding scheme and the transmission rate in the BTS traffic channel. The following options are provided:

Speech TCH/FS	Standard full rate speech coding
Speech TCH/EFS	Enhanced full rate speech coding
Speech TCH/HS	Half rate speech coding
CS Data TCH/F14.4	Full rate data with a transmission rate of 14 400 baud
CS Data TCH/F9.6	Full rate data with a transmission rate of 9 600 baud
CS Data TCH/F4.8	Full rate data with a transmission rate of 4 800 baud
CS Data TCH/H4.8	Half rate data with a transmission rate of 4 800 baud
CS Data TCH/H2.4	Half rate data with a transmission rate of 2 400 baud
ECSD E-TCH/F43.2NT	Extended full rate data (EDGE) at 43 200 baud
PDTCH / CS-1	Packet traffic channels coded according to coding scheme 1 *(CS-1)* specified for GPRS.
...	
PDTCH / CS-4	Coding scheme 4 *(CS-4)* specified for GPRS.
PDTCH / MCS-1	Modulation and coding scheme 1 *(MCS-1)* specified for EGPRS with GMSK modulation.
...	
PDTCH / MCS-4	Modulation and coding scheme 4 *(MCS-4)* specified for EGPRS with GMSK modulation.
PDTCH / MCS-5	Modulation and coding scheme 5 *(MCS-5)* specified for EGPRS with 8PSK modulation.
...	
PDTCH / MCS-9	Modulation and coding scheme 9 *(MCS-9)* specified for EGPRS with 8PSK modulation.

he following TCH types are used for tests on base stations equipped with an AMR (Adaptive Multi-Rate) codec, available with option R&S CMU-K37:

AMR full rate	Test of full rate AMR codec (FR_AMR) with 8 modes and a data rate up to 12.2 kbit/s
AMR half rate	Test of half rate AMR codec (HR_AMR) with 6 modes and a data rate up to 7.95 kbit/s

The speech codecs must be supported by the base station test. With the AMR TCH types an extended version of the *Network* tab with further AMR settings is available; see section *Adaptive Multi-Rate*

(AMR, Option R&S **CMU-K37)** on p. 4.149 ff.

Note: *The ECSD E-TCH/F43.2NT channel type must be used for all 8PSK measurements.*

Option CMU-K39, MOC/MTC, supports the following full-rate channels:
Speech TCH/FS
Speech TCH/EFS
CS Data TCH/F14.4
CS Data TCH/F9.6
CS Data TCH/F4.8
For all other *TCH CH Types* the CMU generates an error message when attempting a call to the BTS.

For packet-switched data traffic channels (PDTCHs), the bit error rate test is modified in such a way that the BTS loops back the received data packets on a block by block basis. The CMU calculates the bit error rate and the ratio of erroneous blocks to the total number of transferred blocks (Data Block Error Rate, DBLER). This test mode is described in section BER Tests of PDTCHs on p. 4.110.

Burst by Burst *measurements (fast BER; see section Receiver Quality Measurements on p. 4.108 ff.) require one of the following TCH Chan. Types:*
Speech TCH/FS
Speech TCH/EFS
Speech TCH/HS
ECSD E-TCH/F43.2NT
EGPRS PDTCH/MCS-5 to MCS-9

Remote control `CONFigure:BSSignal:TCH:CHTYpe <Type>`

> The four coding schemes CS-1 to CS-4 are defined for the GPRS packet data traffic channels (PDTCH). For most packet control channels, coding scheme CS-1 is used. All coding schemes CS-1 to CS-4 are mandatory for MSs supporting GPRS.
>
> The nine modulation and coding schemes MCS-1 to MCS-9 are defined for the EGPRS packet data traffic channels. For all EGPRS packet control channels the corresponding GPRS control channel coding is used. Mobiles supporting EGPRS shall support MCS-1 to MCS-9 in downlink and MCS-1 to MCS-4 in uplink.

Traffic Channel – Puncturing Scheme

Expected puncturing scheme of the received DL TCH. The setting is relevant for EGPRS packet data channels *(TCH Channel Type: PDTCH / MCS-1, … PDTCH / MCS-9).*

A puncturing scheme can be defined for each of the EGPRS modulation and coding schemes MCS1 to MCS9. Puncturing means that bits in the radio blocks are removed after channel coding in order to reduce the amount of transferred data and enhance the useful data rate. The puncturing schemes are selectable so that it is possible to test their influence on measured quantities, e.g. bit error rates.

3 different puncturing schemes (PS) are defined. The modulation and coding schemes MCS3, MCS4 and MCS7 to MCS9 can be combined with 3 PS, the remaining modulation and coding schemes with 2 PS only.

For schemes MCS1 to MCS6, four normal bursts carry one RLC block. For the remaining schemes MCS7 to MCS9, four normal bursts carry two RLC blocks. The puncturing schemes for the two blocks can be set individually.

Remote control `CONFigure:BSSignal:TCH:PSCHeme <PS_1>, ... <PS_12>`

Traffic Channel – Training Sequence

Expected training sequence of the BTS traffic channel. The following settings are provided:

GSM 0 to 7 GSM standard training sequences

The *Training Sequence* can be selected in the synchronization mode *Wired Sync. (External Trigger)* only (see *Sync. Mode* softkey on p. 4.80). In the synchronization mode *CCH Sync. No Loc. Update,* the CMU determines the training sequence of the CCH signal from the BTS; the TCH training sequence is taken to be equal to this CCH training sequence. The *Training Sequence* softkey is disabled but the *CCH RF Chan.* can be selected; see above.

Remote control `CONFigure:BSSignal:TCH:TSEQuence <TSC>`

Signals of the CMU (Connection Control – MS Signal)

The *MS Signal* tab configures the signals of the CMU (which simulates a mobile station transmitting a traffic channel signal) and the transmission parameters. The *MS Signal* tab provides the following settings:

- The parameters for transmission or retransmission of a received signal *(Bit Stream, Transmit Timing, Speech Data Rearrangement)*
- The level of the MS Signal *(MS Signal RF Level)*
- The parameters for forced frequency hopping in TCH test mode; see background information below.
- The uplink CCH generator settings *(CCH Test,* with option R&S CMU-K38)

Frequency hopping in GSM

In GSM networks, frequency hopping is primarily used for error protection in the radio transmission path. It consists of periodically switching over the transmission channels (except BCCH) to other carrier frequencies. The frequency changes after each radio frame so that the dwell time on each carrier frequency is 4.615 ms ("slow" frequency hopping).

Frequency hopping is controlled by the network: The BTS transfers a hopping sequence (hopping list) and the Mobile Allocation Index Offset *(MAIO),* an integer number defining the start of the sequence, to the mobile station. From these parameters, the mobile station calculates the radio frequency channel for each TDMA frame number according to an algorithm described in GSM 05.02.

Slow frequency hopping

The CMU supports slow frequency hopping for all GMSK-modulated full rate channels. To calculate the appropriate radio channels for all TDMA frames the CMU must be set to the *Call Established* state where it receives the hopping list and the MAIO from the BTS. The CMU is able to perform all measurements provided in the *Call Established* state irrespective of the frequency hopping mode. A full rate GMSK-modulated speech or data channel must be selected by means of the *TCH Chan. Type* softkey in the *Signalling* tab of the *Connection Control* menu; see description on p. 4.131.

If the BTS and the CMU is in slow hopping mode, the *TCH RF Channel* parameter line in the *MS Signal* tab of the *Connection Control* menu shows the entry *Hopping* instead of a definite channel number and RF frequency. *Hopping* is also indicated in the parameter lines above the graphical measurement diagrams. In remote control, the frequency hopping mode of the BTS can be queried by means of the command `[SENSe:]BSSignal:TCH:CHANnel:CESTablished:HOPPing?`

Forced hopping

In the *Forced Hopping* mode, the hopping sequence and MAIO is manually set at the CMU. The parameters must be identical to the BTS configuration, however, no parameter transfer (signalling) between the BTS and the tester is required. Measurements in *Forced Hopping* mode can be performed in the *TCH Test* state.

The *Forced Hopping* mode is particularly useful for measurements that are not available in the *Call Established* state, e.g. traffic channel tests on EDGE channels (with option CMU-K41). The *Forced Hopping* parameters can be defined in the *MS Signal* tab of the *Connection Control* menu.

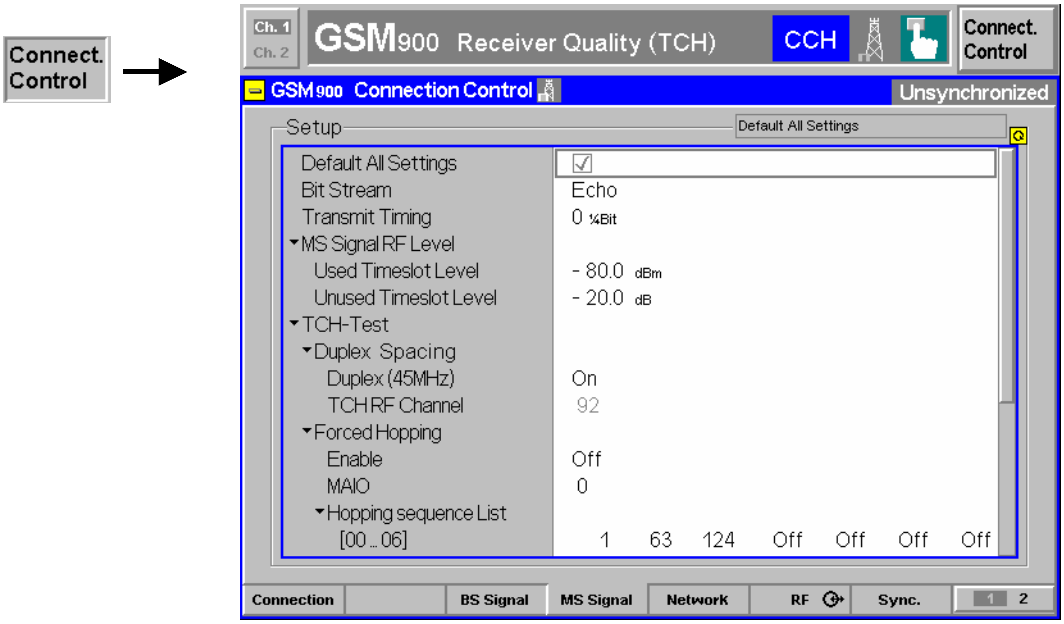


Fig. 4-63 Connection Control – MS Signal

Default Settings The *Default All Settings* switch assigns default values to all parameters of the *MS Signal* tab.

Remote control `DEFault:MSSignal <Mode>`

Bit Stream The table line *Bit Stream* defines the data transmitted on the traffic channel.

Echo	Loop-back mode with delay. The CMU sends back all data received on the TCH after 50 speech frames (Echo).
Loop	Loop-back mode with minimum delay: The CMU sends back all data received on the TCH after 1 speech frame.
Loop Burst by B.	Loop-back mode without channel coding/decoding; see *Fig. 4-64 below*. This mode is available only if *TCH Chan. Type Speech...* or *ECSD E-TCH/F43.NT* is selected (see *TCH Chan. Type* softkey on p. 4.131).
PSR 2E9-1	Transmission of the pseudo random sequence to CCITT O.153.
PSR 2E11-1	Transmission of the pseudo random sequence to CCITT O.153.
PSR 2E15-1	Transmission of the pseudo random sequence to CCITT O.151.
PSR 2E16-1	Transmission of a pseudo random sequence (Polynomial: $x^{16}+x^5+x^3+x^2+1$)
Handset	The CMU sends a bit pattern generated by an analog signal on the speech coder/decoder (*Speech* connector at the front panel of the instrument).

Note: *The bit stream set in the* MS Signal *tab is valid for all transmitter measurements. The bit stream for* Receiver Quality *measurements is set independently; see Bit Stream BER softkey on p. 4.116.* Receiver Quality *measurements must be performed with a pseudo random sequence.*

Remote control `CONFigure:MSSignal:BITStream <Mode>`

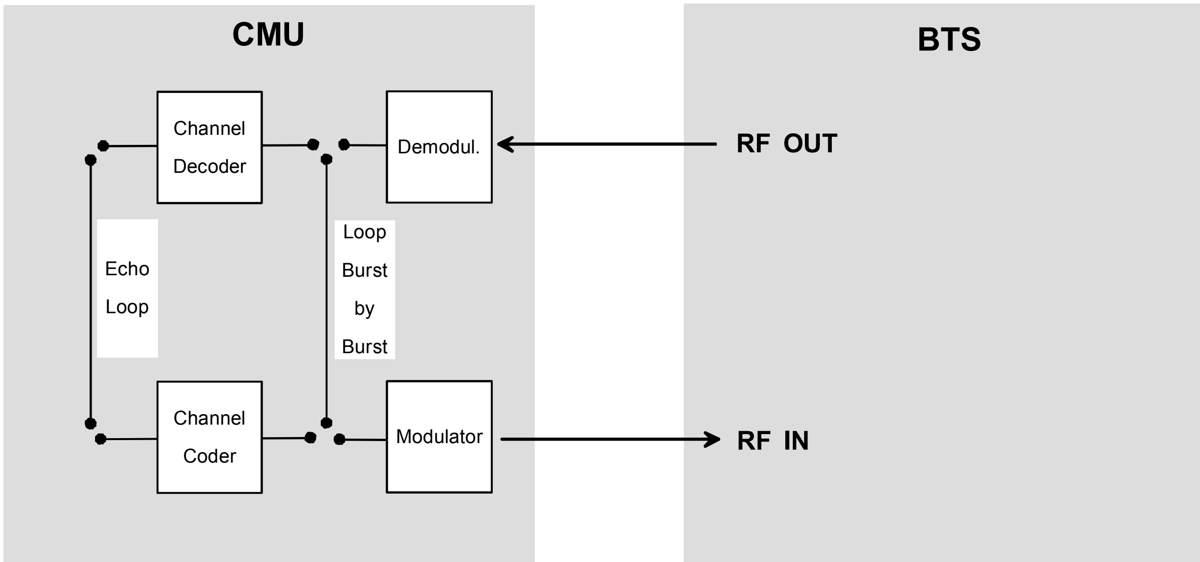


Fig. 4-64 Signal paths for different bit stream settings

Transmit Timing *Transmit Timing* defines a timing offset for the transmitted signal. The value is entered in multiples of ¼ bit and can be used to modify the default offset of three slots between reception and retransmission.

Remote control `CONFigure:MSSignal:TXTiming <Mode>`

Speech Data Rearrangement *Speech Data Rearrangement* configures the speech codec in the TX and RX path:

On In the default setting, the transmitted speech data are rearranged before channel coding according to their subjective importance (see standard 3GPP TS 45.003). Received speech data are assumed to be rearranged according to the standard; the rearrangement is reversed after channel decoding.

Off Rearrangement of the transmitted speech data is switched off; received data are assumed not to be rearranged. This setting is suitable for special applications only, e.g. if the BER is evaluated at the BTS without reversing the rearrangement.

This setting is only valid for speech channels (*TCH Chan. Type* = *Speech TCH/FS* or *Speech TCH/EFS* or *Speech TCH/HS*; see p. 4.131). It has no impact on *Receiver Quality* tests with a closed loop in the BTS and evaluation by the CMU.

Remote control `CONFigure:MSSignal:SDRearrange ON | OFF`

MS Signal RF Level The section *MS Signal RF Level* defines the level of the traffic channel RF signal transmitted by the CMU.

Used Timeslot Level Absolute level (in dBm) in the used timeslot

Unused Timeslot Level Level in the unused timeslots (in dB, relative to the level in the used timeslot)

The permissible value range for the RF levels depends on the RF output selected and of the external attenuation set; see section *Control of Input and Output Signals (Non Signalling)* on p. 4.61 ff.

Remote control
```
CONFigure:MSSignal:LEVel:UTIMeslot <Level>
CONFigure:MSSignal:LEVel:UNTimeslot <Level>
```

TCH Test – Duplex Spacing

The section *Duplex Spacing* the frequency of the MS TCH signal can be selected by eliminating the duplex spacing (see tables on p. 4.62 and p. 4.68) between downlink and uplink signal.

Duplex (xx MHz)

In the *On* setting, the duplex spacing is according to GSM specifications; the uplink *(MS Signal)* frequencies are lower than the downlink *(BS Signal)* frequencies. The *TCH RF Channel* is assigned by the network/BTS under test.

In the *Off* setting, the duplex spacing is eliminated. The CMU generates a TCH using the downlink channel frequency corresponding to the *TCH RF Channel* setting below.

TCH RF Channel

Downlink channel used by the CMU if the *Duplex (xx MHz)* is switched off. If *Duplex (xx MHz)* is on, this setting is disabled because the *TCH RF Channel* is assigned by the network/BTS under test.

Remote control

```
CONFigure:MSSignal:DSPacing:NORMal:ENABle ON | OFF
CONFigure:MSSignal:DSPacing:CHANnel <Channel>
```

The following *Forced Hopping* parameters must be defined in the *Unsynchronized* or *CCH Test* state. Once the *TCH Test* state is reached it is no longer possible to change the hopping parameters or switch to the fixed-channel *TCH Test* mode.

Forced Hopping – Enable

Enable activates forced hopping of the CMU or switches over to the fixed-channel mode (setting *Off)*.

If forced hopping is enabled, the *TCH RF Channel* entry in the *Signalling* table of the *Connection Control* menu shows the entry *Hopping* instead of a definite channel number and RF frequency. *Hopping* is also indicated in the parameter lines above the graphical measurement diagrams.

Remote control

```
CONFigure:MSSignal:FHOPping:ENABle ON | OFF
```

Forced Hopping – MAIO

MAIO defines the Mobile Allocation Index Offset *(MAIO),* an integer number between 0 and 63 defining the start of the hopping sequence. Together with the *Hopping List* (see below), the MAIO determines the radio frequency channel of the CMU for each TDMA frame number.

According to the algorithm for the assignment of channels and TDMA frames (GSM 05.05), all MAIOs differing by the total number of entries in the *Hopping List* are equivalent. In the example of *Fig. 4-63 above*, MAIO = 0 is equivalent to MAIO = 3, 6,..., 63.

Remote control

```
CONFigure:MSSignal:FHOPping:MAIO <Number>
```

Hopping Sequence List

The *Hopping Sequence List* defines the frequency hopping sequence that the CMU uses to determine the radio frequency channel for each TDMA frame number. The list may contain up to 64 of the GSM channel numbers assigned in the current hyperband. If a shorter list is desired, *Off* must be entered for the unused channel numbers.

Note: *The hopping list is sorted internally in ascending order, irrespective of the channels entered. Multiple channels are counted as one channel only. This procedure ensures that the entered* Hopping Sequence List *is compatible to the standard.*

Frequency hopping is controlled by the network and can not be deactivated at the CMU.

Remote control

```
CONFigure:MSSignal:FHOPping:A
  <Channel_No> | OFF {, <Channel_No> | OFF}
```

CCH Test – UL CCH BER

The parameters in section *UL CCH BER* configure the UL Control Channel generator (option CMU-K38, *Uplink Signalling Channels).* If this option is switched on, the TCH usually transmitted in the *TCH Test* state is replaced by a single uplink control channel. The data fields of the CCH are filled with a PRBS sequence so it is possible to perform receiver quality tests at the BTS.

Enable	Switches the control channel on or off.
CCH Channel Type	One of the following uplink control channel types: SDCCH/4, SDCCH/8, FACCH/F, SACCH.
CCH Bit Stream	Pseudo-random bit sequence to be transmitted in the data fields of the selected CCH.

Note: *The receiver quality must be evaluated at the BTS; the* Receiver Quality *measurement is not available for tests on the CCH. The* Receiver Quality *measurement is switched off when the CCH is enabled. In contrast, TX tests can be performed while the CCH is enabled.*

The CCHs must be enabled in the Unsynchronized *signalling state but are transmitted in the TCH Test state only.*

Remote control

```
CONFigure:MSSignal:ULCBer:ENABle <Enable>
CONFigure:MSSignal:ULCBer:CHType <Type>
CONFigure:MSSignal:ULCBer:BITStream <Pattern>
```

Network Parameters (Connection Control – Network, with Option CMU-K39 only)

The *Network* tab defines various parameters that are necessary or useful for setting up a call between the CMU/mobile station and the network/BTS under test. This includes:

- Parameters identifying the mobile station and the subscriber *(Subscriber Identity)*
- Mobile Settings
- Configuration of the *Measurement Reports* of the mobile station
- Configuration of the *Adaptive Multi Rate (AMR)* test

NOTE

A second, panel-oriented version of the Network *tab has been especially designed for AMR tests (with option R&S CMU-K37). See section* Adaptive Multi-Rate (AMR) *on p. 4.149* ff.

Fig. 4-65 Connection Control – Network parameters

Default Settings The *Default All Settings* switch sets all parameters of the *Network* tab to their default values (see command description in chapter 6).

Remote control `DEFault:NETWork ON | OFF`

Subscriber Identity The table section *Subscriber Identity* contains parameters characterizing the CMU/mobile station and the subscriber:

SIM Card PIN	4- to 8-digit Personal Identification Number, usually stored on the SIM card of the GSM mobile phone,
IMSI	International Mobile Subscriber Identity in the format MCC.MNC.MSIN
MCC	3-digit Mobile Country Code
MNC	2-digit Mobile Network Code
MSIN	10-digit Mobile Subscriber Id. No.
IMEI	International Mobile Station Equipment Identity in the format TAC.FAC.SNR.SVN
TAC	6-digit Type Approval Code
FAC	2-digit Final Assembly Code

SNR	6-digit Serial Number
SVN	1|2-digit Software Version Number
Dialed Number	Number dialed at the CMU/mobile station to attempt the call (Mobile Originated Call, MOC),

Remote control `CONFigure:NETWork:SUBScriberid...`

Mobile Settings

The *Mobile Settings* table section sets timing parameters for the CMU that are relevant for the *Call Established* state.

Auto Hook Off	Time after which the CMU automatically accepts a call from the BTS (MTC) and enters the *Call Established* signalling state.
Auto Timing Adjust	If this function is *On,* then the CMU is synchronized to the requested timing that the BTS provides in its SACCH header information. If *Auto Timing Adjust* is switched *Off,* then the requested timing is ignored.

Remote control

```
CONFigure:NETWork[:MS]:AUTohookoff <Time>
CONFigure:NETWork[:MS]:ATADjust ON | OFF
```

Measurement Report

The *Measurement Report* section configures the measurement report containing the signal strength and quality of the base station signal received and measured by the CMU/mobile phone.

The received signal level or RX Level is expressed in terms of dimensionless power levels that depend linearly on the absolute measured power (expressed in dBm). A high RX Level implies a high received signal input power and vice versa:

Table 4-6 Definition of RX Level

Value of RX Level	Corresponding signal strength
63	> –48 dBm
62	–49 dBm to –48 dBm
62	–50 dBm to –49 dBm
...	...
2	–109 dBm to –108 dBm
1	–110 dBm to –109 dBm
0	< –110 dBm

The received signal quality or RX Quality is expressed in terms of dimensionless quality levels (actually “error levels”) that depend linearly on the logarithm of the bit error rate. A high quality level implies a high bit error rate and thus a **poor** received signal quality:

Table 4-7 Definition of RX Quality

Value of RX Quality	Bit error rate
0	0% to 0.2%
1	0.2% to 0.4%
2	0.4% to 0.8%
3	0.8% to 1.6%
4	1.6% to 3.2%
5	3.2% to 6.4%
6	6.4% to 12.8%
7	12.8% to 100%

Mode

The *Mode* parameter determines in which way the measurement reports are generated and transmitted to the base station:

Manual Both the RX Level and the RX Quality value are entered manually and transmitted to the base station

Auto RX Quality The RX Level is entered manually; the CMU selects the corresponding RX Qual from the *Auto* table (see below) and transmits both values to the base station.

Auto RXQual & RXLev
The CMU measures the RX Level, selects the corresponding RX Qual from the *Auto* table (see below) and transmits both values to the base station.

Remote control

```
CONFigure:NETWork:MREPort:MODE
          MANual | RXQualauto | AUTomatic
```

Manual

The *Manual* section defines an RX Level and an RX Quality value to be transmitted to the base station if the measurement report is configured in *Manual* mode.

RX Level Input value for the received signal strength, see *Table 4-6*

RX Quality Input value for the received signal quality, see *Table 4-7*

Remote control

```
CONFigure:NETWork:MREPort:MANual...
```

Auto

The *Auto* section configures a table defining a correlation between the RX Level and RX Quality values. The RX Quality, as a function of the RX Level measured or entered manually, is taken from this table and transmitted to the base station if the measurement report is configured in *Auto RXQual & RXLev* or in *Auto RX Quality* mode.

Note that, although both the RX Level and RX Quality scales are fixed according to *Table 4-6* and *Table 4-7*; the correlation between the two is arbitrary.

Remote control

```
CONFigure:NETWork:MREPort:AUTO...
```

Auto RX Qual

The *Auto RX Qual* section defines an RX Level to be transmitted to the base station if the measurement report is configured in *Auto RX Quality* mode. The corresponding RX Qual value is taken from the *Auto* table, see above.

Remote control

```
CONFigure:NETWork:MREPort:AUTO:RXLevel <Level>
```

Auto RX Lev and RX Qual

The *Auto RX Lev and RX Qual* section modifies the measured RX Level to be transmitted to the base station if the measurement report is configured in *Auto RXQual & RXLev* mode: RX Level is measured, the corresponding RX Qual value is taken from the *Auto* table (see above), then the RX Level value is offset.

Offset Relative offset value (in dB) by which the measured RX Level is shifted

The offset value can be used to better simulate what happens in a real network where the mobile receives an RF signal from the base station after it has been attenuated on its propagation path.

Remote control
```
CONFigure:NETWork:MREPort:AUTO:RXOFfset <Offset>
CONFigure:NETWork:MREPort:AUTO:RXLQ
```

RF Connectors (Connection Control – RF Connector)

The RF tab selects the connectors for RF signals. This includes the definition of:

- RF input and RF output at the CMU *(RF Output, RF Input)*,
- An external attenuation at the connectors *(Ext. Att. Output, Ext. Att. Input)*.

The functions of this menu are described in the section *GSM400/GT800/850/900/1800/1900-BTS Non Signalling* on page 4.70.

Reference Frequency (Connection Control – Sync.)

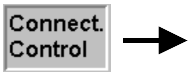
The *Sync.* tab determines the reference signal for synchronization.

The functions in this menu are described in the section *GSM400/GT800/850/900/1800/1900-BTS Non Signalling* on page 4.72.

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 / 2* again switches back to the first group of tabs described above.

The *Trigger* tab defines the trigger condition for the measurement and the input for the external trigger signal.



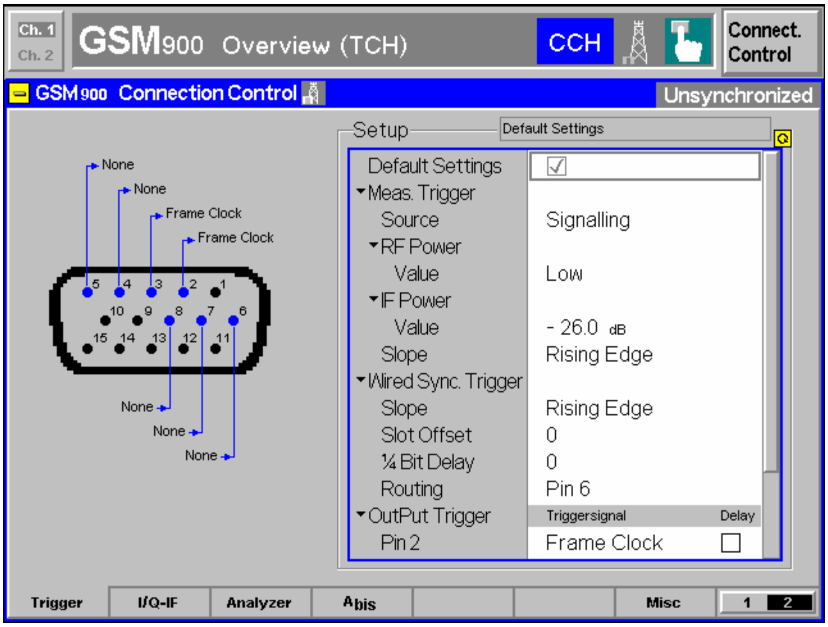


Fig. 4-66 Connection Control – Trigger

The *Meas. Trigger* settings are described in section *GSM400/GT800/850/900/1800/1900-BTS Non Signalling* on page 4.74 ff. In contrast to the *Non Signalling* mode, the measurement must be triggered by the signal from the base station or the CMU's signalling unit; an external trigger signal can not be used.

Trigger – Source

Source selects a signal to trigger the measurements. The following additional settings is available in *Singalling* mode:

Signalling Triggering by the signalling unit of the instrument, according to the frame timing of the RF signal from the BTS under test (downlink frame trigger). The downlink frame trigger is always available while the *Signalling* test mode is active and the CMU transmits an RF signal (i.e. except in the signalling state *Signal Off*).

The downlink frame trigger signal is also fed to pin 2 of the AUX 3 connector at the front of the instrument where is can be tapped off to synchronize external devices; see *Output Trigger* below. It consists of a high-pulse TTL signal with its rising edge at the beginning of timeslot 0 of each BTS TDMA frame except the idle frames and with a length of exactly 1 timeslot (577 µs).

Remote control

```
TRIGger[:SEQuence]:SOURce
  SIGNalling | FRUN | RFPower | IFPower
```

Besides the signaling trigger, the CMU provides the following additional trigger-related settings:

The ***Wired Sync. Trigger*** settings configure the *Wired Sync. (External Trigger)* synchronization mode (see *Sync. Mode* softkey on p. 4.80). The parameters are disabled in the *CCH Sync. No Loc. Update* synchronization mode and their settings have no impact. The *Wired Sync. Trigger* settings must be adapted to the properties of the external trigger signal provided by the BTS under test. The trigger signal is fed in via connector AUX 3 (pin 6, 7 or 8)[1].

Wired Sync. *Slope* defines whether the rising or falling edge of the external trigger signal provide

[1] 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.

Trigger – Slope the timing information for synchronization.

Remote control `CONFigure:EXTernal[:TRIGger][:INPut]:POLarity <Polarity>`

Slot Offset *Slot Offset* defines a number of timeslots by which the TX TCH signal of the CMU is shifted relative to the external trigger signal.

This delay time can be further modified by adding a *¼ Bit Delay*, see below.

Remote control `CONFigure:EXTernal[:TRIGger][:INPut]:SOFFset <Offset>`

¼ Bit Delay *¼ Bit Delay* defines a delay time in ¼ bit units that is added to the slot offset defined by the softkey above.

Remote control `CONFigure:EXTernal[:TRIGger][:INPut]:BITDelay <Delay>`

Output Trigger *Output Trigger* assigns the downlink frame trigger signal (or no signal) to the AUX 3 connector and defines a delay time. The settings are only valid for *Signalling* trigger source; see above.

Pin 2/3/4/5 The frame trigger signal can be assigned to any of the pins no. 2 to 5 of the AUX3 connector. Multiple assignments are allowed. The setting *None* means that no output signal is applied to a pin. If the *Delay* box is checked, the trigger signal at one pin is delayed by an integer number of slots.

Delay Sets a delay time (integer number of 0 to 7 slots) for the trigger signal. The undelayed frame trigger signal coincides with the beginning of timeslot 0 of the BTS signal, so *Delay* can be used to generate a trigger signal with its rising edge at the beginning of any TDMA timeslot.

Remote control
```
TRIGger:OUTPut:PIN<nr>:SIGNal
TRIGger:OUTPut:PIN<nr>:DELay:ENABle
TRIGger:OUTPut:DELay:VALue
```

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. The functions of this menu are described in the section *GSM400/GT800/850/900/1800/1900-MS Non Signalling* on page 4.76 ff.

Input Path (Connection Control – Analyzer)

The *Analyzer* 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 *Analyzer* tab configures the RF input path. The functions of this menu are described in section *GSM400/GT800/850/900/1800/1900-BTS Non Signalling* on page 4.61 ff.

Abis Interface Configuration (Connection Control – Abis)

The *Abis* 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 *Abis* tab monitors the input signal at the Abis interface and provides interface settings. This includes:

- Control of the *Alarm Monitor* and recording of the alarm events *(Alarms)*
- Selection of the Abis link protocol *(Interface Mode)*
- Coding scheme and transmission rate of the BTS traffic channel *(Traffic Type)*
- Timeslot number and bit no. of the PCM signal *(PCM Time Slot, Time Slot Bit No.)*
- Automatic search for the traffic channel on the Abis interface *(Scan)* with appropriate setting of *Start Values*

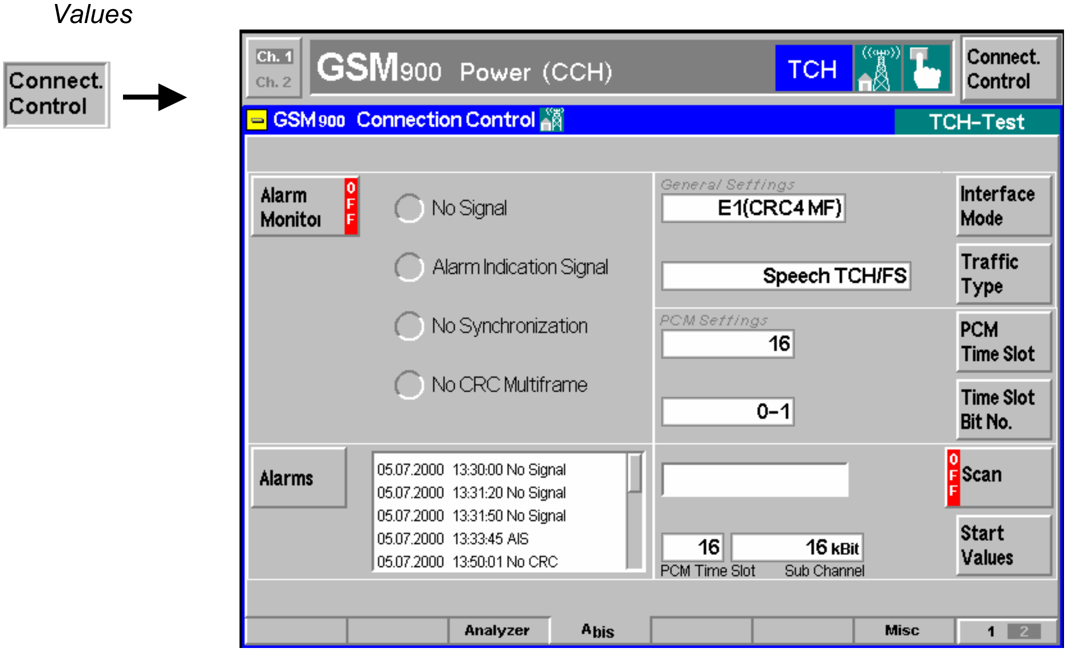


Fig. 4-67 Connection Control – Abis

Alarm Monitor

The *Alarm Monitor* softkey controls the alarm monitor and indicates its status *(RUN or OFF)*. The status can be toggled after softkey selection (pressing once) by means of the *ON/OFF* key.

Note: *The* Alarm Monitor *and the* Scan *can not be active at the same time. To switch on the* Alarm Monitor, *the* Scan *must be switched off and vice versa.*

The alarm monitor is to monitor the signals at Abis input ABIS or ABIS RX; see interface description in section *Receiver Quality Measurements* on p. 4.108 ff. If an abnormal event is detected, one of the green LED symbols to the right of the softkey turns red and an error message is written to the log table displayed below (see *Alarms* softkey).

Four different types of events can be detected:

No Signal	One of the following scenarios is detected: – No input signal at Abis input. – Input signal too low. – Input signal has no PCM frame structure. – The PCM signal is an all zeroes signal, i.e. it contains not more than three ones within a period of 250 µs.
Alarm Ind. S.	The PCM signal is an all ones signal (Alarm Indication Signal, AIS), i.e. it contains not more than two zeroes within a period of 250 µs.
No Synch.	Four consecutive false Frame Alignment Signals (FAS) or four consecutive false Not Frame Alignment Signals (NFAS) were identified in the PCM signal.
No CRC	The Cyclic Redundancy Check (CRC) was not able to identify a CRC4 multiframe or the error rate of the CRC exceeded the threshold of 91%. CRC errors are detected only if one of the modes *E1(CRC4MF)* or *T1(CRC6ESF)* is selected; see *Interface Modes* softkey below.

The four alarm types can be monitored simultaneously; however, if *No Signal* is detected, the CMU is not able to check the remaining alarm types. The status of the alarm monitor is updated roughly every second.

Remote control
`INITiate:ABIS:ALARmmonitor; ABORt:ABIS:ALARmmonitor`
`SENSe:ABIS:ALARmmonitor?` etc.

Alarms

The *Alarms* softkey selects the alarm monitor log table for scrolling. The table shows all alarm events detected in the current measurement session together with the time of recording. The four alarm event types *No Signal, AIS (Alarm Indication Signal), No Synchronization* and *No CRC Multifr*ame are described above.

Remote control
`SENSe:ABIS:ALARmmonitor?`

Interface Mode

The *Interface Mode* softkey selects one of the supported Abis link protocols.

E1(DF)	Double frame
E1(CRC4MF)	CRC4 multiframe
T1(SF)	Standard frame
T1(ESF)	Extended standard frame
T1(CRC6ESF)	CRC6 extended standard frame

The *E1(CRC4MF)* or *T1(CRC6ESF)* link protocol must be selected to detect *No CRC Multiframe* alarm events.

Remote control
```
CONFigure:ABIS:IMODe
  E1DF | E1CRc4mf | T1SF | T1ESf | T1CRc6esf
```

Traffic Type

The *Traffic Type* softkey selects the coding scheme and the transmission rate in the BTS traffic channel transferred via Abis interface. The following options are provided:

Speech TCH/FS	Standard full rate speech coding
Speech TCH/EFS	Enhanced full rate speech coding
Speech TCH/HS	Half rate speech coding
CS Data TCH/F14.4	Full rate data with a transmission rate of 14 400 baud
CS Data TCH/F9.6	Full rate data with a transmission rate of 9 600 baud
CS Data TCH/F4.8	Half rate or full rate data with a transmission rate of 4 800 baud

Compared to the complete list of traffic channel types provided in the *Signalling (Unsynchronized)* tab of the *Connection Control* menu, 8PSK, GPRS and EGPRS channels are not supported. If one of these channel types are selected in the *Signalling* tab and the Abis interface is used, the CMU displays a warning.

Remote control
```
CONFigure:ABIS:TTYPe TTFR | TTEFr | TTHR | TF14 | TF96 | TF48
```

PCM Time Slot

The *PCM Time Slot* softkey selects the timeslot for the PCM (Pulse Code Modulation) traffic channel signal.

In the E1 (T1) interface modes, the PCM signal is divided into 32 (25) timeslots. Timeslot no. 0 is reserved for frame synchronization; each of the remaining timeslots contains 8 data bits corresponding to a 64 kbit/s channel. Consequently, one of the timeslots 1 to 31 (1 to 24) can be selected for the E1 (T1) interface mode.

Remote control
```
CONFigure:ABIS:PCMTimeslot <numeric>
```

Time Slot Bit No.

The *Time Slot Bit No.* softkey selects the bit numbers within the PCM timeslot that define a full rate or half rate channel.

The 64 kbit/s channel of a full timeslot can be divided into 4 full rate sub channels with a transmission rate of 16 kbit/s each, occupying a pair of consecutive bits (0-1, 2-3, 4-5, 6-7). A half rate sub channel with a transmission rate of 8 kbit/s occupies only one of the bits 0 to 7.

Remote control
```
CONFigure:ABIS:TSBitno BN01 | BN23 | BN45 | BN67 | BNR0 |
BNR1 | BNR2 | BNR3 | BNR4 | BNR5 | BNR6 | BNR7
```

Scan

The *Scan* softkey controls the automatic search for the traffic channel on the Abis interface and indicates its status *(RUN / OFF)*. The status can be toggled after softkey selection (pressing once) by means of the *ON/OFF* key.

The scan routine searches from the *PCM Time Slot* defined with the *Start Values* softkey below upwards. The results of the *Scan* supersede the *PCM Time Slot* and *Time Slot Bit No.* settings.

Note: *The* Alarm Monitor *and the* Scan *can not be active at the same time. To switch on the* Alarm Monitor, *the* Scan *must be switched off and vice versa.*

Remote control
`INITiate:ABIS:SCAN; ABORt:ABIS:SCAN`
`SENSe:ABIS:SCAN?` etc.

Start Values

The *Start Values* softkey sets a start value for the *PCM Time Slot* and defines whether the *Scan* searches for a full rate or half rate sub channel. The *Start Values* are of particular importance if several channels of the PCM signal are occupied.

The scan routine searches from the *PCM Time Slot* defined with the *Start Values* softkey upwards. The data rate of the sub channel (full rate channels with 16 kbit/s or half rate channels with 8 kbit/s) is automatically derived from the *Traffic Type* setting where the latter leaves no ambiguity. Otherwise (e.g. for *CS Data TCH/F4.8,* which may be a half rate or a full rate data channel), the scan will not be successful if the wrong *Sub Channel* type is selected. If *16 kBit / 8 dBit* is set, the scan searches for both sub channel types.

Remote control
`CONFigure:ABIS:STARtvalues:PCMTimeslot <numeric>`
`CONFigure:ABIS:STARtvalues:SUBChannel S168 | S16K | S8K`

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)*.

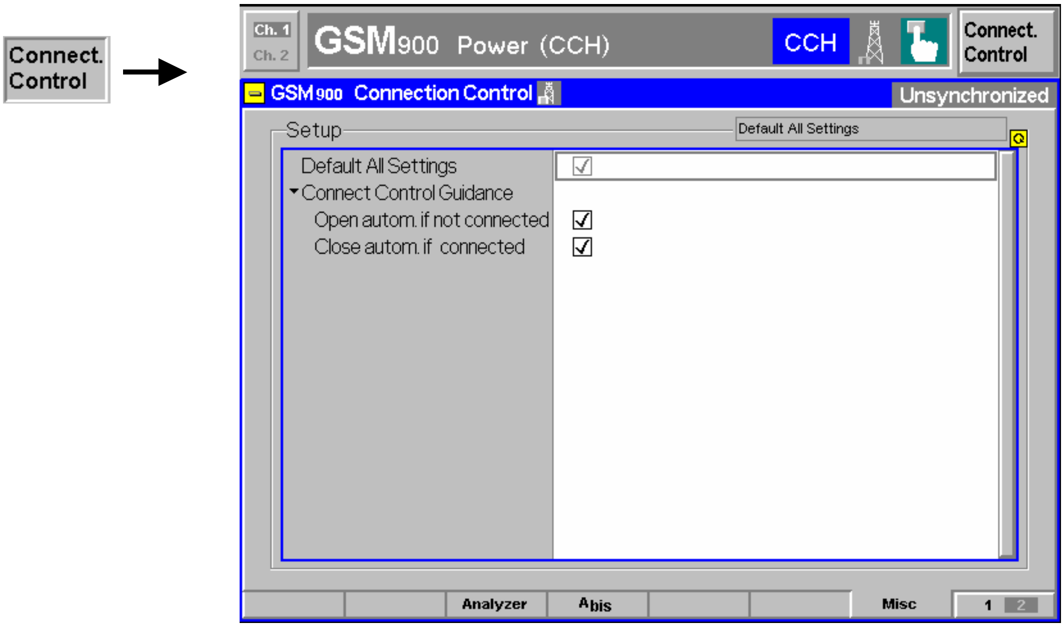


Fig. 4-68 Connection Control – Misc

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 No command; screen configuration only.

Connect. Control Guidance Defines in what instances the *Connection Control* popup menu is automatically opened or closed:

Open autom. if not connected

If the box is checked, the *Connection Control* menu is automatically opened each time the *GSM400/GT800/850/900/1800/1900-BTS* function group is accessed in *Signalling* test mode and each time the connection with the BTS under test is dropped. Otherwise the menu must be opened manually.

Close autom. if connected

If the box is checked, the *Connection Control* menu is automatically closed as soon as the CMU reaches the *Call Established* state. Otherwise the menu must be closed manually.

Remote control No command; screen configuration only.

Adaptive Multi-Rate (AMR, Option R&S CMU-K37)

If an AMR *TCH Channel Type* is selected the *Network* tab displays additional softkeys to configure the AMR codec and test the uplink and downlink codec adaptation (inband signalling). The following settings are provided:

- Selection of a subset of codec modes *(AMR Rate Set).*
- Explicit setting of the R&S CMU300 codec mode (*Codec Mode DL, requested by MS)* and the MS codec mode *(Codec Mode UL, used by MS).*

AMR codec

The Adaptive Multi-Rate (AMR) codec is an integrated speech codec with six or eight fixed user bit rates ranging from 4.75 kbit/s to 7.95 kbit/s (AMR Half Rate) or 12.2 kbit/s (AMR Full Rate). The speech coder is capable of switching its user bit rate upon command.

Decreasing the bit-rate impairs the speech quality but leaves more bits for error protection. This allows a dynamic trade-off between the speech quality and the stability of the connection as the quality of the radio link varies.

Codec mode selection is done from a set of 1 to 4 active codec modes (ACS, Active Codec Set). The necessary signalling messages are included in the AMR speech frames (inband signalling).

To prepare an AMR test…

1. Activate the *Signalling* mode and open the *Connection Control* menu.
2. Press the *Network* hotkey to open the *Network* tab. If necessary, press the hotkey again to access the softkey-oriented version of the tab. This version is available as soon as option R&S CMU-K37 is enabled.
3. Press *TCH Channel Type* and select the AMR codec supported by your base station *(AMR Full Rate* or *AMR Half Rate).* You can select the codec irrespective of the signalling state of your R&S CMU 300.

To test inband signalling…

To decode the codec mode used by the BTS and the codec mode commanded by the BTS, the R&S CMU 300 rate settings must correspond to the rate settings at the BTS and the R&S CMU 300 must be in the *TCH Test* signalling state.

4. Press *AMR Rate Set*. In the popup menu opened, adjust the rate settings to the configuration of your BTS observing the rules described below (softkey *AMR Rate Set*). Again you can do this irrespective of the signalling state of your R&S CMU300.
5. Open the *Connection* tab and command the R&S CMU 300 to the *TCH Test* state.
6. Return to the *Network* tab.

The correct DL codec mode *used by BTS* and the UL codec mode *commanded by BTS* are displayed in the corresponding output fields.

To test the speech quality…

The speech quality of an AMR codec is assessed in terms of bit error rate tests; see section *AMR Bit Error Rate Test* on p. 4.152 ff.

Connect. Control →

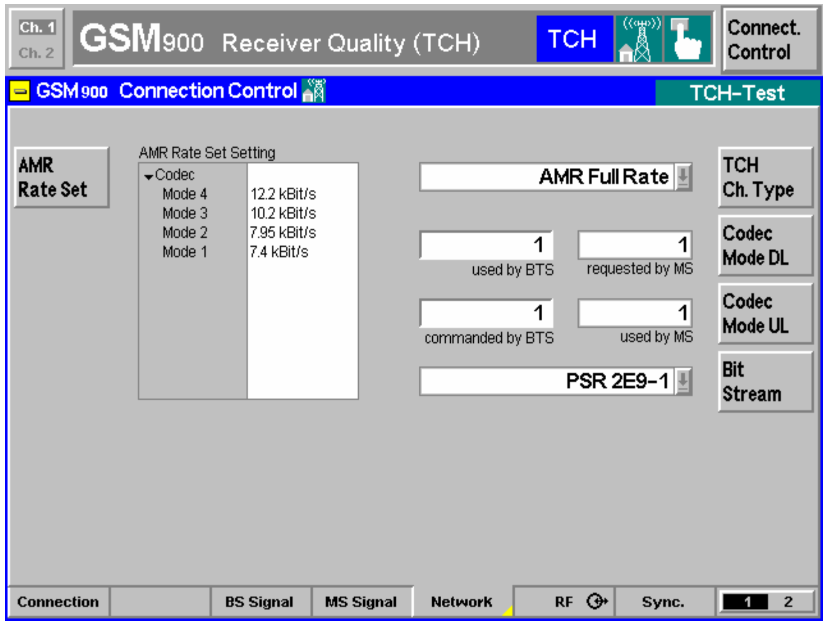


Fig. 4-69 Connection Control – Network parameters (AMR)

AMR Rate Set

The *AMR Rate Set* softkey opens a popup menu to select the data rate for up to four codec modes.

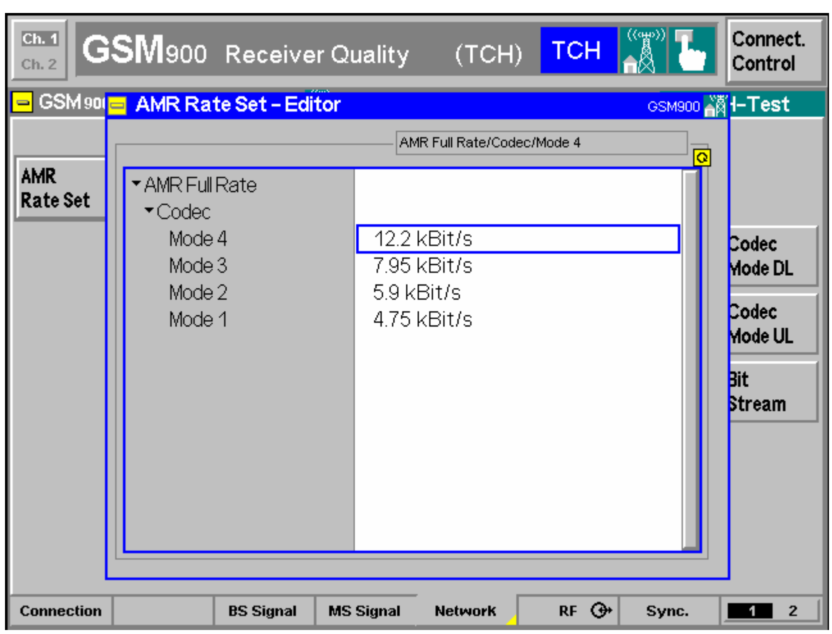


Fig. 4-70 Connection Control – AMR Rate Set (AMR)

AMR Full Rate The first line of the *AMR Rate Set Editor* indicates the AMR codec type (Full Rate or Half Rate) selected by means of the *TCH Channel Type* softkey.

Codec – Mode Selects the data rate for modes 4 to 1. For full rate codecs, the full set of 8 different rates (4.75 kbit/s, 5.15 kbit/s, 5.9 kbit/s, 6.7 kbit/s, 7.4 kbit/s, 7.95 kbit/s, 10.2 kbit/s, 12.2 kbit/s) is available. The last two rates are not provided for half rate codecs.

The selected data rates must be different from each other. The entered values are automatically sorted in descending order so that Rate (Mode 1) < Rate (Mode 2) < Rate (Mode 3) < Rate (Mode 4). To restrict the test model to 1, 2, or 3 modes, the codec modes can be switched off using the *ON/OFF* key.

Remote control
```
CONFigure:NETWork:AMR:HRATe:RSETting
CONFigure:NETWork:AMR:FRATe:RSETting
```

The following two softkeys define the codec modes to be used in both signal directions:

Codec Mode DL

The *Codec Mode DL* softkey sets the codec mode that the BTS under test shall use in downlink direction.

The CMU300 maintains this mode during the measurement, irrespective of the UL codec mode commanded by the BTS under test.

If the R&S CMU 300 can decode the AMR speech frames (see *To test inband signalling…*… on p. 4.149), the DL codec mode that the BTS uses is indicated to the left of the input field for the DL codec mode.

Note: *AMR Reference Sensitivity Tests require equal uplink and downlink codec modes. In addition, all Bit Stream settings involving a closed loop or pseudo-random bit sequences require equal uplink and downlink codec modes. Different codec modes can be tested with* Bit Stream = Handset.

Remote control
```
CONFigure:NETWork:AMR:HRATe:DLCMode
CONFigure:NETWork:AMR:FRATe:DLCMode
[SENSe:]INFO:AMR:HRATe:DLCMode?
[SENSe:]INFO:AMR:FRATe:DLCMode?
```

Codec Mode UL

The *Codec Mode UL* softkey sets the codec mode that the CMU300 uses in uplink direction.

If the R&S CMU 300 can decode the AMR speech frames (see *To test inband signalling…*… on p. 4.149), the UL codec mode commanded by the BTS is indicated to the left of the input field for the UL codec mode.

Note: *AMR Reference Sensitivity Tests require equal uplink and downlink codec modes. In addition, all Bit Stream settings involving a closed loop or pseudo-random bit sequences require equal uplink and downlink codec modes. Different codec modes can be tested with* Bit Stream = Handset.

Remote control
```
CONFigure:NETWork:AMR:HRATe:ULCMode
CONFigure:NETWork:AMR:FRATe:ULCMode
[SENSe:]INFO:AMR:HRATe:ULCMode?
[SENSe:]INFO:AMR:FRATe:ULCMode?
```

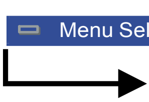
The AMR settings are also in the table-oriented version of the *Network* tab.

AMR Bit Error Rate Test

The bit error rate is measured in the *Receiver Quality* menu; BER and BER Average tests can be made without restriction.

To obtain the AMR Reference Sensitivity Test …

1. In the *Menu Select* menu, select your GSM band and the *Signalling – Receiver Quality – BER CMU* measurement.
2. Press *Connect. Contol* to open the *Connection Control* menu, open the *Connection* tab, synchronize to the control channel *(Start Sync.),* and set up the *Traffic Channel*.
3. Press the *Network* hotkey to open the *Network* tab. If necessary, press the hotkey again to access the softkey-oriented version of the tab.
4. Press *TCH Channel Type* and select the AMR codec supported by your base station *(AMR Full Rate* or *AMR Half Rate).*
5. Press *AMR Rate Set*. In the popup menu opened, adjust the rate settings to the configuration of your BTS observing the rules described above (softkey *AMR Rate Set*).
6. Adjust the DL codec mode *requested by MS* to the DL codec mode of your BTS *(used by MS).* The UL codec mode *used by MS* is adjusted automatically.
7. Close the *Connection Control* menu.
8. In the *Receiver Quality* menu, press *BER CMU Single Shot* or *BER CMU Average – Meas. Mode* and select *BER* or *RBER/FER.*



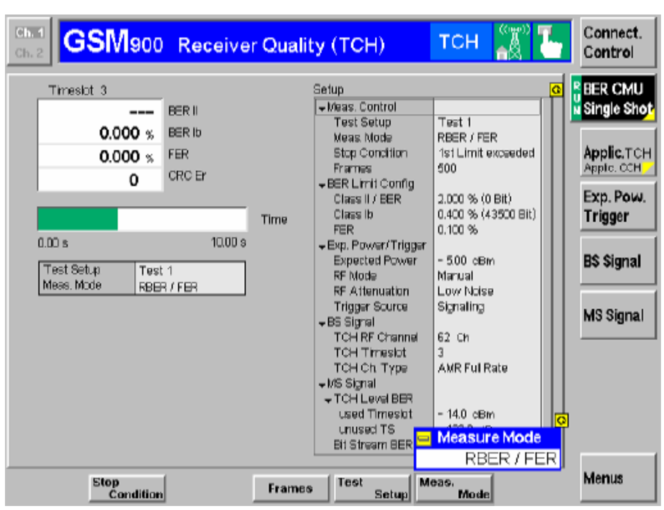


Fig. 4-71 Measurement Menu – Receiver Quality (AMR)

Measurement Procedure

The AMR BER measurement is performed at the TCH level set via *MS Signal – TCH Level BER* and with the bit stream set via *MS Signal – Bit Stream BER.* At very small TCH levels, synchronization of the measurement may fail, in which case the R&S CMU300 displays a warning *"Too many errors. Measurement halted"*.

Results

The AMR BER is displayed in the upper left table. Note that the AMR Full Rate codec does not provide any Class II bits and that both AMR codecs always operate in circuit-switched mode (no BLER results).

Limit Check

If the BER result is above the BER limit defined in the *Limits* tab of the *Receiver Quality Configuration* menu, then the output field turns red.

Contents

5 Remote Control – Basics

This chapter gives a survey of the basic features and concepts of GSM remote control commands. Remote control can be described in terms analogous to the ones used in chapter 3 for the classification of menus and settings for the graphical user interface. In the following, we will particularly point out the similarities and differences between manual and remote control.

Structure and Order of Commands

Chapter 6 of this manual lists gives a description of all GSM remote control commands, including their parameters, default values and permissible ranges.

Function group and mode

The commands for the function groups *GSM400-BTS, GSM850-BTS, GSM900-BTS, GSM1800-BTS* and *GSM1900-BTS* are identical, however, the ranges or default values of their numerical parameters may not coincide. Numerical values are explicitly quoted for all three function groups.

Commands for the two modes *Signalling* and *Non Signalling* are listed separately although many of them have the same syntax.

Addressing

The CMU uses extended addressing: The instrument is assigned a primary address while each function group and test mode is identified via a secondary address. This allows the same remote commands to be used in several function groups and modes:

```
ibwrt(h_GSM400BS_SIG, "INITiate:POWer:NBURst:GMSK")
ibwrt(h_GSM900BS_SIG, "INITiate:POWer:NBURst:GMSK")
ibwrt(h_GSM1800BS_SIG, "INITiate:POWer:NBURst:GMSK")
ibwrt(h_GSM900BS_NSIG, "INITiate:POWer:NBURst:GMSK")
```

provided that the variables `h_GSM900BS_SIG, 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 GSM network tests described in this manual:

GSM400BS_NSig,	*GSM400BS_Sig,*
GSMGT800BS_NSig,	*GSMGT800BS_Sig,*
GSM850BS_NSig,	*GSM850BS_Sig,*
GSM900BS_NSig,	*GSM900BS_Sig,*
GSM1800BS_NSig,	*GSM1800BS_Sig,*
GSM1900BS_NSig,	*GSM1900BS_Sig.*

Order of commands

The commands are arranged to form groups belonging to the same measurement or performing the same type of configurations. These 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 third-level keyword of each command (as in `SPECtrum:MODulation`). Chapter 6 is organized as follows:

- General configurations in the *Non Signalling* mode (`EPOWer, TRIGger, RFANalyzer, RFGenerator, INPut, OUTPut, CORRection:LOSS, DM:CLOCk`)
- Measurement groups in the *Non Signalling* mode (`WPOWer, NPOWer, POWer, MODulation, SPECtrum`)

- General configurations and signalling in the *Signalling* mode (`EPOWer, TRIGger, SIGNalling, BSSignal, MSSignal, NETWork, INPut, OUTPut, CORRection:LOSS, DM:CLOCk, EXTernal:TRIGger, ABIS`)
- Measurement groups in the *Signalling* mode (`WPOWer, NPOWer, INFO, POWer, MODulation..., SPECtrum:MODulation, SPECtrum:SWITching, RXQuality:...BER, RXQuality:...BAVerage, RXQuality:TACHtest`)

The structure of chapter 6 differs from chapter 4 *(Functions and their Application)* where the measurements are presented first and special configurations are reported at the end of each signalling mode section.

The menu of the graphical user interface corresponding to a group of commands is quoted at the beginning of each section. An alphabetical list of all commands is annexed to chapter 6.

SCPI Conformity

In view of the particular requirements of GSM 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.

Remote Control

All commands may be used for control of the CMU via GPIB and serial (RS-232) interface.

Measurement Control

The commands in the measurement groups `WPOWer, NPOWer, POWer, MODulation, SPECtrum`, and `RXQuality` have an analogous structure and syntax. The measurements are controlled according to common concepts which are explained in detail in Chapter 5 of the CMU operating manual. The following sections show how the general concepts are applied to GSM-MS measurements.

Measurement Groups

The measurement groups are referred to as *measurement objects* (keyword <meas_obj>) in remote control. Most measurement objects correspond to a measurement group or application in manual control. For GSM-BTS measurements, the following measurement objects are defined:

Table 5-1Measurement objects in Signalling and Non Signalling mode

Non Signalling		Signalling	
Meas. Object	**Measurement group / Application**	**Meas. Object**	**Measurement group / Application**
WPOWer	*Power* softkey (wide-band peak power measurement).	**WPOWer**	Power softkey (wide-band peak power measurement).
NPOWer	No equivalent in manual control. Narrow-band power.	**NPOWer**	No equivalent in manual control. Narrow-band power.
POWer:NBURst:GMSK **POWer:NBURst:EPSK**	*P/t Norm. GMSK* *P/t Norm. 8PSK* Burst power as a function of time.	**POWer:NBURst:GMSK:CCH** **POWer:NBURst:GMSK:TCH** **POWer:NBURst:EPSK:TCH**	*P/t Norm. GMSK* *P/t Norm. 8PSK* Burst power as a function of time, control channel test (GMSK only) and traffic channel test..
		POWer:SLOT:GMSK:TCH	*P/Slot* Average burst power in 8 timeslots of a TDMA frame for GMSK modulation.
		POWer:MSLot:CCH **POWer:MSLot:TCH**	*P/t Multislot* Burst power vs. time in up to 4 consecutive timeslots (GMSK or 8PSK modulation).
MODulation[:PERRor]:GMSK	*Phase Err. GMSK* Fast phase and frequency error measurement excluding the I/Q imbalance and origin offset.	**MODulation[:PERRor]:GMSK:CCH** **MODulation[:PERRor]:GMSK:TCH**	*Phase Err. GMSK* Fast phase and frequency error measurement excluding the I/Q imbalance and origin offset, control channel test (GMSK only) and traffic channel test..
MODulation:OVERview:EPSK	*Overview 8PSK* 8PSK scalar modulation parameters including statistical evaluation.	**MODulation:OVERview:EPSK:TCH**	*Overview 8PSK* 8PSK scalar modulation parameters including statistical evaluation, traffic channel test.

Non Signalling		Signalling	
Meas. Object	**Measurement group / Application**	**Meas. Object**	**Measurement group / Application**
`MODulation:EVMagnitude:EPSK`	*EVM 8PSK* Error vector magnitude in 8PSK modulation.	`MODulation:EVMagnitude:EPSK:TCH`	*EVM 8PSK* Error vector magnitude in 8PSK modulation, traffic channel test.
`MODulation:PERRor:EPSK`	*Phase Error 8PSK* Phase error in 8PSK modulation.	`MODulation:PERRor:EPSK:TCH`	*Phase Error 8PSK* Phase error in 8PSK modulation, traffic channel test.
`MODulation:MERRor:EPSK`	*Magn. Error 8PSK* Magnitude error in 8PSK modulation.	`MODulation:MERRor:EPSK:TCH`	*Magn. Error 8PSK* Magnitude error in 8PSK modulation, traffic channel test.
`MODulation:IQANalyzer:EPSK`	*I/Q Analyzer 8PSK* I and Q amplitudes	`MODulation:IQANalyzer:EPSK:TCH`	*I/Q Analyzer 8PSK* I and Q amplitudes, TCH test
`SPECtrum:MODulation`	*Modulation (GMSK or 8PSK))* Off-carrier power due to the modulation.	`SPECtrum:MODulation:CCH` `SPECtrum:MODulation:TCH`	*Modulation (GMSK or 8PSK)* Off-carrier power due to the modulation, control channel test (GMSK only) and traffic channel test..
`SPECtrum:SWITching`	*Switching (GMSK or 8PSK)* Off-carrier power due to the switching transients.	`SPECtrum:SWITching:CCH` `SPECtrum:SWITching:TCH`	*Switching (GMSK or 8PSK)* Off-carrier power due to the switching transients control channel test (GMSK only) and traffic channel test..
–		`RXQuality:BER<nr>,` `RXQuality:BAVerage`	*BER CMU Single Shot* *BER CMU Average* Receiver quality measurements, i.e. measurement of the bit error rate and the residual bit error rate, with limit check.
		`RXQuality:ABIS:BER<nr>,` `RXQuality:ABIS:BAVerage`	*BER Abis Single Shot* *BER Abis Average* Receiver quality measurements via Abis interface.
		`RXQuality:RACHtest`	*RACH Test*

The measurement groups are complemented by configuration settings for the inputs and outputs, input and output signals, trigger. In the signalling mode, the BTS signal and network parameters can be configured or read out in addition. For a quick overview, see the list of remote control commands at the end of chapter 6.

Measurement Statistics

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 POWer, MODulation, and SPECtrum measurements, different traces corresponding to the result in the current period, the maximum, minimum, or average evaluated over a set of periods are determined within one measurement. The four 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 burst length (POWer | MODulation | SPECtrum) or a frame (RXQuality measurements). The statistic count is set together with the measured quantity.	CONFigure:<meas_obj>:CONTrol:STATistics **1 ... 1000 | NONE** (<meas_obj> = POWer | MODulation | SPECtrum:MODulation | SPECtrum:SWITching) CONFigure:RXQuality:BER<nr>|BAVerage:CONTrol:STATistics **1 ... 500 | NONE**
Repetition mode Single Shot	The measurement is stopped after one statistics cycle.	CONFigure:<meas_obj>:CONTrol:REPetition **SINGleshot**, <StopCondition> (<meas_obj> = WPOWer | POWer... | MODulation... | SPECtrum...) RXQuality:BER measurements are always performed in single shot mode.
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> (<meas_obj> = WPOWer | POWer... | MODulation... | SPECtrum... | RXQuality...) RXQuality:BAVerage measurements are always performed in continuous mode.
Counting	Repeated single shot measurement with configured statistics cycles.	CONFigure:<meas_obj>:CONTrol:REPetition **1 ... 10000**, <StopCondition> (<meas_obj> = WPOWer | POWer | MODulation | SPECtrum:MODulation, SPECtrum:SWITching) This mode is not available for RXQuality measurements. A counting measurement with 1 evaluation period is equivalent to a single shot measurement..
Traces	The four specifiers CURRent, MAXimum, MINimum, and AVERage allow the trace for the current evaluation period, the maximum, minimum or average of a set of evaluation periods to be retrieved. In general all four traces are evaluated during the measurement. They are selected via a keyword in the queries initiating a measurement and retrieving the results.	Measurement results: READ:ARRay:<meas_obj><disp>? READ:SUBarrays:<meas_obj><disp>? .... where <meas_obj> = POWer... | MODulation... Burst matching: CALCULATE:ARRay:POWER:NBURSt...<disp>: MATChing:LIMit? where <disp> = :CURRent | :AVERage | :MAXimum | MINimum

Limit Definition and Limit Checks

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

<table>
<tr><th>Type</th><th>Description</th><th>Command</th></tr>
<tr><td>Scalar limits</td><td>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.</td><td><code>CONFigure:<meas_obj>:LIMit:<Spec.> [<LowerLimit>,]<UpperLimit></code>

<Spec.> denotes a keyword (an array of keywords) specifying the measured quantity.</td></tr>
<tr><td>Limit lines</td><td>For <code>POWer</code> and <code>SPECtrum</code> measurements a tolerance template consisting of up to 16 time ranges can be defined.</td><td><code>CONFigure:<meas_obj>:LIMit:LINE:<Spec.> <Limit_line_param.></code>

<Spec.> denotes the two keywords specifying the upper or lower limit line in a time range and the burst type considered.

<Limit_line_param.> contains the coordinates of the start and end points of the limit line plus an information whether the current range is valid or not.</td></tr>
<tr><td>Limit check</td><td>All scalar limits belonging to the same measurement group are read out together with the command on the right side.</td><td><code>CALCulate:<meas_obj.>:MATChing:LIMit?</code></td></tr>
<tr><td></td><td>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).</td><td><code>NMAU</code> not matching, underflow
<code>NMAL</code> not matching, overflow
<code>INV</code> measured value invalid
<code>OK</code> no limit failure</td></tr>
<tr><td></td><td>The result of the limit check depends on the statistics settings (see section Measurement Statistics on page 5.5).</td><td><code>CALCULATE::<meas_obj> <disp>:MATChing:LIMit?</code>

where <code><disp> = [:CURRent] | :AVERage | :MAXimum | :MINimum</code></td></tr>
</table>

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. This section is devoted to the particular features concerning GSM BTS 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:CMU:SUM1|2:CMU<nr>:...`

Note: *Symbolic status register evaluation by means of the commands `STATus:OPERation:SYMBolic:ENABle` and `STATus:OPERation:SYMBolic[:EVENt]?` is a convenient alternative method of retrieving status information. See also section* Symbolic Status Event Register Evaluation *in chapter 5 of the CMU operating manual and chapter 6 of this manual.*

GSM BTS tests comprise the two signalling modes *Non Signalling* and *Signalling* for each of the function groups *GSM400/850/900/1800/1900-BTS* so that a total of 10 secondary addresses is used. In the status registers for the *Non Signalling* mode no bits are assigned. In the status registers for the *Signalling* mode the bit assignment is as follows:

Table 5-4 Meaning of the bits used in the `STATus:OPERation:CMU:SUM1|2:CMU<nr>` sub-registers assigned to *GSM400/850/900/1800/1900-BTS Signalling*

Bit-No.	Meaning	Symbol in `STATus:OPERation:SYMBolic...`
0	**Mobile Terminated Call** This bit is set while the CMU receives a call from the base station under test.	**MTC**
1	**Mobile Terminated Call Clearing** This bit is set while the connection to the base station is being released.	**MTCC**
2	**Synchronization Lost** This bit is set if the CMU had to leave the signalling state "Synchronized".	**SLOS**
3	**Location Update** This bit is set while a location update is being performed.	**LUPD**

Special Terms and Notation

Below we list some particular features in the syntax of the GSM 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; all of them are described along the same scheme. From top to bottom, the table rows contain the following entries:

1. Complete command syntax including the complete parameter list or a list of identifiers to be quoted in the parameter description below. The keyword on the right side gives a short description of the command. If possible, it is identical to the corresponding function (softkey, hotkey etc.) in manual control.
2. List of all parameters with short description, range of values and default units (for numerical parameters)
3. Detailed description of the command, signalling state and firmware version required. If no signalling state is indicated, the commands can be executed in any signalling states. Please note the remarks at the beginning of the sections for each measurement group.

Detailed lists of default values are annexed to the command description. Whenever possible, 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: `INITiate:POWer:NBURst:GMSK`

Commands with the keyword *POWer* in the second level belong to the power measurement. The keywords in the third and fourth level indicate that the command controls a power measurement on a normal burst with GMSK modulation.

Scalar results and arrays

To limit the number of remote control commands in an application program, all scalar results of a measurement group are usually measured together and returned in a common list. Arrays (e.g. the traces for `POWer` and `MODulation` measurements) are returned 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

Many commands are supplemented by a parameter or a list of 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>

Alternative settings are described by a common name (literal) written in angle brackets (<>). This literal serves as a description of the parameters only; in an application program it must be replaced by one of the settings given in the detailed parameter description.

