R&S®SMM-K40/-K41
GSM/EDGE, EDGE Evolution
User Manual

1179204802

Version 05

This document describes the following software options:

- R&S®SMM-K40 GSM/EDGE (1441.2020.xx)
- R&S®SMM-K41 EDGE Evolution (1441.2014.xx)

This manual describes firmware version FW 5.30.047.xx and later of the R&S®SMM100A.

The following abbreviations are used throughout this manual: R&S®SMM100A is abbreviated as R&S SMM, R&S®WinIQSIM2™ is abbreviated as R&S WinIQSIM2; the license types 02/03/07/11/13/16/12 are abbreviated as xx.

Contents

1 Welcome to the GSM/EDGE and EDGE evolution digital standard

The R&S SMM-K40 is a firmware application that adds functionality to generate signals in accordance with the GSM/EDGE standard, based on the GMSK and 8PSK modulation. Option R&S SMM-K41 EDGE Evolution extends the GSM/EDGE signal generation with simulation of higher order modulations (QPSK, 16QAM and 32QAM) for higher symbol rate bursts and higher order modulations (16QAM and 32QAM) for normal symbol rate bursts.

The R&S SMM-K40 features:

- Generation of all GSM variants. There is no restriction regarding the use of GSM slots, EDGE slots and EDGE Evolution slots.
- Generation of both the transmitter signal of a base station (BS) and the transmitter signal of user equipment (UE).
- Configuration of all kind of GSM/EDGE data bursts Normal (full rate and half rate) and EDGE; control bursts Access, Frequency Correction and Synchronization; a Dummy Burst; and bursts for test purposes, All_Data (GSM and EDGE).
- Generation of half rate slots and multi slots for HSCSD (high speed circuit switched data) and (E)GPRS (general packet radio service) configurations at the physical level.
  Allocation of multiple slots to a single connection (channel banding).
- Three configuration modes for each the normal and the higher symbol rate mode: unframed, frame (single) and frame (double)

The R&S SMM-K41 features:

- Generation of burst types defined for normal symbol rate and higher order modulation schemes such as the data burst Normal (16QAM and 32QAM) and All_Data (16QAM and 32QAM) as well as with the burst types defined for higher symbol rates HSR (QPSK, 16QAM and 32QAM) and HSR All_Data (QPSK, 16QAM and 32QAM).
- Configuration and generation of burst for VAMOS operation. Available are All_Data (AQPSK) and Normal (AQPSK) bursts for full and half rate operation.

For more information, see data sheet.

This user manual contains a description of the functionality that the application provides, including remote control operation.

All functions not discussed in this manual are the same as in the base unit and are described in the R&S SMM100A user manual. The latest version is available at:

www.rohde-schwarz.com/manual/SMM100A

Installation

You can find detailed installation instructions in the delivery of the option or in the R&S SMM100A service manual.

1.1 Accessing the GSM/EDGE dialog

To open the dialog with GSM/EDGE settings

► In the block diagram of the R&S SMM100A, select "Baseband > GSM/EDGE".

A dialog box opens that displays the provided general settings.

The signal generation is not started immediately. To start signal generation with the default settings, select "State > On".

1.2 What's new

This manual describes firmware version FW 5.30.047.xx and later of the R&S®SMM100A.

Compared to the previous version, it provides the new features listed below:
- Time-based triggering, see "Time Based Trigger" on page 19 and "Trigger Time" on page 20.
- Editorial changes

1.3 Documentation overview

This section provides an overview of the R&S SMM100A user documentation. Unless specified otherwise, you find the documents at:

www.rohde-schwarz.com/manual/smm100a

1.3.1 Getting started manual

Introduces the R&S SMM100A and describes how to set up and start working with the product. Includes basic operations, typical measurement examples, and general information, e.g. safety instructions, etc. A printed version is delivered with the instrument.

1.3.2 User manuals and help

Separate manuals for the base unit and the software options are provided for download:
- Base unit manual
  Contains the description of all instrument modes and functions. It also provides an introduction to remote control, a complete description of the remote control commands with programming examples, and information on maintenance, instrument interfaces and error messages. Includes the contents of the getting started manual.

- Software option manual
Contains the description of the specific functions of an option. Basic information on operating the R&S SMM100A is not included.

The contents of the user manuals are available as help in the R&S SMM100A. The help offers quick, context-sensitive access to the complete information for the base unit and the software options.

All user manuals are also available for download or for immediate display on the Internet.

1.3.3 Service manual

Describes the performance test for checking compliance with rated specifications, firmware update, troubleshooting, adjustments, installing options and maintenance.

The service manual is available for registered users on the global Rohde & Schwarz information system (GLORIS):

https://gloris.rohde-schwarz.com

1.3.4 Instrument security procedures

Deals with security issues when working with the R&S SMM100A in secure areas. It is available for download on the internet.

1.3.5 Printed safety instructions

Provides safety information in many languages. The printed document is delivered with the product.

1.3.6 Data sheets and brochures

The data sheet contains the technical specifications of the R&S SMM100A. It also lists the options and their order numbers and optional accessories.

The brochure provides an overview of the instrument and deals with the specific characteristics.

See www.rohde-schwarz.com/brochure-datasheet/smm100a

1.3.7 Release notes and open source acknowledgment (OSA)

The release notes list new features, improvements and known issues of the current firmware version, and describe the firmware installation.

The software makes use of several valuable open source software packages. An open-source acknowledgment document provides verbatim license texts of the used open source software.

See www.rohde-schwarz.com/firmware/smm100a

1.3.8 Application notes, application cards, white papers, etc.

These documents deal with special applications or background information on particular topics.

See www.rohde-schwarz.com/application/smm100a

1.3.9 Videos

Find various videos on Rohde & Schwarz products and test and measurement topics on YouTube: https://www.youtube.com/@RohdeundSchwarz

On the menu bar, search for your product to find related videos.

Figure 1-1: Product search on YouTube

1.4 Scope

Tasks (in manual or remote operation) that are also performed in the base unit in the same way are not described here.

In particular, it includes:

- Managing settings and data lists, like saving and loading settings, creating and accessing data lists, or accessing files in a particular directory.
- Information on regular trigger, marker and clock signals and filter settings, if appropriate.
- General instrument configuration, such as checking the system configuration, configuring networks and remote operation
- Using the common status registers

For a description of such tasks, see the R&S SMM100A user manual.

1.5　Notes on screenshots

When describing the functions of the product, we use sample screenshots. These screenshots are meant to illustrate as many as possible of the provided functions and possible interdependencies between parameters. The shown values may not represent realistic usage scenarios.

The screenshots usually show a fully equipped product, that is: with all options installed. Thus, some functions shown in the screenshots may not be available in your particular product configuration.

2 About the GSM/EDGE options

2.1 Required options

The basic equipment layout for generating GSM/EDGE signals includes the options:

- Baseband Generator(R&S SMM-B9)
- Baseband real-time extension (R&S SMM-K520)
- Option GSM/EDGE (R&S SMM-K40)
- Option EDGE evolution (R&S SMM-K41)
- Frequency option (e.g. R&S SMM-B1006)

You can generate signals via play-back of waveform files at the signal generator. To create the waveform file using R&S WinIQSIM2, you do not need a specific option.

To play back the waveform file at the signal generator, you have two options:

- Install the R&S WinIQSIM2 option of the digital standard, e.g. R&S SMM-K255 for playing LTE waveforms
- If supported, install the real-time option of the digital standard, e.g. R&S SMM-K55 for playing LTE waveforms

For more information, see data sheet.

2.2 GSM/EDGE

GSM is a TDMA standard for cellular mobile radio networks.

Every TDMA frame consists of eight timeslots (or simply "slots"). Each slot can be separately turned on or off. A maximum of seven different level attenuation values can be defined and allocated separately to the eight slots independently of one another.

To configure a slot, it is necessary to define a burst type. Different burst types are available, depending on the installed options. Available are burst types defined for normal symbol rate and higher-order modulation schemes and with the burst types defined for higher symbol rates HSR.

Higher symbol rates are achieved by reduction of the symbol period and employing of higher symbol rate bursts (HB) instead of the normal burst (NB). A normal burst contains 116 encrypted symbols and uses timeslots with normal duration (156 or 157 symbols long). The higher symbol rate bursts carry information on full rate packet traffic channels, contain 138 encrypted symbols and use timeslots with reduced symbol duration (187 or 188 symbols long).

The modulation data is continuously inserted into the chosen slots. In this fashion, the data generator uses a digital signal processor to generate a data stream complete with modulation data and control signals for power ramping.

This data stream is converted into I/Q signals in the modulation encoder.

The R&S SMM100A processes the signal depending on the configured modulation scheme and selected symbol rate mode:

- In accordance with the GSM standard, the MSK modulation type is set by default to a symbol rate of 270.833 ksymb/s and gauss filtering.
  You can adjust the symbol rate. Also, you can use an FSK modulation with configurable span.
- In accordance with the standard, the EDGE slots use 8PSK modulation type with 3/8 rotation at a symbol rate of 270.833 ksymb/s and gauss linearized filtering.
- In accordance to EDGE evolution specifications (option R&S SMM-K41), the EDGE evolution slots in a normal burst (NB) are 16QAM or 32QAM modulated. They use a symbol rate of 270.833 ksymb/s and are gauss linearized filtered. The EDGE evolution slots in higher symbol rate bursts (HB) are QPSK, 16QAM or 32QAM modulated. They use a symbol rate of 325 ksymb/s and are spectrally narrow or wide pulse shape filtered.
- In accordance to VAMOS specifications (option R&S SMM-K41), the slots are AQPSK modulated at a symbol rate of 270.833 ksymb/s and gauss linearized filtering.

You can configure the GSM/EDGE signal in on of the following modes:

- **Mode unframed** - a signal with standard-compliant modulation parameters but without slot and frame structure is generated.
- **Mode frame (single)** - a signal consisting of a frame is generated; it is also possible to choose half rate bursts and to define multi-slots.
- **Mode frame (double)** - a signal consisting of two frames is generated; the frames are repeated according to a defined default.

2.3 VAMOS (voice services over adaptive multi-user channels on one slot)

According to 3GPP TS 45.001, 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.

Each of the two VAMOS users is assigned a so-called VAMOS subchannel, i.e. the physical radio resource is split into two subchannels, one for each VAMOS user. 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 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, two GMSK modulated signals interfere with each other and the base station receiver requires an advanced multi-user detection algorithm.

In the downlink, a novel 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 1 component and a subchannel 2 component, as shown in the following figure.
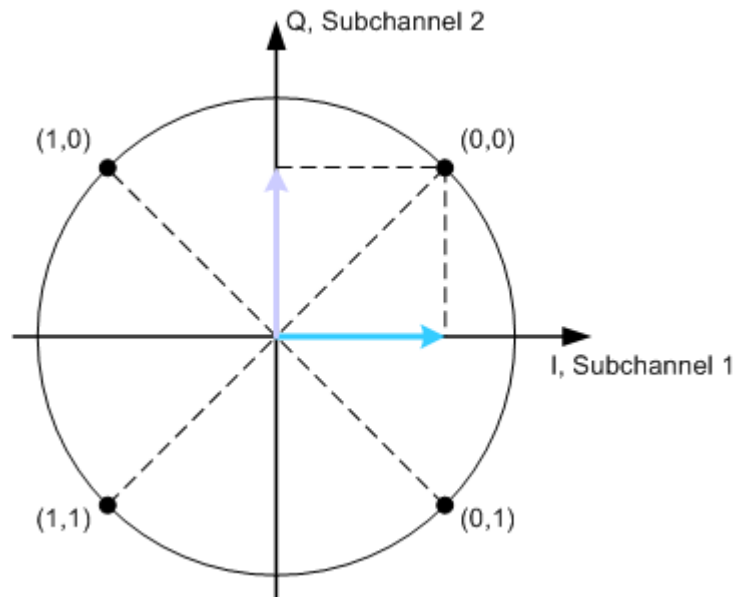
Figure 2-1: QPSK modulation, sum of both subchannels

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 adaptive QPSK (AQPSK). The following figure shows an example where subchannel 2 mapped to the Q-axis uses a higher power level than subchannel 1 mapped to the I-axis.

