R&S®CMW-KG2xx/-KM2xx/-KS2xx GSM Firmware Applications
User Manual

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Test & Measurement

User Manual

ROHDE & SCHWARZ

This user manual describes the following R&S®CMW options:

- R&S®CMW-KG200 (GSM GPRS EDGE R6, generator, downlink)
- R&S®CMW-KM200 (GSM GPRS EDGE R6, TX measurement, uplink)
- R&S®CMW-KM201 (GSM R7 EGRPS2-A, TX measurement, uplink)
- R&S®CMW-KM012 (TX measurement, multi evaluation list mode for GSM)
- R&S®CMW-KS200 (GSM GPRS EDGE R6, basic signaling)
- R&S®CMW-KS201 (GSM R7 EDGEevo, basic signaling)
- R&S®CMW-KS203 (GSM R9 VAMOS, basic signaling)
- R&S®CMW-KS210 (GSM GPRS EDGE R6, advanced signaling)
- R&S®CMW-KE100 (Basic fading support: AWGN generator)
- R&S®CMW-KE200 (GSM fading profiles TS 45.005, excerpts)

Mühldorfstr. 15, 81671 München, Germany
Phone: +49 89 41 29 - 0
Fax: +49 89 41 29 12 164
E-mail: info@rohde-schwarz.com
Internet: www.rohde-schwarz.com

The following abbreviations are used throughout this manual: R&S®CMW is abbreviated as R&S CMW.

Contents

1 Preface

The operation of the R&S CMW is described in several user manuals:

- The R&S CMW user manual describes the base software, common features of the firmware applications and basic principles for manual operation and remote control.
- Additional user manuals, like this document, describe the firmware applications.

Rohde & Schwarz provides registered users a "CMW Customer Web" section on GLORIS, the Global Rohde & Schwarz Information System: https://extranet.rohde-schwarz.com. From this resource you can download software updates, waveform library updates and documentation updates, e.g. updates of this document.

1.1 How to Read Firmware Application Chapters

Each firmware application is described in a separate chapter. These chapters can be read independently of each other. However, they are all organized as follows:

1. General Description
2. Application Sheets (optional)
3. GUI Reference
4. Programming Examples
5. Command Reference

The chapters "System Overview" and "Remote Control" in the R&S CMW user manual provide additional important information independent of the individual firmware applications. The most important parts are referenced by the firmware application descriptions.

1.1.1 General Description

This section provides a general description of the firmware application, independent of a specific operation mode (manual or remote control). It gives a high-level introduction to the capabilities of the firmware application. Background information related to the network standard is given as far as it is directly related to administrable parameters. For measurement applications a detailed description of measurement results and a description of configurable limits is given, including the relation to conformance requirements defined in network standard specifications.

1.1.2 Application Sheets

This optional section provides short application examples for select issues and related background information.

1.1.3 GUI Reference

The GUI reference describes the manual operation of the firmware application via the Graphical User Interface (GUI).

The description of a configuration dialog usually starts with a screenshot presenting the preset values of the parameters (sometimes preset values are modified to enable hidden parts of a dialog). Below the screenshot all shown parameters are described. For each single parameter a link to the corresponding command description in the "Command Reference" is provided. Ranges for numeric parameters and reset values are given there.

For measurement results links to the corresponding command descriptions are provided (commands to retrieve the results). The measurement results are described in detail in the "General Description".

1.1.4 Programming Examples

The programming examples show how to control and configure the firmware application via a remote-control program and how to retrieve measurement results. The examples consist of comprehensive command sequences. You can check just a single command of a sequence to get an example for the syntax of this single command. But you can also consider an entire sequence showing the commands in the context of a command script, under consideration of dependencies and required orders of the commands.

The command sequences are written with the intention to list most commands of the firmware application. They do not show the fastest way for a given configuration task. The fastest way would use many reset values and omit the corresponding commands.

The examples are referenced by the command descriptions of the "Command Reference".

1.1.5 Command Reference

The command reference provides information on the remote commands of the firmware application. The commands are grouped according to their function.

Each command description indicates the syntax of the command header and of the parameters. For input parameters the allowed ranges, reset values and default units are listed, for returned values the expected ranges and default units. Most commands have a command form and a query form. Exceptions are marked by "Setting only", "Query only" or "Event". Furthermore a link to the "Programming Examples" is provided and the first software version supporting the command is indicated.

2 GSM Signaling

With the "GSM Signaling" application, the R&S CMW can emulate a GSM base station (BS) transmitting a GSM downlink signal to which the GSM mobile station (MS) under test can synchronize. The R&S CMW also provides the necessary higher-layer protocol functions so that the MS can perform a location update in the Circuit Switched (CS) domain and an attach in the Packet Switched (PS) domain. A connection can be set up in one of the domains.

The basic GSM Release 6 signaling functionality provided by R&S CMW-KS200 can be enhanced by the following options:

- R&S CMW-KS210 offers additional flexibility concerning advanced GSM Release 6 parameter settings and is required for fading.
- R&S CMW-KS201 provides a basic GSM Release 7 signaling functionality.
- R&S CMW-KS203 provides a basic GSM Release 9 signaling functionality (i.e. support of VAMOS).
- R&S CMW-KE100 and R&S CMW-KE200 enable internal fading (R&S CMW-KS210 and fader I/Q board also required).

Most tests can be performed using the GSM "Multi Evaluation" measurement (option R&S CMW-KM200). Data transfer tests can be performed using the Data Application Unit (DAU, option R&S CMW-B450x and R&S CMW-KM050).

Additionally the "GSM Signaling" application provides the following measurements:

- BER CS Measurement
- BER PS Measurement
- BLER Measurement
- RLC Throughput Measurement
- CMR Performance Measurement

2.1 What's New in this Revision

This revision describes version 3.2.70 and later of the GSM signaling firmware application.

Compared to version 3.2.60 it provides the following new features:

- BSIC parameter for GSM neighbor cell settings, see GSM
- Echo Delay
- Initial Power Reduction
- Cell Barring
- Timing Advance
- Handover extensions, see Inter/Intra RAT ... (hotkey):
  - Mobility mode
  - Redirection GSM to GSM within one R&S CMW

  - Redirection GSM to another instrument, supported target destinations are GSM, LTE, WCDMA and TD-SCDMA
- Connection control extensions:
  - PS TBF release timer T3192
  - Alerting timeout, see Connection Error (CS and PS)
  - Hotkey "Release PDP Context", see Connect / Disconnect / Send SMS / Release PDP Context (hotkeys)
  - Rejection of a location update or attach requests, see Reject Causes
- Classmark information element, see Requested Mobile Data and Early Classmark Sending
- SMS extensions:
  - Segment parameter for outgoing SMS, see Segment
  - Service Center Time Stamp
- Discontinuous transmission in downlink, see DTX DL
- Bad frame indication CS BER measurement, see Mode "BFI"
- Remote commands for MS measurement report, see MS Measurement Report Settings
- Extended ranges of measured entities in BER measurements, see Bursts / Speech Frames / Frames / Blocks and RLC Data Blocks

Software Version

To check your R&S CMW software version, open the "Setup" dialog and click "HW/SW Equipment". The initial software version for each remote control command is quoted in the reference description.

2.2 General Description

The following sections describe how to use the R&S CMW for "GSM Signaling" tests and provide useful background information.

2.2.1 Test Setups

The following sections provide an overview of typical test setups for the individual scenarios.

2.2.1.1 Test Setup for Scenario Standard Cell

The basic test setup for a standard cell scenario uses a bidirectional RF connection between the tester and the device under test (DUT), carrying both the downlink and the uplink signal:

- The R&S CMW transmits the downlink (base station) signal to which the DUT can synchronize in order to perform registration and establish a connection. The downlink signal is used to transfer signaling messages and user data to the DUT.
- The DUT transmits an uplink signal that the R&S CMW can receive and decode in order to set up a connection and perform various measurements.

For this setup the DUT is connected to one of the bidirectional RF COM connectors at the front panel of the R&S CMW. No additional cabling and no external trigger is needed. The input level ranges of all RF COM connectors are identical.

See also: "RF Connectors" in the R&S CMW user manual, chapter "Getting Started"

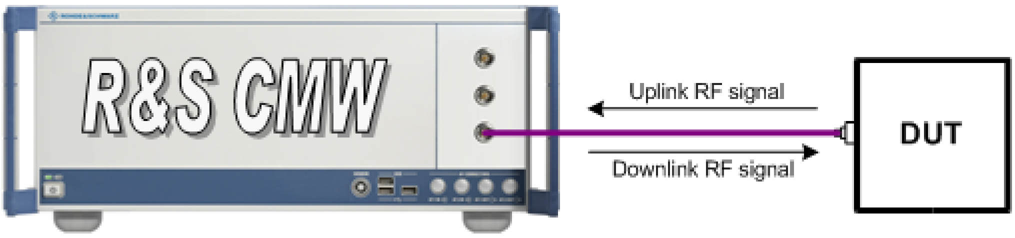


Fig. 2-1: Test setup for standard cell

2.2.1.2 Test Setup for Scenario IQ out - RF in

For the scenario "IQ out - RF in" the uplink RF signal is routed via an RF COM connector at the front panel. The downlink digital I/Q signal is routed via a DIG IQ OUT connector at the rear panel. This connector is only available if an I/Q board is installed (option R&S CMW-B510x/-B520x). Additional instruments can be inserted into the downlink path to manipulate the downlink signal.

A typical use case is to insert an R&S SMU200A into the downlink path to superimpose fading on the downlink signal. The following figure provides an overview of this setup. In this example the R&S SMU200A is synchronized to a 10-MHz reference signal provided by the R&S CMW. It is also possible to synchronize the R&S CMW to the R&S SMU200A.

The following figure shows a possible rear panel cabling using the first I/Q board (DIG IQ 1 to 4).

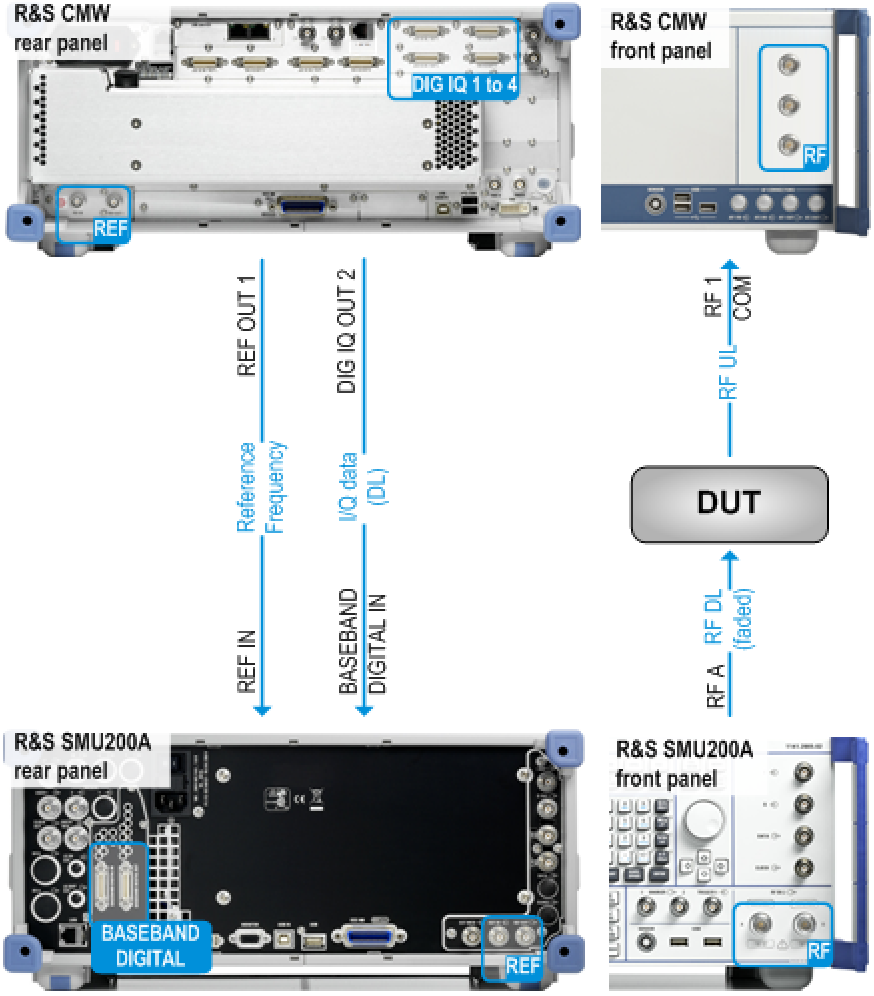


Fig. 2-2: Test setup for scenario "IQ out - RF in" (example)

2.2.1.3 Test Setup for Scenario BCCH and TCH/PDCH

A test setup for this scenario involves one uplink and two downlink signals. One downlink signal transmits the TCH/PDCH, the other one the BCCH. The two downlink signals must be transmitted via different TX modules, which implies that the instrument must support at least two TX paths. The RF connectors to be used depend on the installed frontends.

Typical scenarios:

- Two basic frontends are installed at the R&S CMW:
  Use a bidirectional RF connector for the uplink and one downlink signal and a separate RF connector for the second downlink signal. Connect both RF connectors to an external combiner and connect the combiner to the MS.
- An advanced frontend is installed at the R&S CMW:
  Use one bidirectional RF connector for the uplink and both downlink signals. This is the same cabling as for a standard cell scenario.

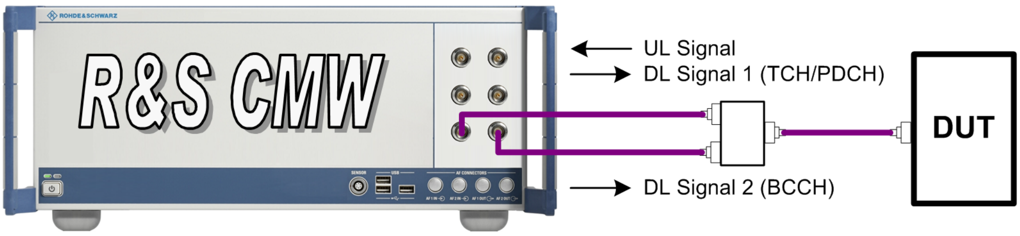


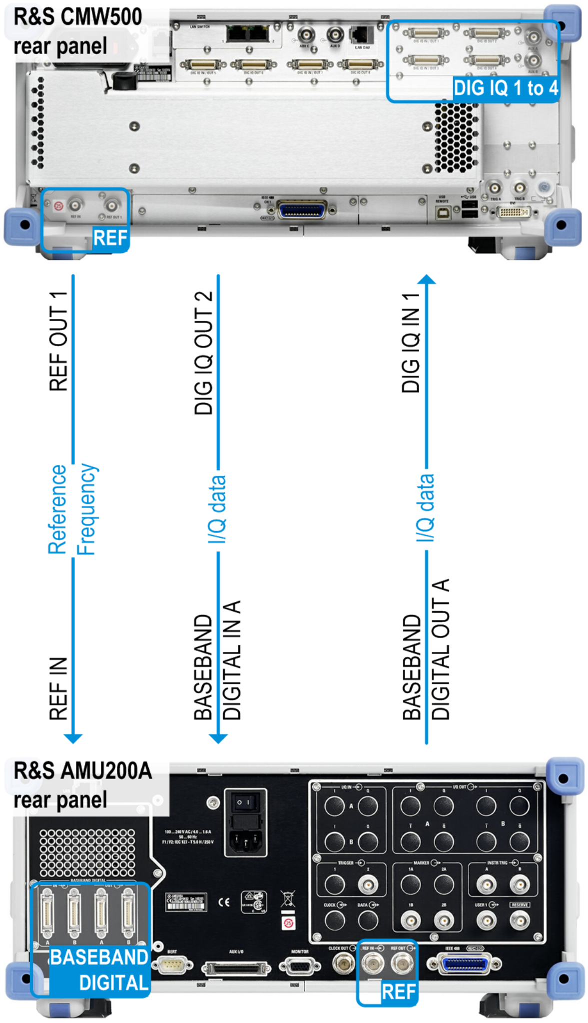
Fig. 2-3: Test setup using two RF connectors and an external combiner

2.2.1.4 Test Setup for Standard Cell External Fading

You can integrate an R&S AMU200A into a test setup in order to superimpose fading on the baseband signal. The R&S AMU200A must be connected to the digital I/Q interface of the R&S CMW. At least one I/Q board must be installed at the R&S CMW for that purpose (option R&S CMW-B510x/-B520x).

All connections between R&S CMW and R&S AMU200A are established via the rear panels of the instruments.

The following figure shows a possible rear panel cabling using the first I/Q board (DIG IQ 1 to 4).



The RF connections between R&S CMW and DUT must be established in the same way as without external fading.

2.2.1.5 Test Setup for Standard Cell Internal Fading

If internal fading shall be used, the test setup is the same as for the standard cell scenario without fading.

2.2.2 Initiating Signaling Tests

The signal generator of the "GSM Signaling" application is controlled like any other real-time or signaling generator, see ON | OFF (key) / GSM Signaling (softkey). The GSM downlink signal is turned on as long as the "GSM Signaling" softkey indicates the "ON" state (after switching on, wait until the hour glass symbol has disappeared). In this state, the connection states can be controlled via hotkeys at the R&S CMW and via actions at the mobile.

The default settings of the R&S CMW generally ensure a DL signal with suitable characteristics for connection setup. The most important settings can be modified directly in the main view.

Checks in case of failed registration

If the registration of the mobile fails, check the following R&S CMW settings:

- The mobile must support the selected GSM band.
- The "DL Reference Level" must be sufficient so that the mobile under test can receive the DL signal.
- The external attenuation settings should be in accordance with characteristics of the RF connection.
- The security settings in the "Network" section of the configuration dialog must be in accordance with the MS capabilities.
  Registration can fail if authentication is enabled but not supported by the MS or the SIM card type or secret key do not match.

Checks in case of failed connection setup

If the setup of a PS connection or a PDP context activation fails, check the following R&S CMW settings:

- The PS slot configuration must be compatible to the MS capabilities, especially to the multislot class.
  Refer to 3GPP TS 45.002, Annex B for a table listing the individual classes. The multislot class determines for example the maximum number of DL and UL timeslots per TDMA frame, the maximum sum of DL+UL timeslots and the minimum distance between UL and DL slots. For the proper multislot settings use the auto slot configuration function, see "Connection Setup" on page 80.

Performing measurements

The required settings vary depending on the measurement to be performed. However, the general procedure outlined below is applicable to most measurements.

1. Connect your mobile to the R&S CMW (see chapter 2.2.1, "Test Setups", on page 13).
2. Open the "GSM Signaling" firmware application.
3. Configure the signaling application according to the test to be performed.
4. To turn on the DL signal, click/press ON | OFF and wait until the "GSM Signaling" softkey indicates the "ON" state and the hour glass symbol has disappeared.
5. Switch on the mobile phone.

   The mobile synchronizes to the DL signal, performs a location update in the CS domain and attaches to the PS domain (if it supports both domains). The R&S CMW enters the "Synchronized" CS state and the "Attached" PS state.
6. Set up a connection in the CS domain or the PS domain:

a) Click/press the "CS Connect" hotkey and wait until the R&S CMW has entered the "Call Established" CS state.
b) Click/press the "PS Connect" hotkey and wait until the R&S CMW has entered the "TBF Established" PS state.

7. Use the "GSM RX Meas" or "GSM Multi Eval" softkey to switch to the measurement application. The GSM RX measurements are provided by the "GSM Signaling" firmware application. The GSM multi evaluation measurement is available as option R&S CMW-KM200.
8. Configure and start the measurement.

Order of steps

The measurements of the "GSM Signaling" application may be initiated before turning on the DL signal. In that case the measurement starts as soon as the preconditions are fulfilled. A BER CS measurement for instance starts as soon as the CS connection has been established.

2.2.3 External Fading

An external fading scenario allows to route the downlink baseband signal to an R&S AMU200A that superimposes fading on the signal and routes it back. Thus fading can be added to the downlink signal.

Configuring and activating fading

1. Connect the DUT and the R&S AMU200A to the R&S CMW (see chapter 2.2.1.4, "Test Setup for Standard Cell External Fading", on page 15).
2. Configure the signaling application according to the test to be performed, especially select the "Standard Cell Fading" scenario with external fading and configure the downlink settings.
3. At the signaling application, turn on the downlink signal and set up a connection.
4. In the configuration tree, section "IQ Settings > IQ Out", note the "Baseband PEP" and the "Crest Factor".
5. Configure the R&S AMU200A, especially the following settings:

   Reference oscillator settings:
   - Source = External
   - External Reference Frequency = 10 MHz

   Baseband input settings for all used connectors:
   - Sample Rate = User Defined, 100 MHz
   - Baseband Input Level: enter the crest factor and the PEP displayed in step 4.

   Digital I/Q output settings for all used connectors:
   - Sample Rate = User Defined, 100 MHz

- Set Level Via = PEP
- PEP = PEP value displayed in step 4

6. In the R&S AMU200A, activate fading and note the signal level. If you add noise to the signal, note the signal level without noise.
7. Configure the I/Q input of the R&S CMW:
In the configuration tree, section "IQ Settings > IQ In > Baseband Level", enter the signal level noted in the previous step.
Alternatively it is also possible, to specify the signal output level of the R&S AMU200A, to note the resulting PEP and to enter this PEP value at the R&S CMW for "Baseband PEP". But this is not recommended.
8. Turn the downlink signal at the signaling application off and on again.

   The configuration is now complete. Fading is active.
   Note that a reconfiguration of the settings at the R&S AMU200A during an active connection to the DUT may result in the loss of the connection or in erroneous measurement results.
   After a reconfiguration of the baseband input settings of the R&S AMU200A, you must turn the downlink signal at the signaling application off and on again.

Please note that external fading might not work properly, if a frequency-dependent attenuation table is active in downlink direction. When using external fading, deactivate frequency-dependent attenuation tables for the downlink direction of the used "RF Output" connector.

2.2.4 Internal Fading

Testing under realistic air interface conditions is important in order to verify the receiver performance and the correct operation of the DUT's protocol stack implementation. For example bit error rates and throughput performance can be evaluated.

The internal fading module comes with a fading simulator and AWGN generator that can be selectively enabled. It manipulates the generated downlink I/Q data stream to emulate typical signal conditions at the DUT's receiver.

The following options are required to use the internal fading simulator in GSM:

- one fader I/Q board R&S CMW-B510F or R&S CMW-B520F per signaling instance using internal fading
- one option R&S CMW-KS210 "GSM GPRS EDGE R6, advanced signaling" per signaling instance using fading
- a single option R&S CMW-KE100 "Basic Fading support: AWGN generator"
- a single option R&S CMW-KE200 "GSM fading profiles TS 45.005, excerpts"

Please note that internal fading might not work properly, if a frequency-dependent attenuation table is active in downlink direction. When using internal fading, deactivate frequency-dependent attenuation tables for the downlink direction of the used "RF Output" connector.

2.2.4.1 Fading Simulator

Multi-path fading is an effect which occurs in real world situations. A signal sent from the base station may take different routes (direct line of sight and/or reflected) and reach the receiving antenna at different times leading to a sum of phase shifted and, if the receiver is moving, frequency shifted signals.

The internal fading simulator supports multipath propagation conditions defined in Annex C.3 of 3GPP TS 45.005.

A faded signal has a higher crest factor than an unfaded one. In order to avoid distortion, the baseband signal must be attenuated before entering the fading module, with the necessary attenuation (insertion loss) depending on the selected fading profile.

In GSM signaling, the insertion loss at the baseband level can be calculated automatically or set manually. It is automatically compensated on the HF level, which implies a shift of the allowed DL power level range to the same extent, but in opposite direction.

2.2.4.2 AWGN Generator

Additional White Gaussian Noise (AWGN) may lead to a decrease of throughput. The quality of the received signal is affected by the ratio of the signal power to the surrounding traffic noise level (signal to noise ratio).

The internal fading module supports AWGN insertion with configurable bandwidth and signal to noise ratio. Insertion loss at the baseband level is calculated and compensated automatically at the HF.

Restriction for the AWGN generator in GSM

The frequency of the AWGN generator signal is fixed and equals the center frequency of the corresponding GSM band:

- **GSM 850**: channel 190, 881.6 MHz
- **GSM 900**: channel 62, 947.2 MHz
- **GSM 1800**: channel 699, 1842.6 MHz
- **GSM 1900**: channel 661, 1960.0 MHz

2.2.5 End to End Packet Data Connections

To set up a GSM packet data connection you need the Data Application Unit (DAU) in addition to the "GSM signaling" application. The DAU itself is available as option R&S CMW-B450x and the DAU measurements as R&S CMW-KM050. For IPv4 option R&S CMW-KA100 is required, for IPv6 additionally option R&S CMW-KA150.

For configuration of the DAU, e.g. for initial configuration of the DAU IP settings, please refer to the DAU documentation.

To set up an end to end packet data connection, proceed as follows:

1. Configure the IP settings of DAU according to the DAU documentation.

2. Enable packet switched services, see chapter 2.3.7.1, "General Network Parameters", on page 106.
3. Configure other GSM signaling settings as desired.
4. Switch on the cell signal and attach the MS.
5. Initiate a mobile originated packet data connection at the MS.
   It is not possible to initiate a mobile terminated packet data connection at the instrument.

When the packet data connection has been established, you can use the DAU to perform IP-based data tests (see DAU documentation).

You can also perform "Multi Evaluation" measurements (option R&S CMW-KM200). The RX measurements provided by the signaling application can not be performed with an end to end packet data connection.

Most measurements require the transmission of data. For a test mode connection the signaling application takes care of data transmission. For an end to end packet data connection the signaling application does not transfer data. So you must generate IP traffic by other means, e.g. using the DAU. You may for example initiate an IPerf measurement or an FTP data transfer. For details refer to the DAU documentation.

Some DAU measurements and applications require to enter the IP address(es) assigned to the MS. You can retrieve this information from the "MS Info" section, see chapter 2.3.1.5, "MS Info", on page 77.

2.2.6 Audio Measurements

The "Audio Measurements" application provides an audio signal for audio tests and can analyze the audio signal by means of audio measurement option. This allows for example microphone- and speaker tests for a mobile phone.

In addition the audio board houses a speech codec board, that provides an interface to the signaling units of the R&S CMW. It decodes the signal delivered by a GSM signaling application or encodes an audio signal and delivers it to the GSM signaling application.

The speech codec allows a signaling application GSM to support the whole transmission chain of the signal from analog input into the DUT's microphone through the RF to the output of the AF signal, as well as the reverse way. Here, the format of the AF signal is selectable between digital (SPDIF) and analog (AF connectors).

Which option is required, depends on your instrument:

- Option R&S CMW-B400B "Audio Analyzer/Generator" is compatible to R&S CMW delivered after November 2011. It is also compatible to R&S CMW delivered before November 2011, that have been upgraded with R&S CMW-U5024.
- Option R&S CMW-U400 "Audio Analyzer/Generator" is compatible to R&S CMW delivered before November 2011, that have not been upgraded with R&S CMW-U5024.

- The audio board must be enhanced with a speech codec board (R&S CMW-B405A).
- The latest audio firmware/software package (Setup_CMW_AUDIO.exe) has to be installed at your R&S CMW. This firmware application provides the routing of speech coder either to audio connectors or to internal audio generator and measurements.

The procedure outlined below is applicable to audio measurements with the "GSM Signaling" application and describes an example of the test setup for the microphone- and speaker test. For the detailed information and additional test setups refer to the user manual of the audio measurements application.

To set up an audio connection, perform the following steps:

1. Connect the DUT with the analog AF connectors provided by the R&S CMW with an installed audio board.

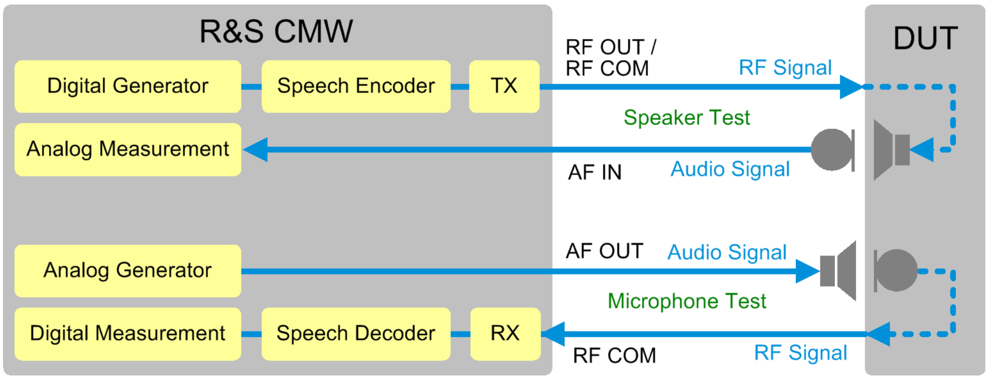


Fig. 2-4: Test setup for microphone and speaker test

2. In the audio application main view, at the top, select the scenario "microphone- and speakertest".
3. Before switching on the cell signal, ensure that the usage of the speech codec is enabled in the GSM signaling application, see "Enable Speech Codec" on page 90.
4. Select a Data Source = "Speech".
5. Configure any other settings as desired (as for a connection without the audio board) and switch on the cell signal.
6. Turn on an internal audio generator of the audio measurements application according to the steps below:
   a) Select the "Analog Meas" tab or "Digital Meas" tab.
   b) Select the relevant generator softkey ("Analog Generator" or "Digital Generator").
   c) Press "ON | OFF" and wait until the generator softkey indicates the "ON" state and the hour glass symbol has disappeared.

7. Click/press the "CS Connect" hotkey and wait until the R&S CMW has entered the "Call Established" CS state.
8. Analyze the audio signal e.g. by means of the audio measurements application. The GSM TX measurements evaluate the different characteristics of the signal as well.

2.2.7 Connection States

A GSM core network consists of two service domains, the Circuit Switched (CS) domain and the Packet Switched (PS) domain. The GSM cell emulated by the R&S CMW supports CS services. The additional support of PS services is configurable.

A mobile that supports both CS and PS services can perform a location update in the CS domain and an attach in the PS domain. The R&S CMW also supports combined attach.

Afterwards a connection can be set up in one domain. The current software version does not support simultaneous CS and PS connections (dual transfer mode).

2.2.7.1 CS Connection States

The main Circuit Switched (CS) connection states are described in the following table.

CS State	Description
Off	No GSM downlink signal transmission
On	The R&S CMW emulates a GSM cell, transmitting a DL GSM signal to which the mobile can synchronize. MS may or may not be synchronized to the cell signal, but no location update or attach has been performed.
Synchronized	Synchronization and location update have been performed.
Alerting	The R&S CMW is attempting a connection to the MS. The MS is responding (ringing) but the connection is not yet established.
Call Established	A call to/from the mobile has been established. The R&S CMW can vary connection parameters, perform transmitter and receiver tests, or initiate a handover.

Control commands initiated by the R&S CMW or by the mobile switch between the CS states. The following figure shows possible state transitions.

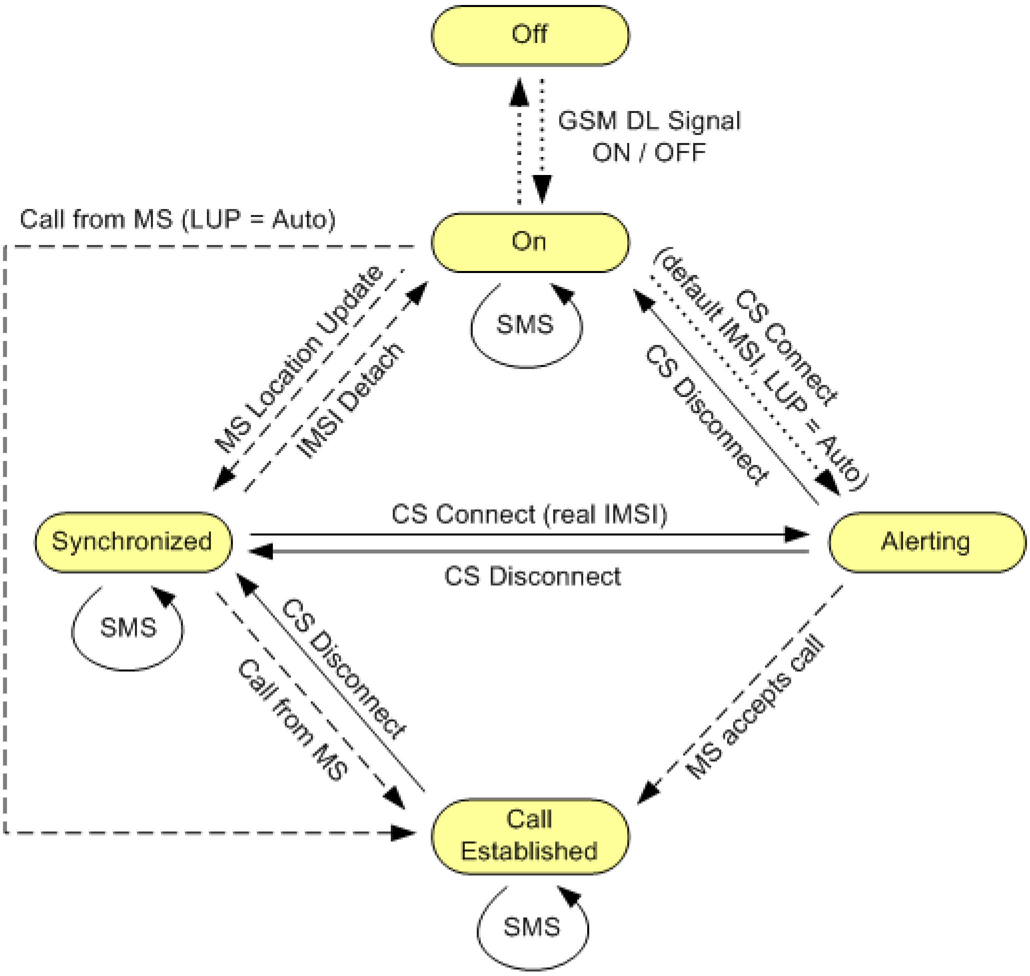


Fig. 2-5: Connection states CS domain

dotted line = action initiated by instrument
dashed line = action initiated by MS
solid line = action initiated by MS or instrument

In addition to the main states shown in the table and the figure the instrument indicates the following transitory states:

- **Location Update**
  Displayed during location update and preceding synchronization. When the necessary information has been exchanged (e.g. the real IMSI of the mobile), the connection state changes to "Synchronized".
- **IMSI Detach**
  Displayed during an IMSI detach.
- **Connecting**
  Displayed during call setup until a mobile originating call has been established or the mobile starts alerting for a mobile terminating call.
  A call setup can be initiated after the mobile has completed synchronization to the downlink signal. Synchronization with location update (Location Update = Always) results in state "Synchronized". For synchronization without location update (Location Update = Auto) the state remains "On". See also "Location Update" on page 116.

- **Releasing**
  The call is being released.
- **Sending Message**
  Displayed while an SMS message is sent to the MS.
- **Receiving Message**
  Displayed while an SMS message is received from the MS. To check the received message see "Message Text / Message Length" on page 142.
- **Incoming Handover in Progress**
  Displayed while an inter-RAT handover from another signaling application is performed.
- **Outgoing Handover in Progress**
  Displayed while an inter-RAT handover to another signaling application is performed.
- **Handover: Dualband**
  Indicates that the connection was handed over to a destination band different from the original GSM band, so that the BCCH and the TCH are now in different GSM bands. The message disappears when a handover back to the original GSM band is performed and the TCH uses again the same band as the BCCH.
  See also chapter 2.2.8, "Handover", on page 27.

Additional transitions

The transitions in the figure above are not complete. The "Off" state can be reached from any state by turning off the cell signal (ON | OFF). Moreover, incidents like an alerting timeout or a loss of the radio link cause additional transitions.

2.2.7.2 PS Connection States

The main Packet Switched (PS) connection states are described in the following table.

PS State	Description
Off	No signal transmission.
On (Idle)	The R&S CMW emulates a GSM cell, transmitting a GSM control channel signal. A GPRS mobile station can detect this signal, synchronize to its timing and frequency and then read the system information. It learns that the instrument (representing the current cell in a real network) supports GPRS services and can initiate a GPRS attach.
Attached	The mobile station is GPRS-attached.
PDP Context Activated	A Packet Data Protocol (PDP) context has been activated, triggered by a PDP context request from the MS. PDP is a network protocol used by an external packet data network interfacing to GPRS. This state is for example displayed when a packet data end to end connection has been successfully set up.
TBF Established	A TBF connection has been established. This state is for example displayed when a test mode connection has been successfully set up.

The "TBF Established" state was specified especially in order to facilitate production tests. The PS states "On", "Attached" and "TBF Established" must not be confused with the mobility management states Idle, Standby and Ready defined in 3GPP TS 23.060.

A Temporary Block Flow (TBF) is established for signaling or data transmission in any state, not only in state "TBF Established". The main signaling view of the GSM signaling application indicates the main PS state and additionally, whether an UL and/or DL TBF is currently established.

Control commands initiated by the R&S CMW or by the mobile switch between the PS main states. The following figure shows possible state transitions.

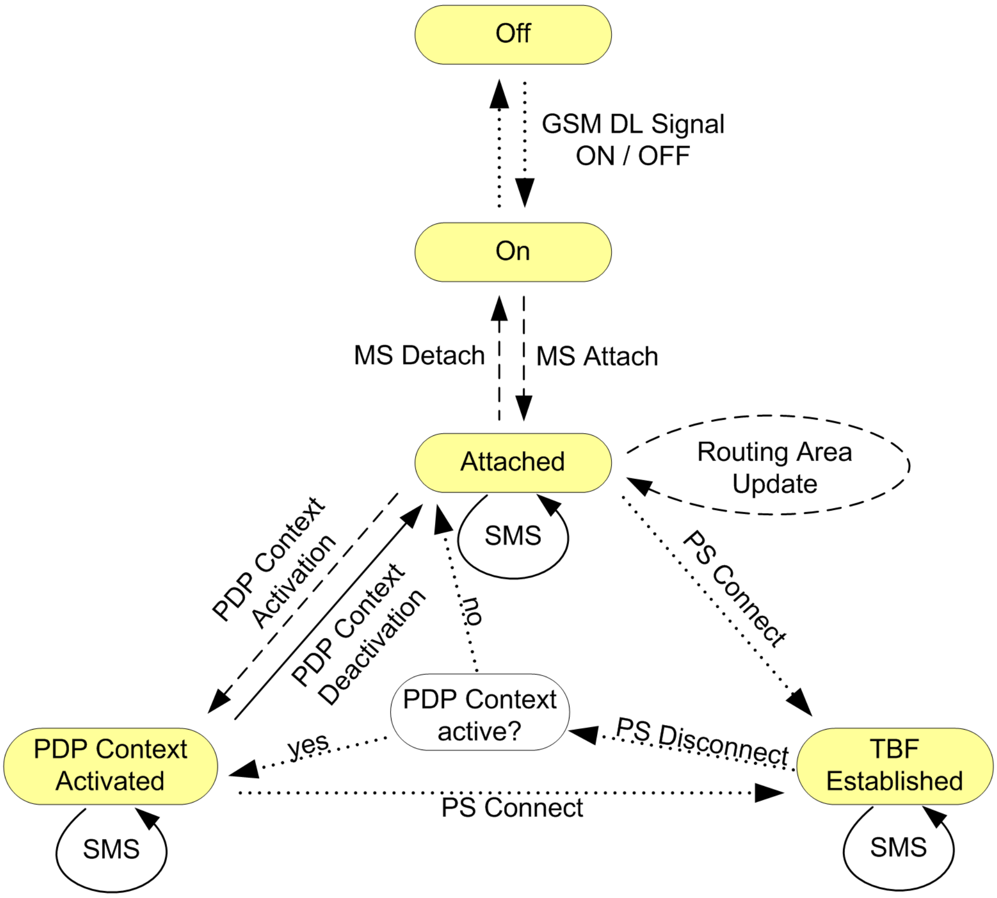


Fig. 2-6: Connection states PS domain

dotted line = action initiated by instrument
dashed line = action initiated by MS
solid line = action initiated by MS or instrument

In addition to the main states shown in the table and the figure the instrument indicates the following transitory states:

- **Attaching**:
  A GPRS attach is always initiated by the mobile station. The MS identifies itself and indicates its presence to the instrument for the purpose of using GPRS Point to Point (PTP) services. This can be done any time in PS state "On".

If the MS performs a combined attach, the CS "Synchronized" state is reached together with the PS "Attached" state.

- **Detaching**:
  A GPRS detach is always initiated by the mobile station.
- **Route Area Update**:
  The mobile performs a routing area update, either triggered by timer T3312 (periodic routing area update) or because the Routing Area Code (RAC) has been changed.
- **PDP Context Activation**:
  A PDP context activation is always triggered by a PDP context request sent by the MS.
- **PDP Context Deactivation**:
  A PDP context deactivation is triggered by the MS or by the R&S CMW.
- **Connecting**:
  The R&S CMW attempts to access the "TBF Established" state. The TBF connection must be initiated by the instrument.
- **Releasing**
  The TBF connection is being released (from "TBF Established" to "Attached").
- **Sending Message**
  Displayed while an SMS message is sent to the MS.
- **Receiving Message**
  Displayed while an SMS message is received from the MS. To check the received message see "Message Text / Message Length" on page 142.

Additional transitions and handover

The transitions in the figure above are not complete. The "Off" state can be reached from any state by turning off the cell signal (ON | OFF). Moreover, incidents like a timeout or a loss of the radio link cause additional transitions.

A GSM dual-band handover can be performed in the "TBF Established" PS state. The PS state does not change during the handover. See also chapter 2.2.8, "Handover", on page 27.

2.2.8 Handover

A handover is the process of transferring an ongoing call from one network to another. The GSM signaling application supports a handover within the signaling application and a handover to another signaling application.

The following handover mechanisms are supported:

- Handover within the GSM signaling application:
  The R&S CMW performs an Radio Resource (RR) reconfiguration.
  Additionally a GSM dual-band handover of circuit switched (CS) or packet switched (PS) connections between different GSM bands is supported. After the dual-band handover, the BCCH and the TCH use different GSM bands.

The handover parameters are different for CS and PS connections, see section "Inter/Intra RAT ... (hotkey)" on page 86. After successful handover, the connection is continued, using the "Destination Parameters".

- Redirection:
  The R&S CMW performs an RR connection release with redirection information. This mechanism is relevant for a handover to another signaling application or another instrument.
  A redirection results in a new registration of the MS at the handover destination. The GSM connection is released, the DUT attaches to the destination target cell, no new connection is set up.
  Supported technologies are for example LTE and TD-SCDMA.
- Mobile terminating circuit switched fallback:
  This mechanism is only supported for handover from LTE. The R&S CMW informs the UE via a CS service notification about an incoming mobile terminating call. The UE answers with an extended service request with Circuit Switched Fallback (CSFB) response. Then the R&S CMW performs an RRC connection release with redirection information. The UE sends a paging response to the handover destination (GSM) and a new CS connection is established by the GSM signaling application.

To perform a handover, proceed as follows:

1. For a handover to another signaling application, ensure that the two signaling applications use different RX/TX modules ("Converter" setting).
2. In the GSM signaling application, establish a connection to the MS.
3. Press the hotkey "Inter/Intra RAT ..." to open the handover configuration dialog.
4. Configure the settings in the dialog:
   a) Select the handover target - either the GSM signaling application or another signaling application or "No Connection" for an external instrument.
   b) For a handover to another signaling application, select the "Mobility Mode" (handover mechanism to be used).
   c) Configure the destination parameters. For a handover to an external instrument the parameters must reflect the actual configuration of the external instrument.
   d) If you have selected another signaling application as target, the target cell is activated automatically (downlink signal switched on). Wait until the cell icon  includes "RDY" to indicate that the handover target is ready to receive the handover.
5. Press the button "Execute" to start the handover process.

   You can monitor the handover process in the "Event Log" area of the main view of the signaling applications.

When the same downlink path is used for BCCH and TCH (e.g. standard cell scenario), the BCCH is usually no longer available after the handover, because the frequency bandwidth supported by a single RF path is too small to cover both the BCCH band and the TCH band. Using separate paths for BCCH and TCH (scenario BCCH and TCH/PDCH) guarantees that the BCCH is still available after a dual-band handover.

If you want to reconfigure only one parameter of the GSM signaling application, you can also do this directly, without using the "Inter/Intra RAT ..." hotkey. Simply modify the channel or the operating band or the cell bandwidth during an established connection. The R&S CMW then initiates a redirection procedure to reconfigure the parameter.

2.2.9 GSM Characteristics

The following sections provide useful background information about GSM signals and operating modes.

2.2.9.1 GSM Bands and Channels

The GSM frequency bands are defined in 3GPP TS 45.005. A band contains a set of adjacent channels, each with a bandwidth of 200 kHz. The channel numbers and the assignment between channel numbers and frequencies are band-specific.

In all frequency bands, the downlink frequencies are higher than the corresponding uplink frequencies. The difference between downlink and uplink frequencies is termed the duplex spacing; it is also band-specific. The table below gives an overview of the supported GSM bands with their channel numbers and the downlink and uplink center frequencies.

Table 2-1: GSM operating bands and frequencies

Band	Channel No.	Downlink Freq. [MHz]	Uplink Freq. [MHz]
GSM 850 (GSM 850 and MXM 850)	128 to 251	869.2 to 893.8	824.2 to 848.8
GSM 900 (P/R/E-GSM 900)	0 to 124 940 to 1023	935.0 to 959.8 918.2 to 934.8	890.0 to 914.8 873.2 to 889.8
GSM 1800 (DCS 1800)	512 to 885	1805.2 to 1879.8	1710.2 to 1784.8
GSM 1900 (PCS 1900 and MXM 1900)	512 to 810	1930.2 to 1989.8	1850.2 to 1909.8

2.2.9.2 Power Control Levels

Power control levels (PCL) are used for dynamic control of the mobile power. The PCL range depends on the GSM band as shown below (phase 2 specifications).

Power Control Level (PCL)	P_{nom} [dBm], GSM 400/GT 800/700/850/900	P_{nom} [dBm], GSM 1800	P_{nom} [dBm], GSM 1900
0	39	30	30
1	39	28	28
2	39	26	26
3	37	24	24
4	35	22	22
5	33	20	20
6	31	18	18
7	29	16	16
8	27	14	14
9	25	12	12
10	23	10	10
11	21	8	8
12	19	6	6
13	17	4	4
14	15	2	2
15	13	0	0
16	11	0	0
17	9	0	0
18	7	0	0
19 – 28	5	0	0
29	5	36	0
30	5	34	33
31	5	32	32

2.2.9.3 GPRS Uplink Power Control

Power control of the MS is important for spectral efficiency in the cellular system as well as for the reduction of power consumption of the mobile station. In circuit switched mode, where a continuous two way connection between the BTS and the MS is maintained, **closed loop** power control is used: The BTS measures the received signal level from the MS and dynamically adapts the MS output power in 2-dB steps using a fixed scale of Power Control Levels (PCL), see chapter 2.2.9.2, "Power Control Levels", on page 30.

In **open loop** power control, the path loss in downlink and in uplink is assumed to be identical. If the MS detects a reduction of the received signal level C, it tries to compensate for the changed propagation conditions by increasing its own output power P_{CH} by the same amount: The sum of P_{CH} + C is always kept constant. This fast but inaccurate power control mode is useful at the beginning of a packet transmission.

For a discontinuous, packet switched GPRS connection, a combination of open loop and closed loop power control is used (see 3GPP TS 45.008, Annex B). The RF output power P_{CH} on each individual uplink PDCH shall be:

$P_{CH} = min\ (\Gamma_0 - \Gamma_{CH} - \alpha(C+48), P_{MAX})$

where:

- Γ_0 is a network-specific constant (39 dBm for GSM 400, GSM GT 800, GSM 850 and GSM 900, 36 dBm for GSM 1800 and GSM 1900, i.e. the maximum nominal output power of an MS in the network)
- Γ_{CH} is a power control parameter depending on the MS and channel (analogous to the PCL in circuit switched mode). The values are in the range 0 to 31, corresponding to relative powers of 0 dB, 2 dB, ..., 62 dB.
  This parameter is individually configurable per uplink timeslot, see chapter 2.3.1.7, "Slot Configuration Dialog", on page 81.
- α represents a system parameter.
  A pure open loop power control is achieved by setting α = 1 and keeping Γ_{CH} constant. A closed loop is achieved by setting α = 0. The "GSM Signaling" application always sets α = 0.
- P_{MAX} is the maximum allowed output power in the cell. For configuration see "PMax (PCL)" on page 96.

Example for P_{CH} calculation

Assumptions: GSM 900 network (Γ_0 = 39 dBm), Γ_{CH} = 12, calculated $P_{CH} < P_{MAX}$

Calculation: $P_{CH} = (\Gamma_0 - \Gamma_{CH}) = 39\ dBm - 24\ dB = 15\ dBm$

2.2.9.4 VAMOS

Legacy GSM channel organization allows only one Mobile Station (MS) to use a physical resource, i.e. a certain frequency channel and timeslot. With VAMOS it is possible to serve two MS simultaneously on the same physical resource. Thus the voice channel capacity in the CS domain can be doubled. VAMOS stands for "Voice services over Adaptive Multi-user channels on One Slot" and is defined in 3GPP TS 45.001.

Each of the two VAMOS users is assigned a so-called VAMOS subchannel. The two subchannels are separated in uplink and downlink via training sequences. For this purpose 3GPP TS 45.002 defines two sets of Training Sequence Codes (TSC). One VAMOS user/subchannel gets a training sequence from TSC set 1, the other from TSC set 2. This ensures that the two training sequences have a very low cross-correlation. All mobiles must support TSC set 1, but only mobiles explicitly indicating support for VAMOS must also support TSC set 2.

In the uplink the VAMOS subchannels are spatially orthogonal because of independent multipath propagation. The base station hardware requires antenna diversity to receive the two users in parallel.

In the downlink a binary modulation scheme is used for each subchannel. The two subchannels are combined orthogonally by mapping them to the I and Q axis. This results in a QPSK modulation scheme, where each constellation point has a subchannel 0 component and a subchannel 1 component, as shown in the following figure.

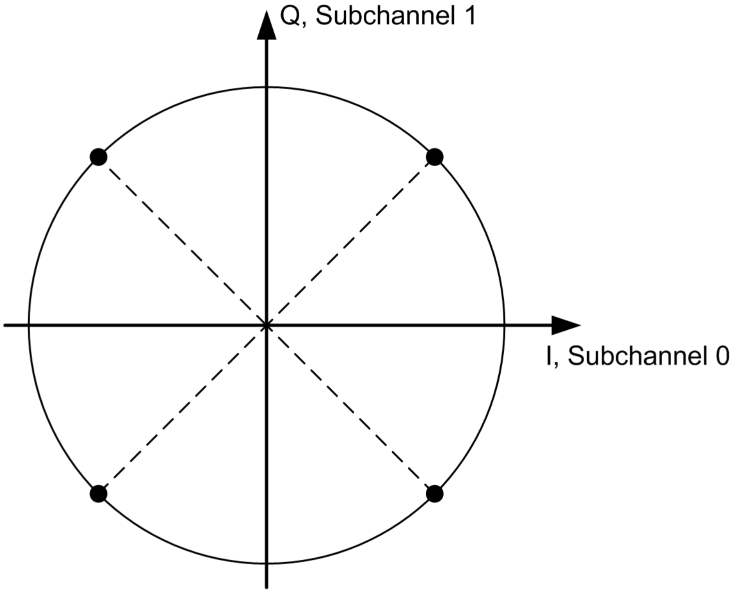


Fig. 2-7: QPSK modulation, sum of both subchannels

In this figure both subchannels use the same power level. VAMOS allows subchannel-specific power control, so that the two subchannels can use different power levels, e.g. when the two users are located at different distances from the base station. The resulting modulation scheme is called adapted QPSK (AQPSK). The following figure shows an example where subchannel 1 mapped to the Q-axis uses a higher power level than subchannel 0 mapped to the I-axis. The subchannel power distribution is illustrated by the length of the colored vectors.

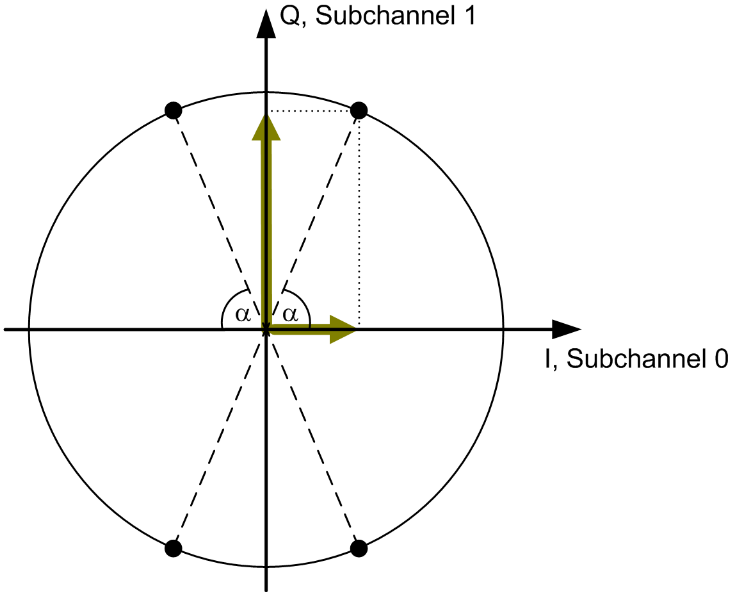


Fig. 2-8: AQPSK modulation, subchannel 1 with higher power level

The power level of subchannel 0 relative to the power level of subchannel 1 is called Subchannel Power Imbalance Ratio (SCPIR). It is related to the angle α as follows:

$SCPIR = 20 * log_{10}(tan\ \alpha)\ dB$

For α = 45° the SCPIR equals 0 dB and the two power levels are equal.

AQPSK modulation is applied in the downlink if speech frames have to be transmitted on both subchannels simultaneously.

When there are no speech frames to be transmitted on one of the two subchannels, DTX is active for this subchannel. In that case, most TDMA frames are not used at all by the inactive subchannel. In these TDMA frames GMSK modulation is applied for the active second subchannel.

However DTX means also that some TDMA frames are used by the inactive subchannel to transmit Silence Descriptor (SID) frames and the SACCH as specified in 3GPP TS 45.008. For these TDMA frames AQPSK modulation is applied.

VAMOS support by the "GSM Signaling" application

The "GSM Signaling" application allows to establish a CS VAMOS call for one mobile station. The second VAMOS user is only virtually present, i.e. there is only one DUT at a time.

You can set the SCPIR and configure which VAMOS subchannel, TSC set and TSC are used for the DUT. For the virtual second VAMOS user the other subchannel is used and you can configure the TSC set and TSC. The 3GPP standard specifies two different support levels for VAMOS. VAMOS II mobiles must fulfill additional performance requirements and use a modified mapping of logical channels onto the physical channel. The R&S CMW supports both support levels.

Other downlink properties depend on the selected profile. Three profiles are available:

- **Single User**: There is no second VAMOS user at all. The downlink signal contains speech frames and signaling data for the DUT only. GMSK modulation is used. The main difference to disabled VAMOS is that the VAMOS specific training sequences can be applied (TSC set 2).
- **Two users, both active**: The downlink signal contains speech frames and signaling data for both users. AQPSK modulation is applied.
  For the virtual user PRBS 2E9-1 is sent as data and no channel coding is applied. For the subchannel used by the DUT the same data source (e.g. Echo) as without VAMOS is selected. This applies to all profiles.
- **Two users, only one active**: The downlink signal contains speech frames for the DUT only. For the virtual user DTX is transmitted. Depending on the TDMA frame number either GMSK modulation (virtual user transmits nothing) or AQPSK modulation (virtual user transmits SID or SACCH) is applied.

For configuration of VAMOS see chapter 2.3.8.2, "Circuit Switched General Connection Parameters", on page 124.

2.2.10 Trigger Signals

The GSM signaling application provides trigger signals that can be used by other R&S CMW applications to synchronize to the generated GSM downlink signal. This is especially useful to trigger GSM TX measurements (option R&S CMW-KM200).

The available trigger signals are described below. All of them are high-pulse TTL signals with the rising edge at the beginning of a timeslot and a length of exactly 1 symbol.

To address the trigger signals in remote commands, use the following strings, with <i> replaced by the instance number of the signaling application:

- "GSM Sig<i>: FrameTrigger"
- "GSM Sig<i>: HoppingTrigger"
- "GSM Sig<i>: Control ACK"

Frame Trigger

The frame trigger signal is aligned to the beginning of uplink timeslot 0. You can configure whether it is generated for each uplink frame, for each uplink frame except idle frames (single frame trigger) or for each 26th, 52nd or 104th uplink frame (multiframe trigger).

Multiframe trigger signals can be used to synchronize to the full GSM frame timing of the R&S CMW.

For configuration see chapter 2.3.9, "Trigger Signal Settings", on page 137.

Hopping Trigger

The hopping trigger signal is aligned to the beginning of downlink timeslot 0 of each TDMA frame (including the idle frames).

It is generated while the following two conditions are met:

- A connection has been established (CS state "Call Established" or PS state "TBF Established") and this state has been reached at least 30 TDMA frames ago.
- Frequency hopping of the R&S CMW is enabled (see "Enable" on page 98) and the R&S CMW has encountered the first channel in the hopping list (entry number 0).

The R&S CMW performs frequency hopping according to 3GPP TS 45.002 using the configured hopping list. The frequency of the BS signal is changed after each TDMA frame. Depending on the Mobile Allocation Index Offset (MAIO), hopping does not necessarily start from the beginning of the sequence. The first hopping trigger pulse occurs when the first channel in the hopping list (MAI = 0) is used for the first time.

Control ACK Trigger

The Control ACK trigger event occurs with each EGPRS UL radio block carrying Control ACK information. As an EGPRS UL radio block consists of 4 TDMA frames, each trigger event consists of 4 trigger signals. The Control ACK trigger signal is aligned to the beginning of uplink timeslot 0.

In contrast to the other EGPRS blocks, CTRL_ACK blocks are transferred on either GMSK-modulated normal bursts or on access bursts (see "Control Ack Type" on page 136). Thus the Control ACK trigger signal can be used to analyze access bursts with the "GSM Multi Evaluation" measurement.

2.2.11 BER CS Measurement

The Bit Error Rate (BER) measurement for Circuit Switched (CS) connections is installed together with the "GSM Signaling" application. It provides a separate measurement tab and configuration dialog and can be enabled in the "Measurement Controller" dialog, entry "RX Measurement...".

The BER CS measurement provides several measurement modes, using different measurement principles.

Some measurement modes involve a test loop at the mobile. In these modes the measurement evaluates the data returned by the mobile under consideration of the sent data in order to test the performance of the mobile station receiver.

The detected errors are usually produced on the way from the instrument to the MS. Transmission errors produced on the way back (from the MS to the instrument) can usually be neglected because a higher signal level is used in uplink direction. However, in some measurement modes the MS calculates a CRC value for the looped back data. Thus data destroyed on the way back can be detected in a cyclic redundancy check in the R&S CMW and is ignored for the calculation of transmission errors.

The measurement modes and the related measurement results are described in the following sections. You can configure the mode via a hotkey or via the configuration dialog, see "Measure Mode" on page 149.

The burst by burst mode is included in R&S CMW-KS200. The other modes require R&S CMW-KS210.

Test SIM

Most mobiles require a test SIM in order to close a test loop. Rohde & Schwarz provides an appropriate test SIM card (R&S CMW-Z04, stock no. 1207.9901.02).

2.2.11.1 Test Procedure

For BER CS measurements a Circuit Switched (CS) connection is required.

The measurement involves the following stages:

1. Configure the "GSM Signaling" application.
   a) For repeated DL FACCH and repeated DL SACCH tests, enable "Connection > Circuit Switched > Repeated FACCH" and "Connection > Circuit Switched > Repeated SACCH" in the "GSM Signaling Configuration" dialog. These settings must be configured before settings up a connection.
   b) For AMR Inband FER tests, select an AMR codec supported by the MS ("Connection > Circuit Switched > Traffic Mode = AMR..."). The "Traffic Mode" setting is also available directly in the BER CS measurement view. It can be changed later on, even for an established connection.
2. Connect your mobile.
3. Set up a CS connection. Wait until the R&S CMW has entered the "Call Established" state.
   For details refer to chapter 2.2.2, "Initiating Signaling Tests", on page 16.
4. Open the BER CS measurement, e.g. via the "GSM RX Meas" softkey.
5. Configure the BER CS measurement, e.g. the "Measure Mode".
6. Press ON | OFF to start the BER test.
7. Wait until the R&S CMW has measured the full statistics cycle and read the results from the left part of the tab.

Speeding up repeated measurements

The BER CS measurement requires a PRBS pattern as data source and a specific test loop depending on the measure mode. The related parameters of the "GSM Signaling" application are configured and grayed out automatically when the measurement is started.

To speed up repeated measurements you can also configure the parameters manually before starting a measurement.

2.2.11.2 Mode "Burst by Burst"

In "Burst by Burst" mode the R&S CMW transmits only bits without error protection (class II bits). The absence of guard bits enhances the BER measurement speed.

Loop mode C is used, so the internal test loop of the MS is closed before any channel decoding/encoding and the bit error rate is evaluated on a burst by burst basis.

For background information see chapter 2.2.11.12, "Test Loops", on page 46 and chapter 2.2.11.13, "Frame Structure for BER CS Tests", on page 47.

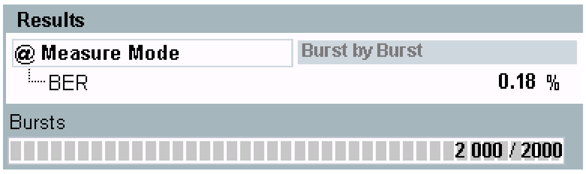


Fig. 2-9: BER CS results (Burst by burst mode)

- **BER**: Bit Error Rate, percentage of received erroneous bits (relative to total number of received bits).
- **Bursts**: number of already evaluated bursts and total number of bursts to be evaluated.

2.2.11.3 Mode "BER"

In "BER" mode the BER result is determined for class Ib bits and for class II bits.

Loop mode B is used, so the internal test loop of the MS is closed after channel decoding.

Please note that AMR full rate speech frames contain no class II bits, so select a different speech channel coding if you want to measure the BER for class II bits.

For background information see chapter 2.2.11.12, "Test Loops", on page 46 and chapter 2.2.11.13, "Frame Structure for BER CS Tests", on page 47.

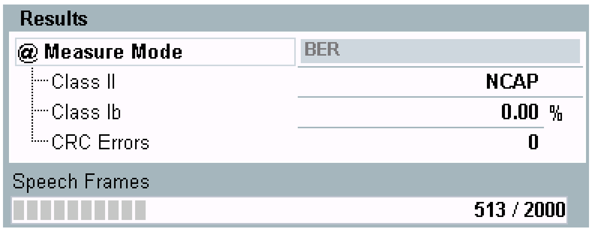


Fig. 2-10: BER CS results (BER mode)

- **Class II**: BER Class II, percentage of received erroneous class II bits (relative to total number of received class II bits)
- **Class Ib**: BER Class Ib, percentage of received erroneous class Ib bits (relative to total number of received class Ib bits)
- **CRC errors**: number of speech frames with failed CRC check. The check is performed in the R&S CMW on looped-back speech frames. Bits in frames with CRC error do not contribute to the BER.
- **Speech frames**: number of already evaluated speech frames without CRC error and total number of speech frames to be evaluated.

2.2.11.4 Mode "RBER/FER"

In loop mode A the MS receiver detects bad frames and declares them as erased frames. The remaining good frames are also called residual frames.

In this context two measurement results are defined. The Residual Bit Error Rate (RBER) characterizes the quality of transmission of the residual frames and the Frame Erasure Ratio (FER) indicates the percentage of erased frames.

Please note that AMR full rate speech frames contain no class II bits, so select a different speech channel coding if you want to measure the RBER for class II bits.

For background information see chapter 2.2.11.12, "Test Loops", on page 46 and chapter 2.2.11.13, "Frame Structure for BER CS Tests", on page 47.

Fig. 2-11: BER CS results (RBER/FER mode)

- **Class II / class Ib**: Residual Bit Error Rate for Class II / Class Ib bits
- **FER**: Frame Erasure Ratio, percentage of erased frames (relative to total number of transferred frames)
- **CRC errors**: number of speech frames with failed CRC check. The check is performed in the R&S CMW on looped-back speech frames. Bits in frames with CRC error do not contribute to the RBER and FER results.
- **Speech frames**: number of already evaluated speech frames without CRC error and total number of speech frames to be evaluated.

2.2.11.5 Mode "FER FACCH"

The R&S CMW provides FER FACCH tests for either non-repeated or repeated DL FACCH transmission.

The Fast Associated Control Channel (FACCH) is used to transmit urgent control messages. Each FACCH information block from layer-2 ("L2 Frame") contains 184 bits; on a full rate TCH, it replaces ("steals") one speech frame. In "FER FACCH" mode the R&S CMW sends L2 frames over the FACCH and counts the number of retransmission requests of the MS under test.

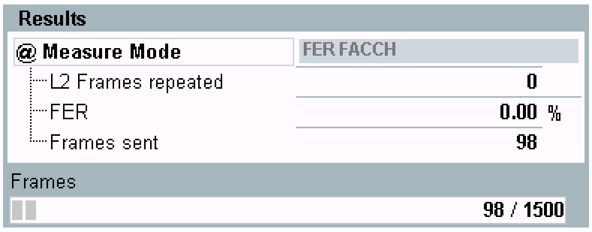


Fig. 2-12: BER CS results (FER FACCH mode)

- **L2 frames repeated**: Number of FACCH frames that the MS under test failed to decode properly (= number of retransmission requests received from the MS)

- **FER**: Frame Error Rate, percentage of the repeated frames relative to the total number of frames sent:
  <FER> = <L2 Frames Repeated> / <Frames Sent>
- **Frames sent**: Number of L2 frames sent since the start of the (single shot) measurement.

According to GSM specifications, each FACCH block can be sent twice to improve the robustness of FACCH signaling. If the repeated FACCH functionality is enabled ("Connection > Circuit Switched > Repeated FACCH: On" in the "GSM Signaling Configuration" dialog), the MS will only request a retransmission if it cannot decode both frames. A retransmission request in repeated FACCH mode causes the retransmission ("repetition") of both frames as shown below.

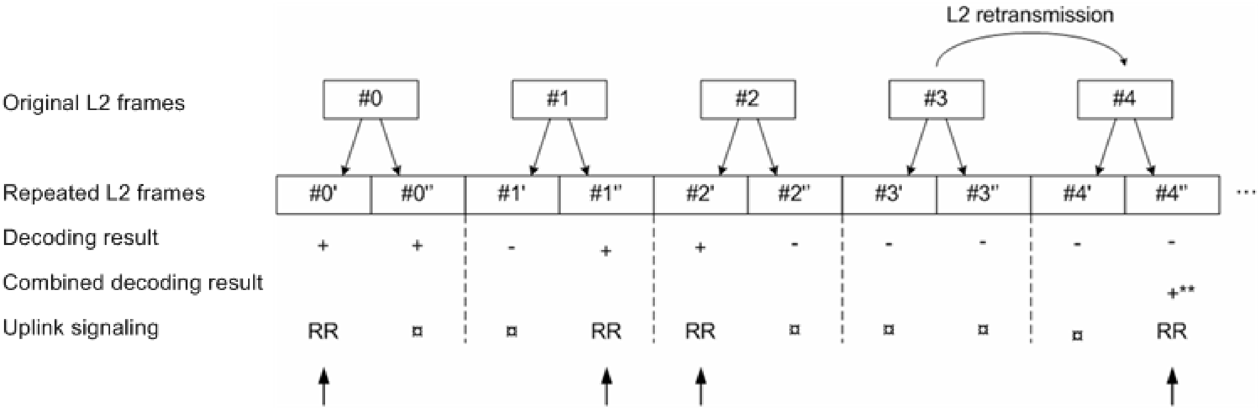


Fig. 2-13: FER for repeated FACCH

+ = L2 frame decoded successfully
- = L2 frame not decoded successfully
+** = combined decoding succeeded
RR = ready to receive
¤ = no action/response

A "L2 Frames Repeated" event occurs if the MS does not send an RR message in a sequence of two identical FACCH blocks. In the example above, this occurs for L2 frame #3; the measured FER is 1/5 = 20 %.

Reference sensitivity tests for full-rate and half-rate FACCHs and for full-rate repeated FACCHs are specified in 3GPP TS 51.010, clause 14.2.

2.2.11.6 Mode "FER SACCH"

The R&S CMW provides FER SACCH tests for either non-repeated or repeated DL SACCH transmission.

The downlink Slow Associated Control Channel (SACCH) is used to transmit slow, but regularly changing control information, such as Power Control Level (PCL) instructions, to the MS. On uplink, the SACCH carries e.g. the receiver reports of the MS. On a full rate TCH, SACCH bursts occur once every 26 TDMA frames. Each SACCH message ("SACCH Frame", also termed SACCH "Block") is interleaved over four SACCH bursts; therefore a SACCH frame can be sent once every 480 ms. In "FER SACCH" mode the

R&S CMW sends PCL instructions over the SACCH and compares them with the reported PCL of the MS.

To make the evaluation possible, varying PCL values are transmitted in consecutive SACCH frames. The R&S CMW changes between the PCL values 7, 8, and 9, following the rules for the repeated SACCH reference sensitivity test (see 3GPP TS 51.010, clause 14.2.26).

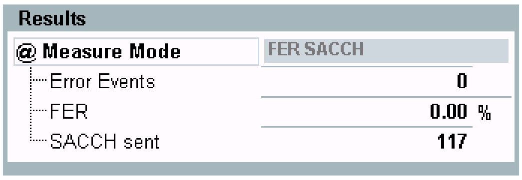


Fig. 2-14: BER CS results (FER SACCH mode)

- **Error events**: Number of SACCH frames that the MS under test failed to decode properly (= number of reported PCL values which differ from the PCL transmitted on downlink).
- **FER**: Frame Error Rate, percentage of the error events relative to the total number of SACCH frames sent:
  <FER> = <Error Events> / <SACCH Sent>
- **SACCH sent**: Number of SACCH frames sent since the start of the (single shot) measurement. The first SACCH frame is not counted because an error decision involves the comparison of two consecutive frames or frame pairs (see examples below).

According to GSM specifications, each SACCH frame can be sent twice to improve the robustness of SACCH signaling. If the repeated SACCH functionality is enabled ("Connection > Circuit Switched > Repeated SACCH: On" in the "GSM Signaling Configuration" dialog), an error event will be counted only if the MS fails to decode both frames. A repeated SACCH transmission without error events is shown below. Messages in angular brackets [...] are transmitted in the same reporting period. Curly brackets {...} enclose repeated SACCH frames.

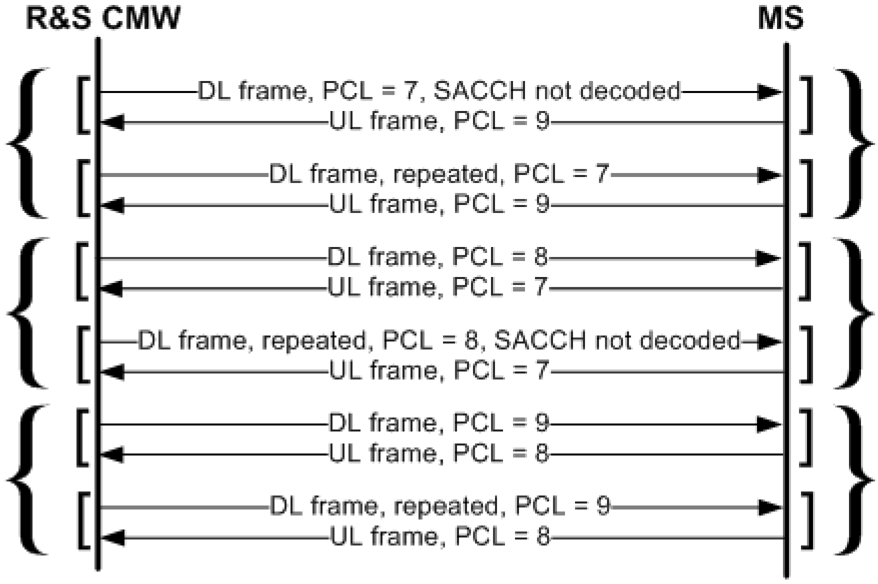


Fig. 2-15: FER for repeated SACCH (no error event)

In the following example, the MS fails to detect both the first SACCH frame and its repetition.

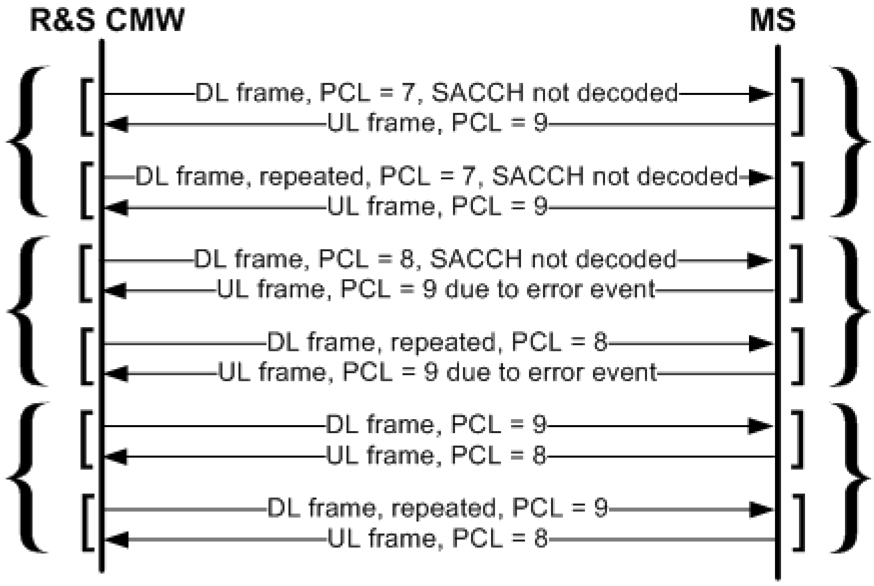


Fig. 2-16: FER for repeated SACCH (one error event)

An "Error Event" occurs if the MS does not report the requested PC value after a sequence of two SACCH blocks. In the example above, this occurs for the first frame pair. The R&S CMW counts two "SACCH Sent" frame pairs; the measured FER is 1/2 = 50 %.

Start condition for FER SACCH tests

In the current software version, the R&S CMW expects a definite initial input power at the beginning of the FER SACCH test. Always set the PCL to 7 ("RF Settings > TCH/PDCH > Circuit Switched > PCL: 7") before you initiate the test.

2.2.11.7 Mode "RBER/UFR"

In loop mode D the MS receiver detects unreliable frames (UFI=1) and bad frames (BFI=1). Bad frames and unreliable frames are declared as erased frames.

The Residual Bit Error Ratio (RBER) is defined as the Bit Error Ratio (BER) in frames which have not been declared as erased.

The Unreliable Frame Ratio (UFR) is defined as the ratio of frames declared as erased (BFI=1), or unreliable (UFI=1), to the total number of frames transmitted.

In this context two measurement results are defined. The RBER characterizes the quality of transmission of the residual frames and the UFR indicates the percentage of unreliable frames.

Please note that this mode is relevant for the half-rate V1 speech frames only.

For background information see chapter 2.2.11.12, "Test Loops", on page 46 and chapter 2.2.11.13, "Frame Structure for BER CS Tests", on page 47.

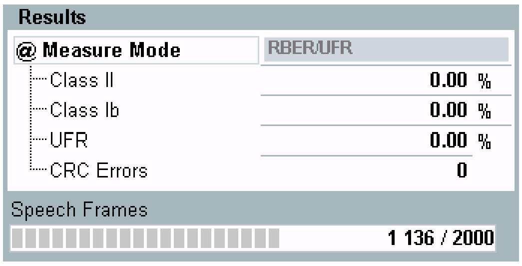


Fig. 2-17: BER CS results (RBER/UFR mode)

- **Class II / Class Ib**: Residual bit error rate for Class II / Class Ib bits
- **UFR**: Unreliable frame ratio, percentage of erased and unreliable frames (relative to total number of transferred frames)
- **CRC errors**: Number of speech frames with failed CRC check. The check is performed in the R&S CMW on looped-back speech frames. Bits in frames with CRC error do not contribute to the RBER and UFR results.
- **Speech frames**: Number of already evaluated speech frames without CRC error and total number of speech frames to be evaluated.

2.2.11.8 Mode "AMR Inband FER"

In "AMR Inband FER" mode the Frame Error Rate (FER) for inband signaling codewords is determined. Loop mode I is used. An AMR codec must be selected as "Traffic Mode".

This measurement mode allows to measure the reference sensitivity and the co-channel rejection according to 3GPP TS 51.010 (see sections "Reference Sensitivity – TCH/AFS-INB, TCH/AHS-INB" and "Co-Channel Rejection – TCH/AFS-INB, TCH/AHS-INB"; interfering signals must be provided by external means).

The UL and DL codec modes are changed every 22 speech frames according to the scanning pattern specified in 3GPP TS 51.010.

For information about loop mode I see chapter 2.2.11.12, "Test Loops", on page 46.

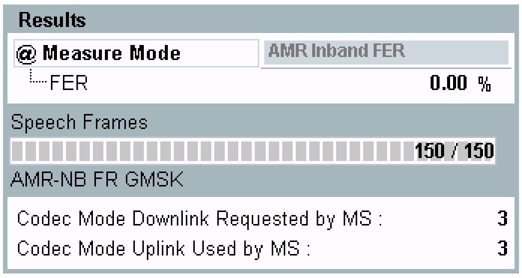


Fig. 2-18: BER CS results (AMR Inband FER mode)

- **FER**: Frame Error Rate for inband signaling codewords, percentage of erroneous frames (relative to total number of transferred frames)
  A frame error is registered when the UL codeword received from the MS differs from the transmitted DL codeword.
- **Speech frames**: number of already evaluated speech frames and total number of speech frames to be evaluated. One AMR speech frame contains one codeword.

2.2.11.9 Mode "Mean BEP"

"Mean BEP" mode is possible, if enhanced measurement report is switched on. In "Mean BEP" mode, the R&S CMW transmits a full channel coded downlink DL signal. This allows the MS to calculate enhanced measurement reports.

Loop mode C is used, so the internal test loop of the MS is closed before any channel decoding/encoding and the bit error rate is evaluated on a burst by burst basis.

The calculation of the BER result is done in the same way as in Mode "Burst by Burst". Additional intermediate results at the remote interface are available while the measuement is running, see FETCh:INTermediate:GSM:SIGN<i>:BER:CSWitched:MBEP?. This allows to get BER results related with the enhanced measurement results from the MS. The intermediate results are grouped within the frame number where they were measured.

For background information see chapter 2.2.11.12, "Test Loops", on page 46 and chapter 2.2.11.13, "Frame Structure for BER CS Tests", on page 47.

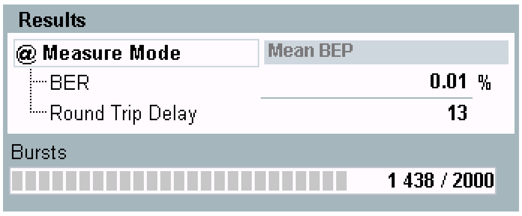


Fig. 2-19: BER CS results (mean BEP mode)

- **BER**: Bit Error Rate, average Bit Error Probability (BEP) of the bursts, averaged over all bursts within the MS reporting period.
- **Round trip delay**: duration in bursts the loopback signal needs from a transmission to detection by the R&S CMW.
- **Bursts**: number of already evaluated bursts and total number of bursts to be evaluated.

2.2.11.10 Mode "Signal Quality"

"Signal Quality" mode is possible, if enhanced measurement report is switched off. In "Signal Quality" mode, the R&S CMW transmits a full channel coded downlink DL signal. This allows the MS to calculate normal measurement reports.

Loop mode C is used, so the internal test loop of the MS is closed before any channel decoding/encoding and the bit error rate is evaluated on a burst by burst basis.

The calculation of the BER result is done in the same way as in Mode "Burst by Burst". Additional intermediate results at the remote interface are available while the measuement is running, see `FETCh:INTermediate:GSM:SIGN<i>:BER:CSWitched:MBEP?`. This allows to get BER results related with RX quality full and RX quality sub results of the normal measurement result from the MS. The intermediate results are grouped within the frame number where they were measured.

The received signal quality is determined by the MS. The reported RX quality full result is measured over the full set of TDMA frames. The RX quality sub result is obtained in a subset of four SACCH frames and the special frame types employed during discontinuous transmission (DTX). For details refer to the radio subsystem link control specification 3GPP TS 45.008.

The received signal quality is expressed in terms of dimensionless quality levels, see table below.

Table 2-2: Mapping between the RX quality value and BER

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 %

RX quality	Bit error rate
5	3.2 % to 6.4 %
6	6.4 % to 12.8 %
7	12.8 % to 100 %

For background information see chapter 2.2.11.12, "Test Loops", on page 46 and chapter 2.2.11.13, "Frame Structure for BER CS Tests", on page 47.

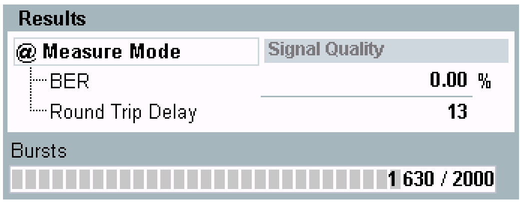


Fig. 2-20: BER CS results (signal quality mode)

- **BER**: Bit Error Rate, percentage of received erroneous bits (relative to total number of received bits).
- **Round trip delay**: duration in bursts the loopback signal needs from a transmission to detection by the R&S CMW.
- **Bursts**: number of already evaluated bursts and total number of bursts to be evaluated.

2.2.11.11 Mode "BFI"

The BFI test verifies the effectiveness of the MS under DTX conditions.

The BFI is measured on a full or half rate speech by counting the number of undetected bad frames.

During the test the R&S CMW simulates DTX operation. Loop A is required during the test. From the looped back signal, the R&S CMW records the number of frames where the Bad Frame Indication (BFI) is not set.

The BFI tests are specified in 3GPP TS 51.010, section 14.1.

For background information see chapter 2.2.11.12, "Test Loops", on page 46.

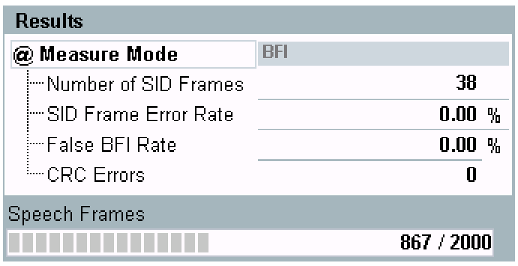


Fig. 2-21: BER CS results (BFI mode)

- **Number of SID frames**: number of Silence Insertion Descriptor (SID) frames that have been sent.
- **SID frame error rate**: number of SID frames that the MS did not receive relative to the total number of sent SID frames.
- **False BFI rate**: the relative number of DTX frames that the MS did not recognize as bad frames. SID frames have no impact on the false BFI rate.
- **CRC errors**: number of speech frames with failed CRC check. The check is performed in the R&S CMW on looped-back speech frames.
- **Speech frames**: number of already evaluated speech frames and total number of speech frames to be evaluated.

2.2.11.12 Test Loops

The MS test loops for conformance tests are specified in 3GPP TS 44.014. For BER CS measurements the following test loops are relevant (see also next figure):

- **Loop A**:
  Loop A is a TCH loop placed after the channel decoder, including signaling of erased frames.
  Every good speech frame received by the MS is taken from the output of the channel decoder, put into the channel encoder and transmitted back to the instrument. For received bad frames only zeros are put into the channel encoder and transmitted back. Bad frames detected in the MS receiver are also called erased frames.
  Loop A is required to determine the Frame Erasure Ratio (FER) and the Residual Bit Error Ratio (RBER).
- **Loop B**:
  Loop B is a TCH loop placed after the channel decoder, without signaling of erased frames.
  It loops back all speech frames, including bad frames. The content of a bad (erased) frame is taken from the output of the channel decoder, put into the channel encoder and transmitted back to the instrument, marked as good speech frame.
  Loop B is required to determine class Ib and class II bit error ratios.
- **Loop C**:
  Loop C is a burst by burst TCH loop placed after the demodulator. It bypasses the channel decoder and the following signal-processing stages in the MS. No CRC values are calculated and no CRC check is performed.
  Loop C is required for burst by burst BER tests.
- **Loop D**:
  Loop D is a TCH loop for Half Rate Traffic Channels (TCH/HR) placed after the channel decoder, including signaling of erased frames and unreliable frames.
  Every good speech frame received by the MS is taken from the output of the channel decoder, put into the channel encoder and transmitted back to the instrument. For received bad speech frame or an unreliable frame (BFI = 1 or UFI = 1) only zeros are put into the channel encoder and transmitted back. Bad frames detected in the MS receiver are declared as erased frames.
  Loop D is required to determine the Unreliable Frame Ratio (UFR) and the Residual Bit Error Ratio (RBER).

- **Loop I**:
  Loop I is a TCH loop placed after the channel decoder, without signaling of erased frames.
  It loops back the decoded downlink inband signaling bits. The decoded downlink Codec Mode Indication (CMI) is looped back as uplink Codec Mode Request (CMR). The decoded downlink Codec Mode Command (CMC) is sent back as uplink CMI.
  Loop I is required to determine the frame error rate for inband signaling codewords.

The following figure provides an overview of the CS test loops. The measurement modes related to the test loops are indicated in brackets.

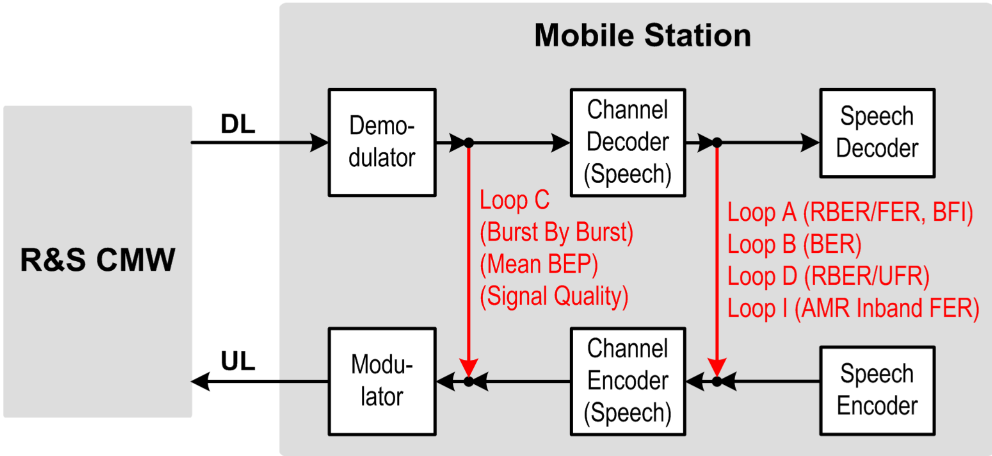


Fig. 2-22: Loops for BER CS measurements

2.2.11.13 Frame Structure for BER CS Tests

The GSM speech encoder combines the speech information into "speech frames". The bits of each speech frame are divided into bit classes (see 3GPP TS 45.003):

- Class II bits are unprotected. They are most likely to produce bit errors in the MS receiver.
- Class I bits are protected during channel encoding:
  - Class Ib bits are protected by the convolutional code.
  - Class Ia bits are protected by a cyclic code and the convolutional code.

Depending on the measure mode the basic data entities for the BER CS measurement are either bursts, speech frames or FACCH / SACCH frames. The structure of a burst or speech frame depends on the channel coder settings. The following table provides an overview of the bit contents.

Table 2-3: Frame structure of bursts and speech frames

Unit	Channel coder	Bits per burst or speech frame
Bursts	GMSK full-rate (V1, V2, AMR-NB, AMR-WB)	114 class II bits
	GMSK half-rate (V1, AMR-NB)	57 class II bits (114 bits per burst and every second burst canceled = average 57 bits/burst)
	8PSK full-rate (AMR-WB)	342 class II bits
	8PSK half-rate (AMR-NB and AMR-WB)	171 class II bits (342 bits per burst and every second burst canceled = average 171 bits/burst)
Speech Frames	full-rate version 1	260 (50 class Ia + 132 class Ib + 78 class II)
	full-rate version 2	244 (50 class Ia + 124 class Ib + 70 class II)
	half-rate version 1	112 (22 class Ia + 73 class Ib + 17 class II)
	AMR-NB full-rate GMSK: 12.20 kbit/s 10.20 kbit/s 7.95 kbit/s 7.40 kbit/s 6.70 kbit/s 5.90 kbit/s 5.15 kbit/s 4.75 kbit/s	 244 (81 class Ia + 163 class Ib) 204 (65 class Ia + 139 class Ib) 159 (75 class Ia + 84 class Ib) 148 (61 class Ia + 87 class Ib) 134 (55 class Ia + 79 class Ib) 118 (55 class Ia + 63 class Ib 103 (49 class Ia + 54 class Ib) 95 (39 class Ia + 56 class Ib)
	AMR-NB half-rate GMSK: 7.95 kbit/s 7.40 kbit/s 6.70 kbit/s 5.90 kbit/s 5.15 kbit/s 4.75 kbit/s	 159 (67 class Ia + 56 class Ib + 36 class II) 148 (61 class Ia + 59 class Ib + 28 class II) 134 (55 class Ia + 55 class Ib + 24 class II) 118 (55 class Ia + 47 class Ib + 16 class II) 103 (49 class Ia + 42 class Ib + 12 class II) 95 (39 class Ia + 44 class Ib + 12 class II)
	AMR-NB half-rate 8PSK: 12.20 kbit/s 10.20 kbit/s 7.95 kbit/s 7.40 kbit/s 6.70 kbit/s 5.90 kbit/s 5.15 kbit/s 4.75 kbit/s	 244 (81 class Ia + 163 class Ib) 204 (65 class Ia + 139 class Ib) 159 (75 class Ia + 84 class Ib) 148 (61 class Ia + 87 class Ib) 134 (55 class Ia + 79 class Ib) 118 (55 class Ia + 63 class Ib 103 (49 class Ia + 54 class Ib) 95 (39 class Ia + 56 class Ib)
	AMR-WB full-rate GMSK: 12.65 kbit/s 8.85 kbit/s 6.60 kbit/s	 253 (72 class Ia + 181 class Ib) 177 (64 class Ia + 113 class Ib) 132 (54 class Ia + 78 class Ib)

Unit	Channel coder	Bits per burst or speech frame
	AMR-WB full-rate 8PSK: 12.65 kbit/s 8.85 kbit/s 6.60 kbit/s	 253 (72 class Ia + 181 class Ib) 177 (64 class Ia + 113 class Ib) 132 (54 class Ia + 78 class Ib)
	AMR-WB half-rate 8PSK: 23.85 kbit/s 15.85 kbit/s 12.65 kbit/s 8.85 kbit/s 6.60 kbit/s	 477 (72 class Ia + 405 class Ib) 317 (72 class Ia + 245 class Ib) 253 (72 class Ia + 181 class Ib) 177 (64 class Ia + 113 class Ib) 132 (54 class Ia + 78 class Ib)

2.2.12 BER PS Measurement

The Bit Error Rate (BER) measurement for Packet Switched (PS) connections is installed together with the "GSM Signaling" application. It provides a separate measurement tab and configuration dialog and can be enabled in the "Measurement Controller" dialog, entry "RX Measurement...".

The BER PS measurement can be performed with test loop (test mode B, SRB mode) or without test loop (test mode A).

With test loop the BER measurement tests the transmission performance on the complete signal path from the R&S CMW to the MS under test and back. The results are derived from a comparison of the output signal sent by the R&S CMW with the signal looped back by the mobile station.

In test mode A (no test loop) measurement results related to the Uplink State Flag (USF) can be measured.

The BER PS measurement is especially suitable to assess the characteristics and the performance of the mobile station receiver at low RF power levels. Because of the higher signal level, transmission errors produced on the way back (from the MS to the instrument) can usually be neglected. However, in test mode A and B data destroyed on the way back is detected in a cyclic redundancy check (CRC) and not taken into account in the calculation of transmission errors.

Test SIM

Most mobiles require a test SIM in order to close a test loop and perform BER tests. Rohde & Schwarz provides an appropriate test SIM card (R&S CMW-Z04, stock no. 1207.9901.02).

2.2.12.1 Test Procedure

For BER PS measurements a Packet Switched (PS) connection is required.

The measurement involves the following stages:

1. Configure the "GSM Signaling" application.
   a) Configure the PS connection parameters (see chapter 2.3.8.5, "Packet Switched Connection Parameters", on page 133):
      - Set "Service Selection" to test mode A, test mode B or SRB.
      - Select the UL coding scheme and a data source.
      - Configure the slot offset.

   b) Specify the slot configuration (see chapter 2.3.1.7, "Slot Configuration Dialog", on page 81):
      - Ensure that the UL slot to be measured and the related DL slot are active. Additional UL and DL slots may be active, but only one slot is measured.
      - Select the DL coding schemes.

   c) If several UL slots are active, select the slot to be measured, see "Measurement Slot UL" on page 143.
      If only one UL slot is active, this step can be skipped (slot will be selected automatically).
2. Connect your mobile.
3. Set up a PS connection. Wait until the R&S CMW has entered the "TBF Established" state.
   For details refer to chapter 2.2.2, "Initiating Signaling Tests", on page 16.
4. Open the BER PS measurement, e.g. via the "GSM RX Meas" softkey.
5. Configure the BER PS measurement, e.g. the measure mode or limits.
6. Press ON | OFF to start the BER test.
7. Wait until the R&S CMW has measured the full statistics cycle and read the results from the left part of the tab.

2.2.12.2 Measurement Mode

In BER PS measurement the receiver quality is measured for Packet Data Traffic Channels (PDTCHs). These measurements can be used as an alternative to the Block Error Ratio (BLER) measurement. The BLER measurement is defined in 3GPP TS 51.010. See also chapter 2.2.13, "BLER Measurement", on page 55.

In the results, for each slot the configured DL power is displayed for information (in the figure either -80 dBm or Off).

Each GPRS/EGPRS radio block is divided into the header information including the Uplink State Flag (USF) and the data bits. Only the data bits of a radio block contribute to the BER and DBLER calculation. The USF contributes to the "USF BLER" and to the "False USF Detection" result.

The measurement results are displayed separately for each timeslot used for downlink and uplink, however, the uplink signal is delayed by 3 timeslot periods.

Mode "BER/DBLER"

The R&S CMW compares the looped-back data (N bit) in uplink to the transmitted data in downlink. Assuming statistical independence of the bit errors the result is equal to the BER of all N data bits.

Mode "Mean BEP"

Mean BEP denotes the average Bit Error Probability (BEP) of the radio blocks, averaged over all blocks within the MS reporting period.

The MS calculates the mean bit error probability ($Mean\_BEP_{block}$) as defined below for the last four consecutive slots of each fully received and correctly decoded block.

$Mean\_BEP_{block} = 1/4\sum(BEP_{bursti}),\ i = 1 \ldots 4$

$Mean\_BEP = \text{average of } Mean\_BEP_{block}$

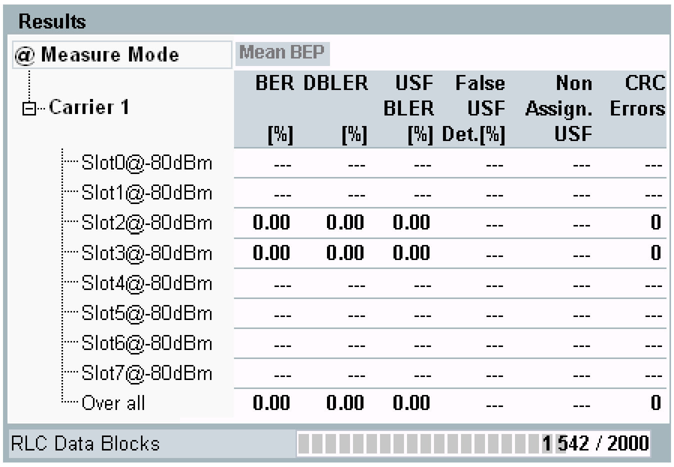
Mean BEP is defined in standard 3GPP TS 45.008. It is expressed in terms of dimensionless values, see following table.

Table 2-4: Range of parameter Mean BEP

Mean BEP	$\log_{10}$(actual BEP) GMSK modulation	$\log_{10}$(actual BEP) 8PSK, 16-QAM, 32-QAM modulation
0	> -0.60	> -0.60
1	-0.70 to -0.60	-0.64 to -0.60
2	-0.80 to -0.70	-0.68 to -0.64
...	...	...
29	-3.50 to -3.40	-3.44 to -3.28
30	-3.60 to -3.50	-3.60 to -3.44
31	< -3.60	< -3.60

2.2.12.3 Measurement Results

The results of the BER measurement are shown in the left part of the tab. They are described briefly below.



Results

@ Measure Mode | Mean BEP

Carrier 1	BER [%]	DBLER [%]	USF BLER [%]	False USF Det.[%]	Non Assign. USF	CRC Errors
Slot0@-80dBm	---	---	---	---	---	---
Slot1@-80dBm	---	---	---	---	---	---
Slot2@-80dBm	0.00	0.00	0.00	---	---	0
Slot3@-80dBm	0.00	0.00	0.00	---	---	0
Slot4@-80dBm	---	---	---	---	---	---
Slot5@-80dBm	---	---	---	---	---	---
Slot6@-80dBm	---	---	---	---	---	---
Slot7@-80dBm	---	---	---	---	---	---
Over all	0.00	0.00	0.00	---	---	0

RLC Data Blocks 1 542 / 2000

Fig. 2-23: BER PS results

For each slot the configured DL power is displayed for information (in the figure either -80 dBm or Off).

- **BER**: Bit Error Rate, only class II bits transmitted
- **DBLER**: Data Block Error Rate, percentage of received blocks with at least one erroneous data field
- **USF BLER**: Uplink State Flag Block Error Rate, percentage of USFs in data blocks assigned to the MS but received in error so that the MS fails to start transmission
- **False USF Det.**: False USF Detection, percentage of USFs in data blocks not assigned to the MS but received in error so that the MS nevertheless starts transmission
  The USF duty cycle must be less than 100% in order to obtain a valid result, see "USF Duty Cycle" on page 84 .
- **Non Assign. USF**: Number of USFs in data blocks not assigned to the MS.
- **CRC Errors**: Number of RLC data blocks with failed CRC check. The check is performed in the R&S CMW on the looped-back data. Bits in data blocks with CRC errors do not contribute to the measurement results. In SRB loopback mode no CRC check is performed.
- **RLC Data Blocks/Radio Blocks**: Number of evaluated RLC data blocks without CRC error (test mode B) or number of radio blocks (SRB loop). For configuration of the total number of blocks to be evaluated, see "RLC Data Blocks" on page 154.

2.2.12.4 Test Modes

The GPRS test modes A and B are specified in 3GPP TS 44.014. Any (E)GPRS MS must be capable of operating either in test mode A, in test mode B or in both test modes. In addition to the GPRS test modes, 3GPP defines an EGPRS Switched Radio Block (SRB) loopback mode. It must be supported by any EGPRS MS.

- **Test Mode A**:
  In test mode A, the MS is commanded to continuously transmit RLC data blocks containing a pseudo random data sequence.

The test mode can be maintained until the TBF is released. Alternatively the duration of test mode A can be limited to a fixed number of PDUs that the MS has to transmit.

- **Test Mode B**:
  In test mode B, the R&S CMW transmits RLC blocks on the downlink containing a pseudo random data sequence. The MS loops back the received data.
  As long as the TBF is established, the test mode is maintained. Symmetrical coding schemes must be used (configured) in downlink and uplink.
- **SRB**:
  The EGPRS switched radio block loopback mode is a physical RF layer loopback performed before channel decoding. It is designed to support BER testing for EGPRS.
  Coding schemes CS-x are not supported in SRB loopback mode.
  As there is no channel decoding/encoding, no CRC values are calculated and no CRC check is performed.

It depends on the test mode which measurement results are available. The following table provides an overview.

Result	Test mode A	Test mode B	SRB
BER	-	X	X
DBLER	-	X	X
USF BLER	X[1)]	X	X
False USF Detect	X	X	X
CRC Errors	X	X	-
[1)] Please note that in test mode A the "Uplink State Flag" in the downlink signal is always CS-1 coded, independent of the currently configured downlink coding scheme.			

The following figure shows the data flow for a packet switched BER measurement (SRB loop and Test Mode A/B) and a Block Error Rate (BLER) measurement ("RLC Layer", Ack/Nack).

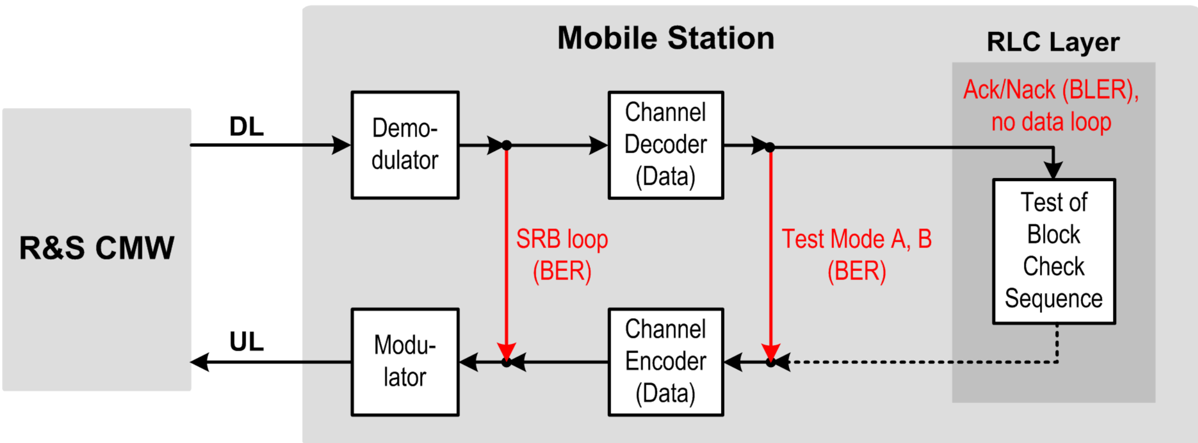


Fig. 2-24: Loops for BER PS and BLER measurements

2.2.12.5 Comparison of DBLER and BLER

The Data Block Error Rate (DBLER) considers only data fields. The possibility of an error in the header is not taken into account. In contrast the Block Error Ratio (BLER) considers errors both in data fields and in the header.

Thus the DBLER is a good approximation of the BLER if the probability for an error in the data fields, which depends on the used coding scheme, is much higher than the probability for an error in the header.

The difference between the BLER defined in 3GPP TS 51.010 and the DBLER 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. The figure below shows a comparison for the coding schemes CS-4 and CS-1.

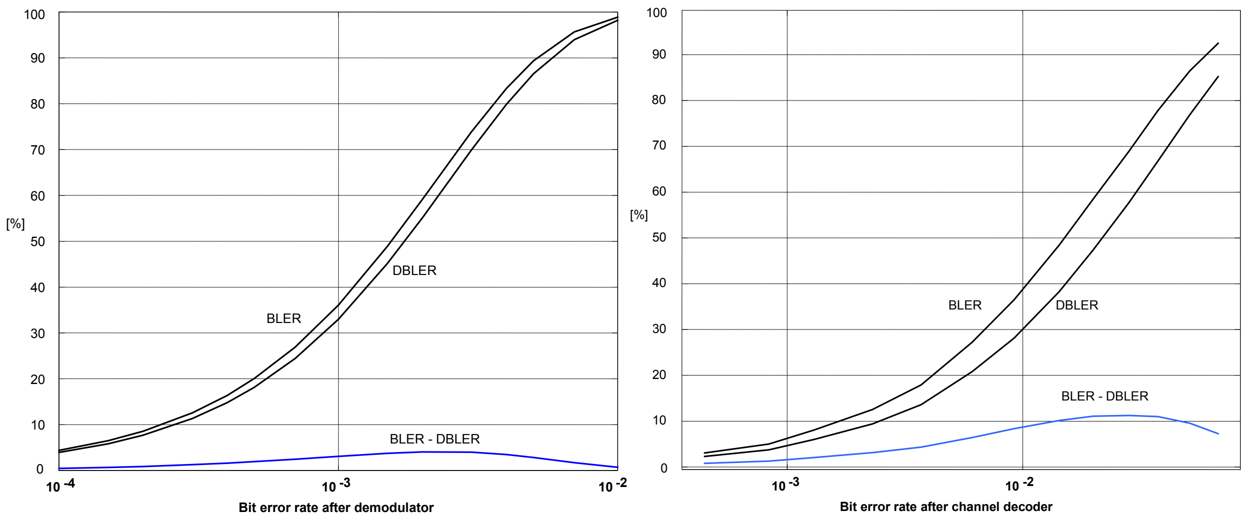


Fig. 2-25: Comparison between BLER and DBLER: CS-4 (left diagram) and CS-1

2.2.12.6 Bits per Radio Block / RLC Data Block

The number of bits contained in an RLC data block depends on the (modulation and) coding scheme. Using the following table you can determine the number of bits contained in a radio block or RLC data block.

Please note that a BER PS measurement with test mode B is not supported for the EGPRS2-A modulation and coding schemes DAS-i and UAS-i.

Channel coding	Bits per RLC data block	RLC data blocks per radio block
CS-1	160	1
CS-2	240	1

Channel coding	Bits per RLC data block	RLC data blocks per radio block
CS-3	288	1
CS-4	400	1
MCS-1	176	1
MCS-2	224	1
MCS-3	296	1
MCS-4	352	1
MCS-5	448	1
MCS-6	592	1
MCS-7	448	2
MCS-8	544	2
MCS-9	592	2
DAS-5	448	1
DAS-6	544	1
DAS-7	656	1
DAS-8	448	2
DAS-9	544	2
DAS-10	656	2
DAS-11	544	3
DAS-12	656	3
UAS-7	448	2
UAS-8	512	2
UAS-9	592	2
UAS-10	448	3
UAS-11	512	3

2.2.13 BLER Measurement

A Block Error Ratio (BLER) measurement is based on a comparison of the transmitted data with the data that the mobile under test receives and demodulates.

For this purpose, the R&S CMW transmits a definite number of RLC blocks in different timeslots. The MS receives the RLC blocks and checks the "Block Check Sequence" (BCS). If the BCS indicates an error, the MS sends a "Packet Not Acknowledge" in the "Packet Downlink Ack/Nack" message.

In contrast to BER measurements, the BLER measurement does not require a loop-back of data; the evaluation is performed by the mobile under test; refer to figure 2-24.

2.2.13.1 Test Procedure

For BLER measurements a Packet Switched (PS) connection is required.

The measurement involves the following stages:

1. Configure the "GSM Signaling" application.
   a) Configure the PS connection parameters (see chapter 2.3.8.5, "Packet Switched Connection Parameters", on page 133):
      - Set "Service Selection" to "BLER".
      - For EGPRS receiver tests, configure "Incremental Redundancy" (disable for layer 1 tests, enable for incremental redundancy performance tests).
      - Select a data source.

   b) Specify the slot configuration (see chapter 2.3.1.7, "Slot Configuration Dialog", on page 81):
      - Specify a slot configuration compatible to the multislot class of the MS. One active UL slot is sufficient. Additional UL slots do not speed up the measurement. Up to 5 active DL slots are supported by the measurement and provide maximum measurement speed.
        The uplink measurement slot setting is irrelevant for the BLER measurement.
      - Select the DL coding schemes.

   c) See also chapter 2.3.1.7, "Slot Configuration Dialog", on page 81.
2. Connect your mobile.
3. Set up a PS connection. Wait until the R&S CMW has entered the "TBF Established" state.
   For details refer to chapter 2.2.2, "Initiating Signaling Tests", on page 16.
4. Open the BLER measurement, e.g. via the "GSM RX Meas" softkey.
5. Configure the BLER measurement.
6. Press ON | OFF to start the BLER test.
7. Wait until the R&S CMW has measured the full statistics cycle and read the results from the left part of the tab.

2.2.13.2 Measurement Results

The results of the BLER measurement are shown in the left part of the tab. They are described briefly below.

Carrier 1	BLER [%]	RLC Data Blocks	Data rate [kBit/s]
Slot0/Off	---	---	---
Slot1/Off	---	---	---
Slot2@-80dBm	11.03	145	7.78
Slot3@-80dBm	8.97	145	7.96
Slot4@-80dBm	10.27	146	7.90
Slot5@-80dBm	6.90	145	8.14
Slot6/Off	---	---	---
Slot7/Off	---	---	---
Over all	9.29	581	31.79

Long-Term Throughput:			
Over All	23.64 kbit/s	Per Slot	5.91 kbit/s
RLC Data Blocks			581 / 2000
Corrupted Blocks	41		
False ACKed Blocks	0		

Fig. 2-26: Display of BLER results

For each slot the configured DL power is displayed for information (in the figure either -80 dBm or Off).

BLER

Block Error Ratio, erroneous RLC data blocks received by the MS since the start of the measurement.

The BLER is presented as absolute number or as percentage (relative to the total number of received RLC data blocks). To switch between the display modes use the "Results" hotkey accessible via the "Display" softkey.

The BLER is measured per timeslot. The "Over all" result in "Absolute" mode is the sum over all timeslots. In "Percentage" mode it is the weighted average over all timeslots, i.e. the sum of (BLER in each slot multiplied with RLC data blocks in the slot) divided by the total number of RLC data blocks.

RLC Data Blocks (column)

Indicates the number of RLC data blocks received by the MS per timeslot and in total ("Over all") since the start of the measurement

Data rate

The RLC data rate corresponds to the net data transmission rate. It considers the RLC data blocks that are correctly received since the start of the measurement so that the data rate decreases as the BLER increases. Besides, the data rate depends on the number of bits per block and thus on the coding scheme; see chapter 2.2.12.6, "Bits per Radio Block / RLC Data Block", on page 54.

At the very beginning of a measurement the measured data rates fluctuate and may even show data rates above the theoretical maximum value. For details see chapter 2.2.13.3, "Multiframe Structure and Data Rate", on page 58.

Furthermore during the BLER measurement the R&S CMW periodically transmits a packet system information message on one of the configured slots. This message is not recognized as a data block, and it is therefore not counted as RLC data block, but it requires about 20 ms transmission time, which are included in the total measurement time. In other words, the measurement time remains the same although periodically a data block is omitted, which results in a slightly lower data rate than theoretically possible.

The data rate is determined for each timeslot separately. The "Over all" result is the sum of the data rates in all enabled timeslots.

Long-Term Throughput
Average overall RLC data rate since the start of the measurement ("Over All") and divided by the number of active slots ("Per Slot").

The long-term throughput is calculated from the number of transmitted blocks and the related transmission time. All blocks from the beginning of the current measurement cycle up to the lower end of the DL window are counted, e.g. up to the first "gap" which is caused by the oldest block that was acknowledged to be faulty by the MS.

Blocks sent after this "gap" are not relevant for the count, even if they are received correctly, which usually causes the long-term throughput to be a little lower than the theoretical data transmission maximum.

The effects described for the "Data rate" result apply also to this result (fluctuation due to multiframe structure and lower throughput due to packet system information message).

According to 3GPP TS 51.010, section 14.18 "EGPRS Receiver Tests", an MS operating in Incremental Redundancy RLC mode must achieve the following long term throughput:

- for EGPRS with MCS-9: 20 kbps per timeslot
- for EGPRS2-A with DAS-12: 33 kbps per timeslot

RLC Data Blocks (row)
Number of evaluated RLC data blocks. For configuration of the total number of RLC data blocks to be evaluated, see "RLC Data Block Count" on page 157.

Corrupted Blocks
Number of corrupted blocks the R&S CMW generates. For configuration of the corrupted data rate see "BCS Data Corruption Rate" on page 137.

False Acknowledged Blocks
Number of corrupted blocks reported by the MS incorrectly as fault free.

2.2.13.3 Multiframe Structure and Data Rate

The R&S CMW provides a signal with a 52-multiframe structure as shown in the figure below. Each 52-multiframe contains 12 radio blocks (B0 to B11) with 4 consecutive frames each, 2 idle frames (X) and 2 frames usable for the Packet Timing Advance Control Channel (X). All radio blocks in the signal are coded and modulated with the same coding and puncturing scheme.

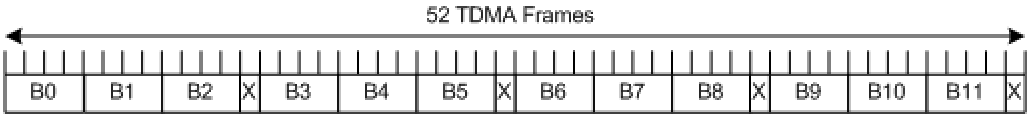


Fig. 2-27: 52-multiframe for PDCH

This multiframe structure is important when measuring data rates. Only the radio blocks carry data and contribute to the data rate. Thus the data rate measured for a single radio block is higher than the average data rate of an entire multiframe.

At the very beginning of a measurement, the measured data rates fluctuate even for an ideal MS. While radio block B0 to B2 are measured, the data rate is higher than the theoretical maximum average value. Then the 13th frame is measured (not carrying data) and the data rate drops to the theoretical maximum. For B3 to B5 the data rate rises again and drops again for the 26th frame. This effect is relevant within the first seconds of a BLER measurement.

Example:

Assume a single slot with coding scheme MCS-9, two RLC data blocks per radio block and 592 bits per RLC data block (see also chapter 2.2.12.6, "Bits per Radio Block / RLC Data Block", on page 54).

A multiframe carries *12 radio blocks * 2 RLC data blocks / radio block * 592 bits / RLC data block = 14208 bits*. The transmission of a multiframe requires 240 ms. Thus the theoretical average data rate for the multiframe is *14208 bits / 240 ms = 59.2 kbit/s*.

The following table shows the measured average data rate for the first 12 radio blocks. The following formula is used:

*<Data Rate> = <RLC data blocks> * 592 bits / (<Frames> * 240 ms / 52)*

Position in Multiframe	Frames	RLC Data Blocks	Data Rate [kbit/s]
B0	4	2	64.133
B1	8	4	64.133
B2	12	6	64.133
X	13	6	59.2
B3	17	8	60.361
B4	21	10	61.079
B5	25	12	61.568
X	26	12	59.2
B6	30	14	59.858
B7	34	16	60.361
B8	38	18	60.758
X	39	18	59.2
B9	43	20	59.659
B10	47	22	60.040

Position in Multiframe	Frames	RLC Data Blocks	Data Rate [kbit/s]
B11	51	24	60.361
X	52	24	59.2

2.2.14 RLC Throughput Measurement

The GSM Signaling "RLC Throughput" measurement provides the total data throughput (PDU) and the useful data throughput (SDU) in the downlink and in the uplink.

RLC Throughput Dialogs

The R&S CMW provides a separate tab and configuration dialog for RLC Throughput tests, to be accessed from the "Measurement Controller" dialog, entry "RX Measurement...".

2.2.14.1 Performing RLC Throughput Measurements

You can perform the measurement either with an end to end data connection or with one of the PS connection services Test Mode A, Test Mode B BLER or SRB.

The required steps are described below for both alternatives.

Measurement with end to end data connection

You must set up an end to end data connection and generate IP traffic. For these tasks you need a Data Application Unit (DAU) and related options.

1. Set up an end to end data connection as described in chapter 2.2.5, "End to End Packet Data Connections", on page 20.
   The required options are also listed there.
2. Use the DAU to generate IP traffic in the direction to be measured (uplink and/or downlink). You may for example perform an IPerf measurement. Or you could transfer data via FTP.
   For details refer to the DAU documentation.
3. Start the "RLC Throughput" measurement and evaluate the results.

Measurement with other RX PS measurements.

Set up a PS BER or BLER connection with specific settings. A DAU is not required.

1. Set up a loop connection with the parameter Service Selection = "Test Mode A ", "Test Mode B " or "BLER ".
2. Start the "RLC Throughput" measurement and evaluate the results.

2.2.14.2 Measurement Results

All results of the measurement are shown on the "RLC Throughput" tab of the RX measurements view. The results are described below.

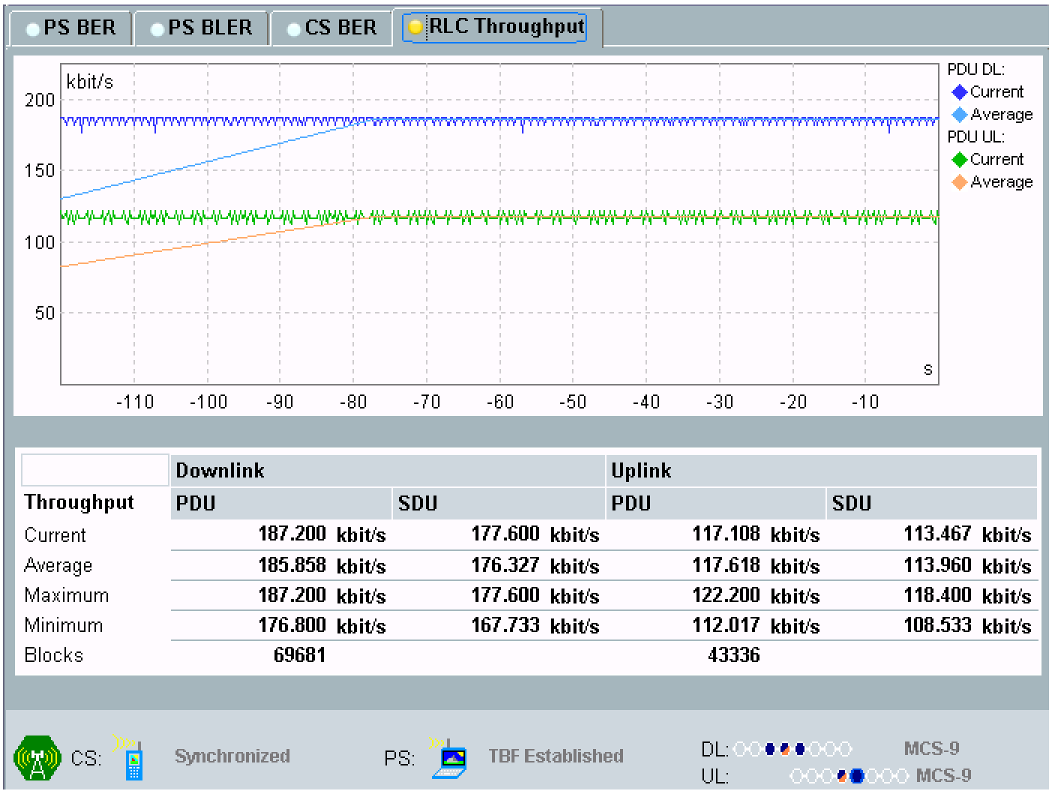


Fig. 2-28: RLC throughput tab

Diagram

The diagram provides a graphical presentation of the PDU or SDU throughput results over the duration of a single-shot measurement.

The single-shot duration and the time interval used to derive a single result are configurable, see chapter 2.3.19.3, "Measurement Settings", on page 159.

You can enable/disable the display of the individual traces via the softkey - hotkey combination "Display > Select Trace".

To switch between PDU and SDU traces use the softkey - hotkey combination "Display > PDU | SDU".

Table

The throughput table indicates statistical throughput results for downlink and uplink, PDU and SDU.

In the downlink all sent blocks are considered, including retransmissions. The uplink results reflect all blocks that the R&S CMW could receive and take into account.

The data rates are calculated from the block size times the number of transmitted (PDU) or acknowledged (SDU) blocks per time unit. The PDU throughput corresponds to the nominal data rate of the connection; the SDU throughput is a measure for the useful data rate. If it is averaged over a sufficient period of time, the SDU throughput is always smaller than the PDU throughput.

The SDU throughput tends to jitter because the SDUs are not necessarily acknowledged immediately, which causes variable overlaps of the acknowledgement status reports from the UE and the evaluation periods for a single result. The jitter increases as the result interval is reduced. The PDU throughput is jitter-free because it is measured byte-wise on RLC level.

The "Blocks" value indicates the number of RLC PDUs that the R&S CMW transmitted (DL PDUs) or received (UL PDUs) since the beginning of the measurement.

Statistical Results

The statistical values are calculated as follows:

- **Current:** Value obtained in the last result interval.
- **Average:** Average of all "Current" values currently seen in the diagram.
- **Minimum, Maximum:** Largest or smallest "Current" value that the R&S CMW obtained since the start of the measurement.

2.2.15 CMR Performance Measurement

When a traffic channel supporting an Adaptive Multi-Rate (AMR) speech codec is activated, the Codec Mode Request (CMR) is sent by the MS every other speech frame to indicate to the BS which recommended codec mode of the Active Codec Set (ACS) should be used on the downlink. The CMR performance measurement for AMR codecs is used to test whether the MS generates the CMRs with a defined accuracy, as described in 3GPP TS 51.010, section 14.10.

The R&S CMW provides a hopping trigger to allow the external interferer to hop synchronously with the R&S CMW, see also "Hopping" on page 98. Hopping is required by 3GPP TS 51.010.

It is also possible to do a CMR performance measurement on a static channel with a static interfering signal without hopping.

During the call, the MS under test continuously estimates the link quality and adapts the CMR. To test the CMR performance the R&S CMW alters the carrier-to interferer ratio (C/I). The MS has to request a new codec mode at least 200 ms afterwards.

By changing the TCH signal level (see "DL Reference Level" on page 98) you change also the C/I, as the interferer signal level is unchanged throughout the test. The target power level is set in the RX measurement configuration tree, see "Target Level" on page 162.

The AMR CMR measurement also depends on the up/down decision thresholds defined for each of the four codec modes, see chapter 2.3.8.3, "AMR Configuration", on page 129.

2.2.15.1 Performing CMR Performance Measurements

For CMR performance measurements a CS connection is required.

The measurement involves the following stages:

1. Configure the GSM signaling application.
   a) Select an AMR CS connection: Connection > Circuit Switched > Traffic Mode = "AMR - ...".
   b) Verify the codec mode up/down thresholds, see "Threshold" on page 131.
   c) Configure any other settings as desired.
2. If needed, connect and configure the external interferer (e.g. by an R&S AMU). Use the hopping trigger provided by GSM signaling.
3. Connect your mobile.
4. Set up a CS connection. Wait until the R&S CMW has entered the "Call Established" state.
   For details refer to chapter 2.2.2, "Initiating Signaling Tests", on page 16.
5. Open the CMR performance measurements, e.g. via the "GSM RX Meas" softkey.
6. Set the target level of CMR performance measurements, see "Target Level" on page 162.
7. Press ON | OFF to start the CMR performance test.
8. Wait until the R&S CMW has measured the full statistics cycle. Analyze the results from the CMR performance tab.

2.2.15.2 Measurement Results

The CMR values recorded for each measurement step are shown in the CMR performance measurement tab.

After the measurement is started, the R&S CMW waits for a valid starting point, which can be one of the frames numbered 4, 13, or 21 of each TDMA 26-multiframe. When this is reached, the R&S CMW changes its TCH output power to the target level and starts recording the received CMRs.

Fig. 2-29: CMR performance measurement tab

The first value shows the initial CMR. The next entries display the received CMRs, which the R&S CMW receives in regular 40 ms intervals mapped to the x-axis. The measurement is successful if there is a new CMR displayed within the first 5 entries, which confirms that the MS requested a new CMR within 200 ms.

After the measurement is finished, the target level from the measurement is automatically set as the new used TS TCH initial power level. This way, the next measurement can be set up by simply entering a new target level.

The CMR performance measurement is a single shot measurement.

2.3 GUI Reference

The following sections provide detailed reference information on the parameters of the GSM signaling application (option R&S CMW-KS200). Most of the signaling parameters are arranged in the "GSM Signaling Configuration" dialog. Additional dialogs allow to configure the measurements included in the signaling application.

Many of the signaling parameters are available in a subset of connection states only (e.g. handover is only possible when a circuit switched connection is established). Temporarily unavailable parameters are grayed out in the configuration dialogs; softkeys and hotkeys appear and disappear dynamically, depending on the connection state.

The screenshots in this chapter show the GUI with all available options installed. Depending on the installed options some parameters may not be configurable (display the default value) or may be hidden completely. To show such hidden parameters see chapter 2.3.14, "Show Features at Inactive SW Licenses", on page 145.

The following options are indicated in the parameter descriptions if they are required in addition to R&S CMW-KS200:

- R&S CMW-KS201, GSM Release 7 signaling basic functionality
- R&S CMW-KS203, GSM Release 9 signaling basic functionality
- R&S CMW-KS210, GSM Release 6 signaling advanced functionality

The "GSM Signaling" application is configured using the following groups of settings:

2.3.1 Signaling View

The signaling view shows status information and information derived from the uplink signal to the left and the most important settings to the right. All settings in this view can also be accessed via the configuration dialog.

For the shortcut softkeys refer to chapter 2.3.15, "Using the Shortcut Softkeys", on page 145.

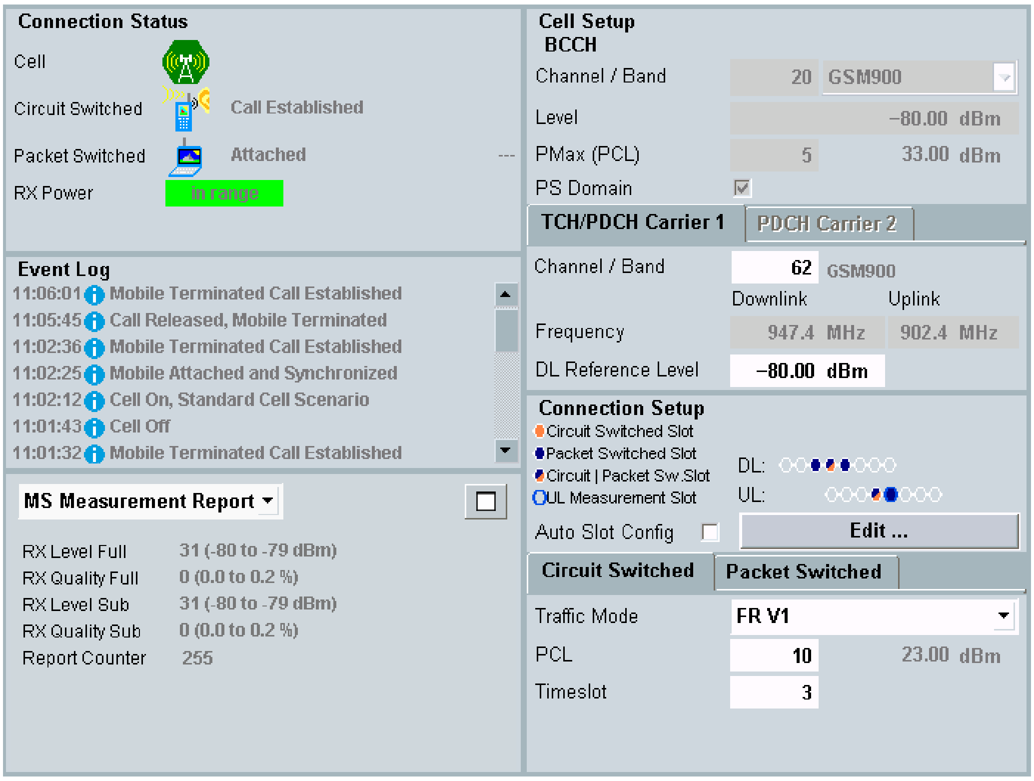


Fig. 2-30: GSM signaling view

For descriptions of the individual areas of the view, refer to the subsections.

2.3.1.1 Connection Status

The connection status area displays the current connection states and information for troubleshooting.

For related hotkeys refer to chapter 2.3.2, "Signaling and Connection Control", on page 84.

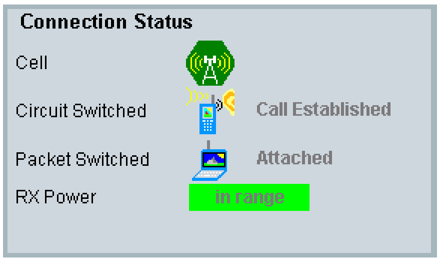


Fig. 2-31: Connection status area of the main view

Cell

Indicates the overall state of the cell (green = on, gray = off, additional = pending).

For the packet switched domain the presence of TBF connections is indicated:

- --- = no TBF
- = UL TBF present
- = DL TBF present

Circuit Switched, Packet Switched

Displays the corresponding connection states, see also chapter 2.2.7, "Connection States", on page 23.

RX Power

Indicates the quality of the received uplink power:

- **- - -**: no signal from MS detected; the MS may be switched off or in idle mode.
- **in range**: the MS power is in the expected range, according to the expected power during location update (PMax) or during the connection (transmit power instructions (PCL, Gamma) signaled to the MS). Accurate measurements can be performed in this state.
- **overdriven**: the MS power is above the expected range. An inappropriate external attenuation may be set, or the MS may not transmit at the correct power.
- **underdriven**: the MS power is below the expected range. An inappropriate external attenuation may be set, the connecting cable may be defective, or the MS may not transmit at the correct power.

Remote command:

`SENSe:GSM:SIGN<i>:MSSinfo:RXPower?`

2.3.1.2 Event Log

The event log area reports events like connection and cell state changes.

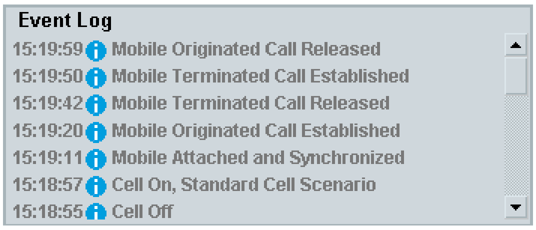


Fig. 2-32: Event log area of the main view

Event Log Entries

Each entry consists of a timestamp, an icon indicating the category of the event and a short text describing the event.

Meaning of the category icons: = information, warning and error

Remote command:

`SENSe:GSM:SIGN<i>:ELOG:LAST?`

`SENSe:GSM:SIGN<i>:ELOG:ALL?`

2.3.1.3 MS Measurement Report

To display the measurement report information, select "MS Measurement Report" in the field below the event log area. Press the button to the right to maximize the measurement report area.

The displayed information is provided by the connected MS in its periodic measurement reports.

GSM mobile phones continuously measure the signal strength and quality of the serving and neighbor cells. The MS regularly transmits "measurement reports" to inform the serving cell BTS about its measurement results. The measurements are averaged over so-called "reporting periods"; for details refer to 3GPP TS 45.008.

The MS reports different parameters in the CS domain and in the PS domain. In the PS domain the displayed parameters depend on the configured TBF Level.

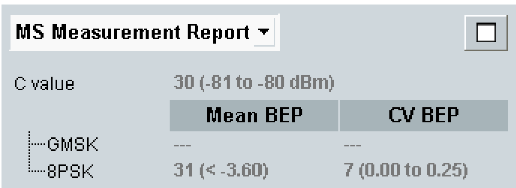


Fig. 2-33: Measurement report (PS, EGPRS)

The minimized default presentation shows all measurement report values for the serving GSM cell.