Example: `CONFigure:POWer:NBURst:GMSK:CONTrol:RMODe <Mode>`

with `<Mode> = SCALar | ARRay`
possible syntax: `CONF:POW:NBUR:GMSK:CONT SCAL`

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 e.g. 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:

`DEFault:TRIGger[:SEQuence] 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.

List 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 by alphabetical order.

Parameters: The *Parameter* column lists the parameters of the commands.

Remarks: The *Remarks* column gives additional information about the commands which

- Have no query form *(no query)*
- Have only a query form *(query only)*
- Can be used both as setting commands and as queries (*with query*, this applies to all commands belonging to none of the two preceding categories)

Alphabetical Lists Chapter 6 concludes with alphabetical command lists for both test modes.

Contents

6 Remote Control – Commands

In the following, all remote-control commands for the function groups *GSM400/GT800/850/900/1800/1900-BTS* will be presented in tabular form with their parameters and the ranges of values. The structure of this chapter is analogous to that of the reference part for manual operation (chapter 4).

- The measurement modes *Non Signalling* and *Signalling* are presented separately.
- Within the measurement modes, first general configurations and then the individual measurement groups are described.

General notes on remote control in the function group *GSM400/GT800/850/900/1800/1900-BTS* can be found in chapter 5. An introduction to remote control according to SCPI standard and the status registers of the CMU is given in chapter 5 of the operating manual for the CMU basic instrument.

GSM Module Tests (Non Signalling)

In the *Non Signalling* mode, a GSM-specific RF signal can be generated and an RF signal with GSM characteristics can be analyzed. No signalling parameters are transferred.

Connection Control

The remote-control commands presented in this section determine the RF analyzer and trigger settings and the signals generated by the CMU, the inputs and outputs used as well as the reference frequency. They correspond to the settings in the popup menu of the softkey *Connect. Control*, located to the right of the headline of each main menu.

Subsystem EPOWer (Expected Input Power)

The subsystem *EPOWer* determines the expected input power for the currently used input. It corresponds to the table section *Expected Power* in the *Analyzer* tab of the *Connection Control* menu.

[SENSe:]EPOWer:MODE <*Mode*>				Input Power – Mode
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
MANual | **AUTomatic**	Manual setting Automatic setting corresponding to average power of signal applied	AUT	–	V2.80
Description of command				
This command defines the mode for setting the expected input power.				

[SENSe:]EPOWer:VALue *<Power>*		Expected Power – Manual		
<Power>	Description of parameters	Def. value	Def. unit	FW vers.
–40 dBm to +53 dBm **–54 dBm to +39 dBm** **–77 dBm to 0 dBm**	Expected input power for RF 1 Expected input power for RF 2 Expected input power for RF 4 IN	30.0 30.0 0.0	dBm dBm dBm	V2.80Power
Description of command				
This command defines the expected maximum input power. The setting is possible even if the power is determined automatically (command `EPOW:MODE AUT`). The permissible value range depends on the RF input used and the external attenuation set (see `[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]` command).				

[SENSe:]EPOWer: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)	LNO	–	V2.80
Description of command				
This command defines an attenuation or gain factor for the RF input signal.				

DEFault:EPOWer <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	–	V2.80
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). In the query format, the command returns ON if all the parameters of the subsystem correspond to their default values, otherwise it returns OFF.				

Subsystem RFANalyzer (Analyzed Input Signals)

The subsystem *RFANalyzer* contains the commands to determine the signals received and analyzed by the CMU. It corresponds to the panel *Analyzer Settings* in the *Analyzer* tab of the popup menu *Connect. Control*.

[SENSe:]RFANalyzer:FREQuency:UNIT <*Unit*>				Frequency Unit
<Unit>	Description of parameters	Def. value	Def. unit	FW vers.
Hz | KHZ | MHZ | GHZ | CH	Frequency unit Channel number	Hz	Hz	V2.80
Description of command				
This command defines whether the frequency of the RF signal analyzed is specified in frequency units or as an GSM channel number. Frequency units must be used to select input signals that are outside the designated GSM channel range.				

[SENSe:]RFANalyzer:FREQuency <*Frequency*>				RF Channel
<Frequency>	Description of parameters	Def. value	Def. unit	FW vers.
0.2 MHz to 2700 MHz (see also data sheet)	Input frequency (in multiples of 200 kHz)	467 000 000 (GSM400) 859 000 000 (GSM GT800) 882 000 000 (GSM850) 948 000 000 (GSM900) 1 842 000 000 (GSM1800) 1 960 000 000 (GSM1900)	Hz Hz Hz Hz Hz	V2.80
Description of command				
This command defines the frequency of the RF signal analyzed. With the command `[SENSe:]RFANalyzer:FREQuency:UNIT`, the default frequency unit can be changed, and even GSM channel numbers can be entered instead of frequencies. In the latter case, the assignment of channel numbers and frequencies meets the specification for the downlink channel (signal direction from base station under test to CMU).				

[SENSe:]RFANalyzer:FOFFset <*FreqOffset*>				Frequency Offset
<FreqOffset>	Description of parameters	Def. value	Def. unit	FW vers.
–100 kHz to +100 kHz	Offset for channel frequency	0.0	Hz	V2.80
Description of command				
This command defines an offset shifting the channel frequency set with the command `[SENSe:]RFANalyzer:FREQuency <Number>`. The offset frequency must be in multiples of 1 Hz.				

[SENSe:]RFANalyzer:TSEQuence <*TrainingSequence*>				Training Sequence
<TrainingSequence>	Description of parameters	Def. value	Def. unit	FW vers.
OFF | GSM0 to GSM7 | DUMMy | ANY	No training sequence detected GSM-specific training sequence GSM dummy burst Arbitrary training sequence allowed	ANY	–	V2.80
Description of command				
This command defines the training sequence of the signal to be analyzed. If no training sequence is specified *(OFF),* the CMU measures all signals. In the setting ANY, it uses any training sequence for synchronization.				

[SENSe:]RFANalyzer:MCONtrol:TSOFfset <*Trigger Slot Offset*>				Trigger Slot Offset
<TrainingSequence>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7	Trigger slot offset	0	(slots)	3.22
Description of command				
This command defines a delay time between the trigger time and the measured timeslot.				

Generator Object "RFGenerator" – Generator control

The subsystem *RFGenerator* controls the internal RF generator. It corresponds to the softkey *RF Generator* in the tab *Signal* in the popup menu *Connection Control* and the measurement menu *Analyzer/Generator*.

INITiate:RFGenerator **ABORt:RFGenerator**	Start RF generator, reserve resources ⇒ Switch off RF generator, release resources ⇒	*RUN* *OFF*
Description of command		FW vers.
These commands have no query form. They start and stop the RF generator, setting it to the status given in the top right column.		V2.80

FETCh:RFGenerator:STATus?				Generator Status
Return	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	–	V2.80
Description of command				
This command is always a query. It returns the current generator status.				

Generator Level – Subsystem RFGenerator:LEVel

The subsystem *RFGenerator:LEVel* determines the level of the generated RF signals. It corresponds to the input field *RF Level* of the panel *RF Generator* in the tab *Signal* in the popup menu *Connection Control*.

SOURce:RFGenerator:LEVel:UTIMeslot <*Level*>				RF Level used
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–137 dBm to –27 dBm **–137 dBm to –10 dBm** **–90 dBm to +13 dBm**	RF1 level in used timeslot RF2 level in used timeslot RF 3 OUT level in used timeslot	–27 –27 –27	dBm dBm dBm	V2.80
Description of command				
This command determines the RF generator level in the used timeslot. The permissible value range depends on the used RF output of the CMU and the external attenuation set (see [SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude] command). V 1.12 MMI				

SOURce:RFGenerator:LEVel:UNTimeslot *<Level>*				RF Level unused
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–110 dB to 0 dB **–110 dB to 17 dB** **–63 dB to 40 dB**	Level in unused timeslots, RF 1 Level in unused timeslots, RF 2 Level in unused timeslots, RF 3 OUT	–80 –80 –63	dB dB dB	V2.80
Description of command				

This command determines the RF generator level in the unused timeslots relative to the level in the used time-slot.

The level range quoted above applies if the RF level in the used timeslot (P^{used}) is at its default value. In general, the range for P^{unused} is adjusted such that the absolute level range in the unused timeslots corresponds to the range of the RF outputs, i.e. (in logarithmic units):

$$P^{unused}_{min} = P^{used}_{min} - P^{used}_{act}; \qquad P^{unused}_{max} = P^{used}_{max} - P^{used}_{act};$$

the indices *min, max, act* denoting the minimum and maximum level allowed and the actual level set.

RF Generator Frequency – Subsystem RFGenerator:FREQuency

The subsystem *RFGenerator:FREQuency* determines the frequency of the generated RF signals. It corresponds to the softkeys *RF Channel* and *Freq. Offset* of the panel *RF Generator* in the tab *Signal* in the popup menu *Connection Control*.

SOURce:RFGenerator:FREQuency:UNIT *<Unit>*				Frequency Unit
<Unit>	Description of parameters	Def. value	Def. unit	FW vers.
Hz | KHZ | MHZ | GHZ | CH	Frequency unit | Channel number	Hz	Hz	V2.80
Description of command				

This command defines whether the frequency of the RF signal generated is specified in frequency units or as a GSM channel number. Frequency units must be used to select input signals that are outside the designated GSM channel range.

SOURce:RFGenerator:FREQuency *<Frequency>*				RF Channel
<Frequency>	Description of parameters	Def. value	Def. unit	FW vers.
0.2 MHz to 2700 MHz **(see also data sheet)**	Output frequency (in multiples of 200 Hz)	457 000 000 (GSM400) 814 000 000 (GSM GT 800) 837 000 000 (GSM850) 903 000 000 (GSM900) 1 747 000 000 (GSM 1800) 1 880 000 000 (GSM 1900)	Hz Hz Hz Hz Hz	V2.80
Description of command				

This command defines the frequency of the RF signal generated. With the command `SOURce:RFGenerator:FREQuency:UNIT`, the default frequency unit can be changed, and even GSM channel numbers can be entered instead of frequencies. In the latter case, the assignment of channel numbers and frequencies meets the specification for the uplink channel (signal direction from CMU to base station under test).

SOURce:RFGenerator:FOFFset <*FrequencyOffset*>				Frequency Offset
<FrequencyOffset>>	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 kHz to +100.0 kHz	Frequency offset	0.0	Hz	V2.80
Description of command				
This command determines a frequency offset for the CMU signals in the selected RF channel (with respect to the frequency specified in the GSM standard).				

Subsystem RFGenerator:MODulation

The subsystem *RFGenerator:MODulation* defines an information which is modulated on the RF signal generated by the CMU and the signal shape. It corresponds to the panel *Generator Modulation* in the tab *Signal* in the popup menu *Connection Control*.

CONFigure:RFGenerator:MODulation:BMODulation <*Selection*>				Bit Modulation
<Selection>	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **PRBS |** **DUMMy |** **ALL0 |** **EALL0** **EPRBs**	No modulation sequence Pseudo-random bit sequence GSM dummy bursts Modulation sequence consisting of zeros Zeros, in 8PSK modulation PRBS, in 8PSK modulation	ALL0	–	V2.80
Description of command				
The command selects a bit sequence used to modulate the signal generated by the CMU. The parameters `EALL0` and `EPRBS` are available with option CMU-K41 only.				

CONFigure:RFGenerator:MODulation:TSEQuence <*SELection*>				Training Sequence
<Selection>	Description of parameters	Def. value	Def. unit	FW vers.
ALL0 | **GSM0 to GSM7 |** **DUMMy**	Training sequence consisting of zeros GSM standard training sequences no. 0 to 7 GSM dummy burst	GSM0	–	V2.80
Description of command				
The command selects a training sequence used to modulate the signal generated by the CMU.				

CONFigure:RFGenerator:MODulation:TRANsmission <*Transmission*>				Transmission
<Transmission>	Description of parameters	Def. value	Def. unit	FW vers.
BURSt | **CONTinuous**	Bursted RF signal Continuous signal	BURSt	–	V2.80
Description of command				
This command determines whether the the CMU generates a bursted or a contiunuous RF carrier signal.				

Subsystem for RF Input and Output Connectors

The following commands configure the RF input and output connectors. The commands 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	–	V2.80
Description of command				
This command determines the connector to be used for incoming RF signals. The bidirectional connectors RF 1 and RF 2 can be used both as input and output connectors in the very same measurement (see `OUTPut[:STATe]`). Only one input and one output may be active at a time, which is why the currently active one is automatically deactivated on switchover.				

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	–	V2.80
Description of command				
This command determines the connector to be used for outgoing RF signals. The bidirectional connectors RF 1 and RF 2 can be used both as input and output connectors in the very same measurement. Only one input and one output may be active at a time, which is why the currently active one is automatically deactivated on switchover.				

[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude] <*Absorption*> **SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude] <*Absorption*>**				Ext. Att. Input
<*Absorption*>	Description of parameters	Def. value	Def. unit	FW vers.
–50 dB to +90 dB	Value for external attenuation at Input<nr>, where <nr> = 1,2,4	0	dB	V2.80
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] <*Absorption*> **SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude] <*Absorption*>**				Ext. Att. Output
<*Absorption*>	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	dB	V2.80
Description of command				
This command assigns an external attenuation value to the outputs of the instrument *(RF 1, RF 2, RF 3 OUT).*				

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
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Switch on/off system clock	OFF	–	V2.80
Description of command				
This commands 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.
1.2190 MHz to 39.000 MHz	Input value for reference frequency	13.000	MHz	V2.80
Description of command				
This command defines the clock frequency applied to output *REF OUT 2*. The frequency entered is rounded to one of the following discrete values:				

39.000 MHz,	19.500 MHz,	13.000 MHz,	9.750 MHz,	7.800 MHz,	6.500 MHz,	5.571 MHz,
4.875 MHz,	4.333 MHz,	3.900 MHz,	3.545 MHz,	3.250 MHz,	3.000 MHz,	2.786 MHz,
2.600 MHz,	2.438 MHz,	2.294 MHz,	2.166 MHz,	2.053 MHz,	1.950 MHz,	1.857 MHz,
1.773 MHz,	1.696 MHz,	1.625 MHz,	1.560 MHz,	1.500 MHz,	1.444 MHz,	1.393 MHz,
1.349 MHz,	1.300 MHz,	1.258 MHz,	1.219 MHz			

Subsystem TRIGger (Trigger Mode)

The subsystem *TRIGger* determines the trigger mode. It corresponds to the *Trigger* tab in the *Connection Control* menu.

TRIGger[:SEQuence]:SOURce <*Source*>				Trigger Source
<Source>	Description of parameters	Def. Value	Def. unit	FW vers.
FRUN	The power measurement is triggered by the TDMA timing of the GSM input signal	IFP	–	V2.80
RFPower	Wideband RF power trigger			
IFPower	Narrow-band IF power trigger			
EXTern	External trigger signal at connector AUX3/4.			
Description of command				
This command determines the trigger condition. The settings *RFPower* and *IFPower* require burst signals. The setting *FRUN* requires burst signals with incorporated training sequence.				

TRIGger[:SEQuence]:THReshold:RFPower <*Threshold*>				Level – RF Power
<Threshold>	Parameter description	Def. value	Default unit	FW vers.
LOW | MEDium | HIGH	Low trigger threshold *(RF Max. Level* – 26 dB) Medium trigger threshold *(RF Max. Level* – 16 dB) High trigger threshold *(RF Max. Level* – 6 dB)	MEDium	–	V3.22
Command description				
This command sets the RF input signal level at which the measurement is triggered relative to the maximum RF input level; see `[SENSe:]EPOWer:VALue`. The setting has effect for trigger source `RFPower` only (see `TRIG:SEQ:SOUR`).				

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	V3.22
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:]EPOWer:VALue`. 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	–	V3.22
Command description				
This command qualifies whether the trigger event occurs on the *Rising Edge* or on the *Falling Edge* of the trigger signal. The setting has no influence on *Free Run* measurements (see `TRIG:SEQ:SOUR`).				

TRIGger[:SEQuence]:SOURce:EXTernal <*Source*>				Ext. Trigger (AUX 3/4)
<Source>	Description of parameters	Def. value	Def. unit	FW vers.
PIN6 | PIN7 | PIN8	Pin for external trigger signal	PIN8	–	V3.22
Description of command				
This command determines the pins on the AUX 3 or AUX4 connectors used for the external trigger signal. The setting only has effect if the trigger source is an *External* signal.				

DEFault:TRIGger[:SEQuence] <Enable>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	V2.80
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). In the query format, the command returns ON if all the parameters of the subsystem correspond to their default values, otherwise it returns OFF.				

WPOWer

The subsystem *WPOWer* measures the power of the signal from the base transceiver station using a wide-band filter. It corresponds to the softkey *Power* of the *Signal* tab in the menu group *Connection Control* and the associated output field.

INITiate:WPOWer	Start new measurement	⇒ *RUN*
ABORt:WPOWer	Abort measurement and switch off	⇒ *OFF*
STOP:WPOWer	Stop measurement	⇒ *STOP*
CONTinue:WPOWer	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.		V2.80

CONFigure:WPOWer: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 SOPC No reporting	OFF	–	V2.80
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:WPOWer:STATus?				Measurement Status
Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,** **1 to 10000 |** **NONE**	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 Counter for current statistics cycle No counting mode set	OFF NONE	– –	V2.80
Description of command				
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).				

CONFigure:WPOWer: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	
SOERror | **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	–	V2.80
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.				

READ[:SCALar]:WPOWer? **FETCh[:SCALar]:WPOWer?** **SAMPle[:SCALar]:WPOWer?**		Start single shot measurement and return results Read out measurement results (unsynchronized) Read out measurement results (synchronized)		
Return	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dBm to +53.0 dBm	Maximum burst power (not averaged)	NAN	dBm	V2.80
Description of command				
These commands are always queries. They start the measurement of the maximum burst power of the signals sent by the base station *(`READ...`)* and output the result.				

NPOWer

The subsystem *NPOWer* measures the power of the signal transmitted by the base station using the RF analyzer configuration of the *POWer* measurement. Compared to *WPOWer*, the *NPOWer* measurement uses a narrow-band (500 kHz Gauss) filter.

The narrow-band *NPOWer* measurement yields the average, maximum and minimum burst power of the current burst (display mode *Current)* and of the averaged measurement curve (display mode *Average)*. The entire measurement curves (arrays) are not available, and no limit check is performed. *NPOWer* is a quick and precise alternative to the *WPOWer* or *POWer* measurements if only scalar results are needed.

Note: *A* Free Run *trigger (`TRIGger[:SEQuence]:SOURce FRUN`) should be avoided because it delays the `NPOWer` measurement.*

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.		V3.07

CONFigure:NPOWer:EREPorting <*Mode*>				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU200 operating manual).				V3.07

FETCh:NPOWer:STATus?				Measurement
Return	Description of parameters	Def. value	Def. unit	Unit ring
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	–	–
	Counter for current statistics cycle			
1 to 10000 | **NONE**	No counting mode set	NONE	–	–
	Counter for current evaluation period within a cycle			
1 to 1000 | **NONE**	Statistic count set to off	NONE	–	
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual operating manual).				V3.07

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 *<Statistics>*, *<Repetition>*,*<StopCond>*,*<Stepmode>*				Scope of Measurement
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	No. of bursts within a statistics cycle Statistics off	100	–	
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
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	Unit ring
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	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–
Description of command				FW vers.
This command selects the type of measured values and determines the number of bursts forming one statistics cycle.				V3.07

CONFigure:NPOWer:CONTrol:STATistics *<Statistics>*				Scope of Measurement
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	No. of bursts within a statistics cycle Statistics off	100	–	
Description of command				FW vers.
This command selects the type of measured values and determines the number of bursts forming one statistics cycle.				V3.07

CONFigure:NPOWer:CONTrol:REPetition *<Repetition>,<StopCond>,<Stepmode>*				Test cycles
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
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	Unit ring
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	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–
Description of command				FW vers.
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.				V3.07

Measured Values – Subsystem NPOWer?

The subsystem *NPOWer?* retrieves the results of the narrow-band power measurement.

READ[:SCALar]:NPOWer? **FETCh[:SCALar]:NPOWer?** **SAMPle[:SCALar]:NPOWer?**	Start single shot measurement and return results Read out measurement results (unsynchronized) Read out measurement results (synchronized)			
Returned values	Value range	Def. value	Def. unit	Unit ring
Avg. Power of Current Burst,	–137 dBm to +53 dBm	NAN	dBm	
Min. Power of Current Burst,	–137 dBm to +53 dBm	NAN	dBm	
Max. Power of Current Burst,	–137 dBm to +53 dBm	NAN	dBm	
Avg. Power of Average Burst,	–137 dBm to +53 dBm	NAN	dBm	
Min. Power of Average Burst,	–137 dBm to +53 dBm	NAN	dBm	
Max. Power of Average Burst	–137 dBm to +53 dBm	NAN	dBm	
Description of command				FW vers.
These commands are always queries. They start the *NPOWer* measurement and return the results.				V3.07

POWer

The subsystem *POWer* measures the signal power. The subsystem corresponds to the measurement menu *Power* and the associated popup menu *Power Configuration.*

Important Note!

The keywords `:GMSK` and `:EPSK` in the remote control commands denote GMSK and 8PSK modulation, respectively. The `:EPSK` commands are available with option CMU-K41 only.

Measurerment Control – Subsystem Power

The subsystem *POWer* controls the power measurement.

INITiate:POWer:NBURst:GMSK **INITiate:POWer:NBURst:EPSK**	Start new measurement	⇒ RUN
ABORt:POWer:NBURst:GMSK **ABORt:POWer:NBURst:EPSK**	Abort running measurement and switch off	⇒ OFF
STOP:POWer:NBURst:GMSK **STOP:POWer:NBURst:EPSK**	Stop measurement after current stat. cycle	⇒ STOP
CONTinue:POWer:NBURst:GMSK **CONTinue:POWer:NBURst:EPSK**	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, setting it to the status indicated in the top right column.		V2.80

CONFigure:POWer:NBURst:GMSK:EREPorting <*Mode*>
CONFigure:POWer:NBURst:EPSK: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 SOPC No reporting	OFF	–	V2.80

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:POWer:NBURst:GMSK:STATus? **FETCh:POWer:NBURst:EPSK: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	–	V2.80
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).				

Subsystem POWer:NBURst...:CONTrol

The subsystem *POWer:NBURst...:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* and *Statistics* tabs in the popup menu *Power Configuration.*

CONFigure:POWer:NBURst:GMSK:CONTrol <*Mode*>, <*Statistics*>, <*Repetition*>, <*StopCond*>, <*Stepmode*> **CONFigure:POWer:NBURst:EPSK:CONTrol <*Mode*>, <*Statistics*>, <*Repetition*>, <*StopCond*>, <*Stepmode*>**		Scope of Measurement		
<Mode>	Desciption of parameters	Def. value	Def. unit	
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	
<Statistics>	Description of parameters	Def. value	Def. unit	
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	
<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	
SOERror | **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	–	V2.80
Description of command				
This command defines the scope of the power measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).				

CONFigure:POWer:NBURst:GMSK:CONTrol:RMODe <*Mode*> Result Mode
CONFigure:POWer:NBURst:EPSK:CONTrol:RMODe <*Mode*>

<Mode>	Desciption of parameters	Def. value	Def. unit	FW-Vers.
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	V2.80
Description of command				
This command specifies the type of measured values.				

CONFigure:POWer:NBURst:GMSK:CONTrol:STATistics <*Statistics*> Statistics Count
CONFigure:POWer:NBURst:EPSK:CONTrol:STATistics <*Statistics*>

<Statistics>	Description of parameters	Def. value	Def. unit	FW-Vers.
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	V2.80
Description of command				
This command defines the number of bursts forming a statistics cycle.				

CONFigure:POWer:NBURst:GMSK:CONTrol:REPetition
CONFigure:POWer:NBURst:EPSK: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	
SOERror | **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	–	V2.80
Description of command				
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.				
Note: In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.				

CONFigure:POWer:NBURst:GMSK:FILTer <*Filter*> Filter
CONFigure:POWer:NBURst:EPSK:FILTer <*Filter*>

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
G500 | **B600**	500 kHz Gaussian filter 600 kHz bandpass filter	G500 for GMSK modulation B600 for 8PSK modulation	–	V3.07
Description of command				
This command selects the measurement filter for the *P/t* measurement. The default filter setting differs for the two modulation schemes.				

DEFault:POWer:NBURst:GMSK:CONTrol <Enable>
DEFault:POWer:NBURst:EPSK: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	–	V2.80

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).

In the query format, the command returns ON if all the parameters of the subsystem correspond to their default values, otherwise it returns OFF..

Test Configuration

The commands of the following subsystems determine the parameters of the signal power measurement. For a detailed explanation of the power tolerance template defined in the GSM standard see Chapter 4.

Subsystem POWer:NBURst...:LIMit:LINE

The subsystem *POWer:NBURst...:LIMit:LINE* defines the limit lines and tolerance values for the power measurement. The subsystem corresponds to the tab *Limit Lines* in the popup menu *Power Configuration.*

CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:UPPer:AREA<nr> Upper Limit Line
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>
<StartTime>, <StopTime>, <StartRelLevel>, <StopRelLevel>, <StartAbsLevel>, <StopAbsLevel>, <Enable>

CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:ENABle
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:ENABle
<Enable>

CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue
<StartTime>, <StopTime>, <StartRelLevel>, <StopRelLevel>, <StartAbsLevel>, <StopAbsLevel>

Parameters	Value range	Description of parameters	Def. unit
<Enable>	ON | OFF	Limit check in area on/off	See below
<StartTime>,	–10 bit/symb. to 157.25 bit/symb. | OFF	Start point of time	
<StopTime>,	–10 bit/symb. to 157.25 bit/symb. | OFF	Last point of time	
<StartRelLevel>,	–100 dB to 10 dB | OFF,	Start point of level (relative)	
<StopRelLevel>,	–100 dB to 10 dB | OFF,	Last point of level (relative)	
<StartAbsLevel>,	–90 dBm to 30 dBm | OFF,	Start point of level (absolute)	
<StopAbsLevel>	–90 dBm to 30 dBm | OFF	Last point of level (absolute)	

Description of command	FW vers.
These commands activate and define upper limit lines for normal bursts. The limit lines are defined area by area; the suffix <nr> numbers the various areas in the burst diagram (see chapter 4).	V2.80

8 areas are defined in the default setting, another 8 areas can be activated if required. The default settings for GSM400/GT800/850/900/1800 at GMSK modulation in the defined areas are given in the table below:

	for Enable	for Table					
Suffix	Enable	Start Time / [bit]	Stop Time / [bit]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level
1	ON	–10.00	–7.25	–30.0 dB	–30.0 dB	OFF	OFF
2	ON	–7.25	–4.50	–30.0 dB	–30.0 dB	OFF	OFF
3	ON	–4.50	–2.25	–6.0 dB	–6.0 dB	OFF	OFF
4	ON	–2.25	0.50	+4.0 dB	+4.0 dB	OFF	OFF
5	ON	0.50	150.25	+1.0 dB	+1.0 dB	OFF	OFF
6	ON	150.25	152.50	–6.0 dB	–6.0 dB	OFF	OFF
7	ON	152.50	155.25	–30.0 dB	–30.0 dB	OFF	OFF
8	ON	155.25	157.00	–30.0 dB	–30.0 dB	OFF	OFF

The setting *Enable* = *Off* implies that the range, including the limit check, is switched off.

The default settings for GSM1900 at GMSK modulation in the defined areas are given in the table below:

	for Enable	for Table					
Suffix	Enable	Start Time / [bit]	Stop Time / [bit]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level
1	ON	–10.00	–7.25	–30.0 dB	–30.0 dB	OFF	OFF
2	ON	–7.25	–4.50	–30.0 dB	–30.0 dB	OFF	OFF
3	ON	–4.50	–2.25	–30.0 dB	0.0 dB	OFF	OFF
4	ON	–2.25	0.50	+4.0 dB	+4.0 dB	OFF	OFF
5	ON	0.50	150.25	+1.0 dB	+1.0 dB	OFF	OFF
6	ON	150.25	152.50	0.0 dB	–30.0 dB	OFF	OFF
7	ON	152.50	155.25	–30.0 dB	–30.0 dB	OFF	OFF
8	ON	155.25	157.00	–30.0 dB	–30.0 dB	OFF	OFF

The default settings for all GSM bands at 8PSK modulation in the defined areas are given in the table below:

	for Enable	for Table					
Suffix	Enable	Start Time / [symb]	Stop Time / [symb]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level
1	ON	–10.00	–7.00	–30.0 dB	–30.0 dB	OFF	OFF
2	ON	–7.00	–4.50	–30.0 dB	–30.0 dB	OFF	OFF
3	ON	–4.50	–2.25	–6.0 dB	–6.0 dB	OFF	OFF
4	ON	–2.25	0.50	+4.0 dB	+4.0 dB	OFF	OFF
5	ON	0.50	1.5	+2.4 dB	+2.4 dB	OFF	OFF
6	ON	1.50	146.5	+4.0 dB	+4.0 dB	OFF	OFF
7	ON	146.50	147.5	+2.4 dB	+2.4 dB	OFF	OFF
8	ON	147.50	150.25	+4.0 dB	+4.0 dB	OFF	OFF
9	ON	150.25	152.50	–6.0 dB	–6.0 dB	OFF	OFF
10	ON	152.50	155.00	–30.0 dB	–30.0 dB	OFF	OFF
11	ON	155.00	157.00	–30.0 dB	–30.0 dB	OFF	OFF

CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:LOWer:AREA<nr> Lower Limit Line
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>
<StartTime>, <StopTime>, <StartRelLevel>, <StopRelLevel>, <StartAbsLevel>, <StopAbsLevel>, <Enable>

CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:ENABle
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:ENABle
<Enable>

CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue
<StartTime>, <StopTime>, <StartRelLevel>, <StopRelLevel>, <StartAbsLevel>, <StopAbsLevel>

Parameters	Value range	Description of parameters	Def. value
<Enable>	ON | OFF	Limit check in area on/off	See below
<StartTime>,	–10 bit/symb. to 157.25 bit/symb. | OFF	Start point of time	
<StopTime>,	–10 bit/symb. to 157.25 bit/symb. | OFF	Last point of time	
<StartRelLevel>,	–100 dB to 10 dB | OFF,	Start point of level (relative)	
<StopRelLevel>,	–100 dB to 10 dB | OFF,	Last point of level (relative)	
<StartAbsLevel>,	–90 dBm to 30 dBm | OFF,	Start point of level (absolute)	
<StopAbsLevel>	–90 dBm to 30 dBm | OFF	Last point of level (absolute)	

Description of command	FW vers.
These commands activate and define lower limit lines for normal bursts. The limit lines are defined area by area; the suffix <nr> numbers the various areas in the burst diagram (see chapter 4).	V2.80

Only 1 area is defined in the default setting, another 15 areas can be activated if required. The default settings for all GSM bands at GMSK modulation in the defined areas are given in the table below:

	for Enable	for Table					
Suffix	Enable	Start Time / [bit]	Stop Time / [bit]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level
1	ON	–10.00	0.50	OFF	OFF	OFF	OFF
2	ON	0.50	147.50	–1.0 dB	–1.0 dB	OFF	OFF
3	ON	147.50	157.00	OFF	OFF	OFF	OFF

The default settings for all GSM bands at 8PSK modulation in the defined areas are given in the table below:

	for Enable	for Table					
Suffix	Enable	Start Time / [symb]	Stop Time / [symb]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level
1	ON	–10.00	0.50	OFF	OFF	OFF	OFF
2	ON	0.50	1.0	–2.0 dB	–2.0 dB	OFF	OFF
3	ON	1.0	1.5	0.0 dB	0.0 dB	OFF	OFF
4	ON	1.50	146.50	–20.0 dB	–20.0 dB	OFF	OFF
7	ON	146.50	147.00	0.0 dB	0.0 dB	OFF	OFF
8	ON	147.00	147.50	–2.0 dB	–2.0 dB	OFF	OFF
7	ON	147.50	157.00	OFF	OFF	OFF	OFF

Upper Limit Line on/off

CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:UPPer:ENABle <*Mode*>
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:UPPer:ENABle <*Mode*>

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	Switch on upper limit lines	ON	–	V2.80
OFF	Switch off upper limit lines			

Description of command

This command switches the upper limit lines in all areas on or off.

Lower Limit Line on/off

CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:LOWer:ENABle <*Mode*>
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:LOWer:ENABle <*Mode*>

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	Switch on lower limit lines	ON	–	V2.80
OFF	Switch off lower limit lines			

Description of command

This command switches the lower limit lines in all areas on or off.

DEFault:POWer:NBURst:GMSK:LIMit:LINE <Enable> **DEFault:POWer:NBURst:EPSK:LIMit:LINE <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	–	V2.80
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). In the query format, the command returns ON if all the parameters of the subsystem correspond to their default values, otherwise it returns OFF..				

Subsystem POWer:NBURst...:TOFFset

The subsystem *POWer:NBURst...:TOFFset* contains the command for shifting the burst relative to the time axis (and thus the tolerance template). The subsystem corresponds to the popup window *Time - Mode* in the graphical measurement menu *Power.*

CONFigure:POWer:NBURst:GMSK:TOFFset <*Offset*> **CONFigure:POWer:NBURst:EPSK:TOFFset <*Offset*>**	Time Offset			
<Offset>	Description of parameters	Def. value	Def. unit	FW vers.
–4.00 to +4.00	Number of bits (GMSK) or symbols (8PSK)	0	(bit/symb)	V2.80
Description of command				
This command defines an offset time in ¼ bit/symbol units by which the burst is shifted relative to the time axis and the tolerance template.				

Subsystem POWer:NBURst...:RPMode

The subsystem *POWer:NBURst...:RPMode* contains the command determining the way how the reference power is calculated in 8PSK modulation. The subsystem corresponds to the *Ref. Power Mode* parameter in the *Control* tab of the *Power Configuration* menu.

CONFigure:POWer:NBURst:EPSK:RPMode <*Mode*>	Ref. Power Mode			
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
CURRent | **AVERage |** **DCOMpensated**	Ref. Power calculated from current burst Ref. Power calculated from average curve Data compensated/corrected reference power	CURR	–	V2.80
Description of command				
This command determines how the reference power (0-dB line in the *P/t Norm. 8PSK* test diagram) for 8PSK-modulated signals is calculated.				

Subsystem SUBarrays:POWer

The subsystem *SUBarrays:POWer* defines the measurement range and the type of output values.

CONFigure:SUBarrays:POWer:NBURst:GMSK Definition of Subarrays
CONFigure:SUBarrays:POWer:NBURst:EPSK
<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	
–10 bit to 156 ¾ bit,	Start time in current range (in bit for GMSK, symbols for 8PSK modulation)	–10	bit / symb	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 668	Number of samples in current range	668	–	V2.80

Description of command

This command configures the `READ:SUBarrays:POWer...`, `FETCh:SUBarrays:POWer...`, and `SAMPle:SUBarrays:POWer` 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 ¼ bit.

The subranges may overlap but must be within the total range of the *POWer* 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:NBURst...

The subsystem *POWer:NBURst...* determines and outputs the results of the signal power measurement. They correspond to the graphical measurement menu *Power* with its various display elements.

READ[:SCALar]:POWer:NBURst:GMSK? Scalar results:
READ[:SCALar]:POWer:NBURst:EPSK? Start single shot measurement and return results
FETCh[:SCALar]:POWer:NBURst:GMSK?
FETCh[:SCALar]:POWer:NBURst:EPSK? Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:NBURst:GMSK?
SAMPle[:SCALar]:POWer:NBURst:EPSK? Read out measurement results (synchronized)

Return	Value range	Def. value	Def. unit	FW vers.
BurstsOutOfTol,	0.0 % to 100.0 %	NAN	%	V2.80
AvgBurstPower,	–100.0 dBm to +20.0 dBm	NAN	dBm	
PeakBurstPower,	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstMatching,	MATC | NMAT | INV | NTSC | OUT | NTRG | UFLW | OFLW	INV	–	
AvgBurstPwAverage	–100.0 dBm to +20.0 dBm	NAN	dBm	

Description of command

These commands are always queries. They start a measurement and output all scalar measurement results (see chapter 5 of CMU operating manual). The results are:

Bursts out of tolerance (percentage)
Average power of current burst
Peak power of current burst
Average power of averaged trace Burst template matching

The calculation of results in an *average* or *peak* measurement is described in chapter 3 (cf. *display modes*).The following messages may be output for the value *BurstMatching*:

MATC	matching
NMAT	not matching
INV	invalid
NTSC	no training sequence code
OUT	out of range
NTRG	not triggered
UFLW	underflow
OFLW	overflow

CALCulate[:SCALar]:POWer:NBURst:GMSK:MATChing:LIMit?
CALCulate[:SCALar]:POWer:NBURst:EPSK:MATChing:LIMit? Limit Matching

Return	Value range	Def. value	Def. unit	FW vers.
AvgBurstPower,	NMAU | NMAL | INV | OK	INV	–	V2.80
PeakBurstPower,	NMAU | NMAL | INV | OK	INV	–	
BurstMatching,	MATC | NMAT | INV | NTSC | OUT | NTRG | UFLW | OFLW	INV	–	
AvgBurstPwAverage	NMAU | NMAL | INV | OK	INV	–	

Description of command
This command is always a query. It indicates whether and in which way the permissible tolerances for the scalar measured values (see command above) have been exceeded. The following messages may be output for the values A*vgBurstPower and PeakBurstPower*: NMAU — Tolerance value underflow — *not matching, underflow* NMAL — Tolerance value exceeded — *not matching, overflow* INV — Measurement invalid — *invalid* OK — Tolerance value matched The following messages may be output for the value *BurstMatching*: MATC — matching NMAT — not matching INV — invalid NTSC — no training sequence code OUT — out of range NTRG — not triggered UFLW — underflow OFLW — overflow

READ:ARRay:POWer:NBURst:GMSK:CURRent? Burst Power
READ:ARRay:POWer:NBURst:EPSK:CURRent?
READ:ARRay:POWer:NBURst:GMSK:AVERage?
READ:ARRay:POWer:NBURst:EPSK:AVERage?
READ:ARRay:POWer:NBURst:GMSK:MAXimum?
READ:ARRay:POWer:NBURst:EPSK:MAXimum?
READ:ARRay:POWer:NBURst:GMSK:MINimum?
READ:ARRay:POWer:NBURst:EPSK:MINimum?
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:POWer:NBURst:GMSK:CURRent?
FETCh:ARRay:POWer:NBURst:EPSK:CURRent?
FETCh:ARRay:POWer:NBURst:GMSK:AVERage?
FETCh:ARRay:POWer:NBURst:EPSK:AVERage?
FETCh:ARRay:POWer:NBURst:GMSK:MAXimum?
FETCh:ARRay:POWer:NBURst:EPSK:MAXimum?
FETCh:ARRay:POWer:NBURst:GMSK:MINimum?
FETCh:ARRay:POWer:NBURst:EPSK:MINimum?
Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:POWer:NBURst:GMSK:CURRent?
SAMPle:ARRay:POWer:NBURst:EPSK:CURRent?
SAMPle:ARRay:POWer:NBURst:GMSK:AVERage?
SAMPle:ARRay:POWer:NBURst:EPSK:AVERage?
SAMPle:ARRay:POWer:NBURst:GMSK:MAXimum?
SAMPle:ARRay:POWer:NBURst:EPSK:MAXimum?
SAMPle:ARRay:POWer:NBURst:GMSK:MINimum?
SAMPle:ARRay:POWer:NBURst:EPSK:MINimum?
Read results (synchronized) ⇒ *RUN*

Return	Description of parameters	Def. value	Def. unit	FW vers.
–100 dB to +20.0 dB,	BurstPower[1],	NAN	dB	V2.80
...,	...	...	...	
–100 dB to +20.0 dB	BurstPower[668],	NAN	dB	

Description of command
These commands are always queries. They output the burst power versus time in a fixed ¼- bit pattern. The number of measured values is 668, corresponding to a time range of –10 bit to +156¾ bit. The calculation of results in the modes *current, average, maximum* and *minimu*m is explained in chapter 3 (cf. *display modes*).

READ:SUBarrays:POWer:NBURst:GMSK:CURRent? Subarray Results
READ:SUBarrays:POWer:NBURst:EPSK:CURRent?
READ:SUBarrays:POWer:NBURst:GMSK:AVERage?
READ:SUBarrays:POWer:NBURst:EPSK:AVERage?
READ:SUBarrays:POWer:NBURst:GMSK:MAXimum?
READ:SUBarrays:POWer:NBURst:EPSK:MAXimum?
READ:SUBarrays:POWer:NBURst:GMSK:MINimum?
READ:SUBarrays:POWer:NBURst:EPSK:MINimum?
Start single shot measurement and return results ⇒ *RUN*
FETCh:SUBarrays:POWer:NBURst:GMSK:CURRent?
FETCh:SUBarrays:POWer:NBURst:EPSK:CURRent?
FETCh:SUBarrays:POWer:NBURst:GMSK:AVERage?
FETCh:SUBarrays:POWer:NBURst:EPSK:AVERage?
FETCh:SUBarrays:POWer:NBURst:GMSK:MAXimum?
FETCh:SUBarrays:POWer:NBURst:EPSK:MAXimum?
FETCh:SUBarrays:POWer:NBURst:GMSK:MINimum?
FETCh:SUBarrays:POWer:NBURst:EPSK:MINimum?
Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:SUBarrays:POWer:NBURst:GMSK:CURRent?
SAMPle:SUBarrays:POWer:NBURst:EPSK:CURRent? SAM-Ple:SUBarrays:POWer:NBURst:GMSK:AVERage?
SAMPle:SUBarrays:POWer:NBURst:EPSK:AVERage?
SAMPle:SUBarrays:POWer:NBURst:GMSK:MAXimum?
SAMPle:SUBarrays:POWer:NBURst:EPSK:MAXimum?
SAMPle:SUBarrays:POWer:NBURst:GMSK:MINimum?
SAMPle:SUBarrays:POWer:NBURst:EPSK:MINimum?
Read results (synchronized) ⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–100 dB to +20.0 dB, **...,** **–100 dB to +20.0 dB**	BurstPower[1], ... BurstPower[n]	NAN ... NAN	dB ... dB	V2.80

Description of command
These commands are always queries. They output the burst power versus time in a fixed ¼-bit pattern and in the subranges defined by means of the `CONFigure:SUBarrays:POWer` 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:POWer` 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. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).

CALCulate:ARRay:POWer:NBURst:GMSK:CURRent:MATChing:LIMit? Burst Matching
CALCulate:ARRay:POWer:NBURst:EPSK:CURRent:MATChing:LIMit?

CALCulate:ARRay:POWer:NBURst:GMSK:AVERage:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:EPSK:AVERage:MATChing:LIMit?

CALCulate:ARRay:POWer:NBURst:GMSK:MAXimum:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:EPSK:MAXimum:MATChing:LIMit?

CALCulate:ARRay:POWer:NBURst:GMSK:MINimum:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:EPSK:MINimum:MATChing:LIMit?

Return	Value range	Def. value	Def. unit	FW vers.
Matching	MATC | NMAT | INV | NTSC | OUT | NTRG | UFLW | OFLW	INV	–	V2.80

Description of command

This command is always a query. It indicates whether and in which way the permissible tolerances for the burst power (see preceding command) have been exceeded.

The following messages may be output for the measured value *Matching*:

MATC	matching
NMAT	not matching
INV	invalid
NTSC	no training sequence code
OUT	out of range
NTRG	not triggered
UFLW	underflow
OFLW	overflow

CALCulate:ARRay:POWer:NBURst:GMSK:CURRent:MATChing:AREA? Range Violation
CALCulate:ARRay:POWer:NBURst:EPSK:CURRent:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:AVERage:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:EPSK:AVERage:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:MAXimum:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:EPSK:MAXimum:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:MINimum:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:EPSK:MINimum:MATChing:AREA?

Return	Description of parameters	Def. value	Def. unit	FW vers.
32 bit field,	Indicator for upper limit matching in area 1 to 16 (16 least significant bits),	NAN	–	–
32 bit field	Indicator for lower limit matching in area 1 to 16 (16 least significant bits)	NAN	–	V2.80

Description of command

This command is always a query. Any bit of the two returned fields that is set indicates that the corresponding area of the limit lines is violated.

MODulation:PERRor

The subsystem *MODulation:PERRor:GMSK* measures the modulation parameters (frequency and phase errors) in GMSK modulation. The subsystem corresponds to the measurement menu *Modulation,* application *Phase Error GMSK,* and the associated popup menu *Modulation Configuration.*

Measurement Control

The subsystem *MODulation:PERRor:GMSK* controls the modulation measurement. It corresponds to the softkey *Phase Err. GMSK* in the measurement menu *Modulation*.

INITiate:MODulation:PERRor:GMSK	Start new measurement	⇒ *RUN*
ABORt:MODulation:PERRor:GMSK	Abort running measurement and switch off	⇒ *OFF*
STOP:MODulation:PERRor:GMSK	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:PERRor:GMSK	Next measurement 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.		V2.80

CONFigure:MODulation:PERRor:GMSK: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 SOPC No reporting	OFF	–	V2.80
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:MODulation:PERRor:GMSK: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	–	V2.80
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).				

Subsystem MODulation:PERRor:GMSK:CONTrol

The subsystem *MODulation:PERRor:GMSK:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* and *Statistics* tabs in the popup menu *Modulation Configuration*.

CONFigure:MODulation:PERRor:GMSK:CONTrol <*Mode*>, <*Statistics*>, <*Repetition*>, <*StopCond*>, <*Stepmode*> — Scope of Measurement

<Mode>	Desciption of parameters	Def. value	Def. unit	
SCALar | ARRay,	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	
<Statistics>	Description of parameters	Def. value	Def. unit	
1 to 1000 | NONE	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	
<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	
SOERror | 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	–	V2.80

Description of command

This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).

CONFigure:MODulation:PERRor:GMSK:CONTrol:RMODe <*Mode*> — Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	FW-Vers.
SCALar | ARRay,	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	V2.80

Description of command

This command specifies the type of measured values.

CONFigure:MODulation:PERRor:GMSK:CONTrol:STATistics <*Statistics*> — Statistics Count

<Statistics>	Description of parameters	Def. value	Def. unit	FW-Vers.
1 to 1000 | NONE	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	V2.80

Description of command

This command defines the number of bursts forming a statistics cycle.

CONFigure:MODulation:PERRor:GMSK: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	
SOERror | **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	–	V2.80

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:PERRor:GMSK: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	–	V2.80

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). In the query format, the command returns ON if all the parameters of the subsystem correspond to their default values, otherwise it returns OFF..

Tolerance values – Subsystem MODulation...:LIMit

The subsystem *MODulation...:LIMit* defines tolerance values for the modulation measurement. The subsystem corresponds to the tab *Limits* in the popup menu *Modulation.*

CONFigure:MODulation:PERRor:GMSK:CMMax:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue **<PhaseErrorPeak>,<PhaseErrorRMS>,<FrequencyError>** Limits for Current and Min./Max. Trace

Parameter	Description of parameters	Def. value	Def. unit	FW vers.
0.0 deg to +50.0 deg, **0.0 deg to +50.0 deg,** **0.0 Hz to +999.0 Hz**	PhaseErrorPeak PhaseErrorRMS FrequencyError	+20.0 +5.0 +45	deg deg Hz	V2.80

Description of command

This command defines upper limits for the peak and RMS phase error as well as for the frequency error in the *Current* and in the *Min./Max.* trace. The default frequency error is 23 Hz for GSM 400, 45 Hz for GSM850 and GSM900, 90 Hz for GSM1800/1900. The measurement is out of tolerance if the measured RMS phase error, the absolute value of the peak phase error, or the absolute value of the frequency error exceeds the specified limits.

CONFigure:MODulation:PERRor:GMSK:AVERage:LIMit[:SCALar]:SYMMetric [:COMBined]:VALue <PhaseErrorPeak>,<PhaseErrorRMS>,<FrequencyError>				Limits for Average Trace
Parameter	Description of parameters	Def. value	Def. unit	FW vers.
0.0 deg to +50.0 deg, **0.0 deg to +50.0 deg,** **0.0 Hz to +999.0 Hz**	PhaseErrorPeak PhaseErrorRMS FrequencyError	+20.0 +5.0 +45	deg deg Hz	V2.80
Description of command				
This command defines upper limits for the peak and RMS phase error as well as for the frequency error in the *Average* trace. The default frequency error is 23 Hz for GSM 400, 45 Hz for GSM850 and GSM900, 90 Hz for GSM1800/1900. The measurement is out of tolerance if the measured RMS phase error, the absolute value of the peak phase error, or the absolute value of the frequency error exceeds the specified limits.				

DEFault:MODulation:PERRor:GMSK:LIMit <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	–	V2.80
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). In the query format, the command returns ON if all the parameters of the subsystem correspond to their default values, otherwise it returns OFF..				

Subsystem MODulation...:TIME

The subsystem *MODulation...:TIME* defines the decoding for the *Modulation* measurement. The subsystem corresponds to the popup window *Decode* in the graphical measurement menu *Modulation.*

CONFigure:MODulation:PERRor:GMSK:TIME:DECode <*Mode*>				Decode
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
STANdard **GTBits**	The standard bit range is decoded The guard and tail bits are also decoded	GTB	–	V2.80
Description of command				
This command selects the type of decoding applied for the determination of phase and frequency errors.				

Subsystem SUBarrays:MODulation

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:PERRor:GMSK **<Mode>,<Start>,<Samples>{,<Start>,<Samples>}**
Definition of Subarrays

<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 bit to 146 ¾ bit,	Start time in current range	0	bit	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 588	Number of samples in current range	588	–	V2.80

Description of command

This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation` 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 ¼ bit.

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.

By default, only one range corresponding to the total measurement range is used and all measurement values are returned.

Measured Values – Subsystem MODulation:PERRor:GMSK

The subsystem *MODulation:PERRor:GMSK* measures and returns the frequency and phase errors and compares it with the tolerance values. The subsystem corresponds to the various output elements in the graphical measurement menu *MODulation.*

	Scalar results:
READ[:SCALar]:MODulation:PERRor:GMSK	Start single shot measurement and return results
FETCh[:SCALar]:MODulation:PERRor:GMSK?	Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:PERRor:GMSK?	Read out measurement results (synchronized)

Return	Value range	Def. value	Def. unit	FW vers.
PhErrPeakCurrent,	–100.0 ° to +100.0 °	NAN	deg	V2.80
PhErrPeakAverage,	–100.0 ° to +100.0 °	NAN	deg	
PhErrPeakMaxMin,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSCurrent,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSAverage,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSMaxMin,	–100.0 ° to +100.0 °	NAN	deg	
FreqErrCurrent,	–1000.0 Hz to + 1000.0 Hz	NAN	Hz	
FreqErrAverage,	–1000.0 Hz to + 1000.0 Hz	NAN	Hz	
FreqErrMaxMin	–1000.0 Hz to + 1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr	–100.0 dBm to +20.0 dBm	NAN	dBm	
AvgBurstPowerAvg	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command

These commands are always queries. They start a measurement and output all scalar measurement results (see chapter 5 of CMU operating manual). These are:

Peak phase error of *Current* burst
Peak phase error of *Average* trace
Peak phase error of *Max./Min.* trace

RMS phase error of *Current* burst
RMS phase error of *Average* trace
RMS phase error of *Max./Min.* trace

Frequency error of *Current* burst
Frequency error of *Average* trace
Frequency error of *Max./Min.* trace

Average burst power of current burst
Average burst power of average burst
Relative portion of faulty bursts

The calculation of results in an *Average* or *Max./Min.* measurement is described in chapter 3 (cf. *calculation of statistical quantities*).

CALCulate[:SCALar]:MODulation:PERRor:GMSK:MATChing:LIMit? Bursts out of Tolerance

Return	Value range	Def. value	Def. unit	FW vers.
PhErrPeakCurrent,		INV	–	V2.80
PhErrPeakAverage,		INV	–	
PhErrPeakMaxMin,		INV	–	
PhErrRMSCurrent,		INV	–	
PhErrRMSAverage,	For all measured values:	INV	–	
PhErrRMSMaxMin,		INV	–	
FreqErrCurrent,		INV	–	
FreqErrAverage,		INV	–	
FreqErrMaxMin	NMAU | NMAL | INV | OK	INV	–	
AvgBurstPowerCurr		INV	–	
AvgBurstPowerAvg		INV	–	

Description of command

This command is always a query. It indicates whether and in which way the permissible error limits for the scalar measured values (see above command) have been exceeded.

The following messages may be output for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	all tolerances matched	

READ:ARRay:MODulation:PERRor:GMSK:CURRent? Phase Error in Burst
READ:ARRay:MODulation:PERRor:GMSK:AVERage?
READ:ARRay:MODulation:PERRor:GMSK:MMAXimum?
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:PERRor:GMSK:CURRent?
FETCh:ARRay:MODulation:PERRor:GMSK:AVERage?
FETCh:ARRay:MODulation:PERRor:GMSK:MMAXimum?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:PERRor:GMSK:CURRent? SAMPle:ARRay:MODulation:PERRor:GMSK:AVERage?
SAMPle:ARRay:MODulation:PERRor:GMSK:MMAXimum?
Read measurement results (synchronized) ⇒ *RUN*

Return	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 deg to +100.0 deg,	Phase Error [1],	NAN	deg	V2.80
... ,	...	...	...	
–100.0 deg to +100.0 deg	Phase Error [588]	NAN	deg	

Description of command

These commands are always queries. They return the values for the phase error of the burst in a fixed ¼-bit pattern. The number of measured values is 588, corresponding to a time range of 0 bit to 146 ¾ bit.

The calculation of *current, average, minimum* and *maximum* results is explained in chapter 3 (cf. *display mode*).

READ:SUBarrays:MODulation:PERRor:GMSK:CURRent? Subarray Results
READ:SUBarrays:MODulation:PERRor:GMSK:AVERage?
READ:SUBarrays:MODulation:PERRor:GMSK:MMAXimum?
Start single shot measurement and return results ⇒ *RUN*
FETCh:SUBarrays:MODulation:PERRor:GMSK:CURRent?
FETCh:SUBarrays:MODulation:PERRor:GMSK:AVERage?
FETCh:SUBarrays:MODulation:PERRor:GMSK:MMAXimum?
Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:SUBarrays:MODulation:PERRor:GMSK:CURRent? SAMPle:SUBarrays:MODulation:PERRor:GMSK:AVERage?
SAMPle:SUBarrays:MODulation:PERRor:GMSK:MMAXimum?
Read results (synchronized) ⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 deg to +100.0 deg,	Phase Error [1],	NAN	deg	V2.80
... ,	...	...	...	
–100.0 deg to +100.0 deg	Phase Error [n]	NAN	deg	

Description of command

These commands are always queries. They output the phase error versus time in a fixed ¼- bit pattern and in the subranges defined by means of the `CONFigure:SUBarrays:MODulation...` 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` 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.

The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).

MODulation:OVERview

The subsystem *MODulation:OVERview:EPSK* measures general scalar modulation parameters in 8PSK modulation. The subsystem corresponds to the measurement menu *Modulation,* application *Overview 8PSK,* and the associated popup menu *Modulation Configuration.*

Important Note!

The keyword `:EPSK` *in the remote control commands of this section denotes 8PSK modulation. The commands are available with option CMU-K41 only.*

Measurerment Control – Subsystem MODulation:OVERview:EPSK

The subsystem *MODulation:OVERview:EPSK* controls the modulation measurement. It corresponds to the softkey *Overview 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation:OVERview:EPSK	Start new measurement	*⇒ RUN*
ABORt:MODulation:OVERview:EPSK	Abort running measurement and switch off	*⇒ OFF*
STOP:MODulation:OVERview:EPSK	Stop measurement after current stat. cycle	*⇒ STOP*
CONTinue:MODulation:OVERview:EPSK	Next measurement 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.		V2.80

CONFigure:MODulation:OVERview:EPSK: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 SOPC No reporting	OFF	–	V2.80
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:MODulation:OVERview:EPSK:STATus?				Measurement Status
Ret. values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V2.80
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			
	Counter for current statistics cycle			
1 to 10000 |	No counting mode set			
NONE,		NONE	–	
	Counter for current evaluation period within a cycle			
1 to 1000 |	Statistic count set to off			
NONE		NONE	–	
Description of command				
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).				

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* application.

Subsystem MODulation:OVERview:EPSK:CONTrol

The subsystem *MODulation:OVERview:EPSK:CONTrol* configures the modulation measurement. It corresponds to the tabs *Control* and *Statistics* in the popup menu *Modulation Configuration*.

CONFigure:MODulation:OVERview:EPSK:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>*				Scope of Measurement
<Mode>	Desciption of parameters	Def. value	Def. unit	
SCALar |	Scalar values only (incl. ramp matching)	ARRay	–	
ARRay,	Scalar measured values and arrays			
<Statistics>	Description of parameters	Def. value	Def. unit	
1 to 1000 |	Number of bursts per statistics cycle	200	–	
NONE	Statistics off (equivalent to 1)			
<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	
SOERror |	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 | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	1.0
Description of command				
This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).				

CONFigure:MODulation:OVERview:EPSK:CONTrol:RMODe *<Mode>*				Result Mode
<Mode>	Desciption of parameters	Def. value	Def. unit	FW-Vers.
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	1.0
Description of command				
This command specifies the type of measured values.				

CONFigure:MODulation:OVERview:EPSK:CONTrol:STATistics *<Statistics>*				Statistics Count
<Statistics>	Description of parameters	Def. value	Def. unit	FW-Vers.
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	200	–	1.0
Description of command				
This command defines the number of bursts forming a statistics cycle.				

CONFigure:MODulation:OVERview:EPSK: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	
SOERror | **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	–	V2.80
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:OVERview:EPSK:CONTrol *<Mode>*				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	V2.80
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). In the query format, the command returns ON if all the parameters of the subsystem correspond to their default values, otherwise it returns OFF..				

Tolerance values – Subsystem MODulation:OEMP:EPSK:LIMit

The subsystem *MODulation:OEMP:EPSK:LIMit* defines tolerance values for the modulation measurement **in all four 8PSK applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

CONFigure:MODulation:OEMP:EPSK:CMMax:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue **CONFigure:MODulation:OEMP:EPSK:AVERage:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue** ***<EVMErrorPeak>,<EVMErrorRMS>,<MagnErrorPeak>, <MagnErrorRMS>,*** ***<PhaseErrorPeak>, <PhaseErrorRMS>, <OriginOffset>, <FreqError>***				Limits Current & Max
Parameter	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to +50.0 %,	EVM Error Peak	+22.0	%	V2.80
0.0 % to +50.0 %,	EVM Error RMS	+8.0	%	
0.0 % to +50.0 %,	Magnitude Error Peak	+22.0	%	
0.0 % to +50.0 %,	Magnitude Error RMS	+8.0	%	
0.0 deg to +50.0 deg,	Phase Error Peak	+180.0	deg	
0.0 deg to +50.0 deg,	Phase Error RMS	+180.0	deg	
–100.0 dB to 0.0 dB,	Origin Offset	–35.0	dB	
0 Hz to 999 Hz	Frequency Error	+45	Hz	
Description of command				
These commands define upper limits for the *Current* and *Max./Min*. traces (keyword `CMMax`) as well as for the *Average* trace (keyword `AVERage`) and for the scalar modulation parameters derived from them. The default value for the frequency error depends on the GSM band: It is 23 Hz for GSM 400, 45 Hz for GSM 900, and 90 Hz for GSM 1800 and GSM 1900.				

CONFigure:MODulation:OEMP:EPSK:P95Th:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue ***<EVM95%>, <MError95%>, <PError95%>***				95th Percentile
Parameter	Description of parameters	Def. value	Def. unit	FW vers.
0% to 50.0%,	95th percentile EVM	+11.0	%	V2.80
0% to 50.0%,	95th percentile magnitude error	+11.0	%	
0° to 180°	95th percentile phase error	+11.0	deg	
Description of command				
This command defines upper limits for the 95th percentile of the three quantities *error vector magnitude*, *magnitude error*, and *phase error*. The 95th percentile is the limit below which 95% of the measured errors are located.				

DEFault:MODulation:OEMP:EPSK:LIMit <*Mode*>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	V2.80
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). In the query format, the command returns ON if all the parameters of the subsystem correspond to their default values, otherwise it returns OFF..				

Subsystem MODulation:OEMP...:RPMode

The subsystem *MODulation:OEMP...:RPMode* contains the command determining the way how the reference power is calculated in 8PSK modulation. The subsystem corresponds to the *Ref. Power Mode* parameter in the *Control* tab of the *Modulation Configuration* menu.

CONFigure:MODulation:OEMP:EPSK:RPMode <*Mode*>				Ref. Power Mode
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
CURRent | **AVERage |** **DCOMpensated**	Ref. Power calculated from current burst Ref. Power calculated from average curve Data compensated/corrected reference power	CURR	–	V3.07
Description of command				
This command determines how the reference power (0-dB line in the *P/t Norm. 8PSK* test diagram) for 8PSK-modulated signals is calculated.				

Measured Values – Subsystem MODulation:OVERview:EPSK

The subsystem *MODulation:OVERview:EPSK* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the *Modulation* measurement menu, application *Overview 8PSK.*

READ[:SCALar]:MODulation:OVERview:EPSK? **FETCh[:SCALar]:MODulation:OVERview:EPSK?** **SAMPle[:SCALar]:MODulation:OVERview:EPSK?**	Scalar Results: Start single shot measurement and return results Read out meas. results (unsynchronized) Read out measurement results (synchronized)			
Returned values	Value range	Def. value	Def. unit	FW vers.
95thPercentileEVM,	0.0 % to 100.0 %	NAN	%	V2.80
95thPercentileMagErr,	0.0 % to 100.0 %	NAN	%	
95thPercentilePhErr,	0.0 deg to +180.0 deg	NAN	deg	
EVMPeak (x3),	0.0 % to 100.0 %	NAN	%	
EVMRMS (x3),	0.0 % to 100.0 %	NAN	%	
MagnErrorPeak (x3),	0.0 % to 100.0 %	NAN	%	
MagnErrorRMS (x3),	0.0 % to 100.0 %	NAN	%	
PhErrorPeak(x3),	–100.0 deg to +100.0 deg	NAN	deg	
PhErrorRMS (x3),	–100.0 deg to +100.0 deg	NAN	deg	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command

These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4). The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.

CALCulate[:SCALar]:MODulation:OVERview:EPSK:MATChing:LIMit?	Bursts out of Tolerance			
Returned values	Value range	Def. value	Def. unit	FW vers.
95thPercentileEVM,		INV	–	V2.80
95thPercentileMagErr,		INV	–	
95thPercentilePhErr,		INV	–	
EVMPeak (x3),	For all measured values:	INV	–	
EVMRMS (x3),		INV	–	
MagnErrorPeak (x3),		INV	–	
MagnErrorRMS (x3),		INV	–	
PhErrorPeak(x3),	NMAU | NMAL | INV | OK	INV	–	
PhErrorRMS (x3),		INV	–	
OriginOffset (x3),		INV	–	
FrequencyError (x3),		INV	–	
AvgBurstPowerCurr		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 above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.

The following messages may be output for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	all tolerances matched	

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,* application *Error Vect. Magn. 8PSK,* and the associated popup menu *Modulation Configuration.*

Important Note!

The keyword `:EPSK` in the remote control commands of this section denotes 8PSK modulation. The commands are available with option CMU-K41 only.

Measurerment Control – Subsystem MODulation:EVMagnitude

The subsystem *MODulation:EVMagnitude* controls the modulation measurement. It corresponds to the softkey *EVM 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation:EVMagnitude:EPSK	Start new measurement	⇒	*RUN*
ABORt:MODulation:EVMagnitude:EPSK	Abort running measurement and switch off	⇒	*OFF*
STOP:MODulation:EVMagnitude:EPSK	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:MODulation:EVMagnitude:EPSK	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.			V2.80

CONFigure:MODulation:EVMagnitude:EPSK: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 SOPC No reporting	OFF	–	V2.80
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:MODulation:EVMagnitude:EPSK:STATus?		Measurement Status		
Ret. 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	–	V2.80
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).				

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 *Error Vector Magnitude* application.

Subsystem MODulation:EVMagnitude:EPSK:CONTrol

The subsystem *MODulation:EVMagnitude:EPSK:CONTrol* configures the modulation measurement. It corresponds to the tabs *Control* and *Statistics* in the popup menu *Modulation Configuration*.

CONFigure:MODulation:EVMagnitude:EPSK:CONTrol *<Mode>, <Statistics>*, *<Repetition>, <StopCond>, <Stepmode>*		Scope of Measurement		
<Mode>	Desciption of parameters	Def. value	Def. unit	
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	
<Statistics>	Description of parameters	Def. value	Def. unit	
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	
<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	
SOERror | **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	–	1.0
Description of command				
This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).				

CONFigure:MODulation:EVMagnitude:EPSK:CONTrol:RMODe *<Mode>*				Result Mode
<Mode>	Desciption of parameters	Def. value	Def. unit	FW-Vers.
SCALar | **ARRay**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	1.0
Description of command				
This command specifies the type of measured values.				

CONFigure:MODulation:EVMagnitude:EPSK:CONTrol:STATistics *<Statistics>*				Statistics Count
<Statistics>	Description of parameters	Def. value	Def. unit	FW-Vers.
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	1.0
Description of command				
This command defines the number of bursts forming a statistics cycle.				

CONFigure:MODulation:EVMagnitude:EPSK: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	
SOERror | **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	–	V2.80
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:EVMagnitude:EPSK:CONTrol *<Mode>*				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	V2.80
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). In the query format, the command returns ON if all the parameters of the subsystem correspond to their default values, otherwise it returns OFF..				

Tolerance values – Subsystem MODulation:OEMP:EPSK:LIMit

The subsystem *MODulation:OEMP:EPSK:LIMit* (see p. 6.39 ff) defines tolerance values for the modulation measurement **in all four EPSK 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:EPSK **<Mode>,<Start>,<Samples>{,<Start>,<Samples>}**				Definition of Subarrays
<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	
3 symb to 144 symb,	Start time in current range	0	symb	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 142	Number of samples in current range	142	–	V2.80
Description of command				
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK` 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 symb. 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. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.				

Measured Values – Subsystem MODulation:EVMagnitude:EPSK

The subsystem *MODulation:EVMagnitude:EPSK* 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 *EVM 8PSK.*

Scalar Results:

READ[:SCALar]:MODulation:EVMagnitude:EPSK	Start single shot measurement and return results
FETCh[:SCALar]:MODulation:EVMagnitude:EPSK	Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:EVMagnitude:EPSK	Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
95thPercentileEVM	0.0 % to 100.0 %	NAN	%	V2.80
EVMPeak (x3),	0.0 % to 100.0 %	NAN	%	
EVMRMS (x3),	0.0 % to 100.0 %	NAN	%	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
AvgBurstPowerAvg	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command

These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4). The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.

CALCulate[:SCALar]:MODulation:EVMagnitude:EPSK:MATChing:LIMit? Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	FW vers.
95thPercentileEVM		INV	–	V2.80
EVMPeak (x3),		INV	–	
EVMRMS (x3),	For all measured values:	INV	–	
		INV	–	
OriginOffset (x3),	NMAU | NMAL | INV | OK			
FrequencyError(x3)		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 above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value. The limits are defined with the `CONFigure:MODulation:OEMP`... commands.

The following messages may be output for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	all tolerances matched	

READ:ARRay:MODulation:EVMagnitude:EPSK:CURRent? Phase Error in Burst
READ:ARRay:MODulation:EVMagnitude:EPSK:AVERage?
READ:ARRay:MODulation:EVMagnitude:EPSK:MMAXimum?
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:EVMagnitude:EPSK:CURRent?
FETCh:ARRay:MODulation:EVMagnitude:EPSK:AVERage?
FETCh:ARRay:MODulation:EVMagnitude:EPSK:MMAXimum?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:CURRent? SAMPle:ARRay:MODulation:EVMagnitude:EPSK:AVERage?
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:MMAXimum?
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	%	V2.80
... ,	...	...	...	
0.0 % to +100.0 %	142nd 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. The number of measured values is 142, corresponding to a time range of 3 symb to 144 symb.

The calculation of *Current, Average, and MMax* (Min./Max.) results is explained in chapter 3 (see *display mode*).

READ:SUBarrays:MODulation:EVMagnitude:EPSK:CURRent? Subarray Results
READ:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?
READ:SUBarrays:MODulation:EVMagnitude:EPSK:MMAXimum?
Start single shot measurement and return results ⇒ *RUN*
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:CURRent?
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:MMAXimum?
Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:CURRent? SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:MMAXimum?
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	%	V2.80
... ,	...	...	...	
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:EPSK` 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:EPSK` 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.

The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (see *display mode*).

Demodulated Bits (MODulation:EVMagnitude:EPSK:DBITs…)

The following commands select the symbol range and control the readout of the demodulated bits. In manual control the symbol range is selected via marker functions; the demodulated bits are displayed in a bar below the test diagram.

NOTE

The demodulation of symbols must be disabled explicitly using `CONFigure:MODulation:EVMagnitude:EPSK:DBITs ON`, otherwise the remaining commands in this section return invalid results.

CONFigure:MODulation:EVMagnitude:EPSK:DBITs *<Enable>*		Enable/Disable Demodulation		
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Demodulation enabled Demodulated disabled, no valid results	OFF	–	V3.82
Description of command				
This command enables or disables the demodulation of symbols in the *EVM 8PSK* application.				

		Peak Values		
READ[:SCALar]:MODulation:EVMagnitude:EPSK:DBITS:PEAK?		Start single shot meas. and return results		
FETCh[:SCALar]:MODulation:EVMagnitude:EPSK:DBITS:PEAK?		Read out meas. results (unsynchronized)		
SAMPle[:SCALar]:MODulation:EVMagnitude:EPSK:DBITS:PEAK?		Read out meas. results (synchronized)		
Returned values	Value range	Def. value	Def. unit	FW vers.
3 to 144, **0 to 7**	Symbol no. with the peak EVM Demod. bits at the EVM peak	NAN NAN	(symb.) –	V3.82
Description of command				
These commands are always queries. They start a modulation measurement (`READ…`) and/or return the number of the symbol with the peak EVM and the demodulated bits at this position. The demodulated bits are returned as a decimal value, 1 corresponding to 001 in the measurement menu.				