Figure 2-2: AQPSK modulation, subchannel 2 with higher power level

The power level of subchannel 2 relative to the power level of subchannel 1 is called subchannel power imbalance ratio (SCPIR). It is related to the angle α as follows:
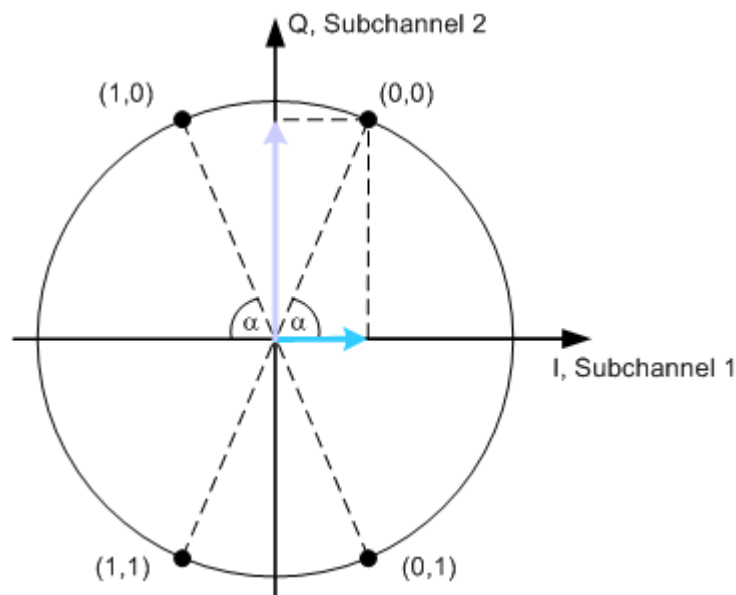
SCPIR = 20 * log$_{10}$(tan α) dB

Where the value of α is chosen such that |SCPIR|≤10dB

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.

In this implementation, you can set the SCPIR and configure the VAMOS subchannels, TSC set and TSC used. The available VAMOS settings depend on the mode the signal is generated in:

- "Unframed"
  Two data sources are provided, one per each VAMOS subchannel; the data is AQPSK modulated but only one SCPIR can be configured.

- "Framed (Single)"
  Full rate, half rate and combination of both slot types are supported. The characteristics of each of the half rate slots can be adjusted individually
  Separate data source is provided per each VAMOS subchannel and each user in half rate mode; the data is AQPSK modulated and eight SCPIRs can be configured
  Training sequence (TSC) set and TSC used can be configured on a VAMOS subchannel/User basis

- "Framed (Double)"
  The settings of each of the two frames are as in the "Framed (Single)" mode.

3 GSM/EDGE configuration and settings

Access:

► Select "Baseband" > "GSM/EDGE".

The remote commands required to define these settings are described in Chapter 4, "Remote-control commands", on page 62.

3.1 General settings

This tab provides access to the default and the "Save/Recall" settings. The selected sequence mode determines the available parameters.
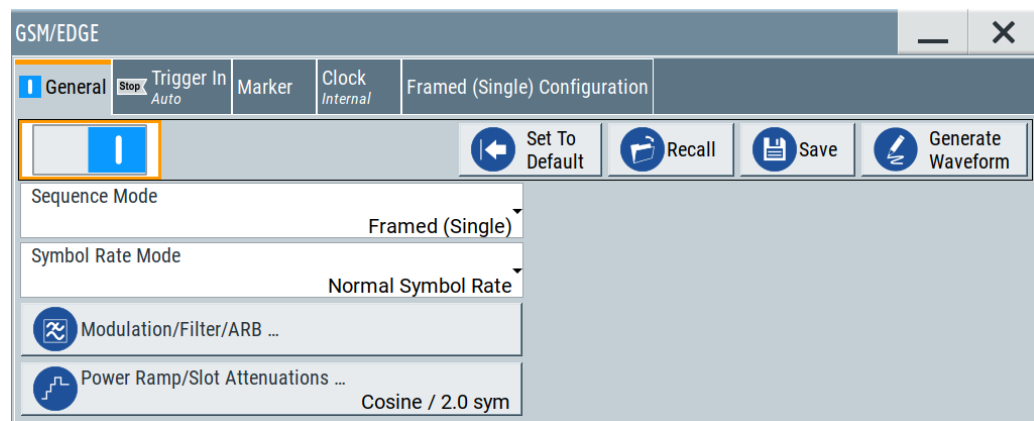
Settings

State

Activates the standard and deactivates all the other digital standards and digital modulation modes in the same path.

Remote command:
[:SOURce<hw>]:BB:GSM:STATe on page 69

Set to Default

Calls the default settings. The values of the main parameters are listed in the following table.

Parameter	Value
State	Not affected by "Set to Default"
Mode	Framed (single)
Modulation	
Symbol Rate Mode	Normal Symbol Rate
Symbol Rate	270.833 ksymb/s
Ignore 1/4...	Off
Force Dummy Bits to 1	Off
Mod. Type GSM	MSK 1bit/sym
Filter	Gauss
Filter Par. BT	0.3
Power Ramp Control	
Ramp Time	2 sym
Function	Cosine
Slot Attenuation 1...7	0 dB
Slot 0 Configuration	
Burst Type	Normal (full rate)
Slot Level	Full
Multislot	Off
Number of Slots	1
Data	PRBS 9
Use Stealing Flag	On
Stealing Flag	0
TSC	Set 1, TSC 0
Slot 1 to 7 Configuration	
Slot Level, other settings as slot 0	Off

Remote command:

[:SOURce<hw>]:BB:GSM:PRESet on page 65

Save/Recall

Accesses the "Save/Recall" dialog, that is the standard instrument function for saving and recalling the complete dialog-related settings in a file. The provided navigation possibilities in the dialog are self-explanatory.

The settings are saved in a file with predefined extension. You can define the filename and the directory, in that you want to save the file.

See also, chapter "File and Data Management" in the R&S SMM100A user manual.

Remote command:

[:SOURce<hw>]:BB:GSM:SETTing:CATalog? on page 66
[:SOURce<hw>]:BB:GSM:SETTing:LOAD on page 67
[:SOURce<hw>]:BB:GSM:SETTing:STORe on page 67
[:SOURce<hw>]:BB:GSM:SETTing:DELete on page 66

Generate Waveform File…

With enabled signal generation, triggers the instrument to save the current settings of an arbitrary waveform signal in a waveform file with predefined extension *.wv. You can define the filename and the directory, in that you want to save the file.

Using the ARB modulation source, you can play back waveform files and/or process the file to generate multi-carrier or multi-segment signals.

Remote command:
[:SOURce<hw>]:BB:GSM:WAVeform:CREate on page 69

Sequence Mode

Selects GSM/EDGE mode.

There are three modes available:
- Unframed
  See Chapter 3.6, "Mode unframed", on page 25
- Framed (single)
  See Chapter 3.7, "Mode framed (single)", on page 27
- Framed (double)
  See Chapter 3.8, "Mode framed (double)", on page 29

Remote command:
[:SOURce<hw>]:BB:GSM:MODE on page 65

Symbol Rate Mode

(with option R&S SMM-K41 EDGE Evolution)

Set the symbol rate mode, i.e. determines whether a normal burst (NB) or higher symbol rate bursts (HB) is generated.

Remote command:
[:SOURce<hw>]:BB:GSM:SRATe:MODE on page 68

Simulation Mode

Selects the modulation for the signal for the "Unframed" "Sequence Mode"

The signal is generated without slot or frame structure.

The available simulation modes depend on the selected symbol rate:
- Normal Symbol Rate - GSM (MSK or FSK), AQPSK, 8PSK/EDGE, 16QAM and 32QAM
- Higher Symbol Rate - HSR QPSK, HSR 16QAM and HSR 32QAM.

For GSM, the modulation to be used (MSK or FSK) is set by means of the parameter "Modulation" in the "Modulation/Filter" menu.

Note: "Higher Symbol Rate Mode" and "Simulation Modes" AQPSK, 16QAM, 32QAM, HSR QPSK, HSR 16QAM and HSR 32QAM require option R&S SMM-K41 EDGE Evolution

Remote command:
`[:SOURce<hw>]:BB:GSM:SMODe` on page 67

Modulation/Filter/ARB
Accesses the "Modulation/Filter/ARB" dialog, see Chapter 3.10, "Modulation/filter", on page 32.

Remote command:
n.a.

Power Ramp/Slot Attenuations
Requires "Sequence Mode > Framed (Single)/Framed Double".

Accesses the "Power Ramp / Slot Attenuations" dialog, see Chapter 3.11, "Power ramping/slot attenuation", on page 41. The dialog is used to set the power ramping parameters and for setting values for the level attenuation in dB.

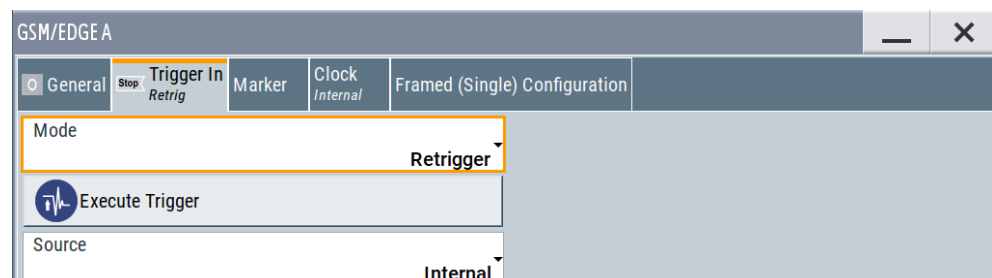The currently selected ramp function and ramp time are displayed.

Remote command:
n.a.

3.2 Trigger settings

Access:

► Select "GSM/EDGE" > "Trigger In".

This tab provides settings to select and configure the trigger, like trigger source, trigger mode and trigger delays, and to arm or trigger an internal trigger manually.

The header of the tab displays the status of the trigger signal and trigger mode. As in the tabs "Marker" and "Clock", this tab provides also access to the settings of the related connectors.

Routing and activating a trigger signal

1. Define the effect of a trigger event and the trigger signal source.

   a) Select "Trigger In" > "Mode".
   b) Select "Trigger In" > "Source".

2. For external trigger signals, define the connector for signal input. See Chapter 3.5, "Local and global connectors settings", on page 25.
   You can map trigger signals to one or more User x or T/M connectors.

   Local and global connectors settings allow you to configure the signal mapping, the polarity, the trigger threshold and the input impedance of the input connectors.

3. Activate baseband signal generation. In the block diagram, set "Baseband" > "On".

   The R&S SMM100A starts baseband signal generation after the configured trigger event.

About baseband trigger signals

This section focuses on the available settings.

For information on how these settings affect the signal, refer to section "Basics on ..." in the R&S SMM100A user manual.

Settings:

Mode

Selects trigger mode, i.e. determines the effect of a trigger event on the signal generation.

- "Auto"
  The signal is generated continuously.
- "Retrigger"
  The signal is generated continuously. A trigger event (internal or external) causes a restart.
- "Armed Auto"

The signal is generated only when a trigger event occurs. Then the signal is generated continuously.

An "Arm" stops the signal generation. A subsequent trigger event (internal or external) causes a restart.