To show also neighbor cell measurement results, press the button to the right. This maximizes the area vertically.

To maximize the area also horizontally, press the button again.

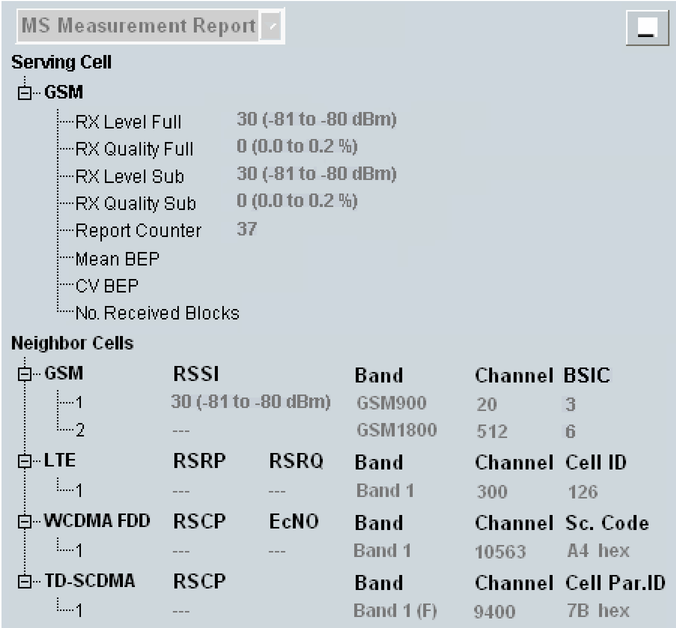


Fig. 2-34: Maximized report area (CS)

Neighbor cell measurements are by default disabled and can be enabled separately for each neighbor cell, see chapter 2.3.7.2, "Neighbor Cell Settings", on page 106.

The measurement results displayed in the maximized report area are described below. Additionally configured neighbor cell settings are displayed (band, channel, ...).

Serving Cell

The MS measurement report for the serving cell is dependant on the active connection. The MS measurements for CS and PS connections are described below.

RX Level Full / Sub (CS) ← Serving Cell
"RX Level" denotes the received signal power. The reported "RX Level Full" result is measured over the full set of TDMA frames. The "RX Level Sub" result is obtained in a subset of 4 SACCH frames and the special frame types employed during discontinuous transmission (DTX).

The levels are expressed in terms of dimensionless power levels depending linearly on the absolute measured power. A high power level implies a high received signal input power, see following table.

RX Level	Received signal power [dBm]
63	> -48 dBm
62	-49 dBm to -48 dBm
61	-50 dBm to -49 dBm
...	...
2	-109 dBm to -108 dBm
1	-110 dBm to -109 dBm
0	< -110 dBm

Remote command:
`SENSe:GSM:SIGN<i>:RREPort:RXLevel?`
`SENSe:GSM:SIGN<i>:RREPort:RXLevel:RANGe?`
`SENSe:GSM:SIGN<i>:RREPort:RXLevel:SUB?`
`SENSe:GSM:SIGN<i>:RREPort:RXLevel:SUB:RANGe?`

RX Quality Full / Sub (CS) ← Serving Cell
RQ quality denotes the received signal quality. The reported "RX Quality Full" is measured over the full set of TDMA frames. The "RX Quality Sub" result is obtained in a subset of 4 SACCH frames and the special frame types employed during discontinuous transmission (DTX).

The received signal quality is expressed in terms of dimensionless quality levels (actually "error levels"). A high quality level implies a high bit error rate and thus a poor received signal quality, see following table.

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 %

Remote command:
`SENSe:GSM:SIGN<i>:RREPort:RXQuality?`
`SENSe:GSM:SIGN<i>:RREPort:RXQuality:RANGe?`
`SENSe:GSM:SIGN<i>:RREPort:RXQuality:SUB?`
`SENSe:GSM:SIGN<i>:RREPort:RXQuality:SUB:RANGe?`

Report Counter (CS) ← Serving Cell
Number of measurement reports received since the connection was established. According to GSM specifications, a report is transmitted every 4 multiframes.

Remote command:
`SENSe:GSM:SIGN<i>:RREPort:COUNt?`

Enhanced Measurements (CS) ← Serving Cell
When the enhanced measurement report is activated (see "Enhanced Measurement Report" on page 116), the following MS measurements are provided.

Mean BEP ← Enhanced Measurements (CS) ← Serving Cell
Denotes the average Bit Error Probability (BEP) of the radio blocks, averaged over all blocks within the MS reporting period. Modulation independent mean BEP value is calculated for circuit switched connections. For details refer to table 2-4.

Remote command:
`SENSe:GSM:SIGN<i>:RREPort:CSWitched:MBEP?`
`SENSe:GSM:SIGN<i>:RREPort:CSWitched:MBEP:RANGe?`

CV BEP ← Enhanced Measurements (CS) ← Serving Cell
Denotes the Coefficient of Variation of the Bit Error Probability (CV BEP) of the radio blocks, averaged over all blocks within the MS reporting period. The coefficient of variation is the standard deviation of the measured BEP of the different bursts within the block. It vanishes if all bursts have equal BEP.

In 3GPP TS 45.008 the parameter is called CV_BEP. It is expressed in terms of dimensionless values, see following table.

CV BEP	Value range
0	1.75 to 2.00
1	1.50 to 1.75
2	1.25 to 1.50
3	1.00 to 1.25
4	0.75 to 1.00
5	0.50 to 0.75
6	0.25 to 0.50
7	0 to 0.25

Remote command:
`SENSe:GSM:SIGN<i>:RREPort:CSWitched:CBEP?`
`SENSe:GSM:SIGN<i>:RREPort:CSWitched:CBEP:RANGe?`

No of Received Blocks ← Enhanced Measurements (CS) ← Serving Cell
Indicates the number of blocks that theR&S CMW received in the UL since the beginning of the measurement.

Remote command:
`SENSe:GSM:SIGN<i>:RREPort:CSWitched:NRBLocks?`

RX Quality (PS, TBF level = GPRS) ← Serving Cell
RQ Quality denotes the received signal quality. It is expressed in terms of dimensionless quality levels (actually "error levels"). The same table as for the CS domain applies, see "RX Quality Full / Sub (CS)" on page 70.

Remote command:
`SENSe:GSM:SIGN<i>:RREPort:RXQuality?`
`SENSe:GSM:SIGN<i>:RREPort:RXQuality:RANGe?`

C value (PS) ← Serving Cell
The C value is the normalized received signal level at the MS, averaged over the radio blocks. The level is expressed in terms of dimensionless numbers ranging from 0 to 63. The assignment between C values and absolute received signal levels is equal to the assignment for RX Levels, see "RX Level Full / Sub (CS)" on page 70.

The C value is used for GPRS uplink power control, see chapter 2.2.9.3, "GPRS Uplink Power Control", on page 30.

Remote command:
`SENSe:GSM:SIGN<i>:RREPort:CVALue?`
`SENSe:GSM:SIGN<i>:RREPort:CVALue:RANGe?`

Sign. Var. (PS, TBF level = GPRS) ← Serving Cell
Denotes the variance of the received signal level within the radio blocks, averaged over all blocks within the MS reporting period. The variance is a measure of the difference between the received signal levels of the different bursts within the block. It vanishes if all burst levels are equal.

In 3GPP TS 45.008 the parameter is called SIGN_VAR. It is expressed in terms of dimensionless values, see following table.

Sign. Var.	Value range
63	> 15.75 dB^2
62	> 15.50 dB^2 to 15.75 dB^2
61	> 15.25 dB^2 to 15.50 dB^2
...	...
2	> 0.50 dB^2 to 0.75 dB^2
1	> 0.25 dB^2 to 0.50 dB^2
0	0 dB^2 to 0.25 dB^2

Remote command:
SENSe:GSM:SIGN<i>:RREPort:SVARiance?
SENSe:GSM:SIGN<i>:RREPort:SVARiance:RANGe?

Mean BEP (PS, TBF level ≠ GPRS) ← Serving Cell
Denotes the average Bit Error Probability (BEP) of the radio blocks, averaged over all blocks within the MS reporting period. Independent MEAN_BEP parameters are available for the different modulation schemes, see table 2-4.

Remote command:
SENSe:GSM:SIGN<i>:RREPort:GMBep?
SENSe:GSM:SIGN<i>:RREPort:GMBep:RANGe?
SENSe:GSM:SIGN<i>:RREPort:EMBep?
SENSe:GSM:SIGN<i>:RREPort:EMBep:RANGe?
SENSe:GSM:SIGN<i>:RREPort:NSRQam<ModOrder>:MBEP?
SENSe:GSM:SIGN<i>:RREPort:NSRQam<ModOrder>:MBEP:RANGe?
SENSe:GSM:SIGN<i>:RREPort:HSRQam<ModOrder>:MBEP?
SENSe:GSM:SIGN<i>:RREPort:HSRQam<ModOrder>:MBEP:RANGe?

CV BEP (PS, TBF level ≠ GPRS) ← Serving Cell
Denotes the Coefficient of Variation of the Bit Error Probability (CV BEP) of the radio blocks, averaged over all blocks within the MS reporting period.

Individual CV BEP parameters are available for the different modulation schemes.

See also: "CV BEP" on page 71.

Remote command:
SENSe:GSM:SIGN<i>:RREPort:GCBep?
SENSe:GSM:SIGN<i>:RREPort:GCBep:RANGe?
SENSe:GSM:SIGN<i>:RREPort:ECBep?
SENSe:GSM:SIGN<i>:RREPort:ECBep:RANGe?
SENSe:GSM:SIGN<i>:RREPort:NSRQam<ModOrder>:CBEP?
SENSe:GSM:SIGN<i>:RREPort:NSRQam<ModOrder>:CBEP:RANGe?
SENSe:GSM:SIGN<i>:RREPort:HSRQam<ModOrder>:CBEP?
SENSe:GSM:SIGN<i>:RREPort:HSRQam<ModOrder>:CBEP:RANGe?

Neighbor Cells
Option R&S CMW-KS210 is required.

For the measured neighbor cells, the following values are displayed for the supported RATs:

GSM > RSSI ← Neighbor Cells
For the measured GSM neighbor cell specified by band, channel and BSIC, the following value is displayed:

The Received Signal Strength Indicator (RSSI) denotes the received wideband power within the GSM channel bandwidth, measured on a GSM BCCH carrier.

The measurement report displays the reported dimensionless value and in brackets the corresponding measured value range.

Remote command:
`SENSe:GSM:SIGN<i>:RREPort:NCELl:GSM:CELL<no>?`
`SENSe:GSM:SIGN<i>:RREPort:NCELl:GSM:CELL<no>:RANGe?`

LTE > RSRP, RSRQ ← Neighbor Cells
For the measured LTE neighbor cell specified by band and channel, the following values are displayed:

- The Reference Signal Received Power (RSRP) denotes the average power of the resource elements carrying cell-specific reference signals.
- The Reference Signal Received Quality (RSRQ) is calculated as *RSRQ = N×RSRP / (E-UTRA carrier RSSI)*. The "E-UTRA carrier RSSI" denotes the average of the total received power (including interferers etc.) observed in OFDM symbols containing reference symbols for antenna port 0 within the measurement bandwidth (N resource blocks).

The measurement report displays the reported dimensionless values and in brackets the corresponding measured value range.

Remote command:
`SENSe:GSM:SIGN<i>:RREPort:NCELl:LTE:CELL<no>?`
`SENSe:GSM:SIGN<i>:RREPort:NCELl:LTE:CELL<no>:RANGe?`

WCDMA > RSCP, EcNO ← Neighbor Cells
For the measured WCDMA neighbor cell specified by band, channel and scrambling code, the following values are displayed:

- The Received Signal Code Power (RSCP) denotes the received power on one code, measured on the primary CPICH of the neighbor WCDMA cell.
- The Ec/No denotes the ratio of the received energy per PN chip for the primary CPICH to the total received power spectral density in the WCDMA band.

The measurement report displays the reported dimensionless values and in brackets the corresponding measured value range.

Remote command:
`SENSe:GSM:SIGN<i>:RREPort:NCELl:WCDMa:CELL<no>?`
`SENSe:GSM:SIGN<i>:RREPort:NCELl:WCDMa:CELL<no>:RANGe?`

TD-SCDMA > RSCP ← Neighbor Cells
For the measured TD-SCDMA neighbor cell specified by band, channel and scrambling code, the following value is displayed:

The Received Signal Code Power (RSCP) denotes the received power, measured on the P-CCPCH of the neighbor TD-SCDMA cell.

The measurement report displays the reported dimensionless values and in brackets the corresponding measured value range.

Remote command:
SENSe:GSM:SIGN<i>:RREPort:NCELl:TDSCdma:CELL<no>?
SENSe:GSM:SIGN<i>:RREPort:NCELl:TDSCdma:CELL<no>:RANGe?

2.3.1.4 MS Capabilities

To display this area, select "MS Capabilities" in the field below the event log area.

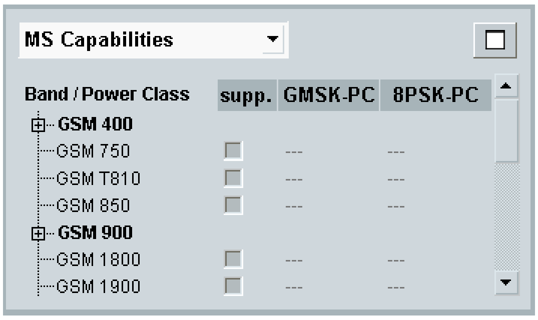
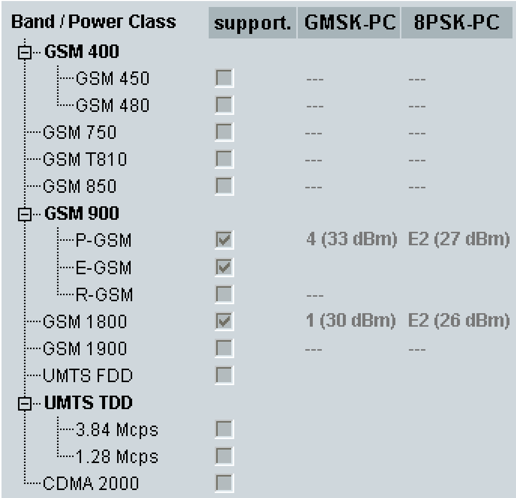


Fig. 2-35: MS capabilities area of the main view (minimized)

The information shown in the MS capabilities area is retrieved during attach in the PS domain.

Press the button to the right to maximize the area. The individual sections are described below.

Bands/Power Class



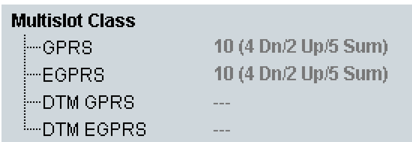
Supported GSM bands/subbands and support indicators for UMTS and CDMA2000 networks.

The columns GMSK-PC and 8PSK-PC indicate the power class for GMSK and 8PSK modulation and the nominal maximum output power in dBm corresponding to the power class.

Remote command:

`SENSe:GSM:SIGN<i>:MSSinfo:BANDs?`

Multislot Class



Multislot class of the mobile station in (E)GPRS and Dual Transfer Mode (DTM) as defined in 3GPP TS 45.002, Annex B.

The multislot class determines for example the maximum number of DL (Rx) and UL (Tx) timeslots supported by the MS per TDMA frame. Some classes define also a maximum for the sum of DL+UL timeslots.

The multislot class is displayed in the following format:

<multislot class> (<Rx> Dn/<Tx> Up/<sum> Sum)

Example: *10 (4 Dn/2 Up/5 Sum)* indicates that the MS supports multislot class 10 with 0 to 4 DL slots, 0 to 2 UL slots, and 1 to 5 UL+DL slots in one TDMA frame.

Remote command:

`SENSe:GSM:SIGN<i>:MSSinfo:MSCLass:GPRS?`
`SENSe:GSM:SIGN<i>:MSSinfo:MSCLass:EGPRs?`
`SENSe:GSM:SIGN<i>:MSSinfo:MSCLass:DGPRs?`
`SENSe:GSM:SIGN<i>:MSSinfo:MSCLass:DEGPrs?`

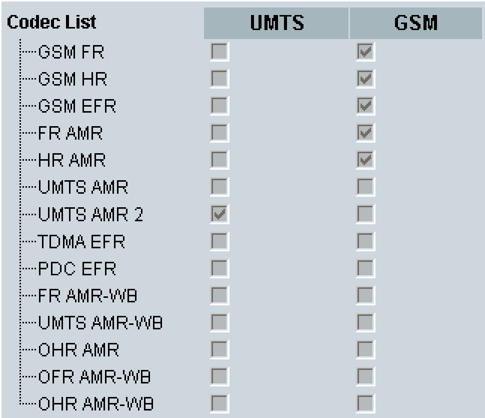
Extended Dynamic Allocation

Support indicators for "Extended Dynamic Allocation" (see 3GPP TS 44.060), for GPRS and EGPRS mode.

Remote command:

`SENSe:GSM:SIGN<i>:MSSinfo:EDALlocation?`

Codec List



Indicates which codec the UE supports in UMTS and GSM networks.

This list comprises the following codec types:

- full rate, half rate and enhanced full rate for GSM
- five adaptive multi-rate codec types (FR AMR, HR AMR, UMTS AMR, UMTS AMR2, OHR AMR)
- TDMA enhanced full rate
- PDC enhanced full rate
- four adaptive multi-rate wideband codec types (FR AMR-WB, UMTS AMR-WB, OFR AMR-WB, OHR AMR-WB)

The speech codec list for GSM and UMTS is defined in 3GPP TS 26.103 section 6.3.

Remote command:

`SENSe:GSM:SIGN<i>:MSSinfo:CODec:GSM?`

`SENSe:GSM:SIGN<i>:MSSinfo:CODec:UMTS?`

2.3.1.5 MS Info

To display this area, select "MS Info" in the field below the event log area. Press the button to the right to maximize the **MS Info** area.

The information shown in the MS info area is retrieved e.g. during location update in the CS domain and attach in the PS domain. For configuration of requested data see chapter 2.3.7.6, "Requested Mobile Data", on page 112.

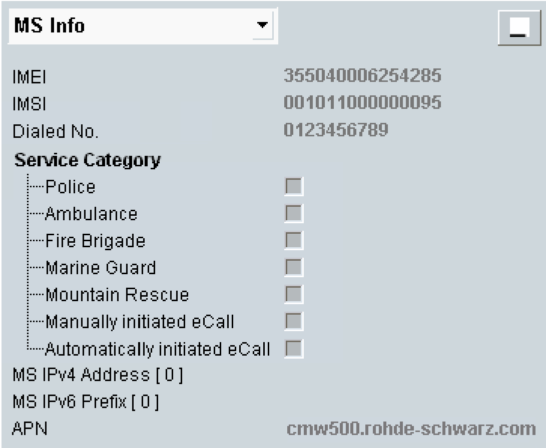


Fig. 2-36: Maximized MS info area

IMEI

International Mobile station Equipment Identity in the format TAC SNR Spare (see 3GPP TS 23.003), where:

- TAC: 8-digit type approval code
- SNR: 6-digit serial no.
- Spare: 1-digit spare bit

Remote command:

SENSe:GSM:SIGN<i>:MSSinfo:IMEI?

IMSI

International Mobile Subscriber Identity in the format MCC MNC MSIN, where:

- MCC: 3-digit mobile country code
- MNC: 2- or 3-digit mobile network code
- MSIN: 10- or 9-digit mobile subscriber ID

Remote command:

SENSe:GSM:SIGN<i>:MSSinfo:IMSI?

Dialed No.

Number dialed at the mobile station (call from MS).

Remote command:

SENSe:GSM:SIGN<i>:MSSinfo:DNUMber?

Service Category
Indicates the category of emergency call.

Remote command:
`SENSe:GSM:SIGN<i>:MSSinfo:SCATegory?`

MS IPv4 Address / IPv6 Prefix
Displays the IPv4 address and/or the IPv6 prefix that have been assigned to the MS by the R&S CMW.

The MS indicates whether it supports IPv4 only or IPv6 only or both. Depending on this information the R&S CMW assigns either an IPv4 address or an IPv6 prefix or both and displays the assigned values.

Remote command:
`SENSe:GSM:SIGN<i>:MSSinfo:MSADdress:IPV<n>?`

APN
Returns the access point name used by the MS during a packet data connection.

Remote command:
`SENSe:GSM:SIGN<i>:MSSinfo:APN?`

2.3.1.6 Settings

The main view provides the most important settings for fast access. Most parameters are also available in the configuration dialog.

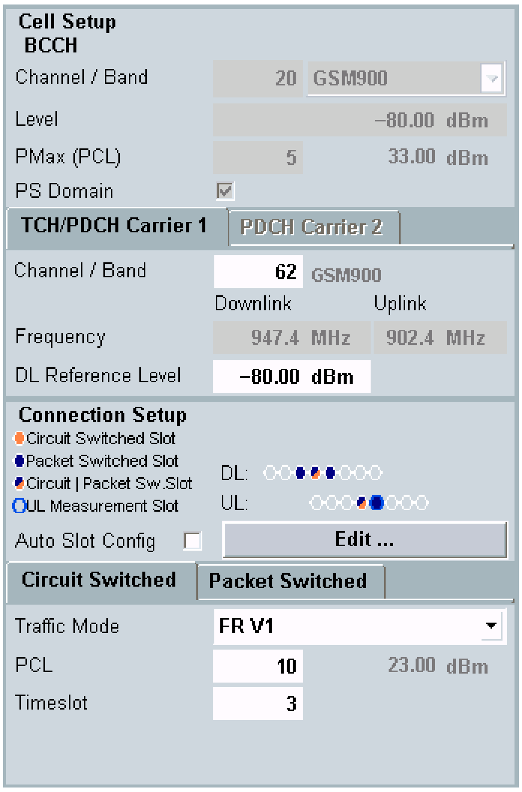


Fig. 2-37: Settings in the main view

Cell Setup

This section contains the most important BCCH and TCH/PDCH RF settings.

Parameters are described in the following sections:

- **BCCH**: see chapter 2.3.5.2, "BCCH Settings", on page 95
- **PS domain**: see "Packet Switched Domain" on page 106
- **TCH/PDCH Carrier 1**: see chapter 2.3.5.3, "TCH/PDCH Settings", on page 97

Connection Setup

Displays a graphical presentation of the DL and UL slot configuration. Slots positioned in the same row are time-aligned.

Click the "Edit" button to open the slot configuration dialog (see also chapter 2.3.1.7, "Slot Configuration Dialog", on page 81).

For configuration of the UL measurement slot see "Measurement Slot UL" on page 143.

Auto Slot Config ← Connection Setup
Sets the parameters in Slot Configuration Dialog automatically. These settings are useful for the PS multislot configuration and depend on the MS multislot class and the specified service (see "Service Selection" on page 134).

Slot configuration will be set to maximum number of slots according to the selected PS service:

- Max UL: used for test mode A and data end to end max UL throughput
- Symmetric: used for test mode B, SRB connection and data end to end max symmetric UL/DL throughput
- Max DL: used for BLER test and data end to end max DL throughput

Remote command:
`CONFigure:GSM:SIGN<i>:CONNection:ASConfig`

Circuit Switched / Packet Switched
Contain the most important CS and PS connection parameters.

The "Max Throughput" information displayed for the packet switched domain indicates the maximum possible downlink and uplink RLC throughput. The values are calculated from the configured number of PS slots and the coding schemes of these slots.

For parameter descriptions refer to:

- chapter 2.3.8.2, "Circuit Switched General Connection Parameters", on page 124
- "Circuit Switched > PCL" on page 100
- chapter 2.3.8.5, "Packet Switched Connection Parameters", on page 133

Remote command:
The throughput information is only displayed in the main view and can be queried via the following commands:
`SENSe:GSM:SIGN<i>:CONNection:ETHRoughput:DL?`
`SENSe:GSM:SIGN<i>:CONNection:ETHRoughput:UL?`

2.3.1.7 Slot Configuration Dialog

The dialog can be opened from the main view, which also offers "Auto Slot Config" function, see "Connection Setup" on page 80.

The purpose of the manual slot configuration is to set the generated GSM downlink signal and to control the UL signals of the mobile station under test, in particular for Packet Switched (PS) connections and multislot operation. Most parameters can be reconfigured in state "TBF Established".

The tabs "Carrier 1" and "Carrier 2" refer to the two PS carriers available in downlink dual carrier mode. The "Carrier 2" tab is only active if this feature is enabled, see "DL Dual Carrier" on page 135. Some PS parameters can be configured per carrier and are present on both tabs. The PS settings only present on the "Carrier 1" tab apply to both carriers.

For a successful connection setup, configure the settings compatible to the MS capabilities, especially to the multislot class, see also "Checks in case of failed connection setup" on page 17.

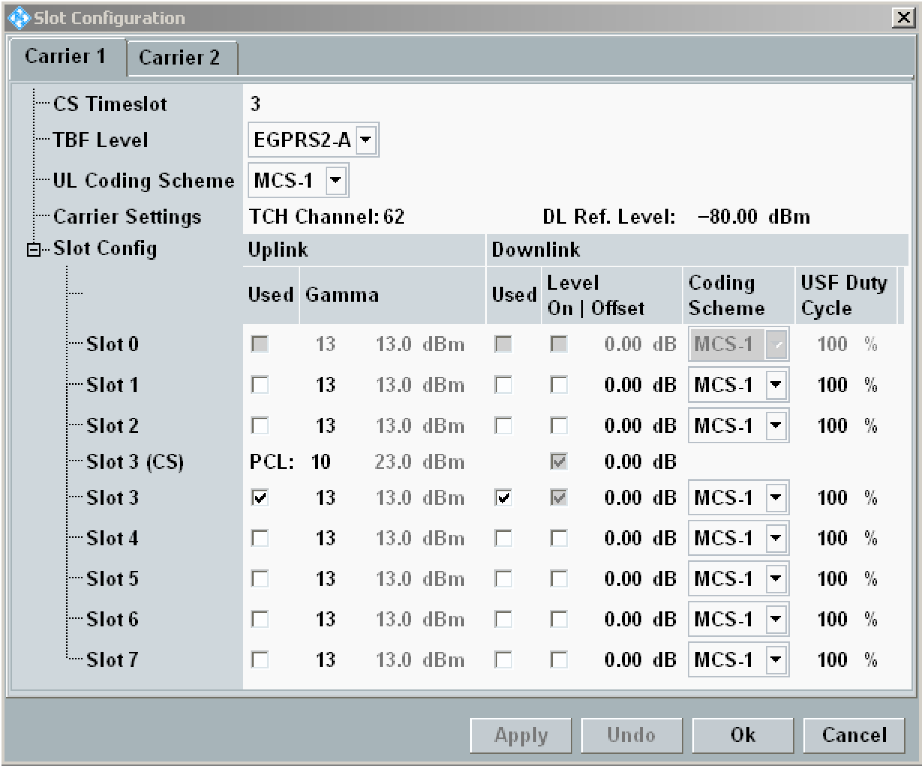


Fig. 2-38: Slot configuration dialog

The "Slot Config" table enables and configures the UL and DL bursts in timeslots 1 to 7. Ensure that the slot configuration is in accordance with the capabilities (multislot class) of your mobile phone.

For the Circuit Switched (CS) domain the table indicates the traffic channel timeslot as "Slot...(CS)". The Power Control Level (PCL) can also be configured (for parameter description see "Circuit Switched > PCL" on page 100).

CS Timeslot

This parameter is also present in the main configuration dialog, see "Timeslot" on page 125.

TBF Level

Selects the set of modulation and coding schemes to be used by the MS and the instrument.

The following sets are available:

- **GPRS**: CS-1 to CS-4
- **EGPRS**: MCS-1 to MCS-9
- **EGPRS2-A**:
  - DL: MCS-1 to MCS-4, MCS-7, MCS-8, DAS-5 to DAS-12
  - UL: MCS-1 to MCS-6, UAS-7 to UAS-11

The setting can be accessed from both tabs, but the same value applies to both carriers. Option R&S CMW-KS201 is required for EGPRS2-A.

Remote command:
`CONFigure:GSM:SIGN<i>:CONNection:PSWitched:TLEVel`

UL Coding Scheme
Selects the coding scheme for uplink packet data channels. The available values depend on the parameter TBF Level.

Remote command:
`CONFigure:GSM:SIGN<i>:CONNection:PSWitched:CSCHeme:UL`
`CONFigure:GSM:SIGN<i>:CONNection:PSWitched:SCONfig:COMBined:CARRier<c>` (configuring also other important PS connection parameters)

Carrier Settings
These parameters are also present in the main configuration dialog, see chapter 2.3.5.3, "TCH/PDCH Settings", on page 97.

The "TCH Channel" can be configured individually per carrier while the same "DL Ref. Level" applies to both carriers.

Slot Config
Configures main slot parameters.

Used ← Slot Config
Specifies the uplink/downlink timeslots the mobile shall use in a packet switched connection. Slot 0 can not be enabled.

The settings can be configured individually downlink per carrier.

Remote command:
`CONFigure:GSM:SIGN<i>:CONNection:PSWitched:SCONfig:ENABle:UL`
`CONFigure:GSM:SIGN<i>:CONNection:PSWitched:SCONfig:ENABle:DL:CARRier<c>`

Gamma ← Slot Config
Channel-specific uplink power control parameter Γ_{CH}. The MS transmitter output power P_{CH} is calculated from Γ_{CH}, see chapter 2.2.9.3, "GPRS Uplink Power Control", on page 30. It is also displayed for information.

Remote command:
`CONFigure:GSM:SIGN<i>:CONNection:PSWitched:SCONfig:GAMMa:UL`

Level ← Slot Config
RF levels in the individual downlink timeslots relative to the "DL Ref. Level" indicated above the "Slot Config" table. Unchecked DL timeslots are inactive, i.e. no DL signal is transmitted in these slots. The DL levels can be changed in all PS signaling states (including "TBF Established").

The settings can be configured individually per carrier.

Option R&S CMW-KS210 is required for configuration.

Remote command:
CONFigure:GSM:SIGN<i>:CONNection:PSWitched:SCONfig:LEVel:DL:CARRier<c>

Coding Scheme ← Slot Config
Coding schemes used for the individual downlink timeslots. The available values depend on the parameter TBF Level.

The setting can be accessed from both tabs, but the same value applies to both carriers.

Remote command:
CONFigure:GSM:SIGN<i>:CONNection:PSWitched:SCONfig:CSCHeme:DL:CARRier<c>

USF Duty Cycle ← Slot Config
Percentage of downlink GPRS radio blocks containing the Uplink State Flag (USF) assigned to the MS (see 3GPP TS 45.002).

100 % assigned means that all blocks contain the assigned USF. 0 % assigned and 100% random means that each USF (0 to 7) except the assigned one is used with a probability of 1/7. 12.5 % assigned and 87.5 % random means that each USF including the assigned one is used with a probability of 1/8.

This setting is provided in TBF established signaling state only, after the USF is actually assigned to the MS under test.

This setting can be used to check whether the USF BLER depends on the transmitted USF.

Option R&S CMW-KS210 required.

Remote command:
CONFigure:GSM:SIGN<i>:CONNection:PSWitched:SCONfig:UDCYcle:DL:CARRier<c>

2.3.2 Signaling and Connection Control

The individual connection states are controlled via the ON | OFF key, via hotkeys and via the MS.

The available hotkeys depend on the current connection state. Below all possible hotkeys are described.

For background information refer to chapter 2.2.7, "Connection States", on page 23.

ON | OFF (key) / GSM Signaling (softkey)

The ON | OFF key is used to turn the DL signal transmission on or off. The current state is shown by the softkey. The signal transmission can be switched off any time, independent of the current connection state. A yellow sandglass symbol indicates that the signaling generator is currently turned on or off.

The state "RDY" means that the signaling application is ready to receive an inter-RAT handover from another signaling application (e.g. from WCDMA). This state is initiated by the application acting as source of the handover.

While the DL signal is on, the signaling application provides a trigger signal, see chapter 2.2.10, "Trigger Signals", on page 34.

Remote command:

`SOURce:GSM:SIGN<i>:CELL:STATe`

`SOURce:GSM:SIGN<i>:CELL:STATe:ALL?`

Connect / Disconnect / Send SMS / Release PDP Context (hotkeys)

Any interaction with a mobile under test requires a GSM downlink signal (cell). As soon as the signal is available (state ON, no sandglass), connection control hotkeys appear in the hotkey bar. The available hotkeys depend on the current connection state which is visualized in the "Connection Status" panel of the "GSM Signaling" view.

Possible hotkeys are:

Hotkey	Description
"CS Connect"	Initiate a connection setup in the CS domain. When the MS starts ringing the connection state Alerting is reached. As soon as the connection is accepted at the MS the connection state changes to Call Established.
"PS Connect"	Initiate a connection setup in the PS domain. When the connection setup is complete the connection state changes to TBF Established.
"Release PDP Context"	Deactivate a PDP context, the connection state changes to Attached.
"CS Disconnect" "PS Disconnect"	Release a CS or PS connection.
"Send CS SMS"	Send an SMS message to the MS via CS domain.

Hotkey	Description
"Send PS SMS"	Send an SMS message to the MS via PS domain.
"Inter/Intra RAT ..."	See "Inter/Intra RAT ... (hotkey)" on page 86

Remote command:
CALL:GSM:SIGN<i>:CSWitched:ACTion
CALL:GSM:SIGN<i>:PSWitched:ACTion
FETCh:GSM:SIGN<i>:CSWitched:STATe?
FETCh:GSM:SIGN<i>:PSWitched:STATe?

Inter/Intra RAT ... (hotkey)

The hotkey appears in the hotkey bar as soon as the R&S CMW enters the "Call Established" CS connection state or the "TBF Established" PS connection state.

The GSM signaling application supports a handover within the signaling application, e.g. to another GSM band (CS or PS dual-band handover), as well as a handover to another instrument or to another signaling application. The two signaling applications must use different RF paths. If they use the same RF path, an error message is displayed.

Note that the handover process can be monitored in the "Connection Status" panel of the "GSM Signaling" main view.

Refer to chapter 2.2.8, "Handover", on page 27 for detailed information about GSM handover.

The hotkey "Inter/Intra RAT ..." opens a dialog for selection and configuration of the handover destination and initiation of the handover. The dialog differs depending on the connection scheme.

Circuit switched connections

The parameter "Target" selects the handover destination. The cell icon indicates the cell state of the currently selected destination.

The parameter "Mobility Mode" specifies the mechanism to be used for handover. Dual band handover is supported within the GSM signaling application, redirection is used for an handover from GSM to another signaling application or to GSM.

The "Destination Parameters" display current settings of the selected signaling application target, typically operating band and channels. You can modify these settings before starting the handover. To configure the settings via remote control commands, use the commands provided by the signaling application target. There are no special handover commands for this purpose.

For the intra GSM handover, the "Destination Parameters" correspond to the following RF and connection parameters in the source network:

- Channel: See "Channel / Frequency" on page 98
- Level: See "DL Reference Level" on page 98
- PCL: See "Circuit Switched > PCL" on page 100
- Timeslot: See "Timeslot" on page 125

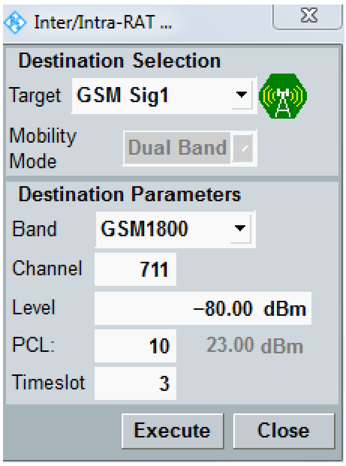


Fig. 2-39: Handover dialog (CS connections)

For a handover to another instrument, select "No Connection" as a target. Instead of "Destination Parameters", the "External Destination Parameters" are displayed (radio access technology and typically operating band and channel). Configure them according to the actual configuration of the other instrument. There is no communication between the two instruments, so the settings at both instruments must match.

Packet switched connections

The additional "Destination Parameters" for PS connections correspond to the "Slot Configuration" parameters described in chapter 2.3.1.7, "Slot Configuration Dialog", on page 81.

Packet switched handover is only possible within the GSM signaling application as a dual band handover.

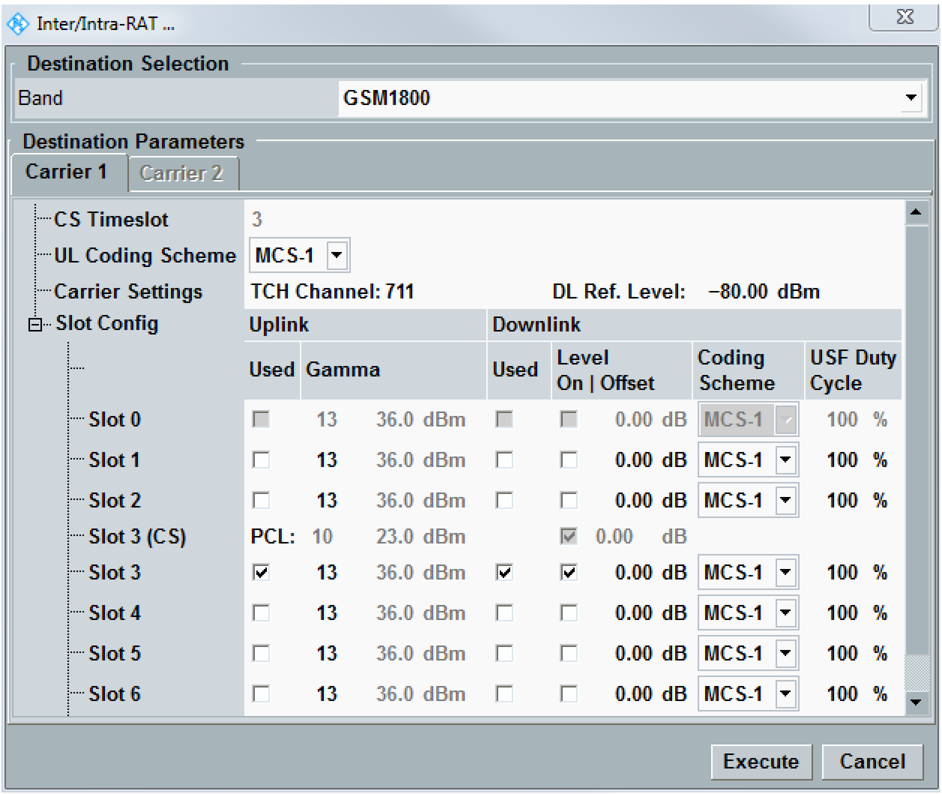


Fig. 2-40: Handover dialog (PS connections)

To initiate a handover, press the "Execute" button.

For a detailed step-by-step description of a handover, see chapter 2.2.8, "Handover", on page 27.

Remote command:
General settings and handover control:
PREPare:GSM:SIGN<i>:HANDover:CATalog:DESTination?
PREPare:GSM:SIGN<i>:HANDover:DESTination
PREPare:GSM:SIGN<i>:HANDover:MMODe
CALL:GSM:SIGN<i>:HANDover:STARt
FETCh:GSM:SIGN<i>:HANDover:STATe?
Intra GSM handover:
PREPare:GSM:SIGN<i>:HANDover:TARGet
SENSe:GSM:SIGN<i>:BAND:TCH?
PREPare:GSM:SIGN<i>:HANDover:CHANnel:TCH
PREPare:GSM:SIGN<i>:HANDover:LEVel:TCH
PREPare:GSM:SIGN<i>:HANDover:PCL
PREPare:GSM:SIGN<i>:HANDover:TSLot
PREPare:GSM:SIGN<i>:HANDover:PSWitched:CSCHeme:UL
PREPare:GSM:SIGN<i>:HANDover:PSWitched:ENABle:UL
PREPare:GSM:SIGN<i>:HANDover:PSWitched:GAMMa:UL
PREPare:GSM:SIGN<i>:HANDover:PSWitched:ENABle:DL:CARRier<c>
PREPare:GSM:SIGN<i>:HANDover:PSWitched:LEVel:DL:CARRier<c>
PREPare:GSM:SIGN<i>:HANDover:PSWitched:CSCHeme:DL:CARRier<c>
Handover to another instrument:
PREPare:GSM:SIGN<i>:HANDover:EXTernal:DESTination
PREPare:GSM:SIGN<i>:HANDover:EXTernal:GSM
PREPare:GSM:SIGN<i>:HANDover:EXTernal:LTE
PREPare:GSM:SIGN<i>:HANDover:EXTernal:TDSCdma
PREPare:GSM:SIGN<i>:HANDover:EXTernal:WCDMa

2.3.3 General Settings

These settings are located at the very top of the configuration dialog.

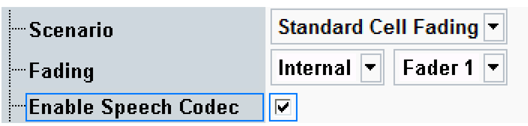


Fig. 2-41: Top of configuration dialog

Scenario, Fading

This parameter allows to switch between certain test situations that require different sets of parameters. Some parameters are only available for a specific scenario or have a different meaning depending on the scenario.

The required test setup also depends on the scenario, see chapter 2.2.1, "Test Set-ups", on page 13.

The scenarios "Standard Cell Fading" and "IQ out - RF in" require an installed I/Q board.

- **Standard Cell**:
  Standard GSM cell with one RF input path and one RF output path
- **Standard Cell Fading**:
  "Standard Cell" plus fading and/or AWGN insertion.
  Either external fading via a connected R&S AMU200A or internal fading via an internal fader I/Q board. For internal fading the I/Q board to be used can be selected. If two signaling applications uses internal fading at the same time, use diverse fader I/Q boards to avoid conflict.
  Option R&S CMW-KS210 is required, for internal fading also R&S CMW-KE100 and R&S CMW-KE200.
  See also chapter 2.2.3, "External Fading", on page 18 and chapter 2.3.6, "Internal Fading", on page 101.
- **IQ out - RF in**:
  RF uplink as for "Standard Cell", baseband downlink via the I/Q board. Allows for example to insert an R&S SMU200A into the downlink path.
- **BCCH and TCH/PDCH**:
  Provides separate downlink signals for the BCCH and the TCH/PDCH.
  This guarantees that the BCCH is still available after a dual-band handover, even if the BCCH band and the TCH band are wide apart and can not be covered by a single downlink path.
  When this scenario is active, separate output paths can be configured for the BCCH and the TCH/PDCH (converter, connector and external attenuation). Furthermore, the BCCH level and the TCH/PDCH level can be configured independently. Swapping between the "Standard Cell" and "BCCH and TCH/PDCH" scenarios is possible even during connection established.

Remote command:

```
ROUTe:GSM:SIGN<i>:SCENario:SCELl
ROUTe:GSM:SIGN<i>:SCENario:IORI
ROUTe:GSM:SIGN<i>:SCENario:BATCh
ROUTe:GSM:SIGN<i>:SCENario:SCFading[:EXTernal]
ROUTe:GSM:SIGN<i>:SCENario:SCFading:INTernal
ROUTe:GSM:SIGN<i>:SCENario:SCFading:INTernal:FFADer
ROUTe:GSM:SIGN<i>:SCENario?
ROUTe:GSM:SIGN<i>?
```

Enable Speech Codec

Enable this parameter if you want to perform CS connection with the audio codec involving the audio measurements application. If this parameter is disabled, no connection is established between the signaling unit and the codec board. Only one signaling application with this parameter enabled can be active at a time (cell on / downlink signal present). The parameter is only configurable while the downlink signal is switched off. The parameter is only displayed if a audio measurements board, codec board, audio firmware/software and option R&S CMW-KS210 are available.

For general prerequisites, required options and background information see chapter 2.2.6, "Audio Measurements", on page 21.

Remote command:
CONFigure:GSM:SIGN<i>:ESCode

2.3.4 I/Q Settings

The parameters in this section configure the I/Q output path and/or the I/Q input path. This is relevant for external fading scenarios and for the "I/Q out - RF in" scenario. Only for these scenarios the section is present.

Depending on the scenario the section configures only the I/Q output path or one input and one output path. Typically an R&S AMU200A or an R&S SMU200A is connected.

When using the "I/Q out - RF in" scenario, it is recommended to specify also the external delay of the test setup in the setup dialog. This allows the "GSM Signaling" application to compensate a time delay in the output path, which results also in a delayed uplink signal.

See also: "Digital IQ" in the R&S CMW user manual, chapter "Basic Instrument Functions"

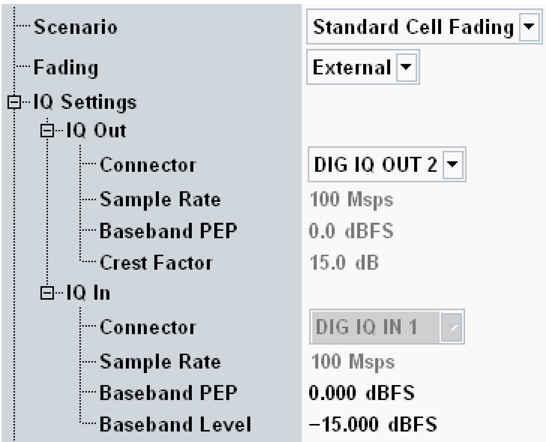


Fig. 2-42: I/Q settings (standard cell fading: external)

Connector (Out / In)

Select the output connector. The input connector depends on the output connector and is displayed for information.

The DIG IQ connectors are located at the rear panel (if an I/Q board is installed).

Remote command:
`ROUTe:GSM:SIGN<i>:SCENario:IORI`
`ROUTe:GSM:SIGN<i>:SCENario:SCFading[:EXTernal]`

Sample Rate (Out / In)
The used sample rate is displayed for information. The value is fixed.

Configure the connected instrument accordingly (baseband input settings and digital I/Q output settings).

Remote command:
`SENSe:GSM:SIGN<i>:IQOut:PATH<n>?`

Baseband PEP (Out / In)
Indicates the peak envelope power of the baseband signal as dB value relative to full scale. "Full scale" in this case corresponds to the maximum representable amplitude of the I/Q samples.

Use the displayed output PEP value to configure the baseband input of the connected instrument.

Configure the input PEP so that it matches the baseband output of the connected instrument.

Remote command:
`SENSe:GSM:SIGN<i>:IQOut:PATH<n>?`
`CONFigure:GSM:SIGN<i>:IQIN:PATH<n>`

Crest Factor (Out)
Indicates the crest factor of the baseband signal, i.e. the ratio of peak to average baseband power. The average power is calculated for time intervals with active downlink traffic channel timeslots only.

The crest factor changes during connection setup or when the coding scheme is changed.

Use the displayed crest factor value to configure the baseband input of the connected instrument.

Remote command:
`SENSe:GSM:SIGN<i>:IQOut:PATH<n>?`

Baseband Level (In)
Indicates the nominal RMS level of the baseband signal during a call (connection established).

Configure the baseband level so that it matches the baseband output of the connected instrument.

Remote command:
`CONFigure:GSM:SIGN<i>:IQIN:PATH<n>`

2.3.5 RF Settings

The parameters in this section configure the RF input and output paths.

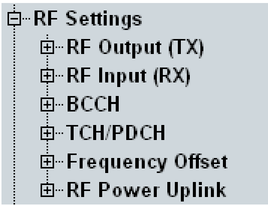


Fig. 2-43: Paths for standard cell

For descriptions of the parameters, refer to the subsections.

2.3.5.1 RF Signal Routing

Depending on the selected scenario this section configures only the RF input path or one input and one output path or one input and two output paths. All parameters are configurable per path.

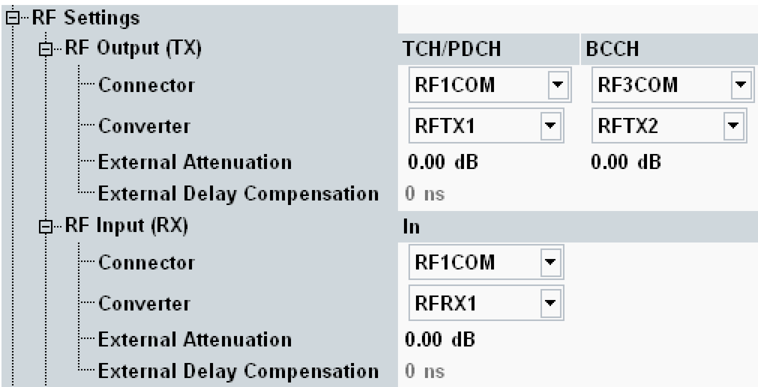


Fig. 2-44: RF path settings (BCCH and TCH/PDCH)

RF Output (TX)
The following parameters configure the RF output path of the R&S CMW.

Routing ← RF Output (TX)
Selects the output path for the generated RF signal, i.e. the output connector and the TX module to be used.

Depending on your hardware configuration there are dependencies between both parameters. Select the RF connector first. The "Converter" parameter offers only values compatible with the selected RF connector.

For scenario "BCCH and TCH/PDCH" there are two sets of settings. The first set (RF Settings > RF Output) defines the output path for the TCH/PDCH downlink signal. The second set (RF Settings > BCCH > RF Output) defines the output path for the BCCH downlink signal.

Remote command:
`ROUTe:GSM:SIGN<i>:SCENario:SCELl`
`ROUTe:GSM:SIGN<i>:SCENario:BATCh`
`ROUTe:GSM:SIGN<i>:SCENario:SCFading[:EXTernal]`
`ROUTe:GSM:SIGN<i>:SCENario:SCFading:INTernal`
`ROUTe:GSM:SIGN<i>:SCENario:SCFading:INTernal:FFADer`

External Attenuation ← RF Output (TX)
Defines the value of an external attenuation (or gain, if the value is negative) in the output path. With an external attenuation of x dB, the power of the generated signal is increased by x dB. The actual generated levels are equal to the displayed values plus the external attenuation.

If a correction table for frequency-dependent attenuation is active for the chosen connector, then the table name and a button are displayed. Press the button to display the table entries.

For scenario "BCCH and TCH/PDCH" there are two sets of settings. The first set (RF Settings > RF Output) defines the output path for the TCH/PDCH downlink signal. The second set (RF Settings > BCCH > RF Output) defines the output path for the BCCH downlink signal.

Remote command:
`CONFigure:GSM:SIGN<i>:RFSettings:EATTenuation:OUTPut<n>`
`CONFigure:GSM:SIGN<i>:RFSettings:EATTenuation:BCCH:OUTPut`

External Delay Compensation ← RF Output (TX)
Defines the value of an external time delay in the output path, for example caused by a very long optical fiber cable or by an additional instrument in the output path.

As a result, the downlink signal is sent earlier, so that the downlink signal arrives at the MS without delay.

Remote command:
`CONFigure:GSM:SIGN<i>:RFSettings:EDC:OUTPut`

RF Input (RX)
The following parameters configure the RF input path of the R&S CMW.

Routing ← RF Input (RX)

Selects the input path for the measured RF signal, i.e. the input connector and the RX module to be used.

Depending on your hardware configuration there may be dependencies between both parameters. Select the RF connector first. The "Converter" parameter offers only values compatible with the selected RF connector.

Remote command:

ROUTe:GSM:SIGN<i>:SCENario:SCELl

ROUTe:GSM:SIGN<i>:SCENario:IORI

ROUTe:GSM:SIGN<i>:SCENario:BATCh

ROUTe:GSM:SIGN<i>:SCENario:SCFading[:EXTernal]

ROUTe:GSM:SIGN<i>:SCENario:SCFading:INTernal:FFADer

External Attenuation ← RF Input (RX)

Defines the value of an external attenuation (or gain, if the value is negative) in the input path. The power readings of the R&S CMW are corrected by the external attenuation value.

The external attenuation value is also used in the calculation of the maximum input power that the R&S CMW can measure.

If a correction table for frequency-dependent attenuation is active for the chosen connector, then the table name and a button are displayed. Press the button to display the table entries.

Remote command:

CONFigure:GSM:SIGN<i>:RFSettings:EATTenuation:INPut

External Delay Compensation ← RF Input (RX)

Defines the value of an external time delay in the input path, for example caused by a very long optical fiber cable.

The signaling application uses this information to compensate for the delay and to synchronize the uplink and the downlink in spite of the delay.

Remote command:

CONFigure:GSM:SIGN<i>:RFSettings:EDC:INPut

2.3.5.2 BCCH Settings

The following parameters configure basic BCCH settings.

Fig. 2-45: RF settings - BCCH settings

Band

Selects the GSM band used for the BCCH. This band is initially also used for the TCH, but the TCH band can be changed via a handover. The GSM band determines the range of available RF "Channels" and the channel/frequency assignment.

For a complete overview of GSM bands refer to chapter 2.2.9.1, "GSM Bands and Channels", on page 29.

At present, the R&S CMW supports a subset of GSM bands.

Remote command:

`CONFigure:GSM:SIGN<i>:BAND:BCCH`

DL Channel/Frequency

GSM channel number for the Broadcast Control Channel (BCCH) that the R&S CMW generates in order to set up and maintain the connection to the mobile station under test. The BCCH is transmitted in timeslot no. 0 of the generated GSM downlink signal.

The carrier center frequency corresponding to the channel number is displayed for information.

The channel settings for the BCCH and the Traffic Channel (TCH) are independent from each other. The allowed channel range depends on the selected GSM band.

For background information see chapter 2.2.9.1, "GSM Bands and Channels", on page 29.

Remote command:

`CONFigure:GSM:SIGN<i>:RFSettings:CHANnel:BCCH`

Level

Absolute level of the Broadcast Control Channel (BCCH) in dBm.

For scenarios using the same path for all downlink channels (e.g. standard cell), the level is identical for all channels. In that case the BCCH level is only displayed for information and is equal to the reference level for the TCH/PDCH channels, see "DL Reference Level" on page 98.

For scenarios using separate paths for BCCH and TCH (e.g. "BCCH and TCH/PDCH" scenario), the BCCH level can be configured independently of the reference level.

This parameter is only available for scenario "BCCH and TCH/PDCH", see chapter 2.3.5.1, "RF Signal Routing", on page 93.

Remote command:

`CONFigure:GSM:SIGN<i>:RFSettings:LEVel:BCCH`

PMax (PCL)

Maximum transmitter output level of the MS allowed in the cell. The value corresponds to the output power at which the mobile station performs a location update (access burst level).

The level P_{Max} is defined as a Power Control Level (PCL) value in the range between 0 and 31. The corresponding absolute level in dBm is displayed for information. The definition of the PCL range depends on the GSM band; see chapter 2.2.9.2, "Power Control Levels", on page 30.

Note: After a dual-band handover to another GSM band, P_{Max} is also valid in the destination network. Due to the band-specific PCL scales, the actual maximum MS output power changes if one of the bands GSM 1800/GSM 1900 and a lower-frequency band is involved.
Example: P_{Max} = 5, handover from GSM 900 to GSM 1800.

In the original network, PCL 5 corresponds to a maximum output power of 33 dBm, in the destination network, to 20 dBm. In order to reach the maximum output power of 30 dBm for GSM 1800, P_{Max} must be set to 0.

Remote command:
`CONFigure:GSM:SIGN<i>:RFSettings:PMAX:BCCH`

2.3.5.3 TCH/PDCH Settings

The following parameters configure basic TCH/PDCH settings.

If the downlink dual carrier mode is enabled, most TCH/PDCH parameters can be configured individually per carrier, see also "DL Dual Carrier" on page 135.

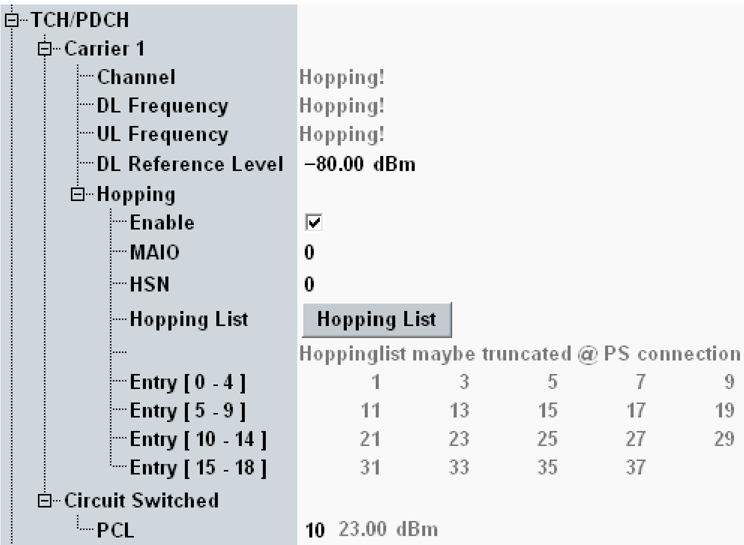


Fig. 2-46: RF settings - TCH/PDCH settings

Carrier 1/2

All parameters below are configurable per carrier. Exceptions are explicitly stated.

For background information see chapter 2.2.9.1, "GSM Bands and Channels", on page 29 and chapter 2.2.9.2, "Power Control Levels", on page 30.

Channel / Frequency ← Carrier 1/2

GSM channel number for the Traffic Channel (TCH, for circuit switched connections) and the Packet Data Channel (PDCH, for packet switched connections). For more TCH/PDCH settings see chapter 2.3.8, "Connection Parameters", on page 123.

TCH and PDCH have equal channel settings, independent from the BCCH settings. The allowed channel range depends on the selected GSM band.

The resulting DL and UL center frequencies are displayed for information.

The parameter UL frequency is not relevant for the carrier 2.

Remote command:

`CONFigure:GSM:SIGN<i>:RFSettings:CHANnel:TCH[:CARRier<c>]`

`CONFigure:GSM:SIGN<i>:RFSettings:CHCCombined:TCH:CSWitched`

DL Reference Level ← Carrier 1/2

Absolute level of the TCH and the PDCH in dBm. The range of values depends of the selected output connector ("RF Output > Routing"). The actual generated TCH/PDCH level is modified if an external output attenuation ("RF Output > External Attenuation") is set.

The R&S CMW uses equal levels for the TCH and the PDCH. Depending on the scenario, the "Reference Level" is also used for the BCCH.

In dual carrier mode both carriers use the same setting.

Remote command:

`CONFigure:GSM:SIGN<i>:RFSettings:LEVel:TCH[:CARRier<c>]`

Hopping ← Carrier 1/2

The hopping is configurable as follows.

Enable ← Hopping ← Carrier 1/2

Enable or disable frequency hopping in the downlink traffic channel.

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 list to the mobile station. From this list, the mobile station calculates the radio frequency channel for each TDMA frame number according to an algorithm described in GSM 45.002.

If hopping is enabled before a circuit switched connection is established, the hopping information is sent to the MS in the TCH assignment message. At which time during a circuit switched call/connection setup the traffic channel is assigned depends on the parameter "TCH Assignment" on page 128.

For packet connections it is not possible to use the full number of 64 entries of the hopping list. It depends on the current GSM band, how many entries are possible. The R&S CMW uses as much entries as possible. At least 18 entries are always possible.

Option R&S CMW-KS210 required.

Remote command:
`CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:ENABle:TCH[:CARRier<c>]`

MAIO ← Hopping ← Carrier 1/2
The Mobile Allocation Index Offset (MAIO) determines, together with the Hopping Sequence Number (HSN), which entry of the hopping list is used as first value.

The hopping sequence generation is defined in 3GPP TS 45.002, section 6.2.3. For HSN = 0 the number of the list entry applied to frame number 0 equals *MAIO modulo N*, with N being the length of the hopping list.

Option R&S CMW-KS210 required.

Remote command:
`CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:MAIO:TCH[:CARRier<c>]`

HSN ← Hopping ← Carrier 1/2
Defines the Hopping Sequence Number (HSN) to be used. The HSN determines in which order the hopping list entries are to be used. HSN = 0 results in cyclic hopping (sequentially go through the hopping list and at the end go back to the start). All other values result in a non-sequential usage of the hopping list.

Option R&S CMW-KS210 required.

Remote command:
`CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:HSN:TCH[:CARRier<c>]`

Hopping List / Entry ... ← Hopping ← Carrier 1/2
For configuration press the "Hopping List" button. A dialog opens where you can activate or deactivate entries and modify the channel numbers. The list is sorted automatically in ascending order.

The "Entry ..." parameters display the currently defined hopping list. The list can contain up to 64 GSM channel numbers - entry 0 to 63.

Option R&S CMW-KS210 required.

Remote command:
`CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:SEQuence:TCH[:CARRier<c>]`

Circuit Switched > PCL
MS transmitter output level in the TCH timeslot that the MS uses for circuit switched connections. The level is signaled to the MS under test as a Power Control Level (PCL) value in the range between 0 and 31. The corresponding absolute level in dBm is displayed for information. The PCL must be smaller than or equal to the maximum output power of the MS, P_{Max}.

The definition of the PCL range depends on the GSM band; see chapter 2.2.9.2, "Power Control Levels", on page 30.

Remote command:
CONFigure:GSM:SIGN<i>:RFSettings:PCL:TCH:CSWitched
CONFigure:GSM:SIGN<i>:RFSettings:CHCCombined:TCH:CSWitched

2.3.5.4 Frequency Offset

The following parameters configure frequency offset settings.

Fig. 2-47: RF settings - frequency offset

Downlink, Uplink
Sets positive or negative frequency offsets to be added to the specified frequencies.

Remote command:
CONFigure:GSM:SIGN<i>:RFSettings:FOFFset:DL
CONFigure:GSM:SIGN<i>:RFSettings:FOFFset:UL

2.3.5.5 Expected Uplink Power Settings

The following parameters configure the expected uplink power.

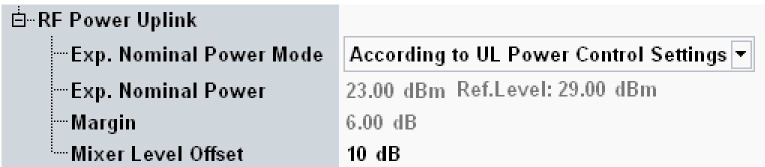


Fig. 2-48: RF settings - expected UL power settings

Exp. Nominal Power, Margin
These parameters configure the expected UL power. Two modes are available:

- **According to UL Power Control Settings**
  The UL power is calculated automatically from the UL power control settings. The resulting expected nominal power is displayed for information. The displayed reference level is calculated as:
  Reference Level = Expected Nominal Power + 7 dB Margin

Which UL power control settings are considered depends on the connection states:
  – No connection: see "PMax (PCL)" on page 96
  – Call established (CS): see "Circuit Switched > PCL" on page 100
  – TBF established (PS): see "Gamma" on page 83
- **Manual**
  In manual mode the expected nominal power and a margin can be defined manually. The displayed reference level is calculated as:
  Reference Level = Expected Nominal Power + Margin

The margin is used to account for the known variations (crest factor) of the RF input signal power.

Note: The actual input power at the connectors (i.e. the "Reference Level" minus the "External Attenuation" value, if all power settings are configured correctly) must be within the level range of the selected RF input connector; refer to the data sheet.

The parameters can be changed in all main connection states including "Connection Established".

Remote command:
CONFigure:GSM:SIGN<i>:RFSettings:ENPMode
CONFigure:GSM:SIGN<i>:RFSettings:ENPower
CONFigure:GSM:SIGN<i>:RFSettings:UMARgin

Mixer Level Offset
Varies the input level of the mixer in the analyzer path of the multi evaluation measurement in combined signal path. A negative offset reduces the mixer input level, a positive offset increases it. Optimize the mixer input level according to the properties of the uplink signal.

Mixer Level Offset	Advantages	Possible Shortcomings
< 0 dB	Suppression of distortion (e.g. of the intermodulation products generated in the mixer)	Lower dynamic range (due to smaller signal-to-noise ratio)
> 0 dB	High signal-to-noise ratio, higher dynamic range	Risk of intermodulation, smaller overdrive reserve

Remote command:
CONFigure:GSM:SIGN<i>:RFSettings:MLOFfset

2.3.6 Internal Fading

This branch of the configuration tree is only visible if the scenario "Standard Cell Fading" is selected and the fading source is set to "Internal".

For general prerequisites, required options and background information see chapter 2.2.4, "Internal Fading", on page 19.

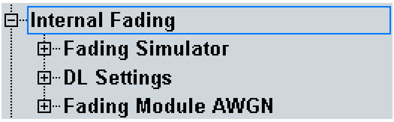


Fig. 2-49: Internal fading settings

2.3.6.1 Fading Simulator

The following parameters allow to enable and set up the fading simulator. For background information see chapter 2.2.4.1, "Fading Simulator", on page 20.

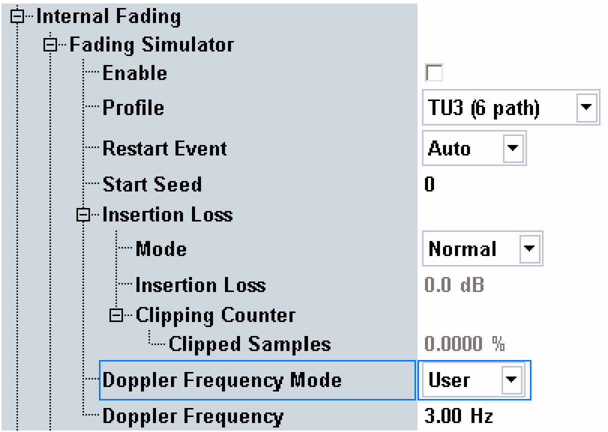


Fig. 2-50: Fading simulator settings

Enable

Enables/disables the fading simulator.

Remote command:

`CONFigure:GSM:SIGN<i>:FADing:FSIMulator:ENABle`

Profile

Selects one of the multipath propagation condition profiles defined in Annex C.3 of 3GPP TS 45.005.

The following types of propagation models are supported: TU (urban area), HT (hilly terrain), RA (rural area), EQ (equalization test) and TI (very small cell).

All models involve a movement of the MS. The speed of movement in km/h is indicated as part of the profile name, the number of propagation paths is also indicated.

Example: "TU3 (6 path)" means urban area, MS moving with 3 km/h, 6 propagation paths.

Remote command:
`CONFigure:GSM:SIGN<i>:FADing:FSIMulator:STANdard`

Restart Event
In "Auto" mode, fading automatically starts with the downlink signal. In "Manual" mode, it is started and restarted manually.

Remote command:
`CONFigure:GSM:SIGN<i>:FADing:FSIMulator:RESTart:MODE`
`CONFigure:GSM:SIGN<i>:FADing:FSIMulator:RESTart`

Start Seed
Sets the start seed for the pseudo-random fading algorithm. This enables reproducible fading conditions.

Remote command:
`CONFigure:GSM:SIGN<i>:FADing:FSIMulator:GLOBal:SEED`

Insertion Loss
In "Normal" mode, the insertion loss (i.e. the required attenuation at fader input) is calculated based on the currently selected Profile. In "Manual" mode it can be adjusted by the user.

A lower insertion loss allows for a higher downlink power but may result in clipping.

Remote command:
`CONFigure:GSM:SIGN<i>:FADing:FSIMulator:ILOSs:MODE`
`CONFigure:GSM:SIGN<i>:FADing:FSIMulator:ILOSs:LOSS`

Clipping Counter
Displays the percentage of clipped samples. This information is useful for insertion loss mode "Manual". It allows you to find the lowest insertion loss value for which no clipping occurs.

Remote command:
`CONFigure:GSM:SIGN<i>:FADing:FSIMulator:ILOSs:CSAMples?`

Doppler Frequency, Mode
Displays the maximum Doppler frequency. In normal mode it is resulting from the selected fading profile, in user mode the maximum Doppler frequency is set manually.

Remote command:
`CONFigure:GSM:SIGN<i>:FADing:FSIMulator:DSHift`
`CONFigure:GSM:SIGN<i>:FADing:FSIMulator:DSHift:MODE`

2.3.6.2 DL Settings

This branch displays noise power values, calculated from the downlink power and the AWGN settings.

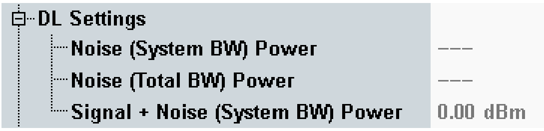


Fig. 2-51: Noise information

Noise (System BW) Power

Displays the noise power on the downlink channel.

Remote command:

`CONFigure:GSM:SIGN<i>:FADing:POWer:NOISe?`

Noise (Total BW) Power

Displays the total noise power, within and outside of the downlink channel.

Remote command:

`CONFigure:GSM:SIGN<i>:FADing:POWer:NOISe:TOTal?`

Signal + Noise (System BW) Power

Displays the total power (signal + noise) on the downlink channel.

Remote command:

`CONFigure:GSM:SIGN<i>:FADing:POWer:SUM?`

2.3.6.3 Fading Module AWGN

The following parameters enable and configure the AWGN insertion on the fading module. For background information see chapter 2.2.4.2, "AWGN Generator", on page 20.

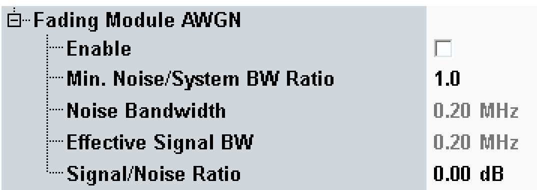


Fig. 2-52: AWGN settings

Enable

Enables/disables AWGN insertion via the fading module.

Remote command:

CONFigure:GSM:SIGN<i>:FADing:AWGN:ENABle

Min. Noise/System BW Ratio

Configures the minimum ratio between the noise bandwidth and the GSM downlink channel bandwidth (200 kHz).

Remote command:

CONFigure:GSM:SIGN<i>:FADing:AWGN:BWIDth:RATio

Noise Bandwidth

Displays the actual noise bandwidth, resulting from the "Min. Noise/System BW Ratio" and the fixed signal bandwidth.

Remote command:

CONFigure:GSM:SIGN<i>:FADing:AWGN:BWIDth:NOISe?

Effective Signal BW

For GSM, the effective signal bandwidth equals 200 kHz (width of one downlink channel).

Signal/Noise Ratio

Specifies the signal to noise ratio.

Remote command:

CONFigure:GSM:SIGN<i>:FADing:AWGN:SNRatio

2.3.7 Network Parameters

This section defines basic network parameters.

Fig. 2-53: Network parameters

For description of the individual parameters refer to the following sections.

2.3.7.1 General Network Parameters

This section describes the highest level of the network section.

Fig. 2-54: Miscellaneous network parameters

Packet Switched Domain
Selects whether the emulated cell supports packet switched connections. Circuit switched connections are always supported.

Remote command:
CONFigure:GSM:SIGN<i>:CELL:PSDomain

2.3.7.2 Neighbor Cell Settings

This section defines neighbor cell information to be broadcast to the MS. For each radio access technology you can define several neighbor cell entries. The signaling messages for broadcast of neighbor cell information are defined in 3GPP TS 44.018.

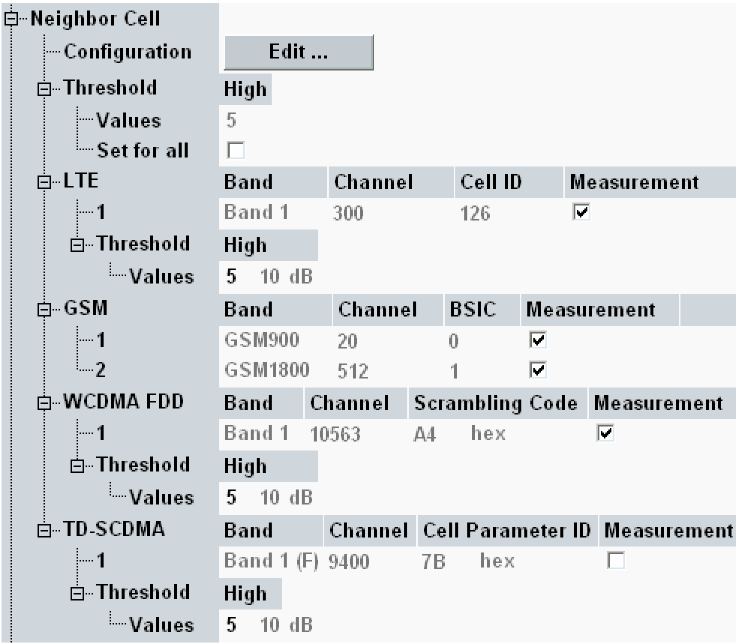


Fig. 2-55: Neighbor cell settings

The column "Measurement" is only configurable for enabled entries. It specifies whether measurement reports for the neighbor cell shall be sent by the MS. Received reports are displayed in the main view, see Neighbor Cells.

The individual neighbor cell settings are described below.

Configuration

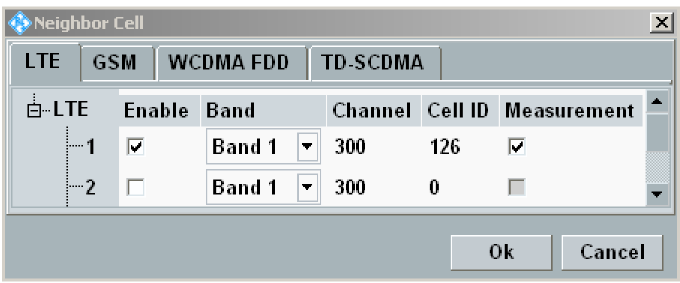


Fig. 2-56: Neighbor cell configuration dialog

To configure the neighbor cell entries, press the "Edit" button. The configuration dialog contains one tab per technology. Only the enabled entries are broadcast.

Threshold
The configured "High" reselection threshold value is broadcast in the BCCH. For GSM cell selection reselection the MS measures all channels within its bands (refer to 3GPP 45.008). For the UTRAN and/or E-UTRAN neighbor cells, the SI 2quater "Rest Octets" information element contains neighbor cell lists and carries "THRESH_UTRAN_high/ THRESH_E-UTRAN_high" defined in 3GPP TS 44.018.

The resulting threshold value in dB is displayed for information.

You can define an individual threshold per technology or a common threshold applicable to all technologies. To apply common thresholds, enable "Threshold > Set for all". Disable the parameter to apply the individual thresholds.

Remote command:
`CONFigure:GSM:SIGN<i>:NCELl:ALL:THResholds:HIGH`
`CONFigure:GSM:SIGN<i>:NCELl:LTE:THResholds:HIGH`
`CONFigure:GSM:SIGN<i>:NCELl:WCDMa:THResholds:HIGH`
`CONFigure:GSM:SIGN<i>:NCELl:TDSCdma:THResholds:HIGH`

LTE
For an LTE neighbor cell entry you can specify the operating band, the downlink channel number and the cell ID. Up to four LTE neighbor cells are possible.

Remote command:
`CONFigure:GSM:SIGN<i>:NCELl:LTE:CELL<n>`

GSM
For a GSM neighbor cell entry you can specify the operating band, the channel number used for the BCCH and the BSIC. The combination of the channel number and BSIC must be unique within the configuration. Up to 16 neighbor cells are possible.

Remote command:
`CONFigure:GSM:SIGN<i>:NCELl:GSM:CELL<n>`

WCDMA FDD
For a WCDMA neighbor cell entry you can specify the operating band, the downlink channel number and the primary scrambling code of the cell. Up to four WCDMA neighbor cells are possible.

Remote command:
`CONFigure:GSM:SIGN<i>:NCELl:WCDMa:CELL<n>`

TD-SCDMA
For a TD-SCDMA neighbor cell entry you can specify the operating band, the channel number and the scrambling code of the cell. Up to four TD-SCDMA neighbor cells are possible.

Remote command:
`CONFigure:GSM:SIGN<i>:NCELl:TDSCdma:CELL<n>`

2.3.7.3 Cell Reselection

The parameters in this section define the cell reselection information to be transmitted in the BCCH. For detailed information refer to 3GPP TS 45.008.

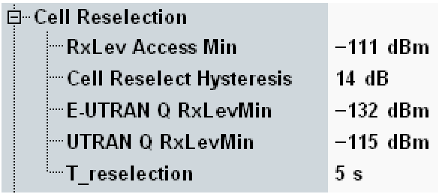


Fig. 2-57: Settings for cell reselection

RxLev Access Min

Sets the minimum received signal level at the MS antenna required to access the GSM cell.

Option R&S CMW-KS210 is required.

Remote command:

`CONFigure:GSM:SIGN<i>:CELL:RESelection:QUALity:RXLevmin:ACCess`

Cell Reselect Hysteresis

Sets the hysteresis for the cell reselection algorithm.

Remote command:

`CONFigure:GSM:SIGN<i>:CELL:RESelection:HYSTeresis`

E-UTRAN Q RxLevMin

Sets the minimum received signal level at the UE antenna required to access the LTE cell.

Option R&S CMW-KS210 is required.

Remote command:

`CONFigure:GSM:SIGN<i>:CELL:RESelection:QUALity:RXLevmin:EUTRan`

UTRAN Q RxLevMin

Sets the minimum received signal level at the UE antenna required to access the UMTS cell.

Option R&S CMW-KS210 is required.

Remote command:

`CONFigure:GSM:SIGN<i>:CELL:RESelection:QUALity:RXLevmin:UTRan`

T_Reselection

Sets the time hysteresis for the cell reselection algorithm.

Option R&S CMW-KS210 is required.

Remote command:

CONFigure:GSM:SIGN<i>:CELL:RESelection:TRESelection

2.3.7.4 Network Identity

Network "Identity" parameters characterize the radio network simulated by the R&S CMW.

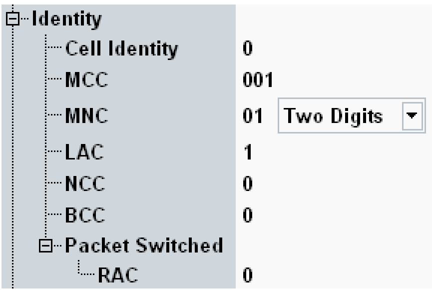


Fig. 2-58: Network identity settings

Cell Identity

Identifier of the simulated GSM cell, unique within a location area.

Remote command:

CONFigure:GSM:SIGN<i>:CELL:IDENtity

MCC

3-digit Mobile Country Code (MCC).

Remote command:

CONFigure:GSM:SIGN<i>:CELL:MCC

MNC

2- or 3-digit Mobile Network Code (MNC). The number of digits can be selected in the adjacent field ("Two Digits" or "Three Digits"), irrespective of the GSM band.

Remote command:

CONFigure:GSM:SIGN<i>:CELL:MNC

CONFigure:GSM:SIGN<i>:CELL:MNC:DIGits

LAC
Specifies the Location Area Code (LAC).

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:LAC`

NCC
Specifies the Network Color Code (NCC).

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:NCC`

BCC
Specifies the Base transceiver station Color Code (BCC). The BCC parameter is also used as Training Sequence Code (TSC).

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:BCC`

RAC
Specifies the Routing Area Code (RAC).

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:RAC`

2.3.7.5 MS Identity

This section defines parameters of a default subscriber. These parameters are required for CS connection setup without previous location update.

Fig. 2-59: MS identity settings

Default IMSI
International Mobile Subscriber Identity (IMSI) which is used to set up the connection to the MS if the mobile does not initiate a location update.

To configure in which situations the MS shall perform a location update, see "Location Update" on page 116.

See also chapter 2.2.7, "Connection States", on page 23.

An IMSI consists of three parts:
- MCC: 3-digit Mobile Country Code
- MNC: 2- or 3-digit mobile network code, depending on the setting in the "Network > Identity" section.
- MSIN: 10- or 9- digit Mobile Subscriber Identification Number. A 10-digit MSIN is used together with a 2-digit MNC; a 9-digit MSIN is used together with a 3-digit MNC.

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:IMSI`

2.3.7.6 Requested Mobile Data

The "Requested Mobile Data" section defines which parameters of the mobile station are requested e.g. during location update or GPRS attach. Some of the requested information is displayed in the "MS Info" section or "MS Capabilities" section of the "GSM Signaling" main dialog. A restriction of the requested information can accelerate the location update or attach procedure.

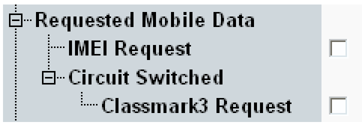


Fig. 2-60: Requested mobile data settings

IMEI Request
Request of the International Mobile Equipment Identity (IMEI).

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:IMEirequest`

Circuit Switched > Classmark3 Request
Activates/deactivates classmark 3 information element as specified in 3GPP TS 24.008, section 10.5.1.7.

During the location update procedure, this element requests the supported bands and the power classes from the MS. In some cases the supported multislot classes are reported by the MS as well.

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:CREQuest`

2.3.7.7 Cell - Common Settings

This section defines basic parameters of the GSM cell. The settings are common for circuit switched and packet switched connections.

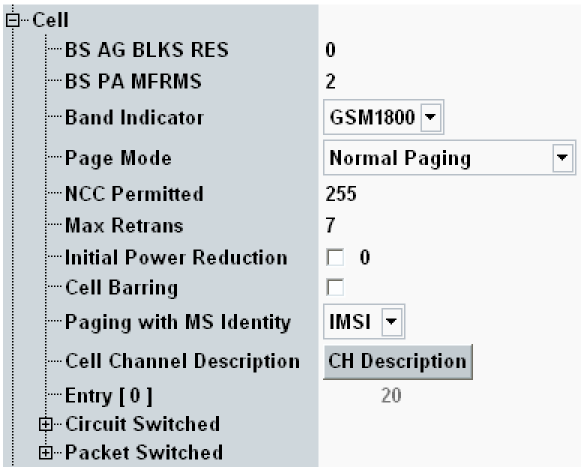


Fig. 2-61: Cell settings

BS AG BLKS RES

Number of Access Grant Channel (AGCH) data blocks reserved for the AGCH access (basic services access grant blocks reserved).

Remote command:

CONFigure:GSM:SIGN<i>:CELL:BSAGblksres

BS PA MFRMS

Interval between two paging requests of the R&S CMW in multiframes (basic service paging blocks available per multiframes).

Remote command:

CONFigure:GSM:SIGN<i>:CELL:BSPamfrms

Band Indicator

Indication of the band GSM 1800 or GSM 1900 that the current BCCH and TCH/PDCH channels belong to. The parameter is relevant for mobiles which can operate in the GSM1800 **and** in the GSM 1900 bands. The information on the band is important because the two bands partially use the same channel numbers for different frequencies.

Remote command:

CONFigure:GSM:SIGN<i>:CELL:BINDicator

Page Mode
Selects paging mode.

- **Normal paging**: the MS listens to its own paging group
- **Paging reorganization**: the MS listens to all paging groups (relevant e.g. for spurious emission measurements according to 3GPP TS 51.010-1, section 12.

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:PMODe`

NCC Permitted
Specifies the neighbor cell by its Network Color Code (NCC) that the MS is allowed to measure.

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:NCC:PERMitted`

Max Retrans
Sets the limit for the retransmissions ordered via RACH.

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:MRETrans`

Initial Power Reduction
Specifies the MS transmit level reduction at the very beginning of the connection before the standard power control algorithm starts. The power reduction only applies for the first transmission of the access burst on the RACH as defined in 3GPP TS 45.008.

Option R&S CMW-KS210 is required.

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:IPReduction`

Cell Barring
Allows/forbids the MS to camp (synchronize/attach) on the R&S CMW cell.

Option R&S CMW-KS210 is required.

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:CBARring`

Paging with MS Identity
Selects the MS identity used by paging.

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:PMIDentity`

Cell Channel Description
Specifies the allowed traffic channel numbers within the simulated GSM cell.

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:CDEScription`

Entry
Displays all traffic channels selected by Cell Channel Description.

2.3.7.8 Cell - CS and PS Parameters

This section defines the CS and PS specific parameters of the GSM cell.

Support of packet switched features

Support of many features of packet switched connections by the mobile station is optional. The packet switched parameters should be set in accordance with the capabilities of the MS under test.

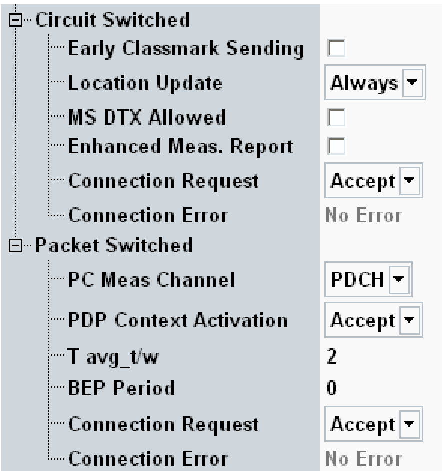


Fig. 2-62: Cell settings (CS and PS)

Circuit Switched

The following parameters configure the cell for CS connections.

Early Classmark Sending ← Circuit Switched

Specifies whether early classmark sending is requested. If enabled, the MS shall send classmark information as early as possible after access to the mobile network.

Classmark information can also be sent by the MS upon explicit request, see "Circuit Switched > Classmark3 Request" on page 112.

Remote command:

`CONFigure:GSM:SIGN<i>:CELL:ECSending`

Location Update ← Circuit Switched
Defines in which instances the MS performs a location update and provides registration information (e.g. the IMSI) so that the R&S CMW can enter the "Synchronized" connection state.

See also chapter 2.2.7, "Connection States", on page 23.

- **Always**: Location update each time the mobile station is switched on.
- **Auto**: Location update only if the mobile detects that it is no longer registered, e.g. because the SIM card or the network IDs of the R&S CMW (e.g. the LAC) are changed. In "Auto" mode, it is possible to initiate a connection from the "CS On" state using the default IMSI. This can be faster than the ordinary connection scheme, provided that it is possible to determine the time when the mobile is synchronized to the cell signal.

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:LUPDate`

MS DTX Allowed ← Circuit Switched
Specifies whether or not the mobile station may use the operating mode DTX (Discontinuous Transmission).

In discontinuous transmission mode the voice activity detection of the mobile station analyzes the language elements and the time intervals in-between in order to decide whether a transmission is required. As a result of this analysis, only useful information is transferred; if nothing is spoken, the mobile station will not transmit anything. DTX mode reduces radio interference and power consumption of the mobile stations.

Note that the DTX mode is disabled by default to ensure that TX measurements can be performed at maximum speed.

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:DTX`

Enhanced Measurement Report ← Circuit Switched
Enables or disables the MS enhanced measurement reports of the mean BEP, CV BEP and the number of received blocks. Results are displayed in the main view, see "Enhanced Measurements (CS)" on page 71.

Remote command:
`CONFigure:GSM:SIGN<i>:RREPort:CSWitched:EMReport:ENABle`

Packet Switched
The following parameters configure the cell for PS connections.

PC Meas Channel ← Packet Switched
Channel type (BCCH or PDCH) that the mobile uses to determine the received signal strength and quality. The parameter corresponds to the GPRS power control parameter PC_MEAS_CHAN in the system information 13 Rest Octets (3GPP TS 44.018) and packet system information 13 (3GPP TS 44.060).

Option R&S CMW-KS210 is required.

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:PSWitched:PCMChannel`

PDP Context Activation ← Packet Switched
Defines how the R&S CMW reacts to a PDP context activation initiated by the MS. The R&S CMW can accept or reject an ACTIVATE PDP CONTEXT REQUEST from the MS (see 3GPP TS 24.008). Note that the APN is hard-coded in the GSM signaling application.

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:PSWitched:PDPContext`

T avg_t/w ← Packet Switched
Specifies the signal level filter period for power control in packet transfer mode (T_{AVG_T}) and packet idle mode (T_{AVG_W}) as defined in 3GPP TS 45.008. With an entered value k, the filter period is $2^{k/2}/6$ multiframes. This parameter defines the update rate of the mobile's PS measurement reports (the larger k, the slower the measurement reports are updated).

Option R&S CMW-KS210 is required.

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:PSWitched:TAVGtw`

BEP Period ← Packet Switched
Configures the BEP_PERIOD specified in 3GPP TS 45.008, section 10.2.3.2.1.

The BEP period is a filter constant for EGPRS channel quality measurements (measurement reports) that the MS uses for the calculation of the Mean BEP and the CV BEP values. BEP_PERIOD is broadcast in the system information.

Option R&S CMW-KS210 is required.

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:PSWitched:BPERiod`

Connection Request (CS and PS)
Specifies the answer of the R&S CMW to the mobile originating connection request.

If "Ignore" is selected, specify the <AcceptAfter> parameter for the further handling.

Remote command:
`CONFigure:GSM:SIGN<i>:CELL:CSWitched:CREQuest`
`CONFigure:GSM:SIGN<i>:CELL:PSWitched:CREQuest`

Connection Error (CS and PS)
Returns error information related to the current connection.

Remote command:
`SENSe:GSM:SIGN<i>:CELL:CERRor?`
`SENSe:GSM:SIGN<i>:CELL:PSWitched:CERRor?`

2.3.7.9 Timers and Constants

The following parameters control the timing of the connection.

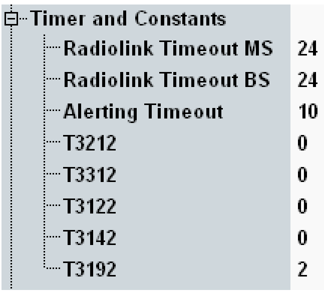


Fig. 2-63: Timer and constants

Radiolink Timeout MS

Defines the time period after which a previously established but interrupted connection is dropped by the mobile station. The timeout indicates the number of missing SACCH blocks (corresponding to 480 ms each). Only multiples of 4 are allowed (4, 8, ..., 64).

Remote command:

`CONFigure:GSM:SIGN<i>:CELL:RTMS`

Radiolink Timeout BS

Defines the time period after which an existing, but interrupted connection is aborted by the R&S CMW. The timeout indicates the number of missing SACCH blocks (corresponding to 480 ms each) in the value range 4 to 64.

Remote command:

`CONFigure:GSM:SIGN<i>:CELL:RTBS`

Alerting Timeout

Maximum time period in seconds during which the phone is ringing in the case of call to mobile (mobile terminated call). If the call is not answered, the R&S CMW returns to the Synchronized state.

Remote command:

`CONFigure:GSM:SIGN<i>:CELL:ATIMeout`

T3212

Value of the timer T3212 of the periodic location update procedure in deci-hours. If the timer is set to 0, no periodic location update is performed.

Remote command:

`CONFigure:GSM:SIGN<i>:CELL:PLUPdate`

T3312

Value of the timer T3312 of the periodic routing area update procedure in deci-hours. If the timer is set to 0, no periodic routing area update is performed.

Remote command:

CONFigure:GSM:SIGN<i>:CELL:PRAupdate

T3122, T3142

Immediate assignment reject timers:

- **T3122**: for CS connection used during random access
- **T3142**: used during packet access on CCCH

Remote command:

CONFigure:GSM:SIGN<i>:CELL:CSWitched:IARTimer

CONFigure:GSM:SIGN<i>:CELL:PSWitched:IARTimer

T3192

Defines the value of the packet switched TBF release timer. It is used when the MS waits after the reception of the final RLC data block. When the timer expires, the MS releases the resources associated with the TBF and begins to monitor its paging channel.

Option R&S CMW-KS210 is required.

Remote command:

CONFigure:GSM:SIGN<i>:CELL:PSWitched:TRTimer

2.3.7.10 Reject Causes

The parameters in this section configure the rejection of location update requests and attach requests received from the MS.

The rejection causes are defined in 3GPP TS 44.018, annex F. The purpose of rejecting MS requests is to test the reaction of the MS: does it repeat the request at all and if so, in which time intervals.

Option R&S CMW-KS210 is required.

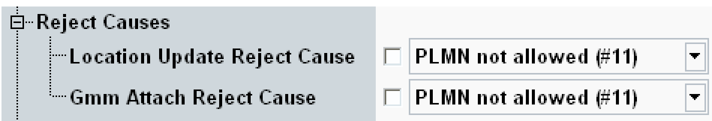


Fig. 2-64: Reject cause settings

Location Update Reject Cause

If the checkbox is enabled, the application rejects location update requests from the MS and includes the selected reject cause in the reject message.

Remote command:

CONFigure:GSM:SIGN<i>:CELL:RCAuse:LOCation

Gmm Attach Reject Cause
If the checkbox is enabled, the application rejects attach requests from the MS and includes the selected reject cause in the reject message.

Remote command:
CONFigure:GSM:SIGN<i>:CELL:RCAuse:ATTach

2.3.7.11 Security Settings

The "Security Settings" configure parameters related to the authentication procedure and other security procedures.

Fig. 2-65: Security settings

Authentication
Enables or disables authentication, to be performed during location update and attach. Authentication requires a test SIM.

An appropriate test SIM can be obtained from Rohde & Schwarz (R&S CMW-Z04, stock no. 1207.9901.02).

Remote command:
CONFigure:GSM:SIGN<i>:CELL:SECurity:AUTHenticat

KI Value
The secret key Ki is used for the authentication procedure. The value is entered as 32-digit hexadecimal number.

Authentication fails unless the secret key set by this parameter is equal to the value stored on the test SIM of the MS under test. The default value is compatible to test SIM cards delivered by Rohde & Schwarz.

Option R&S CMW-KS210 is required.

Remote command:
CONFigure:GSM:SIGN<i>:CELL:SECurity:SKEY

SIM Card Type
Selects the type of the used SIM card.

Option R&S CMW-KS210 is required.

Remote command:
CONFigure:GSM:SIGN<i>:CELL:SECurity:SIMCard

2.3.7.12 Time

The "Time" section allows you to send configurable date and time information to the MS. Thus you can update the date and time displayed by the mobile. In a real network this service is typically used to send the current local time to the MS.

The section is only visible if R&S CMW-KS210 is available.

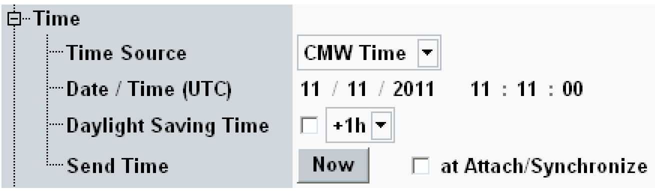


Fig. 2-66: Time settings

Time Source

This parameter selects the date and time source.

- **CMW Time**
  Selects the current CMW (Windows) date and time as source. The Windows settings determine the UTC date, the UTC time, the current daylight saving time offset and the time zone offset.
- **Date / Time**
  Selects the parameters "Date / Time (UTC)" and "Daylight Saving Time" as source. The time zone offset is set to 0.

Option R&S CMW-KS210 is required.

Remote command:

`CONFigure:GSM:SIGN<i>:CELL:TIME:TSOurce`

Date / Time (UTC)

Defines the UTC date and time to be used if "Time Source" is set to "Date / Time".

Option R&S CMW-KS210 is required.

Remote command:

`CONFigure:GSM:SIGN<i>:CELL:TIME:DATE`

`CONFigure:GSM:SIGN<i>:CELL:TIME:TIME`

Daylight Saving Time

Specifies a Daylight Saving Time (DST) offset to be used if "Time Source" is set to "Date / Time".

You can disable DST or enable it with an offset of +1 hour or +2 hours.

Option R&S CMW-KS210 is required.

Remote command:

`CONFigure:GSM:SIGN<i>:CELL:TIME:DSTime`

Send Time
Press "Now" to send the date and time information to the MS. This is only possible if the MS has performed a location update in the CS domain (CS state "Synchronized" or "Call Established").

"at Attach/Synchronize" selects whether the date and time information is sent to the MS during the location update and attach procedures.

Option R&S CMW-KS210 is required.

Remote command:
CONFigure:GSM:SIGN<i>:CELL:TIME:SNOW
CONFigure:GSM:SIGN<i>:CELL:TIME:SATTach

2.3.7.13 Synchronization

The parameters in this section configure the synchronization to other signaling applications.

Fig. 2-67: Synchronization settings

Synchronization Zone
Select the same synchronization zone in all signaling applications that you want to synchronize. "None" means that the application is not synchronized to other signaling applications.

Synchronizing signaling applications means synchronizing the used system time. This is useful for example for evaluation of message logs, because the time stamps in the logs are synchronized.

Synchronizing two GSM signaling applications means also synchronizing the used frame numbers.

The parameter is only configurable while the downlink signal is switched off.

Remote command:
CONFigure:GSM:SIGN<i>:CELL:SYNC:ZONE

Synchronization Offset
Configures the timing offset at cell start, relative to the time zone.

Without offset, the cell signal starts with frame number 0 and a system time according to the time zone. With an offset, the cell starts with frame number 0 plus the offset and a system time according to the time zone plus the offset.

The parameter is only configurable while the downlink signal is switched off.

Remote command:
CONFigure:GSM:SIGN<i>:CELL:SYNC:OFFSet

2.3.8 Connection Parameters

The "Connection" parameters configure the DL Traffic Channels (TCHs) for Circuit Switched (CS) and Packet Switched (PS) connections.

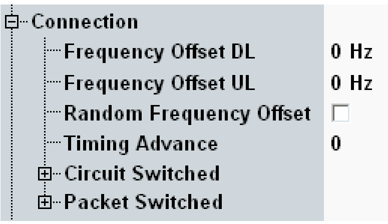


Fig. 2-68: Connection parameters

For parameter descriptions refer to the following sections.

2.3.8.1 Common Connection Settings

This section describes the common settings of the connection parameters.

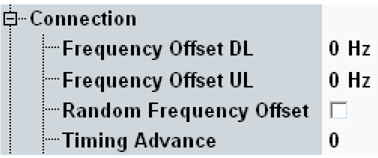


Fig. 2-69: General connection parameters

Frequency Offset

Sets the positive or negative offset to the center frequency of the uplink/downlink traffic channel.

This parameter is suspended if the frequency offset for all channels is set, see chapter 2.3.5.4, "Frequency Offset", on page 100.

Remote command:

```
CONFigure:GSM:SIGN<i>:CONNection:FOFFset:DL
CONFigure:GSM:SIGN<i>:CONNection:FOFFset[:UL]
```

Random Frequency Offset

- **OFF**: fixed frequency offset is applied
- **ON**: alternating frequency offset with ± Frequency Offset values is applied

Option R&S CMW-KS210 required.

Remote command:
CONFigure:GSM:SIGN<i>:CONNection:RFOFfset

Timing Advance
Specifies the value, which the MS uses to advance its UL timing to compensate for propagation. Timing advance is specified in 3GPP TS 44.018, section 10.5.2.40 for circuit switched and in 3GPP TS 44.060, section 12.12 for packet switched.

Option R&S CMW-KS210 required.

Remote command:
CONFigure:GSM:SIGN<i>:CONNection:TADVance

2.3.8.2 Circuit Switched General Connection Parameters

The "Circuit Switched" parameters configure the traffic channel (TCH) for the circuit switched connection. The TCH occupies a fixed timeslot and carries data for the MS under test.

Below, the parameters located at the highest level of the "Circuit Switched" section are described.

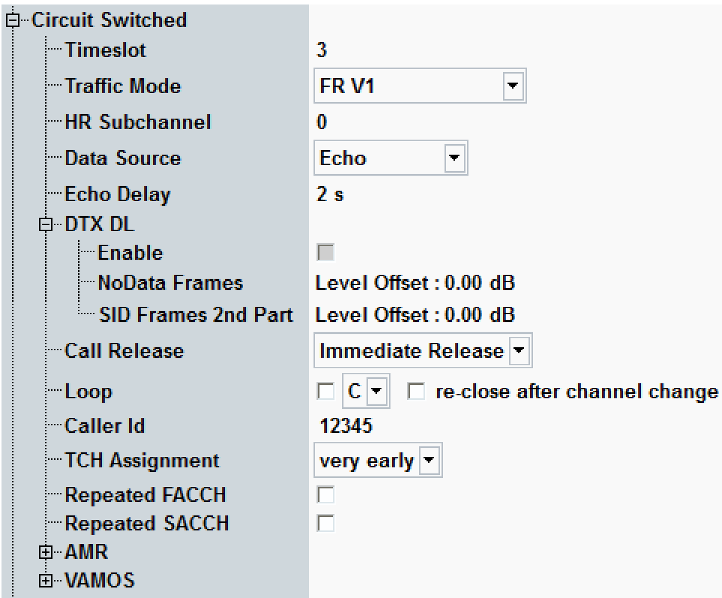


Fig. 2-70: Connection parameters (CS)

Timeslot

Selects a traffic channel timeslot for the circuit switched connection.

Remote command:

`CONFigure:GSM:SIGN<i>:CONNection:CSWitched:TSLot`

`CONFigure:GSM:SIGN<i>:RFSettings:CHCCombined:TCH:CSWitched`

Traffic Mode

Selects the speech channel coding for circuit switched voice connections.

The R&S CMW supports the following traffic modes:

- **FR V1**: full-rate version 1 speech codec
- **FR V2**: full-rate version 2 speech codec
- **HR V1**: half-rate version 1 speech codec
- **AMR-NB FR GMSK**: full-rate narrowband Adaptive Multi-Rate (AMR) codec with 4 modes and 8 data rates up to 12.2 kbit/s
- **AMR-NB HR GMSK**: half-rate narrowband AMR codec with 4 modes and 6 data rates up to 7.95 kbit/s
- **AMR-NB HR 8PSK**: half-rate narrowband AMR codec with 4 modes and 8 data rates up to 12.2 kbit/s
- **AMR-WB FR GMSK**: full-rate wideband AMR codec with 3 modes and 3 data rates up to 12.65 kbit/s
- **AMR-WB FR 8PSK**: full-rate wideband AMR codec with 4 modes and 5 data rates up to 23.85 kbit/s
- **AMR-WB HR 8PSK**: half-rate wideband AMR codec with 3 modes and 3 data rates up to 12.65 kbit/s

Option R&S CMW-KS210 required for all modes except "FR V1".

For configuration of the AMR modes see chapter 2.3.8.3, "AMR Configuration", on page 129.

Remote command:

`CONFigure:GSM:SIGN<i>:CONNection:CSWitched:TMODe`

HR Subchannel

Selects the subchannel to be used for half-rate coding (see "Traffic Mode" on page 125).

Only half of the TDMA frames are used for a connection with half-rate coding, so that two subchannels numbered 0 and 1 are available. The physical channel characteristics of the half-rate channels and the TDMA frame mapping is described in 3GPP TS 45.002, clause 7, table 1. See also the TCH/H channel description in 3GPP TS 44.018.

Option R&S CMW-KS210 is required.

Remote command:

`CONFigure:GSM:SIGN<i>:CONNection:CSWitched:HRSubchannel`

Data Source

Selects the data which the R&S CMW transmits on its DL traffic channel.

The "Echo" and "Speech" setting are appropriate for audio tests; the Pseudo Random Bit Sequences (PRBS) are appropriate for receiver quality measurements. The PRBS data are fully channel coded (including bit swapping and interleaving).

When a BER CS measurement is turned on, this parameter is configured automatically and grayed out. See also chapter 2.2.11, "BER CS Measurement", on page 35

- **Echo**:
  Loop-back with delay: All UL speech data received from the mobile is sent back after a configurable Echo Delay. If the R&S CMW does not receive speech data in this operating mode, it automatically transmits a specific bit pattern in order to produce "silence" in the receiver of the mobile station.
  This mode is suitable for a simple test of the connection: A word spoken into the microphone of the mobile should be returned after a short while.
  The mode is incompatible with an enabled test loop.
- **PRBS 2E9-1, PRBS 2E11-1**:
  PRBS transmission according to CCITT (ITU-T) O.153
- **PRBS 2E15-1**:
  PRBS transmission according to CCITT (ITU-T) O.151
- **PRBS 2E16-1**:
  Transmission of a pseudo random bit sequence defined by the polynomial: $x^{16} + x^5 + x^3 + x^2 + 1$
- **Speech**:
  Voice codec connection: GSM signaling interconnects MS and voice codec board (see chapter 2.2.6, "Audio Measurements", on page 21). This enables measurements performed by audio measurements application.

Remote command:

`CONFigure:GSM:SIGN<i>:CONNection:CSWitched:DSOurce`

Echo Delay

Defines the time that the R&S CMW waits before it loops back the received data. This parameter is only applicable if the Data Source = *Echo*.

Remote command:

`CONFigure:GSM:SIGN<i>:CONNection:CSWitched:EDELay`

DTX DL

Configures the discontinuous transmission of the R&S CMW.

The specified power values are relative to the configured TCH/PDCH level, see "DL Reference Level" on page 98. NoData frames denotes DL frames, where no SID frames and no SACCH frames are sent. The level of the second part of SID frames is required for test case 3GPP 51.010-1, TC 21.1.4.2, step 64.

This parameter is only applicable if the Data Source ≠ *Echo*

Remote command:

`CONFigure:GSM:SIGN<i>:CONNection:CSWitched:DTX:DL`

Call Release

Specifies the signaling volume during the call release:

- **Normal release**: release according to the specification
- **Immediate release**: release with a reduced signaling

Remote command:
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:CRELease

Loop

Activates/deactivates a test loop and selects the loop type. All test loops are defined in 3GPP TS 44.014. For an overview see also chapter 2.2.11.12, "Test Loops", on page 46.

When a BER CS measurement is turned on, the R&S CMW automatically sets this parameter to the required loop type, activates the loop and modifies the parameter display accordingly (grayed out values).

The following loop types are available:
- **A**: TCH loop including signaling of erased frames
- **B**: TCH loop without signaling of erased frames
- **C**: TCH burst-by-burst loop
- **D**: TCH loop including signaling of erased frames and unreliable frames
- **I**: TCH loop for inband signaling

Some MS open the loop when a TCH reconfiguration is performed, e.g. when the used frequency channel, timeslot or PCL is changed. If "Re-close after Channel Change" is selected, the R&S CMW automatically re-establishes the loop after TCH reconfiguration.

Option R&S CMW-KS210 is required for all loop types except C.

Remote command:
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:LOOP
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:LREClose

Caller ID

Defines a 1 to 20-digit ID number for SMS and circuit switched calls. The caller ID is equal to the number digits (octets 4 etc.) of the "Calling party BCD number" described in 3GPP TS 24.008; its purpose is to identify the origin of a call. The caller ID defined here is usually displayed at the mobile under test.

The number digit values are in the range 0 to 9, *, #, a, b, c. Each of the number digit values encodes a four-bit number as described in the standard.

Table 2-5: Number digits according to Table 10.5.118 / 3GPP TS 24.008

Number digit value	Bits
0	0 0 0 0
1	0 0 0 1
2	0 0 1 0
3	0 0 1 1
4	0 1 0 0
5	0 1 0 1
6	0 1 1 0

Number digit value	Bits
7	0 1 1 1
8	1 0 0 0
9	1 0 0 1
*	1 0 1 0
#	1 0 1 1
a	1 1 0 0
b	1 1 0 1
c	1 1 1 0
used as an endmark in the case of an odd number of number digits	1 1 1 1

Remote command:
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:CID

TCH Assignment
Specifies at which time during call/connection setup the traffic channel is assigned:
- **very early**: The TCH is assigned very early. Signaling is done via the Fast Associated Control Channel (FACCH).
- **early**: The TCH is assigned early, which means that alerting takes place on the TCH. For call setup to the traffic channel signaling is done via the Standalone Dedicated Control Channel (SDCCH).
- **late**: The traffic channel is assigned late, which means after alerting. For call setup to the traffic channel and alerting signaling is done via the SDCCH. This is also known as Off-Air Call Setup (OACSU).

Remote command:
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:TCHassign

Repeated FACCH
Specifies how often each DL FACCH frame (L2 frame) is transmitted.
- **Off**: Each L2 frame is transmitted once. The usual L2 protocol is applied.
- **On**: Each L2 frame is transmitted twice. The purpose of repeated FACCH is to improve the robustness of FACCH signaling; its main application on the R&S CMW is the repeated FACCH frame error rate test described in chapter 2.2.11.5, "Mode "FER FACCH"", on page 38.

Option R&S CMW-KS210 is required.

Remote command:
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:RFACch

Repeated SACCH
Specifies how often each DL SACCH frame is transmitted.
- **Off**: Each SACCH frame is transmitted once.
- **On**: Each L2 frame is transmitted twice. The purpose of repeated SACCH is to improve the robustness of SACCH signaling; its main application on the R&S CMW

is the repeated SACCH frame error rate test described in chapter 2.2.11.6, "Mode "FER SACCH"", on page 39.

Option R&S CMW-KS210 is required.

Remote command:

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:RSACch

2.3.8.3 AMR Configuration

The "AMR" parameters configure the Adaptive Multi-Rate (AMR) codec for speech channel coding of circuit switched voice connections.

Option R&S CMW-KS210 required.

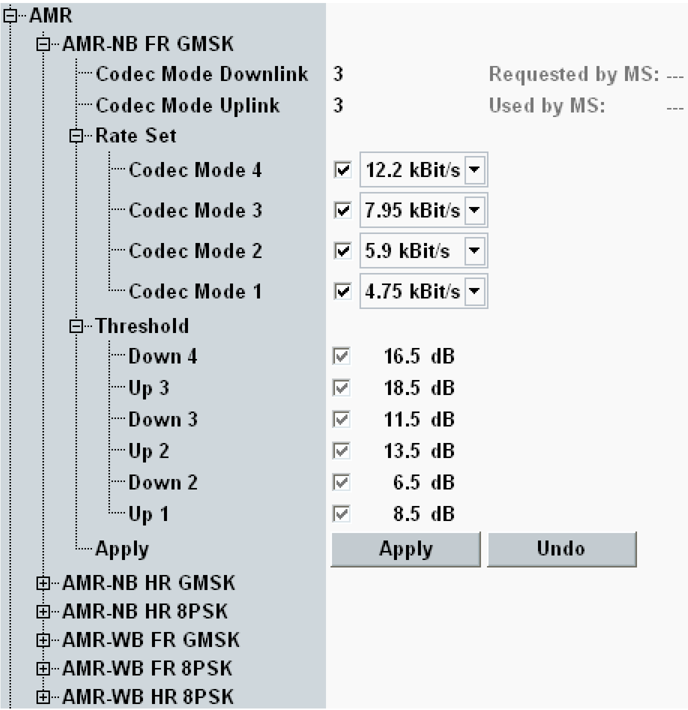


Fig. 2-71: AMR parameters

A typical AMR test consists of defining a rate set and upper and lower thresholds for the codec mode swapping, selecting a downlink and uplink mode from the set of enabled codec modes, and verifying that the MS actually requests/uses the expected codec modes.

- The purpose of the downlink test is to verify that the MS can monitor the quality of the dedicated traffic channel and request a codec mode according to the DL TCH level. The power thresholds for switching the AMR codec modes are specified in standard 3GPP TS 51.010. Vary the DL TCH level ("RF Settings > TCH/PDCH > Carrier 1> DL Reference Level") and compare the codec mode "Requested by MS" with the expected value.
- The purpose of the uplink test is to verify that the MS applies the codec mode indicated by the network/R&S CMW, and that the MS correctly signals the used codec

mode to the network. Verify that the codec mode "Used by MS" is equal to the "Codec Mode Uplink".

The following parameters can be configured individually for each codec type (AMR-NB FR GMSK, AMR-NB HR GMSK, ...).

Codec Mode Downlink / Uplink

"Codec Mode Downlink" specifies the codec mode that the R&S CMW uses to generate the speech data transmitted to the MS under test. This mode is maintained, irrespective of the DL codec mode requested by the MS. The requested mode is displayed to the right for information.

"Codec Mode Uplink" specifies the codec mode that the mobile under test shall use in uplink direction. The actual UL codec mode used by the MS is displayed to the right for information.

Each codec mode corresponds to the data rate selected under Rate Set. All connections involving a closed loop or pseudo-random bit sequences require equal uplink and downlink codec modes.

Remote command:

`CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:CMODe:NB:FRATe:GMSK:DL`

`CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:CMODe:NB:FRATe:GMSK:UL`

`SENSe:GSM:SIGN<i>:MSSinfo:AMR:CMODe:NB:FRATe:GMSK:DL?`

`SENSe:GSM:SIGN<i>:MSSinfo:AMR:CMODe:NB:FRATe:GMSK:UL?`

For other codec types see chapter 2.5.11.3, "AMR Configuration", on page 304.

Rate Set

Selects the supported data rates (modes) for an AMR codec type. Depending on the codec type, either three or four codec modes can be configured.

The selected data rates must be different from each other. They are automatically sorted in descending order so that Rate (Mode n) > Rate (Mode n-1).

You can deactivate modes to restrict the test model to fewer supported modes.

Remote command:

`CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:RSET:NB:FRATe:GMSK`

For other codec types see chapter 2.5.11.3, "AMR Configuration", on page 304.

Threshold

Selects the upper and lower limits for the codec mode swapping (see Rate Set). For detailed information refer to the 3GPP TS 45.009.

Remote command:

```
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:THReshold:NB:FRATe:GMSK
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:THReshold:NB:HRATe:EPSK
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:THReshold:NB:HRATe:GMSK
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:THReshold:WB:FRATe:EPSK
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:THReshold:WB:FRATe:GMSK
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:THReshold:WB:HRATe:EPSK
```

Apply, Undo

When you have finished a reconfiguration press "Apply" to accept the changes. If you close the configuration dialog without pressing "Apply", the changes are lost. "Undo" activates the previous configuration.

These functions are available even during an established CS connection.

2.3.8.4 VAMOS Configuration

The "VAMOS" settings configure Voice services over Adaptive Multi-user Channels on One Slot (VAMOS) for circuit switched connections.

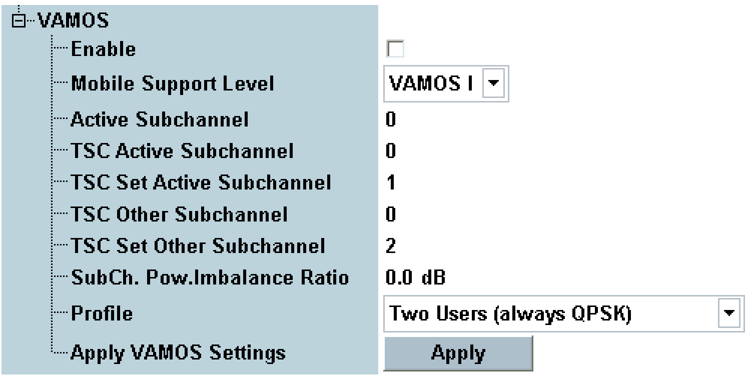


Fig. 2-72: VAMOS parameters

Enable

Activates/deactivates Voice services over Adaptive Multi-user Channels on One Slot (VAMOS).

For background information see chapter 2.2.9.4, "VAMOS", on page 31.

Option R&S CMW-KS203 required.

Remote command:

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:VAMos:ENABle

Mobile Support Level

Selects the VAMOS support level of the mobile. The support levels I and II are defined in standard 3GPP TS 45.001, clause 13.2. VAMOS II mobiles must fulfill additional performance requirements and use a modified mapping of logical channels onto the physical channel, as given in table 1a of 3GPP TS 45.002 (also referred to as "shifted SACCH").

Option R&S CMW-KS203 required.

Remote command:

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:VAMos:MSLevel

Active Subchannel

Selects the VAMOS subchannel to be used for the DUT. The other subchannel is used for the virtual second VAMOS user.

Option R&S CMW-KS203 required.

Remote command:

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:VAMos

TSC Active Subchannel / TSC Set Active Subchannel

Select the training sequence to be used for the DUT. The training sequence is identified via the Training Sequence Code (TSC) set and the TSC within this set.

Option R&S CMW-KS203 required.

Remote command:

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:VAMos

TSC Other Subchannel / TSC Set Other Subchannel

Select the training sequence to be used for the virtual second VAMOS user. The training sequence is identified via the TSC set and the TSC within this set. For a 3GPP compliant configuration, select different TSC sets for the DUT and the virtual user.

Option R&S CMW-KS203 required.

Remote command:

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:VAMos

SubCh. Pow. Imbalance Ratio
The Subchannel Power Imbalance Ratio (SCPIR) defines the power of subchannel 0 relative to the power of subchannel 1.

Option R&S CMW-KS203 required.

Remote command:
`CONFigure:GSM:SIGN<i>:CONNection:CSWitched:VAMos`

Profile
Three profiles are available, determining several downlink properties.

- **Single User (always GMSK)**: There is no second VAMOS user at all. The downlink signal contains speech frames and signaling data for the DUT only. GMSK modulation is used.
- **Two Users (always QPSK)**: The downlink signal contains speech frames and signaling data for both users. AQPSK modulation is applied.
- **Two Users (2nd User in DTX Mode)**: The downlink signal contains speech frames for the DUT only. For the virtual user DTX is transmitted. Depending on the TDMA frame number either GMSK modulation (virtual user transmits nothing) or AQPSK modulation (virtual user transmits SID or SACCH) is applied.

For more details please refer to chapter 2.2.9.4, "VAMOS", on page 31.

Option R&S CMW-KS203 required.

Remote command:
`CONFigure:GSM:SIGN<i>:CONNection:CSWitched:VAMos`

Apply VAMOS Settings
Press this button after you have configured all VAMOS parameters as desired. VAMOS parameter changes are not applied automatically, because an intermediate inconsistent parameter combination could cause the loss of an established CS connection. If you close the configuration dialog without pressing "Apply", the changes are lost.

Option R&S CMW-KS203 required.

Remote command:
n/a, changes via remote command take effect immediately

2.3.8.5 Packet Switched Connection Parameters

The "Packet Switched" parameters configure the traffic channels for packet switched connections. Set these parameters in accordance with the desired measurement application.

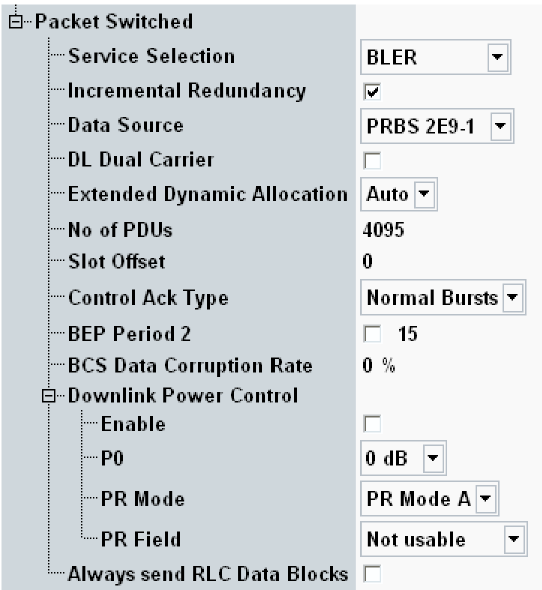


Fig. 2-73: Connection parameters

Service Selection

Selects a service mode for the PS connection, e.g. a test mode. See also 3GPP TS 44.014, chapter 2.2.12.4, "Test Modes", on page 52 and chapter 2.2.13, "BLER Measurement", on page 55.

- **Test Mode A**: The MS continuously transmits RLC data blocks containing a pseudo random data sequence. Recommended for TX tests.
- **Test Mode B**: The R&S CMW transmits RLC blocks on the downlink containing a pseudo random data sequence; the MS loops back the received data. Recommended for BER tests.
- **BLER**: Full signaling involving the RLC layer for Block Error Ratio (BLER) measurements.

- **SRB**: EGPRS switched radio block loopback mode for BER tests. The loopback is performed before channel decoding.

Remote command:
CONFigure:GSM:SIGN<i>:CONNection:PSWitched:SERVice

Incremental Redundancy
Enables or disables the incremental redundancy RLC mode for the downlink. This mode is used on EGPRS channels to minimize the number of data blocks that have to be transferred repeatedly (retransmitted) until they can be successfully decoded.

With enabled incremental redundancy, the R&S CMW cyclically changes the puncturing scheme if data blocks must be retransmitted. This setting corresponds to normal operation of the BTS in the network and is suitable for incremental redundancy performance tests specified in 3GPP TS 51.010.

With disabled incremental redundancy, the puncturing scheme is fixed. This setting is suitable for layer 1 receiver tests.

Option R&S CMW-KS210 is required.

Remote command:
CONFigure:GSM:SIGN<i>:CONNection:PSWitched:IREDundancy

Data Source
Selects the data which the R&S CMW transmits on its DL Packet Data Traffic Channels (PDTCHs).

- **PRBS 2E9-1, PRBS 2E11-1**:
  PRBS transmission according to CCITT (ITU-T) O.153
- **PRBS 2E15-1**:
  PRBS transmission according to CCITT (ITU-T) O.151
- **PRBS 2E16-1**:
  Transmission of a pseudo random bit sequence defined by the polynomial: $x^{16} + x^5 + x^3 + x^2 + 1$

This parameter can be changed in "TBF Established" state

Option R&S CMW-KS210 is required.

Remote command:
CONFigure:GSM:SIGN<i>:CONNection:PSWitched:DSOurce

DL Dual Carrier
Enables or disables the downlink dual carrier mode. In this mode, the R&S CMW uses two radio frequency channels to assign resources to the mobile station; see 3GPP TS 44.060.

Some parameters can be configured individually per carrier. For these parameters there is a "Carrier 1" and a "Carrier 2" setting, see for example "Channel / Frequency" on page 98 and chapter 2.3.1.7, "Slot Configuration Dialog", on page 81.

Option R&S CMW-KS201 required.

Remote command:
CONFigure:GSM:SIGN<i>:CONNection:PSWitched:DLDCarrier:ENABle

Extended Dynamic Allocation
Extended dynamic allocation is an optional medium access mode of the mobile (see 3GPP TS 44.060). It can be enabled, disabled or automatically enabled if supported by the mobile. In the latter case the R&S CMW evaluates the GPRS Extended Dynamic Allocation message received during GPRS Attach to determine whether the mobile supports extended dynamic allocation or not.

Remote command:
`CONFigure:GSM:SIGN<i>:CONNection:PSWitched:EDALlocation`

No of PDUs
Number of Protocol Data Units (PDU) that the MS is to transmit in the uplink during GPRS test mode A.

If supported by the mobile, a value of 0 can be used to request an "infinite" test mode that is not terminated by the mobile after a certain number of PDUs.

Remote command:
`CONFigure:GSM:SIGN<i>:CONNection:PSWitched:NOPDus`

Slot Offset
Timeslot that is to be taken as the first DL timeslot when the MS is in multislot operation (downlink timeslot offset parameter in the GPRS_TEST_MODE_CMD).

When the mobile loops back data, the slot offset determines which DL slot is looped to which UL slot. An offset of 0 indicates that a DL slot shall be looped to the UL slot with the same slot number.

Remote command:
`CONFigure:GSM:SIGN<i>:CONNection:PSWitched:SOFFset`

Control Ack Type
Specifies whether a mobile sends the PACKET CONTROL ACKNOWLEDGEMENT (3GPP TS 44.060) as four access bursts or as an RLC/MAC Packet Control Acknowledgement Control message with four normal bursts.

The "Access Bursts" setting can be used to analyze access bursts while a packet data connection is active. The bursts can be analyzed using the "GSM Multi Evaluation" measurement (option R&S CMW-KM200).

Remote command:
`CONFigure:GSM:SIGN<i>:CONNection:PSWitched:CATYpe`

BEP Period 2
Configures the BEP_PERIOD2 specified in 3GPP TS 45.008, section 10.2.3.2.1.

The BEP period 2 is a filter constant for EGPRS measurement reports that the MS uses for the calculation of the mean BEP and the CV BEP values. BEP_PERIOD2 is sent to the MS via PACCH.

Remote command:
`CONFigure:GSM:SIGN<i>:CONNection:PSWitched:BPERiod<no>`

BCS Data Corruption Rate
Specifies the volume of corrupted data the R&S CMW generates. Measurement results evaluates whether the MS reports the corrupted data correctly (see chapter 2.3.18.2, "PS BLER Tab", on page 156).

Option R&S CMW-KS210 is required.

Remote command:
`CONFigure:GSM:SIGN<i>:CONNection:PSWitched:BDCRate`

Downlink Power Control
Configures the downlink power control for the packet switched connections. For details refer to 3GPP TS 45.008 and 3GPP TS 44.060.

Enable ← Downlink Power Control
Enables/disables the downlink power control for packet data transfer.

Remote command:
`CONFigure:GSM:SIGN<i>:CONNection:PSWitched:DPControl:ENABle`

P0 ← Downlink Power Control
Defines the downlink power control parameter P0, which denotes a power reduction relative to BCCH.

Remote command:
`CONFigure:GSM:SIGN<i>:CONNection:PSWitched:DPControl:P`

PR Mode ← Downlink Power Control
Defines the mode of the power reduction.

- **Mode A**: power control specific to a particular MS in the network
- **Mode B**: power control for all MSs with a TBF established on the same PDCH

Remote command:
`CONFigure:GSM:SIGN<i>:CONNection:PSWitched:DPControl:PMODe`

PR Field ← Downlink Power Control
Indicates the power level reduction of the current RLC block relative to BCCH - P0.

Remote command:
`CONFigure:GSM:SIGN<i>:CONNection:PSWitched:DPControl:PFIeld`

Always send RLC Data Blocks
Commands the MS to transmit dummy data blocks when there are no RLC data blocks to be sent.

Remote command:
`CONFigure:GSM:SIGN<i>:CONNection:PSWitched:ASRDblocks`

2.3.9 Trigger Signal Settings

The following parameters configure trigger signals provided by the "GSM Signaling" application. For an overview of all supported trigger signals see chapter 2.2.10, "Trigger Signals", on page 34.

Fig. 2-74: Trigger parameters

Frame Trigger Mode

Configures the frame trigger signal. It can be generated for each uplink frame, including or not including idle frames (single frame trigger) or for each 26th, 52nd or 104th uplink frame (multiframe trigger).

Remote command:

`CONFigure:GSM:SIGN<i>:TRIGger:FTMode`

2.3.10 Messaging (SMS) Parameters

The "Messaging (SMS)" section configures parameters of the Short Message Service (SMS). Sending an SMS message to the MS is triggered via hotkey, see "Connect / Disconnect / Send SMS / Release PDP Context (hotkeys)" on page 85.

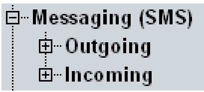


Fig. 2-75: Messaging (SMS) settings

2.3.10.1 Outgoing SMS Parameters

The following section describes the configuration of outgoing text messages.

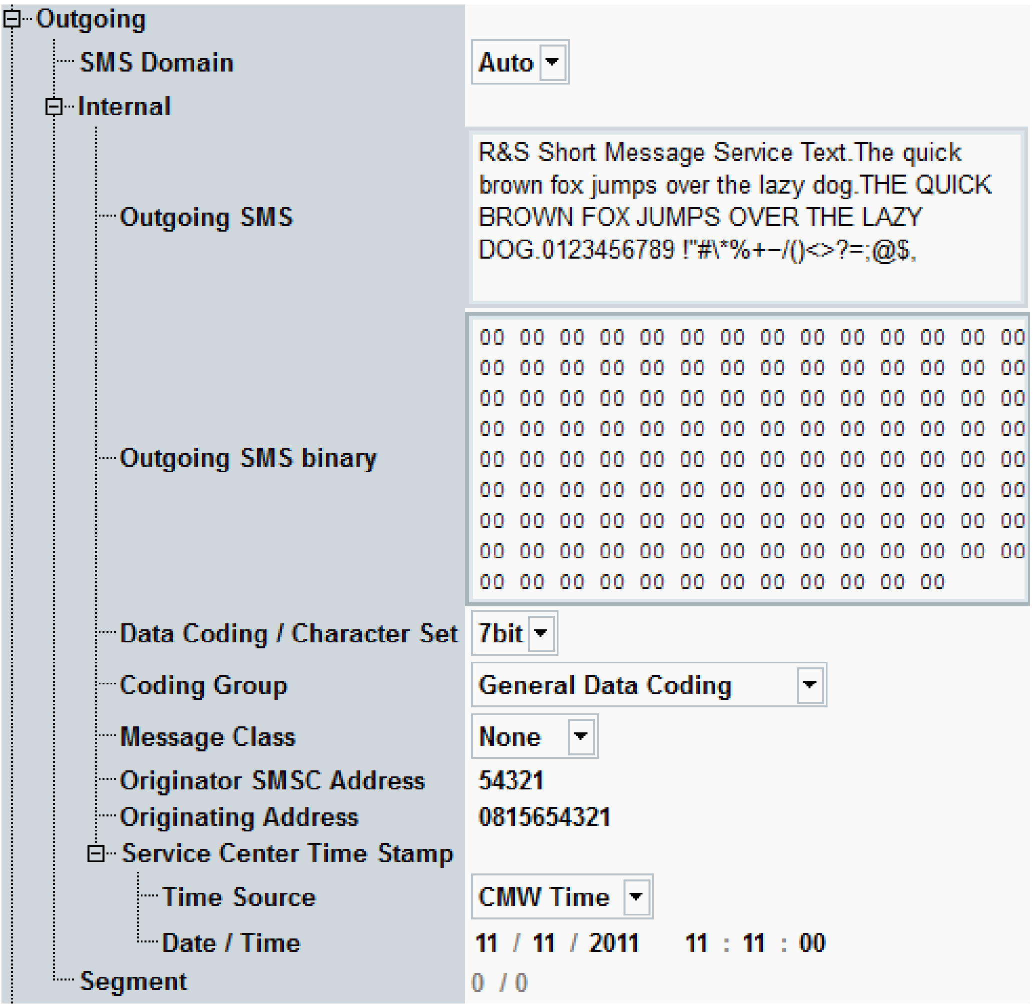


Fig. 2-76: Messaging (SMS) outgoing parameters

SMS Domain

Selects the core network domain for the outgoing SMS. If "Auto" is selected, the domain of actual connection is used.

Remote command:

`CONFigure:GSM:SIGN<i>:SMS:OUTGoing:SDOMain`

Outgoing SMS
Defines the SMS message text to be sent. It is encoded as 7-bit ASCII text and consists of up to 800 characters (up to six concatenated SMS messages including user data header). This SMS is used if Data Coding / Character Set = 7bit.

Remote command:
`CONFigure:GSM:SIGN<i>:SMS:OUTGoing:INTernal`

Outgoing SMS binary
Defines the SMS message to be edited directly in hexadecimal format. This SMS is used if Data Coding / Character Set = 8bit. Its size is limited to 700 Byte.

Remote command:
`CONFigure:GSM:SIGN<i>:SMS:OUTGoing:BINary`

Data Coding / Character Set
Defines the SMS message text to be encoded as 7-bit ASCII text or 8-bit data.

Remote command:
`CONFigure:GSM:SIGN<i>:SMS:OUTGoing:DCODing`

Coding Group
Defines how to interpret SMS signaling information. The "general message coding" and "data coding / message class" coding groups are defined in 3GPP TS 23.038, chapter 4.

Remote command:
`CONFigure:GSM:SIGN<i>:SMS:OUTGoing:CGRoup`

Message Class
Specifies the default savings of the SMS message as defined in 3GPP TS 23.038. The users override any default settings by selecting their own routing.

Remote command:
`CONFigure:GSM:SIGN<i>:SMS:OUTGoing:MCLass`

Originator SMSC Address
Specifies the phone number of the SMS center.

Remote command:
`CONFigure:GSM:SIGN<i>:SMS:OUTGoing:OSADdress`

Originating Address
Specifies the phone number of the SMS originating UE.

Remote command:
`CONFigure:GSM:SIGN<i>:SMS:OUTGoing:OADDress`

Service Center Time Stamp
Configures date and time information used by service center time stamp.