		Single Value		
READ[:SCALar]:MODulation:EVMagnitude:EPSK:DBITS? *<Symbol>*		Start single shot meas. and return results		
FETCh[:SCALar]:MODulation:EVMagnitude:EPSK:DBITS? *<Symbol>*		Read out meas. results (unsynchronized)		
SAMPle[:SCALar]:MODulation:EVMagnitude:EPSK:DBITS? *<Symbol>*		Read out meas. results (synchronized)		
<Symbol>	Value range	Def. value	Def. unit	
3 to 144	Evaluated symbol number	NAN	(symb.)	
Returned values	Value range	Def. value	Def. unit	FW vers.
0 to 7	Demod. bits at the specified symbol	NAN	–	V3.82
Description of command				
These commands are always queries. They start a modulation measurement (`READ…`) and/or return the demodulated bits for a specific symbol. The demodulated bits are returned as a decimal value, 1 corresponding to 001 in the measurement menu.				

				Single Value
READ:ARRay:MODulation:EVMagnitude:EPSK:DBITS?				Start single shot meas. and return results
FETCh:ARRay:MODulation:EVMagnitude:EPSK:DBITS?				Read out meas. results (unsynchronized)
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:DBITS?				Read out meas. results (synchronized)
Returned values	Value range	Def. value	Def. unit	FW vers.
0 to 7,	Demod. bits at symbol no. 3	NAN	–	V3.82
…			–	
0 to 7	Demod. bits at symbol no. 144	NAN	–	
Description of command				
These commands are always queries. They start a modulation measurement (`READ…`) and/or return the demodulated bits at all symbols (142 returned values). The demodulated bits are returned as decimal values, 1 corresponding to 001 in the measurement menu.				

MODulation:PERRor:EPSK

The subsystem *MODulation:PERRor* measures the phase error as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation,* application *Phase Error 8PSK,* and the associated popup menu *Modulation Configuration.*

Important Note!

The keyword `:EPSK` in the remote control commands of this section denotes 8PSK modulation. The commands are available with option CMU-K41 only.

Measurerment Control – Subsystem MODulation:PERRor

The subsystem *MODulation:PERRor* controls the modulation measurement. It corresponds to the softkey *Phase Error 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation:PERRor:EPSK **ABORt:MODulation:PERRor:EPSK** **STOP:MODulation:PERRor:EPSK** **CONTinue:MODulation:PERRor:EPSK**	Start new measurement Abort running measurement and switch off Stop measurement after current stat. cycle Next measurement step (only *stepping mode*)	⇒ *RUN* ⇒ *OFF* ⇒ *STOP* ⇒ *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.		V2.80

CONFigure:MODulation:PERRor:EPSK: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 SOPC No reporting	OFF	–	V2.80
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:MODulation:PERRor:EPSK:STATus?				Measurement Status
Ret. 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	–	V2.80
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).				

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* application.

Subsystem MODulation:PERRor:EPSK:CONTrol

The subsystem *MODulation:PERRor:EPSK:CONTrol* configures the modulation measurement. It corresponds to the tabs *Control* and *Statistics* in the popup menu *Modulation Configuration*.

CONFigure:MODulation:PERRor:EPSK:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>*				Scope of Measurement
<Mode>	Desciption of parameters	Def. value	Def. unit	
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	
<Statistics>	Description of parameters	Def. value	Def. unit	
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	
<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	
SOERror | **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	–	1.0

Description of command

This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).

CONFigure:MODulation:PERRor:EPSK:CONTrol:RMODe *<Mode>* Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	FW-Vers.
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	1.0

Description of command

This command specifies the type of measured values.

CONFigure:MODulation:PERRor:EPSK:CONTrol:STATistics *<Statistics>* Statistics Count

<Statistics>	Description of parameters	Def. value	Def. unit	FW-Vers.
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	1.0

Description of command

This command defines the number of bursts forming a statistics cycle.

CONFigure:MODulation:PERRor:EPSK: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**	
SOERror | **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	–	V2.80

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:PERRor:EPSK:CONTrol <*Mode*>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	V2.80
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). In the query format, the command returns ON if all the parameters of the subsystem correspond to their default values, otherwise it returns OFF..				

Tolerance values – Subsystem MODulation:OEMP:EPSK:LIMit

The subsystem *MODulation:OEMP:EPSK:LIMit* (see p. 6.39 ff) defines tolerance values for the modulation measurement **in all four EPSK applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Subsystem SUBarrays:MODulation:PERRor:EPSK

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:PERRor:EPSK **<Mode>,<Start>,<Samples>{,<Start>,<Samples>}**				Definition of Subarrays
<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	
3 symb to 144 symb,	Start time in current range	0	symb	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 142	Number of samples in current range	142	–	V2.80
Description of command				
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:PERRor:EPSK` 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 symb. 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. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.				

Measured Values – Subsystem MODulation:PERRor:EPSK

The subsystem *MODulation:PERRor:EPSK* 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 *Phase Error 8PSK.*

	Scalar Results:
READ[:SCALar]:MODulation:PERRor:EPSK?	Start single shot measurement and return results
FETCh[:SCALar]:MODulation:PERRor:EPSK?	Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:PERRor:EPSK?	Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
95thPercentilePhError	0.0 deg to 50.0 deg	NAN	deg	V2.80
PhaseErrorPeak (x3),	–100.0 deg to 100.0 deg	NAN	deg	
PhaseErrorRMS (x3),	–100.0 deg to 100.0 deg	NAN	deg	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
AvgBurstPowerAvg	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command

These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4), either for the whole burst or for the 1st ten valid symbols in the burst. The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.

CALCulate[:SCALar]:MODulation:PERRor:EPSK:MATChing:LIMit?	Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	FW vers.
95thPercentilePhError		INV	–	V2.80
PhErrorPeak (x3),		INV	–	
PhErrorRMS (x3),	For all measured values:	INV	–	
			–	
OriginOffset (x3),	NMAU | NMAL | INV | OK	INV		
FrequencyError(x3)		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 above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value. The limits are defined with the `CONFigure:MODulation:OEMP...` commands.

The following messages may be output for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	all tolerances matched	

READ:ARRay:MODulation:PERRor:EPSK:CURRent? **READ:ARRay:MODulation:PERRor:EPSK:AVERage?** **READ:ARRay:MODulation:PERRor:EPSK:MMAXimum?** Start single shot measurement and return results ⇒ *RUN* **FETCh:ARRay:MODulation:PERRor:EPSK:CURRent?** **FETCh:ARRay:MODulation:PERRor:EPSK:AVERage?** **FETCh:ARRay:MODulation:PERRor:EPSK:MMAXimum?** Read measurement results (unsynchronized) ⇒ *RUN* **SAMPle:ARRay:MODulation:PERRor:EPSK:CURRent? SAM-Ple:ARRay:MODulation:PERRor:EPSK:AVERage?** **SAMPle:ARRay:MODulation:PERRor:EPSK:MMAXimum?** Read measurement results (synchronized) ⇒ *RUN*				Phase Error in Burst
Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 deg to +100.0 deg, **... ,** **–100.0 deg to +100.0 deg**	1st value for phase error ... 142nd value for phase error	NAN ... NAN	deg ... deg	V2.80

Description of command

These commands are always queries. They return the phase error vs. time at fixed, equidistant test points. The number of measured values is 142, corresponding to a time range of 3 symb to 144 symb.

The calculation of `CURRent`, `AVERage`, *and* `MMAX` (Min./Max.) results is explained in chapter 3 (see *display mode*).

READ:SUBarrays:MODulation:PERRor:EPSK:CURRent? **READ:SUBarrays:MODulation:PERRor:EPSK:AVERage?** **READ:SUBarrays:MODulation:PERRor:EPSK:MMAXimum?** Start single shot measurement and return results ⇒ *RUN* **FETCh:SUBarrays:MODulation:PERRor:EPSK:CURRent?** **FETCh:SUBarrays:MODulation:PERRor:EPSK:AVERage?** **FETCh:SUBarrays:MODulation:PERRor:EPSK:MMAXimum?** Read meas. results (unsynchronized) ⇒ *RUN* **SAMPle:SUBarrays:MODulation:PERRor:EPSK:CURRent? SAM-Ple:SUBarrays:MODulation:PERRor:EPSK:AVERage?** **SAMPle:SUBarrays:MODulation:PERRor:EPSK:MMAXimum?** Read results (synchronized) ⇒ *RUN*				Subarray Results
Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
100.0 deg to +100.0 deg, **... ,** **–100.0 deg to +100.0 deg**	1st value for phase error ... nth value for phase error	NAN ... NAN	deg ... deg	V2.80

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:EPSK` 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:EPSK` 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.

The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (see *display mode*).

Demodulated Bits (MODulation:PERRor:EPSK:DBITs…)

The following commands select the symbol range and control the readout of the demodulated bits. In manual control the symbol range is selected via marker functions; the demodulated bits are displayed in a bar below the test diagram.

NOTE

The demodulation of symbols must be disabled explicitly using `CONFigure:MODulation:PERRor:EPSK:DBITs ON`*, otherwise the remaining commands in this section return invalid results.*

CONFigure:MODulation:PERRor:EPSK:DBITs <*Enable*>				Enable/Disable Demodulation
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Demodulation enabled Demodulated disabled, no valid results	OFF	–	V3.82
Description of command				
This command enables or disables the demodulation of symbols in the *Phase Error 8PSK* application.				

READ[:SCALar]:MODulation:PERRor:EPSK:DBITS:PEAK? **FETCh[:SCALar]:MODulation:PERRor:EPSK:DBITS:PEAK?** **SAMPle[:SCALar]:MODulation:PERRor:EPSK:DBITS:PEAK?**				Peak Values Start single shot meas. and return results Read out meas. results (unsynchronized) Read out meas. results (synchronized)
Returned values	Value range	Def. value	Def. unit	FW vers.
3 to 144, **0 to 7**	Symbol no. with the peak phase error Demod. bits at the phase error peak	NAN NAN	(symb.) –	V3.82
Description of command				
These commands are always queries. They start a modulation measurement (`READ…`) and/or return the number of the symbol with the largest absolute value of the phase error and the demodulated bits at this position. The demodulated bits are returned as a decimal value, 1 corresponding to 001 in the measurement menu.				

READ[:SCALar]:MODulation:PERRor:EPSK:DBITS? <*Symbol*> **FETCh[:SCALar]:MODulation:PERRor:EPSK:DBITS? <*Symbol*>** **SAMPle[:SCALar]:MODulation:PERRor:EPSK:DBITS? <*Symbol*>**				Single Value Start single shot meas. and return results Read out meas. results (unsynchronized) Read out meas. results (synchronized)
<Symbol>	Value range	Def. value	Def. unit	
3 to 144	Evaluated symbol number	NAN	(symb.)	
Returned values	Value range	Def. value	Def. unit	FW vers.
0 to 7	Demod. bits at the specified symbol	NAN	–	V3.82
Description of command				
These commands are always queries. They start a modulation measurement (`READ…`) and/or return the demodulated bits for a specific symbol. The demodulated bits are returned as a decimal value, 1 corresponding to 001 in the measurement menu.				

	Single Value
READ:ARRay:MODulation:PERRor:EPSK:DBITS?	Start single shot meas. and return results
FETCh:ARRay:MODulation:PERRor:EPSK:DBITS?	Read out meas. results (unsynchronized)
SAMPle:ARRay:MODulation:PERRor:EPSK:DBITS?	Read out meas. results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
0 to 7,	Demod. bits at symbol no. 3	NAN	–	V3.82
…			–	
0 to 7	Demod. bits at symbol no. 144	NAN	–	

Description of command
These commands are always queries. They start a modulation measurement (`READ…`) and/or return the demodulated bits at all symbols (142 returned values). The demodulated bits are returned as decimal values, 1 corresponding to 001 in the measurement menu.

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,* application *Magn. Error 8PSK,* and the associated popup menu *Modulation Configuration.*

Important Note!

The keyword `:EPSK` in the remote control commands of this section denotes 8PSK modulation. The commands are available with option CMU-K41 only.

Measurerment Control – Subsystem MODulation:MERRor

The subsystem *MODulation:MERRor* controls the modulation measurement. It corresponds to the softkey *Magn. Error 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation:MERRor:EPSK	Start new measurement	⇒ *RUN*
ABORt:MODulation:MERRor:EPSK	Abort running measurement and switch off	⇒ *OFF*
STOP:MODulation:MERRor:EPSK	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:MERRor:EPSK	Next measurement 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.		V2.80

CONFigure:MODulation:MERRor:EPSK: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 SOPC No reporting	OFF	–	V2.80
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:MODulation:MERRor:EPSK:STATus?				Measurement Status
Ret. 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	–	V2.80
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).				

Subsystem MODulation:MERRor:EPSK:CONTrol

The subsystem *MODulation:MERRor:EPSK:CONTrol* configures the modulation measurement. It corresponds to the tabs *Control* and *Statistics* in the popup menu *Modulation Configuration*.

CONFigure:MODulation:MERRor:EPSK:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>*				Scope of Measurement
<Mode>	Desciption of parameters	Def. value	Def. unit	
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	
<Statistics>	Description of parameters	Def. value	Def. unit	
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	
<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	
SOERror | **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	–	1.0
Description of command				
This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).				

CONFigure:MODulation:MERRor:EPSK:CONTrol:RMODe <*Mode*>				Result Mode
<Mode>	Desciption of parameters	Def. value	Def. unit	FW-Vers.
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	1.0
Description of command				
This command specifies the type of measured values.				

CONFigure:MODulation:MERRor:EPSK:CONTrol:STATistics <*Statistics*>				Statistics Count
<Statistics>	Description of parameters	Def. value	Def. unit	FW-Vers.
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	1.0
Description of command				
This command defines the number of bursts forming a statistics cycle.				

CONFigure:MODulation:MERRor:EPSK: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	
SOERror | **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	–	V2.80
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:MERRor:EPSK:CONTrol <*Mode*>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	V2.80
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). In the query format, the command returns ON if all the parameters of the subsystem correspond to their default values, otherwise it returns OFF..				

Tolerance values – Subsystem MODulation:OEMP:EPSK:LIMit

The subsystem *MODulation:OEMP:EPSK:LIMit* (see p. 6.39 ff) defines tolerance values for the modulation measurement **in all four EPSK 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:EPSK
<Mode>,<Start>,<Samples>{,<Start>,<Samples>} — Definition of Subarrays

<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	
3 symb to 144 symb,	Start time in current range	0	symb	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 142	Number of samples in current range	142	–	V2.80

Description of command

This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:MERRor:EPSK` 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 symb.

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.

By default, only one range corresponding to the total measurement range is used and all measurement values are returned.

Measured Values – Subsystem MODulation:MERRor:EPSK

The subsystem *MODulation:MERRor:EPSK* 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 *Magn. Error 8PSK.*

				Scalar Results:
READ[:SCALar]:MODulation:MERRor:EPSK?				Start single shot measurement and return results
FETCh[:SCALar]:MODulation:MERRor:EPSK?				Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:MERRor:EPSK?				Read out measurement results (synchronized)
Returned values	Value range	Def. value	Def. unit	FW vers.
95thPercentileMErr	0.0 % to 100.0 %	NAN	%	V2.80
MagnErrorPeak (x3),	0.0 % to 100.0 %	NAN	%	
MagnErrorRMS (x3),	0.0 % to 100.0 %	NAN	%	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
AvgBurstPowerAvg	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	
Description of command				
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4), either for the whole burst or for the 1st ten valid symbols in the burst. The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.				

CALCulate[:SCALar]:MODulation:MERRor:EPSK:MATChing:LIMit?				Bursts out of Tolerance
Returned values	Value range	Def. value	Def. unit	FW vers.
95thPercentileMErr		INV	–	V2.80
MErrPeak (x3),		INV	–	
MErrRMS (x3),	For all measured values:	INV	–	
		INV	–	
OriginOffset (x3),				
FrequencyError (x3)	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 above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value. The limits are defined with the `CONFigure:MODulation:OEMP`... commands.

The following messages may be output for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	all tolerances matched	

READ:ARRay:MODulation:MERRor:EPSK:CURRent? **READ:ARRay:MODulation:MERRor:EPSK:AVERage?** **READ:ARRay:MODulation:MERRor:EPSK:MMAXimum?**	Magnitude Error in Burst
Start single shot measurement and return results	⇒ *RUN*
FETCh:ARRay:MODulation:MERRor:EPSK:CURRent? **FETCh:ARRay:MODulation:MERRor:EPSK:AVERage?** **FETCh:ARRay:MODulation:MERRor:EPSK:MMAXimum?**	
Read measurement results (unsynchronized)	⇒ *RUN*
SAMPle:ARRay:MODulation:MERRor:EPSK:CURRent? SAM-Ple:ARRay:MODulation:MERRor:EPSK:AVERage? **SAMPle:ARRay:MODulation:MERRor:EPSK:MMAXimum?**	
Read measurement results (synchronized)	⇒ *RUN*

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to +100.0 %,	1st value for magnitude error	NAN	%	V2.80
... ,	...	...	...	
0.0 % to +100.0 %	142nd 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. The number of measured values is 142, corresponding to a time range of 3 symb to 144 symb.

The calculation of *current, average, and mmax* (Min./Max.) results is explained in chapter 3 (see *display mode*).

READ:SUBarrays:MODulation:MERRor:EPSK:CURRent? **READ:SUBarrays:MODulation:MERRor:EPSK:AVERage?** **READ:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?**	Subarray Results
Start single shot measurement and return results	⇒ *RUN*
FETCh:SUBarrays:MODulation:MERRor:EPSK:CURRent? **FETCh:SUBarrays:MODulation:MERRor:EPSK:AVERage?** **FETCh:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?**	
Read meas. results (unsynchronized)	⇒ *RUN*
SAMPle:SUBarrays:MODulation:MERRor:EPSK:CURRent? SAM-Ple:SUBarrays:MODulation:MERRor:EPSK:AVERage? **SAMPle:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?**	
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 magnitude error	NAN	%	V2.80
... ,	...	...	...	
0.0 % 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:EPSK` command. In the default setting of the configuration command the `READ:SUBarrays..., FETCh:SUBarrays..., and SAM-Ple:SUBarrays...` command group is equivalent to the `READ:ARRay..., FETCh:ARRay..., and SAM-Ple:ARRay...` command group described above.

The `CONFigure:SUBarrays:MODulation:MERRor:EPSK` 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.

The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (see *display mode*).

Demodulated Bits (MODulation:MERRor:EPSK:DBITs…)

The following commands select the symbol range and control the readout of the demodulated bits. In manual control the symbol range is selected via marker functions; the demodulated bits are displayed in a bar below the test diagram.

NOTE

The demodulation of symbols must be disabled explicitly using `CONFigure:MODulation:MERRor:EPSK:DBITs ON`*, otherwise the remaining commands in this section return invalid results.*

CONFigure:MODulation:MERRor:EPSK:DBITs <*Enable*>		Enable/Disable Demodulation		
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Demodulation enabled Demodulated disabled, no valid results	OFF	–	V3.82
Description of command				
This command enables or disables the demodulation of symbols in the *Magn. Error 8PSK* application.				

READ[:SCALar]:MODulation:MERRor:EPSK:DBITS:PEAK? **FETCh[:SCALar]:MODulation:MERRor:EPSK:DBITS:PEAK?** **SAMPle[:SCALar]:MODulation:MERRor:EPSK:DBITS:PEAK?**	Peak Values Start single shot meas. and return results Read out meas. results (unsynchronized) Read out meas. results (synchronized)			
Returned values	Value range	Def. value	Def. unit	FW vers.
3 to 144, **0 to 7**	Symbol no. with the peak magnitude error Demod. bits at the magnitude error peak	NAN NAN	(symb.) –	V3.82
Description of command				
These commands are always queries. They start a modulation measurement (`READ…`) and/or return the number of the symbol with the largest absolute value of the magnitude error and the demodulated bits at this position. The demodulated bits are returned as a decimal value, 1 corresponding to 001 in the measurement menu.				

READ[:SCALar]:MODulation:MERRor:EPSK:DBITS? <*Symbol*> **FETCh[:SCALar]:MODulation:MERRor:EPSK:DBITS? <*Symbol*>** **SAMPle[:SCALar]:MODulation:MERRor:EPSK:DBITS? <*Symbol*>**	Single Value Start single shot meas. and return results Read out meas. results (unsynchronized) Read out meas. results (synchronized)			
<Symbol>	Value range	Def. value	Def. unit	
3 to 144	Evaluated symbol number	NAN	(symb.)	
Returned values	Value range	Def. value	Def. unit	FW vers.
0 to 7	Demod. bits at the specified symbol	NAN	–	V3.82
Description of command				
These commands are always queries. They start a modulation measurement (`READ…`) and/or return the demodulated bits for a specific symbol. The demodulated bits are returned as a decimal value, 1 corresponding to 001 in the measurement menu.				

Single Value

READ:ARRay:MODulation:MERRor:EPSK:DBITS? Start single shot meas. and return results
FETCh:ARRay:MODulation:MERRor:EPSK:DBITS? Read out meas. results (unsynchronized)
SAMPle:ARRay:MODulation:MERRor:EPSK:DBITS? Read out meas. results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
0 to 7,	Demod. bits at symbol no. 3	NAN	–	V3.82
…			–	
0 to 7	Demod. bits at symbol no. 144	NAN	–	

Description of command

These commands are always queries. They start a modulation measurement (`READ…`) and/or return the demodulated bits at all symbols (142 returned values). The demodulated bits are returned as decimal values, 1 corresponding to 001 in the measurement menu.

MODulation:IQANalyzer

The subsystem *MODulation:IQANalyzer* measures the I and Q amplitudes of the received 8PSK signal as a function of time. The subsystem corresponds to the measurement menu *Modulation,* applications *I/Q Analyzer 8PSK,* and the sections in the popup menu *Modulation Configuration* that are related to the *I/Q Analyzer 8PSK* application.

Control of Measurement – Subsystem MODulation:IQANalyzer

The subsystem *MODulation:IQANalyzer* controls the measurement. It corresponds to the softkey *I/Q Analyzer 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation:IQANalyzer:EPSK ⇒ *RUN*	Start new measurement
ABORt:MODulation:IQANalyzer:EPSK ⇒ *OFF*	Abort running measurement and switch off
STOP:MODulation:IQANalyzer:EPSK ⇒ *STOP*	Stop measurement after current stat. cycle
CONTinue:MODulation:IQANalyzer:EPSK ⇒ *RUN*	Next measurement step (only *stepping mode*)
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.	V3.82

CONFigure:MODulation:IQANalyzer:EPSK: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 SOPC No reporting	OFF	–	V3.82

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:EPSK:STATus? — Measurement Status

Ret. 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	–	V3.82
1 to 10000 | **NONE**	Counter for current statistics cycle 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 following commands configure the *I/Q Analyzer* measurement. They correspond to the *I/Q Analyzer* section in the *Control* tab of the *Modulation Configuration* menu.

CONFigure:MODulation:IQANalyzer:EPSK: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	–	V3.82

Description of command

This command specifies the type of measured values.

CONFigure:MODulation:IQANalyzer:EPSK: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	
NONE	(No stop condition because no limit check)	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	–	V3.82

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:MODulation:IQANalyzer:EPSK:ROTation <*Enable*> — Rotation

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
P38 | **P38R**	3 π/8 rotation conserved 3 π/8 rotation removed	P38R	–	V3.82

Description of command

This command qualifies whether or not the 3π/8 rotation is subtracted off before the symbols are displayed in the constellation diagram.

CONFigure:MODulation:IQANalyzer:EPSK:IQFilter <*Length*> — Measurement Length

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
ISIRemoved | **UNFiltered**	I/Q filter applied No I/Q filter applied	ISIRemoved	–	V3.82

Description of command

This command specifies whether the I/Q data is filtered in order to eliminate the inter-symbol interference (ISI) at all constellation points.

DEFault:MODulation:IQANalyzetar:EPSK: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	–	V3.82
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:IQANalyzer:EPSK

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,* application *I/Q Analyzer 8PSK.*

READ[:SCALar]:MODulation:IQANalyzer:EPSK? **FETCh[:SCALar]:MODulation:IQANalyzer:EPSK?** **SAMPle[:SCALar]:MODulation:IQANalyzer:EPSK?**		Scalar Results: Start single shot measurement and return results Read out meas. results (unsynchronized) Read out measurement results (synchronized)		
Returned values	Value range	Def. value	Def. unit	FW vers.
Error Vector Magnitude (RMS), **Magnitude Error (RMS)** **Phase Error (RMS),** **Avg. Burst Power (Current)**	0.0 % to 100.0 % 0.0 % to 100.0 % –180.0 deg to +180.0 deg –100.0 dBm to +60.0 dBm	NAN NAN NAN NAN	% % deg dBm	V3.82
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 *Signalling* are not available in *Non Singnalling* mode; the *Non Singnalling* output string is shortened.				

READ:ARRay:MODulation:IQANalyzer:EPSK:IPHase? **READ:ARRay:MODulation:IQANalyzer:EPSK:QPHase?** Start single shot measurement and return results **FETCh:ARRay:MODulation:IQANalyzer:EPSK:IPHase?** **FETCh:ARRay:MODulation:IQANalyzer:EPSK:QPHase?** Read measurement results (unsynchronized) **SAMPle:ARRay:MODulation:IQANalyzer:EPSK:IPHase?** **SAMPle:ARRay:MODulation:IQANalyzer:EPSK:QPHase?** Read measurement results (synchronized)		Normalized I/Q Amplitude ⇒ *RUN* ⇒ *RUN* ⇒ *RUN*		
Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–2.0 to +2.0, **... ,** **–2.0 to +2.0**	1st value for normalized I or Q amplitude ... 568th value for normalized I or Q amplitude	NAN ... NAN	deg ... deg	V3.82
Description of command				
These commands are always queries. They return the normalized I and Q amplitudes. The 568 measured values correspond to 142 symbols at an oversampling factor 4.				

SPECtrum[:COMMon]

The subsystem *SPECtrum[:COMMon]* provides settings that are common to the two applic*ations Spectrum due to Modulation* (see p. 6.69 ff) and *Spectrum due to Switching* (see p. 6.81 ff).

CONFigure:SPECtrum[:COMMon]:NOISe:CORRection *<Enable>*		Noise Correction		
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Switch noise correction on or off	ON	–	V2.80
Description of command				
This command switches the noise correction for the Spectrum measurement on or off. The noise correction improves the dynamic range but slightly reduces the speed of the measurement.				

CONFigure:SPECtrum:LIMit:LINE:SELect *<Modulation>*		Limit Selection		
<Modulation>	Description of parameters	Def. value	Def. unit	FW vers.
AUTO | **GMSK |** **EPSK**	Auto-detect modulation and adjust template Use GMSK template Use EPSK template	AUTO	–	V3.65
Description of command				
These commands selects the limit line to be applied. The current template can be queried using `[SENSe:]SPECtrum:<Application>:LIMit:LINE:USED?`.				

SPECtrum due to Modulation

The subsystem *SPECtrum:MODulation* measures the off-carrier power due to the modulation of the GSM signal. The subsystem corresponds to the measurement menus *Spectrum,* application *due to Modulation,* and the associated configuration popups.

Measurerment Control – Subsystem SPECtrum due to MODulation

The subsystem *SPECtrum:MODulation* controls the spectrum measurement.

INITiate:SPECtrum:MODulation	Start new measurement	⇒	*RUN*
ABORt:SPECtrum:MODulation	Abort running meas. and switch off	⇒	OFF
STOP:SPECtrum:MODulation	Stop meas. after current stat. cycle	⇒	STOP
CONTinue:SPECtrum:MODulation	Next meas. 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.			V2.80

CONFigure:SPECtrum:MODulation: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 SOPC No reporting	OFF	–	V2.80
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:SPECtrum:MODulation: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	–	V2.80
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).				

Subsystem SPECtrum:MODulation...:CONTrol

The subsystem *SPECtrum:MODulation...:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* and *Statistics* tabs in the popup menu *Spectrum Configuration*.

CONFigure:SPECtrum:MODulation:CONTrol <*Mode*>, <*Statistics*>, <*Repetition*>, <*StopCond*>, <*Stepmode*>				Scope of Measurement
<Mode>	Desciption of parameters	Def. value	Def. unit	
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	

<Statistics>	Description of parameters	Def. value	Def. unit	
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	200	–	
<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	
SOERror | **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	–	1.0
Description of command				
This command defines the scope of the spectrum measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).				

CONFigure:SPECtrum:MODulation:CONTrol:RMODe <*Mode*>				Result Mode
<Mode>	Desciption of parameters	Def. value	Def. unit	FW-Vers.
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	1.0
Description of command				
This command specifies the type of measured values.				

CONFigure:SPECtrum:MODulation:CONTrol:STATistics <*Statistics*>				Statistics Count
<Statistics>	Description of parameters	Def. value	Def. unit	FW-Vers.
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	200	–	1.0
Description of command				
This command defines the number of bursts forming a statistics cycle.				

CONFigure:SPECtrum:MODulation: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 10000,	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCondition>	Description of parameters	Def. value	Def. unit	
SOERror |	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	–	V2.80
NONE	Continue measurement according to its rep. mode			

Description of command

This command defines the number of test cycles, the stepping mode and, if required, a stop condition 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:SPECtrum:MODulation:CONTrol ***<Enable>*** — Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	All parameters are set to their default values	ON	–	V2.80
OFF	Some or all parameters differ from the default values			

Description of command

If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.

Test Configuration

The commands of the following subsystems configure the spectrum due to modulation. They correspond to the *due to Modulation* sections in the *Spectrum Configuration* menu.

CONFigure:SPECtrum:MODulation:TDFSelect <*Frequency*>				Time D. @ Freq.
<Frequency>	Description of parameters	Def. value	Def. unit	FW vers.
N180 | N160 | N140 | N120 | N100 | N080 | N060 | N040 | N025 | N020 | N010 | **REF |** **P010 | P020 | P025 | P040 | P060 | P080 | P100 | P120 | P140 | P160 | P180 |** **NV4 | NV3 | NV2 | NV1 |** **PV1 | PV2 | PV3 | PV4 |** **OFF | ON**	Fixed measurement points at negative frequencies Carrier frequency (0 Hz offset) Fixed measurement points at positive frequencies Variable measurement points at negative or positive frequencies Switch time domain measurement off or on	OFF	–	V3.65
Description of command				
These commands selects the measurement frequency for the time domain (power vs. time) measurement results, to be retrieved by means of `READ:ARRay:SPECtrum:MODulation:TDOMain?` etc. The time domain measurement can be performed at all enabled fixed and variable measurement points (`CONFigure:SPECtrum:MODulation:CONTrol:MPOint<nr>:ENABle, CONFigure:SPECtrum:MODulation:CONTrol:VMPOint<nr>`). OFF disables the time domain measurement so that `READ:ARRay:SPECtrum:MODulation:TDOMain?` etc. return NAN results.				

CONFigure:SPECtrum:MODulation:AVGareas <*Area*>				Averaging Areas
<Area>	Description of parameters	Def. value	Def. unit	FW vers.
A | B | **AB**	Use averaging area A (before training sequence) or B (after TS) Use averaging area A and B	B	–	V3.65
Description of command				
These commands selects one or two 40-bit sections of the burst which are measured and averaged in order to calculate the *Modulation* results.				

Subsystem SPECTrum:MODulation...:LIMit:LINE

The subsystem *SPECtrum:MODulation...:LIMit:LINE* defines the limit lines, i.e. the tolerance values for the spectrum measurement. The subsystem corresponds to the tab *Limit Lines* in the popup menu *Spectrum Configuration.*

Important Note!

The keywords `:GMSK` and `:EPSK` in the remote control commands denote GMSK and 8PSK modulation, respectively. The `:EPSK` commands are available with option CMU-K41 only.

CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr> Limits
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>
<MinPwLevelRel>, <MaxPwLevelRel>, <AbsPwLevel>, <Enable>
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:ENABle *<Enable>*
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:ENABle *<Enable>*
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:VALue
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:VALue
<MinPwLevelRel>, <MaxPwLevelRel>, <AbsPwLevel>

Numeric Suffix	Value range	Description of parameters	Def. value
<nr>	1 to11	Measurement point (frequency) no.	
Parameters	Value range	Description of parameters	Def. value
<Enable>	ON | OFF	Limit check for frequency point <nr> on/off	See below
<MinPwLevelRel>,	–99.9 dB to 99.9 dB	Limit for relative power below the interpolation range	
<MaxPwLevelRel>,	–99.9 dB to 99.9 dB	Limit for relative power above the interpolation range	
<AbsPwLevel>,	–99.9 dBm to 99.9 dBm	Alternative absolute power limit	

Description of command	FW vers.
These commands activate and define limit lines for the spectrum due to modulation measurement.	V2.80

The limits are defined at up to 11 fixed frequencies numbered by the numeric suffix <nr> and as a function of the BTS output power level. Outside the interpolation range defined via `CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric [:COMBined]:RPOWer`, the fixed relative power limits *<MinPwLevelRel> and <MaxPwLevelRel>* apply. Inside this range, the limits are derived from these values by linear interpolation. As an alternative, an absolute power limit is set. For a more detailed explanation see chapter 4.

To switch on or off the entire limit check please use the command

CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric
[:COMBined]:ENABle <Mode>

Default values for GSM400/GT800/850/900 (the GSM1800/1900 values are given in brackets where they differ from the GSM400/GT800/850/900 values):

Frequency	**Min.P. Lev.rel.**	**Max.P. Lev.rel.**	**Level abs.**
± 0.10 MHz	+0.5 dB	+ 0.5 dB	–65.0 dBm (–57.0 dBm)
± 0.20 MHz	–30.0 dB	– 30.0 dB	–65.0 dBm (–57.0 dBm)
± 0.25 MHz	–33.0 dB	– 33.0 dB	–65.0 dBm (–57.0 dBm)
± 0.40 MHz	–60.0 dB[1]	– 60.0 dB[1]	–65.0 dBm (–57.0 dBm)
± 0.60 MHz	–60.0 dB	– 70.0 dB	–65.0 dBm (–57.0 dBm)
± 0.80 MHz	–60.0 dB	– 70.0 dB	–65.0 dBm (–57.0 dBm)
± 1.00 MHz	–60.0 dB	– 70.0 dB	–65.0 dBm (–57.0 dBm)
± 1.20 MHz	–63.0 dB	– 73.0 dB	–65.0 dBm (–57.0 dBm)
± 1.40 MHz	–63.0 dB	– 73.0 dB	–65.0 dBm (–57.0 dBm)
± 1.60 MHz	–63.0 dB	– 73.0 dB	–65.0 dBm (–57.0 dBm)
± 1.80 MHz	–63.0 dB	– 73.0 dB	–65.0 dBm (–57.0 dBm)

[1] GMSK modulation. With 8PSK modulation, the corresponding value is –56.0 dB.

CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric[:COMBined]:RPOWer Reference Power
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:SYMMetric[:COMBined]:RPOWer
<Minimum>, <Maximum>

<Minimum>	Description of parameters	Def. value	Def. unit	
–99.9 dBm to +99.9 dBm	Ref. power for min. power level	33	dBm	
<Maximum>	Description of parameters	Def. value	Def. unit	FW vers.
–99.9 dBm to +99.9 dBm	Ref. power for max. power level	43	dBm	V2.80

Description of command

This command defines the BTS output power range where the relative limit lines are given by linear interpolation between a minimum and a maximum relative power level. See command `CONFigure:SPECtrum:MODulation:...LIMit:LINE:SYMMetric [:COMBined]:FREQuency<nr>:VALue` and detailed explanation in chapter 4.

Limits on/off
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric[:COMBined]:ENABle *<Mode>*
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:SYMMetric[:COMBined]:ENABle *<Mode>*

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Switch on limit check Switch off limit check	ON	–	V2.80

Description of command

This command switches the limit check for all measurement points on or off.

DEFault:SPECtrum:MODulation:GMSK:LIMit:LINE *<Enable>* Default Settings
DEFault:SPECtrum:MODulation:EPSK:LIMit:LINE *<Enable>*

<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	–	V2.80

Description of command

If used as a setting command with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect).

In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.

Subsystem SPECTrum:MODulation...:MPOint<nr>

The subsystem *SPECtrum:MODulation...:MPOint<nr>* defines at which frequencies the *Spectrum* measurement is performed. The subsystem corresponds to the tab *Meas X* in the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum:MODulation:MPOint<nr>:ENABle <Enable>		Enable/Disable Measurement Points		
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Switch on measurement point <nr> Switch off measurement point <nr>	ON	–	V2.80
Description of command				
This command switches the measurement at the individual frequency points no. 1 to 11 (numbered by the numeric suffix <nr>) on or off.				

CONFigure:SPECtrum:MODulation:CONTrol:VMPoint<nr> *<Frequency>*		Variable Measurement Points		
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 MHz to 2.5 MHz | **0.0 MHz to 1.8 MHz |** **ON | OFF**	Variable meas. point with R&S CMU-U65 Var04 Variable meas. point with oder versions Switch on or off measurement point <nr>	0.9 (<nr> = 1) 1.1 (<nr> = 2) 1.3 (<nr> = 3) 1.5 (<nr> = 4)	MHz MHz MHz MHz	V3.65
Description of command				
This command sets and enables additional pairs of measurement points at up to 4 variable offset frequencies (numbered by the numeric suffix <nr> = 1 to 4). The variable measurement points are switched off after a reset; the parameter `ON` activates the default values quoted above. A measurement point which is selected for the time domain measurement `(CONFigure:SPECtrum:MODulation:TDFSelect)` can not be switched off. On the other hand, a measurement point is switched on automatically when it is selected for the time domain measurement.				

Subsystem SUBarrays:SPECtrum:MODulation

The subsystem *SUBarrays:SPECtrum:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:SPECtrum:MODulation **<Mode>,<Start>,<Samples>{,<Start>,<Samples>}**		Definition of Subarrays		
<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	
–1.8 MHz to 1.8 MHz,	Frequency of first point in current range	–1.8	MHz	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 23	Number of samples in current range	23	–	V2.80

Description of command
This command configures the `READ:SUBarrays..`, `FETCh:SUBarrays..`, and `SAMPle:SUBarrays:SPECtrum:MODulation...` 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 frequency and the number of test points which are located at fixed frequencies (see command `CONFigure:SPECtrum:MODulation:...:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>`). The subranges may overlap but must be within the total range of the spectrum due to modulation 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.

CONFigure:SUBarrays:SPECtrum:MODulation:TDOMain <Mode>,<Start>,<Samples>{,<Start>,<Samples>}		Definition of Subarrays: Time Domain		
<Mode>	Description of parameters	Def. value	Def. unit	
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range Return single interpolated value at <Start>	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	
–30 to +175,	First symbol point in current range	–30	(symb)	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 618	Number of samples in current range	618	–	V3.65
Description of command				
This command configures the `READ:SUBarrays..`, `FETCh:SUBarrays..`, and `SAMPle:SUBarrays:SPECtrum:MODulation:TDOMain` commands. It is analogous to the subarray command for the frequency domain `(CONFigure:SUBarrays:SPECtrum:MODulation[:FDOMain])`.				

Measured Values

The commands of the following subsystems determine and return the results of the spectrum due to modulation measurement. They correspond to the graphical menu *Spectrum* with its various display elements.

Subsystem SPECtrum:MODulation...

The subsystem *SPECtrum:MODulation...* measures and returns of the frequency spectrum (due to modulation) and compares it with tolerance values. The subsystem corresponds to the graphical measurement menu *Spectrum.*

Scalar Results:

READ[:SCALar]:SPECtrum:MODulation? Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:MODulation? Read measurement results unsynchronized
SAMPle[:SCALar]:SPECtrum:MODulation? Read measurement results synchronized

Return	Value range	Def. value	Def. unit	FW vers.
Reference Power, **Matching**	–100.0 dBm to +20.0 dBm INV | MATC | NMAT | NTSC | OUT | NTRG | UFLW | OFLW	NAN INV	dBm –	V2.80

Description of command

These commands are always queries.

`READ` starts a single shot measurement and returns the results.

`FETCh` outputs the results without taking care of the measurement state.

`SAMPle` waits until the results are valid for the first time (depending on the chosen statistic count) and then outputs the results.

For more details refer to the description of measurement control in chapter 5 of the CMU operating manual.

The reference power is the absolute carrier power measured as specified in the GSM standard. The following messages may be output for the value *Matching*:

MATC	matching
NMAT	not matching
INV	invalid
NTSC	no training sequence code
OUT	out of range
NTRG	not triggered
UFLW	underflow
OFLW	overflow

Spectrum Results

READ:ARRay:SPECtrum:MODulation? Start single shot measurement and return results
FETCh:ARRay:SPECtrum:MODulation? Read measurement results (unsynchronized)
SAMPle:ARRay:SPECtrum:MODulation? Read results (synchronized)

Return	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB, **...,** **–100.0 dB to +20.0 dB**	Power at measurement point 1, ..., Power at measurement point 23	NAN ... NAN	dB ... dB	V2.80

Description of command

These commands are always queries. They return the off-carrier power due to modulation at all measurement points.

Subarray Results

READ:SUBarrays:SPECtrum:MODulation?	Start single shot measurement and return results	⇒ *RUN*
FETCh:SUBarrays:SPECtrum:MODulation?	Read meas. results (unsynchronized)	⇒ *RUN*
SAMPle:SUBarrays:SPECtrum:MODulation?	Read results (synchronized)	⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB,	Power at measurement point 1,	NAN	dB	V2.80
...,	...,	...	...	
–100.0 dB to +20.0 dB	Power at measurement point n	NAN	dB	

Description of command

These commands are always queries. They output the off-carrier power due to modulation in the subranges defined by means of the `CONFigure:SUBarrays:SPECtrum:MODulation|EPSK` 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:SPECtrum:MODulation|EPSK` 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.

Spectrum Results: Frequency Domain, Variable Meas. Points

READ:ARRay:SPECtrum:MODulation[:FDOMain]:VMPoint?	Start single shot measurement and return results
FETCh:ARRay:SPECtrum:MODulation[:FDOMain]:VMPoint?	Read measurement results (unsynchronized)
SAMPle:ARRay:SPECtrum:MODulation[:FDOMain]:VMPoint?	Read results (synchronized)

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB,	Power at measurement point 4 (neg. freq. offset)	NAN	dB	V3.65
...,	...	...	...	
–100.0 dB to +20.0 dB,	Power at measurement point 1 (neg. freq. offset)	NAN	dB...	
–100.0 dB to +20.0 dB,	Power at measurement point 1 (pos. freq. offset)	NAN	dB	
…,	...	...		
–100.0 dB to +20.0 dB	Power at measurement point 4 (pos. freq. offset)	NAN	dB	

Description of command

These commands are always queries. They return the off-carrier power due to modulation at all enabled variable measurement points `(CONFigure:SPECtrum:MODulation:CONTrol:VMPOint<nr>)`. NAN is returned at the disabled points.

Spectrum Results: Time Domain

READ:ARRay:SPECtrum:MODulation:TDOMain?	Start single shot measurement and return results
FETCh:ARRay:SPECtrum:MODulation:TDOMain?	Read measurement results (unsynchronized)
SAMPle:ARRay:SPECtrum:MODulation:TDOMain?	Read results (synchronized)

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB,	Power at measurement point 1	NAN	dB	V3.65
...,	…	...	...	
–100.0 dB to +20.0 dB	Power at measurement point 618	NAN	dB	

Description of command

These commands are always queries. They return the off-carrier power vs. time at a definite offset frequency from the carrier `(CONFigure:SPECtrum:MODulation:TDFSelect)`. The position of the measurement points is as reported in the `CONFigure:SUBarrays:SPECtrum:MODulation:TDOMain` command description.

	Subarray Results: Time Domain			
READ:SUBarrays:SPECtrum:MODulation:TDOMain?	Start single shot meas. and return results ⇒ *RUN*			
FETCh:SUBarrays:SPECtrum:MODulation:TDOMain?	Read meas. results (unsynchronized) ⇒ *RUN*			
SAMPle:SUBarrays:SPECtrum:MODulation:TDOMain?	Read results (synchronized) ⇒ *RUN*			
Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB **...** **–100.0 dB to +20.0 dB**	Power[1], 1st value for power ... Power[x], xth value for power	NAN ... NAN	dB ... dB	V3.65
Description of command				

These commands are always queries. They output the off-carrier power due to modulation in the subranges defined by means of the `CONFigure:SUBarrays:SPECtrum:MODulation:TDOMain` 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:SPECtrum:MODulation:TDOMain` 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.

SPECtrum due to SWITching

The subsystem *SPECtrum:SWITching* measures the off-carrier power due to the bursty nature of the GSM signal. The subsystem corresponds to the measurement menu *Spectrum* and the associated configuration popups

Measurerment Control – Subsystem SPECtrum:SWITching

The subsystem *SPECtrum:SWITching* controls the spectrum measurement.

INITiate:SPECtrum:SWITching	Start new measurement	⇒	*RUN*
ABORt:SPECtrum:SWITching	Abort running measurement and switch off	⇒	*OFF*
STOP:SPECtrum:SWITching	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:SPECtrum:SWITching	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.			V2.80

CONFigure:SPECtrum:SWITching: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 SOPC No reporting	OFF	–	V2.80
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:SPECtrum:SWITching: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	–	V2.80
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).				

Subsystem SPECtrum:SWITching...:CONTrol

The subsystem *SPECtrum:SWITching...:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* and *Statistics* tabs in the popup menu *Spectrum Configuration*.

CONFigure:SPECtrum:SWITching:CONTrol <*Mode*>, <*Statistics*>, <*Repetition*>, <*StopCond*>, <*Stepmode*> — Scope of Measurement

<Mode>	Desciption of parameters	Def. value	Def. unit	
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	
<Statistics>	Description of parameters	Def. value	Def. unit	
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	10	–	
<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	
SOERror | **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	–	1.0

Description of command

This command defines the scope of the power measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).

CONFigure:SPECtrum:SWITching:CONTrol:RMODe <*Mode*> — Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	FW-Vers.
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	1.0

Description of command

This command specifies the type of measured values.

CONFigure:SPECtrum:SWITching:CONTrol:STATistics <*Statistics*> — Statistics Count

<Statistics>	Description of parameters	Def. value	Def. unit	FW-Vers.
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	10	–	1.0

Description of command

This command defines the number of bursts forming a statistics cycle.

CONFigure:SPECtrum:SWITching:CONTrol:REPetition Test Cycles
<Repetition>,<StopCondition>, <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	–	
<StopCondition>	Description of parameters	Def. value	Def. unit	
SOERror | **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	–	V2.80

Description of command

This command defines the number of test cycles, the stepping mode and, if required, an stop condition 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:SPECtrum:SWITching: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	–	V2.80

Description of command

If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect).

In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.

Test Configuration

The commands of the following subsystems configure the spectrum due to switching. They correspond to the *due to Switching* sections in the *Spectrum Configuration* menu.

CONFigure:SPECtrum:SWITching:TDFSelect <*Frequency*> Time D. @ Freq.

<Frequency>	Description of parameters	Def. value	Def. unit	FW vers.
N180 | N120 | N060 | N040 | **REF |** **P040 | P060 | P120 | P180 |** **NV4 | NV3 | NV2 | NV1 |** **PV1 | PV2 | PV3 | PV4 |** **OFF | ON**	Fixed meas. points at negative frequencies Carrier frequency (0 Hz offset) Fixed meas. points at positive frequencies Variable measurement points at negative or positive frequencies	OFF	–	V3.65

Description of command

These commands selects the measurement frequency for the time domain (power vs. time) measurement results, to be retrieved by means of `READ:ARRay:SPECtrum:SWITching:TDOMain?` etc. The time domain measurement can be performed at all enabled fixed and variable measurement points (`CONFigure:SPECtrum:SWITching:CONTrol:MPOint<nr>:ENABle`, `CONFigure:SPECtrum:SWITching:CONTrol:VMPOint<nr>`). OFF disables the time domain measurement so that `READ:ARRay:SPECtrum:SWITching:TDOMain?` etc. return NAN results.

CONFigure:SPECtrum:SWITching:NOSLots <*Slots*> Slot Count

<Slots>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 8	Number of slots per TDMA frame measured	1	–	V3.65

Description of command

These commands defines the number of timeslots which are considered for the *Spectrum due to Switching* measurement.

CONFigure:SPECtrum:SWITching:CSMODE <*Mode*> Cont. Stat. Mode

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
PHOL | **SCO**	Peak Hold Statistic Count	PHOL	–	V3.65

Description of command

This command defines the continuous statistical mode for the spectrum due to switching measurement.

Subsystem SPECTrum:SWITching...:LIMit:LINE

The subsystem *SPECtrum:SWITching...:LIMit:LINE* defines the limit lines, i.e. the tolerance values for the spectrum measurement. The subsystem corresponds to the tab *Limit Lines* in the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>
<MinPwLevelRel>, <MaxPwLevelRel>, <AbsPwLevel>, <Enable>
CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle *<Enable>*
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle *<Enable>*
CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:VALue
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:VALue
<MinPwLevelRel>, <MaxPwLevelRel>, <AbsPwLevel>

Limits

Numeric Suffix	Value range	Description of parameters	Def. value
<nr>	1 to 4	Measurement point (frequency) no.	
Parameters	Value range	Description of parameters	Def. value
<Enable>	ON | OFF	Limit check for frequency point <nr> on/off	See below
<MinPwLevelRel>,	–99.9 dB to 99.9 dB	Limit for relative power below the interpolation range	
<MaxPwLevelRel>,	–99.9 dB to 99.9 dB	Limit for relative power above the interpolation range	
<AbsPwLevel>	–99.9 dBm to 99.9 dBm	Alternative absolute power limit	

Description of command	FW vers.
These commands activate and define limit lines for the spectrum due to switching measurement.	V2.80

The relative limits depend on the GSM band and on the measurement points numbered by the numeric suffix <nr>.

For switching on or off one measurement point over all power levels, please use the command

CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE:ENABle[:UPPer]

For totally switching on or off the limit check please use the command

CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE:SYMMetric[:COMBined]:ENABle <Mode>

Default values for the four GSM bands (all in dBc):

Meas. point	Frequ. offset	GSM400/GT800/850/900	GSM1800	GSM1900
1	0.4 MHz	–57[2]	–50	–50
2	0.6 MHz	–67[3]	–58	–58
3	1.2 MHz	–74	–66	–66
4	1.8 MHz	–74	–66	–66

[2] GMSK modulation. With 8PSK modulation, the corresponding value is –52.0 dBc.
[3] GMSK modulation. With 8PSK modulation, the corresponding value is –62.0 dBc.

Limit Check on/off

CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE:SYMMetric[:COMBined]:ENABle *<Mode>*
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:SYMMetric[:COMBined]:ENABle *<Mode>*

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Switch on limit check Switch off limit check	ON	–	V2.80

Description of command

This command switches the limit check for all measurement points on or off.

DEFault:SPECtrum:SWITching:GMSK:LIMit:LINE *<Enable>*
DEFault:SPECtrum:SWITching:EPSK:LIMit:LINE *<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	–	V2.80

Description of command

If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect).

In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.

Subsystem SPECTrum:SWITching...:MPOint<nr>

The subsystem *SPECtrum:SWITching...:MPOint<nr>* defines at which frequencies the *Spectrum* measurement is performed. The subsystem corresponds to the tab *Meas X* in the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum:SWITching:MPOint<nr>:ENABle <Enable> Enable/Disable Measurement Points

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Switch on measurement point <nr> Switch off measurement point <nr>	ON	–	V2.80

Description of command

This command switches the measurement at the individual frequency points no. 1 to 4 (numbered by the numeric suffix <nr>) on or off.

CONFigure:SPECtrum:SWITching:CONTrol:VMPOint<nr> *<Frequency>*	Variable Measurement Points			
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 MHz to 2.5 MHz | **0.0 MHz to 1.8 MHz |** **ON | OFF**	Variable meas. point with R&S CMU-U65 Var04 Variable meas. point with oder versions Switch on or off measurement point <nr>	0.8 (<nr> = 1) 1.0 (<nr> = 2) 1.4 (<nr> = 3) 1.6 (<nr> = 4)	MHz MHz MHz MHz	V3.65
Description of command				

This command sets and enables additional pairs of measurement points at up to 4 variable offset frequencies (numbered by the numeric suffix <nr> = 1 to 4). The variable measurement points are switched off after a reset; the parameter `ON` activates the default values quoted above.

A measurement point which is selected for the time domain measurement `(CONFigure:SPECtrum:SWITching:TDFSelect)` can not be switched off. On the other hand, a measurement point is switched on automatically when it is selected for the time domain measurement.

Subsystem SUBarrays:SPECtrum:SWITching

The subsystem *SUBarrays:SPECtrum:SWITching* defines the measurement range and the type of output values.

CONFigure:SUBarrays:SPECtrum:SWITching **<Mode>,<Start>,<Samples>{,<Start>,<Samples>}**	Definition of Subarrays			
<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	
–1.8 MHz to 1.8 MHz,	Start frequency in current range	–1.8	MHz	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 9	Number of samples in current range	9	–	V2.80
Description of command				

This command configures the `READ:SUBarrays..`, `FETCh:SUBarrays..`, and `SAMPle:SUBarrays:SPECtrum:SWITching...` 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 frequency and the number of test points which are located at fixed frequencies.

The subranges may overlap but must be within the total range of the *spectrum due to switching* 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.

CONFigure:SUBarrays:SPECtrum:SWITching:TDOMain <Mode>,<Start>,<Samples>{,<Start>,<Samples>} Definition of Subarrays: Time Domain

<Mode>	Description of parameters	Def. value	Def. unit	
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range Return single interpolated value at <Start>	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	
–30 to 175 **–186 to 175** **–186 to 331** **–186 to 587** **–186 to 643** **–186 to 799** **–186 to 955** **–186 to 1111**	First symbol point in current range, Slot Count = 1 First symbol point in current range, Slot Count = 2 First symbol point in current range, Slot Count = 3 First symbol point in current range, Slot Count = 4 First symbol point in current range, Slot Count = 5 First symbol point in current range, Slot Count = 6 First symbol point in current range, Slot Count = 7 First symbol point in current range, Slot Count = 8	–30 –186 –186 –186 –186 –186 –186 –186	(symb) (symb) (symb) (symb) (symb) (symb) (symb) (symb)	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 618 **1 to 1086** **1 to 1554** **1 to 2022** **1 to 2490** **1 to 2958** **1 to 3426** **1 to 3894**	Number of samples in current range, Slot Count = 1 Number of samples in current range, Slot Count = 2 Number of samples in current range, Slot Count = 3 Number of samples in current range, Slot Count = 4 Number of samples in current range, Slot Count = 5 Number of samples in current range, Slot Count = 6 Number of samples in current range, Slot Count = 7 Number of samples in current range, Slot Count = 8	618 1086 1554 2022 2490 2958 3426 3894	– – – – – – – –	V3.65

Description of command

This command configures the `READ:SUBarrays..`, `FETCh:SUBarrays..`, and `SAMPle:SUBarrays:SPECtrum:SWITching:TDOMain` commands. It is analogous to the subarray command for the frequency domain (`CONFigure:SUBarrays:SPECtrum:SWITching[:FDOMain]`). The number of samples and the start value depends on the slot count (`CONFigure:SPECtrum:SWITching:NOSLots`)

Measured Values

The commands of the following subsystems determine and output the results of the signal spectrum measurement. They correspond to the graphical menu *Spectrum* with its various display elements.

Subsystem SPECtrum:SWITching...

The subsystem *SPECtrum:SWITching...* measures and returns the frequency spectrum (due to switching) and compares it with tolerance values. The subsystem corresponds to the graphical measurement menu *Spectrum.*

	Scalar Results
READ[:SCALar]:SPECtrum:SWITching?	Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:SWITching?	Read measurement results (unsynchronized)
SAMPle[:SCALar]:SPECtrum:SWITching?	Read measurement results (synchronized)

Return	Value range	Def. value	Def. unit	FW vers.
Reference Power, **Matching**	–100.0 dBm to +20.0 dBm INV | MATC | NMAT | NTSC | OUT | NTR | UFLW | OFLW	NAN INV	dBm –	V2.80

Description of command

These commands are always queries.

`READ` starts a single shot measurement and returns the results.

`FETCh` outputs the results without taking care of the measurement state.

`SAMPle` waits until the results are valid for the first time (depending on the chosen statistic count) and then outputs the results.

For more details refer to the description of measurement control in chapter 5 of the CMU operating manual.

The reference power is the absolute carrier power measured as specified in the GSM standard. The following messages may be output for the value *Matching*:

MATC	matching
NMAT	not matching
INV	invalid
NTSC	no training sequence code
OUT	out of range
NTRG	not triggered
UFLW	underflow
OFLW	overflow

Spectrum Results

READ:ARRay:SPECtrum:SWITching? Start single shot measurement and return results
FETCh:ARRay:SPECtrum:SWITching? Read measurement results (unsynchronized)
SAMPle:ARRay:SPECtrum:SWITching? Read results (synchronized)

Return	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB,	Power at measurement point 1,	NAN	dB	V2.80
...,	...,	...	...	
–100.0 dB to +20.0 dB	Power at measurement point 9	NAN	dB	

Description of command

These commands are always queries. They return the off-carrier power due to switching at all measurement points.

Subarray Results

READ:SUBarrays:SPECtrum:SWITching? Start measurement and return results ⇒ *RUN*
FETCh:SUBarrays:SPECtrum:SWITching? Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:SUBarrays:SPECtrum:SWITching? Read results (synchronized) ⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB,	Power at measurement point 1,	NAN	dB	V2.80
...,	...,	...	...	
–100.0 dB to +20.0 dB	Power at measurement point 9	NAN	dB	

Description of command

These commands are always queries. They output the off-carrier power due to switching in the subranges defined by means of the `CONFigure:SUBarrays:SPECtrum:SWITching|EPSK` 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:SPECtrum:SWITching|EPSK` 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.

Spectrum Results: Frequency Domain, Variable Meas. Points

READ:ARRay:SPECtrum:SWITching[:FDOMain]:VMPoint? Start single shot measurement and return results
FETCh:ARRay:SPECtrum:SWITching[:FDOMain]:VMPoint? Read measurement results (unsynchronized)
SAMPle:ARRay:SPECtrum:SWITching[:FDOMain]:VMPoint? Read results (synchronized)

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB,	Power at meas. point 4 (neg. freq. offset)	NAN	dB	V3.65
...,	...	...	...	
–100.0 dB to +20.0 dB,	Power at meas. point 1 (neg. freq. offset)	NAN	dB	
–100.0 dB to +20.0 dB,	Power at meas. point 1 (pos. freq. offset)	NAN	dB	
…,	...	...		
–100.0 dB to +20.0 dB	Power at meas. point 4 (pos. freq. offset)	NAN	dB	

Description of command

These commands are always queries. They return the off-carrier power due to switching at all enabled variable measurement points `(CONFigure:SPECtrum:SWITching:CONTrol:VMPOint<nr>)`. NAN is returned at the disabled points.

Spectrum Results: Time Domain

READ:ARRay:SPECtrum:SWITching:TDOMain? Start single shot measurement and return results
FETCh:ARRay:SPECtrum:SWITching:TDOMain? Read measurement results (unsynchronized)
SAMPle:ARRay:SPECtrum:SWITching:TDOMain? Read results (synchronized)

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB, **...,** **–100.0 dB to +20.0 dB**	Power at measurement point 1 … Power at measurement point n	NAN ... NAN	dB ... dB	V3.65

Description of command

These commands are always queries. They return the off-carrier power vs. time at a definite offset frequency from the carrier (`CONFigure:SPECtrum:SWITching:TDFSelect`). The number of results depends on the slot count (`CONFigure:SPECtrum:SWITching:NOSLots`):

Slot count	1	2	3	4	5	6	7	8
n	618	1086	1554	2022	2490	2958	3426	3894

The position of the measurement points is as reported in the `CONFigure:SUBarrays:SPECtrum: SWITching:TDOMain` command description.

Subarray Results: Time Domain

READ:SUBarrays:SPECtrum:SWITching:TDOMain? Start single shot meas. and return results ⇒ *RUN*
FETCh:SUBarrays:SPECtrum:SWITching:TDOMain? Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:SUBarrays:SPECtrum:SWITching:TDOMain? Read results (synchronized) ⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB, **...,** **–100.0 dB to +20.0 dB**	Power[1], 1st value for power ... Power[x], xth value for power	NAN ... NAN	dB ... dB	V3.65

Description of command

These commands are always queries. They output the off-carrier power due to modulation in the subranges defined by means of the `CONFigure:SUBarrays:SPECtrum:SWITching:TDOMain` 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:SPECtrum:SWITching:TDOMain` 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.

Spectrum due to Modulation & Switching

In the *Modulation & Switching* application, both spectra are measured in a single measurement shot. The measurement menu contains two diagrams corresponding to the frequency domain bar graphs in the *Modulation* and *Switching* applications. *Modulation & Switching* can be used if both spectra but no power vs. time results are needed.

In remote control, *Modulation & Switching* is identified by the 2nd to 4th level keywords `...SPECtrum:MSWitching...` The combined `MSWitching` measurement takes longer than a single `MODulation` or `SWITching` measurement, however, all results can be retrieved with a single command.

Measurement Control

The subsystem *SPECtrum:MSWitching* controls the spectrum due to modulation and switching measurement.

INITiate:SPECtrum:MSWitching	Start new measurement	⇒	*RUN*
ABORt:SPECtrum:MSWitching	Abort running measurement and switch off	⇒	*OFF*
STOP:SPECtrum:MSWitching	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:SPECtrum:MSWitching	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.			V3.65

CONFigure:SPECtrum:MSWitching: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 SOPC No reporting	OFF	–	V3.65
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:SPECtrum:MSWitching: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	–	V3.65
1 to 1000 | **NONE,**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	
1 to 10000 | **NONE,**	Counter for current statistics cycle for Modulation (→`CONFigure:SPECtrum:Modulation:CONTrol`) Statistic count set to off	NONE	–	
1 to 10000 | **NONE**	Counter for current statistics cycle for Switching (→`CONFigure:SPECtrum:SWITching:CONTrol`) 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 R&S CMU manual).				

Test Configuration

The commands of the following subsystems configure the spectrum due to switching. They correspond to the *Switching* sections in the *Spectrum Configuration* menu.

Subsystem SPECTrum:MSWitching:CONTrol

The subsystem *SPECtrum:MSWitching:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* and *Meas X* tabs of the popup menu *Spectrum Configuration*.

CONFigure:SPECtrum:MSWitching:CONTrol <*Mode*>		Scope of Measurement		
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SCALar | **ARRay**	Only scalar measured values Scalar measured values and arrays	ARRay	–	
Description of command				
This command restricts the type of measured values and determines the number of bursts within a statistics cycle.				

CONFigure:SPECtrum:MSWitching:CONTrol:REPetition ***<Repetition>,<StopCondition>, <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	–	V3.65
<StopCondition>	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	–	V3.65
<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	–	V3.65
Description of command				
This command defines the number of test cycles, the stepping mode and, if required, a stop condition for the measurement. **Note:** *For READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*				

Subsystem SPECTrum:MSWitching:LIMit:LINE

The subsystem *SPECtrum:MSWitching:LIMit:LINE* defines the limit lines, i.e. the tolerance values for the spectrum due to switching measurement. The subsystem corresponds to the *Switching* sections in the tab *Limit Lines* in the popup menu *Spectrum Configuration.*

[SENSe:]SPECtrum:MSWitching:LIMit:LINE:USED?				Current Limit Template
Response	Description of parameters	Def. value	Def. unit	FW vers.
GMSK | EPSK	Use GMSK template Use EPSK template	–	–	V3.65
Description of command				
These commands is always a query and returns the current limit line template. The template can be selected using `CONFigure:SPECtrum:LIMit:LINE:SELect`.				

Measured Values

The following commands return the results of the spectrum due to switching measurement. They correspond to the graphical menu *Spectrum* with its various display elements.

Scalar Results:

READ[:SCALar]:SPECtrum:MSWitching?	Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:MSWitching?	Read measurement results (unsynchronized)
SAMPle[:SCALar]:SPECtrum:MSWitching?	Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Reference Power (Modulation),	–100.0 dBm to +100.0 dBm	NAN	dBm	V3.65
Reference Power (Switching),	–100.0 dBm to +100.0 dBm	NAN	dBm	
Matching (Modulation),	INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	INV	–	
Matching (Switching)	INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	INV	–	

Description of command

These commands are always queries. They start a measurement and return the results. For more details refer to the description of measurement control in Chapter 5 of the R&S CMU operating manual.

The reference powers are absolute carrier powers measured according to GSM conformance test specification for the spectrum due to modulation and spectrum due to switching (see Chapter 4). The following messages may be output for the values *Matching*:

INV	invalid
MATC	matching
NMAT	not matching
OUT	out of range
NTR	no trigger
NRAM	not ramping (burst not found)
OFLW	overflow
UFLW	underflow
NTSC	no training sequence code
OFF	off

Spectrum Results: Frequency Domain, Fixed Meas. Points

READ:ARRay:SPECtrum:MSWitching?	Start single shot measurement and return results
FETCh:ARRay:SPECtrum:MSWitching?	Read measurement results (unsynchronized)
SAMPle:ARRay:SPECtrum:MSWitching?	Read results (synchronized)

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB,	1st modulation result (at –1.8 MHz)	NAN	dB	V3.65
...,	...	...	...	
–100.0 dB to +20.0 dB,	23rd modulation result (at +1.8 MHz)	NAN	dB	
–100.0 dB to +20.0 dB,	1st switching result (at –1.8 MHz)	NAN	dB	
...,	...	...	...	
–100.0 dB to +20.0 dB	9th switching result (at +1.8 MHz)	NAN	dB	

Description of command

These commands are always queries. They return the off-carrier power due to modulation and switching at all enabled fixed measurement points (`CONFigure:SPECtrum:<Application>:CONTrol:MPOint<nr>: ENABle`). NAN is returned at the disabled points.

Spectrum Results: Frequency Domain, Variable Meas. Points

READ:ARRay:SPECtrum:MSWitching:VMPoint? Start single shot measurement and return results
FETCh:ARRay:SPECtrum:MSWitching:VMPoint? Read measurement results (unsynchronized)
SAMPle:ARRay:SPECtrum:MSWitching:VMPoint? Read results (synchronized)

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB,	1st modulation result	NAN	dB	V3.65
...,	...	...	...	
–100.0 dB to +20.0 dB,	8th modulation result	NAN	dB	
–100.0 dB to +20.0 dB,	1st switching result	NAN	dB	
...,	...	...		
–100.0 dB to +20.0 dB	8th switching result	NAN	dB	

Description of command

These commands are always queries. They return the off-carrier power due to modulation and switching at all enabled variable measurement points (CONFigure:SPECtrum:<Application>:CONTrol:VMPOint<nr>). NAN is returned at the disabled points.

CALCulate:ARRay:SPECtrum:MSWitching:AREA:LIMit:MATChing? Limit Matching

Returned value	Description of parameters	Def. value	Def. unit	FW vers.
32 bit value,	Indicator for modulation limit matching at fixed meas. Points (23 least significant bits)	NAN,	–	V3.65
32 bit value	Indicator for switching limit matching at fixed meas. points (9 least significant bits)	NAN		

Description of command

This command is always a query. A bit in the output values is set if the corresponding fixed measurement point exceeds the limit.

Spectrum Results: Frequency Domain, Variable Meas. Points

READ:ARRay:SPECtrum:MSWitching:VMPoint? Start single shot measurement and return results
FETCh:ARRay:SPECtrum:MSWitching:VMPoint? Read measurement results (unsynchronized)
SAMPle:ARRay:SPECtrum:MSWitching:VMPoint? Read results (synchronized)

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB,	1st modulation result	NAN	dB	V3.65
...,	...	...	...	
–100.0 dB to +20.0 dB,	8th modulation result	NAN	dB	
–100.0 dB to +20.0 dB,	1st switching result	NAN	dB	
...,	...	...		
–100.0 dB to +20.0 dB	8th switching result	NAN	dB	

Description of command

These commands are always queries. They return the off-carrier power due to modulation and switching at all enabled variable measurement points (CONFigure:SPECtrum:<Application>:CONTrol:VMPOint<nr>). NAN is returned at the disabled points.

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.

Status Register Evaluation

The following commands are used to retrieve the events reported in function groups *GSM400/GT800/850/900/1800/1900-BTS Non Signalling* and *Signalling*; see section *Symbolic Status Event Register Evaluation* in Chapter 5 of the CMU operating manual.

STATus:OPERation:SYMBolic:ENABle <Event>{,<Event>}				Symbolic status evaluation
Parameter list	Parameter description	Def. Value[4]	Default Unit	Unit Ring
<Event>{,<Event>} | NONE	List of symbols for events to be reported No event reported	NONE	–	
Command description				FW vers.
This command enables event reporting for one or several events in the current *GSMxxx-BTS Signalling* function group, i.e. it sets the corresponding bits in the `STATus:OPERation:CMU:SUM<nr>:CMU<nr_event>:ENABle` register (`<nr> = 1 | 2`, `<nr_event>` denotes the current function group) and in all sum registers up to the status byte. The events and the corresponding symbols for the function group are listed in Chapter 5 (see section *Status Registers).* The symbols may be entered in arbitrary order.				V3.07

STATus:OPERation:SYMBolic[:EVENt]?				Symbolic status evaluation
Response	Parameter description	Def. Value[5]	Default Unit	Unit Ring
NONE | <Event>{,<Event>}	No event in the *RF* function group List of reported events	NONE	–	
Command description				FW vers.
This command is always a query. It lists the events reported in the current *GSMxxx-BTS Signalling* function group and deletes these events in the `STATus:OPERation:CMU:SUM<nr>:CMU<nr_event>:EVENt` register as well as in all sum registers.				V3.07

[4] The default values quoted in this command are achieved after a `STATus:PRESet` command. `*RST` does not overwrite the entries in the status registers; see section *Reset Values of the Status Reporting Systems* in chapter 5.

[5] The default values quoted in this command are achieved after a `*CLS` command. `*RST` does not overwrite the entries in the status registers; see section *Reset Values of the Status Reporting Systems* in chapter 5.

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"	–	–	V3.22
Description of command			
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.			

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.	V3.22

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 **BYIQ** **XOIO** **IOIO** **IOXO** **FPAT** **UDEF**	RX/TX Bypass, `RXPath = BYP, TXPath = BYP` Bypass w. I/Q-OF OUT, `RXPath = TXPath =BYIQ` I/Q IN/OUT, `RXPath = TXPath = XOIO` IF IN_I/Q IN/OUT, `RXPath = TXPath = IOIO` IF IN/OUT, `RXPath = TXPath = IOXO` Fading Path, `RXPath = BYP, TXPath = XOIO` User-defined scenario, can not be set but may be returned by the query `CONF:IQIF:RXTX?`	BYP	–	V3.22

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 **BYIQ** **XOIO** **IOIO** **IOXO**	Bypass Bypass w. I/Q-IF OUT I/Q IN/OUT IF IN_I/Q IN/OUT IF IN/OUT	BYP	–	V3.22

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 **BYIQ** **XOIO** **IOIO** **IOXO**	Bypass Bypass w. I/Q-IF OUT I/Q IN/OUT IF IN_I/Q IN/OUT IF IN/OUT	BYP	–	V3.22

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`.