- "Armed Retrigger"
  The signal is generated only when a trigger event occurs. Then the signal is generated continuously. Every subsequent trigger event causes a restart.
  An "Arm" stops signal generation. A subsequent trigger event (internal or external) causes a restart.

- "Single"
  The signal is generated only when a trigger event occurs. Then the signal is generated once to the length specified at "Signal Duration".
  Every subsequent trigger event (internal or external) causes a restart.

Remote command:

[:SOURce<hw>]:BB:GSM[:TRIGger]:SEQuence on page 82

Signal Duration Unit

Defines the unit for describing the length of the signal sequence to be output in the "Single" trigger mode.

Remote command:

[:SOURce<hw>]:BB:GSM:TRIGger:SLUNit on page 84

Signal Duration

Requires trigger "Mode" > "Single".

Enters the length of the trigger signal sequence.

Use this parameter, for example, for the following applications:
- To output the trigger signal partly.
- To output a predefined sequence of the trigger signal.

Remote command:

[:SOURce<hw>]:BB:GSM:TRIGger:SLENgth on page 84

Running/Stopped

With enabled modulation, displays the status of signal generation for all trigger modes.

- "Running"
  The signal is generated; a trigger was (internally or externally) initiated in triggered mode.

- "Stopped"
  The signal is not generated and the instrument waits for a trigger event.

Remote command:

[:SOURce<hw>]:BB:GSM:TRIGger:RMODe? on page 83

Time Based Trigger

Requires trigger "Mode" > "Armed Auto"/"Single".

Activates time-based triggering with a fixed time reference.

The R&S SMM100A triggers signal generation when its operating system time ("Current Time") matches a specified time trigger ("Trigger Time"). As trigger source, you can use an internal trigger or an external global trigger.

How to: Chapter "Time-based triggering" in the R&S SMM100A user manual.

Remote command:
[:SOURce<hw>]:BB:GSM:TRIGger:TIME[:STATe] on page 86

Trigger Time
Requires trigger "Mode" > "Armed Auto"/"Single".

Sets date and time for a time-based trigger signal.

Set a trigger time that is later than the "Current Time". The current time is the operating system time of the R&S SMM100A. If you set an earlier trigger time than the current time, time-based triggering is not possible.

How to: Chapter "Time-based triggering" in the R&S SMM100A user manual.

"Date"   Sets the date of the time-based trigger in format YYYY-MM-DD.

              Remote command:
              [:SOURce<hw>]:BB:GSM:TRIGger:TIME:DATE on page 85

"Time"   Sets the time of the time-based trigger in format hh:mm:ss.

              Remote command:
              [:SOURce<hw>]:BB:GSM:TRIGger:TIME:TIME on page 86

Arm
Stops the signal generation until subsequent trigger event occurs.

Remote command:
[:SOURce<hw>]:BB:GSM:TRIGger:ARM:EXECute on page 83

Execute Trigger
For internal trigger source, executes trigger manually.

Remote command:
[:SOURce<hw>]:BB:GSM:TRIGger:EXECute on page 83

Source
The following sources of the trigger signal are available:
- "Internal"
  The trigger event is executed manually by the "Execute Trigger".
- "External Global Trigger"
  The trigger event is the active edge of an external trigger signal provided and configured at the User x connectors.
- "Baseband Sync In"
  In primary-secondary instrument mode, secondary instruments are triggered by the active edge of the synchronization signal.

How to: "Routing and activating a trigger signal" on page 18

Remote command:
[:SOURce<hw>]:BB:GSM:TRIGger:SOURce on page 84

Sync. Output to External Trigger/Sync. Output to Trigger
Enables signal output synchronous to the trigger event.

- "On"

Corresponds to the default state of this parameter.

The signal calculation starts simultaneously with the trigger event. Because of the processing time of the instrument, the first samples are cut off and no signal is output. After elapsing of the internal processing time, the output signal is synchronous to the trigger event.
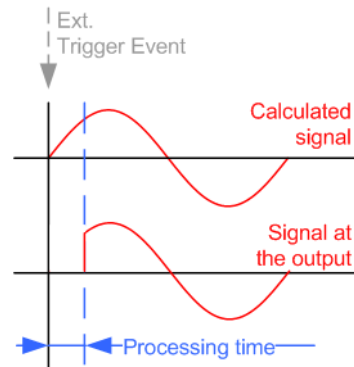
- "Off"

  The signal output begins after elapsing of the processing time. Signal output starts with sample 0. The complete signal is output.

  This mode is recommended for triggering of short signal sequences. Short sequences are sequences with signal duration comparable with the processing time of the instrument.
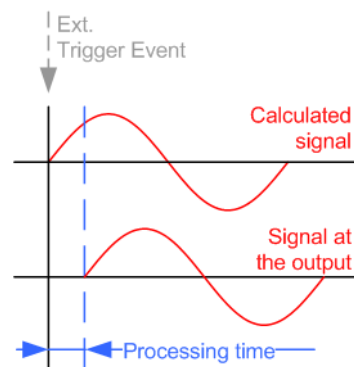
Remote command:

[:SOURce<hw>]:BB:GSM:TRIGger:EXTernal:SYNChronize:OUTPut
on page 83

External Inhibit/Trigger Inhibit

Applies for external trigger signal.

Sets the duration with that any following trigger event is suppressed. In "Retrigger" mode, for example, a new trigger event does not cause a restart of the signal generation until the specified inhibit duration does not expire.

For more information, see chapter "Basics" in the R&S SMM100A user manual.

Remote command:

[:SOURce<hw>]:BB:GSM:TRIGger[:EXTernal]:INHibit on page 85

External Delay/Trigger Delay

Delays the trigger event of the signal from:

- The external trigger source

Use this setting to:

- Synchronize the instrument with the device under test (DUT) or other external devices

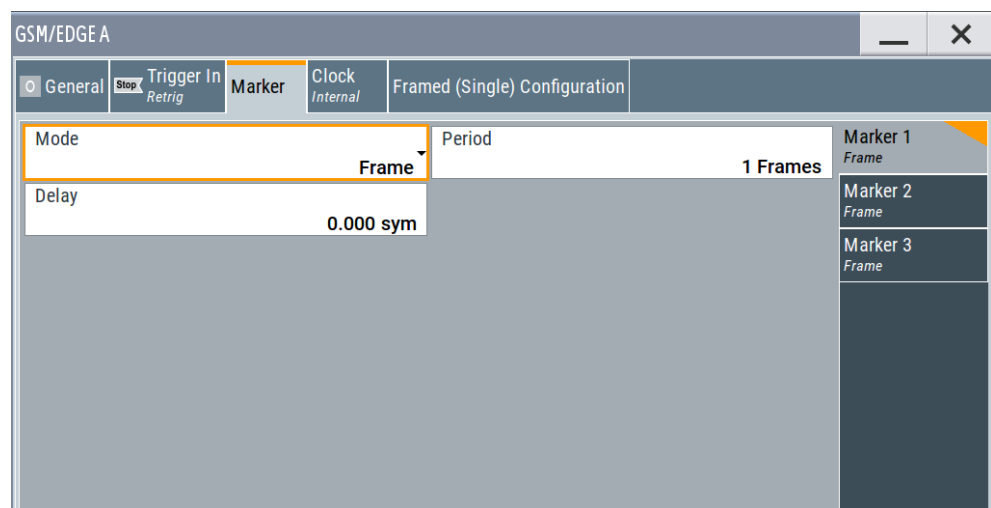For more information, see chapter "Basics on ..." in the R&S SMM100A user manual.

Remote command:
[:SOURce<hw>]:BB:GSM:TRIGger[:EXTernal]:DELay on page 85

3.3 Marker settings

Access:

► Select "GSM/EDGE" > "Marker".

This tab provides settings to select and configure the marker output signal including marker mode and marker delay.

Routing and activating a marker signal

1. To define the signal shape of an individual marker signal "x", select "Marker" > "Marker x" > "Mode".

2. Optionally, define the connector for signal output. See Chapter 3.5, "Local and global connectors settings", on page 25.
   You can map marker signals to one or more User x or T/M connectors.

3. Activate baseband signal generation. In the block diagram, set "Baseband" > "On".

   The R&S SMM100A adds the marker signal to the baseband signal. Also, R&S SMM100A outputs this signal at the configured User x connector.

About marker output signals

This section focuses on the available settings.

For information on how these settings affect the signal, refer to section "Basics on ..." in the R&S SMM100A user manual.

Settings:

Mode

Marker configuration for up to 3 markers. The settings are used to select the marker mode defining the shape and periodicity of the markers. The contents of the dialog change with the selected marker mode.

How to: "Routing and activating a marker signal" on page 22

"As defined in Slots"

The marker defined for each slot separately in the burst editor is used. The name of the marker is displayed to the right of the selection. Definition of the slot marker is described in Chapter 3.13, "Slot marker definition", on page 57.

"Slot"

A slot clock with the slot period specified under Period is generated on the output connector. The marker signal is generated after every specified number of slots.

It is important to be aware of the variation in the GSM/EDGE slot length 156 to 157 symbols. At a slot length of 156 symbols, a period of 1 symbol and a symbol rate of 270.833 ksymb/s the clock is 0.577 ms. At 157 symbols, it is 0.580 ms

"Restart"

A marker signal is generated at the start of each ARB sequence.

"Frame"

A frame clock with the frame period specified under "Period" is generated on the output connector. The marker signal is generated after every specified number of frames.

A GSM/EDGE frame has 1250 symbols. At a symbol rate of 270.833 ksymb/s and a period of 1, the clock is 4.615 ms.

"Pulse"

A regular marker signal is generated. The pulse frequency is defined by entering a divider. The frequency is derived by dividing the sample rate by the divider. The input box for the divider opens when "Pulse" is selected, and the resulting pulse frequency is displayed below it. The maximum pulse frequency is half the symbol rate.

Remote command:

[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:PULSe: DIVider on page 88

[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:PULSe[: FREQuency]? on page 89

"Pattern"   A marker signal that is defined by a bit pattern is generated. The pattern has a maximum length of 64 bits and is defined in an input field which opens when pattern is selected.

Remote command:

`[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:PATTern` on page 88

"On/Off Ratio"   A regular marker signal that is defined by an ON/OFF ratio is generated. A period lasts one ON and OFF cycle.
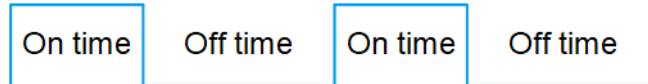
Remote command:

`[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:ONTime` on page 87

`[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:OFFTime` on page 87

Remote command:

`[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:MODE` on page 87

Delay

Delays the marker signal at the marker output relative to the signal generation start.

Variation of the parameter "Marker x" > "Delay" causes signal recalculation.

Remote command:

`[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:DELay` on page 89

3.4 Clock settings

Access:

► Select "GSM/EDGE" > "Clock".
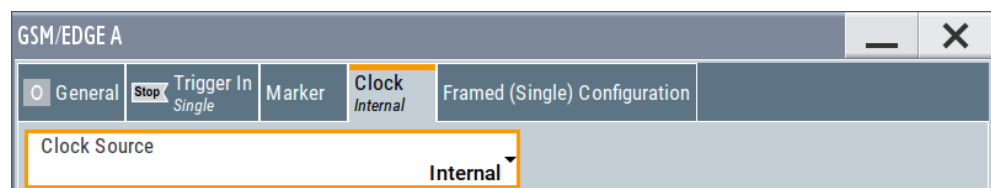
This tab provides settings to select and configure the clock signal, like the clock source and clock mode.

Defining the clock

1. Select "Clock" > "Source" to define the source of clock signal.

2. For external clock signals, define the connector for signal input. See Chapter 3.5, "Local and global connectors settings", on page 25.