The section is only visible if R&S CMW-KS210 is available.

Time Source ← Service Center Time Stamp
This parameter selects the date and time source.

- **CMW Time**
  Selects the current CMW (Windows) date and time as source. The Windows settings determine the service center time stamp date and time.
- **Date / Time**
  Selects the parameters Date / Time as source.

Option R&S CMW-KS210 is required.

Remote command:
CONFigure:GSM:SIGN<i>:SMS:OUTGoing:SCTStamp:TSOurce

Date / Time ← Service Center Time Stamp
Defines the service center time stamp date and time to be used if Time Source is set to "Date / Time".

Option R&S CMW-KS210 is required.

Remote command:
CONFigure:GSM:SIGN<i>:SMS:OUTGoing:SCTStamp:DATE
CONFigure:GSM:SIGN<i>:SMS:OUTGoing:SCTStamp:TIME

Segment
Displays the currently processed SMS segment and the total number of segments.

A concatenated SMS message is larger than 160 characters. All segments belong to one concatenated SMS message.

Remote command:
SENSe:GSM:SIGN<i>:SMS:OUTGoing:INFO:SEGMent?

2.3.10.2 Incoming SMS Parameters

The "Messaging (SMS) > Incoming" section provides information about the received text messages.

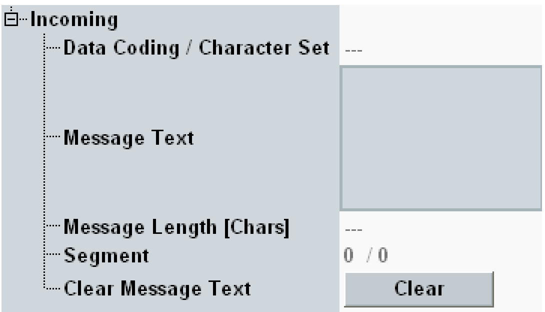


Fig. 2-77: Messaging (SMS) incoming parameters

Data Coding / Character Set
Show the if the last received SMS message is coded as a 7 bit ASCII text or 8 bit binary data.

Remote command:
SENSe:GSM:SIGN<i>:SMS:INComing:INFO:DCODing?

Message Text / Message Length
Show the text and length of the last received SMS message.

The following formats are supported:
- 7-bit, displayed as a ASCII text
- 8-bit, displayed as binary data in hexadecimal format

Remote command:
SENSe:GSM:SIGN<i>:SMS:INComing:INFO:MTEXt?
SENSe:GSM:SIGN<i>:SMS:INComing:INFO:MLENgth?

Segment
Queries the current and total number of segments of the concatenated SMS message (larger than 160 characters).

Remote command:
SENSe:GSM:SIGN<i>:SMS:INComing:INFO:SEGMent?

Clear Message Text
Resets all parameters related to the last received SMS message.

The message text and information about the message length are deleted. The "message read" flag is set to true.

Remote command:
SENSe:GSM:SIGN<i>:SMS:INFO:LRMessage:RFLag?
CLEan:GSM:SIGN<i>:SMS:INComing:INFO:MTEXt

2.3.11 Measurement Connection Parameters

The "Measurement Connection" settings facilitate the transition from the "GSM Signaling" dialog to frequently used measurements.

Fig. 2-78: Measurement connection parameters

Measurement Slot UL
Configures the slot evaluated by measurements running in parallel to the "GSM Signaling" application. The measurement slot is relevant for the GSM signaling measurement BER PS and for "GSM Multi Evaluation" measurements. It is not relevant for GSM signaling BLER and BER CS measurements.

During a CS connection setup, this parameter is set automatically to the active CS timeslot. During a PS connection setup, it is checked whether the configured slot is an active PS UL timeslot - otherwise the first active PS UL timeslot is selected automatically.

While the combined signaling mode is active in the "GSM Multi Evaluation" measurement, the measurement slot setting in the signaling application and the measured slot setting in the measurement are coupled. Changing one value also changes the other value.

Remote command:
`CONFigure:GSM:SIGN<i>:MSLot:UL`

Shortcut Softkey
This section configures the three shortcut softkeys that provide a fast way to switch to selectable measurements. See also chapter 2.3.15, "Using the Shortcut Softkeys", on page 145.

Select Menu ← Shortcut Softkey
Selects a measurement. The corresponding shortcut softkey opens a dialog presenting this measurement as default target or uses the measurement as fixed target.

Select as fixed Target ← Shortcut Softkey
Configures and renames the corresponding shortcut softkey.

- **Enabled**: The softkey directly opens the measurement selected via Select Menu.
- **Disabled**: The softkey opens a dialog box for selection of the target measurement.

2.3.12 MS Measurement Report Settings

This section configures the MS measurement report. The report is shown in the main signaling view, see chapter 2.3.1.3, "MS Measurement Report", on page 68.

For enabling of neighbor cell measurements, see chapter 2.3.7.2, "Neighbor Cell Settings", on page 106.

Fig. 2-79: MS measurement report settings

Report
Enables or disables the MS measurement report.

Configure the other settings before enabling this parameter.

Remote command:
CONFigure:GSM:SIGN<i>:MSReport:ENABle

WCDMA Measurement Quantity
Selects whether the MS shall determine the RSCP or the Ec/No during WCDMA neighbor cell measurements. The setting is signaled to the MS.

Remote command:
CONFigure:GSM:SIGN<i>:MSReport:WMQuantity

LTE Measurement Quantity
Selects whether the MS shall determine the RSRP or the RSRQ during LTE neighbor cell measurements. The setting is signaled to the MS.

Remote command:
CONFigure:GSM:SIGN<i>:MSReport:LMQuantity

2.3.13 Message Monitoring Settings

Messages exchanged between the GSM signaling application and the MS can be monitored. For this purpose the messages are sent to an external PC.

See also: "Logging" in the R&S CMW user manual, chapter "Basic Instrument Functions"

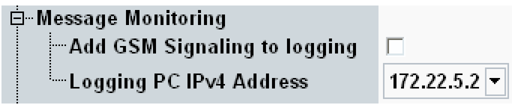


Fig. 2-80: Message monitoring settings

Add GSM Signaling to Logging
Enables or disables message monitoring for the GSM signaling application.

Remote command:
CONFigure:GSM:SIGN<i>:MMONitor:ENABle

Logging PC IPv4 Address
Selects the IP address to which the messages shall be sent for monitoring.

The address pool is configured globally, see "Setup" dialog, section "Logging".

Remote command:
`CONFigure:GSM:SIGN<i>:MMONitor:IPADdress`

2.3.14 Show Features at Inactive SW Licenses

Some parameters can only be configured if a specific option (software license) is installed. If the option is not installed, the parameter is either grayed out, showing the used fixed value or it is hidden completely. To check which parameters are hidden because of missing licenses, you can show these parameters (with grayed out values) by enabling the following setting located at the bottom of the configuration menu.

2.3.15 Using the Shortcut Softkeys

When using the GSM signaling application and a GSM measurement in parallel, it is recommended to use a shortcut softkey to switch to the measurement.

Using one of these softkeys ensures that the measurement is configured compatible to the settings of the signaling application. When you use the softkeys to switch to the "GSM Multi Evaluation" measurement, the combined signal path scenario is activated automatically in the measurement.

Consequences:

- The measurement and the signaling application can be used in parallel, i.e. both DL signal transmission and measurement can be switched on.
- The signaling RF settings are also used for the measurement.
- Some measurement control settings are configured compatible with the signaling settings.
- The frame trigger signal provided by the signaling application is selected as trigger source by the measurement.
- Additional softkeys and hotkeys are displayed in the measurement, so that the signaling application can be controlled and configured from the measurement.

If the softkey label equals "Go to...", the softkey opens a dialog box with a list of all available GSM measurements. If the softkey label indicates a measurement name instead of "Go to...", this measurement has been assigned to the softkey as fixed target, see Select as fixed target.

Three shortcut softkeys are available and can be set to different fixed targets.

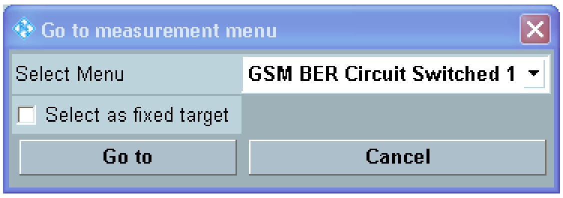


Fig. 2-81: Dialog box opened by "Go to..." softkey

Select Menu
Selects the target measurement you want to switch to.

Select as fixed target
Sets the selected measurement as fixed target of the softkey. The softkey label indicates the measurement name and switches directly to the selected target without opening the dialog box.

When the dialog box has been disabled, you can still change the target measurement or re-enable the dialog box using the configuration menu, see chapter 2.3.11, "Measurement Connection Parameters", on page 142.

Go to / Cancel
Press "Go to" to switch to the selected measurement or "Cancel" to abort.

2.3.16 BER CS Measurement

The Bit Error Rate (BER) Circuit Switched (CS) measurement is included in the "GSM Signaling" application. It must be activated in the "Measurement Controller" dialog via the entry "RX Measurement ...". The measurement provides an own tab and configuration dialog described in this section.

For background information see chapter 2.2.11, "BER CS Measurement", on page 35.

2.3.16.1 Measurement Control

The measurement is turned on or off using the ON | OFF or RESTART | STOP keys.

See also: "Measurement Control" in the R&S CMW user manual, chapter "System Overview"

BER Circuit Switched (Softkey)
The softkey shows the current measurement state. Additional measurement substates can be retrieved via remote control.

Remote command:
`INITiate:GSM:SIGN<i>:BER:CSWitched`
`STOP:GSM:SIGN<i>:BER:CSWitched`
`ABORt:GSM:SIGN<i>:BER:CSWitched`
`FETCh:GSM:SIGN<i>:BER:CSWitched:STATe?`
`FETCh:GSM:SIGN<i>:BER:CSWitched:STATe:ALL?`

2.3.16.2 CS BER Tab

The tab shows measurement results to the left and settings to the right.

The settings are common settings of the "GSM Signaling" application. Changing the values in one view changes the values in all views of the "GSM signaling" application. For parameter descriptions see chapter 2.3.1.6, "Settings", on page 79.

Additional settings of the "GSM signaling" application can be accessed via the "Signaling Parameter" softkey and the related hotkeys.

The connection status information displayed at the bottom is the same as in the "GSM signaling" main view, see chapter 2.3.1.1, "Connection Status", on page 66.

To switch to the signaling application, press the "GSM Signaling" softkey two times.

The "Config" hotkey opens either the configuration dialog of the measurement or the configuration dialog of the signaling application, depending on which softkey is currently active.

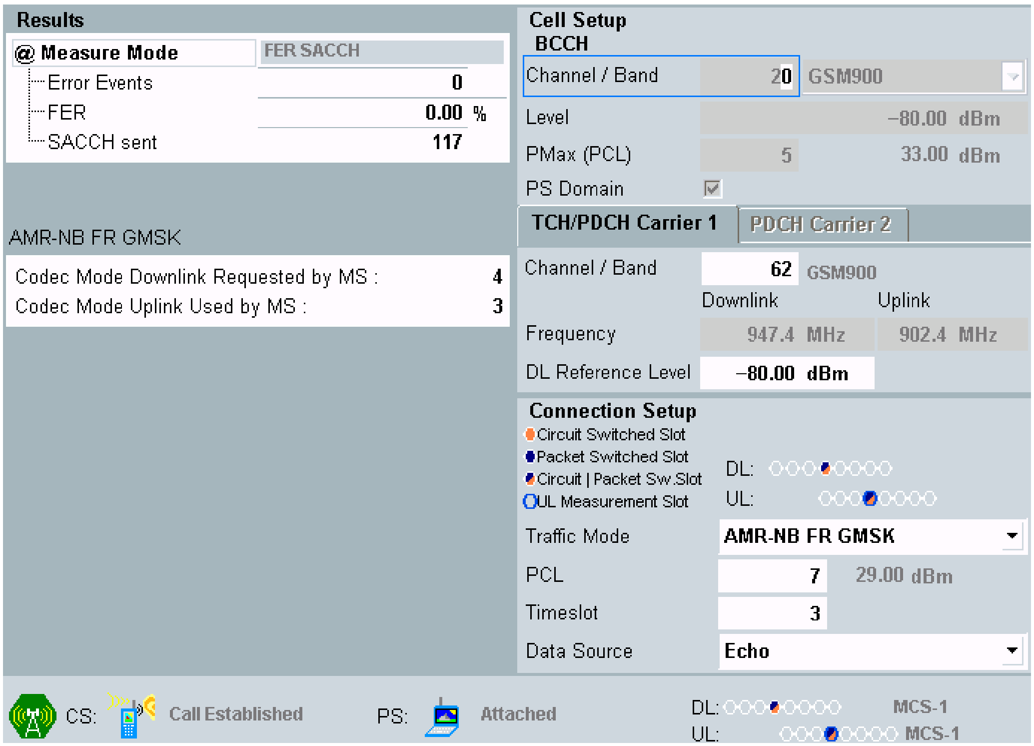


Fig. 2-82: CS BER tab

Results

For a detailed description of the results see chapter 2.2.11, "BER CS Measurement", on page 35.

Remote command:

FETCh:GSM:SIGN<i>:BER:CSWitched?

READ:GSM:SIGN<i>:BER:CSWitched?

FETCh:INTermediate:GSM:SIGN<i>:BER:CSWitched:MBEP?

Codec Mode

Query the DL AMR codec mode requested by the MS and the actual UL codec mode used by the MS. This information is only available if AMR traffic mode is used (see also chapter 2.3.8.3, "AMR Configuration", on page 129).

Separate commands are available for the half-rate (HRATe) and full-rate (FRATe) narrowband (NB) and wideband (WB) AMR codecs, for GMSK and 8PSK modulation.

Remote command:

SENSe:GSM:SIGN<i>:MSSinfo:AMR:CMODe:NB:FRATe:GMSK:DL? etc.

SENSe:GSM:SIGN<i>:MSSinfo:AMR:CMODe:NB:FRATe:GMSK:UL? etc.

2.3.16.3 General BER CS Settings

The settings in the "BER" section of the "GSM BER Configuration" dialog configure the scope of the measurement.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "System Overview"

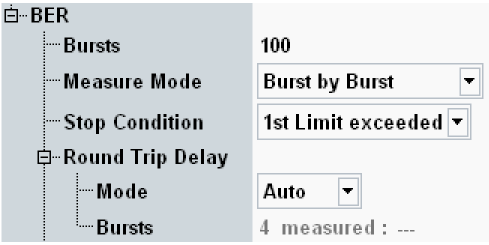


Fig. 2-83: Statistical settings

Bursts / Speech Frames / Frames / Blocks

Defines the number of data entities to be evaluated per measurement cycle (statistics cycle, single-shot measurement). The data entity changes with the measure mode; the size depends on the channel coder settings (see chapter 2.2.11.13, "Frame Structure for BER CS Tests", on page 47). Received data entities with CRC error do not contribute to the statistic count.

See also: "Statistical Results" in the R&S CMW user manual, chapter "System Overview"

Remote command:

`CONFigure:GSM:SIGN<i>:BER:CSWitched:SCOunt`

Measure Mode

Several measure modes providing different sets of results are available.

For a detailed description of the modes see chapter 2.2.11, "BER CS Measurement", on page 35.

The mode "AMR Inband FER" can only be selected if an AMR codec is configured.

The mode "RBER/UFR" can only be selected if traffic mode half-rate version 1 is configured, see "Traffic Mode" on page 125.

"Mean BEP" mode is suspended if the CS enhanced measurement reporting is disabled, see "Enhanced Measurement Report" on page 116.

"Signal Quality" mode is suspended if the CS enhanced measurement reporting is enabled, see "Enhanced Measurement Report" on page 116.

The mode "BFI" is only enabled in the DTX DL operation, see "DTX DL" on page 126.

In the DTX DL operation only the following modes are applicable: "Signal Quality", "Mean BEP" and "BFI".

Option R&S CMW-KS210 is required for all modes except "Burst by Burst", "Mean BEP" and "Signal Quality".

Remote command:

`CONFigure:GSM:SIGN<i>:BER:CSWitched:MMODe`

Stop Condition

Specifies the conditions for an early termination of the measurement:

- **None**: The measurement is performed for the selected "No. of Frames", irrespective of the limit check results.
- **1st Limit Exceeded**: The measurement is stopped as soon as the first limit is exceeded. If no limit failure occurs, the measurement is performed according to the defined Bursts / Speech Frames / Frames / Blocks.
  Use this value for measurements that are essentially intended for checking limits, e.g. production tests.

Remote command:

CONFigure:GSM:SIGN<i>:BER:CSWitched:SCONdition

Round Trip Delay

Round trip delay is defined as duration in bursts the loopback signal needs from a transmission to detection by the R&S CMW. Manual and automatic settings are possible. Additionally the measured round trip delay is displayed.

This parameter is relevant only for measurement modes "Mean BEP" and "Signal Quality".

Note, that a false round trip delay setting results in an increased error rate in BER measurement.

Remote command:

CONFigure:GSM:SIGN<i>:BER:CSWitched:RTDelay

SENSe:GSM:SIGN<i>:BER:CSWitched:RTDelay?

2.3.16.4 Limit Settings

The "Limits" section of the "GSM BER Configuration" dialog defines upper limits for the results of the BER CS measurement.

The conformance test specification 3GPP TS 51.010 defines a variety of test cases related to the BER limits. Adjust the values in accordance with your measurement.

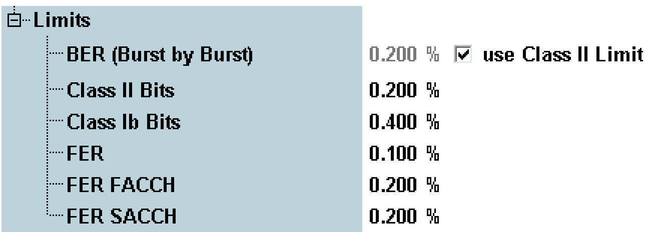


Fig. 2-84: Limit settings

Limits

Defines individual upper limits for the results of the "BER CS" measurement.

The limits apply to the following results:

- **BER (Burst by Burst)**: BER result in burst by burst mode. This limit can be configured individually, but for reasons of backward compatibility it is by default coupled to the class II bits limit.

- **Class II Bits**: all BER and RBER results for class II bits (except "Burst by Burst" mode)
- **Class Ib Bits**: all BER and RBER results for class Ib bits
- **FER**: FER result in mode "RBER/FER" and "AMR Inband FER"
- **FER FACCH**: FER result in mode "FER FACCH"
- **FER SACCH**: FER result in mode "FER SACCH"

Option R&S CMW-KS210 required for all limits except "BER (Burst by Burst)".

Remote command:
CONFigure:GSM:SIGN<i>:BER:CSWitched:LIMit:BER
CONFigure:GSM:SIGN<i>:BER:CSWitched:LIMit:CIIBits
CONFigure:GSM:SIGN<i>:BER:CSWitched:LIMit:CIBBits
CONFigure:GSM:SIGN<i>:BER:CSWitched:LIMit:FER
CONFigure:GSM:SIGN<i>:BER:CSWitched:LIMit:FFACch
CONFigure:GSM:SIGN<i>:BER:CSWitched:LIMit:FSACch

2.3.17 BER PS Measurement

The Bit Error Rate (BER) Circuit Switched (PS) measurement is included in the "GSM Signaling" application. It must be activated in the "Measurement Controller" dialog via the entry "RX Measurement ...". The measurement provides an own tab and configuration dialog described in this section.

For background information see chapter 2.2.12, "BER PS Measurement", on page 49.

2.3.17.1 Measurement Control

The measurement is turned on or off using the ON | OFF or RESTART | STOP keys.

See also: "Measurement Control" in the R&S CMW user manual, chapter "System Overview"

BER Packet Switched (Softkey)
The softkey shows the current measurement state. Additional measurement substates can be retrieved via remote control.

Remote command:
`INITiate:GSM:SIGN<i>:BER:PSWitched`
`STOP:GSM:SIGN<i>:BER:PSWitched`
`ABORt:GSM:SIGN<i>:BER:PSWitched`
`FETCh:GSM:SIGN<i>:BER:PSWitched:STATe?`
`FETCh:GSM:SIGN<i>:BER:PSWitched:STATe:ALL?`

2.3.17.2 PS BER Tab

The tab shows measurement results to the left and settings to the right.

The settings are common settings of the "GSM Signaling" application. Changing the values in one view changes the values in all views of the "GSM signaling" application. For parameter descriptions see chapter 2.3.1.6, "Settings", on page 79.

Additional settings of the "GSM signaling" application can be accessed via the "Signaling Parameter" softkey and the related hotkeys.

The connection status information displayed at the bottom is the same as in the "GSM signaling" main view, see chapter 2.3.1.1, "Connection Status", on page 66.

To switch to the signaling application, press the "GSM Signaling" softkey two times.

The "Config" hotkey opens either the configuration dialog of the measurement or the configuration dialog of the signaling application, depending on which softkey is currently active.

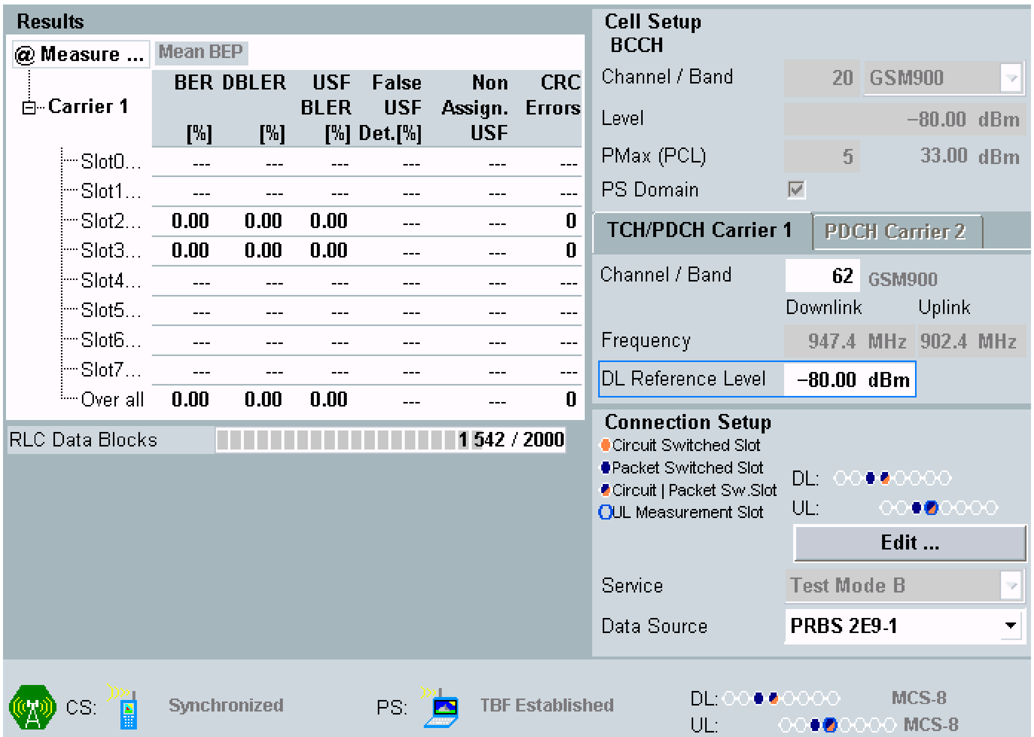


Fig. 2-85: PS BER tab

Results

For a detailed description of the results see chapter 2.2.12, "BER PS Measurement", on page 49.

Remote command:

`FETCh:GSM:SIGN<i>:BER:PSWitched:CARRier<c>?`
`READ:GSM:SIGN<i>:BER:PSWitched:CARRier<c>?`
`FETCh:GSM:SIGN<i>:BER:PSWitched?`
`READ:GSM:SIGN<i>:BER:PSWitched?`
`FETCh:INTermediate:GSM:SIGN<i>:BER:PSWitched:MBEP?`
`FETCh:INTermediate:GSM:SIGN<i>:BER:PSWitched:MBEP:ENHanced?`

2.3.17.3 General BER PS Settings

The settings in the "BER" section of the "GSM BER Configuration" dialog configure the scope of the measurement.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "System Overview"

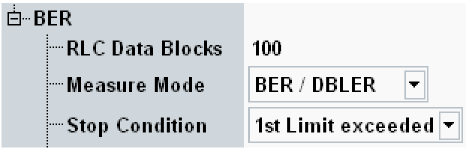


Fig. 2-86: Statistical settings

RLC Data Blocks

Defines the number of RLC data blocks to be evaluated per measurement cycle (statistics cycle, single-shot measurement). Received blocks with CRC error do not contribute to the statistic count.

See also: "Statistical Results" in the R&S CMW user manual, chapter "System Overview"

Remote command:

`CONFigure:GSM:SIGN<i>:BER:PSWitched:SCOunt`

Measure Mode

Specifies the measurement mode for BER PS measurements, see chapter 2.2.12, "BER PS Measurement", on page 49.

The following modes are available:

- **BER/DBLER**: Bit Error Rate / Data Block Error Rate
- **Mean BEP**: Mean Bit Error Probability

Remote command:

`CONFigure:GSM:SIGN<i>:BER:PSWitched:MMODe`

Stop Condition

Specifies the conditions for an early termination of the measurement:

- **None**: The measurement is performed for the selected "No. of Frames", irrespective of the limit check results.
- **1st Limit Exceeded**: The measurement is stopped as soon as the first limit is exceeded. If no limit failure occurs, the measurement is performed according to the defined "RLC Data Blocks" on page 154.
  Use this value for measurements that are essentially intended for checking limits, e.g. production tests.

Remote command:

`CONFigure:GSM:SIGN<i>:BER:PSWitched:SCONdition`

2.3.17.4 Limit Settings

The "Limits" section of the "GSM BER Configuration" dialog defines upper limits for the results of the BER PS measurement.

The conformance test specification 3GPP TS 51.010 specifies a variety of test cases related to the BER limits. Adjust the values in accordance with your measurement.

Fig. 2-87: Limit settings

Limits

Defines individual upper limits for the results of the "BER PS" measurement.

The "Class II Bits" limit applies to the "BER" result.

Remote command:

CONFigure:GSM:SIGN<i>:BER:PSWitched:LIMit:CIIBits
CONFigure:GSM:SIGN<i>:BER:PSWitched:LIMit:DBLer
CONFigure:GSM:SIGN<i>:BER:PSWitched:LIMit:USFBler

2.3.18 BLER Measurement

The Block Error Rate (BLER) measurement is included in the "GSM Signaling" application. It must be activated in the "Measurement Controller" dialog via the entry "RX Measurement ...". The measurement provides an own tab and configuration dialog described in this section.

For background information see chapter 2.2.13, "BLER Measurement", on page 55.

2.3.18.1 Measurement Control

The measurement is turned on or off using the ON | OFF or RESTART | STOP keys.

See also: "Measurement Control" in the R&S CMW user manual, chapter "System Overview"

BLER (Softkey)

The softkey shows the current measurement state. Additional measurement substates can be retrieved via remote control.

Remote command:

INITiate:GSM:SIGN<i>:BLER
STOP:GSM:SIGN<i>:BLER
ABORt:GSM:SIGN<i>:BLER
FETCh:GSM:SIGN<i>:BLER:STATe?
FETCh:GSM:SIGN<i>:BLER:STATe:ALL?

2.3.18.2 PS BLER Tab

The tab shows measurement results to the left and settings to the right.

The settings are common settings of the "GSM Signaling" application. Changing the values in one view changes the values in all views of the "GSM signaling" application. For parameter descriptions see chapter 2.3.1.6, "Settings", on page 79.

Additional settings of the "GSM signaling" application can be accessed via the "Signaling Parameter" softkey and the related hotkeys.

The connection status information displayed at the bottom is the same as in the "GSM signaling" main view, see chapter 2.3.1.1, "Connection Status", on page 66.

To switch to the signaling application, press the "GSM Signaling" softkey two times.

The "Config" hotkey opens either the configuration dialog of the measurement or the configuration dialog of the signaling application, depending on which softkey is currently active.

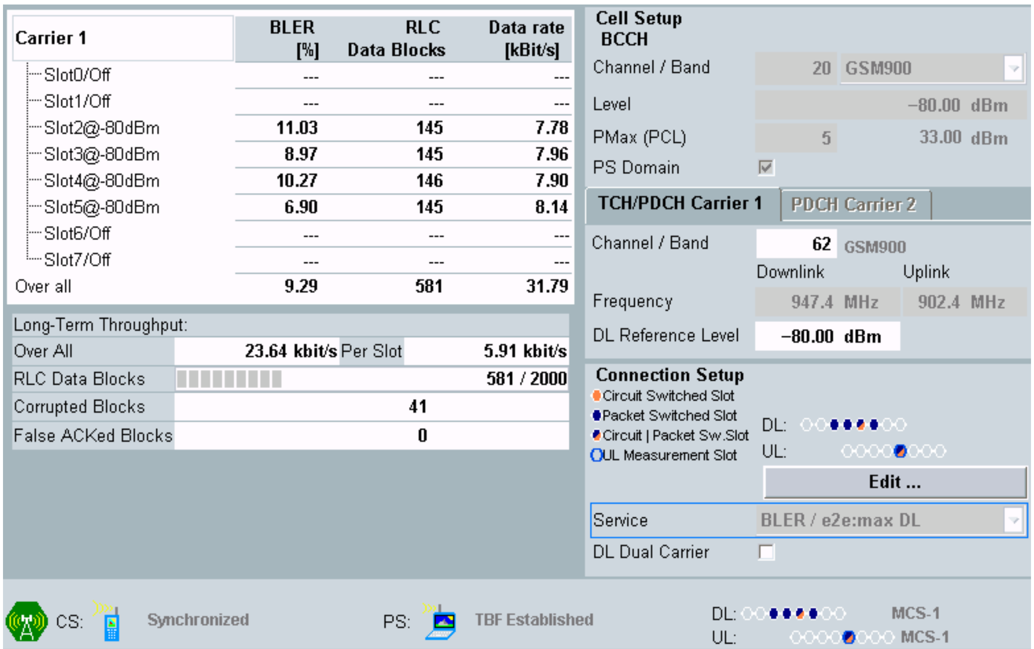


Fig. 2-88: PS BLER tab

Results

For a detailed description of the results see chapter 2.2.13, "BLER Measurement", on page 55.

Remote command:

`FETCh:GSM:SIGN<i>:BLER:CARRier<c>?`

`READ:GSM:SIGN<i>:BLER:CARRier<c>?`

`FETCh:GSM:SIGN<i>:BLER:OALL?`

`READ:GSM:SIGN<i>:BLER:OALL?`

Related hotkeys

To display the hotkeys press the "Display" softkey. The following hotkey is then available at the bottom of the GUI:

Hotkey	Description
"Result"	Switch between absolute and percentage results.

2.3.18.3 Measurement Settings

The parameters in the "BLER" section configure the scope of the measurement.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "System Overview"

Fig. 2-89: Statistical settings

RLC Data Block Count

Defines the number of RLC data blocks to be evaluated per measurement cycle (statistics cycle, single-shot measurement). The number of blocks sent can be larger than the specified value because blocks may be lost on the way to the mobile.

Remote command:

`CONFigure:GSM:SIGN<i>:BLER:SCOunt`

BCS Data Corruption Rate

This setting is covered in the configuration tree, see "BCS Data Corruption Rate" on page 137.

2.3.19 RLC Throughput Measurement

The signaling RLC Throughput measurement is included in the "GSM Signaling" application. It must be activated in the "Measurement Controller" dialog via the entry "RX Measurement...". The "RLC Throughput" tab of the RX measurement view and the related configuration dialog are described in this section.

See also chapter 2.2.14, "RLC Throughput Measurement", on page 60

2.3.19.1 Measurement Control

The measurement is turned on or off using the ON | OFF or RESTART | STOP keys.

See also: "Measurement Control" in the R&S CMW user manual, chapter "System Overview"

RLC Throughput (Softkey)

The softkey shows the current measurement state. Additional measurement substates can be retrieved via remote control.

Remote command:

INITiate:GSM:SIGN<i>:THRoughput

STOP:GSM:SIGN<i>:THRoughput

ABORt:GSM:SIGN<i>:THRoughput

FETCh:GSM:SIGN<i>:THRoughput:STATe?

FETCh:GSM:SIGN<i>:THRoughput:STATe:ALL?

2.3.19.2 RLC Throughput Tab

The tab shows the measurement results and the connection status.

The connection status and setup information displayed at the bottom is the same as in the GSM signaling main view, see chapter 2.3.1.1, "Connection Status", on page 66 and "Connection Setup" on page 80.

The most important settings of the GSM signaling application can be accessed via the "Signaling Parameter" softkey and the related hotkeys.

To switch to the signaling application, press the "GSM Signaling" softkey two times.

The "Config" hotkey opens either the configuration dialog of the measurement or the configuration dialog of the signaling application, depending on which softkey is currently active.

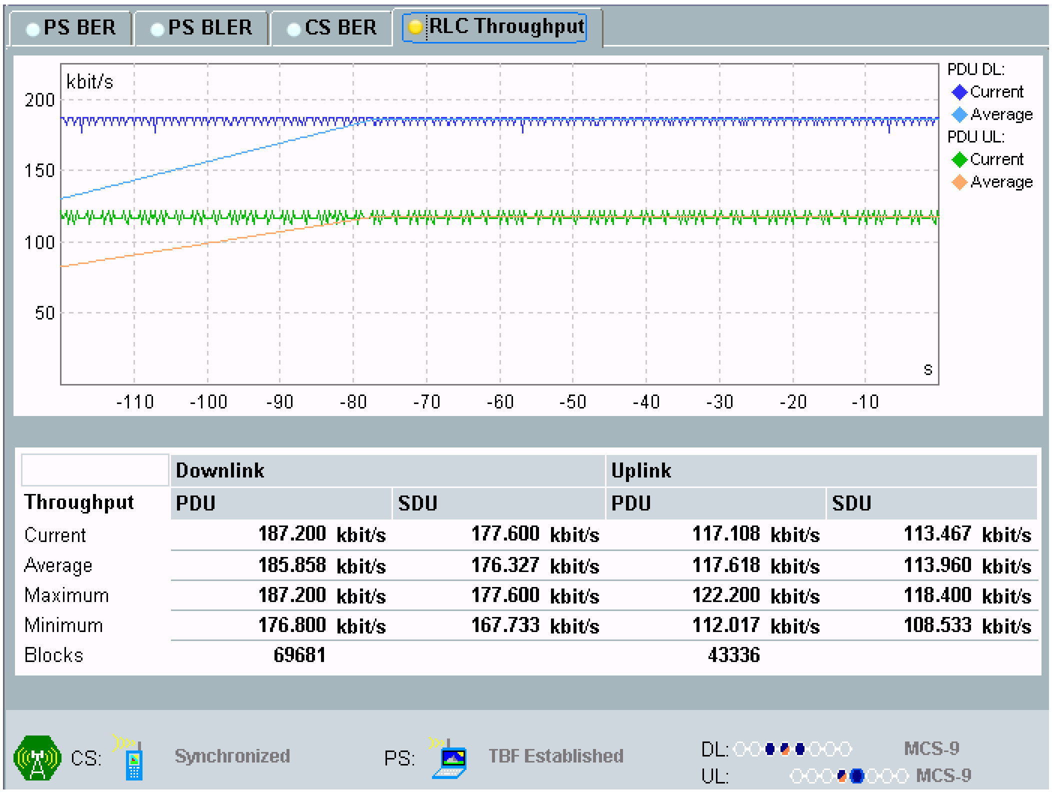


Fig. 2-90: RLC throughput tab

Results

For a description of the results see chapter 2.2.14.2, "Measurement Results", on page 61.

Remote command:

`FETCh:GSM:SIGN<i>:THRoughput:TRACe:DL:PDU:CURRent?` etc.
`FETCh:GSM:SIGN<i>:THRoughput:TRACe:DL:SDU:CURRent?` etc.
`FETCh:GSM:SIGN<i>:THRoughput:TRACe:UL:PDU:CURRent?` etc.
`FETCh:GSM:SIGN<i>:THRoughput:TRACe:UL:SDU:CURRent?` etc.
`FETCh:GSM:SIGN<i>:THRoughput?` etc.

Related hotkeys

To display the hotkeys press the "Display" softkey. The following hotkeys are then available at the bottom of the GUI:

Hotkey	Description
"PDU/SDU"	Switch between PDU and SDU traces.
"Select Trace ..."	Select the trace types to be displayed in the diagram.

2.3.19.3 Measurement Settings

The "Measurement Control" parameters configure the scope of the measurement.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "System Overview"

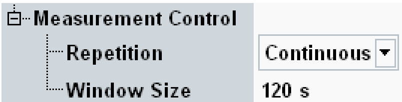


Fig. 2-91: Measurement control settings

Repetition

Defines how often the measurement is repeated if it is not stopped explicitly or by a failed limit check.

- **Continuous:** The measurement is continued until it is explicitly terminated; the results are periodically updated.
- **Single-Shot:** The measurement is stopped after one statistics cycle.

Single-shot is preferable if only a single measurement result is required under fixed conditions, which is typical for remote-controlled measurements. Continuous mode is suitable for monitoring the evolution of the measurement results in time and observe how they depend on the measurement configuration, which is typically done in manual control. The reset/preset values therefore differ from each other.

Remote command:

CONFigure:GSM:SIGN<i>:THRoughput:REPetition

Window Size

Width of the result window displaying the throughput traces (X-axis range). The window size equals the duration of a single shot measurement (one statistics cycle). It is internally rounded down to the next integer multiple of the "Result Interval". As a consequence the number of results in the diagram equals the integer number <Window Size> / result interval of 240 ms.

Remote command:

CONFigure:GSM:SIGN<i>:THRoughput:WINDow

2.3.20 CMR Performance Measurement

The AMR Codec Mode Request (CMR) performance measurement is included in the GSM signaling application. It must be activated in the "Measurement Controller" dialog via the entry "RX Measurement ...". The measurement provides an own tab and configuration dialog described in this section.

For background information see chapter 2.2.15, "CMR Performance Measurement", on page 62.

Option R&S CMW-KS210 required.

2.3.20.1 Measurement Control

The measurement is turned on or off using the ON | OFF or RESTART | STOP keys.

See also: "Measurement Control" in the R&S CMW user manual, chapter "System Overview"

CMR Performance (Softkey)

The softkey shows the current measurement state. Additional measurement substates can be retrieved via remote control.

Remote command:

`INITiate:GSM:SIGN<i>:CPERformance`

`STOP:GSM:SIGN<i>:CPERformance`

`ABORt:GSM:SIGN<i>:CPERformance`

`FETCh:GSM:SIGN<i>:CPERformance:STATe?`

`FETCh:GSM:SIGN<i>:CPERformance:STATe:ALL?`

2.3.20.2 CMR Performance Tab

The tab shows measurement results.

The connection status information displayed at the bottom is the same as in the GSM signaling main view, see chapter 2.3.1.1, "Connection Status", on page 66.

To switch to the signaling application, press the "GSM Signaling" softkey two times.

The "Config" hotkey opens either the configuration dialog of the measurement or the configuration dialog of the signaling application, depending on which softkey is currently active.

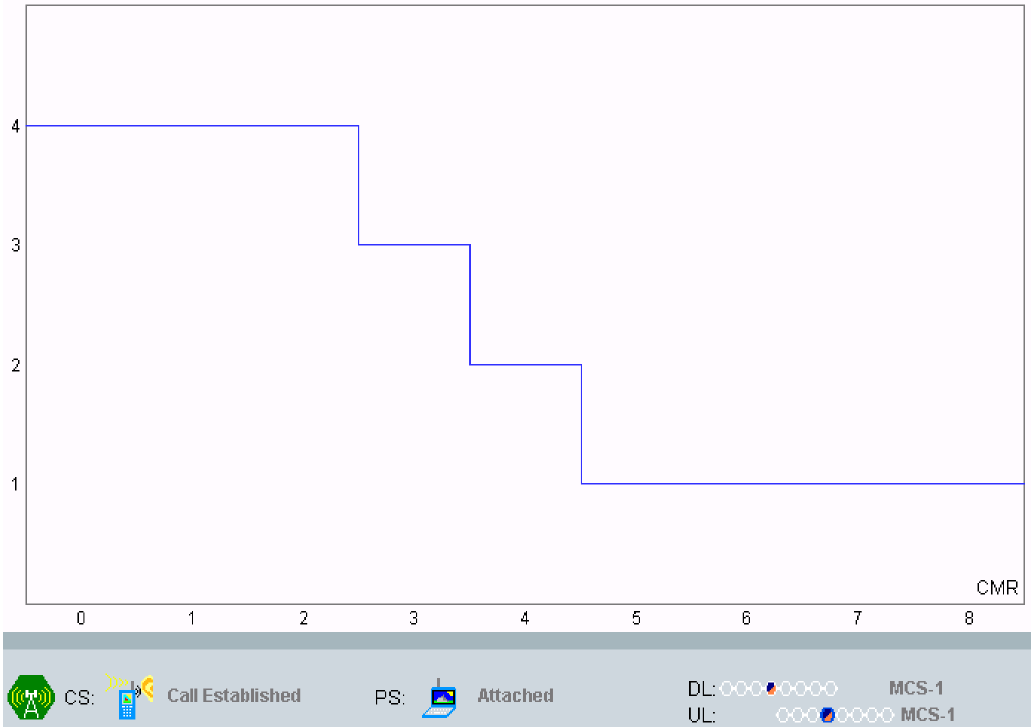


Fig. 2-92: CMR performance tab

Results

For a detailed description of the results see chapter 2.2.15.2, "Measurement Results", on page 63.

Remote command:

`FETCh:GSM:SIGN<i>:CPERformance?`

`READ:GSM:SIGN<i>:CPERformance?`

2.3.20.3 CMR Performance Setting

The settings in the section of the "GSM CMR Performance" dialog configure the target level.

Fig. 2-93: CMR performance setting

Target Level

The target level replaces the used TS level (see "Circuit Switched > PCL" on page 100) as soon as the CMR performance test is started. The target power level should cause the MS under test to request another codec mode, assuming that the related up/down codec mode thresholds are exceeded.

After the CMR performance measurement has finished, the target level value is overtaken by the parameter DL reference level, see "DL Reference Level" on page 98

Remote command:
`CONFigure:GSM:SIGN<i>:CPERformance:TLEVel`

2.4 Programming

The following sections provide programming examples for the GSM signaling application.

The examples contain SCPI commands supported by the R&S CMW and the following symbolic scripting commands:

- `// <comment>`:
  A <comment> ignored by the used programming tool
- `WHILE <query> <> <value>`:
  Waits until the <query> returns a certain <value>, e.g. a specific state is reached.
- `WAITKEY <message>`:
  Displays a dialog box with a <message> and waits until the box is closed by the user.

See also: "Remote Control" in the R&S CMW user manual

2.4.1 General Configuration

The GSM signaling application is programmed as follows:

- The application is controlled by SCPI commands with the following syntax: `...:GSM:SIGN:...`
- After a `*RST`, the DL signal is switched off.
  To activate the DL signal use `SOURce:GSM:SIGN:CELL:STATe ON`.
  Query the cell state using `SOURce:GSM:SIGN:CELL:STATe:ALL?`. The result `ON,ADJ` indicates that the DL signal is available.
- To initiate a connection setup in the CS domain use `CALL:GSM:SIGN:CSWitched:ACTion CONNect`.
  To initiate a connection setup in the PS domain, use `CALL:GSM:SIGN:PSWitched:ACTion CONNect`.
  To query the connection states use `FETCh:GSM:SIGN:CSWitched:STATe?` and `FETCh:GSM:SIGN:PSWitched:STATe?`.

The following sections describe how to configure the signaling application.

The subsequent sections describe how to switch on the cell signal and the MS and how to set up a CS or PS connection. Some examples for actions possible after connection setup are also given.

2.4.1.1 Specifying General Settings

```
// ******************************************************************************
// System-Reset
// ******************************************************************************
*RST; *OPC?
*CLS; *OPC?

// ******************************************************************************
// Define paths for a standard cell with or without external fading,
```

```
// including signal routing and external attenuation.
// ROUTe commands also activate the scenario. Send only one of the two commands.
// *****************************************************************************
ROUTe:GSM:SIGN:SCENario:SCELl RF2C,RX1,RF2C,TX1
ROUTe:GSM:SIGN:SCENario:SCFading RF2C,RX1,RF2C,TX1,IQ2O
CONFigure:GSM:SIGN:RFSettings:EATTenuation:INPut 2
CONFigure:GSM:SIGN:RFSettings:EATTenuation:OUTPut 2

// *****************************************************************************
// Define time delay to be compensated in output and input paths.
// *****************************************************************************
CONFigure:GSM:SIGN:RFSettings:EDC:INPut 5E-9
CONFigure:GSM:SIGN:RFSettings:EDC:OUTPut 5E-9

// *****************************************************************************
// Define input and output paths for the "BCCH and TCH/PDCH" scenario.
// *****************************************************************************
ROUTe:GSM:SIGN:SCENario:BATCh RF1C,RX1,RF1C,TX1,RF3C,TX2
CONFigure:GSM:SIGN:RFSettings:EATTenuation:INPut 2
CONFigure:GSM:SIGN:RFSettings:EATTenuation:OUTPut1 2
CONFigure:GSM:SIGN:RFSettings:EATTenuation:BCCH:OUTPut 2

// *****************************************************************************
// Set frequency offset in DL and UL.
// *****************************************************************************
CONFigure:GSM:SIGN:RFSettings:FOFFset:DL 10000
CONFigure:GSM:SIGN:RFSettings:FOFFset:UL -10000

// *****************************************************************************
// Statically configure the expected uplink power:
// - choose manual expected nominal power mode
// - set the expected nominal power to 23 dBm and apply a margin of 7 dB
// - set the mixer level offset to -7 dB
// *****************************************************************************
CONFigure:GSM:SIGN:RFSettings:ENPMode MANual
CONFigure:GSM:SIGN:RFSettings:ENPower 23
CONFigure:GSM:SIGN:RFSettings:UMARgin 7
CONFigure:GSM:SIGN:RFSettings:MLOFfset -7
```

2.4.1.2 Configuring BCCH, TCH and PDCH

```
// *****************************************************************************
// Define the cell's BCCH:
// - GSM 900 band, channel 20
// - maximum allowed MS output power 33 dBm (PCL 5)
// - level -80 dBm
// *****************************************************************************
CONFigure:GSM:SIGN:BAND:BCCH G09
CONFigure:GSM:SIGN:RFSettings:CHANnel:BCCH 20
```

```
CONFigure:GSM:SIGN:RFSettings:PMAX:BCCH 5
CONFigure:GSM:SIGN:RFSettings:LEVel:BCCH -80

// *****************************************************************************
// Set the traffic channel no to 62 and the DL reference level to -80 dBm.
// *****************************************************************************
CONFigure:GSM:SIGN:RFSettings:CHANnel:TCH 62
CONFigure:GSM:SIGN:RFSettings:LEVel:TCH -80

// *****************************************************************************
// Set the power control level for the uplink to 10, which corresponds to
// an absolute level of -23 dBm in the GSM 900 band.
// *****************************************************************************
CONFigure:GSM:SIGN:RFSettings:PCL:TCH:CSWitched 10

// *****************************************************************************
// Configure frequency hopping: specify the hopping sequence,
// the Mobile Allocation Index Offset (MAIO)
// and the Hopping Sequence Number (HSN); enable frequency hopping.
// *****************************************************************************
CONFigure:GSM:SIGN:RFSettings:HOPPing:SEQuence:TCH 1,62,124,OFF,
    OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,
    OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,
    OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,
    OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF
CONFigure:GSM:SIGN:RFSettings:HOPPing:MAIO:TCH 0
CONFigure:GSM:SIGN:RFSettings:HOPPing:HSN:TCH 0
CONFigure:GSM:SIGN:RFSettings:HOPPing:ENABle:TCH ON
```

2.4.1.3 Configuring Internal Fading

```
// *****************************************************************************
// Select a standard cell scenario with internal fading, alternatively
// use fixed internal fader.
// *****************************************************************************
ROUTe:GSM:SIGN:SCENario:SCFading:INTernal:FFADer RF2C,RX1,RF2C,TX1

ROUTe:GSM:SIGN:SCENario:SCFading:INTernal RF2C,RX1,RF2C,TX1,FAD1

// *****************************************************************************
// Configure the fading simulator:
// Enable it, select a fading profile, start fading automatically,
// set start seed and calculate insertion loss automatically.
// *****************************************************************************
CONFigure:GSM:SIGN:FADing:FSIMulator:ENABle ON
CONFigure:GSM:SIGN:FADing:FSIMulator:STANdard T3
CONFigure:GSM:SIGN:FADing:FSIMulator:RESTart:MODE AUTO
CONFigure:GSM:SIGN:FADing:FSIMulator:GLOBal:SEED 0
CONFigure:GSM:SIGN:FADing:FSIMulator:ILOSs:MODE NORMal
```

```
// *****************************************************************************
// Configure AWGN insertion:
// Enable AWGN, set min noise/system BW ratio, set signal to noise ratio,
// query calculated noise power and clipped samples.
// *****************************************************************************
CONFigure:GSM:SIGN:FADing:AWGN:ENABle ON
CONFigure:GSM:SIGN:FADing:AWGN:BWIDth:RATio 1
CONFigure:GSM:SIGN:FADing:AWGN:SNRatio 1
CONFigure:GSM:SIGN:FADing:POWer:NOISe?
CONFigure:GSM:SIGN:FADing:FSIMulator:ILOSs:CSAMples?
CONFigure:GSM:SIGN:FADing:FSIMulator:DSHift:MODE NORM
CONFigure:GSM:SIGN:FADing:FSIMulator:DSHift?
```

2.4.1.4 Configuring Neighbor Cell and Reselection Parameters

```
// *****************************************************************************
// Specify 2 neighbor cell entries for LTE, GSM, WCDMA, TD-SCDMA.
// Enable the MS neighbor cell measurements for the first cell per RAT.
// *****************************************************************************
CONFigure:GSM:SIGN:NCELl:LTE:CELL1 ON, OB1, 10, 0, ON
CONFigure:GSM:SIGN:NCELl:LTE:CELL2 ON, OB2, 700, 1, OFF
CONFigure:GSM:SIGN:NCELl:GSM:CELL1 ON, G09, 0, ON, 21
CONFigure:GSM:SIGN:NCELl:GSM:CELL2 ON, G09, 124, OFF, 22
CONFigure:GSM:SIGN:NCELl:WCDMa:CELL1 ON, OB1, 10562, #H10A, ON
CONFigure:GSM:SIGN:NCELl:WCDMa:CELL2 ON, OB2, 412, #H10B, OFF
CONFigure:GSM:SIGN:NCELl:TDSCdma:CELL1 ON, OB1, 9400, #H7E, ON
CONFigure:GSM:SIGN:NCELl:TDSCdma:CELL2 ON, OB2, 10050, #H7F, OFF


// *****************************************************************************
// Specify neighbor cell reselection thresholds per technology.
// *****************************************************************************
CONFigure:GSM:SIGN:NCELl:LTE:THResholds:HIGH 5
CONFigure:GSM:SIGN:NCELl:WCDMa:THResholds:HIGH 5
CONFigure:GSM:SIGN:NCELl:TDSCdma:THResholds:HIGH 5

// *****************************************************************************
// Specify reselection criteria GSM, UMTS and LTE cells and
// threshold for reselection 10 s.
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:RESelection:QUALity:RXLevmin:ACCess -100
CONFigure:GSM:SIGN:CELL:RESelection:HYSTeresis 10
CONFigure:GSM:SIGN:CELL:RESelection:QUALity:RXLevmin:UTRan -57
CONFigure:GSM:SIGN:CELL:RESelection:QUALity:RXLevmin:EUTRan -78
CONFigure:GSM:SIGN:CELL:RESelection:TRESelection 10
```

2.4.1.5 Configuring Network and MS Identities

```
// *****************************************************************************
// Query the cell identity.
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:IDENtity?

// *****************************************************************************
// Identify the cell's PLMN:
// - set the mobile country code to 1
// - set the mobile network code length to 2 and the value to 1
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:MCC 1
CONFigure:GSM:SIGN:CELL:MNC:DIGits TWO
CONFigure:GSM:SIGN:CELL:MNC 1

// *****************************************************************************
// Identify the cell's area within the PLMN:
// - set the location area code to 1
// - set the routing area code to 0
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:LAC 1
CONFigure:GSM:SIGN:CELL:RAC 0

// *****************************************************************************
// Configure the Base Station Identity Code (BSIC):
// - set the network color code to 0
// - set the BS colour code to 0
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:NCC 0
CONFigure:GSM:SIGN:CELL:BCC 0

// *****************************************************************************
// Configure the default IMSI.
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:IMSI 1,1,1000000095

// *****************************************************************************
// Synchronize the signaling application to zone 1.
// Apply an offset of 30 µs.
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:SYNC:ZONE Z1
CONFigure:GSM:SIGN:CELL:SYNC:OFFSet 30E-6
```

2.4.1.6 Configuring Requested Mobile Data

```
// *****************************************************************************
// Tell the MS to send its IMEI during location / routing area updates.
// Enable early classmark sending and disable classmark3 request.
```

```
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:IMEirequest ON
CONFigure:GSM:SIGN:CELL:ECSending ON
CONFigure:GSM:SIGN:CELL:CREQuest OFF
```

2.4.1.7 Configuring Cell Parameters

```
// *****************************************************************************
// General settings: Define number of AGCH data blocks reserved for AGCH access,
// set interval between two paging requests, tell mobile to determine channel
// numbers in the GSM 1800 band.
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:BSAGblksres 0
CONFigure:GSM:SIGN:CELL:BSPamfrms 2
CONFigure:GSM:SIGN:CELL:BINDicator G18

// *****************************************************************************
// CS settings: Tell mobile to perform a location update whenever it is
// switched on, don't allow DTX.
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:LUPDate ALWays
CONFigure:GSM:SIGN:CELL:DTX OFF

// *****************************************************************************
// Set paging mode, max retransmissions, MS identity for
// paging, initial power reduction, cell baring, permitted network
// color code and possible channel numbers within the GSM cell.
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:PMODe NPAG
CONFigure:GSM:SIGN:CELL:MRETrans 7
CONFigure:GSM:SIGN:CELL:IPReduction 1
CONFigure:GSM:SIGN:CELL:IPReduction ON
CONFigure:GSM:SIGN:CELL:CBARring OFF
CONFigure:GSM:SIGN:CELL:PMIDentity TMSI
CONFigure:GSM:SIGN:CELL:NCC:PERMitted 10
CONFigure:GSM:SIGN:CELL:CDEScription 102,1011,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,
    OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,
    OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,
    OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF

// *****************************************************************************
// Enable enhanced MS measurement reports for CS connections.
// Accept the first mobile originating CS call request. Establish CS
// call and query the connection error.
// *****************************************************************************
CONFigure:GSM:SIGN:RREPort:CSWitched:EMReport:ENABle ON
CONFigure:GSM:SIGN:CELL:CSWitched:CREQuest ACC
SENSe:GSM:SIGN:CELL:CERRor?
```

```
// *****************************************************************************
// PS settings: Select channel type used by mobile to determine received signal
// strength and quality, accept PDP context activation attempts from the MS,
// specify signal level filter period for power control and BEP period.
// Ignore the first mobile originating PS call request, accept it after
// the first burst. Establish PS call and query the connection error.
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:PSWitched:PCMChannel BCCH
CONFigure:GSM:SIGN:CELL:PSWitched:PDPContext ACCept
CONFigure:GSM:SIGN:CELL:PSWitched:TAVGtw 3
CONFigure:GSM:SIGN:CELL:PSWitched:BPERiod 1
CONFigure:GSM:SIGN:CELL:PSWitched:CREQuest IGN,AA1
SENSe:GSM:SIGN:CELL:PSWitched:CERRor?
```

2.4.1.8 Setting Timers and Constants

```
// *****************************************************************************
// Set the radio link timeout on the MS and BS
// to 24 missing SACCH blocks (~11.5 s).
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:RTMS 24
CONFigure:GSM:SIGN:CELL:RTBS 24

// *****************************************************************************
// Specify the timeout for unanswered mobile-terminating calls.
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:ATIMeout 1

// *****************************************************************************
// Tell the mobile
// - to perform a periodic location update every 6 minutes (Timer T3212)
// - not to perform periodic routing area updates (Timer T3312)
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:PLUPdate 1
CONFigure:GSM:SIGN:CELL:PRAupdate 0

// *****************************************************************************
// Set the CS and PS immediate assignment reject timer.
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:CSWitched:IARTimer 255
CONFigure:GSM:SIGN:CELL:PSWitched:IARTimer 255

// *****************************************************************************
// Set the PS TBF release timer.
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:PSWitched:TRTimer 5
```

2.4.1.9 Configuring Reject Causes

```
// *****************************************************************************
// Configure reject causes.
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:RCAuse:LOCation C12
CONFigure:GSM:SIGN:CELL:RCAuse:ATTach C32
```

2.4.1.10 Configuring Security Settings

```
// *****************************************************************************
// Enable authentication, define secret key and select SIM card type.
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:SECurity:AUTHenticat ON
CONFigure:GSM:SIGN:CELL:SECurity:SKEY #H000102030405060708090A0B0C0D0E0F
CONFigure:GSM:SIGN:CELL:SECurity:SIMCard C2G
```

2.4.1.11 Configuring Common Connection Settings

```
// *****************************************************************************
// Set the frequency offset for UL and DL trafic channels,
// enable random frequency offset, set timing advance.
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:FOFFset:DL 100
CONFigure:GSM:SIGN:CONNection:FOFFset:UL 100
CONFigure:GSM:SIGN:CONNection:RFOFfset ON
CONFigure:GSM:SIGN:CONNection:TADVance 15
```

2.4.1.12 Configuring General CS Connection Settings

```
// *****************************************************************************
// Set the timeslot for circuit switched calls;
// (optionally) set the uplink slot for GSM measurement applications.
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:CSWitched:TSLot 3
CONFigure:GSM:SIGN:MSLot:UL 3

// *****************************************************************************
// Select the AMR narrowband half-rate GMSK codec for voice calls and use
// subchannel 1.
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:CSWitched:TMODe ANHG
CONFigure:GSM:SIGN:CONNection:CSWitched:HRSubchannel 1

// *****************************************************************************
// Select echo as data source, set echo delay.
//
// Alternatively select PRBS 2E9-1 as data source.
```

```
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:CSWitched:DSOurce ECHO
CONFigure:GSM:SIGN:CONNection:CSWitched:EDELay 10

CONFigure:GSM:SIGN:CONNection:CSWitched:DSOurce PR9

// *****************************************************************************
// Enable DL DTX and set the level of the DTX and SID frames.
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:CSWitched:DTX:DL ON, -20, -10

// *****************************************************************************
// Select normal CS call release.
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:CSWitched:CRELease NREL

// *****************************************************************************
// Enable a TCH burst-by-burst loop that is re-closed after channel change.
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:CSWitched:LOOP C
CONFigure:GSM:SIGN:CONNection:CSWitched:LREClose ON

// *****************************************************************************
// Set the caller Id.
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:CSWitched:CID 00498941290

// *****************************************************************************
// Configure late traffic channel assignment (off-air call setup).
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:CSWitched:TCHassign LATE
```

2.4.1.13 Configuring AMR Settings

```
// *****************************************************************************
// Configure rate sets and thresholds for different AMR types.
// *****************************************************************************
CONF:GSM:SIGN:CONN:CSW:AMR:RSET:NB:FRATe:GMSK C1220,C0795,C0590,C0475
CONF:GSM:SIGN:CONN:CSW:AMR:RSET:NB:HRATe:GMSK OFF,OFF,C0795,C0515
CONF:GSM:SIGN:CONN:CSW:AMR:RSET:NB:HRATe:EPSK OFF,C1220,C0795,C0590
CONF:GSM:SIGN:CONN:CSW:AMR:RSET:WB:FRATe:GMSK OFF,C0885,C0660
CONF:GSM:SIGN:CONN:CSW:AMR:RSET:WB:FRATe:EPSK OFF,C2385,C1585,C1265
CONF:GSM:SIGN:CONN:CSW:AMR:RSET:WB:HRATe:EPSK OFF,C1265,C0885
CONF:GSM:SIGN:CONN:CSW:AMR:THR:WB:HRATe:EPSK OFF,OFF,1.15,1.35,6.5,8.5

// *****************************************************************************
// Specify the initial codec modes.
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:CSWitched:AMR:CMODe:NB:FRATe:GMSK:DL 3
```

```
CONFigure:GSM:SIGN:CONNection:CSWitched:AMR:CMODe:NB:FRATe:GMSK:UL 3
CONFigure:GSM:SIGN:CONNection:CSWitched:AMR:CMODe:NB:HRATe:GMSK:DL 2
CONFigure:GSM:SIGN:CONNection:CSWitched:AMR:CMODe:NB:HRATe:GMSK:UL 2
CONFigure:GSM:SIGN:CONNection:CSWitched:AMR:CMODe:NB:HRATe:EPSK:DL 3
CONFigure:GSM:SIGN:CONNection:CSWitched:AMR:CMODe:NB:HRATe:EPSK:UL 3
CONFigure:GSM:SIGN:CONNection:CSWitched:AMR:CMODe:WB:FRATe:GMSK:DL 2
CONFigure:GSM:SIGN:CONNection:CSWitched:AMR:CMODe:WB:FRATe:GMSK:UL 2
CONFigure:GSM:SIGN:CONNection:CSWitched:AMR:CMODe:WB:FRATe:EPSK:DL 2
CONFigure:GSM:SIGN:CONNection:CSWitched:AMR:CMODe:WB:FRATe:EPSK:UL 2
CONFigure:GSM:SIGN:CONNection:CSWitched:AMR:CMODe:WB:HRATe:EPSK:DL 2
CONFigure:GSM:SIGN:CONNection:CSWitched:AMR:CMODe:WB:HRATe:EPSK:UL 2

// ******************************************************************************
// Query the DL codec modes requested by the MS (DL) and the actual codec modes
// used by the MS (UL).
// ******************************************************************************
SENSe:GSM:SIGN:MSSinfo:AMR:CMODe:NB:FRATe:GMSK:DL?
SENSe:GSM:SIGN:MSSinfo:AMR:CMODe:NB:FRATe:GMSK:UL?
SENSe:GSM:SIGN:MSSinfo:AMR:CMODe:NB:HRATe:GMSK:DL?
SENSe:GSM:SIGN:MSSinfo:AMR:CMODe:NB:HRATe:GMSK:UL?
SENSe:GSM:SIGN:MSSinfo:AMR:CMODe:NB:HRATe:EPSK:DL?
SENSe:GSM:SIGN:MSSinfo:AMR:CMODe:NB:HRATe:EPSK:UL?
SENSe:GSM:SIGN:MSSinfo:AMR:CMODe:WB:FRATe:GMSK:DL?
SENSe:GSM:SIGN:MSSinfo:AMR:CMODe:WB:FRATe:GMSK:UL?
SENSe:GSM:SIGN:MSSinfo:AMR:CMODe:WB:FRATe:EPSK:DL?
SENSe:GSM:SIGN:MSSinfo:AMR:CMODe:WB:FRATe:EPSK:UL?
SENSe:GSM:SIGN:MSSinfo:AMR:CMODe:WB:HRATe:EPSK:DL?
SENSe:GSM:SIGN:MSSinfo:AMR:CMODe:WB:HRATe:EPSK:UL?
```

2.4.1.14 Configuring VAMOS Support

```
// ******************************************************************************
// Set the VAMOS support level that is required from the mobile.
// ******************************************************************************
CONFigure:GSM:SIGN:CONNection:CSWitched:VAMos:MSLevel VAM1

// ******************************************************************************
// Perform all VAMOS settings:
// - VAMOS subchannel = 0
// - TSC for active subchannel = 0
// - TSC set for active subchannel = 1
// - TSC for other (virtual) subchannel = 0
// - TSC set for other (virtual) subchannel = 2
// - Subchannel power imbalance ratio = 0 dB
// - VAMOS profile = "Two active VAMOS users"
// ******************************************************************************
CONFigure:GSM:SIGN:CONNection:CSWitched:VAMos 0,0,1,0,2,0,TUS

// ******************************************************************************
```

```
// Enable VAMOS.
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:CSWitched:VAMos:ENABle ON
```

2.4.1.15 Configuring PS Connection Settings

```
// *****************************************************************************
// Enable the "Packet Switched Domain" and disable dual carrier mode.
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:PSDomain ON
CONFigure:GSM:SIGN:CONNection:PSWitched:DLDCarrier:ENABle OFF

// *****************************************************************************
// Select "Test Mode B" (PRBS test data looped back at MS) as service mode,
// enable incremental redundancy, select a pseudo-random bit sequence,
// no extended dynamic allocation, the number of PDUs,
// the slot offset for the loopback data and the burst type for CTRL_ACK
// messages, set BEP period to 10 and data corruption rate to 10 percent.
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:PSWitched:SERVice TMB
CONFigure:GSM:SIGN:CONNection:PSWitched:IREDundancy ON
CONFigure:GSM:SIGN:CONNection:PSWitched:DSOurce PR9
CONFigure:GSM:SIGN:CONNection:PSWitched:EDALlocation OFF
CONFigure:GSM:SIGN:CONNection:PSWitched:NOPDus 4095
CONFigure:GSM:SIGN:CONNection:PSWitched:SOFFset 0
CONFigure:GSM:SIGN:CONNection:PSWitched:CATYpe NBURsts
CONFigure:GSM:SIGN:CONNection:PSWitched:BPERiod2 10
CONFigure:GSM:SIGN:CONNection:PSWitched:BDCRate 10

// *****************************************************************************
//  Select EGPRS as transmission scheme.
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:PSWitched:TLEVel EGPRS

// *****************************************************************************
// Select MCS-1 as UL coding scheme.
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:PSWitched:CSCHeme:UL MC1

// *****************************************************************************
// Diasable automatic slot configuration.
// Use slots 1 and 2 for the uplink and slots 4, 5, 6 and 7 for the downlink.
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:ASConfig OFF
CONF:GSM:SIGN:CONN:PSWitched:SCONfig:ENABle:UL OFF,ON,ON,OFF,OFF,OFF,OFF,OFF
CONF:GSM:SIGN:CONN:PSWitched:SCONfig:ENABle:DL:CARR OFF,OFF,OFF,OFF,ON,ON,ON,ON

// *****************************************************************************
// Configure the power in all uplink and downlink slots.
```

```
// ******************************************************************************
CONF:GSM:SIGN:CONN:PSWitched:SCONfig:GAMMa:UL 13,13,13,13,13,13,13,13
CONF:GSM:SIGN:CONN:PSWitched:SCONfig:LEVel:DL:CARRier -5,-5,-5,-5,-5,-5,-5,-5

// ******************************************************************************
// Configure the coding schemes on the downlink.
// ******************************************************************************
CONF:GSM:SIGN:CONN:PSW:SCON:CSCHeme:DL:CARRier MC1,MC1,MC1,MC1,MC1,MC1,MC1,MC1

// ******************************************************************************
// Set USF duty cycle to 25 %.
// ******************************************************************************
CONFigure:GSM:SIGN:CONNection:PSWitched:SCONfig:UDCYcle:DL:CARRier 25,25,
    25,25,25,25,25,25

// ******************************************************************************
// Query the resulting maximum RLC throughput.
// ******************************************************************************
SENSe:GSM:SIGN:CONNection:ETHRoughput:DL?
SENSe:GSM:SIGN:CONNection:ETHRoughput:UL?

// ******************************************************************************
// Configure downlink power control: enable it, select P0, PR mode and
// PR field values.
// ******************************************************************************
CONFigure:GSM:SIGN:CONNection:PSWitched:DPControl:ENABle ON
CONFigure:GSM:SIGN:CONNection:PSWitched:DPControl:P DB12
CONFigure:GSM:SIGN:CONNection:PSWitched:DPControl:PMODe PMA
CONFigure:GSM:SIGN:CONNection:PSWitched:DPControl:PFIeld DB7

// ******************************************************************************
// Disable the filler dummy data blocks.
// ******************************************************************************
CONFigure:GSM:SIGN:CONNection:PSWitched:ASRDblocks OFF
```

2.4.1.16 Configuring Trigger Signals

```
// ******************************************************************************
// Configure the frame trigger signal so that a trigger pulse is generated
// at the start of every frame.
// ******************************************************************************
CONFigure:GSM:SIGN:TRIGger:FTMode EVERy
```

2.4.1.17 Configuring Message Monitoring

```
// ******************************************************************************
// Enable message monitoring for GSM, select address number 2 from the global
// logging PC address pool and query the corresponding IP address string.
// ******************************************************************************
```

```
CONFigure:GSM:SIGN:MMONitor:ENABle ON
CONFigure:GSM:SIGN:MMONitor:IPADdress IP2
CONFigure:GSM:SIGN:MMONitor:IPADdress?
```

2.4.1.18 Switching on the Cell Signal and the MS

```
// *****************************************************************************
// Physically connect the MS (switched off), then switch on the DL signal.
// Query the cell state until it equals ON,ADJ
// (i.e. the DL signal is available at the RF connector).
// *****************************************************************************
WAITKEY >Ensure that the MS is connected to the instrument and switched off<
SOURce:GSM:SIGN:CELL:STATe ON
WHILE SOURce:GSM:SIGN:CELL:STATe:ALL? <> "ON,ADJ"

// *****************************************************************************
// Switch on the MS and wait until it is synchronized and attached.
// Make sure that the PS domain is enabled at all.
// *****************************************************************************
WAITKEY >Switch on the MS<
WHILE FETCh:GSM:SIGN:CSWitched:STATe? <> "SYNC"
WHILE FETCh:GSM:SIGN:PSWitched:STATe? <> "ATT"
```

2.4.1.19 Configuring the I/Q Settings

```
// *****************************************************************************
// Query the properties of the outgoing baseband signal, required to configure
// the baseband input of the connected instrument. Configure the baseband input
// according to the baseband output of the connected instrument.
// *****************************************************************************
SENSe:GSM:SIGN:IQOut:PATH?
CONFigure:GSM:SIGN:IQIN:PATH -30, -20
```

2.4.1.20 Querying MS Capabilities

```
// *****************************************************************************
// Ask for the bands supported by the MS.
// *****************************************************************************
SENSe:GSM:SIGN:MSSinfo:BANDs?

// *****************************************************************************
// Ask for the supported GPRS/EGPRS multislot classes
// in single and dual transfer mode.
// *****************************************************************************
SENSe:GSM:SIGN:MSSinfo:MSCLass:GPRS?
SENSe:GSM:SIGN:MSSinfo:MSCLass:EGPRs?
SENSe:GSM:SIGN:MSSinfo:MSCLass:DGPRs?
SENSe:GSM:SIGN:MSSinfo:MSCLass:DEGPrs?
```

```
// *****************************************************************************
// Query support of extended dynamic allocation.
// *****************************************************************************
SENSe:GSM:SIGN:MSSinfo:EDALlocation?

// *****************************************************************************
// Query the supported codec list.
// *****************************************************************************
SENSe:GSM:SIGN:MSSinfo:CODec:GSM?
SENSe:GSM:SIGN:MSSinfo:CODec:UMTS?
```

2.4.1.21 Querying MS Info

```
// *****************************************************************************
// Ask for the IMEI and IMSI of the MS.
// *****************************************************************************
SENSe:GSM:SIGN:MSSinfo:IMEI?
SENSe:GSM:SIGN:MSSinfo:IMSI?

// *****************************************************************************
// During emergency call query the service category.
// *****************************************************************************
SENSe:GSM:SIGN:MSSinfo:SCATegory?

// *****************************************************************************
// Query the dialed number and RX power.
// *****************************************************************************
WAITKEY >Initiate a mobile originating call at the MS<
SENSe:GSM:SIGN:MSSinfo:DNUMber?
SENSe:GSM:SIGN:MSSinfo:RXPower?
```

2.4.1.22 Configuring MS Measurement Reports

```
// *****************************************************************************
// Enable MS report, set RSRP/RSCP to be measured for LTE/WCDMA
// neighbor cell measurements.
// *****************************************************************************
CONFigure:GSM:SIGN:MSREPort:ENABle ON
CONFigure:GSM:SIGN:MSREPort:LMQuantity RSRP
CONFigure:GSM:SIGN:MSREPort:WMQuantity RSCP
```

2.4.1.23 Querying MS Measurement Reports

```
// *****************************************************************************
// Ask for the MS reports related to neighbor cells, query two cells
// per supported RAT.
// *****************************************************************************
```

```
SENSe:GSM:SIGN:RREPort:NCELl:GSM:CELL1?
SENSe:GSM:SIGN:RREPort:NCELl:GSM:CELL2?
SENSe:GSM:SIGN:RREPort:NCELl:GSM:CELL1:RANGe?
SENSe:GSM:SIGN:RREPort:NCELl:GSM:CELL2:RANGe?
SENSe:GSM:SIGN:RREPort:NCELl:LTE:CELL1?
SENSe:GSM:SIGN:RREPort:NCELl:LTE:CELL2?
SENSe:GSM:SIGN:RREPort:NCELl:LTE:CELL1:RANGe?
SENSe:GSM:SIGN:RREPort:NCELl:LTE:CELL2:RANGe?
SENSe:GSM:SIGN:RREPort:NCELl:TDSCdma:CELL1?
SENSe:GSM:SIGN:RREPort:NCELl:TDSCdma:CELL2?
SENSe:GSM:SIGN:RREPort:NCELl:TDSCdma:CELL1:RANGe?
SENSe:GSM:SIGN:RREPort:NCELl:TDSCdma:CELL2:RANGe?
SENSe:GSM:SIGN:RREPort:NCELl:WCDMa:CELL1?
SENSe:GSM:SIGN:RREPort:NCELl:WCDMa:CELL2?
SENSe:GSM:SIGN:RREPort:NCELl:WCDMa:CELL1:RANGe?
SENSe:GSM:SIGN:RREPort:NCELl:WCDMa:CELL2:RANGe?

// ******************************************************************************
// Ask for the MS reports related to enhanced measurements. Query
// mean BEP and CV BEP with their ranges and the number of received
// blocks.
// ******************************************************************************
SENSe:GSM:SIGN:RREPort:CSWitched:MBEP?
SENSe:GSM:SIGN:RREPort:CSWitched:MBEP:RANGe?
SENSe:GSM:SIGN:RREPort:CSWitched:CBEP?
SENSe:GSM:SIGN:RREPort:CSWitched:CBEP:RANGe?
SENSe:GSM:SIGN:RREPort:CSWitched:NRBLocks?
```

2.4.1.24 Setting up a CS Connection

```
// ******************************************************************************
// Set up a mobile terminating connection.
// Query the connection state until it equals CEST (call established).
// ******************************************************************************
CALL:GSM:SIGN:CSWitched:ACTion CONNect
WHILE FETCh:GSM:SIGN:CSWitched:STATe? <> "CEST"
```

2.4.1.25 Setting up an Audio CS Connection

Connect the DUT with the audio connectors provided by the R&S CMW with an installed audio board. For the detailed information refer to the user manual of the audio measurements application.

```
// ******************************************************************************
// Before switching on a cell, enable audio.
// ******************************************************************************
CONFigure:GSM:SIGN:ESCode ON
```

Switch on the cell signal (see Switching on the Cell Signal and the MS).

```
// ******************************************************************************
// // Set date source to speech and set up a mobile terminating connection.
// Query the connection state until it equals CEST (call established).
// ******************************************************************************
CONFigure:GSM:SIGN:CONNection:CSWitched:DSOurce SP1
CALL:GSM:SIGN:CSWitched:ACTion CONNect
WHILE FETCh:GSM:SIGN:CSWitched:STATe? <> "CEST"
```

2.4.1.26 Retrieving CS Receiver Reports

```
// ******************************************************************************
// Retrieve RX level measurement reports: index values and corresponding ranges.
// ******************************************************************************
SENSe:GSM:SIGN:RREPort:RXLevel?
SENSe:GSM:SIGN:RREPort:RXLevel:RANGe?
SENSe:GSM:SIGN:RREPort:RXLevel:SUB?
SENSe:GSM:SIGN:RREPort:RXLevel:SUB:RANGe?

// ******************************************************************************
// Retrieve quality measurement reports: index values and corresponding ranges.
// ******************************************************************************
SENSe:GSM:SIGN:RREPort:RXQuality?
SENSe:GSM:SIGN:RREPort:RXQuality:RANGe?
SENSe:GSM:SIGN:RREPort:RXQuality:SUB?
SENSe:GSM:SIGN:RREPort:RXQuality:SUB:RANGe?

// ******************************************************************************
// Query the number of received reports.
// ******************************************************************************
SENSe:GSM:SIGN:RREPort:COUNt?
```

2.4.1.27 Sending / Receiving an SMS

```
// ******************************************************************************
// Set SMS via CS domain, set originating address, general data coding,
// message class 1 and SMSC address for an outgoing SMS.
// Edit SMS text as 7 bit text.
// Alternatively edit binary SMS with 8 bit data coding.
// Send the message and query the number of the SMS segments.
// ******************************************************************************
CONFigure:GSM:SIGN:SMS:OUTGoing:SDOMain CS
CONFigure:GSM:SIGN:SMS:OUTGoing:OADDress "+498941290"
CONFigure:GSM:SIGN:SMS:OUTGoing:CGRoup GDC
CONFigure:GSM:SIGN:SMS:OUTGoing:MCLass CL1
CONFigure:GSM:SIGN:SMS:OUTGoing:OSADdress "12345"

CONFigure:GSM:SIGN:SMS:OUTGoing:INTernal "Hello world!"
CONFigure:GSM:SIGN:SMS:OUTGoing:DCODing BIT7
```

```
CONFigure:GSM:SIGN:SMS:OUTGoing:BINary #H5685FF45216A56B456E789
CONFigure:GSM:SIGN:SMS:OUTGoing:DCODing BIT8

CALL:GSM:SIGN:CSWitched:ACTion SMS
SENSe:GSM:SIGN:SMS:OUTGoing:INFO:SEGMent?

// *****************************************************************************
// Select a time source and configure date and time for service
// center time stamp.
// *****************************************************************************
CONFigure:GSM:SIGN:SMS:OUTGoing:SCTStamp:TSOurce DATE
CONFigure:GSM:SIGN:SMS:OUTGoing:SCTStamp:DATE 24,10,2012
CONFigure:GSM:SIGN:SMS:OUTGoing:SCTStamp:TIME 12,40,30

// *****************************************************************************
// Query the state of the "message read" flag.
// *****************************************************************************
SENSe:GSM:SIGN:SMS:INFO:LRMessage:RFLag?

// *****************************************************************************
// If the query returns OFF, there is an unread message. In this case ask
// for the message coding, length and text (for further processing).
// Query the current and total number of the SMS segments.
// *****************************************************************************
SENSe:GSM:SIGN:SMS:INComing:INFO:DCODing?
SENSe:GSM:SIGN:SMS:INComing:INFO:MLENgth?
SENSe:GSM:SIGN:SMS:INComing:INFO:MTEXt?
SENSe:GSM:SIGN:SMS:INComing:INFO:SEGMent?

// *****************************************************************************
// Clean the incoming message buffer (and reset the "message read" flag).
// *****************************************************************************
CLEan:GSM:SIGN:SMS:INComing:INFO:MTEXt
```

2.4.1.28 Sending Date and Time Information to the MS

```
// *****************************************************************************
// Select a time source and configure date, time and DST +1h.
// Send the information to the MS. Enable sending time at attach.
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:TIME:TSOurce DATE
CONFigure:GSM:SIGN:CELL:TIME:DATE 24,10,2012
CONFigure:GSM:SIGN:CELL:TIME:TIME 12,40,30
CONFigure:GSM:SIGN:CELL:TIME:DSTime P1H
CONFigure:GSM:SIGN:CELL:TIME:SNOW
CONFigure:GSM:SIGN:CELL:TIME:SATTach ON
```

2.4.1.29 Performing an Intra-GSM CS Handover

```
// ******************************************************************************
// For the target cell configure:
// - GSM 1800 band, channel 711
// - a level of -80 dBm
// - a power control level index of 10 (corresponds to 10 dBm)
// ******************************************************************************
PREPare:GSM:SIGN:HANDover:TARGet G18
PREPare:GSM:SIGN:HANDover:CHANnel:TCH 711
PREPare:GSM:SIGN:HANDover:LEVel:TCH -80
PREPare:GSM:SIGN:HANDover:PCL 10
PREPare:GSM:SIGN:HANDover:TSLot 3

// ******************************************************************************
// Initiate the handover.
// ******************************************************************************
CALL:GSM:SIGN:HANDover:STARt

// ******************************************************************************
// Check whether the handover has been performed successfully:
// result must be CEST, otherwise the handover has failed
// ******************************************************************************
FETCh:GSM:SIGN:CSWitched:STATe?
```

2.4.1.30 Performing an Inter RAT CS Handover

```
// ******************************************************************************
// An inter RAT handover is a handover to another signaling application.
//
// Query a list of possible handover destinations (signaling applications).
// Select a handover destination from the list.
// Select the handover mechanism.
// Wait until the destination is ready to receive a handover.
// Initiate the handover.
//
// Destination parameters like operating band or channel can be changed using
// commands provided by the destination signaling application. Adjust these
// parameters before executing the following commands.
// ******************************************************************************
PREPare:GSM:SIGN:HANDover:CATalog:DESTination?
PREPare:GSM:SIGN:HANDover:DESTination 'LTE Sig1'
PREPare:GSM:SIGN:HANDover:MMODe RED
WHILE SOURce:LTE:SIGN:CELL:STATe:ALL? <> "RFH", "ADJ"
CALL:GSM:SIGN:CSWitched:ACTion HANDover
```

2.4.1.31 Performing a CS Handover to another Instrument

```
// *****************************************************************************
// Select handover to other instrument ("No Connection").
// Select target RAT (WCDMA) and configure the other destination settings.
// Initiate the handover.
// Prepare also the settings for other target RATs.
// *****************************************************************************
PREPare:GSM:SIGN:HANDover:DESTination "No Connection"
PREPare:GSM:SIGN:HANDover:EXTernal:DESTination WCDMa
PREPare:GSM:SIGN:HANDover:EXTernal:WCDMa OB1, 10565
CALL:GSM:SIGN:CSWitched:ACTion HANDover

PREPare:GSM:SIGN:HANDover:EXTernal:GSM G09, 55, G18
PREPare:GSM:SIGN:HANDover:EXTernal:LTE OB1, 300
PREPare:GSM:SIGN:HANDover:EXTernal:TDSCdma OB1, 9596
```

2.4.1.32 Setting up a PS Connection

```
// *****************************************************************************
// Set up a PS connection.
// Query the connection state until the connection has been established.
// Query the IPv4 address and APN assigned to the MS.
// *****************************************************************************
CALL:GSM:SIGN:PSWitched:ACTion CONNect
WHILE FETCh:GSM:SIGN:PSWitched:STATe? <> TBF
SENSe:GSM:SIGN:MSSinfo:MSADdress:IPV4?
SENSe:GSM:SIGN:MSSinfo:APN?
```

2.4.1.33 Retrieving PS Receiver Reports

```
// *****************************************************************************
// Retrieve the "C value" (i.e. the measured average carrier level) and the
// signal variance: query for index values and corresponding ranges.
// *****************************************************************************
SENSe:GSM:SIGN:RREPort:CVALue?
SENSe:GSM:SIGN:RREPort:CVALue:RANGe?
SENSe:GSM:SIGN:RREPort:SVARiance?
SENSe:GSM:SIGN:RREPort:SVARiance:RANGe?

// *****************************************************************************
// Retrieve the mean bit error probability (MEAN_BEP) and the coefficient of
// variation of the bit error probability (CV_BEP) for the individual
// modulation types:
// GMSK, 8PSK, 16-QAM/32-QAM with normal and higher symbol rate
// *****************************************************************************
SENSe:GSM:SIGN:RREPort:GMBep?
SENSe:GSM:SIGN:RREPort:GMBep:RANGe?
SENSe:GSM:SIGN:RREPort:GCBep?
```

```
SENSe:GSM:SIGN:RREPort:GCBep:RANGe?

SENSe:GSM:SIGN:RREPort:EMBep?
SENSe:GSM:SIGN:RREPort:EMBep:RANGe?
SENSe:GSM:SIGN:RREPort:ECBep?
SENSe:GSM:SIGN:RREPort:ECBep:RANGe?

SENSe:GSM:SIGN:RREPort:NSRQam16:MBEP?
SENSe:GSM:SIGN:RREPort:NSRQam16:MBEP:RANGe?
SENSe:GSM:SIGN:RREPort:NSRQam16:CBEP?
SENSe:GSM:SIGN:RREPort:NSRQam16:CBEP:RANGe?
SENSe:GSM:SIGN:RREPort:NSRQam32:MBEP?
SENSe:GSM:SIGN:RREPort:NSRQam32:MBEP:RANGe?
SENSe:GSM:SIGN:RREPort:NSRQam32:CBEP?
SENSe:GSM:SIGN:RREPort:NSRQam32:CBEP:RANGe?

SENSe:GSM:SIGN:RREPort:HSRQam16:MBEP?
SENSe:GSM:SIGN:RREPort:HSRQam16:MBEP:RANGe?
SENSe:GSM:SIGN:RREPort:HSRQam16:CBEP?
SENSe:GSM:SIGN:RREPort:HSRQam16:CBEP:RANGe?
SENSe:GSM:SIGN:RREPort:HSRQam32:MBEP?
SENSe:GSM:SIGN:RREPort:HSRQam32:MBEP:RANGe?
SENSe:GSM:SIGN:RREPort:HSRQam32:CBEP?
SENSe:GSM:SIGN:RREPort:HSRQam32:CBEP:RANGe?
```

2.4.1.34 Performing an Intra-GSM PS Handover

```
// *****************************************************************************
// For the target cell configure:
// - GSM 1800 band, channel 711
// - MCS-2 as UL coding scheme
// - a DL reference level of -80 dBm
// *****************************************************************************
PREPare:GSM:SIGN:HANDover:TARGet G18
PREPare:GSM:SIGN:HANDover:CHANnel:TCH 711
PREPare:GSM:SIGN:HAND:PSW:CSCHeme:UL MC2
PREPare:GSM:SIGN:HANDover:LEVel:TCH -80

// *****************************************************************************
// Specify the slot configuration for the target cell (single carrier).
// *****************************************************************************
PREPare:GSM:SIGN:HANDover:PSWitched:ENABle:UL OFF,OFF,ON,OFF,OFF,OFF,OFF,OFF
PREPare:GSM:SIGN:HANDover:PSWitched:GAMMa:UL 13,13,13,13,13,13,13,13
PREPare:GSM:SIGN:HAND:PSW:ENABle:DL:CARRier OFF,OFF,ON,OFF,OFF,OFF,OFF,OFF
PREPare:GSM:SIGN:HANDover:PSWitched:LEVel:DL:CARRier -5,-5,-5,-5,-5,-5,-5,-5
PREPare:GSM:SIGN:HAND:PSW:CSCHeme:DL:CARRier MC2,MC2,MC2,MC2,MC2,MC2,MC2,MC2

// *****************************************************************************
// Initiate the handover.
```

```
// *****************************************************************************
CALL:GSM:SIGN:HANDover:STARt

// *****************************************************************************
// Check whether the handover has been performed successfully:
// result must be TBF, otherwise the handover has failed
// *****************************************************************************
FETCh:GSM:SIGN:PSWitched:STATe?
```

2.4.1.35 Performing an Inter-RAT Handover to GSM

```
// *****************************************************************************
// Before handover from another signaling application set routing, channel,
// maximum MS output power and power level of GSM signaling application.
//
// Destination parameters like operating band or channel can be changed using
// commands provided by the GSM signaling application. Adjust these
// parameters before executing the following commands.
//
// Initiate the handover. GSM signaling indicates state incoming HO.
// Wait until the MS is connected with GSM signaling application.
//
// *****************************************************************************
ROUTe:GSM:SIGN:SCENario:SCELl RF3C,RX2,RF3C,TX2
CONFigure:GSM:SIGN:BAND:BCCH G09
CONFigure:GSM:SIGN:RFSettings:CHANnel:BCCH 20
CONFigure:GSM:SIGN:RFSettings:PMAX:BCCH 5
CONFigure:GSM:SIGN:RFSettings:LEVel:BCCH -80

PREPare:WCDMa:SIGN:HANDover:DESTination 'GSM Sig1'
CALL:WCDMa:SIGN:CSWitched:ACTion HANDover
WHILE FETCh:GSM:SIGN:CSWitched:STATe? == "IHAN"
WHILE FETCh:GSM:SIGN:CSWitched:STATe? <> "CEST"
```

2.4.2 BER CS Tests

BER measurements for circuit switched connections are performed using the `...GSM:SIGN:BER:CSWitched...` commands. The required test loops for BER CS measurements are set implicitly by the measurement mode.

2.4.2.1 Measuring in Burst by Burst Mode

Before proceeding, configure the signaling application (band, channel, power levels, slots ...) and set up a circuit switched connection.

```
// *****************************************************************************
// Set the number of bursts to be measured to 100 and the measurement mode to
// "Burst by Burst".
```

```
// *****************************************************************************
CONFigure:GSM:SIGN:BER:CSWitched:MMODe BBB
CONFigure:GSM:SIGN:BER:CSWitched:SCOunt 100

// *****************************************************************************
// Tell the BER measurement to stop if the BER limit (the only limit for this
// measurement mode) is exceeded; set this limit to 0.2%.
// *****************************************************************************
CONFigure:GSM:SIGN:BER:CSWitched:SCONdition FLIM
CONFigure:GSM:SIGN:BER:CSWitched:LIMit:BER 0.2

// *****************************************************************************
// Initiate the measurement and retrieve the results.
// *****************************************************************************
READ:GSM:SIGN:BER:CSWitched?
```

2.4.2.2 Measuring in BER Mode

Before proceeding, configure the signaling application and set up a circuit switched connection.

```
// *****************************************************************************
// Set the number of speech frames to be measured to 100 and
// measurement mode to BER.
// *****************************************************************************
CONFigure:GSM:SIGN:BER:CSWitched:MMODe BER
CONFigure:GSM:SIGN:BER:CSWitched:SCOunt 100

// *****************************************************************************
// Set the error rate limits for Class II and Class Ib bits to 0.2% and 0.4%.
// Tell the BER Measurement to stop if one of these limits is exceeded.
// *****************************************************************************
CONFigure:GSM:SIGN:BER:CSWitched:LIMit:CIIBits 0.2
CONFigure:GSM:SIGN:BER:CSWitched:LIMit:CIBBits 0.4
CONFigure:GSM:SIGN:BER:CSWitched:SCONdition FLIM

// *****************************************************************************
// Initiate the measurement and retrieve the results.
// *****************************************************************************
READ:GSM:SIGN:BER:CSWitched?
```

2.4.2.3 Measuring in RBER/FER Mode

Before proceeding, configure the signaling application and set up a circuit switched connection.

```
// *****************************************************************************
// Set number of speech frames to 100 and measurement mode to "RBER/FER".
// *****************************************************************************
CONFigure:GSM:SIGN:BER:CSWitched:MMODe RFER
```

```
CONFigure:GSM:SIGN:BER:CSWitched:SCOunt 100

// *****************************************************************************
// Set the residual bit error rate limits for Class II and Class Ib bits to 0.2%
// and 0.4%, respectively; set the Frame Erasure Ratio (FER) limit to 0.1%.
// Tell the BER measurement not to stop when a limit is exceeded.
// *****************************************************************************
CONFigure:GSM:SIGN:BER:CSWitched:LIMit:CIIBits 0.2
CONFigure:GSM:SIGN:BER:CSWitched:LIMit:CIBBits 0.4
CONFigure:GSM:SIGN:BER:CSWitched:LIMit:FER 0.1
CONFigure:GSM:SIGN:BER:CSWitched:SCONdition NONE

// *****************************************************************************
// Initiate the measurement and retrieve the results.
// *****************************************************************************
READ:GSM:SIGN:BER:CSWitched?
```

2.4.2.4 Measuring in FER FACCH and FER SACCH Mode

```
// *****************************************************************************
// Re-configure the DL generator for repeated FACCH and repeated SACCH
// transmission. A previous CS connection must be closed, e.g. by means of an
// instrument reset.
// Set PCL = 7 to ensure an appropriate initial power for the FER SCCCH test.
// *****************************************************************************
*RST; *OPC?
...
CONFigure:GSM:SIGN:CONNection:CSWitched:RFACch ON
CONFigure:GSM:SIGN:CONNection:CSWitched:RSACch ON
CONFigure:GSM:SIGN:RFSettings:PCL:TCH:CSWitched 7

WAITKEY >Set up a CS connection via the signaling application<

// *****************************************************************************
// Set the Frame Error Rate (FER) limits to 0.1%.
// Tell the BER Measurement not to stop when a limit is exceeded.
// *****************************************************************************
CONFigure:GSM:SIGN:BER:CSWitched:LIMit:FFACch 0.1
CONFigure:GSM:SIGN:BER:CSWitched:LIMit:FSACch 0.1
CONFigure:GSM:SIGN:BER:CSWitched:SCONdition NONE

// *****************************************************************************
// Set the measurement mode to "FER FACCH" and the number of repeated L2 frames
// to 100. Initiate the measurement and retrieve the results.
// *****************************************************************************
CONFigure:GSM:SIGN:BER:CSWitched:MMODe FFACch
CONFigure:GSM:SIGN:BER:CSWitched:SCOunt 100
READ:GSM:SIGN:BER:CSWitched?
```

```
// *****************************************************************************
// Set the measurement mode to "FER SACCH" and the number of repeated SACCH
// frames to 200. Initiate the measurement and retrieve the results.
// *****************************************************************************
CONFigure:GSM:SIGN:BER:CSWitched:MMODe FSACch
CONFigure:GSM:SIGN:BER:CSWitched:SCOunt 100
READ:GSM:SIGN:BER:CSWitched?
```

2.4.2.5 Measuring in RBER/UFR Mode

Before proceeding, configure the signaling application.

```
// *****************************************************************************
// Configure the traffic mode half-rate version 1 speech codec.
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:CSWitched:TMODe HV1
WAITKEY >Set up a CS connection via the signaling application<

// *****************************************************************************
// Set number of speech frames to 100 and measurement mode to "RBER/UFR".
// *****************************************************************************
CONFigure:GSM:SIGN:BER:CSWitched:MMODe RUFR
CONFigure:GSM:SIGN:BER:CSWitched:SCOunt 100

// *****************************************************************************
// Set the residual bit error rate limits for Class II and Class Ib bits to 0.2%
// and 0.4%, respectively; set the Frame Erasure Ratio (FER) limit to 0.1%.
// Tell the BER measurement not to stop when a limit is exceeded.
// *****************************************************************************
CONFigure:GSM:SIGN:BER:CSWitched:LIMit:CIIBits 0.2
CONFigure:GSM:SIGN:BER:CSWitched:LIMit:CIBBits 0.4
CONFigure:GSM:SIGN:BER:CSWitched:LIMit:FER 0.1
CONFigure:GSM:SIGN:BER:CSWitched:SCONdition NONE

// *****************************************************************************
// Initiate the measurement and retrieve the results.
// *****************************************************************************
READ:GSM:SIGN:BER:CSWitched?
```

2.4.2.6 Measuring in AMR Inband FER Mode

Before proceeding, configure the signaling application.

```
// *****************************************************************************
// Select an AMR codec (e.g. AMR narrowband half-rate GMSK).
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:CSWitched:TMODe ANHG
WAITKEY >Set up a CS connection via the signaling application<

// *****************************************************************************
```

```
// Set number of speech frames to 100 and measurement mode to "AMR Inband FER".
// *****************************************************************************
CONFigure:GSM:SIGN:BER:CSWitched:MMODe AIFer
CONFigure:GSM:SIGN:BER:CSWitched:SCOunt 100
// *****************************************************************************
// Set the FER limit to 0.5%.
// Tell the BER measurement not to stop when a limit is exceeded.
// *****************************************************************************
CONFigure:GSM:SIGN:BER:CSWitched:LIMit:FER 0.5
CONFigure:GSM:SIGN:BER:CSWitched:SCONdition NONE

// *****************************************************************************
// Initiate the measurement and retrieve the results.
// *****************************************************************************
READ:GSM:SIGN:BER:CSWitched?
```

2.4.2.7 Measuring in Mean BEP Mode

Before proceeding, configure the signaling application (band, channel, power levels, slots ...) and set up a circuit switched connection.

```
// *****************************************************************************
// Enable enhanced measurement report, set the number of bursts to be measured
// to 100 and mode to "Mean BEP". Configure round trip delay.
// *****************************************************************************
CONFigure:GSM:SIGN:RREPort:CSWitched:EMReport:ENABle ON
CONFigure:GSM:SIGN:BER:CSWitched:MMODe MBEP
CONFigure:GSM:SIGN:BER:CSWitched:SCOunt 100
CONFigure:GSM:SIGN:BER:CSWitched:RTDelay MAN,8

// *****************************************************************************
// Initiate the measurement and return the contents of the result
// table, stop the measurement.
// *****************************************************************************
WAITKEY >Set up a CS connection via the signaling application<
INIT:GSM:SIGN:BER:CSWitched
FETCh:GSM:SIGN:BER:CSWitched?
FETCh:INTermediate:GSM:SIGN:BER:CSWitched:MBEP?
SENSe:GSM:SIGN:BER:CSWitched:RTDelay?
STOP:GSM:SIGN:BER:CSWitched
```

2.4.2.8 Measuring in Signal Quality Mode

Before proceeding, configure the signaling application (band, channel, power levels, slots ...) and set up a circuit switched connection.

```
// *****************************************************************************
// Disable enhanced measurement report, set the number of bursts to be measured
// to 100 and mode to "Signal Quality". Configure round trip delay.
// *****************************************************************************
```

```
CONFigure:GSM:SIGN:RREPort:CSWitched:EMReport:ENABle OFF
CONFigure:GSM:SIGN:BER:CSWitched:MMODe SQUality
CONFigure:GSM:SIGN:BER:CSWitched:SCOunt 100
CONFigure:GSM:SIGN:BER:CSWitched:RTDelay MAN,8

// *****************************************************************************
// Initiate the measurement and return the contents of the result
// table, stop the measurement.
// *****************************************************************************
WAITKEY >Set up a CS connection via the signaling application<
INIT:GSM:SIGN:BER:CSWitched

FETCh:GSM:SIGN:BER:CSWitched?
SENSe:GSM:SIGN:BER:CSWitched:RTDelay?

STOP:GSM:SIGN:BER:CSWitched
```

2.4.2.9 Measuring in BFI Mode

Before proceeding, configure the signaling application (band, channel, power levels, slots ...) and set up a circuit switched connection.

```
// *****************************************************************************
// Set data source to PRBS 2E9-1 and enable DTX mode.
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:CSWitched:DSOurce PR9
CONFigure:GSM:SIGN:CONNection:CSWitched:DTX:DL ON, -40, 0

// *****************************************************************************
// Set number of speech frames to 100 and measurement mode to "BFI".
// *****************************************************************************
CONFigure:GSM:SIGN:BER:CSWitched:MMODe BFI
CONFigure:GSM:SIGN:BER:CSWitched:SCOunt 100

// *****************************************************************************
// Initiate the measurement and retrieve the results.
// *****************************************************************************
READ:GSM:SIGN:BER:CSWitched?
```

2.4.3 BER PS Tests

```
// *****************************************************************************
// Configure the signaling application (band, channel, power levels, slots ...).
// Select service "Test Mode B" to obtain the full set of measurement results.
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:PSWitched:SERVice TMB

// *****************************************************************************
// Set coding scheme for UL and downlink to MCS-1.
```

```
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:PSWitched:CSCHeme:UL MC1
CONF:GSM:SIGN:CONN:PSW:SCON:CSCHeme:DL:CARRier MC1,MC1,MC1,MC1,MC1,MC1,MC1,MC1

// *****************************************************************************
// Set the number of bursts to be measured to 100 in mode BER/DBLER.
// Set EGPRS measurement interval to 200 bursts.
// *****************************************************************************
CONFigure:GSM:SIGN:BER:PSWitched:SCOunt 100
CONFigure:GSM:SIGN:BER:PSWitched:MMODe BDBL
CONFigure:GSM:SIGN:BER:PSWitched:EGPRs:MINTerval 200

// *****************************************************************************
// Set the error rate limit for Class II bits to 0.2%,
// the Data Block Error Rate (DBLER) limit to 10% and
// the Uplink State Flag Block Error Rate (USF BLER) to 1%.
// Tell the BER measurement to stop if one of these limits is exceeded.
// *****************************************************************************
CONFigure:GSM:SIGN:BER:PSWitched:LIMit:CIIBits 0.2
CONFigure:GSM:SIGN:BER:PSWitched:LIMit:DBLer 10
CONFigure:GSM:SIGN:BER:PSWitched:LIMit:USFBler 1
CONFigure:GSM:SIGN:BER:PSWitched:SCONdition FLIM

// *****************************************************************************
// Set up a packet switched connection.
// Initiate the measurement and retrieve the results.
// *****************************************************************************
WAITKEY >Set up a PS connection via the signaling application<
READ:GSM:SIGN:BER:PSWitched?

// *****************************************************************************
// Set up a packet switched connection.
// Start the measurement and return the contents of the result table.
// Query the measurement state (should be "RDY").
// Stop the measurement.
// *****************************************************************************
WAITKEY >Set up a PS connection via the signaling application<
INIT:GSM:SIGN:BER:PSWitched

FETCh:GSM:SIGN:BER:PSWitched?
FETCh:GSM:SIGN:BER:PSWitched:CARRier?
FETCh:INTermediate:GSM:SIGN:BER:PSWitched:MBEP?
FETCh:INTermediate:GSM:SIGN:BER:PSWitched:MBEP:ENHanced?
FETCh:GSM:SIGN:BER:PSWitched:STATe?

STOP:GSM:SIGN:BER:PSWitched
```

2.4.4 BLER Tests

```
// *****************************************************************************
// Configure the signaling application (band, channel, power levels, slots ...).
// Service "BLER" is required for this measurement.
// *****************************************************************************
CONFigure:GSM:SIGN:CONNection:PSWitched:SERVice BLER

// *****************************************************************************
// Set the number of blocks to be measured to 2000 and data corruption
// rate to 10 percent.
// *****************************************************************************
CONFigure:GSM:SIGN:BLER:SCOunt 2000
CONFigure:GSM:SIGN:CONNection:PSWitched:BDCRate 10

// *****************************************************************************
// Set up a packet switched connection.
// Initiate the measurement and retrieve overall and slot-specific results.
// *****************************************************************************
WAITKEY >Set up a PS connection via the signaling application<
READ:GSM:SIGN:BLER:OALL?
READ:GSM:SIGN:BLER:CARRier?
```

2.4.5 RLC Throughput Tests

The "RLC Throughput" measurement provided by the GSM signaling application is programmed as follows:

- The application is controlled by SCPI commands with the following syntax: `...:GSM:SIGN:THRoughput:...`
- After a `*RST`, the measurement is switched off. Use `READ:GSM:SIGN:THRoughput:...?` to initiate a single-shot measurement and retrieve the results. You can also start the measurement using `INIT:GSM:SIGN:THRoughput` and retrieve the results using `FETCh:GSM:SIGN:THRoughput:...?`.

The examples in this section focus on commands directly related to the RLC throughput measurement. For general configuration of the signaling application refer to General Configuration.

2.4.5.1 Configuring the RLC Throughput Measurement

```
// *****************************************************************************
// System-Reset
// *****************************************************************************
*RST; *OPC?
*CLS; *OPC?

// *****************************************************************************
```

```
// Configure measurement timeout, repetition mode and result window size.
// *****************************************************************************
CONFigure:GSM:SIGN:THRoughput:TOUT 5
CONFigure:GSM:SIGN:THRoughput:REPetition SINGleshot
CONFigure:GSM:SIGN:THRoughput:WINDow 220

// *****************************************************************************
// For the connection to DAU enable packet switched services.
// *****************************************************************************
CONFigure:GSM:SIGN:CELL:PSDomain ON
```

2.4.5.2 Setting up a Data Connection

Proceed as follows:

1. Configure the other settings of the signaling application as desired and configure the Data Application Unit (see DAU documentation).
2. Switch on the cell signal and register the MS, see for example Switching on the Cell Signal and the MS.
3. Initiate a mobile originated PS call at the MS.
4. Generate IP traffic, e.g. using the IPerf measurement provided by the DAU.

2.4.5.3 Performing an RLC Throughput Measurement

```
// *****************************************************************************
// Start the measurement and return the contents of the result table.
// Query the measurement state (should be "RDY").
// *****************************************************************************
INIT:GSM:SIGN:THRoughput
FETCh:GSM:SIGN:THRoughput?
FETCh:GSM:SIGN:THRoughput:STATe?

// *****************************************************************************
// Query the result traces obtained in the last measurement.
// *****************************************************************************
FETCh:GSM:SIGN:THRoughput:TRACe:DL:PDU:CURRent?
FETCh:GSM:SIGN:THRoughput:TRACe:DL:PDU:AVERage?
FETCh:GSM:SIGN:THRoughput:TRACe:DL:SDU:CURRent?
FETCh:GSM:SIGN:THRoughput:TRACe:DL:SDU:AVERage?

FETCh:GSM:SIGN:THRoughput:TRACe:UL:PDU:CURRent?
FETCh:GSM:SIGN:THRoughput:TRACe:UL:PDU:AVERage?
FETCh:GSM:SIGN:THRoughput:TRACe:UL:SDU:CURRent?
FETCh:GSM:SIGN:THRoughput:TRACe:UL:SDU:AVERage?
```

2.4.6 CMR Performance Tests

The "CMR Performance " measurement provided by the GSM signaling application is programmed as follows:

- The application is controlled by SCPI commands with the following syntax: `...:GSM:SIGN:CPERformance:...`
- After a `*RST`, the measurement is switched off. Use `READ:GSM:SIGN:CPERformance:...?` to initiate a single-shot measurement and retrieve the results. You can also start the measurement using `INIT:GSM:SIGN:CPERformance:` and retrieve the results using `FETCh:GSM:SIGN:CPERformance:...?`.

The examples in this section focus on commands directly related to the CMR performance measurement. For general configuration of the signaling application refer to General Configuration.

2.4.6.1 Configuring the CMR Performance Measurement

```
// *****************************************************************************
// System-Reset
// *****************************************************************************
*RST; *OPC?
*CLS; *OPC?

// *****************************************************************************
// Configure measurement timeout and target power.
// *****************************************************************************
CONFigure:GSM:SIGN:CPERformance:TOUT 5
CONFigure:GSM:SIGN:CPERformance:TLEVel -90
```

2.4.6.2 Performing a CMR Performance Measurement

```
// *****************************************************************************
// Start the measurement and return the contents of the result table.
// Query the measurement state (should be "RDY").
// *****************************************************************************
INIT:GSM:SIGN:CPERformance
FETCh:GSM:SIGN:CPERformance?
FETCh:GSM:SIGN:CPERformance:STATe?
```

2.5 Command Reference

The following sections provide detailed reference information on the remote control commands of the "GSM Signaling" application.

2.5.1 Conventions and General Information

The following sections describe the most important conventions and general information concerning the command reference.

2.5.1.1 SIGN<i>

SIGN<i> is used as abbreviation of "SIGNaling<instance>". For better readability, only the abbreviated form (which is also accepted by the instrument) is given in the command reference.

The <instance> is relevant for instruments supporting several instances of the same firmware application. It can be omitted if the instrument supports only one instance, or to address the first instance.

See also: "Firmware Applications" in the R&S CMW user manual, chapter "Remote Control"

2.5.1.2 CARRier<c>

CARRier<c> is used as abbreviation of "CARRier<carrier>". For better readability only the abbreviated form (which is also accepted by the instrument) is given in the command reference.

The <carrier> is relevant for the multi carrier configurations. It can be omitted for the single carrier configuration.

2.5.1.3 FETCh and READ Commands

All commands are used to retrieve measurement results:

- `FETCh:GSM...` returns the results of the current measurement cycle (single-shot measurement) after they are valid. `FETCh...` must be used after the measurement has been started (`INITiate...`, measurement states RUN or RDY).
- `FETCh:INTermediate:GSM...?` does not wait until the end of the current measurement cycle and returns the intermediate results including the reliability indicators..
- `READ...` starts a new single-shot measurement and returns the results.

See also: "Retrieving Measurement Results" in the R&S CMW user manual, chapter "Remote Control"

2.5.1.4 Keywords

Selected keywords used in the command description are described in the following.

- **Command usage**
  If the usage is not explicitly stated, the command allows you to set parameters and query parameters. Otherwise the command usage is stated as follows:
  - "Setting only": command can only be used to set parameters
  - "Query only": command can only be used to query parameters
  - "Event": command initiates an event
- **Parameter usage**
  The parameter usage is indicated by the keyword preceding the parameter(s):
  - "Parameters" are sent with a setting or query command and are returned as the result of a query
  - "Setting parameters" are only sent with a setting command
  - "Query parameters" are only sent with a query command (to refine the query)
  - "Return values" are only returned as the result of a query
- **Firmware/Software:**
  Indicates the lowest software version supporting the command. Command enhancements in later software versions are also indicated.

2.5.1.5 Reliability Indicator

The first value in the output arrays of `FETCh...?, READ...?` and `CALCulate...?` queries indicates the most severe error that has occurred during the measurement.

Example for an output array: 0, 10.22, 10.15, 10.01, 10.29, 100 (reliability = 0, followed by 5 numeric measurement values).

The reliability indicator has one of the following values:

- **0 (OK)**:
  Measurement values available, no error detected.
- **1 (Measurement Timeout)**:

The measurement has been stopped after the (configurable) measurement timeout. Measurement results may be available, however, at least a part of the measurement provides only INValid results or has not completed the full statistic count.

- **2 (Capture Buffer Overflow)**:
  The measurement configuration results in a capture length, exceeding the available memory.
- **3 (Overdriven) / 4 (Underdriven)**:
  The accuracy of measurement results may be impaired because the input signal level was too high / too low.
- **6 (Trigger Timeout)**:
  The measurement could not be started or continued because no trigger event was detected.
- **7 (Acquisition Error)**:
  The R&S CMW could not properly decode the RF input signal.
- **8 (Sync Error)**:
  The R&S CMW could not synchronize to the RF input signal.
- **9 (Uncal)**:
  Due to an inappropriate configuration of resolution bandwidth, video bandwidth or sweep time, the measurement results are not within the specified data sheet limits.
- **15 (Reference Frequency Error)**:
  The instrument has been configured to use an external reference signal but the reference oscillator could not be phase locked to the external signal (e.g. signal level too low, frequency out of range or reference signal not available at all).
- **16 (RF Not Available)**:
  The measurement could not be started because the configured RF input path was not active. This problem may occur e.g. when a measurement is started in combined signal path mode and the master application has not yet activated the input path. The LEDs above the RF connectors indicate whether the input and output paths are active.
- **17 (RF Level not Settled) / 18 (RF Frequency not Settled)**:
  The measurement could not be started because the R&S CMW was not yet ready to deliver stable results after a change of the input signal power / the input signal frequency.
- **19 (Call not Established)**:
  For measurements: The measurement could not be started because no signaling connection to the DUT was established.
  For DAU IMS service: Establishing a voice over IMS call failed.
- **20 (Call Type not Usable)**:
  For measurements: The measurement could not be started because the established signaling connection had wrong properties.
  For DAU IMS service: The voice over IMS settings could not be applied.
- **21 (Call Lost)**:
  For measurements: The measurement was interrupted because the signaling connection to the DUT was lost.
  For DAU IMS service: The voice over IMS call was lost.
- **23 (Missing Option)**:
  The ARB file cannot be played by the GPRF generator due to a missing option.

- **26 (Resource Conflict)**:
  The application could not be started or has been stopped due to a conflicting hardware resource or software option that is allocated by another application.
  Stop the application that has allocated the conflicting resources and try again.
- **27 (No Sensor Connected)**:
  The GPRF External Power Sensor measurement could not be started due to missing power sensor.
- **30 (File not Found)**:
  The specified file could not be found.
- **40 (ARB File CRC Error)**:
  The ARB file CRC check failed. The ARB file is corrupt and not reliable.
- **42 (ARB Header Tag Invalid)**:
  The ARB file selected in the GPRF generator contains an invalid header tag.
- **43 (ARB Segment Overflow)**:
  The number of segments in the multi-segment ARB file is higher than the allowed maximum.
- **44 (ARB File not Found)**:
  The selected ARB file could not be found.
- **45 (ARB Memory Overflow)**:
  The ARB file length is greater than the available memory.
- **50 (Startup Error)**:
  The Data Application Unit (DAU), a DAU service or a DAU measurement could not be started. Please execute a DAU selftest.
- **51 (No Reply)**:
  The DAU has received no response, for example for a ping request.
- **52 (Connection Error)**:
  The DAU could not establish a connection to internal components. Please restart the instrument.
- **53 (Configuration Error)**:
  The current DAU configuration by the user is incomplete or wrong and could not be applied. Check especially the IP address configuration.
- **54 (Filesystem Error)**:
  The hard disk of the DAU is full or corrupt. Please execute a DAU selftest.
- **60 (Invalid RF-Connector Setting)**
  The individual segments of a list mode measurement with R&S CMWS use different connector benches. This is not allowed. All segments must use the same bench.
  Check the "Info" dialog for the relevant segment numbers.
- **101 (Firmware Error)**:
  Indicates a firmware or software error. If you encounter this error for the first time, restart the instrument.
  If the error occurs again, consider the following hints:
  – Firmware errors can often be repaired by restoring the factory default settings. To restore these settings, restart your instrument and press the "Factory Default" softkey during startup.

  - If a software package (update) has not been properly installed this is often indicated in the "Setup" dialog, section "SW/HW-Equipment > Installed Software".
  - A software update correcting the error may be available. Updates are e.g. provided in the "CMW Customer Web" on GLORIS (registration required): https://extranet.rohde-schwarz.com.

  If you get firmware errors even with the properly installed latest software version, please send a problem report including log files to Rohde & Schwarz.
- **102 (Unidentified Error)**:
  Indicates an error not covered by other reliability values. For troubleshooting please follow the steps described for "101 (Firmware Error)".
- **103 (Parameter Error)**:
  Indicates that the measurement could not be performed due to internal conflicting parameter settings.
  A good approach to localize the conflicting settings is to start with a reset or preset or even restore the factory default settings. Then reconfigure the measurement step by step and check when the error occurs for the first time.
  If you need assistance to localize the conflicting parameter settings, please contact Rohde & Schwarz (see http://www.service.rohde-schwarz.com).

2.5.2 General Settings

The following commands enable a connection to the DAU and audio measurements.

CONFigure:GSM:SIGN<i>:ETOE <EndToEndEnable>

Enables the setup of a connection between the signaling unit and the Data Application Unit (DAU), required for IP-based data tests involving the DAU.

Parameters:

<EndToEndEnable> ON

*RST: ON

Firmware/Software: V3.0.20
V3.2.60: multiple end to end connections, OFF disabled

CONFigure:GSM:SIGN<i>:ESCode <Enable>

Enables audio tests involving the "audio measurements" application. Can only be set in the signal OFF state.

Parameters:

<Enable> OFF | ON

Enable speech codec

*RST: OFF

Example: See Setting up an Audio CS Connection

Firmware/Software: V3.2.20

Options: R&S CMW-KS210, R&S CMW-B405A and (R&S CMW-B400B/-U5024 or R&S CMW-U400)

Manual operation: See "Enable Speech Codec" on page 90

2.5.3 Connection Control and States

The following commands control the connection to the mobile under test.

SOURce:GSM:SIGN<i>:CELL:STATe <Control>

Turns the GSM Signaling generator (DL GSM signal) off or on.

Setting parameters:

<Control> ON | OFF

Switch generator **ON** or **OFF**

*RST: OFF

Return values:

<GeneratorState> OFF | PENDing | ON | RFHandover

OFF: generator switched off
PEND: generator switched on but no signal available yet
ON: generator switched on, signal available
RFHandover: ready to receive a handover from another signaling application

*RST: OFF

Example: See Switching on the Cell Signal and the MS

Firmware/Software: V1.0.15.0
V3.0.10: RFHandover added

Manual operation: See "ON | OFF (key) / GSM Signaling (softkey)" on page 85

SOURce:GSM:SIGN<i>:CELL:STATe:ALL?

Returns detailed information about the "GSM Signaling" generator state.

Return values:

<MainState>	OFF | ON | RFHandover **OFF:** generator switched off **ON:** generator has been turned on **RFHandover:** ready to receive a handover from another signaling application
<SyncState>	PENDing | ADJusted **PENDing:** the generator has been turned on (off) but the signal is not yet (still) available **ADJusted:** the physical output signal corresponds to the main generator state
Example:	See Switching on the Cell Signal and the MS
Usage:	Query only
Firmware/Software:	V1.0.15.0 V3.0.10: RFHandover added
Manual operation:	See "ON | OFF (key) / GSM Signaling (softkey)" on page 85

CALL:GSM:SIGN<i>:CSWitched:ACTion <CSAction>

Controls the setup and release of a circuit switched GSM connection or sends a short message to the MS.

To query the current CS connection state see `FETCh:GSM:SIGN<i>:CSWitched:STATe?`.

For background information concerning the state model see chapter 2.2.7, "Connection States", on page 23.

Setting parameters:

<CSAction>	CONNect | DISConnect | SMS
Example:	See Setting up a CS Connection
Usage:	Event
Firmware/Software:	V1.0.15.0 V2.0.10: SMS added
Manual operation:	See "Connect / Disconnect / Send SMS / Release PDP Context (hotkeys)" on page 85

CALL:GSM:SIGN<i>:PSWitched:ACTion <PSAction>

Controls the setup and release of a packet switched GSM connection. The command initiates a transition between different connection states; to be queried via `FETCh:GSM:SIGN<i>:PSWitched:STATe?`. For details refer to chapter 2.2.7, "Connection States", on page 23.

Setting parameters:

<PSAction> CONNect | DISConnect | SMS | RPContext
Connect, disconnect, send SMS, release PDP context

Example: See Setting up a PS Connection

Usage: Event

Firmware/Software: V2.0.20
V3.2.20: added SMS
V3.2.70: added RPContext

Manual operation: See "Connect / Disconnect / Send SMS / Release PDP Context (hotkeys)" on page 85

FETCh:GSM:SIGN<i>:CSWitched:STATe?

Returns the CS connection state. Use CALL:GSM:SIGN<i>:CSWitched:ACTion to initiate a transition between different connection states.

The CS state changes to ON as soon as the signaling generator is started (see SOURce:GSM:SIGN<i>:CELL:STATe).

To make sure that a GSM cell signal is actually available, query the cell state. It must be ON, ADJ (see SOURce:GSM:SIGN<i>:CELL:STATe:ALL?).

Return values:

<CS State> OFF | ON | SYNC | ALER | CEST | LUPD | CONN | REL | IMS | SMESsage | RMESsage | IHANdover | OHANdover

For a description of the states refer to chapter 2.2.7, "Connection States", on page 23.
The values indicate the following states:
SYNC = Synchronized
ALER = Alerting
CEST = Call Established
LUPD = Location Update
CONN = Connecting
REL = Releasing
IMS = IMSI Detach
SMESsage = Sending Message
RMESsage = Receiving Message
IHANdover = Incoming Handover in Progress
OHANdover = Outgoing Handover in Progress

Example: See Switching on the Cell Signal and the MS

Usage: Query only

Firmware/Software: V1.0.15.0
V1.0.15.23: added RRH
V2.0.10: added SMESsage, RMESsage
V3.0.10: removed RRH, added IHANdover, OHANdover

Manual operation: See "Connect / Disconnect / Send SMS / Release PDP Context (hotkeys)" on page 85

FETCh:GSM:SIGN<i>:PSWitched:STATe?

Returns the PS connection state. Use `CALL:GSM:SIGN<i>:PSWitched:ACTion` to initiate a transition between different connection states.

The PS state changes to `ON` as soon as the signaling generator is started (see `SOURce:GSM:SIGN<i>:CELL:STATe`).

To make sure that a GSM cell signal is actually available, query the cell state. It must be `ON, ADJ` (see `SOURce:GSM:SIGN<i>:CELL:STATe:ALL?`).

Return values:

<PS State> OFF | ON | ATT | TBF | PDP | AIPR | RAUP | PAIP | CTIP | REL | PDIP | DIPR

For a description of the states refer to chapter 2.2.7, "Connection States", on page 23.
The values indicate the following states:
ATT = Attached
TBF = TBF Established
PDP = PDP Context Activated
AIPR = Attaching (attach in progress)
RAUP = Route Area Update
PAIP = PDP Context Activation (PDP context activation in progress)
CTIP = Connecting (Connecting TBF in progress)
REL = Releasing
PDIP = PDP Context Deactivation (PDP context deactivation in progress)
DIPR = Detaching (detach in progress)

Example: See Setting up a PS Connection

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "Connect / Disconnect / Send SMS / Release PDP Context (hotkeys)" on page 85

2.5.4 Event Log

The following commands retrieve event log entries.

SENSe:GSM:SIGN<i>:ELOG:LAST?

Queries the latest entry of the event log.

Return values:

<Timestamp>	Timestamp of the entry as string in the format "hh:mm:ss"
<Category>	INFO | WARNing | ERRor | CONTinue Category of the entry, as indicated in the main view by an icon
<Event>	Text string describing the event
Usage:	Query only
Firmware/Software:	V3.0.10
Manual operation:	See "Event Log Entries" on page 68

SENSe:GSM:SIGN<i>:ELOG:ALL?

Queries all entries of the event log.

For each entry three parameters are returned, from oldest to latest entry: {<Timestamp>, <Category>, <Event>}$_{entry\ 1}$, {<Timestamp>, <Category>, <Event>}$_{entry\ 2}$, ...

Return values:

<Timestamp>	Timestamp of the entry as string in the format "hh:mm:ss"
<Category>	INFO | WARNing | ERRor | CONTinue Category of the entry, as indicated in the main view by an icon
<Event>	Text string describing the event
Usage:	Query only
Firmware/Software:	V3.0.10
Manual operation:	See "Event Log Entries" on page 68

2.5.5 Signaling Information

The following queries retrieve information from/about the connected mobile.

2.5.5.1 CS Measurement Reports

The following queries retrieve information that the connected mobile provides in its periodic "measurement reports" in the CS domain.

SENSe:GSM:SIGN<i>:RREPort:RXLevel?

Returns the "RX Level Full" reported by the MS as dimensionless index.

Return values:

<RXLev> Range: 0 to 63

Example: See Retrieving CS Receiver Reports

Usage: Query only

Firmware/Software: V1.0.15.0

Manual operation: See "RX Level Full / Sub (CS)" on page 70

SENSe:GSM:SIGN<i>:RREPort:RXLevel:RANGe?

Returns the power level range, corresponding to the "RX Level Full" index reported by the MS.

Return values:

<Lower> Range: -110 dBm to -48 dBm
Default unit: dBm

<Upper> Range: -110 dBm to -48 dBm
Default unit: dBm

Example: See Retrieving CS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "RX Level Full / Sub (CS)" on page 70

SENSe:GSM:SIGN<i>:RREPort:RXLevel:SUB?

Returns the "RX Level Sub" reported by the MS as dimensionless power level.

Return values:

<RXLev> Range: 0 to 63

Example: See Retrieving CS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "RX Level Full / Sub (CS)" on page 70

SENSe:GSM:SIGN<i>:RREPort:RXLevel:SUB:RANGe?

Returns the power level range, corresponding to the "RX Level Sub" index reported by the MS.

Return values:

<Lower> Range: -110 dBm to -48 dBm
Default unit: dBm

<Upper> Range: -110 dBm to -48 dBm
Default unit: dBm

Example: See Retrieving CS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "RX Level Full / Sub (CS)" on page 70

SENSe:GSM:SIGN<i>:RREPort:RXQuality?

Returns the "RX Quality Full" reported by the MS as dimensionless index.

Return values:

<RXQual> Range: 0 to 7

Example: See Retrieving CS Receiver Reports

Usage: Query only

Firmware/Software: V1.0.15.0

Manual operation: See "RX Quality Full / Sub (CS)" on page 70

SENSe:GSM:SIGN<i>:RREPort:RXQuality:RANGe?

Returns the bit error rate range, corresponding to the "RX Quality Full" index reported by the MS.

Return values:

<Lower> Range: 0 % to 12.8 %
Default unit: %

<Upper> Range: 0.2 % to 100 %
Default unit: %

Example: See Retrieving CS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "RX Quality Full / Sub (CS)" on page 70

SENSe:GSM:SIGN<i>:RREPort:RXQuality:SUB?

Returns the "RX Quality Sub" reported by the MS as dimensionless index.

Return values:

<RXQual> Range: 0 to 7

Example: See Retrieving CS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "RX Quality Full / Sub (CS)" on page 70

SENSe:GSM:SIGN<i>:RREPort:RXQuality:SUB:RANGe?

Returns the bit error rate range, corresponding to the "RX Quality Sub" index reported by the MS.

Return values:

<Lower> Range: 0 % to 12.8 %
Default unit: %

<Upper> Range: 0.2 % to 100 %
Default unit: %

Example: See Retrieving CS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "RX Quality Full / Sub (CS)" on page 70

SENSe:GSM:SIGN<i>:RREPort:COUNt?

Returns the number of measurement reports received since the connection was established.

Return values:

<Count> Range: 0 to n

Example: See Retrieving CS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "Report Counter (CS)" on page 71

SENSe:GSM:SIGN<i>:RREPort:CSWitched:MBEP?

Returns the "Mean BEP", reported by the MS as dimensionless index for a DL signal.

Return values:

<MeanBEP>	Range:	0 to 31

Example: See Querying MS Measurement Reports

Usage: Query only

Firmware/Software: V3.2.30

Manual operation: See "Mean BEP" on page 71

SENSe:GSM:SIGN<i>:RREPort:CSWitched:MBEP:RANGe?

Returns the Bit Error Probability (BEP) range, corresponding to the "Mean BEP" index reported by the MS for a DL signal.

Return values:

<Lower> Log_{10} (lower end of BEP range)

Range: -3.6 to -0.6

<Upper> Log_{10} (upper end of BEP range)

Range: -3.6 to -0.6

Example: See Querying MS Measurement Reports

Usage: Query only

Firmware/Software: V3.2.30

Manual operation: See "Mean BEP" on page 71

SENSe:GSM:SIGN<i>:RREPort:CSWitched:CBEP?

Returns the "CV BEP", reported by the MS as dimensionless index for a DL signal.

Return values:

<CV_BEP> Range: 0 to 7

Example: See Querying MS Measurement Reports

Usage: Query only

Firmware/Software: V3.2.30

Manual operation: See "CV BEP" on page 71

SENSe:GSM:SIGN<i>:RREPort:CSWitched:CBEP:RANGe?

Returns the CV BEP range, corresponding to the "CV BEP" index reported by the MS for a DL signal.

Return values:

<Lower> Range: 0 to 1.75

<Upper> Range: 0.25 to 2

Example: See Querying MS Measurement Reports

Usage: Query only

Firmware/Software: V3.2.30

Manual operation: See "CV BEP" on page 71

SENSe:GSM:SIGN<i>:RREPort:CSWitched:NRBLocks?

Returns the number of blocks that theR&S CMW received in the UL since the beginning of the measurement.

Return values:
<NrRecBlocks> Range: 0 to 63

Example: See Querying MS Measurement Reports

Usage: Query only

Firmware/Software: V3.2.30

Manual operation: See "No of Received Blocks" on page 72

2.5.5.2 PS Measurement Reports

The following queries retrieve information that the connected mobile provides in its periodic "measurement reports" in the PS domain.

SENSe:GSM:SIGN<i>:RREPort:CVALue?

Returns the "C value" reported by the MS as dimensionless index.

Return values:

<CValue>	Range:	0 to 63

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "C value (PS)" on page 72

SENSe:GSM:SIGN<i>:RREPort:CVALue:RANGe?

Returns the signal level range, corresponding to the "C value" index reported by the MS.

Return values:

<Lower>	Range:	-110 dBm to -48 dBm
	Default unit:	dBm
<Upper>	Range:	-110 dBm to -48 dBm
	Default unit:	dBm

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "C value (PS)" on page 72

SENSe:GSM:SIGN<i>:RREPort:SVARiance?

Returns the "Signal Variance" reported by the MS as dimensionless index.

Return values:

<SignalVariance>	Range:	0 to 63

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "Sign. Var. (PS, TBF level = GPRS)" on page 72

SENSe:GSM:SIGN<i>:RREPort:SVARiance:RANGe?

Returns the signal variance range, corresponding to the "Signal Variance" index reported by the MS.

Return values:

<Lower>	Range:	0 dB² to 15.75 dB²
	Default unit:	dB²
<Upper>	Range:	0.25 dB² to 15.75 dB²
	Default unit:	dB²

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "Sign. Var. (PS, TBF level = GPRS)" on page 72

SENSe:GSM:SIGN<i>:RREPort:GMBep?

Returns the "Mean BEP", reported by the MS as dimensionless index for a GMSK modulated DL signal.

Return values:
<MeanBEP_GMSK> Range: 0 to 31

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "Mean BEP (PS, TBF level ≠ GPRS)" on page 73

SENSe:GSM:SIGN<i>:RREPort:GMBep:RANGe?

Returns the Bit Error Probability (BEP) range, corresponding to the "Mean BEP" index reported by the MS for a GMSK modulated DL signal.

Return values:
<Lower> $\log_{10}$(lower end of BEP range)
Range: -3.6 to -0.6

<Upper> $\log_{10}$(upper end of BEP range)
Range: -3.6 to -0.6

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "Mean BEP (PS, TBF level ≠ GPRS)" on page 73

SENSe:GSM:SIGN<i>:RREPort:EMBep?

Returns the "Mean BEP", reported by the MS as dimensionless index for an 8PSK modulated DL signal.

Return values:
<MeanBEP_8PSK> Range: 0 to 31

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "Mean BEP (PS, TBF level ≠ GPRS)" on page 73

SENSe:GSM:SIGN<i>:RREPort:EMBep:RANGe?

Returns the Bit Error Probability (BEP) range, corresponding to the "Mean BEP" index reported by the MS for an 8PSK modulated DL signal.

Return values:

<Lower> $\log_{10}$(lower end of BEP range)
Range: -3.6 to -0.6

<Upper> $\log_{10}$(upper end of BEP range)
Range: -3.6 to -0.6

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "Mean BEP (PS, TBF level ≠ GPRS)" on page 73

SENSe:GSM:SIGN<i>:RREPort:NSRQam<ModOrder>:MBEP?

Returns the "Mean BEP", reported by the MS as dimensionless index for a 16-QAM or 32-QAM modulated DL signal with normal symbol rate (NSR).

Suffix:

<ModOrder> 16,32
Selects the modulation scheme: 16-QAM or 32-QAM

Return values:

<MeanBEP> Range: 0 to 31

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "Mean BEP (PS, TBF level ≠ GPRS)" on page 73

SENSe:GSM:SIGN<i>:RREPort:NSRQam<ModOrder>:MBEP:RANGe?