IQIF:DEFault <Enable>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	V3.22

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)*.

GSM BTS Tests (Signalling)

In the *Signalling* mode, the CMU is able to generate BCCH and TCH signals and to set up a call to the base station. A broad range of signalling parameters can be configured and measurements may be performed with a call connection established.

Connection Control

The remote-control commands presented in this section control the signalling (connection setup and release, services, signalling parameters), determine the inputs and outputs as well as the reference frequency. They correspond to the settings in the popup menu of the softkey *Connect. Control* located to the right of the headline of each main menu.

Important note: Current vs. default values

Some parameters of the CMU can assume two independent values: The ***default*** *value is used to set up a connection; it can be modified in the signalling states* Signal Off, Signal On *and* Registered. *The* ***current*** *value is valid during the connection (signalling state* Call Established). *Whenever the CMU goes into the* Call Established *state the default value overwrites the current value. The current value can still be changed during the connection, however, modifying this current value does not alter the default value. An example for such a double parameter in GSM-MS is the BS signal level in the used and unused timeslots.*
Default values are set with a `CONFigure ...` *command, current values are set with the corresponding* `PROCedure ...` *command.*

Subsystem EPOWer (Expected Input Power)

The subsystem *EPOWer* controls the level in the RF input signal path. It corresponds to the table section *Expected Power* in the *Analyzer* tab of the *Connection Control* menu.

[SENSe:]EPOWer:MODE <*Mode*>				Expected Power – Mode
	Description of parameters	Def. value	Def. unit	FW vers.
MANual | **AUTomatic**	Manual setting Automatic setting corresponding to average power of signal applied	AUT	–	V2.80
Description of command				Sig. State
This command defines the mode for setting the expected input power.				all

[SENSe:]EPOWer:VALue <*Level*>				Expected Power – Manual
<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**	Expected input power for RF 1 Expected input power for RF 2 Expected input power for RF 4 IN	30.0 30.0 0.0	dBm dBm dBm	V2.80
Description of command				Sig. State
This command defines the maximum input level. The permissible value range depends on the RF input used and the external attenuation set (see `[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]` command).				all

[SENSe:]EPOWer: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)	LNO	–	V2.80
Description of command				Sig. State
This command defines the attenuation or gain factor for the RF input signal.				all

DEFault:EPOWer <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	–	V2.80
Description of command				Sig. State
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (the setting OFF causes an error message). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.				all

Subsystem TRIGger (Trigger Mode)

The subsystem *TRIGger* defines the trigger mode. It corresponds to the *Trigger* tab in the *Connection Control* menu.

TRIGger[:SEQuence]:SOURce <*Source*>				Source
<Source>	Description of parameters	Def. value	Def. unit	FW vers.
SIGNalling **FRUN |** **RFPower |** **IFPower**	The measurement is triggered by the signalling unit The measurement is triggered by the TDMA timing (free-run mode) of the analyzed signal Wide-band power trigger Narrow-band trigger	SIGN	–	V2.80
Description of command				Sig. State
This command defines the trigger condition. The settings *RFPower* and *IFPower* require burst signals. The setting *FRUN* requires burst signals with incorporated training sequence.				all

TRIGger[:SEQuence]:THReshold:RFPower <*Threshold*>				Level – RF Power
<Threshold>	Parameter description	Def. value	Default unit	FW vers.
LOW | **MEDium |** **HIGH**	Low trigger threshold *(RF Max. Level* – 26 dB) Medium trigger threshold *(RF Max. Level* – 16 dB) High trigger threshold *(RF Max. Level* – 6 dB)	MEDium	–	V3.22
Command description				
This command sets the RF input signal level at which the measurement is triggered relative to the maximum RF input level; see `[SENSe:]EPOWer:VALue`. The setting has effect for trigger source `RFPower` only (see `TRIG:SEQ:SOUR`).				

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	V3.22

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:]EPOWer:VALue`. 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	–	V3.22

Command description

This command qualifies whether the trigger event occurs on the *Rising Edge* or on the *Falling Edge* of the trigger signal. The setting has no influence on *Free Run* measurements (see `TRIG:SEQ:SOUR`).

TRIGger:OUTPut:PIN<nr>:SIGNal <*Signal*> — Output Trigger Signal

<Signal>	Parameter description	Def. value	Default unit	FW vers.
NONE | FCL	No trigger signal or frame trigger at pin <nr>	FCL (for <nr> = 2, 3), NONE (for <nr> = 4, 5)	–	V3.10

Command description

This command assigns the frame trigger signal (or no signal) to pins 2 to 5 (<nr> = 2 to 5) of the AUX 3 connector. The settings are only valid for *Signalling* trigger source (command `TRIGger[:SEQuence]:SOURce SIGNalling`).

TRIGger:OUTPut:PIN<nr>:DELay:ENABle <*Enable*> — Output Trigger Signal

<Enable>	Parameter description	Def. value	Default unit	FW vers.
ON | OFF	Enable delay at pin 2	OFF (for <nr> = 2, 4, 5) ON (for <nr> = 3)	–	V3.10

Command description

This command qualifies whether the frame trigger signal at pins 2 to 5 (<nr> = 2 to 5) of the AUX 3 connector is delayed by the specified delay time (see command `TRIGger:OUTPut:DELay:VALue` below). The settings are only valid if a trigger signal is actually applied to the pins (command `TRIGger:OUTPut:PIN:SIGNal`).

TRIGger:OUTPut:DELay:VALue <*Slots*> — Delay

<Slots>	Parameter description	Def. value	Default unit	FW vers.
0 to 7	Delay time for frame trigger signal	2	(slots)	V3.10

Command description

This command sets a delay time (integer number of slots) for the trigger signal. 0 slots is equivalent to the *OFF* setting in the `TRIGger:OUTPut:PIN:DELay:ENABle` command.

DEFault:TRIGger[:SEQuence] <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	–	V2.80
Description of command				Sig. State
If used with *ON*, this command sets all the parameters of the subsystem to their default values (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.				all

Connection – Subsystem SIGNalling (Call Setup and Cleardown)

The subsystem *SIGNalling* controls the call setup and cleardown from the CMU to the BTS and determines the signalling parameters. Together with the subsystem *WPOWer* (see below) it corresponds to the four tabs *Connection* (for four different signalling states, see command `PROCedure:SIGNalling:ACTion`) in the popup menu *Connection Control*.

PROCedure:SIGNalling:ACTion *<Action>*				Connection Control
<Action>	Description of parameters	Def. value	Def. unit	FW vers.
SRUN | **SSTP |** **CCH |** **TCH |** **LUP |** **SLUP |** **RLUP |** **MOC |** **SMOC |** **RMOC |** **SCR |** **CREL**	Start synchronization Stop synchronization Switch to control channel Switch to traffic channel Location update Stop location update Retry location update MOC Stop MOC/MTC Retry MOC Stop call release Call release	–	–	V2.80
Description of command				Sig. State
This command has no query form and no default value. It changes between the different signalling states of the CMU.				See below

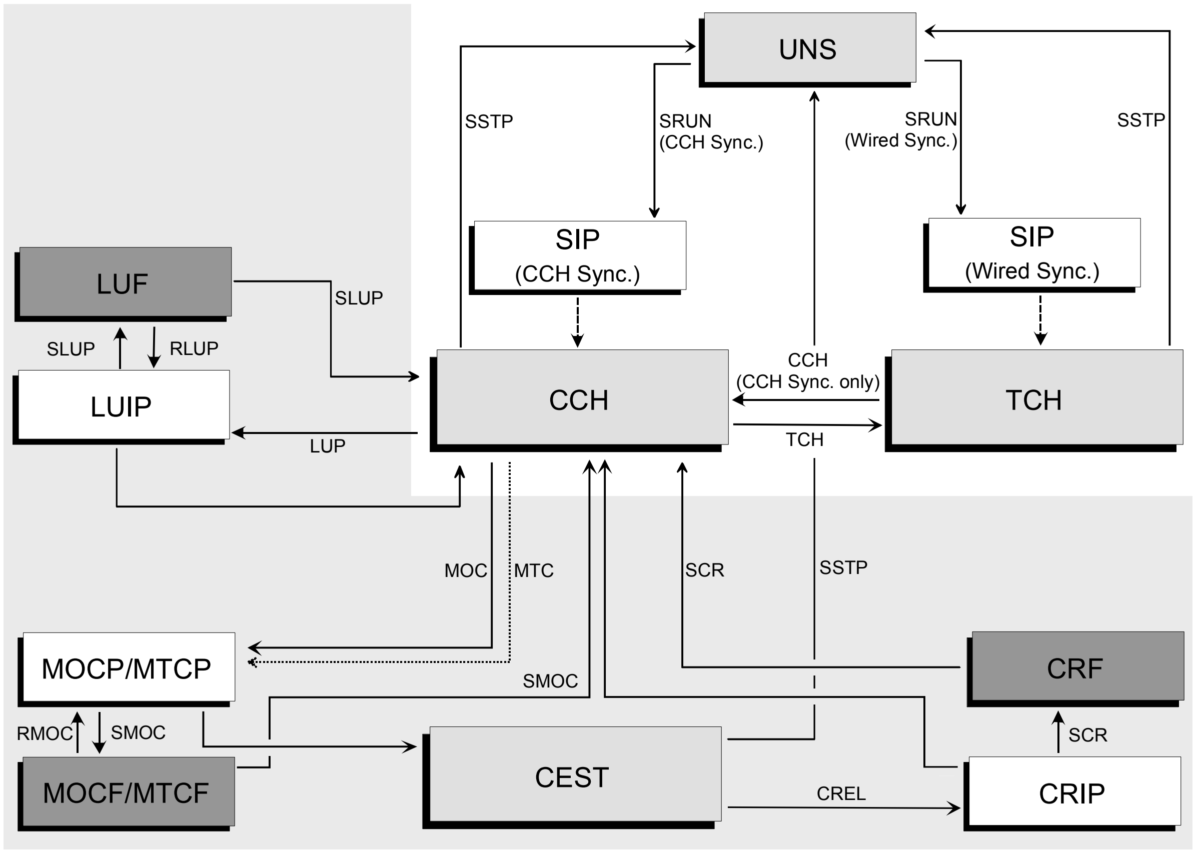


Fig. 6-1 Signalling states of the CMU

Actions: See description of command `PROCedure:SIGNalling:ACTion` above.

Signalling states: See description of command `[SENSe:]SIGNalling:STATe?` below.

Note: *The* CEST *state and all other states in the shaded area in Fig. 6-1 are available with option CMU-K39, MOC/MTC only.*

[SENSe:]SIGNalling:STATe?				Signalling State
Return	Description of parameters	Def. value	Def. unit	FW vers.
UNS |	Unsynchronized	UNS	–	V2.80
SIP |	synchronization in progress			
CCH |	synchronized, CCH Test			
TCH |	synchronized, TCH Test			
LUIP |	Location update in progress			
LUF	Location update failed			
CEST |	Call established			
CREL |	Call release			
CRIP |	Call release in progress			
CRF |	Call release failed			
MOCP	MOC in progress			
MOCF	MOC failed			
MTCP	MTC in progress			
MTCF	MTC failed			
Description of command				Sig. State
This command is always a query. It reads out the current signalling state.				all

CONFigure:SIGNalling:SMODe _<Mode>_				Sync. Mode
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
NUBCch | **NUETrg**	CCH Sync. No Location Update Wired Sync. (External Trigger)	NUBC	–	V2.80
Description of command				Sig. State
This command determines the synchronization mode. Depending on the synchronization mode, either the control channel number or the training sequence code must be defined for the synchronization signal.				UNS Q: all

Subsystem BSSignal (Signal of Base Station)

The subsystem *BSSignal* configures the control and traffic channels for the signals sent by the base station under test. It corresponds to the tab *BS Signal* in the popup menu *Connection Control*.

CONFigure:BSSignal:CCH:CHANnel _<ChannelNumber >_				CCH RF Chan.
<ChannelNumber>	Description of parameters	Def. value	Def. unit	FW vers.
259 to 340	Number of control channel, GSM400	261	–	V2.80
350 to 425	Number of control channel, GSM GT800	362		
128 to 251	Number of control channel, GSM850	162		
0 to 124 | 955 to 1023	Number of control channel, GSM900	32		
512 to 885	Number of control channel, GSM1800	606		
512 to 810	Number of control channel, GSM1900	586		
Description of command				Sig. State
This command defines the control channel number (and thus the frequency) of the signal which the base station transmits for synchronization.				UNS Q: all

CONFigure:BSSignal:TCH:CHANnel _<ChannelNumber >_				TCH RF Chan.
<ChannelNumber>	Description of parameters	Def. value	Def. unit	FW vers.
259 to 340	Number of traffic channel, GSM400	291	–	V2.80
350 to 425	Number of traffic channel, GSM GT800	392		
128 to 251	Number of traffic channel, GSM850	192		
0 to 124 | 955 to 1023	Number of traffic channel, GSM900	62		
512 to 885	Number of traffic channel, GSM1800	696		
512 to 810	Number of traffic channel, GSM1900	661		
Description of command				Sig. State
This command determines the traffic channel number (and thus the frequency) for the BTS traffic channel signal.				≠ CEST Q: all

[SENSe:]BSSignal:TCH:CHANnel[:CESTablished]?				TCH RF Chan.
Returned value	Description of parameters	Def. value	Def. unit	FW vers.
259 to 340 **350 to 425** **128 to 251** **0 to 124 | 955 to 1023** **512 to 885** **512 to 810**	Number of traffic channel, GSM400 Number of traffic channel, GSM GT800 Number of traffic channel, GSM850 Number of traffic channel, GSM900 Number of traffic channel, GSM1800 Number of traffic channel, GSM1900	NAN NAN NAN NAN NAN NAN	–	V2.80
Description of command				Sig. State
This command is always a query. In the *Call Established* signalling state, it queries the traffic channel number (and thus the frequency) for the BTS traffic channel signal.				CEST

CONFigure:BSSignal:TCH:TIMeslot <*Timeslot*>				TCH Timeslot
<Timeslot>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7	Timeslot of traffic channel	3	–	V2.80
Description of command				Sig. State
This command determines the traffic channel timeslot for the BTS traffic channel signal.				≠ CEST Q: all

[SENSe:]BSSignal:TCH:TIMeslot[:CESTablished]?				TCH Timeslot
Returned value	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7	Timeslot of traffic channel	3	–	V2.80
Description of command				Sig. State
This command is always a query. In the *Call Established* signalling state, it queries the traffic channel timeslot for the BTS traffic channel signal.				CEST

CONFigure:BSSignal:TCH:CHTYpe <*Type*>				Channel Type
<Type>	Description of parameters	Def. value	Def. unit	FW vers.
FRATe |	Standard full rate speech coding	FRAT	–	V2.80
EFRate |	Enhanced full rate speech coding			
E432 |	TCH Edge 432			
HRATe |	TCH half rate speech coding			
FD144 |	Full rate data 14400 Baud			
FD96 |	Full rate data 9600 Baud			
FD48 |	Full rate data 4800 Baud			
HD48 |	Half rate data 4800 Baud			
HD24 |	Half rate data 2400 Baud			
EGC1	Extended full rate data (EDGE) at 43 200 baud			V2.82
CS1 |	GPRS coding scheme 1 (CS-1)			
...	...			
CS4 |	GPRS coding scheme 4 (CS-4)			
MCS1 |	EGPRS modulation and coding scheme 1 (MCS-1)			
...	...			
MCS9 |	EGPRS modulation and coding scheme 9 (MCS-9)			
AMRH |	Adaptive Multi-Rate (AMR) half rate (option CMU-K37)			V3.65
AMRF	Adaptive Multi-Rate (AMR) full rate (option CMU-K37)			
Description of command				Sig. State
This command determines the speech coding and transmission rate in the traffic channel.				all

[SENSe:]BSSignal:TCH:CHTYpe[:CESTablished]?				Channel Type
Returned value	Description of parameters	Def. value	Def. unit	FW vers.
FRATe |	Standard full rate speech coding	FRAT	–	V2.80
EFRate |	Enhanced full rate speech coding			
E432 |	TCH Edge 432			
HRATe |	TCH half rate speech coding			
FD144 |	Full rate data 14400 Baud			
FD96 |	Full rate data 9600 Baud			
FD48 |	Full rate data 4800 Baud			
HD48 |	Half rate data 4800 Baud			
HD24 |	Half rate data 2400 Baud			
EGC1	Extended full rate data (EDGE) at 43 200 baud			V2.82
CS1 |	GPRS coding scheme 1 (CS-1)			
...	...			
CS4 |	GPRS coding scheme 4 (CS-4)			
MCS1 |	EGPRS modulation and coding scheme 1 (MCS-1)			
...	...			
MCS9 |	EGPRS modulation and coding scheme 9 (MCS-9)			
AMRH |	Adaptive Multi-Rate (AMR) half rate (option CMU-K37)			V3.65
AMRF	Adaptive Multi-Rate (AMR) full rate (option CMU-K37)			
Description of command				Sig. State
This command is always a query. In the *Call Established* signalling state, it queries the speech coding and transmission rate for the BTS traffic channel signal.				CEST

CONFigure:BSSignal:TCH:PSCHeme <*PS_1*>, ... <*PS_12*>				Puncturing Scheme
Parameters	Description of parameters	Def. value	Def. unit	FW vers.
P1 | P2, **P1 | P2,** **P1 | P2 | P3,** **P1 | P2 | P3,** **P1 | P2,** **P1 | P2,** **P1 | P2 | P3,** **P1 | P2 | P3,** **P1 | P2 | P3,** **P1 | P2 | P3,** **P1 | P2 | P3,** **P1 | P2 | P3**	Puncturing scheme for MCS-1 Puncturing scheme for MCS-2 Puncturing scheme for MCS-3 Puncturing scheme for MCS-4 Puncturing scheme for MCS-5 Puncturing scheme for MCS-6 Puncturing scheme for MCS-7 block 1 Puncturing scheme for MCS-7 block 2 Puncturing scheme for MCS-8 block 1 Puncturing scheme for MCS-8 block 2 Puncturing scheme for MCS-9 block 1 Puncturing scheme for MCS-9 block 2	P1	–	V3.65
Description of command				Sig. State
This command selects the EGPRS puncturing scheme for packet data channels.				all

CONFigure:BSSignal:TCH:TSEQuence <*Sequence*>				Training Sequence
<Sequence>	Description of parameters	Def. value	Def. unit	FW vers.
GSM0 to GSM7	Training sequence of traffic channel	GSM0	–	V2.80
Description of command				Sig. State
This command determines the training sequence in the BTS traffic channel signal. It is avaliable for wired synchronization only, see command `CONFigure:SIGNalling:SMODe NUETrg`.				UNS Q: all

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 Some or all parameters differ from the default values	ON	–	V2.80
Description of command				Sig. State
If used with *ON*, this command sets all the parameters of the subsystem to their default values (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.				all

Slow Frequency Hopping – Remote Control

In the *Call Established* state, the frequency hopping mode of the BTS and the CMU under test can be queried with the following command.

[SENSe:]BSSignal:TCH:CHANnel[:CESTablished]:HOPPing?				Frequeny Hopping State
Returned values	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The BTS and the CMU use slow frequency hopping Transmission at a fixed frequency	OFF	–	2.94
Description of command				Sig. State
This command queries the frequency hopping mode of the CMU and the BTS under test.				CEST

Connection – INFO

The subsystem *INFO* contains the commands for the frame timing and the network data. It corresponds to the *Signalling Info* table in the *Connection (synchronized)* tab.

[SENSe:]INFO:FTIMing:MULTiframe? <*Frame*>				Multiframe
<Frame>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 25	Multiframe	NAN	–	V2.80
Description of command				Sig. State
This command is always a query. It reads the multiframe currently transmitted by the base station.				CCH[4]

[SENSe:]INFO:FTIMing:SUPerframe? <*Frame* >				Superframe
< Frame >	Description of parameters	Def. value	Def. unit	FW vers.
0 to 2047	Superframe	NAN	–	V2.80
Description of command				Sig. State
This command is always a query. It reads the superframe currently transmitted by the base station.				CCH[4]

[SENSe:]INFO:NWData:MCC? <*Code*>				Network Data - MCC
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 999	Mobile Country Code	NAN	–	V2.80
Description of command				Sig. State
This command is always a query. It reads the Mobile Country Code.				CCH

[SENSe:]INFO:NWData:MNC? <*Code*>				Network Data - MNC
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 99	Mobile Network Code	NAN	–	V2.80
Description of command				Sig. State
This command is always a query. It reads the Mobile Network Code.				CCH

[SENSe:]INFO:NWData:BSIC? <*Id*>				Network Data – BSIC
<Id>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 63	Base Station Identification Code	NAN	–	V2.80
Description of command				Sig. State
This command is always a query. It reads the Base Station Identification Code.				CCH

[SENSe:]INFO:NWData:LOCation:AREA? <*Area*>				Network Data – Location Area
<Area>	Description of parameters	Def. Value	Def. unit	FW vers.
0 to 999	Location Area Code	NAN	–	V2.80
Description of command				Sig. State
This command is always a query. It reads the Location Area Code.				CCH

[4] The frame counters are active in signalling state *CCH* and with CCHchronization mode *No Location Update CCH Sync.* only; see command `CONFigure:SIGNalling:SMODe NUBCch`.

[SENSe:]INFO:NWData:LOCation:UPDate? <*State*>				Location Update
<State>	Description of parameters	Def. value	Def. unit	FW vers.
PERFormed | NPERformed	Update flag of the location area	NPER	–	V2.80
Description of command				Sig. State
This command is always a query. It reads the update flag of the location area.				CCH

[SENSe:]INFO:SACChinfo:REQuested:POWer? <*Power*>				Requested Power
<Power>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 31	Transmission Power Level requested by the base station	NAN	–	V2.80
Description of command				Sig. State
This command is always a query. It reads the transmission power level as requested by the base station.				TCH

[SENSe:]INFO:SACChinfo:REQuested:TIMing? <*bit*>				Requested Timing
<bit>	Description of parameters	Def. value	Def. unit	FW vers.
0 bit to 63 bit	Timing requested by the base station	NAN	bit	V2.80
Description of command				Sig. State
This command is always a query. It reads the timing as requested by the base station.				TCH

Connection – Subsystem MSSignal (Signal Parameters)

The subsystem *MSSignal* controls the (re)transmission parameters and the signals of the CMU. It corresponds to the tabs *MS Signal* (for different signalling states, see command `PROCedure:SIGNalling:ACTion`) in the popup menu *Connection Control*.

CONFigure:MSSignal:BITStream <*Mode*>				Bit Stream
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
LOOP | **ECHO |** **PR9 |** **PR11 |** **PR15 |** **PR16 |** **LBBB** **HAND**	Loop-back with delay Loop-back with minimum delay Pseudo random sequences Loop burst by burst Bit pattern generated on the speech codec	ECHO	–	V2.80
Description of command				Sig. State
This command defines the data transmitted in the traffic channel. In a *Receiver Quality* (BER) measurement an independent bit stream is used; see command `CONFigure:RXQuality:CONTrol:BITStream`.				all

CONFigure:MSSignal:TXTiming <*Delay*>				Transmit Timing
<Delay>	Description of parameters	Def. value	Def. unit	FW vers.
–64/4 bit to +64/4 bit	Transmit timing delay in ¼ bit units	0	¼ bit	V2.80
Description of command				Sig. State
This command sets the delay time between the start of the timeslot and the actual transmission of the burst.				all

CONFigure:MSSignal:SDRearrange <*Enable*>				Speech Data Rearrangement
<Channel>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable speech data rearrangement	OFF	–	V3.22
Description of command				Sig. State
This command enables or disables rearrangement of the transmitted and received speech data.				UNS, Q: all

CONFigure:MSSignal:LEVel:UTIMeslot <*Level*>				RF Level
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–137 dBm to –27 dBm **–137 dBm to –10 dBm** **–90 dBm to +13 dBm**	Used timeslot level, ouput RF1 Used timeslot level, ouput RF2 Used timeslot level, ouput RF3 OUT	–80	dBm	V2.80
Description of command				Sig. State
This command determines the RF level in the used timeslot of the CMU traffic and control channel signal.				all

CONFigure:MSSignal:LEVel:UNTimeslot *<Level>*				RF Level
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–127 dB to +127 dB	Unused timeslot level, ouput RF1	–20	dB	–
–127 dB to +127 dB	Unused timeslot level, ouput RF2	–20	dB	–
–127 dB to +127 dB	Unused timeslot level, ouput RF3 OUT	–10	dB	V2.80
Description of command				Sig. State
This command determines the RF level in the unused timeslots relative to the used timeslot level of the CMU traffic and control channel signal. The level range quoted above is restricted by the condition that the absolute level (calculated from the used timeslot level and the relative level in the unused timeslots) must not exceed the level ranges of the RF connectors. **Example:** With output connector RF2 and a default used timeslot level of –80 dBm, the unused timeslot level can be set in the range –57 dB to +70 dB, corresponding to an absolute level of –137 dBm to –10 dBm.				all

CONFigure:MSSignal:DSPacing:CHANnel *<Channel>*				TCH RF Channel
<Channel>	Description of parameters	Def. value	Def. unit	FW vers.
259 to 293, 306 to 340	Downlink channel for GSM400	291	–	V3.07
350 to 425	Downlink channel for GSM GT800	392	–	
128 to 251	Downlink channel for GSM850	192	–	
0 to 124; 955 to 1023	Downlink channel for GSM900	62	–	
512 to 885	Downlink channel for GSM1800	696	–	
512 to 810	Downlink channel for GSM1900	661	–	
Description of command				Sig. State
This command sets the downlink channel used by the CMU if the duplex spacing (see command `CONFigure:MSSignal:DSPacing:NORMal:ENABle` and GSM channel tables in chapter 4) is switched off. If the duplex spacing is on, this setting is disabled because the *TCH RF Channel* is assigned by the network/BTS under test.				all

CONFigure:MSSignal:DSPacing:NORMal:ENABle *<Enable>*				Duplex Spacing On/Off
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	Duplex spacing according to GSM specifications	ON	–	V3.07
OFF	CMU uses downlink frequencies			
Description of command				Sig. State
This command switches the duplex spacing between uplink and downlink frequencies on or off.				all

DEFault:MSSignal *<Enable>*				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	All parameters are set to their default values	ON	–	V2.80
OFF	Some or all parameters differ from the default values			
Description of command				Sig. State
If used with *ON*, this command sets all the parameters of the subsystem to their default values (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.				all

Forced Frequency Hopping

The subsystem `MSSignal:FHOPPing` defines the forced hopping parameters of the CMU. It corresponds to the *Forced Hopping* section in the *MS Signal* tab of the *Connection Control* menu.

CONFigure:MSSignal:FHOPping:ENABle <*Enable*>				Enable Forced Hopping
<Channel>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable forced hopping	OFF	–	V2.84
Description of command				Sig. State
This command switches forced hopping of the CMU in the *TCH Test* state on or off.				UNS, CCH Q: all

CONFigure:MSSignal:FHOPping:MAIO <*Number*>				MAIO
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 63	Mobile Allocation Index Offset (MAIO)	0	–	V2.84
Description of command				Sig. State
This command defines the MAIO that the CMU uses to calculate the radio frequency channel for each TDMA frame.				UNS, CCH Q: all

CONFigure:MSSignal:FHOPping:A <*Channel*>*{,<Channel>}*				Hopping Sequence List
<Channel>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 124, 955 to 1023 | OFF	Sequence of up to 64 GSM channels, depending on the GSM band used (example: GSM900), undefined channel number	see below	–	V2.84
Description of command				Sig. State
These commands define the hopping sequence to be used for forced frequency hopping. The following default sequences are available: **GSM400** 259, 300, 340, OFF, ... OFF **GSM850** 350, 352, 355, OFF, … OFF **GSM850** 128, 190, 251, OFF, ... OFF **GSM900** 1, 63, 124, OFF, ... OFF **GSM1800** 512,699, 885, OFF, ... OFF **GSM1900** 512,661, 810, OFF, ... OFF				UNS, CCH Q: all

UL CCH BER

The subsystem `MSSignal:ULCBer` defines the parameters for the uplink CCH BER test (with option R&S CMU-K38). It corresponds to the *UL CCH BER* section in the *MS Signal* tab of the *Connection Control* menu.

CONFigure:MSSignal:ULCBer:ENABle *<Enable>*				Enable UL CCH
<Channel>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable UL CCH	OFF	–	V3.22
Description of command				Sig. State
This command switches the UL CCHs on or off. ***Note:*** *The CCHs must be switched on in the UNS state but are transmitted in the TCH (Traffic Channel Test) state.*				UNS, Q: all

CONFigure:MSSignal:ULCBer:CHType *<Type>*				CCH Channel Type
<Type>	Description of parameters	Def. value	Def. unit	FW vers.
SDC4 | **SDC8 |** **FACF |** **SAC**	SDCCH/4 SDCCH/8 FACCH/F SACCH	SDC4	–	V3.22
Description of command				Sig. State
This command selects the UL control channel type that the CMU generates for the CCH BER test.				UNS, Q: all

CONFigure:MSSignal:ULCBer:BITStream *<Pattern>*				CCH Bit Stream
<Pattern>	Description of parameters	Def. value	Def. unit	FW vers.
PR9 | **PR11 |** **PR15 |** **PR16**	PSR 2E9-1 pseudo random bit sequence PSR 2E11-1 PSR 2E15-1 PSR 2E16-1	PR9	–	V3.22
Description of command				Sig. State
This command selects the data transmitted on the control channel for the CCH BER test.				UNS, Q: all

Subsystem NETWork (with Option CMU-K39 only)

The subsystem *NETWork* determines the parameters of the radio network and the existing radio link. The subsystem corresponds to the *Network* tab in the *Connection Control* menu.

DEFault:NETWork <*Enable*>		Network – 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	–	V2.80
Description of command				Sig. State
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.				UNS, CCH Q.: all

Subsystem NETWork[:MS] (Mobile settings)

The subsystem *NETWork[:MS]* defines the mobile parameters. The subsystem corresponds to the table field *Mobile Settings* in the popup menu *Network*.

CONFigure:NETWork[:MS]:AUTohookoff <*Time*>		Auto Hook Off		
<*Time*>	Description of parameters	Def. value	Def. unit	FW vers.
1.0 s to 100.0 s	Alerting time at the CMU	1.0	s	V2.80
Description of command				Sig. State
This command sets the time until the CMU accepts a call from the mobile station (equivalent to the time after which a mobile is picked up).				UNS, CCH Q.: all

DEFault:NETWork[:MS]:ATADjust <*Enable*>		Auto Timing Adjust		
<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	CMU is synchronized to the requested timing CMU ignores the requested timing	ON	–	V3.25
Description of command				Sig. State
This command enables or disables synchronization of the CMU to the requested timing that the BTS provides in its SACCH header information.				UNS, CCH Q.: all

Subsystem NETWork:SUBScriberid

The subsystem *NETWork:SUBScriberid* gives information on the identity of the mobile. The subsystem corresponds to the table field *Network Subscriber Identity* in the *Network* tab.

CONFigure:NETWork:SUBScriberid:SCPin <*PIN*>				PIN of the SIM card
<PIN>	Description of parameters	Def. value	Def. unit	FW vers.
"0" to "9999"	PIN of SIM card (string parameter)	"1122"	–	V2.80
Description of command				Sig. State
This command determines the PIN of the SIM card.				UNS, CCH Q.: all

CONFigure:NETWork:SUBScriberid:IMEI <*IMEI*>				International Mobile Station Equipment Identity
<IMEI>	Description of parameters	Def. value	Def. unit	FW vers.
Format: "xxxxxx.xx.xxxxxx.x"	15-digit IMEI (string parameter)	"123456.78.901234.5"	–	V2.80
Description of command				Sig. State
This command determines the international mobile station equipment identity (IMEI). A dot may be inserted after the 6th, 8th and 14th digit (but then at all three positions).				UNS, CCH Q.: all

CONFigure:NETWork:SUBScriberid:IMSI <*IMSI*>				International Mobie Subscriber Identity *(IMSI)*
<IMSI>	Description of parameters	Def. value	Def. unit	FW vers.
Format: GSM400/GT800/900/1800: "xxx.xx.xxxxxxxxxx" GSM850/1900: "xxx.xxx.xxxxxxxxx"	IMSI (string parameter)	"123.45.678901 2345"	–	V2.80
Description of command				Sig. State
This command determines the international mobile subscriber identity *(IMSI).* In GSM400, GSM GT800, GSM900, GSM1800 and UIC networks, the IMSI should consist of 6 to 15 digits. A dot may be inserted after the 3rd and 5th digit (but then at both positions). With GSM850 and GSM1900 the minimum length is 7 digits and dots may be inserted after the 3rd and 6th digit.				UNS, CCH Q.: all

CONFigure:NETWork:SUBScriberid:DNUMber <*Number*>				Dialled Number
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
"max. 20 digits"	Dialled number (string parameter)	"1234567890123 456789"	–	V2.80
Description of command				Sig. State
This command determines the dialled number.				UNS, CCH Q.: all

Subsystem NETWork:MREPort (Measurement Report)

The subsystem *NETWork:MREPort* determines parameters for the received signal. The subsystem corresponds to the table field *Measurement Report* in the *Network* tab.

CONFigure:NETWork:MREPort:MODE <*Mode*>		Measurement Report – Mode		
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
MANual |	CMU transmits preset values for RX Level and RX Quality to the base station	MAN	–	V2.80
RXQualauto |	CMU transmits a preset RX Level plus the corresponding RX Quality from the table *RX Quality at RX Level*.			
AUTomatic	CMU transmits the measured RX Level plus the corresponding RX Quality from the table *RX Quality at RX Level*.			
Description of command				Sig. State
This command selects the mode of configuring the measurement report. The preset values for RX Level and RX Quality are defined by means of the commands `CONFigure:NETWork:MREPort:MANual:RXLevel` and `...MANual:RXQual;` see below. The table *RX Quality at RX Level* is defined via `CONFigure:NETWork:MREPort:AUTO:RXLQ`.				UNS, CCH Q.: all

CONFigure:NETWork:MREPort:MANual:RXLevel <*Level*>		RX Level (Manual)		
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 63	RX Level for manual measurement report	20	–	V2.80
Description of command				Sig. State
This command determines the RX Level which is transmitted to the base station in `MANual` mode.				UNS, CCH Q.: all

CONFigure:NETWork:MREPort:MANUal:RXQuality <*Quality*>		RX Quality (Manual)		
<Quality>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7	RX Quality for manual measurement report	0	–	V2.80
Description of command				Sig. State
This command determines the RX Quality which is transmitted to the base station in `MANual` mode.				UNS, CCH Q.: all

CONFigure:NETWork:MREPort:AUTO:RXLevel <*Level*>		RX Level (Auto RX Qual)		
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 63	RX Level for auto RX Quality measurement report	63	–	V2.80
Description of command				Sig. State
This command determines the RX Level which is transmitted to the base station in `RXQualauto` mode. The corresponding RX Quality value is selected from the *RX Quality at RX Level* table defined via `CONFigure:NETWork:MREPort: AUTO:RXLQ`.				UNS, CCH Q.: all

CONFigure:NETWork:MREPort:AUTO:RXOFfset <*Offset*>		Offset (Auto RX Level and RX Qual)		
<Offset>	Description of parameters	Def. value	Def. unit	FW vers.
-200 dB to 100 dB	Offset added to the measured RX Level	–50	dB	V2.80
Description of command				Sig. State
This command determines the Offset which is added to the measured RX Level in `AUTomatic` mode. The result is transmitted to the base station and is also used to select the corresponding RX Quality value from the *RX Quality at RX Level* table defined via `CONFigure:NETWork:MREPort:AUTO:RXLQ`.				UNS, CCH Q.: all

CONFigure:NETWork:MREPort:AUTO:RXLQ *<RxLevel_1>, ..., <RxLevel_7>*		RX Quality at RX Level		
<RxLevel_n>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 63,	RX Level corresponding to 0.2% < RX Quality ≤ 0.4%	11	–	V2.80
1 to 63,	RX Level corresponding to 0.4% < RX Quality ≤ 0.8%	10		
1 to 63,	RX Level corresponding to 0.8% < RX Quality ≤ 1.6%	9		
1 to 63,	RX Level corresponding to 1.6% < RX Quality ≤ 3.2%	8		
1 to 63,	RX Level corresponding to 3.2% < RX Quality ≤ 6.4%	7		
1 to 63,	RX Level corresponding to 6.4% < RX Quality ≤ 12.8%	6		
1 to 63	RX Level corresponding to RX Quality > 12.8%	5		
Description of command				Sig. State
This command defines the *RX Quality at RX Level* table values which is used in `RXQUalauto` and `AUTomatic` mode.				UNS, CCH Q.: all

Subsystem for RF Input and Output Connectors

The following commands configure the RF input and output connectors. The commands 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	Connector RF1 used as input	RF2	–	V2.80
RF2	Connector RF2 used as input			
RF4	Connector RF4 IN used as input			
Description of command				Sig. State
This command determines the connector to be used for incoming RF signals. The bidirectional connectors RF 1 and RF 2 can be used both as input and output connectors in the very same measurement (see `OUTPut[:STATe]`). When changing to a different subsystem (other band or changing from Signalling to Non-Signalling), the connector settings of the new subsystem are activated.				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	–	V2.80
Description of command				Sig. State
This command determines the connector to be used for outgoing RF signals. The bidirectional connectors RF 1 and RF 2 can be used both as input and output connectors in the very same measurement. When changing to a different subsystem (other band or changing from Signalling to Non-Signalling), the connector settings of the new subsystem are activated.				all

[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude] <*Attenuation* > **SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude] <*Attenuation* >**				Ext. Att. Input
<Attenuation>	Description of parameters	Def. value	Def. unit	FW vers.
–50 dB to +90 dB	Value for external attenuation at Input<nr>, where <nr> = 1,2,4	0	dB	V2.80
Description of command				Sig. State
This command assigns an external attenuation value to one of the inputs defined before (see command `INPut:STATe`).				all

[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude] <*Attenuation*> **SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude] <*Attenuation*>**				Ext. Att. Output
<Attenuation>	Description of parameters	Def. value	Def. unit	FW vers.
–50 dB to +90 dB	Value for external attenuation at Output<nr>, where <nr> = 1,2,3	0	dB	V2.80
Description of command				Sig. State
This command assigns an external attenuation value to one of the outputs defined before (see command `OUTPut:STATe`).				all

Subsystem DM:CLOCk (Clock Frequency)

The subsystem *DM:CLOCk* sets the network-specific clock frequency. The subsystem corresponds to the *REF OUT 2* softkey in the *Sync.* tab of the popup menu *Connection Control*.

SOURce:DM:CLOCk:STATe <*Mode*>				REF OUT 2
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Switching the clock signal on/off	OFF	–	V2.80
Description of command				Sig. State
This command switches the network-specific 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.
1.2190 MHz to 39.000 MHz	Input value for reference frequency	13.000	MHz	V2.80
Description of command				Sig. State
This command defines the clock frequency applied to output *REF OUT 2*. The frequency entered is rounded to one of the following discrete values: 39.000 MHz, 19.500 MHz, 13.000 MHz, 9.750 MHz, 7.800 MHz, 6.500 MHz, 5.571 MHz, 4.875 MHz, 4.333 MHz, 3.900 MHz, 3.545 MHz, 3.250 MHz, 3.000 MHz, 2.786 MHz, 2.600 MHz, 2.438 MHz, 2.294 MHz, 2.166 MHz, 2.053 MHz, 1.950 MHz, 1.857 MHz, 1.773 MHz, 1.696 MHz, 1.625 MHz, 1.560 MHz, 1.500 MHz, 1.444 MHz, 1.393 MHz, 1.349 MHz, 1.300 MHz, 1.258 MHz, 1.219 MHz				all

Subsystem EXTernal:TRIGger (External Trigger Input)

The subsystem *EXTernal:TRIGger* configures the *External Trigger* synchronization mode (see command `CONFigure:SIGNalling:SMODe NUEtrg` on page 6.106; the *EXTernal:TRIGger* commands are not effective in the other synchronization modes). The subsystem corresponds to the *External Trigger Input* panel of the *Synch.* tab in the popup menu *Connection Control*.

CONFigure:EXTernal[:TRIGger][:INPut]:POLarity *<Polarity>*				Polarity
<Polarity>	Description of parameters	Def. value	Def. unit	FW vers.
RISing | FALLing	Synchronization triggered by rising or falling edge of external trigger signal.	RIS	–	V2.80
Description of command				Sig. State
This command defines the polarity of the external trigger.				UNS Q: all

CONFigure:EXTernal[:TRIGger][:INPut]:SOFFset *<Offset>*				Slot Offset
<Offset>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 256	Delay time for TCH signal, no. of timeslots	0	Slots	V2.80
Description of command				Sig. State
This command defines a number of timeslots by which the TX TCH signal of the CMU is shifted relative to the external trigger signal. This delay time can be further modified by the `CONFigure:EXTernal[:TRIGger][:INPut]: BITDelay` command; see below.				UNS Q: all

CONFigure:EXTernal[:TRIGger][:INPut]:BITDelay *<Offset>*				¼ bit Delay
<Offset>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 624	Delay time, ¼ bit periods	0	¼ bit	V2.80
Description of command				Sig. State
This command defines a delay time in ¼ bit units by which the TX TCH signal of the CMU is shifted relative to the external trigger signal. This delay time is added to the slot offset defined by the `CONFigure:EXTernal :TRIGger:INPut: SOFFset` command; see above.				UNS Q: all

Abis Interface – Subsystem ABIS

The subsystem *ABIS* configures the Abis interface of the CMU. It corresponds to the *Abis* tab in the popup menu *Connect. Control*.

CONFigure:ABIS:IMODe <*Mode*>				Interface Mode
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
E1DF | **E1CRc4mf |** **T1SF |** **T1ESf |** **T1CRc6esf**	Double frame CRC4 multiframe Standard frame Extended standard frame CRC6 extended standard frame	E1CR	–	V2.82
Description of command				Sig. State
This command selects one of the supported Abis link protocols.				all

CONFigure:ABIS:TTYPe <*Type*>				Traffic Type
<Type>	Description of parameters	Def. value	Def. unit	FW vers.
TTFR | **TTEFr |** **TTHR |** **TF14 |** **TF96 |** **TF48**	Standard full rate speech coding Enhanced full rate speech coding Half rate speech coding Full rate data with a transmission rate of 14 400 baud Full rate data with a transmission rate of 9 600 baud Half rate or full rate data with a transmission rate of 4 800 baud	TTFR	–	V2.82
Description of command				Sig. State
This command selects the coding scheme and the transmission rate in the BTS traffic channel transferred via Abis interface.				all

CONFigure:ABIS:PCMTimeslot <*Slot_No*>				PCM Time Slot
<Slot_No>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 31	Time slot number	16	–	V2.82
Description of command				Sig. State
This command selects the timeslot for the PCM (Pulse Code Modulation) traffic channel signal. The range of time slot numbers is restricted to 1 to 24 if a T1 link protocol is selected; see `CONFigure:ABIS:IMODe` command.				all

CONFigure:ABIS:TSBitno <*Bit_No*>				Time Slot Bit No.
<Bit_No>	Description of parameters	Def. value	Def. unit	FW vers.
BN01 | BN23 | BN45 | BN67 | **BNR0 to BNR7**	Time slot pair for full rate channels Time slot for half rate channels	BN01	–	V2.82
Description of command				Sig. State
This command selects the bit numbers within the PCM timeslot that define a full rate or half rate channel; see `CONFigure:ABIS:TTYPe` command.				all

CONFigure:ABIS:STARtvalues:PCMTimeslot <*Slot_No*>		Start Values: PCM Time Slot		
<Slot_No>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 31	Time slot number	16	–	V2.82
Description of command				Sig. State
This command sets a start value for the *PCM Time Slot*. The scan routine (see section *Scan – Subsystem ABIS:SCAN* on page 6.123) searches from the *PCM Time Slot* defined with the *Start Values* softkey upwards.				all

CONFigure:ABIS:STARtvalues:SUBChannel <*Type*>		Start Values: Sub Channel		
<Type>	Description of parameters	Def. value	Def. unit	FW vers.
S16K | **S8K |** **S168**	Full rate sub channel (data rate 16 kbit/s) Half rate sub channel (data rate 8 kbit/s) Search for both sub channel types	S16K	–	V2.82
Description of command				Sig. State
This command defines whether the *Scan* (see section *Scan – Subsystem ABIS:SCAN* on page 6.123) searches for a full rate or half rate sub channel.				all

Scan – Subsystem ABIS:SCAN

The subsystem *ABIS:SCAN* controls the automatic search for the sub channel times slot and bit number on the Abis interface. It corresponds to the Scan softkey in the *Abis* tab of the popup menu *Connect. Control*. The results of the scan can be queried by means of the commands `CONFigure:ABIS:PCMTimeslot` and `CONFigure:ABIS:TSBitno`.

INITiate:ABIS:SCAN **ABORt:ABIS:SCAN**	Start scan, reserve resources Switch off scan, release resources	⇒ *RUN* ⇒ *OFF*
Description of command		FW vers.
These commands have no query form. They start and stop the scan, setting it to the status given in the top right column.		V2.82

FETCh:ABIS:SCAN:STATus?		Scan Status		
Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **ERR**	Scan switched off (`ABORt` or `*RST`) Running (`INITiate`) Switched off (could not be started)	OFF	–	V2.82
Description of command				
This command is always a query. It returns the current scan status.				

Alarm Monitor – Subsystem ABIS:ALARmmonitor

The subsystem *ABIS:ALARMMONITOR* controls the alarm monitor on the Abis interface. It corresponds to the *Alarm Monitor* softkey and the *Alarms* output table in the *Abis* tab of the popup menu *Connect. Control*.

INITiate:ABIS:ALARmmonitor	Start alarm monitor, reserve resources	⇒ *RUN*
ABORt:ABIS:ALARmmonitor	Switch off ALARmmonitor, release resources	⇒ *OFF*
Description of command		FW vers.
These commands have no query form. They start and stop the alarm monitor, setting it to the status given in the top right column.		V2.82

FETCh:ABIS:ALARmmonitor:STATus?				Alarm Monitor Status
Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **ERR**	Alarm monitor switched off (`ABORt` or `*RST`) Running (`INITiate`) Switched off (could not be started)	OFF	–	V2.82
Description of command				
This command is always a query. It returns the current status of the alarm monitor.				

[SENSe:]ABIS:ALARmmonitor?				Alarms
Returned values	Description of parameters	Def. value	Def. unit	FW vers.
NACT | ACT | NAPP,	Indicator for alarm type *No Signal*	NACT	–	V2.82
NACT | ACT | NAPP,	Indicator for alarm type *AIS*	NACT	–	
NACT | ACT | NAPP,	Indicator for alarm type *No Synchronization*	NACT	–	
NACT | ACT | NAPP	Indicator for alarm type *No CRC*	NACT	–	
Description of command				
This command is always a query. It returns the current result of the alarm monitor analysis. The three indicators show that an alarm event is not active *(NACT),* active *(ACT)* or not applicable *(NAPP,* this is returned for the alarm type *No CRC* if none of the CRC interface modes is active; see `CONFigure:ABIS:IMODe` command).				

WPOWer (Wide Band Power)

The subsystem *WPOWer* measures the power of the signal received from the base transceiver station using a wide band filter. It corresponds to the softkey *Power* of the tab *Connection* in the menu group *Connection Control*.

INITiate:WPOWer **ABORt:WPOWer** **STOP:WPOWer** **CONTinue:WPOWer**	Start new measurement Abort measurement and switch off Stop measurement Next measurement step (only *counting mode*)		⇒ *RUN* ⇒ *OFF* ⇒ *STOP* ⇒ *RUN*
Description of command		Sig. State	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.		all	V2.80

CONFigure:WPOWer: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 SOPC No reporting	OFF	–	V2.80
Description of command				Sig. State
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU operating manual).				all

FETCh:WPOWer:STATus?				Measurement Status
Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,** **1 to 10000 |** **NONE**	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 Counter for current statistics cycle No counting mode set	OFF NONE	– –	V2.80
Description of command				Sig. State
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).				all

CONFigure:WPOWer: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	
SOERror | 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	–	V2.80
Description of command				Sig. State
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.*				all

READ[:SCALar]:WPOWer? **FETCh[:SCALar]:WPOWer?** **SAMPle[:SCALar]:WPOWer?**	Start single shot measurement and return results Read out measurement results (unsynchronized) Read out measurement results (synchronized)			
Return	Description of parameters	Def. value	Def. unit	FW vers.
–100.0dBm to +53.0 dBm	Maximum burst power (not averaged)	NAN	dBm	V2.80
Description of command				Sig. State
These commands are always queries. They start the measurement of the maximum burst power of the signals transmitted by the base station (`READ...`) and output the result.				all

NPOWer

The subsystem *NPOWer* measures the power of the signal transmitted by the base station using the RF analyzer configuration of the *POWer* measurement. Compared to *WPOWer*, the *NPOWer* measurement uses a narrow-band (500 kHz Gauss) filter.

The narrow-band *NPOWer* measurement yields the average, maximum and minimum burst power of the current burst (display mode *Current)* and of the averaged measurement curve (display mode *Average)*. The entire measurement curves (arrays) are not available, and no limit check is performed. *NPOWer* is a quick and precise alternative to the *WPOWer* or *POWer* measurements if only scalar results are needed.

Note: *A* Free Run *trigger (*`TRIGger[:SEQuence]:SOURce FRUN`*) should be avoided because it delays the* `NPOWer` *measurement.*

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.		V3.07

CONFigure:NPOWer: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 SOPC 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 CMU200 operating manual).				

FETCh:NPOWer:STATus?				Measurement
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
	Counter for current statistics cycle			
1 to 10000 | **NONE**	No counting mode set	NONE	–	
	Counter for current evaluation period within a cycle			
1 to 1000 | **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 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 <*Statistics*>, <*Repetition*>,<*StopCond*>,<*Stepmode*>	Scope of Measurement			
<*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	–	V3.07
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	–	V3.07
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	–	V3.07
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.*				

Measured Values – Subsystem NPOWer?

The subsystem *NPOWer?* retrieves the results of the narrow-band power measurement.

READ[:SCALar]:NPOWer? **FETCh[:SCALar]:NPOWer?** **SAMPle[:SCALar]:NPOWer?**	Start single shot measurement and return results Read out measurement results (unsynchronized) Read out measurement results (synchronized)			
Returned values	Value range	Def. value	Def. unit	FW vers.
Avg. Power of Current Burst, **Min. Power of Current Burst,** **Max. Power of Current Burst,** **Avg. Power of Average Burst,** **Min. Power of Average Burst,** **Max. Power of Average Burst**	–137 dBm to +53 dBm –137 dBm to +53 dBm –137 dBm to +53 dBm –137 dBm to +53 dBm –137 dBm to +53 dBm –137 dBm to +53 dBm	NAN NAN NAN NAN NAN NAN	dBm dBm dBm dBm dBm dBm	V3.07
Description of command				
These commands are always queries. They start the *NPOWer* measurement and return the results.				

POWer

The subsystem *POWer* measures the signal power. The subsystem corresponds to the measurement menu *Power* and the associated popup menu *Power Configuration.* Depending on the signalling state, power measurements of the control channel (state *CCH Test (CCH))* or the traffic channel (state *TCH Test)* can be performed. The alternative keywords *CCH* or *TCH* in the command headers distinguish between these modes.

Important Note!

The keywords `:GMSK` and `:EPSK` in the remote control commands denote GMSK and 8PSK modulation, respectively. The `:EPSK` commands are available with option CMU-K41 only.

Measurement configurations are generally possible in all signalling states. However, to `INITiate`, `ABORt, STOP, CONTinue` a measurement, and to obtain measurement results, the command `PROCedure:SIGNalling:ACTion` must be used to access either the TCH Test *or* Call Established *mode (commands including the keyword `:TCH`; traffic channel tests) or the* CCH *mode (commands including the keyword `:CCH`; control channel tests).*

`:EPSK` measurements are available in the TCH *test mode only.*

Control of Measurement – Subsystem Power

The subsystem *POWer* contains the commands for general control of the power measurement.

INITiate:POWer:NBURst:GMSK:CCH **INITiate:POWer:NBURst:GMSK:TCH** **INITiate:POWer:NBURst:EPSK:TCH**	Start new measurement	⇒ *RUN*
ABORt:POWer:NBURst:GMSK:CCH **ABORt:POWer:NBURst:GMSK:TCH** **ABORt:POWer:NBURst:EPSK:TCH**	Abort running measurement and switch off	⇒ *OFF*
STOP:POWer:NBURst:GMSK:CCH **STOP:POWer:NBURst:GMSK:TCH** **STOP:POWer:NBURst:EPSK:TCH**	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:POWer:NBURst:GMSK:CCH **CONTinue:POWer:NBURst:GMSK:TCH** **CONTinue:POWer:NBURst:EPSK:TCH**	Next meas. step (only *stepping mode*)	⇒ *RUN*

Description of command	Sig. State	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.	CCH TCH CEST	V2.80

CONFigure:POWer:NBURst:GMSK:CCH:EREPorting <*Mode*> **CONFigure:POWer:NBURst:GMSK:TCH:EREPorting <*Mode*>** **CONFigure:POWer:NBURst:EPSK:TCH: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 SOPC No reporting	OFF	–	V2.80
Description of command				Sig. State
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU operating manual).				all

FETCh:POWer:NBURst:GMSK:CCH:STATus? **FETCh:POWer:NBURst:GMSK:TCH:STATus?** **FETCh:POWer:NBURst:EPSK:TCH: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	–	V2.80
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				Sig. State
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).				all

Subsystem POWer...:CONTrol

The subsystem *POWer:NBURst...:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* and *Statistics* tabs in the popup menu *Power Configuration.*

CONFigure:POWer:NBURst:GMSK:CCH:CONTrol <*Mode*>, <*Statistics*>, <*Repetition*>, <*StopCond*>, <*Stepmode*> **CONFigure:POWer:NBURst:GMSK:TCH:CONTrol <*Mode*>, <*Statistics*>, <*Repetition*>, <*StopCond*>, <*Stepmode*>** **CONFigure:POWer:NBURst:EPSK:TCH:CONTrol <*Mode*>, <*Statistics*>, <*Repetition*>, <*StopCond*>, <*Stepmode*>**	Scope of Measurement

<Mode>	Description of parameters	Def. value	Def. unit	
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	
<Statistics>	Description of parameters	Def. value	Def. unit	
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	
<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	
SOERror | **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	–	V2.80
Description of command				Sig. State
This command defines the scope of the power measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).				all

CONFigure:POWer:NBURst:GMSK:CCH:CONTrol:RMODe <*Mode*> Result Mode
CONFigure:POWer:NBURst:GMSK:TCH:CONTrol:RMODe <*Mode*>
CONFigure:POWer:NBURst:EPSK:TCH:CONTrol:RMODe <*Mode*>

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	V2.80
Description of command				Sig. State
This command specifies the type of measured values.				all

CONFigure:POWer:NBURst:GMSK:CCH:CONTrol:STATistics <*Statistics*> Statistics Count
CONFigure:POWer:NBURst:GMSK:TCH:CONTrol:STATistics <*Statistics*>
CONFigure:POWer:NBURst:EPSK:TCH:CONTrol:STATistics <*Statistics*>

<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	V2.80
Description of command				Sig. State
This command defines the number of bursts forming a statistics cycle.				all

CONFigure:POWer:NBURst:GMSK:CCH:CONTrol:REPetition
CONFigure:POWer:NBURst:GMSK:TCH:CONTrol:REPetition
CONFigure:POWer:NBURst:EPSK:TCH: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	–	
<StopCondition>	Description of parameters	Def. value	Def. unit	
SOERror | **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	–	V2.80

Description of command	Sig. State
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.*	all

CONFigure:POWer:NBURst:GMSK:CCH:FILTer *<Filter>* Filter
CONFigure:POWer:NBURst:GMSK:TCH:FILTer *<Filter>*
CONFigure:POWer:NBURst:EPSK:TCH:FILTer *<Filter>*

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
G500 | **B600**	500 kHz Gaussian filter 600 kHz bandpass filter	G500 for GMSK modulation B600 for 8PSK modulation	–	V3.07 (V3.22 for CCH)

Description of command	Sig. State
This command selects the measurement filter for the *P/t* measurement. The default filter setting differs for the two modulation schemes.	all

DEFault:POWer:NBURst:GMSK:CCH:CONTrol *<Enable>*
DEFault:POWer:NBURst:GMSK:TCH:CONTrol *<Enable>*
DEFault:POWer:NBURst:EPSK:TCH: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	–	V2.80

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). In the query format, the command returns ON if all the parameters of the subsystem correspond to their default values, otherwise it returns OFF..	all

Test Configuration

The commands of the following subsystems define the parameters of the signal power measurement. GSM signals are transferred in the form of bursts, which are divided up into different tolerance ranges according to the standard. This is shown in chapter 4 for normal and access bursts.

Subsystem POWer...:LIMit:LINE

The subsystem *POWer ...:LIMit:LINE* defines the limit lines and thus the tolerance values for the power measurement. The subsystem corresponds to the tab *Limit Lines* in the popup menu *Power Configuration.*

Upper Limit Line

CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>
<StartTime>, <StopTime>, <StartRelLevel>, <StopRelLevel>, <StartAbsLevel>, <StopAbsLevel>, <Enable>

CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:ENABle
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:ENABle
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:ENABle
<Enable>

CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue
<StartTime>, <StopTime>, <StartRelLevel>, <StopRelLevel>, <StartAbsLevel>, <StopAbsLevel>

Parameters	Value range	Description of parameters	Def. value
<Enable>	ON | OFF	Limit check in area on/off	See below
<StartTime>,	–10 bit/symb. to 157.25 bit/symb. | OFF	Start point of time	
<StopTime>,	–10 bit/symb. to 157.25 bit/symb. | OFF	Last point of time	
<StartRelLevel>,	–100 dB .. 10 dB | OFF,	Start point of level (relative)	
<StopRelLevel>,	–100 dB .. 10 dB | OFF,	Last point of level (relative)	
<StartAbsLevel>,	–90 dBm .. 30 dBm | OFF,	Start point of level (absolute)	
<StopAbsLevel>	–90 dBm .. 30 dBm | OFF	Last point of level (absolute)	

Description of command	Sig. State	FW vers.
These commands activate and define upper limit lines for normal bursts. The limit lines are defined area by area; the suffix <nr> numbers the various areas in the burst diagram (see chapter 4).		V2.80

8 areas are defined in the default setting, another 8 areas can be activated if required. The default settings for GSM400/GT800/850/900/1800/1900 at GMSK modulation in the defined areas are given in the table below:

	for Enable	for Table					
Suffix	Enable	Start Time / [bit]	Stop Time / [bit]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level
1	ON	–10.00	–7.25	–30.0 dB	–30.0 dB	OFF	OFF
2	ON	–7.25	–4.50	–30.0 dB	–30.0 dB	OFF	OFF
3	ON	–4.50	–2.25	–6.0 dB	–6.0 dB	OFF	OFF
4	ON	–2.25	0.50	+4.0 dB	+4.0 dB	OFF	OFF
5	ON	0.50	150.25	+1.0 dB	+1.0 dB	OFF	OFF
6	ON	150.25	152.50	–6.0 dB	–6.0 dB	OFF	OFF
7	ON	152.50	155.25	–30.0 dB	–30.0 dB	OFF	OFF
8	ON	155.25	157.00	–30.0 dB	–30.0 dB	OFF	OFF

The setting *Enable = Off* implies that the corresponding range, including the limit check, is switched off.

Note: *In the* CCH Test *(command ...*`:GMSK:CCH`*...), the upper limit lines are switched off at the rising and falling edge of the burst (areas no. 1 to 3 and 6 to 8).*

The default settings for GSM1900 at GMSK modulation in the defined areas are given in the table below:

	for Enable	for Table					
Suffix	Enable	Start Time / [bit]	Stop Time / [bit]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level
1	ON	–10.00	–7.25	–30.0 dB	–30.0 dB	OFF	OFF
2	ON	–7.25	–4.50	–30.0 dB	–30.0 dB	OFF	OFF
3	ON	–4.50	–2.25	–30.0 dB	0.0 dB	OFF	OFF
4	ON	–2.25	0.50	+4.0 dB	+4.0 dB	OFF	OFF
5	ON	0.50	150.25	+1.0 dB	+1.0 dB	OFF	OFF
6	ON	150.25	152.50	0.0 dB	–30.0 dB	OFF	OFF
7	ON	152.50	155.25	–30.0 dB	–30.0 dB	OFF	OFF
8	ON	155.25	157.00	–30.0 dB	–30.0 dB	OFF	OFF

Note: *In the* CCH Test *(command ...*`:GMSK:CCH`*...), the upper limit lines are switched off at the rising and falling edge of the burst (areas no. 1 to 3 and 6 to 8).*

The default settings for all GSM bands at 8PSK modulation in the defined areas are given in the table below:

	for Enable	for Table					
Suffix	Enable	Start Time / [symb]	Stop Time / [symb]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level
1	ON	–10.00	–7.00	–30.0 dB	–30.0 dB	OFF	OFF
2	ON	–7.00	–4.50	–30.0 dB	–30.0 dB	OFF	OFF
3	ON	–4.50	–2.25	–6.0 dB	–6.0 dB	OFF	OFF
4	ON	–2.25	0.50	+4.0 dB	+4.0 dB	OFF	OFF
5	ON	0.50	1.5	+2.4 dB	+2.4 dB	OFF	OFF
6	ON	1.50	146.5	+4.0 dB	+4.0 dB	OFF	OFF
7	ON	146.50	147.5	+2.4 dB	+2.4 dB	OFF	OFF
8	ON	147.50	150.25	+4.0 dB	+4.0 dB	OFF	OFF
9	ON	150.25	152.50	–6.0 dB	–6.0 dB	OFF	OFF
10	ON	152.50	155.00	–30.0 dB	–30.0 dB	OFF	OFF
11	ON	155.00	157.00	–30.0 dB	–30.0 dB	OFF	OFF

Lower Limit Line

CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>
<StartTime>, <StopTime>, <StartRelLevel>, <StopRelLevel>,
<StartAbsLevel>, <StopAbsLevel>, <Enable>

CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:ENABle
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:ENABle
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:ENABle
<Enable>

CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue
<StartTime>, <StopTime>, <StartRelLevel>, <StopRelLevel>,
<StartAbsLevel>, <StopAbsLevel>

Parameters	Value range	Description of parameters	Def. value
<Enable>	ON | OFF	Limit check in area on/off	See below
<StartTime>,	–10 bit/symb. to 157.25 bit/symb. | OFF	Start point of time	
<StopTime>,	–10 bit/symb. to 157.25 bit/symb. | OFF	Last point of time	
<StartRelLevel>,	–100 dB .. 10 dB | OFF,	Start point of level (relative)	
<StopRelLevel>,	–100 dB .. 10 dB | OFF,	Last point of level (relative)	
<StartAbsLevel>,	–90 dBm .. 30 dBm | OFF,	Start point of level (absolute)	
<StopAbsLevel>	–90 dBm .. 30 dBm | OFF	Last point of level (absolute)	

Description of command	Sig. State	FW vers.
These commands activate and define lower limit lines for normal bursts. The limit lines are defined area by area; the suffix <nr> numbers the various areas in the burst diagram (Fig. 6-1).	all	V2.80

Only 1 area is defined in the default setting, another 15 areas can be activated if required. The default settings are shown in the table below:

	for Enable	for Table					
Suffix	Enable	Start Time / [bit]	Stop Time / [bit]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level
1	ON	–10.00	0.50	OFF	OFF	OFF	OFF
2	ON	0.50	147.50	–1.0 dB	–1.0 dB	OFF	OFF
3	ON	147.50	157.00	OFF	OFF	OFF	OFF

Note: *In the* CCH Test *(command ...* `:GMSK:CCH`*...), the lower limit lines are entirely switched off.*

The default settings for all GSM bands at 8PSK modulation in the defined areas are given in the table below:

	for Enable	for Table					
Suffix	Enable	Start Time / [symb]	Stop Time / [symb]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Leve
1	ON	–10.00	0.50	OFF	OFF	OFF	OFF
2	ON	0.50	1.0	–2.0 dB	–2.0 dB	OFF	OFF
3	ON	1.0	1.5	0.0 dB	0.0 dB	OFF	OFF
4	ON	1.50	146.50	–20.0 dB	–20.0 dB	OFF	OFF
7	ON	146.50	147.00	0.0 dB	0.0 dB	OFF	OFF
8	ON	147.00	147.50	–2.0 dB	–2.0 dB	OFF	OFF
7	ON	147.50	157.00	OFF	OFF	OFF	OFF

CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:UPPer:ENABle <*Mode*>
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:UPPer:ENABle <*Mode*>
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:UPPer:ENABle <*Mode*>

Upper Limit Line on/off

<*Mode*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Switch on upper limit lines Switch off upper limit lines	ON	–	V2.80

Description of command	Sig. State
This command switches the upper limit lines for the active burst type (normal burst) on or off.	all

CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:LOWer:ENABle <*Mode*>
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:LOWer:ENABle <*Mode*>
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:LOWer:ENABle <*Mode*>

Lower Limit Line on/off

<*Mode*>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Switch on lower limit lines Switch off lower limit lines	ON	–	V2.80

Description of command	Sig. State
This command switches the lower limit lines for the active burst type (normal burst) on or off.	all

DEFault:POWer:NBURst:GMSK:CCH:LIMit:LINE <*Enable*>
DEFault:POWer:NBURst:GMSK:TCH:LIMit:LINE <*Enable*>
DEFault:POWer:NBURst:EPSK:TCH:LIMit:LINE <*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	–	V2.80

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). In the query format, the command returns ON if all the parameters of the subsystem correspond to their default values, otherwise it returns OFF..	all

Subsystem POWer...:TOFFset

The subsystem *POWer...:TOFFset* contains the command for shifting the time axis (and thus the tolerance mask). The subsystem corresponds to the value popup *Time – Mode* in the graphical measurement menu *Power.*

CONFigure:POWer:NBURst:GMSK:CCH:TOFFset <*Mode*> **CONFigure:POWer:NBURst:GMSK:TCH:TOFFset <*Mode*>** **CONFigure:POWer:NBURst:EPSK:TCH:TOFFset <*Mode*>**				Time Offset
<*Mode*>	Description of parameters	Def. value	Def. unit	FW vers.
–4.00 to +4.00	Number of bits (GMSK) or symbols (8PSK)	0	(bit/symb)	V2.80
Description of command				Sig. State
This command defines an offset time in ¼ bit or symbol units by which the burst is shifted relative to the time axis and the tolerance template.				all

Subsystem POWer:NBURst...:RPMode

The subsystem *POWer:NBURst...:RPMode* contains the command determining the way how the reference power is calculated in 8PSK modulation. The subsystem corresponds to the *Ref. Power Mode* parameter in the *Control* tab of the *Power Configuration* menu*.*

CONFigure:POWer:NBURst:EPSK:TCH:RPMode <*Mode*>				Ref. Power Mode
<*Mode*>	Description of parameters	Def. value	Def. unit	FW vers.
CURRent | **AVERage |** **DCOMpensated**	Ref. Power calculated from current burst Ref. Power calculated from average curve Data compensated/corrected reference power	CURR	–	V2.80
Description of command				FW vers.
This command determines how the reference power (0-dB line in the *P/t Norm. 8PSK* test diagram) for 8PSK-modulated signals is calculated.				V2.80

Subsystem SUBarrays:POWer

The subsystem *SUBarrays:POWer* defines the measurement range and the type of output values.

CONFigure:SUBarrays:POWer:NBURst:GMSK:CCH **CONFigure:SUBarrays:POWer:NBURst:GMSK:TCH** **CONFigure:SUBarrays:POWer:NBURst:EPSK:TCH**	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	
–10 bit to 156 ¾ bit,	Start time in current range (in bit for GMSK, symbols for 8PSK modulation)	–10	bit / symb	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 668	Number of samples in current range	668	–	V2.80
Description of command				Sig. State
This command configures the `READ:SUBarrays:POWer...`, `FETCh:SUBarrays:POWer...`, and `SAMPle:SUBarrays:POWer` 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 ¼ bit. The subranges may overlap but must be within the total range of the *POWer* 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.				all

Measured Values

The commands of the following subsystems determine and output the results of the signal power measurement. They correspond to the graphical menu *Power* with its various display elements.

Subsystem POWer...