You can map clock signals to one or more User x or T/M connectors.

Local and global connectors settings allow you to configure the signal mapping, the polarity, the trigger threshold and the input impedance of the input connectors.

3. Activate baseband signal generation. In the block diagram, set "Baseband" > "On".

The R&S SMM100A starts baseband signal generation with a symbol rate that equals the clock rate.

About clock signals

This section focuses on the available settings.

For information on how these settings affect the signal, refer to section "Basics on ..." in the R&S SMM100A user manual.

Settings:

Clock Source
Selects the clock source.
●   "Internal"
    The instrument uses its internal clock reference.

How to: "Defining the clock" on page 24

Remote command:
`[:SOURce<hw>]:BB:GSM:CLOCk:SOURce` on page 81

3.5 Local and global connectors settings

Accesses a dialog to configure local connectors or global connectors.

The button is available in the following dialogs or tabs:
●   "Trigger / Marker / Clock" dialog that is accessible via the "TMC" block in the block diagram.
●   "Trigger In", "Marker" and "Clock" tabs that are accessible via the "Baseband" block in the block diagram.
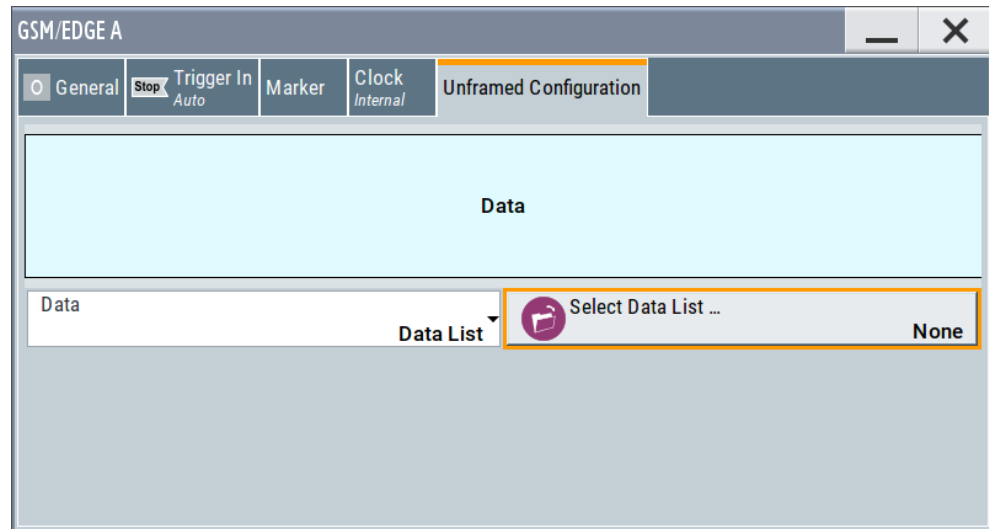

See also chapter "Local and global connectors settings" in the user manual.

3.6 Mode unframed

1. To access this dialog select "General > Sequence Mode > Unframed".

2. Select "Unframed Configuration".

This dialog displays the signal in "Unframed" mode - no frames, no power ramping.

In "Unframed" mode, a modulation signal without slot or frame structure is generated. The modulated carrier without power ramping is often enough for initial tests, and in case the complete signal is not yet needed.

Since all the modulation parameters for the signal are conform to the standard, only the symbol rate mode and the modulation have to be selected. The symbol rate and filter configuration are set accordingly.

This mode can be used for quick measurements of the spectrum or signal quality (e.g. EVM).

Data
Selects data source.

The following standard data sources are available:
* "All 0, All 1"
  An internally generated sequence containing 0 data or 1 data.
* "PNxx"
  An internally generated pseudo-random noise sequence.
* "Pattern"
  An internally generated sequence according to a bit pattern.
  Use the "Pattern" box to define the bit pattern.
* "Data List/Select DList"
  A binary data from a data list, internally or externally generated.
  Select "Select DList" to access the standard "Select List" dialog.
  – Select the "Select Data List > navigate to the list file *.dm_iqd > Select" to select an existing data list.
  – Use the "New" and "Edit" functions to create internally new data list or to edit an existing one.
  – Use the standard "File Manager" function to transfer external data lists to the instrument.

See also:
- Section "Modulation Data" in the R&S SMM100A user manual.
- Section "File and Data Management" in the R&S SMM100A user manual.
- Section "Data List Editor" in the R&S SMM100A user manual
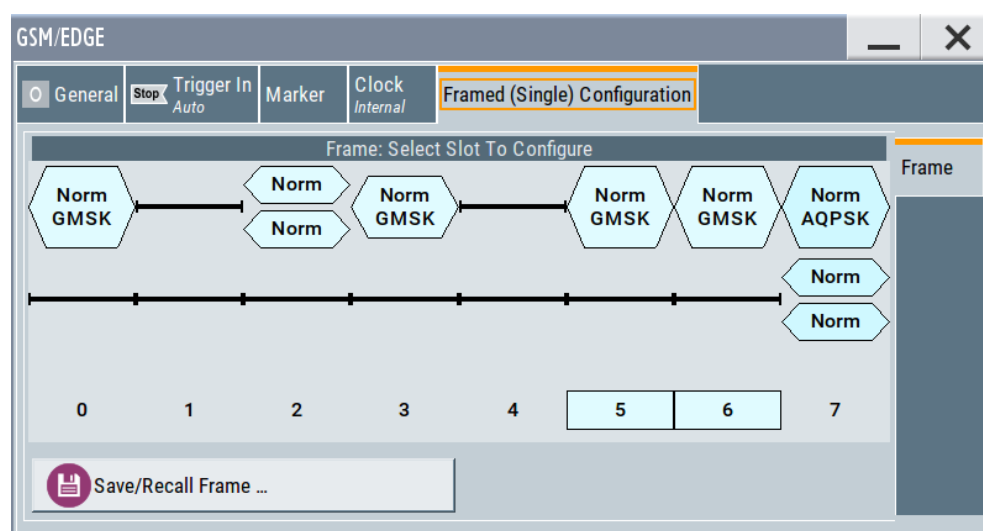
Remote command:

`[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>][:SOURce]:DATA` on page 95

`[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>][:SOURce]:DATA:PATTern` on page 97

`[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>][:SOURce]:DATA:DLISt` on page 96

3.7 Mode framed (single)

1. To access this dialog select "General > Sequence Mode > Framed (Single)".

2. Select "Framed (Single) Configuration".

This dialog displays the frame structure and provides access to the dialog for saving and loading a frame structure.

The "Framed (single)" mode generates a modulation signal which is defined by the structure of a single frame. The frame structure is repeated cyclically, but the useful data is continuously generated.

The frame structure is displayed in graphical form. Slot parameters can be defined in the burst editor, which is called when the slot is selected in the graphical display (see Chapter 3.12, "Burst editor", on page 45). You can define half rate slots. The characteristics of each half rate slot can be defined separately. Each active slot is represented by a burst symbol. Two half rate slots occupy the space of a full rate slot. A slot in which the level has been attenuated is represented by a lower amplitude burst. Inactive

slots (Slot Level = Off) are shown as a horizontal bar. Defined multislots are banded and surrounded by a frame.

When a half rate slot has been selected, two frames are generated alternately. Each frame holds one of the two half rate users.

Example:

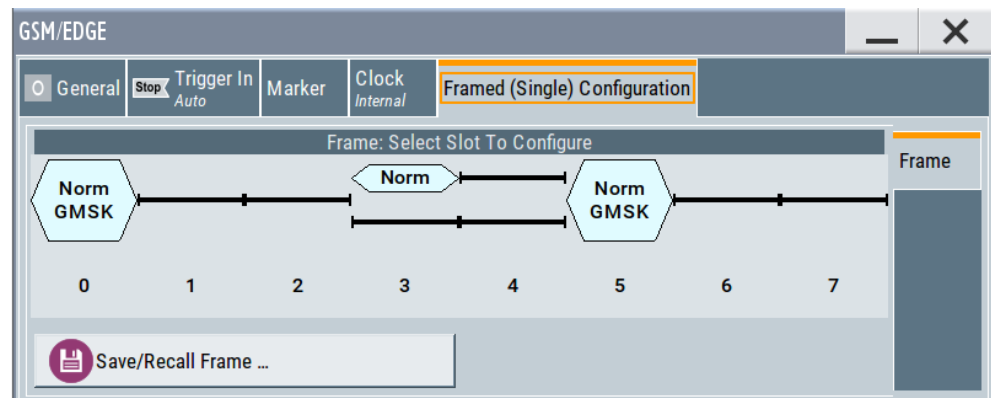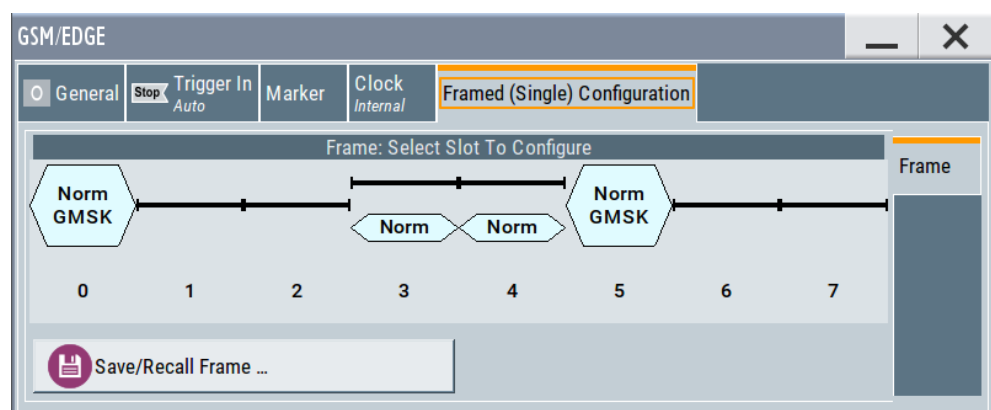The following configuration is set, from a frame with two slots that contain half rate users:
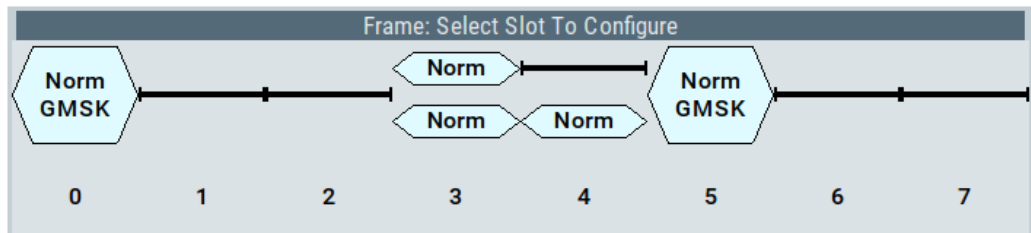
As a result, the following two frames are generated alternately:

- Frame with half rate user 1:
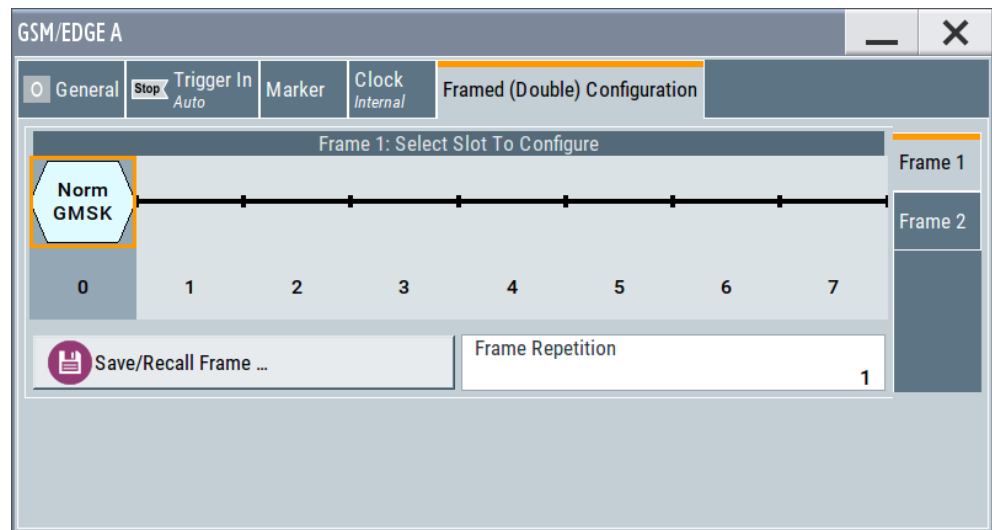

- Frame with half rate user 2

Save/Recall Frame …

Access the "Save/Recall Frame" dialog for selecting of predefined or user defined frames, see Chapter 3.9, "Save recall frame/slots", on page 30.