Returns the Bit Error Probability (BEP) range, corresponding to the "Mean BEP" index reported by the MS for a 16-QAM or 32-QAM modulated DL signal with normal symbol rate (NSR).

Suffix:

<ModOrder> 16,32
Selects the modulation scheme: 16-QAM or 32-QAM

Return values:

<Lower> Range: -3.6 to -0.6

<Upper> Range: -3.6 to -0.6

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "Mean BEP (PS, TBF level ≠ GPRS)" on page 73

SENSe:GSM:SIGN<i>:RREPort:HSRQam<ModOrder>:MBEP?

Returns the "Mean BEP", reported by the MS as dimensionless index for a 16-QAM or 32-QAM modulated DL signal with higher symbol rate (HSR).

Suffix:
<ModOrder> 16,32
Selects the modulation scheme: 16-QAM or 32-QAM

Return values:
<MeanBEP> Range: 0 to 31

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "Mean BEP (PS, TBF level ≠ GPRS)" on page 73

SENSe:GSM:SIGN<i>:RREPort:HSRQam<ModOrder>:MBEP:RANGe?

Returns the Bit Error Probability (BEP) range, corresponding to the "Mean BEP" index reported by the MS for a 16-QAM or 32-QAM modulated DL signal with higher symbol rate (HSR).

Suffix:
<ModOrder> 16,32
Selects the modulation scheme: 16-QAM or 32-QAM

Return values:
<Lower> Range: -3.6 to -0.6

<Upper> Range: -3.6 to -0.6

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "Mean BEP (PS, TBF level ≠ GPRS)" on page 73

SENSe:GSM:SIGN<i>:RREPort:GCBep?

Returns the "CV BEP", reported by the MS as dimensionless index for a GMSK modulated DL signal.

Return values:

<CV_BEP_GMSK>	Range:	0 to 7

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "CV BEP (PS, TBF level ≠ GPRS)" on page 73

SENSe:GSM:SIGN<i>:RREPort:GCBep:RANGe?

Returns the CV BEP range, corresponding to the "CV BEP" index reported by the MS for a GMSK modulated DL signal.

Return values:

<Lower>	Range:	0 to 1.75
<Upper>	Range:	0.25 to 2

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "CV BEP (PS, TBF level ≠ GPRS)" on page 73

SENSe:GSM:SIGN<i>:RREPort:ECBep?

Returns the "CV BEP", reported by the MS as dimensionless index for an 8PSK modulated DL signal.

Return values:

<CV_BEP_8PSK>	Range:	0 to 7

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "CV BEP (PS, TBF level ≠ GPRS)" on page 73

SENSe:GSM:SIGN<i>:RREPort:ECBep:RANGe?

Returns the CV BEP range, corresponding to the "CV BEP" index reported by the MS for an 8PSK modulated DL signal.

Return values:

<Lower>	Range:	0 to 1.75
<Upper>	Range:	0.25 to 2

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "CV BEP (PS, TBF level ≠ GPRS)" on page 73

SENSe:GSM:SIGN<i>:RREPort:NSRQam<ModOrder>:CBEP?

Returns the "CV BEP", reported by the MS as dimensionless index for a 16-QAM or 32-QAM modulated DL signal with normal symbol rate (NSR).

Suffix:
<ModOrder> 16,32
Selects the modulation scheme: 16-QAM or 32-QAM

Return values:
<CV_BEP> Range: 0 to 7

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "CV BEP (PS, TBF level ≠ GPRS)" on page 73

SENSe:GSM:SIGN<i>:RREPort:NSRQam<ModOrder>:CBEP:RANGe?

Returns the CV BEP range, corresponding to the "CV BEP" index reported by the MS for a 16-QAM or 32-QAM modulated DL signal with normal symbol rate (NSR).

Suffix:
<ModOrder> 16,32
Selects the modulation scheme: 16-QAM or 32-QAM

Return values:
<Lower> Range: 0 to 1.75

<Upper> Range: 0.25 to 2

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "CV BEP (PS, TBF level ≠ GPRS)" on page 73

SENSe:GSM:SIGN<i>:RREPort:HSRQam<ModOrder>:CBEP?

Returns the "CV BEP", reported by the MS as dimensionless index for a 16-QAM or 32-QAM modulated DL signal with higher symbol rate (HSR).

Suffix:
<ModOrder> 16,32
Selects the modulation scheme: 16-QAM or 32-QAM

Return values:

<CV_BEP> Range: 0 to 7

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "CV BEP (PS, TBF level ≠ GPRS)" on page 73

SENSe:GSM:SIGN<i>:RREPort:HSRQam<ModOrder>:CBEP:RANGe?

Returns the CV BEP range, corresponding to the "CV BEP" index reported by the MS for a 16-QAM or 32-QAM modulated DL signal with higher symbol rate (HSR).

Suffix:

<ModOrder> 16,32
Selects the modulation scheme: 16-QAM or 32-QAM

Return values:

<Lower> Range: 0 to 1.75

<Upper> Range: 0.25 to 2

Example: See Retrieving PS Receiver Reports

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "CV BEP (PS, TBF level ≠ GPRS)" on page 73

2.5.5.3 Neighbor Cell Measurement Reports

The following queries check whether MS measurement reports related the neighbor cell are pending and retrieve information from the received reports.

SENSe:GSM:SIGN<i>:RREPort:NCELl:GSM:CELL<no>?

Returns the RSSI value reported for a selected GSM neighbor cell as dimensionless index.

Suffix:

<no> 1..16
Selects the GSM neighbor cell

Return values:

<RSSI> RSSI as dimensionless index

Range: 0 to 63

Example: See Querying MS Measurement Reports

Usage: Query only

Firmware/Software: V3.2.30

Options: R&S CMW-KS210

Manual operation: See "GSM > RSSI" on page 74

SENSe:GSM:SIGN<i>:RREPort:NCELl:GSM:CELL<no>:RANGe?

Returns the value range corresponding to the dimensionless RSSI index value reported for a selected GSM neighbor cell.

Suffix:

<no> 1..16
Selects the GSM neighbor cell

Return values:

<RSSIlower> RSSI minimum value

Range: -110 dBm to -48 dBm
Default unit: dBm

<RSSIupper> RSSI maximum value

Range: -110 dBm to -48 dBm
Default unit: dBm

Example: See Querying MS Measurement Reports

Usage: Query only

Firmware/Software: V3.2.30

Options: R&S CMW-KS210

Manual operation: See "GSM > RSSI" on page 74

SENSe:GSM:SIGN<i>:RREPort:NCELl:LTE:CELL<no>?

Returns measurement report values for a selected LTE neighbor cell.

Suffix:

<no> 1..4
Selects the LTE neighbor cell

Return values:

<RSRP> RSRP as dimensionless index

Range: 0 to 63

<RSRQ> RSRQ as dimensionless index

Range: 0 to 34

Example: See Querying MS Measurement Reports

Usage: Query only

Firmware/Software: V3.2.30

Options: R&S CMW-KS210

Manual operation: See "LTE > RSRP, RSRQ" on page 74

SENSe:GSM:SIGN<i>:RREPort:NCELl:LTE:CELL<no>:RANGe?

Returns the value ranges corresponding to the dimensionless index values reported for a selected LTE neighbor cell.

Suffix:

<no> 1..4
Selects the LTE neighbor cell

Return values:

<RSRPlower> RSRP minimum value

Range: -140 dBm to -44 dBm
Default unit: dBm

<RSRPupper> RSRP maximum value

Range: -140 dBm to -44 dBm
Default unit: dBm

<RSRQlower> RSRQ minimum value

Range: -19.5 dB to -3 dB
Default unit: dB

<RSRQupper> RSRQ maximum value

Range: -19.5 dB to -3 dB
Default unit: dB

Example: See Querying MS Measurement Reports

Usage: Query only

Firmware/Software: V3.2.30

Options: R&S CMW-KS210

Manual operation: See "LTE > RSRP, RSRQ" on page 74

SENSe:GSM:SIGN<i>:RREPort:NCELl:TDSCdma:CELL<no>?

Returns measurement report values for a selected TD-SCDMA neighbor cell.

Suffix:

<no> 1..4
Selects the TD-SCDMA neighbor cell

Return values:

<RSCP> RSCP as dimensionless index

Range: -5 to 91

Example: See Querying MS Measurement Reports

Usage: Query only

Firmware/Software: V3.2.30

Options: R&S CMW-KS210

Manual operation: See "TD-SCDMA > RSCP" on page 74

SENSe:GSM:SIGN<i>:RREPort:NCELl:TDSCdma:CELL<no>:RANGe?

Suffix:

<no> 1..4
Selects the TD-SCDMA neighbor cell

Return values:

<RSCPlower> RSCP minimum value

Range: -120 dBm to -25 dBm
Default unit: dBm

<RSCPupper> RSCP maximum value

Range: -120 dBm to -25 dBm
Default unit: dBm

Example: See Querying MS Measurement Reports

Usage: Query only

Firmware/Software: V3.2.30

Options: R&S CMW-KS210

Manual operation: See "TD-SCDMA > RSCP" on page 74

SENSe:GSM:SIGN<i>:RREPort:NCELl:WCDMa:CELL<no>?

Returns measurement report values for a selected WCDMA neighbor cell.

Suffix:

<no> 1..4
Selects the WCDMA neighbor cell

Return values:

<RSCP> RSCP as dimensionless index

Range: -5 to 91

<EcNO> Ec/No as dimensionless index

Range: 0 to 49

Example: See Querying MS Measurement Reports

Usage: Query only

Firmware/Software: V3.2.30

Options: R&S CMW-KS210

Manual operation: See "WCDMA > RSCP, EcNO" on page 74

SENSe:GSM:SIGN<i>:RREPort:NCELl:WCDMa:CELL<no>:RANGe?

Returns the value ranges corresponding to the dimensionless index values reported for a selected WCDMA neighbor cell.

Suffix:

<no> 1..4
Selects the WCDMA neighbor cell

Return values:

<RSCPlower> RSCP minimum value
Range: -120 dBm to -25 dBm
Default unit: dBm

<RSCPupper> RSCP maximum value
Range: -120 dBm to -25 dBm
Default unit: dBm

<EcNOlower> Ec/No minimum value
Range: -24 dB to 0 dB
Default unit: dB

<EcNOupper> Ec/No maximum value
Range: -24 dB to 0 dB
Default unit: dB

Example: See Querying MS Measurement Reports

Usage: Query only

Firmware/Software: V3.2.30

Options: R&S CMW-KS210

Manual operation: See "WCDMA > RSCP, EcNO" on page 74

2.5.5.4 MS Capabilities

The following queries retrieve information about the connected mobile as shown in the "MS Capabilities" section of the main view.

SENSe:GSM:SIGN<i>:MSSinfo:BANDs?

Returns the supported GSM band(s), support indicators for UMTS and CDMA2000 and the power class.

The number to the left of each result parameter is provided for easy identification of the parameter position within the result array.

Return values:

<1_G450>	OFF | ON Support of GSM 450 band
<2_G450_GMSK>	Power class for GMSK modulation in the GSM 450 band Range: 1 to 5
<3_G450_8PSK>	U | E1 | E2 | E3 Power class for 8PSK modulation in the GSM 450 band
<4_G480>	OFF | ON Support of GSM 480 band
<5_G480_GMSK>	Power class for GMSK modulation in the GSM 480 band Range: 1 to 5
<6_G480_8PSK>	U | E1 | E2 | E3 Power class for 8PSK modulation in the GSM 480 band
<7_G750>	OFF | ON Support of GSM 750 band
<8_G750_GMSK>	Power class for GMSK modulation in the GSM 750 band Range: 1 to 5
<9_G750_8PSK>	U | E1 | E2 | E3 Power class for 8PSK modulation in the GSM 750 band
<10_GT810>	OFF | ON Support of GSM T 810 band
<11_GT810_GMSK>	Power class for GMSK modulation in the GSM T 810 band Range: 1 to 5
<12_GT810_8PSK>	U | E1 | E2 | E3 Power class for 8PSK modulation in the GSM T 810 band
<13_G850>	OFF | ON Support of GSM 850 band
<14_G850_GMSK>	Power class for GMSK modulation in the GSM 850 band Range: 1 to 5

<15_G850_8PSK> U | E1 | E2 | E3
Power class for 8PSK modulation in the GSM 850 band

<16_G900P> OFF | ON
Support of P-GSM 900 band

<17_G900P_GMSK> Power class for GMSK modulation in the P-GSM 900 band
Range: 1 to 5

<18_G900P_8PSK> U | E1 | E2 | E3
Power class for 8PSK modulation in the P-GSM 900 band

<19_G900E> OFF | ON
Support of E-GSM 900 band

<20_G900R> OFF | ON
Support of R-GSM 900 band

<21_G900R_GMSK> Power class for GMSK modulation in the R-GSM 900 band
Range: 1 to 5

<22_G1800> OFF | ON
Support of GSM 1800 band

<23_G1800_GMSK> Power class for GMSK modulation in the GSM 1800 band
Range: 1 to 5

<24_G1800_8PSK> U | E1 | E2 | E3
Power class for 8PSK modulation in the GSM 1800 band

<25_G1900> OFF | ON
Support of GSM 1900 band

<26_G1900_GMSK> Power class for GMSK modulation in the GSM 1900 band
Range: 1 to 5

<27_G1900_8PSK> U | E1 | E2 | E3
Power class for 8PSK modulation in the GSM 1900 band

<28_U_FDD> OFF | ON
Support of UMTS FDD

<29_U_TDD384> OFF | ON
Support of UMTS TDD 3.84 Mcps

<30_U_TDD128> OFF | ON
Support of UMTS TDD 1.28 Mcps

<31_CDMA2000> OFF | ON
Support of CDMA2000

Example: See Querying MS Capabilities

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "Bands/Power Class" on page 76

SENSe:GSM:SIGN<i>:MSSinfo:MSCLass:GPRS?

Returns the multislot class of the mobile station in GPRS mode.

Return values:
<GPRS> Range: 1 to 45

Example: See Querying MS Capabilities

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "Multislot Class" on page 76

SENSe:GSM:SIGN<i>:MSSinfo:MSCLass:EGPRs?

Returns the multislot class of the mobile station in EGPRS mode.

Return values:
<EGPRS> Range: 1 to 45

Example: See Querying MS Capabilities

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "Multislot Class" on page 76

SENSe:GSM:SIGN<i>:MSSinfo:MSCLass:DGPRs?

Returns the multislot class of the mobile station in GPRS DTM mode.

Return values:
<DTM_GPRS> Range: 1 to 45

Example: See Querying MS Capabilities

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "Multislot Class" on page 76

SENSe:GSM:SIGN<i>:MSSinfo:MSCLass:DEGPrs?

Returns the multislot class of the mobile station in EGPRS DTM mode.

Return values:
<DTM_EGPRS> Range: 1 to 45

Example: See Querying MS Capabilities

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "Multislot Class" on page 76

SENSe:GSM:SIGN<i>:MSSinfo:EDALlocation?

Returns support indicators for extended dynamic allocation.

Return values:

<GPRS> OFF | ON
Support of extended dynamic allocation in GPRS mode

<EGPRS> OFF | ON
Support of extended dynamic allocation in EGPRS mode

Example: See Querying MS Capabilities

Usage: Query only

Firmware/Software: V3.0.20

Manual operation: See "Extended Dynamic Allocation" on page 77

SENSe:GSM:SIGN<i>:MSSinfo:CODec:GSM?
SENSe:GSM:SIGN<i>:MSSinfo:CODec:UMTS?

Indicates codec list supported by the UE in GSM and UMTS networks.

The number to the left of each result parameter is provided for easy identification of the parameter position within the result array.

Return values:

<Supported> OFF | ON

14 values indicate support for:
1: GSM FR
2: GSM HR
3: GSM EFR
4: FR AMR
5: HR AMR
6: UMTS AMR
7: UMTS AMR 2
8: TDMA EFR
9: PDC EFR
10: FR AMR-WB
11: UMTS AMR-WB
12: OHR AMR
13: OFR AMR-WB
14: OHR AMR-WB

Example: See Querying MS Capabilities

Usage: Query only

Firmware/Software: V3.2.20

Manual operation: See "Codec List" on page 77

2.5.5.5 MS Info

The following queries retrieve connection information as shown in the "MS Info" section of the main view.

SENSe:GSM:SIGN<i>:MSSinfo:RXPower?

Indicates the quality of the received uplink power.

Return values:

<Power> OK | UFL | OFL

OK: in range
UFL: underflow (underdriven)
OFL: overflow (overdriven)

Example: See Querying MS Info

Usage: Query only

Firmware/Software: V3.2.30

Manual operation: See "RX Power" on page 67

SENSe:GSM:SIGN<i>:MSSinfo:IMEI?

Returns the International Mobile station Equipment Identity (IMEI) of the mobile under test.

The IMEI consists of four parts

- TAC: 8-digit type approval code
- SNR: 6-digit serial no.
- Spare: 1-digit spare bit

Return values:

<IMEI> 'TAC SNR Spare' (string variable)

Example: See Querying MS Info

Usage: Query only

Firmware/Software: V1.0.15.0

Manual operation: See "IMEI" on page 78

SENSe:GSM:SIGN<i>:MSSinfo:IMSI?

Returns the International Mobile Subscriber Identity (IMSI) of the mobile under test.

The IMSI consists of three parts

- MCC: 3-digit mobile country code
- MNC: 2- or 3-digit mobile network code
- MSIN: 10- or 9-digit mobile subscriber ID

Return values:
<IMSI> 'MCC MNC MSIN' (string variable)

Example: See Querying MS Info

Usage: Query only

Firmware/Software: V1.0.15.0

Manual operation: See "IMSI" on page 78

SENSe:GSM:SIGN<i>:MSSinfo:DNUMber?

Returns the number dialed at the mobile under test (call from MS).

Return values:
<Number> 'max. 20 digits' (string variable)

Example: See Querying MS Info

Usage: Query only

Firmware/Software: V1.0.15.0

Manual operation: See "Dialed No." on page 78

SENSe:GSM:SIGN<i>:MSSinfo:SCATegory?

Returns the service category during emergency call.

Return values:
<Police> OFF | ON

OFF: no emergency call to police
ON: emergency call to police

<Ambulance> OFF | ON

<FireBrigade> OFF | ON

<MarineGuard> OFF | ON

<MountainRescue> OFF | ON

<Manual>	OFF | ON **OFF**: no emergency call set up manually **ON**: emergency call set up manually
<Automatical>	OFF | ON **OFF**: no emergency call set up automatically **ON**: emergency call set up automatically
Example:	See Querying MS Info
Usage:	Query only
Firmware/Software:	V3.2.30
Manual operation:	See "Service Category" on page 79

SENSe:GSM:SIGN<i>:MSSinfo:MSADdress:IPV<n>?

Returns the IPv4 address (<n> = 4) or the IPv6 prefix (<n> = 6) assigned to the MS by the R&S CMW.

Suffix:

<n>	4,6

Return values:

<IPAddresses>	IP address/prefix as string
Example:	See Setting up a PS Connection
Usage:	Query only
Firmware/Software:	V3.0.20
Manual operation:	See "MS IPv4 Address / IPv6 Prefix" on page 79

SENSe:GSM:SIGN<i>:MSSinfo:APN?

Returns the access point name used by the MS during a packet data connection.

Return values:

<APN>

Example:	See Setting up a PS Connection
Usage:	Query only
Firmware/Software:	V3.2.30
Manual operation:	See "APN" on page 79

2.5.6 Slot Configuration and Resulting Throughput

The following commands configure the generated GSM downlink signal and control the UL signals of the mobile station under test, in particular for packet switched connections and multislot operation. The resulting PS RLC throughput can be queried.

CONFigure:GSM:SIGN<i>:CONNection:ASConfig <AutoSlotConfig>

Enables/disables the automatic setting of the PS parameters in Slot Configuration Dialog.

Parameters:

<AutoSlotConfig> OFF | ON

*RST: OFF

Example: See Configuring PS Connection Settings

Firmware/Software: V3.2.30

Manual operation: See "Auto Slot Config" on page 81

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:SCONfig:ENABle:UL <Enable>(8)

Specifies the uplink timeslots the mobile shall use in a packet switched connection.

Timeslot 0 can not be enabled (always OFF).

Parameters:

<Enable> OFF | ON

List of 8 values for timeslot 0 to 7

*RST: OFF,OFF,OFF,ON,OFF,OFF,OFF,OFF

Example: See Configuring PS Connection Settings

Firmware/Software: V2.0.20

Manual operation: See "Used" on page 83

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:SCONfig:GAMMa:UL <Gamma>(8)

Specifies the power control parameter Γ_{CH} per UL timeslot.

Parameters:

<Gamma> List of 8 gamma values for slot 0 to 7

Range: 0 to 31

*RST: 13

Example: See Configuring PS Connection Settings

Firmware/Software: V2.0.20

Manual operation: See "Gamma" on page 83

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:SCONfig:ENABle:DL:CARRier<c> <Enable>(8)

Specifies the downlink timeslots the mobile shall use in a packet switched connection.

Timeslot 0 can not be enabled (always OFF).

Suffix:

<c> 1..2
Selects the carrier in dual carrier mode. For disabled dual carrier mode the suffix must be omitted or set to 1.

Parameters:

<Enable> OFF | ON

List of 8 values for timeslot 0 to 7

*RST: OFF,OFF,OFF,ON,OFF,OFF,OFF,OFF

Example: See Configuring PS Connection Settings

Firmware/Software: V2.0.20

Options: R&S CMW-KS201 for carrier 2

Manual operation: See "Used" on page 83

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:SCONfig:LEVel:DL:CARRier<c> <Level>(8)

Defines the DL signal level in all timeslots relative to the reference level (see `CONFigure:GSM:SIGN<i>:RFSettings:LEVel:TCH[:CARRier<c>]`. The DL timeslot level can also be set to off level (no signal transmission).

Suffix:

<c> 1..2
Selects the carrier to be configured - only relevant in dual carrier mode

Parameters:

<Level> List of 8 signal levels for slot 0 to 7

Range: -40 dB to 0 dB
*RST: OFF, OFF, OFF, 0 dB, OFF, OFF, OFF, OFF
Default unit: dB
Additional parameters: OFF | ON (disables | enables DL signal transmission)

Example: See Configuring PS Connection Settings

Firmware/Software: V2.0.20

Options: R&S CMW-KS210
R&S CMW-KS201 for carrier 2

Manual operation: See "Level" on page 84

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:SCONfig:CSCHeme:DL:CARRier<c> <CScheme>(8)

Selects the coding schemes for all downlink timeslots in the packet switched domain.

The selected values must be compatible to the configured set of modulation and coding schemes, see `CONFigure:GSM:SIGN<i>:CONNection:PSWitched:TLEVel` on page 314.

In the current software version the same value applies to all downlink slots and to both carriers. You can not set different values.

Suffix:

<c> 1..2
Selects the carrier in dual carrier mode. For disabled dual carrier mode the suffix must be omitted or set to 1.

Parameters:

<CScheme> C1 | C2 | C3 | C4 | MC1 | MC2 | MC3 | MC4 | MC5 | MC6 | MC7 | MC8 | MC9 | DA5 | DA6 | DA7 | DA8 | DA9 | DA10 | DA11 | DA12

List of 8 coding schemes for slot 0 to 7. All 8 values must be identical.
C1 to C4: CS-1 to CS-4
MC1 to MC9: MCS-1 to MCS-9
DA5 to DA12: DAS-5 to DAS-12

*RST: MC1

Example: See Configuring PS Connection Settings

Firmware/Software: V2.0.20

Options: R&S CMW-KS201 for DAS-i and for carrier 2

Manual operation: See "Coding Scheme" on page 84

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:SCONfig:UDCYcle:DL:CARRier<c> <Assigned>(8)

Percentage of downlink GPRS radio blocks containing the USF assigned to the MS.

Suffix:

<c> 1
For future use.

Parameters:

<Assigned> Range: 0 | 1 | 25 | 50 | 75| 100
*RST: 100 %
Default unit: %

Example: See Configuring PS Connection Settings

Firmware/Software: V3.2.30

Options: R&S CMW-KS210

Manual operation: See "USF Duty Cycle" on page 84

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:SCONfig:COMBined:CARRier<c> <EnableDL>(8), <LevelDL>(8), <CodingSchemeDL>(8), <EnableUL>(8), <GammaUL>(8), <CodingSchemeUL>, <Channel>

Specifies most slot configuration parameters and some other important packet switched connection parameters.

This command is especially useful for consistent and efficient reconfiguration in state "TBF Established". It combines several alternative commands into a single command.

Suffix:

<c> 1..2
Selects the carrier in dual carrier mode. For disabled dual carrier mode the suffix must be omitted or set to 1.

Parameters:

<EnableDL> OFF | ON

List of 8 values for downlink slot 0 to 7, specifying for each slot whether the MS shall listen to a signal in the slot or not
Timeslot 0 can not be enabled (always OFF).

*RST: OFF,OFF,OFF,ON,OFF,OFF,OFF,OFF

<LevelDL> List of 8 signal levels for downlink slot 0 to 7, defining the downlink signal level relative to the reference level
Option R&S CMW-KS210 is required to modify this setting. Without the option only KEEP is allowed.

Range: -40 dB to 0 dB
*RST: OFF, OFF, OFF, 0 dB, OFF, OFF, OFF, OFF
Default unit: dB
Additional parameters: OFF | ON (disables | enables DL signal transmission using the previous/default power values)

<CodingSchemeDL> C1 | C2 | C3 | C4 | MC1 | MC2 | MC3 | MC4 | MC5 | MC6 | MC7 | MC8 | MC9 | DA5 | DA6 | DA7 | DA8 | DA9 | DA10 | DA11 | DA12

List of 8 coding schemes for downlink slot 0 to 7. All 8 values must be identical. In the current software version the same value applies to all downlink slots and to both carriers.
The value must be compatible to the configured TBF level, see `CONFigure:GSM:SIGN<i>:CONNection:PSWitched:TLEVel` on page 314.
C1 to C4: CS-1 to CS-4
MC1 to MC9: MCS-1 to MCS-9
DA5 to DA12: DAS-5 to DAS-12

*RST: MC1

<EnableUL> OFF | ON

List of 8 values enabling/disabling uplink slot 0 to 7
Timeslot 0 can not be enabled (always OFF).

*RST: OFF,OFF,OFF,ON,OFF,OFF,OFF,OFF

<GammaUL> List of 8 gamma values for uplink slot 0 to 7, specifying the power control parameter Γ_{CH}

Range: 0 to 31
*RST: 13

<CodingSchemeUL> C1 | C2 | C3 | C4 | MC1 | MC2 | MC3 | MC4 | MC5 | MC6 | MC7 | MC8 | MC9 | UA7 | UA8 | UA9 | UA10 | UA11

Coding scheme for uplink packet data channels. The value must be compatible to the configured TBF level, see `CONFigure:GSM:SIGN<i>:CONNection:PSWitched:TLEVel` on page 314.
C1 to C4: CS-1 to CS-4
MC1 to MC9: MCS-1 to MCS-9
UA7 to UA11: UAS-7 to UAS-11

*RST: MC1

<Channel> GSM channel number for TCH and PDCH. The range of values depends on the selected band; for an overview see chapter 2.2.9.1, "GSM Bands and Channels", on page 29. The values below are for GSM 900.

Range: 1 to 124, 955 to 1023
*RST: 62 for carrier 1, 72 for carrier 2

Example: The following example assumes that R&S CMW-KS210 is not available. In that case KEEP must be sent for the downlink levels.

```
CONF:GSM:SIGN:CONN:PSW:SCON:COMB:CARR
OFF,OFF,OFF,ON,OFF,OFF,OFF,OFF,KEEP,KEEP,KEEP,
KEEP,KEEP,KEEP,KEEP,KEEP,MC1,MC1,MC1,MC1,MC1,
MC1,MC1,MC1,OFF,OFF,OFF,ON,OFF,OFF,OFF,OFF,
13,13,13,13,13,13,13,13,MC1,62
```

Firmware/Software: V2.1.60

Options: R&S CMW-KS201 for carrier 2 and for coding schemes DAS-i and UAS-i
R&S CMW-KS210 for modification of <LevelDL>

Manual operation: See "UL Coding Scheme" on page 83

SENSe:GSM:SIGN<i>:CONNection:ETHRoughput:DL?

Queries the maximum possible RLC throughput in the downlink, resulting from the downlink PS slot configuration.

Return values:
<Throughput> Range: 0 bit/s to 1E+6 bit/s
Default unit: bit/s

Example: See Configuring PS Connection Settings

Usage: Query only

Firmware/Software: V3.0.20

Manual operation: See "Circuit Switched / Packet Switched" on page 81

SENSe:GSM:SIGN<i>:CONNection:ETHRoughput:UL?

Queries the maximum possible RLC throughput in the uplink, resulting from the uplink PS slot configuration.

Return values:
<Throughput> Range: 0 bit/s to 100E+3 bit/s
Default unit: bit/s

Example: See Configuring PS Connection Settings

Usage: Query only

Firmware/Software: V3.0.20

Manual operation: See "Circuit Switched / Packet Switched" on page 81

2.5.7 Handover Settings

The following commands configure and control handover.

2.5.7.1 General Handover Settings

The following commands configure and control a handover generally.

PREPare:GSM:SIGN<i>:HANDover:CATalog:DESTination?

Lists all handover destinations that can be selected using `PREPare:GSM:SIGN<i>:HANDover:DESTination`.

Return values:

<Destination> — Comma separated list of all supported destinations. Each destination is represented as a string.

Example: See Performing an Inter RAT CS Handover

Usage: Query only

Firmware/Software: V3.2.20

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

PREPare:GSM:SIGN<i>:HANDover:DESTination <Destination>

Selects the handover destination. A complete list of all supported values can be displayed using `PREPare:GSM:SIGN<i>:HANDover:CATalog:DESTination?`.

Parameters:

<Destination> — Destination as string

Example: See Performing an Inter RAT CS Handover

Firmware/Software: V3.2.20

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

PREPare:GSM:SIGN<i>:HANDover:MMODe <Mode>

Selects the mechanism to be used for handover to another signaling application.

Parameters:

<Mode> — REDirection | MTCSfallback

Redirection or MT CS fallback

*RST: RED

Example: See Performing an Inter RAT CS Handover

Firmware/Software: V3.2.70

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

CALL:GSM:SIGN<i>:HANDover:STARt

Initiates a handover to a network selected via `PREPare:GSM:SIGN<i>:HANDover:TARGet`.

Example: See Performing an Intra-GSM CS Handover

Usage: Event

Firmware/Software: V1.0.15.0

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

FETCh:GSM:SIGN<i>:HANDover:STATe?

Returns whether or not the BCCH and the TCH are in different GSM bands. Initially both channels use the same band, but the band used by the TCH can be changed via a dual-band handover. A disconnect resets the parameter.

Return values:

<HandoverState> OFF | DUALband

OFF: BCCH channel and TCH channel are in the same GSM band - either because no handover at all has been performed or the last handover target was the original band
DUALband: Dual-band handover to another GSM band has been performed successfully; BCCH and TCH are in different GSM bands

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

2.5.7.2 Intra-GSM Handover Settings

The following commands configure a dual-band handover to another GSM band.

PREPare:GSM:SIGN<i>:HANDover:TARGet <Band>

Selects a handover destination band/network; see chapter 2.2.9.1, "GSM Bands and Channels", on page 29.

Parameters:

<Band> G085 | G09 | G18 | G19

GSM 850, GSM 900, GSM 1800, GSM 1900

*RST: G18

Example: See Performing an Intra-GSM CS Handover

Firmware/Software: V2.0.10

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

SENSe:GSM:SIGN<i>:BAND:TCH?

Returns the current GSM band used for the traffic channel. After a handover this band may differ from the BCCH band configured via `CONFigure:GSM:SIGN<i>:BAND:BCCH`.

Return values:

<Band> G085 | G09 | G18 | G19

GSM 850, GSM 900, GSM 1800, GSM 1900

*RST: G09

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

PREPare:GSM:SIGN<i>:HANDover:CHANnel:TCH <Channel>

Selects the TCH/PDCH channel in the destination GSM band. The range of values depends on the selected band (`PREPare:GSM:SIGN<i>:HANDover:TARGet`); for an overview see chapter 2.2.9.1, "GSM Bands and Channels", on page 29. The values below are for GSM 900.

Parameters:

<Channel> Range: 512 to 885
*RST: 711

Example: See Performing an Intra-GSM CS Handover

Firmware/Software: V2.0.10

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

PREPare:GSM:SIGN<i>:HANDover:LEVel:TCH <Level>

Defines the absolute TCH/PDCH level in the destination GSM band.

Parameters:

<Level>	Range:	Depending on RF connector (-130 dBm to -5 dBm for COM connectors)
	Increment:	0.01 dB
	*RST:	-80 dBm
	Default unit:	dBm

Example: See Performing an Intra-GSM CS Handover

Firmware/Software: V2.0.10

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

PREPare:GSM:SIGN<i>:HANDover:PCL <PCL>

Selects the PCL of the mobile in the destination GSM band.

Parameters:

<PCL>	Range:	0 to 31
	*RST:	10

Example: See Performing an Intra-GSM CS Handover

Firmware/Software: V2.0.10

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

PREPare:GSM:SIGN<i>:HANDover:TSLot <Slot>

Selects the timeslot for the circuit switched connection in the target GSM band.

Parameters:

<Slot>	Range:	1 to 7
	*RST:	3

Example: See Performing an Intra-GSM CS Handover

Firmware/Software: V2.0.10

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

PREPare:GSM:SIGN<i>:HANDover:PSWitched:CSCHeme:UL <CodingScheme>

Specifies the coding scheme for all uplink timeslots in the destination GSM band (packet switched domain, one value).

The selected values must be compatible to the configured TBF level, see `CONFigure:GSM:SIGN<i>:CONNection:PSWitched:TLEVel` on page 314.

Parameters:

<CodingScheme> C1 | C2 | C3 | C4 | MC1 | MC2 | MC3 | MC4 | MC5 | MC6 | MC7 | MC8 | MC9 | UA7 | UA8 | UA9 | UA10 | UA11

Coding scheme for all UL slots
C1 to C4: CS-1 to CS-4
MC1 to MC9: MCS-1 to MCS-9
UA7 to UA11: UAS-7 to UAS-9

*RST: MC1

Example: See Performing an Intra-GSM PS Handover

Firmware/Software: V2.1.25

Options: R&S CMW-KS201 for UAS-i

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

PREPare:GSM:SIGN<i>:HANDover:PSWitched:ENABle:UL <Enable>(8)

Specifies the uplink timeslots the mobile shall use in a packet switched connection in the destination GSM band.

Timeslot 0 can not be enabled (always OFF).

Parameters:

<Enable> OFF | ON

List of 8 values for timeslot 0 to 7

*RST: OFF,OFF,OFF,ON,OFF,OFF,OFF,OFF

Example: See Performing an Intra-GSM PS Handover

Firmware/Software: V3.0.10

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

PREPare:GSM:SIGN<i>:HANDover:PSWitched:GAMMa:UL <Gamma>(8)

Specifies the power control parameter Γ_{CH} per UL timeslot in the destination GSM band.

Parameters:

<Gamma> Range: 0 to 31
*RST: 13

Example: See Performing an Intra-GSM PS Handover

Firmware/Software: V2.0.20

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

PREPare:GSM:SIGN<i>:HANDover:PSWitched:ENABle:DL:CARRier<c> <Enable>(8)

Specifies the downlink timeslots the mobile shall use in a packet switched connection in the destination GSM band.

Timeslot 0 can not be enabled (always OFF).

Suffix:

<c> 1..2
Selects the carrier in dual carrier mode. For disabled dual carrier mode the suffix must be omitted or set to 1.

Parameters:

<Enable> OFF | ON
List of 8 values for timeslot 0 to 7
*RST: OFF,OFF,OFF,ON,OFF,OFF,OFF,OFF

Example: See Performing an Intra-GSM PS Handover

Firmware/Software: V3.0.10

Options: R&S CMW-KS201 for carrier 2

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

PREPare:GSM:SIGN<i>:HANDover:PSWitched:LEVel:DL:CARRier<c> <Level>(8)

Defines the DL signal level in the destination GSM band in all timeslots relative to the reference level (see `CONFigure:GSM:SIGN<i>:RFSettings:LEVel:TCH[:CARRier<c>]`. The DL timeslot level can also be set to off level (no signal transmission).

Suffix:

<c> 1..2
Selects the carrier to be configured - only relevant in dual carrier mode

Parameters:

<Level> List of 8 signal levels for slot 0 to 7
Range: -40 dB to 0 dB
*RST: OFF, OFF, OFF, 0 dB, OFF, OFF, OFF, OFF
Default unit: dB
Additional parameters: OFF | ON (disables | enables DL signal transmission)

Example: See Performing an Intra-GSM PS Handover

Firmware/Software: V2.0.20

Options: R&S CMW-KS210
R&S CMW-KS201 for carrier 2

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

PREPare:GSM:SIGN<i>:HANDover:PSWitched:CSCHeme:DL:CARRier<c> <CodingScheme>(8)

Selects the coding schemes for all downlink timeslots in the destination GSM band (packet switched domain).

The selected values must be compatible to the configured TBF level, see `CONFigure:GSM:SIGN<i>:CONNection:PSWitched:TLEVel` on page 314.

In the current software version the same value applies to all downlink slots and to both carriers. You can not set different values.

Suffix:

<c> 1..2
Selects the carrier in dual carrier mode. For disabled dual carrier mode the suffix must be omitted or set to 1.

Parameters:

<CodingScheme> C1 | C2 | C3 | C4 | MC1 | MC2 | MC3 | MC4 | MC5 | MC6 | MC7 | MC8 | MC9 | DA5 | DA6 | DA7 | DA8 | DA9 | DA10 | DA11 | DA12

List of 8 coding schemes for slot 0 to 7. All 8 values must be identical.
C1 to C4: CS-1 to CS-4
MC1 to MC9: MCS-1 to MCS-9
DA5 to DA12: DAS-5 to DAS-12

*RST: MC1

Example: See Performing an Intra-GSM PS Handover

Firmware/Software: V2.1.10

Options: R&S CMW-KS201 for DAS-i and for carrier 2

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

2.5.7.3 External Handover Settings

The following commands configure the handover to another instrument.

PREPare:GSM:SIGN<i>:HANDover:EXTernal:DESTination <Destination>

Selects the target radio access technology for handover to another instrument.

Parameters:

<Destination> LTE | GSM | WCDMa | TDSCdma

*RST: LTE

Example: See Performing a CS Handover to another Instrument

Firmware/Software: V3.2.70

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

PREPare:GSM:SIGN<i>:HANDover:EXTernal:GSM <Band>, <DLChannel>, <BandIndicator>

Configures the destination parameters for handover to a GSM destination at another instrument.

For channel number ranges depending on operating bands see chapter 2.2.9.1, "GSM Bands and Channels", on page 29.

Parameters:

<Band> G085 | G09 | G18 | G19

GSM 850, GSM 900, GSM 1800, GSM 1900

*RST: G09

<DLChannel> Channel number used for the Broadcast Control Channel (BCCH)

Range: 0 to 1023, depending on GSM band
*RST: 20

<BandIndicator> G18 | G19

Band Indicator for distinction of GSM 1800 and GSM 1900 bands. The two bands partially use the same channel numbers for different frequencies.

*RST: G18

Example: See Performing a CS Handover to another Instrument

Firmware/Software: V3.2.70

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

PREPare:GSM:SIGN<i>:HANDover:EXTernal:LTE <Band>, <DLChannel>

Configures the destination parameters for handover to an LTE destination at another instrument.

Parameters:

<Band> OB1 | OB2 | OB3 | OB4 | OB5 | OB6 | OB7 | OB8 | OB9 | OB10 | OB11 | OB12 | OB13 | OB14 | OB15 | OB16 | OB17 | OB18 | OB19 | OB20 | OB21 | OB22 | OB23 | OB24 | OB25 | OB26 | OB27 | OB28 | OB29 | OB30 | OB31 | OB32 | OB33 | OB34 | OB35 | OB36 | OB37 | OB38 | OB39 | OB40 | OB41 | OB42 | OB43

Operating band 1 to 43

*RST: OB1

<DLChannel> Downlink channel number

Range: The allowed range depends on the LTE band, see table below.

*RST: 300

Example: See Performing a CS Handover to another Instrument

Firmware/Software: V3.2.70

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

Table 2-6: Channel numbers

FDD band	Channel no. N_{DL}
1	0 to 599
2	600 to 1199
3	1200 to 1949
4	1950 to 2399
5	2400 to 2649
6	2650 to 2749
7	2750 to 3449
8	3450 to 3799
9	3800 to 4149
10	4150 to 4749
11	4750 to 4949
12	5010 to 5179
13	5180 to 5279
14	5280 to 5379
15	5380 to 5579
16	5580 to 5729
17	5730 to 5849
18	5850 to 5999
19	6000 to 6149
20	6150 to 6449
21	6450 to 6599
22	6600 to 7499
23	7500 to 7699
24	7700 to 8039
25	8040 to 8689
26	8690 to 9039

FDD band	Channel no. N_{DL}
27	9040 to 9209
28	9210 to 9659
29	9660 to 9769
30	9770 to 9869
31	9870 to 9919
32	10562 to 10838

Table 2-7: Channel number range depending on LTE TDD band

TDD band	Channel no. N
33	36000 to 36199
34	36200 to 36349
35	36350 to 36949
36	36950 to 37549
37	37550 to 37749
38	37750 to 38249
39	38250 to 38649
40	38650 to 39649
41	39650 to 41589
42	41590 to 43589
43	43590 to 45589

PREPare:GSM:SIGN<i>:HANDover:EXTernal:TDSCdma <Band>, <DLChannel>

Configures the destination parameters for handover to a TD-SCDMA destination at another instrument.

Parameters:

<Band> OB1 | OB2 | OB3

OB1: Band 1 (F), 1880 MHz to 1920 MHz
OB2: Band 2 (A), 2010 MHz to 2025 MHz
OB3: Band 3 (E), 2300 MHz to 2400 MHz

*RST: OB1

<DLChannel> Downlink channel number

Range: The allowed range depends on the frequency band, see table below.
*RST: 9400

Example: See Performing a CS Handover to another Instrument

Firmware/Software: V3.2.70

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

Table 2-8: TD-SCDMA channel numbers

Band	Channel number	F [MHz]
a (China)	10054 to 10121	2010.8 to 2024.2
e	11504 to 11996	2300.8 to 2399.2
f	9404 to 9596	1880.8 to 1919.2

PREPare:GSM:SIGN<i>:HANDover:EXTernal:WCDMa <Band>, <DLChannel>

Configures the destination parameters for handover to a WCDMA destination at another instrument.

Parameters:

<Band> OB1 | OB2 | OB3 | OB4 | OB5 | OB6 | OB7 | OB8 | OB9 | OB10 | OB11 | OB12 | OB13 | OB14 | OB19 | OB20 | OB21 | OBS1 | OBS2 | OBS3 | OBL1

OB1, ..., OB14: Operating Band I to XIV
OB19, ..., OB21: Operating Band XIX to XXI
OBS1: Operating Band S
OBS2: Operating Band S 170 MHz
OBS3: Operating Band S 190 MHz
OBL1: Operating Band L

*RST: OB1

<DLChannel> Downlink channel number

Range: 412 to 11000, depending on operating band, see table below
*RST: 10563

Example: See Performing a CS Handover to another Instrument

Firmware/Software: V3.2.70

Manual operation: See "Inter/Intra RAT ... (hotkey)" on page 86

Table 2-9: Channel numbers

Operating band	Channel number
OB1	10562 to 10838
OB2	412 to 687 (step 25), 9662 to 9938
OB3	1162 to 1513
OB4	1537 to 1738, 1887 to 2087 (step 25)
OB5	1007, 1012, 1032, 1037, 1062, 1087, 4357 to 4458
OB6	1037, 1062, 4387 to 4413
OB7	2237 to 2563, 2587 to 2912 (step 25)
OB8	2937 to 3088

Operating band	Channel number
OB9	9237 to 9387
OB10	3112 to 3388, 3412 to 3687 (step 25)
OB11	3712 to 3812
OB12	3837 to 3903, 3927, 3932, 3957, 3962, 3987, 3992
OB13	4017 to 4043, 4067, 4092
OB14	4117 to 4143, 4167, 4192
OB19	712 to 763, 787, 812, 837
OB20	4512 to 4638
OB21	862 to 912
OBS1	5912 to 5987 (step 25), 10912 to 10988
OBS2	10900 to 10950
OBS3	5962, 5987, 10950 to 11000
OBL1	7637 to 7783, 7788 to 7933

2.5.8 Routing Settings

The following commands configure the signal input and output paths.

2.5.8.1 Signal Routing

The following commands configure the scenario, select the paths for the generated BS signal (output) and the analyzed signal (input), define external attenuation and external delay compensation values.

ROUTe:GSM:SIGN<i>:SCENario:SCELI <RXConnector>, <RXConverter>, <TXConnector>, <TXConverter>

Activates the "Standard Cell" scenario and selects the RF input (RX) and output (TX) path, i.e. RF connectors and RX/TX modules. To query the active scenario, use `ROUTe:GSM:SIGN<i>:SCENario?`.

Depending on the installed hardware and the active sub-instrument or instance <i> only a subset of the described parameter values is allowed. The *RST values and the mapping of virtual connector names to physical connectors also depend on the active sub-instrument or instance <i>.

All instruments are equipped with the RF 1 and RF 2 connectors and one RX and TX module. Additional RF connectors and RX/TX modules are optional.

See also: "Signal Path Settings" in the R&S CMW user manual, chapter "Remote Control"

Connector names:

- RF1C | RF2C | RF3C | RF4C | = RF 1 COM to RF 4 COM, front panel
- RFAC | RFBC = virtual names for the RF COM connectors
- RF1O | RF3O = RF 1 OUT | RF 3 OUT, front panel
- RFAO = virtual name for the RF OUT connectors

Parameters:

<RXConnector>	RF1C | RF2C | RF3C | RF4C | RFAC | RFBC RF connector for the input path
<RXConverter>	RX1 | RX2 | RX3 | RX4 RX module for the input path
<TXConnector>	RF1C | RF1O | RF2C | RF3C | RF3O | RF4C | RFAC | RFAO | RFBC RF connector for the output path
<TXConverter>	TX1 | TX2 | TX3 | TX4 TX module for the output path

Example: See Specifying General Settings

Firmware/Software: V1.0.15.0
V2.0.10: additional RF, RX and TX values

Manual operation: See "Scenario, Fading" on page 89

ROUTe:GSM:SIGN<i>:SCENario:IORI <RXConnector>, <RXConverter>, <TXConnector>, <TXConverter>

Activates the "IQ out - RF in" scenario and selects the RF input (RX) and baseband output (TX) path, i.e. connectors and converters. To query the active scenario, use `ROUTe:GSM:SIGN<i>:SCENario?`.

Depending on the installed hardware and the active sub-instrument or instance <i> only a subset of the described parameter values is allowed. The *RST values and the mapping of virtual connector names to physical connectors also depend on the active sub-instrument or instance <i>.

All instruments are equipped with the RF 1 and RF 2 connectors and one RX and TX module. Additional RF connectors and RX/TX modules are optional.

See also: "Signal Path Settings" in the R&S CMW user manual, chapter "Remote Control"

Connector names:

- RF1C | RF2C | RF3C | RF4C = RF 1 COM to RF 4 COM, front panel
- RFAC | RFBC = virtual names for the RF COM connectors
- IQ2O | IQ4O | IQ6O | IQ8O = DIG IQ OUT 2 to 8, rear panel

Parameters:

<RXConnector> RF1C | RF2C | RF3C | RF4C | RFAC | RFBC
RF connector for the input path

<RXConverter> RX1 | RX2 | RX3 | RX4
RX module for the input path

<TXConnector> IQ2O | IQ4O | IQ6O | IQ8O
DIG IQ OUT rear panel connector for the output path

<TXConverter> ITX1 | ITX2
For future use. In this software version it is recommended to always send KEEP to ensure compatible settings.

Firmware/Software: V2.0.10

Manual operation: See "Scenario, Fading" on page 89

ROUTe:GSM:SIGN<i>:SCENario:BATCh <RXConnector>, <RXConverter>, <TXConnector>, <TXConverter>, <TX2Connector>, <TX2Converter>

Activates the scenario "BCCH and TCH/PDCH", using two RF output (TX) paths and one RF input (RX) path. Selects the RF connectors and RX/TX modules to be used. To query the active scenario, use `ROUTe:GSM:SIGN<i>:SCENario?`.

Depending on the installed hardware and the active sub-instrument or instance <i> only a subset of the described parameter values is allowed. The *RST values and the mapping of virtual connector names to physical connectors also depend on the active sub-instrument or instance <i>.

All instruments are equipped with the RF 1 and RF 2 connectors and one RX and TX module. Additional RF connectors and RX/TX modules are optional.

See also: "Signal Path Settings" in the R&S CMW user manual, chapter "Remote Control"

Connector names:

- RF1C | RF2C | RF3C | RF4C = RF 1 COM to RF 4 COM, front panel

- RFAC | RFBC = virtual names for the RF COM connectors
- RF1O | RF3O = RF 1 OUT | RF 3 OUT, front panel
- RFAO = virtual name for the RF OUT connectors

Parameters:

<RXConnector>	RF1C | RF2C | RF3C | RF4C | RFAC | RFBC RF connector for the input path
<RXConverter>	RX1 | RX2 | RX3 | RX4 RX module for the input path
<TXConnector>	RF1C | RF1O | RF2C | RF3C | RF3O | RF4C | RFAC | RFAO | RFBC RF connector for the first output path, used for TCH/PDCH
<TXConverter>	TX1 | TX2 | TX3 | TX4 TX module for the first output path. Select different modules for the two paths.
<TX2Connector>	RF1C | RF1O | RF2C | RF3C | RF3O | RF4C | RFAC | RFAO | RFBC RF connector for the second output path, used for BCCH
<TX2Converter>	TX1 | TX2 | TX3 | TX4 TX module for the second output path. Select different modules for the two paths.

Example: See Specifying General Settings

Firmware/Software: V3.0.10

Manual operation: See "Scenario, Fading" on page 89

ROUTe:GSM:SIGN<i>:SCENario:SCFading[:EXTernal] <RXConnector>, <RXConverter>, <TXConnector>, <TXConverter>, <IQConnector>

Activates the "Standard Cell Fading: External" scenario and selects the RF connectors, RX/TX modules and digital I/Q output connector to be used. To query the active scenario, use `ROUTe:GSM:SIGN<i>:SCENario?`.

Depending on the installed hardware and the active sub-instrument or instance <i> only a subset of the described parameter values is allowed. The *RST values and the mapping of virtual connector names to physical connectors also depend on the active sub-instrument or instance <i>.

All instruments are equipped with the RF 1 and RF 2 connectors and one RX and TX module. Additional RF connectors and RX/TX modules are optional.

See also: "Signal Path Settings" in the R&S CMW user manual, chapter "Remote Control"

Connector names:

- RF1C | RF2C | RF3C | RF4C | = RF 1 COM to RF 4 COM, front panel

- RFAC | RFBC = virtual names for the RF COM connectors
- RF1O | RF3O = RF 1 OUT | RF 3 OUT, front panel
- RFAO = virtual name for the RF OUT connectors
- IQ2O | IQ4O | IQ6O | IQ8O = DIG IQ OUT 2 to 8, rear panel

Parameters:

<RXConnector> RF1C | RF2C | RF3C | RF4C | RFAC | RFBC
RF connector for the input path

<RXConverter> RX1 | RX2 | RX3 | RX4
RX module for the input path

<TXConnector> RF1C | RF1O | RF2C | RF3C | RF3O | RF4C | RFAC | RFAO | RFBC
RF connector for the output path

<TXConverter> TX1 | TX2 | TX3 | TX4
TX module for the output path

<IQConnector> IQ2O | IQ4O | IQ6O | IQ8O
DIG IQ OUT connector for external fading of the output path

Example: See Specifying General Settings

Firmware/Software: V3.0.20

Options: R&S CMW-KS210

Manual operation: See "Scenario, Fading" on page 89

ROUTe:GSM:SIGN<i>:SCENario:SCFading:INTernal:FFADer <RXConnector>, <RXConverter>, <TXConnector>, <TXConverter>

Activates the "Standard Cell Fading: Internal" scenario and selects the RF input (RX) and output (TX) path, i.e. RF connectors and RX/TX modules. To query the active scenario, use `ROUTe:GSM:SIGN<i>:SCENario?`.

Depending on the installed hardware and the active sub-instrument or instance <i> only a subset of the described parameter values is allowed. The *RST values and the mapping of virtual connector names to physical connectors also depend on the active sub-instrument or instance <i>.

All instruments are equipped with the RF 1 and RF 2 connectors and one RX and TX module. Additional RF connectors and RX/TX modules are optional.

See also: "Signal Path Settings" in the R&S CMW user manual, chapter "Remote Control"

Connector names:

- RF1C | RF2C | RF3C | RF4C | = RF 1 COM to RF 4 COM, front panel
- RFAC | RFBC = virtual names for the RF COM connectors
- RF1O | RF3O = RF 1 OUT | RF 3 OUT, front panel
- RFAO = virtual name for the RF OUT connectors

Parameters:

<RXConnector>	RF1C | RF2C | RF3C | RF4C | RFAC | RFBC RF connector for the input path
<RXConverter>	RX1 | RX2 | RX3 | RX4 RX module for the input path
<TXConnector>	RF1C | RF1O | RF2C | RF3C | RF3O | RF4C | RFAC | RFAO | RFBC RF connector for the output path
<TXConverter>	TX1 | TX2 | TX3 | TX4 TX module for the output path

Example: See Configuring Internal Fading

Firmware/Software: V3.0.20

Options: R&S CMW-KS210, R&S CMW-KE100 and R&S CMW-KE200

Manual operation: See "Scenario, Fading" on page 89

ROUTe:GSM:SIGN<i>:SCENario:SCFading:INTernal <RXConnector>, <RXConverter>, <TXConnector>, <TXConverter>, <Fader>

Activates the "Standard Cell Fading: Internal" scenario, selects the RF input (RX) and output (TX) path, i.e. RF connectors and RX/TX modules and specifies fader to be used. To query the active scenario, use `ROUTe:GSM:SIGN<i>:SCENario?`.

Depending on the installed hardware and the active sub-instrument or instance <i> only a subset of the described parameter values is allowed. The *RST values and the mapping of virtual connector names to physical connectors also depend on the active sub-instrument or instance <i>.

All instruments are equipped with the RF 1 and RF 2 connectors and one RX and TX module. Additional RF connectors and RX/TX modules are optional.

See also: "Signal Path Settings" in the R&S CMW user manual, chapter "Remote Control"

Connector names:

- RF1C | RF2C | RF3C | RF4C | = RF 1 COM to RF 4 COM, front panel
- RFAC | RFBC = virtual names for the RF COM connectors
- RF1O | RF3O = RF 1 OUT | RF 3 OUT, front panel
- RFAO = virtual name for the RF OUT connectors

Parameters:

<RXConnector>	RF1C | RF2C | RF3C | RF4C | RFAC | RFBC RF connector for the input path
<RXConverter>	RX1 | RX2 | RX3 | RX4 RX module for the input path

<TXConnector>	RF1C | RF1O | RF2C | RF3C | RF3O | RF4C | RFAC | RFAO | RFBC RF connector for the output path
<TXConverter>	TX1 | TX2 | TX3 | TX4 TX module for the output path
<Fader>	FAD1 | FAD2 Internal fading I/Q board to be used

Example: See Configuring Internal Fading

Firmware/Software: V3.2.10

Options: R&S CMW-KS210, R&S CMW-KE100 and R&S CMW-KE200

Manual operation: See "Scenario, Fading" on page 89

ROUTe:GSM:SIGN<i>:SCENario?

Returns the active scenario.

Return values:

<Scenario>	SCEL | IORI | BATC | SCF **SCEL**: Standard Cell **IORI**: IQ out - RF in **BATC**: BCCH and TCH/PDCH **SCF**: Standard Cell Fading
<Fader>	EXTernal | INTernal Only returned for fading scenario SCF Indicates whether internal or external fading is active.

Usage: Query only

Firmware/Software: V2.0.10
V3.0.10: BATC added
V3.0.20: added <Fader> and SCF

Manual operation: See "Scenario, Fading" on page 89

ROUTe:GSM:SIGN<i>?

Returns the configured routing settings. The number of returned values depends on the active scenario (6 to 8 values).

Connector names:

- RF1C | RF2C | RF3C | RF4C = RF 1 COM to RF 4 COM, front panel
- RF1O | RF3O = RF 1 OUT | RF 3 OUT, front panel
- IQ2O | IQ4O | IQ6O | IQ8O = DIG IQ OUT 2 to 8, rear panel

Return values:

<Scenario>	SCEL | IORI | BATC | SCF **SCEL**: Standard Cell **IORI**: IQ out - RF in **BATC**: BCCH and TCH/PDCH **SCF**: Standard Cell Fading
<Controller>	For future use - returned value not relevant
<RXConnector>	RF1C | RF2C | RF3C | RF4C RF connector for the input path
<RXConverter>	RX1 | RX2 | RX3 | RX4 RX module for the input path
<TXConnector1>	RF1C | RF1O | RF2C | RF3C | RF3O | RF4C | IQ2O | IQ4O | IQ6O | IQ8O Connector for output path 1
<TXConverter1>	TX1 | TX2 | TX3 | TX4 | ITX1 | ITX2 TX module for output path 1
<TXConnector2>	RF1C | RF1O | RF2C | RF3C | RF3O | RF4C RF connector for output path 2, only returned for scenarios with two RF output paths
<TXConverter2>	TX1 | TX2 | TX3 | TX4 TX module for output path 2, only returned for scenarios with two RF output paths
<IQ1Connector>	IQ2O | IQ4O | IQ6O | IQ8O DIG IQ OUT connector for the first output path, only returned for scenarios with external fading

Usage: Query only

Firmware/Software: V2.0.10
V3.0.10: scenario BATC added
V3.0.20: <IQConnector> and scenario SCF added

Manual operation: See "Scenario, Fading" on page 89

CONFigure:GSM:SIGN<i>:RFSettings:EATTenuation:INPut <ExtRFInAtt>

Defines an external attenuation (or gain, if the value is negative), to be applied to the RF input connector.

Parameters:

<ExtRFInAtt>
Range: depends on expected nominal power mode
Increment: 0.01 dB
*RST: 0 dB
Default unit: dB

Example: See Specifying General Settings

Firmware/Software: V1.0.15.0

Manual operation: See "External Attenuation" on page 95

CONFigure:GSM:SIGN<i>:RFSettings:EATTenuation:OUTPut<n> <ExtRFOutAtt>

Defines an external attenuation (or gain, if the value is negative), to be applied to the RF output connector. Depending on the scenario several RF output paths are used and the attenuation can be configured per output path.

Suffix:

<n> 1..2
Selects the output path - can be omitted for scenarios using only one output path

Parameters:

<ExtRFOutAtt> Range: -50 dB to 80 dB
*RST: 0 dB
Default unit: dB

Example: See Specifying General Settings

Firmware/Software: V1.0.15.0
V3.0.10: <n> added for path selection

Manual operation: See "External Attenuation" on page 94

CONFigure:GSM:SIGN<i>:RFSettings:EATTenuation:BCCH:OUTPut <ExtRFOutAtt>

Defines an external attenuation (or gain, if the value is negative), to be applied to the RF output connector for the BCCH path. This is only relevant for scenario "BCCH and TCH/PDCH".

Parameters:

<ExtRFOutAtt> Range: -50 dB to 90 dB
*RST: 0 dB
Default unit: dB

Example: See Specifying General Settings

Firmware/Software: V3.0.10

Manual operation: See "External Attenuation" on page 94

CONFigure:GSM:SIGN<i>:RFSettings:EDC:INPut <Time>
CONFigure:GSM:SIGN<i>:RFSettings:EDC:OUTPut <Time>

Define the value of an external time delay in the output path and in the input path, so that it can be compensated.

Parameters:

<Time>	Range: 0 s to 20E-6 s *RST: 0 s Default unit: s

Example: See Specifying General Settings

Firmware/Software: V3.2.30

Manual operation: See "External Delay Compensation" on page 94

2.5.8.2 Signal Settings

The following commands provide settings for the GSM downlink and uplink signals.

SENSe:GSM:SIGN<i>:IQOut:PATH<n>?

Queries properties of the baseband signal at the I/Q output.

Suffix:

<n>	1..2 Selects the path to be queried - only path 1 is relevant in the current software version

Return values:

<SampleRate>	M100 Fixed value, indicating a sample rate of 100 Msps (100 MHz)
<PEP>	Peak envelope power of the baseband signal Range: -60 dBFS to 0 dBFS Default unit: dBFS

<CrestFactor> Crest factor of the baseband signal

Range: 15 dB
Default unit: dB

Example: See Configuring the I/Q Settings

Usage: Query only

Firmware/Software: V3.0.20

Manual operation: See "Sample Rate (Out / In)" on page 92

CONFigure:GSM:SIGN<i>:IQIN:PATH<n> <PEP>, <Level>

Specifies properties of the baseband signal at the I/Q input.

Suffix:

<n> 1..2
Selects the path to be configured - only path 1 is relevant in the current software version

Parameters:

<PEP> Peak envelope power of the incoming baseband signal

Range: -60 dBFS to 0 dBFS
Default unit: dBFS

<Level> Average level of the incoming baseband signal (without noise)

Range: depends on crest factor and level of outgoing baseband signal
Default unit: dBFS

Example: See Configuring the I/Q Settings

Firmware/Software: V3.0.20

Manual operation: See "Baseband PEP (Out / In)" on page 92

CONFigure:GSM:SIGN<i>:BAND:BCCH <Band>

Selects the GSM band used for the BCCH and initially also for the TCH. The TCH band can be changed via a handover.

To check the current TCH band see `SENSe:GSM:SIGN<i>:BAND:TCH?` on page 235.

Parameters:

<Band> G085 | G09 | G18 | G19

GSM 850, GSM 900, GSM 1800, GSM 1900 bands

*RST: G09

Example: See Configuring BCCH, TCH and PDCH

Firmware/Software: V2.0.10

Manual operation: See "Band" on page 96

CONFigure:GSM:SIGN<i>:RFSettings:CHANnel:BCCH <Channel>

Sets the GSM channel number for the Broadcast Control Channel (BCCH). The range of values depends on the selected band (`CONFigure:GSM:SIGN<i>:BAND:BCCH`); for an overview see chapter 2.2.9.1, "GSM Bands and Channels", on page 29. The values below are for GSM 900.

Parameters:

<Channel> Range: 0 to 124, 955 to 1023
*RST: 20

Example: See Configuring BCCH, TCH and PDCH

Firmware/Software: V1.0.15.0

Manual operation: See "DL Channel/Frequency" on page 96

CONFigure:GSM:SIGN<i>:RFSettings:LEVel:BCCH <Level>

Defines the absolute level of the Broadcast Control Channel (BCCH). Setting the BCCH level is only allowed for scenario "BCCH and TCH/PDCH". For other scenarios, the BCCH level equals the reference level configured for the TCH/PDCH.

The allowed value range can be calculated as follows:

Range (Level) = Range (Output Power) - External Attenuation - Insertion Loss + (Baseband Level + 15 dB)

Range (Output Power) = -130 dBm to -5 dBm (RFx COM) or -120 dBm to 3 dBm (RFx OUT); please also notice the ranges quoted in the data sheet.

Insertion Loss is only relevant for internal fading, *(Baseband Level + 15 dB)* only for external fading.

Parameters:

<Level> Range: see above
*RST: -80 dBm
Default unit: dBm

Example: See Configuring BCCH, TCH and PDCH

Firmware/Software: V3.0.10

Manual operation: See "Level" on page 96

CONFigure:GSM:SIGN<i>:RFSettings:PMAX:BCCH <PCL>

Defines the maximum transmitter output level of the MS in any uplink (UL) timeslots. The level P_{Max} is signaled to the MS under test as a Power Control Level (PCL) value.

Parameters:

<PCL> Range: 0 to 31
*RST: 5

Example: See Configuring BCCH, TCH and PDCH

Firmware/Software: V1.0.15.0

Manual operation: See "PMax (PCL)" on page 96

CONFigure:GSM:SIGN<i>:RFSettings:CHANnel:TCH[:CARRier<c>] <Channel>

Sets the GSM channel number for the Traffic Channel (TCH, for circuit switched connections) and the PDCH (Packet Data Channel, for packet switched connections).

The range of values depends on the selected band, for an overview see chapter 2.2.9.1, "GSM Bands and Channels", on page 29.

Suffix:

<c> 1..2
Selects the carrier to be configured - only relevant in dual carrier mode

Parameters:

<Channel> The default values are for GSM 900.

Range: 1 to 124, 955 to 1023
*RST: 62 for carrier 1, 72 for carrier 2

Example: See Configuring BCCH, TCH and PDCH

Firmware/Software: V1.0.15.0

Options: R&S CMW-KS201 for carrier 2

Manual operation: See "Channel / Frequency" on page 98

CONFigure:GSM:SIGN<i>:RFSettings:LEVel:TCH[:CARRier<c>] <Level>

Defines the absolute level of the Traffic Channel (TCH) and the PDCH (Packet Data Channel).

The allowed value range can be calculated as follows:

Range (Level) = Range (Output Power) - External Attenuation - Insertion Loss + (Baseband Level + 15 dB)

Range (Output Power) = -130 dBm to -5 dBm (RFx COM) or -120 dBm to 3 dBm (RFx OUT); please also notice the ranges quoted in the data sheet.

Insertion Loss is only relevant for internal fading, *(Baseband Level + 15 dB)* only for external fading.

Suffix:

<c> 1..2
Selects the carrier - only relevant in dual carrier mode. In this software version both carriers use the setting of carrier 1. Carrier 2 can only be queried.

Parameters:

<Level> Range: see above
Increment: 0.01 dB
*RST: -80 dBm
Default unit: dBm

Example: See Configuring BCCH, TCH and PDCH

Firmware/Software: V1.0.15.0

Options: R&S CMW-KS201 for carrier 2

Manual operation: See "DL Reference Level" on page 98

CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:ENABle:TCH[:CARRier<c>] <Enable>

Enable or disable frequency hopping in the downlink traffic channel.

Suffix:

<c> 1..2
Selects the carrier to be configured - only relevant in dual carrier mode

Parameters:

<Enable> OFF | ON
*RST: OFF

Example: See Configuring BCCH, TCH and PDCH

Firmware/Software: V2.0.10

Options: R&S CMW-KS210
R&S CMW-KS201 for carrier 2

Manual operation: See "Enable" on page 98

CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:MAIO:TCH[:CARRier<c>] <MAIO>

Specifies the Mobile Allocation Index Offset (MAIO).

Suffix:

<c> 1..2
Selects the carrier to be configured - only relevant in dual carrier mode

Parameters:

<MAIO> Range: 0 to 63
*RST: 0

Example: See Configuring BCCH, TCH and PDCH

Firmware/Software: V2.0.10

Options: R&S CMW-KS210

R&S CMW-KS201 for carrier 2

Manual operation: See "MAIO" on page 99

CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:HSN:TCH[:CARRier<c>] <HSN>

Specifies the Hopping Sequence Number (HSN) to be used.

Suffix:

<c> 1..2
Selects the carrier to be configured - only relevant in dual carrier mode

Parameters:

<HSN> Range: 0 to 63
*RST: 0

Example: See Configuring BCCH, TCH and PDCH

Firmware/Software: V2.0.10

Options: R&S CMW-KS210
R&S CMW-KS201 for carrier 2

Manual operation: See "HSN" on page 99

CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:SEQuence:TCH[:CARRier<c>]
<Number>(64)

Defines the hopping list. Each entry equals a channel number.

You can specify the 64 entries in any order. The list is sorted automatically from lowest channel number to highest channel number followed by eventual OFF entries.

The range of values depends on the selected band. For an overview see chapter 2.2.9.1, "GSM Bands and Channels", on page 29

Suffix:

<c> 1..2
Selects the carrier to be configured - only relevant in dual carrier mode

Parameters:

<Number> Comma separated list of 64 list entries (channel numbers)

Range: 1 to 124, 955 to 1023
*RST: carrier 1: 1, 62, 124; carrier 2: 2, 63, 123; remaining entries OFF
Additional parameters: OFF | ON (disables | enables the list entry using the previous/default value)

Example: See Configuring BCCH, TCH and PDCH

Firmware/Software: V2.0.10

Options: R&S CMW-KS210
R&S CMW-KS201 for carrier 2

Manual operation: See "Hopping List / Entry ..." on page 99

CONFigure:GSM:SIGN<i>:RFSettings:PCL:TCH:CSWitched <PCL>

Defines the MS transmitter output level in the TCH timeslot that the MS uses for circuit switched connections. The level is signaled to the MS under test as a Power Control Level (PCL) value.

Parameters:

<PCL>	Range:	0 to 31
	*RST:	10

Example: See Configuring BCCH, TCH and PDCH

Firmware/Software: V1.0.15.0

Manual operation: See "Circuit Switched > PCL" on page 100

CONFigure:GSM:SIGN<i>:RFSettings:CHCCombined:TCH:CSWitched <Channel>, <Timeslot>, <PCL>

Sets/changes the GSM channel number, timeslot, and PCL. All parameters can be changed during a connection.

This command combines the following three commands:

- `CONFigure:GSM:SIGN<i>:RFSettings:CHANnel:TCH[:CARRier<c>]` for carrier 1
- `CONFigure:GSM:SIGN<i>:CONNection:CSWitched:TSLot`
- `CONFigure:GSM:SIGN<i>:RFSettings:PCL:TCH:CSWitched`

The range of channel numbers depends on the selected band, for an overview see chapter 2.2.9.1, "GSM Bands and Channels", on page 29.

Parameters:

<Channel>	Range:	0 to 124, 955 to 1023
	*RST:	62
<Timeslot>	Range:	1 to 7
	*RST:	3
<PCL>	Range:	0 to 31
	*RST:	10

Example: See Configuring BCCH, TCH and PDCH

Firmware/Software: V1.0.15.0
V2.0.10: timeslot range extended (1 and 7 added)

Manual operation: See "Channel / Frequency" on page 98

CONFigure:GSM:SIGN<i>:RFSettings:FOFFset:DL <Offset>

Specifies a positive or negative frequency offset to be added to the downlink center frequency of the configured channel, see `CONFigure:GSM:SIGN<i>:RFSettings:CHANnel:TCH[:CARRier<c>]`.

Parameters:

<Offset> Range: -100000 Hz to 100000 Hz
*RST: 0 Hz
Default unit: Hz

Example: See Specifying General Settings

Firmware/Software: V3.2.10

Manual operation: See "Downlink, Uplink" on page 100

CONFigure:GSM:SIGN<i>:RFSettings:FOFFset:UL <Offset>

Specifies a positive or negative frequency offset to be added to the uplink center frequency of the configured channel, see `CONFigure:GSM:SIGN<i>:RFSettings:CHANnel:TCH[:CARRier<c>]`.

Parameters:

<Offset> Range: -100000 Hz to 100000 Hz
*RST: 0 Hz
Default unit: Hz

Example: See Specifying General Settings

Firmware/Software: V3.2.10

Manual operation: See "Downlink, Uplink" on page 100

CONFigure:GSM:SIGN<i>:RFSettings:ENPMode <Mode>

Selects the expected nominal power mode. The expected nominal power of the UL signal can be defined manually or calculated automatically, according to the UL power control settings.

For manual configuration see:

- `CONFigure:GSM:SIGN<i>:RFSettings:ENPower` on page 261
- `CONFigure:GSM:SIGN<i>:RFSettings:UMARgin` on page 261

Parameters:

<Mode> MANual | ULPC

MANual: The expected nominal power and margin are specified manually.
ULPC: The expected nominal power is calculated according to the UL power control settings. For the margin 7 dB are applied.

*RST: ULPC

Example: See Specifying General Settings

Firmware/Software: V2.0.10

Manual operation: See "Exp. Nominal Power, Margin" on page 100

CONFigure:GSM:SIGN<i>:RFSettings:ENPower <ExpectedPower>

Sets the expected nominal power of the UL signal in manual mode or queries the result if the expected nominal power is calculated automatically according to the UL power control settings.

To configure the expected nominal power mode see `CONFigure:GSM:SIGN<i>:RFSettings:ENPMode` on page 260.

Parameters:

<ExpectedPower> In manual mode the range of the expected nominal power can be calculated as follows:
Range (Expected Nominal Power) = Range (Input Power) + External Attenuation - Margin

Range: -47 dBm to 42 dBm for the input power at the RF COM connectors (please notice also the ranges quoted in the data sheet)
*RST: 23 dBm
Default unit: dBm

Example: See Specifying General Settings

Firmware/Software: V2.0.10

Manual operation: See "Exp. Nominal Power, Margin" on page 100

CONFigure:GSM:SIGN<i>:RFSettings:UMARgin <Margin>

Sets the margin that the R&S CMW adds to the expected nominal power in order to determine the reference level in manual mode. If the expected nominal power is calculated automatically according to the UL power control settings, a fix margin of 6 dB is used instead.

The reference level minus the external input attenuation must be within the power range of the selected input connector; refer to the data sheet.

Refer also to the following commands:

- `CONFigure:GSM:SIGN<i>:RFSettings:ENPMode` on page 260
- `CONFigure:GSM:SIGN<i>:RFSettings:ENPower` on page 261
- `CONFigure:GSM:SIGN<i>:RFSettings:EATTenuation:INPut` on page 251

Parameters:

<Margin> Range: 0 dB to (55 dB + External Attenuation - Expected Nominal Power)
*RST: 6 dB
Default unit: dB

Example: See Specifying General Settings

Firmware/Software: V2.0.10

Manual operation: See "Exp. Nominal Power, Margin" on page 100

CONFigure:GSM:SIGN<i>:RFSettings:MLOFfset <MixLevOffset>

Sets the input level offset of the mixer in the analyzer path.

Parameters:

<MixLevOffset> Range: -10 dB to 10 dB
*RST: 10 dB
Default unit: dB

Example: See Specifying General Settings

Firmware/Software: V3.2.10

Manual operation: See "Mixer Level Offset" on page 101

2.5.9 Internal Fading

The following commands configure the internal fader of the R&S CMW.

2.5.9.1 Fading Simulator

The following commands configure the fading simulator of the internal fader.

CONFigure:GSM:SIGN<i>:FADing:FSIMulator:ENABle <Enable>

Enables or disables the fading simulator.

Parameters:

<Enable> OFF | ON
*RST: OFF

Example: See Configuring Internal Fading

Firmware/Software: V3.0.20

Options: R&S CMW-KS210, R&S CMW-KE100 and R&S CMW-KE200

Manual operation: See "Enable" on page 102

CONFigure:GSM:SIGN<i>:FADing:FSIMulator:STANdard <Standard>

Selects one of the multipath propagation condition profiles defined in Annex C.3 of 3GPP TS 45.005.

Parameters:

<Standard> TI5 | T1P5 | T3 | T3P6 | T6 | T50 | T60 | T100 | H100 | H120 | H200 | R130 | R250 | R300 | R500 | E50 | E60 | E100 | T25 | TU1P5 | TU3 | TU25 | TU50 | HT100

The letter indicates the type of the model as follows:
TI: TI (2 path)
T: TUx (6 path)
H: HTx (6 path)
R: RAx (6 path)
E: EQx (6 path)
TU: TUx (12 path)
HT: HTx (12 path)
The number indicates the speed of the mobile in km/h.
Example: HT100 means 100 km/h, T1P5 means 1.5 km/h.

*RST: T3

Example: See Configuring Internal Fading

Firmware/Software: V3.0.20
V3.2.10: T25, TU1.5, TU3, TU25, TU50, HT10 added
V3.2.20: parameter HT10 changed to HT100

Options: R&S CMW-KS210, R&S CMW-KE100 and R&S CMW-KE200

Manual operation: See "Profile" on page 102

CONFigure:GSM:SIGN<i>:FADing:FSIMulator:RESTart:MODE <RestartMode>

Sets the restart mode of the fading simulator.

Parameters:

<RestartMode> AUTO | MANual

AUTO: fading automatically starts with the DL signal
MANual: fading is started and restarted manually (see `CONFigure:GSM:SIGN<i>:FADing:FSIMulator:RESTart`)

*RST: AUTO

Example: See Configuring Internal Fading

Firmware/Software: V3.0.20

Options: R&S CMW-KS210, R&S CMW-KE100 and R&S CMW-KE200

Manual operation: See "Restart Event" on page 103

CONFigure:GSM:SIGN<i>:FADing:FSIMulator:RESTart

Restarts the fading process in `MANual` mode (see `CONFigure:GSM:SIGN<i>:FADing:FSIMulator:RESTart:MODE`).

Usage: Event

Firmware/Software: V3.0.20

Options: R&S CMW-KS210, R&S CMW-KE100 and R&S CMW-KE200

Manual operation: See "Restart Event" on page 103

CONFigure:GSM:SIGN<i>:FADing:FSIMulator:GLOBal:SEED <Seed>

Sets the start seed for the pseudo-random fading algorithm.

Parameters:

<Seed> Range: 0 to 9
*RST: 0

Example: See Configuring Internal Fading

Firmware/Software: V3.0.20

Options: R&S CMW-KS210, R&S CMW-KE100 and R&S CMW-KE200

Manual operation: See "Start Seed" on page 103

CONFigure:GSM:SIGN<i>:FADing:FSIMulator:ILOSs:MODE <InsertLossMode>

Sets the insertion loss mode.

Parameters:

<InsertLossMode> NORMal | USER

NORMal: the insertion loss is determined by the fading profile
USER: the insertion loss can be adjusted by the user

*RST: NORM

Example: See Configuring Internal Fading

Firmware/Software: V3.0.20

Options: R&S CMW-KS210, R&S CMW-KE100 and R&S CMW-KE200

Manual operation: See "Insertion Loss" on page 103

CONFigure:GSM:SIGN<i>:FADing:FSIMulator:ILOSs:LOSS <InsertionLoss>

Sets the insertion loss for the fading simulator.

A setting is only allowed in `MANual` mode (see `CONFigure:GSM:SIGN<i>:FADing:FSIMulator:ILOSs:MODE`).

Parameters:

<InsertionLoss>	Range:	0 dB to 18 dB
	*RST:	0 dB
	Default unit:	dB

Firmware/Software: V3.0.20

Options: R&S CMW-KS210, R&S CMW-KE100 and R&S CMW-KE200

Manual operation: See "Insertion Loss" on page 103

CONFigure:GSM:SIGN<i>:FADing:FSIMulator:ILOSs:CSAMples?

Displays the percentage of clipped samples.

Return values:

<ClippedSamples>	Range:	0 % to 100 %
	Default unit:	%

Example: See Configuring Internal Fading

Usage: Query only

Firmware/Software: V3.2.10

Options: R&S CMW-KS210, R&S CMW-KE100 and R&S CMW-KE200

Manual operation: See "Clipping Counter" on page 103

CONFigure:GSM:SIGN<i>:FADing:FSIMulator:DSHift <Frequency>

Displays the maximum Doppler frequency for the fading simulator.

A setting is only allowed in `USER` mode (see `CONFigure:GSM:SIGN<i>:FADing:FSIMulator:DSHift:MODE`).

Parameters:

<Frequency>	Range:	1 Hz to 2000 Hz
	*RST:	3 Hz
	Default unit:	Hz

Example: See Configuring Internal Fading

Firmware/Software: V3.2.20

Options: R&S CMW-KS210, R&S CMW-KE100 and R&S CMW-KE200

Manual operation: See "Doppler Frequency, Mode" on page 103

CONFigure:GSM:SIGN<i>:FADing:FSIMulator:DSHift:MODE <Mode>

Sets the Doppler shift mode.

Parameters:

<Mode> NORMal | USER

NORMal: the maximum Doppler frequency is determined by the fading profile
USER: the maximum Doppler frequency can be adjusted by the user

*RST: NORM

Example: See Configuring Internal Fading

Firmware/Software: V3.2.20

Options: R&S CMW-KS210, R&S CMW-KE100 and R&S CMW-KE200

Manual operation: See "Doppler Frequency, Mode" on page 103

2.5.9.2 DL Settings

The following commands query noise power information.

CONFigure:GSM:SIGN<i>:FADing:POWer:NOISe?

Queries the calculated noise power on the downlink channel.

Return values:

<NoisePower> Default unit: dBm

Example: See Configuring Internal Fading

Usage: Query only

Firmware/Software: V3.0.20

Options: R&S CMW-KS210, R&S CMW-KE100 and R&S CMW-KE200

Manual operation: See "Noise (System BW) Power" on page 104

CONFigure:GSM:SIGN<i>:FADing:POWer:NOISe:TOTal?

Queries the total noise power.

Return values:

<NoisePower> Default unit: dBm

Usage: Query only

Firmware/Software: V3.0.20

Options: R&S CMW-KS210, R&S CMW-KE100 and R&S CMW-KE200

Manual operation: See "Noise (Total BW) Power" on page 104

CONFigure:GSM:SIGN<i>:FADing:POWer:SUM?

Queries the calculated total power (signal + noise) on the downlink channel.

Return values:

<Power>	Default unit: dBm
Usage:	Query only
Firmware/Software:	V3.0.20
Options:	R&S CMW-KS210, R&S CMW-KE100 and R&S CMW-KE200
Manual operation:	See "Signal + Noise (System BW) Power" on page 104

2.5.9.3 Fading Module AWGN

The following commands configure the AWGN generator of the internal fader.

CONFigure:GSM:SIGN<i>:FADing:AWGN:ENABle <Enable>

Enables or disables AWGN insertion via the fading module.

Parameters:

<Enable>	OFF | ON *RST: OFF
Example:	See Configuring Internal Fading
Firmware/Software:	V3.0.20
Options:	R&S CMW-KS210, R&S CMW-KE100 and R&S CMW-KE200
Manual operation:	See "Enable" on page 105

CONFigure:GSM:SIGN<i>:FADing:AWGN:BWIDth:RATio <Ratio>

Specifies the minimum ratio between noise bandwidth and channel bandwidth.

Parameters:

<Ratio>	Range: 1 to 250 *RST: 1
Example:	See Configuring Internal Fading
Firmware/Software:	V3.0.20
Options:	R&S CMW-KS210, R&S CMW-KE100 and R&S CMW-KE200
Manual operation:	See "Min. Noise/System BW Ratio" on page 105

CONFigure:GSM:SIGN<i>:FADing:AWGN:BWIDth:NOISe?

Queries the noise bandwidth.

Return values:

<NoiseBandwidth> Range: 0 Hz to 80E+6 Hz
Default unit: Hz

Usage: Query only

Firmware/Software: V3.0.20

Options: R&S CMW-KS210, R&S CMW-KE100 and R&S CMW-KE200

Manual operation: See "Noise Bandwidth" on page 105

CONFigure:GSM:SIGN<i>:FADing:AWGN:SNRatio <Ratio>

Specifies the signal to noise ratio for the AWGN inserted on the internal fading module.

Parameters:

<Ratio> Range: -25 dB to 30 dB
*RST: 0 dB
Default unit: dB

Example: See Configuring Internal Fading

Firmware/Software: V3.0.20
V3.2.10: changed <Ratio> range

Options: R&S CMW-KS210, R&S CMW-KE100 and R&S CMW-KE200

Manual operation: See "Signal/Noise Ratio" on page 105

2.5.10 Network Settings

The following commands define how the R&S CMW, simulating the GSM base station and GSM network, sets up and maintains the connection to the mobile under test.

2.5.10.1 Miscellaneous

The following command defines whether the emulated cell supports packet switched connections.

CONFigure:GSM:SIGN<i>:CELL:PSDomain <Enable>

Enables or disables the support of packet switched connections by the emulated cell.

Parameters:

<Enable>	OFF | ON	
	*RST:	ON

Example: See Configuring PS Connection Settings

Firmware/Software: V2.0.20

Manual operation: See "Packet Switched Domain" on page 106

2.5.10.2 Neighbor Cell

The following commands define parameters of the neighbor cells signaled by the R&S CMW.

CONFigure:GSM:SIGN<i>:NCELl:ALL:THResholds:HIGH <Valid>, <High>

Configures a common reselection high threshold value applicable to all technologies.

Alternatively to a common threshold you can also use individual thresholds. They are defined per technology via the commands `CONFigure:GSM:SIGN<i>:NCELl:<Technology>:THResholds:HIGH`. The parameter `<Valid>` selects whether common or individual thresholds are used.

Parameters:

<Valid> OFF | ON

OFF: use individual thresholds defined by separate commands
ON: use common threshold defined by this command

*RST: OFF

<High> Range: 0 to 31
*RST: 5

Example: See Configuring Neighbor Cell and Reselection Parameters

Firmware/Software: V3.2.20

Manual operation: See "Threshold" on page 108

CONFigure:GSM:SIGN<i>:NCELl:LTE:THResholds:HIGH <High>

Configures the reselection threshold value "THRESH_E-UTRAN_high" for LTE neighbor cells.

Parameters:

<High> Range: 0 to 31
*RST: 5
Default unit: 2 dB

Example: See Configuring Neighbor Cell and Reselection Parameters

Firmware/Software: V3.2.20

Manual operation: See "Threshold" on page 108

CONFigure:GSM:SIGN<i>:NCELl:WCDMa:THResholds:HIGH <High>

Configures the reselection threshold value "THRESH_UTRAN_high" for WCDMA neighbor cells.

Parameters:

<High> Range: 0 to 31
*RST: 5
Default unit: dB

Example: See Configuring Neighbor Cell and Reselection Parameters

Firmware/Software: V3.2.20

Manual operation: See "Threshold" on page 108

CONFigure:GSM:SIGN<i>:NCELl:TDSCdma:THResholds:HIGH <High>

Configures the high reselection threshold value for TD-SCDMA neighbor cells.

Parameters:

<High> Range: 0 to 31
*RST: 5
Default unit: dB

Example: See Configuring Neighbor Cell and Reselection Parameters

Firmware/Software: V3.2.30

Manual operation: See "Threshold" on page 108

CONFigure:GSM:SIGN<i>:NCELl:GSM:CELL<n> <Enable>, <Band>, <Channel>[, <Measurement>, <BSIC>]

Configures an entry of the neighbor cell list for GSM.

For channel number ranges depending on operating bands see table 2-1.

Suffix:

<n> 1..16
Number of the entry

Parameters:

<Enable> OFF | ON
Enables or disables the entry
*RST: OFF

<Band> G085 | G09 | G18 | G19
GSM 850, GSM 900, GSM 1800, GSM 1900
*RST: G09

<Channel> Channel number used for the Broadcast Control Channel (BCCH), see GSM Bands and Channels
Range: depends on operating band
*RST: 20

<Measurement> OFF | ON
Enables or disables the MS neighbor cell measurement
*RST: OFF

<BSIC> Base station identity code
Range: 0 to 63
*RST: 0

Example: See Configuring Neighbor Cell and Reselection Parameters

Firmware/Software: V3.2.20
V3.2.30 added `<Measurement>`
V3.2.70: added `<BSIC>`

Manual operation: See "GSM" on page 108

CONFigure:GSM:SIGN<i>:NCELl:LTE:CELL<n> <Enable>, <Band>, <Channel>, <CellID>[, <Measurement>]

Configures an entry of the neighbor cell list for LTE.

Suffix:

<n> 1..4
Number of neighbor cell

Parameters:

<Enable> OFF | ON
Enables or disables the entry
*RST: OFF

<Band> OB1 | OB2 | OB3 | OB4 | OB5 | OB6 | OB7 | OB8 | OB9 | OB10 | OB11 | OB12 | OB13 | OB14 | OB15 | OB16 | OB17 | OB18 | OB19 | OB20 | OB21 | OB22 | OB23 | OB24 | OB25 | OB26 | OB27 | OB28 | OB29 | OB30 | OB31 | OB32 | OB33 | OB34 | OB35 | OB36 | OB37 | OB38 | OB39 | OB40 | OB41 | OB42 | OB43

Operating bands 1 to 43

*RST: OB1

<Channel> Downlink channel number

Range: 0 to 45589, depending on operating band, see tables below

*RST: 300

<CellID> Physical cell ID (scrambling code)

Range: 0 to 503

*RST: 0

<Measurement> OFF | ON

Enables or disables the MS neighbor cell measurement

*RST: OFF

Example: See Configuring Neighbor Cell and Reselection Parameters

Firmware/Software: V3.2.20
V3.2.30 added <Measurement>

Manual operation: See "LTE" on page 108

Table 2-10: Channel number range depending on LTE FDD band

FDD band	Channel no. N_{DL}
1	0 to 599
2	600 to 1199
3	1200 to 1949
4	1950 to 2399
5	2400 to 2649
6	2650 to 2749
7	2750 to 3449
8	3450 to 3799
9	3800 to 4149
10	4150 to 4749
11	4750 to 4949
12	5010 to 5179
13	5180 to 5279
14	5280 to 5379

FDD band	Channel no. N_{DL}
15	5380 to 5579
16	5580 to 5729
17	5730 to 5849
18	5850 to 5999
19	6000 to 6149
20	6150 to 6449
21	6450 to 6599
22	6600 to 7499
23	7500 to 7699
24	7700 to 8039
25	8040 to 8689
26	8690 to 9039
27	9040 to 9209
28	9210 to 9659
29	9660 to 9769
30	9770 to 9869
31	9870 to 9919
32	10562 to 10838

Table 2-11: Channel number range depending on LTE TDD band

TDD band	Channel no. N
33	36000 to 36199
34	36200 to 36349
35	36350 to 36949
36	36950 to 37549
37	37550 to 37749
38	37750 to 38249
39	38250 to 38649
40	38650 to 39649
41	39650 to 41589
42	41590 to 43589
43	43590 to 45589

CONFigure:GSM:SIGN<i>:NCELl:WCDMa:CELL<n> <Enable>, <Band>, <Channel>, <ScramblingCode>[, <Measurement>]

Configures an entry of the neighbor cell list for WCDMA.

Suffix:

<n> 1..4
Number of the entry

Parameters:

<Enable> OFF | ON
Enables or disables the entry
*RST: OFF

<Band> OB1 | OB2 | OB3 | OB4 | OB5 | OB6 | OB7 | OB8 | OB9 | OB10 | OB11 | OB12 | OB13 | OB14 | OB19 | OB20 | OB21 | OBS1 | OBS2 | OBS3 | OBL1

OB1, ..., OB14: Operating Band I to XIV
OB19, ..., OB21: Operating Band XIX to XXI
OBS1: Operating Band S
OBS2: Operating Band S 170 MHz
OBS3: Operating Band S 190 MHz
OBL1: Operating Band L
*RST: OB1

<Channel> Downlink channel number
Range: 412 to 11000, depending on operating band, see table below
*RST: 10563

<ScramblingCode> Primary scrambling code
Range: #H0 to #H1FF
*RST: #H0

<Measurement> OFF | ON
Enables or disables the MS neighbor cell measurement
*RST: OFF

Example: See Configuring Neighbor Cell and Reselection Parameters

Firmware/Software: V3.2.20
V3.2.30 added <Measurement>

Manual operation: See "WCDMA FDD" on page 108

Table 2-12: Channel number ranges depending on WCDMA band

Band	Channel No N_{DL}
1	10562 to 10838
2	9662 to 9938 412 to 687 (step 25)
3	1162 to 1513

Band	Channel No N_{DL}
4	1537 to 1738 1887 to 2087 (step 25)
5	4357 to 4458 1007, 1012, 1032, 1037, 1062, 1087
6	4387 to 4413 1037, 1062
7	2237 to 2563 2587 to 2912 (step 25)
8	2937 to 3088
9	9237 to 9387
10	3112 to 3388 3412 to 3687 (step 25)
11	3712 to 3812
12	3837 to 3903 3927, 3932, 3957, 3962, 3987, 3992
13	4017 to 4043 4067, 4092
14	4117 to 4143 4167, 4192
19	712 to 763 787, 812, 837
20	4512 to 4638
21	862 to 912
S	10912 to 10988 5912 to 5987 (step 25)
S 170 MHz	10900 to 10950
S 190 MHz	10950 to 11000 5962, 5987
L	7788 to 7933 7637 to 7783

CONFigure:GSM:SIGN<i>:NCELl:TDSCdma:CELL<n> <Enable>, <Band>, <Channel>, <CellParameterID>[, <Measurement>]

Configures an entry of the neighbor cell list for TD-SCDMA.

Suffix:

<n> 1..4
Number of the entry

Parameters:

<Enable>	OFF | ON Enables or disables the entry *RST: OFF
<Band>	OB1 | OB2 | OB3 **OB1:** Band 1 (F), channel 9400 to 9600 **OB2:** Band 2 (A), channel 10050 to 10125 **OB3:** Band 3 (E), channel 11500 to 12000 *RST: OB1
<Channel>	Range: depends on operating band, see table below *RST: not documented
<CellParameterID>	Scrambling code Range: #H0 to #H7F *RST: #H0
<Measurement>	OFF | ON Enables or disables the MS neighbor cell measurement *RST: OFF

Example: See Configuring Neighbor Cell and Reselection Parameters

Firmware/Software: V3.2.20
V3.2.30 added <Measurement>

Manual operation: See "TD-SCDMA" on page 108

Table 2-13: Channel number ranges depending on TD-SCDMA band

Band	Channel No
a (China)	10054 to 10121
e	11504 to 11996
f	9404 to 9596

2.5.10.3 Cell Reselection

The following commands configure the reselection parameters.

CONFigure:GSM:SIGN<i>:CELL:RESelection:QUALity:RXLevmin:ACCess <Qrxlevmin>

Defines the minimum RX level at an MS antena required for access to the GSM cell. This parameter is transmitted via BCCH.

Parameters:

<Qrxlevmin>	Range:	-111 dBm to -48 dBm
	*RST:	-111 dBm

Example: See Configuring Neighbor Cell and Reselection Parameters

Firmware/Software: V3.2.20

Options: R&S CMW-KS210

Manual operation: See "RxLev Access Min" on page 109

CONFigure:GSM:SIGN<i>:CELL:RESelection:HYSTeresis <Hysteresis>

Sets the hysteresis for the cell reselection algorithm.

Parameters:

<Hysteresis>	Range:	0 dB to 14 dB
	*RST:	14 dB
	Default unit:	dB

Example: See Configuring Neighbor Cell and Reselection Parameters

Firmware/Software: V3.2.30

Manual operation: See "Cell Reselect Hysteresis" on page 109

CONFigure:GSM:SIGN<i>:CELL:RESelection:QUALity:RXLevmin:EUTRan <Qrxlevmin>

Defines the minimum RX level at a UE antena required for access to the LTE cell. This parameter is transmitted via BCCH.

Parameters:

<Qrxlevmin>	Range:	-140 dBm to -78 dBm
	*RST:	-132 dBm

Example: See Configuring Neighbor Cell and Reselection Parameters

Firmware/Software: V3.2.20

Options: R&S CMW-KS210

Manual operation: See "E-UTRAN Q RxLevMin" on page 109

CONFigure:GSM:SIGN<i>:CELL:RESelection:QUALity:RXLevmin:UTRan <Qrxlevmin>

Defines the minimum RX level at a UE antena required for access to the UMTS cell. This parameter is transmitted via BCCH.

Parameters:

<Qrxlevmin>	Range:	-119 dBm to -57 dBm
	*RST:	-115 dBm

Example: See Configuring Neighbor Cell and Reselection Parameters

Firmware/Software: V3.2.20

Options: R&S CMW-KS210

Manual operation: See "UTRAN Q RxLevMin" on page 109

CONFigure:GSM:SIGN<i>:CELL:RESelection:TRESelection <T_reselection>

Sets the time hysteresis for the cell reselection algorithm.

Parameters:

<T_reselection> Range: 5 s to 20 s
Increment: 5
*RST: 5 s
Default unit: s

Example: See Configuring Neighbor Cell and Reselection Parameters

Firmware/Software: V3.2.20

Options: R&S CMW-KS210

Manual operation: See "T_Reselection" on page 109

2.5.10.4 Identity

The following commands define identities of the radio network simulated by the R&S CMW.

CONFigure:GSM:SIGN<i>:CELL:IDENtity <Identity>

Defines the cell identity of the simulated cell.

Parameters:

<Identity> Range: 0 to 2^{16} - 1 (65535)
*RST: 0

Example: See Configuring Network and MS Identities

Firmware/Software: V1.0.15.0
V3.2.30: setting enabled

Manual operation: See "Cell Identity" on page 110

CONFigure:GSM:SIGN<i>:CELL:MCC <MCC>

Defines the Mobile Country Code of the simulated network.

Parameters:

<MCC> Range: 0 to 999
*RST: 1

Example: See Configuring Network and MS Identities

Firmware/Software: V1.0.15.0

Manual operation: See "MCC" on page 110

CONFigure:GSM:SIGN<i>:CELL:MNC <MNC>

Defines the Mobile Network Code of the simulated radio network.

Parameters:

<MNC> Range: 0 to 99 / 999 (two / three-digit MNC)
*RST: 1

Example: See Configuring Network and MS Identities

Firmware/Software: V1.0.15.0

Manual operation: See "MNC" on page 110

CONFigure:GSM:SIGN<i>:CELL:MNC:DIGits <NoDigits>

Defines the number of digits of the Mobile Network Code (MNC).

Parameters:

<NoDigits> TWO | THRee
2- or 3-digit MNC
*RST: TWO

Example: See Configuring Network and MS Identities

Firmware/Software: V1.0.15.0

Manual operation: See "MNC" on page 110

CONFigure:GSM:SIGN<i>:CELL:LAC <LAC>

Defines the Location Area Code of the simulated base station.

Parameters:

<LAC> Range: 0 to 2^16 - 1 (65535)
*RST: 1

Example: See Configuring Network and MS Identities

Firmware/Software: V1.0.15.0

Manual operation: See "LAC" on page 111

CONFigure:GSM:SIGN<i>:CELL:NCC <NCC>

Defines the Network Color Code of the simulated radio network.

Parameters:

<NCC>	Range:	0 to 7
	*RST:	0

Example: See Configuring Network and MS Identities

Firmware/Software: V1.0.15.0

Manual operation: See "NCC" on page 111

CONFigure:GSM:SIGN<i>:CELL:BCC <BCC>

Defines the Base transceiver station Color Code of the simulated base station.

Parameters:

<BCC>	Range:	0 to 7
	*RST:	0

Example: See Configuring Network and MS Identities

Firmware/Software: V1.0.15.0

Manual operation: See "BCC" on page 111

CONFigure:GSM:SIGN<i>:CELL:RAC <RAC>

Defines the Routing Area Code of the simulated base station.

Parameters:

<RAC>	Range:	0 to 255
	*RST:	0

Example: See Configuring Network and MS Identities

Firmware/Software: V2.0.20

Manual operation: See "RAC" on page 111

2.5.10.5 MS Identity

The following commands define parameters of a default subscriber.

CONFigure:GSM:SIGN<i>:CELL:IMSI <MCC>, <MNC>, <MSIN>

Defines the default IMSI which is used to set up the connection if the mobile does not initiate a location update. See also `CONFigure:GSM:SIGN<i>:CELL:LUPDate` on page 285.

Parameters:

<MCC>	Range:	0 to 999
	*RST:	001

<MNC>	Range:	01 to 99 (2-digit MNC) or 001 to 999 (3-digit MNC)
	*RST:	01
<MSIN>	Range:	0 to 9999999999 (2-digit MNC) or 0 to 999999999 (3-digit MNC)
	*RST:	1000000095

Example: See Configuring Network and MS Identities

Firmware/Software: V1.0.15.0

Manual operation: See "Default IMSI" on page 111

2.5.10.6 Requested Mobile Data

The following commands define which parameters of the mobile station are requested by the R&S CMW.

CONFigure:GSM:SIGN<i>:CELL:IMEirequest <Enable>

Enables or disables request of the IMEI during location update.

Parameters:

<Enable> OFF | ON

*RST: OFF

Example: See Configuring Requested Mobile Data

Firmware/Software: V1.0.15.0

Manual operation: See "IMEI Request" on page 112

CONFigure:GSM:SIGN<i>:CELL:CREQuest <Enable>

Activates/deactivates the classmark 3 information element as specified in 3GPP TS 24.008, section 10.5.1.7.

Parameters:

<Enable> OFF | ON

*RST: OFF

Example: See Configuring Requested Mobile Data

Firmware/Software: V3.2.70

Manual operation: See "Circuit Switched > Classmark3 Request" on page 112

CONFigure:GSM:SIGN<i>:CELL:ECSending <Enable>

Activates/deactivates early clasmark sending as defined in 3GPP TS 44.018.

Parameters:

<Enable> OFF | ON

*RST: OFF

Example: See Configuring Requested Mobile Data

Firmware/Software: V3.2.70

Manual operation: See "Early Classmark Sending" on page 115

2.5.10.7 Cell

The following commands configure the radio link for connection setup.

CONFigure:GSM:SIGN<i>:CELL:BSAGblksres <Blocks>

Defines the number of Access Grant Channel (AGCH) data blocks reserved for the AGCH access.

Parameters:

<Blocks>	Range:	0 to 2
	*RST:	0

Example: See Configuring Cell Parameters

Firmware/Software: V1.0.15.0

Manual operation: See "BS AG BLKS RES" on page 113

CONFigure:GSM:SIGN<i>:CELL:BSPamfrms <Frames>

Defines the interval between two paging requests of the R&S CMW in multiframes (basic service paging blocks available per multiframes).

Parameters:

<Frames>	Range:	2 to 9
	*RST:	2

Example: See Configuring Cell Parameters

Firmware/Software: V1.0.15.0

Manual operation: See "BS PA MFRMS" on page 113

CONFigure:GSM:SIGN<i>:CELL:BINDicator <Band>

Indicates the band GSM1800 or GSM1900 that the MS under test can use.

Parameters:

<Band> G18 | G19

GSM1800 | GSM1900

*RST: G18

Example: See Configuring Cell Parameters

Firmware/Software: V1.0.15.0

Manual operation: See "Band Indicator" on page 113

CONFigure:GSM:SIGN<i>:CELL:PMODe <PageMode>

Selects paging mode.

Parameters:

<PageMode> NPAGing | PREorganize

NPAGing: normal paging
PREorganize: paging reorganization

*RST: NPAG

Example: See Configuring Cell Parameters

Firmware/Software: V3.2.30

Manual operation: See "Page Mode" on page 114

CONFigure:GSM:SIGN<i>:CELL:NCC:PERMitted <NCCpermitted>

Specifies the neighbor cell by its Network Color Code (NCC) that the MS is allowed to measure.

Parameters:

<NCCpermitted>	Range:	0 to 255
	*RST:	255

Example: See Configuring Cell Parameters

Firmware/Software: V3.2.30

Manual operation: See "NCC Permitted" on page 114

CONFigure:GSM:SIGN<i>:CELL:MRETrans <MaxRetrans>

Maximum no. of the DL retransmissions.

Parameters:

<MaxRetrans> Range: 1, 2, 4, 7
*RST: 7

Example: See Configuring Cell Parameters

Firmware/Software: V3.2.30

Manual operation: See "Max Retrans" on page 114

CONFigure:GSM:SIGN<i>:CELL:IPReduction <Value>

Specifies the MS transmit level reduction for the RACH at the very beginning of the connection before the standard power control algorithm starts.

Parameters:

<Value> **0**: 10 dB
1: 10 dB, for emergency calls no power reduction
Range: 0 to 1
*RST: 0
ON (OFF) commands the MS to apply (not apply) the initial power reduction.

Example: See Configuring Cell Parameters

Firmware/Software: V3.2.70

Options: R&S CMW-KS210

Manual operation: See "Initial Power Reduction" on page 114

CONFigure:GSM:SIGN<i>:CELL:CBARring <Enable>

Enables/disables the MS to camp to the R&S CMW cell.

Parameters:

<Enable> OFF | ON
OFF: the MS is allowed to camp to the cell
ON: the MS is not allowed to camp to the cell
*RST: OFF

Example: See Configuring Cell Parameters

Firmware/Software: V3.2.70

Options: R&S CMW-KS210

Manual operation: See "Cell Barring" on page 114

CONFigure:GSM:SIGN<i>:CELL:PMIDentity <Paging>

Selects the MS identity used by paging.

Parameters:

<Paging> IMSI | TMSI

*RST: IMSI

Example: See Configuring Cell Parameters

Firmware/Software: V3.2.30

Manual operation: See "Paging with MS Identity" on page 114

CONFigure:GSM:SIGN<i>:CELL:CDEScription <Number>(64)

Specifies the allowed DL traffic channels within the simulated GSM cell.

Parameters:

<Number> 64 entries: one or several channel numbers in parallel or OFF.

Range: 0 Ch to 1023 Ch

*RST: 20,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF

Example: See Configuring Cell Parameters

Firmware/Software: V3.2.30

Manual operation: See "Cell Channel Description" on page 114

CONFigure:GSM:SIGN<i>:CELL:LUPDate <LocUpdate>

Defines in which instances the MS performs a "location update".

Parameters:

<LocUpdate> ALWays | AUTO

Location update each time the mobile is switched on | only if required

*RST: ALW

Example: See Configuring Cell Parameters

Firmware/Software: V1.0.15.0

Manual operation: See "Location Update" on page 116

CONFigure:GSM:SIGN<i>:CELL:DTX <Mode>

Specifies whether or not the mobile station may use the operating mode DTX (Discontinuous Transmission).

Parameters:

<Mode> OFF | ON

Enable | disable DTX mode

*RST: OFF

Example: See Configuring Cell Parameters

Firmware/Software: V1.0.15.0

Manual operation: See "MS DTX Allowed" on page 116

CONFigure:GSM:SIGN<i>:CELL:PSWitched:PCMChannel <Channel>

Selects the channel type that the mobile uses to determine the received signal strength and quality.

Parameters:

<Channel> BCCH | PDCH

*RST: PDCH

Example: See Configuring Cell Parameters

Firmware/Software: V3.0.20

Options: R&S CMW-KS210

Manual operation: See "PC Meas Channel" on page 116

CONFigure:GSM:SIGN<i>:CELL:PSWitched:PDPContext <Mode>

Defines how the R&S CMW reacts to an ACTIVATE PDP CONTEXT REQUEST sent by the MS.

Parameters:

<Mode> REJect | ACCept

*RST: ACC

Example: See Configuring Cell Parameters

Firmware/Software: V2.0.20

Manual operation: See "PDP Context Activation" on page 117

CONFigure:GSM:SIGN<i>:CELL:PSWitched:TAVGtw <Value>

Specifies the signal level filter period for power control. The same value is used for T_{AVG_T} and T_{AVG_W}.

Parameters:

<Value>	Range:	0 to 25
	*RST:	2

Example: See Configuring Cell Parameters

Firmware/Software: V3.0.20

Options: R&S CMW-KS210

Manual operation: See "T avg_t/w" on page 117

CONFigure:GSM:SIGN<i>:CELL:PSWitched:BPERiod <Value>

Specifies the BEP_PERIOD defined in 3GPP TS 45.008.

Parameters:

<Value>	Range:	0 to 10
	*RST:	0

Example: See Configuring Cell Parameters

Firmware/Software: V3.0.20

Options: R&S CMW-KS210

Manual operation: See "BEP Period" on page 117

CONFigure:GSM:SIGN<i>:RREPort:CSWitched:EMReport:ENABle <Enable>

Enables or disables MS enhanced measurement reports.

Parameters:

<Enable>	OFF | ON	
	*RST:	OFF

Example: See Configuring Cell Parameters

Firmware/Software: V3.2.30

Manual operation: See "Enhanced Measurement Report" on page 116

CONFigure:GSM:SIGN<i>:CELL:CSWitched:CREQuest <ConnectRequest>[, <AcceptAfter>]
CONFigure:GSM:SIGN<i>:CELL:PSWitched:CREQuest <ConnectRequest>[, <AcceptAfter>]

Specifies the handling of the MS originating CS/PS connection request.

Parameters:

<ConnectRequest> ACCept | REJect | IGNore

ACCept: accept connection
REJect: reject connection
IGNore: ignore first attempt, <AcceptAfter> parameter defines further handling

*RST: ACC

<AcceptAfter> AA1 | AA2 | AA3 | AA4 | AA5 | AA6 | AA7 | IALL

AA1 to AA7: accept after burst 1 to 7
IALL: ignore all

*RST: AA1

Example: See Configuring Cell Parameters

Firmware/Software: V3.2.30

Manual operation: See "Connection Request (CS and PS)" on page 117

SENSe:GSM:SIGN<i>:CELL:CERRor?
SENSe:GSM:SIGN<i>:CELL:PSWitched:CERRor?

Returns error information related to the active CS/PS connection.

Return values:

<ConnectionError> NERRor | REJected | RLTimeout | PTIMeout | STIMeout | IGNored | ATIMeout

NERRor: no error
REJected: connection rejected
RLTimeout: radio link timeout
PTIMeout: paging timeout
STIMeout: signaling timeout
IGNored: connection ignored
ATIMeout: alerting timeout

Example: See Configuring Cell Parameters

Usage: Query only

Firmware/Software: V3.2.30
V3.2.70: added `ATIM`

Manual operation: See "Connection Error (CS and PS)" on page 117

2.5.10.8 Timer and Constants

The following commands control the timing of the connection.

CONFigure:GSM:SIGN<i>:CELL:RTMS <Time>

Defines the time period after which a previously established but interrupted connection is dropped by the mobile station (Radiolink Timeout MS).

Parameters:

<Time> Number of missing SACCH blocks, only multiples of 4 are allowed (rounded automatically)

Range: 4 to 64
Increment: 4
*RST: 24

Example: See Setting Timers and Constants

Firmware/Software: V1.0.15.0

Manual operation: See "Radiolink Timeout MS" on page 118

CONFigure:GSM:SIGN<i>:CELL:RTBS <Time>

Defines the time period after which an existing, but interrupted connection is aborted by the R&S CMW ("Radiolink Timeout BS").

Parameters:

<Time> Number of missing SACCH blocks

Range: 4 to 64
Increment: 1
*RST: 24

Example: See Setting Timers and Constants

Firmware/Software: V1.0.15.0

Manual operation: See "Radiolink Timeout BS" on page 118

CONFigure:GSM:SIGN<i>:CELL:ATIMeout <Time>

Defines the maximum time period in seconds during which the phone is ringing in the case of call to mobile (mobile terminated call). If the call is not answered, the R&S CMW returns to the Synchronized state.

Parameters:

<Time> Range: 1 s to 120 s
*RST: 10 s
Default unit: s

Example: See Setting Timers and Constants

Firmware/Software: V2.0.10

Manual operation: See "Alerting Timeout" on page 118

CONFigure:GSM:SIGN<i>:CELL:PLUPdate <Value>

Defines the value of the timer T3212 of the periodic location updating procedure.

Parameters:

<Value> Range: 0 to 255
*RST: 0
Default unit: deci-hours

Example: See Setting Timers and Constants

Firmware/Software: V1.0.15.0

Manual operation: See "T3212" on page 118

CONFigure:GSM:SIGN<i>:CELL:PRAupdate <Value>

Defines the value of the timer T3312 of the periodic routing area updating procedure.

Parameters:

<Value> Range: 0 to 31
*RST: 0
Default unit: deci-hours

Example: See Setting Timers and Constants

Firmware/Software: V1.0.15.0

Manual operation: See "T3312" on page 119

CONFigure:GSM:SIGN<i>:CELL:CSWitched:IARTimer <Value>
CONFigure:GSM:SIGN<i>:CELL:PSWitched:IARTimer <Value>

Sets the immediate assignment reject timers for CS (T3122) / PS (T3142).

Parameters:

<Value> Range: 0 s to 255 s
*RST: 0 s
Default unit: s

Example: See Setting Timers and Constants

Firmware/Software: V3.2.30

Manual operation: See "T3122, T3142" on page 119

CONFigure:GSM:SIGN<i>:CELL:PSWitched:TRTimer <Value>

Defines the TBF release timer for PS.

Parameters:

<Value> For mapping of values and timer durations in ms see the table below.

Range: 0 to 7
*RST: 2

Example: See Setting Timers and Constants

Firmware/Software: V3.2.70

Options: R&S CMW-KS210

Manual operation: See "T3192" on page 119

	0	1	2	3	4	5	6	7
[ms]	500	1000	1500	0	80	120	160	200

2.5.10.9 Reject Causes

The commands in this section configure the rejection of location update requests and attach requests received from the MS.

CONFigure:GSM:SIGN<i>:CELL:RCAuse:LOCation <CauseNumber>

Enables or disables the rejection of location update requests and selects the rejection cause to be transmitted.

Parameters:

<CauseNumber> C2 | C3 | C6 | C11 | C12 | C13 | C15 | C96 | C99 | C100 | C111 | C4 | C5 | C17 | C20 | C21 | C22 | C23 | C25 | C32 | C33 | C34 | C38 | C48 | C95 | C97 | C98 | C101

C2: IMSI unknown in HLR
C3: Illegal Mobile Subscriber
C4: IMSI unknown in VLR
C5: IMEI not accepted
C6: Illegal Mobile Equipment
C11: PLMN not allowed
C12: Location Area not allowed
C13: Roaming not allowed in location area
C15: No suitable cells in location area
C17: Network failure
C20: MAC failure
C21: Synch failure
C22: Congestion
C23: GSM authentication unacceptable
C25: Not authorized for this CSG
C32: Service option not supported
C33: Requested service option not subscribed
C34: Service option temporarily out of order
C38: Call cannot be identified
C48: Retry upon entry into a new cell
C95: Semantically incorrect message
C96: Invalid mandatory information
C97: Mesage type non-existent or not implemented
C98: Mesage type not compatible with protocol state
C99: Information element non-existent or not implemented
C100: Conditional information element error
C101: Mesage not compatible with protocol state
C111: Protocol error, unspecified

*RST: C11, OFF
Additional parameters: OFF | ON (disables | enables the rejection of requests)

Example: See Configuring Reject Causes

Firmware/Software: V3.2.70

Options: R&S CMW-KS210

Manual operation: See "Location Update Reject Cause" on page 119

CONFigure:GSM:SIGN<i>:CELL:RCAuse:ATTach <CauseNumber>

Enables or disables the rejection of attach requests and selects the rejection cause to be transmitted.

Parameters:

<CauseNumber> C2 | C3 | C4 | C5 | C6 | C11 | C12 | C13 | C15 | C17 | C20 | C21 | C22 | C23 | C32 | C33 | C34 | C38 | C95 | C96 | C97 | C98 | C99 | C100 | C101 | C111 | C7 | C8 | C9 | C14 | C16 | C10 | C25 | C28 | C40 | C48

C2: IMSI unknown in HLR
C3: Illegal Mobile Subscriber
C4: IMSI unknown in VLR
C5: IMEI not accepted
C6: Illegal Mobile Equipment
C7: GPRS services not allowed
C8: GPRS services and non-GPRS services not allowed
C9: MS identity cannot be derived by the network
C10: Implicitly detached
C11: PLMN not allowed
C12: Location Area not allowed
C13: Roaming not allowed in location area
C14: GPRS services not allowed in this PLMN
C15: No suitable cells in location area
C16: MSC temporarily not reachable
C17: Network failure
C20: MAC failure
C21: Synch failure
C22: Congestion
C23: GSM authentication unacceptable
C25: Not authorized for this CSG
C28: SMS provided via GPRS in this Routing Area
C32: Service option unsupported
C33: Service option not subscribed
C34: Service option temporarily out of order
C38: Call not identified
C40: No PDP context activated
C48: Retry upon entry into a new cell
C95: Semantically incorrect message
C96: Invalid mandatory information
C97: Message type non-existent or not implemented
C98: Message type not compatible with protocol state
C99: Information element non-existent or not implemented
C100: Conditional information element error
C101: Message not compatible with protocol state
C111: Protocol error, unspecified

*RST: C11, OFF

Additional parameters: OFF | ON (disables | enables the rejection of requests)

Example: See Configuring Reject Causes

Firmware/Software: V3.2.70

Options: R&S CMW-KS210

Manual operation: See "Gmm Attach Reject Cause" on page 120

2.5.10.10 Security Settings

The following commands configure parameters related to the authentication procedure and other security procedures.

CONFigure:GSM:SIGN<i>:CELL:SECurity:AUTHenticat <Enable>

Enables or disables authentication, to be performed during location update or attach.

Parameters:

<Enable> OFF | ON

*RST: OFF

Example: See Configuring Security Settings

Firmware/Software: V3.0.20

Manual operation: See "Authentication" on page 120

CONFigure:GSM:SIGN<i>:CELL:SECurity:SKEY <SecretKey>

Defines the secret key Ki as 32-digit hexadecimal number. Leading zeros may be omitted.

Parameters:

<SecretKey> Range: #H0 to #HFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF

*RST: #H000102030405060708090A0B0C0D0E0F

Example: See Configuring Security Settings

Firmware/Software: V3.0.20

Options: R&S CMW-KS210

Manual operation: See "KI Value" on page 120

CONFigure:GSM:SIGN<i>:CELL:SECurity:SIMCard <SIMcardType>

Selects the type of the used SIM card.

Parameters:

<SIMcardType> C3G | C2G

C3G: 3G USIM
C2G: 2G SIM

*RST: C3G

Example: See Configuring Security Settings

Firmware/Software: V3.0.20

Options: R&S CMW-KS210

Manual operation: See "SIM Card Type" on page 120

2.5.10.11 Time Settings

The commands in this section configure and send date and time information to the MS.

CONFigure:GSM:SIGN<i>:CELL:TIME:TSOurce <SourceTime>

Selects the date and time source.

The time source DATE is configured via the following commands:

- `CONFigure:GSM:SIGN<i>:CELL:TIME:DATE`
- `CONFigure:GSM:SIGN<i>:CELL:TIME:TIME`
- `CONFigure:GSM:SIGN<i>:CELL:TIME:DSTime`

Parameters:

<SourceTime> CMWTime | DATE

CMWTime: Windows date and time
DATE: Date and time specified via remote commands

*RST: CMWT

Example: See Sending Date and Time Information to the MS

Firmware/Software: V3.0.20

Options: R&S CMW-KS210

Manual operation: See "Time Source" on page 121

CONFigure:GSM:SIGN<i>:CELL:TIME:DATE <Day>, <Month>, <Year>

Specifies the UTC date for the time source `DATE` (see `CONFigure:GSM:SIGN<i>:CELL:TIME:TSOurce`).

Parameters:

<Day> Range: 1 to 31
*RST: 11

<Month> Range: 1 to 12
*RST: 11

<Year> Range: 2011 to 9999
*RST: 2011

Example: See Sending Date and Time Information to the MS

Firmware/Software: V3.0.20

Options: R&S CMW-KS210

Manual operation: See "Date / Time (UTC)" on page 121

CONFigure:GSM:SIGN<i>:CELL:TIME:TIME <Hour>, <Minute>, <Second>

Specifies the UTC time for the time source `DATE` (see `CONFigure:GSM:SIGN<i>:CELL:TIME:TSOurce`).

Parameters:

<Hour> Range: 0 to 23
*RST: 11

<Minute> Range: 0 to 59
*RST: 11

<Second> Range: 0 to 59
*RST: 0

Example: See Sending Date and Time Information to the MS

Firmware/Software: V3.0.20

Options: R&S CMW-KS210

Manual operation: See "Date / Time (UTC)" on page 121

CONFigure:GSM:SIGN<i>:CELL:TIME:DSTime <Enable>

Specifies a Daylight Saving Time (DST) offset for the time source `DATE` (see `CONFigure:GSM:SIGN<i>:CELL:TIME:TSOurce` on page 295).

Parameters:

<Enable> P1H | P2H

P1H: +1h offset if DST is ON
P2H: +2h offset if DST is ON

*RST: OFF (P1H)
Additional parameters: OFF | ON (disables | enables DST)

Example: See Sending Date and Time Information to the MS

Firmware/Software: V3.0.20

Options: R&S CMW-KS210

Manual operation: See "Daylight Saving Time" on page 121

CONFigure:GSM:SIGN<i>:CELL:TIME:SNOW

Triggers the transfer of the date and time information to the MS.

Example: See Sending Date and Time Information to the MS

Usage: Event

Firmware/Software: V3.0.20

Options: R&S CMW-KS210

Manual operation: See "Send Time" on page 122

CONFigure:GSM:SIGN<i>:CELL:TIME:SATTach <Enable>

Enables the transfer of the date and time information to the MS at attach and location update.

Parameters:

<Enable> OFF | ON

Example: See Sending Date and Time Information to the MS

Firmware/Software: V3.2.30

Options: R&S CMW-KS210

Manual operation: See "Send Time" on page 122

2.5.10.12 Synchronization Settings

The commands in this section configure the synchronization to other signaling applications.

CONFigure:GSM:SIGN<i>:CELL:SYNC:OFFSet <Offset>

Configures the timing offset relative to the time zone.

Parameters:

<Offset> Range: 0 s to 12533.76 s
*RST: 0 s
Default unit: s

Example: See Configuring Network and MS Identities

Firmware/Software: V3.2.30

Manual operation: See "Synchronization Offset" on page 122

CONFigure:GSM:SIGN<i>:CELL:SYNC:ZONE <Zone>

Selects the synchronization zone for the signaling application.

Parameters:

<Zone> NONE | Z1

NONE: no synchronization
Z1: synchronization to zone 1
*RST: NONE

Example: See Configuring Network and MS Identities

Firmware/Software: V3.2.30

Manual operation: See "Synchronization Zone" on page 122

2.5.11 Connection Settings

The following commands configure settings for circuit switched or packet switched connections.

2.5.11.1 Common Connection Settings

The following commands configure the common settings for circuit switched and packet switched connections.

CONFigure:GSM:SIGN<i>:CONNection:FOFFset:DL <Offset>
CONFigure:GSM:SIGN<i>:CONNection:FOFFset[:UL] <Offset>

Sets the positive or negative offset to the center frequency of the uplink/downlink traffic channel.

Parameters:

<Offset> Range: -100E+3 Hz to 100E+3 Hz
*RST: 0 Hz
Default unit: Hz

Example: See Configuring Common Connection Settings

Firmware/Software: V3.2.30

Manual operation: See "Frequency Offset" on page 123

CONFigure:GSM:SIGN<i>:CONNection:RFOFfset <RandomFrqOffset>

Enables random frequency offset for the traffic channel. The R&S CMW randomly applies the positive and negative frequency offset.

Parameters:

<RandomFrqOffset> OFF | ON
*RST: OFF

Example: See Configuring Common Connection Settings

Firmware/Software: V3.2.30

Options: R&S CMW-KS210

Manual operation: See "Random Frequency Offset" on page 123

CONFigure:GSM:SIGN<i>:CONNection:TADVance <TimingAdvance>

Specifies the value which the MS uses to advance its UL timing.

Parameters:

<TimingAdvance> Range: 0 to 63
*RST: 0

Example: See Configuring Common Connection Settings

Firmware/Software: V3.2.70

Options: R&S CMW-KS210

Manual operation: See "Timing Advance" on page 124

2.5.11.2 CS Connections (General Parameters)

The following commands configure the DL traffic channel and other settings for circuit switched connections.

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:TSLot <Slot>

Selects a traffic channel timeslot for the circuit switched connection.

Parameters:

<Slot> Range: 1 to 7
*RST: 3

Example: See Configuring General CS Connection Settings

Firmware/Software: V1.0.15.0
V2.0.10: range extended (1 and 7 added)

Manual operation: See "Timeslot" on page 125

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:TMODe <Mode>

Selects the speech channel coding for circuit switched connections.

Parameters:

<Mode> FV1 | FV2 | HV1 | ANFG | ANHG | ANH8 | AWFG | AWF8 | AWH8

FV1: full-rate version 1 speech codec
FV2: full-rate version 2 speech codec
HV1: half-rate version 1 speech codec
ANFG: AMR narrowband full-rate GMSK codec
ANHG: AMR narrowband half-rate GMSK codec
ANH8: AMR narrowband half-rate 8PSK codec
AWFG: AMR wideband full-rate GMSK codec
AWF8: AMR wideband full-rate 8PSK codec
AWH8: AMR wideband half-rate 8PSK codec

*RST: FV1

Example: See Configuring General CS Connection Settings

Firmware/Software: V1.0.15.0
V2.0.10: added values FV2, HV1, ANFG, ANHG
V2.1.25 added value AWFG
V2.1.60: added values ANH8, AWF8, AWH8

Options: R&S CMW-KS210 for all modes except FV1

Manual operation: See "Traffic Mode" on page 125

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:HRSubchannel <Channel>

Selects the subchannel to be used for half-rate coding.

Parameters:

<Channel> Range: 0 to 1
*RST: 0

Example: See Configuring General CS Connection Settings

Firmware/Software: V2.1.60

Options: R&S CMW-KS210

Manual operation: See "HR Subchannel" on page 125

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:DSOurce <Mode>

Selects how the R&S CMW transmits data on its CS DL traffic channel.

ECHO is incompatible with an enabled test loop (see `CONFigure:GSM:SIGN<i>:CONNection:CSWitched:LOOP`).

Parameters:

<Mode> ECHO | PR9 | PR11 | PR15 | PR16 | SP1 | SP2

ECHO: loop-back of UL speech data after a fixed delay
PR9: PRBS 2E9-1
PR11: PRBS 2E11-1
PR15: PRBS 2E15-1
PR16: PRBS 2E16-1
SP1: speech interconnection from MS to codec board 1
SP2: speech interconnection from MS to codec board 2

*RST: ECHO

Example: See Configuring General CS Connection Settings

Firmware/Software: V2.1.60
V3.2.20: added SP1, SP2

Options: R&S CMW-KS210 for SP1, SP2

Manual operation: See "Data Source" on page 126

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:DTX:DL <Enable>, <NoDataFrames>, <SIDframes2part>

Configures the discontinuous transmission of the R&S CMW.

Level values are relative to the set TCH/PDCH level, see "DL Reference Level" on page 98.

Parameters:

<Enable> OFF | ON

Enable / disable DL DTX

*RST: OFF

<NoDataFrames> Relative level in the DL DTX frames, where no SID frames and no SACCH frames are sent

Range: -40 dB to 0 dB
*RST: 0 dB
Default unit: dB

<SIDframes2part> Relative level of the second part of SID frames. This level is required for test case 3GPP 51.010-1, TC 21.1.4.2, step 64.

Range: -40 dB to 0 dB
*RST: 0 dB
Default unit: dB

Example: See Configuring General CS Connection Settings

Firmware/Software: V3.2.70

Manual operation: See "DTX DL" on page 126

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:CRELease <CallRelease>

Specifies the signaling volume during the call release.

Parameters:

<CallRelease> NRELease | IRELease

NRELease: normal release
IRELease: immediate release

*RST: IREL

Example: See Configuring General CS Connection Settings

Firmware/Software: V3.2.30

Manual operation: See "Call Release" on page 126

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:EDELay <EchoDelay>

Defines the time that the R&S CMW waits before it loops back the received data in *Echo* mode.

Parameters:

<EchoDelay> Range: 0 s to 10 s
*RST: 2 s
Default unit: s

Example: See Configuring General CS Connection Settings

Firmware/Software: V3.2.70

Manual operation: See "Echo Delay" on page 126

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:LOOP <Loop>

Selects a test loop type and activates/deactivates the test loop (i.e. whether the MS is commanded to establish the test loop).

Parameters:

<Loop> C | A | B | D | I

A: TCH loop including signaling of erased frames
B: TCH loop without signaling of erased frames
C: TCH burst-by-burst loop
D: TCH loop including signaling of erased frames and unreliable frames
I: TCH loop for inband signaling

*RST: C, OFF
Additional parameters: OFF | ON (disables | enables the loop)

Example: See Configuring General CS Connection Settings

Firmware/Software: V1.0.15.0
V2.0.10: added values A, B
V3.0.20: added value I
V3.2.20: added value D

Options: R&S CMW-KS210 for all loop types except C

Manual operation: See "Loop" on page 127

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:LREClose <RecloseLoop>

Enables or disables automatic re-establishing a test loop after TCH reconfiguration. Re-establishing the test loop is required for MS that open an established test loop when a TCH reconfiguration is performed.

Parameters:

<RecloseLoop> OFF | ON
*RST: OFF

Example: See Configuring General CS Connection Settings

Firmware/Software: V2.0.10

Manual operation: See "Loop" on page 127

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:CID <ID>

Defines a 1 to 20-digit ID number for SMS and circuit switched calls, to be displayed at the mobile under test. Values are entered as number digits according to table 2-5.

Parameters:

<ID> Range: '0' to 'cccccccccccccccccccc' (string)
*RST: '12345'

Example: See Configuring General CS Connection Settings

Firmware/Software: V1.0.15.0

Manual operation: See "Caller ID" on page 127

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:TCHassign <TCHassignment>

Specifies at which time during call/connection setup the traffic channel is assigned.

Parameters:

<TCHassignment> VEARly | EARLy | LATE

VEARly: The TCH is assigned very early. Signaling is done via the Fast Associated Control Channel (FACCH).
EARLy: The TCH is assigned early, which means that alerting takes place on the TCH. For call setup to the traffic channel signaling is done via the Standalone Dedicated Control Channel (SDCCH).
LATE: The traffic channel is assigned late, which means after alerting. For call setup to the traffic channel and alerting signaling is done via the SDCCH.

*RST: VEAR

Example: See Configuring General CS Connection Settings

Firmware/Software: V2.0.10

Manual operation: See "TCH Assignment" on page 128

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:RFACch <Enable>
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:RSACch <Enable>

Enables/disables repeated FACCH and repeated SACCH transmission in the DL GSM signal.

Parameters:

<Enable> OFF | ON

*RST: OFF

Example: See Measuring in FER FACCH and FER SACCH Mode

Firmware/Software: V2.1.25

Options: R&S CMW-KS210

Manual operation: See "Repeated SACCH" on page 128

2.5.11.3 AMR Configuration

The following commands configure the Adaptive Multi-Rate (AMR) codec for speech channel coding of circuit switched voice connections.

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:RSET:NB:FRATe:GMSK <CodecMode>(4)

Configures up to four supported modes for the full-rate narrowband AMR codec (GMSK modulation), i.e. assigns data rates to the modes.

The four data rates must be different from each other. They are automatically sorted in descending order so that Rate (Mode 4) > Rate (Mode 3) > Rate (Mode 2) > Rate (Mode 1). You can deactivate modes (OFF) to restrict the test model to less than 4 supported modes.

Parameters:

<CodecMode> C0475 | C0515 | C0590 | C0670 | C0740 | C0795 | C1020 | C1220

Comma separated list of 4 values: data rates for mode 4 to 1
C0475 to C1220: 4.75 kBit/s to 12.2 kBit/s
Additional parameters: OFF | ON (disables | enables the mode)

*RST: C1220, C0795, C0590, C0475

Example: See Configuring AMR Settings

Firmware/Software: V2.0.10

Options: R&S CMW-KS210

Manual operation: See "Rate Set" on page 130

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:RSET:NB:HRATe:GMSK <CodecMode>(4)

Configures up to four supported modes for the half-rate narrowband AMR codec (GMSK modulation), i.e. assigns data rates to the modes.