The subsystem *POWer...* measures the burst power and compares it with tolerance values. The subsystem corresponds to the graphical measurement menu *Power.*

READ[:SCALar]:POWer:NBURst:GMSK:CCH? Scalar results:
READ[:SCALar]:POWer:NBURst:GMSK:TCH?
READ[:SCALar]:POWer:NBURst:EPSK:TCH? Start single shot measurement and return results
FETCh[:SCALar]:POWer:NBURst:GMSK:CCH?
FETCh[:SCALar]:POWer:NBURst:GMSK:TCH?
FETCh[:SCALar]:POWer:NBURst:EPSK:TCH? Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:NBURst:GMSK:CCH?
SAMPle[:SCALar]:POWer:NBURst:GMSK:TCH?
SAMPle[:SCALar]:POWer:NBURst:EPSK:TCH? Read out measurement results (synchronized)

Return	Value range	Def. value	Def. unit	FW vers.
BurstsOutOfTol, **AvgBurstPower,** **PeakBurstPower,**	0.0 % to 100.0 % –100.0 dBm to +20.0 dBm –100.0 dBm to +20.0 dBm	NAN NAN NAN	% dBm dBm	V2.80
BurstMatching,	MATC | NMAT | INV | NTSC | OUT | NTRG | UFLW | OFLW	INV	–	
AvgBurstPwAverage	–100.0 dBm to +20.0 dBm	NAN	dBm	

Description of command	Sig. State
These commands are always queries. They start the power measurement and output the result. For details refer to the description of measurement control in chapter 5 of the CMU operating manual.	CCH TCH CEST

The results are:

Bursts out of tolerance (percentage)
Average power of current burst
Peak power of current burst
Average power of averaged trace *Burst template matching*

The calculation of results in an *average* or *peak* measurement is described in chapter 3 (cf. *display modes*).The following messages may be output for the value *BurstMatching*:

MATC	*matching*
NMAT	*not matching*
INV	*invalid*
NTSC	*no training sequence code*
OUT	*out of range*
NTRG	*not triggered*
UFLW	*underflow*
OFLW	*overflow*

CALCulate[:SCALar]:POWer:NBURst:GMSK:CCH:MATChing:LIMit?
CALCulate[:SCALar]:POWer:NBURst:GMSK:TCH:MATChing:LIMit?
CALCulate[:SCALar]:POWer:NBURst:EPSK:TCH:MATChing:LIMit? Limit Matching

Return	Value range	Def. value	Def. unit	FW vers.
AvgBurstPower,	NMAU | NMAL | INV | OK	INV	–	V2.80
PeakBurstPower,	NMAU | NMAL | INV | OK	INV	–	
BurstMatching,	MATC | NMAT | INV | NTSC | OUT | NTRG | UFLW | OFLW	INV	–	
AvgBurstPwAverage	NMAU | NMAL | INV | OK	INV	–	

Description of command	Sig. State
This command is always a query. It indicates whether and in which way the permissible tolerances for the scalar measured values (see command above) have been exceeded.	CCH TCH CEST

The following messages may be output for the values A*vgBurstPower and PeakBurstPower*:

NMAU	Tolerance value underflow	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Tolerance value matched	

The following messages may be output for the value *BurstMatching*:

MATC	*matching*
NMAT	*not matching*
INV	*invalid*
NTSC	*no training sequence code*
OUT	*out of range*
NTRG	*not triggered*
UFLW	*underflow*
OFLW	*overflow*

READ:ARRay:POWer:NBURst:GMSK:CCH:CURRent?
READ:ARRay:POWer:NBURst:GMSK:TCH:CURRent?
READ:ARRay:POWer:NBURst:EPSK:TCH:CURRent?
READ:ARRay:POWer:NBURst:GMSK:CCH:AVERage?
READ:ARRay:POWer:NBURst:GMSK:TCH:AVERage?
READ:ARRay:POWer:NBURst:EPSK:TCH:AVERage?
READ:ARRay:POWer:NBURst:GMSK:CCH:MAXimum?
READ:ARRay:POWer:NBURst:GMSK:TCH:MAXimum?
READ:ARRay:POWer:NBURst:EPSK:TCH:MAXimum?
READ:ARRay:POWer:NBURst:GMSK:CCH:MINimum?
READ:ARRay:POWer:NBURst:GMSK:TCH:MINimum?
READ:ARRay:POWer:NBURst:EPSK:TCH:MINimum?

Burst Power

Start measurement and return results ⇒ *RUN*

FETCh:ARRay:POWer:NBURst:GMSK:CCH:CURRent?
FETCh:ARRay:POWer:NBURst:GMSK:TCH:CURRent?
FETCh:ARRay:POWer:NBURst:EPSK:TCH:CURRent?
FETCh:ARRay:POWer:NBURst:GMSK:CCH:AVERage?
FETCh:ARRay:POWer:NBURst:GMSK:TCH:AVERage?
FETCh:ARRay:POWer:NBURst:EPSK:TCH:AVERage?
FETCh:ARRay:POWer:NBURst:GMSK:CCH:MAXimum?
FETCh:ARRay:POWer:NBURst:GMSK:TCH:MAXimum?
FETCh:ARRay:POWer:NBURst:EPSK:TCH:MAXimum?
FETCh:ARRay:POWer:NBURst:GMSK:CCH:MINimum?
FETCh:ARRay:POWer:NBURst:GMSK:TCH:MINimum?
FETCh:ARRay:POWer:NBURst:EPSK:TCH:MINimum?

Read meas. results (unsynchronized) ⇒ *RUN*

SAMPle:ARRay:POWer:NBURst:GMSK:CCH:CURRent?
SAMPle:ARRay:POWer:NBURst:GMSK:TCH:CURRent?
SAMPle:ARRay:POWer:NBURst:EPSK:TCH:CURRent?
SAMPle:ARRay:POWer:NBURst:GMSK:CCH:AVERage?
SAMPle:ARRay:POWer:NBURst:GMSK:TCH:AVERage?
SAMPle:ARRay:POWer:NBURst:EPSK:TCH:AVERage?
SAMPle:ARRay:POWer:NBURst:GMSK:CCH:MAXimum?
SAMPle:ARRay:POWer:NBURst:GMSK:TCH:MAXimum?
SAMPle:ARRay:POWer:NBURst:EPSK:TCH:MAXimum?
SAMPle:ARRay:POWer:NBURst:GMSK:CCH:MINimum?
SAMPle:ARRay:POWer:NBURst:GMSK:TCH:MINimum?
SAMPle:ARRay:POWer:NBURst:EPSK:TCH:MINimum?

Read results (synchronized) ⇒ *RUN*

Return	Description of parameters	Def. value	Def. unit	FW vers.
–100 dB to +20.0 dB, **...,** **–100 dB to +20.0 dB**	Burst Power[1], ... Burst Power[668],	NAN ... NAN	dB ... dB	V2.80

Description of command	Sig. State
These commands are always queries. They output the different power values of the bursts in a fixed ¼-bit pattern. The number of measured values is 668. The calculation of *current, average, maximum* and *minimum* values is explained in chapter 3 (cf. *display mode*).	CCH TCH CEST

READ:SUBarrays:POWer:NBURst:GMSK:CCH:CURRent? **READ:SUBarrays:POWer:NBURst:GMSK:TCH:CURRent?** **READ:SUBarrays:POWer:NBURst:EPSK:TCH:CURRent?** **READ:SUBarrays:POWer:NBURst:GMSK:CCH:AVERage?** **READ:SUBarrays:POWer:NBURst:GMSK:TCH:AVERage?** **READ:SUBarrays:POWer:NBURst:EPSK:TCH:AVERage?** **READ:SUBarrays:POWer:NBURst:GMSK:CCH:MAXimum?** **READ:SUBarrays:POWer:NBURst:GMSK:TCH:MAXimum?** **READ:SUBarrays:POWer:NBURst:EPSK:TCH:MAXimum?** **READ:SUBarrays:POWer:NBURst:GMSK:CCH:MINimum?** **READ:SUBarrays:POWer:NBURst:GMSK:TCH:MINimum?** **READ:SUBarrays:POWer:NBURst:EPSK:TCH:MINimum?**	Subarray Results
Start measurement and return resultss	⇒ *RUN*
FETCh:SUBarrays:POWer:NBURst:GMSK:CCH:CURRent? **FETCh:SUBarrays:POWer:NBURst:GMSK:TCH:CURRent?** **FETCh:SUBarrays:POWer:NBURst:EPSK:TCH:CURRent?** **FETCh:SUBarrays:POWer:NBURst:GMSK:CCH:AVERage?** **FETCh:SUBarrays:POWer:NBURst:GMSK:TCH:AVERage?** **FETCh:SUBarrays:POWer:NBURst:EPSK:TCH:AVERage?** **FETCh:SUBarrays:POWer:NBURst:GMSK:CCH:MAXimum?** **FETCh:SUBarrays:POWer:NBURst:GMSK:TCH:MAXimum?** **FETCh:SUBarrays:POWer:NBURst:EPSK:TCH:MAXimum?** **FETCh:SUBarrays:POWer:NBURst:GMSK:CCH:MINimum?** **FETCh:SUBarrays:POWer:NBURst:GMSK:TCH:MINimum?** **FETCh:SUBarrays:POWer:NBURst:EPSK:TCH:MINimum?**	
Read meas. results (unsynchronized)	⇒ *RUN*
SAMPle:SUBarrays:POWer:NBURst:GMSK:CCH:CURRent? **SAMPle:SUBarrays:POWer:NBURst:GMSK:TCH:CURRent?** **SAMPle:SUBarrays:POWer:NBURst:EPSK:TCH:CURRent?** **SAMPle:SUBarrays:POWer:NBURst:GMSK:CCH:AVERage?** **SAMPle:SUBarrays:POWer:NBURst:GMSK:TCH:AVERage?** **SAMPle:SUBarrays:POWer:NBURst:EPSK:TCH:AVERage?** **SAMPle:SUBarrays:POWer:NBURst:GMSK:CCH:MAXimum?** **SAMPle:SUBarrays:POWer:NBURst:GMSK:TCH:MAXimum?** **SAMPle:SUBarrays:POWer:NBURst:EPSK:TCH:MAXimum?** **SAMPle:SUBarrays:POWer:NBURst:GMSK:CCH:MINimum?** **SAMPle:SUBarrays:POWer:NBURst:GMSK:TCH:MINimum?** **SAMPle:SUBarrays:POWer:NBURst:EPSK:TCH:MINimum?**	
Read results (synchronized)	⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–100 dB to +20.0 dB, **...,** **–100 dB to +20.0 dB**	BurstPower[1], ... BurstPower[n],	NAN ... NAN	dB ... dB	V2.80

Description of command	Sig. State
These commands are always queries. They output the burst power versus time in a fixed ¼-bit pattern and in the subranges defined by means of the `CONFigure:SUBarrays:POWer` 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:POWer` 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. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).	CCH TCH CEST

CALCulate:ARRay:POWer:NBURst:GMSK:CCH:AVERage:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:AVERage:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:AVERage:MATChing:LIMit?

CALCulate:ARRay:POWer:NBURst:GMSK:CCH:CURRent:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:CURRent:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:CURRent:MATChing:LIMit?

CALCulate:ARRay:POWer:NBURst:GMSK:CCH:MAXimum:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:MAXimum:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:MAXimum:MATChing:LIMit?

CALCulate:ARRay:POWer:NBURst:GMSK:CCH:MINimum:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:MINimum:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:MINimum:MATChing:LIMit?

Burst Matching

Return	Value range	Def. value	Def. unit	FW vers.
Matching	MATC | NMAT | INV | NTSC | OUT | NTRG | UFLW | OFLW	INV	–	V2.80

Description of command	Sig. State
This command is always a query. It indicates whether and in which way permissible tolerances for the burst power (see command above) have been exceeded. The following messages may be output for the value *Matching*: MATC *matching* NMAT *not matching* INV *invalid* NTSC *no training sequence code* OUT *out of range* NTRG *not triggered* UFLW *underflow* OFLW *overflow*	CCH TCH CEST

CALCulate:ARRay:POWer:NBURst:GMSK:CCH:CURRent:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:CURRent:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:CURRent:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:CCH:AVERage:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:AVERage:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:AVERage:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:CCH:MAXimum:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:MAXimum:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:MAXimum:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:CCH:MINimum:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:MINimum:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:MINimum:MATChing:AREA?

Range Violation

Returned value	Description of parameters	Def. value	Def. unit	FW vers.
32 bit field,	Indicator for upper limit matching in area 1 to 16 (16 least significant bits),	NAN	–	–
32 bit field	Indicator for lower limit matching in area 1 to 16 (16 least significant bits)	NAN	–	V2.80

Description of command	Sig. State
This command is always a query. Any set bit of the two returned fields indicates the violation of the corresponding section of the limit lines.	CCH TCH CEST

Subsystem POWer:SLOT

The subsystem *POWer:SLOT* controls the *Power vs. Slot* measurement. It corresponds to the measurement menu *Power* with the application *P/Slot*: *Power vs. Slot* measurements are available in the TCH test mode and for GMSK modulation only.

INITiate:POWer:SLOT:GMSK:TCH	Start new measurement	⇒	*RUN*
ABORt:POWer:SLOT:GMSK:TCH	Abort running measurement and switch off	⇒	*OFF*
STOP:POWer:SLOT:GMSK:TCH	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:POWer:SLOT:GMSK:TCH	Next measurement step (only *stepping mode*)	⇒	*RUN*
Description of command		Sig. State	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.		CCH TCH CEST	V2.80

CONFigure:POWer:SLOT:GMSK:TCH: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 SOPC No reporting	OFF	–	V2.80
Description of command				Sig. State
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).				all

FETCh:POWer:SLOT:GMSK:TCH: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	–	–
1 to 10000 | **NONE**	Counter for current statistics cycle No counting mode set	NONE	–	V2.80
Description of command				Sig. State
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).				all

Subsystem POWer:SLOT:GMSK:CONTrol

CONFigure:POWer:SLOT:GMSK:TCH:CONTrol:REPetition ***<Repetition>,<StopCond>,<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 10000,	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCond>	Description of parameters	Def. value		
SOERror |	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	–	V2.80
NONE	Continue measurement according to its rep. mode			
Description of command				Sig. State
This command determines the number of statistics cycles and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*				all

DEFault:POWer:SLOT:GMSK:TCH:CONTrol *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	The parameters are set to their default values	ON	–	V2.80
OFF	The parameters differ from the default values (partially or totally)			
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). In the query format, the command returns ON if all the parameters of the subsystem correspond to their default values, otherwise it returns OFF..				all

Subsystem POWer:SLOT:GMSK...

The subsystem *POWer:SLOT:GMSK...* measures and returns the average output power in seven consecutive slots. The subsystem corresponds to the measurement menu *P/Slot.*

READ[:SCALar]:POWer:SLOT:GMSK:TCH? **FETCh[:SCALar]:POWer:SLOT:GMSK:TCH?** **SAMPle[:SCALar]:POWer:SLOT:GMSK:TCH?**	Scalar Results Start single shot measurement and return results Read out measurement results (unsynchronized) Read out measurement results (synchronized)			
Return	Value range	Def. value	Def. unit	FW vers.
Slot0, **...,** **Slot7**	see data sheet, ... see data sheet	NAN, ..., NAN	dBm, ..., dBm	V2.80
Description of command				Sig. State
These commands are always queries. They start a measurement and return all measurement results. The returned list contains the average burst power of the base station in all eight timeslots of a TDMA frame.				CCH TCH CEST

POWer:MSLot

The subsystem *POWer:MSLot* measures the MS output carrier power versus time in up to 4 consecutive timeslots. The subsystem corresponds to the measurement menu *Power,* application *P/t Multislot,* and the associated popup menu *Power Configuration.*

Note: *The* `POWer:MSLot` *measurement can not be carried out with a* Free Run *trigger (*`TRIGger[:SEQuence]:SOURce FRUN`*).*

Control of Measurement – Subsystem POWer:MSLot

The subsystem *POWer:MSLot* controls the P/t multislot measurement.

INITiate:POWer:MSLot:CCH **INITiate:POWer:MSLot:TCH**	Start new measurement	⇒	*RUN*
ABORt:POWer:MSLot:CCH **ABORt:POWer:MSLot:TCH**	Abort measurement and switch off	⇒	*OFF*
STOP:POWer:MSLot:CCH **STOP:POWer:MSLot:TCH**	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:POWer:MSLot:CCH **CONTinue:POWer:MSLot:TCH**	Next meas. 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:MSLot:CCH:EREPorting <*Mode*> **CONFigure:POWer:MSLot:TCH: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 SOPC 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:POWer:MSLot:CCH:STATus? **FETCh:POWer:MSLot:TCH: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	–	V3.07
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 CMU manual of CMU manual).				

Subsystem POWer:MSLot...:CONTrol

The subsystem *POWer:MSLot...:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* tab of the popup menu *Power Configuration.*

CONFigure:POWer:MSLot:CCH:CONTrol *<Mode>,<Statistics>* **CONFigure:POWer:MSLot:TCH:CONTrol *<Mode>,<Statistics>***		Scope of Measurement		
<Mode>	Description of parameters	Def. value	Def. unit	
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	
<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	V3.07
Description of command				
This command restricts the type of measured values to accelerate the measurement and determines the number of bursts within a statistics cycle.				

CONFigure:POWer:MSLot:CCH:CONTrol:REPetition
CONFigure:POWer:MSLot:TCH: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	–	
<StopCondition>	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	–	V3.07

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.*

DEFault:POWer:MSLot:CCH:CONTrol *<Enable>*
DEFault:POWer:MSLot:TCH:CONTrol *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to their default values Some or all parameters are not set to default	ON	–	V3.07

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)*.

Test Configuration

The commands of the following subsystems configure the *P/t Multislot* measurement. They correspond to some of the softkey/hotkey combinations in the graphical measurement menu and to some of the settings in the *Power Configuration* popup menu that are related to the *P/t Multislot* measurement.

CONFigure:POWer:MSLot:CCH:MVIew *<Mod_-1>,<Mod_0>, <Mod_1>, <Mod_2>*
CONFigure:POWer:MSLot:TCH:MVIew *<Mod_-1>,<Mod_0>, <Mod_1>, <Mod_2>* Modulation View

<Mod_1>, ... , <Mod_2>	Description of parameters	Def. value	Def. unit	FW vers.
GMSK | **EPSK |** **ANY |** **OFF**	GMSK modulation required 8PSK modulation required GMSK or 8PSK modulation Inactive timeslot (power off) required	ANY	–	V3.07

Description of command

This command defines the modulation schemes and power/time templates for the Meas. Timeslot –1, Meas. Timeslot and the two following timeslots. Values for timeslots that are currently switched off (see command `CONFigure:POWer:MSLot:CCH:SCOunt`) are not taken into consideration.

CONFigure:POWer:MSLot:CCH:SCOunt *<Slots>*
CONFigure:POWer:MSLot:TCH:SCOunt *<Slots>* Slot Count

<Slots>	Description of parameters	Def. value	Def. unit	FW vers.
1 | **2 |** **3 |** **4**	Meas. timeslot (MTS) MTS – 1, MTS MTS – 1, MTS, MTS + 1 MTS – 1, MTS, MTS + 1, MTS + 2	2	–	V3.07

Description of command

This command defines the number of timeslots measured and determines the length of the measurement arrays (see `READ:ARRay:POWer:MSLot:CCH...` commands). The measured timeslot is defined via `CONFigure:POWer:MSLot:...:MESLot`.

CONFigure:POWer:MSLot:CCH:TOFFset *<Offset>*
CONFigure:POWer:MSLot:TCH:TOFFset *<Offset>* Timing Offset

<Offset>	Description of parameters	Def. value	Def. unit	FW vers.
–4.00 to +4.00	Number of bits (in ¼ symbol steps)	0	symb.	V3.07

Description of command

This command defines an offset time by which the burst is shifted relative to the time axis and the tolerance template. The values entered are rounded to ¼ symbol steps.

CONFigure:POWer:MSLot:CCH:MESLot *<Slot_No>* Meas. Slot**CONFigure:POWer:MSLot:TCH:MESLot *<Slot_No>***

<Slot_No>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 7	Measured timeslot number	0	–	V3.07

Description of command

This command selects the measured timeslot in the multislot application; see also `CONFigure:POWer:MSLot:...:SCOunt` commands.

CONFigure:POWer:MSLot:CCH:FILTer *<Filter>* **CONFigure:POWer:MSLot:TCH:FILTer *<Filter>***				Filter
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
G500 | **B600**	500 kHz Gaussian filter 600 kHz bandpass filter	G500	–	V3.07 (V3.40 for CCH)
Description of command				
This command selects the measurement filter for the measurement.				

CONFigure:POWer:MSLot:CCH:LIMit:LINE:GLEVel *<Level>* **CONFigure:POWer:MSLot:TCH:LIMit:LINE:GLEVel *<Level>***				Multislot Guard
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
0.00 dB to +10.00 dB	Multislot guard level	3	dB	V3.07
Description of command				
This command defines the raising of the upper limit line in the guard period between two consecutive bursts.				

Subsystem SUBarrays:POWer:MSLot...

The subsystem *SUBarrays:POWer:MSLot...* defines the measurement range and the type of output values.

CONFigure:SUBarrays:POWer:MSLot:CCH **CONFigure:SUBarrays:POWer:MSLot:TCH** **<Mode>,<Start>,<Samples>{,<Start>,<Samples>}**				Definition of Subarrays
<Mode>	Description of parameters	Def. value	Def. unit	
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range Return single interpolated value at <Start>	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	
–180 symbols to +520 symbols	Start time in current range, relative to symbol 0 of the meas. slot	–165	symb.	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 2613	Number of samples in current range, depending on `SCOunt` (see commands *READ:ARRay:POWer:MSLot:CCH...*)	2613	–	V3.07

Description of command
This command configures the `READ:SUBarrays:POWer:MSLot...`, `FETCh:SUBarrays:POWer:MSLot...`, and `SAMPle:SUBarrays:POWer:MSLot` 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 ¼ symbols. If <Start> does not coincide with a test point then the range will start at the next test point that is larger than <Start>. For <Mode> = IVAL, the <Samples> parameter is ignored and the CMU returns a single measurement value at the abscissa value <Start>. If <Start> is located beween two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation. The subranges may overlap but must be within the total range of the *POWer* 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

The subsystem *POWer:MSLot...* contains the commands to measure the normal burst power in several timeslots, compare it with the tolerances and retrieve the results. The subsystem corresponds to the graphical measurement menu *Power,* application *P/t Multislot.*

	Scalar results
READ[:SCALar]:POWer:MSLot:CCH? **READ[:SCALar]:POWer:MSLot:TCH?**	Start single shot measurement and return results
FETCh[:SCALar]:POWer:MSLot:CCH? **FETCh[:SCALar]:POWer:MSLot:TCH?**	Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:MSLot:CCH? **SAMPle[:SCALar]:POWer:MSLot:TCH?**	Read out measurement results (synchronized)

Returned values per timeslot	Value range	Def. value	Def. unit	FW vers.
BurstsOutOfTolerance,	0.0 % to 100.0 %	NAN	%	V3.07
AvgBurstPowerCurrent,	–137 dBm to +53 dBm	NAN	dBm	
AvgBurstPwAvg	–137 dBm to +53 dBm	NAN	dBm	
PeakBurstPowerCurrent,	–137 dBm to +53 dBm	NAN	dBm	
TimingError,	–100.0 bit to+100.0 bit	NAN	bit	
BurstMatching	INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	INV	–	

Description of command
These commands are always queries. - `READ` starts a single shot measurement and returns the results. - `FETCh` returns the results irrespective of the measurement state. - `SAMPle` waits until the results are valid (depending on the statistic count) and then returns the results. For more details refer to the description of measurement control in chapter 5 of the CMU200 operating manual. The complete list of results is repeated four times (timeslots 0, –1, +1, +2; see command *`CONFigure:POWer:MSLot:CCH:SCOunt`*).

CALCulate[:SCALar]:POWer:MSLot:CCH:MATChing:LIMit?
CALCulate[:SCALar]:POWer:MSLot:TCH:MATChing:LIMit? Limit Matching

Returned values per timeslot	Value range	Def. value	Def. unit	FW vers.
AvgBurstPowerCurrent,	NMAU | NMAL | INV | OK	INV	–	V3.07
AvgBurstPwAvg	NMAU | NMAL | INV | OK	INV	–	
PeakBurstPowerCurrent,	NMAU | NMAL | INV | OK	INV	–	
TimingError,	OK (no limit check)	–	—	
BurstMatching	INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	INV		

Description of command

This command is always a query. It indicates whether and in which way the permissible tolerances for the scalar measured values (see command above) have been exceeded. The following messages may be output for the values *AvgBurstPowerCurr, PeakBurstPowerCurr* and *AvgBurstPowerAvg*:

OK	Tolerance value matched	*OK.*
NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measured value invalid	*invalid*

The following messages may be output for the value *BurstMatching*:

INV	*invalid*
MATC	*matching*
NMAT	*not matching*
OUT	*out of range*
NTR	*no trigger*
NRAM	*not ramping (burst not found)*
OFLW	*overflow*
UFLW	*underflow*
NTSC	*no training sequence code*
OFF	*off*

The complete list of results is repeated four times (timeslots 0, –1, +1, +2; see command `CONFigure:POWer:MSLot:CCH:SCOunt`).

READ:ARRay:POWer:MSLot:CCH:CURRent? **READ:ARRay:POWer:MSLot:TCH:CURRent?** **READ:ARRay:POWer:MSLot:CCH:AVERage?** **READ:ARRay:POWer:MSLot:TCH:AVERage?** **READ:ARRay:POWer:MSLot:CCH:MAXimum?** **READ:ARRay:POWer:MSLot:TCH:MAXimum?** **READ:ARRay:POWer:MSLot:CCH:MINimum?** **READ:ARRay:POWer:MSLot:TCH:MINimum?**	Burst Power Start single shot measurement and return results
FETCh:ARRay:POWer:MSLot:CCH:CURRent? **FETCh:ARRay:POWer:MSLot:TCH:CURRent?** **FETCh:ARRay:POWer:MSLot:CCH:AVERage?** **FETCh:ARRay:POWer:MSLot:TCH:AVERage?** **FETCh:ARRay:POWer:MSLot:CCH:MAXimum?** **FETCh:ARRay:POWer:MSLot:TCH:MAXimum?** **FETCh:ARRay:POWer:MSLot:CCH:MINimum?** **ETCh:ARRay:POWer:MSLot:TCH:MINimum?**	Read measurement results (unsynchronized)
SAMPle:ARRay:POWer:MSLot:CCH:CURRent? **SAMPle:ARRay:POWer:MSLot:TCH:CURRent?** **SAMPle:ARRay:POWer:MSLot:CCH:AVERage?** **SAMPle:ARRay:POWer:MSLot:TCH:AVERage?** **SAMPle:ARRay:POWer:MSLot:CCH:MAXimum?** **SAMPle:ARRay:POWer:MSLot:TCH:MAXimum?** **SAMPle:ARRay:POWer:MSLot:CCH:MINimum?** **SAMPle:ARRay:POWer:MSLot:TCH:MINimum?**	Read results (synchronized)

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB	BurstPower[1]	NAN	dB	V3.07
...	...	...	...	
–100.0 dB to +20.0 dB	BurstPower[n]	NAN	dB	

Description of command

These commands are always queries. They return the burst power relative to the average burst power in the measurement slot at n equidistant measurement points with a fixed ¼ symbol spacing. The time range measured corresponds to 1 to 4 entire timeslots plus 18 ¼ symbol periods before the beginning (symbol 0) of the first slot and 10 symbol periods after the end of the last slot. The resulting array lengths n are listed below.

Number of timeslots (according to *CONFigure:POWer:MSLot:CCH:SCOunt*)	1	2	3	4
n	738	1363	1988	2613

READ:SUBarrays:POWer:MSLot:CCH:CURRent? Subarray Results
READ:SUBarrays:POWer:MSLot:TCH:CURRent?
READ:SUBarrays:POWer:MSLot:CCH:AVERage?
READ:SUBarrays:POWer:MSLot:TCH:AVERage?
READ:SUBarrays:POWer:MSLot:CCH:MAXimum?
READ:SUBarrays:POWer:MSLot:TCH:MAXimum?
READ:SUBarrays:POWer:MSLot:CCH:MINimum?
READ:SUBarrays:POWer:MSLot:TCH:MINimum?
Start single shot measurement and return results ⇒ *RUN*
FETCh:SUBarrays:POWer:MSLot:CCH:CURRent?
FETCh:SUBarrays:POWer:MSLot:TCH:CURRent?
FETCh:SUBarrays:POWer:MSLot:CCH:AVERage?
FETCh:SUBarrays:POWer:MSLot:TCH:AVERage?
FETCh:SUBarrays:POWer:MSLot:CCH:MAXimum?
FETCh:SUBarrays:POWer:MSLot:TCH:MAXimum?
FETCh:SUBarrays:POWer:MSLot:CCH:MINimum?
FETCh:SUBarrays:POWer:MSLot:TCH:MINimum?
Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:SUBarrays:POWer:MSLot:CCH:CURRent?
SAMPle:SUBarrays:POWer:MSLot:TCH:CURRent?
SAMPle:SUBarrays:POWer:MSLot:CCH:AVERage?
SAMPle:SUBarrays:POWer:MSLot:TCH:AVERage?
SAMPle:SUBarrays:POWer:MSLot:CCH:MAXimum?
SAMPle:SUBarrays:POWer:MSLot:TCH:MAXimum?
SAMPle:SUBarrays:POWer:MSLot:CCH:MINimum?
SAMPle:SUBarrays:POWer:MSLot:TCH:MINimum?
Read results (synchronized) ⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB	BurstPower[1]	NAN	dB	V3.07
...	...	...	...	
–100.0 dB to +20.0 dB	BurstPower[m]	NAN	dB	

Description of command

These commands are always queries. They return the burst power relative to the average burst power in the measurement slot in the subranges defined by means of the `CONFigure:SUBarrays:POWer` 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:POWer` 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.

The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).

CALCulate:ARRay:POWer:MSLot:CCH:CURRent:MATChing:LIMit?
CALCulate:ARRay:POWer:MSLot:TCH:CURRent:MATChing:LIMit?
CALCulate:ARRay:POWer:MSLot:CCH:AVERage:MATChing:LIMit?
CALCulate:ARRay:POWer:MSLot:TCH:AVERage:MATChing:LIMit?
CALCulate:ARRay:POWer:MSLot:CCH:MAXimum:MATChing:LIMit?
CALCulate:ARRay:POWer:MSLot:TCH:MAXimum:MATChing:LIMit?
CALCulate:ARRay:POWer:MSLot:CCH:MINimum:MATChing:LIMit?
CALCulate:ARRay:POWer:MSLot:TCH:MINimum:MATChing:LIMit?

Global Burst Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
Matching	INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	INV	–	–V3.07

Description of command

This command is always a query. It indicates whether and in which way the tolerances for the burst power (see command above) in all measured timeslots have been exceeded.

The following messages may be output for the value *Matching*:

INV	*invalid*
MATC	*matching*
NMAT	*not matching*
OUT	*out of range*
NTR	*no trigger*
NRAM	*not ramping (burst not found)*
OFLW	*overflow*
UFLW	*underflow*
NTSC	*no training sequence code*
OFF	*off*

CALCulate:ARRay:POWer:MSLot:CCH:CURRent:MATChing:AREA?
CALCulate:ARRay:POWer:MSLot:TCH:CURRent:MATChing:AREA?
CALCulate:ARRay:POWer:MSLot:CCH:AVERage:MATChing:AREA?
CALCulate:ARRay:POWer:MSLot:TCH:AVERage:MATChing:AREA?
CALCulate:ARRay:POWer:MSLot:CCH:MAXimum:MATChing:AREA?
CALCulate:ARRay:POWer:MSLot:TCH:MAXimum:MATChing:AREA?
CALCulate:ARRay:POWer:MSLot:CCH:MINimum:MATChing:AREA?
CALCulate:ARRay:POWer:MSLot:TCH:MINimum:MATChing:AREA?

Area Limit Matching

Returned value	Description of parameters	Def. value	Def. unit	FW vers.
32 bit value,	Indicator for upper limit matching in area 1 to n	NAN	–	V3.07
32 bit value	Indicator for lower limit matching in area 1 to n	NAN	–	

Description of command

This command is always a query. A bit in the two output values is set if the corresponding section of the limit lines is exceeded. n ≤ 32 is the total number of areas in the limit lines, depending on the number of bursts measured (according to `CONFigure:POWer:MSLot:CCH:SCOunt).`

Tolerance Template

The subsystem *POWer:MSLot:AREA:LIMit...* contains the commands to return the current position of the multislot tolerance template and the curve. The subsystem has no equivalent in manual control, however, the current template is indicated in the graphical *P/t Multislot* digaram.

[SENSe:]ARRay:POWer:MSLot:AREA:LIMit:UPPer:TIME?
[SENSe:]ARRay:POWer:MSLot:AREA:LIMit:LOWer:TIME? — Time of all Areas

Returned values	Value range	Def. value	Def. unit	FW vers.
–180 symb. to +520 symb. | OFF,	Start time in area no. 1	NAN	symbols	V3.10
–180 symb. to +520 symb. | OFF,	Stop time in area no. 1	NAN		
...				
–180 symb. to +520 symb. | OFF,	Start time in area no. n	NAN		
–180 symb. to +520 symb. | OFF	Stop time in area no. n	NAN		

Description of command

These commands return the time of all areas of the multislot tolerance template, relative to the start of the measured timeslot *(Meas. Slot)*. OFF means that the limit line and limit check in an area is switched off. The number of areas and thus the number of output values varies with the number of measured slots and the definition of the single slot template. The maximum allowed number of output values is 2 x 64.

[SENSe:]ARRay:POWer:MSLot:AREA:LIMit:UPPer:LEVel?
[SENSe:]ARRay:POWer:MSLot:AREA:LIMit:LOWer:LEVel? — Level of all Areas

Returned values	Value range	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB | OFF,	Start level in area no. 1	NAN	dB	V3.10
–100.0 dB to +20.0 dB | OFF,	Stop level in area no. 1	NAN	dB	
...				
–100.0 dB to +20.0 dB | OFF,	Start level in area no. n	NAN	dB	
–100.0 dB to +20.0 dB | OFF	Stop level in area no. n	NAN	dB	

Description of command

These commands return the level of all areas of the multislot tolerance template, relative to the useful level of the measured timeslot *(Meas. Slot)*. OFF means that the limit line and limit check in an area is switched off. The number of areas and thus the number of output values varies with the number of measured slots and the definition of the single slot template. The maximum allowed number of output values is 2 x 64.

[SENSe:]ARRay:POWer:MSLot:AREA:LIMit:UPPer:INFO?
[SENSe:]ARRay:POWer:MSLot:AREA:LIMit:LOWer:INFO? — Timeslot of all Areas

Returned values	Value range	Def. value	Def. unit	FW vers.
–1 | 0 | 1 | 2,	Timeslot of area no. 1	NAN	dB	V3.10
...				
–1 | 0 | 1 | 2*)	Timeslot of area no. n	NAN	dB	

Description of command

These commands return the timeslot of all areas of the multislot tolerance template, relative to the measured timeslot *(Meas. Slot,* slot no. 0*)*. The number of areas and thus the number of output values varies with the number of measured slots and the definition of the single slot template. The maximum allowed number of output values is 64.

*) If the timeslots no. –2 or +3 are active and if an area overlaps to one of these slots, the query may also return –2 or +3.

[SENSe:]ARRay:POWer:MSLot:AREA:LIMit:INFO:STIMe?				Timeslot of all Areas
Returned value	Value range	Def. value	Def. unit	FW vers.
–180 symb. to +520 symb.	Start time of measurement curve	NAN	symb.	V3.10

Description of command

This commands returns the start time of the measurement curve relative to the beginning of the measured timeslot *(Meas. Slot,* slot no. 0*)*. The start time is the relative time of the first sample of the curve; all remaining samples follow with a ¼ symbol spacing.

MODulation:PERRor:GMSK

The subsystem *MODulation:PERRor:GMSK* measures the modulation parameters (frequency and phase errors) in GMSK modulation. The subsystem corresponds to the measurement menu *Modulation,* application *Phase Error GMSK,* and the associated popup menu *Modulation Configuration.*

Important Note!

Measurement configurations are generally possible in all signalling states. However, to `INITiate`*,* `ABORt, STOP, CONTinue` *a measurement, and to obtain measurement results, the command* `PROCedure:SIGNalling:ACTion` *must be used to access either the* TCH *mode (commands including the keyword* `:TCH`*; traffic channel tests) or the* CCH *mode (commands including the keyword* `:CCH`*; control channel tests).*

Control of Measurement

The subsystem *MODulation*... controls the modulation measurement. It corresponds to the softkey *Phase Err. GMSK* in the measurement menu *Modulation*.

INITiate:MODulation:PERRor:GMSK:CCH **INITiate:MODulation:PERRor:GMSK:TCH**	Start new measurement	⇒ *RUN*
ABORt:MODulation:PERRor:GMSK:CCH **ABORt:MODulation:PERRor:GMSK:TCH**	Abort running meas. and switch off	⇒ *OFF*
STOP:MODulation:PERRor:GMSK:CCH **STOP:MODulation:PERRor:GMSK:TCH**	Stop meas. after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:PERRor:GMSK:CCH **CONTinue:MODulation:PERRor:GMSK:TCH**	Next meas. step (only *stepping mode*)	⇒ *RUN*

Description of command	Sig. State	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.	CCH TCH CEST	V2.80

CONFigure:MODulation:PERRor:GMSK:CCH:EREPorting <*Mode*>
CONFigure:MODulation:PERRor:GMSK:TCH: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	–	V2.80

Description of command	Sig. State
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU operating manual).	all

FETCh:MODulation:PERRor:GMSK:CCH:STATus? **FETCh:MODulation:PERRor:GMSK:TCH: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	–	–
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	–	V2.80
Description of command				Sig. State
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).				all

Subsystem MODulation...:CONTrol

The subsystem *MODulation...:CONTrol* configures the modulation measurement. It corresponds to the tabs *Control* and *Statistics* in the popup menu *Modulation Configuration*.

CONFigure:MODulation:PERRor:GMSK:CCH:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>* **CONFigure:MODulation:PERRor:GMSK:TCH:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>***			Scope of Measurement	
<Mode>	Description of parameters	Def. value	Def. unit	
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	
<Statistics>	Description of parameters	Def. value		
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	
<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	
SOERror | **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	–	V2.80
Description of command				Sig. State
This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).				all

CONFigure:MODulation:PERRor:GMSK:CCH:CONTrol:RMODe *<Mode>* Result Mode
CONFigure:MODulation:PERRor:GMSK:TCH:CONTrol:RMODe *<Mode>*

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	V2.80
Description of command				Sig. State
This command specifies the type of measured values.				all

CONFigure:MODulation:PERRor:GMSK:CCH:CONTrol:STATistics *<Statistics>* Statistics Count
CONFigure:MODulation:PERRor:GMSK:TCH:CONTrol:STATistics *<Statistics>*

<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	V2.80
Description of command				Sig. State
This command defines the number of bursts forming a statistics cycle.				all

CONFigure:MODulation:PERRor:GMSK:CCH:CONTrol:REPetition
<Repetition>* ,*<StopCond>*,*<Stepmode>
CONFigure:MODulation:PERRor:GMSK:TCH: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	–	
<StopCondition>	Description of parameters	Def. value	Def. unit	
SOERror | **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	–	V2.80
Description of command				Sig. State
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.*				all

DEFault:MODulation:PERRor:GMSK:CCH:CONTrol <Enable> **DEFault:MODulation:PERRor:GMSK:TCH: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	–	V2.80
Description of command				Sig. State
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 reads out whether all parameters are set to default values *(ON)* or not *(OFF)*.				all

Test Configuration – Subsystem MODulation...:LIMit

The subsystem *MODulation...:LIMit* defines tolerance values for the modulation measurement. The subsystem corresponds to the tab *Limits* in the popup menu *Modulation.*

CONFigure:MODulation:PERRor:GMSK:CCH:CMMax:LIMit[:SCALar]:SYMMetric [:COMBined]:VALue Limits for Current and Min./Max. Trace **CONFigure:MODulation:PERRor:GMSK:TCH:CMMax:LIMit[:SCALar]:SYMMetric [:COMBined]:VALue *<PhaseErrorPeak>, <PhaseErrorRMS>,<FrequencyError>***				
Parameter	Description of parameters	Def. value	Def. unit	FW vers.
0.0 to +50.0 deg **0.0 to +50.0 deg** **0.0 to +999 Hz**	PhaseErrorPeak, limit for max. phase error PhaseErrorRMS, limit for RMS phase error FrequencyError, limit for frequency error	+20.0 +5.0 +45	deg deg Hz	V2.80
Description of command				Sig. State
This command defines upper limits for the peak and RMS phase error as well as for the frequency error in the *Current* and in the *Min./Max.* trace. The default frequency error is 23 Hz for GSM 400, 45 Hz for GSM850 and GSM900, 90 Hz for GSM1800/1900. The measurement is out of tolerance if the measured RMS phase error, the absolute value of the peak phase error, or the absolute value of the frequency error exceeds the specified limits.				all

CONFigure:MODulation:PERRor:GMSK:CCH:AVERage:LIMit:[:SCALar]:SYMMetric [:COMBined]:VALue Limits for Average Trace **CONFigure:MODulation:PERRor:GMSK:TCH:AVERage:LIMit:[:SCALar]:SYMMetric [:COMBined]:VALue *<PhaseErrorPeak>, <PhaseErrorRMS>,<FrequencyError>***				
Parameter	Description of parameters	Def. value	Def. unit	FW vers.
0.0 to +50.0 deg **0.0 to +50.0 deg** **0.0 to +999 Hz**	PhaseErrorPeak, limit for max. phase error PhaseErrorRMS, limit for RMS phase error FrequencyError, limit for frequency error	+20.0 +5.0 +45	deg deg Hz	V2.80
Description of command				Sig. State
This command defines upper limits for the peak and RMS phase error as well as for the frequency error in the *Average* trace. The default frequency error is 23 Hz for GSM 400, 45 Hz for GSM 850 and GSM900, 90 Hz for GSM1800/1900. The measurement is out of tolerance if the measured RMS phase error, the absolute value of the peak phase error, or the absolute value of the frequency error exceeds the specified limits.				all

DEFault:MODulation:PERRor:GMSK:CCH:LIMit **DEFault:MODulation:PERRor:GMSK:TCH:LIMit**				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	–	V2.80
Description of command				Sig. State
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 reads out whether all parameters are set to default values *(ON)* or not *(OFF)*.				all

Subsystem MODulation...:TIME

The subsystem *MODulation...:TIME* defines the decoding for the Modulation measurement. The subsystem corresponds to the popup window *Decode* in the graphical measurement menu *Modulation*

CONFigure:MODulation:PERRor:GMSK:CCH:TIME:DECode <*Mode*> **CONFigure:MODulation:PERRor:GMSK:TCH:TIME:DECode <*Mode*>**				Decode
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
STANdard | **GTBits**	The standard bit range is decoded The guard and tail bits are also decoded	GTB	–	V2.80
Description of command				Sig. State
This command selects the type of decoding applied for the determination of phase and frequency errors.				all

Subsystem SUBarrays:MODulation

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:PERRor:GMSK:CCH
CONFigure:SUBarrays:MODulation:PERRor:GMSK:TCH <Mode>,<Start>,<Samples>{,<Start>,<Samples>}
Definition of Subarrays

<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 bit to 146 ¾ bit,	Start time in current range	0	bit	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 588	Number of samples in current range	588	–	V2.80

Description of command	Sig. State
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation` 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 ¼ bit. 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. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	all

Subsystem MODulation...

The subsystem *MODulation...* measures and returns the frequency and phase errors and compares them with the tolerance values. The subsystem corresponds to the different output elements in the graphical measurement menu *Modulation.*

READ[:SCALar]:MODulation:PERRor:GMSK:CCH
READ[:SCALar]:MODulation:PERRor:GMSK:TCH

Scalar results:
Start single shot measurement and return results

FETCh[:SCALar]:MODulation:PERRor:GMSK:CCH?
FETCh[:SCALar]:MODulation:PERRor:GMSK:TCH?

Read out meas. results (unsynchronized)

SAMPle[:SCALar]:MODulation:PERRor:GMSK:CCH?
SAMPle[:SCALar]:MODulation:PERRor:GMSK:TCH?

Read out measurement results (synchronized)

Return	Value range	Def. value	Def. unit	FW vers.
PhErrPeakCurrent,	–100.0 ° to +100.0 °	NAN	deg	V2.80
PhErrPeakAverage,	–100.0 ° to +100.0 °	NAN	deg	
PhErrPeakMaxMin,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSCurrent,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSAverage,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSMaxMin,	–100.0 ° to +100.0 °	NAN	deg	
FreqErrCurrent,	–1000.0 Hz to + 1000.0 Hz	NAN	Hz	
FreqErrAverage,	–1000.0 Hz to + 1000.0 Hz	NAN	Hz	
FreqErrMaxMin	–1000.0 Hz to + 1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr	–100.0 dBm to +20.0 dBm	NAN	dBm	
AvgBurstPowerAvg	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	Sig. State
These commands are always queries. They start a measurement and output all scalar measurement results (see chapter 5 of CMU operating manual). These are: Peak phase error of *Current* burst Peak phase error of *Average* trace Peak phase error of *Max./Min.* trace RMS phase error of *Current* burst RMS phase error of *Average* trace RMS phase error of *Max./Min.* trace Frequency error of *Current* burst Frequency error of *Average* trace Frequency error of *Max./Min.* trace Average burst power of current burst Average burst power of average burst Relative portion of faulty bursts The calculation of results in an *Average* or *Max./Min.* measurement is described in chapter 3 (cf. *calculation of statistical quantities*).	CCH TCH CEST

CALCulate[:SCALar]:MODulation:PERRor:GMSK:CCH:MATChing:LIMit?
CALCulate[:SCALar]:MODulation:PERRor:GMSK:TCH:MATChing:LIMit? Bursts out of Tolerance

Return	Value range	Def. value	Def. unit	FW vers.
PhErrPeakCurrent, PhErrPeakAverage, PhErrPeakMaxMin,		INV INV INV	– – –	V2.80
PhErrRMSCurrent, PhErrRMSAverage, PhErrRMSMaxMin,	**For all measured values:**	INV INV INV	– – –	
FreqErrCurrent, FreqErrAverage, FreqErrMaxMin	**NMAU | NMAL | INV | OK**	INV INV INV	– – –	
AvgBurstPowerCurr AvgBurstPowerAvg		INV INV	– –	

Description of command	Sig. State
This command is always a query. It indicates whether and in which way the permissible error limits for the scalar measured values (see command above) have been exceeded. The following messages may be output for all measured values: NMAU Underflow of tolerance value *not matching, underflow* NMAL Tolerance value exceeded *not matching, overflow* INV Measurement invalid *invalid* OK. all tolerances matched	CCH TCH CEST

READ:ARRay:MODulation:PERRor:GMSK:CCH:CURRent? Phase Error in Burst
READ:ARRay:MODulation:PERRor:GMSK:TCH:CURRent?
READ:ARRay:MODulation:PERRor:GMSK:CCH:AVERage?
READ:ARRay:MODulation:PERRor:GMSK:TCH:AVERage?
READ:ARRay:MODulation:PERRor:GMSK:CCH:MMAXimum?
READ:ARRay:MODulation:PERRor:GMSK:TCH:MMAXimum?
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:PERRor:GMSK:CCH:CURRent?
FETCh:ARRay:MODulation:PERRor:GMSK:TCH:CURRent?
FETCh:ARRay:MODulation:PERRor:GMSK:CCH:AVERage?
FETCh:ARRay:MODulation:PERRor:GMSK:TCH:AVERage?
FETCh:ARRay:MODulation:PERRor:GMSK:CCH:MMAXimum?
FETCh:ARRay:MODulation:PERRor:GMSK:TCH:MMAXimum?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:PERRor:GMSK:CCH:CURRent?
SAMPle:ARRay:MODulation:PERRor:GMSK:TCH:CURRent?
SAMPle:ARRay:MODulation:PERRor:GMSK:CCH:AVERage?
SAMPle:ARRay:MODulation:PERRor:GMSK:TCH:AVERage?
SAMPle:ARRay:MODulation:PERRor:GMSK:CCH:MMAXimum?
SAMPle:ARRay:MODulation:PERRor:GMSK:TCH:MMAXimum?
Read measurement results (synchronized) ⇒ *RUN*

Return	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 deg to + 100.0 deg **...** **–100.0 deg to + 100.0 deg**	Phase Error [1], ... Phase Error [588]	NAN ... NAN	deg ... deg	V2.80
Description of command				Sig. State
These commands are always queries. They return the values for the phase error of the burst in a fixed ¼-bit pattern. The number of measured values is 588, corresponding to a time range of 0 bit to 146 ¾ bit. The calculation of *current, average, minimum* and *maximum* results is explained in chapter 3 (cf. *display mode*).				CCH TCH CEST

READ:SUBarrays:MODulation:PERRor:GMSK:CCH:CURRent? Subarray Results
READ:SUBarrays:MODulation:PERRor:GMSK:TCH:CURRent?
READ:SUBarrays:MODulation:PERRor:GMSK:CCH:AVERage?
READ:SUBarrays:MODulation:PERRor:GMSK:TCH:AVERage?
READ:SUBarrays:MODulation:PERRor:GMSK:CCH:MMAXimum?
READ:SUBarrays:MODulation:PERRor:GMSK:TCH:MMAXimum?
Start single shot measurement and return results ⇒ *RUN*
FETCh:SUBarrays:MODulation:PERRor:GMSK:CCH:CURRent?
FETCh:SUBarrays:MODulation:PERRor:GMSK:TCH:CURRent?
FETCh:SUBarrays:MODulation:PERRor:GMSK:CCH:AVERage?
FETCh:SUBarrays:MODulation:PERRor:GMSK:TCH:AVERage?
FETCh:SUBarrays:MODulation:PERRor:GMSK:CCH:MMAXimum?
FETCh:SUBarrays:MODulation:PERRor:GMSK:TCH:MMAXimum?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:SUBarrays:MODulation:PERRor:GMSK:CCH:CURRent?
SAMPle:SUBarrays:MODulation:PERRor:GMSK:TCH:CURRent?
SAMPle:SUBarrays:MODulation:PERRor:GMSK:CCH:AVERage?
SAMPle:SUBarrays:MODulation:PERRor:GMSK:TCH:AVERage?
SAMPle:SUBarrays:MODulation:PERRor:GMSK:CCH:MMAXimum?
SAMPle:SUBarrays:MODulation:PERRor:GMSK:TCH:MMAXimum?
Read measurement results (synchronized) ⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 deg to + 100.0 deg **...** **–100.0 deg to + 100.0 deg**	Phase Error [1], ... Phase Error [n]	NAN ... NAN	deg ... deg	V2.80
Description of command				Sig. State
These commands are always queries. They output the phase error versus time in a fixed ¼- bit pattern and in the subranges defined by means of the `CONFigure:SUBarrays:MODulation...` 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` 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. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).				CCH TCH CEST

MODulation:OVERview

The subsystem *MODulation:OVERview:EPSK:TCH* measures general scalar modulation parameters in 8PSK modulation. The subsystem corresponds to the measurement menu *Modulation,* application *Overview 8PSK,* and the associated popup menu *Modulation Configuration.*

Important Note!

The keyword `:EPSK:TCH` in the remote control commands of this section denotes 8PSK modulation (TCH test). The commands are available with option CMU-K41 only.

Control of Measurement – Subsystem MODulation:OVERview:EPSK:TCH

The subsystem *MODulation:OVERview:EPSK:TCH* controls the modulation measurement. It corresponds to the softkey *Overview 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation:OVERview:EPSK:TCH	Start new measurement		⇒ *RUN*
ABORt:MODulation:OVERview:EPSK:TCH	Abort running measurement and switch off		⇒ *OFF*
STOP:MODulation:OVERview:EPSK:TCH	Stop measurement after current stat. cycle		⇒ *STOP*
CONTinue:MODulation:OVERview:EPSK:TCH	Next measurement step (only *stepping mode*)		⇒ *RUN*
Description of command		Sig. State	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.		CCH TCH CEST	V2.80

CONFigure:MODulation:OVERview:EPSK:TCH: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 SOPC No reporting	OFF	–	V2.80
Description of command				Sig. State
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).				all

FETCh:MODulation:OVERview:EPSK:TCH:STATus?				Measurement Status
Ret. 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	–	V2.80
 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				Sig. State
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).				all

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* application.

Subsystem MODulation:OVERview:EPSK:TCH:CONTrol

The subsystem *MODulation:OVERview:EPSK:TCH:CONTrol* configures the modulation measurement. It corresponds to the tabs *Control* and *Statistics* in the popup menu *Modulation Configuration*.

CONFigure:MODulation:OVERview:EPSK:TCH:CONTrol *<Mode>, <Statistics>*, *<Repetition>, <StopCond>, <Stepmode>*				Scope of Measurement
<Mode>	Desciption of parameters	Def. value	Def. unit	
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	
<Statistics>	Description of parameters	Def. value	Def. unit	
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	200	–	
<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	
SOERror | **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	–	V2.80
Description of command				Sig. State
This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe, ...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).				all

CONFigure:MODulation:OVERview:EPSK:TCH:CONTrol:RMODe *<Mode>* Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	FW-Vers.
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	V2.80
Description of command				Sig. State
This command specifies the type of measured values.				all

CONFigure:MODulation:OVERview:EPSK:TCH:CONTrol:STATistics *<Statistics>* Statistics Count

<Statistics>	Description of parameters	Def. value	Def. unit	FW-Vers.
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	200	–	V2.80
Description of command				Sig. State
This command defines the number of bursts forming a statistics cycle.				all

CONFigure:MODulation:OVERview:EPSK:TCH: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	
SOERror | **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	–	V2.80
Description of command				Sig. State
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.*				all

DEFault:MODulation:OVERview:EPSK:TCH:CONTrol <*Mode*>		Default Settings		
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	V2.80
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). In the query format, the command returns ON if all the parameters of the subsystem correspond to their default values, otherwise it returns OFF..				all

Subsystem MODulation:OEMP...:RPMode

The subsystem *MODulation:OEMP...:RPMode* contains the command determining the way how the reference power is calculated in 8PSK modulation. The subsystem corresponds to the *Ref. Power Mode* parameter in the *Control* tab of the *Modulation Configuration* menu.

CONFigure:MODulation:OEMP:EPSK:TCH:RPMode <*Mode*>		Ref. Power Mode		
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
CURRent | **AVERage |** **DCOMpensated**	Ref. Power calculated from current burst Ref. Power calculated from average curve Data compensated/corrected reference power	CURR	–	V3.07
Description of command				Sig. State
This command determines how the reference power (0-dB line in the *P/t Norm. 8PSK* test diagram) for 8PSK-modulated signals is calculated.				all

Tolerance values – Subsystem MODulation:OEMP:EPSK:TCH:LIMit

The subsystem *MODulation:OEMP:EPSK:TCH:LIMit* defines tolerance values for the modulation measurement **in all four 8PSK applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

CONFigure:MODulation:OEMP:EPSK:TCH:CMMax:LIMit[:SCALar]:SYMMetric [:COMBined]:VALue
CONFigure:MODulation:OEMP:EPSK:TCH:AVERage:LIMit[:SCALar]:SYMMetric [:COMBined]:VALue
<EVMErrorPeak>,<EVMErrorRMS>,<MagnErrorPeak>, <MagnErrorRMS>, <PhaseErrorPeak>, <PhaseErrorRMS>, <OriginOffset>, <FreqError>

Limits Current & Max, Average

Parameter	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to +50.0 %,	EVM Error Peak	+22.0	%	V2.80
0.0 % to +50.0 %,	EVM Error RMS	+8.0	%	
0.0 % to +50.0 %,	Magn Error Peak	+22.0	%	
0.0 % to +50.0 %,	Magn Error RMS	+8.0	%	
0.0 deg to +180.0 deg,	Phase Error Peak	+180.0	deg	
0.0 deg to +180.0 deg,	Phase Error RMS	+180.0	deg	
–100.0 dB to 0.0 dB,	Origin Offset	–35.0	dB	
0 Hz to 999 Hz	Frequency Error	+45	Hz	

Description of command

These commands define upper limits for the *Current* and *Max./Min*. traces (keyword `CMMax`) as well as for the *Average* trace (keyword `AVERage)` and for the scalar modulation parameters derived from them. The default value for the frequency error depends on the GSM band: It is 23 Hz for GSM 400, 45 Hz for GSM 900, and 90 Hz for GSM 1800 and GSM 1900.

CONFigure:MODulation:OEMP:EPSK:TCH:P95Th:LIMit[:SCALar]:SYMMetric [:COMBined]:VALue ***<EVM95%>, <MError95%>, <PError95%>***

95th Percentile

Parameter	Description of parameters	Def. value	Def. unit	FW vers.
0% to 50.0%,	95th percentile EVM	+11.0	%	V2.80
0% to 50.0%,	95th percentile magnitude error	+11.0	%	
0° to 180°	95th percentile phase error	+11.0	deg	

Description of command	Sig. State
This command defines upper limits for the 95th percentile of the three quantities *error vector magnitude*, *magnitude error*, and *phase error*. The 95th percentile is the limit below which 95% of the measured errors are located.	all

DEFault:MODulation:OEMP:EPSK:TCH:LIMit *<Mode>*

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	The parameters are set to their default values	ON	–	V2.80
OFF	Some or all 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). In the query format, the command returns ON if all the parameters of the subsystem correspond to their default values, otherwise it returns OFF..	all

Measured Values – Subsystem MODulation:OVERview:EPSK:TCH

The subsystem *MODulation:OVERview:EPSK:TCH* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the *Modulation* measurement menu, application *Overview 8PSK.*

Command	Description
READ[:SCALar]:MODulation:OVERview:EPSK:TCH?	Scalar Results: Start single shot measurement and return results
FETCh[:SCALar]:MODulation:OVERview:EPSK:TCH?	Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:OVERview:EPSK:TCH?	Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
95thPercentileEVM,	0.0 % to 100.0 %	NAN	%	V2.80
95thPercentileMagErr,	0.0 % to 100.0 %	NAN	%	
95thPercentilePhErr,	–100.0 deg to +100.0 deg	NAN	deg	
EVMPeak (x3),	0.0 % to 100.0 %	NAN	%	
EVMRMS (x3),	0.0 % to 100.0 %	NAN	%	
MagnErrorPeak (x3),	0.0 % to 100.0 %	NAN	%	
MagnErrorRMS (x3),	0.0 % to 100.0 %	NAN	%	
PhErrorPeak(x3),	–100.0 deg to +100.0 deg	NAN	deg	
PhErrorRMS (x3),	–100.0 deg to +100.0 deg	NAN	deg	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	Sig. State
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4). The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.	CCH TCH CEST

CALCulate[:SCALar]:MODulation:OVERview:EPSK:TCH:MATChing:LIMit?

Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	FW vers.
95thPercentileEVM,		INV	–	V2.80
95thPercentileMagErr,		INV	–	
95thPercentilePhErr,		INV	–	
EVMPeak (x3),	**For all measured values:**	INV	–	
EVMRMS (x3),		INV	–	
MagnErrorPeak (x3),		INV	–	
MagnErrorRMS (x3),		INV	–	
PhErrorPeak(x3),	**NMAU | NMAL | INV | OK**	INV	–	
PhErrorRMS (x3),		INV	–	
OriginOffset (x3),		INV	–	
FrequencyError (x3),		INV	–	
AvgBurstPowerCurr		INV	–	

Description of command	Sig. State
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value. The following messages may be output for all measured values: NMAU Underflow of tolerance value *not matching, underflow* NMAL Tolerance value exceeded *not matching, overflow* INV Measurement invalid *invalid* OK all tolerances matched	CCH TCH CEST

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,* application *Error Vect. Magn. 8PSK,* and the associated popup menu *Modulation Configuration.*

Important Note!

The keyword `:EPSK:TCH` in the remote control commands of this section denotes 8PSK modulation (TCH test). The commands are available with option CMU-K41 only.

Control of Measurement – Subsystem MODulation:EVMagnitude

The subsystem *MODulation:EVMagnitude* controls the modulation measurement. It corresponds to the softkey *EVM 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation:EVMagnitude:EPSK:TCH Start new measurement ⇒ *RUN* **ABORt:MODulation:EVMagnitude:EPSK:TCH** Abort running measurement and switch off ⇒ *OFF* **STOP:MODulation:EVMagnitude:EPSK:TCH** Stop measurement after current stat. cycle ⇒ *STOP* **CONTinue:MODulation:EVMagnitude:EPSK:TCH** Next meas. step (only *stepping mode*) ⇒ *RUN*		
Description of command	Sig. State	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.	CCH TCH CEST	V2.80

CONFigure:MODulation:EVMagnitude:EPSK:TCH: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 SOPC No reporting	OFF	–	V2.80
Description of command				Sig. State
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).				all

FETCh:MODulation:EVMagnitude:EPSK:TCH:STATus?				Measurement Status
Ret. values	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,** **1 to 10000 |** **NONE,** **1 to 1000 |** **NONE**	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 Counter for current statistics cycle No counting mode set Counter for current evaluation period within a cycle Statistic count set to off	OFF NONE NONE	– – –	V2.80
Description of command				Sig. State
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).				all

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 *Error Vector Magnitude* application.

Subsystem MODulation:EVMagnitude:EPSK:TCH:CONTrol

The subsystem *MODulation:EVMagnitude:EPSK:TCH:CONTrol* configures the modulation measurement. It corresponds to the tabs *Control* and *Statistics* in the popup menu *Modulation Configuration.*

CONFigure:MODulation:EVMagnitude:EPSK:TCH:CONTrol <*Mode*>, <*Statistics*>, <*Repetition*>, <*StopCond*>, <*Stepmode*> — Scope of Measurement

<*Mode*>	Desciption of parameters	Def. value	Def. unit	
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	
<*Statistics*>	Description of parameters	Def. value	Def. unit	
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	
<*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	
SOERror | **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	–	V2.80
Description of command				Sig. State
This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).				all

CONFigure:MODulation:EVMagnitude:EPSK:TCH:CONTrol:RMODe <*Mode*> — Result Mode

<*Mode*>	Desciption of parameters	Def. value	Def. unit	FW-Vers.
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	V2.80
Description of command				Sig. State
This command specifies the type of measured values.				all

CONFigure:MODulation:EVMagnitude:EPSK:TCH:CONTrol:STATistics <*Statistics*> — Statistics Count

<*Statistics*>	Description of parameters	Def. value	Def. unit	FW-Vers.
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	V2.80
Description of command				Sig. State
This command defines the number of bursts forming a statistics cycle.				all

CONFigure:MODulation:EVMagnitude:EPSK:TCH: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	
SOERror | **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	–	V2.80
Description of command				Sig. State
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.*				all

DEFault:MODulation:EVMagnitude:EPSK:TCH:CONTrol *<Mode>*				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	V2.80
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). In the query format, the command returns ON if all the parameters of the subsystem correspond to their default values, otherwise it returns OFF..				all

Tolerance values – Subsystem MODulation:OEMP:EPSK:TCH:LIMit

The subsystem *MODulation:OEMP:EPSK:TCH:LIMit* (see p. 6.174 ff) defines tolerance values for the modulation measurement **in all four EPSK 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:EPSK:TCH <Mode>,<Start>,<Samples>{,<Start>,<Samples>} — Definition of Subarrays

<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	
3 symb to 144 symb,	Start time in current range	0	symb	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 142	Number of samples in current range	142	–	V2.80

Description of command	Sig. State
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation :EVMagnitude:EPSK:TCH` 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 symb. 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. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	all

Measured Values – Subsystem MODulation:EVMagnitude:EPSK:TCH

The subsystem *MODulation:EVMagnitude:EPSK:TCH* 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 *EVM 8PSK.*

READ[:SCALar]:MODulation:EVMagnitude:EPSK:TCH Scalar Results:
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:EVMagnitude:EPSK:TCH
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:EVMagnitude:EPSK:TCH
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
95thPercentileEVM	0.0 % to 100.0 %	NAN	%	V2.80
EVMPeak (x3),	0.0 % to 100.0 %	NAN	%	
EVMRMS (x3),	0.0 % to 100.0 %	NAN	%	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
AvgBurstPowerAvg	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	Sig. State
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4). The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.	CCH TCH CEST

CALCulate[:SCALar]:MODulation:EVMagnitude:EPSK:TCH:MATChing:LIMit?
Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	FW vers.
95thPercentileEVM		INV	–	V2.80
EVMPeak (x3),		INV	–	
EVMRMS (x3),	**For all measured values:**	INV	–	
		INV	–	
OriginOffset (x3),	**NMAU | NMAL | INV | OK**			
FrequencyError(x3)		INV	–	

Description of command	Sig. State
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value. The limits are defined with the `CONFigure:MODulation:OEMP`... commands. The following messages may be output for all measured values: NMAU — Underflow of tolerance value — *not matching, underflow* NMAL — Tolerance value exceeded — *not matching, overflow* INV — Measurement invalid — *invalid* OK — all tolerances matched	CCH TCH CEST

READ:ARRay:MODulation:EVMagnitude:EPSK:TCH:CURRent? Error Vector Magnitude
READ:ARRay:MODulation:EVMagnitude:EPSK:TCH:AVERage?
READ:ARRay:MODulation:EVMagnitude:EPSK:TCH:MMAXimum?
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:EVMagnitude:EPSK:TCH:CURRent?
FETCh:ARRay:MODulation:EVMagnitude:EPSK:TCH:AVERage?
FETCh:ARRay:MODulation:EVMagnitude:EPSK:TCH:MMAXimum?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:TCH:CURRent?
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:TCH:AVERage?
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:TCH:MMAXimum?
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	%	V2.80
... ,	...	...	...	
0.0 % to+ 100.0 %	142nd value for error vector magnitude	NAN	%	

Description of command	Sig. State
These commands are always queries. They return the error vector magnitude vs. time at fixed, equidistant test points. The number of measured values is 142, corresponding to a time range of 3 symb to 144 symb. The calculation of *Current, Average, and MMax* (Min./Max.) results is explained in chapter 3 (see *display mode*).	all

READ:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:CURRent? **READ:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:AVERage?** **READ:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:MMAXimum?**				Subarray Results
	Start single shot measurement and return results			⇒ *RUN*
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:CURRent? **FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:AVERage?** **FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:MMAXimum?**				
	Read meas. results (unsynchronized)			⇒ *RUN*
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:CURRent? **SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:AVERage?** **SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:MMAXimum?**				
	Read results (synchronized)			⇒ *RUN*
Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to + 100.0 %, **... ,** **0.0 % to + 100.0 %**	1st value for error vector magnitude ... nth value for error vector magnitude	NAN ... NAN	% ... %	V2.80
Description of command				Sig. State
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:EPSK:TCH` 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:EPSK:TCH` 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. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (see *display mode*).				CCH TCH CEST

Demodulated Bits (MODulation:EVMagnitude:EPSK:TCH:DBITs…)

The following commands select the symbol range and control the readout of the demodulated bits. In manual control the symbol range is selected via marker functions; the demodulated bits are displayed in a bar below the test diagram.

NOTE

The demodulation of symbols must be disabled explicitly using `CONFigure:MODulation:EVMagnitude:EPSK:TCH:DBITs ON`, otherwise the remaining commands in this section return invalid results.

CONFigure:MODulation:EVMagnitude:EPSK:TCH:DBITs *<Enable>*				Enable/Disable Demodulation
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Demodulation enabled Demodulated disabled, no valid results	OFF	–	V3.82
Description of command				
This command enables or disables the demodulation of symbols in the *EVM 8PSK* application.				

Peak Values

READ[:SCALar]:MODulation:EVMagnitude:EPSK:TCH:DBITS:PEAK? Start single shot meas. and return results
FETCh[:SCALar]:MODulation:EVMagnitude:EPSK:TCH:DBITS:PEAK? Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:EVMagnitude:EPSK:TCH:DBITS:PEAK? Read out meas. results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
3 to 144, **0 to 7**	Symbol no. with the peak EVM Demod. bits at the EVM peak	NAN NAN	(symb.) –	V3.82

Description of command

These commands are always queries. They start a modulation measurement (`READ…`) and/or return the number of the symbol with the peak EVM and the demodulated bits at this position. The demodulated bits are returned as a decimal value, 1 corresponding to 001 in the measurement menu.

Single Value

READ[:SCALar]:MODulation:EVMagnitude:EPSK:TCH:DBITS? *<Symbol>* Start single shot meas. and return results
FETCh[:SCALar]:MODulation:EVMagnitude:EPSK:TCH:DBITS? *<Symbol>* Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:EVMagnitude:EPSK:TCH:DBITS? *<Symbol>* Read out meas. results (synchronized)

<Symbol>	Value range	Def. value	Def. unit	
3 to 144	Evaluated symbol number	NAN	(symb.)	
Returned values	Value range	Def. value	Def. unit	FW vers.
0 to 7	Demod. bits at the specified symbol	NAN	–	V3.82

Description of command

These commands are always queries. They start a modulation measurement (`READ…`) and/or return the demodulated bits for a specific symbol. The demodulated bits are returned as a decimal value, 1 corresponding to 001 in the measurement menu.

				Single Value
READ:ARRay:MODulation:EVMagnitude:EPSK:TCH:DBITS?				Start single shot meas. and return results
FETCh:ARRay:MODulation:EVMagnitude:EPSK:TCH:DBITS?				Read out meas. results (unsynchronized)
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:TCH:DBITS?				Read out meas. results (synchronized)
Returned values	Value range	Def. value	Def. unit	FW vers.
0 to 7,	Demod. bits at symbol no. 3	NAN	–	V3.82
…			–	
0 to 7	Demod. bits at symbol no. 144	NAN	–	
Description of command				
These commands are always queries. They start a modulation measurement (`READ…`) and/or return the demodulated bits at all symbols (142 returned values). The demodulated bits are returned as decimal values, 1 corresponding to 001 in the measurement menu.				

MODulation:PERRor:EPSK:TCH

The subsystem *MODulation:PERRor* measures the phase error as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation,* application *Phase Error 8PSK,* and the associated popup menu *Modulation Configuration.*

Important Note!

The keyword `:EPSK:TCH` *in the remote control commands of this section denotes 8PSK modulation (TCH test). The commands are available with option CMU-K41 only.*

Control of Measurement – Subsystem MODulation:PERRor

The subsystem *MODulation:PERRor* controls the modulation measurement. It corresponds to the softkey *Phase Error 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation:PERRor:EPSK:TCH	Start new measurement	⇒ *RUN*
ABORt:MODulation:PERRor:EPSK:TCH	Abort running measurement and switch off	⇒ *OFF*
STOP:MODulation:PERRor:EPSK:TCH	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:PERRor:EPSK:TCH	Next measurement step (only *stepping mode*)	⇒ *RUN*

Description of command	Sig. State	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.	CCH TCH CEST	V2.80

CONFigure:MODulation:PERRor:EPSK:TCH: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 SOPC No reporting	OFF	–	V2.80

Description of command	Sig. State
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).	all

FETCh:MODulation:PERRor:EPSK:TCH:STATus?				Measurement Status
Ret. 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	–	V2.80
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				Sig. State
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).				all

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 *Magnitude Error* application.