Remote command:
n.a.

3.8 Mode framed (double)

1. To access this dialog select "General > Sequence Mode > Framed (Double)".

2. Select "Framed (Double) Configuration".

This dialog displays the frame structure and gives access to the dialog for saving and loading a frame structure.

The "Framed (double)" mode generates multiframe signals which are defined by the structure of two frames.

For this purpose, two frames are defined as in "Framed (single)" mode. A repetition factor is then specified for each of the two frames. Following a trigger the first frame is repeated the specified number of times, and then the second frame. The frame structures are repeated cyclically, but the useful data is continuously generated.

If one of the frames contains half rate slots (and so actually consists of two frames itself), the repetition factor must be a multiple of 2 (seeChapter 3.7, "Mode framed (single)", on page 27).

The frame structure of the two frames is displayed in graphical form. Slot parameters can be defined in the burst editor, which is called when the slot is selected in the graphical display (seeChapter 3.12, "Burst editor", on page 45).

Save/Recall Frame …
Provides access to the "Save/Recall Frame" dialog for selecting of predefined or user defined frames, see Chapter 3.9, "Save recall frame/slots", on page 30 .

Remote command:
n.a.

Frame Repetition

Sets the number of repetitions for frame 1 or frame 2. First frame 1 is repeated the specified number of times, and then frame 2, then frame 1 starts again, and so on.

Remote command:

`[:SOURce<hw>]:BB:GSM:FRAMe<di>:REPetitions` on page 64

3.9 Save recall frame/slots

1. To access these dialogs select "General > Sequence Mode > Framed (Single) / Framed (Double)".

2. Select "Framed (Single) / Framed (Double) Configuration" .

3. To access the "Save/Recall Frame" dialog, select "Save/Recall Frame"

4. To access the "Save/Recall Slots " dialog, select "Frame x: Select Slot to configure > Slot... > Save/Recall Slots"

The "File Select" dialogs save and load (i.e. recall) user-defined frames or slots. Predefined frames or slots can also be recalled. Each dialog offer access to the "File Manager" for general file management.

Predefined Frames and Slots are stored on a predefined path. This path is automatically set in the "File Select" dialog.

In the Normal Symbol Rate mode, user-defined Frames and Slots are stored as files with the specific file extensions `*.gsm_fu` or `*.gsm_slu`, respectively.

In the Higher Symbol Rate mode, user-defined Frames and Slots are stored as files with the specific file extensions `*.gsm_hfu` or `*.gsm_hslu`, respectively. Independent of the selected symbol rate mode, the files with user-defined Frames and Slots can be stored in a user-determined directory and called from there.

It is not possible to use other file extensions. Attempting to do so causes an error message. If the file extension is modified (e.g. by directly accessing the file system), the files are no longer recognized and therefore invalid.

ⓘ   In the following examples of commands, the files are stored in the default directory which is defined by command `MMEM:CDIRectory`.

Recall Predefined Files

Accesses the standard "File Select" dialog for loading a predefined frame/slot.

"EDGE0"	Predefined frame Slot 0 = On, full level, EDGE burst, all other slots off.
"EDGEAll"	Predefined frame All slots On, full level, EDGE burst
"GsmEdge"	Predefined frame Alternately one slot with NORMAL burst and EDGE burst

"NormalBurst0"

> Predefined frame
> Slot 0 = On, full level, NORMAL burst (full rate), all other slots off

"NormalBurstAll"

> Predefined frame
> All slots On, full level, NORMAL burst (full rate)

"GSM_NB_PN9_TSC0"

> Predefined slot
> NORMAL burst (full rate), full level, attenuation A1, multislot = Off, number of multislots = 1, Data = PRBS 9, Use Stealing Flag = On, TSC0, all slot-marker set to "all down".

"GSM_NB_PN9_TSC0"

> Predefined slot
> EDGE burst (full rate), full level, attenuation A1, multislot = Off, number of multislots = 1, Data = PRBS 9, Use Stealing Flag = On, TSC0, all slot-marker set to "all down"

Remote command:

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:PREDefined:CATalog? on page 71

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:PREDefined:LOAD on page 72

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:PREDefined:CATalog? on page 72

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:PREDefined:LOAD on page 72

Recall User Files

Access the standard "File Select" dialog for loading a user-defined frame/slot.

Remote command:

[:SOURce<hw>]:BB:GSM:FRAMe<di>:ULISt:CATalog? on page 70

[:SOURce<hw>]:BB:GSM:FRAMe<di>:ULISt:LOAD on page 71

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:ULISt:CATalog? on page 73

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:ULISt:LOAD on page 73

Save User Files

Access the standard "File Select" dialog for saving the current frame or slot settings.

Remote command:

[:SOURce<hw>]:BB:GSM:FRAMe<di>:ULISt:STORe on page 71

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:ULISt:STORe on page 74

File Manager

Access the standard "File Manager" dialog, used to copy, delete and rename files and to create directories.

Remote command:

`[:SOURce<hw>]:BB:GSM:FRAMe<di>:ULISt:DELete` on page 70

`[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:ULISt:DELete` on page 73

3.10 Modulation/filter

This dialog provides access to the modulation and filter settings. The selected symbol rate mode and symbol rate determine the available modulation types.

Access:

1. Select "Baseband > GSM/EDGE > General".

2. Select "Modulation/Filter...."

   This dialog contains the settings required for configuring the modulation types, the corresponding filter settings and the ARB settings.
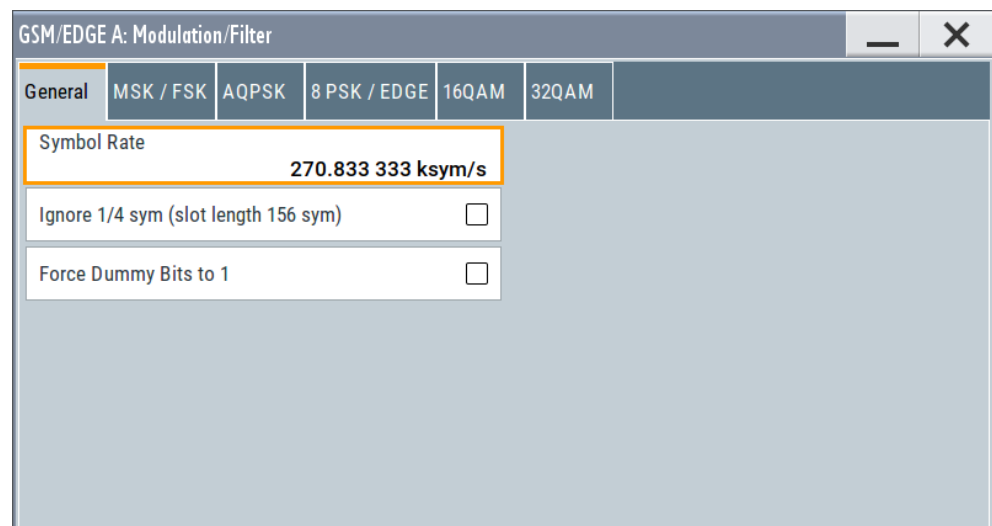
ⓘ   "Higher Symbol Rate Mode", AQPSK modulation and higher order modulations (16QAM and 32QAM) are with option R&S SMM-K41 (EDGE evolution).

3.10.1 General settings

Access:

► Select "General".

This tab contains the parameters to configure the general modulation settings.

Settings:

Symbol Rate
Sets the symbol rate.

The symbol rate is determined by the selected "Symbol Rate Mode":
- "Normal Symbol Rate"
  Sets 270.833 33 ksymb/s default symbol rate for GSM/EDGE.
- "Higher Symbol Rate"
  Sets 325 ksymb/s default symbol rate for EDGE evolution.

Remote command:

[:SOURce<hw>]:BB:GSM:SRATe on page 68

Ignore 1/4 symbol (slot length 156 sym) / Ignore ½ symbol (slot length 187 sym)
Selects constant slot length. This setting affects all burst types.

In a normal burst (NB), the GSM slot has a length of 156.25 symbols. Compensation for the 1/4 symbol takes the form of an extra symbol every 4th slot. This means that some slots are 156 long and some are 157 long. Compensation takes place in the guard field of the burst (seeChapter 3.12, "Burst editor", on page 45).

In a higher symbol rate burst (HB), the average slot is 187.5 symbols long. Compensation for ½ symbol means that each second slot gets an extra symbol and is 188 symbols long, while the rest uses a slot length of 187 symbols.

If the field "Ignore 1/4 symbol (slot length 156 symbols) / Ignore ½ symbol (slot length 187 symbols)" is enabled, all slots are 156 respectively 187 symbols long. The extra 1/4 resp. ½ symbol is omitted. The guard field for the burst always has the same length regardless of the slot index.

For normal burst, a frame is therefore 1248 symbols long instead of 1250.

Respectively, the length of the frame in a higher symbol rate burst is than 1496 symbols long instead of 1500 symbols.

Remote command:
[:SOURce<hw>]:BB:GSM:ISLength on page 64

Force Dummy Bits to 1
A modulating bitstream consisting of consecutive ones is used for inactive slots (according to GSM 05.04). If this parameter is disabled, the inactive slots are filled in with 0.
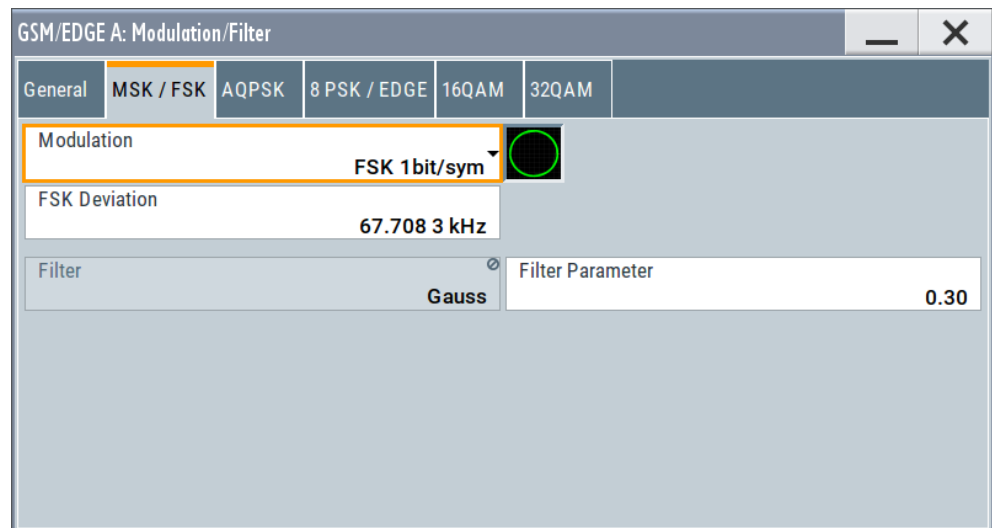
Remote command:
[:SOURce<hw>]:BB:GSM:FONE on page 64

3.10.2 MSK/FSK settings

Access:

1. Select "Symbol Rate Mode > Normal Symbol Rate".

2. Select "MSK/FSK".

This tab contains the parameters required to configure the MSK/FSK modulation.