The selected data rates must be different. They are automatically sorted so that Rate (Mode 4) > Rate (Mode 3) > Rate (Mode 2) > Rate (Mode 1). You can deactivate modes (OFF) to restrict the test model to less than 4 supported modes.

Parameters:

<CodecMode> C0475 | C0515 | C0590 | C0670 | C0740 | C0795

Comma separated list of 4 values: data rates for mode 4 to 1
C0475 to C0795: 4.75 kBit/s to 7.95 kBit/s
Additional parameters: OFF | ON (disables | enables the mode)

*RST: C0795, C0670, C0590, C0515

Example: See Configuring AMR Settings

Firmware/Software: V2.0.10

Options: R&S CMW-KS210

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:RSET:NB:HRATe:EPSK <CodecMode>(4)

Configures up to four supported modes for the half-rate narrowband AMR codec (8PSK modulation), i.e. assigns data rates to the modes.

The four data rates must be different from each other. They are automatically sorted in descending order so that Rate (Mode 4) > Rate (Mode 3) > Rate (Mode 2) > Rate (Mode 1). You can deactivate modes (OFF) to restrict the test model to less than 4 supported modes.

Parameters:

<CodecMode> C0475 | C0515 | C0590 | C0670 | C0740 | C0795 | C1020 | C1220

Comma separated list of 4 values: data rates for mode 4 to 1
C0475 to C1220: 4.75 kBit/s to 12.2 kBit/s
Additional parameters: OFF | ON (disables | enables the mode)

*RST: C1220, C0795, C0590, C0475

Example: See Configuring AMR Settings

Firmware/Software: V2.1.60

Options: R&S CMW-KS210

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:RSET:WB:FRATe:GMSK <CodecMode>(3)

Configures up to three supported modes for the half-rate narrowband AMR codec (GMSK modulation), i.e. assigns data rates to the modes.

The selected data rates must be different. They are automatically sorted so that Rate (Mode 3) > Rate (Mode 2) > Rate (Mode 1). You can deactivate modes (OFF) to restrict the test model to less than 3 supported modes.

Parameters:

<CodecMode> C0660 | C0885 | C1265

Comma separated list of 3 values: data rates for mode 3 to 1
C0660 to C1265: 6.60 kBit/s to 12.65 kBit/s
Additional parameters: OFF | ON (disables | enables the mode)

*RST: C1265, C0885, C0660

Example: See Configuring AMR Settings

Firmware/Software: V2.1.25

Options: R&S CMW-KS210

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:RSET:WB:FRATe:EPSK <CodecMode>(4)

Configures up to four supported modes for the full-rate wideband AMR codec (8PSK modulation), i.e. assigns data rates to the modes.

The four data rates must be different from each other. They are automatically sorted in descending order so that Rate (Mode 4) > Rate (Mode 3) > Rate (Mode 2) > Rate (Mode 1). You can deactivate modes (OFF) to restrict the test model to less than 4 supported modes.

Parameters:

<CodecMode> C0660 | C0885 | C1265 | C1585 | C2385

Comma separated list of 4 values: data rates for mode 4 to 1
C0660 to C2385: 6.6 kBit/s to 23.85 kBit/s
Additional parameters: OFF | ON (disables | enables the mode)

*RST: C2385, C1585, C1265, C0660

Example: See Configuring AMR Settings

Firmware/Software: V2.1.60

Options: R&S CMW-KS210

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:RSET:WB:HRATe:EPSK <CodecMode>(3)

Configures up to three supported modes for the half-rate wideband AMR codec (8PSK modulation), i.e. assigns data rates to the modes.

The three data rates must be different from each other. They are automatically sorted in descending order so that Rate (Mode 3) > Rate (Mode 2) > Rate (Mode 1). You can deactivate modes (OFF) to restrict the test model to less than 3 supported modes.

Parameters:

<CodecMode> C0660 | C0885 | C1265

Comma separated list of 3 values: data rates for mode 3 to 1
C0660 to C1265: 6.6 kBit/s to 12.65 kBit/s
Additional parameters: OFF | ON (disables | enables the mode)

*RST: C1265, C0885, C0660

Example: See Configuring AMR Settings

Firmware/Software: V2.1.60

Options: R&S CMW-KS210

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:THReshold:NB:FRATe:GMSK <Threshold>(6)
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:THReshold:NB:HRATe:EPSK <Threshold>(6)
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:THReshold:NB:HRATe:GMSK <Threshold>(6)
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:THReshold:WB:FRATe:EPSK <Threshold>(6)
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:THReshold:WB:FRATe:GMSK <Threshold>(6)
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:THReshold:WB:HRATe:EPSK <Threshold>(6)

Selects the upper and lower limits for the codec mode swapping.

The threshold sequence is following: lower 4, upper 3, lower 3, upper 2, lower 2, upper 1. thresholds. Value OFF disables threshold.

Parameters:

<Threshold> **OFF**: threshold disabled
0 dB to 31.5 dB: limit of codec mode

Range: OFF, 0 dB to 31.5 dB
*RST: 16.5 dB
Default unit: dB

Example: See Configuring AMR Settings

Firmware/Software: V3.2.20

Options: R&S CMW-KS210

Manual operation: See "Threshold" on page 131

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:CMODe:NB:FRATe:GMSK:DL <CodecMode>
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:CMODe:NB:FRATe:GMSK:UL <CodecMode>

Select the codec modes to be used by the R&S CMW (downlink) and the MS (uplink) for the full-rate narrowband AMR codec (GMSK modulation).

Only active codec modes can be selected. For configuration and activation/deactivation of the codec modes see `CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:RSET:NB:FRATe:GMSK` on page 305.

Parameters:

<CodecMode>	Range:	1 to 4 (if all codec modes are active, otherwise less)
	*RST:	3

Example: See Configuring AMR Settings

Firmware/Software: V2.0.10

Options: R&S CMW-KS210

Manual operation: See "Codec Mode Downlink / Uplink" on page 130

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:CMODe:NB:HRATe:GMSK:DL <CodecMode>
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:CMODe:NB:HRATe:GMSK:UL <CodecMode>

Select the codec modes to be used by the R&S CMW (downlink) and the MS (uplink) for the half-rate narrowband AMR codec (GMSK modulation).

Only active codec modes can be selected. For configuration and activation/deactivation of the codec modes see `CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:RSET:NB:HRATe:GMSK` on page 306.

Parameters:

<CodecMode>	Range:	1 to 4 (if all codec modes are active, otherwise less)
	*RST:	3

Example: See Configuring AMR Settings

Firmware/Software: V2.0.10

Options: R&S CMW-KS210

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:CMODe:NB:HRATe:EPSK:DL <CodecMode>
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:CMODe:NB:HRATe:EPSK:UL <CodecMode>

Select the codec modes to be used by the R&S CMW (downlink) and the MS (uplink) for the half-rate narrowband AMR codec (8PSK modulation).

Only active codec modes can be selected. For configuration and activation/deactivation of the codec modes see `CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:RSET:NB:HRATe:EPSK` on page 306.

Parameters:

<CodecMode>	Range:	1 to 4 (if all codec modes are active, otherwise less)
	*RST:	3

Example: See Configuring AMR Settings

Firmware/Software: V2.1.60

Options: R&S CMW-KS210

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:CMODe:WB:FRATe:GMSK:DL <CodecMode>
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:CMODe:WB:FRATe:GMSK:UL <CodecMode>

Select the codec modes to be used by the R&S CMW (downlink) and the MS (uplink) for the full-rate wideband AMR codec (GMSK modulation).

Only active codec modes can be selected. For configuration and activation/deactivation of the codec modes see `CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:RSET:WB:FRATe:GMSK`.

Parameters:

<CodecMode>	Range:	1 to 3 (if all codec modes are active, otherwise less)
	*RST:	3

Example: See Configuring AMR Settings

Firmware/Software: V2.1.25

Options: R&S CMW-KS210

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:CMODe:WB:FRATe:EPSK:DL <CodecMode>
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:CMODe:WB:FRATe:EPSK:UL <CodecMode>

Select the codec modes to be used by the R&S CMW (downlink) and the MS (uplink) for the full-rate wideband AMR codec (8PSK modulation).

Only active codec modes can be selected. For configuration and activation/deactivation of the codec modes see `CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:RSET:WB:FRATe:EPSK` on page 307.

Parameters:

<CodecMode>	Range:	1 to 4 (if all codec modes are active, otherwise less)
	*RST:	3

Example: See Configuring AMR Settings

Firmware/Software: V2.1.60

Options: R&S CMW-KS210

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:CMODe:WB:HRATe:EPSK:DL <CodecMode>
CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:CMODe:WB:HRATe:EPSK:UL <CodecMode>

Select the codec modes to be used by the R&S CMW (downlink) and the MS (uplink) for the half-rate wideband AMR codec (8PSK modulation).

Only active codec modes can be selected. For configuration and activation/deactivation of the codec modes see `CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:RSET:WB:HRATe:EPSK` on page 307.

Parameters:

<CodecMode>	Range:	1 to 3 (if all codec modes are active, otherwise less)
	*RST:	3

Example: See Configuring AMR Settings

Firmware/Software: V2.1.60

Options: R&S CMW-KS210

SENSe:GSM:SIGN<i>:MSSinfo:AMR:CMODe:NB:HRATe:EPSK:DL?
SENSe:GSM:SIGN<i>:MSSinfo:AMR:CMODe:NB:HRATe:EPSK:UL?
SENSe:GSM:SIGN<i>:MSSinfo:AMR:CMODe:WB:FRATe:EPSK:DL?
SENSe:GSM:SIGN<i>:MSSinfo:AMR:CMODe:WB:FRATe:EPSK:UL?
SENSe:GSM:SIGN<i>:MSSinfo:AMR:CMODe:WB:HRATe:EPSK:DL?
SENSe:GSM:SIGN<i>:MSSinfo:AMR:CMODe:WB:HRATe:EPSK:UL?
SENSe:GSM:SIGN<i>:MSSinfo:AMR:CMODe:NB:FRATe:GMSK:DL?
SENSe:GSM:SIGN<i>:MSSinfo:AMR:CMODe:NB:FRATe:GMSK:UL?
SENSe:GSM:SIGN<i>:MSSinfo:AMR:CMODe:NB:HRATe:GMSK:DL?
SENSe:GSM:SIGN<i>:MSSinfo:AMR:CMODe:NB:HRATe:GMSK:UL?
SENSe:GSM:SIGN<i>:MSSinfo:AMR:CMODe:WB:FRATe:GMSK:DL?
SENSe:GSM:SIGN<i>:MSSinfo:AMR:CMODe:WB:FRATe:GMSK:UL?

Query the DL AMR codec mode requested by the MS (:DL) and the actual UL codec mode used by the MS (:UL). Separate commands are available for the half-rate (HRATe) and full-rate (FRATe) narrowband (NB) and wideband (WB) AMR codecs, for GMSK and 8PSK modulation.

For the modes really used in downlink and requested for uplink, refer to the `CONFigure:GSM:SIGN<i>:CONNection:CSWitched:AMR:CMODe:...` commands.

Return values:

<CodecMode>	Range:	1 to 4 (1 to 3 for WB:FRATe:GMSK and WB:HRATe:EPSK)

Example: See Configuring AMR Settings

Usage: Query only

Firmware/Software: V2.0.10
V2.1.25: AMR-WB codec commands added
V2.1.60: EPSK commands added

Options: R&S CMW-KS210

2.5.11.4 VAMOS Configuration

The following commands configure Voice services over Adaptive Multi-user Channels on One Slot (VAMOS) for circuit switched connections.

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:VAMos:ENABle <Enable>

Activates or deactivates Voice services over Adaptive Multi-user Channels on One Slot (VAMOS).

Parameters:
<Enable> OFF | ON
*RST: OFF

Example: See Configuring VAMOS Support

Firmware/Software: V2.0.10

Options: R&S CMW-KS203

Manual operation: See "Enable" on page 132

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:VAMos:MSLevel <Mode>

Selects the VAMOS support level of the mobile.

Parameters:
<Mode> VAM1 | VAM2
VAMOS support levels I or II
*RST: VAM1

Example: See Configuring VAMOS Support

Firmware/Software: V2.0.20

Options: R&S CMW-KS203

Manual operation: See "Mobile Support Level" on page 132

CONFigure:GSM:SIGN<i>:CONNection:CSWitched:VAMos <Subchannel>, <TSCactiveSubch>, <TSCsetActSubch>, <TSCotherSubch>, <TSCsetOthSubch>, <SubchPowImbRat>, <Proflie>

Configures VAMOS. For background information see chapter 2.2.9.4, "VAMOS", on page 31.

Parameters:

<Subchannel> VAMOS subchannel to be used for the DUT (active subchannel)
Range: 0 to 1
*RST: 0

<TSCactiveSubch> TSC to be used for the DUT (active subchannel)
Range: 0 to 7
*RST: 0

<TSCsetActSubch> TSC set to be used for the DUT (active subchannel)
Range: 1 to 2
*RST: 1

<TSCotherSubch> TSC to be used for the virtual second VAMOS user (other subchannel)
Range: 0 to 7
*RST: 0

<TSCsetOthSubch> TSC set to be used for the virtual second VAMOS user (other subchannel)
Range: 1 to 2
*RST: 2

<SubchPowImbRat> Subchannel power imbalance ratio, i.e. power of VAMOS subchannel 0 relative to VAMOS subchannel 1
Range: -15 dB to 15 dB
*RST: 0 dB
Default unit: dB

<Proflie> SUSer | TUSer | TUDTx
VAMOS profile, determines that the DL signal is generated for:
SUSer: Single VAMOS user. There is no second VAMOS user (not even in DTX mode).
TUSer: Two active VAMOS users. The downlink signal contains speech frames and signaling data for both users.
TUDTx: Two VAMOS users, DUT active, second user in DTX mode. The downlink signal contains speech frames for the DUT only. For the virtual user DTX is transmitted.
*RST: TUS

Example: See Configuring VAMOS Support

Firmware/Software: V2.0.10

Options: R&S CMW-KS203

Manual operation: See "Active Subchannel" on page 132

2.5.11.5 PS Connections

The following commands configure settings for packet switched connections. For additional settings see also chapter 2.5.6, "Slot Configuration and Resulting Throughput", on page 226.

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:SERVice <Service>

Selects a service mode for the PS connection.

Parameters:

<Service> TMA | TMB | BLER | SRB

TMA: test mode A
TMB: test mode B
BLER: BLER mode
SRB: EGPRS switched radio block loopback mode

*RST: BLER

Example: See Configuring PS Connection Settings

Firmware/Software: V2.0.20
V2.1.60: SRB added

Manual operation: See "Service Selection" on page 134

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:TLEVel <TBFlevel>

Selects the set of modulation and coding schemes to be used.

Parameters:

<TBFlevel> GPRS | EGPRs | EG2A

GPRS
CS-1 to CS-4

EGPRs
MCS-1 to MCS-9

EG2A
DL: MCS-1 to MCS-4, MCS-7, MCS-8, DAS-5 to DAS-12
UL: MCS-1 to MCS-6, UAS-7 to UAS-11

*RST: EGPR

Example: See Configuring PS Connection Settings

Firmware/Software: V2.0.20

Options: R&S CMW-KS201 for EG2A

Manual operation: See "TBF Level" on page 82

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:CSCHeme:UL <CScheme>

Selects the coding scheme for uplink packet data channels.

The selected value must be compatible to the configured set of modulation and coding schemes, see `CONFigure:GSM:SIGN<i>:CONNection:PSWitched:TLEVel` on page 314.

Parameters:

<CScheme> C1 | C2 | C3 | C4 | MC1 | MC2 | MC3 | MC4 | MC5 | MC6 | MC7 | MC8 | MC9 | UA7 | UA8 | UA9 | UA10 | UA11

C1 to C4: CS-1 to CS-4
MC1 to MC9: MCS-1 to MCS-9
UA7 to UA11: UAS-7 to UAS-11

*RST: MC1

Example: See Configuring PS Connection Settings

Firmware/Software: V2.0.20

Options: R&S CMW-KS201 for UAS-i

Manual operation: See "UL Coding Scheme" on page 83

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:IREDundancy <Enable>

Enables or disables the incremental redundancy RLC mode for the downlink.

Parameters:

<Enable> OFF | ON

*RST: ON

Example: See Configuring PS Connection Settings

Firmware/Software: V3.0.20

Options: R&S CMW-KS210

Manual operation: See "Incremental Redundancy" on page 135

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:DSOurce <Mode>

Selects the data which the R&S CMW transmits on its DL traffic channel for PS connections.

Parameters:

<Mode> PR9 | PR11 | PR15 | PR16

PR9: PRBS 2E9-1
PR11: PRBS 2E11-1
PR15: PRBS 2E15-1
PR16: PRBS 2E16-1

*RST: PR9

Example: See Configuring PS Connection Settings

Firmware/Software: V2.0.20

Options: R&S CMW-KS210

Manual operation: See "Data Source" on page 135

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:DLDCarrier:ENABle <Enable>

Enables or disables the downlink dual carrier mode. In this mode, the R&S CMW uses two radio frequency channels to assign resources to the mobile station; see 3GPP TS 44.060.

Some settings can be configured individually per carrier. The related commands distinguish the two carriers via the mnemonics `CARRier1` and `CARRier2`. See e.g. `CONFigure:GSM:SIGN<i>:RFSettings:CHANnel:TCH[:CARRier<c>]` on page 256.

Parameters:

<Enable> OFF | ON

*RST: OFF

Example: See Configuring PS Connection Settings

Firmware/Software: V2.0.20

Options: R&S CMW-KS201

Manual operation: See "DL Dual Carrier" on page 135

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:EDALlocation <Mode>

Enables or disables the optional medium access mode "extended dynamic allocation".

Parameters:

<Mode>	OFF | ON | AUTO **OFF**: disabled **ON**: enabled **AUTO**: enabled if supported by the mobile, otherwise disabled *RST: AUTO

Example: See Configuring PS Connection Settings

Firmware/Software: V3.0.20

Manual operation: See "Extended Dynamic Allocation" on page 136

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:NOPDus <Number>

Number of PDUs that the MS is to transmit in the uplink during GPRS test mode A. If supported by the mobile, a value of 0 can be used to request an "infinite" test mode that is not terminated by the mobile after a certain number of PDUs.

Parameters:

<Number>	Range: 0 to 4095 *RST: 4095

Example: See Configuring PS Connection Settings

Firmware/Software: V2.0.20

Manual operation: See "No of PDUs" on page 136

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:SOFFset <Offset>

Timeslot that is to be taken as the first DL timeslot when the MS is in multislot operation (downlink timeslot offset parameter in the GPRS_TEST_MODE_CMD).

Parameters:

<Offset>	Range: 0 to 7 *RST: 0

Example: See Configuring PS Connection Settings

Firmware/Software: V2.0.20

Manual operation: See "Slot Offset" on page 136

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:CATYpe <Mode>

Selects the burst type to be used by a mobile for sending a PACKET CONTROL ACKNOWLEDGEMENT.

Parameters:

<Mode> NBURsts | ABURsts

NBURsts: normal bursts
ABURsts: access bursts

*RST: NBUR

Example: See Configuring PS Connection Settings

Firmware/Software: V2.1.60

Manual operation: See "Control Ack Type" on page 136

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:BPERiod<no> <Value>

Configures the BEP_PERIOD2 defined in 3GPP TS 45.008 that the MS uses for the mean BEP and the CV BEP calculation.

Suffix:

<no> 2
Fixed suffix

Parameters:

<Value> Range: 0 to 15
*RST: 15
ON (OFF) commands the MS to apply (not apply) the BEP period 2.

Example: See Configuring PS Connection Settings

Firmware/Software: V3.2.30

Manual operation: See "BEP Period 2" on page 136

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:BDCRate <Rate>

Specifies volume of corrupted data the R&S CMW generates.

Parameters:

<Rate> Range: 0 % to 100 %
*RST: 0 %
Default unit: %

Example: See Configuring PS Connection Settings

Firmware/Software: V3.2.20

Options: R&S CMW-KS210

Manual operation: See "BCS Data Corruption Rate" on page 137

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:DPControl:ENABle <Enable>

Enables/disables downlink power control.

Parameters:

<Enable> OFF | ON

*RST: OFF

Example: See Configuring PS Connection Settings

Firmware/Software: V3.2.30

Manual operation: See "Enable" on page 137

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:DPControl:P <P0>

Defines a power reduction relative to BCCH.

Parameters:

<P0> DB0 | DB2 | DB4 | DB6 | DB8 | DB10 | DB12 | DB14 | DB16 | DB18 | DB20 | DB22 | DB24 | DB26 | DB28 | DB30

0 dB to 30 dB

*RST: DB0

Example: See Configuring PS Connection Settings

Firmware/Software: V3.2.30

Manual operation: See "P0" on page 137

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:DPControl:PMODe <PRmode>

Defines the power reduction mode of the downlink power control.

Parameters:

<PRmode> PMA | PMB

PMA: power reduction mode A
PMB: power reduction mode B

*RST: PMA

Example: See Configuring PS Connection Settings

Firmware/Software: V3.2.30

Manual operation: See "PR Mode" on page 137

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:DPControl:PFIeld <PRfield>

Indicates the power level reduction of the current RLC block.

Parameters:

<PRfield> DB0 | DB3 | DB7 | NUSable

DB0: 0 dB to 3 dB (excluded) less than BCCH level - P0
DB3: 3 dB to 7dB (excluded) less than BCCH level - P0
DB7: 7 dB to 10 dB less than BCCH level - P0
NUSable: not usable - PR field shall be ignored by the MS

*RST: NUS

Example: See Configuring PS Connection Settings

Firmware/Software: V3.2.30

Manual operation: See "PR Field" on page 137

CONFigure:GSM:SIGN<i>:CONNection:PSWitched:ASRDblocks <Enable>

Enables the filler dummy data blocks.

Parameters:

<Enable> OFF | ON

*RST: OFF

Example: See Configuring PS Connection Settings

Firmware/Software: V3.2.30

Manual operation: See "Always send RLC Data Blocks" on page 137

2.5.12 Trigger Signal Settings

The following command configures trigger signals provided by the "GSM Signaling" application. For an overview of all supported trigger signals see chapter 2.2.10, "Trigger Signals", on page 34.

CONFigure:GSM:SIGN<i>:TRIGger:FTMode <FrameTriggerMod>

Configures the frame trigger signal.

Parameters:

<FrameTriggerMod> EVERy | EWIDle | M26 | M52 | M104

EVERy: The frame trigger signal is generated for each uplink frame (single frame trigger).
EWIDle: The frame trigger signal is generated for each uplink frame except for idle frames (single frame trigger).
M26 | M52 | M104: The frame trigger signal is generated for each 26th, 52nd or 104th uplink frame (multiframe trigger).

*RST: EVER

Example: See Configuring Trigger Signals

Firmware/Software: V2.0.10

Manual operation: See "Frame Trigger Mode" on page 138

2.5.13 Messaging (SMS)

The following commands configure parameters of the Short Message Service (SMS) and return information about received short messages.

CONFigure:GSM:SIGN<i>:SMS:OUTGoing:SDOMain <SMSdomain>

Selects the core network domain for the outgoing SMS.

Parameters:

<SMSdomain> AUTO | CS | PS

AUTO: domain of actual connection
CS: circuit switched domain
PS: packet switched domain

*RST: AUTO

Example: See Sending / Receiving an SMS

Firmware/Software: V3.2.20

Manual operation: See "SMS Domain" on page 139

CONFigure:GSM:SIGN<i>:SMS:OUTGoing:INTernal <SMSInternal>

Defines the message text for SMS messages to be sent to the MS. It is encoded as 7-bit ASCII text.

Parameters:

<SMSInternal> String with up to 800 characters

RST: "R&S Short Message Service Text. The quick brown fox jumps over the lazy dog.THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG. 0123456789 !"#%+-/()<>?=;@$,"

Example: See Sending / Receiving an SMS

Firmware/Software: V2.0.10

Manual operation: See "Outgoing SMS" on page 140

CONFigure:GSM:SIGN<i>:SMS:OUTGoing:BINary <SMSbinary>

Defines the SMS message encoded as 8-bit binary data.

Parameters:

<SMSbinary> SMS message in hexadecimal format.

Example: See Sending / Receiving an SMS

Firmware/Software: V3.2.20

Manual operation: See "Outgoing SMS binary" on page 140

CONFigure:GSM:SIGN<i>:SMS:OUTGoing:CGRoup <CodingGroup>

Defines how to interprete SMS signaling information.

Coding groups are defined in 3GPP TS 23.038 chapter 4.

Parameters:

<CodingGroup> GDCoding | DCMClass

GDCoding: general data coding
DCMClass: data coding / message class

*RST: GDC

Example: See Sending / Receiving an SMS

Firmware/Software: V3.2.20

Manual operation: See "Coding Group" on page 140

CONFigure:GSM:SIGN<i>:SMS:OUTGoing:DCODing <DataCoding>

Defines the short message coding.

Parameters:

<DataCoding> BIT7 | BIT8

BIT7: GSM 7 bit default alphabet
BIT8: 8-bit data for SMS binary

*RST: BIT7

Example: See Sending / Receiving an SMS

Firmware/Software: V3.2.20

Manual operation: See "Data Coding / Character Set" on page 140

CONFigure:GSM:SIGN<i>:SMS:OUTGoing:MCLass <MessageClass>

Specifies default routing of SMS as defined in 3GPP TS 23.038. The users override any default meaning by selecting their own routing.

Parameters:

<MessageClass> CL0 | CL1 | CL2 | CL3 | NONE

CL0: class 0, SMS not to be stored automatically
CL1: SMS to be stored in mobile equipment
CL2: SMS to be stored in SIM
CL3: SMS to be stored in terminal equipment (see 3GPP TS 07.05)
NONE: no message class (relevant only for general data coding)

*RST: NONE

Example: See Sending / Receiving an SMS

Firmware/Software: V3.2.20

Manual operation: See "Message Class" on page 140

CONFigure:GSM:SIGN<i>:SMS:OUTGoing:OADDress <OrigAddress>

Specifies the phone number of the device which has sent SMS.

Parameters:

<OrigAddress> *RST: 815654321

Example: See Sending / Receiving an SMS

Firmware/Software: V3.2.20

Manual operation: See "Originating Address" on page 140

CONFigure:GSM:SIGN<i>:SMS:OUTGoing:OSADdress <OrigSMSCAddress>

Specifies the phone number of SMS center.

Parameters:

<OrigSMSCAddress> *RST: 54321

Example: See Sending / Receiving an SMS

Firmware/Software: V3.2.20

Manual operation: See "Originator SMSC Address" on page 140

SENSe:GSM:SIGN<i>:SMS:OUTGoing:INFO:SEGMent?

Displays the currently processed SMS segment and the total number of segments.

Return values:

<Current> Parameter invalid for the first segment

Range: 2 to 6

<Number> Parameter invalid for the first segment

Range: 2 to 6

Example: See Sending / Receiving an SMS

Usage: Query only

Firmware/Software: V3.2.70

Manual operation: See "Segment" on page 141

CONFigure:GSM:SIGN<i>:SMS:OUTGoing:SCTStamp:DATE <Day>, <Month>, <Year>

Specifies the service center time stamp date for the time source `DATE` (see `CONFigure:GSM:SIGN<i>:SMS:OUTGoing:SCTStamp:TSOurce`).

Parameters:

<Day>	Range:	1 to 31
	*RST:	11
<Month>	Range:	1 to 12
	*RST:	11
<Year>	Range:	2011 to 9999
	*RST:	2011

Example: See Sending / Receiving an SMS

Firmware/Software: V3.2.70

Options: R&S CMW-KS210

Manual operation: See "Date / Time" on page 141

CONFigure:GSM:SIGN<i>:SMS:OUTGoing:SCTStamp:TIME <Hour>, <Minute>, <Second>

Specifies the service center time stamp time for the time source `DATE` (see `CONFigure:GSM:SIGN<i>:SMS:OUTGoing:SCTStamp:TSOurce`).

Parameters:

<Hour>	Range:	0 to 23
	*RST:	11
<Minute>	Range:	0 to 59
	*RST:	11
<Second>	Range:	0 to 59
	*RST:	0

Example: See Sending / Receiving an SMS

Firmware/Software: V3.2.70

Options: R&S CMW-KS210

Manual operation: See "Date / Time" on page 141

CONFigure:GSM:SIGN<i>:SMS:OUTGoing:SCTStamp:TSOurce <SourceTime>

Selects the date and time source for service center time stamp.

The time source DATE is configured via the following commands:

- `CONFigure:GSM:SIGN<i>:SMS:OUTGoing:SCTStamp:DATE`
- `CONFigure:GSM:SIGN<i>:SMS:OUTGoing:SCTStamp:TIME`

Parameters:

<SourceTime> CMWTime | DATE

CMWTime: Windows date and time
DATE: Date and time specified via remote commands

*RST: CMWT

Example: See Sending / Receiving an SMS

Firmware/Software: V3.2.70

Options: R&S CMW-KS210

Manual operation: See "Time Source" on page 141

SENSe:GSM:SIGN<i>:SMS:INComing:INFO:DCODing?

Queries the short message coding.

Return values:

<MessageEncoding>

Example: See Sending / Receiving an SMS

Usage: Query only

Firmware/Software: V3.2.20

Manual operation: See "Data Coding / Character Set" on page 142

SENSe:GSM:SIGN<i>:SMS:INComing:INFO:MTEXt?

Returns the text of the last SMS message received from the MS. Only 7-bit ASCII text is supported.

Return values:

<MessageText> Message text as string

Example: See Sending / Receiving an SMS

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "Message Text / Message Length" on page 142

SENSe:GSM:SIGN<i>:SMS:INComing:INFO:MLENgth?

Returns the length of the last SMS message received from the MS.

Return values:

<MessageLength> Number of characters of the message

Range: 0 to 800

Example: See Sending / Receiving an SMS

Usage: Query only

Firmware/Software: V2.0.10
V3.2.30: range extended

Manual operation: See "Message Text / Message Length" on page 142

SENSe:GSM:SIGN<i>:SMS:INComing:INFO:SEGMent?

Queries the current and total number of segments of the concatenated SMS message.

Return values:

<Current> Parameter not available for the first segment

Range: 2 to 12

<Number> Parameter not available for the first segment

Range: 2 to 12

Example: See Sending / Receiving an SMS

Usage: Query only

Firmware/Software: V3.2.30

Manual operation: See "Segment" on page 142

CLEan:GSM:SIGN<i>:SMS:INComing:INFO:MTEXt

Resets all parameters related to a received SMS message. The message text and the information about the message length are deleted. The "message read" flag is set to true.

Example: See Sending / Receiving an SMS

Usage: Event

Firmware/Software: V2.0.10

Manual operation: See "Clear Message Text" on page 142

SENSe:GSM:SIGN<i>:SMS:INFO:LRMessage:RFLag?

Queries the "message read" flag for the last received message.

The flag is true (ON) in the following cases:

- No SMS message has been received.
- The last received SMS message has been read, see `SENSe:GSM:SIGN<i>:SMS:INComing:INFO:MTEXt?` on page 325.
- The last received SMS message has been deleted, see `CLEan:GSM:SIGN<i>:SMS:INComing:INFO:MTEXt` on page 326.

Return values:

<LastRecMessRead> OFF | ON

OFF: unread message available
ON: no unread message available
*RST: ON

Example: See Sending / Receiving an SMS

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "Clear Message Text" on page 142

2.5.14 Measurement Slot Settings

The following command configures the UL measurement slot.

CONFigure:GSM:SIGN<i>:MSLot:UL <Slot>

Specifies the uplink measurement slot, i.e. the slot evaluated by measurements running in parallel to the "GSM Signaling" application.

Parameters:

<Slot> Range: 0 to 7
*RST: 3

Example: See Configuring General CS Connection Settings

Firmware/Software: V2.0.10

Manual operation: See "Measurement Slot UL" on page 143

2.5.15 MS Measurement Report Settings

The following commands configure MS measurement reports.

CONFigure:GSM:SIGN<i>:MSReport:ENABle <Enable>

Enables or disables the MS measurement report.

Parameters:

<Enable> OFF | ON

*RST: OFF

Example: See Configuring MS Measurement Reports

Firmware/Software: V3.2.70

Manual operation: See "Report" on page 144

CONFiguure:GSM:SIGN<i>:MSReport:LMQuantity <Quantity>

Selects whether the MS shall determine the RSRP or the RSRQ during LTE neighbor cell measurements.

Parameters:

<Quantity> RSRP | RSRQ

*RST: RSRP

Example: See Configuring MS Measurement Reports

Firmware/Software: V3.2.70

Manual operation: See "LTE Measurement Quantity" on page 144

CONFigure:GSM:SIGN<i>:MSReport:WMQuantity <Quantity>

Selects whether the MS shall determine the RSCP or the Ec/No during WCDMA neighbor cell measurements.

Parameters:

<Quantity> RSCP | ECNO

*RST: RSCP

Example: See Configuring MS Measurement Reports

Firmware/Software: V3.2.70

Manual operation: See "WCDMA Measurement Quantity" on page 144

2.5.16 Message Monitoring Settings

The following commands configure message monitoring for GSM.

CONFigure:GSM:SIGN<i>:MMONitor:ENABle <Enable>

Enables or disables message monitoring for the GSM signaling application.

Parameters:

<Enable> OFF | ON

*RST: OFF

Example: See Configuring Message Monitoring

Firmware/Software: V3.2.30

Manual operation: See "Add GSM Signaling to Logging" on page 144

CONFigure:GSM:SIGN<i>:MMONitor:IPADdress <Index>

Selects the IP address to which signaling messages shall be sent for message monitoring. The address pool is configured globally via `CONFigure:BASE:MMONitor:IPADdress<n>`.

A query returns both the current index and the resulting IP address.

Parameters:

<Index> IP1 | IP2 | IP3

Address pool index

Return values:

<IPAddress> Used IP address as string

Example: See Configuring Message Monitoring

Firmware/Software: V3.2.30

Manual operation: See "Logging PC IPv4 Address" on page 144

2.5.17 BER CS Measurement

The following commands control the BER CS measurement and retrieve the results.

General "GSM Signaling" parameters

The BER measurement uses the RF settings and the basic downlink and uplink signal configuration of the "GSM Signaling" application. The additional commands specific for the BER CS measurement are described below.

2.5.17.1 Measurement Control and States

The following commands control the measurement and return the current measurement state.

INITiate:GSM:SIGN<i>:BER:CSWitched
STOP:GSM:SIGN<i>:BER:CSWitched
ABORt:GSM:SIGN<i>:BER:CSWitched

Starts, stops, or aborts the measurement:

- `INITiate...` starts or restarts the measurement; the R&S CMW enters the "RUN" state.
- `STOP...` causes a running measurement to stop after the current evaluation period is terminated and valid results are available; the R&S CMW enters the "RDY" state.
- `ABORt...` causes a running measurement to stop immediately; the R&S CMW enters the "OFF" state.

Use `FETCh...STATe?` to query the current measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Usage: Event

Firmware/Software: V1.0.15.0

Manual operation: See "BER Circuit Switched (Softkey)" on page 147

FETCh:GSM:SIGN<i>:BER:CSWitched:STATe?

Queries the main measurement state. Use `FETCh:...:STATe:ALL?` to query the measurement state including the substates. Use `INITiate...`, `STOP...`, `ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MeasStatus> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after `ABORt...`)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after `INITiate...`, `READ...`), synchronization pending or adjusted, resources active or queued

Usage: Query only

Firmware/Software: V1.0.15.0

Manual operation: See "BER Circuit Switched (Softkey)" on page 147

FETCh:GSM:SIGN<i>:BER:CSWitched:STATe:ALL?

Queries the main measurement state and the measurement substates. Both measurement substates are relevant for running measurements only. Use `FETCh:...:STATe?` to query the main measurement state only. Use `INITiate...`, `STOP...`, `ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MainState>	OFF | RDY | RUN **OFF:** measurement switched off, no resources allocated, no results available (when entered after `STOP...`) **RDY:** measurement has been terminated, valid results may be available **RUN:** measurement running (after `INITiate...`, `READ...`), synchronization pending or adjusted, resources active or queued
<SyncState>	PEND | ADJ | INV **PEND:** waiting for resource allocation, adjustment, hardware switching ("pending") **ADJ:** all necessary adjustments finished, measurement running ("adjusted") **INV:** not applicable because <main_state>: OFF or RDY ("invalid")
<ResourceState>	QUE | ACT | INV **QUE:** measurement without resources, no results available ("queued") **ACT:** resources allocated, acquisition of results in progress but not complete ("active") **INV:** not applicable because <main_state>: OFF or RDY ("invalid")
Usage:	Query only
Firmware/Software:	V1.0.15.0
Manual operation:	See "BER Circuit Switched (Softkey)" on page 147

2.5.17.2 General BER CS Settings

The following commands specify the scope of the measurement.

CONFigure:GSM:SIGN<i>:BER:CSWitched:TOUT <Timeout>

Defines a timeout for the measurement. The timer is started when the measurement is initiated via a `READ` or `INIT` command. It is not started if the measurement is initiated manually (ON/OFF key or RESTART/STOP key).

When the measurement has completed the first measurement cycle (first single shot), the statistical depth is reached and the timer is reset.

If the first measurement cycle has not been completed when the timer expires, the measurement is stopped. The measurement state changes to `RDY` and the reliability indicator is set to 1, indicating that a measurement timeout occurred. Still running `READ`, `FETCh` or `CALCulate` commands are completed, returning the available results. At least for some results there are no values at all or the statistical depth has not been reached.

A timeout of 0 s corresponds to an infinite measurement timeout.

Parameters:

<Timeout> Default unit: s

Firmware/Software: V2.0.10

CONFigure:GSM:SIGN<i>:BER:CSWitched:SCOunt <Frames>

Defines the number of bursts or speech frames to be transmitted per measurement cycle (statistics cycle).

Parameters:

<Frames> Range: 1 to 500E+3
*RST: 100

Example: See Measuring in Burst by Burst Mode

Firmware/Software: V1.0.15.0
V3.2.70: range extended

Manual operation: See "Bursts / Speech Frames / Frames / Blocks" on page 149

CONFigure:GSM:SIGN<i>:BER:CSWitched:MMODe <Mode>

Selects the measurement mode of the BER CS measurement. For a detailed description of the modes see chapter 2.2.11, "BER CS Measurement", on page 35.

Parameters:

<Mode> BBBurst | BER | RFER | FFACch | FSACch | RUFR | AIFer | MBEP | SQUality | BFI

BBBurst: "Burst by Burst" mode
BER: "BER" mode
RFER: "RBER/FER" mode
FFACch: "FER FACCH" mode
FSACch: "FER SACCH" mode
RUFR: "RBER/UFR" mode
AIFer: "AMR Inband FER" mode
MBEP: "Mean BEP" mode
SQUality: "Signal Quality" mode
BFI: "Bad Frame Indication" mode

*RST: BBB

Example: See Measuring in Burst by Burst Mode

Firmware/Software: V2.0.10
V2.1.25: added `FFACch`, `FSACch`
V3.0.20: added `AIFer`
V3.2.20: added `RUFR`
V3.2.30: added `MBEP`, `SQUality`
V3.2.70: added `BFI`

Options: R&S CMW-KS210 for all modes except BBBurst, MBEP, SQUality

Manual operation: See "Measure Mode" on page 149

CONFigure:GSM:SIGN<i>:BER:CSWitched:SCONdition <Condition>

Qualifies whether the measurement is stopped after a failed limit check or continued. When the measurement is stopped it reaches the `RDY` state.

Parameters:

<Condition> NONE | FLIMit

NONE: Continue measurement irrespective of the limit check
FLIMit: Stop measurement on first limit failure

*RST: FLIM

Example: See Measuring in Burst by Burst Mode

Firmware/Software: V1.0.15.0

Manual operation: See "Stop Condition" on page 150

CONFigure:GSM:SIGN<i>:BER:CSWitched:RTDelay <Mode>, <Bursts>

Specifies the number of bursts used as the round trip delay.

Parameters:

<Mode> AUTO | MANual

AUTO: number of bursts set automatically
MAN: number of bursts specified manually

*RST: AUTO

<Bursts> Round trip delay

Range: 0 to 24
*RST: 4
Default unit: burst

Example: See Measuring in Mean BEP Mode

Firmware/Software: V3.2.30

Manual operation: See "Round Trip Delay" on page 150

2.5.17.3 Limit Settings

The following commands define upper limits for the BER CS measurement.

CONFigure:GSM:SIGN<i>:BER:CSWitched:LIMit:BER <Limit>

Specifies an upper limit for the BER results of the BER CS measurement in burst by burst mode. If you set the limit via this command, a coupling to the class II bits limit is removed. The coupling can only be enabled via the GUI.

Parameters:

<Limit> Range: 0 % to 100 %
*RST: 0.2 %
Default unit: %

Example: See Measuring in Burst by Burst Mode

Firmware/Software: V2.0.10

Manual operation: See "Limits" on page 150

CONFigure:GSM:SIGN<i>:BER:CSWitched:LIMit:CIIBits <ClassIIBits>

Specifies upper limits for the BER and RBER class II bit results of the BER CS measurement. A limit for the burst by burst mode can be set separately, see `CONFigure:GSM:SIGN<i>:BER:CSWitched:LIMit:BER` on page 334.

Parameters:

<ClassIIBits> Range: 0 % to 100 %
*RST: 0.2 %
Default unit: %

Example: See Measuring in BER Mode

Firmware/Software: V2.0.10

Options: R&S CMW-KS210

Manual operation: See "Limits" on page 150

CONFigure:GSM:SIGN<i>:BER:CSWitched:LIMit:CIBBits <ClassIbBits>

Specifies upper limits for the BER and RBER class Ib bit results of the BER CS measurement.

Parameters:

<ClassIbBits> Range: 0 % to 100 %
*RST: 0.4 %
Default unit: %

Example: See Measuring in BER Mode

Firmware/Software: V2.0.10

Options: R&S CMW-KS210

Manual operation: See "Limits" on page 150

CONFigure:GSM:SIGN<i>:BER:CSWitched:LIMit:FER <FER>

Specifies an upper limit for the FER results of the BER CS measurement in mode "RBER/FER" and "AMR Inband FER".

Parameters:

<FER> Range: 0 % to 100 %
*RST: 0.1 %
Default unit: %

Example: See Measuring in RBER/FER Mode

Firmware/Software: V2.0.10

Options: R&S CMW-KS210

Manual operation: See "Limits" on page 150

CONFigure:GSM:SIGN<i>:BER:CSWitched:LIMit:FFACch <FERFACCH>
CONFigure:GSM:SIGN<i>:BER:CSWitched:LIMit:FSACch <FERSACCH>

Specifies an upper limit for the Frame Error Rate (FER) results of the BER CS measurement in the measurement modes FER FACCH and FER SACCH.

Parameters:

<FERSACCH>	Range: 0 % to 100 % *RST: 0.2 % Default unit: %

Example: See Measuring in FER FACCH and FER SACCH Mode

Firmware/Software: V2.1.25

Options: R&S CMW-KS210

Manual operation: See "Limits" on page 150

2.5.17.4 Measurement Results

The following commands return the results of the BER CS measurement.

FETCh:GSM:SIGN<i>:BER:CSWitched?
READ:GSM:SIGN<i>:BER:CSWitched?

Returns the results of the BER CS measurement. As indicated in the parameter descriptions below, each measure mode provides valid results for a subset of the parameters only. For the other parameters NCAP is returned.

For details concerning measure modes and results see chapter 2.2.11, "BER CS Measurement", on page 35.

Return values:

<Reliability>	See Reliability Indicator
<Frames>	Number of already transmitted bursts, blocks or frames Range: 0 to 500E+3
<BER>	BER result (mode burst-by-burst, mean BEP, signal quality, signal quality DTX) Range: 0 % to 100 % Default unit: %
<CRC_Errors>	Number of failed CRC checks (BER, RBER/FER, BFI mode) Range: 0 to 500E+3
<ClassII>	BER result for class II bits (BER mode) RBER result for class II bits (RBER/FER mode) Range: 0 % to 100 % Default unit: %

<ClassIb> BER result for class Ib bits (BER mode)
RBER result for class Ib bits (RBER/FER mode)
Range: 0 % to 100 %
Default unit: %

<FER> FER result (modes: RBER/FER, FER FACCH, FER SACCH, AMR Inband FER)
Range: 0 % to 100 %
Default unit: %

<L2FramesRep> Number of repeated L2 frames (FER FACCH mode)
Range: 0 to 500E+3

<ErrorEvents> Number of error events (FER SACCH mode)
Range: 0 to 500E+3

<NumberSIDFrames> Number of already transmitted Silence Insertion Descriptor (SID) frames (BFI mode)
Range: 0 to 500E+3

<SIDFrameErrRate> SID frame error rate (BFI mode)
Range: 0 % to 100 %
Default unit: %

<FalseBFIRate> False BFI rate (BFI mode)
Range: 0 % to 100 %
Default unit: %

Example: See Measuring in Burst by Burst Mode

Usage: Query only

Firmware/Software: V1.0.15.0
V2.0.10: added `<Class II>`, `<Class Ib>`, `<FER>`
V2.1.25: added `<L2 Frames Rep>`, `<Error Events>`
V3.2.70: added `<NumberSIDFrames>`, `<SIDFrameErrRate>`, `<FalseBFIRate>`
V3.2.80: ranges of frames extended

Manual operation: See "Results" on page 148

FETCh:INTermediate:GSM:SIGN<i>:BER:CSWitched:MBEP?

Returns the intermediate results of the BER CS measurement in mean BEP and signal quality mode. As indicated in the parameter descriptions below, each measure mode provides valid results for a subset of the parameters only. For the other parameters INV is returned.

Results return as follows:

<Reliability>, <NumberOfResults>, {<SegReliability>, <RXQualityFull>, <RXQuality-Sub>, <MeanBEP>, <CV_BEP>, <NumberOfBlocks>, <TDMA_FrameNr>, <BER>}$_{\text{segment 1}}$, $\{...\}_{\text{seg. 2}}$, ..., $\{...\}_{\text{<NumberOfResults>}}$

For details concerning measure modes and results see chapter 2.2.11, "BER CS Measurement", on page 35.

Return values:

<Reliability> See Reliability Indicator
Zero reliability indicator indicates that the results in all measured segments are valid. A non-zero value indicates that an error occurred in at least one of the measured segments.

<NumberOfResults> Total number of segments to be displayed
Range: 0 to 10

<SegReliability> Reliability indicator for the segment. The meaning of the returned values is the same as for the common reliability indicator, see <Reliability> parameter.

<RXQualityFull> RX quality full as dimensionless index measured over the full set of TDMA frames
Range: 0 to 7

<RXQualitySub> RX quality sub as dimensionless index measured in a subset of 4 SACCH frames
Range: 0 to 7

<MeanBEP> Mean BEP as dimensionless index
Range: 0 to 31

<CV_BEP> Coefficient of variation of BEP as dimensionless index
Range: 0 to 7

<NumberOfBlocks> Number of already correctly decoded blocks
Range: 0 to 24

<TDMA_FrameNr> Current TDMA frame number
Range: 0 to 2715647

<BER> BER result (for mean BEP and signal quality mode)
Range: 0 % to 100 %
Default unit: %

Example: See Measuring in Mean BEP Mode

Usage: Query only

Firmware/Software: V3.2.30

Manual operation: See "Results" on page 148

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

SENSe:GSM:SIGN<i>:BER:CSWitched:RTDelay?

Queries duration in bursts the loopback signal needs from a transmission to detection by the R&S CMW.

Return values:

<Bursts> Range: 0 to 24

Example: See Measuring in Mean BEP Mode

Usage: Query only

Firmware/Software: V3.2.30

Manual operation: See "Round Trip Delay" on page 150

2.5.18 BER PS Measurement

The following commands control the BER PS measurement and retrieve the results.

General "GSM Signaling" parameters

The BER measurement uses the RF settings and the basic downlink and uplink signal configuration of the "GSM Signaling" application. The additional commands specific for the BER PS measurement are described below.

2.5.18.1 Measurement Control and States

The following commands control the measurement and return the current measurement state.

INITiate:GSM:SIGN<i>:BER:PSWitched
STOP:GSM:SIGN<i>:BER:PSWitched
ABORt:GSM:SIGN<i>:BER:PSWitched

Starts, stops, or aborts the measurement:

- `INITiate...` starts or restarts the measurement; the R&S CMW enters the "RUN" state.
- `STOP...` causes a running measurement to stop after the current evaluation period is terminated and valid results are available; the R&S CMW enters the "RDY" state.
- `ABORt...` causes a running measurement to stop immediately; the R&S CMW enters the "OFF" state.

Use FETCh...STATe? to query the current measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Usage: Event

Firmware/Software: V2.0.20

Manual operation: See "BER Packet Switched (Softkey)" on page 152

FETCh:GSM:SIGN<i>:BER:PSWitched:STATe?

Queries the main measurement state. Use FETCh:...:STATe:ALL? to query the measurement state including the substates. Use INITiate..., STOP..., ABORt... to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MeasStatus> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after ABORt...)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after INITiate..., READ...), synchronization pending or adjusted, resources active or queued

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "BER Packet Switched (Softkey)" on page 152

FETCh:GSM:SIGN<i>:BER:PSWitched:STATe:ALL?

Queries the main measurement state and the measurement substates. Both measurement substates are relevant for running measurements only. Use FETCh:...:STATe? to query the main measurement state only. Use INITiate..., STOP..., ABORt... to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MainState> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after STOP...)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after INITiate..., READ...), synchronization pending or adjusted, resources active or queued

<SyncState> PEND | ADJ | INV

PEND: waiting for resource allocation, adjustment, hardware switching ("pending")
ADJ: all necessary adjustments finished, measurement running ("adjusted")
INV: not applicable because <main_state>: OFF or RDY ("invalid")

<ResourceState> QUE | ACT | INV

QUE: measurement without resources, no results available ("queued")
ACT: resources allocated, acquisition of results in progress but not complete ("active")
INV: not applicable because <main_state>: OFF or RDY ("invalid")

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "BER Packet Switched (Softkey)" on page 152

2.5.18.2 General BER PS Settings

The following commands specify the scope of the measurement and the measurement mode.

CONFigure:GSM:SIGN<i>:BER:PSWitched:TOUT <Timeout>

Defines a timeout for the measurement. The timer is started when the measurement is initiated via a `READ` or `INIT` command. It is not started if the measurement is initiated manually (ON/OFF key or RESTART/STOP key).

When the measurement has completed the first measurement cycle (first single shot), the statistical depth is reached and the timer is reset.

If the first measurement cycle has not been completed when the timer expires, the measurement is stopped. The measurement state changes to `RDY` and the reliability indicator is set to 1, indicating that a measurement timeout occurred. Still running `READ`, `FETCh` or `CALCulate` commands are completed, returning the available results. At least for some results there are no values at all or the statistical depth has not been reached.

A timeout of 0 s corresponds to an infinite measurement timeout.

Parameters:

<Timeout> Default unit: s

Firmware/Software: V2.0.20

CONFigure:GSM:SIGN<i>:BER:PSWitched:SCOunt <Frames>

Defines the number of RLC data blocks or radio blocks to be transmitted per measurement cycle (statistics cycle).

Parameters:

<Frames>	Range:	1 to 500E+3
	*RST:	100

Example: See BER PS Tests

Firmware/Software: V2.0.20
V3.2.70: range extended

Manual operation: See "RLC Data Blocks" on page 154

CONFigure:GSM:SIGN<i>:BER:PSWitched:MMODe <Mode>

Defines the measurement mode for BER PS measurements.

Parameters:

<Mode> BDBLer | MBEP

BDBLer: BER/DBLER
MBEP: mean BEP

*RST: BDBLer

Example: See BER PS Tests

Firmware/Software: V3.2.30

Manual operation: See "Measure Mode" on page 154

CONFigure:GSM:SIGN<i>:BER:PSWitched:SCONdition <Condition>

Qualifies whether the measurement is stopped after a failed limit check or continued. When the measurement is stopped it reaches the `RDY` state.

Parameters:

<Condition> NONE | FLIMit

NONE: Continue measurement irrespective of the limit check
FLIMit: Stop measurement on first limit failure

*RST: FLIM

Example: See BER PS Tests

Firmware/Software: V2.0.20

Manual operation: See "Stop Condition" on page 154

2.5.18.3 Limit Settings

The following commands define upper limits for the BER PS measurement.

CONFigure:GSM:SIGN<i>:BER:PSWitched:LIMit:CIIBits <ClassIIBits>

Specifies upper limits for the BER class II bit results of the BER PS measurement.

Parameters:

<ClassIIBits> Range: 0 % to 100 %
*RST: 0.2 %
Default unit: %

Example: See BER PS Tests

Firmware/Software: V2.0.20

Manual operation: See "Limits" on page 155

CONFigure:GSM:SIGN<i>:BER:PSWitched:LIMit:DBLer <DBLER>

Specifies upper limits for the DBLER results of the BER PS measurement.

Parameters:

<DBLER> Range: 0 % to 100 %
*RST: 10 %
Default unit: %

Example: See BER PS Tests

Firmware/Software: V2.0.20

Manual operation: See "Limits" on page 155

CONFigure:GSM:SIGN<i>:BER:PSWitched:LIMit:USFBler <USFBLER>

Specifies upper limits for the USF BLER results of the BER PS measurement.

Parameters:

<USFBLER> Range: 0 % to 100 %
*RST: 1 %
Default unit: %

Example: See BER PS Tests

Firmware/Software: V2.0.20

Manual operation: See "Limits" on page 155

2.5.18.4 Measurement Results

The following commands return the results of the BER PS measurement.

FETCh:GSM:SIGN<i>:BER:PSWitched:CARRier<c>?
READ:GSM:SIGN<i>:BER:PSWitched:CARRier<c>?

Returns the results of the BER PS measurement for the individual timeslots.

For details concerning the results see chapter 2.2.12, "BER PS Measurement", on page 49.

The number to the left of each result parameter is provided for easy identification of the parameter position within the result array.

Suffix:

<c> 1
Selects the carrier for which the results shall be queried - only relevant in dual carrier mode

Return values:

<1_Reliability> see Reliability Indicator

<2_Frames_0>
<9_Frames_7>
Number of already transmitted blocks in timeslot 0 to 7
Range: 0 to 500E+3

<10_FramesAll> Total number of already transmitted blocks
Range: 0 to 500E+3

<11_BER_0>
<18_BER_7>
BER results for timeslot 0 to 7
Range: 0 % to 100 %
Default unit: %

<19_BERall> BER result as weighted average over all timeslots
Range: 0 % to 100 %
Default unit: %

<20_DBLER_0>
<27_DBLER_7>
DBLER results for timeslot 0 to 7
Range: 0 % to 100 %
Default unit: %

<28_DBLERall> DBLER result as weighted average over all timeslots
Range: 0 % to 100 %
Default unit: %

<29_USF_BLER_0>
<36_USF_BLER_7>
USF BLER results for timeslot 0 to 7
Range: 0 % to 100 %
Default unit: %

<37_USF_BLERall> USF BLER result as weighted average over all timeslots
Range: 0 % to 100 %
Default unit: %

<38_FalseUSF_0> <45_FalseUSF_7>	False USF BLER results for timeslot 0 to 7 Range: 0 % to 100 % Default unit: %
<46_FalseUSFall>	False USF BLER result as weighted average over all timeslots Range: 0 % to 100 % Default unit: %
<47_NoAssigUSF_0> <54_NoAssigUSF_7>	Detected non assigned USF results for timeslot 0 to 7 Range: 0 to 500E+3
<55_NoAssigUSFAll>	Detected non assigned USF result as weighted average over all timeslots Range: 0 to 500E+3
<56_CRCerrors_0> <63_CRCerrors_7>	CRC error results for timeslot 0 to 7 Range: 0 to 500E+3
<64_CRCerrorsAll>	CRC error result as weighted average over all timeslots Range: 0 to 500E+3
Example:	See BER PS Tests
Usage:	Query only
Firmware/Software:	V2.2.30 V3.2.30: added <Frames>, <FramesAll>, results per timeslot and overall results V3.2.70: ranges of blocks extended
Options:	R&S CMW-KS201 for carrier 2
Manual operation:	See "Results" on page 153

FETCh:GSM:SIGN<i>:BER:PSWitched?
READ:GSM:SIGN<i>:BER:PSWitched?

Returns the results of the BER PS measurement over all carriers.

For details concerning the results see chapter 2.2.12, "BER PS Measurement", on page 49.

Return values:

<Reliability>	See Reliability Indicator
<Frames>	Number of already transmitted blocks Range: 0 to 500E+3
<BER>	BER Range: 0 % to 100 % Default unit: %
<DBLER>	DBLER Range: 0 % to 100 % Default unit: %

<USF_BLER> USF BLER
Range: 0 % to 100 %
Default unit: %

<FalseUSFdetect> False USF BLER
Range: 0 % to 100 %
Default unit: %

<CRCerrors> CRC errors
Range: 0 to 500E+3

<NonAssignedUSF> USFs in data blocks not assigned to the MS
Range: 0 to 500E+3

Example: See BER PS Tests

Usage: Query only

Firmware/Software: V2.2.30
V3.2.30: added <NonAssignedUSF>
V3.2.70: ranges of blocks extended

Manual operation: See "Results" on page 153

FETCh:INTermediate:GSM:SIGN<i>:BER:PSWitched:MBEP?

Returns the intermediate results of the BER PS measurement for mean BEP measurement (TBF level EGPRS) in "Mean BEP" mode.

Results return as follows:

<Reliability>, <NumberOfResults>, {<SegReliability>, <MeanBEP_GMSK>, <CV_BEP_GMSK>, <MeanBEP_8PSK>, <CV_BEP_8PSK>, <TDMA_FrameNr>, <BER>}$_{\text{segment 1}}$, {...}$_{\text{seg. 2}}$, ..., {...}$_{\text{<NumberOfResults>}}$

For details concerning measure modes and results see chapter 2.2.12, "BER PS Measurement", on page 49.

Return values:

<Reliability> See Reliability Indicator
Zero reliability indicator indicates that the results in all measured segments are valid. A non-zero value indicates that an error occurred in at least one of the measured segments.

<NumberOfResults> Total number of segments to be displayed
Range: 0 to 10

<SegReliability> Reliability indicator for the segment. The meaning of the returned values is the same as for the common reliability indicator, see <Reliability> parameter.

<MeanBEP_GMSK> Mean BEP (GMSK) as dimensionless index
Range: 0 to 31

<CV_BEP_GMSK> Coefficient of variation of BEP (GMSK) as dimensionless index
Range: 0 to 7

<MeanBEP_8PSK> Mean BEP (8PSK) as dimensionless index
Range: 0 to 31

<CV_BEP_8PSK> Coefficient of variation of BEP (8PSK) as dimensionless index
Range: 0 to 7

<TDMA_FrameNr> Current TDMA frame number
Range: 0 to 2715647

<BER> Overall BER result from the start of the measurement
Range: 0 % to 100 %
Default unit: %

Example: See BER PS Tests

Usage: Query only

Firmware/Software: V3.2.30

Manual operation: See "Results" on page 153

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

FETCh:INTermediate:GSM:SIGN<i>:BER:PSWitched:MBEP:ENHanced?

Returns the intermediate results of the BER PS measurement for enhanced mean BEP measurement (TBF level EGPRS2-A) in "Mean BEP" mode.

Results return as follows:

<Reliability>, <NoOfResults>, {<SegReliability>, <MeanBEP_GMSK>, <CV_BEP_GMSK>, <MeanBEP_8PSK>, <CV_BEP_8PSK>, <MeanBEP_QPSK>, <CV_BEP_QPSK>, <MeanBEP_16QAM>, <CV_BEP_16QAM>, <MeanBEP_32QAM>, <CV_BEP_32QAM>, <MBEP_16QAM_HSR>, <CBEP_16QAM_HSR>, <MBEP_32QAM_HSR>, <CBEP_32QAM_HSR>, <TDMA_FrameNr>, <BER>}$_{\text{segment 1}}$, {...}$_{\text{seg. 2}}$, ..., {...}$_{\text{<NoOfResults>}}$

For details concerning measure modes and results see chapter 2.2.12, "BER PS Measurement", on page 49.

The number to the left of each result parameter is provided for easy identification of the parameter position within the result array.

Return values:

<1_Reliability> See Reliability Indicator
Zero reliability indicator indicates that the results in all measured segments are valid. A non-zero value indicates that an error occurred in at least one of the measured segments.

<2_NoOfResults> Total number of segments to be displayed
Range: 0 to 10

<3_SegReliability>	Reliability indicator for the segment. The meaning of the returned values is the same as for the common reliability indicator, see <Reliability> parameter.
<4_MBEP_GMSK>	Mean BEP (GMSK) as dimensionless index Range: 0 to 31
<5_CV_BEP_GMSK>	Coefficient of variation of BEP (GMSK) as dimensionless index Range: 0 to 7
<6_MBEP_8PSK>	Mean BEP (8PSK) as dimensionless index Range: 0 to 31
<7_CV_BEP_8PSK>	Coefficient of variation of BEP (8PSK) as dimensionless index Range: 0 to 7
<8_MBEP_QPSK>	Mean BEP (QPSK) as dimensionless index Range: 0 to 31
<9_CV_BEP_QPSK>	Coefficient of variation of BEP (QPSK) as dimensionless index Range: 0 to 7
<10_MBEP_16Q>	Mean BEP (16-QAM) as dimensionless index Range: 0 to 31
<11_CV_BEP_16Q>	Coefficient of variation of BEP (16-QAM) as dimensionless index Range: 0 to 7
<12_MBEP_32Q>	Mean BEP (32-QAM) as dimensionless index Range: 0 to 31
<13_CV_BEP_32Q>	Coefficient of variation of BEP (32-QAM) as dimensionless index Range: 0 to 7
<14_MBEP_16-HSR>	Mean BEP (16-QAM higher symbol rates) as dimensionless index Range: 0 to 31
<15_CBEP_16-HSR>	Coefficient of variation of BEP (16-QAM higher symbol rates) as dimensionless index Range: 0 to 7
<16_MBEP_32-HSR>	Mean BEP (32-QAM higher symbol rates) as dimensionless index Range: 0 to 31
<17_CBEP_32-HSR>	Coefficient of variation of BEP (32-QAM higher symbol rates) as dimensionless index Range: 0 to 7
<18_TDMA_Frame>	Current TDMA frame number Range: 0 to 2715647

<19_BER> Overall BER result from the start of the measurement

Range: 0 % to 100 %
Default unit: %

Example: See BER PS Tests

Usage: Query only

Firmware/Software: V3.2.30

Options: R&S CMW-KS201 for EGPRS2-A

Manual operation: See "Results" on page 153

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

2.5.19 BLER Measurement

The following commands control the BLER measurement and retrieve the results.

General "GSM Signaling" parameters

The BLER measurement uses the RF settings and the basic downlink and uplink signal configuration of the "GSM Signaling" application. The additional commands specific for the BLER measurement are described below.

2.5.19.1 Measurement Control and States

The following commands control the measurement and return the current measurement state.

INITiate:GSM:SIGN<i>:BLER
STOP:GSM:SIGN<i>:BLER
ABORt:GSM:SIGN<i>:BLER

Starts, stops, or aborts the measurement:

- `INITiate...` starts or restarts the measurement; the R&S CMW enters the "RUN" state.

- `STOP...` causes a running measurement to stop after the current evaluation period is terminated and valid results are available; the R&S CMW enters the "RDY" state.
- `ABORt...` causes a running measurement to stop immediately; the R&S CMW enters the "OFF" state.

Use `FETCh...STATe?` to query the current measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Usage: Event

Firmware/Software: V2.0.20

Manual operation: See "BLER (Softkey)" on page 155

FETCh:GSM:SIGN<i>:BLER:STATe?

Queries the main measurement state. Use `FETCh:...:STATe:ALL?` to query the measurement state including the substates. Use `INITiate...`, `STOP...`, `ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MeasStatus> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after `ABORt...`)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after `INITiate...`, `READ...`), synchronization pending or adjusted, resources active or queued

Usage: Query only

Firmware/Software: V2.0.20

Manual operation: See "BLER (Softkey)" on page 155

FETCh:GSM:SIGN<i>:BLER:STATe:ALL?

Queries the main measurement state and the measurement substates. Both measurement substates are relevant for running measurements only. Use `FETCh:...:STATe?` to query the main measurement state only. Use `INITiate...`, `STOP...`, `ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MainState>	OFF | RDY | RUN **OFF:** measurement switched off, no resources allocated, no results available (when entered after `STOP...`) **RDY:** measurement has been terminated, valid results may be available **RUN:** measurement running (after `INITiate...`, `READ...`), synchronization pending or adjusted, resources active or queued
<SyncState>	PEND | ADJ | INV **PEND:** waiting for resource allocation, adjustment, hardware switching ("pending") **ADJ:** all necessary adjustments finished, measurement running ("adjusted") **INV:** not applicable because <main_state>: OFF or RDY ("invalid")
<ResourceState>	QUE | ACT | INV **QUE:** measurement without resources, no results available ("queued") **ACT:** resources allocated, acquisition of results in progress but not complete ("active") **INV:** not applicable because <main_state>: OFF or RDY ("invalid")
Usage:	Query only
Firmware/Software:	V2.0.20
Manual operation:	See "BLER (Softkey)" on page 155

2.5.19.2 Measurement Settings

The following commands specify the scope of the measurement.

CONFigure:GSM:SIGN<i>:BLER:TOUT <Timeout>

Defines a timeout for the measurement. The timer is started when the measurement is initiated via a `READ` or `INIT` command. It is not started if the measurement is initiated manually (ON/OFF key or RESTART/STOP key).

When the measurement has completed the first measurement cycle (first single shot), the statistical depth is reached and the timer is reset.

If the first measurement cycle has not been completed when the timer expires, the measurement is stopped. The measurement state changes to `RDY` and the reliability indicator is set to 1, indicating that a measurement timeout occurred. Still running `READ`, `FETCh` or `CALCulate` commands are completed, returning the available results. At least for some results there are no values at all or the statistical depth has not been reached.

A timeout of 0 s corresponds to an infinite measurement timeout.

Parameters:

<Timeout> Default unit: s

Firmware/Software: V2.0.20

CONFigure:GSM:SIGN<i>:BLER:SCOunt <RLCBlockCount>

Defines the number of RLC data blocks to be transmitted per measurement cycle (statistics cycle).

Parameters:

<RLCBlockCount> Range: 1 to 10E+6
*RST: 2000

Example: See BLER Tests

Firmware/Software: V2.0.20

Manual operation: See "RLC Data Block Count" on page 157

2.5.19.3 Measurement Results

The following commands return the results of the BLER measurement.

FETCh:GSM:SIGN<i>:BLER:CARRier<c>?
READ:GSM:SIGN<i>:BLER:CARRier<c>?

Returns the results of the BLER measurement for the individual timeslots. For details see chapter 2.2.13, "BLER Measurement", on page 55.

The number to the left of each result parameter is provided for easy identification of the parameter position within the result array.

Suffix:

<c> 1..2
Selects the carrier for which the results shall be queried - only relevant in dual carrier mode

Return values:

<1_Reliability> see Reliability Indicator

<2_BLER_TS0> ... <9_BLER_TS7>	BLER results for timeslot 0 to 7 Range: 0 % to 100 % Default unit: %
<10_BLERAll>	BLER result as weighted average over all timeslots Range: 0 % to 100 % Default unit: %
<11_Blocks_TS0> ... <18_Blocks_TS7>	Number of RLC data blocks received by the MS in timeslot 0 to 7 Range: 0 to 10E+7
<19_BlocksAll>	Total number of RLC data blocks received by the MS Range: 0 to 10E+7
<20_Rate_TS0> ... <27_Rate_TS7>	Data rates for timeslot 0 to 7 Range: 0 kbit/s to 130 kbit/s Default unit: kbit/s
<28_RateAll>	Total data rate in all timeslots Range: 0 kbit/s to 130 kbit/s times the no. of slots Default unit: kbit/s
Example:	See BLER Tests
Usage:	Query only
Firmware/Software:	V2.0.20
Options:	R&S CMW-KS201 for carrier 2
Manual operation:	See "Results" on page 156

FETCh:GSM:SIGN<i>:BLER:OALL?
READ:GSM:SIGN<i>:BLER:OALL?

Returns the overall results of the BLER measurement.

For details see chapter 2.2.13, "BLER Measurement", on page 55.

Return values:

<Reliability>	see Reliability Indicator
<BLER>	BLER as weighted average over all timeslots Range: 0 % to 100 % Default unit: %
<RLCBlocks>	Total number of RLC data blocks received by the MS Range: 0 to 10E+7
<RLCDataRate>	Total data rate in all timeslots Range: 0 kbit/s to 130 kbit/s times the no. of slots Default unit: kbit/s

<Throughput>	Overall long term throughput Range: 0 kbit/s to 130 kbit/s times the no. of slots Default unit: kbit/s
<ThroughputSlot>	Long term throughput per slot Range: 0 kbit/s to 130 kbit/s Default unit: kbit/s
<CorruptedBlocks>	Number of corrupted data blocks transmitted in DL Range: 0 to 10E+7
<FalseACKblocks>	Number of corrupted data blocks reported by the MS as fault free Range: 0 to 10E+7
Example:	See BLER Tests
Usage:	Query only
Firmware/Software:	V2.0.20 V3.2.20: <CorruptedBlocks> and <FalseACKblocks> added
Manual operation:	See "Results" on page 156

2.5.20 RLC Throughput Measurement

The following sections describe the commands related to the signaling "RLC Throughput" measurement.

2.5.20.1 Measurement Control and States

The following commands control the measurement and return the current measurement state.

INITiate:GSM:SIGN<i>:THRoughput
STOP:GSM:SIGN<i>:THRoughput
ABORt:GSM:SIGN<i>:THRoughput

Starts, stops, or aborts the measurement:

- `INITiate...` starts or restarts the measurement; the R&S CMW enters the "RUN" state.

- `STOP...` causes a running measurement to stop after the current evaluation period is terminated and valid results are available; the R&S CMW enters the "RDY" state.
- `ABORt...` causes a running measurement to stop immediately; the R&S CMW enters the "OFF" state.

Use `FETCh...STATe?` to query the current measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Example: See Performing an RLC Throughput Measurement

Usage: Event

Firmware/Software: V3.2.20

Manual operation: See "RLC Throughput (Softkey)" on page 158

FETCh:GSM:SIGN<i>:THRoughput:STATe?

Queries the main measurement state. Use `FETCh:...:STATe:ALL?` to query the measurement state including the substates. Use `INITiate...`, `STOP...`, `ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<State> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after `ABORt...`)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after `INITiate...`, `READ...`), synchronization pending or adjusted, resources active or queued

*RST: OFF

Example: See Performing an RLC Throughput Measurement

Usage: Query only

Firmware/Software: V3.2.20

Manual operation: See "RLC Throughput (Softkey)" on page 158

FETCh:GSM:SIGN<i>:THRoughput:STATe:ALL?

Queries the main measurement state and the measurement substates. Both measurement substates are relevant for running measurements only. Use `FETCh:...:STATe?` to query the main measurement state only. Use `INITiate...`, `STOP...`, `ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MainState> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after `STOP...`)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after `INITiate..., READ...`), synchronization pending or adjusted, resources active or queued

*RST: OFF

<SyncState> PEND | ADJ | INV

PEND: waiting for resource allocation, adjustment, hardware switching ("pending")
ADJ: all necessary adjustments finished, measurement running ("adjusted")
INV: not applicable because <main_state>: OFF or RDY ("invalid")

<RessourceState> QUE | ACT | INV

QUE: measurement without resources, no results available ("queued")
ACT: resources allocated, acquisition of results in progress but not complete ("active")
INV: not applicable because <main_state>: OFF or RDY ("invalid")

Usage: Query only

Firmware/Software: V3.2.20

Manual operation: See "RLC Throughput (Softkey)" on page 158

2.5.20.2 Measurement Settings

The following commands configure the measurement.

CONFigure:GSM:SIGN<i>:THRoughput:TOUT <Timeout>

Defines a timeout for the measurement. The timer is started when the measurement is initiated via a `READ` or `INIT` command. It is not started if the measurement is initiated manually (ON/OFF key or RESTART/STOP key).

When the measurement has completed the first measurement cycle (first single shot), the statistical depth is reached and the timer is reset.

If the first measurement cycle has not been completed when the timer expires, the measurement is stopped. The measurement state changes to `RDY` and the reliability indicator is set to 1, indicating that a measurement timeout occurred. Still running `READ`, `FETCh` or `CALCulate` commands are completed, returning the available results. At least for some results there are no values at all or the statistical depth has not been reached.

A timeout of 0 s corresponds to an infinite measurement timeout.

Parameters:

<Timeout> Default unit: s

Firmware/Software: V3.2.20

CONFigure:GSM:SIGN<i>:THRoughput:REPetition <Repetition>

Specifies the repetition mode of the measurement. The repetition mode specifies whether the measurement is stopped after a single-shot or repeated continuously. Use `CONFigure:GSM:SIGN<i>:THRoughput:WINDow` to configure the duration of a single shot.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<Repetition> SINGleshot | CONTinuous

SINGleshot: Single-shot measurement
CONTinuous: Continuous measurement

*RST: SING

Example: See Configuring the RLC Throughput Measurement

Firmware/Software: V3.2.20

Manual operation: See "Repetition" on page 160

CONFigure:GSM:SIGN<i>:THRoughput:WINDow <Size>

Specifies the duration of a single-shot measurement, i.e. the time interval covered by a throughput result trace.

The value is internally rounded up to the next integer multiple of the time interval used to calculate a single result (240 ms).

Parameters:

<Size> Range: 10 s to 240 s
*RST: 120 s
Default unit: s

Example: See Configuring the RLC Throughput Measurement

Firmware/Software: V3.2.20

Manual operation: See "Window Size" on page 160

2.5.20.3 Measurement Results

The following commands return the measurement results.

FETCh:GSM:SIGN<i>:THRoughput?
READ:GSM:SIGN<i>:THRoughput?

Returns all single value throughput results.

Return values:

<1_Reliability>	see Reliability Indicator
<2_CurrDlPDU> <3_AvgDlPDU> <4_MaxDlPDU> <5_MinDlPDU>	Current, average, maximum and minimum DL PDU results Range: 0 bit/s to 100E+6 bit/s Default unit: bit/s
<6_CurrDlSDU> <7_AvgDlSDU> <8_MaxDlSDU> <9_MinDlSDU>	Current, average, maximum and minimum DL SDU results Range: 0 bit/s to 100E+6 bit/s Default unit: bit/s
<10_BlocksDlPDU>	Number of transmitted RLC PDUs Range: 0 to 1E+6
<11_CurrUlPDU> <12_AvgUlPDU> <13_MaxUlPDU> <14_MinUlPDU>	Current, average, maximum and minimum UL PDU results Range: 0 bit/s to 100E+6 bit/s Default unit: bit/s
<15_CurrUlSDU> <16_AvgUlSDU> <17_MaxUlSDU> <18_MinUlSDU>	Current, average, maximum and minimum UL SDU results Range: 0 bit/s to 100E+6 bit/s Default unit: bit/s

<19_BlocksUlPDU> Number of received RLC PDUs
Range: 0 to 1E+6

Example: See Performing an RLC Throughput Measurement

Usage: Query only

Firmware/Software: V3.2.20

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

FETCh:GSM:SIGN<i>:THRoughput:TRACe:DL:PDU:AVERage?
FETCh:GSM:SIGN<i>:THRoughput:TRACe:DL:PDU:CURRent?
FETCh:GSM:SIGN<i>:THRoughput:TRACe:DL:SDU:AVERage?
FETCh:GSM:SIGN<i>:THRoughput:TRACe:DL:SDU:CURRent?
READ:GSM:SIGN<i>:THRoughput:TRACe:DL:PDU:AVERage?
READ:GSM:SIGN<i>:THRoughput:TRACe:DL:PDU:CURRent?
READ:GSM:SIGN<i>:THRoughput:TRACe:DL:SDU:AVERage?
READ:GSM:SIGN<i>:THRoughput:TRACe:DL:SDU:CURRent?

Return the values of the downlink PDU and SDU throughput traces. The results of the average and current traces can be retrieved.

The number of trace values n depends on the configured <result interval> and <window size>:

n = integer (<window size> / <result interval>)

Return values:
<Reliability> see Reliability Indicator

<Throughput> Comma separated list of n throughput trace values
Range: 0 bit/s to 100E+6 bit/s
Default unit: bit/s

Example: See Performing an RLC Throughput Measurement

Usage: Query only

Firmware/Software: V3.2.20

For additional information concerning syntax elements and returned values refer to Conventions and General Information

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FETCh:GSM:SIGN<i>:THRoughput:TRACe:UL:PDU:AVERage?
FETCh:GSM:SIGN<i>:THRoughput:TRACe:UL:PDU:CURRent?
FETCh:GSM:SIGN<i>:THRoughput:TRACe:UL:SDU:AVERage?
FETCh:GSM:SIGN<i>:THRoughput:TRACe:UL:SDU:CURRent?
READ:GSM:SIGN<i>:THRoughput:TRACe:UL:PDU:AVERage?
READ:GSM:SIGN<i>:THRoughput:TRACe:UL:PDU:CURRent?

READ:GSM:SIGN<i>:THRoughput:TRACe:UL:SDU:AVERage?
READ:GSM:SIGN<i>:THRoughput:TRACe:UL:SDU:CURRent?

Return the values of the uplink PDU and SDU throughput traces. The results of the current and average traces can be retrieved.

The number of trace values n depends on the configured <result interval> and <window size>:

n = integer (<window size> / <result interval>)

Return values:

<Reliability> See Reliability Indicator

<Throughput> Comma separated list of n throughput trace values
Range: 0 bit/s to 100E+6 bit/s
Default unit: bit/s

Example: See Performing an RLC Throughput Measurement

Usage: Query only

Firmware/Software: V3.2.20

For additional information concerning syntax elements and returned values refer to Conventions and General Information

2.5.21 CMR Performance Measurement

The following sections describe the commands related to the signaling "CMR Performance" measurement.

2.5.21.1 Measurement Control and States

The following commands control the measurement and return the current measurement state.

INITiate:GSM:SIGN<i>:CPERformance
STOP:GSM:SIGN<i>:CPERformance
ABORt:GSM:SIGN<i>:CPERformance

Starts, stops, or aborts the measurement:

- `INITiate...` starts or restarts the measurement; the R&S CMW enters the "RUN" state.

- STOP... causes a running measurement to stop after the current evaluation period is terminated and valid results are available; the R&S CMW enters the "RDY" state.
- ABORt... causes a running measurement to stop immediately; the R&S CMW enters the "OFF" state.

Use FETCh...STATe? to query the current measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Example: See CMR Performance Tests

Usage: Event

Firmware/Software: V3.2.30

Options: R&S CMW-KS210

Manual operation: See "CMR Performance (Softkey)" on page 161

FETCh:GSM:SIGN<i>:CPERformance:STATe?

Queries the main measurement state. Use FETCh:...:STATe:ALL? to query the measurement state including the substates. Use INITiate..., STOP..., ABORt... to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<State> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after ABORt...)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after INITiate..., READ...), synchronization pending or adjusted, resources active or queued

*RST: OFF

Example: See CMR Performance Tests

Usage: Query only

Firmware/Software: V3.2.30

Options: R&S CMW-KS210

Manual operation: See "CMR Performance (Softkey)" on page 161

FETCh:GSM:SIGN<i>:CPERformance:STATe:ALL?

Queries the main measurement state and the measurement substates. Both measurement substates are relevant for running measurements only. Use `FETCh:...:STATe?` to query the main measurement state only. Use `INITiate...`, `STOP...`, `ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MainState> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after `STOP...`)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after `INITiate...`, `READ...`), synchronization pending or adjusted, resources active or queued

*RST: OFF

<SyncState> PEND | ADJ | INV

PEND: waiting for resource allocation, adjustment, hardware switching ("pending")
ADJ: all necessary adjustments finished, measurement running ("adjusted")
INV: not applicable because <main_state>: OFF or RDY ("invalid")

<RessourceState> QUE | ACT | INV

QUE: measurement without resources, no results available ("queued")
ACT: resources allocated, acquisition of results in progress but not complete ("active")
INV: not applicable because <main_state>: OFF or RDY ("invalid")

Usage: Query only

Firmware/Software: V3.2.30

Options: R&S CMW-KS210

Manual operation: See "CMR Performance (Softkey)" on page 161

2.5.21.2 Measurement Settings

The following commands configure the measurement.

CONFigure:GSM:SIGN<i>:CPERformance:TLEVel <TargetLevel>

Target level reported to the MS during CMR performance test.

Parameters:

<TargetLevel>	Range:	-130 dBm to -11 dBm
	*RST:	-105 dBm
	Default unit:	dBm

Firmware/Software: V3.2.30

Options: R&S CMW-KS210

Manual operation: See "Target Level" on page 162

CONFigure:GSM:SIGN<i>:CPERformance:TOUT <Timeout>

Defines a timeout for the measurement. The timer is started when the measurement is initiated via a `READ` or `INIT` command. It is not started if the measurement is initiated manually (ON/OFF key or RESTART/STOP key).

When the measurement has completed the first measurement cycle (first single shot), the statistical depth is reached and the timer is reset.

If the first measurement cycle has not been completed when the timer expires, the measurement is stopped. The measurement state changes to `RDY` and the reliability indicator is set to 1, indicating that a measurement timeout occurred. Still running `READ`, `FETCh` or `CALCulate` commands are completed, returning the available results. At least for some results there are no values at all or the statistical depth has not been reached.

A timeout of 0 s corresponds to an infinite measurement timeout.

Parameters:

<Timeout> Default unit: s

Firmware/Software: V3.2.30

Options: R&S CMW-KS210

2.5.21.3 Measurement Results

The following commands return the measurement results.

FETCh:GSM:SIGN<i>:CPERformance?
READ:GSM:SIGN<i>:CPERformance?

Returns all results of the signaling CMR performance measurement.

Return values:

<Reliability> See Reliability Indicator

<Result> Used codec mode number
9 values: initial value and one value per 40 ms
Range: 1 to 4

Usage: Query only

Firmware/Software: V3.2.30

Options: R&S CMW-KS210

Manual operation: See "Results" on page 162

2.6 List of Commands

3 GSM Measurements

The "GSM Multi Evaluation Measurement" (option R&S CMW-KM200) provides TX and RX tests on GSM uplink signals. The tests cover the following mobile transmitter properties:

- Transmitter output power over a wide range of timeslots
- Modulation accuracy
- Spectrum due to switching and due to modulation
- Off-carrier emissions vs. time
- I/Q constellation diagram
- Bit Error Rate (BER) test

Many of the tests and conformance requirements are specified in 3GPP TS 51.010-1, Digital cellular telecommunications system (Phase 2+); Mobile Station (MS) conformance specification.

With option R&S CMW-KM201, GPRS EDGE Evolution (EGPRS2-A, Uplink), the R&S CMW can also measure 16QAM-modulated bursts.

3.1 What's New in this Revision

This revision describes version 3.2.70 and later of the "GSM Measurements" firmware application. Compared to version 3.2.30 it provides the following new feature:

GPRF generator shortcut, see Generator Shortcut

Software Version

To check your R&S CMW software version, open the "Setup" dialog and click "HW/SW Equipment". The initial software version for each remote control command is quoted in the reference description.

3.2 General Description

The GSM "Multi Evaluation" measurement (option R&S CMW-KM200) captures an uplink (UL) GSM signal and provides the TX measurement results over a series of consecutive slots. With an additional ARB generator, it is also possible to perform Bit Error Rate measurements (RX tests).

The following sections describe how to perform and configure the measurement.

3.2.1 GSM TX Tests

TX tests have many characteristics in common. The following sections describe these characteristics and show how to perform TX tests.

3.2.1.1 Test Setup

The external RF signal source (mobile station, signal generator etc.) is connected to one of the RF input connectors (RF COM) at the front panel of the R&S CMW. No additional cabling and no external trigger is needed.

The input level ranges of all RF COM connectors are identical.

See also: "RF Connectors" in the R&S CMW user manual, chapter "Getting Started"

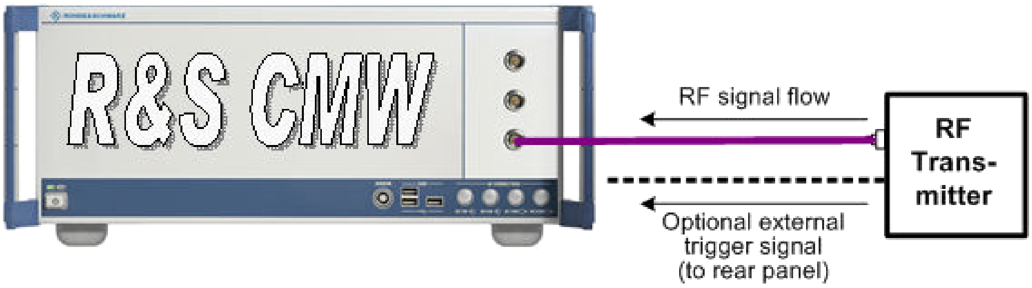


Fig. 3-1: Connecting an RF transmitter to the instrument

3.2.1.2 Measuring an UL GSM Signal

After connecting your GSM mobile phone to the R&S CMW as shown above, you have to adjust the following analyzer settings to the properties of the analyzed UL GSM signal:

- The analyzer "Frequency"
- The "Expected Nominal Power" and (optional) a "User Margin" and "External Attenuation". Recommended values: "Expected Nominal Power" = average power of the UE signal; "User Margin" = + 5 dB (for 8PSK-modulated bursts) and +7.5 dB (for 16-QAM-modulated bursts).

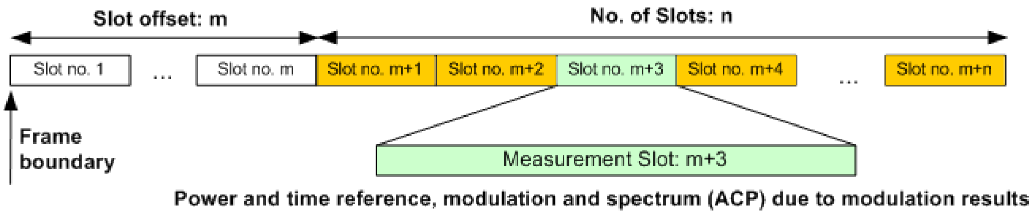
The R&S CMW uses an RF power trigger and should be able to synchronize to the incoming bursts and decode the signal.

3.2.1.3 Defining the Scope of the Measurement

The GSM "Multi Evaluation" measurement is a multislot application: The R&S CMW can measure up to 8 consecutive GSM slots (1 frame) and store the power results for all slots.

Within this measurement interval, a single slot ("Measurement Slot") is selected for a more detailed analysis. The measurement slot provides:

- The reference power and time reference (symbol no. 0) for the "Power vs. Time" diagram.
- The results in all modulation and spectrum due to modulation diagrams (the spectrum due to switching results are measured over all slots).
- The statistical results in the detailed views of all modulation and spectrum diagrams.
- The list mode results.



If the interval of n measured slots is measured repeatedly, the R&S CMW can evaluate the trace and slot statistics in consecutive intervals.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "System Overview"

Tip: Burst pattern selection

The measurement provides different mechanisms for detecting and selecting multislot configurations with specific properties. Refer to the application sheets Detecting GSM Multislot Frames and Capturing GSM Burst Sequences.

3.2.1.4 Configuring the Spectrum Measurement

The spectrum measurements are performed in the "Measurement Slot". Compared to the power vs. time and modulation measurements, spectrum measurements depend on the following additional settings:

- The frequency offsets for the spectrum due to modulation and spectrum due to switching measurements in the frequency domain.
- The evaluation area for the spectrum due to modulation measurement and the peak hold mode for spectrum due to switching.
- The frequency offsets for the spectrum vs. time measurements.
- The spectrum vs. time measurements can slow down the measurement (see Speed Considerations), so they can be enabled separately.

3.2.1.5 Speed Considerations

The following measurement settings provide additional results but can slow down the measurement:

- Evaluation of the spectrum vs. time measurements
- Evaluation of the "AM-PM" delay for polar modulators
- Access burst search

The following settings improve the accuracy of the results but require additional processing time:

- Measurement of 8PSK or 16-QAM-modulated bursts in "Data Compensated" reference power mode.

3.2.1.6 Trigger Settings

The GSM multi evaluation measurement can be performed in "Free Run" (untriggered) mode, however, an internal trigger is suitable for most measurement tasks.

Note the following Trigger Source settings:

- With a "Power" trigger, the measurement is triggered by the power ramp of the received GSM bursts. Use this trigger source for single-slot measurements and for unique events such as the access burst transmitted during the connection setup.
- With an "Acquisition" trigger, the R&S CMW analyzes the RF input signal and derives a frame trigger using information about the active slots. Use this trigger source for multislot measurements, in particular those with repeated burst patterns.

Refer also to the application sheet Detecting GSM Multislot Frames.

3.2.1.7 Parallel Signaling and Measurement

The TX multi evaluation measurement can be used in parallel to the GSM signaling application (options R&S CMW-KS200), i.e. a connection to the DUT can be set up by the signaling application and the resulting uplink signal can be measured using the multi evaluation measurement.

To use both applications in parallel, the combined signal path scenario must be activated (see "Scenario" on page 418). Most signal routing and analyzer settings and some measurement control settings are then configured by the signaling application. The multi evaluation measurement displays the corresponding signaling settings instead of its own settings. These signaling settings can be configured in both measurement and signaling application GUIs. Signaling application commands need to be used to configure the settings via remote control. For a command mapping table refer to chapter 3.6.4, "Combined Signal Path Commands", on page 577.

In the measurement GUI the most important signaling parameters can be configured via additional hotkeys, see chapter 3.4.2.12, "Additional Softkeys and Hotkeys", on page 440.

In the combined signal path scenario, the trigger signal from the signaling application shall be used as the measurement application trigger input. The selection of the trigger is done automatically, based on scenario.

3.2.2 GSM RX Tests

RX tests can be carried out in parallel to the GSM TX Tests. This section describes the principle of the GSM Bit Error Rate (BER) measurement.

The R&S CMW uses either the GPRF (ARB) generator or the GSM real-time generator to send a bit pattern to the receiver of the mobile under test. The mobile must loop back the received bits. The "GSM Multi Evaluation" measurement can compare the looped-back bit pattern with the original pattern in order to calculate the BER.

The R&S CMW supports two different BER measurements for GMSK and 8PSK-modulated signals, respectively. For each measurement, the configuration of the mobile, the ARB or real-time generator and the measurement must match.

The two ARB files for GSM BER measurements provide signals with the following properties:

- File `LoopC_1040.wv` provides a GMSK-modulated, channel-coded full rate speech TCH. The raw bit pattern is an alternating 010101... sequence, however, the signal is channel-coded so that the transferred bit sequence is approximately random. Channel coding means that the mobile can measure the channel quality, therefore you may compare the RxQual values with the BER measured by the R&S CMW. Each GMSK-modulated normal burst carries 114 data bits to be compared for the BER measurement.
- File `SRB_8PSK_1040.wv` provides an 8PSK-modulated signal. Only the header is channel-coded, the transferred data bit sequence is approximately random. With this signal, the R&S CMW can perform BER tests for modulation and coding schemes MCS7, MCS8 and MCS9.
  The 42 header bits in a 8PSK-modulated normal burst are not considered for the BER calculation. This leaves 306 data bits per burst to be compared for the BER measurement.

The bit patterns of both ARB generator signals have a four-burst periodicity. During a BER test, the R&S CMW evaluates one burst in each measurement interval (defined by the selected "No. of Slots", e.g. 8 slots for an entire TDMA frame). The default trigger source ("Power") ensures that a burst filled with looped-back data is captured. The whole BER test extends over a selectable number of measurement intervals/bursts ("Statistic Count" setting).

Real-time generator signals

The GSM real-time generator provides traffic channel ("TCH") signals with the same properties as the signals generated by the `LoopC_1040.wv` and `SRB_8PSK_1040.wv`.

- The TCH signal with "Data Source: Alternating" corresponds to the GMSK-modulated loop C signal (equivalent to file `LoopC_1040.wv`).
- The TCH signal with "Data Source: BER pattern" and "Traffic Mode: SRB MCS-9*) corresponds to the 8PSK-modulated SRB loop signal (equivalent to file `SRB_8PSK_1040.wv`). The real-time generator also provides an alternative signal with non-interleaved data fields ("Traffic Mode: SRB MCS-9*) that may be used for BER tests.

Refer to the documentation of the GSM generator for further information.

Note: Limitations of the GSM BER measurement

Due to the four-burst periodicity, the generator produces four different burst types, each carrying a different bit pattern. The R&S CMW must assign each captured burst to one of the four types before it can calculate the BER. This measurement method ensures accurate BER results up to approx. 15%. BER results > 30 % are not displayed; the R&S CMW shows invalid results.

For a measurement example refer to the application sheet GSM BER Tests on ARB Signals.

See also: "RX Measurements" in the R&S CMW user manual, chapter "System Overview"

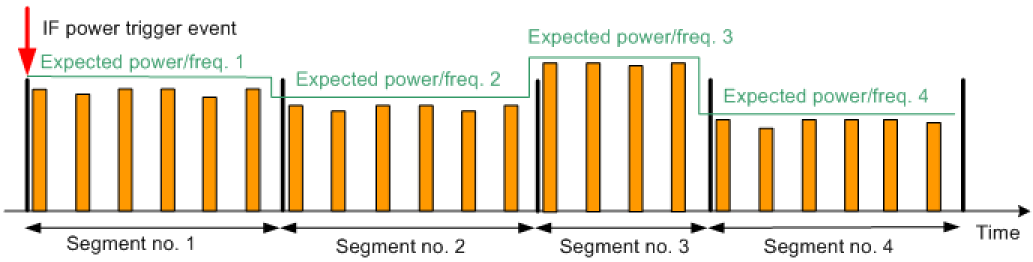
3.2.3 List Mode

The GSM multi evaluation list mode requires option R&S CMW-KM012. In this mode the measurement interval is subdivided into segments, according to the expected power and frequency steps of the mobile station (MS) under test.

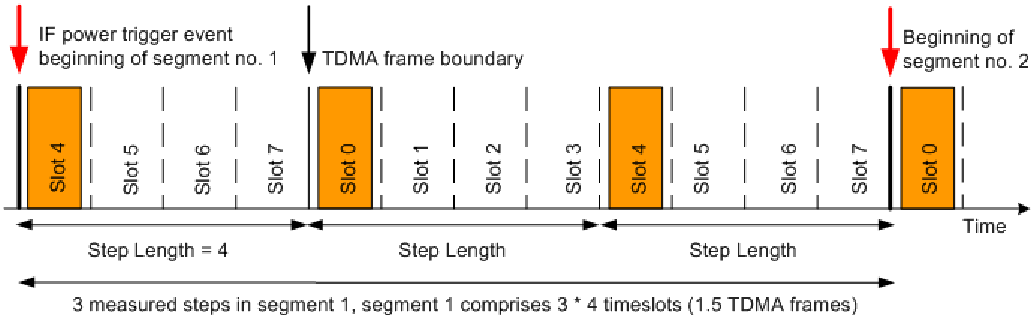
The following sections describe how to configure the measurement and evaluate the results.

3.2.3.1 List Mode Configuration

Each segment contains an integer number of timeslots and is measured at constant analyzer settings (i.e. at constant expected nominal power and RF frequency). The figure below shows a series of four segments with different lengths. Orange bars depict measured timeslots.

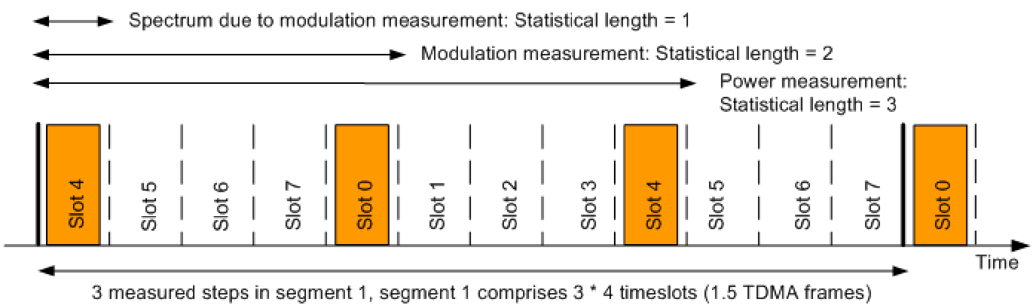


The standard application of the GSM list mode is to measure a range of equidistant timeslots separated by gaps. The distance between 2 measured timeslots ("step length") can vary between 1 and 8 timeslots (1 TDMA frame). The relationship between the step length, measured steps per segment and segment length is shown below. The figure shows four measured, active slots (orange). The remaining slots may be active or inactive; they are not measured. With a step length of 4 slots, segment no. 1 contains 3 measured steps and has a duration of 12 timeslots (1.5 TDMA frames).



An "evaluation offset" excludes an integer number of timeslots at the beginning of each segment from the measurement.

In list mode the R&S CMW can measure all power, modulation, spectrum due to modulation and spectrum due to switching results. It is possible to enable or disable the measured quantities individually for each segment. Moreover, it is possible to define a statistical length for the calculation of average, minimum and maximum results.



The R&S CMW supports up to 24000 captured GSM timeslots. Thus with a step length of 1 up to 24000 steps can be measured, while with a step length of 8, up to 3000 steps can be measured. A segment may contain up to 3000 steps, of which up to 1000 steps can be measured (maximum statistical length, for some results up to 100 steps).

Idle frame evaluation

Each 26th frame of a GSM uplink signal is an idle frame and causes a "Signal low" error. It can be configured, whether this "Signal low" error is ignored or indicated, e.g. via the reliability indicator and the return code. Both indicators are returned when measurement results are queried.

Possible settings:

- Do not Ignore Idle Frames: The reliability indicator and the return code indicate "Signal low" when an idle frame is measured.
- Ignore Idle Frames: A certain number of "Signal low" errors is ignored and not indicated via reliability indicator and return code. How many "Signal low" errors are ignored, depends on the number of measured frames and the number of slots measured per frame.
  Example: If three slots are measured per frame, the first three "Signal low" errors of each measured 26 frames are ignored. If a fourth (fifth, sixth, ...) "Signal low" error occurs within the 26 frames, it is indicated.

Trigger modes

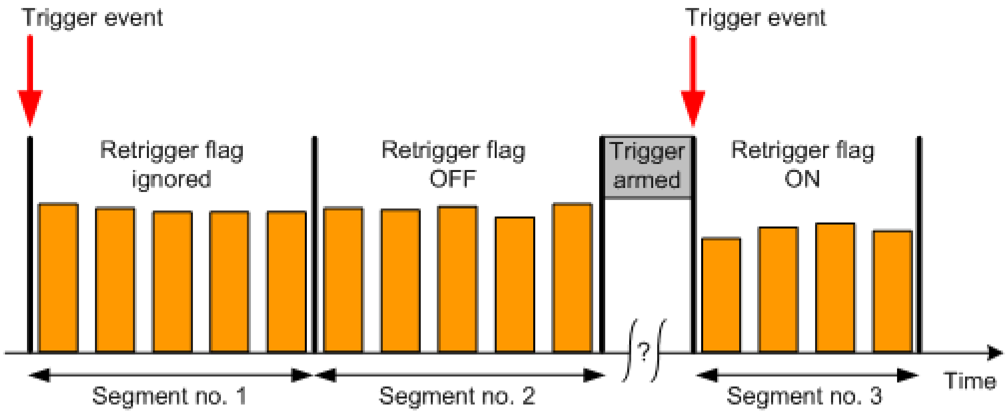
A list mode measurement can either be triggered only once, or it can be retriggered at the beginning of specified segments.

In "Once" mode a trigger event is only required to start the measurement. As a result the entire range of segments (up to 512) is measured without additional trigger event. The trigger is rearmed after the measurement has been finished. Specified retrigger flags are ignored.

The "Once" mode is recommended for UL signals with accurate timing over the entire range of segments.

In "Segment" mode the retrigger flag of each segment is evaluated. It defines whether the measurement waits for a trigger event before measuring the segment, or not. Retriggering the measurement is recommended if the timing of the first timeslot of a segment is inaccurate, e.g. because of signal reconfiguration at the UE. Furthermore retriggering from time to time can compensate for a possible time drift of the UE. The retrigger flag of the first segment of the measurement is always ignored (implicitly set to ON).

In the example shown below the "Segment" trigger mode is enabled. The retrigger flag is OFF for the second segment and ON for the third segment. Thus the measurement stops when the first and second segment have been captured and waits for a trigger event before capturing the third segment.



Configuration of segments and measurement

Segment configuration and measurement are independent from each other. To perform a sequence of measurements at maximum speed,

1. Configure all segments ever needed.

   The R&S CMW supports a range of up to 2000 configured segments.

2. Select up to 512 consecutive segments within the configured segment range.
3. Measure the selected segments.
4. Repeat steps 2 and 3 as often as needed.

The list mode is essentially a single-shot remote control application; an application example is reported in section Using GSM List Mode. The essential remote control commands are listed below.

Table 3-1: List mode commands

Parameters	SCPI commands
Activate list mode	`CONFigure:GSM:MEAS<i>:MEValuation:LIST`
Segment configuration: steps per segment, expected power, RF frequency, PCL, retrigger, evaluation offset	`CONFigure:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:SETup`
Step length	`CONFigure:GSM:MEAS<i>:MEValuation:LIST:SLENgth`
Statistical length	`CONFigure:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:PVTime` (analogous for modulation, spectrum, BER)
Ignore idle frames or not	`CONFigure:GSM:MEAS<i>:MEValuation:LIST:IIFRames`
Trigger segment or entire measurement interval	`TRIGger:GSM:MEAS<i>:MEValuation:LIST:MODE`

Parameters	SCPI commands
Select range of measured segments	CONFigure:GSM:MEAS<i>:MEValuation:LIST:LRANge
Retrieve results	FETCh:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:... FETCh:GSM:MEAS<i>:MEValuation:LIST:... See chapter 3.6.3.30, "List Mode Results (One Segment)", on page 544, chapter 3.6.3.32, "List Mode Results (All Segments, Result Groups)", on page 567 and chapter 3.6.3.31, "List Mode Results (All Segments, One Result)", on page 554. Note that the segment number <no> for configure commands is an absolute number (1..2000) while the segment number <no> for result retrieval is a relative number within the range of measured segments (1..512). Example: Segment 1 to 100 configured. Segment 50 to 59 measured. For result retrieval <no> = 1 refers to segment 50, <no> = 10 to segment 59.

Global and list mode parameters

The RF settings (expected power, RF frequency) and most of the "Measurement Control" settings (step length, steps per segment, averaging lengths, enable/disable results) are special list mode settings. The R&S CMW ignores the corresponding "multi evaluation" parameters. All other settings are taken from the multi evaluation measurement, e.g.:

- Measure on Exception
- Slot Offset, Number of Slots, Measurement Slot: always use the *RST values (0, 1, 0) for list mode measurements
- Access Burst Search
- Special "Power", "Modulation", "Spectrum Modulation" and "Spectrum Switching" settings
- All trigger settings (note that an "Acquisition" trigger cannot be used in list mode)
- All limit settings

3.2.3.2 Extension for Multislot Measurements

In principle, the list mode is compatible with any MS signal configuration. For multislot configurations, a special "frame pattern" mode is available. In this mode, the R&S CMW can measure an arbitrary number of (not necessarily equidistant) slots per 8-slot period. The first 8-slot period starts with the trigger event; it does not have to coincide with the TDMA frame boundary of the measured GSM signal.

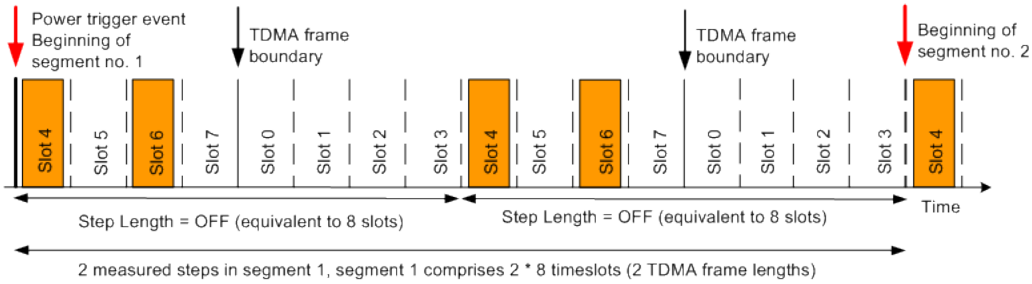


Fig. 3-2: Frame pattern mode for multislot configurations

The frame pattern mode is active as long as the step length is set to OFF. An 8-bit binary parameter describes the measured slots within each consecutive 8-slot period.

Example: The following commands configure a frame pattern mode according to the figure above (measured slots: no. 1 and 3 after the power trigger event).

```
CONFigure:GSM:MEAS:MEValuation:LIST:SLENgth OFF
CONFigure:GSM:MEAS:MEValuation:LIST:SEGMent1:PVTime 5, ON,
#B10100000
```

3.2.3.3 Conditions and Restrictions

The list mode parameters, in particular the selected "step length" or "frame pattern", must be compatible with the properties of the measured signal. A *RST at the beginning of the remote control program is recommended.

Initial trigger

The list mode is most conveniently triggered using a "Power" trigger. The measurement must be initiated **before** the mobile phone signal is turned on. This ensures that the measurement will start at the first active timeslot.

Adjustment of analyzer settings

If two consecutive segments are measured at different RF frequencies and expected powers, the R&S CMW must change its analyzer settings after the last measured slot in the first segment. Adjustment starts in the middle of the step length. This means that, with a step length of one timeslot, the last step in the first segment cannot be measured. No restrictions apply to larger step lengths.

3.2.3.4 Offline Mode and Offline Segment

In list mode, it is possible to select the results of a single segment for display in the measurement diagram (see also List Mode Configuration). This "offline mode" offers several advantages:

- Check of the measurement results (e.g. while developing test scripts)

- Calculation and display of additional measurement results (traces). Use the `FETCh:GSM:MEAS:MEValuation:TRACe:...` commands to retrieve these results.

After a list mode measurement is completed, the measurement diagram shows the last segment measured. Calculation of the offline results in an arbitrary segment requires a two-stage measurement:

1. Start a single-shot list mode measurement (`INITiate:GSM:MEAS:MEValuation`) to collect all measurement data.
2. Select the offline segment (CONFigure:GSM:MEAS:MEValuation:LIST:OSINdex <Segment>), then initiate a second measurement (repeat `INITiate:GSM:MEAS:MEValuation`) and go to local in order to view the results.

The second measurement stage implies a calculation of all measurement results in the offline segment from the existing raw data; no new measurement data is acquired. By repeating this second stage for different segments, you can obtain a complete set of measurement results over the entire measurement length.

Reconfiguration of the measurement, example

To obtain consistent results in the second measurement stage, the raw data must still correspond to the measurement settings. Avoid any reconfiguration that would require a new measurement (e.g. a change of the step length), if you wish to re-use your data in offline mode.

For a measurement example see Using GSM List Mode.

3.2.4 GSM UL Signal Properties

The GSM physical channel uses a combination of frequency and time division multiplexing and is defined as a sequence of radio frequency channels and timeslots. The basic system and physical channel parameters are listed below.

Table 3-2: Basic GSM parameters

Parameter	Value
TDMA frame duration	60/13 ms ≈ 4.615 ms
Slot duration (8 slots per TDMA frame)	15/26 ms ≈ 576.9 µs
Symbol rate	270.833 ksymbols/s
Symbol duration	3.69 µs/symbol (--> 156.25 symbols per timeslot)
Modulation schemes	GMSK (1 bit per symbol) 8PSK (3 bits per symbol) 16QAM (4 bits per symbol)

8PSK channels (the so-called EDGE channels) and 16-QAM channels are used for data transmission; only normal bursts are transmitted. The R&S CMW supports uplink 16-QAM channels at normal symbol rate (EGPRS2-A channels). Hence, the symbol rate for 8PSK channels and 16-QAM channels is the same as for GMSK modulation, which corresponds to a bit rate of 3 x 270.833 kbit/s and 4 x 270.833 kbit/s, respectively.

For further reference refer to the following standards:

- 3GPP TS 45.002, physical channels and bursts
- 3GPP TS 45.004, modulation formats
- 3GPP TS 45.005, transmitter and receiver requirements

3.2.5 GSM Frequency Bands and Channels

The GSM frequency bands are defined in standard 3GPP TS 25.021. A band contains a set of adjacent channels, each with a bandwidth of 200 kHz. The channel numbers and the assignment between channel numbers and frequencies are band-specific.

In all frequency bands, the downlink frequencies are higher than the corresponding uplink frequencies. The difference between downlink and uplink frequencies is termed the duplex spacing; it is also band-specific.

The tables below give an overview all supported GSM bands with their channel numbers and the downlink and uplink center frequencies.

Band	Channel Numbers	Center Frequencies F_{DL} [MHz]	Center Frequencies F_{UL} [MHz]
GSM400 1)	259 to 340	460.6 to 495.0	450.6 to 485.0
GSMGT800 2)	350 to 425	851.0 to 866.0	806.0 to 821.0
GSM850 3)	128 to 251	869.2 to 893.8	824.2 to 848.8
GSM900 (P-GSM900) (R-GSM900) (E-GSM900)	 0 to 124 940 to 974 975 to 1023	 935.0 to 959.8 918.2 to 925.0 925.2 to 934.8	 890.0 to 914.8 873.2 to 880.0 880.2 to 889.8
GSM1800 4)	512 to 885	1805.2 to 1879.8	1710.2 to 1784.8
GSM1900 5)	512 to 810	1930.2 to 1989.8	1850.2 to 1909.8

1) This R&S CMW band comprises the bands GSM450 and GSM480 from the standard.

2) This R&S CMW band corresponds to band T-GSM810 from the standard.

3) This R&S CMW band corresponds to the bands GSM850 and MXM850 from the standard.

4) This R&S CMW band corresponds to the band DCS1800 from the standard.

5) This R&S CMW band corresponds to the bands PCS1900 and MXM1900 from the standard.

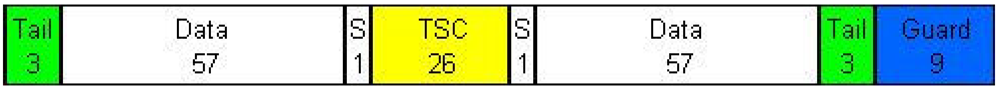
3.2.6 Burst Types

The GSM physical channel is a sequence of timeslots, each of which is divided into 156.25 symbol periods; see GSM UL Signal Properties. A burst represents the physical content of a timeslot. Standard 3GPP TS 05.02 defines the different burst types together with their bit structure. The GSM multi evaluation measurement supports all specified uplink burst types.

GMSK-modulated normal burst

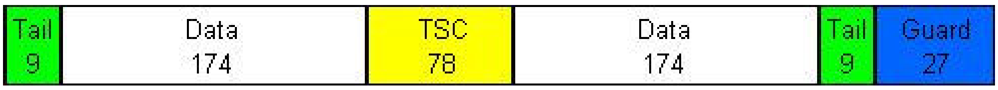
The GSMK-modulated normal burst is used for data transmission on the traffic channel and on the control channels (except the RACH, PRACH and CPRACH).

The normal burst contains two 57-bit long data fields for the transmission of the user information. The training sequence (TSC) in the center is flanked by two "stealing flag" bits (S1); each of them is set to 0. The 2 times 3 tail bits at the beginning and at the end of the burst are all set to 0, the 8.25-bit guard period at the end is transmission-free.



8PSK-modulated normal burst

An EDGE burst is an 8PSK-modulated normal burst; see GSM UL Signal Properties. EDGE bursts are used for data transmission at higher data rates. Due to the higher-order modulation scheme, the bit content of all fields is tripled. The "stealing flag" bits are not present. All tail bits are set to 1. The length of the guard period is 24.75 bits.

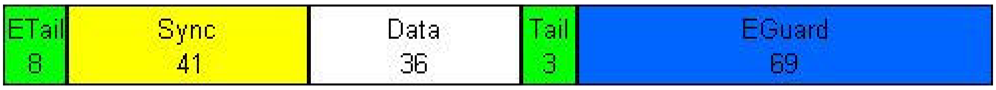


16-QAM-modulated normal burst

To further increase the data rate, EDGE Evolution introduces 16-QAM-modulated normal bursts; see GSM UL Signal Properties. The burst structure is equal to the 8-PSK-modulated normal burst, however, the bit content is multiplied by a factor of 4/3: The burst contains (12 + 232 + 104 + 232 + 36) bits.

Access burst

The access burst is used by mobile stations for initial random access to the network and for handover. In packet data mode, it is also possible to use access bursts for the transmission of CONTROL_ACK_TYPE messages. Compared to a normal burst, the access burst has an extended guard period (EGuard, 68.25 symbols instead of 8.25 symbols) whereas the useful duration is shortened by 60 symbols. Access bursts are always GMSK-modulated



3.2.7 Limit Settings and Conformance Requirements

Conformance requirements for GSM transmitter tests are specified in 3GPP TS 51.010-1, section 13, "Transmitter Characteristics" and in the related specifications quoted therein, in particular 3GPP TS 45.005.

The following sections give an overview of the R&S CMW limit settings and the related test requirements.

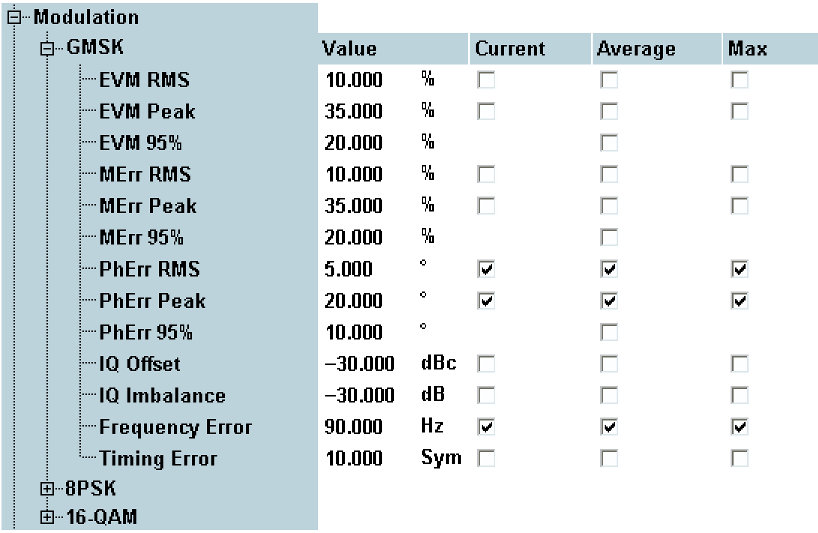
3.2.7.1 Transmit Modulation Limits

A poor modulation accuracy of the mobile transmitter increases the transmission errors in the uplink channel of the GSM network. The frequency error and the phase error are the critical quantities to assess the modulation accuracy of a GSM mobile phone.

For GMSK modulation 3GPP defines that the frequency error, measured at various mobile transmitter output powers and frequencies, shall not exceed 0.1 ppm (0.2 ppm for GSM 400). In addition, the RMS phase error, measured after adjustment for the effect of the frequency error and averaged over all samples in the useful part of the burst, shall not exceed 5 deg. The peak phase error shall not exceed 20 deg. At each channel and mobile output power, the measurement shall be repeated with a statistic count ≥ 20 deg.

For 8PSK (16-QAM) modulation 3GPP defines that the RMS EVM over the useful part of any burst of the signal shall not exceed 9 % (7 %), the peak EVM shall not exceed 30 % and the EVM 95th percentile shall not exceed 15 %. In addition the I/Q Offset shall be better than -30 dB. The frequency error shall not exceed 0.1 ppm (0.2 ppm for GSM 400).

The specified limits can be set in the configuration dialog, along with limits for the other measured quantities (for reference information refer to Modulation).



Modulation	Value		Current	Average	Max
GMSK					
EVM RMS	10.000	%	☐	☐	☐
EVM Peak	35.000	%	☐	☐	☐
EVM 95%	20.000	%		☐	
MErr RMS	10.000	%	☐	☐	☐
MErr Peak	35.000	%	☐	☐	☐
MErr 95%	20.000	%		☐	
PhErr RMS	5.000	°	☑	☑	☑
PhErr Peak	20.000	°	☑	☑	☑
PhErr 95%	10.000	°		☐	
IQ Offset	−30.000	dBc	☐	☐	☐
IQ Imbalance	−30.000	dB	☐	☐	☐
Frequency Error	90.000	Hz	☑	☑	☑
Timing Error	10.000	Sym	☐	☐	☐
8PSK					
16-QAM					

The table below lists the test requirements of specification 3GPP TS 51.010-1.

Characteris-tics	Refer to 3GPP TS 51.010-1, section...	Specified Limit
Frequency Error	13.1 Frequency Error and Phase Error see also: 13.6, 13.16.1, 13.17.1	< 0.2 ppm (GSM 400) < 0.1 ppm (all other GSM bands)
Phase Error	13.1 Frequency Error and Phase Error see also: 13.6, 13.16.1	RMS < 5 deg peak < 20 deg
EVM Error	13.17.1 Frequency Error and Modulation Accuracy	RMS < 9 % (7 %) peak < 30 % percentile < 15 %
I/Q Offset	13.17.1 Frequency Error and Modulation Accuracy	> -30 dB

3.2.7.2 Avg. Burst Power Limits

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

GSM mobile phones are divided into different power classes according to their maximum output power.

Table 3-3: GSM power classes

Power class	Nominal maximum output power in dBm		
	GSM 400 GSM GT800 GSM 850 GSM 900	GSM 1800	GSM 1900
1	–	30	30
2	39	24	24
3	37	36	33
4	33	–	–
5	29	–	–

The actual transmitter output power is controlled using the dimensionless Power Control Level (PCL) scale.

Table 3-4: GSM power control levels

PCL	Nominal maximum output power in dBm		
	GSM 400 GSM GT800 GSM 850 GSM 900	GSM 1800	GSM 1900
0	39	30	30
1	39	28	28
2	39	26	26
3	37	24	24
4	35	22	22
5	33	20	20
6	31	18	18
7	29	16	16
8	27	14	14
9	25	12	12
10	23	10	10
11	21	8	8
12	19	6	6
13	17	4	4
14	15	2	2
15	13	0	0
16	11	0	0
17	9	0	0
18	7	0	0
19 to 28	5	0	0
29	5	36	36
30	5	34	34
31	5	32	32

According to the GSM standard, the tolerances for the average burst powers, measured at various frequencies,depend on the GSM band and PCL; see tables below. The tolerances are applicable for both normal and access bursts.

The limits can be set in the configuration dialog (for reference information refer to Avg. Burst Power).

Power vs Time		from PCL	to PCL	Lower	Upper
Avg.Burst Power					
Range [0]	☑	5	5	-2.0 dB	2.0 dB
Range [1]	☑	0	2	-2.0 dB	2.0 dB
Range [2]	☑	3	15	-3.0 dB	3.0 dB
Range [3]	☑	16	31	-5.0 dB	5.0 dB
Range [4]	☐	0	0	0.0 dB	0.0 dB
Range [5]	☐	0	0	0.0 dB	0.0 dB
Range [6]	☐	0	0	0.0 dB	0.0 dB
Range [7]	☐	0	0	0.0 dB	0.0 dB
Range [8]	☐	0	0	0.0 dB	0.0 dB
Range [9]	☐	0	0	0.0 dB	0.0 dB
Guard Period	☑	3.0 dB			

The tables below list the test requirements of specification 3GPP TS 51.010-1, section 13.3. The following tolerances apply to GSM 400, GSMGT800, GSM 800 and GSM900 networks:

Power class				Power control level	Transmitter output power	Tolerances	
2	3	4	5		dBm	normal	extreme
•				2	39	±2 dB	±2,5 dB
•	•			3	37	±3 dB (note)	±4 dB (note)
•	•			4	35	±3 dB	±4 dB
•	•	•		5	33	±3 dB (note)	±4 dB (note)
•	•	•		6	31	±3 dB	±4 dB
•	•	•	•	7	29	±3 dB (note)	±4 dB (note)
•	•	•	•	8	27	±3 dB	±4 dB
•	•	•	•	9	25	±3 dB	±4 dB
•	•	•	•	10	23	±3 dB	±4 dB
•	•	•	•	11	21	±3 dB	±4 dB
•	•	•	•	12	19	±3 dB	±4 dB
•	•	•	•	13	17	±3 dB	±4 dB
•	•	•	•	14	15	±3 dB	±4 dB
•	•	•	•	15	13	±3 dB	±4 dB
•	•	•	•	16	11	±5 dB	±6 dB
•	•	•	•	17	9	±5 dB	±6 dB
•	•	•	•	18	7	±5 dB	±6 dB
•	•	•	•	19	5	±5 dB	±6 dB

NOTE: When the power control level corresponds to the power class of the MS, then the tolerances shall be 2,0 dB under normal test conditions and 2,5 dB under extreme test conditions.

The following tolerances apply to GSM 1800 networks:

Power class			Power control level	Transmitter output power	Tolerances	
1	2	3		dBm	normal	extreme
		•	29	36	±2,0 dB	±2,5 dB
		•	30	34	±3,0 dB	±4,0 dB
		•	31	32	±3,0 dB	±4,0 dB
•		•	0	30	±3,0 dB (note)	±4 dB (note)
•		•	1	28	±3 dB	±4 dB
•		•	2	26	±3 dB	±4 dB
•	•	•	3	24	±3 dB (note)	±4 dB (note)
•	•	•	4	22	±3 dB	±4 dB
•	•	•	5	20	±3 dB	±4 dB
•	•	•	6	18	±3 dB	±4 dB
•	•	•	7	16	±3 dB	±4 dB
•	•	•	8	14	±3 dB	±4 dB
•	•	•	9	12	±4 dB	±5 dB
•	•	•	10	10	±4 dB	±5 dB
•	•	•	11	8	±4 dB	±5 dB
•	•	•	12	6	±4 dB	±5 dB
•	•	•	13	4	±4 dB	±5 dB
•	•	•	14	2	±5 dB	±6 dB
•	•	•	15	0	±5 dB	±6 dB
NOTE:	When the power control level corresponds to the power class of the MS, then the tolerances shall be 2,0 dB under normal test conditions and 2,5 dB under extreme test conditions.					

The following tolerances apply to GSM 1900 networks:

Power class			Power control level	Transmitter output power	Tolerances	
1	2	3		dBm	Normal	Extreme
		•	30	33	±2,0 dB	±2,5 dB
		•	31	32	±2,0 dB	±2,5 dB
•		•	0	30	±3,0 dB (note)	±4 dB (note)
•		•	1	28	±3 dB	±4 dB
•		•	2	26	±3 dB	±4 dB
•	•	•	3	24	±3 dB (note)	±4 dB (note)
•	•	•	4	22	±3 dB	±4 dB
•	•	•	5	20	±3 dB	±4 dB
•	•	•	6	18	±3 dB	±4 dB
•	•	•	7	16	±3 dB	±4 dB
•	•	•	8	14	±3 dB	±4 dB
•	•	•	9	12	±4 dB	±5 dB
•	•	•	10	10	±4 dB	±5 dB
•	•	•	11	8	±4 dB	±5 dB
•	•	•	12	6	±4 dB	±5 dB
•	•	•	13	4	±4 dB	±5 dB
•	•	•	14	2	±5 dB	±6 dB
•	•	•	15	0	±5 dB	±6 dB
NOTE:	When the power control level corresponds to the power class of the MS, then the tolerances shall be 2,0 dB under normal test conditions and 2,5 dB under extreme test conditions.					

In multislot operation, a reduction of the maximum transmitter output power is allowed; see specification 3GPP TS 51.010-1, sections 13.7 and 13.16.2. Moreover, during the guard periods between any two active timeslots, the power must not be larger than 3 dB above the nominal burst power (dBc value); see also multislot Power Templates.

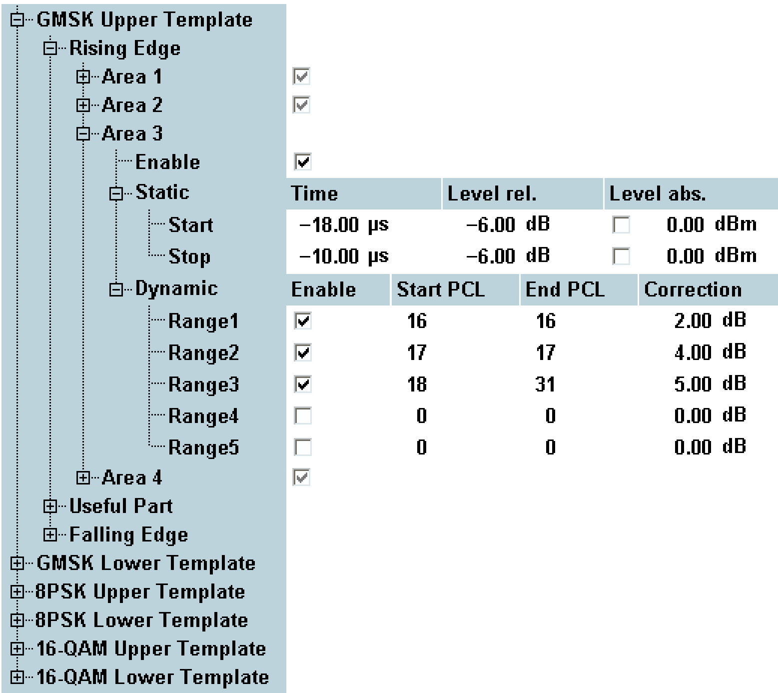
3.2.7.3 Power Templates

The GSM power templates specify the dynamic structure (power/time relationship) of the transmitted GSM bursts in single-slot and multislot operation. The burst is subdivided into different time intervals (areas) with specified upper and lower transmitter output power. The entire power template is defined relative to the average burst power, however, some the burst edges are PCL-dependent ("Dynamic" limit line correction). Power templates and average burst power limits complement each other.

Dynamic correction

If the "GSM Multi Evaluation" measurement is performed in combination with the "GSM Signaling" application, the PCL value for the dynamic correction is taken from the signaling application. In "Standalone (Non Signaling)" mode the R&S CMW estimates the PCL according to the received average burst power.

The power templates depend on the modulation scheme of the burst; they can be set in the configuration dialog (for reference information refer to Power Templates).



The figures below show the test requirements of specification 3GPP TS 51.010-1, section 13.3 and specification 3GPP TS 45.005, Annex B. The following tolerances apply to GPSK-modulated bursts (see legend below the 8PSK template below):

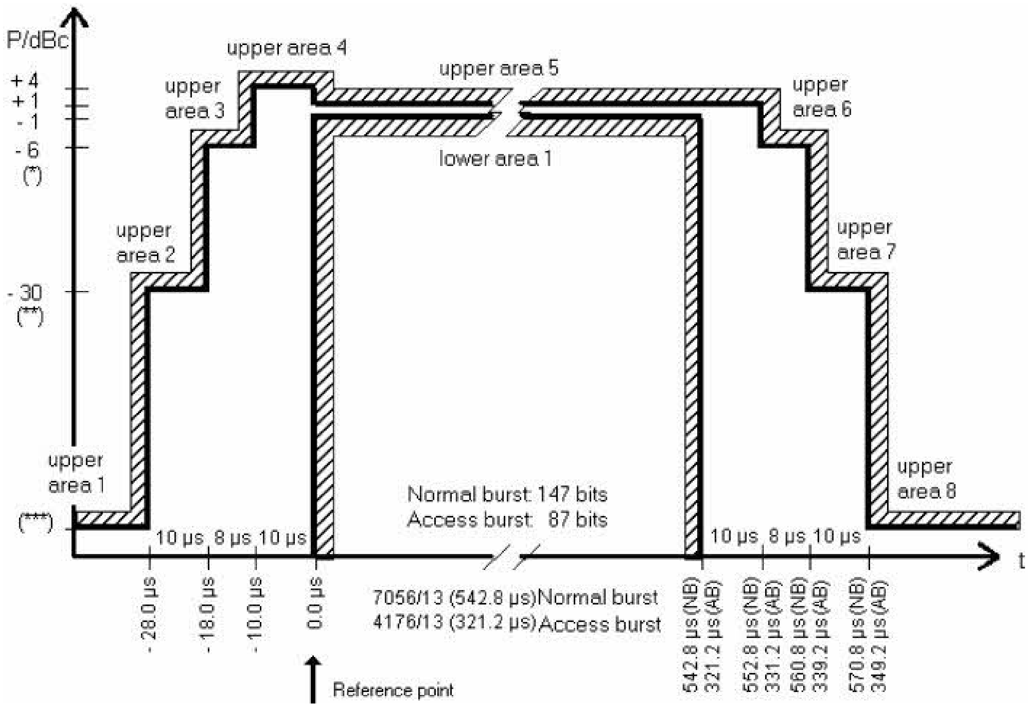


Fig. 3-3: Time mask at GMSK modulation

The following tolerances apply to 8PSK-modulated bursts:

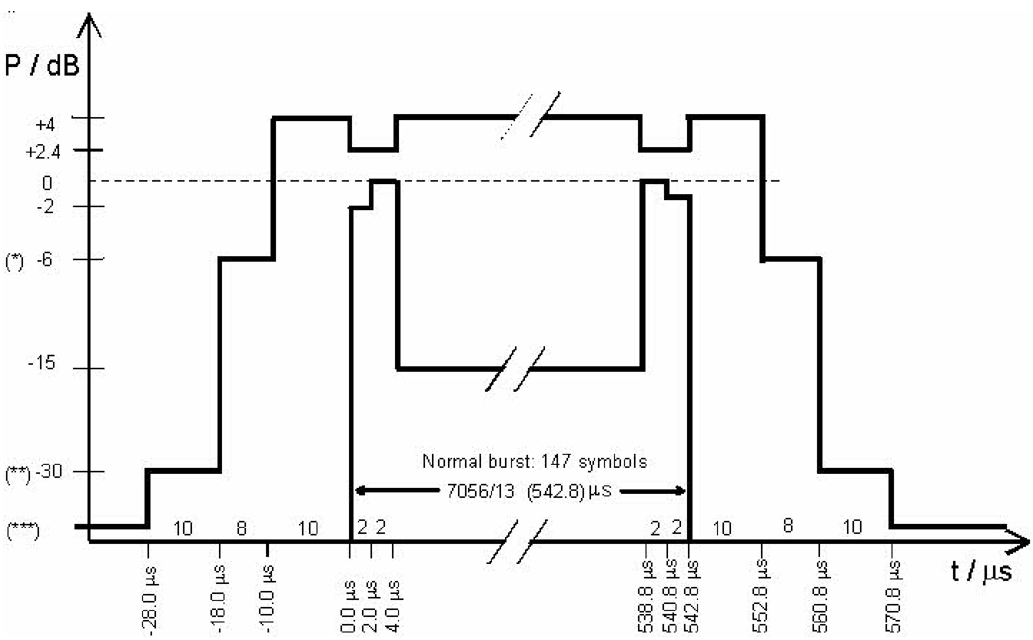


Fig. 3-4: Time mask at 8PSK modulation

GSM400/GT800/850/900-MS	GSM1800/1900-MS
(*) –4.0 dBc for power control level (PCL) 16 –2.0 dBc for PCL 17 –1.0 dBc for PCL 18 and 19 to 31	–4.0 dBc for PCL 11 –2.0 dBc for PCL 12 –1.0 dBc for PCL 13, 14 and 15 to 28
(**) –30.0 dBc or –17.0 dBm (higher value)	–30.0 dBc or –20.0 dBm (higher value)
(***) –59.0 dBc or –36.0 dBm (higher value)	–48 dBc or 48 dBm (higher value)

The following tolerances apply to 16-QAM-modulated bursts:

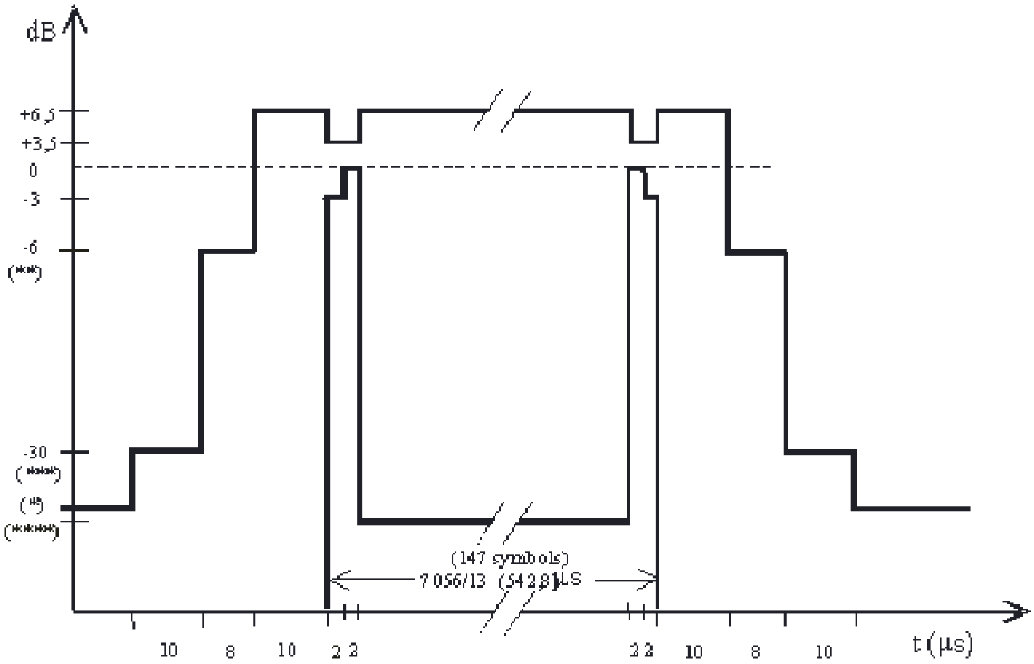


Fig. 3-5: Time mask at 16-QAM modulation

GSM400/GT800/850/900-MS	GSM1800/1900-MS
(*) –59.0 dBc or –36.0 dBm (higher value)	–48 dBc or 48 dBm (higher value)
(**) –4.0 dBc for power control level (PCL) 16 –2.0 dBc for PCL 17 –1.0 dBc for PCL 18 and 19 to 31	–4.0 dBc for PCL 11 –2.0 dBc for PCL 12 –1.0 dBc for PCL 13, 14 and 15 to 28
(***) –30.0 dBc or –17.0 dBm (higher value)	–30.0 dBc or –20.0 dBm (higher value)
(****) Lower limit within the useful part of the burst undefined	Lower limit within the useful part of the burst undefined

According to specification 3GPP TS 51.010-1, sections 13.7 and 13.16.2, 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 below.