Subsystem MODulation:PERRor:EPSK:TCH:CONTrol

The subsystem *MODulation:PERRor:EPSK:TCH:CONTrol* configures the modulation measurement. It corresponds to the tabs *Control* and *Statistics* in the popup menu *Modulation Configuration.*

CONFigure:MODulation:PERRor:EPSK:TCH:CONTrol <*Mode*>, <*Statistics*>, <*Repetition*>, <*StopCond*>, <*Stepmode*> — Scope of Measurement

<Mode>	Desciption of parameters	Def. value	Def. unit	
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	
<Statistics>	Description of parameters	Def. value	Def. unit	
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	
<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	
SOERror | **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	–	V2.80
Description of command				Sig. State
This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).				all

CONFigure:MODulation:PERRor:EPSK:TCH:CONTrol:RMODe <*Mode*> — Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	FW-Vers.
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	V2.80
Description of command				Sig. State
This command specifies the type of measured values.				all

CONFigure:MODulation:PERRor:EPSK:TCH:CONTrol:STATistics <*Statistics*> — Statistics Count

<Statistics>	Description of parameters	Def. value	Def. unit	FW-Vers.
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	V2.80
Description of command				Sig. State
This command defines the number of bursts forming a statistics cycle.				all

CONFigure:MODulation:PERRor:EPSK:TCH: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	
SOERror | **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	–	V2.80
Description of command				Sig. State
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.*				all

DEFault:MODulation:PERRor:EPSK:TCH:CONTrol ***<Mode>***				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	V2.80
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). In the query format, the command returns ON if all the parameters of the subsystem correspond to their default values, otherwise it returns OFF..				all

Tolerance values – Subsystem MODulation:OEMP:EPSK:TCH:LIMit

The subsystem *MODulation:OEMP:EPSK:TCH:LIMit* (see p. 6.174 ff) defines tolerance values for the modulation measurement **in all four EPSK applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Subsystem SUBarrays:MODulation:PERRor:EPSK:TCH

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

<table>
<tr><td colspan="4">CONFigure:SUBarrays:MODulation:PERRor:EPSK:TCH
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}</td><td>Definition of Subarrays</td></tr>
<tr><td><Mode></td><td>Description of parameters</td><td>Def. value</td><td>Def. unit</td><td></td></tr>
<tr><td>ALL |
ARIThmetical |
MINimum |
MAXimum,</td><td>Return all measurement values
Return arithm. mean value in every range
Return minimum value in every range
Return maximum value in every range</td><td>ALL</td><td>–</td><td></td></tr>
<tr><td><Start></td><td>Description of parameters</td><td>Def. value</td><td>Def. unit</td><td></td></tr>
<tr><td>3 symb to 144 symb,</td><td>Start time in current range</td><td>0</td><td>symb</td><td></td></tr>
<tr><td><Samples></td><td>Description of parameters</td><td>Def. value</td><td>Def. unit</td><td>FW vers.</td></tr>
<tr><td>0 to 142</td><td>Number of samples in current range</td><td>142</td><td>–</td><td>V2.80</td></tr>
<tr><td colspan="4">Description of command</td><td>Sig. State</td></tr>
<tr><td colspan="4">This command configures the <code>READ:SUBarrays...</code>, <code>FETCh:SUBarrays...</code>, and <code>SAMPle:SUBarrays:MODulation:PERRor: EPSK:TCH</code> 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 symb.

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.

By default, only one range corresponding to the total measurement range is used and all measurement values are returned.</td><td>all</td></tr>
</table>

Measured Values – Subsystem MODulation:PERRor:EPSK:TCH

The subsystem *MODulation:PERRor:EPSK:TCH* 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 *Phase Error 8PSK.*

READ[:SCALar]:MODulation:PERRor:EPSK:TCH? Scalar Results: Start single shot measurement and return results

FETCh[:SCALar]:MODulation:PERRor:EPSK:TCH? Read out meas. results (unsynchronized)

SAMPle[:SCALar]:MODulation:PERRor:EPSK:TCH? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
95thPercentilePhError	0.0 deg to 50.0 deg	NAN	deg	V2.80
PhaseErrorPeak (x3),	–100.0 deg to 100.0 deg	NAN	deg	
PhaseErrorRMS (x3),	–100.0 deg to 100.0 deg	NAN	deg	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
AvgBurstPowerAvg	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	Sig. State
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4), either for the whole burst or for the 1st ten valid symbols in the burst. The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.	CCH TCH CEST

CALCulate[:SCALar]:MODulation:PERRor:EPSK:TCH:MATChing:LIMit? Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	FW vers.
95thPercentilePhError		INV	–	V2.80
PhErrorPeak (x3),		INV	–	
PhErrorRMS (x3),	**For all measured values:**	INV	–	
		INV	–	
OriginOffset (x3),	**NMAU | NMAL | INV | OK**			
FrequencyError(x3)		INV	–	

Description of command	Sig. State
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value. The limits are defined with the `CONFigure:MODulation:OEMP`... commands. The following messages may be output for all measured values: NMAU Underflow of tolerance value *not matching, underflow* NMAL Tolerance value exceeded *not matching, overflow* INV Measurement invalid *invalid* OK all tolerances matched	CCH TCH CEST

READ:ARRay:MODulation:PERRor:EPSK:TCH:CURRent? **READ:ARRay:MODulation:PERRor:EPSK:TCH:AVERage?** **READ:ARRay:MODulation:PERRor:EPSK:TCH:MMAXimum?**				Phase Error in Burst
	Start single shot measurement and return results			⇒ *RUN*
FETCh:ARRay:MODulation:PERRor:EPSK:TCH:CURRent? **FETCh:ARRay:MODulation:PERRor:EPSK:TCH:AVERage?** **FETCh:ARRay:MODulation:PERRor:EPSK:TCH:MMAXimum?**				
	Read measurement results (unsynchronized)			⇒ *RUN*
SAMPle:ARRay:MODulation:PERRor:EPSK:TCH:CURRent? **SAMPle:ARRay:MODulation:PERRor:EPSK:TCH:AVERage?** **SAMPle:ARRay:MODulation:PERRor:EPSK:TCH:MMAXimum?**				
	Read measurement results (synchronized)			⇒ *RUN*
Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 deg to +100.0 deg, **... ,** **–100.0 deg to +100.0 deg**	1st value for phase error ... 142nd value for phase error	NAN ... NAN	deg ... deg	V2.80
Description of command				Sig. State
These commands are always queries. They return the the phase error vs. time at fixed, equidistant test points. The number of measured values is 142, corresponding to a time range of 3 symb to 144 symb. The calculation of *current, average, and mmax* (Min./Max.) results is explained in chapter 3 (see *display mode*).				all

READ:SUBarrays:MODulation:PERRor:EPSK:TCH:CURRent? **READ:SUBarrays:MODulation:PERRor:EPSK:TCH:AVERage?** **READ:SUBarrays:MODulation:PERRor:EPSK:TCH:MMAXimum?** Start single shot measurement and return results ⇒ *RUN* **FETCh:SUBarrays:MODulation:PERRor:EPSK:TCH:CURRent?** **FETCh:SUBarrays:MODulation:PERRor:EPSK:TCH:AVERage?** **FETCh:SUBarrays:MODulation:PERRor:EPSK:TCH:MMAXimum?** Read meas. results (unsynchronized) ⇒ *RUN* **SAMPle:SUBarrays:MODulation:PERRor:EPSK:TCH:CURRent?** **SAMPle:SUBarrays:MODulation:PERRor:EPSK:TCH:AVERage?** **SAMPle:SUBarrays:MODulation:PERRor:EPSK:TCH:MMAXimum?** Read results (synchronized) ⇒ *RUN*				Subarray Results
Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 deg to +100.0 deg, **... ,** **–100.0 deg to +100.0 deg**	1st value for phase error ... nth value for phase error	NAN ... NAN	deg ... deg	V2.80
Description of command				Sig. State
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:EPSK:TCH` 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:EPSK:TCH` 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. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (see *display mode*).				CCH TCH CEST

Demodulated Bits (MODulation:PERRor:EPSK:TCH:DBITs…)

The following commands select the symbol range and control the readout of the demodulated bits. In manual control the symbol range is selected via marker functions; the demodulated bits are displayed in a bar below the test diagram.

NOTE

The demodulation of symbols must be disabled explicitly using `CONFigure:MODulation:PERRor:EPSK:TCH:DBITs ON`, otherwise the remaining commands in this section return invalid results.

CONFigure:MODulation:PERRor:EPSK:TCH:DBITs *<Enable>*		Enable/Disable Demodulation		
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Demodulation enabled Demodulated disabled, no valid results	OFF	–	V3.82
Description of command				
This command enables or disables the demodulation of symbols in the *Phase Error 8PSK* application.				

		Peak Values		
READ[:SCALar]:MODulation:PERRor:EPSK:TCH:DBITS:PEAK?		Start single shot meas. and return results		
FETCh[:SCALar]:MODulation:PERRor:EPSK:TCH:DBITS:PEAK?		Read out meas. results (unsynchronized)		
SAMPle[:SCALar]:MODulation:PERRor:EPSK:TCH:DBITS:PEAK?		Read out meas. results (synchronized)		
Returned values	Value range	Def. value	Def. unit	FW vers.
3 to 144, **0 to 7**	Symbol no. with the peak phase error Demod. bits at the phase error peak	NAN NAN	(symb.) –	V3.82
Description of command				
These commands are always queries. They start a modulation measurement (`READ…`) and/or return the number of the symbol with the largest absolute value of the phase error and the demodulated bits at this position. The demodulated bits are returned as a decimal value, 1 corresponding to 001 in the measurement menu.				

		Single Value		
READ[:SCALar]:MODulation:PERRor:EPSK:TCH:DBITS? *<Symbol>*		Start single shot meas. and return results		
FETCh[:SCALar]:MODulation:PERRor:EPSK:TCH:DBITS? *<Symbol>*		Read out meas. results (unsynchronized)		
SAMPle[:SCALar]:MODulation:PERRor:EPSK:TCH:DBITS? *<Symbol>*		Read out meas. results (synchronized)		
<Symbol>	Value range	Def. value	Def. unit	
3 to 144	Evaluated symbol number	NAN	(symb.)	
Returned values	Value range	Def. value	Def. unit	FW vers.
0 to 7	Demod. bits at the specified symbol	NAN	–	V3.82
Description of command				
These commands are always queries. They start a modulation measurement (`READ…`) and/or return the demodulated bits for a specific symbol. The demodulated bits are returned as a decimal value, 1 corresponding to 001 in the measurement menu.				

				Single Value
READ:ARRay:MODulation:PERRor:EPSK:TCH:DBITS?		Start single shot meas. and return results		
FETCh:ARRay:MODulation:PERRor:EPSK:TCH:DBITS?		Read out meas. results (unsynchronized)		
SAMPle:ARRay:MODulation:PERRor:EPSK:TCH:DBITS?		Read out meas. results (synchronized)		
Returned values	Value range	Def. value	Def. unit	FW vers.
0 to 7,	Demod. bits at symbol no. 3	NAN	–	V3.82
…			–	
0 to 7	Demod. bits at symbol no. 144	NAN	–	
Description of command				
These commands are always queries. They start a modulation measurement (`READ…`) and/or return the demodulated bits at all symbols (142 returned values). The demodulated bits are returned as decimal values, 1 corresponding to 001 in the measurement menu.				

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,* application *Magn. Error 8PSK,* and the associated popup menu *Modulation Configuration.*

Important Note!

The keyword `:EPSK:TCH` in the remote control commands of this section denotes 8PSK modulation (TCH test). The commands are available with option CMU-K41 only.

Control of Measurement – Subsystem MODulation:MERRor

The subsystem *MODulation:MERRor* controls the modulation measurement. It corresponds to the softkey *Magn. Error 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation:MERRor:EPSK:TCH	Start new measurement	⇒ *RUN*
ABORt:MODulation:MERRor:EPSK:TCH	Abort running measurement and switch off	⇒ *OFF*
STOP:MODulation:MERRor:EPSK:TCH	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:MERRor:EPSK:TCH	Next measurement step (only *stepping mode*)	⇒ *RUN*

Description of command	Sig. State	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.	CCH TCH CEST	V2.80

CONFigure:MODulation:MERRor:EPSK:TCH:EREPorting <*Mode*> — Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V2.80
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command	Sig. State
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).	all

FETCh:MODulation:MERRor:EPSK:TCH:STATus?				Measurement Status
Ret. 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	–	V2.80
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				Sig. State
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).				all

Subsystem MODulation:MERRor:EPSK:TCH:CONTrol

The subsystem *MODulation:MERRor:EPSK:TCH:CONTrol* configures the modulation measurement. It corresponds to the tabs *Control* and *Statistics* in the popup menu *Modulation Configuration.*

CONFigure:MODulation:MERRor:EPSK:TCH:CONTrol *<Mode>, <Statistics>*, *<Repetition>, <StopCond>, <Stepmode>*				Scope of Measurement
<Mode>	Desciption of parameters	Def. value	Def. unit	
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	
<Statistics>	Description of parameters	Def. value	Def. unit	
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	
<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	
SOERror | **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	–	V2.80
Description of command				Sig. State
This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe, ...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).				all

CONFigure:MODulation:MERRor:EPSK:TCH:CONTrol:RMODe *<Mode>*				Result Mode
<Mode>	Desciption of parameters	Def. value	Def. unit	FW-Vers.
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	V2.80
Description of command				Sig. State
This command specifies the type of measured values.				all

CONFigure:MODulation:MERRor:EPSK:TCH:CONTrol:STATistics *<Statistics>*				Statistics Count
<Statistics>	Description of parameters	Def. value	Def. unit	FW-Vers.
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	V2.80
Description of command				Sig. State
This command defines the number of bursts forming a statistics cycle.				all

CONFigure:MODulation:MERRor:EPSK:TCH: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	
SOERror | **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	–	V2.80
Description of command				Sig. State
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.*				all

DEFault:MODulation:MERRor:EPSK:TCH:CONTrol *<Mode>*				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	V2.80
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). In the query format, the command returns ON if all the parameters of the subsystem correspond to their default values, otherwise it returns OFF..				all

Tolerance values – Subsystem MODulation:OEMP:EPSK:TCH:LIMit

The subsystem *MODulation:OEMP:EPSK:TCH:LIMit* (see p. 6.174 ff) defines tolerance values for the modulation measurement **in all four EPSK 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:EPSK:TCH <Mode>,<Start>,<Samples>{,<Start>,<Samples>}	Definition of Subarrays			
<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	
3 symb to 144 symb,	Start time in current range	0	symb	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 142	Number of samples in current range	142	–	V2.80
Description of command				Sig. State
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation :MERRor:EPSK:TCH` 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 symb. 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. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.				all

Measured Values – Subsystem MODulation:MERRor:EPSK:TCH

The subsystem *MODulation:MERRor:EPSK:TCH* 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 *Magn. Error 8PSK.*

READ[:SCALar]:MODulation:MERRor:EPSK:TCH? Scalar Results:
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:MERRor:EPSK:TCH?
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:MERRor:EPSK:TCH?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
95thPercentileMErr	0.0 % to 100.0 %	NAN	%	V2.80
MagnErrorPeak (x3),	0.0 % to 100.0 %	NAN	%	
MagnErrorRMS (x3),	0.0 % to 100.0 %	NAN	%	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
AvgBurstPowerAvg	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	Sig. State
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4), either for the whole burst or for the 1st ten valid symbols in the burst. The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.	CCH TCH CEST

CALCulate[:SCALar]:MODulation:MERRor:EPSK:TCH:MATChing:LIMit?
Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	FW vers.
95thPercentileMErr		INV	–	V2.80
MErrPeak (x3),		INV	–	
MErrRMS (x3),	**For all measured values:**	INV	–	
		INV	–	
OriginOffset (x3),				
FrequencyError (x3)	**NMAU | NMAL | INV | OK**	INV	–	

Description of command	Sig. State
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value. The limits are defined with the `CONFigure:MODulation:OEMP`... commands. The following messages may be output for all measured values: NMAU Underflow of tolerance value *not matching, underflow* NMAL Tolerance value exceeded *not matching, overflow* INV Measurement invalid *invalid* OK all tolerances matched	CCH TCH CEST

READ:ARRay:MODulation:MERRor:EPSK:TCH:CURRent? Magnitude Error in Burst
READ:ARRay:MODulation:MERRor:EPSK:TCH:AVERage?
READ:ARRay:MODulation:MERRor:EPSK:TCH:MMAXimum?
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:MERRor:EPSK:TCH:CURRent?
FETCh:ARRay:MODulation:MERRor:EPSK:TCH:AVERage?
FETCh:ARRay:MODulation:MERRor:EPSK:TCH:MMAXimum?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:MERRor:EPSK:TCH:CURRent?
SAMPle:ARRay:MODulation:MERRor:EPSK:TCH:AVERage?
SAMPle:ARRay:MODulation:MERRor:EPSK:TCH:MMAXimum?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to +100.0 %,	1st value for magnitude error	NAN	%	V2.80
... ,	...	...	...	
0.0 % to +100.0 %	142nd value for magnitude error	NAN	%	

Description of command	Sig. State
These commands are always queries. They return the magnitude error vs. time at fixed, equidistant test points. The number of measured values is 142, corresponding to a time range of 3 symb to 144 symb. The calculation of *current, average, and mmax* (Min./Max.) results is explained in chapter 3 (see *display mode*).	CCH TCH CEST

READ:SUBarrays:MODulation:MERRor:EPSK:TCH:CURRent? **READ:SUBarrays:MODulation:MERRor:EPSK:TCH:AVERage?** **READ:SUBarrays:MODulation:MERRor:EPSK:TCH:MMAXimum?**	Start single shot measurement and return results			Subarray Results ⇒ *RUN*
FETCh:SUBarrays:MODulation:MERRor:EPSK:TCH:CURRent? **FETCh:SUBarrays:MODulation:MERRor:EPSK:TCH:AVERage?** **FETCh:SUBarrays:MODulation:MERRor:EPSK:TCH:MMAXimum?**	Read meas. results (unsynchronized)			⇒ *RUN*
SAMPle:SUBarrays:MODulation:MERRor:EPSK:TCH:CURRent? **SAMPle:SUBarrays:MODulation:MERRor:EPSK:TCH:AVERage?** **SAMPle:SUBarrays:MODulation:MERRor:EPSK:TCH:MMAXimum?**	Read results (synchronized)			⇒ *RUN*
Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to +100.0 %, **... ,** **0.0 % to +100.0 %**	1st value for magnitude error ... nth value for magnitude error	NAN ... NAN	% ... %	V2.80
Description of command				Sig. State
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:EPSK:TCH` 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:EPSK:TCH` 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. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (see *display mode*).				CCH TCH CEST

Demodulated Bits (MODulation:MERRor:EPSK:TCH:DBITs…)

The following commands select the symbol range and control the readout of the demodulated bits. In manual control the symbol range is selected via marker functions; the demodulated bits are displayed in a bar below the test diagram.

NOTE

The demodulation of symbols must be disabled explicitly using `CONFigure:MODulation:MERRor:EPSK:TCH:DBITs ON`, otherwise the remaining commands in this section return invalid results.

CONFigure:MODulation:MERRor:EPSK:TCH:DBITs *<Enable>*		Enable/Disable Demodulation		
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Demodulation enabled Demodulated disabled, no valid results	OFF	–	V3.82
Description of command				
This command enables or disables the demodulation of symbols in the *Magn. Error 8PSK* application.				

Peak Values

READ[:SCALar]:MODulation:MERRor:EPSK:TCH:DBITS:PEAK? Start single shot meas. and return results
FETCh[:SCALar]:MODulation:MERRor:EPSK:TCH:DBITS:PEAK? Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:MERRor:EPSK:TCH:DBITS:PEAK? Read out meas. results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
3 to 144, **0 to 7**	Symbol no. with the peak magnitude error Demod. bits at the magnitude error peak	NAN NAN	(symb.) –	V3.82
Description of command				
These commands are always queries. They start a modulation measurement (`READ…`) and/or return the number of the symbol with the largest absolute value of the magnitude error and the demodulated bits at this position. The demodulated bits are returned as a decimal value, 1 corresponding to 001 in the measurement menu.				

Single Value

READ[:SCALar]:MODulation:MERRor:EPSK:TCH:DBITS? *<Symbol>*
Start single shot meas. and return results
FETCh[:SCALar]:MODulation:MERRor:EPSK:TCH:DBITS? *<Symbol>*
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:MERRor:EPSK:TCH:DBITS? *<Symbol>*
Read out meas. results (synchronized)

<Symbol>	Value range	Def. value	Def. unit	
3 to 144	Evaluated symbol number	NAN	(symb.)	
Returned values	Value range	Def. value	Def. unit	FW vers.
0 to 7	Demod. bits at the specified symbol	NAN	–	V3.82
Description of command				
These commands are always queries. They start a modulation measurement (`READ…`) and/or return the demodulated bits for a specific symbol. The demodulated bits are returned as a decimal value, 1 corresponding to 001 in the measurement menu.				

	Single Value
READ:ARRay:MODulation:MERRor:EPSK:TCH:DBITS?	Start single shot meas. and return results
FETCh:ARRay:MODulation:MERRor:EPSK:TCH:DBITS?	Read out meas. results (unsynchronized)
SAMPle:ARRay:MODulation:MERRor:EPSK:TCH:DBITS?	Read out meas. results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
0 to 7,	Demod. bits at symbol no. 3	NAN	–	V3.82
…			–	
0 to 7	Demod. bits at symbol no. 144	NAN	–	

Description of command

These commands are always queries. They start a modulation measurement (`READ…`) and/or return the demodulated bits at all symbols (142 returned values). The demodulated bits are returned as decimal values, 1 corresponding to 001 in the measurement menu.

MODulation:IQANalyzer

The subsystem *MODulation:IQANalyzer* measures the I and Q amplitudes of the received 8PSK signal as a function of time. The subsystem corresponds to the measurement menu *Modulation,* applications *I/Q Analyzer 8PSK,* and the sections in the popup menu *Modulation Configuration* that are related to the *I/Q Analyzer 8PSK* application.

Control of Measurement – Subsystem MODulation:IQANalyzer

The subsystem *MODulation:IQANalyzer* controls the measurement. It corresponds to the softkey *I/Q Analyzer 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation:IQANalyzer:EPSK:TCH ⇒ *RUN*	Start new measurement
ABORt:MODulation:IQANalyzer:EPSK:TCH ⇒ *OFF*	Abort running measurement and switch off
STOP:MODulation:IQANalyzer:EPSK:TCH ⇒ *STOP*	Stop measurement after current stat. cycle
CONTinue:MODulation:IQANalyzer:EPSK:TCH ⇒ *RUN*	Next measurement step (only *stepping mode*)
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.	V3.82

CONFigure:MODulation:IQANalyzer:EPSK:TCH: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 SOPC No reporting	OFF	–	V3.82

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:EPSK:TCH:STATus? Measurement Status

Ret. 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	–	V3.82
1 to 10000 | **NONE**	Counter for current statistics cycle 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 following commands configure the *I/Q Analyzer* measurement. They correspond to the *I/Q Analyzer* section in the *Control* tab of the *Modulation Configuration* menu.

CONFigure:MODulation:IQANalyzer:EPSK:TCH: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	–	V3.82
Description of command				
This command specifies the type of measured values.				

CONFigure:MODulation:IQANalyzer:EPSK:TCH: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	
NONE	(No stop condition because no limit check)	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	–	V3.82
Description of command				
This command determines the number of statistics cycles and the stepping mode for the measurement. te: *For READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*				

CONFigure:MODulation:IQANalyzer:EPSK:TCH:ROTation *<Enable>*				Rotation
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
P38 | **P38R**	3 π/8 rotation conserved 3 π/8 rotation removed	P38R	–	V3.82
Description of command				
This command qualifies whether or not the 3π/8 rotation is subtracted off before the symbols are displayed in the constellation diagram.				

CONFigure:MODulation:IQANalyzer:EPSK:TCH:IQFilter *<Length>*				Measurement Length
<Length>	Description of parameters	Def. value	Def. unit	FW vers.
ISIRemoved | **UNFiltered**	I/Q filter applied No I/Q filter applied	ISIRemoved	–	V3.82
Description of command				
This command specifies whether the I/Q data is filtered in order to eliminate the inter-symbol interference (ISI) at all constellation points.				

DEFault:MODulation:IQANalyzetar:EPSK: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	–	V3.82
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:IQANalyzer:EPSK:TCH

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,* application *I/Q Analyzer 8PSK.*

READ[:SCALar]:MODulation:IQANalyzer:EPSK:TCH? **FETCh[:SCALar]:MODulation:IQANalyzer:EPSK:TCH?** **SAMPle[:SCALar]:MODulation:IQANalyzer:EPSK:TCH?**	Scalar Results: Start single shot measurement and return results Read out meas. results (unsynchronized) Read out measurement results (synchronized)			
Returned values	Value range	Def. value	Def. unit	FW vers.
Error Vector Magnitude (RMS), **Magnitude Error (RMS)** **Phase Error (RMS),** **Timing Advance Error,** **Avg. Burst Power (Current)**	0.0 % to 100.0 % 0.0 % to 100.0 % –180.0 deg to +180.0 deg –100 symbols to +100 symbols –100.0 dBm to +60.0 dBm	NAN NAN NAN NAN NAN	% % deg (symb.) dBm	V3.82
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 *Signalling* are not available in *Non Singnalling* mode; the *Non Singnalling* output string is shortened.				

READ:ARRay:MODulation:IQANalyzer:EPSK:TCH:IPHase? **READ:ARRay:MODulation:IQANalyzer:EPSK:TCH:QPHase?** Start single shot measurement and return results **FETCh:ARRay:MODulation:IQANalyzer:EPSK:TCH:IPHase?** **FETCh:ARRay:MODulation:IQANalyzer:EPSK:TCH:QPHase?** Read measurement results (unsynchronized) **SAMPle:ARRay:MODulation:IQANalyzer:EPSK:TCH:IPHase?** **SAMPle:ARRay:MODulation:IQANalyzer:EPSK:TCH:QPHase?** Read measurement results (synchronized)	Normalized I/Q Amplitude ⇒ *RUN* ⇒ *RUN* ⇒ *RUN*			
Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–2.0 to +2.0, **... ,** **–2.0 to +2.0**	1st value for normalized I or Q amplitude ... 568th value for normalized I or Q amplitude	NAN ... NAN	deg ... deg	V3.82
Description of command				
These commands are always queries. They return the normalized I and Q amplitudes. The 568 measured values correspond to 142 symbols at an oversampling factor 4.				

SPECtrum[:COMMon]

The subsystem *SPECtrum[:COMMon]* provides settings that are common to the two applic*ations Spectrum due to Modulation* (see p. 6.209 ff) and *Spectrum due to Switching* (see p. 6.222 ff).

CONFigure:SPECtrum[:COMMon]:NOISe:CORRection *<Enable>*				Noise Correction
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Switch noise correction on or off	ON	–	V2.80
Description of command				Sig. State
This command switches the noise correction for the Spectrum measurement on or off. The noise correction improves the dynamic range but slightly reduces the speed of the measurement.				all

CONFigure:SPECtrum:TCH:LIMit:LINE:SELect *<Modulation>*				Limit Selection
<Modulation>	Description of parameters	Def. value	Def. unit	FW vers.
AUTO | **GMSK |** **EPSK**	Auto-detect modulation and adjust template Use GMSK template Use EPSK template	AUTO	–	V3.65
Description of command				
These commands selects the limit line to be applied. The current template can be queried using `[SENSe:]SPECtrum:<Application>:LIMit:LINE:USED?`.				

SPECtrum due to Modulation

The subsystem *SPECtrum:MODulation* measures the off-carrier power due to the modulation of the GSM signal. The subsystem corresponds to the measurement menus *Spectrum* and the associated configuration popups.

Important Note!

Spectrum measurements on 8PSK modulated bursts require option CMU-K41; they are available in the TCH *test mode only.*

Measurement configurations are generally possible in all signalling states. However, to `INITiate`, `ABORt`, `STOP`, `CONTinue` *a measurement, and to obtain measurement results, the command* `PROCedure:SIGNalling:ACTion` *must be used to access either the* TCH *mode (commands including the keyword* `:TCH`*; traffic channel tests) or the* CCH *mode (commands including the keyword* `:CCH`*; control channel tests).*

Control of Measurement

The subsystem *SPECtrum:MODulation* controls the spectrum measurement.

INITiate:SPECtrum:MODulation:CCH **INITiate:SPECtrum:MODulation:TCH**	Start new measurement	⇒	*RUN*
ABORt:SPECtrum:MODulation:CCH **ABORt:SPECtrum:MODulation:TCH**	Abort running meas. and switch off	⇒	*OFF*
STOP:SPECtrum:MODulation:CCH **STOP:SPECtrum:MODulation:TCH**	Stop meas. after current stat. cycle	⇒	*STOP*
CONTinue:SPECtrum:MODulation:CCH **CONTinue:SPECtrum:MODulation:TCH**	Next meas. step (only *stepping mode*)	⇒	*RUN*

Description of command	Sig. State	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.	CCH TCH CEST	V2.80

CONFigure:SPECtrum:MODulation:CCH:EREPorting <*Mode*> Event Reporting
CONFigure:SPECtrum:MODulation:TCH:EREPorting <*Mode*>

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	V2.80

Description of command	Sig. State
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).	all

FETCh:SPECtrum:MODulation:CCH:STATus? Measurement Status
FETCh:SPECtrum:MODulation:TCH: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	–	–
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	–	V2.80

Description of command	Sig. State
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).	all

Subsystem SPECtrum:MODulation...:CONTrol

The subsystem *SPECtrum:MODulation...:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* and *Statistics* tabs in the popup menu *Spectrum Configuration*.

CONFigure:SPECtrum:MODulation:CCH:CONTrol <*Mode*>, <*Statistics*>, <*Repetition*>, <*StopCond*>, <*Stepmode*> — Scope of Measurement
CONFigure:SPECtrum:MODulation:TCH:CONTrol <*Mode*>, <*Statistics*>, <*Repetition*>, <*StopCond*>, <*Stepmode*>

<Mode>	Description of parameters	Def. value	Def. unit	
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	
<Statistics>	Description of parameters	Def. value	Def. unit	
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	200	–	
<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	
SOERror | **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	–	V2.80
Description of command				Sig. State
This command defines the scope of the spectrum measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).				all

CONFigure:SPECtrum:MODulation:CCH:CONTrol:RMODe <*Mode*> — Result Mode
CONFigure:SPECtrum:MODulation:TCH:CONTrol:RMODe <*Mode*>

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	V2.80
Description of command				Sig. State
This command specifies the type of measured values.				all

CONFigure:SPECtrum:MODulation:CCH:CONTrol:STATistics <*Statistics*> **CONFigure:SPECtrum:MODulation:TCH:CONTrol:STATistics <*Statistics*>**				Statistics Count
<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	200	–	V2.80
Description of command				Sig. State
This command defines the number of bursts forming a statistics cycle.				all

CONFigure:SPECtrum:MODulation:CCH:CONTrol:REPetition **CONFigure:SPECtrum:MODulation:TCH:CONTrol:REPetition** **<Repetition>,<StopCondition>, ><Stepmode>**				Test Cycles
<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (*continuous*, until `STOP` or `ABORT`) Single measurement *(single shot*, `until Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCondition>	Description of parameters	Def. value		
SOERror | **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	–	V2.80
Description of command				Sig. State
This command defines the number of test cycles, the stepping mode and, if required, a stop condition 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.*				all

DEFault:SPECtrum:MODulation:CCH:CONTrol <*Enable*> **DEFault:SPECtrum:MODulation:TCH: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	–	V2.80
Description of command				Sig. State
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.				all

Test Configuration

The commands of the following subsystems configure the spectrum due to modulation. They correspond to the *due to Modulation* sections in the *Spectrum Configuration* menu.

CONFigure:SPECtrum:MODulation:CCH:TDFSelect *<Frequency>* CONFigure:SPECtrum:MODulation+20.0:TDFSelect *<Frequency>*				Time D. @ Freq.
<Frequency>	Description of parameters	Def. value	Def. unit	FW vers.
N180 | N160 | N140 | N120 | N100 | N080 | N060 | N040 | N025 | N020 | N010 | REF | P010 | P020 | P025 | P040 | P060 | P080 | P100 | P120 | P140 | P160 | P180 | NV4 | NV3 | NV2 | NV1 | PV1 | PV2 | PV3 | PV4 | OFF | ON	Fixed measurement points at negative frequencies Carrier frequency (0 Hz offset) Fixed measurement points at positive frequencies Variable measurement points at negative or positive frequencies Switch time domain measurement off or on	OFF	–	V3.65
Description of command				
These commands selects the measurement frequency for the time domain (power vs. time) measurement results, to be retrieved by means of `READ:ARRay:SPECtrum:MODulation:CCH:TDOMain?` etc. The time domain measurement can be performed at all enabled fixed and variable measurement points (`CONFigure:SPECtrum:MODulation:CCH:CONTrol:MPOint<nr>:ENABle`, `CONFigure:SPECtrum:MODulation:CCH:CONTrol:VMPOint<nr>)`. OFF disables the time domain measurement so that `READ:ARRay:SPECtrum:MODulation:CCH:TDOMain?` etc. return NAN results.				

CONFigure:SPECtrum:MODulation:CCH:AVGareas <*Area*> CONFigure:SPECtrum:MODulation+20.0:AVGareas <*Area*>				Averaging Areas
<*Area*>	Description of parameters	Def. value	Def. unit	FW vers.
A | B | AB	Use averaging area A (before training sequence) or B (after TS) Use averaging area A and B	B	–	V3.65
Description of command				
These commands selects one or two 40-bit sections of the burst which are measured and averaged in order to calculate the *Modulation* results.				

Subsystem SPECTrum:MODulation...:LIMit:LINE

The subsystem *SPECtrum:MODulation...:LIMit:LINE* defines the limit lines, i.e. the tolerance values for the spectrum measurement. The subsystem corresponds to the tab *Limit Lines* in the popup menu *Spectrum Configuration.*

Important Note!

The keywords `:GMSK` *and* `:EPSK` *in the remote control commands denote GMSK and 8PSK modulation, respectively. The* `:EPSK` *commands are available with option CMU-K41 only.*

`:EPSK` *measurements are available in the* TCH *test mode only.*

Limits

CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>
<MinPwLevelRel>, <MaxPwLevelRel>, <AbsPwLevel>, <Enable>
CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle <Enable>
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle <Enable>
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle <Enable>
CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:VALue
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:VALue
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:VALue
<MinPwLevelRel>, <MaxPwLevelRel>, <AbsPwLevel>

Numeric Suffix	Value range	Description of parameters	Def. value
<nr>	1 to11	Measurement point (frequency) no.	

Parameters	Value range	Description of parameters	Def. value
<Enable>	ON | OFF	Limit check for frequency point <nr> on/off	See below
<MinPwLevelRel>,	–99.9 dB to 99.9 dB	Limit for relative power below the interpolation range	
<MaxPwLevelRel>,	–99.9 dB to 99.9 dB	Limit for relative power above the interpolation range	
<AbsPwLevel>	–99.9 dBm to 99.9 dBm	Alternative absolute power limit	

Description of command	Sig. State	FW vers.
These commands activate and define limit lines for the spectrum due to modulation measurement. The limits are defined at up to 11 fixed frequencies numbered by the numeric suffix <nr> and as a function of the BTS output power level. Outside the interpolation range defined via `CONFigure:SPECtrum:MODulation:CCH:...:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>`, the fixed relative power limits *<MinPwLevelRel> and <MaxPwLevelRel>* apply. Inside this range, the limits are derived from these values by linear interpolation. As an alternative, an absolute power limit is set. For a more detailed explanation see chapter 4. For totally switching on or off the limit check please use the commands `CONFigure:SPECtrum:MODulation:CCH:...LIMit:LINE:SYMMetric[:COMBined]:ENABle <Mode>`	all	V2.80

Default values for GSM400/GT800/850/900 (the GSM1800/1900 values are given in brackets where they differ from the GSM900 values):

Frequency	Min.P. Lev.rel.	Max.P. Lev.rel.	Level abs.
± 0.10 MHz	+0.5 dB	+ 0.5 dB	–65.0 dBm (–57.0 dBm)
± 0.20 MHz	–30.0 dB	– 30.0 dB	–65.0 dBm (–57.0 dBm)
± 0.25 MHz	–33.0 dB	– 33.0 dB	–65.0 dBm (–57.0 dBm)
± 0.40 MHz	–60.0 dB[5]	– 60.0 dB[5]	–65.0 dBm (–57.0 dBm)
± 0.60 MHz	–60.0 dB	– 70.0 dB	–65.0 dBm (–57.0 dBm)
± 0.80 MHz	–60.0 dB	– 70.0 dB	–65.0 dBm (–57.0 dBm)
± 1.00 MHz	–60.0 dB	– 70.0 dB	–65.0 dBm (–57.0 dBm)
± 1.20 MHz	–63.0 dB	– 73.0 dB	–65.0 dBm (–57.0 dBm)
± 1.40 MHz	–63.0 dB	– 73.0 dB	–65.0 dBm (–57.0 dBm)
± 1.60 MHz	–63.0 dB	– 73.0 dB	–65.0 dBm (–57.0 dBm)
± 1.80 MHz	–63.0 dB	– 73.0 dB	–65.0 dBm (–57.0 dBm)

Reference Power

CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:RPOWer
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:RPOWer
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:RPOWer
<Minimum>, <Maximum>

<Minimum>	Description of parameters	Def. value	Def. unit	
–99.9 dBm to +99.9 dBm	Ref. power for min. power level	33	dBm	
<Maximum>	Description of parameters	Def. value	Def. unit	FW vers.
–99.9 dBm to +99.9 dBm	Ref. power for max. power level	43	dBm	V2.80

Description of command	Sig. State
This command defines the BTS output power range where the relative limit lines are given by linear interpolation between a minimum and a maximum relative power level. See command `CONFigure:SPECtrum:MODulation:CCH...:LIMit :LINE:UPPer<nr>` and detailed explanation in chapter 4.	all

Limits on/off

CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:ENABle ***<Mode>***
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:ENABle ***<Mode>***
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:ENABle ***<Mode>***

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Switch on limit check Switch off limit check	ON	–	V2.80

Description of command	Sig. State
This command switches the limit check for all measurement points.	all

[5] GMSK modulation. With 8PSK modulation, the corresponding value is –56.0 dB.

DEFault:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE <*Enable*> **DEFault:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE <*Enable*>** **DEFault:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE <*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	–	V2.80
Description of command				Sig. State
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.				all

Subsystem SPECTrum:MODulation...:MPOint<nr>

The subsystem *SPECtrum:MODulation...:MPOint<nr>* defines at which frequencies the *Spectrum* measurement is performed. The subsystem corresponds to the tab *Meas X* in the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum:MODulation:CCH:MPOint<nr>:ENABle <Enable> **CONFigure:SPECtrum:MODulation:TCH:MPOint<nr>:ENABle <Enable>**				Enable/Disable Measurement Points
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Switch on measurement point <nr> Switch off measurement point <nr>	ON	–	V2.80
Description of command				Sig. State
This command switches the measurement at the individual frequency points no. 1 to 11 (numbered by the numeric suffix <nr>) on or off.				all

CONFigure:SPECtrum:MODulation:CCH:CONTrol:VMPoint<nr> <*Frequency*> **CONFigure:SPECtrum:MODulation:TCH:CONTrol:VMPoint<nr> <*Frequency*>**				Variable Measurement Points
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 MHz to 2.5 MHz | **0.0 MHz to 1.8 MHz |** **ON | OFF**	Variable meas. point with R&S CMU-U65 Var04 Variable meas. point with oder versions Switch on or off measurement point <nr>	0.9 (<nr> = 1) 1.1 (<nr> = 2) 1.3 (<nr> = 3) 1.5 (<nr> = 4)	MHz MHz MHz MHz	V3.65
Description of command				
This command sets and enables additional pairs of measurement points at up to 4 variable offset frequencies (numbered by the numeric suffix <nr> = 1 to 4). The variable measurement points are switched off after a reset; the parameter `ON` activates the default values quoted above. A measurement point which is selected for the time domain measurement `(CONFigure:SPECtrum:MODulation:CCH:TDFSelect)` can not be switched off. On the other hand, a measurement point is switched on automatically when it is selected for the time domain measurement.				

Subsystem SUBarrays:SPECtrum:MODulation…

The subsystem *SUBarrays:SPECtrum:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:SPECtrum:MODulation:CCH **CONFigure:SUBarrays:SPECtrum:MODulation:TCH** **<Mode>,<Start>,<Samples>{,<Start>,<Samples>}**	Definition of Subarrays			
<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	
–1.8 MHz to 1.8 MHz,	Frequency of first point in current range	–1.8	MHz	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 23	Number of samples in current range	23	–	V2.80
Description of command				Sig. State
This command configures the `READ:SUBarrays..`, `FETCh:SUBarrays..`, and `SAMPle:SUBarrays:SPECtrum:MODulation:CCH...` 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 frequency and the number of test points which are located at fixed frequencies (see command `CONFigure:SPECtrum:MODulation:CCH...LIMit:LINE...`). The subranges may overlap but must be within the total range of the *spectrum due to modulation* 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.				all

CONFigure:SUBarrays:SPECtrum:MODulation:CCH:TDOMain **CONFigure:SUBarrays:SPECtrum:MODulation:TCH:TDOMain** **<Mode>,<Start>,<Samples>{,<Start>,<Samples>}**	Definition of Subarrays: Time Domain			
<Mode>	Description of parameters	Def. value	Def. unit	
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range Return single interpolated value at <Start>	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	
–30 to +175,	First symbol point in current range	–30	(symb)	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 618	Number of samples in current range	618	–	V3.65
Description of command				
This command configures the `READ:SUBarrays..`, `FETCh:SUBarrays..`, and `SAMPle:SUBarrays:SPECtrum:MODulation:CCH:TDOMain` commands. It is analogous to the subarray command for the frequency domain `(CONFigure:SUBarrays:SPECtrum:MODulation:CCH[:FDOMain]).`				

Measured Values

The commands of the following subsystems determine and return the results of the spectrum due to modulation measurement. They correspond to the graphical menu *Spectrum* with its various display elements.

Subsystem SPECtrum:MODulation...

The subsystem *SPECtrum:MODulation...* measures and returns of the frequency spectum (due to modulation) and compares it with tolerance values. The subsystem corresponds to the graphical measurement menu *Spectrum.*

READ[:SCALar]:SPECtrum:MODulation:CCH? — Scalar Results
READ[:SCALar]:SPECtrum:MODulation:TCH? — Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:MODulation:CCH?
FETCh[:SCALar]:SPECtrum:MODulation:TCH? — Read out meas. results (unsynchronized)
SAMPle[:SCALar]:SPECtrum:MODulation:CCH?
SAMPle[:SCALar]:SPECtrum:MODulation:TCH? — Read out meas. results (synchronized)

Return	Value range	Def. value	Def. unit	FW vers.
Reference Power, **Matching**	–100,0 dBm to +20,0 dBm INV | MATC | NMAT | NTSC | OUT | NTRG | OFLW | UFLW	NAN INV	dBm –	V2.80

Description of command	Sig. State
These commands are always queries.	CCH TCH CEST

These commands are always queries.

- `READ` starts a single shot measurement and returns the results.
- `FETCh` outputs the results without taking care of the measurement state.
- `SAMPle` waits until the results are valid for the first time (depending on the chosen statistic count) and then outputs the results.

For more details refer to the description of measurement control in chapter 5 of the CMU operating manual.

The reference power is the absolute carrier power measured as specified in the GSM standard. The following messages may be output for the value *Matching*:

MATC	*matching*
NMAT	*not matching*
INV	*invalid*
NTSC	*no training sequence code*
OUT	*out of range*
NTRG	*not triggered*
UFLW	*underflow*
OFLW	*overflow*

READ:ARRay:SPECtrum:MODulation:CCH? **READ:ARRay:SPECtrum:MODulation:TCH?** **FETCh:ARRay:SPECtrum:MODulation:CCH?** **FETCh:ARRay:SPECtrum:MODulation:TCH?** **SAMPle:ARRay:SPECtrum:MODulation:CCH?** **SAMPle:ARRay:SPECtrum:MODulation:TCH?**	Spectrum Results Start single shot measurement and return results Read measurement results (unsynchronized) Read results (synchronized)			
Return	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB, **...,** **–100.0 dB to +20.0 dB**	Power at measurement point 1 ... Power at measurement point 23	NAN ... NAN	dB ... dB	V2.80
Description of command				Sig. State
These commands are always queries. They return the off-carrier power due to modulation at all measurement points.				CCH TCH CEST

READ:SUBarrays:SPECtrum:MODulation:CCH? **READ:SUBarrays:SPECtrum:MODulation:TCH?** **FETCh:SUBarrays:SPECtrum:MODulation:CCH?** **FETCh:SUBarrays:SPECtrum:MODulation:TCH?** **SAMPle:SUBarrays:SPECtrum:MODulation:CCH?** **SAMPle:SUBarrays:SPECtrum:MODulation:TCH?**	Subarray Results Start single shot measurement and return results Read measurement results (unsynchronized) Read results (synchronized)			
Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB **...** **–100.0 dB to +20.0 dB**	Power at measurement point 1 ... Power at measurement point n	NAN ... NAN	dB ... dB	V2.80
Description of command				Sig. State
These commands are always queries. They output the off-carrier power due to modulation in the subranges defined by means of the CONFigure:SUBarrays:SPECtrum:MODulation:CCH 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:SPECtrum:MODulation:CCH 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.				CCH TCH CEST

READ:ARRay:SPECtrum:MODulation:CCH:TDOMain? Spectrum Results: Time Domain
READ:ARRay:SPECtrum:MODulation:TCH:TDOMain? Start single shot measurement and return results

FETCh:ARRay:SPECtrum:MODulation:CCH:TDOMain?
FETCh:ARRay:SPECtrum:MODulation:TCH:TDOMain? Read measurement results (unsynchronized)

SAMPle:ARRay:SPECtrum:MODulation:CCH:TDOMain?
SAMPle:ARRay:SPECtrum:MODulation:TCH:TDOMain? Read results (synchronized)

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB, **...,** **–100.0 dB to +20.0 dB**	Power at measurement point 1 … Power at measurement point 618	NAN ... NAN	dB ... dB	V3.65

Description of command

These commands are always queries. They return the off-carrier power vs. time at a definite offset frequency from the carrier `(CONFigure:SPECtrum:MODulation:CCH:TDFSelect)`. The position of the measurement points is as reported in the `CONFigure:SUBarrays:SPECtrum:MODulation:CCH:TDOMain` command description.

READ:SUBarrays:SPECtrum:MODulation:CCH:TDOMain? Subarray Results: Time Domain
READ:SUBarrays:SPECtrum:MODulation:TCH:TDOMain? Start single shot meas. and return results ⇒ *RUN*

FETCh:SUBarrays:SPECtrum:MODulation:CCH:TDOMain?
FETCh:SUBarrays:SPECtrum:MODulation:TCH:TDOMain? Read meas. results (unsynchronized) ⇒ *RUN*

SAMPle:SUBarrays:SPECtrum:MODulation:CCH:TDOMain?
SAMPle:SUBarrays:SPECtrum:MODulation:TCH:TDOMain? Read results (synchronized) ⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB **...** **–100.0 dB to +20.0 dB**	Power[1], 1st value for power ... Power[x], xth value for power	NAN ... NAN	dB ... dB	V3.65

Description of command

These commands are always queries. They output the off-carrier power due to modulation in the subranges defined by means of the `CONFigure:SUBarrays:SPECtrum:MODulation:CCH:TDOMain` 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:SPECtrum:MODulation:CCH:TDOMain` 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.

Spectrum Results: Frequency Domain, Variable Meas. Points

READ:ARRay:SPECtrum:MODulation:CCH[:FDOMain]:VMPoint?
READ:ARRay:SPECtrum:MODulation:TCH[:FDOMain]:VMPoint?

Start single shot measurement and return results

FETCh:ARRay:SPECtrum:MODulation:CCH[:FDOMain]:VMPoint?
FETCh:ARRay:SPECtrum:MODulation:TCH[:FDOMain]:VMPoint?

Read measurement results (unsynchronized)

SAMPle:ARRay:SPECtrum:MODulation:CCH[:FDOMain]:VMPoint?
SAMPle:ARRay:SPECtrum:MODulation:TCH[:FDOMain]:VMPoint?

Read results (synchronized)

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB,	Power at measurement point 4 (neg. freq. offset)	NAN	dB	V3.65
...,	...	...	...	
–100.0 dB to +20.0 dB,	Power at measurement point 1 (neg. freq. offset)	NAN	dB...	
–100.0 dB to +20.0 dB,	Power at measurement point 1 (pos. freq. offset)	NAN	dB	
…,	...	...		
–100.0 dB to +20.0 dB	Power at measurement point 4 (pos. freq. offset)	NAN	dB	

Description of command

These commands are always queries. They return the off-carrier power due to modulation at all enabled variable measurement points `(CONFigure:SPECtrum:MODulation:CCH:CONTrol:VMPOint<nr>)`. NAN is returned at the disabled points.

SPECtrum due to SWITching

The subsystem *SPECtrum:SWITching* measures the off-carrier power due to the bursty nature of the GSM signal. The subsystem corresponds to the measurement menu *Spectrum* and the associated configuration popups

Important Note!

Spectrum measurements on 8PSK modulated bursts require option CMU-K41; they are available in the TCH *test mode only.*

Measurement configurations are generally possible in all signalling states. However, to `INITiate`, `ABORt`, `STOP`, `CONTinue` *a measurement, and to obtain measurement results, the command* `PROCedure:SIGNalling:ACTion` *must be used to access either the* TCH *mode (commands including the keyword* `:TCH`*; traffic channel tests) or the* CCH *mode (commands including the keyword* `:CCH`*; control channel tests).*

Control of Measurement – Subsystem SPECtrum:SWITching

The subsystem *SPECtrum:SWITching* controls the spectrum measurement.

INITiate:SPECtrum:SWITching:CCH **INITiate:SPECtrum:SWITching:TCH**	Start new measurement	⇒	*RUN*
ABORt:SPECtrum:SWITching:CCH **ABORt:SPECtrum:SWITching:TCH**	Abort running meas. and switch off	⇒	*OFF*
STOP:SPECtrum:SWITching:CCH **STOP:SPECtrum:SWITching:TCH**	Stop meas. after current stat. cycle	⇒	*STOP*
CONTinue:SPECtrum:SWITching:CCH **CONTinue:SPECtrum:SWITching:TCH**	Next meas. step (only *stepping mode*)	⇒	*RUN*

Description of command	Sig. State	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.	CCH TCH CEST	V2.80

CONFigure:SPECtrum:SWITching:CCH:EREPorting <*Mode*>
CONFigure:SPECtrum:SWITching:TCH: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 SOPC No reporting	OFF	–	V2.80

Description of command	Sig. State
This command defines the events generated when the measurement is terminated or stopped (*event reporting,* see chapter 5 of CMU manual).	all

FETCh:SPECtrum:SWITching:CCH:STATus?
FETCh:SPECtrum:SWITching:TCH:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V2.80
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	–	
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	

Description of command	Sig. State
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).	all

Subsystem SPECtrum:SWITching...:CONTrol

The subsystem *SPECtrum:SWITching...:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* and *Statistics* tabs in the popup menu *Spectrum Configuration*.

CONFigure:SPECtrum:SWITching:CCH:CONTrol *<Mode>, <Statistics>*, *<Repetition>, <StopCond>, <Stepmode>*
CONFigure:SPECtrum:SWITching:TCH:CONTrol *<Mode>, <Statistics>*, *<Repetition>, <StopCond>, <Stepmode>* Scope of Measurement

<Mode>	Description of parameters	Def. value	Def. unit	
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	
<Statistics>	Description of parameters	Def. value	Def. unit	
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	10	–	
<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	
SOERror | **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	–	V2.80
Description of command				Sig. State
This command defines the scope of the spectrum measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).				all

CONFigure:SPECtrum:SWITching:CCH:CONTrol:RMODe <*Mode*> **CONFigure:SPECtrum:SWITching:TCH:CONTrol:RMODe <*Mode*>**				Result Mode
<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARR	–	V2.80
Description of command				Sig. State
This command specifies the type of measured values.				all

CONFigure:SPECtrum:SWITching:CCH:CONTrol:STATistics <*Statistics*> **CONFigure:SPECtrum:SWITching:TCH:CONTrol:STATistics <*Statistics*>**				Statistics Count
<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	10	–	V2.80
Description of command				Sig. State
This command defines the number of bursts forming a statistics cycle.				all

CONFigure:SPECtrum:SWITching:CCH:CONTrol:REPetition
CONFigure:SPECtrum:SWITching:TCH:CONTrol:REPetition
<Repetition>,<StopCondition>, <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	–	
<StopCondition>	Description of parameters	Def. value	Def. unit	
SOERror | **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	–	V2.80

Description of command	Sig. State
This command defines the number of test cycles, the stepping mode and, if required, an stop condition 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*	all

DEFault:SPECtrum:SWITching:CCH:CONTrol *<Enable>*
DEFault:SPECtrum:SWITching:TCH: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	–	V2.80

Description of command	Sig. State
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.	all

Test Configuration

The commands of the following subsystems configure the spectrum due to switching. They correspond to the *due to Switching* sections in the *Spectrum Configuration* menu.

CONFigure:SPECtrum:SWITching:CCH:TDFSelect *<Frequency>* **CONFigure:SPECtrum:SWITching:TCH:TDFSelect *<Frequency>***				Time D. @ Freq.
<Frequency>	Description of parameters	Def. value	Def. unit	FW vers.
N180 | N120 | N060 | N040 | **REF |** **P040 | P060 | P120 | P180 |** **NV4 | NV3 | NV2 | NV1 |** **PV1 | PV2 | PV3 | PV4 |** **OFF | ON**	Fixed meas. points at negative frequencies Carrier frequency (0 Hz offset) Fixed meas. points at positive frequencies Variable measurement points at negative or positive frequencies	OFF	–	V3.65
Description of command				
These commands selects the measurement frequency for the time domain (power vs. time) measurement results, to be retrieved by means of `READ:ARRay:SPECtrum:SWITching:CCH:TDOMain?` etc. The time domain measurement can be performed at all enabled fixed and variable measurement points (`CONFigure:SPECtrum:SWITching:CCH:CONTrol:MPOint<nr>:ENABle`, `CONFigure:SPECtrum:SWITching:CCH:CONTrol:VMPOint<nr>`). OFF disables the time domain measurement so that `READ:ARRay:SPECtrum:SWITching:CCH:TDOMain?` etc. return NAN results.				

CONFigure:SPECtrum:SWITching:CCH:NOSLots *<Slots>* **CONFigure:SPECtrum:SWITching:TCH:NOSLots *<Slots>***				Slot Count
<Slots>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 8	Number of slots per TDMA frame measured	1	–	V3.65
Description of command				
These commands defines the number of timeslots which are considered for the *Spectrum due to Switching* measurement.				

CONFigure:SPECtrum:SWITching:CCH:CSMODE *<Mode>* **CONFigure:SPECtrum:SWITching:TCH:CSMODE *<Mode>***				Cont. Stat. Mode
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
PHOL | **SCO**	Peak Hold Statistic Count	PHOL	–	V3.65
Description of command				
This command defines the continuous statistical mode for the spectrum due to switching measurement.				

Subsystem SPECTrum:SWITching...:LIMit:LINE

The subsystem *SPECtrum:SWITching...:LIMit:LINE* defines the limit lines, i.e. the tolerance values for the spectrum measurement. The subsystem corresponds to the tab *Limit Lines* in the popup menu *Spectrum Configuration.*

Important Note!

The keywords `:GMSK` and `:EPSK` in the remote control commands denote GMSK and 8PSK modulation, respectively. The `:EPSK` commands are available with option CMU-K41 only.

`:EPSK` measurements are available in the TCH *test mode only.*

CONFigure:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr> Limits
CONFigure:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>
CONFigure:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>
<MinPwLevelRel>, <MaxPwLevelRel>, <AbsPwLevel>, <Enable>
CONFigure:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle <Enable>
CONFigure:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle <Enable>
CONFigure:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle <Enable>
CONFigure:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:VALue
CONFigure:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:VALue
CONFigure:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:VALue
<MinPwLevelRel>, <MaxPwLevelRel>, <AbsPwLevel> Limits

Numeric Suffix	Value range	Description of parameters	Def. value
<nr>	1 to 4	Measurement point (frequency) no.	

Parameters	Value range	Description of parameters	Def. value
<Enable>	ON | OFF	Limit check for frequency point <nr> on/off	See below
<MinPwLevelRel>,	–99.9 dB to 99.9 dB	Limit for relative power below the interpolation range	
<MaxPwLevelRel>,	–99.9 dB to 99.9 dB	Limit for relative power above the interpolation range	
<AbsPwLevel>,	–99.9 dBm to 99.9 dBm	Alternative absolute power limit	

Description of command	Sig. State	FW vers.
These commands activate and define limit lines for the spectrum due to switching measurement.	all	V2.80

The relative limits depend on the GSM band and on the measurement points numbered by the numeric suffix <nr>.

For totally switching on or off the limit check please use the command

```
CONFigure:SPECtrum:SWITching:GMSK...:LIMit:LINE:SYMMetric[:COMBined]
:ENABle <Mode>
```

Default values for the four GSM bands (all in dBc):

Meas. point	Frequ. offset	GSM400/GT800/850/900	GSM1800	GSM1900
1	0.4 MHz	–57[6]	–50	–50
2	0.6 MHz	–67[7]	–58	–58
3	1.2 MHz	–74	–66	–66
4	1.8 MHz	–74	–66	–66

[6] GMSK modulation. With 8PSK modulation, the corresponding value is –52.0 dBc.
[7] GMSK modulation. With 8PSK modulation, the corresponding value is –62.0 dBc.

Limit Check on/off

CONFigure:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:ENABle ***<Mode>***
CONFigure:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:ENABle ***<Mode>***
CONFigure:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:ENABle ***<Mode>***

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Switch on limit check Switch off limit check	ON	–	V2.80

Description of command	Sig. State
This command switches the limit check for all measurepoints.	all

DEFault:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE *<Enable>* Default Settings
DEFault:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE *<Enable>*
DEFault:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE *<Enable>*

<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	–	V2.80

Description of command	Sig. State
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.	all

Subsystem SPECTrum:SWITching...:MPOint<nr>

The subsystem *SPECtrum:SWITching...:MPOint<nr>* defines at which frequencies the *Spectrum* measurement is performed. The subsystem corresponds to the tab *Meas X* in the popup menu *Spectrum Configuration.*

Enable/Disable Measurement Points

CONFigure:SPECtrum:SWITching:CCH:MPOint<nr>:ENABle <Enable>
CONFigure:SPECtrum:SWITching:TCH:MPOint<nr>:ENABle <Enable>
CONFigure:SPECtrum:SWITching:EPSK:TCH:MPOint<nr>:ENABle <Enable>

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	Switch on measurement point <nr> Switch off measurement point <nr>	ON	–	V2.80

Description of command	Sig. State
This command switches the measurement at the individual frequency points no. 1 to 4 (numbered by the numeric suffix <nr>) on or off.	all

CONFigure:SPECtrum:SWITching:CCH:CONTrol:VMPOint<nr> *<Frequency>* Variable Measurement Points **CONFigure:SPECtrum:SWITching:TCH:CONTrol:VMPOint<nr> *<Frequency>***				
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 MHz to 2.5 MHz | **0.0 MHz to 1.8 MHz |** **ON | OFF**	Variable meas. point with R&S CMU-U65 Var04 Variable meas. point with oder versions Switch on or off measurement point <nr>	0.8 (<nr> = 1) 1.0 (<nr> = 2) 1.4 (<nr> = 3) 1.6 (<nr> = 4)	MHz MHz MHz MHz	V3.65
Description of command				
This command sets and enables additional pairs of measurement points at up to 4 variable offset frequencies (numbered by the numeric suffix <nr> = 1 to 4). The variable measurement points are switched off after a reset; the parameter `ON` activates the default values quoted above. A measurement point which is selected for the time domain measurement (`CONFigure:SPECtrum:SWITching:CCH:TDFSelect`) can not be switched off. On the other hand, a measurement point is switched on automatically when it is selected for the time domain measurement.				

Subsystem SUBarrays:SPECtrum:SWITching…

The subsystem *SUBarrays:SPECtrum:SWITching* defines the measurement range and the type of output values.

CONFigure:SUBarrays:SPECtrum:SWITching:CCH Definition of Subarrays **CONFigure:SUBarrays:SPECtrum:SWITching:TCH <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	
–1.8 MHz to 1.8 MHz,	Start frequency in current range	–1.8	MHz	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 9	Number of samples in current range	9	–	V2.80
Description of command				Sig. State
This command configures the `READ:SUBarrays..`, `FETCh:SUBarrays..`, and `SAMPle:SUBarrays:SPECtrum:SWITching:CCH...` 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 frequency and the number of test points which are located at fixed frequencies (see command `CONFigure:SPECtrum:SWITching:CCH:LIMit:LINE<nr>`). The subranges may overlap but must be within the total range of the *spectrum due to switching* 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.				all

CONFigure:SUBarrays:SPECtrum:SWITching:CCH:TDOMain **CONFigure:SUBarrays:SPECtrum:SWITching:TCH:TDOMain** **<Mode>,<Start>,<Samples>{,<Start>,<Samples>}**	Definition of Subarrays: Time Domain			
<Mode>	Description of parameters	Def. value	Def. unit	
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range Return single interpolated value at <Start>	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	
–30 to 175 **–186 to 175** **–186 to 331** **–186 to 587** **–186 to 643** **–186 to 799** **–186 to 955** **–186 to 1111**	First symbol point in current range, Slot Count = 1 First symbol point in current range, Slot Count = 2 First symbol point in current range, Slot Count = 3 First symbol point in current range, Slot Count = 4 First symbol point in current range, Slot Count = 5 First symbol point in current range, Slot Count = 6 First symbol point in current range, Slot Count = 7 First symbol point in current range, Slot Count = 8	–30 –186 –186 –186 –186 –186 –186 –186	(symb) (symb) (symb) (symb) (symb) (symb) (symb) (symb)	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 618 **1 to 1086** **1 to 1554** **1 to 2022** **1 to 2490** **1 to 2958** **1 to 3426** **1 to 3894**	Number of samples in current range, Slot Count = 1 Number of samples in current range, Slot Count = 2 Number of samples in current range, Slot Count = 3 Number of samples in current range, Slot Count = 4 Number of samples in current range, Slot Count = 5 Number of samples in current range, Slot Count = 6 Number of samples in current range, Slot Count = 7 Number of samples in current range, Slot Count = 8	618 1086 1554 2022 2490 2958 3426 3894	– – – – – – – –	V3.65
Description of command				
This command configures the `READ:SUBarrays..`, `FETCh:SUBarrays..`, and `SAMPle:SUBarrays:SPECtrum:SWITching:CCH:TDOMain` commands. It is analogous to the subarray command for the frequency domain (`CONFigure:SUBarrays:SPECtrum:SWITching:CCH[:FDOMain]`). The number of samples and the start value depends on the slot count (`CONFigure:SPECtrum:SWITching:CCH:NOSLots`)				

Measured Values

The commands of the following subsystems determine and output the results of the signal spectrum measurement. They correspond to the graphical menu *Spectrum* with its various display elements.

Subsystem SPECtrum:SWITching...

The subsystem *SPECtrum:SWITching...* measures and returns the frequency spectum (due to switching) and compares it with tolerance values. The subsystem corresponds to the graphical measurement menu *Spectrum.*

READ[:SCALar]:SPECtrum:SWITching:CCH? Scalar Results:
READ[:SCALar]:SPECtrum:SWITching:TCH? Start single shot measurement and return results

FETCh[:SCALar]:SPECtrum:SWITching:CCH?
FETCh[:SCALar]:SPECtrum:SWITching:TCH? Read measurement results (unsynchronized)

SAMPle[:SCALar]:SPECtrum:SWITching:CCH?
SAMPle[:SCALar]:SPECtrum:SWITching:TCH? Read measurement results (synchronized)

Return	Value range	Def. value	Def. unit	FW vers.
Reference Power, **Matching**	–100.0 dBm to +20.0 dBm INV | MATC | NMAT | NTSC | OUT | NTRG | UFLW | OFLW	NAN INV	dBm –	V2.80

Description of command	Sig. State
These commands are always queries. - `READ` starts a single shot measurement and returns the results. - `FETCh` outputs the results without taking care of the measurement state. - `SAMPle` waits until the results are valid for the first time (depending on the chosen statistic count) and then outputs the results. For more details refer to the description of measurement control in chapter 5 of the CMU operating manual. The reference power is the absolute carrier power measured as specified in the GSM standard. The following messages may be output for the value *Matching*: MATC *matching* NMAT *not matching* INV *invalid* NTSC *no training sequence code* OUT *out of range* NTRG *not triggered* UFLW *underflow* OFLW *overflow*	CCH TCH CEST

READ:ARRay:SPECtrum:SWITching:CCH? Spectrum Results
READ:ARRay:SPECtrum:SWITching:TCH? Start single shot measurement and return results

FETCh:ARRay:SPECtrum:SWITching:CCH?
FETCh:ARRay:SPECtrum:SWITching:TCH? Read measurement results (unsynchronized)

SAMPle:ARRay:SPECtrum:SWITching:CCH?
SAMPle:ARRay:SPECtrum:SWITching:TCH? Read results (synchronized)

Return	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB, **...,** **–100.0 dB to +20.0 dB**	Power at measurement point 1 ... Power at measurement point 9	NAN ... NAN	dB ... dB	V2.80

Description of command	Sig. State
These commands are always queries. They return the off-carrier power due to switching at all measurement points.	CCH TCH CEST

READ:SUBarrays:SPECtrum:SWITching:CCH? Subarray Results
READ:SUBarrays:SPECtrum:SWITching:TCH? Start single shot measurement and return results

FETCh:SUBarrays:SPECtrum:SWITching:CCH?
FETCh:SUBarrays:SPECtrum:SWITching:TCH? Read measurement results (unsynchronized)

SAMPle:SUBarrays:SPECtrum:SWITching:CCH?
SAMPle:SUBarrays:SPECtrum:SWITching:TCH? Read results (synchronized)

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB **...** **–100.0 dB to +20.0 dB**	Power at measurement point 1 ... Power at measurement point n	NAN ... NAN	dB ... dB	V2.80

Description of command	Sig. State
These commands are always queries. They output the off-carrier power due to switching in the subranges defined by means of the `CONFigure:SUBarrays:SPECtrum:SWITching:CCH` 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:SPECtrum:SWITching:CCH` 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.	CCH TCH CEST

Spectrum Results: Time Domain

READ:ARRay:SPECtrum:SWITching:CCH:TDOMain?
READ:ARRay:SPECtrum:SWITching:TCH:TDOMain? Start single shot measurement and return results

FETCh:ARRay:SPECtrum:SWITching:CCH:TDOMain?
FETCh:ARRay:SPECtrum:SWITching:TCH:TDOMain? Read measurement results (unsynchronized)

SAMPle:ARRay:SPECtrum:SWITching:CCH:TDOMain?
SAMPle:ARRay:SPECtrum:SWITching:TCH:TDOMain? Read results (synchronized)

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB, **...,** **–100.0 dB to +20.0 dB**	Power at measurement point 1 … Power at measurement point n	NAN ... NAN	dB ... dB	V3.65

Description of command

These commands are always queries. They return the off-carrier power vs. time at a definite offset frequency from the carrier (`CONFigure:SPECtrum:SWITching:CCH:TDFSelect`). The number of results depends on the slot count (`CONFigure:SPECtrum:SWITching:CCH:NOSLots`):

Slot count	1	2	3	4	5	6	7	8
n	618	1086	1554	2022	2490	2958	3426	3894

The position of the measurement points is as reported in the `CONFigure:SUBarrays:SPECtrum:SWITching:TDOMain` command description.

Subarray Results: Time Domain

READ:SUBarrays:SPECtrum:SWITching:CCH:TDOMain?
READ:SUBarrays:SPECtrum:SWITching:TCH:TDOMain? Start single shot meas. and return results ⇒ *RUN*

FETCh:SUBarrays:SPECtrum:SWITching:CCH:TDOMain?
FETCh:SUBarrays:SPECtrum:SWITching:TCH:TDOMain? Read meas. results (unsynchronized) ⇒ *RUN*

SAMPle:SUBarrays:SPECtrum:SWITching:CCH:TDOMain?
SAMPle:SUBarrays:SPECtrum:SWITching:TCH:TDOMain? Read results (synchronized) ⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB, **...,** **–100.0 dB to +20.0 dB**	Power[1], 1st value for power ... Power[x], xth value for power	NAN ... NAN	dB ... dB	V3.65

Description of command

These commands are always queries. They output the off-carrier power due to modulation in the subranges defined by means of the `CONFigure:SUBarrays:SPECtrum:SWITching:CCH:TDOMain` 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:SPECtrum:SWITching:CCH:TDOMain` 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.

Spectrum Results: Frequency Domain, Variable Meas. Points

READ:ARRay:SPECtrum:SWITching:CCH[:FDOMain]:VMPoint?
READ:ARRay:SPECtrum:SWITching:TCH[:FDOMain]:VMPoint?
Start single shot measurement and return results

FETCh:ARRay:SPECtrum:SWITching:CCH[:FDOMain]:VMPoint?
FETCh:ARRay:SPECtrum:SWITching:TCH[:FDOMain]:VMPoint? Read measurement results (unsynchronized)

SAMPle:ARRay:SPECtrum:SWITching:CCH[:FDOMain]:VMPoint?
SAMPle:ARRay:SPECtrum:SWITching:TCH[:FDOMain]:VMPoint? Read results (synchronized)

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB,	Power at meas. point 4 (neg. freq. offset)	NAN	dB	V3.65
...,	...	...	...	
–100.0 dB to +20.0 dB,	Power at meas. point 1 (neg. freq. offset)	NAN	dB	
–100.0 dB to +20.0 dB,	Power at meas. point 1 (pos. freq. offset)	NAN	dB	
…,	...	...		
–100.0 dB to +20.0 dB	Power at meas. point 4 (pos. freq. offset)	NAN	dB	

Description of command

These commands are always queries. They return the off-carrier power due to switching at all enabled variable measurement points `(CONFigure:SPECtrum:SWITching:CCH:CONTrol:VMPOint<nr>)`. NAN is returned at the disabled points.

Spectrum due to Modulation and Switching

The subsystem *SPECtrum:MSWitching* controls the spectrum due to modulation and switching measurement.

INITiate:SPECtrum:MSWitching:CCH **INITiate:SPECtrum:MSWitching:TCH**	Start new measurement	⇒	*RUN*
ABORt:SPECtrum:MSWitching:CCH **ABORt:SPECtrum:MSWitching:TCH**	Abort running measurement and switch off	⇒	*OFF*
STOP:SPECtrum:MSWitching:CCH **STOP:SPECtrum:MSWitching:TCH**	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:SPECtrum:MSWitching:CCH **CONTinue:SPECtrum:MSWitching:TCH**	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.			V3.65

CONFigure:SPECtrum:MSWitching:CCH:EREPorting <*Mode*>
CONFigure:SPECtrum:MSWitching:TCH: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 SOPC No reporting	OFF	–	V3.65

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:SPECtrum:MSWitching:CCH:STATus?
FETCh:SPECtrum:MSWitching:TCH: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	–	V3.65
1 to 1000 | **NONE,**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	
1 to 10000 | **NONE,**	Counter for current statistics cycle for Modulation (→`CONFigure:SPECtrum:Modulation:CONTrol`) Statistic count set to off	NONE	–	
1 to 10000 | **NONE**	Counter for current statistics cycle for Switching (→`CONFigure:SPECtrum:SWITching:CONTrol`) 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 R&S CMU manual).