Modulation
Selects the modulation type for the GSM signal.

- "MSK 1bit/symbol" = Minimum Shift Keying
- "FSK 1bit/symbol" = Frequency Shift Keying

The selected modulation is also displayed in graphical form.

Remote command:
[:SOURce<hw>]:BB:GSM:FORMat on page 74

FSK Deviation
Sets the deviation for FSK.

When MSK is selected, the deviation is set permanently to symbol_rate/4.

Remote command:
[:SOURce<hw>]:BB:GSM:FSK:DEViation on page 75

Filter
Indicates the filter used for the GSM signal. The filter is permanently set to Gauss.

Remote command:

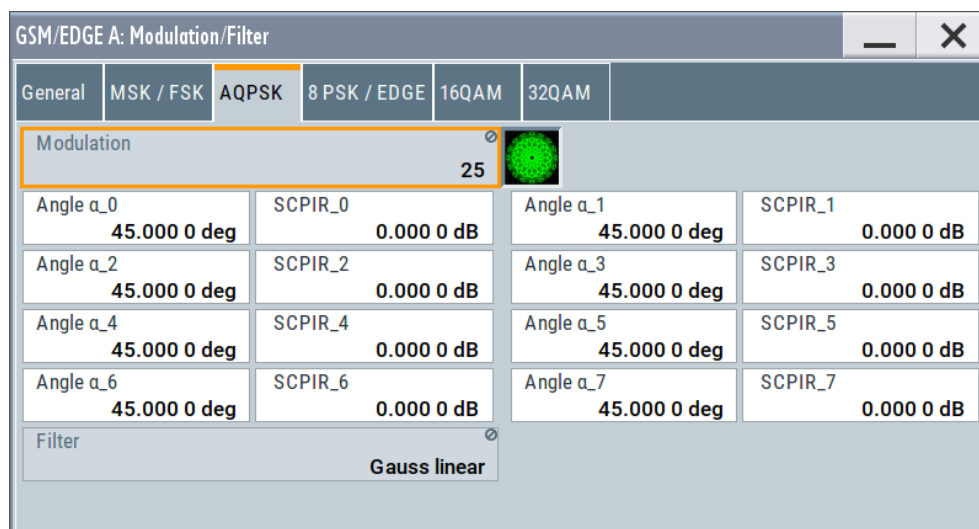[:SOURce<hw>]:BB:GSM:FILTer:TYPE? on page 79

Filter Parameter

Sets the BxT value for the GAUSS filter. The GSM default value is 0.3.

Remote command:

[:SOURce<hw>]:BB:GSM:FILTer:PARameter on page 79

3.10.3 AQPSK settings

1. To access this dialog select "Symbol Rate Mode > Normal Symbol Rate".

2. Select "AQPSK".

This tab contains the parameters necessary to configure the AQPSK modulation (requires option R&S SMM-K41.

Modulation AQPSK

Displays the modulation type for the GSM signal. The modulation type is set perma-nently to AQPSK (see Chapter 2.3, "VAMOS (voice services over adaptive multi-user channels on one slot)", on page 11).

Remote command:

[:SOURce<hw>]:BB:GSM:AQPSk:FORMat? on page 75

Angle alpha_0 ... alpha_7

Sets the angle alpha (see Chapter 2.3, "VAMOS (voice services over adaptive multi-user channels on one slot)", on page 11).

Remote command:

[:SOURce<hw>]:BB:GSM:AQPSk:ANGLe<ch0> on page 78

SCPIR_0 to SCPIR_7

The power level of subchannel 1 relative to the power level of subchannel 2 is called subchannel power imbalance ratio (SCPIR). It is related to the angle α as follows:

*SCPIR = 20 * log$_{10}$(tan α) dB,*

Where the value of α is chosen such that |SCPIR|≤10dB

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

Remote command:
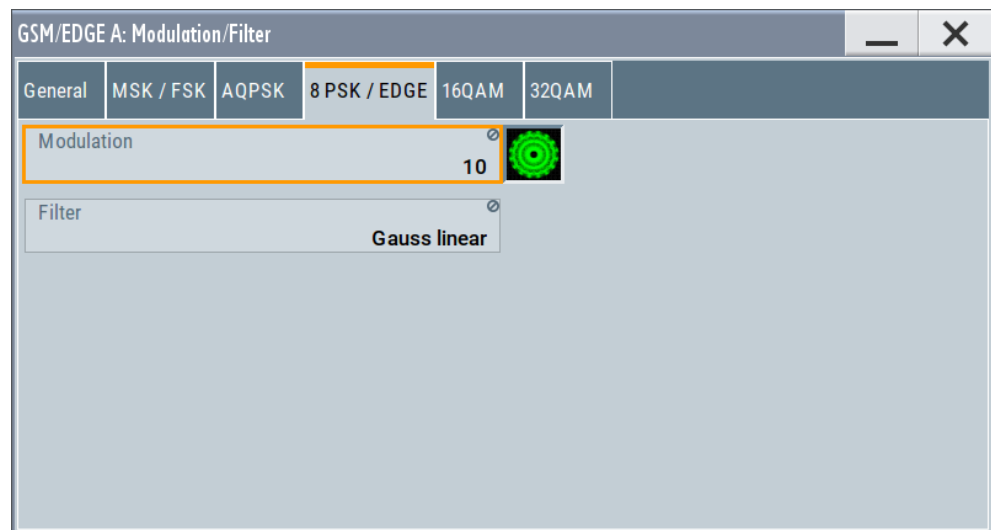[:SOURce<hw>]:BB:GSM:AQPSk:SCPIR<ch0> on page 78

Filter

Indicates the filter type used for AQPSK modulation. The filter is permanently set to Gauss linearized.

Remote command:
[:SOURce<hw>]:BB:GSM:FILTer:AQPSK:TYPE? on page 79

3.10.4 8 PSK/EDGE settings

1. To access this dialog select "Symbol Rate Mode > Normal Symbol Rate".

2. Select "8 PSK/EDGE".

This tab contains the parameters required to configure the 8 PSK/EDGE modulation.

Modulation Type EDGE

Displays the modulation type for the EDGE signal. The modulation type is set permanently to 8PSK EDGE (3pi/8 8PSK). Unlike the modulation types for GSM, the modulation type for EDGE has 3 bits per symbol.

Remote command:
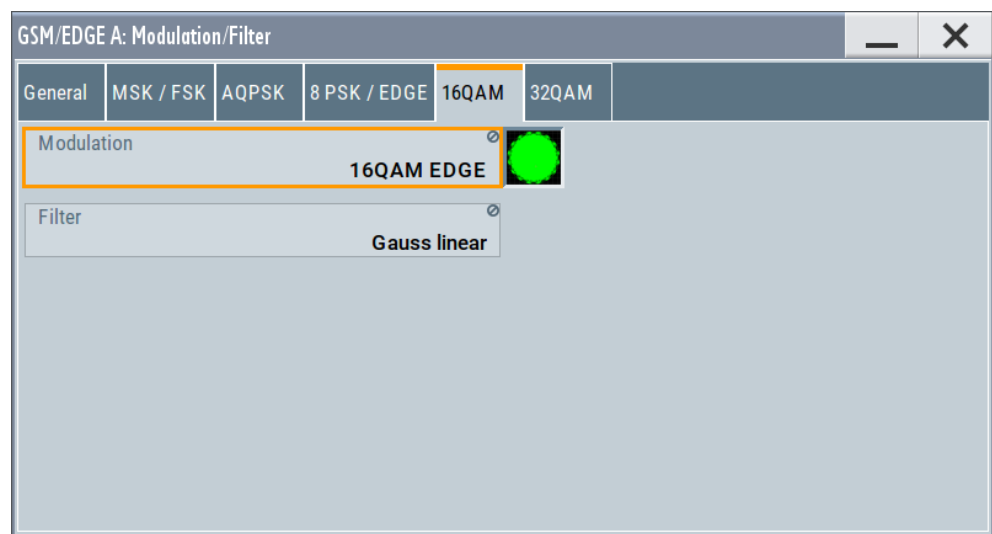[:SOURce<hw>]:BB:GSM:EDGE:FORMat? on page 75

Filter

Indicates the filter used for the EDGE signal. The filter is permanently set to Gauss linearized.

Remote command:
[:SOURce<hw>]:BB:GSM:FILTer:EDGE:TYPE? on page 80

3.10.5 16QAM settings

1. To access this dialog select "Symbol Rate Mode > Normal Symbol Rate".

2. Select "16 QAM".

This tab contains the parameters required to configure the 16 QAM modulation. (requires option R&S SMM-K41)

Modulation Type 16QAM

Displays the modulation type for the signal.

The modulation type 16QAM has 4 bits per symbol.

Remote command:
[:SOURce<hw>]:BB:GSM:N16Qam:FORMat? on page 77

Filter

Indicates the filter used for the 16QAM signal. The filter is permanently set to Gauss linearized.

Remote command:
[:SOURce<hw>]:BB:GSM:FILTer:N16Qam:TYPE? on page 80

3.10.6 32QAM settings

1. To access this dialog select "Symbol Rate Mode > Normal Symbol Rate".

2. Select "32 QAM".

This tab contains the parameters required to configure the 32QAM modulation. (requires option R&S SMM-K41)

Modulation Type 32QAM

Displays the modulation type for the signal.

The modulation type 32QAM has 5 bits per symbol.

Remote command:
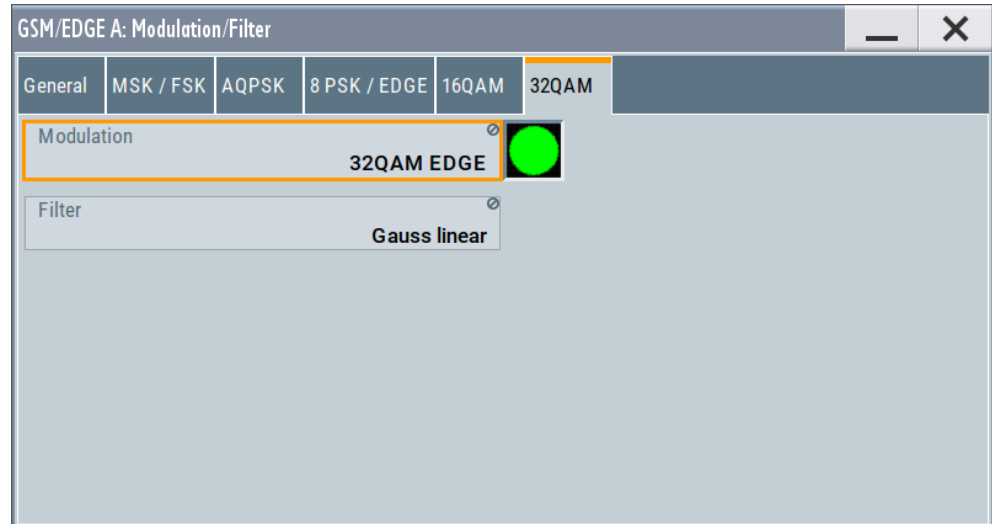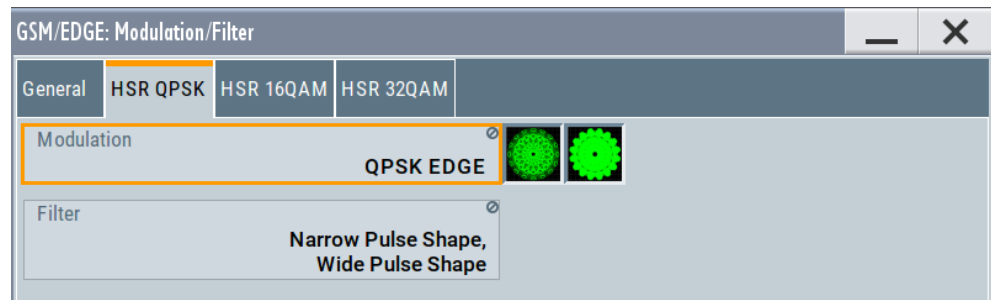[:SOURce<hw>]:BB:GSM:N32Qam:FORMat? on page 77

Filter

Indicates the filter used for the 32QAM signal. The filter is permanently set to Gauss linearized.
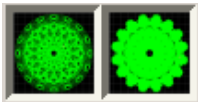
Remote command:
[:SOURce<hw>]:BB:GSM:FILTer:N32Qam:TYPE? on page 80

3.10.7 HSR QPSK settings

1. To access this dialog select "Symbol Rate Mode > Higher Symbol Rate".

2. Select "HSR QPSK".

This tab contains the parameters required to configure the HSR QPSK modulation. (requires option R&S SMM-K41)

Modulation Type HSR QPSK
(for "Higher Symbol Rate")

Displays the modulation type for the signal.