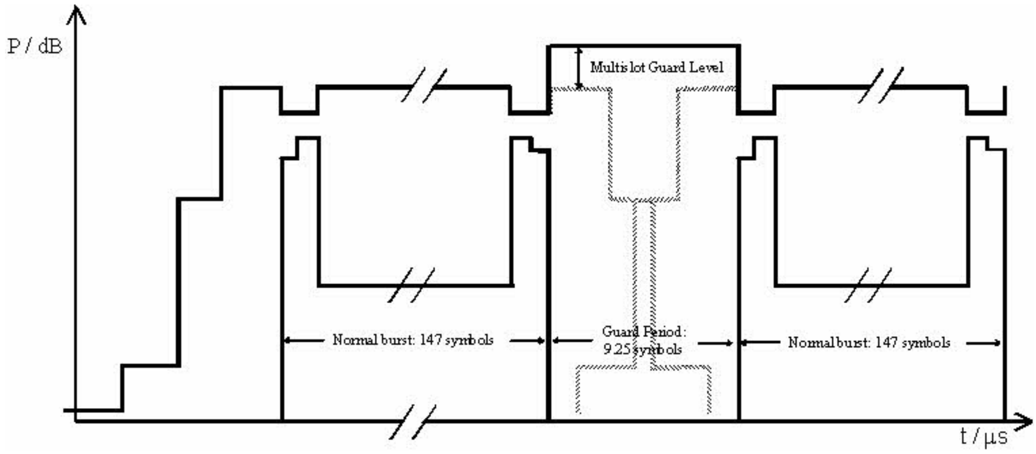
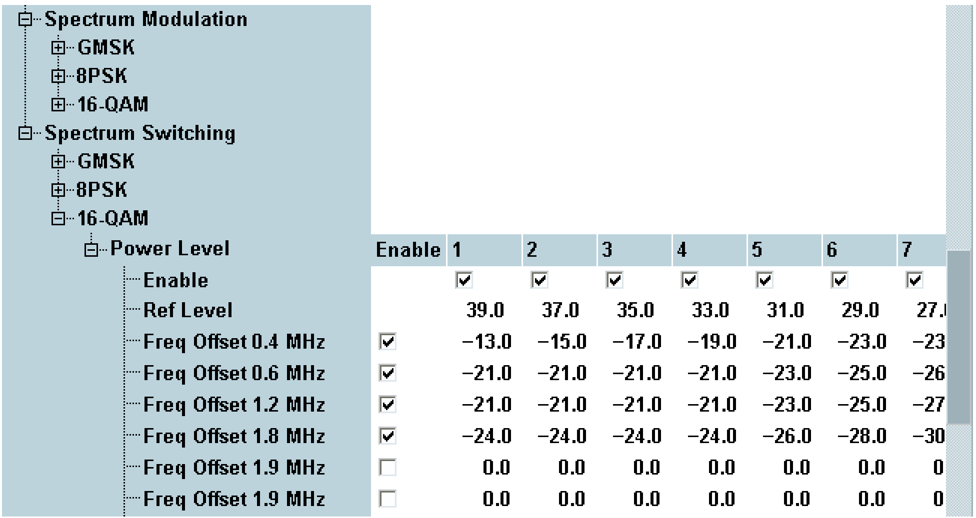


Fig. 3-6: Time mask of a multislot configuration

3.2.7.4 Spectrum Limits

The energy that spills outside the designated radio channel increases the interference with adjacent channels and decreases the system capacity. According to the conformance test specification 3GPP TS 51.010-1, the amount of unwanted off-carrier energy is assessed by the spectrum due to modulation and the spectrum due to switching (the "Spectrum Modulation" and "Spectrum Switching" results of the multi evaluation measurement). The spectrum limits are defined in the configuration dialog.



- Spectrum Modulation
  - GMSK
  - 8PSK
  - 16-QAM
- Spectrum Switching
  - GMSK
  - 8PSK
  - 16-QAM
    - Power Level

Power Level	Enable	1	2	3	4	5	6	7
Enable		☑	☑	☑	☑	☑	☑	☑
Ref Level		39.0	37.0	35.0	33.0	31.0	29.0	27.
Freq Offset 0.4 MHz	☑	−13.0	−15.0	−17.0	−19.0	−21.0	−23.0	−23
Freq Offset 0.6 MHz	☑	−21.0	−21.0	−21.0	−21.0	−23.0	−25.0	−26
Freq Offset 1.2 MHz	☑	−21.0	−21.0	−21.0	−21.0	−23.0	−25.0	−27
Freq Offset 1.8 MHz	☑	−24.0	−24.0	−24.0	−24.0	−26.0	−28.0	−30
Freq Offset 1.9 MHz	☐	0.0	0.0	0.0	0.0	0.0	0.0	0
Freq Offset 1.9 MHz	☐	0.0	0.0	0.0	0.0	0.0	0.0	0

The GSM limit specifications are equal for all modulation schemes, however, the limits can be chosen independently on the R&S CMW.

Spectrum Modulation Limits

The limit lines for the spectrum due to modulation depend on the GSM band, the frequency and (for frequencies that differ from the carrier frequency by more than 400 kHz) on the output power of the mobile station. The following values apply up to a frequency offset of 1.8 MHz:

	GSM400/GT800/850/900 Relative power at MS output power		**GSM1800/1900** Relative power at MS output power	
Frequency offset / [MHz]	**≤ 33 dBm (in dBc)**	**≥ 39 dBm (in dBc)**	**≤ 24 dBm (in dBc)**	**≥ 36 dBm (in dBc)**
0.1	+0.5	+0.5	+0.5	+0.5
0.2	–30	–30	–30	–30
0.25	–33	–33	–33	–33
0.4	–60 (GMSK mod.) –54 (8PSK and 16-QAM mod.)	–60	–60 (GMSK mod.) –54 and –60 (8PSK/16-QAM mod.)*)	–60
≥ 0.6, ≤ 1.8	–60	–66	–60	–60

*) For equipment supporting 8PSK/16-QAM, the limit of –54 dBc applies to MS output powers up to +30 dBm, –60 dBc to MS output powers above +30 dBm.

In the frequency range above 400 kHz from the carrier and for output powers between 33 dBm and 39 dBm (GSM400/GT800/850/900), the limit depends linearly on the output power. The resulting spectral mask for GMSK modulation is shown below.

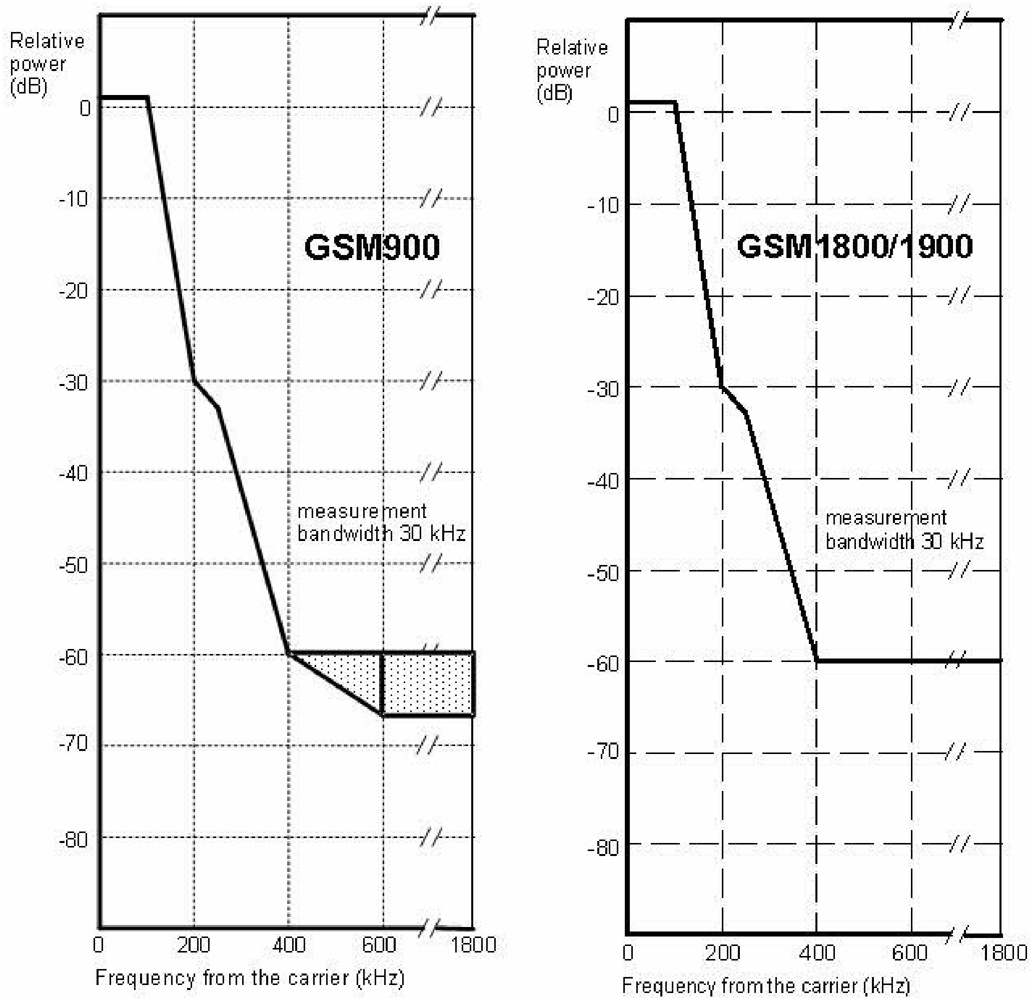


Fig. 3-7: Spectral mask for the spectrum due to modulation

As an alternative to the relative limit values quoted above, 3GPP specifies the following absolute limits, again depending on the frequency offset from the carrier and the GSM band. If the relative limits are below the absolute limits, the latter shall be applied.

Frequency offset [MHz]	Absolute power GSM400/GT800/850/900	Absolute power GSM1800/1900
< 0.6	–36 dBm	–36 dBm
≥0.6, <1.8	–51 dBm	–56 dBm
≥1.8	–46 dBm	–51 dBm

Spectrum Switching Limits

The limit lines for the spectrum due to switching cover offset frequencies between 0.4 and 1.8 MHz. They depend on the output power of the mobile station. The following limits are specified in specification 3GPP TS 51.010. Note that the figures allow for superimposed contributions from the modulation spectrum (measured in peak hold mode), especially at higher power levels.

GSM 400 / GT 800 / GSM850 / GSM900	Maximum MS level measured (peak hold) / [dBm] at frequency offset			
MS power / [dBm]	0.4 MHz	0.6 MHz	1.2 MHz	1.8 MHz
+39	–13	–21	–21	–24
+37	–15	–21	–21	–24
+35	–17	–21	–21	–24
+33	–19	–21	–21	–24
+31	–21	–23	–23	–26
+29	–23	–25	–25	–28
+27	–23	–26	–27	–30
+25	–23	–26	–29	–32
+23	–23	–26	–31	–34
≤21	–23	–26	–32	–36

GSM 1800	Maximum MS level measured (peak hold) / [dBm] at frequency offset			
MS power / [dBm]	0.4 MHz	0.6 MHz	1.2 MHz	1.8 MHz
+36	–16	–21	–21	–24
+34	–18	–21	–21	–24
+32	–20	–22	–22	–25
+30	–22	–24	–24	–27
+28	–23	–25	–26	–29
+26	–23	–26	–28	–31
+24	–23	–26	–30	–33
+22	–23	–26	–31	–35
≤20	–23	–26	–32	–36

GSM 1900	Maximum MS level measured (peak hold) / [dBm] at frequency offset			
MS power / [dBm]	0.4 MHz	0.6 MHz	1.2 MHz	1.8 MHz
+33	–19	–22	–22	–25
+32	–20	–22	–22	–25
+30	–22	–24	–24	–27
+28	–23	–25	–26	–29
+26	–23	–26	–28	–31

GSM 1900	Maximum MS level measured (peak hold) / [dBm] at frequency offset			
MS power / [dBm]	0.4 MHz	0.6 MHz	1.2 MHz	1.8 MHz
+24	–23	–26	–30	–33
+22	–23	–26	–31	–35
≤20	–23	–26	–32	–36

3.2.8 Measurement Results

The results of the GSM multi evaluation measurement are displayed in several different views. Use the "Display" parameters to select the views and to change the appearance and contents of the views. The views are described in the following sections.

3.2.8.1 Overview

The overview dialog shows several or all of the detailed views in a single diagram.

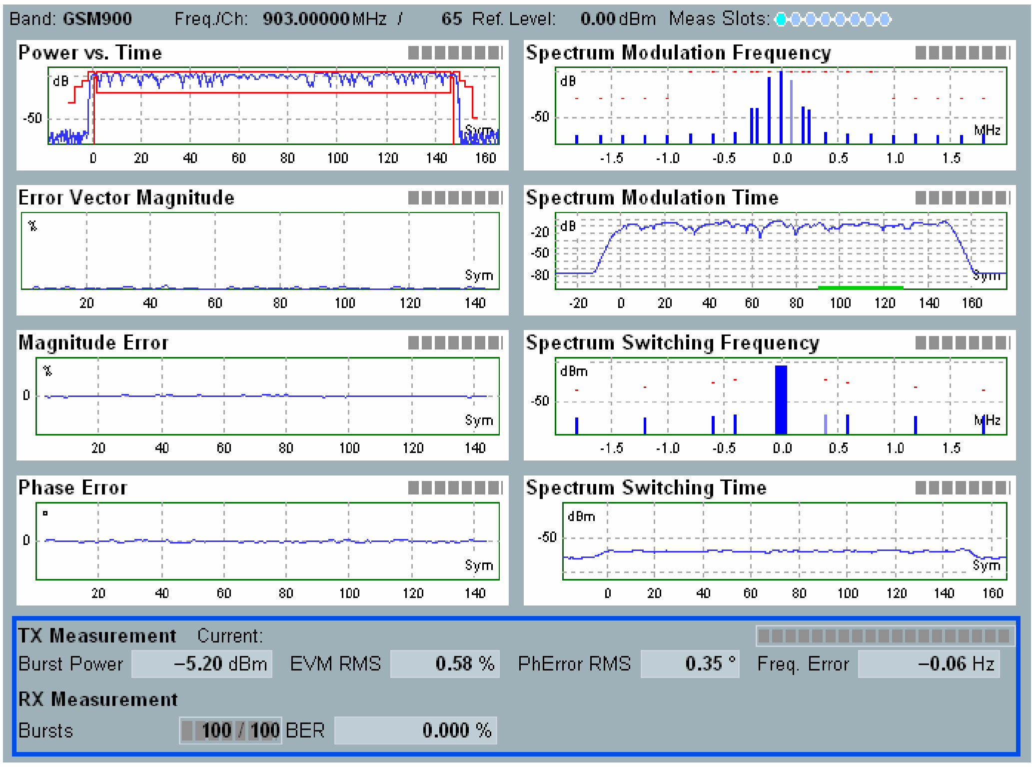


Fig. 3-8: GSM multi evaluation: Overview

You can limit the results to be measured and displayed in the overview using the hotkey "Multi Evaluation > Assign Views". You can enlarge each of the diagrams in the overview in order to obtain a detailed view with additional measurement results, see Selecting and Modifying Views.

3.2.8.2 Detailed Views: EVM, Magnitude Error, Phase Error and Spectrum

This section applies to the following detailed views:

- Error Vector Magnitude
- Magnitude Error
- Phase Error
- All spectrum diagrams

See also: "TX Measurements" in the R&S CMW user manual, chapter "System Overview"

Each of the views shows a diagram and a statistical overview of single-slot results. All results are determined in the "Measurement Slot".

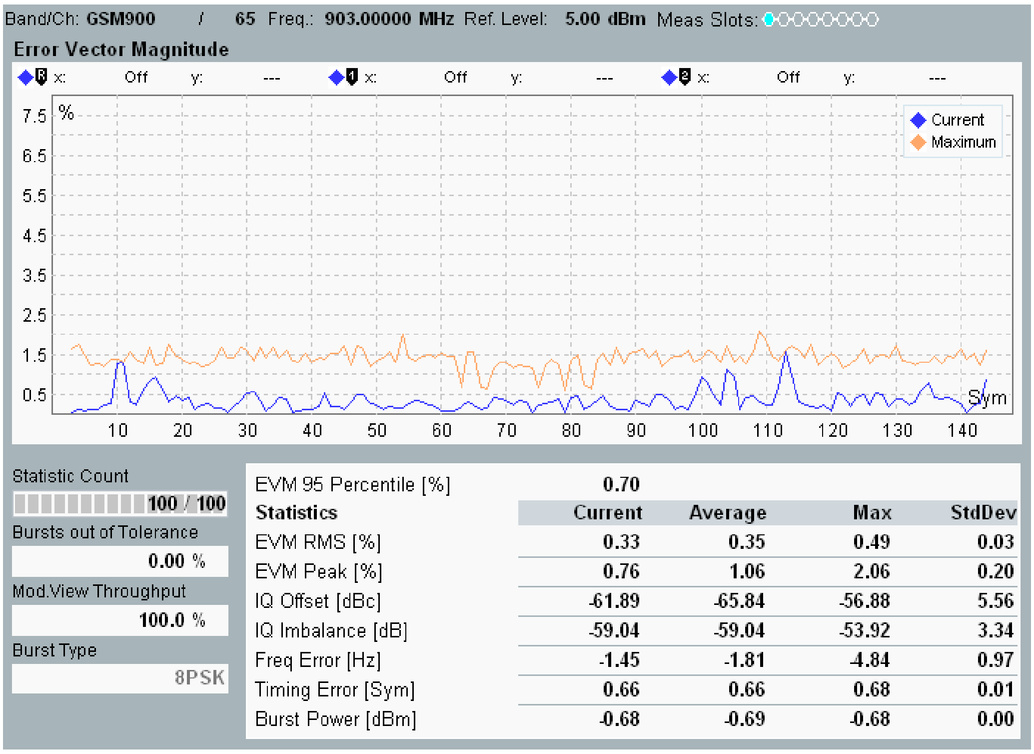


Fig. 3-9: GSM multi evaluation: EVM

The diagrams contain the following results:

- **Error Vector Magnitude, Magnitude Error and Phase Error**
  The modulation diagrams cover a time interval of 1 timeslot (the "Measurement Slot"). The traces contain 4 samples/symbol in GMSK and 1 sample/symbol in 8PSK and 16-QAM.
- **Spectrum Modulation Frequency, Spectrum Switching Frequency**
  The spectrum due to modulation results are measured in the "Measurement Slot". The central bar shows the power at the nominal carrier frequency; the symmetric bars to the left and the right show the off-carrier emissions. All spectrum results are measured in a 30 kHz bandwidth. The spectrum due to switching results are acquired in all slots, preferably in peak hold mode. The "Ref. Power" result in the spectrum views denotes the power at the nominal carrier frequency.
- **Spectrum Modulation Time, Spectrum Switching Time**
  The spectrum due to modulation results are measured in the "Measurement Slot", the spectrum due to switching in all measured slots. The diagrams show the power vs. time at a selectable offset frequency from the carrier, measured in a 30 KHz bandwidth.

The single-slot results in the tables below the diagrams are also displayed in the TX Measurement Scalar and BER diagrams. For additional information refer to Common View Elements.

3.2.8.3 Detailed Views: Power vs Time

The power vs. time results are displayed in one or more diagrams and as a table of statistical results.

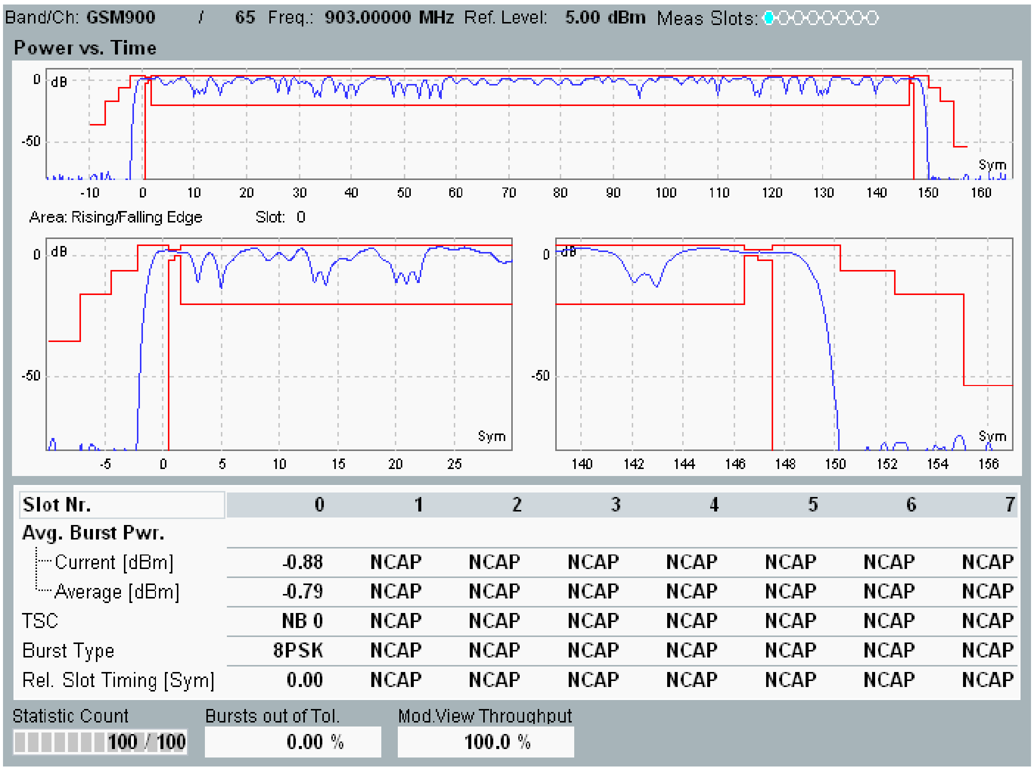


Fig. 3-10: GSM multi evaluation: power vs. time

The upper diagram covers a time interval of up to 8 timeslots (1 complete TDMA frame, corresponding to 1260 symbol periods or 4.615 ms). The burst power is displayed with an oversampling factor of 16 (16 samples per symbol period) and normalized to the average burst power in the "Measurement Slot" (0-dB reference). According to the conformance test specification 3GPP TS 51.010-1, the average burst power is defined as the average power of the samples over the 147 useful symbols in each burst.

Using the softkey-hotkey combination "Display > Display Areas" you can activate and configure the lower diagram, showing only a specific part of one selected slot/burst: either the useful part of the burst or the rising and falling edges of the burst or the upper part of the rising and falling edges.

If the lower diagram is hidden, an additional bar is shown below the remaining upper diagram:

The vertical blue lines in this bar mark the area borders of the time mask (vertical red lines in the diagram). The upper half corresponds to upper limit lines, the lower half to lower limit lines. When a limit is exceeded, the corresponding area in the bar is marked red. So the bar visualizes, in which areas the limits are currently exceeded and whether the power is too high or too low.

The table below the diagrams provides statistical results for the measured slots:

- **Burst Power:** Average burst power, evaluated over the useful part of the burst (see 3GPP TS 51.010-1).
- **TSC**: Detected burst type (normal burst NB, access burst AB, inactive slot OFF, dummy burst) and for access bursts and normal bursts also the detected Training Sequence Code (TSC).
- **Burst Type**: Burst type detected in the measured slot (GMSK/8PSK/16-QAM modulated normal burst, access burst, inactive slot).
- **Relative Slot Timing**: Slot timing relative to the timing of the "Measurement Slot", i.e. deviation of the measured relative timing from the nominal timing, which is based on a timeslot length of 156.25 symbol durations.

For additional screen elements refer to Common View Elements.

3.2.8.4 Detailed Views: IQ Constellation Diagram

The constellation diagram shows the modulation symbols as points in the I/Q plane.

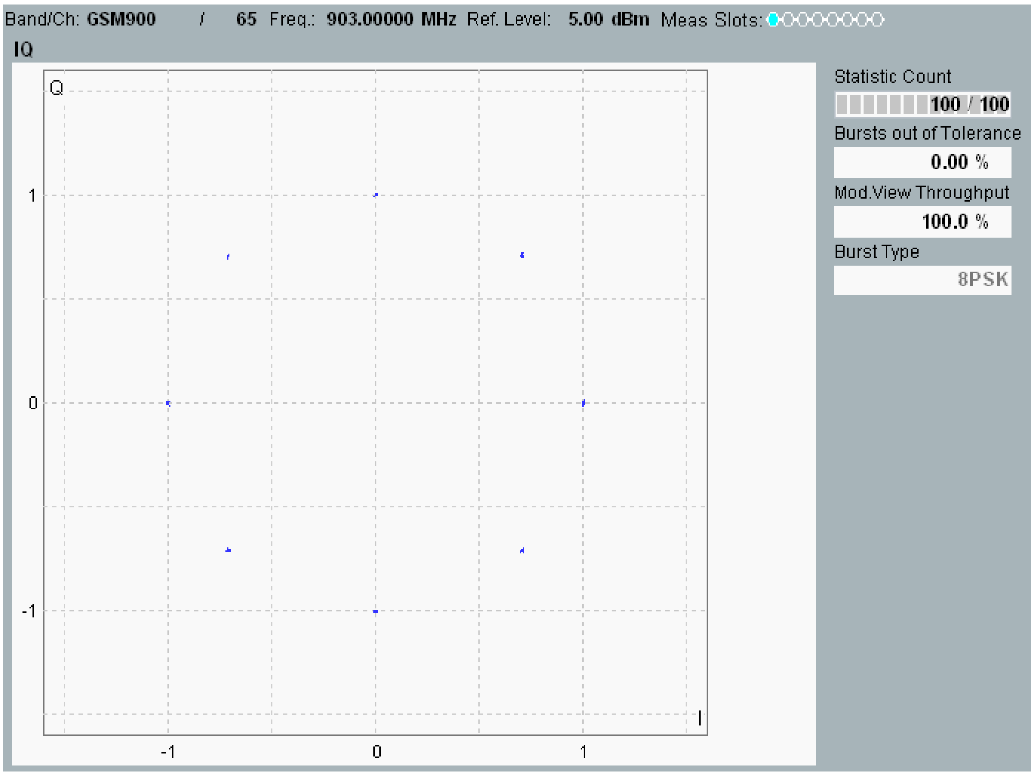


Fig. 3-11: GSM multi evaluation: I/Q constellation diagram

The constellation diagrams depend on the modulation type and on the "Rotation" and "I/Q Filter" settings; see Additional Softkeys and Hotkeys. For an ideal signal, the 8PSK constellation diagram consists of eight points, located on a circle around the origin, with relative phase angles of 45 deg (see example above); the 16-QAM diagram shows 16 points in a regular, rectangular pattern. Constellation diagrams are normalized such that the average distance of all points from the origin is 1.

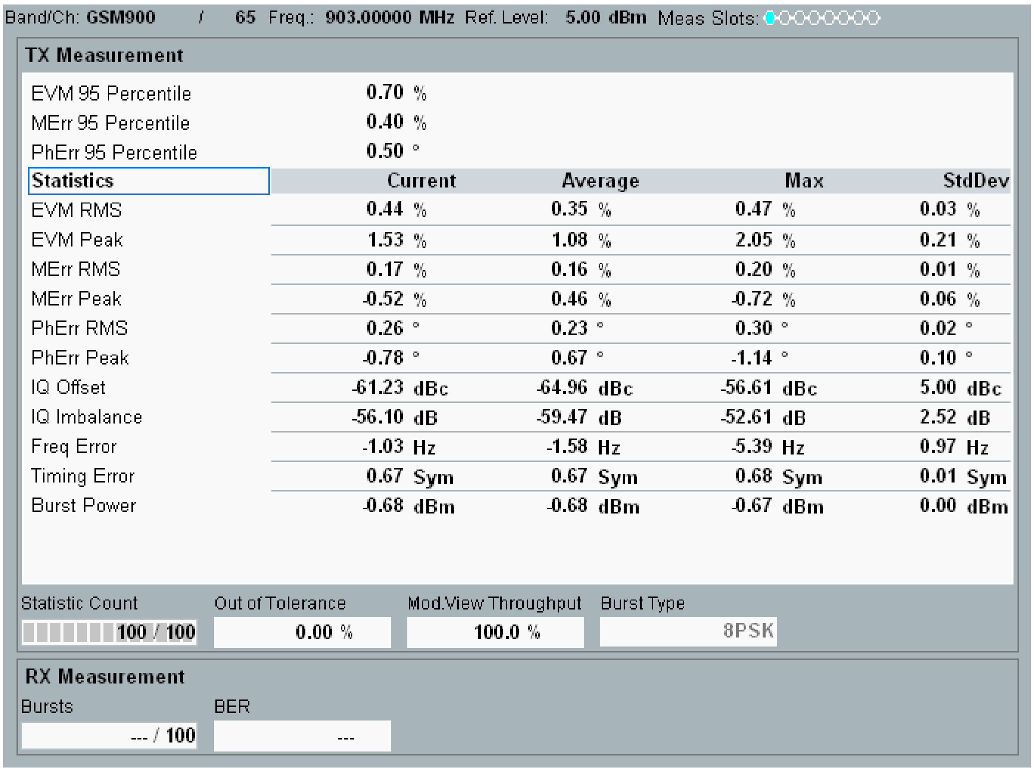
Constellation diagrams give a graphical representation of the signal quality and can help to reveal typical modulation errors causing signal distortions.

See also: "I/Q Constellation Diagram" in the R&S CMW user manual, chapter "System Overview"

For additional screen elements refer to Common View Elements.

3.2.8.5 TX Measurement Scalar and BER

The "TX Measurement Scalar" or "BER" dialogs contain tables of statistical results for the TX and RX measurements.



Band/Ch: GSM900 / 65 Freq.: 903.00000 MHz Ref. Level: 5.00 dBm Meas Slots:

TX Measurement

EVM 95 Percentile	0.70 %			
MErr 95 Percentile	0.40 %			
PhErr 95 Percentile	0.50 °			
Statistics	**Current**	**Average**	**Max**	**StdDev**
EVM RMS	0.44 %	0.35 %	0.47 %	0.03 %
EVM Peak	1.53 %	1.08 %	2.05 %	0.21 %
MErr RMS	0.17 %	0.16 %	0.20 %	0.01 %
MErr Peak	-0.52 %	0.46 %	-0.72 %	0.06 %
PhErr RMS	0.26 °	0.23 °	0.30 °	0.02 °
PhErr Peak	-0.78 °	0.67 °	-1.14 °	0.10 °
IQ Offset	-61.23 dBc	-64.96 dBc	-56.61 dBc	5.00 dBc
IQ Imbalance	-56.10 dB	-59.47 dB	-52.61 dB	2.52 dB
Freq Error	-1.03 Hz	-1.58 Hz	-5.39 Hz	0.97 Hz
Timing Error	0.67 Sym	0.67 Sym	0.68 Sym	0.01 Sym
Burst Power	-0.68 dBm	-0.68 dBm	-0.67 dBm	0.00 dBm

Statistic Count	Out of Tolerance	Mod.View Throughput	Burst Type
100 / 100	0.00 %	100.0 %	8PSK

RX Measurement

Bursts	BER
--- / 100	---

Fig. 3-12: GSM multi evaluation: TX measurement scalar

The "TX Measurement" table consists of two sections:

- **95 Percentile**
  Value of the measured quantity below which 95 % of all observations fall. An EVM 95th percentile of 0.8 indicates that 95 % of all measured EVM results were below 0.8, 5 % equal to or larger than 0.8.
- **Statistics table**
  – **Error Vector Magnitude** (EVM): calculated percentage of vector error (RMS and peak) between the received signal and an ideal signal.

– **Magnitude Error**: difference in amplitude (RMS and peak) between the received signal waveform and an ideal signal waveform.
– **Phase Error**: phase difference (RMS and peak) of the I/Q components of the signal received from the MS and an ideal reference signal at the detection points.
– **I/Q Offset**: estimated from the distribution of the constellation points.
– **I/Q Imbalance**: the amplitude ratio between the I and Q components of the signal.
– **Frequency Error**: the difference between the nominal frequency of the selected channel and the measured frequency.
– **Timing Error:** Difference between the actual timing of the slot and the expected timing. The actual timing is given by the training sequence. The expected timing is derived from the detected frame timing, therefore the "Timing Error" measurement requires an internal trigger (Trigger Source = "Power" or "Acquisition").
– **Burst Power:** Average burst power, evaluated over the useful part of the burst (see 3GPP TS 51.010-1).
– **AM PM Delay:** Time delay of the amplitude vs. time trajectory of the baseband modulation vector relative to the phase vs. time trajectory that is needed to minimize the modulation errors (EVM). The AM PM delay is a characteristic quantity for polar modulation schemes which make use of polar coordinates (amplitude and phase) rather than Cartesian coordinates (I and Q amplitudes).

For additional screen elements refer to Common View Elements.

The "RX Measurement" panel displays the progress and result of the bit error rate test, see GSM RX Tests.

- **Bursts**
  Progress bar of the measurement; see "Statistic Count" above.
- **BER**
  Measured Bit Error Rate: The percentage of bits that the DUT received in error.

See also: "Modulation Accuracy" in the R&S CMW user manual, chapter "System Overview"

For query of the results via remote control, see chapter 3.4.3, "Measurement Results", on page 444.

3.2.8.6 Selecting and Modifying Views

Use the "Display" parameters to select the views and to change the appearance and contents of the views. Depending on the selected view the following "Display" hotkeys are available:

Hotkey	Description
"Select View ..."	Switch to a certain detailed view or overview. Alternatively select a diagram in the overview and press ENTER or the rotary knob.
"Select Trace ..."	Select the trace types to be displayed in the view.

Hotkey	Description
"X Scale... / Y Scale..."	Modify the ranges of the X-axis and the Y-axis.
"Display > Time Curve"	In the "Spectrum Frequency" view: Change to the "Spectrum Time" diagram.
"Display > Demod Bits"	In modulation views: Display a table with all demodulated bits of the "Measurement Slot". The table contains one cell per symbol. An 8PSK (16-QAM) symbol corresponds to 3 (4) bits. The table can be used to analyze the correlation between modulation errors and the transferred bit pattern.
"Display > Display Areas"	In the power vs time view: activate and configure an additional trace, showing a detail of the power vs time trace with enhanced resolution, e.g. the rising and falling edges of one burst.

Additional options are available in the "Measurement Control" section of the configuration dialog.

3.2.8.7 Using Markers

Use the "Marker" parameters to activate markers and to modify their position. The following "Marker" hotkeys are available:

Hotkey	Description
"Ref. Marker ..."	Enable or disable the reference marker, select a trace and the marker position on that trace
"Marker 1 /2 ..."	Enable or disable marker 1 or 2 and define the marker position (absolute or relative to the reference marker) Depending on the trace mode, a trace can also be selected.
"Select Trace Mode"	Define whether all markers are collectively set to the same trace or to individual traces

See also: "Markers" in the R&S CMW user manual, chapter "System Overview"

3.2.8.8 Common View Elements

Below the title bar, all views show the most important RF and analyzer settings as shown below.

For configuration see chapter 3.4.2.1, "Signal Routing and Analyzer Settings", on page 417.

Tables

The "Statistics" tables show a statistical evaluation in the measurement slot. They contain four columns. For each measurement result the values are calculated as follows:

- **Current:** Value of the modulation result obtained in the last measurement interval. For EVM, magnitude and phase error, a current RMS result (the average over all samples in the "Measured Slot" except the guard period) and current peak value (the peak of all samples the preselected slot except the guard period) is available.

- **Average:** Average of all "Current" values referenced to the last statistics cycle.
- **Max.:** Largest or smallest "Current" value that the R&S CMW obtained since the start of the measurement.
- **StdDev.:** Standard deviation of all "Current" values since the start of the measurement.

All statistical results (statistical tables and traces) are calculated according to the general rules for statistical results.

See also: "Statistical Results" in the R&S CMW user manual, chapter "System Overview"

Statistic Count

Progress bar for the measurement. During the first single shot after the start of the measurement, the bar shows the current measurement interval relative to the "Statistic Count". A filled progress bar indicates that the first shot is complete and the statistical depth has been reached.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "System Overview"

Out of Tolerance

Percentage of measurement intervals / bursts that were failed because they exceeded the limits in the diagram.

Mod. View Throughput

Percentage of measurement intervals where the detected burst pattern was found to correspond to the Modulation View settings. Only frames which contribute to the "Mod. View Throughput" are displayed, counted and used for the statistical results; other frames are rejected.

The "Mod. View Throughput" is evaluated in a moving window of 1000 frames. If a non-matching signal configuration is changed according to the "Modulation View" settings, the throughput increases linearly from 0 % to 100 %.

Burst Type

Burst type detected in the measured slot (GMSK/8PSK/16-QAM modulated normal burst, access burst, inactive slot).

3.3 Application Sheets

Application sheets describe short application examples for select issues and provide related background information. The following application sheets are related to the "GSM Measurements" firmware application.

3.3.1 Detecting GSM Multislot Frames

This application sheet describes the use of the R&S CMW trigger system for detecting and measuring GSM frames filled with a particular burst sequence. With appropriate trigger settings the R&S CMW can filter frames with the following properties:

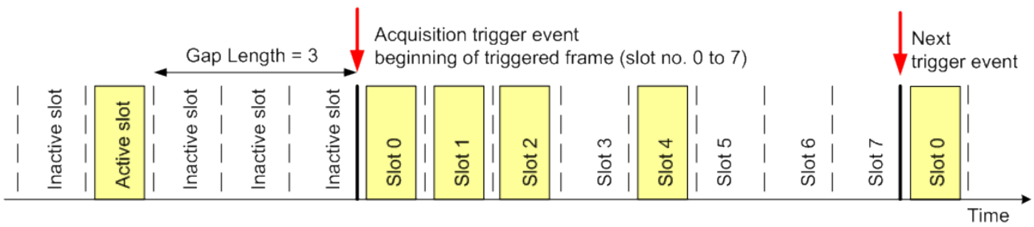
- Frames with several active timeslots but with 1 to 3 slot gap.
- Frames with a particular pattern of inactive bursts and bursts of a definite modulation scheme.

3.3.1.1 Measurement Principle

With an active "Acquisition" trigger, the R&S CMW analyzes the RF input signal and derives a frame trigger using information about the active slots. After frame detection, the acquisition trigger events are repeated periodically according to the GSM frame clock. TSC detection is performed continuously in order to compensate for a possible drift. Two different acquisition trigger modes – "Gap" and "Pattern" – are available.

Gap Trigger

In the gap trigger mode the R&S CMW searches for a gap in the sequence of active slots. A gap is a series of 1 to 3 inactive slots. The trigger event is generated at the beginning of the first slot after the gap and is repeated periodically.

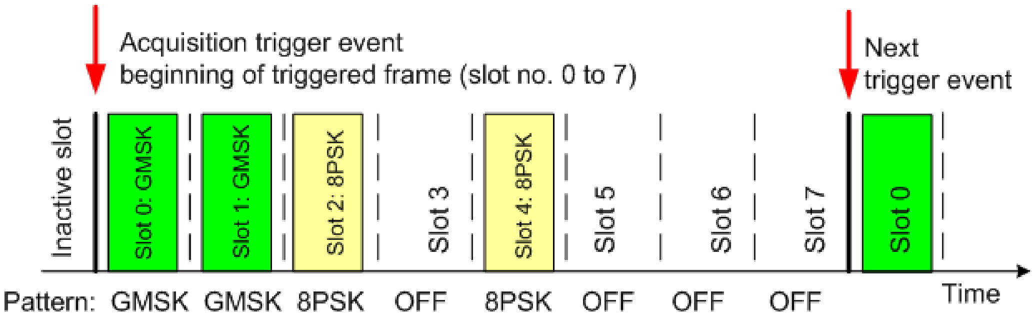


To use the gap trigger as shown above,

1. Feed the GSM uplink signal to the input connector and perform the necessary analyzer settings, see Measuring an UL GSM Signal.
2. Open the "GSM Measurement – Multi Evaluation Configuration" dialog.
3. Select "Trigger > Trigger Source: Acquisition", "Trigger > Acquisition > Mode: Gap", "Trigger > Acquisition > Gap Length: 3".
4. Start the GSM Multi Evaluation measurement and observe the triggered frames in the "Power vs. Time" diagram.

Pattern Trigger

In the pattern trigger mode the R&S CMW analyzes the modulation scheme of the received bursts and searches for a predefined burst pattern. The trigger events are generated at the beginning of the pattern and repeated according to the GSM frame clock, even though the true burst pattern may have changed.



To use the pattern trigger as shown above,

1. Feed the GSM uplink signal to the input connector and perform the necessary analyzer settings, see Measuring an UL GSM Signal.
2. Open the "GSM Measurement – Multi Evaluation Configuration" dialog.
3. Select "Trigger > Trigger Source: Acquisition", "Trigger > Acquisition > Mode: Pattern", "Trigger > Acquisition > Pattern: GMSK GMSK 8PSK OFF 8PSK OFF OFF OFF".
4. Start the GSM Multi Evaluation measurement and observe the triggered frames in the "Power vs. Time" diagram.

3.3.1.2 Possible Extensions

You can use various other multi configuration settings for fine-tuning your measurement:

- Select a suitable "Trigger Delay" to delay the trigger events (and thus the start of the measurement) relative to the detected frame boundaries. This is advantageous in gap trigger mode, if the gap is not located at the end of the frame.
- Use the "Modulation View" pattern to measure only burst sequences with a particular burst type and modulation scheme. This can be advantageous in combination with a gap trigger or in combination with a pattern trigger, especially if the burst sequence is not strictly periodic.
  See chapter 3.3.2, "Capturing GSM Burst Sequences", on page 409.

3.3.2 Capturing GSM Burst Sequences

This application sheet describes the use of the R&S CMW Modulation View settings for capturing GSM frames filled with a particular burst sequence. The R&S CMW can detect and filter GMSK, 8PSK, 16-QAM, and access bursts.

Appropriate "Modulation View" settings are essential for measuring frames with burst sequences that the mobile transmits only occasionally, e.g:

- SACCH frames and idle frames that the mobile transmits with a periodicity of 26 frames.
- The periodic access bursts that the mobile may use during packet data connections in order to transmit its CTRK_ACK messages.

If no filter condition is specified ("Modulation View: Any"), the R&S CMW measures any burst sequence. Varying burst types during the measurement will cause inconsistent statistical results.

3.3.2.1 Measurement Principle

Capturing a particular burst sequence requires two steps:

1. The R&S CMW determines the frame structure of the measured signal (slot nos. 0 to 7), most conveniently using a gap or pattern trigger (see Detecting GSM Multislot Frames).
   After this step, the GSM multi evaluation measurement is frame-aligned; it is continued irrespective of the actual burst pattern in the measured frames.
2. Use the "Modulation View" settings to filter frames with a definite burst pattern, rejecting all other frames.

Trigger and "Modulation View" settings

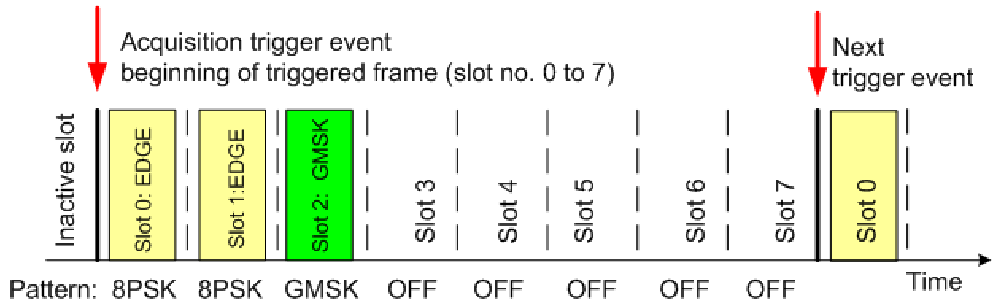
The acquisition trigger and modulation view settings are completely independent of each other. It is possible to specify the same burst pattern for the pattern trigger and the modulation view. However, it is also possible to use different settings, e.g. in order to pin down the frame boundary using the predominant burst pattern and then measure a different, occasionally transmitted burst pattern.

Example: Two EDGE bursts and one access burst

The mobile transmits two 8PSK-modulated EDGE bursts in slots 0 and 1, followed by a GMSK-modulated burst in slot 2. Suppose that the GMSK-modulated burst is occasionally replaced by an access burst.

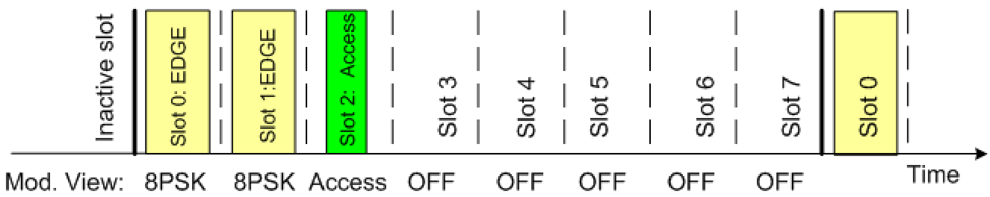
To detect the frame boundary and measure the access burst frames, proceed as follows:

1. Feed the GSM uplink signal to the input connector and perform the necessary analyzer settings, see Measuring an UL GSM Signal.
2. Open the "GSM Measurement – Multi Evaluation Configuration" dialog.
3. Select "Trigger > Trigger Source: Acquisition (Internal)", "Trigger > Acquisition > Mode: Pattern", "Trigger > Acquisition > Pattern: 8PSK 8PSK GMSK OFF OFF OFF OFF OFF".

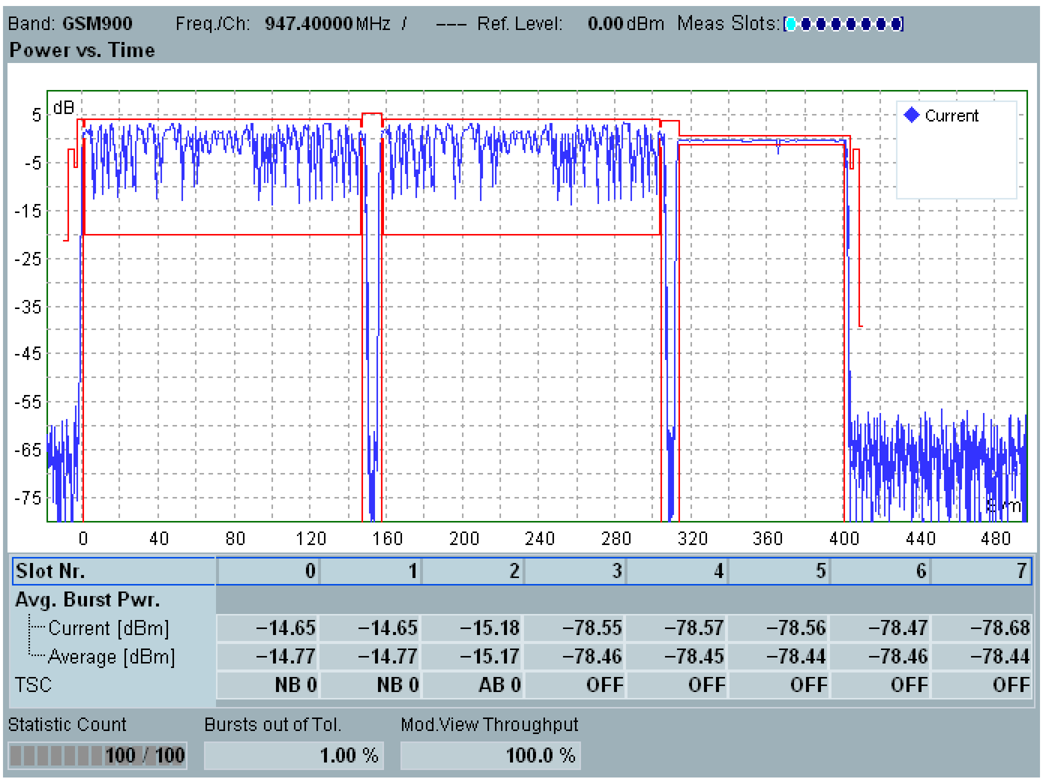


4. Activate the access burst search: "Measurement Control > Access Burst Search: On".

5. Select "Measurement Control > Modulation View > Setting: 8PSK 8PSK Access OFF OFF OFF OFF OFF".



6. Start the GSM Multi Evaluation measurement and observe the triggered frames in the "Power vs. Time" diagram.



Mod. View Throughput

The "Modulation View Throughput" result across the bottom of the diagram denotes the number of captured frames which fulfilled the "Modulation View" conditions (matching frames). In the example above, about 1/4 of the frames were matching frames. The remaining frames were not considered for the measurement.

Depending on the periodicity of the matching frames and the duration of the measurement intervals, the "Modulation View Throughput" can vary around the expected value.

3.3.2.2 Possible Extensions

You can use various other multi configuration settings for fine-tuning your measurement and improving the accuracy:

- When measuring EDGE bursts, select the data compensated "Reference Power Mode" in order to increase the accuracy of the burst power results.
- Define an appropriate "Two Shot Assembly Level" to enhance the dynamic range.

3.3.3 Using GSM List Mode

This application sheet describes a GSM multi evaluation measurement in list mode, where the R&S CMW measures at a sequence of segments with individual analyzer settings. The measurement is essentially remote-controlled, however, you can switch to offline mode in order to view results in a particular segment.

The measurement provides:

- Average burst power, modulation, spectrum due to modulation, and spectrum due to switching results in all segments. A BER measurement is supported in addition.
- In addition, all measurement curves of the GSM multi evaluation measurement in any of the measured segments (offline mode).

Initial trigger

The list mode is most conveniently triggered using a "Power" trigger. The measurement must be initiated **before** the mobile phone signal is turned on. This ensures that the measurement will start at the first active timeslot.

3.3.3.1 Options and Equipment Required

Analysis of an uplink GSM signal in multi evaluation list mode requires a R&S CMW tester which is equipped with the following options:

- Option R&S CMW KM200, GSM TX Measurements
- Option R&S CMW-KM012, Multi Evaluation List Mode

3.3.3.2 List Mode Configuration

In the following example an uplink GSM signal with the following properties is measured:

- Measured Slot: Timeslot no. 0, timeslots 1 to 7 do not have to be analyzed
- Burst type: Normal, 8PSK-modulated (EDGE burst)
- Measurement duration: 120 slots (15 TDMA frames)
- RF frequencies and powers, frames 1 to 5: 903.000 MHz, +5 dBm
- RF frequencies and powers, frames 6 to 10: 947.000 MHz, +10 dBm
- RF frequencies and powers, frames 11 to 15: 909.000 MHz, +15 dBm

1. According to the signal properties, configure a list mode with 3 segments using the following command sequence:
   ```
   CONFigure:GSM:MEAS:MEValuation:LIST:SLENgth 8
   CONFigure:GSM:MEAS:MEValuation:LIST:SEGMent1:SETup 5, 10,
   9.03E+8, 19, ON, 0
   CONFigure:GSM:MEAS:MEValuation:LIST:SEGMent2:SETup 5, 15,
   9.47E+8, 17, OFF, 0
   CONFigure:GSM:MEAS:MEValuation:LIST:SEGMent3:SETup 5, 20,
   9.09E+8, 14, OFF, 0
   ```
2. Enable the calculation of all power, modulation, spectrum due to modulation, and spectrum due to switching results in segment no. 1 and enable the list mode.
   ```
   CONFigure:GSM:MEAS:MEValuation:LIST:SEGMent1:PVTime 5, ON,
   #B10000000
   CONFigure:GSM:MEAS:MEValuation:LIST:SEGMent1:MODulation 5,
   ON, ON, ON, ON, #B10000000
   CONFigure:GSM:MEAS:MEValuation:LIST:SEGMent1:SMODulation 5,
   ON, #B10000000
   CONFigure:GSM:MEAS:MEValuation:LIST:SEGMent1:SSWitching 5,
   ON, #B10000000
   CONFigure:GSM:MEAS:MEValuation:LIST ON
   ```
3. Restrict the measurement to a subrange of the configured segments (segments 2 and 3).
   ```
   CONFigure:GSM:MEAS:MEValuation:LIST:LRANge 2, 2
   ```
4. Initiate the measurement and retrieve average burst power result in segment no. 2.
   ```
   INIT:GSM:MEAS:MEValuation
   <Turn on your mobile phone under test, list mode will be
   triggered on the first active timeslot>
   FETCh:GSM:MEAS:MEValuation:LIST:SEGMent2:PVTime:CURRent?
   ```
   A possible response is: 0, 0, 100, EPSK, OFF, 0, –5.1
   (No general error, no error in segment, all bursts measured, 8PSK-modulated measured, uniform burst type, no limits exceeded, average burst power result: –5.1 dBm).

3.3.3.3 Using Offline Mode

► Select segment no. 2 for a calculation of the complete measurement results, calculate the results in segment no. 2, and go to local.

```
CONFigure:GSM:MEAS:MEValuation:LIST:OSINdex 2
INIT:GSM:MEAS:MEValuation
&GTL
```

The results are displayed as follows:

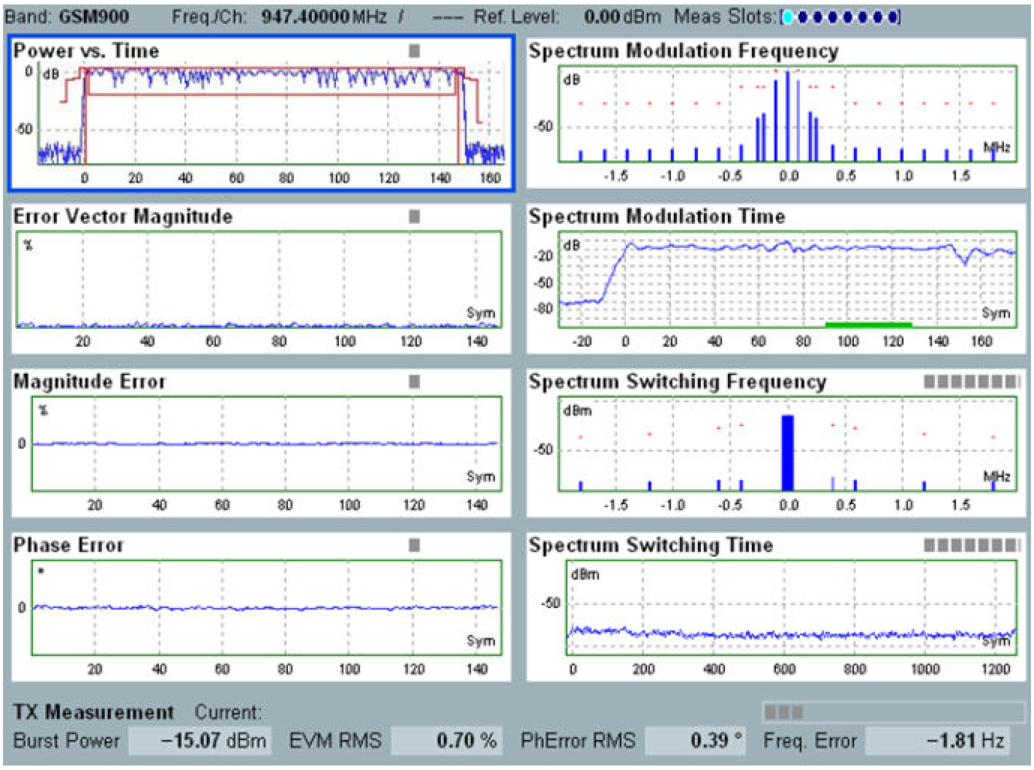


Fig. 3-13: GSM list mode in offline mode

3.3.3.4 Possible Extensions

You can vary the list mode settings or use other settings to refine the evaluation:

- Disable the calculation of some results if you need a subset only, and if you wish to gain speed.
- Conversely, if you wish to analyze the results in all segments, enable the result calculation and step through the segments using the procedure in section Using Offline Mode repeatedly.
- For maximum measurement speed, first configure all segments, then perform repeated measurements in different sub-ranges.
- Switch off the step length and use the <FramePattern> parameter if you wish to measure several (possibly non-equidistant) frame-periodic slots.

3.3.4 GSM BER Tests on ARB Signals

This application sheet describes a GSM Bit Error Rate (BER) test using the ARB generator as a test signal source.

3.3.4.1 Options and Equipment Required

Generation and analysis of ARB GSM signals requires an R&S CMW tester which is equipped with the following options:

- Option R&S CMW-KW200, "GSM ARB Generator"
- Option R&S CMW-KM200, "GSM TX Measurements"

3.3.4.2 Test Setup

The downlink RF generator signal of the R&S CMW is fed to the input of the DUT. The R&S CMW measures the uplink signal. Most conveniently, a bi-directional connection with a single coax cable is used. The DUT is connected to one of the RF input connectors (RF COM) at the front panel of the R&S CMW. No additional cabling and no external trigger is needed.

The input level ranges of all RF COM connectors are identical.

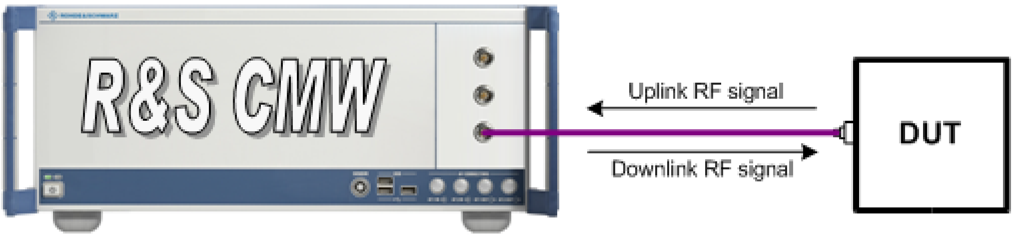


Fig. 3-14: Test setup for RX tests

3.3.4.3 General Procedure (GMSK Bursts)

The configuration of the mobile, the generator, and the measurement must match, in accordance with the selected modulation type (GMSK, 8PSK).

For BER tests on GMSK-modulated signals, proceed as follows:

1. Establish the basic test setup for RX tests, connecting the mobile under test to one to the RF connectors RF 1 COM or RF 2 COM.
2. **Mobile:** Command the mobile to test loop C to ensure that it loops back the received data using GMSK-modulated normal bursts.
3. **Generator:** Open the "GPRF Generator" application and start the pre-configured ARB file for BER tests named "`LoopC_1040.wv`": Select "Baseband Mode: ARB" and press the "ARB > Select ARB File..." hotkey to open a dialog from where you can select the file. Press "ON | OFF" to turn on the RF generator.

4. **Measurement:** Open the "GSM Multi Evaluation" measurement application and enable the BER measurement ("Multi Evaluation > Assign Views > BER: ON"). Select the appropriate loop ("Config... > Measurement Control > BER > Loop: C") and view ("Display > Select View: BER") and press "ON | OFF" to start the measurement.

3.3.4.4 Comparison of GMSK and 8PSK Test Settings

The following table describes the configuration for BER tests on GMSK and 8PSK-modulated signals.

Modulation	Mobile configuration	Generator configuration	Measurement configuration
GMSK	Test loop C	LoopC_1040.wv	Loop: C
8PSK	SRB loop	SRB_8PSK_1040.wv	Loop: SRB

The ARB generator signal may be replaced by a real-time generator signal; refer to the separate application sheet "GSM BER Tests on Real-Time Signals".

3.3.4.5 Additional Information

The properties of the ARB files are reported in section GSM RX Tests.

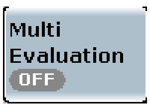
3.4 GUI Reference

The following sections provide detailed reference information on the Graphical User Interface (GUI) and the parameters of the GSM multi evaluation measurement.

3.4.1 Measurement Control

The measurement is turned on or off using the ON | OFF or RESTART | STOP keys.

See also: "Measurement Control" in the R&S CMW user manual, chapter "System Overview"



Multi Evaluation (Softkey)
The softkey shows the current measurement state. Additional measurement substates can be retrieved via remote control.

Remote command:
```
INITiate:GSM:MEAS<i>:MEValuation
STOP:GSM:MEAS<i>:MEValuation
ABORt:GSM:MEAS<i>:MEValuation
FETCh:GSM:MEAS<i>:MEValuation:STATe?
FETCh:GSM:MEAS<i>:MEValuation:STATe:ALL?
```

3.4.2 Parameters and Settings

The most important settings of the GSM multi evaluation measurement are displayed in the measurement dialog.

The "Meas Slots" parameter in the figure above represents one GSM frame with slot 0 to slot 7.

The graphic results from three settings (Measurement Slot Settings):

- the measurement slot is highlighted in the graphic
- the slot ofset determines the position of the left bracket
- the no. of slots determines the number of slots within the brackets

All settings are defined via softkeys and hotkeys or using the "GSM Multi Evaluation Configuration" dialog. The configuration dialog is described in the following sections.

3.4.2.1 Signal Routing and Analyzer Settings

The measurement is configured using the parameters in the "Multi Evaluation Configuration" dialog. The following parameters configure the RF input path.

See also: "Connection Control (Measurements)" in the R&S CMW user manual, chapter "System Overview"

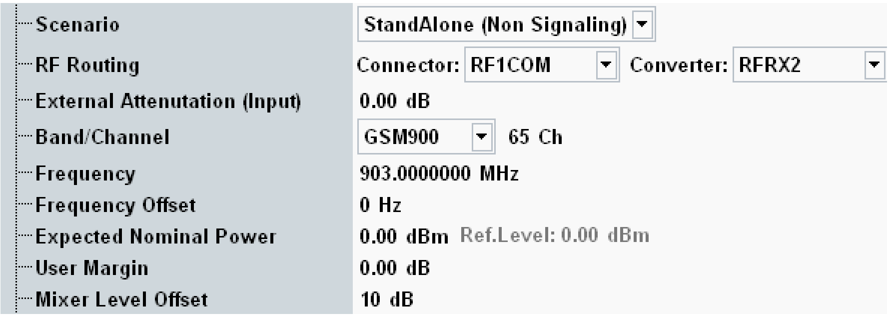


Fig. 3-15: Signal routing and analyzer settings

Scenario

Selects the measurement scenario. The GSM measurement can be used in "Standalone" mode or in combination with another R&S CMW application.

- **Standalone:**
  Perform the non-signaling measurement independently, using all GSM measurement settings.
- **Combined Signal Path:**
  Combined Signal Path (CSP) allows you to use a GSM signaling application (options R&S CMW-KS200) in combination with GSM measurement. The signaling application is selected by the additional parameter "Controlled by".
  The signal routing and analyzer settings in the GSM measurement display values determined by the signaling application. The corresponding measurement settings are remembered in the background and displayed again when switching back to the standalone scenario. For more details refer to chapter 3.2.1.7, "Parallel Signaling and Measurement", on page 376.
  Connection status information of the master application is displayed at the bottom of the measurement views. Softkeys and hotkeys allow to configure and control the master application from the measurement, see chapter 3.4.2.12, "Additional Softkeys and Hotkeys", on page 440.
- **Measure@ProtocolTest:**
  Allows to use a GSM protocol test application in parallel to the GSM multi evaluation measurement. The protocol test application is selected by the additional parameter "Controlled by".
  The signal routing and analyzer settings described in this section are ignored by the measurement application. The corresponding settings have to be configured within the protocol test application. The remaining GSM measurement settings must be compatible with the configuration of the protocol test application.

Protocol test applications are available for R&S CMW500, but not for R&S CMW270 and R&S CMW280.

Remote command:
ROUTe:GSM:MEAS<i>:SCENario:SALone
ROUTe:GSM:MEAS<i>:SCENario:CSPath
ROUTe:GSM:MEAS<i>:SCENario:MAPRotocol
ROUTe:GSM:MEAS<i>:SCENario?
ROUTe:GSM:MEAS<i>?

RF Routing
Selects the input path for the measured RF signal, i.e. the input connector and the RX module to be used.

Depending on your hardware configuration there may be dependencies between both parameters. Select the RF connector first. The "Converter" parameter offers only values compatible with the selected RF connector.

In the Standalone (SA) scenario, these parameters are controlled by the measurement. In the Combined Signal Path (CSP) scenario, they are controlled by the signaling application.

For connector and converter settings in the combined signal path scenario, use one of the ROUTe:GSM:SIGN<i>:SCENario:... signaling commands.

Remote command:
ROUTe:GSM:MEAS<i>:SCENario:SALone (SA)
ROUTe:GSM:SIGN<i>:SCENario:... (CSP)

External Attenuation (Input)
Defines the value of an external attenuation (or gain, if the value is negative) in the input path. The power readings of the R&S CMW are corrected by the external attenuation value.

The external attenuation value is also used in the calculation of the maximum input power that the R&S CMW can measure.

If a correction table for frequency-dependent attenuation is active for the chosen connector, then the table name and a button are displayed. Press the button to display the table entries.

In the Standalone (SA) scenario, this parameter is controlled by the measurement. In the Combined Signal Path (CSP) scenario, it is controlled by the signaling application.

Remote command:
CONFigure:GSM:MEAS<i>:RFSettings:EATTenuation (SA)
CONFigure:GSM:SIGN<i>:RFSettings:EATTenuation:INPut (CSP)

Band, Channel / Frequency
Center frequency of the RF analyzer. Set this frequency to the frequency of the measured RF signal to obtain a meaningful measurement result.

The relation between GSM band, RF frequency and channel number is defined by 3GPP (see GSM Frequency Bands and Channels).

You can specify the RF frequency in two ways:

- Enter the frequency directly. The band and channel settings can be ignored or used for validation of the entered frequency. For validation select the designated band. The channel number resulting from the selected band and frequency is displayed. For an invalid combination no channel number is displayed.
- Select a band and enter a channel number valid for this band. The R&S CMW calculates the resulting frequency.

In a combined signal path scenario, the measurement is restricted to valid GSM channels.

In the Standalone (SA) scenario, these parameters are controlled by the measurement. In the Combined Signal Path (CSP) scenario, they are controlled by the signaling application.

Remote command:

CONFigure:GSM:MEAS<i>:RFSettings:FREQuency (SA)
CONFigure:GSM:MEAS<i>:BAND (SA)
CONFigure:GSM:MEAS<i>:CHANnel (SA)
CONFigure:GSM:SIGN<i>:BAND:BCCH (CSP)
SENSe:GSM:SIGN<i>:BAND:TCH? (CSP)
CONFigure:GSM:SIGN<i>:RFSettings:CHANnel:TCH[:CARRier<c>] (CSP)
CONFigure:GSM:SIGN<i>:RFSettings:CHCCombined:TCH:CSWitched (CSP)
CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:ENABle:TCH[:CARRier<c>] (CSP)
CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:MAIO:TCH[:CARRier<c>] (CSP)
CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:HSN:TCH[:CARRier<c>] (CSP)
CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:SEQuence:TCH[:CARRier<c>] (CSP)

Frequency Offset

Sets positive or negative frequency offsets to be added to the center frequency of the configured channel.

In the Standalone (SA) scenario, this parameter is controlled by the measurement. In the Combined Signal Path (CSP) scenario, it is controlled by the signaling application.

Remote command:

CONFigure:GSM:MEAS<i>:RFSettings:FOFFset (SA)
CONFigure:GSM:SIGN<i>:RFSettings:FOFFset:UL (CSP)
CONFigure:GSM:SIGN<i>:CONNection:RFOFfset (CSP)

Expected Nominal Power

Sets the analyzer in accordance with the nominal power of the RF signal to be measured. The nominal power is the average output power at the DUT during the measurement intervals where the RF transmitter is on. The "Ref. Level" is calculated as the expected peak power at the output of the DUT:

Reference level = Expected Nominal Power + User Margin

The actual input power at the connectors (i.e. the "Reference Level" minus the "External Attenuation (Input)" value, if all power settings are configured correctly) must be within the level range of the selected RF input connector; refer to the data sheet.

In the Standalone (SA) scenario, this parameter is controlled by the measurement. In the Combined Signal Path (CSP) scenario, it is controlled by the signaling application.

Remote command:
CONFigure:GSM:MEAS<i>:RFSettings:ENPower (SA)
CONFigure:GSM:SIGN<i>:RFSettings:ENPMode (CSP)
CONFigure:GSM:SIGN<i>:RFSettings:ENPower (CSP)

User Margin

Margin that the R&S CMW adds to the "Expected Nominal Power" in order to determine its reference power ("Ref. Level"). The "User Margin" is typically used to account for the known variations of the RF input signal power, e.g. the variations due to a specific channel configuration.

The appropriate values depend on the configuration of the UL GSM signal, e.g. on the modulation scheme. It is small for GMSK-modulated bursts because GMSK is a constant-envelope modulation scheme. For 8PSK (16-QAM)-modulated bursts, a user margin of approx. 5 dB (7.5 dB) is sufficient.

In the Standalone (SA) scenario, this parameter is controlled by the measurement. In the Combined Signal Path (CSP) scenario, it is controlled by the signaling application.

Remote command:
CONFigure:GSM:MEAS<i>:RFSettings:UMARgin (SA)
CONFigure:GSM:SIGN<i>:RFSettings:UMARgin (CSP)

Mixer Level Offset

Varies the input level of the mixer in the analyzer path. A negative offset reduces the mixer input level, a positive offset increases it. Optimize the mixer input level according to the properties of the measured signal.

Mixer Level Offset	Advantages	Possible Shortcomings
< 0 dB	Suppression of distortion (e.g. of the intermodulation products generated in the mixer)	Lower dynamic range (due to smaller signal-to-noise ratio)
> 0 dB	High signal-to-noise ratio, higher dynamic range	Risk of intermodulation, smaller overdrive reserve

In the Standalone (SA) scenario, this parameter is controlled by the measurement. In the Combined Signal Path (CSP) scenario, it is controlled by the signaling application.

Remote command:
CONFigure:GSM:MEAS<i>:RFSettings:MLOFfset (SA)
CONFigure:GSM:SIGN<i>:RFSettings:MLOFfset (CSP)

3.4.2.2 Measurement Control Settings

The "Measurement Control" parameters configure the scope of the measurement. They are described in this section and the following sections.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "System Overview"

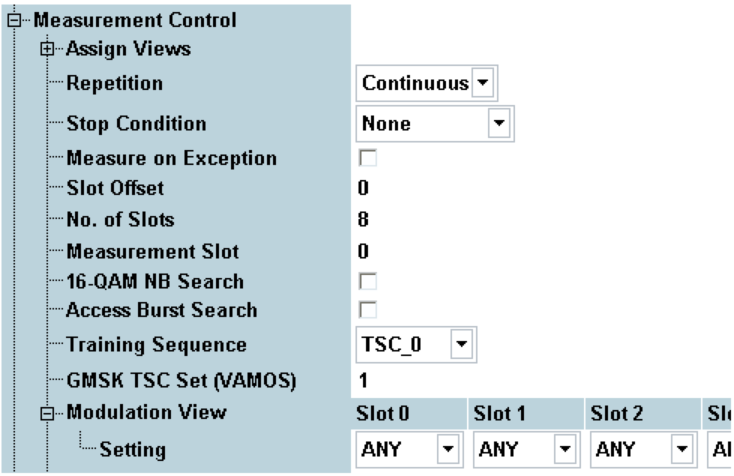


Fig. 3-16: Measurement control settings

Assign Views

Selects the view types to be displayed in the "Overview" dialog. The R&S CMW does not evaluate the results for disabled views. Therefore, limiting the number of assigned views can speed up the measurement.

It is recommended to disable the "Spectrum … Time" views if the results are not needed.

Remote command:
CONFigure:GSM:MEAS<i>:MEValuation:RESult[:ALL],
CONFigure:GSM:MEAS<i>:MEValuation:RESult:PVTime,
CONFigure:GSM:MEAS<i>:MEValuation:RESult:SSTime,
CONFigure:GSM:MEAS<i>:MEValuation:RESult:BER etc.

Repetition
Defines how often the measurement is repeated if it is not stopped explicitly or by a failed limit check.

- **Continuous:** The measurement is continued until it is explicitly terminated; the results are periodically updated.
- **Single-Shot:** The measurement is stopped after one statistics cycle.

Single-shot is preferable if only a single measurement result is required under fixed conditions, which is typical for remote-controlled measurements. Continuous mode is suitable for monitoring the evolution of the measurement results in time and observe how they depend on the measurement configuration, which is typically done in manual control. The reset/preset values therefore differ from each other.

Remote command:
`CONFigure:GSM:MEAS<i>:MEValuation:REPetition`

Stop Condition
Specifies the conditions for an early termination of the measurement:
- **None:** The measurement is performed according to its "Repetition" mode and "Statistic Count", irrespective of the limit check results.
- **On Limit Failure:** The measurement is stopped as soon as one of the limits is exceeded, irrespective of the repetition mode set. If no limit failure occurs, it is performed according to its "Repetition" mode and "Statistic Count". Use this setting for measurements that are essentially intended for checking limits, e.g. production tests.

Remote command:
`CONFigure:GSM:MEAS<i>:MEValuation:SCONdition`

Measure on Exception
Specifies whether measurement results that the R&S CMW identifies as faulty or inaccurate are rejected. A faulty result occurs e.g. when an overload is detected. In remote control, the cause of the error is indicated by the "reliability indicator".

- **Off:** Faulty results are rejected. The measurement is continued; the statistical counters are not re-set. Use this mode to ensure that a single faulty result does not affect the entire measurement.
- **On:** Results are never rejected. Use this mode e.g. for development purposes, if you want to analyze the reason for occasional wrong transmissions.

Remote command:
`CONFigure:GSM:MEAS<i>:MEValuation:MOEXception`

Measurement Slot Settings
For more information refer to Defining the Scope of the Measurement.
- **"Slot Offset"**: specifies the start of the measurement interval (measured multislot range) relative to the GSM frame boundary, detected with an internal trigger ("Power" or "Acquisition").
- **"No. of Slots"**: specifies the number of slots to be measured and displayed in the different power and modulation views. The R&S CMW can measure between 1 and 8 consecutive slots (1 GSM frame).

- **"Measurement Slot"**: selects the slot to be used for the modulation and spectrum due to modulation measurement. The measurement slot must be part of the measured multislot range, therefore:
  Slot Offset ≤ Measurement Slot ≤ Slot Offset + No. of Slots – 1
  The measurement slot should be active in multislot configurations, because it provides the 0-dB reference in the "Power vs. Time" diagram.

In the Standalone (SA) scenario, these parameters are controlled by the measurement. In the Combined Signal Path (CSP) scenario, they are controlled by the signaling application.

Remote command:

`CONFigure:GSM:MEAS<i>:MEValuation:MSLots` (SA)

`CONFigure:GSM:SIGN<i>:MSLot:UL` (CSP)

16-QAM NB Search

Enables or disables the search for 16-QAM-modulated normal bursts (with option R&S CMW-KM201). With enabled 16-QAM NB burst search, the R&S CMW can measure 16-QAM-modulated normal bursts and other burst types in one multislot range.

The detection of 16-QAM busts is based on the π/4 rotation angle of the I/Q symbols (see also Multi Evaluation > Rotation). With disabled 16-QAM NB search, the demodulation of 16-QAM bursts will fail. If only one slot is active, the R&S CMW will either detect a 8PSK-modulated burst with a very large frequency error or encounter a synchronization problem.

Remote command:

`CONFigure:GSM:MEAS<i>:MEValuation:NBQSearch`

Access Burst Search

Enables or disables the search for GMSK-modulated access bursts. With enabled access burst search, the R&S CMW can measure normal and access bursts in one multislot range.

The detection of access bursts is based on the three training sequences for access bursts specified in the GSM standard. The "Training Sequence" setting has no impact on the access burst search. The transmission of access bursts is part of the connection setup procedure. Moreover, a mobile in packet data mode can use periodic access bursts for the transmission of CONTROL_ACK_TYPE messages.

The access burst search is time-consuming because the R&S CMW has to search for one out of three possible training sequences within a relatively wide time interval.

Remote command:

`CONFigure:GSM:MEAS<i>:MEValuation:ABSearch`

Training Sequence

Selects the training sequence of the analyzed bursts: With a specific training sequence setting, the R&S CMW will analyze bursts with this training sequence only. The setting has no impact on the access burst search.

- **TSC 0 to TSC 7:** One of the 8 26-bit training sequences defined in the GSM standard
- **Dummy:** GSM-specific dummy burst

- **TSC Any:** Search for any of the training sequences TSC 0 to TSC 7; use the detected training sequence for synchronization.
- **Off:** Do not decode the training sequence, measure any burst. This mode is appropriate for a rough analysis only because the R&S CMW cannot use the training sequence for synchronization and for compensation of a time drift.

In the Standalone (SA) scenario, this parameter is controlled by the measurement. In the Combined Signal Path (CSP) scenario, it is controlled by the signaling application.

Remote command:
`CONFigure:GSM:MEAS<i>:MEValuation:TSEQuence` (SA)
`CONFigure:GSM:SIGN<i>:CELL:BCC` (CSP)

GSM TSC Set (VAMOS)
Specifies the expected VAMOS Training Sequence Code (TSC) set of the measured GSM uplink signal. With a specific TSC set selection, the R&S CMW will analyze bursts with this TSC set only.

The two TSC sets 1 and 2 identify the uplink subchannel for a VAMOS user. All mobiles must support TSC set 1, but only mobiles explicitly indicating support for VAMOS must also support TSC set 2. VAMOS stands for "Voice services over Adaptive Multi-user channels on One Slot" and is defined in 3GPP TS 45.001. For a short introduction refer to the documentation of the "GSM Signaling" application.

Remote command:
`CONFigure:GSM:MEAS<i>:MEValuation:VAMos:TSCSet`

Modulation View
Defines the expected modulation scheme and burst type in all measured timeslots and adjusts the Power Templates. The modulation view settings act as a filter for the triggered GSM frames: To obtain a valid measurement result, the actual modulation scheme and burst type in all measured slots must be compatible with the "Modulation View" settings. Incompatible frames are rejected. For application examples see Detecting GSM Multislot Frames.

- **GMSK:** GMSK modulation and normal bursts expected; the GMSK template is used.
- **8PSK:** 8PSK modulation and normal bursts expected; the 8PSK template is used.
- **16QAM:** 16-QAM modulation and normal bursts expected; the 16QAM template is used (with option R&S CMW-KM201).
- **Access:** Access bursts expected; the template for access bursts is used. The access burst search must be active for this setting.
- **Any:** Arbitrary modulation scheme and burst type; the R&S CMW determines the modulation of the measured burst and uses the appropriate template. Valid results are obtained with all supported modulation types.
- **Off:** No signal expected: timeslot must be inactive to obtain a valid result.

Note: If the burst type or modulation scheme changes during the measurement, the modulation view setting "Any" can cause inconsistent statistical results. In general, a comparison or average of the results for different burst types does not make sense. Moreover, the R&S CMW has to adjust the evaluation areas and oversampling factors to the burst type, which makes the different traces incompatible.

The evaluation areas and oversampling factors for the different burst types are automatically selected in accordance with the GSM conformance test specification. The following table gives an overview.

Burst type	Measured quantity	Oversampling	Samples	Evaluation area (symb. nos.)
8PSK / 16-QAM	EVM, Magn. Error, Phase Error	1	142	3 to 144
	I/Q Data	4	568	3 to 144
GMSK, normal burst	EVM, Magn. Error, Phase Error	4	588	0.5 to 147.5
	I/Q Data	4	588	0.5 to 147.5
GMSK, access burst	EVM, Magn. Error, Phase Error	4	348	0.5 to 87.5
	I/Q Data	4	348	0.5 to 87.5

Remote command:
`CONFigure:GSM:MEAS<i>:MEValuation:MVIew`

3.4.2.3 List Mode Configuration

The "List Mode" parameters are basic control elements for the GSM multi evaluation list mode. R&S CMW-KM012 is required.

Multi evaluation list mode in GSM

In list mode, the measurement interval is subdivided into segments, according to the expected power and frequency steps of the mobile station (MS) under test. The list mode is essentially a remote control feature; for an introduction see List Mode.

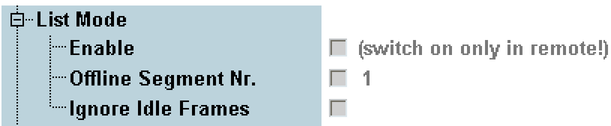


Fig. 3-17: List mode settings

Enable

Shows whether the list mode is enabled and disables an enabled list mode. The list mode must be enabled using the remote control command below.

Remote command:
`CONFigure:GSM:MEAS<i>:MEValuation:LIST`

Offline Segment Nr.
Selects the list mode segment to be displayed in the measurement diagram. For details see chapter 3.2.3.4, "Offline Mode and Offline Segment", on page 383.

To select a segment number, the list mode must be enabled.

Remote command:
`CONFigure:GSM:MEAS<i>:MEValuation:LIST:OSINdex`

Ignore Idle Frames
Selects whether idle frames are ignored or cause a "Signal low" error. For details see "Idle frame evaluation" on page 380.

To set the parameter at the GUI, the list mode must be enabled.

Remote command:
`CONFigure:GSM:MEAS<i>:MEValuation:LIST:IIFRames`

3.4.2.4 Power vs. Time Settings

The following parameters configure the power vs. time settings of the GSM multi evaluation measurement. They are contained in section "Measurement Control".

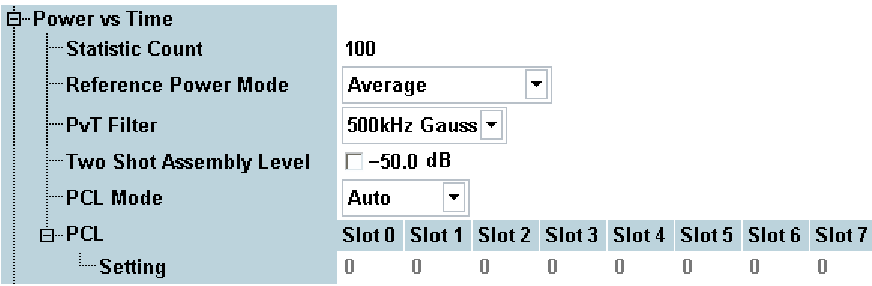


Fig. 3-18: Power vs. time settings

Statistic Count
Defines the number of measurement intervals per measurement cycle (statistics cycle, single-shot measurement). This value is also relevant for continuous measurements, because the averaging procedures depend on the statistic count.

The measurement interval for all TX measurements ("Power vs. Time", "Modulation", "Spectrum due to Modulation", Spectrum due to Switching") is completed when the R&S CMW has measured the full slot sequence ("No. of Slots"). The measurement provides independent statistic counts for the power, modulation and spectrum results. In single-shot mode and with shorter spectrum statistic counts, the spectrum evaluation is stopped while the R&S CMW still continues providing new power and modulation results.

Remote command:
`CONFigure:GSM:MEAS<i>:MEValuation:SCOunt:PVTime`

Reference Power Mode
Determines how the reference power, i.e. the 0-dB line in the "Power vs. Time" measurement diagram and the "(Average) Burst Power" is calculated for 8PSK and 16-QAM-modulated bursts where the amplitude of the modulated carrier varies with the transmitted data. The setting is not valid for slots containing GMSK-modulated bursts.

See also: "Statistical Results" in the R&S CMW user manual, chapter "System Overview"

- **Current:** The current power is calculated for each measured 8PSK or 16-QAM-modulated burst, based on the actual, data-dependent power in the useful part of the burst. Reference powers for the "Average", "Minimum" and "Maximum" curves are calculated from the "Current" results according to the general statistical rules.
  Use this mode for fast measurements on bursts containing random data.
- **Average:** The reference power is equal to the average power of the "Average" measurement curve, irrespective of the selected statistical curve. Regular transmitted bit patterns (e.g. an all zero sequence) result in a systematic deviation between the "Average" and the "Data Compensated" powers.
  Use this mode for measurements on bursts containing random data.
- **Data Compensated:** The current power is calculated as the long-term average for random data; see below. Reference powers for the "Average", "Minimum" and "Maximum" curves are calculated from the "Current" results according to the general statistical rules. The reference power and "(Average) Burst Power" no longer depends on the transmitted data.
  Data compensated mode can slow down the measurement. Use this mode for accurate power measurements, especially if a non-random bit pattern is transmitted.

Data compensation

The amplitude of an 8PSK or 16-QAM-modulated RF signal varies with the transmitted data. The transmitter output power of a mobile phone is defined as the long term average of the power for random data. This long time average (rather than the average power of the current burst) also represents the correct reference power (0-dB line) for the "Power vs. Time" measurement on 8PSK or 16-QAM-modulated bursts.

In the "Data Compensated" mode, each burst is demodulated in order to estimate a correction for the measured average power. As a consequence, all busts are displayed with their correct power, irrespective of the transmitted data.

Example 1 – Regular burst pattern: A regular burst sequence consisting of all zeros is transmitted. The "Current" and "Average" power results are approximately equal; the correct "Data Compensated" result is manifestly different. At constant MS power, the power variations from one measurement interval to the next are small, irrespective of the reference power mode.

Example 2 – Pseudo-random burst patterns: A pseudo-random burst sequence is transmitted. The power in "Current" mode varies from one measurement interval to the next around the long-term average. The power in "Average" mode tends towards the long-term average; it becomes more and more stable as more bursts are averaged. Again, the "Data Compensated" mode provides stable and correct results from the first measurement interval.

Remote command:
`CONFigure:GSM:MEAS<i>:MEValuation:RPMode`

PvT Filter
IF filter to be used for measuring the "Power vs Time" results. All filter settings are in accordance with the conformance specification 3GPP TS 51.010-1.

- **500 kHz Gauss:** Filter of Gaussian shape with a 3-dB bandwidth of 500 kHz, recommended for GMSK-modulated signals
- **1 MHz Gauss:** Filter of Gaussian shape with a 3-dB bandwidth of 1 MHz (faster than the default filter but less frequency-selective)

Remote command:
`CONFigure:GSM:MEAS<i>:MEValuation:FILTer:PVTime`

Two Shot Assembly Level
Enables or disables the two-shot measurement mode for high dynamic range and defines an assembly level for the two consecutive measurement results.

In the two-shot measurement the multislot range is measured in two frames using two different "Expected Nominal Power" settings. The results of the two stages are combined and displayed together in the "Power vs. Time" diagram.

The two maximum levels differ by 30 dB, which means that – depending on the level range of the MS under test and the external test setup – a gain in dynamic range up to 30 dB can be achieved. The two stage measurement ensures a sufficient dynamic range for arbitrary slot powers but increases the measurement time by a factor of 2.

The assembly level is the signal level relative to the reference level (the "Expected Nominal Power" plus the "User Margin") where the two results obtained in a two stage measurement are joined together: All trace points above the assembly level are obtained with a large "Expected Nominal Power", the ones below are measured with lower "Expected Nominal Power".

The assembly level is ignored as long as the two-shot mode is disabled. For combined signal path measurements, it is always disabled.

Remote command:
`CONFigure:GSM:MEAS<i>:MEValuation:HDALevel`

PCL Mode

Defines how the R&S CMW determines the PCL of the measured signal.

- **Auto:** The R&S CMW estimates the PCL in each timeslot according to the measured average burst power. The dynamic limit lines are calculated according to the estimated PCL values. The "PCL > Setting" values are ignored; no PCL setting is required.
- **PCL:** The R&S CMW expects an input signal in accordance with the "PCL > Setting" values. The specified values are also used for the dynamic limit lines. Incorrect settings can cause wrong limit check results.

Remote command:

CONFigure:GSM:MEAS<i>:MEValuation:PCLMode

PCL > Setting

Sets the expected PCL values in all timeslots, to be used in "PCL Mode: PCL". See "PCL Mode" on page 430. The list mode provides segment-specific PCL settings.

Note that the PCL values are interpreted according to the current GSM band setting; see table 3-4.

In the Standalone (SA) scenario, this parameter is controlled by the measurement. In the Combined Signal Path (CSP) scenario, it is controlled by the signaling application.

Remote command:

CONFigure:GSM:MEAS<i>:MEValuation:PCL (SA)

CONFigure:GSM:SIGN<i>:RFSettings:PCL:TCH:CSWitched (CSP)

CONFigure:GSM:SIGN<i>:RFSettings:CHCCombined:TCH:CSWitched (CSP)

3.4.2.5 Modulation Settings

The following parameters configure the modulation settings of the GSM multi evaluation measurement. They are contained in section "Measurement Control".

Fig. 3-19: Modulation settings

Evaluate AM-PM

Indicates whether the AM PM delay is evaluated and displayed in modulation result tables.

Remote command:

CONFigure:GSM:MEAS<i>:MEValuation:RESult:AMPM

Statistic Count

Defines the number of measurement intervals per measurement cycle (statistics cycle, single-shot measurement). This value is also relevant for continuous measurements, because the averaging procedures depend on the statistic count.

The measurement interval is completed when the R&S CMW has measured the full slot sequence ("No. of Slots").

Remote command:

CONFigure:GSM:MEAS<i>:MEValuation:SCOunt:MODulation

Decode

Defines whether or not guard and tail bits are decoded (for GMSK modulation only).

- **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 command:

CONFigure:GSM:MEAS<i>:MEValuation:MODulation:DECode

3.4.2.6 Spectrum Settings

The following parameters configure the spectrum due to modulation and due to switching settings of the GSM multi evaluation measurement. They are contained in section "Measurement Control".

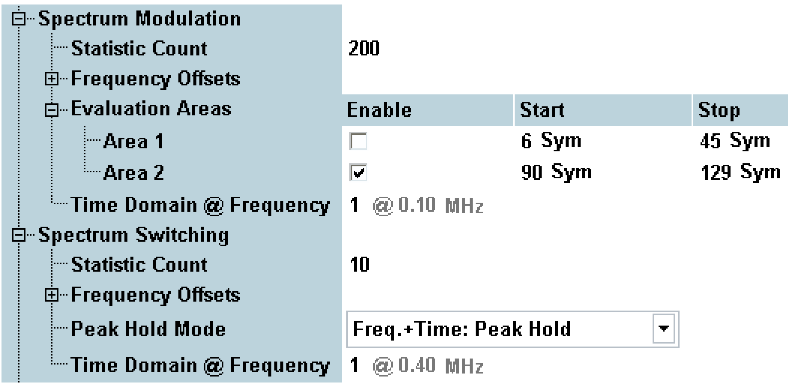


Fig. 3-20: Spectrum settings

Statistic Count

Defines the number of measurement intervals per measurement cycle (statistics cycle, single-shot measurement). This value is also relevant for continuous measurements, because the averaging procedures depend on the statistic count.

The measurement interval is completed when the R&S CMW has measured the full slot sequence ("No. of Slots").

Remote command:

`CONFigure:GSM:MEAS<i>:MEValuation:SCOunt:SMODulation`

`CONFigure:GSM:MEAS<i>:MEValuation:SCOunt:SSWitching`

Frequency Offsets

Enables the spectrum measurement at up to 20 offsets from the analyzer frequency (to be set to the nominal carrier frequency of the measured UL GSM signal). Each enabled frequency offset corresponds to a symmetric pair of bars in the "Spectrum Modulation Frequency" and "Spectrum Switching Frequency" diagrams.

The frequency offsets can be set to arbitrary values between 0 MHz and 3 MHz. The default configuration corresponds to the conformance test specification 3GPP TS 51.010-1 with 11 enabled frequency offsets for the "Spectrum Modulation" measurement and 4 enabled offsets for the "Spectrum Switching" measurement.

Remote command:

`CONFigure:GSM:MEAS<i>:MEValuation:SMODulation:OFRequence`

`CONFigure:GSM:MEAS<i>:MEValuation:SSWitching:OFRequence`

Evaluation Areas

Enables and configures two time intervals (areas) that are used for the "Spectrum Modulation" measurement; see Configuring the Spectrum Measurement. The purpose of the evaluation areas is to "gate" the spectrum in accordance with the test specification 3GPP TS 51.010-1: Only the symbols in the enabled areas contribute to the displayed "Spectrum due to Modulation".

Remote command:

`CONFigure:GSM:MEAS<i>:MEValuation:SMODulation:EARea`

Time Domain @ Frequency

Defines an offset frequency for the "Spectrum Modulation Time" or "Spectrum Switching Time" diagram. The diagrams show the measured power vs. time at the selected offset frequency. The numbers 1 to 20 select the negative frequency offsets from the "Frequency Offsets" list, numbers 21 to 40 select the positive frequency offsets.

Remote command:

`CONFigure:GSM:MEAS<i>:MEValuation:SMODulation:TDFSelect`

`CONFigure:GSM:MEAS<i>:MEValuation:SSWitching:TDFSelect`

Peak Hold Mode

Specifies whether peak hold mode is used for the "Spectrum Switching" results in frequency domain (bar graphs) and in time domain. Peak hold mode means that the R&S CMW displays the largest values obtained since the start of the measurement. The old results are only cleared when a new measurement is started.

In the alternative setting, the frequency domain diagram shows the largest values in the current measurement cycle (peak hold mode per statistics cycle), the time domain diagram shows current results (peak hold mode disabled).

Peak hold mode is in accordance with the test procedure described in the conformance test specification.

Remote command:

`CONFigure:GSM:MEAS<i>:MEValuation:SSWitching:PHMode`

3.4.2.7 BER Settings

The following parameters configure the BER settings of the GSM multi evaluation measurement. They are contained in section "Measurement Control".

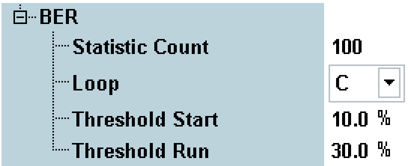


Fig. 3-21: BER settings

Statistic Count

Defines the number of measurement intervals per measurement cycle (statistics cycle, single-shot measurement). This value is also relevant for continuous measurements, because the averaging procedures depend on the statistic count.

The measurement interval for the BER measurement equals one GSM burst.

Remote command:

`CONFigure:GSM:MEAS<i>:MEValuation:SCOunt:BER`

Loop

Configures the BER measurement (see GSM RX Tests) for one of the following loops:

- **C**: The R&S CMW assumes that a BER test on GMSK-modulated signals is performed, i.e. that loop C is closed at the mobile under test and one of the following data sources is used:
  – The ARB generator uses the `LoopC_1040.wv` file.
  – The GSM real-time generator provides an "Alternating" bit pattern.
- **SRB**: The R&S CMW assumes that a BER test on 8PSK-modulated signals is performed, i.e. that an SRB loop is closed at the mobile under test and one of the following data sources is used:
  – The ARB generator uses the `SRB_8PSK_1040.wv` file.
  – The GSM real-time generator provides a "BER Test" bit pattern.

Remote command:

`CONFigure:GSM:MEAS<i>:MEValuation:BER:LOOP`

Threshold Start
Defines a maximum bit error rate for the **first** evaluated burst. The purpose of this parameter is to avoid misleading BER results due to non-TCH bursts (e.g. SACCH bursts). The BER measurement will start with the first triggered burst providing a BER below the "Threshold Start" value, which is likely to be a TCH burst.

To improve the accuracy of the BER measurement, you can set the "Threshold Start" to a value that is close to the expected BER.

Remote command:
CONFigure:GSM:MEAS<i>:MEValuation:BER:TSTart

Threshold Run
Defines a maximum bit error rate for the evaluated bursts following the first burst. The purpose of this parameter is to avoid misleading BER results due to non-TCH bursts (e.g. SACCH bursts). The BER measurement will be based on bursts with a bit error rate below the "Threshold Run" value only, which are likely to be TCH bursts.

For varying test conditions, the threshold should be well above the expected BER. It should also be well below the expected BER of non-TCH bursts (50 %). Note that the BER measurement does not display BER results above 30 %; see GSM RX Tests.

Remote command:
CONFigure:GSM:MEAS<i>:MEValuation:BER:TRUN

3.4.2.8 Trigger Settings

The "Trigger" parameters configure the trigger system for the GSM multi evaluation measurement.

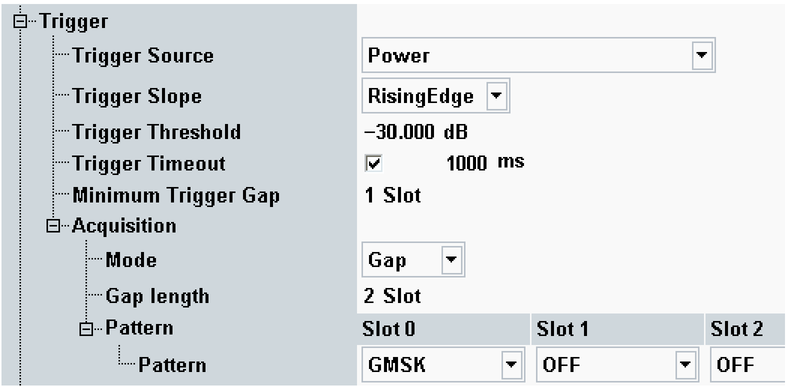


Fig. 3-22: Trigger settings

Trigger Source
Selects the source of the trigger event. Some of the trigger sources require additional options.

- **Free Run:**
  The measurement starts immediately after it is initiated; no trigger is used. The remaining trigger settings are not relevant for "Free Run" measurements.
- **Power:**
  The measurement is triggered by the power of the received signal. The trigger event coincides with the rising or falling edge of the detected GSM burst. Use this trigger source for single-slot measurements and for unique events such as the access burst transmitted during the connection setup.
- **Acquisition:**
  The R&S CMW analyzes the RF input signal and derives a frame trigger using information about the active slots (see Mode settings). Use this trigger source for multislot measurements, in particular those with repeated burst patterns. The "Acquisition (Internal)" trigger algorithm can cope with several active slots with possibly different burst powers and modulation types. It is even appropriate for continuous signals with no power ramps.
  After frame detection, the acquisition trigger events are repeated periodically according to the GSM frame clock. TSC detection is performed continuously in order to compensate for a possible drift.
- **...External...:**
  External trigger signal fed in via TRIG A or TRIG B on the rear panel of the instrument.

Remote command:
`TRIGger:GSM:MEAS<i>:MEValuation:CATalog:SOURce?`
`TRIGger:GSM:MEAS<i>:MEValuation:SOURce`

Trigger Slope
Qualifies whether the trigger event is generated at the rising or at the falling edge of the trigger pulse. This setting has no influence on "Free Run" measurements and for evaluation of trigger pulses provided by other firmware applications.

Remote command:
`TRIGger:GSM:MEAS<i>:MEValuation:SLOPe`

Trigger Threshold
Defines the input signal power where the trigger condition is satisfied and a trigger event is generated. The trigger threshold is valid for power trigger sources. It is a dB value, relative to the reference level minus the external attenuation (<Ref. Level> – <External Attenuation (Input)> – <Frequency Dependent External Attenuation>). If the reference level is set to the actual maximum output power of the DUT, and the external attenuation settings are in accordance with the test setup, then the trigger threshold is referenced to the actual maximum RF input power at the R&S CMW.

A low threshold may be required to ensure that the R&S CMW can always detect the input signal. A higher threshold can prevent unintended trigger events.

Remote command:
`TRIGger:GSM:MEAS<i>:MEValuation:THReshold`

Trigger Timeout

Sets a time after which an initiated measurement must have received a trigger event. If no trigger event is received, a trigger timeout is indicated in manual operation mode. In remote control mode the measurement is automatically stopped. The parameter can be disabled so that no timeout occurs.

This setting has no influence on "Free Run" measurements.

Remote command:

`TRIGger:GSM:MEAS<i>:MEValuation:TOUT`

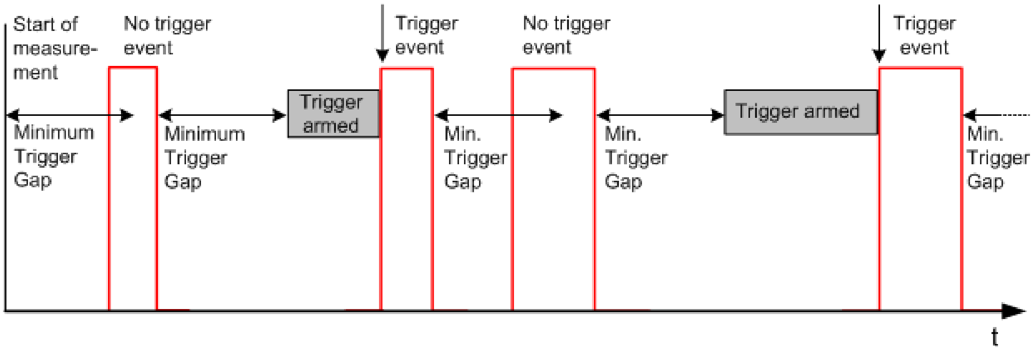
Minimum Trigger Gap

Defines a minimum duration of the power-down periods (gaps) between two triggered power pulses. This setting is valid for an "(IF) Power" trigger source.

The trigger system is controlled by means of a timer which is reset to zero in the following instances:

- At the IF power-down ramp of each triggered or untriggered pulse, even though the previous counter may not have elapsed yet. A power-down ramp is detected when the signal power falls below the trigger threshold.
- At the beginning of each measurement: The minimum gap defines the minimum time between the start of the measurement and the first trigger event.

The trigger system is re-armed as soon as the timer has reached the specified minimum gap.



In the GSM multi evaluation measurement, the "Minimum Trigger Gap" separates any two consecutive measurements by a minimum number of timeslots.

Remote command:

`TRIGger:GSM:MEAS<i>:MEValuation:MGAP`

Acquisition

The following parameters apply to the acquisition settings.

Mode ← Acquisition

Selects the synchronization method that the R&S CMW uses to derive the frame boundary of the received UL signal and generate the "Acquisition (Internal)" trigger events.

- **Gap**: The R&S CMW searches for a gap, i.e. for a series of 1 to 3 inactive slots. The trigger event is generated at the beginning of the first slot after the gap and repeated according to the GSM frame clock. Use this simple synchronization method for frames that start with a series of active slots and end with inactive slots.

- **Pattern**: The R&S CMW searches for a definite burst pattern, defined via "Acquisition > Pattern".The trigger events are generated at the beginning of the pattern and repeated according to the GSM frame clock, even though the true burst pattern may have changed. Use this synchronization method for arbitrary multislot configurations.

Remote command:

`CONFigure:GSM:MEAS<i>:MEValuation:AMODe`

Gap Length ← Acquisition

Number of consecutive inactive slots preceding the frame boundary (and therefore the acquisition trigger event).

Remote command:

`CONFigure:GSM:MEAS<i>:MEValuation:GLENgth`

Pattern ← Acquisition

Burst pattern in the UL frame. Each of the 8 timeslots can be inactive ("OFF") or carry a GMSK-modulated or 8PSK/16-QAM-modulated burst.

Remote command:

`CONFigure:GSM:MEAS<i>:MEValuation:APATtern`

3.4.2.9 Limits

The "Limits" in the "Multi Evaluation Configuration" dialog define upper limits for the modulation, power vs. time and spectrum results. See also Limit Settings and Conformance Requirements.

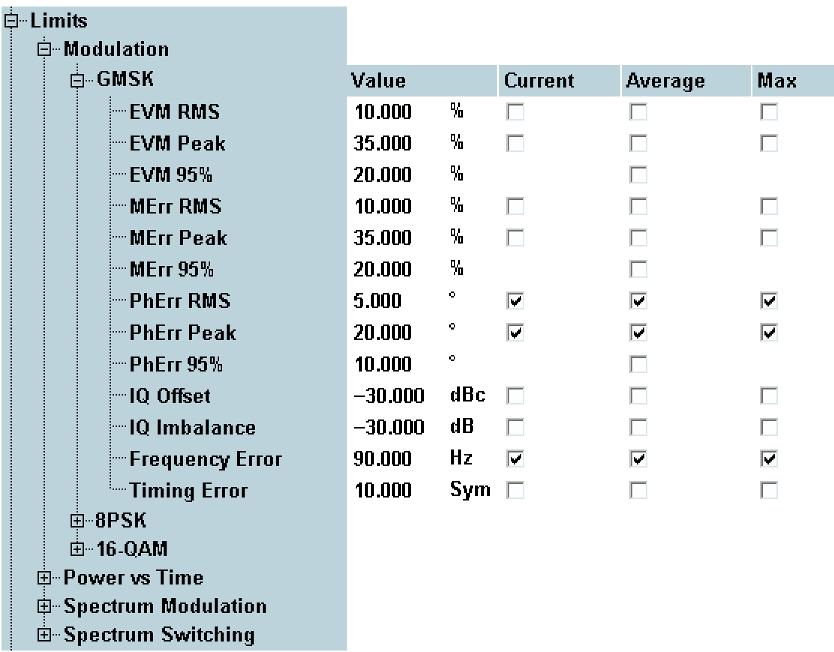


Fig. 3-23: Limit settings

The limits for the different modulation schemes are defined separately.

Modulation

Upper limits for the measured quantities which characterize the modulation accuracy.

Three different limits are provided for the EVM, magnitude error and phase error:

- **EVM RMS:** Upper limit for the EVM, RMS-averaged over the burst
- **EVM Peak:** Upper limit for the peak EVM value in the burst
- **EVM 95%:** Upper limit for the 95^{th} percentile of the EVM. The 95^{th} percentile is the value of the measured quantity below which 95 % of all observations fall. E.g. an EVM 95^{th} percentile of 0.8 indicates that 95 % of all measured EVM results were below 0.8, 5 % equal to or larger than 0.8.

The definition of the phase error and magnitude error limits is similar.

A single limit is provided for the remaining quantities, however, it is possible to enable each limit check separately for the "Current", "Average" and "Max" results.

Remote command:

`CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:EVMagnitude`
`CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:MERRor`
`CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:PERRor`
`CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:IQOFfset`
`CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:IQIMbalance`
`CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:FERRor`
`CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:TERRor`
(same list for EPSK (=8PSK) and QAM16 (=16-QAM) modulation)

Power vs. Time

The following limit settings is available for the power vs. time measurements:

Avg. Burst Power ← Power vs. Time

Upper and lower limits for the burst power, averaged over all symbols in the useful part of the burst. According to the conformance specification (see Avg. Burst Power Limits), the average burst power limits depend on the transmitter output power of the mobile phone, defined in terms of the Power Control Level (PCL). The limits are relative to the nominal output power of the mobile phone, corresponding to its PCL.

The R&S CMW can define and enable limits for 10 independent PCL ranges (from PCL ... to PCL). For greater flexibility, lower and upper limits may be asymmetric (i.e. not of the same magnitude).

"Guard Period" is relevant for multislot configurations; this value specifies the maximum power in the guard period between any two consecutive active slots; see Power Templates. The multislot guard level is defined as a dB value relative to the average burst power in the measurement slot (see "Measurement Slot Settings" on page 423).

Remote command:

`CONFigure:GSM:MEAS<i>:MEValuation:LIMit:PVTime:ABPower<no>`
`CONFigure:GSM:MEAS<i>:MEValuation:LIMit:PVTime:GPLevel`

Power Templates ← Power vs. Time

Upper and lower limit lines for the measured power vs. time. The limit lines for the different modulation schemes can be set independently; see Power Templates.

Both upper limit lines and lower limit lines consist of several areas. In each of these areas, it is possible to specify a relative limit (in dBc units) and an alternative absolute limit. If it is enabled, the absolute limit replaces the relative limit whenever it is above the relative limit. These "Static" (i.e. power-independent) limit settings can be further modified by adding a "Dynamic" (i.e. PCL-dependent) correction.

The power templates of the R&S CMW are more flexible than necessary to define the templates specified in the conformance test specification.

Note: Dynamic correction. If the "GSM Multi Evaluation" measurement is performed in combination with the "GSM Signaling" application, the PCL value for the dynamic correction is taken from the signaling application. In "Standalone (Non Signaling)" mode the R&S CMW estimates the PCL according to the received average burst power.

Remote command:

`CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:PVTime:UPPer:REDGe<no>:STATic`

`CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:PVTime:UPPer:UPARt<no>:STATic`

`CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:PVTime:UPPer:FEDGe<no>:STATic`

`CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:PVTime:LOWer:UPARt<no>:STATic`

`CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:PVTime:UPPer:REDGe<no>:DYNamic<Range>`

`CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:PVTime:UPPer:UPARt<no>:DYNamic<Range>`

`CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:PVTime:UPPer:FEDGe<no>:DYNamic<Range>`

`CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:PVTime:LOWer:UPARt<no>:DYNamic<Range>`

(same list for EPSK (=8PSK) and QAM16 (=16-QAM) modulation)

Spectrum Modulation and Spectrum Switching

Upper limits for spectrum due to modulation and spectrum due to switching; see Spectrum Limits. The limits for the different modulation schemes can be defined independently, each at up to 20 different offsets from the nominal carrier frequency. The offset frequencies are taken from the "Measurement Control > Spectrum Modulation / Spectrum Switching > Frequency Offsets" lists.

The "Ref. Power" range for the spectrum due to modulation ("Spectrum Modulation") defines the MS carrier output power range where the limit lines are to be determined by linear interpolation (see table in section Spectrum Modulation Limits): Below the lower "Ref. Power", the lower limit line ("Low Pwr" values) applies, above the upper "Ref. Power", the upper limit line ("High Pwr" values) applies. The "Low Pwr" and "High Pwr" values are relative to the MS output power, measured in 30 kHz on the carrier. The "Abs" values define alternative absolute limits for the spectrum due to modulation. They are applied whenever the relative limits are below the absolute values.

The limits for the spectrum due to switching ("Spectrum Switching") are defined at up to 10 different "Ref. Levels" and in absolute (dBm) units. For measured average burst powers between the "Ref. Levels", the limits are calculated by linear interpolation.

Remote command:

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:SMODulation:RPOWer
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:SMODulation:MPOint<no>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:SSWitching:PLEVel
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:SSWitching:MPOint<no>
(same list for EPSK (=8PSK) and QAM16 (=16-QAM) modulation)

3.4.2.10 Display Configuration

The "Display" parameters select the diagram type to be displayed ("Active View").

Fig. 3-24: Display settings

Use the hotkeys associated with the "Display" softkey to enable and scale the diagrams and select the trace types to be displayed.

All display settings are self-explanatory. No remote control is provided.

3.4.2.11 Generator Shortcut

This feature enables the user to start the GPRF generator and use GPRF related hotkeys and softkeys within the measurement application. It improves the usability for non signaling tests where the DUT's reaction on varying generator signals is measured (see also chapter 3.2.2, "GSM RX Tests", on page 377).

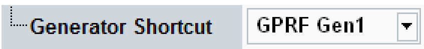


Fig. 3-25: GPRF generator shortcut

As soon as a connection to the GPRF generator instance is established, two additional softkeys with corresponding hotkey bars provide access to the generator configuration, see chapter 3.4.2.12, "Additional Softkeys and Hotkeys", on page 440.

Use the appropriate softkey/hotkey combination to access the generator parameters.

For details on the available parameters see the GPRF generator documentation.

3.4.2.12 Additional Softkeys and Hotkeys

The "GSM Multi Evaluation" measurement provides some softkey/hotkey combinations which have no equivalent in the configuration dialog. Most of these hotkeys provide display configurations (like diagram scaling). They are self-explanatory and do not have any remote-control commands assigned.

The remaining softkeys > hotkeys are described below:

- Softkeys "Signaling Parameter" and "GSM Signaling":
  These softkeys are displayed only while the combined signal path scenario is active and are provided by the "GSM Signaling" application selected as master application.
  While one of these softkeys is selected, the "Config" hotkey opens the configuration dialog of the signaling application, not the configuration dialog of the measurement.
- Hotkeys "Multi Evaluation" > "Rotation" and "I/Q Filter":
  These hotkeys configure the "I/Q Constellation" diagram and are displayed only while the corresponding single view is displayed.

Signaling Parameter > ...
Provides access to the most essential settings of the "GSM Signaling" application.

Remote command:
Use the remote-control commands of the signaling application.

GSM Signaling
Select this softkey and press ON | OFF to turn the downlink signal transmission on or off.

Press the softkey two times (select it and press it again) to switch to the signaling application.

Remote command:
Use the remote-control commands of the signaling application.

ARB/List Mode, GPRF<i> Generator
Select this softkeys to vary GPRF generator signals during non signaling tests. Use the appropriate softkey/hotkey combination to access the generator parameters directly from the GSM measurement GUI.

The "Configure Generator..." hotkey opens the configuration tree of the connected GPRF generator instance.

Multi Evaluation > Rotation
According to 3GPP TS 100.959 the 8PSK (16-QAM) symbols are continuously rotated with 3π/8 (π/4) 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 (π/4) rotation is subtracted off before the symbols are displayed in the constellation diagram.

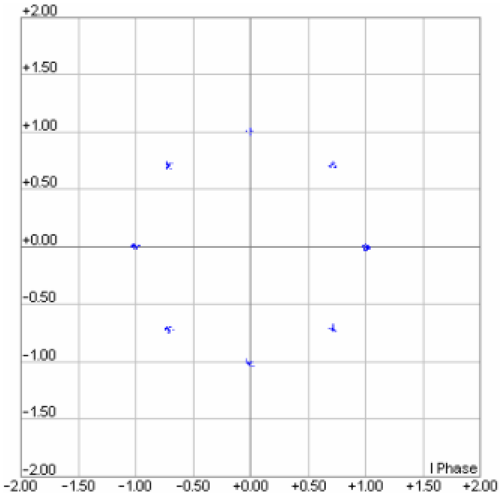
The setting is not valid for GMSK-modulated signals; see following table.

Table 3-5: Modulation type dependencies

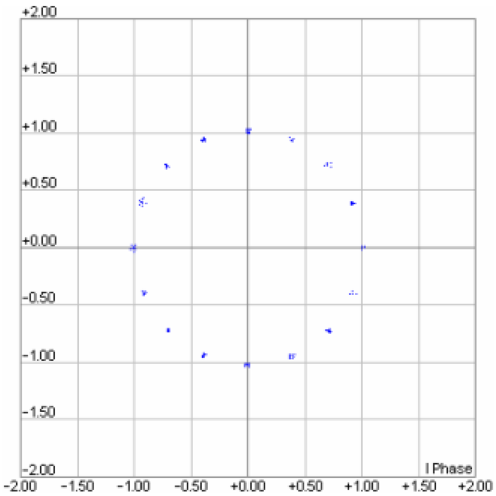
Modulation	Rotation	I/Q Filter
GMSK	not used	Unfiltered
8PSK / 16-QAM	Removed	ISI Removed
8PSK / 16-QAM	Not Removed (no correction of received signal)	ISI Removed Unfiltered 90 kHz

The examples below show an 8PSK-modulated signal.

"Removed" The constellation points appear as if no phase rotation occurred; the constellation diagram contains 8 symbol point locations . The symbol mapping of the modulating bits into the 8 symbols is in accordance with specification 3GPP TS 100.959.



"Not Removed" The phase-rotated constellation points are displayed; the constellation diagram contains 16 symbol point locations.



Remote command:

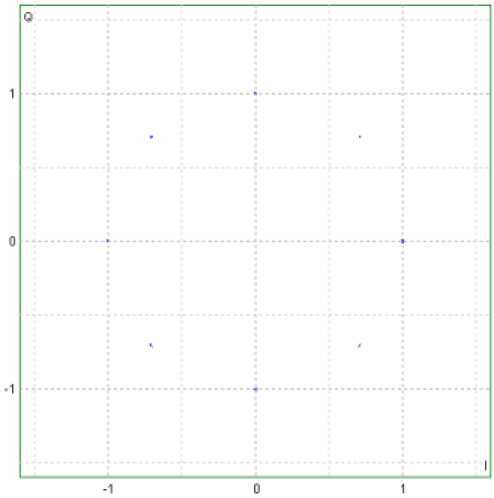
CONFigure:GSM:MEAS<i>:MEValuation:ROTation:IQ

Multi Evaluation > I/Q Filter

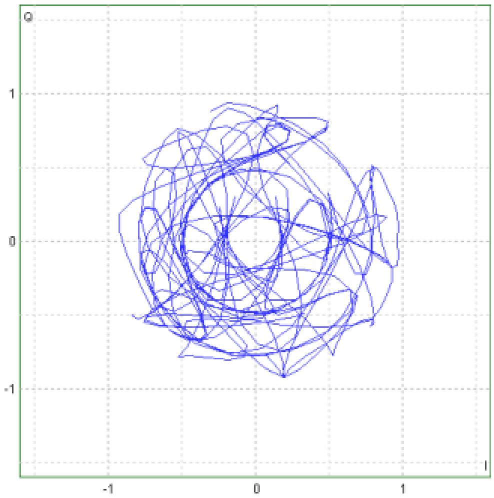
Specifies whether the I/Q data is filtered in order to eliminate the inter-symbol interference (ISI) at all constellation points and selects the diagram type.

GMSK modulated signals are always unfiltered; see table 3-5.

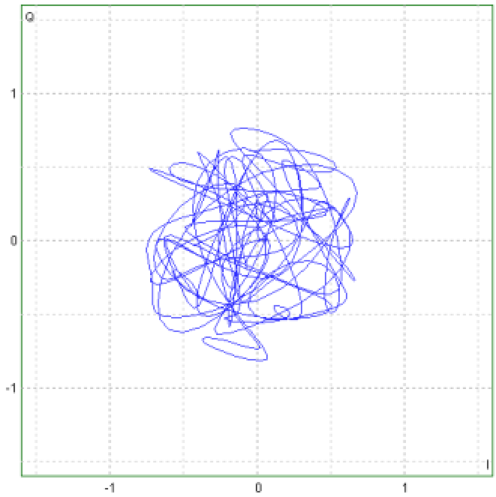
"ISI Removed" The constellation points appear at fixed locations. No trajectories between the points are drawn. The number of points depends on the "Rotation" setting.



"Unfiltered" No I/Q filter applied. The diagram shows the trajectory of the modulation vector. Due to the effect of the 3π/8 rotation, the trajectory remains outside a circle around the origin.



"90 kHz" 90 kHz filter applied. The standard stipulates this filter for EVM measurements, so the I/Q diagram shows the modulation vector that the EVM is based on. Like in the "Unfiltered" setting, the trajectory of the modulation vector is drawn.



Remote command:
CONFigure:GSM:MEAS<i>:MEValuation:FILTer:IQ

3.4.3 Measurement Results

The GSM "Multi Evaluation" measurement dialog shows all results in several alternative views; see detailed description in section Measurement Results.

The multi evaluation measurement provides an overview dialog and a detailed view for each diagram in the overview. Each dialog shows the most important RF and analyzer settings. The dialogs also visualize the limit check results.

See also: "Limit Check" in the R&S CMW user manual, chapter "System Overview"

The overview dialog displays the power vs. time, modulation and spectrum results as traces or histograms.

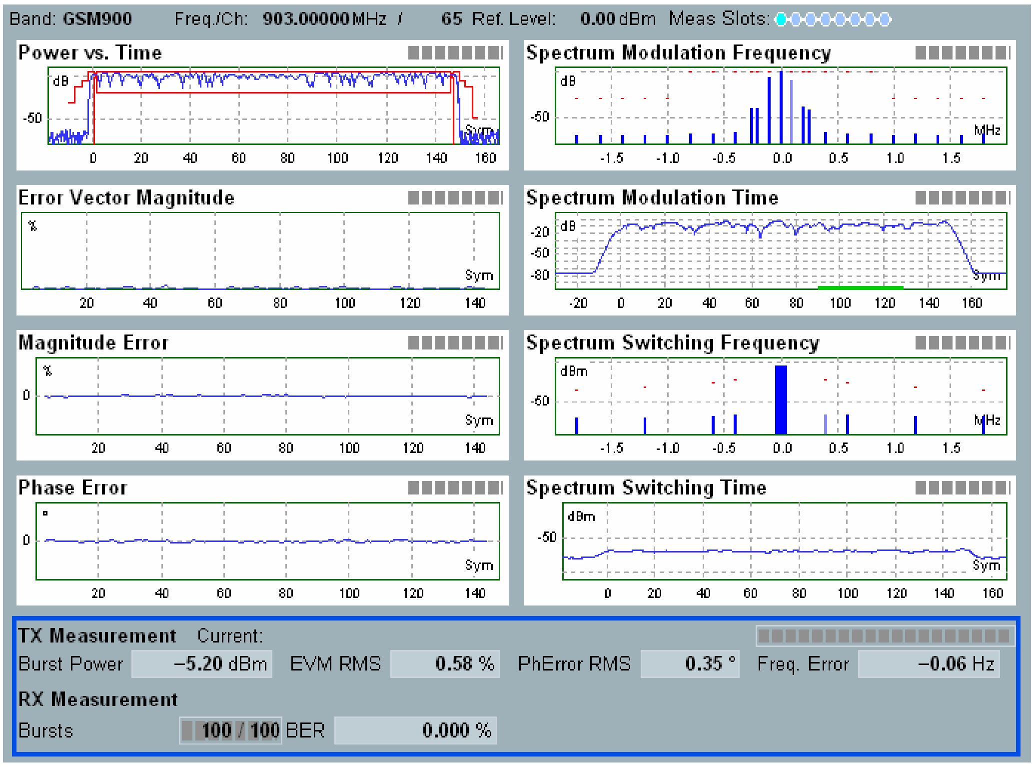


Fig. 3-26: Result overview

Each of the detailed views shows a diagram and a statistical overview of single-slot results.

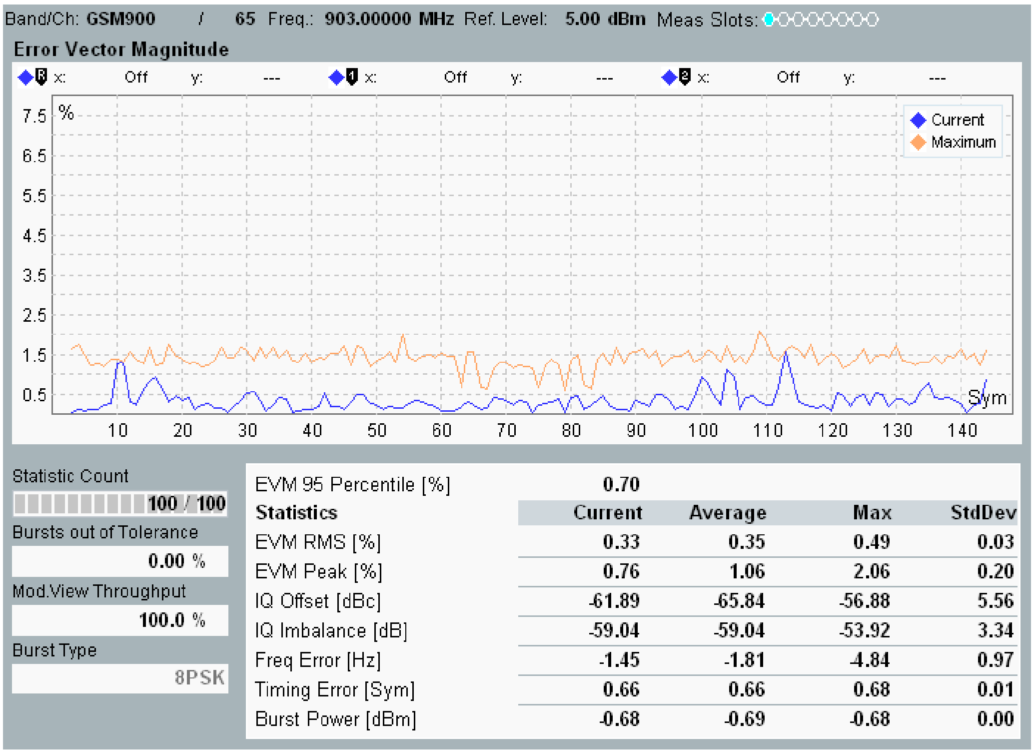


Fig. 3-27: Detailed view for EVM results

Traces and Histograms

To retrieve the values in the traces and histograms, use commands of the following type.

Remote command:

FETCh:GSM:MEAS<i>:MEValuation:TRACe:PVTime:CURRent? etc.
FETCh:GSM:MEAS<i>:MEValuation:TRACe:EVMagnitude:CURRent? etc.
FETCh:GSM:MEAS<i>:MEValuation:TRACe:MERRor:CURRent? etc.
FETCh:GSM:MEAS<i>:MEValuation:TRACe:PERRor:CURRent? etc.
FETCh:GSM:MEAS<i>:MEValuation:SMODulation:FREQuency? etc.
FETCh:GSM:MEAS<i>:MEValuation:TRACe:SMODulation:TIME[:CURRent]?
etc.
FETCh:GSM:MEAS<i>:MEValuation:SSWitching:FREQuency? etc.
FETCh:GSM:MEAS<i>:MEValuation:TRACe:SSWitching:TIME[:CURRent]?
etc.
FETCh:GSM:MEAS<i>:MEValuation:TRACe:IQ[:CURRent]?

Statistical Overviews

To retrieve the additional values in the detailed views, use the following commands.

Remote command:
`FETCh:GSM:MEAS<i>:MEValuation:PVTime[:ALL]?` etc.
`FETCh:GSM:MEAS<i>:MEValuation:MODulation:CURRent?` etc.
`FETCh:GSM:MEAS<i>:MEValuation:SMODulation?` etc.
`FETCh:GSM:MEAS<i>:MEValuation:SSWitching?` etc.
`FETCh:GSM:MEAS<i>:MEValuation:BER?` etc.

3.5 Programming

The following sections provide programming examples for the GSM multi evaluation measurement.

The examples have been tested with the aid of a simple software tool.

See also: "Remote Control" in the R&S CMW user manual

3.5.1 General Examples

The GSM multi evaluation measurement is programmed as follows:

- The measurement is controlled by SCPI commands with the following syntax: `...GSM:MEAS:MEValuation...`
- Use general commands of the type `...:GSM:MEAS...` (no `:MEValuation` mnemonic) to define the signal routing and perform RF and analyzer settings.
- After a `*RST`, the measurement is switched off. Use `READ:GSM:MEAS:MEValuation?` to initiate a single-shot measurement and retrieve the results. You can also start the measurement using `INIT:GSM:MEAS:MEValuation` and retrieve the results using `FETCh:GSM:MEAS:MEValuation...?`.