Test Configuration

The commands of the following subsystems configure the spectrum due to switching. They correspond to the *Switching* sections in the *Spectrum Configuration* menu.

Subsystem SPECtrum:MSWitching…:CONTrol

The subsystem *SPECtrum:MSWitching…:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* and *Meas X* tabs of the popup menu *Spectrum Configuration*.

CONFigure:SPECtrum:MSWitching:CCH:CONTrol <*Mode*> **CONFigure:SPECtrum:MSWitching:TCH:CONTrol <*Mode*>**				Scope of Measurement
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SCALar | **ARRay**	Only scalar measured values Scalar measured values and arrays	ARRay	–	V3.65
Description of command				
This command restricts the type of measured values and determines the number of bursts within a statistics cycle.				

CONFigure:SPECtrum:MSWitching:CCH:CONTrol:REPetition **CONFigure:SPECtrum:MSWitching:TCH:CONTrol:REPetition** ***<Repetition>,<StopCondition>, <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	–	V3.65
<StopCondition>	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	–	V3.65
<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	–	V3.65
Description of command				
This command defines the number of test cycles, the stepping mode and, if required, a stop condition for the measurement. **Note:** *For READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*				

Subsystem SPECTrum:MSWitching…:LIMit:LINE

The subsystem *SPECtrum:MSWitching…:LIMit:LINE* defines the limit lines, i.e. the tolerance values for the spectrum due to switching measurement. The subsystem corresponds to the *Switching* sections in the tab *Limit Lines* in the popup menu *Spectrum Configuration.*

[SENSe:]SPECtrum:MSWitching:CCH:LIMit:LINE:USED? **[SENSe:]SPECtrum:MSWitching:TCH:LIMit:LINE:USED?**		Current Limit Template		
Response	Description of parameters	Def. value	Def. unit	FW vers.
GMSK | **EPSK**	Use GMSK template Use EPSK template	–	–	V3.65
Description of command				
These commands is always a query and returns the current limit line template. The template can be selected using `CONFigure:SPECtrum:LIMit:LINE:SELect`.				

Measured Values

The following commands return the results of the spectrum due to switching measurement. They correspond to the graphical menu *Spectrum* with its various display elements.

READ[:SCALar]:SPECtrum:MSWitching:CCH? **READ[:SCALar]:SPECtrum:MSWitching:TCH?**		Scalar Results: Start single shot measurement and return results		
FETCh[:SCALar]:SPECtrum:MSWitching:CCH? **FETCh[:SCALar]:SPECtrum:MSWitching:TCH?**		Read measurement results (unsynchronized)		
SAMPle[:SCALar]:SPECtrum:MSWitching:CCH? **SAMPle[:SCALar]:SPECtrum:MSWitching:TCH?**		Read measurement results (synchronized)		
Returned values	Value range	Def. value	Def. unit	FW vers.
Reference Power (Modulation), **Reference Power (Switching),** **Matching (Modulation),** **Matching (Switching)**	–100.0 dBm to +100.0 dBm –100.0 dBm to +100.0 dBm INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	NAN NAN INV INV	dBm dBm – –	V3.65
Description of command				
These commands are always queries. They start a measurement and return the results. For more details refer to the description of measurement control in Chapter 5 of the R&S CMU operating manual. The reference powers are absolute carrier powers measured according to GSM conformance test specification for the spectrum due to modulation and spectrum due to switching (see Chapter 4). The following messages may be output for the values *Matching*: INV *invalid* MATC *matching* NMAT *not matching* OUT *out of range* NTR *no trigger* NRAM *not ramping (burst not found)* OFLW *overflow* UFLW *underflow* NTSC *no training sequence code* OFF *off*				

Spectrum Results: Frequency Domain, Fixed Meas. Points

READ:ARRay:SPECtrum:MSWitching:CCH?
READ:ARRay:SPECtrum:MSWitching:TCH? Start single shot measurement and return results

FETCh:ARRay:SPECtrum:MSWitching:CCH?
FETCh:ARRay:SPECtrum:MSWitching:TCH? Read measurement results (unsynchronized)

SAMPle:ARRay:SPECtrum:MSWitching:CCH?
SAMPle:ARRay:SPECtrum:MSWitching:TCH? Read results (synchronized)

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB,	1st modulation result (at –1.8 MHz)	NAN	dB	V3.65
...,	...	...	...	
–100.0 dB to +20.0 dB,	23rd modulation result (at +1.8 MHz)	NAN	dB	
–100.0 dB to +20.0 dB,	1st switching result (at –1.8 MHz)	NAN	dB	
...,	...	...	...	
–100.0 dB to +20.0 dB	9th switching result (at +1.8 MHz)	NAN	dB	

Description of command

These commands are always queries. They return the off-carrier power due to modulation and switching at all enabled fixed measurement points (`CONFigure:SPECtrum:<Application>:CONTrol:MPOint<nr>:ENABle`). NAN is returned at the disabled points.

Spectrum Results: Frequency Domain, Variable Meas. Points

READ:ARRay:SPECtrum:MSWitching:CCH:VMPoint?
READ:ARRay:SPECtrum:MSWitching:RCH:VMPoint? Start single shot measurement and return results

FETCh:ARRay:SPECtrum:MSWitching:CCH:VMPoint?
FETCh:ARRay:SPECtrum:MSWitching:RCH:VMPoint? Read measurement results (unsynchronized)

SAMPle:ARRay:SPECtrum:MSWitching:CCH:VMPoint?
SAMPle:ARRay:SPECtrum:MSWitching:RCH:VMPoint? Read results (synchronized)

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB,	1st modulation result	NAN	dB	V3.65
...,	...	...	...	
–100.0 dB to +20.0 dB,	8th modulation result	NAN	dB	
–100.0 dB to +20.0 dB,	1st switching result	NAN	dB	
...,	...	...		
–100.0 dB to +20.0 dB	8th switching result	NAN	dB	

Description of command

These commands are always queries. They return the off-carrier power due to modulation and switching at all enabled variable measurement points (`CONFigure:SPECtrum:<Application>:CONTrol:VMPOint<nr>`). NAN is returned at the disabled points.

CALCulate:ARRay:SPECtrum:MSWitching:CCH:AREA:LIMit:MATChing?
CALCulate:ARRay:SPECtrum:MSWitching:TCH:AREA:LIMit:MATChing? Limit Matching

Returned value	Description of parameters	Def. value	Def. unit	FW vers.
32 bit value, **32 bit value**	Indicator for modulation limit matching at fixed meas. Points (23 least significant bits) Indicator for switching limit matching at fixed meas. points (9 least significant bits)	NAN, NAN	–	V3.65

Description of command

This command is always a query. A bit in the output values is set if the corresponding fixed measurement point exceeds the limit.

Spectrum Results: Frequency Domain, Variable Meas. Points

READ:ARRay:SPECtrum:MSWitching:CCH:VMPoint?
READ:ARRay:SPECtrum:MSWitching:TCH:VMPoint? Start single shot measurement and return results

FETCh:ARRay:SPECtrum:MSWitching:CCH:VMPoint?
FETCh:ARRay:SPECtrum:MSWitching:TCH:VMPoint? Read measurement results (unsynchronized)

SAMPle:ARRay:SPECtrum:MSWitching:CCH:VMPoint?
SAMPle:ARRay:SPECtrum:MSWitching:TCH:VMPoint? Read results (synchronized)

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to +20.0 dB,	1st modulation result	NAN	dB	V3.65
...,	...	...	...	
–100.0 dB to +20.0 dB,	8th modulation result	NAN	dB	
–100.0 dB to +20.0 dB,	1st switching result	NAN	dB	
...,	...	...		
–100.0 dB to +20.0 dB	8th switching result	NAN	dB	

Description of command

These commands are always queries. They return the off-carrier power due to modulation and switching at all enabled variable measurement points (`CONFigure:SPECtrum:<Application>:CONTrol:VMPOint<nr>`). NAN is returned at the disabled points.

RXQuality (Bit Error Rate Tests)

The subsystem *RXQuality* measures the BTS receiver quality. The settings are used to assess the quality of transmission between the CMU and the device under test. The subsystem corresponds to the main menu *Receiver Quality* and the associated popup menu *Receiver Quality Configuration.*

Test Configuration – Subsystem RXQuality:CONTrol

The subsystem *RXQuality:CONTrol* controls all receiver quality measurements.

CONFigure:RXQuality:CONTrol:HTIMe <AGCTime>, <*SynchTime*>				AGC/Sync. Holdoff Time
<value>	Description of parameters	Def. value	Def. Unit	
0 s to 100 s	AGC holdoff time (Automatic Gain Control)	3.0	s	
<value>	Description of parameters	Def. value	Def. Unit	FW vers.
0 s to 100 s	Synchronization holdoff time	3.0	s	V2.80
Description of command				Sig. State
This command defines hold off times during which the R&S CMU can adapt itself to the new RF level at the beginning of the receiver quality measurement and synchronize to the received bit stream. By reducing the hold off times, the measurement can be speeded up. The default settings for both holdoffs do not depend on the application.				all

CONFigure:RXQuality:CONTrol:BITStream <*Mode*>				Bit Stream
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
PR9 | PR11 | PR15 | PR16	Pseudo random sequences	PR9	–	V3.07
Description of command				Sig. State
This command defines the data transmitted in the traffic channel during the bit error rate test.				all

RXQuality:BER

The subsystem *RXQuality:BER* measures the receiver quality in the single shot mode. The subsystem corresponds to the main menu *Receiver Quality,* Application *BER CMU* and the corresponding parts of the associated popup menu *Receiver Quality Configuration.*

Control of Measurement – Subsystem RXQuality:BER

The subsystem *RXQuality:BER* controls the single shot receiver quality measurements.

CONFigure:RXQuality:BER:TSETup <*Testsetup*>				Test Setup
<Application>	Description of parameters	Def. value	Def. unit	FW vers.
T1 | **T2 |** **...** **T10**	Single Shot Test Setup 1 ... Single Shot Test Setup 10	T1	–	V2.80
Description of command				Sig. State
This command selects one out of 10 data sets as application, enabling 10 different single shot receiver quality measurements to be parameterized separately. When an application is selected, the running measurement is stopped and all measured values are set to invalid.				all

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	Sig. State	FW vers.
These commands do not exist as queries. They start or stop one the selected Single Shot measurement, setting it to the status indicated in the top right column.	TCH CCH CEST	V2.80

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 SOPC No reporting	OFF	–	V2.80
Description of command				Sig. State
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU operating manual).				all

FETCh:RXQuality:BER:STATus?				Measurement Status
Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,** **1 to 50000 |** **NONE**	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 Counter for current evaluation period within a cycle Statistic count set to off	OFF NONE	– –	– V2.80
Description of command				Sig. State
This command is always a query. It returns the status of the measurement (see chapter 5 of CMU operating manual).				all

Subsystem RXQuality:BER:CONTrol

The subsystem *RXQuality:BER:CONTrol* sets the parameters for the single shot *Receiver Quality* measurement. The subsystem corresponds to the tab *Control* in the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:BER<nr>:CONTrol <*Mode*>, <*FramesToSend*>				Frames
<Mode>	Description of parameters	Def. value	Def. unit	
RFER | **BER |** **BBB |** **BDBL**	Residual Bit Error Rate, Frame Erasure Rate Bit Error RateBurst by Burst Bit Error Rate / Data Block Error Rate	RFER	–	
<FramesToSend>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 50000 | **NONE**	No. of frames to be sent in single shot mode No average (only 1 frame considered)	See below	–	V2.80
Description of command				Sig. State
This command defines the measured value and the number of frames to be sent in a single shot measurement, constituting a statistics cycle. The suffix <nr> numbers the test setup (<nr> = 1 to 10, see command `CONFigure:RXQuality:BER:TSETup`). For a definition of the measured values (BER, RFER etc.) see chapter 4. ***Note:*** *Burst by burst measurements are only possible if one of the following TCH channel types is used (see command `CONFigure:BSSignal:TCH:CHType`): FRATe, EFRate, HRATe, E432, MCS5 to MCS9.* The following default settings are valid for the command parameters:				all

Test setup	1	2	3	4	5	6	7	8	9	10
Mode	RFER	RFER	RFER	RFER	RFER	RFER	RFER	RFER	RFER	RFER
Frames	100	100	500	500	100	500	500	100	100	100

CONFigure:RXQuality:BER<nr>:CONTrol:REPetition <*StopCondition*> ,<Stepmode> Test Cycles

<StopCondition>	Description of parameters	Def. value	Def. unit	
ALIMits | **FLIMit |** **NONE**	Measurement aborted when all permissible limit values are violated Aborted when first limit value is violated Not aborted, measurement over all frames	See below	–	
<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	–	V2.80

Description of command	Sig. State
This command determines the stop condition and the stepping mode for the measurement. The suffix <nr> numbers the test setup (<nr> = 1 to 10, see command `CONFigure:RXQuality:BER:TSETup`). Depending on the application, the following default settings are valid:	all

Test setup	1	2	3	4	5	6	7	8	9	10
StopCond	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM

CONFigure:RXQuality:BER<nr>:CONTrol:TCH:LEVel:UTIMeslot <*Level*>

TCH BER Level, Used Timeslot

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–137 dBm to –27 dBm **–137 dBm to –10 dBm** **–90 dBm to +13 dBm**	RF1 level in used timeslot RF2 level in used timeslot RF3 OUT level in used timeslot	See below	dBm	V2.80

Description of command	Sig. State
This command defines the absolute level of the traffic channel (*TCH*) in the used timeslot for the single shot receiver quality measurement.	all

This level applies to the Receiver Quality measurement only. The default setting depends on the test setup (<nr> = 1 to 10; all level values in dBm):

Test setup	1	2	3	4	5	6	7	8	9	10
Level	–102.0	–104.0	–102.0	–104.0	–100.0	–100.0	–100.0	–102.0	–102.0	–102.0

CONFigure:RXQuality:BER<nr>:CONTrol:TCH:LEVel:UNTimeslot <*Level*>

TCH BER Level, Unused Timeslot

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–127 dB to +127 dB	Level in unused timeslots	see below	dB	V2.80

Description of command	Sig. State
This command defines the relative level of the traffic channel (*TCH*) in the unused timeslots for the single shot receiver quality measurement.	all

This level applies to the *receiver quality* measurement only. The value range quoted above is valid with the restriction that the sum of the absolute level of the used timeslot and the relative value for the unused timeslots must not exceed the value ranges for the absolute level of the used timeslot (for RF 1, RF 2 and RF 3 OUT).The default setting depends on the test setup (<nr> = 1 to 10; all level values in dB):

Test setup	1	2	3	4	5	6	7	8	9	10
Level	–18.0	–16.0	–18.0	–16.0	–20.0	–20.0	–20.0	–18.0	–18.0	–20.0

Subsystem RXQuality:BER<nr>:LIMit

The subsystem *RXQuality:BER<nr>:LIMit* defines tolerance values for the single shot receiver quality measurements. The subsystem corresponds to the tab *Limits* in the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:BER<nr>:LIMit:CLII <*ClassIIBER*>				Class II Bits
<ClassIIBER>	Description of parameters	Def. value	Def. unit	FW vers.
0 % to 100 %	Upper limit of error rate for class II bits	2	%	V2.80
Description of command				Sig. State
This command defines an upper limit for the bit error rate of class II (unprotected bits, see chapter 4) for the current test setup (<nr> = 1 to 10). Irrespective of the test setup, the default setting is 2 %.				all

CONFigure:RXQuality:BER<nr>:LIMit:CLIB <*ClassIbBER*>				Class Ib Bits
<ClassIbBER>	Description of parameters	Def. value	Def. unit	FW vers.
0 % to 100 %	Upper limit of error rate for class Ib bits	0.4	%	V2.80
Description of command				Sig. State
This command defines an upper limit for the bit error rate of class IB (partly protected bits, see chapter 4) for the current test setup (<nr> = 1 to 10). Irrespective of the test setup, the default setting is 0.4 %.				all

CONFigure:RXQuality:BER<nr>:LIMit:FERRors <Frame Errors>				Frame Errors
<FERRors>	Description of parameters	Def. value	Def. unit	FW vers.
0 % to 100 %	Upper limit for erased frame errors	0.1	%	V2.80
Description of command				Sig. State
This command defines an upper limit for frame errors for the current test setup (<nr> = 1 to 10). Irrespective of the test setup, the default setting is 0.1 %.				all

CONFigure:RXQuality:BER<nr>:LIMit:DBLer <Data_BLER> Data Block Error Rate				
<Data_BLER>	Description of parameters	Def. value	Def. unit	FW vers.
0 % to 100 %	Upper limit for data block error rate	10	%	V2.82
Description of command				Sig. State
This command defines an upper limit for the ratio of blocks with bit errors in their data field to the total number of transferred blocks (*data block error rate*, see chapter 4) in the measurement of the residual bit error rate (*RFER*, see command `CONFigure:RXQuality:BER<nr>:CONTrol`) on packet-switched channels.				all

DEFault:RXQuality:BER<nr>:LIMit				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	–	V2.80
Description of command				Sig. State
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.				all

Measured Values – Subsystem RXQuality:BER

The subsystem *RXQuality:BER* measures the bit error rate and compares it with the tolerance values. The subsystem corresponds to the measurement menus *Receiver Quality* in the *BER* application.

				Scalar Results:
READ[:SCALar]:RXQuality:BER? **FETCh[:SCALar]:RXQuality:BER?** **SAMPle[:SCALar]:RXQuality:BER?**	Start single shot measurement and return results Read out meas. results (unsynchronized) Read out measurement results (synchronized)			
Return for RFER, speech	Value range	Def. value	Def. unit	
Progress Time, **ClassII Bits,** **ClassIb Bits,** **FER,** **CRC Errors,** **Status,** **(for future extensions),** **(for future extensions)**	0.0 to 100.0 % 0.000 to 100.000 % 0.000 to 100.000 % 0.000 to 100.000 % 1 to 50000 INV | PASS | FAIL | TMER | IMP NAN NAN	NAN NAN NAN NAN NAN INV NAN NAN	% % % % – – – –	
Return for BER, speech	Value range	Def. value	Def. unit	
Progress Time, **ClassII Bits,** **ClassIb Bits,** **CRC Errors,** **Status,** **(for future extensions),** **(for future extensions)**	0.0 to 100.0 % 0.000 to 100.000 % 0.000 to 100.000 % 1 to 50000 INV | PASS | FAIL | TMER | IMP NAN NAN	NAN NAN NAN NAN INV NAN NAN	% % % – – – –	
Return for BurstByBurst	Value range	Def. value	Def. unit	
Progress Time, **Raw BER,** **CRC Errors,** **Status,** **(for future extensions),** **(for future extensions)**	0.0 to 100.0 % 0.000 to 100.000 % 1 to 50000 INV | PASS | FAIL | TMER | IMP NAN NAN	NAN NAN NAN INV NAN NAN	% % – – – –	

Return for BER, circuit-switched data	Value range	Def. value	Def. unit	
Progress Time,	0.0 to 100.0 %	NAN	%	
BER-CS,	0.000 to 100.000 %	NAN	%	
(not significant),	–	NAN	–	
CRC Errors,	NAN	NAN	–	
Status,	INV | PASS | FAIL | TMER | IMP	INV	–	
(for future extensions),	NAN	NAN	–	
(for future extensions)	NAN	NAN	–	
Return for DBLER, packet-switched data[1]	Value range	Def. value	Def. unit	
Progress Time,	0.0 to 100.0 %	NAN	%	
BER-PS,	0.000 to 100.000 %	NAN	%	
(not significant),	–	NAN	–	
DBLER,	0.000 to 100.000 %	NAN	%	
CRC Errors,	1 to 50000	NAN	–	
Status,	INV | PASS | FAIL | TMER | IMP	INV	–	
(for future extensions),	NAN	NAN	–	
(for future extensions)	NAN	NAN	–	
Return for BER, packet-switched data	Value range	Def. value	Def. unit	FW vers.
Progress Time,	0.0 to 100.0 %	NAN	%	V2.82
BER-PS,	0.000 to 100.000 %	NAN	%	
(not significant),	–	NAN	–	
CRC Errors,	1 to 50000	NAN	–	
Status,	INV | PASS | FAIL | TMER | IMP	INV	–	
(for future extensions),	NAN	NAN	–	
(for future extensions)	NAN	NAN	–	

Description of command	Sig. State
These commands are always queries. They start a bit-error-rate test in the single shot repetition mode and output the measurement results (see also detailed explanation of measured values in chapter 4). The results depend on the measurement mode set via the `CONFigure:RXQuality:BER<nr>:CONTrol` command (RFER, BER, or BBB). They are	all

ProgressTime	Relative progress of the measurement
ClassIIBits	(Residual) bit error rate for class II bits (speech)
ClassIbBits	(Residual) bit error rate for class Ib bits (speech)
BER-CS	Bit error rate for circuit-switched data channels
BER-PS	Bit error rate in the data field of GPRS/EGPRS blocks (packet-switched TCHs)
FER	Frame erasure rate
DBLER	Data Block Error Rate of GPRS/EGPRS blocks (packet-switched TCHs)
CRCErrors	Cyclic redundancy check (CRC) errors
RawBER	Raw bit error rate in burst by burst mode
Status	Measurement status

The following messages can be output for the measurement status:

INV	Measurement invalid	*invalid*
PASS	all tolerances matched	*passed*
FAIL	Not all tolerances matched	*failed*
TMER	CMU could not synchronize	*too many errors*
IMP	Measurement impossible, therefore invalid	*impossible*

The output string elements for BER tests on packet-switched channels marked (not significant) have been introduced for reasons of compatibility.

[1] The same result is returned for *RFER, packet-switched data.*

CALCulate[:SCALar]:RXQuality:BER:MATChing:LIMit?				Limit Matching
Return for RFER	Value range	Def. value	Def. unit	
Total, **ClassII Bits,** **ClassIb Bits,** **FER,** **CRC Errors**	**PASS | FAIL | INV | TMER | IMP** **NMAU | INV | OK** **NMAU | INV | OK** **NMAU | INV | OK** **NMAU | INV | OK**	INV INV INV INV INV	– – – – –	
Return for BER	Value range	Def. value	Def. unit	
Total, **ClassII Bits,** **ClassIb Bits,** **CRC**	**PASS | FAIL | INV | TMER | IMP** **NMAU | INV | OK** **NMAU | INV | OK** **NMAU | INV | OK**	INV INV INV INV	– – – –	
Return for BurstByBurst	Value range	Def. value	Def. unit	FW vers.
Total, **Raw BER** **CRC**	**PASS | FAIL | INV | TMER | IMP** **NMAU | INV | OK** **NMAU | INV | OK**	INV INV INV	– – –	V2.80
Description of command				Sig. State
This command is always a query. It indicates whether and in which way the permissible error limits for the measured values of the bit error rate test (see command above) have been exceeded. The following messages can be output for the measured quantities:				all

PASS	all tolerances matched	*passed*
FAIL	Not all tolerances matched	*failed*
INV	Invalid measurement	*invalid*
TMER	CMU could not synchronize	*too many errors*
IMP	Measurement impossible, therefore invalid	*impossible*
NMAU	Tolerance exceeded	*not matching, underflow*
INV	Invalid measurement	*invalid*
OK	all tolerances matched	

For BER tests on packet-switched (GPRS and EGPRS) channels in RFER and BER mode, the ClassIbBits output string element is always set to INV.

[2] The same result is returned for *RFER, packet-switched data.*

RXQuality:ABIS:BER

The subsystem *RXQuality:ABIS:BER* measures the receiver quality via Abis interface in the single shot mode. The subsystem corresponds to the main menu *Receiver Quality,* application *BER CMU* and the corresponding parts of the associated popup menu *Receiver Quality Configuration.*

Control of Measurement – Subsystem RXQuality:ABIS:BER

The subsystem *RXQuality:ABIS:BER* controls the single shot receiver quality measurements via Abis interface.

CONFigure:RXQuality:ABIS:BER:TSETup <*Testsetup*>				Test Setup
<Application>	Description of parameters	Def. value	Def. unit	FW vers.
T1 | **T2 |** **...** **T10**	Single Shot Test Setup 1 ... Single Shot Test Setup 10	T1	–	V2.82
Description of command				Sig. State
This command selects one out of 10 data sets as application, enabling 10 different single shot *Receiver Quality* measurements that can be parameterized. When an application is switched over, the running measurement is stopped and all measured values are set invalid.				CEST

INITiate:RXQuality:ABIS:BER	Start new measurement	⇒	*RUN*
ABORt:RXQuality:ABIS:BER	Abort running measurement and switch off	⇒	*OFF*
STOP:RXQuality:ABIS:BER	Stop measurement	⇒	*STOP*
CONTinue:RXQuality:ABIS:BER	Next measurement step (only *stepping mode*)	⇒	*RUN*
Description of command		Sig. State	FW vers.
These commands do not exist as queries. They start or stop one the selected single shot measurement, setting it to the status indicated in the top right column.		all	V2.82

CONFigure:RXQuality:ABIS: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 SOPC No reporting	OFF	–	V2.82
Description of command				Sig. State
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU operating manual).				all

FETCh:RXQuality:ABIS:BER:STATus?				Measurement Status
Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,** **1 to 50000 |** **NONE**	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 Counter for current evaluation period within a cycle Statistic count set to off	OFF NONE	– –	V2.82
Description of command				Sig. State
This command is always a query. It returns the status of the measurement (see chapter 5 of CMU operating manual).				all

Subsystem RXQuality:ABIS:BER:CONTrol

The subsystem *RXQuality:ABIS:BER:CONTrol* sets the parameters for the single shot *Receiver Quality* measurement via Abis interface. The subsystem corresponds to the tab *Control* in the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:ABIS:BER<nr>:CONTrol *<Mode>, <FramesToSend>*				Frames
<Mode>	Description of parameters	Def. value	Def. unit	
RFER | **BER**	Residual bit error rate, FER Bit error rate	RFER	–	
<FramesToSend>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 50000 | **NONE**	No. of frames to be sent in single shot mode No average (only 1 frame considered)	See below	–	V2.82
Description of command				Sig. State
This command defines the measured value and the number of frames to be sent in a single shot measurement, constituting a statistics cycle. The suffix <nr> numbers the test setup (<nr> = 1 to 10, see command `CONFigure:RXQuality:ABIS:BER:TSETup`). For a definition of the measured values (BER, RFER etc.) see chapter 4. The following default settings are valid for the command parameters:				all

Test setup	1	2	3	4	5	6	7	8	9	10
Mode	BER	BER	BER	BER	BER	BER	BER	BER	BER	BER
Frames	100	100	500	500	100	500	500	100	100	100

CONFigure:RXQuality:ABIS:BER<nr>:CONTrol:REPetition <*StopCondition*> ,<Stepmode>

Test Cycles

<StopCondition>	Description of parameters	Def. value	Def. unit	
ALIMits | **FLIMit |** **NONE**	Measurement aborted when all permissible limit values are violated Aborted when first limit value is violated Not aborted, measurement over all frames	See below	–	–
<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	–	V2.82

Description of command	Sig. State
This command determines the stop condition and the stepping mode for the measurement. The suffix <nr> numbers the test setup (<nr> = 1 to 10, see command `CONFigure:RXQuality:ABIS:BER:TSETup`). Depending on the application, the following default settings are valid:	all

Test setup	1	2	3	4	5	6	7	8	9	10
StopCond	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM

CONFigure:RXQuality:ABIS:BER<nr>:CONTrol:TCH:LEVel:UTIMeslot <*Level*>

TCH BER Level, Used Timeslot

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–137 dBm to –27 dBm **–137 dBm to –10 dBm** **–90 dBm to +13 dBm**	RF1 level in used timeslot RF2 level in used timeslot RF3 OUT level in used timeslot	See below	dBm	V2.82

Description of command	Sig. State
This command defines the absolute level of the traffic channel (*TCH*) in the used timeslot for the single shot receiver quality measurement.	all

This level applies to the Receiver Quality measurement only. The default setting depends on the test setup (<nr> = 1 to 10; all level values in dBm):

Test setup	1	2	3	4	5	6	7	8	9	10
Level	–102.0	–104.0	–102.0	–104.0	–100.0	–100.0	–100.0	–102.0	–102.0	–102.0

CONFigure:RXQuality:ABIS:BER<nr>:CONTrol:TCH:LEVel:UNTimeslot <*Level*>

TCH BER Level, Unused Timeslot

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–127 dB to +127 dB	Level in unused timeslots	see below	dB	V2.82

Description of command	Sig. State
This command defines the relative level of the traffic channel (*TCH*) in the unused timeslots for the single shot receiver quality measurement.	all

This level applies to the *receiver quality* measurement only. The value range quoted above is valid with the restriction that the sum of the absolute level of the used timeslot and the relative value for the unused timeslots must not exceed the value ranges for the absolute level of the used timeslot (for RF 1, RF 2 and RF 3 OUT).The default setting depends on the test setup (<nr> = 1 to 10; all level values in dB):

Test setup	1	2	3	4	5	6	7	8	9	10
Level	–18.0	–16.0	–18.0	–16.0	–20.0	–20.0	–20.0	–18.0	–18.0	–20.0

Subsystem RXQuality:ABIS:BER<nr>:LIMit

The subsystem *RXQuality:ABIS:BER<nr>:LIMit* defines tolerance values for the single shot receiver quality measurements. The subsystem corresponds to the tab *Limits* in the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:ABIS:BER<nr>:LIMit:CLII <*ClassIIBER*>				Class II Bits
<ClassIIBER>	Description of parameters	Def. value	Def. unit	FW vers.
0 % to 100 %	Upper limit of error rate for class II bits	2	%	V2.82
Description of command				Sig. State
This command defines an upper limit for the bit error rate of class II (unprotected bits, see chapter 4) for the current test setup (<nr> = 1 to 10). Irrespective of the test setup, the default setting is 2 %.				

CONFigure:RXQuality:ABIS:BER<nr>:LIMit:CLIB <*ClassIbBER*>				Class Ib Bits
<ClassIbBER>	Description of parameters	Def. value	Def. unit	FW vers.
0 % to 100 %	Upper limit of error rate for class Ib bits	0.4	%	V2.82
Description of command				Sig. State
This command defines an upper limit for the bit error rate of class IB (partly protected bits, see chapter 4) for the current test setup (<nr> = 1 to 10). Irrespective of the test setup, the default setting is 0.4 %.				

CONFigure:RXQuality:ABIS:BER<nr>:LIMit:FERRors <Frame Errors>				Frame Errors
<FERRors>	Description of parameters	Def. value	Def. unit	FW vers.
0 % to 100 %	Upper limit for erased frame errors	0.1	%	V2.82
Description of command				Sig. State
This command defines an upper limit for frame errors for the current test setup (<nr> = 1 to 10). Irrespective of the test setup, the default setting is 0.1 %.				

Measured Values – Subsystem RXQuality:ABIS:BER

The subsystem *RXQuality:ABIS:BER* measures the bit error rate and compares it with the tolerance values. The subsystem corresponds to the measurement menus *Receiver Quality* in the *BER* application.

Scalar Results:

READ[:SCALar]:RXQuality:ABIS:BER?	Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:ABIS:BER?	Read out meas. results (unsynchronized)
SAMPle[:SCALar]:RXQuality:ABIS:BER?	Read out measurement results (synchronized)

Return for RFER	Value range	Def. value	Def. unit	
ProgressTime,	0.0 to 100.0 %	NAN	%	
ClassIIBits,	0.000 to 100.000 %	NAN	%	
ClassIbBits,	0.000 to 100.000 %	NAN	%	
FER,	0.000 to 100.000 %	NAN	%	
Status,	INV | PASS | FAIL | TMER | IMP	INV	–	
(for future extensions),	NAN	NAN	–	
(for future extensions)	NAN	NAN	–	
Return for BER	Value range	Def. value	Def. unit	FW vers.
ProgressTime,	0.0 to 100.0 %	NAN	%	V2.82
ClassIIBits,	0.000 to 100.000 %	NAN	%	
ClassIbBits,	0.000 to 100.000 %	NAN	%	
Status,	INV | PASS | FAIL | TMER | IMP	INV	–	
(for future extensions),	NAN	NAN	–	
(for future extensions)	NAN	NAN	–	

Description of command	Sig. State
These commands are always queries. They start a bit-error-rate test in the single shot repetition mode and output the measurement results (see also detailed explanation of measured values in chapter 4). The results depend on the measurement mode set via the `CONFigure:RXQuality:ABIS:BER<nr> :CONTrol` command (RFER or BER). They are	all

ProgressTime	Relative progress of the measurement
ClassIIBits	(Residual) bit error rate for class II bits
ClassIbBits	(Residual) bit error rate for class Ib bits
FER	Frame erasure rate
Status	Measurement status

The following messages can be output for the measurement status:

INV	Measurement invalid	*invalid*
PASS	all tolerances matched	*passed*
FAIL	Not all tolerances matched	*failed*
TMER	CMU could not synchronize	*too many errors*
IMP	Measurement impossible, therefore invalid	*impossible*

CALCulate[:SCALar]:RXQuality:ABIS:BER:MATChing:LIMit?				Limit Matching
Return for RFER	Value range	Def. value	Def. unit	
Total,	PASS | FAIL | INV | TMER | IMP	INV	–	
ClassIIBits,	NMAU | INV | OK	INV	–	
ClassIbBits,	NMAU | INV | OK	INV	–	
FER	NMAU | INV | OK	INV	–	
Return for BER	Value range	Def. value	Def. unit	FW vers.
Total,	PASS | FAIL | INV | TMER | IMP	INV	–	V2.82
ClassIIBits,	NMAU | INV | OK	INV	–	
ClassIbBits	NMAU | INV | OK	INV	–	
Description of command				Sig. State
This command is always a query. It indicates whether and in which way the permissible error limits for the measured values of the bit error rate test (see command above) have been exceeded. The following messages can be output for the measured quantities:				all

PASS	all tolerances matched	*passed*
FAIL	Not all tolerances matched	*failed*
INV	Invalid measurement	*invalid*
TMER	CMU could not synchronize	*too many errors*
IMP	Measurement impossible, therefore invalid	*impossible*
NMAU	Tolerance exceeded	*not matching, underflow*
INV	Invalid measurement	*invalid*
OK	all tolerances matched	

RXQuality:RACHtest

The subsystem *RXQuality:RACHtest* contains the commands for the RACH test. The subsystem corresponds to the main menu *Receiver Quality*, Application *RACH Test* and the corresponding parts of the associated popup menu *Receiver Quality Configuration.*

Control of Measurement – Subsystem RXQuality:RACHtest

The subsystem *RXQuality:RACHtest* controls the RACH test.

INITiate:RXQuality:RACHtest **ABORt:RXQuality:RACHtest** **STOP:RXQuality:RACHtest** **CONTinue:RXQuality:RACHtest**	Start new measurement Abort running measurement and switch off Stop measurement Next measurement step (only *stepping mode*)		⇒ *RUN* ⇒ *OFF* ⇒ *STOP* ⇒ *RUN*
Description of command		Sig. State	FW vers.
These commands do not exist as queries. They start or stop the measurement, setting it to the status indicated in the top right column.		all	V3.07

CONFigure:RXQuality:RACHtest: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 SOPC No reporting	OFF	–	V3.07
Description of command				Sig. State
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU operating manual).				all

FETCh:RXQuality:RACHtest:STATus?				Measurement Status
Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,** **1 to 500 |** **NONE**	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 Counter for current evaluation period within a cycle Statistic count set to off	OFF NONE	– –	V3.07
Description of command				Sig. State
This command is always a query. It returns the status of the measurement (see chapter 5 of CMU operating manual).				all

Subsystem RXQuality:RACHtest:CONTrol

The subsystem *RXQuality:RACHtest:CONTrol* sets the parameters for the RACH test. The subsystem corresponds to the tab *Control* in the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:RACHtest:CONTrol:BTSend <*BurstsToSend*>
Bursts to Send

<*BurstsToSend*>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1 000 000	No. of access bursts to be sent	100000	–	V3.07
Description of command				Sig. State
This command defines the number of access bursts to be sent in a RACH test.				all

CONFigure:RXQuality:RACHtest:CONTrol:RTIMe <*Time*>
Repeat Time

<*Time*>	Description of parameters	Def. value	Def. unit	FW vers.
1 ms to 100 000 ms	Time between bursts	6000	ms	V3.07
Description of command				Sig. State
This command defines the time elapsed between two consecutive access bursts sent in a RACH test.				all

CONFigure:RXQuality:RACHtest:CONTrol:CCH:LEVel:UTIMeslot <*Level*>
RACH Level, Used Timeslot

<*Level*>	Description of parameters	Def. value	Def. unit	FW vers.
–137 dBm to –27 dBm **–137 dBm to –10 dBm** **–90 dBm to +13 dBm**	RF1 level in used timeslot RF2 level in used timeslot RF 3 OUT level in used timeslot	–103.3 –103.3 –90.0	dBm dBm dBm	V3.07
Description of command				Sig. State
This command defines the absolute control channel (*CCH*) level in the timeslot used for the RACH test.				all

CONFigure:RXQuality:RACHtest:CONTrol:CCH:LEVel:UNTimeslot <*Level*>
RACH Level, Unused Timeslot

<*Level*>	Description of parameters	Def. value	Def. unit	FW vers.
–127 dB to +127 dB	Level in unused timeslots	–10.0	dB	V3.07
Description of command				Sig. State
This command defines the relative control channel level (*CCH*) in the unused timeslots for the RACH test. The value range quoted above is valid with the restriction that the sum of the absolute level of the used timeslot and the relative value for the unused timeslots must not exceed the value ranges for the absolute level of the used timeslot (for RF 1, RF 2 and RF 3 OUT).				all

Subsystem RXQuality:RACHtest:LIMit

The subsystem *RXQuality:RACHtestt:LIMit* defines tolerance values for the RACH test via Abis interface. The subsystem corresponds to the tab *Limits* in the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:RACHtest:LIMit:FERRors <Frame Errors>				Frame Errors
<FERRors>	Description of parameters	Def. value	Def. unit	FW vers.
0 % to 100 %	Upper limit for erased frame errors	0.1	%	V3.07
Description of command				Sig. State
This command defines an upper limit for the relative portion of invalid and therefore erased frames (*frame erasure rate*, see chapter 4) in the measurement of the residual bit error rate (*RFER*, see command `CONFigure:RXQuality:RACHtest:CONTrol`) and for the continuous application.				

Measured Values – Subsystem RXQuality:RACHtest

The subsystem *RXQuality:RACHtest* measures the bit error rate and compares it with the tolerance values. The subsystem corresponds to the measurement menus *Receiver Quality* for the single shot type of measurement and measured values *(RFER, BER).*

				Scalar Results:
READ[:SCALar]:RXQuality:RACHtest? **FETCh[:SCALar]: RXQuality:RACHtest?** **SAMPle[:SCALar]: RXQuality:RACHtest?**	Start single shot measurement and return results Read out meas. results (unsynchronized) Read out measurement results (synchronized)			
Return for RFER	Value range	Def. value	Def. unit	
ProgressTime, **ClassIIBits,** **ClassIbBits,** **FER,** **Status**	0.0 to 100.0 % 0.000 to 100.000 % 0.000 to 100.000 % 0.000 to 100.000 % INV | PASS | FAIL | TMER | IMP	NAN NAN NAN NAN INV	% % % % –	
Return for BER	Value range	Def. value	Def. unit	FW vers.
ProgressTime, **ClassIIBits,** **ClassIbBits,** **Status**	0.0 to 100.0 % 0.000 to 100.000 % 0.000 to 100.000 % INV | PASS | FAIL | TMER | IMP	NAN NAN NAN INV	% % % –	V3.07

Description of command	Sig. State
These commands are always queries. They start a bit-error-rate test in the continuous repetition mode and output the measurement results (see also detailed explanation of measured values in chapter 4). These are	all

ProgressTime	Relative progress of the measurement
ClassIIBits	(Residual) bit error rate for class II bits
ClassIbBits	(Residual) bit error rate for class Ib bits
FER	Frame erasure rate
Status	Measurement status

The following messages can be output for the measurement status:

INV	Measurement invalid	*invalid*
PASS	all tolerances matched	*passed*
FAIL	Not all tolerances matched	*failed*
TMER	CMU could not synchronize	*too many errors*
IMP	Measurement impossible, therefore invalid	*impossible*

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

Return for RFER	Value range	Def. value	Def. unit	
Total,	PASS | FAIL | INV | TMER | IMP	INV	–	
ClassIIBits,	NMAU | INV | OK	INV	–	
ClassIbBits,	NMAU | INV | OK	INV	–	
FER	NMAU | INV | OK	INV	–	
Return for BER	Value range	Def. value	Def. unit	FW vers.
Total,	PASS | FAIL | INV | TMER | IMP	INV	–	V3.07
ClassIIBits,	NMAU | INV | OK	INV	–	
ClassIbBits	NMAU | INV | OK	INV	–	

Description of command	Sig. State
This command is always a query. It indicates whether and in which way the permissible error limits for the measured values of the bit error rate test (see command above) have been exceeded.	all

The following messages can be output for the measured quantities:

PASS	all tolerances matched	*passed*
FAIL	Not all tolerances matched	*failed*
INV	Invalid measurement	*invalid*
TMER	CMU could not synchronize	*too many errors*
IMP	Measurement impossible, therefore invalid	*impossible*
NMAU	Tolerance exceeded	*not matching, underflow*
INV	Invalid measurement	*invalid*
OK	all tolerances matched	

Adaptive Multi-Rate (AMR) Tests

With option R&S CMU-K37, the R&S CMU 300 provides the functionality for AMR speech codec tests. The additional commands belong the the *NETWork…* and *INFO* subsystems.

Note: *The AMR codecs must be selected via* `CONFigure:BSSignal:TCH:CHTYpe AMRF | AMRH`*.*

Subsystem NETWork:AMR (AMR Codec Test)

The subsystem *NETWork:AMR* comprises the commands to configure and test the AMR speech codec. The subsystem corresponds to the *Adaptive Multi-Rate (AMR)* functionality in the *Network* tab of the *Connection Control* menu.

CONFigure:NETWork:AMR:HRATe:DLCMode <*Mode*>		Codec Mode DL, Half Rate		
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
CM1 | CM2 | CM3 | CM4	DL codec mode 1, 2, 3, 4	CM3	–	V3.65
Description of command				Sig. State
This command sets the codec mode that the R&S CMU requests from the BTS. The setting is valid for Half Rate AMR speech coder tests (`CONFigure:BSSignal:TCH:CHTYpe AMRH`). DL codec mode and UL codec mode (see `CONFigure:NETWork:AMR:HRATe:ULCMode` on p. 6.259) overwrite each other unless the bit stream is set to *Handset* (`CONFigure:MSSignal:BITStream HAND`). To query the DL codec mode actually used by the BTS use `[SENSe:]INFO:AMR:HRATe:DLCMode?` (p. 6.260).				all

CONFigure:NETWork:AMR:FRATe:DLCMode <*Mode*>		Codec Mode DL, Full Rate		
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
CM1 | CM2 | CM3 | CM4	DL codec mode 1, 2, 3, 4	CM3	–	V3.65
Description of command				Sig. State
This command sets the codec mode that the R&S CMU requests from the BTS. The setting is valid for Full Rate AMR speech coder tests (`CONFigure:BSSignal:TCH:CHTYpe AMRF`). DL codec mode and UL codec mode (see `CONFigure:NETWork:AMR:FRATe:ULCMode` on p. 6.259) overwrite each other unless the bit stream is set to *Handset* (`CONFigure:MSSignal:BITStream HAND`). To query the DL codec mode actually used by the BTS use `[SENSe:]INFO:AMR:FRATe:DLCMode?` (see p. 6.260).				all

CONFigure:NETWork:AMR:HRATe:ULCMode *<Mode>* — Codec Mode UL, Half Rate

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
CM1 | CM2 | CM3 | CM4	UL codec mode 1, 2, 3, 4	CM3	–	V3.65

Description of command	Sig. State
This command sets the codec mode that the R&S CMU uses in uplink direction. The setting is valid for Half Rate AMR speech coder tests (`CONFigure:BSSignal:TCH:CHTYpe AMRH`). UL codec mode and DL codec mode (see `CONFigure:NETWork:AMR:HRATe:DLCMode` on p. 6.258) overwrite each other unless the bit stream is set to *Handset* (`CONFigure:MSSignal:BITStream HAND`). To query the UL codec mode commanded by the BTS use `[SENSe:]INFO:AMR:HRATe:ULCMode?` (see p. 6.260).	all

CONFigure:NETWork:AMR:FRATe:ULCMode *<Mode>* — Codec Mode UL, Full Rate

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
CM1 | CM2 | CM3 | CM4	UL codec mode 1, 2, 3, 4	CM3	–	V3.65

Description of command	Sig. State
This command sets the codec mode that the R&S CMU uses in uplink direction. The setting is valid for Full Rate AMR speech coder tests (`CONFigure:BSSignal:TCH:CHTYpe AMRF`). UL codec mode and DL codec mode (see `CONFigure:NETWork:AMR:FRATe:DLCMode` on p. 6.258) overwrite each other unless the bit stream is set to *Handset* (`CONFigure:MSSignal:BITStream HAND`). To query the UL codec mode commanded by the BTS use `[SENSe:]INFO:AMR:FRATe:ULCMode?` (see p. 6.261).	all

CONFigure:NETWork:AMR:HRATe:RSETting *<CM4>, <CM3>, CM2>, <CM1>* — AMR Rate Set, Half Rate

<CM4>, <CM3>, <CM2>, CM1>	Description of parameters	Def. value	Def. unit	FW vers.
C1220 | C1020 | C0795 | C0740 | C0670 | C0590 | C0515 | C0475 | **OFF**	User bit rate for codec modes 4 to 1. The rates must be in descending order so that <CM4> is the largest bit rate. Mode switched off.	C0795, C0670, C0590, C0515,	–	V3.65

Description of command	Sig. State
This command selects the bit rates for the four codec modes. The settings are valid for Half Rate AMR speech coder tests (`CONFigure:BSSignal:TCH:CHTYpe AMRH`). The instrument rejects the settings (SCPI error –221, Settings conflict) unless the values meet the following conditions: • The rates must be in descending order so that <CM4> is the largest bit rate. • Up to 3 codec modes can be switched off. OFF must be the first values of the parameter list, preceding the used codec modes.	all

CONFigure:NETWork:AMR:FRATe:RSETting ***<CM4>, <CM3>, CM2>, <CM1>***	AMR Rate Set, Full Rate			
<CM4>, <CM3>, <CM2>, CM1>	Description of parameters	Def. value	Def. unit	FW vers.
C1220 | C1020 | C0795 | C0740 | C0670 | C0590 | C0515 | C0475 | **OFF**	User bit rate for codec modes 4 to 1. The rates must be in descending order so that <CM4> is the largest bit rate. Mode switched off.	C1220, C0795, C0590, C0475,	–	V3.65
Description of command				Sig. State
This command selects the bit rates for the four codec modes. The settings are valid for Full Rate AMR speech coder tests (`CONFigure:BSSignal:TCH:CHTYpe AMRF`). The instrument rejects the settings (SCPI error –221, Settings conflict) unless the values meet the following conditions: • The rates must be in descending order so that <CM4> is the largest bit rate. • Up to 3 codec modes can be switched off. OFF must be the first values of the parameter list, preceding the used codec modes.				all

INFO (AMR Codec Modes)

The subsystem *INFO* contains the commands to query the AMR codec modes used and commanded by the BTS. The information is provided in the *Network* tab of the *Connection Control* menu.

[SENSe:]INFO:AMR:HRATe:DLCMode?	Codec Mode DL, used by BTS (Half Rate)			
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
CM1 | CM2 | CM3 | CM4	DL codec mode 1, 2, 3, 4	NAN	–	V3.65
Description of command				Sig. State
This command is always a query and returns the codec mode used by the BTS. The setting is valid for Half Rate AMR speech coder tests (`CONFigure:BSSignal:TCH:CHTYpe AMRH`).				TCH

[SENSe:]INFO:AMR:FRATe:DLCMode?	Codec Mode DL, used by BTS (Full Rate)			
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
CM1 | CM2 | CM3 | CM4	DL codec mode 1, 2, 3, 4	NAN	–	V3.65
Description of command				Sig. State
This command is always a query and returns the codec mode used by the BTS. The setting is valid for Full Rate AMR speech coder tests (`CONFigure:BSSignal:TCH:CHTYpe AMRF`).				TCH

[SENSe:]INFO:AMR:HRATe:ULCMode?	Codec Mode UL, commanded by BTS (Half Rate)			
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
CM1 | CM2 | CM3 | CM4	UL codec mode 1, 2, 3, 4	NAN	–	V3.65
Description of command				Sig. State
This command is always a query and returns the UL codec mode commanded by the BTS, irrespective of the used UL codec mode (see command `CONFigure:NETWork:AMR:HRATe:ULCMode` on p. 6.259). The setting is valid for Half Rate AMR speech coder tests (`CONFigure:BSSignal:TCH:CHTYpe AMRH`).				TCH

[SENSe:]INFO:AMR:FRATe:ULCMode?	Codec Mode UL, commanded by BTS (Full Rate)			
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
CM1 | CM2 | CM3 | CM4	UL codec mode 1, 2, 3, 4	NAN	–	V3.65
Description of command				Sig. State
This command is always a query and returns the actual UL codec mode commanded by the BTS, irrespective of the used UL codec mode (see command `CONFigure:NETWork:AMR:FRATe:ULCMode` on p. 6.259). The setting is valid for Full Rate AMR speech coder tests (`CONFigure:BSSignal:TCH:CHTYpe AMRF`).				TCH

List of Commands

In the following, all remote-control commands of the function group GSM900-BTS implemented in the CMU will be listed 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 operating modes with and without signalling are listed separately.

Commands for GSM Module Tests

Table 6-1 Remote-control commands: Non Signalling

Command (Non Signalling)	Parameter	Remark	Page
Inputs and outputs			
[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]	–50 dB to +90 dB	with query	6.7
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude]	–50 dB to +90 dB	with query	6.7
[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]	–50 dB to 90 dB	with query	6.7
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]	–50 dB to 90 dB	with query	6.7
SOURce:DM:CLOCk:FREQuency	<Frequency>	with query	6.8
SOURce:DM:CLOCk:STATe	ON | OFF	with query	6.8
INPut[:STATe]	RF1 | RF2 | RF4	with query	6.7
OUTPut[:STATe]	RF1 | RF2 | RF3	with query	6.7
Expected power			
DEFault:EPOWer	ON | OFF	with query	6.2
[SENSe:]EPOWer:ATTenuation	NORMal | LNOise | LDIStortion	with query	6.2
[SENSe:]EPOWer:MODE	MANual | AUTO	with query	6.1
[SENSe:]EPOWer:VALue	<Power>	with query	6.2
I/Q-IF Interface			
IQIF:DEFault	ON | OFF	with query	6.100
CONFigure:IQIF:RXPath	BYP | BYIQ | XOIO | IOIO | IOXO	with query	6.99
CONFigure:IQIF:RXTXcombined	BYP | BYIQ | XOIO | IOIO | IOXO | FPAT | UDEF	with query	6.99
CONFigure:IQIF:TXPath	BYP | BYIQ | XOIO | IOIO | IOXO	with query	6.99
Modulation measurement			

Command (Non Signalling)	Parameter	Remark	Page
INITiate:MODulation:EVMagnitude:EPSK	–	no query	6.42
ABORt:MODulation:EVMagnitude:EPSK	–	no query	6.42
STOP:MODulation:EVMagnitude:EPSK	–	no query	6.42
CONTinue:MODulation:EVMagnitude:EPSK	–	no query	6.42
CONFigure:SUBarrays:MODulation:EVMagnitude:EPSK	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{ ,<Start>,<Samples>}	with query	6.45
READ:ARRay:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.47
FETCh:ARRay:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.47
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.47
READ:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.47
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.47
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.47
CONFigure:MODulation:EVMagnitude:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.43
DEFault:MODulation:EVMagnitude:EPSK:CONTrol	ON | OFF	with query	6.45
CONFigure:MODulation:EVMagnitude:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.44
CONFigure:MODulation:EVMagnitude:EPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.44
CONFigure:MODulation:EVMagnitude:EPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.44
READ:ARRay:MODulation:EVMagnitude:EPSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.47
FETCh:ARRay:MODulation:EVMagnitude:EPSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.47
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.47
READ:SUBarrays:MODulation:EVMagnitude:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.47
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.47
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.47
READ[:SCALar]:MODulation:EVMagnitude:EPSK:DBITS:PEAK?	0 to 7	query only	6.48
FETCh[:SCALar]:MODulation:EVMagnitude:EPSK:DBITS:PEAK?	0 to 7	query only	6.48
SAMPle[:SCALar]:MODulation:EVMagnitude:EPSK:DBITS:PEAK?	0 to 7	query only	6.48

Command (Non Signalling)	Parameter	Remark	Page
READ[:SCALar]:MODulation:EVMagnitude:EPSK:DBITS?	0 to 7	query only	6.48
FETCh[:SCALar]:MODulation:EVMagnitude:EPSK:DBITS?	0 to 7	query only	6.48
SAMPle[:SCALar]:MODulation:EVMagnitude:EPSK:DBITS?	0 to 7	query only	6.48
READ:ARRay:MODulation:EVMagnitude:EPSK:DBITS?	0 to 7, …	query only	6.49
FETCh:ARRay:MODulation:EVMagnitude:EPSK:DBITS?	0 to 7, …	query only	6.49
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:DBITS?	0 to 7, …	query only	6.49
CONFigure:MODulation:EVMagnitude:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.42
CALCulate[:SCALar]:MODulation:EVMagnitude:EPSK: MATChing:LIMit?	<Result>	query only	6.46
READ:ARRay:MODulation:EVMagnitude:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.47
FETCh:ARRay:MODulation:EVMagnitude:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.47
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.47
READ:SUBarrays:MODulation:EVMagnitude:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.47
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.47
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.47
FETCh:MODulation:EVMagnitude:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.43
READ[:SCALar]:MODulation:EVMagnitude:EPSK?	<Result>	query only	6.46
FETCh[:SCALar]:MODulation:EVMagnitude:EPSK?	<Result>	query only	6.46
SAMPle[:SCALar]:MODulation:EVMagnitude:EPSK?	<Result>	query only	6.46
INITiate:MODulation:IQANalyzer:EPSK	–	no query	6.66
ABORt:MODulation:IQANalyzer:EPSK	–	no query	6.66
STOP:MODulation:IQANalyzer:EPSK	–	no query	6.66
CONTinue:MODulation:IQANalyzer:EPSK	–	no query	6.66
DEFault:MODulation:IQANalyzer:EPSK:CONTrol	ON | OFF	with query	6.68
CONFigure:MODulation:IQANalyzer:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, NONE, STEP | NONE	with query	6.67
CONFigure:MODulation:IQANalyzer:EPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.67
CONFigure:MODulation:IQANalyzer:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.66
READ:ARRay:MODulation:IQANalyzer:EPSK:IPHase?	–2.0 to +2.0 (568 values)	query only	6.68

Command (Non Signalling)	Parameter	Remark	Page
FETCh:ARRay:MODulation:IQANalyzer:EPSK:IPHase?	–2.0 to +2.0 (568 values)	query only	6.68
SAMPle:ARRay:MODulation:IQANalyzer:EPSK:IPHase?	–2.0 to +2.0 (568 values)	query only	6.68
CONFigure:MODulation:IQANalyzer:EPSK:IQFilter	ISIRemoved | UNFiltered	with query	6.67
READ:ARRay:MODulation:IQANalyzer:EPSK:QPHase?	–2.0 to +2.0 (568 values)	query only	6.68
FETCh:ARRay:MODulation:IQANalyzer:EPSK:QPHase?	–2.0 to +2.0 (568 values)	query only	6.68
SAMPle:ARRay:MODulation:IQANalyzer:EPSK:QPHase?	–2.0 to +2.0 (568 values)	query only	6.68
CONFigure:MODulation:IQANalyzer:EPSK:ROTation	P38 | P38R	with query	6.67
FETCh:MODulation:IQANalyzer:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.66
READ[:SCALar]:MODulation:IQANalyzer:EPSK?	<Result>	query only	6.68
FETCh[:SCALar]:MODulation:IQANalyzer:EPSK?	<Result>	query only	6.68
SAMPle[:SCALar]:MODulation:IQANalyzer:EPSK?	<Result>	query only	6.68
INITiate:MODulation:MERRor:EPSK	–	no query	6.58
ABORt:MODulation:MERRor:EPSK	–	no query	6.58
STOP:MODulation:MERRor:EPSK	–	no query	6.58
CONTinue:MODulation:MERRor:EPSK	–	no query	6.58
CONFigure:SUBarrays:MODulation:MERRor:EPSK	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.61
READ:ARRay:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.63
FETCh:ARRay:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.63
SAMPle:ARRay:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.63
READ:SUBarrays:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.63
FETCh:SUBarrays:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.63
SAMPle:SUBarrays:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.63
CONFigure:MODulation:MERRor:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.59
DEFault:MODulation:MERRor:EPSK:CONTrol	ON | OFF	with query	6.60
CONFigure:MODulation:MERRor:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,	with query	6.60

Command (Non Signalling)	Parameter	Remark	Page
	STEP | NONE		
CONFigure:MODulation:MERRor:EPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.60
CONFigure:MODulation:MERRor:EPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.60
READ:ARRay:MODulation:MERRor:EPSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.63
FETCh:ARRay:MODulation:MERRor:EPSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.63
SAMPle:ARRay:MODulation:MERRor:EPSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.63
READ:SUBarrays:MODulation:MERRor:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.63
FETCh:SUBarrays:MODulation:MERRor:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.63
SAMPle:SUBarrays:MODulation:MERRor:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.63
CONFigure:MODulation:MERRor:EPSK:DBITs	ON | OFF	with query	6.64
READ[:SCALar]:MODulation:MERRor:EPSK:DBITS:PEAK?	0 to 7	query only	6.64
FETCh[:SCALar]:MODulation:MERRor:EPSK:DBITS:PEAK?	0 to 7	query only	6.64
SAMPle[:SCALar]:MODulation:MERRor:EPSK:DBITS:PEAK?	0 to 7	query only	6.64
READ[:SCALar]:MODulation:MERRor:EPSK:DBITS?	0 to 7	query only	6.64
FETCh[:SCALar]:MODulation:MERRor:EPSK:DBITS?	0 to 7	query only	6.64
SAMPle[:SCALar]:MODulation:MERRor:EPSK:DBITS?	0 to 7	query only	6.64
READ:ARRay:MODulation:MERRor:EPSK:DBITS?	0 to 7, …	query only	6.65
FETCh:ARRay:MODulation:MERRor:EPSK:DBITS?	0 to 7, …	query only	6.65
SAMPle:ARRay:MODulation:MERRor:EPSK:DBITS?	0 to 7, …	query only	6.65
CONFigure:MODulation:MERRor:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.58
CALCulate[:SCALar]:MODulation:MERRor:EPSK:MATChing:LIMit?	<Result>	query only	6.62
READ:ARRay:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.63
FETCh:ARRay:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.63
SAMPle:ARRay:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.63
READ:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.63
FETCh:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.63
SAMPle:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.63
FETCh:MODulation:MERRor:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.59

Command (Non Signalling)	Parameter	Remark	Page
READ[:SCALar]:MODulation:MERRor:EPSK?	<Result>	query only	6.62
FETCh[:SCALar]:MODulation:MERRor:EPSK?	<Result>	query only	6.62
SAMPle[:SCALar]:MODulation:MERRor:EPSK?	<Result>	query only	6.62
CONFigure:MODulation:OEMP:EPSK:AVERage:LIMit [:SCALar]:SYMMetric[:COMBined]:VALue	<EVMErrorPeak>, <EVMErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>, <PhaseErrorPeak>, <PhaseErrorRMS>, <OriginOffset>, <FreqError>	with query	6.39
CONFigure:MODulation:OEMP:EPSK:CMMax:LIMit [:SCALar]:SYMMetric[:COMBined]:VALue	<EVMErrorPeak>, <EVMErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>, <PhaseErrorPeak>, <PhaseErrorRMS>, <OriginOffset>, <FreqError>	with query	6.39
DEFault:MODulation:OEMP:EPSK:LIMit	ON | OFF	with query	6.40
CONFigure:MODulation:OEMP:EPSK:P95Th:LIMit [:SCALar]:SYMMetric[:COMBined]:VALue	<EVM95%>, <MError95%>, <PError95%>	with query	6.39
CONFigure:MODulation:OEMP:EPSK:RPMode	CURRent | AVERage | DCOMpensated	with query	6.40
INITiate:MODulation:OVERview:EPSK	–	no query	6.36
ABORt:MODulation:OVERview:EPSK	–	no query	6.36
STOP:MODulation:OVERview:EPSK	–	no query	6.36
CONTinue:MODulation:OVERview:EPSK	–	no query	6.36
CONFigure:MODulation:OVERview:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.37
DEFault:MODulation:OVERview:EPSK:CONTrol	ON | OFF	with query	6.39
CONFigure:MODulation:OVERview:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.38
CONFigure:MODulation:OVERview:EPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.38
CONFigure:MODulation:OVERview:EPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.38
CONFigure:MODulation:OVERview:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.36
CALCulate[:SCALar]:MODulation:OVERview:EPSK:MATChing:LIMit?	<Result>	query only	6.41
FETCh:MODulation:OVERview:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.37

Command (Non Signalling)	Parameter	Remark	Page
READ[:SCALar]:MODulation:OVERview:EPSK?	<Result>	query only	6.41
FETCh[:SCALar]:MODulation:OVERview:EPSK?	<Result>	query only	6.41
SAMPle[:SCALar]:MODulation:OVERview:EPSK?	<Result>	query only	6.41
INITiate:MODulation:PERRor:EPSK	–	no query	6.50
ABORt:MODulation:PERRor:EPSK	–	no query	6.50
STOP:MODulation:PERRor:EPSK	–	no query	6.50
CONTinue:MODulation:PERRor:EPSK	–	no query	6.50
CONFigure:SUBarrays:MODulation:PERRor:EPSK	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.53
READ:ARRay:MODulation:PERRor:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.55
FETCh:ARRay:MODulation:PERRor:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.55
SAMPle:ARRay:MODulation:PERRor:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.55
READ:SUBarrays:MODulation:PERRor:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.55
FETCh:SUBarrays:MODulation:PERRor:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.55
SAMPle:SUBarrays:MODulation:PERRor:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.55
CONFigure:MODulation:PERRor:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.51
DEFault:MODulation:PERRor:EPSK:CONTrol	ON | OFF	with query	6.53
CONFigure:MODulation:PERRor:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.52
CONFigure:MODulation:PERRor:EPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.52
CONFigure:MODulation:PERRor:EPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.52
READ:ARRay:MODulation:PERRor:EPSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.55
FETCh:ARRay:MODulation:PERRor:EPSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.55
SAMPle:ARRay:MODulation:PERRor:EPSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.55
READ:SUBarrays:MODulation:PERRor:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.55
FETCh:SUBarrays:MODulation:PERRor:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.55
SAMPle:SUBarrays:MODulation:PERRor:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.55

Command (Non Signalling)	Parameter	Remark	Page
CONFigure:MODulation:PERRor:EPSK:DBITs	ON | OFF	with query	6.56
READ[:SCALar]:MODulation:PERRor:EPSK:DBITS:PEAK?	0 to 7	query only	6.56
FETCh[:SCALar]:MODulation:PERRor:EPSK:DBITS:PEAK?	0 to 7	query only	6.56
SAMPle[:SCALar]:MODulation:PERRor:EPSK:DBITS:PEAK?	0 to 7	query only	6.56
READ[:SCALar]:MODulation:PERRor:EPSK:DBITS?	0 to 7	query only	6.56
FETCh[:SCALar]:MODulation:PERRor:EPSK:DBITS?	0 to 7	query only	6.56
SAMPle[:SCALar]:MODulation:PERRor:EPSK:DBITS?	0 to 7	query only	6.56
READ:ARRay:MODulation:PERRor:EPSK:DBITS?	0 to 7, …	query only	6.57
FETCh:ARRay:MODulation:PERRor:EPSK:DBITS?	0 to 7, …	query only	6.57
SAMPle:ARRay:MODulation:PERRor:EPSK:DBITS?	0 to 7, …	query only	6.57
CONFigure:MODulation:PERRor:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.50
CALCulate[:SCALar]:MODulation:PERRor:EPSK:MATChing:LIMit?	<Result>	query only	6.54
READ:ARRay:MODulation:PERRor:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.55
FETCh:ARRay:MODulation:PERRor:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.55
SAMPle:ARRay:MODulation:PERRor:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.55
READ:SUBarrays:MODulation:PERRor:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.55
FETCh:SUBarrays:MODulation:PERRor:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.55
SAMPle:SUBarrays:MODulation:PERRor:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.55
FETCh:MODulation:PERRor:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.51
READ[:SCALar]:MODulation:PERRor:EPSK?	<Result>	query only	6.54
FETCh[:SCALar]:MODulation:PERRor:EPSK?	<Result>	query only	6.54
SAMPle[:SCALar]:MODulation:PERRor:EPSK?	<Result>	query only	6.54
INITiate:MODulation:PERRor:GMSK	–	no query	6.28
ABORt:MODulation:PERRor:GMSK	–	no query	6.28
STOP:MODulation:PERRor:GMSK	–	no query	6.28
CONTinue:MODulation:PERRor:GMSK	–	no query	6.28
CONFigure:SUBarrays:MODulation:PERRor:GMSK	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.32

Command (Non Signalling)	Parameter	Remark	Page
CONFigure:MODulation:PERRor:GMSK:AVERage:LIMit:[:SCALar]:SYMMetric[:COMBined]:VALue	0.0 deg to 50.0 deg, 0.0 deg to 50.0 deg, 0 Hz to 1000 Hz	with query	6.31
READ:ARRay:MODulation:PERRor:GMSK:AVERage?	–100.0 deg to +100.0 deg	query only	6.34
FETCh:ARRay:MODulation:PERRor:GMSK:AVERage?	–100.0 deg to +100.0 deg	query only	6.34
SAMPle:ARRay:MODulation:PERRor:GMSK:AVERage?	–100.0 deg to +100.0 deg	query only	6.34
READ:SUBarrays:MODulation:PERRor:GMSK:AVERage?	–100.0 deg to +20.0 deg	query only	6.35
FETCh:SUBarrays:MODulation:PERRor:GMSK:AVERage?	–100.0 deg to +20.0 deg	query only	6.35
SAMPle:SUBarrays:MODulation:PERRor:GMSK:AVERage?	–100.0 deg to +20.0 deg	query only	6.35
CONFigure:MODulation:PERRor:GMSK:CMMax:LIMit:[:SCALar]:SYMMetric[:COMBined]:VALue	0.0 deg to 50.0 deg, 0.0 deg to 50.0 deg, 0 Hz to 1000 Hz	with query	6.30
CONFigure:MODulation:PERRor:GMSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.29
DEFault:MODulation:PERRor:GMSK:CONTrol	ON | OFF	with query	6.30
CONFigure:MODulation:PERRor:GMSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.30
CONFigure:MODulation:PERRor:GMSK:CONTrol:RMODe	SCALar | ARRay	with query	6.29
CONFigure:MODulation:PERRor:GMSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.29
READ:ARRay:MODulation:PERRor:GMSK:CURRent?	–100.0 deg to +100.0 deg	query only	6.34
FETCh:ARRay:MODulation:PERRor:GMSK:CURRent?	–100.0 deg to +100.0 deg	query only	6.34
SAMPle:ARRay:MODulation:PERRor:GMSK:CURRent?	–100.0 deg to +100.0 deg	query only	6.34
READ:SUBarrays:MODulation:PERRor:GMSK:CURRent?	–100.0 deg to +20.0 deg	query only	6.35
FETCh:SUBarrays:MODulation:PERRor:GMSK:CURRent?	–100.0 deg to +20.0 deg	query only	6.35
SAMPle:SUBarrays:MODulation:PERRor:GMSK:CURRent?	–100.0 deg to +20.0 deg	query only	6.35
CONFigure:MODulation:PERRor:GMSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.28
DEFault:MODulation:PERRor:GMSK:LIMit	ON | OFF	with query	6.31
CALCulate[:SCALar]:MODulation:PERRor:GMSK:MATChing:LIMit?	<Result>	query only	6.33
READ:ARRay:MODulation:PERRor:GMSK:MMAXimum?	–100.0 deg to +100.0 deg	query only	6.34
FETCh:ARRay:MODulation:PERRor:GMSK:MMAXimum?	–100.0 deg to +100.0 deg	query only	6.34
SAMPle:ARRay:MODulation:PERRor:GMSK:MMAXimum?	–100.0 deg to +100.0 deg	query only	6.34

Command (Non Signalling)	Parameter	Remark	Page
READ:SUBarrays:MODulation:PERRor:GMSK:MMAXimum?	–100.0 deg to +20.0 deg	query only	6.35
FETCh:SUBarrays:MODulation:PERRor:GMSK:MMAXimum?	–100.0 deg to +20.0 deg	query only	6.35
SAMPle:SUBarrays:MODulation:PERRor:GMSK:MMAXimum?	–100.0 deg to +20.0 deg	query only	6.35
FETCh:MODulation:PERRor:GMSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.28
CONFigure:MODulation:PERRor:GMSK:TIME:DECode	STANdard | GTBits	with query	6.31
READ[:SCALar]:MODulation:PERRor:GMSK?	<Result>	query only	6.32
FETCh[:SCALar]:MODulation:PERRor:GMSK?	<Result>	query only	6.32
SAMPle[:SCALar]:MODulation:PERRor:GMSK?	<Result>	query only	6.32
CONFigure:MODulation[:PERRor]:EPSK:DBITs	ON | OFF	with query	6.48
Narrow-band power measurement			
INITiate:NPOWer	–	no query	6.12
ABORt:NPOWer	–	no query	6.12
STOP:NPOWer	–	no query	6.12
CONTinue:NPOWer	–	no query	6.12
CONFigure:NPOWer:CONTrol	1 to 1000 | NONE,CONTinuous | SINGleshot | 1 ... 10000, SONerror | NONE,STEP | NONE	with query	6.13
CONFigure:NPOWer:CONTrol:REPetition	CONTinuous | SINGleshot | 1 ... 10000, SONerror | NONE,STEP | NONE	with query	6.14
CONFigure:NPOWer:CONTrol:STATistics	1 to 1000 | NONE	with query	6.13
CONFigure:NPOWer:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.12
FETCh:NPOWer:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE, 1 to 1000 | NONE	query only	6.12
READ[:SCALar]:NPOWer?	–30 dBm to +30 dBm	query only	6.14
FETCh[:SCALar]:NPOWer?	–30 dBm to +30 dBm	query only	6.14
SAMPle[:SCALar]:NPOWer?	–30 dBm to +30 dBm	query only	6.14
Options query			
SYSTem:OPTions:INFO:CURRent?	–	query only	6.98