The modulation type QPSK EDGE has 2 bits per symbol.

Remote command:
[:SOURce<hw>]:BB:GSM:HQPSk:FORMat? on page 77

Filter
(for "Higher Symbol Rate")

Indicates the filters used for the HSR QPSK EDGE signal.

The two possible filters are displayed. The currently used filter is set per HSR QPSK slot with the parameter "Filter".

Remote command:
[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:FILTer:TYPE on page 94
[:SOURce<hw>]:BB:GSM:FILTer:HQPSk:TYPE on page 81

3.10.8 HSR 16QAM settings

1. To access this dialog select "Symbol Rate Mode > Higher Symbol Rate".

2. Select "HSR 16QAM".

This tab contains the parameters required to configure the HSR 16QAM modulation.

Modulation Type HSR 16QAM

(for "Higher Symbol Rate")

Displays the modulation type for the signal.

The modulation type 16QAM has 4 bits per symbol.

Remote command:

`[:SOURce<hw>]:BB:GSM:H16Qam:FORMat?` on page 76

Filter

(for "Higher Symbol Rate")

Indicates the filters used for the HSR 16QAM signal.

The two possible filters are displayed. The currently used filter is set per HSR 16QAM slot with the parameter Filter.
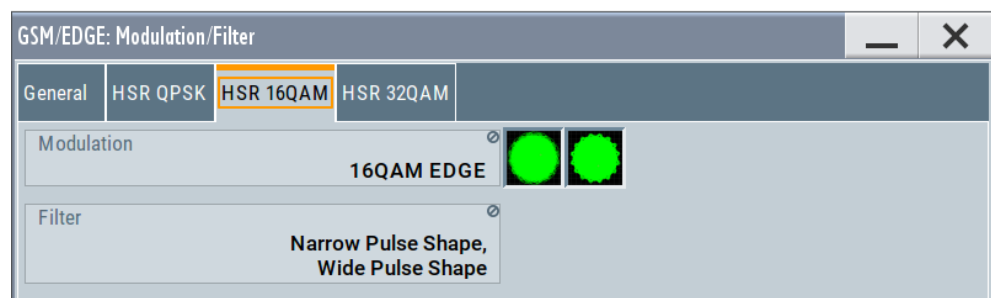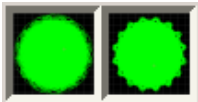
Remote command:

`[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:FILTer:TYPE` on page 94

`[:SOURce<hw>]:BB:GSM:FILTer:H32Qam:TYPE` on page 81

3.10.9 HSR 32QAM settings

1. To access this dialog select "Symbol Rate Mode > Higher Symbol Rate".

2. Select "HSR 32QAM".

This tab contains the parameters required to configure the HSR 32QAM modulation.

Modulation Type HSR 32QAM

(for "Higher Symbol Rate")

Displays the modulation type for the signal.

The modulation type 32QAM has 5 bits per symbol.

Remote command:

`[:SOURce<hw>]:BB:GSM:H32Qam:FORMat?` on page 76

Filter

(for "Higher Symbol Rate")

Indicates the filters used for the 32QAM signal.

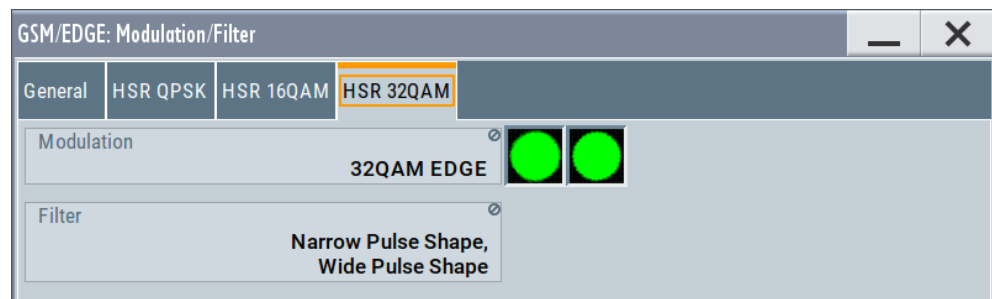The two possible filters are displayed. The currently used filter is set per HSR 32QAM slot with the parameter Filter.

Remote command:
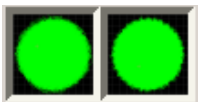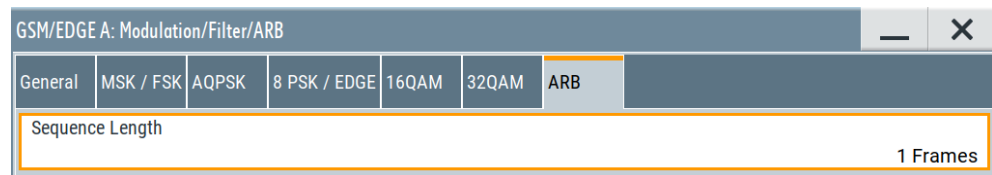`[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:FILTer:TYPE` on page 94
`[:SOURce<hw>]:BB:GSM:FILTer:H32Qam:TYPE` on page 81

3.10.10 ARB settings

Access:

1. Select "Baseband > GSM/EDGE > General".

2. Select "Modulation/Filter.... > ARB"

GSM/EDGE A: Modulation/Filter/ARB							—	✕
General	MSK / FSK	AQPSK	8 PSK / EDGE	16QAM	32QAM	ARB		
Sequence Length								
								1 Frames

This tab contains the parameters required to configure the ARB waveform component of the signal.

Sequence Length ARB
Sets the sequence length of the arbitrary waveform component of the signal. This component is calculated in advance and output in the arbitrary waveform generator.

The maximum number of frames depends on the installed ARB waveform memory size and the current "Symbol Rate".

Remote command:
`[:SOURce<hw>]:BB:GSM:FLENgth` on page 63

3.11 Power ramping/slot attenuation

This dialog provides access to the settings for power ramping and level attenuation.

You can set the power ramp envelope, and define seven possible values for level attenuation. Slot Attenuations, used in burst editors enables you to define seven possible values for level attenuation. These values can be selected from the burst editor for the slot currently being edited. An eighth value is permanently set to 0 dB and corresponds to the "Slot Level Full" setting in the burst editor.

Power ramping /Level attenuation is used for restricting power ramping to the baseband signal.

Access:

1. Select "Baseband > GSM/EDGE".

2. Select "Power Ramp/Slot Attenuation"

   This dialog contains the parameters required to configure the power ramp envelope and the slot attenuations.

3. Select "Slot Attenuations".

You can define the seven values for level attenuation.

4. Select "Power Ramping/ Level Attenuation"
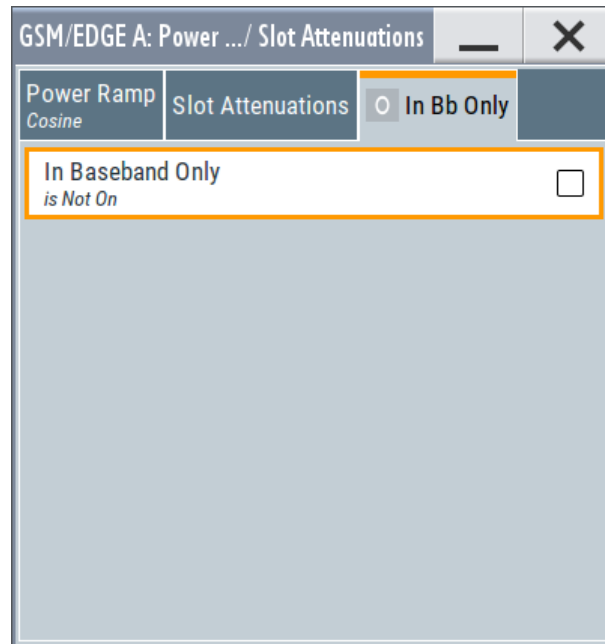
Enable the provided parameter to restrict power ramping to the baseband signal.

Power Ramp
Access:

Select "Baseband > GSM/EDGE > Power Ramp Slot Attenuations > Power Ramp".

Ramp Function ← Power Ramp
Sets the form of the transmitted power during the switching operation, i.e. the shape of the rising and falling edges of the envelope.

"Linear"   The transmitted power rises and falls linear fashion.

"Cosine"   The transmitted power rises and falls with a cosine-shaped edge. This causes a more favorable spectrum than the "Linear" setting.

Remote command:
[:SOURce<hw>]:BB:GSM:PRAMp:SHAPe on page 91

Ramp Time ← Power Ramp
Sets the power ramping rise time and fall time for a burst. The setting is expressed in symbols.

Do not switch the transmitted power abruptly at the start and end of a burst, because the switching operation would otherwise generate excessively strong non-harmonics. The switching operation is therefore stretched over several symbol clocks.

Remote command:
[:SOURce<hw>]:BB:GSM:PRAMp:TIME on page 91

Rise Delay ← Power Ramp

Sets the offset in the rising edge of the envelope at the start of a burst. A positive value causes a delay and a negative value causes an advance. The setting is expressed in symbols.

Remote command:
[:SOURce<hw>]:BB:GSM:PRAMp:RDELay on page 90

Fall Delay ← Power Ramp

Sets the offset in the falling edge of the envelope at the end of a burst. A positive value causes a delay and a negative value causes an advance. The setting is expressed in symbols.

Remote command:
[:SOURce<hw>]:BB:GSM:PRAMp:FDELay on page 90

Slot Attenuations

Access:

Select "Baseband > GSM/EDGE > Power Ramp Slot Attenuations > Slot Attenuations".

Slot Attenuation A1 to A7 ← Slot Attenuations

Sets the seven different values for level attenuation.

The burst editor can be used to set the level attenuation for the eight slots to one of these predefined values independently of one another.

The burst editor is likewise used to assign the "Slot Level" attribute "Attenuated" to individual slots.

Remote command:
[:SOURce<hw>]:BB:GSM:SATTenuation<ch> on page 66

In Bb Only

Access:

Select "Baseband > GSM/EDGE > Power Ramp Slot Attenuations > In Bb Only".

In Baseband Only ← In Bb Only

Restricts power ramping to the baseband signal.