Speed considerations

The following measurement settings provide additional results but can slow down the measurement:

- Evaluation of the spectrum vs. time measurements
- Evaluation of the "AM-PM" delay for polar modulators
- Access burst search

3.5.1.1 Specifying General Measurement Settings

```
// ***************************************************************************
// System-Reset
// ***************************************************************************
*RST; *OPC?
*CLS; *OPC?

// ***************************************************************************
// Check signal routing options, perform RF and analyzer settings
// for a GSM900 uplink signal (channel 1) with a
// nominal power of 20 dBm, GMSK/8PSK modulation and
// frequency offset 1 kHz
// ***************************************************************************
ROUTe:GSM:MEAS:SCENario:CSPath 'GSM Sig1'
ROUTe:GSM:MEAS:SCENario:MAProtocol
ROUTe:GSM:MEAS:SCENario?
ROUTe:GSM:MEAS?
ROUTe:GSM:MEAS:SCENario:SALone RF1C, RX1

CONFigure:GSM:MEAS:RFSettings:EATTenuation 2
CONFigure:GSM:MEAS:RFSettings:ENPower 20
CONFigure:GSM:MEAS:RFSettings:UMARgin 5
CONFigure:GSM:MEAS:RFSettings:FREQuency 890.2E+6
CONFigure:GSM:MEAS:RFSettings:FOFFset 1000

// ***************************************************************************
// Redefine the frequency entering frequency band and channel number.
// ***************************************************************************
CONFigure:GSM:MEAS:BAND G04
CONFigure:GSM:MEAS:CHANnel 300
```

3.5.1.2 Specifying Measurement-Specific Settings

```
// ***************************************************************************
// Select a 1.5 s timeout for the measurement.
// Define statistic cycles and error handling
// (no stop when tolerances are exceeded, measure on exception)
// ***************************************************************************
CONFigure:GSM:MEAS:MEValuation:TOUT 1.5
CONFigure:GSM:MEAS:MEValuation:SCOunt:PVTime 100
CONFigure:GSM:MEAS:MEValuation:SCOunt:MODulation 10
CONFigure:GSM:MEAS:MEValuation:SCOunt:SMODulation 10
CONFigure:GSM:MEAS:MEValuation:SCOunt:SSWitching 10
CONFigure:GSM:MEAS:MEValuation:SCONdition SLFail
CONFigure:GSM:MEAS:MEValuation:MOEXception ON

// ***************************************************************************
// Specify the expected PCL values in all timeslots (for power measurements)
```

```
// *****************************************************************************
CONFigure:GSM:MEAS:MEValuation:PCLMode PCL
CONFigure:GSM:MEAS:MEValuation:PCL 5, 5, 5, 5, 5, 5, 5, 5

// *****************************************************************************
// Query all available trigger sources (for development)
// Use a power trigger to start the measurement
// Configure the instrument for a single-slot measurement in the active
// timeslot detected by the trigger system, set a minimum duration
// of two slots between two consecutive trigger events
// *****************************************************************************
TRIGger:GSM:MEAS:MEValuation:CATalog:SOURce?
TRIGger:GSM:MEAS:MEValuation:SOURce "POWer"
TRIGger:GSM:MEAS:MEValuation:SLOPe REDGe
TRIGger:GSM:MEAS:MEValuation:THReshold -2.5E+1
TRIGger:GSM:MEAS:MEValuation:TOUT 1.0E+3
CONFigure:GSM:MEAS:MEValuation:MSLots 0, 1, 0
TRIGger:GSM:MEAS:MEValuation:MGAP 2
```

3.5.1.3 Performing Single-Shot Measurements

```
// *****************************************************************************
// Power vs. time and modulation configuration: change reference power mode
// for 8PSK-modulated bursts, select a wider IF filter, decode guard and
// tail bits.
// Start a single-shot power vs. time measurement and return the average
// burst power trace. Query the measurement status (should be "RDY" and
// "RDY ,ADJ,ACT").
// *****************************************************************************
CONFigure:GSM:MEAS:MEValuation:RPMode CURRent
CONFigure:GSM:MEAS:MEValuation:FILTer:PVTime G10M
CONFigure:GSM:MEAS:MEValuation:MODulation:DECode GTBits
READ:GSM:MEAS:MEValuation:TRACe:PVTime:AVERage?

// *****************************************************************************
// Read the average error vector magnitude trace obtained in the
// last measurement without re-starting the measurement
// Query additional measurement results
// *****************************************************************************
READ:GSM:MEAS:MEValuation:TRACe:EVMagnitude:AVERage?
FETCh:GSM:MEAS:MEValuation:MVTHroughput?
FETCh:GSM:MEAS:MEValuation:PVTime:BTYPe?
FETCh:GSM:MEAS:MEValuation:PVTime:RSTiming?
FETCh:GSM:MEAS:MEValuation:PVTime:TSC?
```

3.5.1.4 Single-Shot and Continuous Measurements

```
// *****************************************************************************
// Start single-shot measurement, return magnitude error trace.
```

```
// Return maximum magnitude error trace and maximum phase
// (without repeating the measurement. Query the measurement state
// should be "RDY").
// ************************************************************************
INIT:GSM:MEAS:MEValuation
FETCh:GSM:MEAS:MEValuation:TRACe:MERRor:MAXimum?
FETCh:GSM:MEAS:MEValuation:TRACe:PERRor:MAXimum?
FETCh:GSM:MEAS:MEValuation:STATe?

// ************************************************************************
// Start continuous measurement; wait for 5 ms and return measurement
// results of the last measured cycle.
// Query measurement state and substates (should be "RUN,ADJ,ACT").
// ************************************************************************
CONFigure:GSM:MEAS:MEValuation:REPetition CONTinuous
INIT:GSM:MEAS:MEValuation
Pause 5000
FETCh:GSM:MEAS:MEValuation:MODulation:CURRent?
CALCulate:GSM:MEAS:MEValuation:MODulation:CURRent?
FETCh:GSM:MEAS:MEValuation:STATe:ALL?
```

3.5.1.5 Configuring a Spectrum Measurement

```
// ************************************************************************
// Spectrum Modulation configuration: Define and enable five frequency
// offsets, define evaluation areas
// ************************************************************************
CONF:GSM:MEAS:MEV:SMODulation:OFRequence 0.1e+6,0.2e+6,0.25e+6,0.4e+6,
    0.6e+6,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF
CONFigure:GSM:MEAS:MEValuation:SMODulation:EARea OFF, 0, 1, ON, 90, 147

// ************************************************************************
// Spectrum Switching configuration: Define and enable five offsets,
// set peak hold mode for spectrum vs. frequency graphs only
// ************************************************************************
CONF:GSM:MEAS:MEV:SSWitching:OFRequence 0.1e+6,0.2e+6,0.25e+6,0.4e+6,
    0.6e+6,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF,OFF
CONFigure:GSM:MEAS:MEValuation:SSWitching:PHMode SCO

// ************************************************************************
// Re-start measurement and return spectrum results including limit check
// ************************************************************************
INIT:GSM:MEAS:MEValuation
FETCh:GSM:MEAS:MEValuation:SMODulation:FREQuency?
CALCulate:GSM:MEAS:MEValuation:SMODulation:FREQuency?
FETCh:GSM:MEAS:MEValuation:SSWitching:FREQuency?
CALCulate:GSM:MEAS:MEValuation:SSWitching:FREQuency?

// ************************************************************************
```

```
// Enable spectrum vs. time measurements,query all enabled measurements,
// define offset frequencies, retrieve measurement results
// *************************************************************************
CONFigure:GSM:MEAS:MEValuation:RESult:SMTime ON
CONFigure:GSM:MEAS:MEValuation:RESult:SSTime ON
CONFigure:GSM:MEAS:MEValuation:RESult:ALL?
CONFigure:GSM:MEAS:MEValuation:SMODulation:TDFSelect 21
CONFigure:GSM:MEAS:MEValuation:SSWitching:TDFSelect 22
FETCh:GSM:MEAS:MEValuation:TRACe:SMODulation:TIME?
FETCh:GSM:MEAS:MEValuation:TRACe:SSWitching:TIME?
```

3.5.1.6 Selecting Specific Burst Types

```
// *************************************************************************
// Select only GMSK-modulated normal bursts with a definite
// training sequence (TSC 1) and VAMOS TSC set 1. Start a single-shot
// modulation measurement and return the statistical results
// *************************************************************************
CONFigure:GSM:MEAS:MEValuation:TSEQuence TSC1
CONFigure:GSM:MEAS:MEV:MVIew GMSK, GMSK, GMSK, GMSK, GMSK, GMSK, GMSK, GMSK
CONFigure:GSM:MEAS:MEValuation:VAMos:TSCSet 1
READ:GSM:MEAS:MEValuation:MODulation:CURRent?
CALCulate:GSM:MEAS:MEValuation:MODulation:CURRent?

// *************************************************************************
// Perform a multi-slot measurement, use a frame trigger, knowing
// that slots no. 5, 6 and 7 of the analyzed signal are inactive
// *************************************************************************
TRIGger:GSM:MEAS:MEValuation:SOURce "Acquisition"
CONFigure:GSM:MEAS:MEValuation:AMODe GAP
CONFigure:GSM:MEAS:MEValuation:GLENgth 3

// *************************************************************************
// Perform a multi-slot measurement, use a frame trigger, knowing
// that slots no. 2, 3 and 4 of the analyzed signal are 8PSK-modulated,
// and that the remaining slots are inactive
// *************************************************************************
TRIGger:GSM:MEAS:MEValuation:SOURce "Acquisition"
CONFigure:GSM:MEAS:MEValuation:AMODe PATTern
CONFigure:GSM:MEAS:MEV:APATtern OFF, OFF, EPSK, EPSK, EPSK, OFF, OFF, OFF
```

3.5.2 GSM List Mode

The list mode for the GSM multi evaluation measurement is programmed as follows:

- The measurement is controlled by SCPI commands with the following syntax: `...GSM:MEAS:MEValuation:LIST...`
- Use general commands of the type `...:GSM:MEAS...` (no `:MEValuation` mnemonic) to define the signal routing and perform RF and analyzer settings.

- After a `*RST`, the measurement is switched off and list mode is disabled. Use `CONFigure:GSM:MEAS:MEValuation:LIST ON` to enable the list mode and `INIT:GSM:MEAS:MEValuation` to initiate a single-shot measurement.
- Use `FETCh:GSM:MEAS:MEValuation:LIST:SEGMent<Seg>:...?` commands to retrieve the results.

Speed considerations

The following measurement settings have an impact on the measurement speed:

- The number and size of the segments and the number of measured slots in each segment
- The number and type of results that the R&S CMW needs to calculate

See also remarks about "Configuration of segments and measurement" in section List Mode Configuration.

3.5.2.1 Specifying General Measurement Settings

```
// *************************************************************************
// System-Reset
// *************************************************************************
*RST; *OPC?
*CLS; *OPC?

// *************************************************************************
// Define signal routing and external attenuation
// (Note: The general RF frequency and expected power settings are
// not used in list mode)
// *************************************************************************
ROUTe:GSM:MEAS:SCENario:SALone RF1C, RX1
CONFigure:GSM:MEAS:RFSettings:EATTenuation 2
```

3.5.2.2 Specifying Measurement-Specific Settings

```
// *************************************************************************
// Define segments, enable list mode with 2 segments and a step length
// of 8 slots (one slot per TDMA frame measured).
// *************************************************************************
CONFigure:GSM:MEAS:MEValuation:LIST:SLENgth 8

// *************************************************************************
// Define length of segments (one 52-multiframe each) and analyzer settings
// *************************************************************************
CONFigure:GSM:MEAS:MEValuation:PCLMode PCL
CONFigure:GSM:MEAS:MEValuation:LIST:SEGMent1:SETup 52, 17, 9.04E+8, 14
CONFigure:GSM:MEAS:MEValuation:LIST:SEGMent2:SETup 52, 15, 9.05E+8, 15

// *************************************************************************
// Measure power in both segments, modulation and spectrum in segment 2
```

```
// Select an averaging length of 52 (all measured slots in the segment)
// Enable list mode
// ***************************************************************************
CONFigure:GSM:MEAS:MEValuation:LIST:LRANge 1,2
CONFigure:GSM:MEAS:MEValuation:LIST:SEGMent1:PVTime 52, ON, #B10000000
CONFigure:GSM:MEAS:MEValuation:LIST:SEGMent2:PVTime 52, ON, #B10000000
CONF:GSM:MEAS:MEValuation:LIST:SEGMent2:MOD 52, ON, ON, ON, ON, #B10000000
CONFigure:GSM:MEAS:MEValuation:LIST:SEGMent2:SMODulation 52, ON, #B10000000
CONFigure:GSM:MEAS:MEValuation:LIST:SEGMent2:SSWitching 52, ON, #B10000000
CONFigure:GSM:MEAS:MEValuation:LIST ON

// ***************************************************************************
// Idle frames shall not cause "Signal low" errors
// ***************************************************************************
CONFigure:GSM:MEAS:MEValuation:LIST:IIFRames ON

// ***************************************************************************
// Use a power trigger to start the measurement
// ***************************************************************************
TRIGger:GSM:MEAS:MEValuation:SOURce 'Power'
TRIGger:GSM:MEAS:MEValuation:SLOPe REDGe
TRIGger:GSM:MEAS:MEValuation:THReshold -25
TRIGger:GSM:MEAS:MEValuation:TOUT 1
```

3.5.2.3 Performing Single-Shot Measurements

```
// ***************************************************************************
// Start single-shot measurement, return current power results
// (the average power in the last slot in segment 2).
// Return average modulation results and spectrum results (without repeating
// the measurement. Query the measurement state (should be "RDY").
// ***************************************************************************
INIT:GSM:MEAS:MEValuation
FETCh:GSM:MEAS:MEValuation:LIST:SEGMent2:PVTime:CURRent?
FETCh:GSM:MEAS:MEValuation:LIST:SEGMent2:PVTime:CURRent:SVECtor?
FETCh:GSM:MEAS:MEValuation:LIST:SEGMent2:MODulation:CURRent?
FETCh:GSM:MEAS:MEValuation:LIST:SEGMent2:MODulation:PERCentile?
FETCh:GSM:MEAS:MEValuation:LIST:SEGMent2:SMODulation?
FETCh:GSM:MEAS:MEValuation:LIST:SEGMent2:SSWitching?
FETCh:GSM:MEAS:MEValuation:LIST:SEGMent2:BER?
FETCh:GSM:MEAS:MEValuation:STATe?

// ***************************************************************************
// Return list mode results in all segments
// ***************************************************************************
FETCh:GSM:MEAS:MEValuation:LIST:PVTime:CURRent?
FETCh:GSM:MEAS:MEValuation:LIST:PVTime:CURRent:SVECtor?
FETCh:GSM:MEAS:MEValuation:LIST:MODulation:CURRent?
FETCh:GSM:MEAS:MEValuation:LIST:MODulation:SDEViation?
```

```
FETCh:GSM:MEAS:MEValuation:LIST:MODulation:PERCentile?
FETCh:GSM:MEAS:MEValuation:LIST:BER?

// *****************************************************************************
// Return an overview of list mode results in all segments
// *****************************************************************************
FETCh:GSM:MEAS:MEValuation:LIST:OVERview?

// *****************************************************************************
// Select segment no. 2 as the offline segment. Restart the measurement
// to calculate all results in segment 2 and go to local to view results.
// *****************************************************************************
CONFigure:GSM:MEAS:MEValuation:LIST:OSINdex 2
INIT:GSM:MEAS:MEValuation
&GTL
```

3.5.2.4 Retrieving Single Results for All Segments

```
// *****************************************************************************
// Return selected power vs time results
// *****************************************************************************
FETCh:GSM:MEAS:MEValuation:LIST:PVTime:ABPower:AVERage?
FETCh:GSM:MEAS:MEValuation:LIST:PVTime:SVECtor:UMAXimum:MAXimum?
FETCh:GSM:MEAS:MEValuation:LIST:PVTime:SVECtor:UMINimum:AVERage?
FETCh:GSM:MEAS:MEValuation:LIST:PVTime:SVECtor:SUBVector10:MINimum?

// *****************************************************************************
// Return selected modulation results
// *****************************************************************************
FETCh:GSM:MEAS:MEValuation:LIST:MODulation:EVM:RMS:AVERage?
FETCh:GSM:MEAS:MEValuation:LIST:MODulation:EVM:PEAK:CURRent?
FETCh:GSM:MEAS:MEValuation:LIST:MODulation:EVM:PERCentile?
FETCh:GSM:MEAS:MEValuation:LIST:MODulation:MERRor:RMS:AVERage?
FETCh:GSM:MEAS:MEValuation:LIST:MODulation:MERRor:PEAK:AVERage?
FETCh:GSM:MEAS:MEValuation:LIST:MODulation:MERRor:PERCentile?
FETCh:GSM:MEAS:MEValuation:LIST:MODulation:PERRor:RMS:AVERage?
FETCh:GSM:MEAS:MEValuation:LIST:MODulation:PERRor:PEAK:AVERage?
FETCh:GSM:MEAS:MEValuation:LIST:MODulation:PERRor:PERCentile?
FETCh:GSM:MEAS:MEValuation:LIST:MODulation:IQOFfset:AVERage?
FETCh:GSM:MEAS:MEValuation:LIST:MODulation:IQIMbalance:MAXimum?
FETCh:GSM:MEAS:MEValuation:LIST:MODulation:FERRor:SDEViation?
FETCh:GSM:MEAS:MEValuation:LIST:MODulation:TERRor:MAXimum?
FETCh:GSM:MEAS:MEValuation:LIST:MODulation:BPOWer:AVERage?
FETCh:GSM:MEAS:MEValuation:LIST:MODulation:APDelay:AVERage?

// *****************************************************************************
// Return all BER results
// *****************************************************************************
FETCh:GSM:MEAS:MEValuation:LIST:BER:BER?
```

```
FETCh:GSM:MEAS:MEValuation:LIST:BER:ABSolute?
FETCh:GSM:MEAS:MEValuation:LIST:BER:COUNt?

// *************************************************************************
// Return selected spectrum due to modulation/switching results
// *************************************************************************
FETCh:GSM:MEAS:MEValuation:LIST:SMODulation:CPOWer?
FETCh:GSM:MEAS:MEValuation:LIST:SSWitching:CPOWer?
FETCh:GSM:MEAS:MEValuation:LIST:SMODulation:POFFset15?
FETCh:GSM:MEAS:MEValuation:LIST:SSWitching:POFFset16?

// *************************************************************************
// Return the individual segment reliability indicators
// *************************************************************************
FETCh:GSM:MEAS:MEValuation:LIST:SRELiability?
```

3.5.3 BER Measurement

This example focuses on the BER measurement commands. It assumes that the general measurement settings have already been adjusted, see Specifying General Measurement Settings.

```
// *************************************************************************
// Enable BER measurement and define a statistic count of 1000 bursts
// Select a loop C measurement (for GMSK modulation), adjust thresholds
// *************************************************************************
CONFigure:GSM:MEAS:MEValuation:RESult:BER ON
CONFigure:GSM:MEAS:MEValuation:SCOunt:BER 200
CONFigure:GSM:MEAS:MEValuation:BER:LOOP C
CONFigure:GSM:MEAS:MEValuation:BER:TSTart 5
CONFigure:GSM:MEAS:MEValuation:BER:TRUN 30

// *************************************************************************
// Start single-shot measurement, return BER results
// Query the measurement state (should be "RDY").
// *************************************************************************
INIT:GSM:MEAS:MEValuation
FETCh:GSM:MEAS:MEValuation:BER?
FETCh:GSM:MEAS:MEValuation:STATe?
```

3.5.4 I/Q Constellation Diagram

This example focuses on the I/Q constellation diagram commands. It assumes that the general measurement settings have already been adjusted, see Specifying General Measurement Settings.

```
// *************************************************************************
// Switch on I/Q constellation diagram and define statistics cycle,
// rotation and filter settings
```

```
// *************************************************************************
CONFigure:GSM:MEAS:MEValuation:RESult:IQ ON
CONFigure:GSM:MEAS:MEValuation:SCOunt:MODulation 1
CONFigure:GSM:MEAS:MEValuation:FILTer:IQ ISIRemoved
CONFigure:GSM:MEAS:MEValuation:ROTation:IQ P38R

// *************************************************************************
// Start single-shot measurement. Return IQ constellation results.
// Query the measurement state (should be "RDY").
// *************************************************************************
INIT:GSM:MEAS:MEValuation
FETCh:GSM:MEAS:MEValuation:TRACe:IQ?
FETCh:GSM:MEAS:MEValuation:STATe?
```

3.6 Command Reference

The following sections provide detailed reference information on the remote control commands of the "GSM Measurements" application.

3.6.1 Conventions and General Information

The following sections describe the most important conventions and general informations concerning the command reference.

3.6.1.1 MEAS<i>

MEAS<i> is used as abbreviation of "MEASurement<instance>". For better readability only the abbreviated form (which is also accepted by the instrument) is given in the command reference.

The <instance> is relevant for instruments supporting several instances of the same firmware application. It can be omitted if the instrument supports only one instance, or to address the first instance.

See also: "Firmware Applications" in the R&S CMW user manual, chapter "Remote Control"

3.6.1.2 FETCh, READ and CALCulate Commands

All commands are used to retrieve measurement results:

- `FETCh...` returns the results of the current measurement cycle (single-shot measurement) after they are valid. `FETCh...` must be used after the measurement has been started (`INITiate...`, measurement states RUN or RDY).
- `READ...` starts a new single-shot measurement and returns the results.
- `CALCulate...` returns one limit check result per `FETCh` result:
  - **OK**: The `FETCh` result is located within the limits or no limit has been defined/ enabled for this result.
  - **ULEU** (User limit exceeded upper): An upper limit is violated. The `FETCh` result is located above the limit.
  - **ULEL** (User limit exceeded lower): A lower limit is violated. The `FETCh` result is located below the limit.

See also: "Retrieving Measurement Results" in the R&S CMW user manual, chapter "Remote Control"

3.6.1.3 Current and Statistical Results

The R&S CMW repeats measurements according to the selected statistic count and repetition mode. Consecutive measurement values are stored and used to calculate statistical results, e.g. average, minimum, maximum and standard deviation.

See also: "Statistical Results" in the R&S CMW user manual, chapter "System Overview"

3.6.1.4 Keywords

Selected keywords used in the command description are described in the following.

- **Command usage**
  If the usage is not explicitly stated, the command allows you to set parameters and query parameters. Otherwise the command usage is stated as follows:
  - "Setting only": command can only be used to set parameters
  - "Query only": command can only be used to query parameters
  - "Event": command initiates an event
- **Parameter usage**
  The parameter usage is indicated by the keyword preceding the parameter(s):
  - "Parameters" are sent with a setting or query command and are returned as the result of a query
  - "Setting parameters" are only sent with a setting command
  - "Query parameters" are only sent with a query command (to refine the query)
  - "Return values" are only returned as the result of a query
- **Firmware/Software:**
  Indicates the lowest software version supporting the command. Command enhancements in later software versions are also indicated.

3.6.1.5 Reliability Indicator

The first value in the output arrays of `FETCh...?`, `READ...?` and `CALCulate...?` queries indicates the most severe error that has occurred during the measurement.

Example for an output array: 0, 10.22, 10.15, 10.01, 10.29, 100 (reliability = 0, followed by 5 numeric measurement values).

The reliability indicator has one of the following values:

- **0 (OK)**:
  Measurement values available, no error detected.
- **1 (Measurement Timeout)**:
  The measurement has been stopped after the (configurable) measurement timeout. Measurement results may be available, however, at least a part of the measurement provides only INValid results or has not completed the full statistic count.
- **2 (Capture Buffer Overflow)**:
  The measurement configuration results in a capture length, exceeding the available memory.
- **3 (Overdriven) / 4 (Underdriven)**:
  The accuracy of measurement results may be impaired because the input signal level was too high / too low.
- **6 (Trigger Timeout)**:
  The measurement could not be started or continued because no trigger event was detected.
- **7 (Acquisition Error)**:
  The R&S CMW could not properly decode the RF input signal.
- **8 (Sync Error)**:
  The R&S CMW could not synchronize to the RF input signal.
- **9 (Uncal)**:
  Due to an inappropriate configuration of resolution bandwidth, video bandwidth or sweep time, the measurement results are not within the specified data sheet limits.
- **15 (Reference Frequency Error)**:
  The instrument has been configured to use an external reference signal but the reference oscillator could not be phase locked to the external signal (e.g. signal level too low, frequency out of range or reference signal not available at all).
- **16 (RF Not Available)**:
  The measurement could not be started because the configured RF input path was not active. This problem may occur e.g. when a measurement is started in combined signal path mode and the master application has not yet activated the input path. The LEDs above the RF connectors indicate whether the input and output paths are active.
- **17 (RF Level not Settled) / 18 (RF Frequency not Settled)**:
  The measurement could not be started because the R&S CMW was not yet ready to deliver stable results after a change of the input signal power / the input signal frequency.
- **19 (Call not Established)**:
  For measurements: The measurement could not be started because no signaling connection to the DUT was established.

For DAU IMS service: Establishing a voice over IMS call failed.

- **20 (Call Type not Usable)**:
For measurements: The measurement could not be started because the established signaling connection had wrong properties.
For DAU IMS service: The voice over IMS settings could not be applied.
- **21 (Call Lost)**:
For measurements: The measurement was interrupted because the signaling connection to the DUT was lost.
For DAU IMS service: The voice over IMS call was lost.
- **23 (Missing Option)**:
The ARB file cannot be played by the GPRF generator due to a missing option.
- **26 (Resource Conflict)**:
The application could not be started or has been stopped due to a conflicting hardware resource or software option that is allocated by another application.
Stop the application that has allocated the conflicting resources and try again.
- **27 (No Sensor Connected)**:
The GPRF External Power Sensor measurement could not be started due to missing power sensor.
- **30 (File not Found)**:
The specified file could not be found.
- **40 (ARB File CRC Error)**:
The ARB file CRC check failed. The ARB file is corrupt and not reliable.
- **42 (ARB Header Tag Invalid)**:
The ARB file selected in the GPRF generator contains an invalid header tag.
- **43 (ARB Segment Overflow)**:
The number of segments in the multi-segment ARB file is higher than the allowed maximum.
- **44 (ARB File not Found)**:
The selected ARB file could not be found.
- **45 (ARB Memory Overflow)**:
The ARB file length is greater than the available memory.
- **50 (Startup Error)**:
The Data Application Unit (DAU), a DAU service or a DAU measurement could not be started. Please execute a DAU selftest.
- **51 (No Reply)**:
The DAU has received no response, for example for a ping request.
- **52 (Connection Error)**:
The DAU could not establish a connection to internal components. Please restart the instrument.
- **53 (Configuration Error)**:
The current DAU configuration by the user is incomplete or wrong and could not be applied. Check especially the IP address configuration.
- **54 (Filesystem Error)**:
The hard disk of the DAU is full or corrupt. Please execute a DAU selftest.
- **60 (Invalid RF-Connector Setting)**

The individual segments of a list mode measurement with R&S CMWS use different connector benches. This is not allowed. All segments must use the same bench.
Check the "Info" dialog for the relevant segment numbers.

- **101 (Firmware Error)**:
Indicates a firmware or software error. If you encounter this error for the first time, restart the instrument.
If the error occurs again, consider the following hints:
  - Firmware errors can often be repaired by restoring the factory default settings. To restore these settings, restart your instrument and press the "Factory Default" softkey during startup.
  - If a software package (update) has not been properly installed this is often indicated in the "Setup" dialog, section "SW/HW-Equipment > Installed Software".
  - A software update correcting the error may be available. Updates are e.g. provided in the "CMW Customer Web" on GLORIS (registration required): https://extranet.rohde-schwarz.com.

  If you get firmware errors even with the properly installed latest software version, please send a problem report including log files to Rohde & Schwarz.
- **102 (Unidentified Error)**:
Indicates an error not covered by other reliability values. For troubleshooting please follow the steps described for "101 (Firmware Error)".
- **103 (Parameter Error)**:
Indicates that the measurement could not be performed due to internal conflicting parameter settings.
A good approach to localize the conflicting settings is to start with a reset or preset or even restore the factory default settings. Then reconfigure the measurement step by step and check when the error occurs for the first time.
If you need assistance to localize the conflicting parameter settings, please contact Rohde & Schwarz (see http://www.service.rohde-schwarz.com).

3.6.2 General Measurement Settings

The commands valid for all GSM measurements are divided into the groups listed below.

3.6.2.1 Signal Routing

The following commands configure the scenario, select the connector and define an external attenuation value.

ROUTe:GSM:MEAS<i>:SCENario:SALone <RXConnector>, <RFConverter>

Activates the standalone scenario and selects the RF input path for the measured RF signal, i.e. the RF connector and the RX module.

Depending on the installed hardware and the active sub-instrument or instance <i> only a subset of the described parameter values is allowed. The *RST values and the mapping of virtual connector names to physical connectors also depend on the active sub-instrument or instance <i>.

All instruments are equipped with the RF 1 and RF 2 connectors and one RX and TX module. Additional RF connectors and RX/TX modules are optional.

See also: "Signal Path Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<RXConnector> RF1C | RF2C | RF3C | RF4C | RFAC | RFBC

RF1C, RF2C, RF3C, RF4C:
RF 1 COM to RF 4 COM front panel connectors

RFAC, RFBC:
Virtual names for the RF COM connectors

<RFConverter> RX1 | RX2 | RX3 | RX4

RX module for the input path

Example: See Specifying General Measurement Settings

Firmware/Software: V1.0.15.0
V2.0.10: additional values RF3/4/A/B..., RX2

Manual operation: See "Scenario" on page 418

ROUTe:GSM:MEAS<i>:SCENario:CSPath <Master>

Activates the combined signal path scenario and selects a master firmware application for the GSM measurements. The master controls the signal routing settings and analyzer settings while the combined signal path scenario is active.

Parameters:

<Master> String parameter containing the master application, e.g. "GSM Sig1" or "GSM Sig2"

Example: See Specifying General Measurement Settings

Firmware/Software: V1.0.15.0

Manual operation: See "Scenario" on page 418

ROUTe:GSM:MEAS<i>:SCENario:MAPRotocol [<Controler>]

Activates the Measure@ProtocolTest scenario and optionally selects the controlling protocol test application.

The signal routing and analyzer settings are ignored by the measurement application. The corresponding settings have to be configured within the protocol test application used in parallel.

Setting parameters:

<Controler> String parameter selecting the protocol test application e.g. `'Protocol Test1'`

Example: See Specifying General Measurement Settings

Usage: Event

Firmware/Software: V1.0.15.20
V2.1.60: added <Controler>

Manual operation: See "Scenario" on page 418

CONFigure:GSM:MEAS<i>:RFSettings:EATTenuation <ExternalAtt>

Defines an external attenuation (or gain, if the value is negative), to be applied to the RF input connector.

This command is only relevant for the standalone scenario. For the combined signal path scenario, use `CONFigure:GSM:SIGN<i>:RFSettings:EATTenuation:INPut`.

Parameters:

<ExternalAtt> Range: -50 dB to 90 dB
*RST: 0 dB
Default unit: dB

Example: See Specifying General Measurement Settings

Firmware/Software: V1.0.0.4

Manual operation: See "External Attenuation (Input)" on page 419

ROUTe:GSM:MEAS<i>:SCENario?

Queries the active scenario.

Return values:

<Scenario> SALone | CSPath | MAPRotocol
Standalone, combined signal path, measure at protocol test (R&S CMW500 only)

Example: See Specifying General Measurement Settings

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "Scenario" on page 418

ROUTe:GSM:MEAS<i>?

Queries the active test scenario and connector assignment.

Return values:

<Scenario> SALone | CSPath | MAPRotocol

Standalone, combined signal path, measure at protocol test (R&S CMW500 only)

<Controller> String variable containing the master application, e.g. "GSM Sig1"

<RXConnector> RF1C | RF2C | RF3C | RF4C | RFAC | RFBC

RF 1 COM to RF 4 COM front panel connectors

<RFConverter> RX1 | RX2 | RX3 | RX4

RX module for the input path

Example: See Specifying General Measurement Settings

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "Scenario" on page 418

3.6.2.2 Analyzer Settings

The following commands configure the RF input path.

CONFigure:GSM:MEAS<i>:BAND <Band>

Selects the GSM frequency band.

This command is only relevant for the standalone scenario. For the combined signal path scenario, use:

- `CONFigure:GSM:SIGN<i>:BAND:BCCH`
- `SENSe:GSM:SIGN<i>:BAND:TCH?`

Parameters:

<Band> G04 | G085 | G09 | G18 | G19 | GG08

G04: GSM400
G085: GSM850
G09: GSM900
G18: GSM1800
G19: GSM1900
GG08: GSMGT800

*RST: G09

Example: See Specifying General Measurement Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Band, Channel / Frequency" on page 419

CONFigure:GSM:MEAS<i>:CHANnel <Channel>

Selects the channel number. The channel number must be valid for the current frequency band, for dependencies see GSM Frequency Bands and Channels.

The corresponding center frequency (`CONFigure:GSM:MEAS<i>:RFSettings:FREQuency`) is calculated and set.

This command is only relevant for the standalone scenario. For the combined signal path scenario, use:

- `CONFigure:GSM:SIGN<i>:RFSettings:CHANnel:TCH[:CARRier<c>]`
- `CONFigure:GSM:SIGN<i>:RFSettings:CHCCombined:TCH:CSWitched`
- `CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:ENABle:TCH[:CARRier<c>]`
- `CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:MAIO:TCH[:CARRier<c>]`
- `CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:HSN:TCH[:CARRier<c>]`
- `CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:SEQuence:TCH[:CARRier<c>]`

Parameters:

<Channel> GSM channel number

Range: depends on frequency band
*RST: 65

Example: See Specifying General Measurement Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Band, Channel / Frequency" on page 419

CONFigure:GSM:MEAS<i>:RFSettings:FREQuency <Frequency>

Selects the center frequency of the RF analyzer.

If the center frequency is valid for the current frequency band the corresponding channel number is also calculated and set.

See also:

- GSM Frequency Bands and Channels
- `CONFigure:GSM:MEAS<i>:BAND`
- `CONFigure:GSM:MEAS<i>:CHANnel`

This command is only relevant for the standalone scenario. For the combined signal path scenario, use:

- `CONFigure:GSM:SIGN<i>:RFSettings:CHANnel:TCH[:CARRier<c>]`
- `CONFigure:GSM:SIGN<i>:RFSettings:CHCCombined:TCH:CSWitched`
- `CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:ENABle:TCH[:CARRier<c>]`
- `CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:MAIO:TCH[:CARRier<c>]`
- `CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:HSN:TCH[:CARRier<c>]`
- `CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:SEQuence:TCH[:CARRier<c>]`

Parameters:

<Frequency> Range: 100E+6 Hz to 6E+9 Hz
*RST: 903E+6 Hz
Default unit: Hz

Example: See Specifying General Measurement Settings

Firmware/Software: V1.0.0.4

Manual operation: See "Band, Channel / Frequency" on page 419

CONFigure:GSM:MEAS<i>:RFSettings:FOFFset <Offset>

Specifies a positive or negative frequency offset to be added to the center frequency of the configured channel.

This command is only relevant for the standalone scenario. For the combined signal path scenario, use:

- `CONFigure:GSM:SIGN<i>:RFSettings:FOFFset:UL`
- `CONFigure:GSM:SIGN<i>:CONNection:RFOFfset`

Parameters:

<Offset> Range: -100000 Hz to 100000 Hz
*RST: 0 Hz
Default unit: Hz

Example: See Specifying General Measurement Settings

Firmware/Software: V3.2.10

Manual operation: See "Frequency Offset" on page 420

CONFigure:GSM:MEAS<i>:RFSettings:ENPower <ExpNomPower>

Sets the expected nominal power of the measured RF signal.

This command is only relevant for the standalone scenario. For the combined signal path scenario, use:

- `CONFigure:GSM:SIGN<i>:RFSettings:ENPMode`
- `CONFigure:GSM:SIGN<i>:RFSettings:ENPower`

Parameters:

<ExpNomPower> The range of the expected nominal power can be calculated as follows:
Range (Expected Nominal Power) = Range (Input Power) + External Attenuation - User Margin

Range: -47 dBm to 42 dBm for the input power at the RF COM connectors (please notice also the ranges quoted in the data sheet).
*RST: 0 dBm
Default unit: dBm

Example: See Specifying General Measurement Settings

Firmware/Software: V1.0.0.4
V3.0.10: enhanced range

Manual operation: See "Expected Nominal Power" on page 420

CONFigure:GSM:MEAS<i>:RFSettings:UMARgin <UserMargin>

Sets the margin that the R&S CMW adds to the expected nominal power in order to determine its reference power. The reference power minus the external input attenuation must be within the power range of the selected input connector; refer to the data sheet.

This command is only relevant for the standalone scenario. For the combined signal path scenario, use `CONFigure:GSM:SIGN<i>:RFSettings:UMARgin`.

Parameters:

<UserMargin> Range: 0 dB to (55 dB + External Attenuation - Expected Nominal Power)
*RST: 0 dB
Default unit: dB

Example: See Specifying General Measurement Settings

Firmware/Software: V1.0.0.4
V3.0.10: enhanced range

Manual operation: See "User Margin" on page 421

CONFigure:GSM:MEAS<i>:RFSettings:MLOFfset <MixLevOffset>

Varies the input level of the mixer in the analyzer path.

This command is only relevant for the standalone scenario. For the combined signal path scenario, use `CONFigure:GSM:SIGN<i>:RFSettings:MLOFfset`.

Parameters:

<MixLevOffset> Range: -10 dB to 10 dB
*RST: 10 dB
Default unit: dB

Example: See Specifying General Measurement Settings

Firmware/Software: V1.0.15.20

Manual operation: See "Mixer Level Offset" on page 421

3.6.3 Multi Evaluation Measurement Commands

The commands for the GSM "Multi Evaluation" measurement are divided into the groups listed below. The general measurement settings also affect the measurement, see General Measurement Settings.

3.6.3.1 Measurement Control and States

The following commands control the measurement and return the current measurement state.

INITiate:GSM:MEAS<i>:MEValuation
STOP:GSM:MEAS<i>:MEValuation
ABORt:GSM:MEAS<i>:MEValuation

Starts, stops, or aborts the measurement:

- `INITiate...` starts or restarts the measurement; the R&S CMW enters the "RUN" state.
- `STOP...` causes a running measurement to stop after the current evaluation period is terminated and valid results are available; the R&S CMW enters the "RDY" state.
- `ABORt...` causes a running measurement to stop immediately; the R&S CMW enters the "OFF" state.

Use `FETCh...STATe?` to query the current measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Example: See Single-Shot and Continuous Measurements

Usage: Event

Firmware/Software: V1.0.0.4

Manual operation: See "Multi Evaluation (Softkey)" on page 417

FETCh:GSM:MEAS<i>:MEValuation:STATe?

Queries the main measurement state. Use `FETCh:...:STATe:ALL?` to query the measurement state including the substates. Use `INITiate...`, `STOP...`, `ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MeasStatus> OFF | RUN | RDY

OFF: measurement switched off, no resources allocated, no results available (when entered after `ABORt...`)
RUN: measurement running (after `INITiate..., READ...`), synchronization pending or adjusted, resources active or queued
RDY: measurement has been terminated, valid results may be available

*RST: OFF

Example: See Single-Shot and Continuous Measurements

Usage: Query only

Firmware/Software: V1.0.0.4

Manual operation: See "Multi Evaluation (Softkey)" on page 417

FETCh:GSM:MEAS<i>:MEValuation:STATe:ALL?

Queries the main measurement state and the measurement substates. Both measurement substates are relevant for running measurements only. Use `FETCh:...:STATe?` to query the main measurement state only. Use `INITiate..., STOP..., ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MainState> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after `STOP...`)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after `INITiate..., READ...`), synchronization pending or adjusted, resources active or queued

*RST: OFF

<SyncState> PEND | ADJ | INV

PEND: waiting for resource allocation, adjustment, hardware switching ("pending")
ADJ: all necessary adjustments finished, measurement running ("adjusted")
INV: not applicable because <main_state>: OFF or RDY ("invalid")

<ResourceState> QUE | ACT | INV

QUE: measurement without resources, no results available ("queued")
ACT: resources allocated, acquisition of results in progress but not complete ("active")
INV: not applicable because <main_state>: OFF or RDY ("invalid")

Example: See Single-Shot and Continuous Measurements

Usage: Query only

Firmware/Software: V1.0.0.4

Manual operation: See "Multi Evaluation (Softkey)" on page 417

3.6.3.2 Enabling Results and Views

The following commands select the evaluated results and the displayed views.

CONFigure:GSM:MEAS<i>:MEValuation:RESult:PVTime <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:RESult:EVMagnitude <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:RESult:MERRor <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:RESult:PERRor <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:RESult:IQ <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:RESult:SMFRequency <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:RESult:SMTime <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:RESult:SSFRequency <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:RESult:SSTime <Enable>

Enables or disables the evaluation of results and shows or hides the views in the multi evaluation measurement. The last mnemonic denotes the view type: Power vs. Time, Error Vector Magnitude, Magnitude Error, Phase Error, I/Q Constellation, Spectrum Modulation Frequency, Spectrum Modulation Time, Spectrum Switching Frequency, Spectrum Switching Time.

Use `READ...?` queries to retrieve results for disabled views.

Parameters:

<Enable> ON | OFF

ON: Evaluate results and show view
OFF: Do not evaluate results, hide view

*RST: ON (all except MERRor, SMTime, SSTime, IQ)

Example: See Configuring a Spectrum Measurement

Firmware/Software: V1.0.0.4 (V1.0.5.3 for IQ)

Manual operation: See "Assign Views" on page 422

CONFigure:GSM:MEAS<i>:MEValuation:RESult:AMPM <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:RESult:MSCalar <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:RESult:BER <Enable>

Enables or disables the evaluation of the AM-PM results, the scalar modulation results, and the Bit Error Rate (BER).

Parameters:

<Enable> ON | OFF

ON: Evaluate results
OFF: Do not evaluate results

*RST: OFF (all except MSCalar)

Example: See BER Measurement

Firmware/Software: V1.0.0.4 (V1.0.5.3 for `BER`)

Manual operation: See "Assign Views" on page 422

CONFigure:GSM:MEAS<i>:MEValuation:RESult[:ALL] <PvT>, <EVM>, <MagnitudeError>, <PhaseError>, <IQ>, <ACPModFrequency>, <ACPModTime>, <ACPSwitFreq>, <ACPSwitTime>, <ModScalar>, <BER>, <AMPM>

Enables or disables the evaluation of results and shows or hides the views in the multi evaluation measurement. This command combines all other `CONFigure:GSM:MEAS<i>:MEValuation:RESult...` commands.

Parameters:

<PvT> OFF | ON

Power vs. Time
ON: Evaluate results and show the view
OFF: Do not evaluate results, hide the view (if applicable)

*RST: ON

<EVM> OFF | ON

Error Vector Magnitude

*RST: ON

<MagnitudeError>	OFF | ON Magnitude Error *RST: OFF
<PhaseError>	OFF | ON Phase Error *RST: ON
<IQ>	OFF | ON I/Q Constellation *RST: OFF
<ACPModFrequency>	OFF | ON ACP Spectrum Modulation Frequency *RST: ON
<ACPModTime>	OFF | ON ACP Spectrum Modulation Time *RST: OFF
<ACPSwitFreq>	OFF | ON ACP Spectrum Switching Frequency *RST: ON
<ACPSwitTime>	OFF | ON ACP Spectrum Switching Time *RST: OFF
<ModScalar>	OFF | ON Scalar Modulation Results *RST: ON
<BER>	OFF | ON Bit Error Rate *RST: OFF
<AMPM>	OFF | ON AM-PM *RST: OFF

Example: See Configuring a Spectrum Measurement

Firmware/Software: V1.0.10.1

Manual operation: See "Assign Views" on page 422

3.6.3.3 Statistical Settings

The following commands specify the scope of the measurement.

CONFigure:GSM:MEAS<i>:MEValuation:TOUT <Timeout>

Defines a timeout for the measurement. The timer is started when the measurement is initiated via a `READ` or `INIT` command. It is not started if the measurement is initiated manually (ON/OFF key or RESTART/STOP key).

When the measurement has completed the first measurement cycle (first single shot), the statistical depth is reached and the timer is reset.

If the first measurement cycle has not been completed when the timer expires, the measurement is stopped. The measurement state changes to `RDY` and the reliability indicator is set to 1, indicating that a measurement timeout occurred. Still running `READ`, `FETCh` or `CALCulate` commands are completed, returning the available results. At least for some results there are no values at all or the statistical depth has not been reached.

A timeout of 0 s corresponds to an infinite measurement timeout.

Parameters:

<Timeout> Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V2.0.10

CONFigure:GSM:MEAS<i>:MEValuation:REPetition <Repetition>

Specifies the repetition mode of the measurement. The repetition mode specifies whether the measurement is stopped after a single-shot or repeated continuously. Use `CONFigure:..:MEAS<i>:...:SCOunt` to determine the number of measurement intervals per single shot.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<Repetition> SINGleshot | CONTinuous

SINGleshot: Single-shot measurement
CONTinuous: Continuous measurement

*RST: SING

Example: See Single-Shot and Continuous Measurements

Firmware/Software: V1.0.0.4

Manual operation: See "Repetition" on page 423

CONFigure:GSM:MEAS<i>:MEValuation:SCOunt:PVTime <StatisticCount>

Specifies the statistic count of the measurement. The statistic count is equal to the number of measurement intervals per single shot. Use `CONFigure:...:MEAS<i>:...:REPetition SINGleshot | CONTinuous` to select either single-shot or continuous measurements.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<StatisticCount> Number of measurement intervals for the "Power vs. Time" measurement

Range: 1 to 1000
*RST: 10

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.0.4

Manual operation: See "Statistic Count" on page 427

CONFigure:GSM:MEAS<i>:MEValuation:SCOunt:MODulation <StatisticCount>

Specifies the statistic count of the measurement. The statistic count is equal to the number of measurement intervals per single shot. Use `CONFigure:...:MEAS<i>:...:REPetition SINGleshot | CONTinuous` to select either single-shot or continuous measurements.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<StatisticCount> Number of measurement intervals for the "Modulation" measurement

Range: 1 to 1000
*RST: 10

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.0.4

Manual operation: See "Statistic Count" on page 431

CONFigure:GSM:MEAS<i>:MEValuation:SCOunt:SMODulation <StatisticCount>

Specifies the statistic count of the measurement. The statistic count is equal to the number of measurement intervals per single shot. Use `CONFigure:...:MEAS<i>:...:REPetition SINGleshot | CONTinuous` to select either single-shot or continuous measurements.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<StatisticCount> Number of measurement intervals for the "Spectrum Modulation" measurement

Range: 1 to 1000
*RST: 20

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.0.4

Manual operation: See "Statistic Count" on page 431

CONFigure:GSM:MEAS<i>:MEValuation:SCOunt:SSWitching <StatisticCount>

Specifies the statistic count of the measurement. The statistic count is equal to the number of measurement intervals per single shot. Use `CONFigure:...:MEAS<i>:...:REPetition SINGleshot | CONTinuous` to select either single-shot or continuous measurements.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<StatisticCount> Number of measurement intervals for the "Spectrum Switching" measurement

Range: 1 to 100
*RST: 10

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.0.4

Manual operation: See "Statistic Count" on page 431

CONFigure:GSM:MEAS<i>:MEValuation:SCOunt:BER <StatisticCount>

Specifies the statistic count of the measurement. The statistic count is equal to the number of measurement intervals per single shot. Use `CONFigure:...:MEAS<i>:...:REPetition SINGleshot | CONTinuous` to select either single-shot or continuous measurements.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<StatisticCount> Number of measurement intervals (bursts) for the "BER" measurement

Range: 1 to 1000
*RST: 10

Example: See BER Measurement

Firmware/Software: V1.0.5.3

Manual operation: See "Statistic Count" on page 433

CONFigure:GSM:MEAS<i>:MEValuation:SCONdition <StopCondition>

Qualifies whether the measurement is stopped after a failed limit check or continued. `SLFail` means that the measurement is stopped and reaches the `RDY` state as soon as one of the results exceeds the limits.

Parameters:

<StopCondition> NONE | SLFail

NONE: Continue measurement irrespective of the limit check
SLFail: Stop measurement on limit failure

*RST: NONE

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.0.4

Manual operation: See "Stop Condition" on page 423

CONFigure:GSM:MEAS<i>:MEValuation:MOEXception <MeasOnException>

Specifies whether measurement results that the R&S CMW identifies as faulty or inaccurate are rejected.

Parameters:

<MeasOnException> ON | OFF

ON: Results are never rejected
OFF: Faulty results are rejected

*RST: OFF

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.0.4

Manual operation: See "Measure on Exception" on page 423

CONFigure:GSM:MEAS<i>:MEValuation:MSLots <SlotOffset>, <SlotCount>, <MeasSlot>

Defines settings for the measured slots.

This command is only relevant for the standalone scenario. For the combined signal path scenario, use `CONFigure:GSM:SIGN<i>:MSLot:UL`.

Parameters:

<SlotOffset> Start of the measurement interval relative to the GSM frame boundary

Range: 0 to 7
*RST: 0

<SlotCount> Number of slots to be measured

Range: 1 to 8
*RST: 1

<MeasSlot> Slot to be measured for one-slot measurements

Range: 0 to 7
*RST: 0

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.0.4

Manual operation: See "Measurement Slot Settings" on page 423

3.6.3.4 Measurement Settings

The following commands provide general measurement settings.

CONFigure:GSM:MEAS<i>:MEValuation:FCRange <Mode>

Selects the width of the frequency range that the R&S CMW analyzes in order to establish time-synchronization with the received signal.

Parameters:

<Mode> NORMal | WIDE

NORMal: Normal frequency range
WIDE: Wide frequency range

*RST: NORM

Firmware/Software: V1.0.0.4

CONFigure:GSM:MEAS<i>:MEValuation:HDALevel <HighDynAssLevel>

Defines a signal level relative to the "Expected Nominal Power" (`CONFigure:GSM:MEAS<i>:RFSettings:ENPower`) where the two results obtained in a two stage measurement are joined together.

Parameters:

<HighDynAssLevel> Range: -60 dB to -10 dB
*RST: -50 dB
Default unit: dB
Additional parameters: OFF | ON (disables | enables two-shot measurement)

Firmware/Software: V1.0.0.4

Manual operation: See "Two Shot Assembly Level" on page 429

CONFigure:GSM:MEAS<i>:MEValuation:NBQSearch <Enable>

Enables or disables the search for 16-QAM-modulated normal bursts.

Parameters:

<Enable> OFF | ON

ON: Enable 16-QAM NB search
OFF: Disable 16-QAM NB search

*RST: OFF

Firmware/Software: V1.0.15.0

Options: R&S CMW-KM201

Manual operation: See "16-QAM NB Search" on page 424

CONFigure:GSM:MEAS<i>:MEValuation:ABSearch <Enable>

Enables or disables the access burst measurement.

Parameters:

<Enable> OFF | ON

ON: Enable access burst search
OFF: Disable access burst search

*RST: OFF

Firmware/Software: V1.0.0.4

Manual operation: See "Access Burst Search" on page 424

CONFigure:GSM:MEAS<i>:MEValuation:TSEQuence <TSC>

Selects the training sequence of the analyzed bursts.

This command is only relevant for the standalone scenario. For the combined signal path scenario, use `CONFigure:GSM:SIGN<i>:CELL:BCC`.

Parameters:

<TSC> OFF | TSC0 | TSC1 | TSC2 | TSC3 | TSC4 | TSC5 | TSC6 | TSC7 | TSCA | DUMM

OFF: Analyze all bursts, irrespective of their training sequence
TSC0 ... TSC7: Analyze bursts with a particular GSM training sequence
TSCA: Analyze bursts with any of the GSM training sequences TSC0 to TSC7
DUMMY: Analyze GSM-specific dummy bursts

*RST: TSC0

Example: See Selecting Specific Burst Types

Firmware/Software: V1.0.0.4

Manual operation: See "Training Sequence" on page 424

CONFigure:GSM:MEAS<i>:MEValuation:VAMos:TSCSet <TSCset>

Specifies the expected VAMOS Training Sequence Code (TSC) set of the measured GSM uplink signal. With a specific TSC set selection, the R&S CMW will analyze bursts with this TSC set only.

Parameters:

<TSCset> Range: 1 to 2
*RST: 1

Example: See Selecting Specific Burst Types

Firmware/Software: V2.0.10

Manual operation: See "GSM TSC Set (VAMOS)" on page 425

CONFigure:GSM:MEAS<i>:MEValuation:MVIew <Timeslot0>, ..., <Timeslot7>

Defines the expected modulation scheme and burst type in all timeslots and adjusts the power/time template accordingly.

Parameters:

<Timeslot0> ... <Timeslot7> ANY | OFF | GMSK | EPSK | ACCess | Q16

ANY: Any burst type can be analyzed
OFF: No signal expected
GMSK: GMSK-modulated normal bursts
EPSK: 8PSK-modulated normal bursts
ACCess: Access bursts
Q16: 16-QAM-modulated normal bursts

*RST: ANY

Example: See Selecting Specific Burst Types

Firmware/Software: V1.0.0.4 (`Q16` in V1.0.15.0)

Options: for Q16: R&S CMW-KM201

Manual operation: See "Modulation View" on page 425

3.6.3.5 List Mode Settings

The following commands configure the list mode. For retrieving list mode results see chapter 3.6.3.30, "List Mode Results (One Segment)", on page 544, chapter 3.6.3.32, "List Mode Results (All Segments, Result Groups)", on page 567 and chapter 3.6.3.31, "List Mode Results (All Segments, One Result)", on page 554.

For a description of the list mode see chapter 3.2.3, "List Mode", on page 378.

The segment number <no> in the following commands refers to the complete range of configured segments (1..2000).

CONFigure:GSM:MEAS<i>:MEValuation:LIST <Enable>

Enables or disables the list mode.

Parameters:

<Enable> OFF | ON

ON: Enable list mode
OFF: Disable list mode

*RST: OFF

Example: See GSM List Mode

Firmware/Software: V1.0.4.11

Options: R&S CMW-KM012

Manual operation: See "Enable" on page 426

CONFigure:GSM:MEAS<i>:MEValuation:LIST:LRANge <StartIndex>, <NrSegments>

Select a range of measured segments. The segments must be configured using `CONFigure:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:SETup`.

Parameters:

<StartIndex> First measured segment in the range of configured segments
Range: 1 to 2000
*RST: 1

<NrSegments> Relative number within the range of measured segments
Range: 1 to 512
*RST: 10

Example: See GSM List Mode

Firmware/Software: V1.0.15.21
V3.2.30: increased number of measured segments (from 200)

Options: R&S CMW-KM012

CONFigure:GSM:MEAS<i>:MEValuation:LIST:OSINdex <OfflineSegIndex>

Selects the number of the segment to be displayed in the measurement diagram. The selected index must be within the range of measured segments (`CONFigure:GSM:MEAS<i>:MEValuation:LIST:LRANge`).

Setting a value also enables the offline mode.

Parameters:

<OfflineSegIndex> Range: 1 to 200
*RST: OFF
Additional parameters: OFF (disables offline mode)

Example: See GSM List Mode

Firmware/Software: V1.0.4.11

Options: R&S CMW-KM012

Manual operation: See "Offline Segment Nr." on page 427

TRIGger:GSM:MEAS<i>:MEValuation:LIST:MODE <Mode>

Specifies whether a trigger event will initiate a measurement of the entire measurement interval (comprising the number of segments defined via `CONFigure:GSM:MEAS<i>:MEValuation:LIST:LRANge`) or a measurement of single segment.

Parameters:

<Mode> ONCE | SEGMent

ONCE: A trigger event is only required to start the measurement. The entire range of segments to be measured is captured without additional trigger event. The retrigger flags of the segments are ignored.
SEGMent: The retrigger flag of each segment is evaluated. It defines whether the measurement waits for a trigger event before capturing the segment, or not.

*RST: ONCE

Firmware/Software: V1.0.15.0 (retrigger mechanism changed in V2.0.10)

Options: R&S CMW-KM012

CONFigure:GSM:MEAS<i>:MEValuation:LIST:IIFRames <Ignore>

Selects whether idle frames are ignored or cause a "Signal low" error. For details see "Idle frame evaluation" on page 380.

Parameters:

<Ignore> OFF | ON

*RST: OFF

Example: See GSM List Mode

Firmware/Software: V2.1.60

Manual operation: See "Ignore Idle Frames" on page 427

CONFigure:GSM:MEAS<i>:MEValuation:LIST:SLENgth <StepLength>

Selects the step length, i.e. the time difference between two measured TDMA time-slots. A step length of 1 means that every slot is measured, a step length of 8 means that a single timeslot per TDMA frame is measured.

If the step length is set to OFF, an arbitrary number of slots in each TDMA frame can be measured. The measured slots are defined by the <FramePattern> parameter of the following commands:

- `CONFigure:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:MODulation`
- `CONFigure:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:PVTime`
- `CONFigure:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:SMODulation`
- `CONFigure:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:SSWitching`
- `CONFigure:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:BER`

Parameters:

<StepLength> Step length as number of TDMA slots

Range: 1 to 8
*RST: 8
Additional parameters: OFF (Use <FramePattern>)

Example: See GSM List Mode

Firmware/Software: V1.0.4.11 (parameter OFF: V1.0.10.1)

Options: R&S CMW-KM012

CONFigure:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:MODulation <ModStatistics>, <EVMenable>, <MagErrorEnable>, <PhaseErrEnable>, <AMPMenable>[, <FramePattern>]

Defines the statistical length for the `AVERage`, `MIN`, and `MAX` calculation and enables the calculation of the different modulation results in segment no. <no>; see List Mode.

Suffix:

<no> 1..2000
Segment number

Parameters:

<ModStatistics> The statistical length is defined in slots. It is limited by the number of evaluated slots (defined via step length or frame pattern).

Range: 1 to 1000
*RST: 100

<EVMenable> OFF | ON

ON: Enable measurement of EVM
OFF: Disable measurement of EVM

*RST: OFF

<MagErrorEnable> OFF | ON

Enable or disable measurement of magnitude error

*RST: OFF

<PhaseErrEnable> OFF | ON

Enable or disable measurement of phase error

*RST: OFF

<AMPMenable> OFF | ON

Enable or disable measurement of AM PM delay

*RST: OFF

<FramePattern> 8-digit binary value, defines the evaluated timeslots in each TDMA frame. Used only if no step length is configured (see `CONFigure:GSM:MEAS<i>:MEValuation:LIST:SLENgth`).

Range: #B00000000 to #B11111111 (no slots ... all slots measured)
*RST: #B10000000 (first slot in each frame measured)

Example: See GSM List Mode

Firmware/Software: V1.0.4.11 (parameter <FrameLength>: V1.0.10.1)

Options: R&S CMW-KM012

CONFigure:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:PVTime <Statistic>, <Enable>[, <FramePattern>]

Defines the statistical length for averaging and enables the power vs. time measurement in segment no. <no>; see List Mode.

Suffix:

<no> 1..2000
Segment number

Parameters:

<Statistic> The statistical length is defined in slots. It is limited by the number of evaluated slots (defined via step length or frame pattern).

Range: 1 to 1000
*RST: 1000

<Enable> OFF | ON

ON: Enable measurement of power vs. time
OFF: Disable measurement

*RST: OFF

<FramePattern> 8-digit binary value, defines the evaluated timeslots in each TDMA frame. Used only if no step length is configured (see `CONFigure:GSM:MEAS<i>:MEValuation:LIST:SLENgth`).

Range: #B00000000 to #B11111111 (no slots ... all slots measured)
*RST: #B10000000 (first slot in each frame measured)

Example: See GSM List Mode

Firmware/Software: V1.0.4.11 (parameter <FrameLength>: V1.0.10.1)

Options: R&S CMW-KM012

CONFigure:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:SMODulation <Statistic>, <Enable>[, <FramePattern>]

Defines the statistical length for averaging and enables the spectrum due to modulation measurement in segment no. <no>; see List Mode.

Suffix:

<no> 1..2000
Segment number

Parameters:

<Statistic> The statistical length is defined in slots. It is limited by the number of evaluated slots (defined via step length or frame pattern).

Range: 1 to 1000
*RST: 200

<Enable> OFF | ON

ON: Enable measurement of spectrum due to modulation results (including the "Spectrum Modulation Time" results in offline mode)
OFF: Disable measurement

*RST: OFF

<FramePattern> 8-digit binary value, defines the evaluated timeslots in each TDMA frame. Used only if no step length is configured (see CONFigure:GSM:MEAS<i>:MEValuation:LIST:SLENgth).

Range: #B00000000 to #B11111111 (no slots ... all slots measured)
*RST: #B10000000 (first slot in each frame measured)

Example: See GSM List Mode

Firmware/Software: V1.0.4.11 (parameter <FrameLength>: V1.0.10.1)

Options: R&S CMW-KM012

CONFigure:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:SSWitching <Statistic>, <Enable>[, <FramePattern>]

Defines the statistical length for the maximum calculation (peak hold mode) and enables the spectrum due to switching measurement in segment no. <no>; see List Mode.

Suffix:

<no> 1..2000
Segment number

Parameters:

<Statistic> The statistical length is defined in slots. It is limited by the number of evaluated slots (defined via step length or frame pattern).

Range: 1 to 100
*RST: 10

<Enable> OFF | ON

ON: Enable measurement of spectrum due to switching (including the "Spectrum Switching Time" results in offline mode)
OFF: Disable measurement

*RST: OFF

<FramePattern> 8-digit binary value, defines the evaluated timeslots in each TDMA frame. Used only if no step length is configured (see CONFigure:GSM:MEAS<i>:MEValuation:LIST:SLENgth).

Range: #B00000000 to #B11111111 (no slots ... all slots measured)
*RST: #B10000000 (first slot in each frame measured)

Example: See GSM List Mode

Firmware/Software: V1.0.4.11 (parameter <FrameLength>: V1.0.10.1)

Options: R&S CMW-KM012

CONFigure:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:BER <Statistic>, <Enable>, <Looptype>[, <FramePattern>]

Defines the statistical length for averaging and enables the BER measurement in segment no. <no>; see List Mode.

Suffix:

<no> 1..2000
Segment number

Parameters:

<Statistic> The statistical length is defined in slots. It is limited by the number of evaluated slots (defined via step length or frame pattern).

Range: 1 to 100
*RST: 10

<Enable> OFF | ON

ON: Enable BER measurement
OFF: Disable measurement

*RST: OFF

<Looptype> C | SRB

C: Loop C
SRB: SRB Loop

*RST: C

<FramePattern> 8-digit binary value, defines the evaluated timeslots in each TDMA frame. Used only if no step length is configured (see `CONFigure:GSM:MEAS<i>:MEValuation:LIST:SLENgth`).

Range: #B00000000 to #B11111111 (no slots ... all slots measured)
*RST: #B10000000 (first slot in each frame measured)

Example: See GSM List Mode

Firmware/Software: V1.0.10.1

Options: R&S CMW-KM012

CONFigure:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:SETup <SegmentLength>, <Level>, <Frequency>[, <PCL>, <RetriggerFlag>, <EvaluatOffset>]

Defines the length, the analyzer settings, the expected PCL, retrigger setting and evaluation offset of a selected segment. In general this command must be sent for all measured segments (`CONFigure:GSM:MEAS<i>:MEValuation:LIST:LRANge`).

The PCL values are used if the global "PCL Mode: PCL" is set (`CONFigure:GSM:MEAS<i>:MEValuation:PCLMode PCL`). They can affect the limit check results; see "PCL Mode" on page 430.

The current GSM band setting (CONFigure:GSM:MEAS<i>:BAND) specifies the exact meaning of the PCL; see table 3-4.

Suffix:

<no> 1..2000
Segment number

Parameters:

<SegmentLength> Number of steps or frames in the segment, depending on the configured step length (CONFigure:GSM:MEAS<i>:MEValuation:LIST:SLENgth).
If the step length is set to OFF, the segment length is defined in frames. So the number of slots in the segment equals 8 * <SegmentLength>.
If a step length is defined (1 to 8), the segment length is defined in steps. So the number of slots in the segment equals <StepLength> * <SegmentLength>.
Range: 1 to 3000
*RST: 1

<Level> Expected nominal power in the segment. The range of the expected nominal power can be calculated as follows:
Range (Expected Nominal Power) = Range (Input Power) + External Attenuation - User Margin
Range: -47 dBm to 55 dBm for the input power at the RF COM connectors (please notice also the ranges quoted in the data sheet)
*RST: 0 dBm
Default unit: dBm

<Frequency> Range: 100E+6 Hz to 6E+9 Hz
*RST: 903E+6 Hz
Default unit: Hz

<PCL> Expected power control level for the segment
Range: 0 to 31
*RST: 0

<RetriggerFlag> OFF | ON
Specifies whether a trigger event is required for the segment or not. The setting is ignored for the first segment of a measurement and for trigger mode ONCE (see TRIGger:GSM:MEAS<i>:MEValuation:LIST:MODE).
OFF: measure the segment without retrigger
ON: wait for trigger event before measuring the segment
*RST: ON

<EvaluatOffset> Number of steps at the beginning of the segment which are not measured
Range: 0 to 1000
*RST: 0

Example: See GSM List Mode

Firmware/Software: V1.0.4.11 (parameters <PCL>, <Retrigger Flag>, <EvaluatOff-set> added in V2.0.10)

Options: R&S CMW-KM012

3.6.3.6 Power vs. Time Settings

The following commands configure the "Power vs. Time" measurement.

CONFigure:GSM:MEAS<i>:MEValuation:RPMode <RefPowerMode>

Defines how the reference power, i.e. the 0-dB line in the measurement diagram, is calculated.

Parameters:

<RefPowerMode> CURRent | DCOMpensated | AVERage

DCOMpensated means "Data Compensated"

*RST: AVER

Example: See Performing Single-Shot Measurements

Firmware/Software: V1.0.0.4

Manual operation: See "Reference Power Mode" on page 428

CONFigure:GSM:MEAS<i>:MEValuation:FILTer:PVTime <Filter>

Selects the bandwidth of the IF filter.

Parameters:

<Filter> G05M | G10M

G05M: 500 kHz Gauss filter
G10M: 1 MHz Gauss filter

*RST: G05M

Example: See Performing Single-Shot Measurements

Firmware/Software: V1.0.0.4

Manual operation: See "PvT Filter" on page 429

CONFigure:GSM:MEAS<i>:MEValuation:PCLMode <PCLmode>

Defines how the R&S CMW determines the PCL of the measured signal.

Parameters:

<PCLmode> AUTO | PCL | SIGNaling

AUTO: Estimated PCL
PCL: PCL defined via CONFigure:GSM:MEAS<i>:MEValuation:PCL
SIGNaling: PCL determined by coupled signaling application (combined signal path only)

*RST: AUTO

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V2.0.10

Manual operation: See "PCL Mode" on page 430

CONFigure:GSM:MEAS<i>:MEValuation:PCL <Slot0>, <Slot1>, <Slot2>, <Slot3>, <Slot4>, <Slot5>, <Slot6>, <Slot7>

Sets the expected PCL values in all timeslots, to be used in CONFigure:GSM:MEAS<i>:MEValuation:PCLMode on page 488 PCL. The PCL values are interpreted according to the current GSM band setting (CONFigure:GSM:MEAS<i>:BAND).

This command is only relevant for the standalone scenario. For the combined signal path scenario, use:

- CONFigure:GSM:SIGN<i>:RFSettings:PCL:TCH:CSWitched
- CONFigure:GSM:SIGN<i>:RFSettings:CHCCombined:TCH:CSWitched

Parameters:

<Slot0> Range: 0 to 31
*RST: 0

<Slot1> Range: 0 to 31
*RST: 0

<Slot2> Range: 0 to 31
*RST: 0

<Slot3> Range: 0 to 31
*RST: 0

<Slot4> Range: 0 to 31
*RST: 0

<Slot5> Range: 0 to 31
*RST: 0

<Slot6> Range: 0 to 31
*RST: 0

<Slot7> Range: 0 to 31
*RST: 0

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V2.0.10

Manual operation: See "PCL > Setting" on page 430

3.6.3.7 Modulation Settings

The following command configures the "Modulation" measurement.

CONFigure:GSM:MEAS<i>:MEValuation:MODulation:DECode <Decode>

Defines whether or not guard or tail bits are decoded.

Parameters:

<Decode> STANdard | GTBits

STANdard: Guard and tail bits are assumed to be in line with GSM and therefore not decoded.
GTBits: Guard and tail bits are also decoded.

*RST: STAN

Example: See Performing Single-Shot Measurements

Firmware/Software: V2.1.25

Manual operation: See "Decode" on page 431

3.6.3.8 Spectrum Modulation Settings

The following commands define settings for spectrum modulation frequency measurements.

CONFigure:GSM:MEAS<i>:MEValuation:SMODulation:OFRequence
<FreqOffset0>, ..., <FreqOffset19>

Defines the frequency offsets to be used for spectrum modulation measurements. The offsets are defined relative to the analyzer frequency. Up to 20 offsets can be defined and enabled.

Parameters:

<FreqOffset0> ... <FreqOffset19> Set and enable frequency offset.

Range: 0 Hz to 3E+6 Hz
*RST: Offset 0 to 10 [MHz]: 0.1, 0.2, 0.25, 0.4, 0.6, 0.8, 1, 1.2, 1.4, 1.6, 1.8 (all ON); Offset 11 to 19: 1.9 MHz (all OFF)
Default unit: Hz
Additional parameters: OFF | ON (disables offset | enables offset using the previous/default value)

Example: See Configuring a Spectrum Measurement

Firmware/Software: V1.0.4.11

Manual operation: See "Frequency Offsets" on page 432

CONFigure:GSM:MEAS<i>:MEValuation:SMODulation:EARea <Enable1>, <Start1>, <Stop1>, <Enable2>, <Start2>, <Stop2>

Defines the time intervals (evaluation areas) to be used for spectrum modulation measurements.

Parameters:

<Enable1> OFF | ON

ON: Enable area 1
OFF: Disable area 1

*RST: OFF

<Start1> Start of evaluation area 1

Range: 0 Sym to 146 Sym
*RST: 6 Sym
Default unit: Sym

<Stop1> Stop of evaluation area 1

Range: 1 Sym to 147 Sym
*RST: 45 Sym
Default unit: Sym

<Enable2> OFF | ON

ON: Enable area 2
OFF: Disable area 2

*RST: ON

<Start2> Start of evaluation area 2

Range: 0 Sym to 146 Sym
*RST: 90 Sym
Default unit: Sym

<Stop2> Stop of evaluation area 2

Range: 1 Sym to 147 Sym
*RST: 129 Sym
Default unit: Sym

Example: See Configuring a Spectrum Measurement

Firmware/Software: V1.0.0.4

Manual operation: See "Evaluation Areas" on page 432

CONFigure:GSM:MEAS<i>:MEValuation:SMODulation:TDFSelect <NrFreqOffset>

Defines the offset frequency for the "Spectrum Modulation Time" diagram. The diagram shows the measured power vs. time at the selected offset frequency.

The numbers 1 to 20 select the negative frequency offsets from the "Frequency Offsets" list, numbers 21 to 40 select the positive frequency offsets.

Parameters:

<NrFreqOffset>	Range:	0 to 40
	*RST:	21

Example: See Configuring a Spectrum Measurement

Firmware/Software: V1.0.0.4

Manual operation: See "Time Domain @ Frequency" on page 432

3.6.3.9 Spectrum Switching Settings

The following commands define settings for spectrum switching frequency measurements.

CONFigure:GSM:MEAS<i>:MEValuation:SSWitching:OFRequence <FreqOffset0>, ..., <FreqOffset19>

Defines the frequency offsets to be used for spectrum switching measurements. The offsets are defined relative to the analyzer frequency. Up to 20 offsets can be defined and enabled.

Parameters:

<FreqOffset0> ... <FreqOffset19>: Set and enable frequency offset.

Range: 0 Hz to 3E+6 Hz
*RST: Offset 0 to 3 [MHz]: 0.4, 0.6, 1.2, 1.8 (all ON); Offset 4 to 19: 1.9 MHz (all OFF)
Default unit: Hz
Additional parameters: OFF | ON (disables offset | enables offset using the previous/default value)

Example: See Configuring a Spectrum Measurement

Firmware/Software: V1.0.4.11

Manual operation: See "Frequency Offsets" on page 432

CONFigure:GSM:MEAS<i>:MEValuation:SSWitching:TDFSelect <NrFreqOffset>

Defines the offset frequency for the "Spectrum Modulation Time" diagram. The diagram shows the measured power vs. time at the selected offset frequency.

The numbers 1 to 20 select the negative frequency offsets from the "Frequency Offsets" list, numbers 21 to 40 select the positive frequency offsets.

Parameters:

<NrFreqOffset>	Range:	0 to 40
	*RST:	21

Example: See Configuring a Spectrum Measurement

Firmware/Software: V1.0.0.4

Manual operation: See "Time Domain @ Frequency" on page 432

CONFigure:GSM:MEAS<i>:MEValuation:SSWitching:PHMode <PeakHoldMode>

Specifies how the peak hold mode is used for the "Spectrum Switching" results in frequency domain (bar graphs) and in time domain.

Parameters:

<PeakHoldMode> PHOL | SCO

PHOL: Frequency and Time: Peak Hold
SCO: Frequency: Stat. Count, Time: Current

*RST: PHOL

Example: See Configuring a Spectrum Measurement

Firmware/Software: V1.0.0.4

Manual operation: See "Peak Hold Mode" on page 432

3.6.3.10 BER Settings

The following commands configure the "BER" measurement.

CONFigure:GSM:MEAS<i>:MEValuation:BER:LOOP <Loop>

Selects the loop for BER tests.

Parameters:

<Loop> C | SRB

C: Loop C (for GMSK signals, with channel coding)
SRB: SRB loop (for 8PSK-modulated signals, MCS7 to MCS9)

*RST: C

Example: See BER Measurement

Firmware/Software: V1.0.5.3

Manual operation: See "Loop" on page 433

CONFigure:GSM:MEAS<i>:MEValuation:BER:TSTart <ThresholdStart>

Selects the "Threshold Start" value for BER tests. This is the maximum bit error rate in the first burst of the BER measurement.

Parameters:

<ThresholdStart>	Range:	0 % to 100 %
	*RST:	10 %
	Default unit:	%

Example: See BER Measurement

Firmware/Software: V1.0.10.1

Manual operation: See "Threshold Start" on page 434

CONFigure:GSM:MEAS<i>:MEValuation:BER:TRUN <ThresholdRun>

Selects the "Threshold Run" value for BER tests. This is the maximum bit error rate in any burst considered for the BER measurement.

Parameters:

<ThresholdRun>	Range:	0 % to 100 %
	*RST:	30 %
	Default unit:	%

Example: See BER Measurement

Firmware/Software: V1.0.10.1

Manual operation: See "Threshold Run" on page 434

3.6.3.11 I/Q Constellation Settings

The following commands provide settings for the "IQ Constellation" diagram.

CONFigure:GSM:MEAS<i>:MEValuation:ROTation:IQ <Rotation>

Specifies whether or not the rotation of the 8PSK and 16-QAM symbols is subtracted off before the symbols are displayed in the constellation diagram.

Parameters:

<Rotation> P38 | P38R

P38: Rotation not removed, phase-rotated symbols displayed
P38R: Rotation removed

*RST: P38R

Example: See I/Q Constellation Diagram

Firmware/Software: V1.0.5.3

Manual operation: See "Multi Evaluation > Rotation" on page 441

CONFigure:GSM:MEAS<i>:MEValuation:FILTer:IQ <Filter>

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

Parameters:

<Filter> ISIRemoved | UNFiltered | F90Khz

ISIRemoved: ISI removed
UNFiltered: Unfiltered data
F90Khz: 90 kHz filter

*RST: ISIR

Example: See I/Q Constellation Diagram

Firmware/Software: V1.0.5.3

Manual operation: See "Multi Evaluation > I/Q Filter" on page 443

3.6.3.12 Trigger Settings

The following commands define the trigger parameters.

TRIGger:GSM:MEAS<i>:MEValuation:CATalog:SOURce?

Lists all trigger source values that can be set using `TRIGger:GSM:MEAS<i>:MEValuation:SOURce`.

Return values:

<Sourcelist> Comma separated list of all supported values. Each value is represented as a string.

Example: See Specifying Measurement-Specific Settings

Usage: Query only

Firmware/Software: V1.0.4.11

Manual operation: See "Trigger Source" on page 435

TRIGger:GSM:MEAS<i>:MEValuation:SOURce <Source>

Selects the source of the trigger events. Some values are always available in this firmware application. They are listed below. Depending on the installed options additional values may be available. A complete list of all supported values can be displayed using `TRIGger:...:CATalog:SOURce?`.

Parameters:

<Source>
'Power': Power trigger (received RF power)
'Acquisition': Frame trigger according to defined burst pattern
'Free Run': Free Run (untriggered)
'Base1: External TRIG A': External trigger fed in at TRIG A connector
'Base1: External TRIG B': External trigger fed in at TRIG B connector
*RST: 'Power'

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Trigger Source" on page 435

TRIGger:GSM:MEAS<i>:MEValuation:SLOPe <Slope>

Qualifies whether the trigger event is generated at the rising or at the falling edge of the trigger pulse (valid for external and power trigger sources).

Parameters:

<Slope> REDGe | FEDGe
REDGe: Rising edge
FEDGe: Falling edge
*RST: REDG

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Trigger Slope" on page 435

TRIGger:GSM:MEAS<i>:MEValuation:THReshold <Threshold>

Defines the trigger threshold for power trigger sources.

Parameters:

<Threshold>
Range: -50 dB to 0 dB
*RST: -30 dB
Default unit: dB (full scale, i.e. relative to reference level minus external attenuation)

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Trigger Threshold" on page 435

TRIGger:GSM:MEAS<i>:MEValuation:TOUT <TriggerTimeOut>

Selects the maximum time that the R&S CMW will wait for a trigger event before it stops the measurement in remote control mode or indicates a trigger timeout in manual operation mode. This setting has no influence on "Free Run" measurements.

Parameters:

<TriggerTimeOut>
Range: 0.01 s to 167.77215E+3 s
*RST: 0.1 s
Default unit: s
Additional parameters: OFF | ON (disables timeout | enables timeout using the previous/default values)

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Trigger Timeout" on page 436

TRIGger:GSM:MEAS<i>:MEValuation:MGAP <MinTriggerGap>

Sets a minimum time during which the IF signal must be below the trigger threshold before the trigger is armed so that an IF power trigger event can be generated.

Parameters:

<MinTriggerGap>
Range: 1 slot to 7 slots
*RST: 1 slot
Default unit: slots

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.5.3

Manual operation: See "Minimum Trigger Gap" on page 436

CONFigure:GSM:MEAS<i>:MEValuation:AMODe <AcquisitionMode>

Selects the method that the R&S CMW uses for frame synchronization.

Parameters:

<AcquisitionMode> GAP | PATTern

GAP: Gap
PATTern: Pattern

*RST: GAP

Example: See Selecting Specific Burst Types

Firmware/Software: V1.0.4.11

Manual operation: See "Mode" on page 436

CONFigure:GSM:MEAS<i>:MEValuation:GLENgth <GapLength>

Defines the gap length as an integer number of slots. The gap length is used for frame synchronization if the gap acquisition mode is active (see `CONFigure:GSM:MEAS<i>:MEValuation:AMODe`).

Parameters:

<GapLength>	Range:	1 slot to 3 slots
	*RST:	2 slots
	Default unit:	slots

Example: See Selecting Specific Burst Types

Firmware/Software: V1.0.4.11

Manual operation: See "Gap Length" on page 437

CONFigure:GSM:MEAS<i>:MEValuation:APATtern <Timeslot0>, ..., <Timeslot7>

Defines the burst pattern that the R&S CMW expects in the TDMA frames of the received GSM signal. The pattern is used for frame synchronization if the pattern acquisition mode is active (see `CONFigure:GSM:MEAS<i>:MEValuation:AMODe`).

Parameters:

<Timeslot0> ... <Timeslot7>: OFF | GMSK | EPSK

Pattern selection for corresponding timeslot (0 to 7)
OFF: No signal expected
GMSK: GMSK-modulated normal bursts
EPSK: 8PSK/16-QAM-modulated normal bursts

*RST: GMSK (timeslot 0), OFF (timeslots 1 to 7)

Example: See Selecting Specific Burst Types

Firmware/Software: V1.0.4.11

Options: R&S CMW-KM201 (for 16-QAM modulation)

Manual operation: See "Pattern" on page 437

3.6.3.13 Limits (GMSK Modulation)

The following commands define limits for results which characterize the modulation accuracy for the GMSK modulation scheme.

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:EVMagnitude <LimitRMS>, <LimitPeak>, <Limit95%>, <StatRMSCurrent>, <StatRMSAverage>, <StatRMSMax>, <StatPeakCurrent>, <StatPeakAverage>, <StatPeakMax>, <Stat95%>

Defines and activates upper limits for the RMS, peak and 95th percentile values of the error vector magnitude (EVM).

Parameters:

<LimitRMS> Range: 0 % to 50 %
*RST: 10 %
Default unit: %

<LimitPeak> Range: 0 % to 50 %
*RST: 35 %
Default unit: %

<Limit95%> Range: 0 % to 50 %
*RST: 20 %
Default unit: %

<StatRMSCurrent>
<StatRMSAverage>
<StatRMSMax>
<StatPeakCurrent>
<StatPeakAverage>
<StatPeakMax>
<Stat95%>

ON | OFF
ON: Apply limit to the Current, Average, Max, 95th percentile values
OFF: Do not apply limit
*RST: OFF

Firmware/Software: V1.0.0.4

Manual operation: See "Modulation" on page 438

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:MERRor <LimitRMS>, <LimitPeak>, <Limit95%>, <StatRMSCurrent>, <StatRMSAverage>, <StatRMSMax>, <StatPeakCurrent>, <StatPeakAverage>, <StatPeakMax>, <Stat95%>

Defines and activates upper limits for the RMS, peak and 95th percentile values of the magnitude error.

Parameters:

<LimitRMS> Range: 0 % to 100 %
*RST: 10 %
Default unit: %

<LimitPeak> Range: 0 % to 100 %
*RST: 35 %
Default unit: %

<Limit95%> Range: 0 % to 100 %
*RST: 20 %
Default unit: %

<StatRMSCurrent> <StatRMSAverage> <StatRMSMax> <StatPeakCurrent> <StatPeakAverage> <StatPeakMax> <Stat95%>	ON | OFF **ON:** Apply limit to the Current, Average, Max, 95th percentile values **OFF:** Do not apply limit *RST: OFF

Firmware/Software: V1.0.0.4

Manual operation: See "Modulation" on page 438

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:PERRor <LimitRMS>, <LimitPeak>, <Limit95%>, <StatRMSCurrent>, <StatRMSAverage>, <StatRMSMax>, <StatPeakCurrent>, <StatPeakAverage>, <StatPeakMax>, <Stat95%>

Defines and activates upper limits for the RMS, peak and 95th percentile values of the phase error.

Parameters:

<LimitRMS>	Range: 0 deg to 180 deg *RST: 5 deg Default unit: deg
<LimitPeak>	Range: 0 deg to 180 deg *RST: 20 deg Default unit: deg
<Limit95%>	Range: 0 deg to 180 deg *RST: 10 deg Default unit: deg
<StatRMSCurrent> <StatRMSAverage> <StatRMSMax> <StatPeakCurrent> <StatPeakAverage> <StatPeakMax> <Stat95%>	ON | OFF **ON:** Apply limit to the Current, Average, Max, 95th percentile values **OFF:** Do not apply limit *RST: ON, (<Stat95%> OFF)

Firmware/Software: V1.0.0.4

Manual operation: See "Modulation" on page 438

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:IQOFfset <Limit>, <StatCurrent>, <StatAverage>, <StatMax>

Defines and activates upper limits for the I/Q origin offset values.

Parameters:

<Limit>	Range: -100 dB to 0 dB *RST: -30 dB Default unit: dB
<StatCurrent> <StatAverage> <StatMax>	ON | OFF **ON:** Apply limit to the Current, Average, Max values **OFF:** Do not apply limit *RST: OFF

Firmware/Software: V1.0.0.4

Manual operation: See "Modulation" on page 438

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:IQIMbalance <Limit>, <StatCurrent>, <StatAverage>, <StatMax>

Defines and activates upper limits for the I/Q imbalance values.

Parameters:

<Limit>	Range: -100 dB to 0 dB *RST: -30 dB Default unit: dB
<StatCurrent> <StatAverage> <StatMax>	ON | OFF **ON:** Apply limit to the Current, Average, Max values **OFF:** Do not apply limit *RST: OFF

Firmware/Software: V1.0.0.4

Manual operation: See "Modulation" on page 438

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:TERRor <Limit>, <StatCurrent>, <StatAverage>, <StatMax>

Defines and activates upper limits for the timing error.

Parameters:

<Limit>	Range: -1000 Sym to 1000 Sym *RST: 10 Sym Default unit: Sym
<StatCurrent> <StatAverage> <StatMax>	ON | OFF **ON:** Apply limit to the Current, Average, Max values **OFF:** Do not apply limit *RST: OFF

Firmware/Software: V1.0.0.4

Manual operation: See "Modulation" on page 438

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:FERRor <Limit>, <StatCurrent>, <StatAverage>, <StatMax>

Defines and activates upper limits for the frequency error.

Parameters:

<Limit>	Range: 0 Hz to 1000 Hz *RST: 90 Hz Default unit: Hz
<StatCurrent> <StatAverage> <StatMax>	ON | OFF **ON:** Apply limit to the Current, Average, Max values **OFF:** Do not apply limit *RST: OFF
Firmware/Software:	V1.0.0.4
Manual operation:	See "Modulation" on page 438

3.6.3.14 Limits (8PSK Modulation)

The following commands define limits for results which characterize the modulation accuracy for the 8PSK modulation scheme.

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:EVMagnitude <LimitRMS>, <LimitPeak>, <Limit95%>, <StatRMSCurrent>, <StatRMSAverage>, <StatRMSMax>, <StatPeakCurrent>, <StatPeakAverage>, <StatPeakMax>, <Stat95%>

Defines and activates upper limits for the RMS, peak and 95th percentile values of the error vector magnitude (EVM).

Parameters:

<LimitRMS>	Range: 0 % to 50 % *RST: 9 % Default unit: %
<LimitPeak>	Range: 0 % to 50 % *RST: 30 % Default unit: %
<Limit95%>	Range: 0 % to 50 % *RST: 15 % Default unit: %

<StatRMSCurrent> <StatRMSAverage> <StatRMSMax> <StatPeakCurrent> <StatPeakAverage> <StatPeakMax> <Stat95%>	ON | OFF **ON:** Apply limit to the Current, Average, Max, 95th percentile values **OFF:** Do not apply limit *RST: ON

Firmware/Software: V1.0.0.4

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:MERRor <LimitRMS>, <LimitPeak>, <Limit95%>, <StatRMSCurrent>, <StatRMSAverage>, <StatRMSMax>, <StatPeakCurrent>, <StatPeakAverage>, <StatPeakMax>, <Stat95%>

Defines and activates upper limits for the RMS, peak and 95th percentile values of the magnitude error.

Parameters:

<LimitRMS>	Range: 0 % to 100 % *RST: 9 % Default unit: %
<LimitPeak>	Range: 0 % to 100 % *RST: 30 % Default unit: %
<Limit95%>	Range: 0 % to 100 % *RST: 15 % Default unit: %
<StatRMSCurrent> <StatRMSAverage> <StatRMSMax> <StatPeakCurrent> <StatPeakAverage> <StatPeakMax> <Stat95%>	ON | OFF **ON:** Apply limit to the Current, Average, Max, 95th percentile values **OFF:** Do not apply limit *RST: OFF

Firmware/Software: V1.0.0.4

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:PERRor <LimitRMS>, <LimitPeak>, <Limit95%>, <StatRMSCurrent>, <StatRMSAverage>, <StatRMSMax>, <StatPeakCurrent>, <StatPeakAverage>, <StatPeakMax>, <Stat95%>

Defines and activates upper limits for the RMS, peak and 95th percentile values of the phase error.

Parameters:

<LimitRMS>	Range:	0 deg to 180 deg
	*RST:	5 deg
	Default unit:	deg
<LimitPeak>	Range:	0 deg to 180 deg
	*RST:	20 deg
	Default unit:	deg
<Limit95%>	Range:	0 deg to 180 deg
	*RST:	10 deg
	Default unit:	deg

<StatRMSCurrent>
<StatRMSAverage>
<StatRMSMax>
<StatPeakCurrent>
<StatPeakAverage>
<StatPeakMax>
<Stat95%>

ON | OFF

ON: Apply limit to the Current, Average, Max, 95th percentile values
OFF: Do not apply limit

*RST: OFF

Firmware/Software: V1.0.0.4

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:IQOFfset <Limit>, <StatCurrent>, <StatAverage>, <StatMax>

Defines and activates upper limits for the I/Q origin offset values.

Parameters:

<Limit>	Range:	-100 dB to 0 dB
	*RST:	-30 dB
	Default unit:	dB

<StatCurrent>
<StatAverage>
<StatMax>

ON | OFF

ON: Apply limit to the Current, Average, Max values
OFF: Do not apply limit

*RST: OFF (ON for Average)

Firmware/Software: V1.0.0.4

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:IQIMbalance <Limit>, <StatCurrent>, <StatAverage>, <StatMax>

Defines and activates upper limits for the I/Q imbalance values.

Parameters:

<Limit>	Range:	-100 dB to 0 dB
	*RST:	-30 dB
	Default unit:	dB

<StatCurrent> <StatAverage> <StatMax>	ON | OFF **ON:** Apply limit to the Current, Average, Max values **OFF:** Do not apply limit *RST: OFF (ON for Average)

Firmware/Software: V1.0.0.4

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:TERRor <Limit>, <StatCurrent>, <StatAverage>, <StatMax>

Defines and activates upper limits for the timing error.

Parameters:

<Limit>	Range: -1000 Sym to 1000 Sym *RST: 10 Sym Default unit: Sym
<StatCurrent> <StatAverage> <StatMax>	ON | OFF **ON:** Apply limit to the Current, Average, Max values **OFF:** Do not apply limit *RST: OFF

Firmware/Software: V1.0.0.4

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:FERRor <Limit>, <StatCurrent>, <StatAverage>, <StatMax>

Defines and activates upper limits for the frequency error.

Parameters:

<Limit>	Range: 0 Hz to 1000 Hz *RST: 90 Hz Default unit: Hz
<StatCurrent> <StatAverage> <StatMax>	ON | OFF **ON:** Apply limit to the Current, Average, Max values **OFF:** Do not apply limit *RST: ON

Firmware/Software: V1.0.0.4

3.6.3.15 Limits (16-QAM Modulation)

The following commands define limits for results which characterize the modulation accuracy for the 16-QAM modulation scheme.

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:EVMagnitude <LimitRMS>, <LimitPeak>, <Limit95%>, <StatRMSCurrent>, <StatRMSAverage>, <StatRMSMax>, <StatPeakCurrent>, <StatPeakAverage>, <StatPeakMax>, <Stat95%>

Defines and activates upper limits for the RMS, peak and 95th percentile values of the error vector magnitude (EVM).

Suffix:

<ModOrder> 16
Modulation order, at present fixed

Parameters:

<LimitRMS> Range: 0 % to 50 %
*RST: 7 %
Default unit: %

<LimitPeak> Range: 0 % to 50 %
*RST: 30 %
Default unit: %

<Limit95%> Range: 0 % to 50 %
*RST: 15 %
Default unit: %

<StatRMSCurrent> <StatRMSAverage> <StatRMSMax> <StatPeakCurrent> <StatPeakAverage> <StatPeakMax> <Stat95%>
ON | OFF
ON: Apply limit to the Current, Average, Max, 95th percentile values
OFF: Do not apply limit
*RST: ON

Firmware/Software: V1.0.15.0

Options: R&S CMW-KM201 (for QAM16)

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:MERRor <LimitRMS>, <LimitPeak>, <Limit95%>, <StatRMSCurrent>, <StatRMSAverage>, <StatRMSMax>, <StatPeakCurrent>, <StatPeakAverage>, <StatPeakMax>, <Stat95%>

Defines and activates upper limits for the RMS, peak and 95th percentile values of the magnitude error.

Suffix:

<ModOrder> 16
Modulation order, at present fixed

Parameters:

<LimitRMS>	Range: 0 % to 100 % *RST: 7 % Default unit: %
<LimitPeak>	Range: 0 % to 100 % *RST: 30 % Default unit: %
<Limit95%>	Range: 0 % to 100 % *RST: 15 % Default unit: %
<StatRMSCurrent> <StatRMSAverage> <StatRMSMax> <StatPeakCurrent> <StatPeakAverage> <StatPeakMax> <Stat95%>	ON | OFF **ON:** Apply limit to the Current, Average, Max, 95th percentile values **OFF:** Do not apply limit *RST: OFF

Firmware/Software: V1.0.15.0

Options: R&S CMW-KM201 (for QAM16)

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:PERRor <LimitRMS>, <LimitPeak>, <Limit95%>, <StatRMSCurrent>, <StatRMSAverage>, <StatRMSMax>, <StatPeakCurrent>, <StatPeakAverage>, <StatPeakMax>, <Stat95%>

Defines and activates upper limits for the RMS, peak and 95th percentile values of the phase error.

Suffix:

<ModOrder>	16 Modulation order, at present fixed

Parameters:

<LimitRMS>	Range: 0 deg to 180 deg *RST: 5 deg Default unit: deg
<LimitPeak>	Range: 0 deg to 180 deg *RST: 20 deg Default unit: deg
<Limit95%>	Range: 0 deg to 180 deg *RST: 10 deg Default unit: deg

<StatRMSCurrent> <StatRMSAverage> <StatRMSMax> <StatPeakCurrent> <StatPeakAverage> <StatPeakMax> <Stat95%>	ON | OFF **ON:** Apply limit to the Current, Average, Max, 95th percentile values **OFF:** Do not apply limit *RST: OFF

Firmware/Software: V1.0.15.0

Options: R&S CMW-KM201 (for QAM16)

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:IQOFfset <Limit>, <StatCurrent>, <StatAverage>, <StatMax>

Defines and activates upper limits for the I/Q origin offset values.

Suffix:

<ModOrder> 16
Modulation order, at present fixed

Parameters:

<Limit> Range: -100 dB to 0 dB
*RST: -30 dB
Default unit: dB

<StatCurrent>
<StatAverage>
<StatMax>
ON | OFF
ON: Apply limit to the Current, Average, Max values
OFF: Do not apply limit
*RST: OFF (ON for Average)

Firmware/Software: V1.0.15.0

Options: R&S CMW-KM201 (for QAM16)

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:IQIMbalance <Limit>, <StatCurrent>, <StatAverage>, <StatMax>

Defines and activates upper limits for the I/Q imbalance values.

Suffix:

<ModOrder> 16
Modulation order, at present fixed

Parameters:

<Limit> Range: -100 dB to 0 dB
*RST: -30 dB
Default unit: dB

<StatCurrent>
<StatAverage>
<StatMax>
ON | OFF
ON: Apply limit to the Current, Average, Max values
OFF: Do not apply limit
*RST: OFF (ON for Average)

Firmware/Software: V1.0.15.0

Options: R&S CMW-KM201 (for QAM16)

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:TERRor <Limit>, <StatCurrent>, <StatAverage>, <StatMax>

Defines and activates upper limits for the timing error.

Suffix:

<ModOrder> 16
Modulation order, at present fixed

Parameters:

<Limit> Range: -1000 Sym to 1000 Sym
*RST: 10 Sym
Default unit: Sym

<StatCurrent>
<StatAverage>
<StatMax> ON | OFF
ON: Apply limit to the Current, Average, Max values
OFF: Do not apply limit
*RST: OFF

Firmware/Software: V1.0.15.0

Options: R&S CMW-KM201 (for QAM16)

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:FERRor <Limit>, <StatCurrent>, <StatAverage>, <StatMax>

Defines and activates upper limits for the frequency error.

Suffix:

<ModOrder> 16
Modulation order, at present fixed

Parameters:

<Limit> Range: 0 Hz to 1000 Hz
*RST: 90 Hz
Default unit: Hz

<StatCurrent>
<StatAverage>
<StatMax> ON | OFF
ON: Apply limit to the Current, Average, Max values
OFF: Do not apply limit
*RST: ON

Firmware/Software: V1.0.15.0

Options: R&S CMW-KM201 (for QAM16)

3.6.3.16 Limits (Power vs. Time)

The following commands define limit lines for power vs. time measurements.

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:PVTime:ABPower<no> <StartPCL>, <EndPCL>, <LowerLimit>, <UpperLimit>, <Enable>

Defines and activates limits for the average burst power, i.e. tolerances for ranges of template power control levels (TPCLs).

Suffix:

<no> 1..10
Number of the group

Parameters:

<StartPCL> Number of first TPCL to which the limits are applied
Range: 0 to 31
*RST: see table below

<EndPCL> Number of last TPCL to which the limits are applied
Range: 0 to 31
*RST: see table below

<LowerLimit> Range: -10 dB to 0 dB
*RST: see table below
Default unit: dB

<UpperLimit> Range: 0 dB to 10 dB
*RST: see table below
Default unit: dB

<Enable> OFF | ON
ON: Enable limits for the given <no>
OFF: Disable limits for the given <no>
*RST: see table below

Firmware/Software: V1.0.0.4

Manual operation: See "Avg. Burst Power" on page 438

The default settings for GSM 900/1800/1900 are according to the following table. The default settings for GSM850, GSM GT800, and GSM400 are identical to GSM900.

	<Enable>	**<StartPCL>**	**<EndPCL>**	**<LowerLimit> [dB]**	**<UpperLimit> [dB]**
<no>=1	ON	5/0/0	5/0/0	-2	2
<no>=2	ON	0	2/8/8	-2/-3/-3	2/3/3
<no>=3	ON	3/9/9	15/13/13	-3/-4/-4	3/4/4
<no>=4	ON	16/14/14	31/28/15	-5	5
<no>=5	OFF/ON/ON	-/29/30	-/29/31	-/-2/-2	-/2/2
<no>=6	OFF/ON/OFF	-/30/-	-/31/-	-/-3/-	-/3/-
<no>=7 to 10	OFF	-	-	-	-

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:PVTime:GPLevel <GuardPeriodLev>

Defines the raising of the upper limit line in the guard period between two consecutive bursts.

Parameters:

<GuardPeriodLev> Range: 0 dB to 10 dB
*RST: 3 dB
Default unit: dB

Firmware/Software: V1.0.0.4

Manual operation: See "Avg. Burst Power" on page 438

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:PVTime:UPPer:REDGe<no>:STATic <TimeStart>, <TimeEnd>, <RelLevStart>, <RelLevEnd>, <AbsLevStart>, <AbsLevEnd>, <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:PVTime:UPPer:UPARt<no>:STATic <TimeStart>, <TimeEnd>, <RelLevStart>, <RelLevEnd>, <AbsLevStart>, <AbsLevEnd>, <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:PVTime:UPPer:FEDGe<no>:STATic <TimeStart>, <TimeEnd>, <RelLevStart>, <RelLevEnd>, <AbsLevStart>, <AbsLevEnd>, <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:PVTime:UPPer:REDGe<no>:STATic <TimeStart>, <TimeEnd>, <RelLevStart>, <RelLevEnd>, <AbsLevStart>, <AbsLevEnd>, <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:PVTime:UPPer:UPARt<no>:STATic <TimeStart>, <TimeEnd>, <RelLevStart>, <RelLevEnd>, <AbsLevStart>, <AbsLevEnd>, <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:PVTime:UPPer:FEDGe<no>:STATic <TimeStart>, <TimeEnd>, <RelLevStart>, <RelLevEnd>, <AbsLevStart>, <AbsLevEnd>, <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:PVTime:UPPer:REDGe<no>:STATic <TimeStart>, <TimeEnd>, <RelLevStart>, <RelLevEnd>, <AbsLevStart>, <AbsLevEnd>, <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:PVTime:UPPer:UPARt<no>:STATic <TimeStart>, <TimeEnd>, <RelLevStart>, <RelLevEnd>, <AbsLevStart>, <AbsLevEnd>, <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:PVTime:UPPer:FEDGe<no>:STATic <TimeStart>, <TimeEnd>, <RelLevStart>, <RelLevEnd>, <AbsLevStart>, <AbsLevEnd>, <Enable>

These commands define and activate upper limit lines for the measured power vs. time. The lines apply to the modulation schemes GMSK, 8PSK (EPSK) or 16-QAM (QAM16). Each line consists of three sections: rising edge (REDGe), useful part (UPARt) and falling edge (FEDGe). Each section consists of several areas for which relative and absolute limits can be defined (if both are defined the higher limit overrules the lower one).

Suffix:

<ModOrder> 16
Modulation order, at present fixed

<no> 1..4 for rising/falling edge, 1..3 for useful part
Number of the area

Parameters:

<TimeStart>
<TimeEnd>
Start and end time of the area
Range: -50 µs to 600 µs
*RST: see tables below
Default unit: s

<RelLevStart>
<RelLevEnd>
Start and end level of the relative limit for the area
Range: -100 dB to 10 dB
*RST: see tables below
Default unit: dB

<AbsLevStart>
<AbsLevEnd>
Start and end level of the absolute limit for the area
Range: -100 dBm to 10 dBm
*RST: see tables below
Default unit: dBm
Additional parameters: OFF | ON (disables start/end level | enables start/end level using the previous/default values)

<Enable> ON | OFF
ON: Enable area <no>
OFF: Disable area <no>
*RST: see tables below

Firmware/Software: V1.0.0.4 (V1.0.15.0 for `QAM16`)

Options: R&S CMW-KM201 (for QAM16)

The default settings for GSM 900/1800 are according to the following tables. The default settings for GSM850 and GSM400 are identical to GSM900, the ones for GSM 1900 are identical to GSM 1800.

Table 3-6: Rising edge GMSK and 8PSK

	<TimeStart> [µs]	**<TimeEnd> [µs]**	**<RelLevStart> (=<RelLevEnd>) [dB]**	**<AbsLevStart> (=<AbsLevEnd>) [dBm], <Status>**	**<Enable>**
<no>=1	-38	-28	-59/-48	-36/-48, ON	ON
<no>=2	-28	-18	-30	-17/-20, ON	ON
<no>=3	-18	-10	-6*	OFF	ON
<no>=4	-10	0	4	OFF	ON

Table 3-7: Rising edge 16-QAM

	<TimeStart> [µs]	<TimeEnd> [µs]	<RelLevStart> (=<RelLevEnd>) [dB]	<AbsLevStart> (=<AbsLevEnd>) [dBm], <Status>	<Enable>
<no>=1	-38	-28	-59/-48	-36/-48, ON	ON
<no>=2	-28	-18	-30	-17/-20, ON	ON
<no>=3	-18	-10	-6*	OFF	ON
<no>=4	-10	0	6.5	OFF	ON

Table 3-8: Useful part GMSK

	<TimeStart> [µs]	<TimeEnd> [µs]	<RelLevStart> (=<RelLevEnd>) [dB]	<AbsLevStart> (=<AbsLevEnd>) [dBm], <Status>	<Enable>
<no>=1	0	542.8	1	OFF	ON
<no>=2	-	-	-	-	OFF
<no>=3	-	-	-	-	OFF

Table 3-9: Useful part 8PSK

	<TimeStart> [µs]	<TimeEnd> [µs]	<RelLevStart> (=<RelLevEnd>) [dB]	<AbsLevStart> (=<AbsLevEnd>) [dBm], <Status>	<Enable>
<no>=1	0	4	2.4	OFF	ON
<no>=2	4	538.8	4	OFF	ON
<no>=3	538.8	542.8	2.4	OFF	ON

Table 3-10: Useful part 16-QAM

	<TimeStart> [µs]	<TimeEnd> [µs]	<RelLevStart> (=<RelLevEnd>) [dB]	<AbsLevStart> (=<AbsLevEnd>) [dBm], <Status>	<Enable>
<no>=1	0	4	3.5	OFF	ON
<no>=2	4	538.8	6.5	OFF	ON
<no>=3	538.8	542.8	3.5	OFF	ON

Table 3-11: Falling edge GMSK and 8PSK

	<TimeStart> [µs]	<TimeEnd> [µs]	<RelLevStart> (=<RelLevEnd>) [dB]	<AbsLevStart> (=<AbsLevEnd>) [dBm], <Status>	<Enable>
<no>=1	542.8	552.8	GMSK: 1, 8PSK: 4	OFF	ON
<no>=2	552.8	560.8	-6*	OFF	ON
<no>=3	560.8	570.8	-30	-17/-20, ON	ON
<no>=4	570.8	580.8	-59/-48	-54/-48, ON	ON

Table 3-12: Falling edge 16-QAM

	<TimeStart> [µs]	<TimeEnd> [µs]	<RelLevStart> (=<RelLevEnd>) [dB]	<AbsLevStart> (=<AbsLevEnd>) [dBm], <Status>	<Enable>
<no>=1	542.8	552.8	6.5	OFF	ON
<no>=2	552.8	560.8	-6*	OFF	ON
<no>=3	560.8	570.8	-30	-17/-20, ON	ON
<no>=4	570.8	580.8	-59/-48	-54/-48, ON	ON

*) Corrections apply in several PCL ranges, see dynamic limit commands

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:PVTime:LOWer:UPARt<no>:STATic <TimeStart>, <TimeEnd>, <RelLevStart>, <RelLevEnd>, <AbsLevStart>, <AbsLevEnd>, <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:PVTime:LOWer:UPARt<no>:STATic <TimeStart>, <TimeEnd>, <RelLevStart>, <RelLevEnd>, <AbsLevStart>, <AbsLevEnd>, <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:PVTime:LOWer:UPARt<no>:STATic <TimeStart>, <TimeEnd>, <RelLevStart>, <RelLevEnd>, <AbsLevStart>, <AbsLevEnd>, <Enable>

These commands define and activate lower limit lines for the measured power vs. time. The lines apply to the "useful part" of a burst for modulation schemes GMSK, 8PSK (EPSK) or 16-QAM (QAM16). Each line may consist of several areas for which relative and absolute limits can be defined (if both are defined the lower limit overrules the higher one).

Suffix:

<no> 1..5
Number of the area

<ModOrder> 16
Modulation order, at present fixed

Parameters:

<TimeStart> Start time of the area

Range: -50 µs to 600 µs
*RST: see table below
Default unit: s

<TimeEnd> End time of the area

Range: -50 µs to 600 µs
*RST: see table below
Default unit: s

<RelLevStart> Start level of the relative limit for the area

Range: -100 dB to 10 dB
*RST: see table below
Default unit: dB

<RelLevEnd> End level of the relative limit for the area

Range: -100 dB to 10 dB
*RST: see table below
Default unit: dB

<AbsLevStart> Start level of the absolute limit for the area

Range: -100 dBm to 10 dBm
*RST: see table below
Default unit: dBm
Additional parameters: OFF | ON (disables start and end level | enables start and end level using the previous/default values)

<AbsLevEnd> End level of the absolute limit for the area

Range: -100 dBm to 10 dBm
*RST: see table below
Default unit: dBm
Additional parameters: OFF | ON (disables start and end level | enables start and end level using the previous/default values)

<Enable> OFF | ON

ON: Enable area <no>
OFF: Disable area <no>

*RST: see table below

Firmware/Software: V1.0.0.4 (V1.0.15.0 for `QAM16`)

Options: R&S CMW-KM201 (for QAM16)

The default settings are according to the following tables.

Table 3-13: GMSK

	<TimeStart> [µs]	<TimeEnd> [µs]	<RelLevStart> (=<RelLevEnd>) [dB]	<AbsLevStart> (=<AbsLevEnd>) [dBm], <Status>	<Enable>
<no>=1	0	542.8	-1	OFF	ON
<no>=2 to 5	-	-	-	-	OFF

Table 3-14: 8PSK

	<TimeStart> [µs]	<TimeEnd> [µs]	<RelLevStart> (=<RelLevEnd>) [dB]	<AbsLevStart> (=<AbsLevEnd>) [dBm], <Status>	<Enable>
<no>=1	0	2	-2	OFF	ON
<no>=2	2	4	0	OFF	ON
<no>=3	4	538.8	-20	OFF	ON
<no>=4	538.8	540.8	0	OFF	ON
<no>=5	540.8	542.8	-2	OFF	ON

Table 3-15: 16-QAM

	<TimeStart> [µs]	<TimeEnd> [µs]	<RelLevStart> (=<RelLevEnd>) [dB]	<AbsLevStart> (=<AbsLevEnd>) [dBm], <Status>	<Enable>
<no>=1	0	2	-3	OFF	ON
<no>=2	2	4	0	OFF	ON
<no>=3	4	538.8	undefined	OFF	ON
<no>=4	538.8	540.8	0	OFF	ON
<no>=5	540.8	542.8	-3	OFF	ON

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:PVTime:UPPer:REDGe<no>:DYNamic<Range> <Enable>, <PCLStart>, <PCLEnd>, <Correction>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:PVTime:UPPer:REDGe<no>:DYNamic<Range> <Enable>, <PCLStart>, <PCLEnd>, <Correction>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:PVTime:UPPer:REDGe<no>:DYNamic<Range> <Enable>, <PCLStart>, <PCLEnd>, <Correction>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:PVTime:UPPer:UPARt<no>:DYNamic<Range> <Enable>, <PCLStart>, <PCLEnd>, <Correction>

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:PVTime:UPPer:UPARt<no>:DYNamic<Range> <Enable>, <PCLStart>, <PCLEnd>, <Correction>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:PVTime:UPPer:UPARt<no>:DYNamic<Range> <Enable>, <PCLStart>, <PCLEnd>, <Correction>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:PVTime:UPPer:FEDGe<no>:DYNamic<Range> <Enable>, <PCLStart>, <PCLEnd>, <Correction>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:PVTime:UPPer:FEDGe<no>:DYNamic<Range> <Enable>, <PCLStart>, <PCLEnd>, <Correction>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:PVTime:UPPer:FEDGe<no>:DYNamic<Range> <Enable>, <PCLStart>, <PCLEnd>, <Correction>

These commands define and activate dynamic (PCL-dependent) corrections to the upper limit lines for the measured power vs. time. The corrections apply to the modulation schemes GMSK, 8PSK (EPSK) or 16-QAM (QAM16) and to the three limit line sections: rising edge (REDGe), useful part (UPARt) and falling edge (FEDGe). Each limit line section consists of several areas (<no>). Each dynamic correction is defined for up to five different PCL ranges (<Range>)).

Suffix:

<no> 1..4 for rising/falling edge, 1..3 for useful part
Number of the area

<Range> 1..5
Number of the PCL range

<ModOrder> 16
Modulation order, at present fixed

Parameters:

<Enable> OFF | ON
Disable or enable dynamic correction
*RST: see tables below

<PCLStart> First PCL in PCL range
Range: 0 to 31
*RST: see tables below

<PCLEnd> Last PCL in PCL range (may be equal to <PCLStart>)
Range: 0 to 31
*RST: see tables below

<Correction> Correction value for power template
Range: -100 dB to 100 dB
*RST: see tables below
Default unit: dB

Firmware/Software: V1.0.15.20

Options: R&S CMW-KM201 (for QAM16)

The default settings for GSM 900/1800 are according to the following tables. The default settings for GSM850 and GSM400 are identical to GSM900, the ones for GSM 1900 are identical to GSM 1800. The default dynamic corrections are equal for all modulation schemes.

Table 3-16: Rising edge, area <no> = 3

<Range>	<Enable>	<PCLStart>	<PCLEnd>	<Correction> / [dB]
1	ON	16 / 11	16 / 11	2.00 /
2	ON	17 / 12	17 / 12	4.00
3	ON	18 / 13	31 / 28	5.00
4	OFF	0	0	0.00
5	OFF	0	0	0.00

The dynamic corrections in all other areas (<no> ≠ 3, useful part and falling edge) are disabled and set to zero.

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:PVTime:LOWer:UPARt<no>:DYNamic<Range> <Enable>, <PCLStart>, <PCLEnd>, <Correction>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:PVTime:LOWer:UPARt<no>:DYNamic<Range> <Enable>, <PCLStart>, <PCLEnd>, <Correction>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:PVTime:LOWer:UPARt<no>:DYNamic<Range> <Enable>, <PCLStart>, <PCLEnd>, <Correction>

These commands define and activate dynamic (PCL-dependent) corrections to the lower limit lines for the measured power vs. time. The corrections apply to the modulation schemes GMSK, 8PSK (EPSK) or 16-QAM (QAM16). Each limit line section may consist of different areas (<no>). Each dynamic correction is defined for up to five different PCL ranges (<Range>)).

In the default configuration, the dynamic corrections for all lower limit lines are set to zero and disabled.

Suffix:

<no> 1..5
Number of the area

<Range> 1..5
Number of the PCL range

<ModOrder> 16
Modulation order, at present fixed

Parameters:

<Enable> OFF | ON
Disable or enable dynamic correction
*RST: OFF

<PCLStart> First PCL in PCL range
Range: 0 to 31
*RST: 0

<PCLEnd> Last PCL in PCL range (may be equal to <PCLStart>)
Range: 0 to 31
*RST: 0

<Correction> Correction value for power template
Range: -100 dB to 100 dB
*RST: 0 dB
Default unit: dB

Firmware/Software: V1.0.15.20

Options: R&S CMW-KM201 (for QAM16)

3.6.3.17 Limits (Spectrum Modulation)

The following commands define limit lines for spectrum due to modulation measurements.

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:SMODulation:RPOWer <Minimum>, <Maximum>

Defines two reference power values for the modulation scheme GMSK. These values are relevant in the context of `CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:SMODulation:MPOint<no>`.

Parameters:

<Minimum> Low reference power value
Range: 0 dBm to 43 dBm
*RST: 33 dBm
Default unit: dBm

<Maximum> High reference power value
Range: 0 dBm to 43 dBm
*RST: 39 dBm
Default unit: dBm

Firmware/Software: V1.0.0.4

Manual operation: See "Spectrum Modulation and Spectrum Switching" on page 439

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:SMODulation:MPOint<no> <MinPowLevelRel>, <MaxPowLevelRel>, <AbsPowerLevel>, <Enable>

Defines and activates a limit line for the modulation scheme GMSK for a certain frequency offset. The specified limits apply above the high power reference value and below the low power reference value defined by `CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:SMODulation:RPOWer`. Between the two reference power values the limits are determined by linear interpolation.

Suffix:

<no> 1..20
Number of the frequency offset value.
The offsets are defined by the command `CONFigure:GSM:MEAS<i>:MEValuation:SMODulation:OFRequence`.

Parameters:

<MinPowLevelRel> Relative power limit applicable below the low reference power
Range: -120 dB to 31.5 dB
*RST: <no> = 1 to 3 [dB]: 0.5, -30, -33 / <no> = 4 to 20: -60 dB
Default unit: dB

<MaxPowLevelRel> Relative power limit applicable above the high reference power
Range: -120 dB to 31.5 dB
*RST: <no> = 1 to 4 [dB]: 0.5, -30, -33, -60 / <no> = 5 to 20: -66 dB
Default unit: dB

<AbsPowerLevel> Alternative absolute power limit. If the relative limits are tighter than the absolute limit, the latter applies.
Range: -120 dBm to 31.5 dBm
*RST: <no> = 1 to 4: -36 dBm / <no> = 5 to 20: -51 dBm
Default unit: dBm

<Enable> OFF | ON
ON: Enable limits for the given <no>
OFF: Disable limits for the given <no>
*RST: <no> = 1 to 11: ON / <no> = 12 to 20: OFF

Firmware/Software: V1.0.0.4

Manual operation: See "Spectrum Modulation and Spectrum Switching" on page 439

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:SMODulation:RPOWer <Minimum>, <Maximum>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:SMODulation:RPOWer <Minimum>, <Maximum>

Define two reference power values for the modulation schemes 8PSK and 16-QAM. These values are relevant in the context of `CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:SMODulation:MPOint<no>` and `CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:SMODulation:MPOint<no>`.

Suffix:

<ModOrder> 16
Modulation order, at present fixed

Parameters:

<Minimum> Low reference power value
Range: 0 dBm to 43 dBm
*RST: 33 dBm
Default unit: dBm

<Maximum> High reference power value
Range: 0 dBm to 43 dBm
*RST: 34 dBm
Default unit: dBm

Firmware/Software: V1.0.0.4 (V1.0.15.0 for `QAM16`)

Options: R&S CMW-KM201 (for QAM16)

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:SMODulation:MPOint<no> <MinPowLevelRel>, <MaxPowLevelRel>, <AbsPowerLevel>, <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:SMODulation:MPOint<no> <MinPowLevelRel>, <MaxPowLevelRel>, <AbsPowerLevel>, <Enable>

Defines and activates a limit line for the modulation schemes 8PSK and 16-QAM and for a certain frequency offset. The specified limits apply above the high power reference value and below the low power reference value defined by `CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:SMODulation:RPOWer` and `CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:SMODulation:RPOWer`. Between the two reference power values the limits are determined by linear interpolation.

Suffix:

<no> 1..20
Number of the frequency offset value.
The offsets are defined by the command `CONFigure:GSM:MEAS<i>:MEValuation:SMODulation:OFRequence`.

<ModOrder> 16
Modulation order, at present fixed

Parameters:

<MinPowLevelRel> Relative power limit applicable below the low reference power

Range: -120 dB to 31.5 dB
*RST: <no> = 1 to 4 [dB]: 0.5, -30, -33, -54 / <no> = 5 to 20: -60 dB
Default unit: dB

<MaxPowLevelRel> Relative power limit applicable above the high reference power

Range: -120 dB to 31.5 dB
*RST: <no> = 1 to 4 [dB]: 0.5, -30, -33, -54 / <no> = 5 to 20: -66 dB
Default unit: dB

<AbsPowerLevel> Alternative absolute power limit. If the relative limits are tighter than the absolute limit, the latter applies.

Range: -120 dBm to 31.5 dBm
*RST: <no> = 1 to 4: -36 dBm / <no> = 5 to 20: -51 dBm
Default unit: dBm

<Enable> ON | OFF

ON: Enable limits for the given <no>
OFF: Disable limits for the given <no>

*RST: <no> = 1 to 11: ON / <no> = 12 to 20: OFF

Firmware/Software: V1.0.0.4 (V1.0.15.0 for `QAM16`)

Options: R&S CMW-KM201 (for QAM16)

3.6.3.18 Limits (Spectrum Switching)

The following commands define limit lines for spectrum due to switching measurements.

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:SSWitching:PLEVel <Enable1>, ..., <Enable10>, <PowerLevel1>, ..., <PowerLevel10>

Defines and activates reference power values for the modulation scheme GMSK. These values are relevant in the context of `CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:SSWitching:MPOint<no>`.

Parameters:

<Enable1> ... <Enable10>	ON | OFF **ON:** Enable reference value **OFF:** Disable reference value *RST: ON
<PowerLevel1> ... <PowerLevel10>	Reference power value Range: 0 dBm to 39 dBm *RST: Level 1 to 10 [dBm]: 39, 37, 35, 33, 31, 29, 27, 25, 23, 21 Default unit: dBm

Firmware/Software: V1.0.0.4

Manual operation: See "Spectrum Modulation and Spectrum Switching" on page 439

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:SSWitching:MPOint<no> <PowerLimit1>, ..., <PowerLimit10>, <Enable>

Defines and activates a limit line for the modulation scheme GMSK for a certain frequency offset. The specified limits apply at the reference power values defined by `CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:SSWitching:PLEVel`. Between the reference power values the limits are determined by linear interpolation.

Suffix:

<no>	1..20 Number of the frequency offset value. The offsets are defined by the command `CONFigure:GSM:MEAS<i>:MEValuation:SSWitching:OFRequence`

Parameters:

<PowerLimit1> ... <PowerLimit10>	Relative power limit applicable at the corresponding reference power Range: -60 dB to 30 dB *RST: see table below Default unit: dB
<Enable>	ON | OFF **ON:** Enable limits for the given <no> **OFF:** Disable limits for the given <no> *RST: see table below

Firmware/Software: V1.0.0.4

Manual operation: See "Spectrum Modulation and Spectrum Switching" on page 439

The default settings for GSM 900/1800/1900 are according to the following tables. The default settings for GSM850, GSM GT800, and GSM400 are identical to GSM900.

Table 3-17: Default values GSM 900 for <Enable> (ON/OFF) and <PowerLimit> (values in dB) depending on <no>

<no>	Enable	Limit1	Limit2	Limit3	Limit4	Limit5	Limit6	Limit7	Limit8	Limit9	Limit10
1	ON	-13	-15	-17	-19	-21	-23	-23	-23	-23	-23
2	ON	-21	-21	-21	-21	-23	-25	-26	-26	-26	-26
3	ON	-21	-21	-21	-21	-23	-25	-27	-29	-31	-32
4	ON	-24	-24	-24	-24	-26	-28	-30	-32	-34	-36
5 to 20	OFF	0	0	0	0	0	0	0	0	0	0

Table 3-18: Default values GSM 1800 for <Enable> (ON/OFF) and <PowerLimit> (values in dB) depending on <no>

<no>	Enable	Limit1	Limit2	Limit3	Limit4	Limit5	Limit6	Limit7	Limit8	Limit9	Limit10
1	ON	-16	-18	-20	-22	-23	-23	-23	-23	-23	OFF, 0
2	ON	-21	-21	-22	-24	-25	-26	-26	-26	-26	OFF, 0
3	ON	-21	-21	-22	-24	-26	-28	-30	-31	-32	OFF, 0
4	ON	-24	-24	-25	-27	-29	-31	-33	-35	-36	OFF, 0
5 to 20	OFF	0	0	0	0	0	0	0	0	0	0

Table 3-19: Default values GSM 1900 for <Enable> (ON/OFF) and <PowerLimit> (values in dB) depending on <no>

<no>	Enable	Limit1	Limit2	Limit3	Limit4	Limit5	Limit6	Limit7	Limit8	Limit9/10
1	ON	-19	-20	-22	-23	-23	-23	-23	-23	OFF, 0
2	ON	-22	-22	-24	-25	-26	-26	-26	-26	OFF, 0
3	ON	-22	-22	-24	-26	-28	-30	-31	-32	OFF, 0
4	ON	-25	-25	-27	-29	-31	-33	-35	-36	OFF, 0
5 to 20	OFF	0	0	0	0	0	0	0	0	0

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:SSWitching:PLEVel <Enable1>, ..., <Enable10>, <PowerLevel1>, ..., <PowerLevel10>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:SSWitching: PLEVel <Enable1>, ..., <Enable10>, <PowerLevel1>, ..., <PowerLevel10>

Define and activate reference power values for the modulation schemes 8PSK and 16-QAM. These values are relevant in the context of `CONFigure:GSM:MEAS<i>:MEValuation:LIMit:GMSK:SSWitching:MPOint<no>` and `CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:SSWitching:MPOint<no>`.

Suffix:

<ModOrder> 16
Modulation order, at present fixed

Parameters:

<Enable1> ... <Enable10>	OFF | ON **ON:** Enable reference value **OFF:** Disable reference value *RST: ON
<PowerLevel1> ... <PowerLevel10>	Reference power value Range: 0 dBm to 39 dBm *RST: Level 1 to 10 [dBm]: 39, 37, 35, 33, 31, 29, 27, 25, 23, 21 Default unit: dBm

Firmware/Software: V1.0.0.4 (V1.0.15.0 for `QAM16`)

Options: R&S CMW-KM201 (for QAM16)

CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:SSWitching:MPOint<no> <PowerLimit1>, ..., <PowerLimit10>, <Enable>
CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:SSWitching:MPOint<no> <PowerLimit1>, ..., <PowerLimit10>, <Enable>

Define and activate a limit line for the modulation schemes 8PSK and 16-QAM for a certain frequency offset. The specified limits apply at the reference power values defined by `CONFigure:GSM:MEAS<i>:MEValuation:LIMit:EPSK:SSWitching:PLEVel` and `CONFigure:GSM:MEAS<i>:MEValuation:LIMit:QAM<ModOrder>:SSWitching:PLEVel`. Between the reference power values the limits are determined by linear interpolation.

Suffix:

<no>	1..20 Number of the frequency offset value. The offsets are defined by the command `CONFigure:GSM:MEAS<i>:MEValuation:SSWitching:OFRequence`
<ModOrder>	16 Modulation order, at present fixed

Parameters:

<PowerLimit1> ... <PowerLimit10>	Relative power limit applicable at the corresponding reference power Range: -60 dB to 30 dB *RST: see table below Default unit: dB
<Enable>	OFF | ON **ON:** Enable limits for the given <no> **OFF:** Disable limits for the given <no> *RST: see table below

Firmware/Software: V1.0.0.4 (V1.0.15.0 for `QAM16`)

Options: R&S CMW-KM201 (for QAM16)

The default settings for GSM 900/1800/1900 are according to the following tables. The default settings for GSM850, GSM GT800, and GSM400 are identical to GSM900.

Table 3-20: Default values GSM 900 for <Enable> (ON/OFF) and <PowerLimit> (values in dB) depending on <no>

<no>	Enable	Limit1	Limit2	Limit3	Limit4	Limit5	Limit6	Limit7	Limit8	Limit9	Limit10
1	ON	-13	-15	-17	-19	-21	-23	-23	-23	-23	-23
2	ON	-21	-21	-21	-21	-23	-25	-26	-26	-26	-26
3	ON	-21	-21	-21	-21	-23	-25	-27	-29	-31	-32
4	ON	-24	-24	-24	-24	-26	-28	-30	-32	-34	-36
5 to 20	OFF	0	0	0	0	0	0	0	0	0	0

Table 3-21: Default values GSM 1800 for <Enable> (ON/OFF) and <PowerLimit> (values in dB) depending on <no>

<no>	Enable	Limit1	Limit2	Limit3	Limit4	Limit5	Limit6	Limit7	Limit8	Limit9	Limit10
1	ON	-16	-18	-20	-22	-23	-23	-23	-23	-23	OFF, 0
2	ON	-21	-21	-22	-24	-25	-26	-26	-26	-26	OFF, 0
3	ON	-21	-21	-22	-24	-26	-28	-30	-31	-32	OFF, 0
4	ON	-24	-24	-25	-27	-29	-31	-33	-35	-36	OFF, 0
5 to 20	OFF	0	0	0	0	0	0	0	0	0	0

Table 3-22: Default values GSM 1900 for <Enable> (ON/OFF) and <PowerLimit> (values in dB) depending on <no>

<no>	Enable	Limit1	Limit2	Limit3	Limit4	Limit5	Limit6	Limit7	Limit8	Limit9/10
1	ON	-19	-20	-22	-23	-23	-23	-23	-23	OFF, 0
2	ON	-22	-22	-24	-25	-26	-26	-26	-26	OFF, 0
3	ON	-22	-22	-24	-26	-28	-30	-31	-32	OFF, 0
4	ON	-25	-25	-27	-29	-31	-33	-35	-36	OFF, 0
5 to 20	OFF	0	0	0	0	0	0	0	0	0

3.6.3.19 Modulation View Throughput Result

The following command returns information about the modulation view throughput, indicating whether the detected burst pattern corresponds to the measurement settings.

FETCh:GSM:MEAS<i>:MEValuation:MVTHroughput?

Returns the modulation view throughput, i.e. the percentage of measurement intervals where the detected burst pattern was found to correspond to the Modulation View settings.

See also "Mod. View Throughput" on page 407

Return values:

<Reliability> Reliability Indicator

<MVThroughput> Modulation view throughput

Range: 0 % to 100 %
Default unit: %

Example: See Performing Single-Shot Measurements

Usage: Query only

Firmware/Software: V3.0.20

3.6.3.20 EVM Results (Traces)

The following commands return the EVM trace results of the multi evaluation measurement for the "measured slot" (`CONFigure:GSM:MEAS<i>:MEValuation:MSLots`).

FETCh:GSM:MEAS<i>:MEValuation:TRACe:EVMagnitude:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:TRACe:EVMagnitude:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:TRACe:EVMagnitude:MAXimum?
READ:GSM:MEAS<i>:MEValuation:TRACe:EVMagnitude:CURRent?
READ:GSM:MEAS<i>:MEValuation:TRACe:EVMagnitude:AVERage?
READ:GSM:MEAS<i>:MEValuation:TRACe:EVMagnitude:MAXimum?

Returns the values of the EVM traces. The results of the current, average and maximum traces can be retrieved.

Return values:

<Reliability> Reliability Indicator

<Result_1> ... <Result_n> n EVM results, depending on the burst and modulation type
8PSK/16-QAM modulation: 142 values (one value per symbol period, symbol 3 to symbol 144)
GMSK modulation: 588 values (four values per symbol period, symbol 0.5 to symbol 147.5)
Access burst: 348 values (four values per symbol period, symbol 0.5 to symbol 87.5)

Range: 0 % to 100 %
Default unit: %

Usage: Query only

Firmware/Software: V1.0.0.4

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

3.6.3.21 Magnitude Error Results (Traces)

The following commands return the magnitude error trace results of the multi evaluation measurement for the "measured slot" (`CONFigure:GSM:MEAS<i>:MEValuation:MSLots`).

FETCh:GSM:MEAS<i>:MEValuation:TRACe:MERRor:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:TRACe:MERRor:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:TRACe:MERRor:MAXimum?
READ:GSM:MEAS<i>:MEValuation:TRACe:MERRor:CURRent?
READ:GSM:MEAS<i>:MEValuation:TRACe:MERRor:AVERage?
READ:GSM:MEAS<i>:MEValuation:TRACe:MERRor:MAXimum?

Returns the values of the magnitude error traces. The results of the current, average and minimum/maximum traces can be retrieved.

Return values:

<Reliability> Reliability Indicator

<Result_1> ... <Result_n> n magnitude error results, depending on the type of modulation
8PSK/16-QAM modulation: 142 values (one value per symbol period, symbol 3 to symbol 144)
GMSK modulation: 588 values (four values per symbol period, symbol 0.5 to symbol 147.5)
Access burst: 348 values (four values per symbol period, symbol 0.5 to symbol 87.5)

Range: -100 % to 100 %
Default unit: %

Usage: Query only

Firmware/Software: V1.0.0.4

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

3.6.3.22 Phase Error Results (Traces)

The following commands return the phase error trace results of the multi evaluation measurement for the "measured slot" (`CONFigure:GSM:MEAS<i>:MEValuation:MSLots`).

FETCh:GSM:MEAS<i>:MEValuation:TRACe:PERRor:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:TRACe:PERRor:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:TRACe:PERRor:MAXimum?
READ:GSM:MEAS<i>:MEValuation:TRACe:PERRor:CURRent?
READ:GSM:MEAS<i>:MEValuation:TRACe:PERRor:AVERage?
READ:GSM:MEAS<i>:MEValuation:TRACe:PERRor:MAXimum?

Returns the values of the phase error traces. The results of the current, average and minimum/maximum traces can be retrieved.

Return values:

<Reliability> Reliability Indicator

<Result_1> ... <Result_n>	n phase error results, depending on the type of modulation 8PSK/16-QAM modulation: 142 values (one value per symbol period, symbol 3 to symbol 144) GMSK modulation: 588 values (four values per symbol period, symbol 0.5 to symbol 147.5) Access burst: 348 values (four values per symbol period, symbol 0.5 to symbol 87.5) Range: -180 deg to 180 deg Default unit: deg
Usage:	Query only
Firmware/Software:	V1.0.0.4

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

3.6.3.23 Modulation Results (Single Values)

The following commands return results of the multi evaluation measurement, measured in the "Measured Slot" (`CONFigure:GSM:MEAS<i>:MEValuation:MSLots`).

FETCh:GSM:MEAS<i>:MEValuation:MODulation:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:MODulation:MAXimum?
READ:GSM:MEAS<i>:MEValuation:MODulation:CURRent?
READ:GSM:MEAS<i>:MEValuation:MODulation:MAXimum?
CALCulate:GSM:MEAS<i>:MEValuation:MODulation:CURRent?
CALCulate:GSM:MEAS<i>:MEValuation:MODulation:MAXimum?

Returns the current and minimum/maximum single slot modulation results of the multi evaluation measurement.

The values described below are returned by `FETCh` and `READ` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

The number to the left of each result parameter is provided for easy identification of the parameter position within the result array.