Command (Non Signalling)	Parameter	Remark	Page
Power measurement			
INITiate:POWer:NBURst:EPSK	–	no query	6.15
ABORt:POWer:NBURst:EPSK	–	no query	6.15
STOP:POWer:NBURst:EPSK	–	no query	6.15
CONTinue:POWer:NBURst:EPSK	–	no query	6.15
CONFigure:SUBarrays:POWer:NBURst:EPSK	ALL | ARITHmetical | MINimum | MAXimum,<Start>,<Samples>{ ,<Start>,<Samples>}	with query	6.23
CALCulate:ARRay:POWer:NBURst:EPSK:AVERage: MATChing:AREA?	<Matching>	query only	6.27
CALCulate:ARRay:POWer:NBURst:EPSK:AVERage: MATChing:LIMit?	<Matching>	query only	6.27
READ:ARRay:POWer:NBURst:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.25
FETCh:ARRay:POWer:NBURst:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.25
SAMPle:ARRay:POWer:NBURst:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.25
READ:SUBarrays:POWer:NBURst:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.26
FETCh:SUBarrays:POWer:NBURst:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.26
SAMPle:SUBarrays:POWer:NBURst:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.26
CONFigure:POWer:NBURst:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.16
DEFault:POWer:NBURst:EPSK:CONTrol	ON | OFF	with query	6.18
CONFigure:POWer:NBURst:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.17
CONFigure:POWer:NBURst:EPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.17
CONFigure:POWer:NBURst:EPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.17
CALCulate:ARRay:POWer:NBURst:EPSK:CURRent: MATChing:AREA?	<Matching>	query only	6.27
CALCulate:ARRay:POWer:NBURst:EPSK:CURRent: MATChing:LIMit?	<Matching>	query only	6.27
READ:ARRay:POWer:NBURst:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.25
FETCh:ARRay:POWer:NBURst:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.25

Command (Non Signalling)	Parameter	Remark	Page
SAMPle:ARRay:POWer:NBURst:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.25
READ:SUBarrays:POWer:NBURst:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.26
FETCh:SUBarrays:POWer:NBURst:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.26
SAMPle:SUBarrays:POWer:NBURst:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.26
CONFigure:POWer:NBURst:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.15
CONFigure:POWer:NBURst:EPSK:FILTer	G500 | B600	with query	6.17
DEFault:POWer:NBURst:EPSK:LIMit:LINE	ON | OFF	with query	6.22
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric: LOWer:AREA<nr>	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.20
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric: LOWer:AREA<nr>:ENABle	ON | OFF	with query	6.20
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric: LOWer:AREA<nr>:VALue	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>	with query	6.20
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric: LOWer:ENABle	ON | OFF	with query	6.21
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric: UPPer:AREA<nr>	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.19
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric: UPPer:AREA<nr>:ENABle	ON | OFF	with query	6.19
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric: UPPer:AREA<nr>:VALue	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>	with query	6.19
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric: UPPer:ENABle	ON | OFF	with query	6.21
CALCulate[:SCALar]:POWer:NBURst:EPSK:MATChing:LIMit?	<Result>	query only	6.24
CALCulate:ARRay:POWer:NBURst:EPSK:MAXimum: MATChing:AREA?	<Matching>	query only	6.27
CALCulate:ARRay:POWer:NBURst:EPSK:MAXimum: MATChing:LIMit?	<Matching>	query only	6.27
READ:ARRay:POWer:NBURst:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.25
FETCh:ARRay:POWer:NBURst:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.25

Command (Non Signalling)	Parameter	Remark	Page
SAMPle:ARRay:POWer:NBURst:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.25
READ:SUBarrays:POWer:NBURst:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.26
FETCh:SUBarrays:POWer:NBURst:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.26
SAMPle:SUBarrays:POWer:NBURst:EPSK:MAXimum?	–100.0 dB dB to +20.0 dB	query only	6.26
CALCulate:ARRay:POWer:NBURst:EPSK:MINimum: MATChing:AREA?	<Matching>	query only	6.27
CALCulate:ARRay:POWer:NBURst:EPSK:MINimum: MATChing:LIMit?	<Matching>	query only	6.27
READ:ARRay:POWer:NBURst:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.25
FETCh:ARRay:POWer:NBURst:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.25
SAMPle:ARRay:POWer:NBURst:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.25
READ:SUBarrays:POWer:NBURst:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.26
FETCh:SUBarrays:POWer:NBURst:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.26
SAMPle:SUBarrays:POWer:NBURst:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.26
CONFigure:POWer:NBURst:EPSK:RPMode	CURRent | AVERage | DCOMpensated	with query	6.22
FETCh:POWer:NBURst:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.16
CONFigure:POWer:NBURst:EPSK:TOFFset	–4.00 to +4.00	with query	6.22
READ[:SCALar]:POWer:NBURst:EPSK?	<Result>	query only	6.24
FETCh[:SCALar]:POWer:NBURst:EPSK?	<Result>	query only	6.24
SAMPle[:SCALar]:POWer:NBURst:EPSK?	<Result>	query only	6.24
INITiate:POWer:NBURst:GMSK	–	no query	6.15
ABORt:POWer:NBURst:GMSK	–	no query	6.15
STOP:POWer:NBURst:GMSK	–	no query	6.15
CONTinue:POWer:NBURst:GMSK	–	no query	6.15
CONFigure:SUBarrays:POWer:NBURst:GMSK	ALL | ARITHmetical | MINimum | MAXimum,<Start>,<Samples>{ ,<Start>,<Samples>}	with query	6.23
CALCulate:ARRay:POWer:NBURst:GMSK:AVERage: MATChing:AREA?	<Matching>	query only	6.27
CALCulate:ARRay:POWer:NBURst:GMSK:AVERage: MATChing:LIMit?	<Matching>	query only	6.27

Command (Non Signalling)	Parameter	Remark	Page
READ:ARRay:POWer:NBURst:GMSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.25
FETCh:ARRay:POWer:NBURst:GMSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.25
SAMPle:ARRay:POWer:NBURst:GMSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.25
READ:SUBarrays:POWer:NBURst:GMSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.26
FETCh:SUBarrays:POWer:NBURst:GMSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.26
SAMPle:SUBarrays:POWer:NBURst:GMSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.26
CONFigure:POWer:NBURst:GMSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.16
DEFault:POWer:NBURst:GMSK:CONTrol	ON | OFF	with query	6.18
CONFigure:POWer:NBURst:GMSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.17
CONFigure:POWer:NBURst:GMSK:CONTrol:RMODe	SCALar | ARRay	with query	6.17
CONFigure:POWer:NBURst:GMSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.17
CALCulate:ARRay:POWer:NBURst:GMSK:CURRent: MATChing:AREA?	<Matching>	query only	6.27
CALCulate:ARRay:POWer:NBURst:GMSK:CURRent: MATChing:LIMit?	<Matching>	query only	6.27
READ:ARRay:POWer:NBURst:GMSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.25
FETCh:ARRay:POWer:NBURst:GMSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.25
SAMPle:ARRay:POWer:NBURst:GMSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.25
READ:SUBarrays:POWer:NBURst:GMSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.26
FETCh:SUBarrays:POWer:NBURst:GMSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.26
SAMPle:SUBarrays:POWer:NBURst:GMSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.26
CONFigure:POWer:NBURst:GMSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.15
CONFigure:POWer:NBURst:GMSK:FILTer	G500 | B600	with query	6.17
DEFault:POWer:NBURst:GMSK:LIMit:LINE	ON | OFF	with query	6.22
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric: LOWer:AREA<nr>	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.20
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:	ON | OFF	with query	6.20

Command (Non Signalling)	Parameter	Remark	Page
LOWer:AREA<nr>:ENABle			
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric: LOWer:AREA<nr>:VALue	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>	with query	6.20
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric: LOWer:ENABle	ON | OFF	with query	6.21
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric: UPPer:AREA<nr>	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.19
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric: UPPer:AREA<nr>:ENABle	ON | OFF	with query	6.19
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric: UPPer:AREA<nr>:VALue	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>	with query	6.19
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric: UPPer:ENABle	ON | OFF	with query	6.21
CALCulate[:SCALar]:POWer:NBURst:GMSK:MATChing:LIMit?	<Result>	query only	6.24
CALCulate:ARRay:POWer:NBURst:GMSK:MAXimum: MATChing:AREA?	<Matching>	query only	6.27
CALCulate:ARRay:POWer:NBURst:GMSK:MAXimum: MATChing:LIMit?	<Matching>	query only	6.27
READ:ARRay:POWer:NBURst:GMSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.25
FETCh:ARRay:POWer:NBURst:GMSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.25
SAMPle:ARRay:POWer:NBURst:GMSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.25
READ:SUBarrays:POWer:NBURst:GMSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.26
FETCh:SUBarrays:POWer:NBURst:GMSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.26
SAMPle:SUBarrays:POWer:NBURst:GMSK:MAXimum?	–100.0 dB dB to +20.0 dB	query only	6.26
CALCulate:ARRay:POWer:NBURst:GMSK:MINimum: MATChing:AREA?	<Matching>	query only	6.27
CALCulate:ARRay:POWer:NBURst:GMSK:MINimum: MATChing:LIMit?	<Matching>	query only	6.27
READ:ARRay:POWer:NBURst:GMSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.25
FETCh:ARRay:POWer:NBURst:GMSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.25
SAMPle:ARRay:POWer:NBURst:GMSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.25

Command (Non Signalling)	Parameter	Remark	Page
READ:SUBarrays:POWer:NBURst:GMSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.26
FETCh:SUBarrays:POWer:NBURst:GMSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.26
SAMPle:SUBarrays:POWer:NBURst:GMSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.26
FETCh:POWer:NBURst:GMSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.16
CONFigure:POWer:NBURst:GMSK:TOFFset	–4.00 to +4.00	with query	6.22
READ[:SCALar]:POWer:NBURst:GMSK?	<Result>	query only	6.24
FETCh[:SCALar]:POWer:NBURst:GMSK?	<Result>	query only	6.24
SAMPle[:SCALar]:POWer:NBURst:GMSK?	<Result>	query only	6.24
Reset of the Function Group			
SYSTem:RESet:CURRent	–	no query	6.98
RF Analyzer			
[SENSe:]RFANalyzer:FOFFset	<FreqOffset>	with query	6.3
[SENSe:]RFANalyzer:FREQuency	<Frequency>	with query	6.3
[SENSe:]RFANalyzer:FREQuency:UNIT	Hz | KHZ | MHZ | GHZ | CH	with query	6.3
[SENSe:]RFANalyzer:MCONTrol:TSOFfset	0 to 7	with query	6.4
[SENSe:]RFANalyzer:TSEQuence	OFF | GSM0 to GSM7 | DUMMy | ANY	with query	6.3
RF Generator			
INITiate:RFGenerator	–	no query	6.4
ABORt:RFGenerator	–	no query	6.4
SOURce:RFGenerator:FOFFset	<FrequencyOffset>	with query	6.6
SOURce:RFGenerator:FREQuency	<Frequency>	with query	6.5
SOURce:RFGenerator:FREQuency:UNIT	Hz | KHZ | MHZ | GHZ | CH	with query	6.5
SOURce:RFGenerator:LEVel:UNTimeslot	<Level>	with query	6.5
SOURce:RFGenerator:LEVel:UTIMeslot	<Level>	with query	6.4
CONFigure:RFGenerator:MODulation:BMODulation	<Selection>	with query	6.6
CONFigure:RFGenerator:MODulation:TRANsmission	<TRANsmission>	with query	6.6
CONFigure:RFGenerator:MODulation:TSEQuence	<Selection>	with query	6.6

Command (Non Signalling)	Parameter	Remark	Page
FETCh:RFGenerator:STATus?	OFF | RUN | STOP | ERR	query only	6.4
Spectrum measurements			
CONFigure:SPECtrum:LIMit:LINE:SELect	GMSK | EPSK	with query	6.69
INITiate:SPECtrum:MODulation	–	no query	6.69
ABORt:SPECtrum:MODulation	–	no query	6.69
STOP:SPECtrum:MODulation	–	no query	6.69
CONTinue:SPECtrum:MODulation	–	no query	6.69
CONFigure:SUBarrays:SPECtrum:MODulation	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.76
CONFigure:SPECtrum:MODulation:AVGareas	A | B | AB	with query	6.73
CONFigure:SPECtrum:MODulation:AVGareas	A | B | AB	with query	6.84
CONFigure:SPECtrum:MODulation:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.70
DEFault:SPECtrum:MODulation:CONTrol	ON | OFF	with query	6.72
CONFigure:SPECtrum:MODulation:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.72
CONFigure:SPECtrum:MODulation:CONTrol:RMODe	SCALar | ARRay	with query	6.71
CONFigure:SPECtrum:MODulation:CONTrol:STATistics	1 to 1000 | NONE	with query	6.71
CONFigure:SPECtrum:MODulation:CONTrol:VMPoint<nr>	0 MHz to 2.5 MHz | OFF	with query	6.76
DEFault:SPECtrum:MODulation:EPSK:LIMit:LINE	ON | OFF	with query	6.75
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:SYMMetric[:COMBined]:ENABle	ON | OFF	with query	6.75
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.74
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:ENABle	ON | OFF	with query	6.74
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:VALue	<MinLevel>,<MaxLevel>,<AbsLevel>	with query	6.74
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE :SYMMetric[:COMBined]:RPOWer	<Minimum>, <Maximum>	with query	6.75
CONFigure:SPECtrum:MODulation:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.70

Command (Non Signalling)	Parameter	Remark	Page
DEFault:SPECtrum:MODulation:GMSK:LIMit:LINE	ON | OFF	with query	6.75
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE :SYMMetric[:COMBined]:ENABle	ON | OFF	with query	6.75
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.74
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:ENABle	ON | OFF	with query	6.74
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:VALue	<MinLevel>,<MaxLevel>,<AbsLevel>	with query	6.74
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE :SYMMetric[:COMBined]:RPOWer	<Minimum>, <Maximum>	with query	6.75
CONFigure:SPECtrum:MODulation:MPOint<nr>:ENABle	ON | OFF	with query	6.76
FETCh:SPECtrum:MODulation:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.70
CONFigure:SPECtrum:MODulation:TDFSelect	N180|N160|N140|N120|N100|N080|N060|N040|N025|N020|N010 | REF | P010|P020|P025|P040|P060|P080|P100|P120|P140|P160|P180|NV4|NV3|NV2|NV1|PV1|PV2|PV3|PV4|OFF|ON	with query	6.73
CONFigure:SUBarrays:SPECtrum:MODulation:TDOMain	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.77
READ:ARRay:SPECtrum:MODulation:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.79
FETCh:ARRay:SPECtrum:MODulation:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.79
SAMPle:ARRay:SPECtrum:MODulation:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.79
READ:SUBarrays:SPECtrum:MODulation:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.80
FETCh:SUBarrays:SPECtrum:MODulation:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.80
SAMPle:SUBarrays:SPECtrum:MODulation:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.80
READ[:SCALar]:SPECtrum:MOdulation?	<Result>	only query	6.78
FETCh[:SCALar]:SPECtrum:MODulation?	<Result>	only query	6.78
SAMPle[:SCALar]:SPECtrum:MODulation?	<Result>	only query	6.78
READ:ARRay:SPECtrum:MODulation?	–100.0 dB to +20.0 dB	only query	6.78
FETCh:ARRay:SPECtrum:MODulation?	–100.0 dB to +20.0 dB	only query	6.78
SAMPle:ARRay:SPECtrum:MODulation?	–100.0 dB to +20.0 dB	only query	6.78

Command (Non Signalling)	Parameter	Remark	Page
READ:SUBarrays:SPECtrum:MODulation?	–100.0 dB to +20.0 dB, ...	query only	6.79
FETCh:SUBarrays:SPECtrum:MODulation?	–100.0 dB to +20.0 dB, ...	query only	6.79
SAMPle:SUBarrays:SPECtrum:MODulation?	–100.0 dB to +20.0 dB, ...	query only	6.79
READ:ARRay:SPECtrum:MODulation[:FDOMain]:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.79
FETCh:ARRay:SPECtrum:MODulation[:FDOMain]:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.79
SAMPle:ARRay:SPECtrum:MODulation[:FDOMain]:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.79
INITiate:SPECtrum:MSWitching	–	no query	6.92
ABORt:SPECtrum:MSWitching	–	no query	6.92
STOP:SPECtrum:MSWitching	–	no query	6.92
CONTinue:SPECtrum:MSWitching	–	no query	6.92
CALCulate:ARRay:SPECtrum:MSWitching:AREA:LIMit:MATChing?	<Matching>	query only	6.96
CONFigure:SPECtrum:MSWitching:CONTrol	SCALar | ARRay	with query	6.93
CONFigure:SPECtrum:MSWitching:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.94
CONFigure:SPECtrum:MSWitching:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.92
[SENSe:]SPECtrum:MSWitching:LIMit:LINE:USED?	GMSK | EPSK	query only	6.94
FETCh:SPECtrum:MSWitching:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 1000 | NONE, 1 to 10000 | NONE, 1 to 10000 | NONE	only query	6.93
READ:ARRay:SPECtrum:MSWitching:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.96
FETCh:ARRay:SPECtrum:MSWitching:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.96
SAMPle:ARRay:SPECtrum:MSWitching:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.96
READ:ARRay:SPECtrum:MSWitching:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.96
FETCh:ARRay:SPECtrum:MSWitching:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.96
SAMPle:ARRay:SPECtrum:MSWitching:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.96
READ[:SCALar]:SPECtrum:MSWitching?	<Result>	only query	6.95
FETCh[:SCALar]:SPECtrum:MSWitching?	<Result>	only query	6.95
SAMPle[:SCALar]:SPECtrum:MSWitching?	<Result>	only query	6.95
READ:ARRay:SPECtrum:MSWitching?	<32 results>	only query	6.95
FETCh:ARRay:SPECtrum:MSWitching?	<32 results>	only query	6.95

<table>
<tr><th>Command (Non Signalling)</th><th>Parameter</th><th>Remark</th><th>Page</th></tr>
<tr><td>SAMPle:ARRay:SPECtrum:MSWitching?</td><td><32 results></td><td>only query</td><td>6.95</td></tr>
<tr><td>INITiate:SPECtrum:SWITching</td><td>–</td><td>no query</td><td>6.81</td></tr>
<tr><td>ABORt:SPECtrum:SWITching</td><td>–</td><td>no query</td><td>6.81</td></tr>
<tr><td>STOP:SPECtrum:SWITching</td><td>–</td><td>no query</td><td>6.81</td></tr>
<tr><td>CONTinue:SPECtrum:SWITching</td><td>–</td><td>no query</td><td>6.81</td></tr>
<tr><td>CONFigure:SUBarrays:SPECtrum:SWITching</td><td>ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}</td><td>with query</td><td>6.87</td></tr>
<tr><td>SAMPle[:SCALar]:SPECtrum:SWITching ?</td><td><Result></td><td>only query</td><td>6.89</td></tr>
<tr><td>CONFigure:SPECtrum:SWITching:CONTrol</td><td>SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE</td><td>with query</td><td>6.82</td></tr>
<tr><td>DEFault:SPECtrum:SWITching:CONTrol</td><td>ON | OFF</td><td>with query</td><td>6.83</td></tr>
<tr><td>CONFigure:SPECtrum:SWITching:CONTrol:REPetition</td><td>CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE</td><td>with query</td><td>6.83</td></tr>
<tr><td>CONFigure:SPECtrum:SWITching:CONTrol:RMODe</td><td>SCALar | ARRay</td><td>with query</td><td>6.82</td></tr>
<tr><td>CONFigure:SPECtrum:SWITching:CONTrol:STATistics</td><td>1 to 1000 | NONE</td><td>with query</td><td>6.82</td></tr>
<tr><td>CONFigure:SPECtrum:SWITching:CONTrol:VMPOint<nr></td><td>0 MHz to 2.5 MHz | OFF</td><td>with query</td><td>6.87</td></tr>
<tr><td>CONFigure:SPECtrum:SWITching:CSMODE</td><td>PHOL | SCO</td><td>with query</td><td>6.84</td></tr>
<tr><td>DEFault:SPECtrum:SWITching:EPSK:LIMit:LINE</td><td>ON | OFF</td><td>with query</td><td>6.86</td></tr>
<tr><td>CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:SYMMetric[:COMBined]:ENABle</td><td>ON | OFF</td><td>with query</td><td>6.86</td></tr>
<tr><td>CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr></td><td><MinLevel>,<MaxLevel>,<AbsLevel>,<Enable></td><td>with query</td><td>6.85</td></tr>
<tr><td>CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:ENABle</td><td>ON | OFF</td><td>with query</td><td>6.85</td></tr>
<tr><td>CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:VALue</td><td><MinLevel>,<MaxLevel>,<AbsLevel></td><td>with query</td><td>6.85</td></tr>
<tr><td>CONFigure:SPECtrum:SWITching:EPSK:MPOint<nr>:ENABle</td><td>ON | OFF</td><td>with query</td><td>6.86</td></tr>
<tr><td>CONFigure:SPECtrum:SWITching:EREPorting</td><td>SRQ | SOPC | SRSQ | OFF</td><td>with query</td><td>6.81</td></tr>
<tr><td>DEFault:SPECtrum:SWITching:GMSK:LIMit:LINE</td><td>ON | OFF</td><td>with query</td><td>6.86</td></tr>
<tr><td>CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE :SYMMetric[:COMBined]:ENABle</td><td>ON | OFF</td><td>with query</td><td>6.86</td></tr>
</table>

Command (Non Signalling)	Parameter	Remark	Page
CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.85
CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:ENABle	ON | OFF	with query	6.85
CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:VALue	<MinLevel>,<MaxLevel>,<AbsLevel>	with query	6.85
CONFigure:SPECtrum:SWITching:MPOint<nr>:ENABle	ON | OFF	with query	6.86
FETCh:SPECtrum:SWITching:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.81
CONFigure:SPECtrum:SWITching:TDFSelect	N180|N120|N060|N040|REF|P040|P060|P120|P180|NV4|NV3|NV2|NV1|PV1|PV2|PV3|PV4|OFF|ON	with query	6.84
CONFigure:SUBarrays:SPECtrum:SWITching:TDOMain	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.88
READ:ARRay:SPECtrum:SWITching:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.91
FETCh:ARRay:SPECtrum:SWITching:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.91
SAMPle:ARRay:SPECtrum:SWITching:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.91
READ:SUBarrays:SPECtrum:SWITching:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.91
FETCh:SUBarrays:SPECtrum:SWITching:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.91
SAMPle:SUBarrays:SPECtrum:SWITching:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.91
READ[:SCALar]:SPECtrum:SWITching?	<Result>	only query	6.89
FETCh[:SCALar]:SPECtrum:SWITching?	<Result>	only query	6.89
READ:ARRay:SPECtrum:SWITching?	–100.0 dB to +20.0 dB	only query	6.90
FETCh:ARRay:SPECtrum:SWITching?	–100.0 dB to +20.0 dB	only query	6.90
SAMPle:ARRay:SPECtrum:SWITching?	–100.0 dB to +20.0 dB	only query	6.90
READ:SUBarrays:SPECtrum:SWITching?	–100.0 dB to +20.0 dB, ...	query only	6.90
FETCh:SUBarrays:SPECtrum:SWITching?	–100.0 dB to +20.0 dB, ...	query only	6.90
SAMPle:SUBarrays:SPECtrum:SWITching?	–100.0 dB to +20.0 dB, ...	query only	6.90
READ:ARRay:SPECtrum:SWITching[:FDOMain]:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.90
FETCh:ARRay:SPECtrum:SWITching[:FDOMain]:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.90
SAMPle:ARRay:SPECtrum:SWITching[:FDOMain]:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.90

Command (Non Signalling)	Parameter	Remark	Page
CONFigure:SPECtrum[:COMMon]:NOISe:CORRection	ON | OFF	with query	6.69
Symbolic Status Register Evaluation			
STATus:OPERation:SYMBolic:ENABle	<Event>{,<Event>}	with query	6.97
STATus:OPERation:SYMBolic[:EVENt]?	NONE | <Event>{,<Event>}	query only	6.97
DEFault:TRIGger[:SEQuence]	ON | OFF	with query	6.9
Trigger			
TRIGger[:SEQuence]:SLOPe	POSitive | NEGative	with query	6.9
TRIGger[:SEQuence]:SOURce	IMMediate | POWer | EXTern	with query	6.8
TRIGger[:SEQuence]:SOURce:EXTernal	PIN6 | PIN7 | PIN8	with query	6.9
TRIGger[:SEQuence]:THReshold:IFPower	<Threshold>	with query	6.9
TRIGger[:SEQuence]:THReshold:RFPower	LOW | MEDium | HIGH	with query	6.9
Wide band power			
INITiate:WPOWer	–	no query	6.10
ABORt:WPOWer	–	no query	6.10
STOP:WPOWer	–	no query	6.10
CONTinue:WPOWer	–	no query	6.10
CONFigure:WPOWer:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.11
CONFigure:WPOWer:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.10
FETCh:WPOWer:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.10
READ[:SCALar]:WPOWer?	–	query only	6.11
FETCh[:SCALar]:WPOWer?	–	query only	6.11
SAMPle[:SCALar]:WPOWer?	–	query only	6.11

Commands for GSM Mobile Tests

Table 6-2 Remote-control commands: Signalling mode

Command (Signalling)	Parameter	Remark	Page
Abis Settings			
INITiate:ABIS:ALARmmonitor	–	no query	6.124
ABORt:ABIS:ALARmmonitor	–	no query	6.124
FETCh:ABIS:ALARmmonitor:STATus?	OFF | RUN | STOP | ERR	query only	6.124
[SENSe:]ABIS:ALARmmonitor?	OFF | RUN | STOP | ERR	query only	6.124
CONFigure:ABIS:IMODe	E1DF | E1CRc4mf | T1SF | T1ESf | T1CRc6esf	with query	6.122
CONFigure:ABIS:PCMTimeslot	<Slot_No>	with query	6.122
INITiate:ABIS:SCAN	–	no query	6.123
ABORt:ABIS:SCAN	–	no query	6.123
FETCh:ABIS:SCAN:STATus?	OFF | RUN | STOP | ERR	query only	6.123
CONFigure:ABIS:STARtvalues:PCMTimeslot	<Slot_No>	with query	6.123
CONFigure:ABIS:STARtvalues:SUBChannel	<Type>	with query	6.123
CONFigure:ABIS:TSBitno	<Bit_No>	with query	6.122
CONFigure:ABIS:TTYPe	TTFR | TTEFr | TTHR | TF14 | TF96 | TF48	with query	6.122
Signal from the base station under test			
DEFault:BSSignal	ON | OFF	with query	6.109
CONFigure:BSSignal:CCH:CHANnel	<ChannelNumber>	with query	6.106
CONFigure:BSSignal:TCH:CHANnel	<ChannelNumber>	with query	6.106
[SENSe:]BSSignal:TCH:CHANnel[:CESTablished]:HOPPing?	ON | OFF	query only	6.109
[SENSe:]BSSignal:TCH:CHANnel[:CESTablished]?	<ChannelNumber>	with query	6.107
CONFigure:BSSignal:TCH:CHTYpe	<Type>	with query	6.108
[SENSe:]BSSignal:TCH:CHTYpe[:CESTablished]?	<Type>	with query	6.108
CONFigure:BSSignal:TCH:PSCHeme	<PS_1>, ... <PS_12>	with query	6.109
CONFigure:BSSignal:TCH:TIMeslot	0 to 7	with query	6.107
[SENSe:]BSSignal:TCH:TIMeslot[:CESTablished]?	0 to 7	with query	6.107

Command (Signalling)	Parameter	Remark	Page
CONFigure:BSSignal:TCH:TSEQuence	GSM0 to GSM7	with query	6.109
Inputs and Outputs			
[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]	<Attenuation>	with query	6.120
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude]	<Attenuation>	with query	6.120
[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]	<Attenuation>	with query	6.120
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]	<Attenuation>	with query	6.120
SOURce:DM:CLOCk:FREQuency	<Frequency>	with query	6.121
SOURce:DM:CLOCk:STATe	ON | OFF	with query	6.120
INPut[:STATe]	RF1 | RF2 | RF4	with query	6.119
OUTPut[:STATe]	RF1 | RF2 | RF3	with query	6.120
Expected power			
DEFault:EPOWer	ON | OFF	with query	6.102
[SENSe:]EPOWer:ATTenuation	NORMal | LNOise | LDIStortion	with query	6.102
[SENSe:]EPOWer:MODE	MANual | AUTO	with query	6.101
[SENSe:]EPOWer:VALue	<Level>	with query	6.101
External trigger			
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READ:SUBarrays:MODulation:PERRor:EPSK:TCH:CURRent?	–100.0 dB to +20.0 dB	query only	6.194
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READ:ARRay:MODulation:PERRor:EPSK:TCH:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.193
FETCh:ARRay:MODulation:PERRor:EPSK:TCH:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.193
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FETCh[:SCALar]:MODulation:PERRor:EPSK:TCH?	<Result>	query only	6.192
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CONFigure:MODulation:PERRor:GMSK:CCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.162
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FETCh:ARRay:MODulation:PERRor:GMSK:CCH:MMAXimum?	–100.0 deg to +100.0 deg	only query	6.168
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FETCh:SUBarrays:MODulation:PERRor:GMSK:CCH:MMAXimum?	–100.0 deg to +100.0 deg	only query	6.169
SAMPle:SUBarrays:MODulation:PERRor:GMSK:CCH:MMAXimum?	–100.0 deg to +20.0 deg	only query	6.169
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CONFigure:NETWork:AMR:HRATe:RSETting	<CM4>, <CM3>, CM2>, <CM1>	with query	6.259
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CONFigure:NPOWer:CONTrol:REPetition	CONTinuous | SINGleshot | 1 ... 10000, SONerror | NONE,STEP | NONE	with query	6.129
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FETCh:ARRay:POWer:MSLot:CCH:AVERage?	–100.0 dB to +20.0 dB	query only	6.156
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CALCulate:ARRay:POWer:MSLot:CCH:CURRent:MATChing:AREA?	<Matching>	query only	6.158
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CALCulate[:SCALar]:POWer:MSLot:CCH:MATChing:LIMit?	AvgBurstPowerCurr, PeakBurstPowerCurr, BurstMatching, AvgBurstPowerAvg	query only	6.155
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FETCh:ARRay:POWer:MSLot:TCH:MAXimum?	–100.0 dB to +20.0 dB	query only	6.156
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SAMPle[:SCALar]:POWer:NBURst:GMSK:CCH?	<Result>	only query	6.140
INITiate:POWer:NBURst:GMSK:TCH	–	no query	6.130
ABORt:POWer:NBURst:GMSK:TCH	–	no query	6.130
STOP:POWer:NBURst:GMSK:TCH	–	no query	6.130
CONTinue:POWer:NBURst:GMSK:TCH	–	no query	6.130
CONFigure:SUBarrays:POWer:NBURst:GMSK:TCH	ALL | ARITHmetical | MINimum | MAXimum,<Start>,<Samples>{ ,<Start>,<Samples>}	with query	6.139
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:AVERage: MATChing:AREA?	<Matching>	query only	6.145
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:AVERage: MATChing:LIMit?	<Matching>	only query	6.144
READ:ARRay:POWer:NBURst:GMSK:TCH:AVERage?	–100.0 dB to +20 dB	only query	6.142
FETCh:ARRay:POWer:NBURst:GMSK:TCH:AVERage?	–100.0 dB to +20 dB	only query	6.142
SAMPle:ARRay:POWer:NBURst:GMSK:TCH:AVERage?	–100.0 dB to +20 dB	only query	6.142
READ:SUBarrays:POWer:NBURst:GMSK:TCH:AVERage?	–100.0 dB to +20 dB	only query	6.143
FETCh:SUBarrays:POWer:NBURst:GMSK:TCH:AVERage?	–100.0 dB to +20 dB	only query	6.143
SAMPle:SUBarrays:POWer:NBURst:GMSK:TCH:AVERage?	–100.0 dB to +20 dB	only query	6.143
CONFigure:POWer:NBURst:GMSK:TCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.131
DEFault:POWer:NBURst:GMSK:TCH:CONTrol	ON | OFF	with query	6.133
CONFigure:POWer:NBURst:GMSK:TCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.133
CONFigure:POWer:NBURst:GMSK:TCH:CONTrol:RMODe	SCALar | ARRay	with query	6.132
CONFigure:POWer:NBURst:GMSK:TCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.132

Command (Signalling)	Parameter	Remark	Page
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:CURRent: MATChing:AREA?	<Matching>	query only	6.145
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:CURRent: MATChing:LIMit?	<Matching>	only query	6.144
READ:ARRay:POWer:NBURst:GMSK:TCH:CURRent?	–100.0 dB to +20 dB	only query	6.142
FETCh:ARRay:POWer:NBURst:GMSK:TCH:CURRent?	–100.0 dB to +20 dB	only query	6.142
SAMPle:ARRay:POWer:NBURst:GMSK:TCH:CURRent?	–100.0 dB to +20 dB	only query	6.142
READ:SUBarrays:POWer:NBURst:GMSK:TCH:CURRent?	–100.0 dB to +20 dB	only query	6.143
FETCh:SUBarrays:POWer:NBURst:GMSK:TCH:CURRent?	–100.0 dB to +20 dB	only query	6.143
SAMPle:SUBarrays:POWer:NBURst:GMSK:TCH:CURRent?	–100.0 dB to +20 dB	only query	6.143
CONFigure:POWer:NBURst:GMSK:TCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.131
CONFigure:POWer:NBURst:GMSK:TCH:FILTer	G500 | B600	with query	6.133
DEFault:POWer:NBURst:GMSK:TCH:LIMit:LINE	ON | OFF	with query	6.137
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE: ASYMmetric:LOWer:AREA<nr>	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.136
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE: ASYMmetric:LOWer:AREA<nr>:ENABle	ON | OFF	with query	6.136
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE: ASYMmetric:LOWer:AREA<nr>:VALue	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>	with query	6.136
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE: ASYMmetric:LOWer:ENABle	ON | OFF	with query	6.137
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE: ASYMmetric:UPPer:AREA<nr>	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.134
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE: ASYMmetric:UPPer:AREA<nr>:ENABle	ON | OFF	with query	6.134
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE: ASYMmetric:UPPer:AREA<nr>:VALue	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>	with query	6.134
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE: ASYMmetric:UPPer:ENABle	ON | OFF	with query	6.137
CALCulate[:SCALar]:POWer:NBURst:GMSK:TCH:MATChing:	<Result>	only query	6.141

Command (Signalling)	Parameter	Remark	Page
LIMit?			
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:MAXimum: MATChing:AREA?	<Matching>	query only	6.145
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:MAXimum: MATChing:LIMit?	<Matching>	only query	6.144
READ:ARRay:POWer:NBURst:GMSK:TCH:MAXimum?	–100.0 dB to +20 dB	only query	6.142
FETCh:ARRay:POWer:NBURst:GMSK:TCH:MAXimum?	–100.0 dB to +20 dB	only query	6.142
SAMPle:ARRay:POWer:NBURst:GMSK:TCH:MAXimum?	–100.0 dB to +20.0 dB	only query	6.142
READ:SUBarrays:POWer:NBURst:GMSK:TCH:MAXimum?	–100.0 dB to +20 dB	only query	6.143
FETCh:SUBarrays:POWer:NBURst:GMSK:TCH:MAXimum?	–100.0 dB to +20 dB	only query	6.143
SAMPle:SUBarrays:POWer:NBURst:GMSK:TCH:MAXimum?	–100.0 dB to +20.0 dB	only query	6.143
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:MINimum: MATChing:AREA?	<Matching>	query only	6.145
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:MINimum: MATChing:LIMit?	<Matching>	only query	6.144
READ:ARRay:POWer:NBURst:GMSK:TCH:MINimum?	–100.0 dB to +20 dB	only query	6.142
FETCh:ARRay:POWer:NBURst:GMSK:TCH:MINimum?	–100.0 dB to +20 dB	only query	6.142
SAMPle:ARRay:POWer:NBURst:GMSK:TCH:MINimum?	–100.0 dB to +20.0 dB	only query	6.142
READ:SUBarrays:POWer:NBURst:GMSK:TCH:MINimum?	–100.0 dB to +20 dB	only query	6.143
FETCh:SUBarrays:POWer:NBURst:GMSK:TCH:MINimum?	–100.0 dB to +20 dB	only query	6.143
SAMPle:SUBarrays:POWer:NBURst:GMSK:TCH:MINimum?	–100.0 dB to +20.0 dB	only query	6.143
FETCh:POWer:NBURst:GMSK:TCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.131
CONFigure:POWer:NBURst:GMSK:TCH:TOFFset	????	with query	6.138
READ[:SCALar]:POWer:NBURst:GMSK:TCH?	<Result>	only query	6.140
FETCh[:SCALar]:POWer:NBURst:GMSK:TCH?	<Result>	only query	6.140
SAMPle[:SCALar]:POWer:NBURst:GMSK:TCH?	<Result>	only query	6.140
INITiate:POWer:SLOT:GMSK:TCH	–	no query	6.146
ABORt:POWer:SLOT:GMSK:TCH	–	no query	6.146
STOP:POWer:SLOT:GMSK:TCH	–	no query	6.146
CONTinue:POWer:SLOT:GMSK:TCH	–	no query	6.146
DEFault:POWer:SLOT:GMSK:TCH:CONTrol	ON | OFF	with query	6.147

Command (Signalling)	Parameter	Remark	Page
CONFigure:POWer:SLOT:GMSK:TCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.147
CONFigure:POWer:SLOT:GMSK:TCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.146
FETCh:POWer:SLOT:GMSK:TCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.146
READ[:SCALar]:POWer:SLOT:GMSK:TCH?	<Result>	query only	6.148
FETCh[:SCALar]:POWer:SLOT:GMSK:TCH?	<Result>	query only	6.148
SAMPle[:SCALar]:POWer:SLOT:GMSK:TCH?	<Result>	query only	6.148
Reset of the Function Group			
SYSTem:RESet:CURRent		no query	6.98
Receiver Quality measurements			
INITiate:RXQuality:ABIS:BER	–	no query	6.248
ABORt:RXQuality:ABIS:BER	–	no query	6.248
STOP:RXQuality:ABIS:BER	–	no query	6.248
CONTinue:RXQuality:ABIS:BER	–	no query	6.248
CONFigure:RXQuality:ABIS:BER:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.248
CALCulate[:SCALar]:RXQuality:ABIS:BER:MATChing:LIMit?	<Result>	only query	6.253
FETCh:RXQuality:ABIS:BER:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 50000 | NONE	only query	6.249
CONFigure:RXQuality:ABIS:BER:TSETup	T1 | T2 | T3 | T4 | T5 | T6 | T7 | T8 | T9 | T10	with query	6.248
READ[:SCALar]:RXQuality:ABIS:BER?	<Result>	only query	6.252
FETCh[:SCALar]:RXQuality:ABIS:BER?	<Result>	only query	6.252
SAMPle[:SCALar]:RXQuality:ABIS:BER?	<Result>	only query	6.252
CONFigure:RXQuality:ABIS:BER<nr>:CONTrol	RFER | BER, 0 to 50000|OFF	with query	6.249
CONFigure:RXQuality:ABIS:BER<nr>:CONTrol:REPetition	ALIMits | FLIMit | NONE, STEP | NONE	with query	6.250
CONFigure:RXQuality:ABIS:BER<nr>:CONTrol:TCH:LEVel: UNTimeslot	–127 dB to +127 dB	with query	6.250
CONFigure:RXQuality:ABIS:BER<nr>:CONTrol:TCH:LEVel: UTIMeslot	<Level>	with query	6.250

Command (Signalling)	Parameter	Remark	Page
CONFigure:RXQuality:ABIS:BER<nr>:LIMit:CLIB	0 % to 100 %	with query	6.251
CONFigure:RXQuality:ABIS:BER<nr>:LIMit:CLII	0 % to 100 %	with query	6.251
CONFigure:RXQuality:ABIS:BER<nr>:LIMit:FERRors	0 % to 100 %	with query	6.251
INITiate:RXQuality:BER	–	no query	6.241
ABORt:RXQuality:BER	–	no query	6.241
STOP:RXQuality:BER	–	no query	6.241
CONTinue:RXQuality:BER	–	no query	6.241
CONFigure:RXQuality:BER:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.241
CALCulate[:SCALar]:RXQuality:BER:MATChing:LIMit?	<Result>	only query	6.247
FETCh:RXQuality:BER:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 50000 | NONE	only query	6.242
CONFigure:RXQuality:BER:TSETup	T1 | T2 | T3 | T4 | T5 | T6 | T7 | T8 | T9 | T10	with query	6.241
READ[:SCALar]:RXQuality:BER?	<Result>	only query	6.245
FETCh[:SCALar]:RXQuality:BER?	<Result>	only query	6.245
SAMPle[:SCALar]:RXQuality:BER?	<Result>	only query	6.245
CONFigure:RXQuality:BER<nr>:CONTrol	RFER | BER , 0 to 50000|OFF	with query	6.242
CONFigure:RXQuality:BER<nr>:CONTrol:REPetition	ALIMits | FLIMit | NONE, STEP | NONE	with query	6.243
CONFigure:RXQuality:BER<nr>:CONTrol:TCH:LEVel:UNTimeslot	–127 dB to +127 dB	with query	6.243
CONFigure:RXQuality:BER<nr>:CONTrol:TCH:LEVel:UTIMeslot	<Level>	with query	6.243
DEFault:RXQuality:BER<nr>:LIMit	ON | OFF	with query	6.245
CONFigure:RXQuality:BER<nr>:LIMit:CLIB	0 % to 100 %	with query	6.244
CONFigure:RXQuality:BER<nr>:LIMit:CLII	0 % to 100 %	with query	6.244
CONFigure:RXQuality:BER<nr>:LIMit:FERRors	0 % to 100 %	with query	6.244
CONFigure:RXQuality:BER<nr>LIMit:DBLer	0 % to 100 %	with query	6.244
CONFigure:RXQuality:CONTrol:BITStream	PR9 | PR11 PR15 | PR16	with query	6.240
CONFigure:RXQuality:CONTrol:HTIMe	1 s to 100 s, 1 s to 100 s	with query	6.240
INITiate:RXQuality:RACHtest	–	no query	6.254
ABORt:RXQuality:RACHtest	–	no query	6.254

Command (Signalling)	Parameter	Remark	Page
STOP:RXQuality:RACHtest	–	no query	6.254
CONTinue:RXQuality:RACHtest	–	no query	6.254
CONFigure:RXQuality:RACHtest:CONTrol:BTSend	1 to 1 000 000	with query	6.255
CONFigure:RXQuality:RACHtest:CONTrol:BTSend	RFER | BER, 0 to 50000|OFF	with query	6.255
CONFigure:RXQuality:RACHtest:CONTrol:CCH:LEVel:UNTimeslot	–127 dB to +127 dB	with query	6.255
CONFigure:RXQuality:RACHtest:CONTrol:CCH:LEVel:UTIMeslot	<Level>	with query	6.255
CONFigure:RXQuality:RACHtest:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.254
CONFigure:RXQuality:RACHtest:LIMit:FERRors	0 % to 100 %	with query	6.256
CALCulate[:SCALar]:RXQuality:RACHtest:MATChing:LIMit?	<Result>	only query	6.257
FETCh:RXQuality:RACHtest:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 500 | NONE	only query	6.254
READ[:SCALar]:RXQuality:RACHtest?	<Result>	only query	6.256
FETCh[:SCALar]:RXQuality:RACHtest?	<Result>	only query	6.256
SAMPle[:SCALar]:RXQuality:RACHtest?	<Result>	only query	6.256
Signalling			
PROCedure:SIGNalling:ACTion	SRUN | SSTP | CCH | TCH | LUP | SLUP | RLUP | MOC | SMOC | RMOC | SCR | CREL	with query	6.104
CONFigure:SIGNalling:SMODe	<Mode>	with query	6.106
[SENSe:]SIGNalling:STATe?	CCH | UNS | TCH | SIP | LUIP | LUF | CEST | CREL | CRIP | CRF | MOCP | MOCF | MTCP | MTCF	query only	6.105
Spectrum due to modulation measurements			
CONFigure:SPECtrum:MODulation:AVGareas	A | B | AB	with query	6.226
CONFigure:SPECtrum:MODulation:AVGareas	A | B | AB	with query	6.226
INITiate:SPECtrum:MODulation:CCH	–	no query	6.210
ABORt:SPECtrum:MODulation:CCH	–	no query	6.210
STOP:SPECtrum:MODulation:CCH	–	no query	6.210
CONTinue:SPECtrum:MODulation:CCH	–	no query	6.210
CONFigure:SUBarrays:SPECtrum:MODulation:CCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{	with query	6.217

Command (Signalling)	Parameter	Remark	Page
	,<Start>,<Samples>}		
CONFigure:SPECtrum:MODulation:CCH:AVGareas	A | B | AB	with query	6.213
CONFigure:SPECtrum:MODulation:CCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.211
DEFault:SPECtrum:MODulation:CCH:CONTrol	ON | OFF	with query	6.212
CONFigure:SPECtrum:MODulation:CCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.212
CONFigure:SPECtrum:MODulation:CCH:CONTrol:RMODe	SCALar | ARRay	with query	6.211
CONFigure:SPECtrum:MODulation:CCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.212
CONFigure:SPECtrum:MODulation:CCH:CONTrol:VMPoint<nr>	0 MHz to 2.5 MHz | OFF	with query	6.216
CONFigure:SPECtrum:MODulation:CCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.210
CONFigure:SPECtrum:MODulation:CCH:MPOint<nr>:ENABle	ON | OFF	with query	6.216
FETCh:SPECtrum:MODulation:CCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.210
CONFigure:SPECtrum:MODulation:CCH:TDFSelect	N180|N160|N140|N120|N100|N080|N060|N040|N025|N020|N010 | REF | P010|P020|P025|P040|P060|P080|P100|P120|P140|P160|P180|NV4|NV3|NV2|NV1|PV1|PV2|PV3|PV4|OFF|ON	with query	6.213
CONFigure:SUBarrays:SPECtrum:MODulation:CCH:TDOMain	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.217
READ:ARRay:SPECtrum:MODulation:CCH:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.220
FETCh:ARRay:SPECtrum:MODulation:CCH:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.220
SAMPle:ARRay:SPECtrum:MODulation:CCH:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.220
READ:SUBarrays:SPECtrum:MODulation:CCH:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.220
FETCh:SUBarrays:SPECtrum:MODulation:CCH:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.220
SAMPle:SUBarrays:SPECtrum:MODulation:CCH:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.220
READ[:SCALar]:SPECtrum:MODulation:CCH?	<Result>	only query	6.218
FETCh[:SCALar]:SPECtrum:MODulation:CCH?	<Result>	only query	6.218
SAMPle[:SCALar]:SPECtrum:MODulation:CCH?	<Result>	only query	6.218

Command (Signalling)	Parameter	Remark	Page
READ:ARRay:SPECtrum:MODulation:CCH?	–100.0 dB to +20 dB	only query	6.219
FETCh:ARRay:SPECtrum:MODulation:CCH?	–100.0 dB to +20 dB	only query	6.219
SAMPle:ARRay:SPECtrum:MODulation:CCH?	–100.0 dB to +20 dB	only query	6.219
READ:SUBarrays:SPECtrum:MODulation:CCH?	–100.0 dB to +20 dB	only query	6.219
FETCh:SUBarrays:SPECtrum:MODulation:CCH?	–100.0 dB to +20 dB	only query	6.219
SAMPle:SUBarrays:SPECtrum:MODulation:CCH?	–100.0 dB to +20 dB	only query	6.219
READ:ARRay:SPECtrum:MODulation:CCH[:FDOMain]:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.221
FETCh:ARRay:SPECtrum:MODulation:CCH[:FDOMain]:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.221
SAMPle:ARRay:SPECtrum:MODulation:CCH[:FDOMain]:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.221
DEFault:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE	ON | OFF	with query	6.216
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE :SYMMetric[:COMBined]:ENABle	ON | OFF	with query	6.215
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.214
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:ENABle	ON | OFF	with query	6.214
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:VALue	<MinLevel>,<MaxLevel>,<AbsLevel>	with query	6.214
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE :SYMMetric[:COMBined]:RPOWer	<Minimum>, <Maximum>	with query	6.215
DEFault:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE	ON | OFF	with query	6.216
CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE :SYMMetric[:COMBined]:ENABle	ON | OFF	with query	6.215
CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.214
CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:ENABle	ON | OFF	with query	6.214
CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:VALue	<MinLevel>,<MaxLevel>,<AbsLevel>	with query	6.214
CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE :SYMMetric[:COMBined]:RPOWer	<Minimum>, <Maximum>	with query	6.215
DEFault:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE	ON | OFF	with query	6.216
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE :SYMMetric[:COMBined]:ENABle	ON | OFF	with query	6.215
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.214

Command (Signalling)	Parameter	Remark	Page
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:ENABle	ON | OFF	with query	6.214
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:VALue	<MinLevel>,<MaxLevel>,<AbsLevel>	with query	6.214
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE :SYMMetric[:COMBined]:RPOWer	<Minimum>, <Maximum>	with query	6.215
INITiate:SPECtrum:MODulation:TCH	–	no query	6.210
ABORt:SPECtrum:MODulation:TCH	–	no query	6.210
STOP:SPECtrum:MODulation:TCH	–	no query	6.210
CONTinue:SPECtrum:MODulation:TCH	–	no query	6.210
CONFigure:SUBarrays:SPECtrum:MODulation:TCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.217
CONFigure:SPECtrum:MODulation:TCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.211
DEFault:SPECtrum:MODulation:TCH:CONTrol	ON | OFF	with query	6.212
CONFigure:SPECtrum:MODulation:TCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.212
CONFigure:SPECtrum:MODulation:TCH:CONTrol:RMODe	SCALar | ARRay	with query	6.211
CONFigure:SPECtrum:MODulation:TCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.212
CONFigure:SPECtrum:MODulation:TCH:CONTrol:VMPoint<nr>	0 MHz to 2.5 MHz | OFF	with query	6.216
CONFigure:SPECtrum:MODulation:TCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.210
CONFigure:SPECtrum:MODulation:TCH:MPOint<nr>:ENABle	ON | OFF	with query	6.216
FETCh:SPECtrum:MODulation:TCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.210
CONFigure:SUBarrays:SPECtrum:MODulation:TCH:TDOMain	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.217
READ:ARRay:SPECtrum:MODulation:TCH:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.220
FETCh:ARRay:SPECtrum:MODulation:TCH:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.220
SAMPle:ARRay:SPECtrum:MODulation:TCH:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.220
READ:SUBarrays:SPECtrum:MODulation:TCH:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.220

Command (Signalling)	Parameter	Remark	Page
FETCh:SUBarrays:SPECtrum:MODulation:TCH:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.220
SAMPle:SUBarrays:SPECtrum:MODulation:TCH:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.220
READ[:SCALar]:SPECtrum:MODulation:TCH?	<Result>	only query	6.218
FETCh[:SCALar]:SPECtrum:MODulation:TCH?	<Result>	only query	6.218
SAMPle[:SCALar]:SPECtrum:MODulation:TCH?	<Result>	only query	6.218
READ:ARRay:SPECtrum:MODulation:TCH?	–100.0 dB to +20 dB	only query	6.219
FETCh:ARRay:SPECtrum:MODulation:TCH?	–100.0 dB to +20 dB	only query	6.219
SAMPle:ARRay:SPECtrum:MODulation:TCH?	–100.0 dB to +20 dB	only query	6.219
READ:SUBarrays:SPECtrum:MODulation:TCH?	–100.0 dB to +20 dB	only query	6.219
FETCh:SUBarrays:SPECtrum:MODulation:TCH?	–100.0 dB to +20 dB	only query	6.219
SAMPle:SUBarrays:SPECtrum:MODulation:TCH?	–100.0 dB to +20 dB	only query	6.219
READ:ARRay:SPECtrum:MODulation:TCH[:FDOMain]:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.221
FETCh:ARRay:SPECtrum:MODulation:TCH[:FDOMain]:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.221
SAMPle:ARRay:SPECtrum:MODulation:TCH[:FDOMain]:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.221
CONFigure:SPECtrum:MODulation+20.0:AVGareas	A | B | AB	with query	6.213
CONFigure:SPECtrum:MODulation+20.0:TDFSelect	N180|N160|N140|N120|N100|N080|N060|N040|N025|N020|N010 | REF | P010|P020|P025|P040|P060|P080|P100|P120|P140|P160|P180|NV4|NV3|NV2|NV1|PV1|PV2|PV3|PV4|OFF|ON	with query	6.213
INITiate:SPECtrum:MSWitching:CCH	–	no query	6.235
ABORt:SPECtrum:MSWitching:CCH	–	no query	6.235
STOP:SPECtrum:MSWitching:CCH	–	no query	6.235
CONTinue:SPECtrum:MSWitching:CCH	–	no query	6.235
CALCulate:ARRay:SPECtrum:MSWitching:CCH:AREA:LIMit:MATChing?	<Matching>	query only	6.238
CONFigure:SPECtrum:MSWitching:CCH:CONTrol	SCALar | ARRay	with query	6.236
CONFigure:SPECtrum:MSWitching:CCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.236
CONFigure:SPECtrum:MSWitching:CCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.235
[SENSe:]SPECtrum:MSWitching:CCH:LIMit:LINE:USED?	GMSK | EPSK	query only	6.237

Command (Signalling)	Parameter	Remark	Page
FETCh:SPECtrum:MSWitching:CCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 1000 | NONE, 1 to 10000 | NONE, 1 to 10000 | NONE	only query	6.235
READ:ARRay:SPECtrum:MSWitching:CCH:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.238
FETCh:ARRay:SPECtrum:MSWitching:CCH:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.238
SAMPle:ARRay:SPECtrum:MSWitching:CCH:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.238
READ:ARRay:SPECtrum:MSWitching:CCH:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.239
FETCh:ARRay:SPECtrum:MSWitching:CCH:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.239
SAMPle:ARRay:SPECtrum:MSWitching:CCH:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.239
READ[:SCALar]:SPECtrum:MSWitching:CCH?	<Result>	only query	6.237
FETCh[:SCALar]:SPECtrum:MSWitching:CCH?	<Result>	only query	6.237
SAMPle[:SCALar]:SPECtrum:MSWitching:CCH?	<Result>	only query	6.237
READ:ARRay:SPECtrum:MSWitching:CCH?	<32 results>	only query	6.238
FETCh:ARRay:SPECtrum:MSWitching:CCH?	<32 results>	only query	6.238
SAMPle:ARRay:SPECtrum:MSWitching:CCH?	<32 results>	only query	6.238
READ:ARRay:SPECtrum:MSWitching:RCH:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.238
FETCh:ARRay:SPECtrum:MSWitching:RCH:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.238
SAMPle:ARRay:SPECtrum:MSWitching:RCH:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.238
INITiate:SPECtrum:MSWitching:TCH	–	no query	6.235
ABORt:SPECtrum:MSWitching:TCH	–	no query	6.235
STOP:SPECtrum:MSWitching:TCH	–	no query	6.235
CONTinue:SPECtrum:MSWitching:TCH	–	no query	6.235
CALCulate:ARRay:SPECtrum:MSWitching:TCH:AREA:LIMit:MATChing?	<Matching>	query only	6.238
CONFigure:SPECtrum:MSWitching:TCH:CONTrol	SCALar | ARRay	with query	6.236
CONFigure:SPECtrum:MSWitching:TCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.236
CONFigure:SPECtrum:MSWitching:TCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.235
[SENSe:]SPECtrum:MSWitching:TCH:LIMit:LINE:USED?	GMSK | EPSK	query only	6.237
FETCh:SPECtrum:MSWitching:TCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 1000 | NONE, 1 to 10000 | NONE, 1	only query	6.235

Command (Signalling)	Parameter	Remark	Page
	to 10000 | NONE		
READ:ARRay:SPECtrum:MSWitching:TCH:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.239
FETCh:ARRay:SPECtrum:MSWitching:TCH:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.239
SAMPle:ARRay:SPECtrum:MSWitching:TCH:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.239
READ[:SCALar]:SPECtrum:MSWitching:TCH?	<Result>	only query	6.237
FETCh[:SCALar]:SPECtrum:MSWitching:TCH?	<Result>	only query	6.237
SAMPle[:SCALar]:SPECtrum:MSWitching:TCH?	<Result>	only query	6.237
READ:ARRay:SPECtrum:MSWitching:TCH?	<32 results>	only query	6.238
FETCh:ARRay:SPECtrum:MSWitching:TCH?	<32 results>	only query	6.238
SAMPle:ARRay:SPECtrum:MSWitching:TCH?	<32 results>	only query	6.238
INITiate:SPECtrum:SWITching:CCH	–	no query	6.222
ABORt:SPECtrum:SWITching:CCH	–	no query	6.222
STOP:SPECtrum:SWITching:CCH	–	no query	6.222
CONTinue:SPECtrum:SWITching:CCH	–	no query	6.222
CONFigure:SUBarrays:SPECtrum:SWITching:CCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.229
SAMPle[:SCALar]:SPECtrum:SWITching:CCH ?	<Result>	only query	6.231
CONFigure:SPECtrum:SWITching:CCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.223
DEFault:SPECtrum:SWITching:CCH:CONTrol	ON | OFF	with query	6.225
CONFigure:SPECtrum:SWITching:CCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.225
CONFigure:SPECtrum:SWITching:CCH:CONTrol:RMODe	SCALar | ARRay	with query	6.224
CONFigure:SPECtrum:SWITching:CCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.224
CONFigure:SPECtrum:SWITching:CCH:CONTrol:VMPOint<nr>	0 MHz to 2.5 MHz | OFF	with query	6.229
CONFigure:SPECtrum:SWITching:CCH:CSMODE	PHOL | SCO	with query	6.226
CONFigure:SPECtrum:SWITching:CCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.222
CONFigure:SPECtrum:SWITching:CCH:MPOint<nr>:ENABle	ON | OFF	with query	6.228

<table>
<tr><th>Command (Signalling)</th><th>Parameter</th><th>Remark</th><th>Page</th></tr>
<tr><td>FETCh:SPECtrum:SWITching:CCH:STATus?</td><td>OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE</td><td>only query</td><td>6.223</td></tr>
<tr><td>CONFigure:SPECtrum:SWITching:CCH:TDFSelect</td><td>N180|N120|N060|N040|REF|P040|P060|P120|P180|NV4|NV3|NV2|NV1|PV1|PV2|PV3|PV4|OFF|ON</td><td>with query</td><td>6.226</td></tr>
<tr><td>CONFigure:SUBarrays:SPECtrum:SWITching:CCH:TDOMain</td><td>ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}</td><td>with query</td><td>6.230</td></tr>
<tr><td>READ:ARRay:SPECtrum:SWITching:CCH:TDOMain?</td><td>–100.0 dB to +20.0 dB, ...</td><td>query only</td><td>6.233</td></tr>
<tr><td>FETCh:ARRay:SPECtrum:SWITching:CCH:TDOMain?</td><td>–100.0 dB to +20.0 dB, ...</td><td>query only</td><td>6.233</td></tr>
<tr><td>SAMPle:ARRay:SPECtrum:SWITching:CCH:TDOMain?</td><td>–100.0 dB to +20.0 dB, ...</td><td>query only</td><td>6.233</td></tr>
<tr><td>READ:SUBarrays:SPECtrum:SWITching:CCH:TDOMain?</td><td>–100.0 dB to +20.0 dB, ...</td><td>query only</td><td>6.233</td></tr>
<tr><td>FETCh:SUBarrays:SPECtrum:SWITching:CCH:TDOMain?</td><td>–100.0 dB to +20.0 dB, ...</td><td>query only</td><td>6.233</td></tr>
<tr><td>SAMPle:SUBarrays:SPECtrum:SWITching:CCH:TDOMain?</td><td>–100.0 dB to +20.0 dB, ...</td><td>query only</td><td>6.233</td></tr>
<tr><td>READ[:SCALar]:SPECtrum:SWITching:CCH?</td><td><Result></td><td>only query</td><td>6.231</td></tr>
<tr><td>FETCh[:SCALar]:SPECtrum:SWITching:CCH?</td><td><Result></td><td>only query</td><td>6.231</td></tr>
<tr><td>READ:ARRay:SPECtrum:SWITching:CCH?</td><td>–100.0 dB to +20 dB</td><td>only query</td><td>6.232</td></tr>
<tr><td>FETCh:ARRay:SPECtrum:SWITching:CCH?</td><td>–100.0 dB to +20 dB</td><td>only query</td><td>6.232</td></tr>
<tr><td>SAMPle:ARRay:SPECtrum:SWITching:CCH?</td><td>–100.0 dB to +20 dB</td><td>only query</td><td>6.232</td></tr>
<tr><td>READ:SUBarrays:SPECtrum:SWITching:CCH?</td><td>–100.0 dB to +20.0 dB</td><td>only query</td><td>6.232</td></tr>
<tr><td>FETCh:SUBarrays:SPECtrum:SWITching:CCH?</td><td>–100.0 dB to +20.0 dB</td><td>only query</td><td>6.232</td></tr>
<tr><td>SAMPle:SUBarrays:SPECtrum:SWITching:CCH?</td><td>–100.0 dB to +20.0 dB</td><td>only query</td><td>6.232</td></tr>
<tr><td>READ:ARRay:SPECtrum:SWITching:CCH[:FDOMain]:VMPoint?</td><td>–100.0 dB to +20.0 dB, ...</td><td>query only</td><td>6.234</td></tr>
<tr><td>FETCh:ARRay:SPECtrum:SWITching:CCH[:FDOMain]:VMPoint?</td><td>–100.0 dB to +20.0 dB, ...</td><td>query only</td><td>6.234</td></tr>
<tr><td>SAMPle:ARRay:SPECtrum:SWITching:CCH[:FDOMain]:VMPoint?</td><td>–100.0 dB to +20.0 dB, ...</td><td>query only</td><td>6.234</td></tr>
<tr><td>DEFault:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE</td><td>ON | OFF</td><td>with query</td><td>6.228</td></tr>
<tr><td>CONFigure:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE :SYMMetric[:COMBined]:ENABle</td><td>ON | OFF</td><td>with query</td><td>6.228</td></tr>
<tr><td>CONFigure:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr></td><td><MinLevel>,<MaxLevel>,<AbsLevel>,<Enable></td><td>with query</td><td>6.227</td></tr>
<tr><td>CONFigure:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:ENABle</td><td>ON | OFF</td><td>with query</td><td>6.227</td></tr>
</table>

Command (Signalling)	Parameter	Remark	Page
CONFigure:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:VALue	<MinLevel>,<MaxLevel>,<AbsLevel>	with query	6.227
CONFigure:SPECtrum:SWITching:EPSK:TCH:MPOint<nr>:ENABle	ON | OFF	with query	6.228
DEFault:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE	ON | OFF	with query	6.228
CONFigure:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE :SYMMetric[:COMBined]:ENABle	ON | OFF	with query	6.228
CONFigure:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.227
CONFigure:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:ENABle	ON | OFF	with query	6.227
CONFigure:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:VALue	<MinLevel>,<MaxLevel>,<AbsLevel>	with query	6.227
DEFault:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE	ON | OFF	with query	6.228
CONFigure:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE :SYMMetric[:COMBined]:ENABle	ON | OFF	with query	6.228
CONFigure:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.227
CONFigure:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:ENABle	ON | OFF	with query	6.227
CONFigure:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE :SYMMetric[:COMBined]:FREQuency<nr>:VALue	<MinLevel>,<MaxLevel>,<AbsLevel>	with query	6.227
INITiate:SPECtrum:SWITching:TCH	–	no query	6.222
ABORt:SPECtrum:SWITching:TCH	–	no query	6.222
STOP:SPECtrum:SWITching:TCH	–	no query	6.222
CONTinue:SPECtrum:SWITching:TCH	–	no query	6.222
CONFigure:SUBarrays:SPECtrum:SWITching:TCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.229
SAMPle[:SCALar]:SPECtrum:SWITching:TCH ?	<Result>	only query	6.231
CONFigure:SPECtrum:SWITching:TCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.223
DEFault:SPECtrum:SWITching:TCH:CONTrol	ON | OFF	with query	6.225
CONFigure:SPECtrum:SWITching:TCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.225

Command (Signalling)	Parameter	Remark	Page
CONFigure:SPECtrum:SWITching:TCH:CONTrol:RMODe	SCALar | ARRay	with query	6.224
CONFigure:SPECtrum:SWITching:TCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.224
CONFigure:SPECtrum:SWITching:TCH:CONTrol:VMPOint<nr>	0 MHz to 2.5 MHz | OFF	with query	6.229
CONFigure:SPECtrum:SWITching:TCH:CSMODE	PHOL | SCO	with query	6.226
CONFigure:SPECtrum:SWITching:TCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.222
CONFigure:SPECtrum:SWITching:TCH:MPOint<nr>:ENABle	ON | OFF	with query	6.228
FETCh:SPECtrum:SWITching:TCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.223
CONFigure:SPECtrum:SWITching:TCH:TDFSelect	N180|N120|N060|N040|REF|P040|P060|P120|P180|NV4|NV3|NV2|NV1|PV1|PV2|PV3|PV4|OFF|ON	with query	6.226
CONFigure:SUBarrays:SPECtrum:SWITching:TCH:TDOMain	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.230
READ:ARRay:SPECtrum:SWITching:TCH:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.233
FETCh:ARRay:SPECtrum:SWITching:TCH:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.233
SAMPle:ARRay:SPECtrum:SWITching:TCH:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.233
READ:SUBarrays:SPECtrum:SWITching:TCH:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.233
FETCh:SUBarrays:SPECtrum:SWITching:TCH:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.233
SAMPle:SUBarrays:SPECtrum:SWITching:TCH:TDOMain?	–100.0 dB to +20.0 dB, ...	query only	6.233
READ[:SCALar]:SPECtrum:SWITching:TCH?	<Result>	only query	6.231
FETCh[:SCALar]:SPECtrum:SWITching:TCH?	<Result>	only query	6.231
READ:ARRay:SPECtrum:SWITching:TCH?	–100.0 dB to +20 dB	only query	6.232
FETCh:ARRay:SPECtrum:SWITching:TCH?	–100.0 dB to +20 dB	only query	6.232
SAMPle:ARRay:SPECtrum:SWITching:TCH?	–100.0 dB to +20 dB	only query	6.232
READ:SUBarrays:SPECtrum:SWITching:TCH?	–100.0 dB to +20.0 dB	only query	6.232
FETCh:SUBarrays:SPECtrum:SWITching:TCH?	–100.0 dB to +20.0 dB	only query	6.232
SAMPle:SUBarrays:SPECtrum:SWITching:TCH?	–100.0 dB to +20.0 dB	only query	6.232
READ:ARRay:SPECtrum:SWITching:TCH[:FDOMain]:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.234
FETCh:ARRay:SPECtrum:SWITching:TCH[:FDOMain]:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.234

Command (Signalling)	Parameter	Remark	Page
SAMPle:ARRay:SPECtrum:SWITching:TCH[:FDOMain]:VMPoint?	–100.0 dB to +20.0 dB, ...	query only	6.234
CONFigure:SPECtrum:TCH:LIMit:LINE:SELect	GMSK | EPSK	with query	6.209
CONFigure:SPECtrum[:COMMon]:NOISe:CORRection	ON | OFF	with query	6.209
Symbolic Status Register Evaluation			
STATus:OPERation:SYMBolic:ENABle	<Event>{,<Event>}	with query	6.97
STATus:OPERation:SYMBolic[:EVENt]?	NONE | <Event>{,<Event>}	query only	6.97
Trigger			
TRIGger:OUTPut:DELay:VALue	0 to 7	with query	6.103
TRIGger:OUTPut:PIN<nr>:DELay:ENABle	ON | OFF	with query	6.103
TRIGger:OUTPut:PIN<nr>:SIGNal	NONE | FCL	with query	6.103
DEFault:TRIGger[:SEQuence]	ON | OFF	with query	6.104
TRIGger[:SEQuence]:SLOPe	POSitive | NEGative	with query	6.103
TRIGger[:SEQuence]:SOURce	SIGNalling | IMMediate | RFPower | IFPower	with query	6.102
TRIGger[:SEQuence]:THReshold:IFPower	<Threshold>	with query	6.103
TRIGger[:SEQuence]:THReshold:RFPower	LOW | MEDium | HIGH	with query	6.102
Wide-band power			
INITiate:WPOWer	–	no query	6.125
ABORt:WPOWer	–	no query	6.125
STOP:WPOWer	–	no query	6.125
CONTinue:WPOWer	–	no query	6.125
CONFigure:WPOWer:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.126
CONFigure:WPOWer:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.125
FETCh:WPOWer:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.125
READ[:SCALar]:WPOWer?	–	query only	6.126
FETCh[:SCALar]:WPOWer?	–	query only	6.126
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Alphabetical Command Lists

Table 6-3 Remote-control commands: *Non Signalling* mode

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Command (Non Signalling, alphabetical) Page

Command (Non Signalling, alphabetical)	Page
FETCh:NPOWer:STATus?	6.12
FETCh:POWer:NBURst:EPSK:STATus?	6.16
FETCh:POWer:NBURst:GMSK:STATus?	6.16
FETCh:RFGenerator:STATus?	6.4
FETCh:SPECtrum:MODulation:STATus?	6.70
FETCh:SPECtrum:MSWitching:STATus?	6.93
FETCh:SPECtrum:SWITching:STATus?	6.81
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?	6.47
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:CURRent?	6.47
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:MMAXimum?	6.47
FETCh:SUBarrays:MODulation:MERRor:EPSK:AVERage?	6.63
FETCh:SUBarrays:MODulation:MERRor:EPSK:CURRent?	6.63
FETCh:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?	6.63
FETCh:SUBarrays:MODulation:PERRor:EPSK:AVERage?	6.55
FETCh:SUBarrays:MODulation:PERRor:EPSK:CURRent?	6.55
FETCh:SUBarrays:MODulation:PERRor:EPSK:MMAXimum?	6.55
FETCh:SUBarrays:MODulation:PERRor:GMSK:AVERage?	6.35
FETCh:SUBarrays:MODulation:PERRor:GMSK:CURRent?	6.35
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