Return values:

<1_Reliability> Reliability Indicator

<2_OutOfTolerance> Percentage of measurement intervals / bursts of the statistic count (CONFigure:GSM:MEAS<i>:MEValuation:SCOunt:MODulation) exceeding the specified modulation limits.
Range: 0 % to 100 %
Default unit: %

<3_EVMRMS>
<4_EVMpeak> Error vector magnitude RMS and peak value
Range: 0 % to 100 %
Default unit: %

<5_MagErrorRMS> Magnitude error RMS value
Range: 0 % to 100 %
Default unit: %

<6_MagErrorPeak> Magnitude error peak value
Range: -100 % to 100 %
Default unit: %

<7_PhaseErrorRMS> Phase error RMS value
Range: 0 deg to 180 deg
Default unit: deg

<8_PhaseErrorPeak> Phase error peak value
Range: -180 deg to 180 deg
Default unit: deg

<9_IQoffset> I/Q origin offset
Range: -100 dB to 0 dB
Default unit: dB

<10_IQimbalance> I/Q imbalance
Range: -100 dB to 0 dB
Default unit: dB

<11_FrequencyError> Carrier frequency error
Range: -56000 Hz to 56000 Hz
Default unit: Hz

<12_TimingError> Transmit time error
Range: -100 Sym to 100 Sym
Default unit: Sym

<13_BurstPower> Burst Power
Range: -100 dBm to 55 dBm
Default unit: dBm

<14_AMPMdelay> AM-PM delay (determined for 8PSK and 16-QAM modulation only - for GMSK zeros are returned)
Range: -0.9225E-6 s to 0.9225E-6 s
Default unit: s

Example: See Single-Shot and Continuous Measurements

Usage: Query only

Firmware/Software: V1.0.0.4

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

FETCh:GSM:MEAS<i>:MEValuation:MODulation:AVERage?
READ:GSM:MEAS<i>:MEValuation:MODulation:AVERage?
CALCulate:GSM:MEAS<i>:MEValuation:MODulation:AVERage?

Returns the average single slot modulation results of the multi evaluation measurement.

The values described below are returned by `FETCh` and `READ` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

The number to the left of each result parameter is provided for easy identification of the parameter position within the result array.

Return values:

<1_Reliability> Reliability Indicator

<2_OutOfTolerance> Percentage of measurement intervals / bursts of the statistic count (`CONFigure:GSM:MEAS<i>:MEValuation:SCOunt:MODulation`) exceeding the specified modulation limits.
Range: 0 % to 100 %
Default unit: %

<3_EVMRMS>
<4_EVMpeak> Error vector magnitude RMS and peak value
Range: 0 % to 100 %
Default unit: %

<5_MagErrorRMS>
<6_MagErrorPeak> Magnitude error RMS and peak value
Range: 0 % to 100 %
Default unit: %

<7_PhaseErrorRMS>
<8_PhaseErrorPeak> Phase error RMS and peak value
Range: 0 deg to 180 deg
Default unit: deg

<9_IQoffset> I/Q origin offset
Range: -100 dB to 0 dB
Default unit: dB

<10_IQimbalance>	I/Q imbalance Range: -100 dB to 0 dB Default unit: dB
<11_FrequencyError>	Carrier frequency error Range: -56000 Hz to 56000 Hz Default unit: Hz
<12_TimingError>	Transmit time error Range: -100 Sym to 100 Sym Default unit: Sym
<13_BurstPower>	Burst Power Range: -100 dBm to 55 dBm Default unit: dBm
<14_AMPMdelay>	AMPM delay (determined for 8PSK and 16-QAM modulation only - for GMSK zeros are returned) Range: -0.9225E-6 s to 0.9225E-6 s Default unit: s

Usage: Query only

Firmware/Software: V1.0.0.4

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

READ:GSM:MEAS<i>:MEValuation:MODulation:SDEViation?
FETCh:GSM:MEAS<i>:MEValuation:MODulation:SDEViation?

Returns the standard deviation of the single slot modulation results of the multi evaluation measurement.

The number to the left of each result parameter is provided for easy identification of the parameter position within the result array.

Return values:

<1_Reliability>	Reliability Indicator
<2_OutOfTolerance>	Percentage of measurement intervals / bursts of the statistic count (`CONFigure:GSM:MEAS<i>:MEValuation:SCOunt:SMODulation`) exceeding the specified modulation limits. Range: 0 % to 100 % Default unit: %
<3_EVMRMS> <4_EVMpeak>	Error vector magnitude RMS and peak value Range: 0 % to 50 % Default unit: %
<5_MagErrorRMS> <6_MagErrorPeak>	Magnitude error RMS and peak value Range: 0 % to 50 % Default unit: %

<7_PhaseErrorRMS> <8_PhaseErrorPeak> Phase error RMS and peak value
Range: 0 deg to 90 deg
Default unit: deg

<9_IQoffset> I/Q origin offset
Range: 0 dB to 50 dB
Default unit: dB

<10_IQimbalance> I/Q imbalance
Range: 0 dB to 50 dB
Default unit: dB

<11_FrequencyError> Carrier frequency error
Range: 0 Hz to 56000 Hz
Default unit: Hz

<12_TimingError> Transmit time error
Range: 0 Sym to 100 Sym
Default unit: Sym

<13_BurstPower> Burst Power
Range: 0 dB to 71 dB
Default unit: dB

<14_AMPMdelay> AMPM delay (determined for 8PSK and 16-QAM modulation only - for GMSK zeros are returned)
Range: 0 s to 0.9225E-6 s
Default unit: s

Usage: Query only

Firmware/Software: V1.0.0.4

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

FETCh:GSM:MEAS<i>:MEValuation:MODulation:PERCentile?
READ:GSM:MEAS<i>:MEValuation:MODulation:PERCentile?
CALCulate:GSM:MEAS<i>:MEValuation:MODulation:PERCentile?

Returns the 95th percentile results of the multi evaluation measurement.

The values described below are returned by `FETCh` and `READ` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

The number to the left of each result parameter is provided for easy identification of the parameter position within the result array.

Return values:
<1_Reliability> Reliability Indicator

<2_OutOfTolerance> Percentage of measurement intervals / bursts of the statistic count (CONFigure:GSM:MEAS<i>:MEValuation:SCOunt:MODulation) exceeding the specified modulation limits.
Range: 0 % to 100 %
Default unit: %

<3_EVMRMS> Error vector magnitude percentile
Range: 0 % to 100 %
Default unit: %

<4_MagnitudeError> Magnitude error percentile
Range: 0 % to 100 %
Default unit: %

<5_PhaseError> Phase error percentile
Range: 0 deg to 180 deg
Default unit: deg

Usage: Query only

Firmware/Software: V1.0.0.4

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

FETCh:GSM:MEAS<i>:MEValuation:MODulation:DBITs?

Returns the demodulated bits of the "Measurement Slot". For GMSK modulation a symbol consists of 1 bit, for 8PSK of 3 bits, for 16-QAM of 4 bits.

Return values:

<Reliability> Reliability Indicator

<DemodBits> 142 values, one value per symbol, representing the demodulated bits of the symbol in decimal presentation
Range: 0 to 15

Usage: Query only

Firmware/Software: V2.1.60

3.6.3.24 Power vs Time Results (Traces)

The following commands return the power vs. time trace results of the multi evaluation measurement.

FETCh:GSM:MEAS<i>:MEValuation:TRACe:PVTime:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:TRACe:PVTime:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:TRACe:PVTime:MINimum?
FETCh:GSM:MEAS<i>:MEValuation:TRACe:PVTime:MAXimum?
READ:GSM:MEAS<i>:MEValuation:TRACe:PVTime:CURRent?
READ:GSM:MEAS<i>:MEValuation:TRACe:PVTime:AVERage?

READ:GSM:MEAS<i>:MEValuation:TRACe:PVTime:MINimum?
READ:GSM:MEAS<i>:MEValuation:TRACe:PVTime:MAXimum?

Returns the values of the power vs. time traces. 16 results are available for each symbol period of the measured slots (CONFigure:GSM:MEAS<i>:MEValuation:MSLots). The trace covers 18.25 symbol periods before the beginning of the first slot in the measured slot range, 10 symbol periods after the end of the last measured slot. The length of the trace is given as:

$$n = 16 \times (18.25 + < SlotCount > \times 156.25 + 10)$$

The first sample of the "Measurement Slot" is located at position m in the trace, where:

$$m = 16 \times (18.25 + < MeasSlot > \times 156.25)$$

The results of the current, average minimum and maximum traces can be retrieved.

Return values:

<Reliability>	Reliability Indicator
<Result_1> ... <Result_n>	Range: -100 dB to 100 dB Default unit: dBm
Usage:	Query only
Firmware/Software:	V1.0.0.4

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

3.6.3.25 Power vs Time Results (Single Values)

The following commands return the statistical power vs. time results of the multi evaluation measurement.

FETCh:GSM:MEAS<i>:MEValuation:PVTime[:ALL]?
READ:GSM:MEAS<i>:MEValuation:PVTime[:ALL]?
CALCulate:GSM:MEAS<i>:MEValuation:PVTime[:ALL]?

Returns burst power values for slot 0 to slot 7. In addition to the current value statistical values are returned (average, minimum and maximum). The relative number of bursts out of tolerance is also returned.

The values described below are returned by FETCh and READ commands. CALCulate commands return limit check results instead, one value for each result listed below.

The number to the left of each result parameter is provided for easy identification of the parameter position within the result array.

Return values:

<1_Reliability> Reliability Indicator

<2_BurstsOutTol> Percentage of measurement intervals / bursts of the statistic count (CONFigure:GSM:MEAS<i>:MEValuation:SCOunt:PVTime) exceeding the specified limits, see Limits (Power vs. Time)

Range: 0 % to 100 %
Default unit: %

<3_AvgPow0> ... <10_AvgPow7> "Average" burst power values for slot 0 to slot 7

Range: -100 dBm to 55 dBm
Default unit: dBm

<11_CurPow0> ... <18_CurPow7> "Current" burst power values for slot 0 to slot 7

Range: -100 dBm to 55 dBm
Default unit: dBm

<19_MaxPow0> ... <26_MaxPow7> "Maximum" burst power values for slot 0 to slot 7

Range: -100 dBm to 55 dBm
Default unit: dBm

<27_MinPow0> ... <34_MinPow7> "Minimum" burst power values for slot 0 to slot 7

Range: -100 dBm to 55 dBm
Default unit: dBm

Usage: Query only

Firmware/Software: V1.0.0.4

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

FETCh:GSM:MEAS<i>:MEValuation:PVTime:CURRent:SVECtor?
FETCh:GSM:MEAS<i>:MEValuation:PVTime:AVERage:SVECtor?
FETCh:GSM:MEAS<i>:MEValuation:PVTime:MINimum:SVECtor?
FETCh:GSM:MEAS<i>:MEValuation:PVTime:MAXimum:SVECtor?

Returns special burst power values for the "Measure Slot".

The number to the left of each result parameter is provided for easy identification of the parameter position within the result array.

Return values:

<1_Reliability> Reliability Indicator

<2_UsefulPartMin>
<3_UsefulPartMax>
Minimum and maximum power across the useful part of the "Measure Slot".

Range: -100 dB to 100 dB
Default unit: dB

<4_Subvector1> ...
<15_Subvector12>
Burst power at [µs]: –28 , –18, –10, 0, 2, 4, 538.2, 540.2, 542.8, 552.8, 560.8, 570.8

Range: -100 dB to 100 dB
Default unit: dB

Usage: Query only

Firmware/Software: V1.0.10.1

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

FETCh:GSM:MEAS<i>:MEValuation:PVTime:BTYPe?

Returns the detected burst type for all measured timeslots. 8 values are returned, irrespective of the "No. of Slots" measured (`CONFigure:GSM:MEAS<i>:MEValuation:MSLots`). If "No. of Slots" < 8, some of the returned values are `NAN`.

Return values:

<Reliability> Reliability Indicator

<BurstType> OFF | GMSK | EPSK | ACCess | Q16

Detected burst type (8 values):
GMSK: Normal burst, GMSK-modulated
EPSK: Normal burst, 8PSK-modulated
ACCess: Access burst
Q16: Normal burst, 16-QAM-modulated
OFF: Inactive slot

Example: See Performing Single-Shot Measurements

Usage: Query only

Firmware/Software: V2.0.10

Options: R&S CMW-KM201 (for 16-QAM)

FETCh:GSM:MEAS<i>:MEValuation:PVTime:RSTiming?

Returns the slot timing for all measured timeslots, relative to the timing of the "Measurement Slot". The relative slot timing of the "Measurement Slot" is always zero. The relative slot timing of the other timeslots is the deviation of the measured relative timing from the nominal timing, which is based on a timeslot length of 156.25 symbol durations.

The command returns 8 values, irrespective of the "No. of Slots" measured (`CONFigure:GSM:MEAS<i>:MEValuation:MSLots`). If "No. of Slots" < 8, some of the returned values are `NAN`.

Return values:

<Reliability>	Reliability Indicator
<RelSlotTiming>	Range: -100 Sym to 100 Sym Default unit: symbols
Example:	See Performing Single-Shot Measurements
Usage:	Query only
Firmware/Software:	V2.0.10

FETCh:GSM:MEAS<i>:MEValuation:PVTime:TSC?

Returns the detected Training Sequence Code (TSC) and burst type for all measured timeslots. 8 values are returned, irrespective of the "No. of Slots" measured (`CONFigure:GSM:MEAS<i>:MEValuation:MSLots`). If "No. of Slots" < 8, some of the returned values are `NAN`.

Return values:

<Reliability>	Reliability Indicator
<TSC>	OFF | NB0 | NB1 | NB2 | NB3 | NB4 | NB5 | NB6 | NB7 | DUMMy | AB0 | AB1 | AB2 Detected TSC (8 values): **OFF:** Inactive slot **NB0 ... NB7:** Normal burst, training sequence TSC0 to TSC7 **DUMMY:** Dummy burst **AB0 ... AB2:** Access burst, TSC 0 to TSC2
Example:	See Performing Single-Shot Measurements
Usage:	Query only
Firmware/Software:	V2.0.10

3.6.3.26 Spectrum Modulation Results

The following commands return the spectrum modulation results of the multi evaluation measurement.

FETCh:GSM:MEAS<i>:MEValuation:SMODulation:FREQuency?
READ:GSM:MEAS<i>:MEValuation:SMODulation:FREQuency?
CALCulate:GSM:MEAS<i>:MEValuation:SMODulation:FREQuency?

Returns the average burst power measured at a series of frequencies. The frequencies are determined by the offset values defined via the command `CONFigure:GSM:MEAS<i>:MEValuation:SMODulation:OFRequence`. All defined offset values are considered (irrespective of their activation status).

The values described below are returned by `FETCh` and `READ` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

The number to the left of each result parameter is provided for easy identification of the parameter position within the result array.

Return values:

<1_Reliability>	Reliability Indicator
<2_PowOffsetM19> ... <21_PowOffsetM0> <22_PowCarrier> <23_PowOffsetP0> ... <42_PowOffsetP19>	<PowOffsetM/P n> refers to the average burst power at the carrier frequency minus/plus the frequency offset value number n. Range: -100 dB to 100 dB Default unit: dB

Example: See Configuring a Spectrum Measurement

Usage: Query only

Firmware/Software: V1.0.0.4

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

FETCh:GSM:MEAS<i>:MEValuation:TRACe:SMODulation:TIME[:CURRent]?
READ:GSM:MEAS<i>:MEValuation:TRACe:SMODulation:TIME[:CURRent]?

Returns the spectrum due to modulation trace values measured at a selected offset frequency (`CONFigure:GSM:MEAS<i>:MEValuation:SMODulation:TDFSelect`).

Return values:

<Reliability>	Reliability Indicator
<Result_1> ... <Result_n>	n power results, 4 for each symbol period of the "Measured Slot" Range: -100 dB to 100 dB Default unit: dB

Example: See Configuring a Spectrum Measurement

Usage: Query only

Firmware/Software: V1.0.0.4

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

READ:GSM:MEAS<i>:MEValuation:SMODulation?
FETCh:GSM:MEAS<i>:MEValuation:SMODulation?

Returns general spectrum modulation results.

Return values:

<Reliability> Reliability Indicator

<OutOfTolCount> Percentage of measurement intervals / bursts of the statistic count (CONFigure:GSM:MEAS<i>:MEValuation:SCOunt:SMODulation) exceeding the specified limits (see Limits (Spectrum Modulation)).

Range: 0 % to 100 %
Default unit: %

<CarrierPower> Measured carrier output power (reference power)

Range: -100 dBm to 55 dBm
Default unit: dBm

Usage: Query only

Firmware/Software: V1.0.0.4

Manual operation: See "Statistical Overviews" on page 447

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

3.6.3.27 Spectrum Switching Results

The following commands return the spectrum switching results of the multi evaluation measurement.

FETCh:GSM:MEAS<i>:MEValuation:SSWitching:FREQuency?
READ:GSM:MEAS<i>:MEValuation:SSWitching:FREQuency?
CALCulate:GSM:MEAS<i>:MEValuation:SSWitching:FREQuency?

Returns the maximum burst power measured at a series of frequencies. The frequencies are determined by the offset values defined via the command CONFigure:GSM:MEAS<i>:MEValuation:SSWitching:OFRequence. All defined offset values are considered (irrespective of their activation status).

The values described below are returned by FETCh and READ commands. CALCulate commands return limit check results instead, one value for each result listed below.

The number to the left of each result parameter is provided for easy identification of the parameter position within the result array.

Return values:

<1_Reliability> Reliability Indicator

<2_PowOffsetM19> ... <21_PowOffsetM0> <22_PowCarrier> <23_PowOffsetP0> ... <42_PowOffsetP19>
<PowOffset M/P n> refers to the maximum burst power at the carrier frequency minus/plus the frequency offset value number n.
Range: -100 dBm to 55 dBm
Default unit: dBm

Example: See Configuring a Spectrum Measurement

Usage: Query only

Firmware/Software: V1.0.0.4

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

FETCh:GSM:MEAS<i>:MEValuation:TRACe:SSWitching:TIME[:CURRent]?
READ:GSM:MEAS<i>:MEValuation:TRACe:SSWitching:TIME[:CURRent]?

Returns the spectrum due to switching trace values measured at a selected offset frequency (`CONFigure:GSM:MEAS<i>:MEValuation:SSWitching:TDFSelect`).

Return values:

<Reliability> Reliability Indicator

<Result_1> ... <Result_n>
n power results, 4 for each symbol period of all measured slots
Range: -100 dBm to 55 dBm
Default unit: dBm

Example: See Configuring a Spectrum Measurement

Usage: Query only

Firmware/Software: V1.0.0.4

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

READ:GSM:MEAS<i>:MEValuation:SSWitching?
FETCh:GSM:MEAS<i>:MEValuation:SSWitching?

Returns general spectrum switching results.

Return values:

<Reliability> Reliability Indicator

<OutOfTolCount> Percentage of measurement intervals / bursts of the statistic count (`CONFigure:GSM:MEAS<i>:MEValuation:SCOunt:SSWitching`) exceeding the specified limits, see Limits (Spectrum Switching)

Range: 0 % to 100 %
Default unit: %

<CarrierPower> Measured carrier output power (reference power)

Range: -100 dBm to 55 dBm
Default unit: dBm

Usage: Query only

Firmware/Software: V1.0.0.4

Manual operation: See "Statistical Overviews" on page 447

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

3.6.3.28 I/Q Constellation Results (Traces)

The following commands return the results in the I/Q constellation diagram.

FETCh:GSM:MEAS<i>:MEValuation:TRACe:IQ[:CURRent]?
READ:GSM:MEAS<i>:MEValuation:TRACe:IQ[:CURRent]?

Returns the results in the I/Q constellation diagram.

Return values:

<Reliability> Reliability Indicator

<IPhase_1> ... <IPhase_n> <QPhase_1> ... <QPhase_n>

n normalized I and Q amplitudes, depending on the burst and modulation type
8PSK/16-QAM modulation: 568 values (four values per symbol period, symbol 3 to symbol 144)
GMSK modulation: 588 values (four values per symbol period, symbol 0.5 to symbol 147.5)
Access burst: 348 values (four values per symbol period, symbol 0.5 to symbol 87.5)

Range: -2 to 2

Example: See I/Q Constellation Diagram

Usage: Query only

Firmware/Software: V1.0.5.3

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

3.6.3.29 BER Results

The following commands return the BER results of the multi evaluation measurement.

FETCh:GSM:MEAS<i>:MEValuation:BER?
READ:GSM:MEAS<i>:MEValuation:BER?

Returns the measured Bit Error Rate. The BER measurement must be enabled using CONFigure:GSM:MEAS<i>:MEValuation:RESult:BER.

Return values:

<Reliability> Reliability Indicator

<BER> % Bit Error Rate

Range: 0 % to 100 %
Default unit: %

<BERabsolute> Total number of detected bit errors
The BER measurement evaluates 114 data bits per GMSK-modulated normal burst, 306 data bits per 8PSK-modulated burst.

Range: 0 to <no. of measured bits>

<BERcount> Total number of evaluated bits

Range: 0 to <no. of measured bits>

Example: See BER Measurement

Usage: Query only

Firmware/Software: V1.0.5.3

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

3.6.3.30 List Mode Results (One Segment)

The following commands return the list mode results for a selected segment.

To configure the list mode use the commands described in chapter 3.6.3.5, "List Mode Settings", on page 480.

For a description of the list mode see chapter 3.2.3, "List Mode", on page 378.

The segment number <no> in the following commands refers to the range of measured segments (1..512), see CONFigure:GSM:MEAS<i>:MEValuation:LIST:LRANge on page 480. It may differ from the absolute segment number used for segment configuration.

FETCh:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:PVTime:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:PVTime:AVERage?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:PVTime:CURRent?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:PVTime:AVERage?

Returns power vs. time results for segment <no> in list mode.

The values described below are returned by `FETCh` commands. The first six values (Reliability to Out of Tolerance result) are also returned by `CALCulate` commands. The remaining values returned by `CALCulate` commands are limit check results, one value for each result listed below.

Suffix:

<no> 1..512
Relative number within the range of measured segments

Return values:

<1_Reliability> Reliability Indicator
In list mode, a zero reliability indicator indicates that the results in all measured segments are valid. A non-zero value indicates that an error occurred in at least one of the measured segments.

<2_SegReliability> Reliability indicator for the segment. The meaning of the returned values is the same as for the common reliability indicator, see previous parameter.

<3_StatistExpired> Number of measured steps
Range: 0 to <Statistical Length> (integer value)

<4_BurstType> GMSK | EPSK | ACCess | Q16 | OFF
Detected burst type of the last measured burst
GMSK: Normal burst, GMSK-modulated
EPSK: Normal burst, 8PSK-modulated
ACCess: Access burst
Q16: Normal burst, 16-QAM-modulated
OFF: Inactive slot

<5_SlotStatistic> ON | OFF
ON: Averaging over different burst type
OFF: Uniform burst type in the averaging range

<6_OutOfTolerance> Percentage of measured bursts with failed limit check

Range: 0 % to 100 %
Default unit: %

<7_AverBurstPow> Range: -100 dBm to 55 dBm
Default unit: dBm

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V1.0.4.11
V2.0.20: CALCulate commands added.
V3.2.30: increased number of measured segments (from 200)

Options: R&S CMW-KM012; R&S CMW-KM201 (for 16-QAM)

FETCh:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:PVTime:CURRent:SVECtor?
FETCh:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:PVTime:AVERage:SVECtor?
FETCh:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:PVTime:MINimum:SVECtor?
FETCh:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:PVTime:MAXimum:SVECtor?

Returns special burst power results for segment <no> in list mode.

Suffix:

<no> 1..512
Relative number within the range of measured segments

Return values:

<1_Reliability> Reliability Indicator
In list mode, a zero reliability indicator indicates that the results in all measured segments are valid. A non-zero value indicates that an error occurred in at least one of the measured segments.

<2_SegReliability> Reliability indicator for the segment. The meaning of the returned values is the same as for the common reliability indicator, see previous parameter.

<3_StatistExpired> Number of measured steps

Range: 0 to <Statistical Length> (integer value)

<4_BurstType> GMSK | EPSK | ACCess | Q16 | OFF

Detected burst type of the last measured burst
GMSK: Normal burst, GMSK-modulated
EPSK: Normal burst, 8PSK-modulated
ACCess: Access burst
Q16: Normal burst, 16-QAM-modulated
OFF: Inactive slot

<5_SlotStatistic>	ON | OFF **ON:** Averaging over different burst type **OFF:** Uniform burst type in the averaging range
<6_OutOfTolerance>	Percentage of measured bursts with failed limit check Range: 0 % to 100 % Default unit: %
<7_UsefulPartMin> <8_UsefulPartMax>	Minimum and maximum power across the useful part of the burst Range: -100 dB to 100 dB Default unit: dB
<9_Subvector1> ... <20_Subvector12>	Burst power at [µs]: –28, –18, –10, 0, 2, 4, 538.2, 540.2, 542.8, 552.8, 560.8, 570.8. Range: -100 dB to 100 dB Default unit: dB
Usage:	Query only
Firmware/Software:	V1.0.5.3 V3.2.30: increased number of measured segments (from 200)
Options:	R&S CMW-KM012; R&S CMW-KM201 (for 16-QAM)

FETCh:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:MODulation:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:MODulation:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:MODulation:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:MODulation:SDEViation?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:MODulation:CURRent?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:MODulation:AVERage?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:MODulation:MAXimum?

Returns the modulation results for segment <no> in list mode.

The values described below are returned by `FETCh` commands. The first six values (Reliability to Out of Tolerance result) are also returned by `CALCulate` commands. The remaining values returned by `CALCulate` commands are limit check results, one value for each result listed below.

The ranges indicated below apply to all results except standard deviation results. The minimum for standard deviation results equals 0. The maximum equals the width of the indicated range divided by two. Exceptions are explicitly stated.

Suffix:

<no>	1..512 Relative number within the range of measured segments

Return values:

<1_Reliability> Reliability Indicator
In list mode, a zero reliability indicator indicates that the results in all measured segments are valid. A non-zero value indicates that an error occurred in at least one of the measured segments.

<2_SegReliability> Reliability indicator for the segment. The meaning of the returned values is the same as for the common reliability indicator, see previous parameter.

<3_StatistExpired> Number of measured steps
Range: 0 to <Statistical Length> (integer value)

<4_BurstType> GMSK | EPSK | ACCess | Q16 | OFF
Detected burst type of the last measured burst
GMSK: Normal burst, GMSK-modulated
EPSK: Normal burst, 8PSK-modulated
ACCess: Access burst
Q16: Normal burst, 16-QAM-modulated
OFF: Inactive slot

<5_SlotStatistic> ON | OFF
ON: Averaging over different burst type
OFF: Uniform burst type in the averaging range

<6_OutOfTolerance> Percentage of measured bursts with failed limit check
Range: 0 % to 100 %
Default unit: %

<7_EVMRMS>
<8_EVMpeak> Error vector magnitude RMS and peak value
Range: 0 % to 100 %
Default unit: %

<9_MagErrorRMS> Magnitude error RMS value
Range: 0 % to 100 %
Default unit: %

<10_MagErrorPeak> Magnitude error peak value
Range: -100 % to 100 % (AVERage: 0% to 100 %, SDEViation: 0 % to 50 %)
Default unit: %

<11_PhErrorRMS> Phase error RMS value
Range: 0 deg to 180 deg
Default unit: deg

<12_PhErrorPeak> Phase error peak value
Range: -180 deg to 180 deg (AVERage: 0 deg to 180 deg, SDEViation: 0 deg to 90 deg)
Default unit: deg

<13_IQoffset> I/Q origin offset
Range: -100 dB to 0 dB
Default unit: dB

<14_IQimbalance> I/Q imbalance
Range: -100 dB to 0 dB
Default unit: dB

<15_FrequencyError> Carrier frequency error
Range: -56000 Hz to 56000 Hz
Default unit: Hz

<16_TimingError> Transmit time error
Range: -100 Sym to 100 Sym
Default unit: Sym

<17_BurstPower> Burst Power
Range: -100 dBm to 55 dBm
Default unit: dBm

<18_AMPMdelay> AM-PM delay, determined for 8PSK and 16-QAM modulation only - for GMSK zeros are returned
Range: -0.9225E-6 s to 0.9225E-6 s (a quarter of a symbol period)
Default unit: s

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V1.0.4.11
V.2.0.20: CALCulate commands added.
V3.2.30: increased number of measured segments (from 200)

Options: R&S CMW-KM012; R&S CMW-KM201 (for 16-QAM)

FETCh:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:MODulation:PERCentile?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:MODulation:PERCentile?

Returns the 95th percentile of the modulation results for segment <no> in list mode.

The values described below are returned by `FETCh` commands. The first six values (Reliability to Out of Tolerance result) are also returned by `CALCulate` commands. The remaining values returned by `CALCulate` commands are limit check results, one value for each result listed below.

Suffix:
<no> 1..512
Relative number within the range of measured segments

Return values:

<1_Reliability>	Reliability Indicator In list mode, a zero reliability indicator indicates that the results in all measured segments are valid. A non-zero value indicates that an error occurred in at least one of the measured segments.
<2_SegReliability>	Reliability indicator for the segment. The meaning of the returned values is the same as for the common reliability indicator, see previous parameter.
<3_StatistExpired>	Number of measured steps Range: 0 to <Statistical Length> (integer value)
<4_BurstType>	GMSK | EPSK | ACCess | Q16 | OFF Detected burst type of the last measured burst **GMSK:** Normal burst, GMSK-modulated **EPSK:** Normal burst, 8PSK-modulated **ACCess:** Access burst **Q16:** Normal burst, 16-QAM-modulated **OFF:** Inactive slot
<5_SlotStatistic>	ON | OFF **ON:** Averaging over different burst type **OFF:** Uniform burst type in the averaging range
<6_OutOfTolerance>	Percentage of measured bursts with failed limit check Range: 0 % to 100 % Default unit: %
<7_EVM>	Error vector magnitude percentile Range: 0 % to 100 % Default unit: %
<8_MagnitudeError>	Magnitude error percentile Range: 0 % to 100 % Default unit: %
<9_PhaseError>	Phase error percentile Range: 0 deg to 180 deg Default unit: deg
Example:	See GSM List Mode
Usage:	Query only
Firmware/Software:	V1.0.4.11 V2.0.20: CALCulate command added. V3.2.30: increased number of measured segments (from 200)
Options:	R&S CMW-KM012; R&S CMW-KM201 (for 16-QAM)

FETCh:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:SMODulation?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:SMODulation?

Returns the spectrum due to modulation results for segment <no> in list mode. The result is averaged over the statistical length.

The values described below are returned by `FETCh` commands. The first six values (Reliability to Out of Tolerance result) are also returned by `CALCulate` commands. The remaining values returned by `CALCulate` commands are limit check results, one value for each result listed below.

Suffix:

<no> 1..512
Relative number within the range of measured segments

Return values:

<1_Reliability> Reliability Indicator
In list mode, a zero reliability indicator indicates that the results in all measured segments are valid. A non-zero value indicates that an error occurred in at least one of the measured segments.

<2_SegReliability> Reliability indicator for the segment. The meaning of the returned values is the same as for the common reliability indicator, see previous parameter.

<3_StatistExpired> Number of measured steps
Range: 0 to <Statistical Length> (integer value)

<4_BurstType> GMSK | EPSK | ACCess | Q16 | OFF
Detected burst type of the last measured burst
GMSK: Normal burst, GMSK-modulated
EPSK: Normal burst, 8PSK-modulated
ACCess: Access burst
Q16: Normal burst, 16-QAM-modulated
OFF: Inactive slot

<5_SlotStatistic> ON | OFF
ON: Averaging over different burst type
OFF: Uniform burst type in the averaging range

<6_OutOfTolerance> Percentage of measured bursts with failed limit check
Range: 0 % to 100 %
Default unit: %

<7_CarrierPower> Measured carrier output power (reference power)
Range: -100 dBm to 55 dBm
Default unit: dBm

<8_PowOffsetM19> ... <27_PowOffsetM0> <28_PowCarrier> <29_PowOffsetP0> ... <48_PowOffsetP19>
<PowOffset M/P n> refers to the average burst power at the carrier frequency minus/plus the frequency offset value number n.
Range: -100 dB to 100 dB
Default unit: dB

Example:	See GSM List Mode
Usage:	Query only
Firmware/Software:	V1.0.4.11 V2.0.20: CALCulate command added. V3.2.30: increased number of measured segments (from 200)
Options:	R&S CMW-KM012; R&S CMW-KM201 (for 16-QAM)

FETCh:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:SSWitching?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:SSWitching?

Returns the spectrum due to switching results for segment <no> in list mode. The result corresponds to the maximum over the statistical length (peak hold mode).

The values described below are returned by `FETCh` commands. The first six values (Reliability to Out of Tolerance result) are also returned by `CALCulate` commands. The remaining values returned by `CALCulate` commands are limit check results, one value for each result listed below.

Suffix:

<no>	1..512 Relative number within the range of measured segments

Return values:

<1_Reliability>	Reliability Indicator In list mode, a zero reliability indicator indicates that the results in all measured segments are valid. A non-zero value indicates that an error occurred in at least one of the measured segments.
<2_SegReliability>	Reliability indicator for the segment. The meaning of the returned values is the same as for the common reliability indicator, see previous parameter.
<3_StatistExpired>	Number of measured steps Range: 0 to <Statistical Length> (integer value)
<4_BurstType>	GMSK | EPSK | ACCess | Q16 | OFF Detected burst type of the last measured burst **GMSK:** Normal burst, GMSK-modulated **EPSK:** Normal burst, 8PSK-modulated **ACCess:** Access burst **Q16:** Normal burst, 16-QAM-modulated **OFF:** Inactive slot
<5_SlotStatistic>	ON | OFF **ON:** Averaging over different burst type **OFF:** Uniform burst type in the averaging range
<6_OutOfTolerance>	Percentage of measured bursts with failed limit check Range: 0 % to 100 % Default unit: %

<7_CarrierPower>	Measured carrier output power (reference power) Range: -100 dBm to 55 dBm Default unit: dBm
<8_PowOffsetM19> ... <27_PowOffsetM0> <28_PowCarrier> <29_PowOffsetP0> ... <48_PowOffsetP19>	<PowOffset M/P n> refers to the average burst power at the carrier frequency minus/plus the frequency offset value number n. Range: -100 dBm to 55 dBm Default unit: dBm

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V1.0.4.11
V2.0.20: CALCulate command added
V3.2.30: increased number of measured segments (from 200)

Options: R&S CMW-KM012; R&S CMW-KM201 (for 16-QAM)

FETCh:GSM:MEAS<i>:MEValuation:LIST:SEGMent<no>:BER?

Returns the BER results for segment <no> in list mode.

Suffix:

<no>	1..512 Relative number within the range of measured segments

Return values:

<1_Reliability>	Reliability Indicator In list mode, a zero reliability indicator indicates that the results in all measured segments are valid. A non-zero value indicates that an error occurred in at least one of the measured segments.
<2_SegReliability>	Reliability indicator for the segment. The meaning of the returned values is the same as for the common reliability indicator, see previous parameter.
<3_StatistExpired>	Number of measured steps Range: 0 to <Statistical Length> (integer value)
<4_BurstType>	GMSK | EPSK | ACCess | OFF Detected burst type of the last measured burst **GMSK:** Normal burst, GMSK-modulated **EPSK:** Normal burst, 8PSK-modulated **ACCess:** Access burst **OFF:** Inactive slot
<5_SlotStatistic>	ON | OFF **ON:** Averaging over different burst type **OFF:** Uniform burst type in the averaging range

<6_BER>	% Bit Error Rate Range: 0 % to 100 % Default unit: %
<7_BERabsolute>	Total number of detected bit errors The BER measurement evaluates: 114 data bits per GMSK-modulated normal burst 306 data bits per 8PSK-modulated burst. Range: 0 to <no. of measured bits>
<8_BERcount>	Total number of measured bursts Range: 0 to <StatisticCount> For <StatisticCount> see `CONFigure:GSM:MEAS<i>:MEValuation:SCOunt:BER`
Example:	See GSM List Mode
Usage:	Query only
Firmware/Software:	V1.0.10.1 V3.2.30: increased number of measured segments (from 200)
Options:	R&S CMW-KM012; R&S CMW-KM201 (for 16-QAM)

3.6.3.31 List Mode Results (All Segments, One Result)

Each of the following commands returns a selected list mode result for all measured segments. The number of returned results depends on the number of measured segments, see `CONFigure:GSM:MEAS<i>:MEValuation:LIST:LRANge` on page 480.

To configure the list mode use the commands described in chapter 3.6.3.5, "List Mode Settings", on page 480.

For a description of the list mode see chapter 3.2.3, "List Mode", on page 378.

Indicated ranges apply to all statistical results except standard deviation results. The minimum for standard deviation results equals 0. The maximum equals the width of the indicated range divided by two. Exceptions are explicitly stated.

FETCh:GSM:MEAS<i>:MEValuation:LIST:SRELiability?

Returns the segment reliability for all measured list mode segments.

A common reliability indicator of zero indicates that the results in all measured segments are valid. A non-zero value indicates that an error occurred in at least one of the measured segments. If you get a non-zero common reliability indicator, you can use this command to retrieve the individual reliability values of all measured segments for further analysis.

Return values:

<Reliability>	Reliability Indicator
<SegReliability>	Comma separated list of values, one per measured segment The meaning of the returned values is the same as for the common reliability indicator, see previous parameter.

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

CALCulate:GSM:MEAS<i>:MEValuation:LIST:PVTime:ABPower:CURRent?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:PVTime:ABPower:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:LIST:PVTime:ABPower:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:LIST:PVTime:ABPower:AVERage?

Return average burst power results for all measured list mode segments.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Return values:

<Reliability> Reliability Indicator

<AverageBurstPow> Comma separated list of values, one per measured segment
Range: -100 dBm to 55 dBm
Default unit: dBm

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

FETCh:GSM:MEAS<i>:MEValuation:LIST:PVTime:SVECtor:UMAXimum:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:LIST:PVTime:SVECtor:UMAXimum:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:LIST:PVTime:SVECtor:UMAXimum:MINimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:PVTime:SVECtor:UMAXimum:MAXimum?

Return maximum power across the useful part of the burst for all measured list mode segments.

Return values:

<Reliability> Reliability Indicator

<UsefullPartMax> Comma separated list of values, one per measured segment
Range: -100 dB to 100 dB
Default unit: dB

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

FETCh:GSM:MEAS<i>:MEValuation:LIST:PVTime:SVECtor:UMINimum:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:LIST:PVTime:SVECtor:UMINimum:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:LIST:PVTime:SVECtor:UMINimum:MINimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:PVTime:SVECtor:UMINimum:MAXimum?

Return minimum power across the useful part of the burst for all measured list mode segments.

Return values:

<Reliability> Reliability Indicator

<UsefullPartMin> Comma separated list of values, one per measured segment
Range: -100 dB to 100 dB
Default unit: dB

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

FETCh:GSM:MEAS<i>:MEValuation:LIST:PVTime:SVECtor:SUBVector<no>:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:LIST:PVTime:SVECtor:SUBVector<no>:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:LIST:PVTime:SVECtor:SUBVector<no>:MINimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:PVTime:SVECtor:SUBVector<no>:MAXimum?

Return burst power at a specific burst position for all measured list mode segments.

Suffix:

<no> 1..12
Index selecting one of the following burst positions [µs]: –28, –18, –10, 0, 2, 4, 538.2, 540.2, 542.8, 552.8, 560.8, 570.8

Return values:

<Reliability> Reliability Indicator

<Subvector> Comma separated list of values, one per measured segment
Range: -100 dB to 100 dB
Default unit: dB

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:EVM:RMS:CURRent?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:EVM:RMS:AVERage?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:EVM:RMS:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:EVM:RMS:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:EVM:RMS:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:EVM:RMS:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:EVM:RMS:SDEViation?

Return error vector magnitude RMS values for all measured list mode segments.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Return values:

<Reliability> Reliability Indicator

<EVM_RMS> Comma separated list of values, one per measured segment
Range: 0 % to 100 %
Default unit: %

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:EVM:PEAK:CURRent?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:EVM:PEAK:AVERage?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:EVM:PEAK:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:EVM:PEAK:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:EVM:PEAK:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:EVM:PEAK:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:EVM:PEAK:SDEViation?

Return error vector magnitude peak values for all measured list mode segments.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Return values:

<Reliability> Reliability Indicator

<EVMpeak> Comma separated list of values, one per measured segment

Range: 0 % to 100 %
Default unit: %

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:EVM:PERCentile?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:EVM:PERCentile?

Return error vector magnitude 95th percentile values for all measured list mode segments.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Return values:

<Reliability> Reliability Indicator

<EVM> Comma separated list of values, one per measured segment

Range: 0 % to 100 %
Default unit: %

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:MERRor:RMS:CURRent?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:MERRor:RMS:AVERage?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:MERRor:RMS:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:MERRor:RMS:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:MERRor:RMS:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:MERRor:RMS:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:MERRor:RMS:SDEViation?

Return magnitude error RMS values for all measured list mode segments.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Return values:

<Reliability> Reliability Indicator

<MagErrorRMS> Comma separated list of values, one per measured segment
Range: 0 % to 100 %
Default unit: %

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:MERRor:PEAK:CURRent?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:MERRor:PEAK:AVERage?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:MERRor:PEAK:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:MERRor:PEAK:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:MERRor:PEAK:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:MERRor:PEAK:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:MERRor:PEAK:SDEViation?

Return magnitude error peak values for all measured list mode segments.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Return values:
<Reliability> Reliability Indicator

<MagErrorPeak> Comma separated list of values, one per measured segment
Range: -100 % to 100 % (AVERage: 0 % to 100 %, SDEViation: 0 % to 50 %)
Default unit: %

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:MERRor:PERCentile?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:MERRor:PERCentile?

Return magnitude error 95th percentile values for all measured list mode segments.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Return values:
<Reliability> Reliability Indicator

<MagnitudeError> Comma separated list of values, one per measured segment
Range: 0 % to 100 %
Default unit: %

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:PERRor:RMS:CURRent?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:PERRor:RMS:AVERage?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:PERRor:RMS:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:PERRor:RMS:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:PERRor:RMS:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:PERRor:RMS:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:PERRor:RMS:SDEViation?

Return phase error RMS values for all measured list mode segments.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Return values:

<Reliability> Reliability Indicator

<PhaseErrorRMS> Comma separated list of values, one per measured segment
Range: 0 deg to 180 deg
Default unit: deg

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:PERRor:PEAK:CURRent?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:PERRor:PEAK:AVERage?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:PERRor:PEAK:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:PERRor:PEAK:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:PERRor:PEAK:AVERage?

FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:PERRor:PEAK:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:PERRor:PEAK:SDEViation?

Return phase error peak values for all measured list mode segments.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Return values:

<Reliability> Reliability Indicator

<PhaseErrorPeak> Comma separated list of values, one per measured segment
Range: -180 deg to 180 deg (AVERage: 0 deg to 180 deg, SDEViation: 0 deg to 90 deg)
Default unit: deg

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:PERRor:PERCentile?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:PERRor:PERCentile?

Return phase error 95^{th} percentile values for all measured list mode segments.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Return values:

<Reliability> Reliability Indicator

<PhaseError> Comma separated list of values, one per measured segment
Range: 0 deg to 180 deg
Default unit: deg

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:IQOFfset:CURRent?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:IQOFfset:AVERage?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:IQOFfset:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:IQOFfset:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:IQOFfset:AVERage?

FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:IQOFfset:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:IQOFfset:SDEViation?

Return I/Q origin offset results for all measured list mode segments.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Return values:

<Reliability> Reliability Indicator

<IQoffset> Comma separated list of values, one per measured segment
Range: -100 dB to 0 dB
Default unit: dB

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:IQIMbalance:CURRent?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:IQIMbalance:AVERage?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:IQIMbalance:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:IQIMbalance:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:IQIMbalance:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:IQIMbalance:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:IQIMbalance:SDEViation?

Return I/Q imbalance results for all measured list mode segments.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Return values:

<Reliability> Reliability Indicator

<IQimbalance> Comma separated list of values, one per measured segment
Range: -100 dB to 0 dB
Default unit: dB

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:FERRor:CURRent?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:FERRor:AVERage?

CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:FERRor:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:FERRor:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:FERRor:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:FERRor:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:FERRor:SDEViation?

Return carrier frequency error results for all measured list mode segments.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Return values:

<Reliability> Reliability Indicator

<FrequencyError> Comma separated list of values, one per measured segment

Range: -56000 Hz to 56000 Hz
Default unit: Hz

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:TERRor:CURRent?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:TERRor:AVERage?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:TERRor:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:TERRor:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:TERRor:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:TERRor:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:TERRor:SDEViation?

Return transmit time error values for all measured list mode segments.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Return values:

<Reliability> Reliability Indicator

<TimingError> Comma separated list of values, one per measured segment

Range: -100 Sym to 100 Sym
Default unit: Sym

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:BPOWer:CURRent?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:BPOWer:AVERage?

CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:BPOWer:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:BPOWer:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:BPOWer:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:BPOWer:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:BPOWer:SDEViation?

Return burst power values for all measured list mode segments.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Return values:

<Reliability> Reliability Indicator

<BurstPower> Comma separated list of values, one per measured segment

Range: -100 dBm to 55 dBm
Default unit: dBm

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:APDelay:CURRent?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:APDelay:AVERage?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:APDelay:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:APDelay:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:APDelay:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:APDelay:MAXimum?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:APDelay:SDEViation?

Return AM-PM delay results for all measured list mode segments.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Return values:

<Reliability> Reliability Indicator

<AMPMdelay> Comma separated list of values, one per measured segment

Range: -0.9225E-6 s to 0.9225E-6 s
Default unit: s

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

FETCh:GSM:MEAS<i>:MEValuation:LIST:BER:BER?

Returns the bit error rate for each measured list mode segment.

Return values:

<Reliability>	Reliability Indicator
<BER>	Comma separated list of values, one per measured segment Range: 0 % to 100 % Default unit: %
Example:	See GSM List Mode
Usage:	Query only
Firmware/Software:	V2.1.60
Options:	R&S CMW-KM012

FETCh:GSM:MEAS<i>:MEValuation:LIST:BER:ABSolute?

Returns the total number of detected bit errors for each measured list mode segment.

Return values:

<Reliability>	Reliability Indicator
<BERabsolute>	Comma separated list of values, one per measured segment Range: 0 to <no. of measured bits>
Example:	See GSM List Mode
Usage:	Query only
Firmware/Software:	V2.1.60
Options:	R&S CMW-KM012

FETCh:GSM:MEAS<i>:MEValuation:LIST:BER:COUNt?

Returns the number of measured bursts for each list mode segment.

Return values:

<Reliability>	Reliability Indicator
<BERcount>	Comma separated list of values, one per measured segment Range: 0 to <StatisticCount>
Example:	See GSM List Mode
Usage:	Query only
Firmware/Software:	V2.1.60
Options:	R&S CMW-KM012

CALCulate:GSM:MEAS<i>:MEValuation:LIST:SMODulation:CPOWer?
FETCh:GSM:MEAS<i>:MEValuation:LIST:SMODulation:CPOWer?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:SSWitching:CPOWer?
FETCh:GSM:MEAS<i>:MEValuation:LIST:SSWitching:CPOWer?

Return carrier output power results for all measured list mode segments, for spectrum due to modulation or spectrum due to switching measurement.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Return values:

<Reliability> Reliability Indicator

<CarrierPower> Comma separated list of values, one per measured segment
Range: -100 dBm to 55 dBm
Default unit: dBm

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

CALCulate:GSM:MEAS<i>:MEValuation:LIST:SMODulation:POFFset<no>?
FETCh:GSM:MEAS<i>:MEValuation:LIST:SMODulation:POFFset<no>?

Return the burst power at the carrier frequency minus/plus a selected frequency offset, for all measured list mode segments of the spectrum due to modulation measurement.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Suffix:

<no> 1..41
Index selecting one of the configured frequency offsets
1..20 = minus offset 19 to minus offset 0
21 = carrier frequency, no offset
22..41 = plus offset 0 to plus offset 19

Return values:

<Reliability> Reliability Indicator

<Power> Comma separated list of values, one per measured segment
Range: -100 dB to 100 dB
Default unit: dB

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

CALCulate:GSM:MEAS<i>:MEValuation:LIST:SSWitching:POFFset<no>?
FETCh:GSM:MEAS<i>:MEValuation:LIST:SSWitching:POFFset<no>?

Return the burst power at the carrier frequency minus/plus a selected frequency offset, for all measured list mode segments of the spectrum due to switching measurement.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Suffix:

<no> 1..41
Index selecting one of the configured frequency offsets
1..20 = minus offset 19 to minus offset 0
21 = carrier frequency, no offset
22..41 = plus offset 0 to plus offset 19

Return values:

<Reliability> Reliability Indicator

<Power> Comma separated list of values, one per measured segment
Range: -100 dBm to 55 dBm
Default unit: dBm

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V2.1.60

Options: R&S CMW-KM012

3.6.3.32 List Mode Results (All Segments, Result Groups)

The following commands return groups of list mode results for all segments.

To configure the list mode use the commands described in chapter 3.6.3.5, "List Mode Settings", on page 480.

For a description of the list mode see chapter 3.2.3, "List Mode", on page 378.

FETCh:GSM:MEAS<i>:MEValuation:LIST:PVTime:CURRent? [<SegmentStart>, <SegmentCount>]
FETCh:GSM:MEAS<i>:MEValuation:LIST:PVTime:AVERage? [<SegmentStart>, <SegmentCount>]
CALCulate:GSM:MEAS<i>:MEValuation:LIST:PVTime:CURRent? [<SegmentStart>, <SegmentCount>]
CALCulate:GSM:MEAS<i>:MEValuation:LIST:PVTime:AVERage? [<SegmentStart>, <SegmentCount>]

Returns the power vs. time results in list mode. By default results are returned for all measured segments. Use the optional parameters to query only a subset.

The values listed below in curly brackets {} are returned for each measured segment: $\{...\}_{seg\ 1}$, $\{...\}_{seg\ 2}$, ..., $\{...\}_{seg\ n}$. The position of measured segments within the range of configured segments and their number n is determined by `CONFigure:GSM:MEAS<i>:MEValuation:LIST:LRANge`.

The values described below are returned by `FETCh` commands. The first six values (Reliability to Out of Tolerance result) are also returned by `CALCulate` commands. The remaining values returned by `CALCulate` commands are limit check results, one value for each result listed below.

Query parameters:

<SegmentStart>	First segment to be returned
<SegmentCount>	Number of segments to be returned

Return values:

<1_Reliability>	Reliability Indicator
{<2_SegReliability>	Reliability indicator for the segment. The meaning of the returned values is the same as for the common reliability indicator, see previous parameter.
<3_StatistExpired>	Number of measured steps Range: 0 to <Statistical Length> (integer value)
<4_BurstType>	GMSK | EPSK | ACCess | Q16 | OFF Detected burst type of the last measured burst **GMSK:** Normal burst, GMSK-modulated **EPSK:** Normal burst, 8PSK-modulated **ACCess:** Access burst **Q16:** Normal burst, 16-QAM-modulated **OFF:** Inactive slot
<5_SlotStatistic>	ON | OFF **ON:** Averaging over different burst type **OFF:** Uniform burst type in the averaging range

<6_OutOfTolerance> Percentage of measured bursts with failed limit check

Range: 0 % to 100 %
Default unit: %

<7_AverBurstPow>} Range: -100 dBm to 55 dBm
Default unit: dBm

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V1.0.5.3
V.2.0.20: CALCulate commands added.

Options: R&S CMW-KM012; R&S CMW-KM201 (for 16-QAM)

FETCh:GSM:MEAS<i>:MEValuation:LIST:PVTime:CURRent:SVECtor?

Returns special burst power values in list mode.

The values listed below in curly brackets {} are returned for each measured segment: $\{...\}_{seg\ 1}$, $\{...\}_{seg\ 2}$, ..., $\{...\}_{seg\ n}$. The position of measured segments within the range of configured segments and their number n is determined by `CONFigure:GSM:MEAS<i>:MEValuation:LIST:LRANge`.

Return values:

<1_Reliability> Reliability Indicator
In list mode, a zero reliability indicator indicates that the results in all measured segments are valid. A non-zero value indicates that an error occurred in at least one of the measured segments.

{<2_SegReliability> Reliability indicator for the segment. The meaning of the returned values is the same as for the common reliability indicator, see previous parameter.

<3_StatistExpired> Number of measured steps

Range: 0 to <Statistical Length> (integer value)

<4_BurstType> GMSK | EPSK | ACCess | Q16 | OFF

Detected burst type of the last measured burst
GMSK: Normal burst, GMSK-modulated
EPSK: Normal burst, 8PSK-modulated
ACCess: Access burst
Q16: Normal burst, 16-QAM-modulated
OFF: Inactive slot

<5_SlotStatistic> ON | OFF

ON: Averaging over different burst type
OFF: Uniform burst type in the averaging range

<6_OutOfTolerance> Percentage of measured bursts with failed limit check

Range: 0 % to 100 %
Default unit: %

<7_UsefulPartMin> <8_UsefulPartMax>	Minimum and maximum power across the useful part of the burst Range: -100 dB to 100 dB Default unit: dB
<9_Subvector1> ... <20_Subvector12>}	Burst power at [µs]: –28, –18, –10, 0, 2, 4, 538.2, 540.2, 542.8, 552.8, 560.8, 570.8 Range: -100 dB to 100 dB Default unit: dB

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V1.0.10.1

Options: R&S CMW-KM012; R&S CMW-KM201 (for 16-QAM)

FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:CURRent?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:AVERage?
FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:MAXimum?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:CURRent?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:AVERage?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:MAXimum?

Returns the modulation results in list mode.

The values listed below in curly brackets {} are returned for each measured segment: $\{...\}_{seg\ 1}$, $\{...\}_{seg\ 2}$, ..., $\{...\}_{seg\ n}$. The position of measured segments within the range of configured segments and their number n is determined by `CONFigure:GSM:MEAS<i>:MEValuation:LIST:LRANge`.

The values described below are returned by `FETCh` commands. The first six values (Reliability to Out of Tolerance result) are also returned by `CALCulate` commands. The remaining values returned by `CALCulate` commands are limit check results, one value for each result listed below.

Return values:

<1_Reliability>	Reliability Indicator In list mode, a zero reliability indicator indicates that the results in all measured segments are valid. A non-zero value indicates that an error occurred in at least one of the measured segments.
{<2_SegReliability>	Reliability indicator for the segment. The meaning of the returned values is the same as for the common reliability indicator, see previous parameter.
<3_StatistExpired>	Number of measured steps Range: 0 to <Statistical Length> (integer value)

<4_BurstType>	GMSK | EPSK | ACCess | Q16 | OFF Detected burst type of the last measured burst **GMSK:** Normal burst, GMSK-modulated **EPSK:** Normal burst, 8PSK-modulated **ACCess:** Access burst **Q16:** Normal burst, 16-QAM-modulated **OFF:** Inactive slot
<5_SlotStatistic>	ON | OFF **ON:** Averaging over different burst type **OFF:** Uniform burst type in the averaging range
<6_OutOfTolerance>	Percentage of measured bursts with failed limit check Range: 0 % to 100 % Default unit: %
<7_EVMRMS> <8_EVMpeak>	Error vector magnitude RMS and peak value Range: 0 % to 100 % Default unit: %
<9_MagErrorRMS>	Magnitude error RMS value Range: 0 % to 100 % Default unit: %
<10_MagErrorPeak>	Magnitude error peak value Range: -100 % to 100 % (AVERage: 0% to 100 %) Default unit: %
<11_PhErrorRMS>	Phase error RMS value Range: 0 deg to 180 deg Default unit: deg
<12_PhErrorPeak>	Phase error peak value Range: -180 deg to 180 deg (AVERage: 0 deg to 180 deg) Default unit: deg
<13_IQoffset>	I/Q origin offset Range: -100 dB to 0 dB Default unit: dB
<14_IQimbalance>	I/Q imbalance Range: -100 dB to 0 dB Default unit: dB
<15_FrequencyError>	Average carrier frequency error Range: -56000 Hz to 56000 Hz Default unit: Hz
<16_TimingError>	Transmit time error Range: -100 Sym to 100 Sym Default unit: Sym

<17_BurstPower> Burst Power

Range: -100 dBm to 55 dBm
Default unit: dBm

<18_AMPMdelay>} AM-PM delay (determined for 8PSK and 16-QAM modulation only - for GMSK zeros are returned)

Range: -0.9225E-6 s to 0.9225E-6 s (a quarter of a symbol period)
Default unit: s

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V1.0.5.3
V2.0.20: CALCulate commands added.

Options: R&S CMW-KM012; R&S CMW-KM201 (for 16-QAM)

FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:SDEViation?

Returns the standard deviation of the modulation results in list mode.

The values listed below in curly brackets {} are returned for each measured segment: $\{...\}_{seg\ 1}$, $\{...\}_{seg\ 2}$, ..., $\{...\}_{seg\ n}$. The position of measured segments within the range of configured segments and their number n is determined by `CONFigure:GSM:MEAS<i>:MEValuation:LIST:LRANge`.

Return values:

<1_Reliability> Reliability Indicator

In list mode, a zero reliability indicator indicates that the results in all measured segments are valid. A non-zero value indicates that an error occurred in at least one of the measured segments.

{<2_SegReliability> Reliability indicator for the segment. The meaning of the returned values is the same as for the common reliability indicator, see previous parameter.

<3_StatistExpired> Number of measured steps

Range: 0 to <Statistical Length> (integer value)

<4_BurstType> GMSK | EPSK | ACCess | Q16 | OFF

Detected burst type of the last measured burst
GMSK: Normal burst, GMSK-modulated
EPSK: Normal burst, 8PSK-modulated
ACCess: Access burst
Q16: Normal burst, 16-QAM-modulated
OFF: Inactive slot

<5_SlotStatistic> ON | OFF

ON: Averaging over different burst type
OFF: Uniform burst type in the averaging range

<6_OutOfTolerance>	Percentage of measured bursts with failed limit check Range: 0 % to 100 % Default unit: %
<7_EVMRMS> <8_EVMpeak>	Error vector magnitude RMS and peak value Range: 0 % to 50 % Default unit: %
<9_MagErrorRMS> <10_MagErrorPeak>	Magnitude error RMS and peak value Range: 0 % to 50 % Default unit: %
<11_PhErrorRMS> <12_PhErrorPeak>	Phase error RMS and peak value Range: 0 deg to 90 deg Default unit: deg
<13_IQoffset>	I/Q origin offset Range: 0 dB to 50 dB Default unit: dB
<14_IQimbalance>	I/Q imbalance Range: 0 dB to 50 dB Default unit: dB
<15_FrequencyError>	Carrier frequency error Range: 0 Hz to 56000 Hz Default unit: Hz
<16_TimingError>	Transmit time error Range: 0 Sym to 100 Sym Default unit: Sym
<17_BurstPower>	Burst Power Range: 0 dB to 71 dB Default unit: dB
<18_AMPMdelay>}	AM-PM delay (determined for 8PSK and 16-QAM modulation only - for GMSK zeros are returned) Range: 0 s to 0.9225E-6 s Default unit: s

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V1.0.5.3

Options: R&S CMW-KM012; R&S CMW-KM201 (for 16-QAM)

FETCh:GSM:MEAS<i>:MEValuation:LIST:MODulation:PERCentile?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:MODulation:PERCentile?

Returns the 95th percentile of the modulation results in list mode.

The values listed below in curly brackets {} are returned for each measured segment: $\{...\}_{seg\ 1}$, $\{...\}_{seg\ 2}$, ..., $\{...\}_{seg\ n}$. The position of measured segments within the range of configured segments and their number n is determined by `CONFigure:GSM:MEAS<i>:MEValuation:LIST:LRANge`.

The values described below are returned by `FETCh` commands. The first six values (Reliability to Out of Tolerance result) are also returned by `CALCulate` commands. The remaining values returned by `CALCulate` commands are limit check results, one value for each result listed below.

Return values:

<1_Reliability> Reliability Indicator
In list mode, a zero reliability indicator indicates that the results in all measured segments are valid. A non-zero value indicates that an error occurred in at least one of the measured segments.

{<2_SegReliability> Reliability indicator for the segment. The meaning of the returned values is the same as for the common reliability indicator, see previous parameter.

<3_StatistExpired> Number of measured steps
Range: 0 to <Statistical Length> (integer value)

<4_BurstType> GMSK | EPSK | ACCess | Q16 | OFF
Detected burst type of the last measured burst
GMSK: Normal burst, GMSK-modulated
EPSK: Normal burst, 8PSK-modulated
ACCess: Access burst
Q16: Normal burst, 16-QAM-modulated
OFF: Inactive slot

<5_SlotStatistic> ON | OFF
ON: Averaging over different burst type
OFF: Uniform burst type in the averaging range

<6_OutOfTolerance> Percentage of measured bursts with failed limit check
Range: 0 % to 100 %
Default unit: %

<7_EVM> Error vector magnitude percentile
Range: 0 % to 100 %
Default unit: %

<8_MagnitudeError> Magnitude error percentile
Range: 0 % to 100 %
Default unit: %

<9_PhaseError>} Phase error percentile
Range: 0 deg to 180 deg
Default unit: deg

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V1.0.5.3
V2.0.20: CALCulate command added.

Options: R&S CMW-KM012; R&S CMW-KM201 (for 16-QAM)

FETCh:GSM:MEAS<i>:MEValuation:LIST:BER?

Returns the BER results in list mode.

The values listed below in curly brackets {} are returned for each measured segment: $\{...\}_{seg\ 1}$, $\{...\}_{seg\ 2}$, ..., $\{...\}_{seg\ n}$. The position of measured segments within the range of configured segments and their number n is determined by `CONFigure:GSM:MEAS<i>:MEValuation:LIST:LRANge`.

Return values:

<1_Reliability> Reliability Indicator
In list mode, a zero reliability indicator indicates that the results in all measured segments are valid. A non-zero value indicates that an error occurred in at least one of the measured segments.

{<2_SegReliability> Reliability indicator for the segment. The meaning of the returned values is the same as for the common reliability indicator, see previous parameter.

<3_StatistExpired> Number of measured steps
Range: 0 to <Statistical Length> (integer value)

<4_BurstType> GMSK | EPSK | ACCess | OFF
Detected burst type of the last measured burst
GMSK: Normal burst, GMSK-modulated
EPSK: Normal burst, 8PSK-modulated
ACCess: Access burst
OFF: Inactive slot

<5_SlotStatistic> ON | OFF
ON: Averaging over different burst type
OFF: Uniform burst type in the averaging range

<6_BER> % Bit Error Rate
Range: 0 % to 100 %
Default unit: %

<7_BERabsolute> Total number of detected bit errors
The BER measurement evaluates:
114 data bits per GMSK-modulated normal burst
306 data bits per 8PSK-modulated burst.
Range: 0 to <no. of measured bits>

<8_BERcount>} Total number of measured bursts
Range: 0 to <StatisticCount>
For <StatisticCount> see `CONFigure:GSM:MEAS<i>:MEValuation:SCOunt:BER`

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V1.0.10.1

Options: R&S CMW-KM012; R&S CMW-KM201 (for 16-QAM)

FETCh:GSM:MEAS<i>:MEValuation:LIST:OVERview?
CALCulate:GSM:MEAS<i>:MEValuation:LIST:OVERview?

Returns all single results in list mode.

The values listed below in curly brackets {} are returned for each measured segment: $\{...\}_{\text{seg 1}}$, $\{...\}_{\text{seg 2}}$, ..., $\{...\}_{\text{seg n}}$. The position of measured segments within the range of configured segments and their number n is determined by `CONFigure:GSM:MEAS<i>:MEValuation:LIST:LRANge`.

The values described below are returned by `FETCh` commands. `CALCulate` commands return limit check results instead, one value for each result listed below.

Return values:

<1_Reliability> Reliability Indicator

{<2_SegReliability> Reliability indicator for the segment. The meaning of the returned values is the same as for the common reliability indicator, see previous parameter.

<3_OutOfTolerance> Percentage of measured bursts with failed limit check
Range: 0 % to 100 %
Default unit: %

<4_AverBurstPow> Range: -100 dBm to 55 dBm
Default unit: dBm

<5_EVMRMS>
<6_EVMpeak> Error vector magnitude RMS and peak value
Range: 0 % to 100 %
Default unit: %

<7_EVM95Perc> Error vector magnitude percentile
Range: 0 % to 100 %
Default unit: %

<8_PhErrorRMS> Phase error RMS value
Range: 0 deg to 180 deg
Default unit: deg

<9_PhErrorPeak> Phase error peak value
Range: -180 deg to 180 deg
Default unit: deg

<10_IQoffset> Average I/Q origin offset
Range: -100 dB to 0 dB
Default unit: dB

<11_FreqError> Average carrier frequency error

Range: -56000 Hz to 56000 Hz
Default unit: Hz

<12_SpecModM5>
<13_SpecModM4>
<14_ModCarrier>
<15_SpecModP4>
<16_SpecModP5>
Spectrum due to modulation results. <SpecMod M/P n> refers to the average burst power at the carrier frequency minus/plus the frequency offset value number n.

Range: -100 dB to 100 dB
Default unit: dB

<17_SpecSwM2>
<18_SpecSwM1>
<19_SwCarrier>
<20_SpecSwP1>
<21_SpecSwP2>}
Spectrum due to switching results. <SpecSw M/P n> refers to the average burst power at the carrier frequency minus/plus the frequency offset value number n.

Range: -100 dBm to 55 dBm
Default unit: dBm

Example: See GSM List Mode

Usage: Query only

Firmware/Software: V1.0.15.21
V2.0.20: CALCulate command added.

Options: R&S CMW-KM012; R&S CMW-KM201 (for 16-QAM)

3.6.4 Combined Signal Path Commands

For some settings, the command to be used depends on the active scenario. While the Combined Signal Path (CSP) scenario is active, these settings are configured via commands of the signaling application. While the Standalone (SA) scenario is active, they are configured via measurement commands.

The following mapping tables provide an overview for general measurement settings and for multi evaluation measurement commands.

Table 3-23: Mapping for measurement settings

Setting	Commands for SA scenario	Commands for CSP scenario
Connector, converter	ROUTe:GSM:MEAS<i>:SCENario:SALone	ROUTe:GSM:MEAS<i>:SCENario:CSPath ROUTe:GSM:SIGN<i>:SCENario:... See "Scenario, Fading" on page 89.
External attenuation	CONFigure:GSM:MEAS<i>:RFSettings:EATTenuation	CONFigure:GSM:SIGN<i>:RFSettings:EATTenuation:INPut
Band	CONFigure:GSM:MEAS<i>:BAND	CONFigure:GSM:SIGN<i>:BAND:BCCH SENSe:GSM:SIGN<i>:BAND:TCH?
Frequency, channel	CONFigure:GSM:MEAS<i>:RFSettings:FREQuency CONFigure:GSM:MEAS<i>:CHANnel	CONFigure:GSM:SIGN<i>:RFSettings:CHANnel:TCH[:CARRier<c>] CONFigure:GSM:SIGN<i>:RFSettings:CHCCombined:TCH:CSWitched

Setting	Commands for SA scenario	Commands for CSP scenario
		CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:ENABle:TCH[:CARRier<c>] CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:MAIO:TCH[:CARRier<c>] CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:HSN:TCH[:CARRier<c>] CONFigure:GSM:SIGN<i>:RFSettings:HOPPing:SEQuence:TCH[:CARRier<c>]
Frequency offset	CONFigure:GSM:MEAS<i>:RFSettings:FOFFset	CONFigure:GSM:SIGN<i>:RFSettings:FOFFset:UL CONFigure:GSM:SIGN<i>:CONNection:RFOFfset
Expected nominal power	CONFigure:GSM:MEAS<i>:RFSettings:ENPower	CONFigure:GSM:SIGN<i>:RFSettings:ENPMode CONFigure:GSM:SIGN<i>:RFSettings:ENPower
User margin	CONFigure:GSM:MEAS<i>:RFSettings:UMARgin	CONFigure:GSM:SIGN<i>:RFSettings:UMARgin
Mixer level offset	CONFigure:GSM:MEAS<i>:RFSettings:MLOFfset	CONFigure:GSM:SIGN<i>:RFSettings:MLOFfset
Measurement slot settings	CONFigure:GSM:MEAS<i>:MEValuation:MSLots	CONFigure:GSM:SIGN<i>:MSLot:UL
Training sequence	CONFigure:GSM:MEAS<i>:MEValuation:TSEQuence	CONFigure:GSM:SIGN<i>:CELL:BCC
PCL setting	CONFigure:GSM:MEAS<i>:MEValuation:PCL	CONFigure:GSM:SIGN<i>:RFSettings:PCL:TCH:CSWitched CONFigure:GSM:SIGN<i>:RFSettings:CHCCombined:TCH:CSWitched

3.7 List of Commands

4 GSM Generator

The GSM generator (option R&S CMW-KG200) provides a flexible GSM downlink test signal. Refer to the following sections for a detailed description of the generator including manual and remote operation.

4.1 What's New in this Revision

This revision describes version 2.0.10 and later of the "GSM Generator" firmware application. Compared to previous software versions it provides the following new features:

- RF Routing: command `ROUTe:GSM:GEN<i>:RFSettings:CONNector` no longer supported; substituted by `ROUTe:GSM:GEN<i>:SCENario:SALone` on page 611.
- New command `ROUTe:GSM:GEN<i>?`.

Software Version

To check your R&S CMW software version, open the "Setup" dialog and click "HW/SW Equipment". The initial software version for each remote control command is quoted in the reference description.

4.2 General Description

The GSM generator provides a flexible GSM test signal at arbitrary RF carrier frequency (in-band or out of band) and selectable level. The signal is either frame-periodic or has a GSM multiframe structure. Each of the 8 timeslots of the TDMA frame may contain a burst of a particular type.

The data fields of the configurable burst types can be filled with periodic or pseudo-random bit sequences. The data may be transmitted with or without channel coding. With these properties the GSM generator signal is well suited for layer 1 and RF tests and for Bit Error Rate (BER) measurements.

The following sections provide more detailed information about the properties of the GSM signal.

4.2.1 GSM Signal Parameters

The GSM physical channel uses a combination of frequency and time division multiplexing and is defined as a sequence of radio frequency channels and timeslots. The basic system and physical channel parameters are listed below.

Table 4-1: Basic GSM parameters

Parameter	Value
TDMA frame duration	60/13 ms ≈ 4.615 ms
Slot duration (8 slots per TDMA frame)	15/26 ms ≈ 576.9 µs
Transmission rate (symbol rate)	270.833 ksymbols/s
Symbol duration	3.69 µs/symbol (--> 156.25 symbols per timeslot)
Modulation schemes	GMSK (1 bit per symbol) 8PSK (3 bits per symbol)

8PSK modulation was introduced to GSM with release 1999 (3GPP TS 05.05 version 7.1.0). 8PSK channels (the so-called EDGE or EGPRS channels) are used for data transmission; only normal bursts are transmitted. The transmission rate for EGPRS channels is the same as in GMSK modulation, which corresponds to a bit rate of 3 x 270.833 kbit/s.

In the GSM generator application, GMSK and 8PSK-modulated normal bursts are termed "NB GMSK" and "NB 8PSK", respectively. Access bursts, synchronization bursts, frequency correction bursts and dummy bursts are always GMSK-modulated (see chapter 4.2.3, "Burst Types", on page 589).

4.2.2 GSM Frequency Bands and Channels

The GSM frequency bands are defined in standard 3GPP TS 25.021. A band contains a set of adjacent channels, each with a bandwidth of 200 kHz. The channel numbers and the assignment between channel numbers and frequencies are band-specific.

In all frequency bands, the downlink frequencies are higher than the corresponding uplink frequencies. The difference between downlink and uplink frequencies is termed the duplex spacing; it is also band-specific.

The tables below give an overview all supported GSM bands with their channel numbers and the downlink and uplink center frequencies.

Table 4-2: GSM bands and channels

Band	Channel Numbers	Center Frequencies FDL [MHz]	Center Frequencies FUL [MHz]
GSM400[1)]	259 to 340	460.6 to 495.0	450.6 to 485.0
GSMGT800[2)]	350 to 425	851.0 to 866.0	806.0 to 821.0
GSM850[3)]	128 to 251	869.2 to 893.8	824.2 to 848.8
GSM900			
(P-GSM900)	0 to 124	935.0 to 959.8	890.0 to 914.8
(R-GSM900)	955 to 974	921.2 to 925.0	876.2 to 880.0
(E-GSM900)	975 to 1023	925.2 to 934.8	880.2 to 889.8
GSM1800[4)]	512 to 885	1805.2 to 1879.8	1710.2 to 1784.8
GSM1900[5)]	512 to 810	1930.2 to 1989.8	1850.2 to 1909.8

1) This R&S CMW band comprises the bands GSM450 and GSM480 from the standard.

2) This R&S CMW band corresponds to band T-GSM810 from the standard.

3) This R&S CMW band corresponds to the bands GSM850 and MXM850 from the standard.

4) This R&S CMW band corresponds to the band DCS1800 from the standard.

5) This R&S CMW band corresponds to the bands PCS1900 and MXM1900 from the standard.

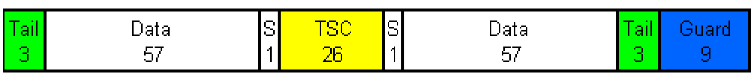
4.2.3 Burst Types

The GSM physical channel is a sequence of timeslots, each of which is divided into 156.25 symbol periods; see GSM Signal Parameters. A burst represents the physical content of a timeslot. Standard 3GPP TS 05.02 defines the different burst types together with their bit structure. The R&S CMW supports all specified burst types.

Normal burst, GMSK

The GSMK-modulated normal burst is used for data transmission on the traffic channel and on the control channels (except the RACH, PRACH, and CPRACH).

The normal burst contains two 57-bit long data fields for the transmission of the user information. The training sequence (TSC) in the center is flanked by two "stealing flag" bits (S1); each of them is set to 0. The 2 times 3 tail bits at the beginning and at the end of the burst are all set to 0, the 8.25-bit guard period at the end is transmission-free.



Normal burst, 8PSK

An 8PSK-modulated normal burst is also termed EDGE burst; see chapter 4.2.1, "GSM Signal Parameters", on page 588. EDGE bursts are used for data transmission at higher data rates. Due to the higher-order modulation scheme, the bit content of all fields is tripled. The "stealing flag" bits are not present. All tail bits are set to 1. The length of the guard period is 24.75 bits.

Tail	Data	TSC	Data	Tail	Guard
9	174	78	174	9	27

Synchronization burst

The synchronization burst is used for time synchronization of the mobile. It is broadcast by the base station, together with the frequency correction burst, but not used by mobile stations.

The synchronization burst uses a fixed "extended training sequence" (ETSC), flanked by two shortened data fields. In the network, the data fields carry the information of the TDMA frame number and base station identity code (BSIC). The 2 times 3 tail bits at the beginning and at the end of the burst are all set to 0.

Tail	Data	ETSC	Data	Tail	Guard
3	39	64	39	3	9

Frequency correction burst

The frequency correction burst is used for frequency synchronization of the mobile. It is broadcast by the base station, together with the BCCH, but is not used by mobile stations.

The frequency correction burst uses a fixed bit field that is filled by all zeros. The 2 times 3 tail bits at the beginning and at the end of the burst are all set to 0.

Tail	Fixed	Tail	Guard
3	142	3	9

Dummy burst

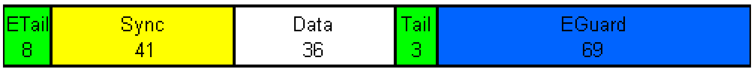
The dummy burst is transmitted by the base station in order to "fill" unused timeslots in the downlink C0 channels, in case that no other channel requires a burst to be transmitted. The dummy burst is not used by mobile stations.

The dummy burst uses a fixed sequence of "Mixed Bits". The 2 times 3 tail bits at the beginning and at the end of the burst are all set to 0.

Tail	Mixed	Tail	Guard
3	142	3	9

Access burst

The access burst is used by mobile stations for initial random access to the network and for handover. In packet data mode, it is also possible to use access bursts for the transmission of CONTROL_ACK_TYPE messages. Compared to a normal burst, the access burst has an extended guard period (EGuard, 68.25 symbols instead of 8.25 symbols) whereas the useful duration is shortened by 60 symbols.



BCCH and TCH bursts

The BCCH and TCH burst types are used to generate GSM signals with a multiframe structure and with (partially) channel-coded data; see chapter 4.2.6, "BCCH and TCH Bursts", on page 594.

4.2.4 Training Sequences

Training sequences are sequences of modulating bits which are used for time synchronization. The training sequences for the different burst types are defined in standard 3GPP TS 05.02. This standard also defines the position of the training sequence field in the center of the useful part of the burst.

The following types of training sequences are used in the GSM generator.

TSC 0 to TSC 7

26-symbol training sequences used for normal bursts. The training sequences occupy symbols no. 61 to 86 of the 148 useful symbols in the normal burst. The Training Sequence Code (TSC) 0 to 7 for GMSK-modulated normal bursts numbers the following sequences:

Table 4-3: Training sequences TSC 0 to TSC 7: Normal burst

Training Sequence Code	Training Sequence Bits (BN61 to BN86)
TSC 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)
TSC 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)
TSC 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)
TSC 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)
TSC 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)
TSC 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)
TSC 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)
TSC 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)

EDGE bursts are 8PSK-modulated so that each symbol encodes three bits. The training sequences contain 78 bits; they read as follows:

Table 4-4: Training sequences TSC 0 to TSC 7: EDGE burst

Training Sequence Code	Training Sequence Bits (BN61 to BN86)
TSC 0	(1,1,1;1,1,1;0,0,1;1,1,1;1,1,1;0,0,1;1,1,1;0,0,1;0,0,1;0,0,1;1,1,1;1,1,1;1,1,1; 1,1,1;0,0,1;1,1,1;1,1,1;1,1,1;0,0,1;1,1,1;1,1,1;0,0,1;1,1,1;0,0,1;0,0,1;0,0,1)
TSC 1	(1,1,1;1,1,1;0,0,1;1,1,1;0,0,1;0,0,1;1,1,1;0,0,1;0,0,1;0,0,1;1,1,1;0,0,1;0,0,1; 0,0,1;0,0,1;1,1,1;1,1,1;1,1,1;0,0,1;1,1,1;0,0,1;0,0,1;1,1,1;0,0,1;0,0,1;0,0,1)
TSC 2	(1,1,1;0,0,1;1,1,1;1,1,1;1,1,1;1,1,1;0,0,1;0,0,1;0,0,1;1,1,1;0,0,1;0,0,1;0,0,1; 1,1,1;0,0,1;1,1,1;1,1,1;0,0,1;1,1,1;1,1,1;1,1,1;1,1,1;0,0,1;0,0,1;0,0,1;1,1,1)
TSC 3	(1,1,1;0,0,1;1,1,1;1,1,1;1,1,1;0,0,1;0,0,1;0,0,1;0,0,1;1,1,1;0,0,1;0,0,1;1,1,1; 0,0,1;1,1,1;1,1,1;1,1,1;0,0,1;1,1,1;1,1,1;1,1,1;0,0,1;0,0,1;0,0,1;0,0,1;1,1,1)
TSC 4	(1,1,1;1,1,1;1,1,1;0,0,1;0,0,1;1,1,1;0,0,1;1,1,1;0,0,1;0,0,1;0,0,1;1,1,1;1,1,1; 0,0,1;1,1,1;1,1,1;1,1,1;1,1,1;1,1,1;0,0,1;0,0,1;1,1,1;0,0,1;1,1,1;0,0,1;0,0,1)
TSC 5	(1,1,1;0,0,1;1,1,1;1,1,1;0,0,1;0,0,1;0,0,1;1,1,1;0,0,1;1,1,1;0,0,1;0,0,1;1,1,1; 1,1,1;1,1,1;1,1,1;1,1,1;0,0,1;1,1,1;1,1,1;0,0,1;0,0,1;0,0,1;1,1,1;0,0,1;1,1,1)
TSC 6	(0,0,1;1,1,1;0,0,1;1,1,1;1,1,1;0,0,1;0,0,1;0,0,1;0,0,1;0,0,1;1,1,1;0,0,1;0,0,1; 1,1,1;1,1,1;1,1,1;0,0,1;1,1,1;0,0,1;1,1,1;1,1,1;0,0,1;0,0,1;0,0,1;0,0,1;0,0,1)
TSC 7	(0,0,1;0,0,1;0,0,1;1,1,1;0,0,1;0,0,1;0,0,1;0,0,1;1,1,1;1,1,1;1,1,1;0,0,1;1,1,1; 1,1,1;0,0,1;1,1,1;0,0,1;0,0,1;0,0,1;1,1,1;0,0,1;0,0,1;0,0,1;0,0,1;1,1,1;1,1,1)

Standard

"Standard" denotes the 64-bit extended training sequence that is used for synchronization bursts. The training sequence occupies bits no. 42 to 105 of the 148 useful bits in the synchronization burst. The standard training sequence bits for synchronization bursts are:

(BN42, BN43 ... BN105) = (1, 0, 1, 1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 0, 1, 1, 0, 1, 0, 1, 0, 0, 0, 1, 0, 1, 0, 1, 1, 1, 0, 1, 1, 0, 0, 0, 0, 1, 1, 0, 1, 1)

"Standard" also denotes the 142-bit long "Fixed" pattern for frequency correction bursts. The "Fixed" pattern occupies bits no. 3 to 144 of the 148 useful bits in the frequency correction burst and consists of all zeroes:

(BN3, BN4 ... BN144) = (0, 0 ... 0)

Mixed Bits

"Mixed Bits" denotes the 142-bit long "Mixed Bits" pattern for dummy bursts. This pattern occupies bits no. 3 to 144 of the 148 useful bits in the dummy burst. The "Mixed Bits" are defined as:

(BN3, BN4 ... BN144) = (1, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 1, 0, 1, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 1, 0, 0, 1, 1, 1, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 0, 0, 0, 1, 1, 1, 0, 0, 0, 1, 0, 1, 1, 1, 0, 0, 0, 1, 0, 1, 1, 1, 0, 0, 0, 1, 0, 1 0, 1, 1, 1, 0, 1, 0, 0, 1, 0, 1, 0, 0, 0, 1, 1, 0, 0, 1, 1, 0, 0, 1, 1, 1, 0, 0, 1, 1, 1, 1, 0, 1, 0, 0, 1, 1, 1, 1, 1, 0, 0, 0, 1, 0, 0, 1, 0, 1, 1, 1, 1, 1, 0, 1, 0, 1, 0)

TS 0 to TS 2

41-bit synchronization sequences for access bursts. The training sequences occupy bits no. 8 to 48 of the 88 useful bits in the access burst. The synchronization sequences TS 0 to TS 2 for access bursts contain the following bits:

Table 4-5: Training sequences TS 0 to TS 2: Access burst

Training Sequence Code	Training Sequence Bits (BN61 to BN86)
TS 0	0, 1, 0, 0, 1, 0, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 1, 1, 0, 0,1, 1, 0, 1, 0, 1, 0, 1, 0, 0, 0, 1, 1, 1, 1, 0, 0, 0)
TS 1	(0, 1, 0, 1, 0, 1, 0, 0, 1, 1, 1, 1, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 1, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 1, 1, 0, 1)
TS 2	(1, 1, 1, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 1, 1, 1, 0, 1, 0, 1, 0, 1, 1, 0, 0, 0, 0, 0, 1, 1, 0, 1, 1, 0, 1, 1, 1, 0, 1, 1, 1)

4.2.5 Power Control Levels

Power control levels (PCL) are used for dynamic control of the mobile power. The PCL range depends on the GSM band as shown below (phase 2 specifications).

Power Control Level (PCL)	P_{nom} [dBm], GSM 400/GT 800/700/850/900	P_{nom} [dBm], GSM 1800	P_{nom} [dBm], GSM 1900
0	39	30	30
1	39	28	28
2	39	26	26
3	37	24	24
4	35	22	22
5	33	20	20
6	31	18	18
7	29	16	16
8	27	14	14
9	25	12	12
10	23	10	10
11	21	8	8
12	19	6	6
13	17	4	4
14	15	2	2
15	13	0	0
16	11	0	0
17	9	0	0
18	7	0	0
19 – 28	5	0	0
29	5	36	0
30	5	34	33
31	5	32	32

4.2.6 BCCH and TCH Bursts

The Broadcast Control Channel (BCCH) and Traffic Channel (TCH) burst types are used to generate GSM signals with a multiframe structure according to standard 3GPP 45.002 and with (possibly) channel-coded data.

- The BCCH bursts are always transmitted in timeslot no. 0 and with a 51-multiframe structure (CCH multiframe). They occupy the frames numbered 2, 3, 4, and 5 in each 51-multiframe. According to the standard, the remaining timeslots no. 0 are occupied by other control channels.
- The GMSK-modulated TCH bursts are transmitted in timeslots no. 1 to seven and with a 26-multiframe structure (TCH). They occupy all frames in a 26-multiframe except the SACCH and IDLE frames (no. 12, 25, depending on the slot configuration).
- The 8PSK-modulated TCH bursts are transmitted in timeslots no. 1 to seven and with a 52-multiframe structure (PDCH). They occupy all frames in a 52-multiframe except the PTCCH and IDLE frames (no. 12, 25, 38, 51).

The SACCH frames are used for PCL signaling while a TCH burst configuration is active. The data content of the BCCH bursts and the TCH bursts is described in the following sections.

4.2.6.1 BCCH Data

In order to facilitate MS operation, the R&S CMW transmits System Information (SI) messages in its BCCH burst. The transmission is periodic, the SI message content is repeated after every 8 51-multiframes. Let FN be the GSM frame number and TC = (FN DIV 51) mod 8. The mapping between SI types and 51-multiframe numbers TC is as shown in the following table.

Table 4-6: Mapping of SI types to 51-multiframes

TC	SI Type
0	1
1 or 5	2
2 or 6	3
3 or 7	4
4	13

The BCCH data is always channel-coded. The SI message content depends on the selected GSM band.

4.2.6.2 TCH Data

The TCH bursts are filled with regular bit patterns or Pseudo Random Bit Sequences (PRBS) of different length. The "Traffic Mode" defines the modulation and channel coding scheme of the TCH data; the following table gives an overview. The TCH data is used to fill each frame except SACCH frames (full rate channels).

Table 4-7: Traffic modes and TCH data

Traffic mode	Modulation	Radio block header*)	Data
TCH/FS	GMSK	n/a	Channel coding
TCH/FS*	GMSK	n/a	No channel coding
SRB/MCS-5	8PSK	Channel coding, bit swapping, interleaving	No channel coding , bit swapping, interleaving
SRB/MCS-5*	8PSK	Channel coding, bit swapping, interleaving	No channel coding , bit swapping, no interleaving
SRB/MCS-9	8PSK	Channel coding, bit swapping, interleaving	No channel coding , bit swapping, interleaving
SRB/MCS-9*	8PSK	Channel coding, bit swapping, interleaving	No channel coding , bit swapping, no interleaving

*) The block header includes the Uplink State Flag (USF)

The EGPRS modulation and coding schemes 5 and 9 use different header formats; see standard 3GPP TS 45.002, section 6.3.1.3.

The TCH/FS signals (in combination with an alternating data source) and SRB/MCS-9 signals (in combination with a "BER Pattern") are particularly suited for Bit Error Rate (BER) tests using the "GSM Measurement" application (with option R&S CMW-KM200); refer to the relevant documentation.

4.2.7 Dynamic Aspects

In general the GSM generator must be re-started when the slot configuration is changed. This means that the mobile under test has to re-synchronize to the changed GSM generator signal.

The following parameters can be changed without interrupting the signal and re-synchronizing the mobile:

- The RF channel/frequency and the GSM band. If a BCCH burst type is active in slot 0 and the GSM band is changed, the generator will continue sending the BCCH with the System Information of the new band.
- The Power Control Level (PCL) that is signaled to the mobile on the SACCH in order to control the mobile's output power.

See also chapter 4.2.2, "GSM Frequency Bands and Channels", on page 588 and chapter 4.2.2, "GSM Frequency Bands and Channels", on page 588.

4.3 Application Sheets

Application sheets describe short application examples for select issues and provide related background information. The following application sheets are related to the "GSM Generator" firmware application.

4.3.1 Generating and Measuring a GSM Signal

This application sheet describes the generation and analysis of a GSM multislot signal containing different burst types and levels. The signal is generated by the real-time GSM generator; the GSM multi evaluation measurement is used to visualize the generated signal. Some basic measurement settings, in particular the trigger source and the access burst search, must be adjusted to the signal properties.

4.3.1.1 Options and Equipment Required

Generation and analysis of real-time GSM signals requires an R&S CMW500 or R&S CMW280 tester which is equipped with the following options:

- Option R&S CMW-KG200, "GSM Generator"

- Option R&S CMW-KM200, "GSM TX Measurements"

4.3.1.2 General Procedure

The signal is generated and analyzed as follows:

1. Define the signal properties using the "GSM – Generator" dialog and turn on the generator.
2. Open the "GSM TX Measurement – Multi Evaluation" dialog and adjust the measurement settings.
3. Select the appropriate views to display the signal properties.

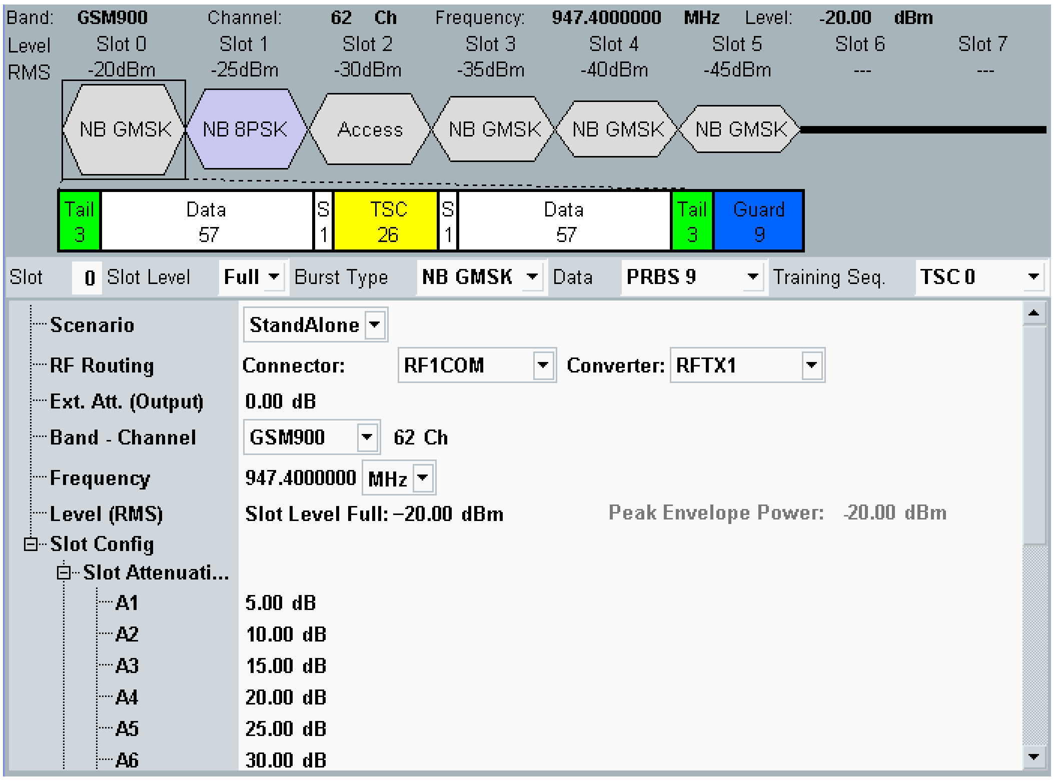
You can use different output and input connectors for the generated signal. In this case you have to connect both connectors using a coax cable. Alternatively (in particular, if absolute levels are not part of the analysis), you can even use the same bidirectional RF connector for the generated and measured signal.

4.3.1.3 Generating the Signal

To generate a multislot GSM signal with the specific frame structure shown below, proceed as follows:

1. Press "RESET" and perform a preset in order to set your R&S CMW to a defined state.
2. Open the task bar or the generator controller dialog and select the "GSM Generator" firmware application.
3. Click "Level (RMS) > Slot Level Full" and increase the full burst power to –20 dBm.
4. Click "Slot Config > Slot Attenuations" and define "A1: 5.00 dB", "A2: 10.00 dB", "A3: 15.00 dB", "A4: 20.00 dB", "A5: 25 dB", etc.
5. Use the input fields below the slot diagram and define slot 0 as follows: "Slot: Slot0", "Slot Level: Full", "Burst Type: NB GMSK".
6. Change the slot configuration of slots 1 to 4 as follows:
   "Slot: Slot1", "Slot Level: A1", "Burst Type: NB 8PSK"
   "Slot: Slot2", "Slot Level: A2", "Burst Type: Access"
   "Slot: Slot3", "Slot Level: A3", "Burst Type: NB GMSK"
   "Slot: Slot4", "Slot Level: A4", "Burst Type: NB GMSK"
   "Slot: Slot5", "Slot Level: A5", "Burst Type: NB GMSK"
7. Press ON | OFF to swich on the GSM generator.

The generated signal is routed to the default connector RF1 COM. The generator dialog visualizes the frame structure:The signal is generated and analyzed as follows:



4.3.1.4 Adjusting the Measurement Settings

To adjust the multi evaluation measurement to the properties of the signal, proceed as follows:

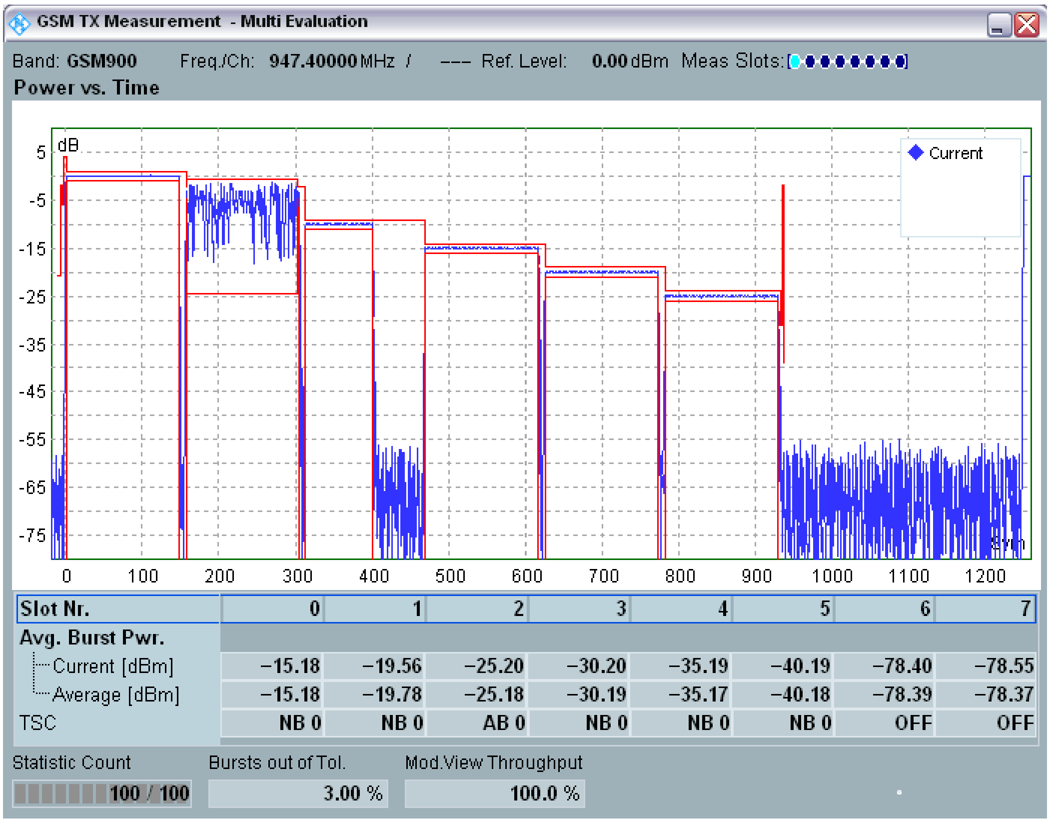
1. Open the task bar or the generator controller dialog and select the "GSM Multi Eval." firmware application.
2. Press "ON | OFF" to switch on the measurement.
3. Click "RF Settings > Frequency / Channel" and set the analyzer to the RF carrier frequency of 947.4 MHz. You may leave the remaining "RF Settings" unchanged.
4. Click "Trigger > Trigger Source: Acquisition", leaving the remaining "Trigger" settings unchanged.
5. Click "Config." to open the "GSM Multi Evaluation Configuration" dialog.
6. In the configuration dialog, select "Measurement Control > Access Burst Search: On".
7. Close the configuration dialog and return to the measurement dialog.

The "Acquisition" trigger locates the 2-slot gap in timeslots 6 and 7 to determine the beginning of the frame; the enabled access burst search is a prerequisite for the access burst measurement.

4.3.1.5 Visualizing the Signal

In the "GSM TX Measurement – Multi Evaluation" diagram, you can use the "Display" settings to select a view and optimize its appearance. Several of the "GSM TX Measurement – Multi Evaluation" views are well suited for the analysis of the generated multislot signal.

The "Power vs. Time" view below shows the entire GSM frame with the six active and two inactive slots. Normal bursts use a constant-envelope (GMSK) modulation scheme, causing only small power variations on the useful part of the burst. The EDGE burst in slot no. 1 is clearly distinguished by its large power variations, due to 8PSK modulation. The access burst in slot no. 3 is shorter than the other burst types. The power steps between the slots correspond to the selected attenuation values.



The "Overview" dialog shows the power vs. time view but also various modulation and spectrum results. The modulation accuracy of the generated signal is excellent, the spectrum results comply with GSM specifications.

Limitations concerning measured burst types

Synchronization bursts, dummy bursts, and frequency correction bursts are transmitted by GSM base stations only. The GSM multi evaluation measurement is optimized for mobile station tests; it is not appropriate for measuring these downlink burst types.

4.3.2 GSM BER Tests on Real-Time Signals

This application sheet describes a GSM Bit Error Rate (BER) test using the real-time GSM generator as a test signal source.

4.3.2.1 Options and Equipment Required

Generation and analysis of real-time GSM signals requires an R&S CMW500 or R&S CMW280 tester which is equipped with the following options:

- Option R&S CMW-KG200, "GSM Generator"
- Option R&S CMW-KM200, "GSM TX Measurements"

4.3.2.2 Test Setup

The downlink RF generator signal of the R&S CMW is fed to the input of the DUT. The R&S CMW measures the uplink signal and decodes the looped-back data. Most conveniently, a bi-directional connection with a single coax cable is used. The DUT is connected to one of the RF input connectors (RF COM) at the front panel of the R&S CMW. No additional cabling and no external trigger is needed. The input level ranges of all RF COM connectors are identical.

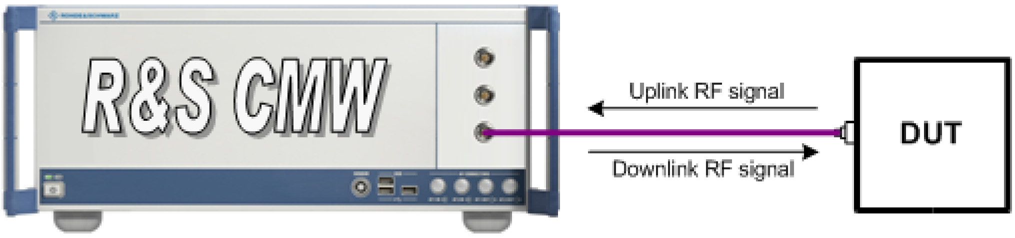


Fig. 4-1: Test setup for RX tests

4.3.2.3 General Procedure (GMSK Bursts)

The configuration of the mobile, the generator, and the measurement must match, in accordance with the selected modulation type (GMSK, 8PSK). For BER tests on GMSK-modulated, channel-coded signals, proceed as follows:

1. Establish the basic test setup for RX tests, connecting the mobile under test to one to the RF connectors RF 1 COM or RF 2 COM.
2. **Mobile:** Command the mobile to test loop C to ensure that it loops back the received data using GMSK-modulated normal bursts.
3. **Generator:** Open the "GSM Generator" application and select the following slot configuration: Slot 0, Burst Type: BCCH, Slot 1 (or any other slot(s)): Burst Type: TCH, Data Source: Alternating, Traffic Mode: Traffic Mode: TCH/FS (see figure below). Start the generator.
4. **Measurement:** Open the "GSM Multi Evaluation" measurement application and enable the BER measurement ("Multi Evaluation > Assign Views > BER: ON"). Select the appropriate loop ("Config... > Measurement Control > BER > Loop: C") and view ("Display > Select View: BER") and press "ON | OFF" to start the measurement.

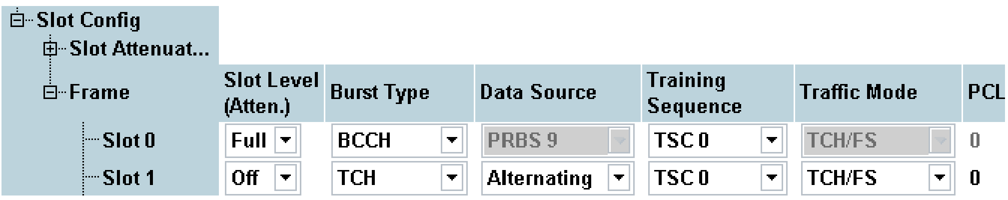


Fig. 4-2: Sample configuration of the GSM generator (GMSK burst, channel-coded)

4.3.2.4 Comparison of GMSK and 8PSK Test Settings

The following table describes the configuration for BER tests on GMSK and 8PSK-modulated signals.

Modulation	Mobile configuration	Generator configuration	Measurement configuration
GMSK	Test loop C	Burst Type: TCH Data Source: Alternating Traffic Mode: TCH/FS	Loop: C
8PSK	SRB loop	Burst Type: TCH Data Source: BER pattern Traffic Mode: SRB/MCS9*	Loop: SRB

The GSM generator may be replaced by a suitable waveform file; refer to the separate application sheet "GSM BER Tests on ARB Signals".

4.4 GUI Reference

The GSM generator is configured using the following groups of settings.

4.4.1 Generator Control

The generator is turned on or off using the ON | OFF key.

See also: "Generator Control" in the R&S CMW user manual, chapter "System Overview"

GSM Generator (Softkey)
The softkey shows the current generator state.

Remote command:
SOURce:GSM:GEN<i>:STATe

4.4.2 Signal Routing and RF Settings

The following settings define the output path and the RF properties of the generated GSM signal.

See also: "RF Path Settings (Generators)" in the R&S CMW user manual, chapter "System Overview"

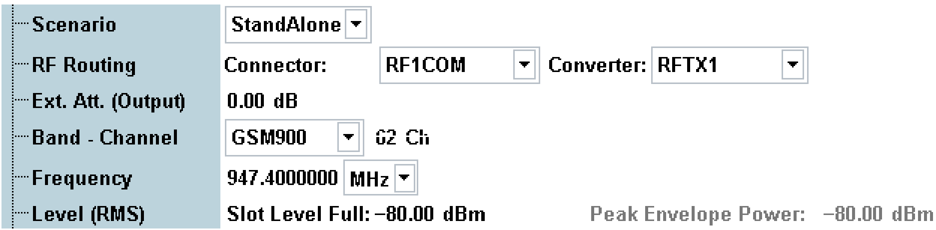


Fig. 4-3: GSM generator RF settings

Scenario

This software version supports only a standalone scenario.

Remote command:
n/a

Routing

Selects the output path for the generated RF signal, i.e. the output connector and the TX module to be used.

Depending on your hardware configuration there are dependencies between both parameters. Select the RF connector first. The "Converter" parameter offers only values compatible with the selected RF connector.

Remote command:

`ROUTe:GSM:GEN<i>:SCENario:SALone`

`ROUTe:GSM:GEN<i>?`

External Attenuation (Output)

Defines the value of an external attenuation (or gain, if the value is negative) in the output path. With an external attenuation of x dB, the power of the generated signal is increased by x dB. The actual generated levels are equal to the displayed values plus the external attenuation.

If a correction table for frequency-dependent attenuation is active for the chosen connector, then the table name and a button are displayed. Press the button to display the table entries.

Remote command:

`SOURce:GSM:GEN<i>:RFSettings:EATTenuation`

Band – Channel / Frequency

Sets the RF carrier frequency of the GSM generator. The relation between band, frequency and channel number is defined by 3GPP (see "GSM Frequency Bands and Channels").

You can specify the RF frequency in two ways:

- Enter the frequency directly. The band and channel settings can be ignored or used for validation of the entered frequency. For validation select the designated band. The channel number resulting from the selected band and frequency is displayed. For an invalid combination no channel number is displayed.
- Select a band and enter a channel number valid for this band. The R&S CMW calculates the resulting frequency.

Note: Dynamic band and channel change . You can change the channel and even the GSM band while the GSM generator is running. There is no need to re-start the generator and re-synchronize the mobile under test. If a BCCH burst type is active in slot 0 and the GSM band is changed, the generator will continue sending the BCCH with the System Information of the new band.

Remote command:

`SOURce:GSM:GEN<i>:BAND`

`SOURce:GSM:GEN<i>:RFSettings:FREQuency`

`SOURce:GSM:GEN<i>:CHANnel`

Level (RMS)

Sets the base level of the generator ("Slot Level Full"). The individual slot levels are defined relative to this base level.

The resulting actual Peak Envelope Power (PEP) is measured and displayed for information when the generator is turned on. The indicated PEP corresponds to the actual peak output level at the output connector, assuming the External Attenuation (Output) is zero.

The signal at the output connector is limited to the maximum level stated in the data sheet. When the settings result in a signal exceeding this limit, the Level (RMS) is decreased automatically.

Remote command:

`SOURce:GSM:GEN<i>:RFSettings:LEVel:RMS`

`SOURce:GSM:GEN<i>:RFSettings:LEVel:PEAK?`

4.4.3 Slot Configuration

The GSM signal is periodic; it consists of a repeated TDMA frame. The frame contains 8 timeslots, each of which can be filled with a burst. There are almost no restrictions concerning the burst types in a slot, their levels and the transmitted data.

The entire slot is displayed graphically. The example below shows a frame with three active timeslots. The first timeslot (slot no. 0) accommodates an access burst; slot no. 2 contains a GMSK-modulated normal burst, slot no. 3 an 8PSK-modulated normal burst. The different height of the burst symbols indicate different burst powers. The zoomed-out rectangular diagram below the frame shows the bit structure of the selected "NB GMSK" burst.

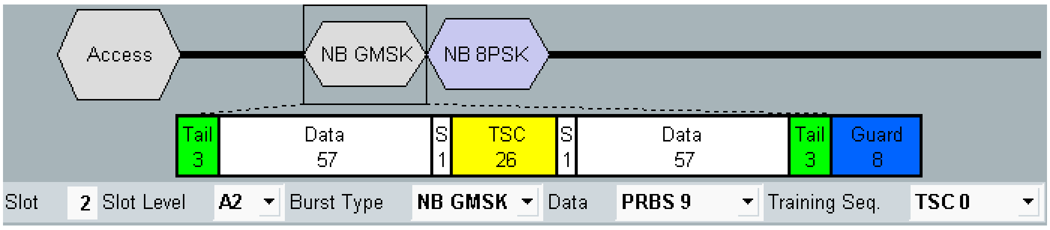


Fig. 4-4: GSM slot configuration

The signal properties in each timeslot are defined below the diagrams. Alternatively, you can access all slot settings in the settings tree below the diagram area via "Slot Config. > Frame".

Slot

Selects the slot to be configured; see "GSM Signal Parameters" on page 3

Remote command:

No explicit command. The parameters for all slots are defined with a single command; see below.

Slot Level

Selects the average burst power in the slot. "Off" turns off the slot power entirely: the timeslot is inactive.

The average burst power is the average power in the useful part of the burst (see standards 3GPP TS 05.05 and 3GPP TS 05.02), excluding the guard period where the mobile transmission is attenuated (power-up and power-down ramps). For normal bursts the useful part comprises 147 symbol periods; it is centered around the transition between bits 13/14 of the training sequence; see "Burst Types" on page 5.

Note: Absolute and relative slot levels . The maximum slot level to be set is the "Full" slot level. With this selection, the average burst power corresponds to the "Slot Level Full" setting in the tabular section of the generator dialog.
To define lower slot levels, use one of the "Slot Attenuations" A1 to A7, which will reduce the burst power by a dB-factor relative to the full level. In this way you can set the level in each slot independently.

Remote command:

`SOURce:GSM:GEN<i>:SCONfig:SLEVel`

Burst Type

The burst type defines the length, modulation and bit structure of the burst; see "Burst Types" on page 5.

Broadcast Control Channel (BCCH) bursts are reserved for slot 0, while Traffic Channel (TCH) bursts are reserved for slots 1 to 7.

Remote command:

SOURce:GSM:GEN<i>:SCONfig:BTYPe

Data Source

Selects the bit sequence to be transmitted in the data fields of the bursts.

- **All 0:** Regular bit pattern 0000 ...
- **All 1:** Regular bit pattern 1111 ...
- **Alternating:** Regular bit pattern 010101 ... The "Alternating" pattern is suitable for BER tests on GMSK-modulated signals using the "GSM Measurement" application (with option R&S CMW-KM200); see chapter 4.3.2, "GSM BER Tests on Real-Time Signals", on page 600.
- **PRBS9 ... PRBS23:** Pseudo Random Bit Sequences of different length according to CCITT 0.153
- **BER Pattern:** PRBS sequence, to be used for a 8PSK-modulated signal with modulation and coding scheme MCS-9 ("Traffic Mode: SRB MCS-9 or SRB MCS-9*"). The "BER Pattern" is suitable for BER tests on EGPRS channels using the "GSM Measurement" application (with option R&S CMW-KM200); see chapter 4.3.2, "GSM BER Tests on Real-Time Signals", on page 600.

The data fields for frequency correction bursts, dummy bursts and BCCH bursts are not configurable, so the selected "Data" is not valid for these burst types. The BCCH bursts (slot 0) carry System Information messages; see chapter 4.2.6, "BCCH and TCH Bursts", on page 594.

Remote command:

SOURce:GSM:GEN<i>:SCONfig:DSOurce

Training Sequence

Sets one of the specified GSM training sequences TSC 0 to TSC 7 for the burst; see "Training Sequences" on page 6 . For access bursts, only three training sequences TS 0 to TS 2 are available. Synchronization, frequency correction and dummy bursts use fixed or arbitrary ("Mixed") sequences, so no training sequence selection is possible.

Remote command:

SOURce:GSM:GEN<i>:SCONfig:TSEQuence

Slot Config

Configures up to 7 relative slot levels, to be used for individual "Slot Level" settings.

Slot Attenuations ← Slot Config

If the "Slot Level" is set to one of the A<n> values (<n> = 1 to 7), the burst level in the slot is reduced to:

Burst level = <Slot Level Full> — A<n>

Remote command:

SOURce:GSM:GEN<i>:SCONfig:SATTenuation

Frame ← Slot Config
Tabular overview of the burst settings in all 8 timeslots.

In addition to the settings described above, the "Frame" section provides the "Traffic Mode" and "PCL" selection for traffic channels (TCH).

Traffic Mode ← Frame ← Slot Config
Selects the modulation scheme and coding for the transfer of speech data or radio blocks via traffic channels. The setting is valid for traffic channel burst types only (slots 1 to 7).The traffic mode for slot 0 is unavailable irrespective of the burst type setting.
- **TCH/FS:** Traffic channel / full rate speech
- **TCH/FS*:** Traffic channel / full rate speech uncoded
- **SRB MCS-5:** EGPRS Switching Radio Blocks (8PSK modulation), modulation and coding scheme MCS-5, channel-coded header and interleaved data
- **SRB MCS-5*:** Like before, but non-interleaved data
- **SRB MCS-9** EGPRS Switching Radio Blocks (8PSK modulation), modulation and coding scheme MCS-9, channel-coded header and interleaved data
- **SRB MCS-9*:** Like before, but non-interleaved data

For more detailed information refer to chapter 4.2.6.2, "TCH Data", on page 595.

Remote command:
`SOURce:GSM:GEN<i>:SCONfig:TMODe`

PCL ← Frame ← Slot Config
XE "PCL (GSM Generator)" Selects the Power Control Level (PCL) that is signaled to the mobile under test on the Slow Associated Control Channel (SACCH) in order to control its output power. The setting is valid for traffic channel (TCH) burst types and speech channels ("Traffic Mode: TCH/FS or TCH/FS*") only.

The PCL values for slots 1 to 7 control the output power of the mobile in the corresponding timeslots 0 to 7. The PCL for slot 0 is ignored.

Note: Dynamic PCL change. You can change the PCL settings (and thus modify the mobile output power) while the GSM generator is running. There is no need to re-start the generator and re-synchronize the mobile under test.

For more information refer to chapter 2.2.9.2, "Power Control Levels", on page 30.

Remote command:
`SOURce:GSM:GEN<i>:SCONfig:PCL`

4.5 Programming

The following examples show how to control and configure the GSM generator via a remote-control program.

See also: "Remote Control" in the R&S CMW user manual

4.5.1 Key Features

The GSM generator is programmed as follows:

- The generator is controlled by SCPI commands with the following syntax: `...:GSM:GEN:...`
- After a `*RST`, the generator must be switched on: `SOURce:GSM:GEN:STATe ON`. `*OPC?` ensures that the RF generator signal is actually available at the selected RF output before the next command line is executed.

An RF signal is available at the selected RF output as soon as the RF generator has reached the ON state. Use `SOURce:GSM:GEN:STATe?` to query the generator state.

4.5.2 Specifying General and RF Settings

```
FPRINT *************************************************************************
FPRINT System-Reset
FPRINT *************************************************************************
*RST; *OPC?
*CLS; *OPC?

FPRINT *************************************************************************
FPRINT Route output signal, define external attenuation.
FPRINT *************************************************************************
ROUTe:GSM:GEN:SCENario:SALone RF1C, TX1
SOURce:GSM:GEN:RFSettings:EATTenuation 2.2

FPRINT *************************************************************************
FPRINT Set frequency and level.
FPRINT *************************************************************************
SOURce:GSM:GEN:RFSettings:FREQuency 9.594E+008
SOURce:GSM:GEN:RFSettings:LEVel:RMS -70.0

FPRINT *************************************************************************
FPRINT Alternatively set the frequency indirectly via band and channel
FPRINT (Channel 122 in GSM900 corresponds to 959.4 MHz).
FPRINT *************************************************************************
SOURce:GSM:GEN:BAND G09
SOURce:GSM:GEN:CHANnel 122
SOURce:GSM:GEN:RFSettings:FREQuency?

WAITKEY >RF settings completed, press "OK" to configure slots<
```

4.5.3 Slot Configuration

```
FPRINT *************************************************************************
FPRINT Define multislot configuration in timeslots 0 to 7:
FPRINT Define slot attenuations, define level, burst type,
FPRINT data source, and training sequence for each slot.
```

```
FPRINT ************************************************************************
SOURce:GSM:GEN:SCONfig:SATTenuation
    5.000E00, 1.000E+01, 1.500E+01, 2.000E+01, 2.500E+01, 3.000E+01, 3.500E+01
SOURce:GSM:GEN:SCONfig:SLEVel FULL, A1, A2, A3, A4, OFF, OFF, OFF
SOURce:GSM:GEN:SCONfig:BTYPe ACCess, GMSK, EPSK, DUMMy, SYNCh, FCOR, GMSK, GMSK
SOURce:GSM:GEN:SCONfig:DSOurce PR9, PR9, PR9, PR9, PR9, PR9, PR9, PR9

WAITKEY >Slot configuration completed, press "OK" to turn the signal on<
```

4.5.4 Switching on the Generator

```
FPRINT ************************************************************************
FPRINT Switch on generator. With command synchronization, the queried
FPRINT generator state is "ON".
FPRINT ************************************************************************
SOURce:GSM:GEN:STATe ON; *OPC?
SOURce:GSM:GEN:STATe?

FPRINT ************************************************************************
FPRINT Query the peak envelope power
FPRINT ************************************************************************
SOURce:GSM:GEN:RFSettings:LEVel:PEAK?
```

The GSM signal configuration defined by the command sequence above is shown in the following figure.

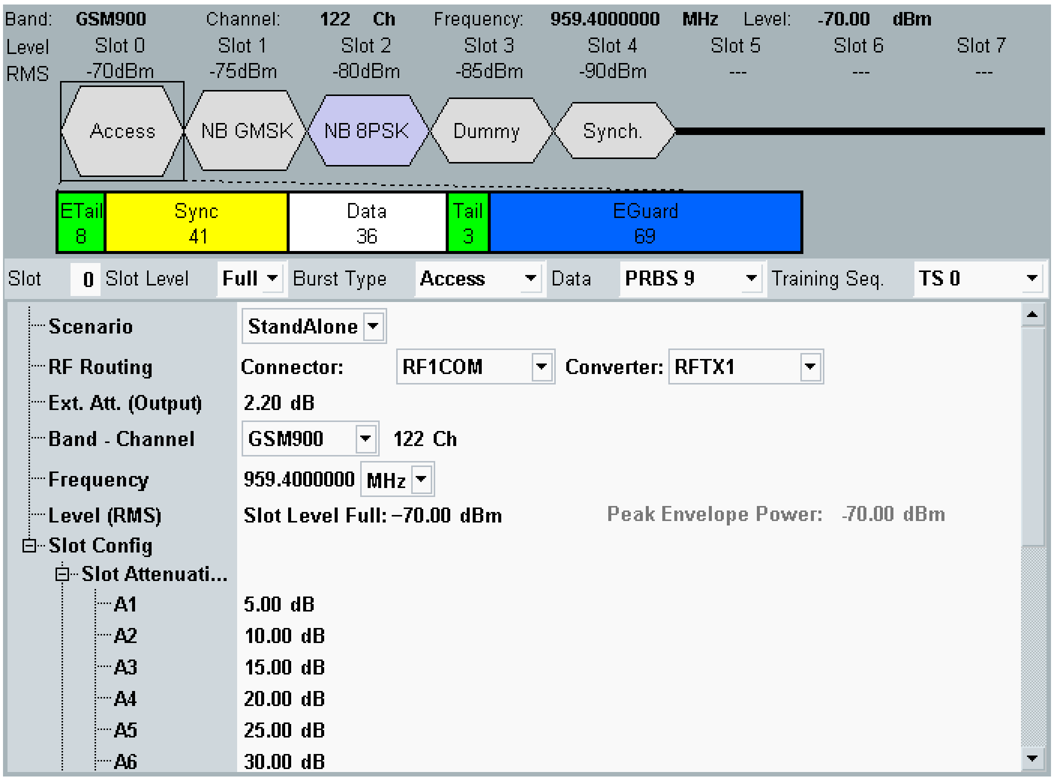


Fig. 4-5: Example for GSM generator configuration

4.6 Command Reference

The following sections provide detailed reference information on the remote control commands of the GSM generator.

Issues of special interest for all commands

GEN<i> is used as abbreviation of "GENerator<instance>". For better readability only the abbreviated form (which is also accepted by the instrument) is given in the command reference.

The <instance> is relevant for instruments supporting several instances of the same firmware application. It can be omitted if the instrument supports only one instance, or to address the first instance.

See also: "Firmware Applications" in the R&S CMW user manual, chapter "Remote Control"

Command groups

The commands of the GSM generator are divided into the groups listed below.

4.6.1 Generator Control and States

The following command controls the generator and retrieves its state.

SOURce:GSM:GEN<i>:STATe <Control>

Turns the generator on or off.

See also: "Generator Control" in the R&S CMW user manual, chapter "Remote Control"

Setting parameters:

<Control> ON | OFF

Switch generator **ON** or **OFF**

*RST: OFF

Return values:

<State> OFF | PENDing | ON

OFF: generator switched off
PEND: generator switched on but no signal available yet
ON: generator switched on, signal available

*RST: OFF

Example: See Switching on the Generator

Firmware/Software: V1.0.4.11

Manual operation: See "GSM Generator (Softkey)" on page 602

4.6.2 Signal Routing

The following commands select the connector for the generator and define an external attenuation value.

ROUTe:GSM:GEN<i>:SCENario:SALone <TXConnector>, <RFConverter>

Activates the standalone scenario and selects the output path for the generated RF signal, i.e. the RF connector and the TX module.

Depending on the installed hardware and the active sub-instrument or instance <i> only a subset of the described parameter values is allowed. The *RST values and the mapping of virtual connector names to physical connectors also depend on the active sub-instrument or instance <i>.

All instruments are equipped with the RF 1 and RF 2 connectors and one RX and TX module. Additional RF connectors and RX/TX modules are optional.

See also: "Signal Path Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<TXConnector> RF1C | RF1O | RF2C | RF3C | RF3O | RF4C | RFAC | RFAO | RFBC

RF1C, RF2C, RF3C, RF4C, RF1O, RF3O:
RF 1 COM to RF 4 COM and RF 1/3 OUT front panel connectors

RFAC, RFBC, RFAO:
Virtual names for the RF COM and RF OUT connectors

<RFConverter> TX1 | TX2 | TX3 | TX4

TX module for the output path

Example: See Specifying General and RF Settings

Firmware/Software: V2.0.10

Manual operation: See "Routing" on page 603

ROUTe:GSM:GEN<i>?

Queries the active test scenario and connector assignment.

Return values:

<Scenario> SALone

standalone scenario (unique value)

<Controller> "CMWBase1"

<TXConnector> RF1C | RF1O | RF2C | RF3C | RF3O | RF4C

RF 1 COM to RF 4 COM and RF 1/3 OUT front panel connectors

<RFConverter> TX1 | TX2 | TX3 | TX4

TX module for the output path

Example: See Specifying General and RF Settings

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "Routing" on page 603

SOURce:GSM:GEN<i>:RFSettings:EATTenuation <ExtRFOutAtt>

Defines an external attenuation (or gain, if the value is negative), to be applied to the RF output connector.

Parameters:

<ExtRFOutAtt> Range: -50 dB to 90 dB
*RST: 0 dB
Default unit: dB

Example: See Specifying General and RF Settings

Firmware/Software: V1.0.4.11

Manual operation: See "External Attenuation (Output)" on page 603

4.6.3 RF Settings

The following commands configure general generator settings, e.g. frequency and base level.

SOURce:GSM:GEN<i>:RFSettings:FREQuency <Frequency>

Sets the RF carrier frequency of the GSM generator. Use `SOURce:GSM:GEN<i>:CHANnel` to specify the RF frequency as a GSM channel number.

Parameters:

<Frequency> Range: 100 MHz to 6000 MHz (increment 0.1 Hz)
*RST: 947.4E+6 Hz
Default unit: Hz

Example: See Specifying General and RF Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Band – Channel / Frequency" on page 603

SOURce:GSM:GEN<i>:CHANnel <Channel>

Sets the RF carrier frequency as a GSM channel number.

If the channel number is valid for the current frequency band (`SOURce:GSM:GEN<i>:BAND`) the corresponding center frequency (`SOURce:GSM:GEN<i>:RFSettings:FREQuency`) is set.

If the channel number is queried while an out-of-band frequency is set, the response is "INV".

Parameters:

<Channel> Range: Depending on the current frequency band
*RST: 62

Example: See Specifying General and RF Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Band – Channel / Frequency" on page 603

SOURce:GSM:GEN<i>:BAND <Band>

Selects the frequency band of the generated GSM signal. The frequency band is relevant if channel numbers are used to specify the RF frequency (`SOURce:GSM:GEN<i>:CHANnel`).

Parameters:

<Band> G04 | GG08 | G085 | G09 | G18 | G19

G04: GSM400
GG08: GSMGT800
G085: GSM850
G09: GSM900
G18: GSM1800
G19: GSM1900

*RST: G09

Example: See Specifying General and RF Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Band – Channel / Frequency" on page 603

SOURce:GSM:GEN<i>:RFSettings:LEVel:RMS <RMS>

Sets the "Full-Slot Level" (RMS level) of the generator.

Parameters:

<RMS> Range: -130 dBm to -5 dBm at RF 1 COM and RF 2 COM, -120 dBm to 3 dBm at RF 1 OUT (increment 0.01 dB); please also notice the ranges quoted in the data sheet.
*RST: -80 dBm
Default unit: dBm

Example: See Specifying General and RF Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Level (RMS)" on page 604

SOURce:GSM:GEN<i>:RFSettings:LEVel:PEAK?

Queries the Peak Envelope Power (PEP) of the RF generator.

Return values:

<PeakOutputPower> Range: -130 dBm to -5 dBm at RF 1 COM and RF 2 COM, -120 dBm to 3 dBm at RF 1 OUT (increment 0.01 dB); please also notice the ranges quoted in the data sheet.
*RST: -80 dBm
Default unit: dBm

Example: See Switching on the Generator

Usage: Query only

Firmware/Software: V1.0.4.11

Manual operation: See "Level (RMS)" on page 604

4.6.4 Slot Configuration

The following commands configure the 8 timeslots of the generated GSM signal.

SOURce:GSM:GEN<i>:SCONfig:SLEVel <SlotLevel0>, <SlotLevel1>, <SlotLevel2>, <SlotLevel3>, <SlotLevel4>, <SlotLevel5>, <SlotLevel6>, <SlotLevel7>

Defines the average burst power in timeslots 0 to 7.

Parameters:

<SlotLevel0> ... <SlotLevel8>
: OFF | FULL | A1 | A2 | A3 | A4 | A5 | A6 | A7

OFF: Level off (slot inactive)
FULL: Full slot level; see `SOURce:GSM:GEN<i>:RFSettings:LEVel:RMS`
A1 to A7: Full-slot level attenuated by values A1 ... A7; see `SOURce:GSM:GEN<i>:SCONfig:SATTenuation`

*RST: FULL (slot 0), OFF (all other slots)

Example: See Slot Configuration

Firmware/Software: V1.0.4.11

Manual operation: See "Slot Level" on page 605

SOURce:GSM:GEN<i>:SCONfig:BTYPe <BurstType0>, <BurstType1>, <BurstType2>, <BurstType3>, <BurstType4>, <BurstType5>, <BurstType6>, <BurstType7>

Selects the bust type (defining the length, modulation type, and bit structure) of the bursts in timeslots 0 to 7.

Parameters:

<BurstType0> ... <BurstType7>
: GMSK | EPSK | SYNCh | FCOR | DUMMy | ACCess | BCCH | TCH

GMSK: Normal, GMSK-modulated burst
EPSK: Normal, 8PSK-modulated burst
SYNCh: Synchronization burst
FCOR: Frequency correction burst
DUMMy: GSM-specific dummy burst
ACCess: Access burst
BCCH: Broadcast control channel (for slot 0)
TCH: Traffic channel (for slots 1 to 7)

*RST: GMSK

Example: See Slot Configuration

Firmware/Software: V1.0.4.11

Manual operation: See "Burst Type" on page 606

SOURce:GSM:GEN<i>:SCONfig:DSOurce <DataSource0>, <DataSource1>, <DataSource2>, <DataSource3>, <DataSource4>, <DataSource5>, <DataSource6>, <DataSource7>

Selects the bit sequence to be transmitted in the data fields of the bursts in slot 0 to 7. The allowed settings depend on the burst type (`SOURce:GSM:GEN<i>:SCONfig:BTYPe`): The data fields for frequency correction bursts, dummy bursts are not configurable.

Parameters:

<DataSource0> ... <DataSource7>
ALL0 | ALL1 | PR9 | PR11 | PR15 | PR16 | PR20 | PR21 | PR23 | ALTernating | BERPattern

ALL0, ALL1: Regular bit patterns All 0 or All 1
PR9, PR11 ... PR23: Pseudo random bit sequences of different lengths
ALTernating: Aternating 0101... sequence
BERPattern: PRBS sequence for BER tests

*RST: Depending on the burst type (PR9 for normal bursts)

Example: See Slot Configuration

Firmware/Software: V1.0.4.11
V1.0.10.1 for `ALTernating` and `BERPattern`

Manual operation: See "Data Source" on page 606

SOURce:GSM:GEN<i>:SCONfig:TSEQuence <TrainingSeq0>, <TrainingSeq1>, <TrainingSeq2>, <TrainingSeq3>, <TrainingSeq4>, <TrainingSeq5>, <TrainingSeq6>, <TrainingSeq7>

Sets one of the specified GSM training sequences TSC 0 to TSC 7 for the burst in slot 0 to 7. The allowed settings depend on the burst type `SOURce:GSM:GEN<i>:SCONfig:BTYPe`().

Parameters:

<TrainingSeq0> ... <TrainingSeq7>
TSC0 | TSC1 | TSC2 | TSC3 | TSC4 | TSC5 | TSC6 | TSC7 | STANdard | TS0 | TS1 | TS2

TS0 to TS2: Standard GSM training sequences TS 0 to TS 2, for access bursts
STANdard: Standard sequence, for synchronization bursts and frequency correction bursts
TSC0 to TSC7: Standard GSM training sequences TSC 0 to TSC 7, for all other burst types except the dummy burst

*RST: Depending on the burst type (TSC 0 for normal bursts)

Example: See Slot Configuration

Firmware/Software: V1.0.4.11

Manual operation: See "Training Sequence" on page 606

SOURce:GSM:GEN<i>:SCONfig:SATTenuation <Attenuation1>, <Attenuation2>, <Attenuation3>, <Attenuation4>, <Attenuation5>, <Attenuation6>, <Attenuation7>

Configures 7 relative slot levels, to be used for individual slot level settings (`SOURce:GSM:GEN<i>:SCONfig:SLEVel`).

Parameters:

<Attenuation1> ... <Attenuation7>

Range: 0 dB to 40 dB
*RST: 0 dB
Default unit: dB

Example: See Slot Configuration

Firmware/Software: V1.0.4.11

Manual operation: See "Slot Attenuations" on page 606

SOURce:GSM:GEN<i>:SCONfig:TMODe <TrafficMode0>, <TrafficMode1>, <TrafficMode2>, <TrafficMode3>, <TrafficMode4>, <TrafficMode5>, <TrafficMode6>, <TrafficMode7>

Selects the modulation scheme and coding for the transfer of speech data or radio blocks via traffic channels. The setting is valid for traffic channel burst types only (`SOURce:GSM:GEN<i>:SCONfig:BTYPe` TCH). Slot no. 0 must carry a BCCH channel with TCH/FS traffic mode, therefore the first entry (<Mode 0>) is ignored.

Parameters:

<TrafficMode0> ... <TrafficMode7>

TFS | TFS2 | SM5 | SM52 | SM9 | SM92

TFS: TCH/FS
TFS2: TCH/FS*
SM5: SRB/MCS-5
SM52: SRB/MCS-5*
SM9: SRB/MCS-9
SM92: SRB/MCS-9*

*RST: TFS

Example: See Slot Configuration

Firmware/Software: V1.0.4.11

Manual operation: See "Traffic Mode" on page 607

SOURce:GSM:GEN<i>:SCONfig:PCL <PCL0>, <PCL1>, <PCL2>, <PCL3>, <PCL4>, <PCL5>, <PCL6>, <PCL7>

Selects the Power Control Level (PCL) that is signaled to the mobile under test. The setting is valid for traffic channel burst types only (`SOURce:GSM:GEN<i>:SCONfig:BTYPe` TCH). The PCL values <PCL 1> to <PCL 7> control the output power of the mobile in slots 0 to 7; the first entry (<PCL 0>) is ignored.

Parameters:

<PCL0> ... <PCL7> Range: 0 to 31
*RST: 0

Example: See Slot Configuration

Firmware/Software: V1.0.4.11

Manual operation: See "PCL" on page 607

4.7 List of Commands

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Symbols