"Off"   Level attenuation is effected via the attenuator stages in the RF section; only the remaining part is attenuated in the baseband. The signal is issued at the RF output with the defined level values. This setting provides the best possible dynamic for burst signals.

"On"   Level attenuation affects the baseband only.

This setting is mandatory in the following cases:
- When only the baseband signal is issued at the I/Q outputs
  It is thus ensured that, with power ramping active, this signal is output with the defined level values.
- When a baseband signal is applied to two RF paths of a two-path instrument.
  The RF paths having separate frequency and level settings, the remaining attenuation in the baseband would have to be different for the two paths and is therefore not possible.
- When a burst baseband signal (GSM/EDGE) is combined with a continuous baseband signal (e.g. 3GPP), or a noise signal and both signals are applied to one RF path.
  Blanking in the RF is unsuitable, because the RF section would not only blank the burst signal of the first baseband but also the continuous signal or the noise signal.

Remote command:
[:SOURce<hw>]:BB:GSM:PRAMp:BBONly[:STATe] on page 89

3.12 Burst editor

This dialog provides the settings for configuring a burst slot. The burst type for the selected slot, for example the burst structure determines the available parameters.

Access:

1. Select "Baseband > GSM/EDGE > General".

2. Select the "Sequence Mode"

3. Depending on the "Sequence Mode", select:
   - "Unframed Configuration" or
   - "Framed (Single) Configuration" or
   - "Framed (Double) Configuration".

   The corresponding dialog opens and displays a graph of the current frame.

4. In the frame graph "Frame: Select Slot To Configure", select a slot.

This dialog contains the parameters for configuring a burst slot. The graph shows the structure of the current burst type.

The individual fields of the burst type are color-coded:

Field	Color
Data, Fixed, Mixed, Stealing	white
Training Sequences: TSC, ETSC, SYNC	yellow
Tail, extended Tail	green
Guard, extended Guard	blue

ⓘ "Higher Symbol Rate Mode", AQPSK modulation and higher order modulations (16QAM and 32QAM) require optionR&S SMM-K41 (EDGE evolution).

Settings:

Burst Type

Selects the burst type.

The burst types available depend on the selected "Symbol Rate Mode". The symbol rate mode a burst type applies to is denoted ("Normal ..." and "HSR ..." ("high symbol rate mode").

Note: "Higher Symbol Rate Mode", AQPSK modulation and higher order modulations (16QAM and 32QAM) require optionR&S SMM-K41 (EDGE evolution).

"Normal (GMSK/Full Rate)"

The useful data is transmitted in the normal burst (NB).
A normal burst carries 2*58 = 116 encrypted bits.

"Normal (GMSK/Half Rate)"

The useful data is transmitted in the normal burst.
Half rate user 1 is transmitted in all the frames with an even index (frames 0, 2, 4, etc.). Half rate user 2 is transmitted in the frames with an odd index (frames 1, 3, etc.).
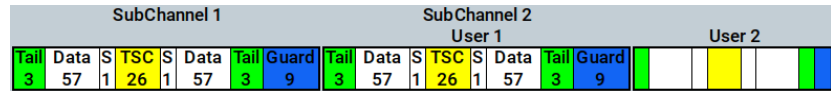See alsoChapter 3.7, "Mode framed (single)", on page 27 .

"Normal (AQPSK/Full Rate - Full Rate)"

The data of pair of users is multiplexed on the two VAMOS subchannels of a single physical radio resource.
See also Chapter 2.3, "VAMOS (voice services over adaptive multi-user channels on one slot)", on page 11.

"Normal (AQPSK/Full Rate - Half Rate)"

Three users are using the same radio resource, one full rate VAMOS user on the subchannel 1 and two half rate VAMOS users on the sub-channel 2.

	SubChannel 1							SubChannel 2 User 1							User 2				
Tail 3	Data 57	S 1	TSC 26	S 1	Data 57	Tail 3	Guard 9	Tail 3	Data 57	S 1	TSC 26	S 1	Data 57	Tail 3	Guard 9				

"Normal (AQPSK/Half Rate - Half Rate)"

A single timeslot is shared by four users: two VAMOS subchannels, each used by two half rate users.

SubChannel 1 User 1					User 2					SubChannel 2 User 1					User 2				
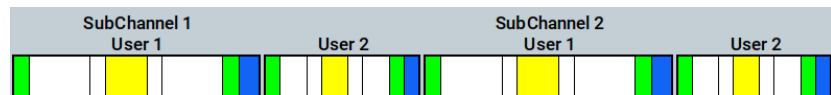
"Normal (8PSK/EDGE)"

The higher bit clock associated with EDGE achieves correspondingly higher data transfer rates.

If a frame contains an active EDGE burst, the higher bit clock (3 x symbol clock) is always output on the clock outputs. If the EDGE burst is removed from the frame, the lower bit clock (=symbol clock) is automatically output again.

An EDGE burst carries 2x(3*58) = 348 encrypted bits.

Tail 9	Data 174	TSC 78	Data 174	Tail 9	Guard 27
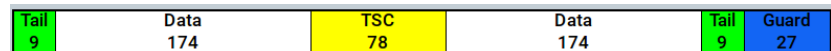
"Normal (16QAM)"

Selects a normal burst with 16QAM modulation scheme (4 bits per symbol).

A normal 16QAM burst carries 2x(4*58) = 464 encrypted bits.

Tail 12	Data 232	TSC 104	Data 232	Tail 12	Guard 36
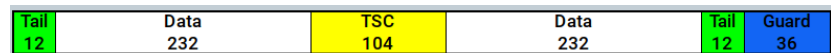
"Normal (32QAM)"

Selects a normal burst with 32QAM modulation scheme (5 bits per symbol).

A normal 32QAM burst carries 2x(5*58) = 580 encrypted bits.

Tail 15	Data 290	TSC 130	Data 290	Tail 15	Guard 45
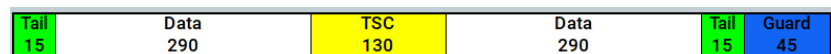
"Synchronization"

(Normal Symbol Rate)

The synchronization burst is sent by the base station only and is used for bit synchronization. For this purpose, it contains a 64-bit extended training sequence.

Tail 3	Data 39	ETSC 64	Data 39	Tail 3	Guard 9
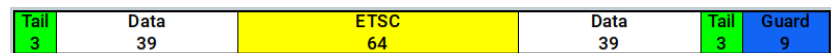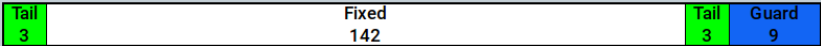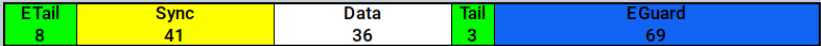
"Frequency Correction"

(Normal Symbol Rate)

The Frequency Correction burst is sent by the base station only. The user equipment uses the burst to synchronize with the carrier fre-quency and to compensate for any possible Doppler effect.

Tail 3	Fixed 142	Tail 3	Guard 9
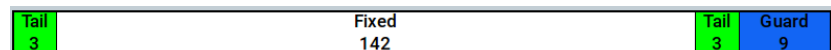
"Dummy"   (Normal Symbol Rate)
                 The dummy burst is sent by the base station only. It acts as a modu-
                 lation signal when there is no data burst available. This burst type is
                 defined in the standard and has an unalterable, precisely defined
                 data pattern.

Tail 3	Fixed 142	Tail 3	Guard 9

"Access"   (Normal Symbol Rate)
                 This burst type is sent by a user equipment to a base station as the
                 first burst, to determine the timing advance. It is used for synchroniz-
                 ing with the base station.

ETail 8	Sync 41	Data 36	Tail 3	EGuard 69

"All Data   (Normal Symbol Rate)
(GMSK)"   This and the following normal symbol rate burst types are not defined
                 in the standard. They serve as the output basis for defining a new
                 burst type with user-programmable data content for test purposes.
                 An All_Data GMSK burst carries 148 encrypted bits.

Data 148	Guard 9

"All Data   An All_Data AQPSK burst carries 148 encrypted bits per subchannel.
(AQPSK)"

SubChannel 1		SubChannel 2	
Data 148	Guard 9	Data 148	Guard 9

"All Data   (Normal Symbol Rate)
(8PSK/EDGE)"   An All_Data EDGE burst carries 3x148 = 444 encrypted bits.

Data 444	Guard 27

"All Data   (Normal Symbol Rate)
(16QAM)"   An All_Data 16QAM burst carries 4x148 = 592 encrypted bits.

Data 592	Guard 36

"All Data   (Normal Symbol Rate)
(32QAM)"   An All_Data 32QAM burst carries 5x148 = 740 encrypted bits.

Data 740	Guard 45

"HSR (QPSK)"   (Higher Symbol Rate)
                 Selects a higher symbol rate burst with QPSK modulation scheme (2
                 bits per symbol).
                 A higher symbol rate burst carries 2*69 = 138 unmodulated encrypted
                 bits, i.e. an HSR QPSK burst carries 2x(2*69) = 276 encrypted bits.

Tail 8	Data 138	TSC 62	Data 138	Tail 8	Guard 22

"HSR (16QAM)"	(Higher Symbol Rate)
	Selects a higher symbol rate burst with 16QAM modulation scheme (4 bits per symbol).
	An HSR 16QAM burst carries 4x(2*69) = 552 encrypted bits.

| Tail 16 | Data 276 | TSC 124 | Data 276 | Tail 16 | Guard 44 |

"HSR (32QAM)"	(Higher Symbol Rate)
	Selects a higher symbol rate burst with 32QAM modulation scheme (5 bits per symbol).
	An HSR 32QAM burst carries 5x(2*69) = 690 encrypted bits.

| Tail 20 | Data 345 | TSC 155 | Data 345 | Tail 20 | Guard 55 |

"HSR All Data (QPSK)"	(Higher Symbol Rate)
	This and the following higher symbol rate burst types are not defined in the standard. They serve as the output basis for defining a new burst type with user-programmable data content for test purposes.
	An HSR All_Data QPSK burst carries 2x177 = 354 encrypted bits.

| Data 354 | Guard 22 |

| "HSR All Data (16QAM)" | (Higher Symbol Rate) |
| | An HSR All_Data 16QAM burst carries 4x177 = 708 encrypted bits. |

| Data 708 | Guard 44 |

| "HSR All Data (32QAM)" | (Higher Symbol Rate) |
| | An HSR All_Data 32QAM burst carries 5x177 = 885 encrypted bits. |

| Data 885 | Guard 55 |

Remote command:

`[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>:TYPE` on page 92

Save/Recall Slots

Accesses the "Save/Recall Slot" dialog with standard "File Select" and file management functions, see Chapter 3.9, "Save recall frame/slots", on page 30.

Remote command:
n.a.

User x

When burst type "Normal (Half Rate)" is selected, the users can be set separately in dialog sections User 1 and User 2.

Remote command:
n.a.

SCPIR

Selects the SCPIR.

The value of SCPIR affects the shape of the AQPSK constellation, see Figure 2-2. For an SCPIR of 0 dB, the constellation is square (as in "normal" QPSK), while for other values of SCPIR the constellation becomes rectangular.

Use the Modulation/filter dialog to define eight different values for SCPIR. You can select from the values displayed.

Remote command:

`[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:SCPIRatio` on page 94

Slot Level

Sets the level for the selected slot.

"Off"　　　　　　Attenuation is maximum. The slot is inactive.

"Attenuated"　　Level is reduced by the level attenuation set in "Slot Attenuation".

"Full"　　　　　　The level corresponds to the level indicated in the display.

Remote command:

`[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:LEVel` on page 93

Slot Attenuation

Selects the level attenuation for the "Slot Level Attenuated" setting.

Use the Power ramping/slot attenuation dialog to define seven different values for level attenuation. You can select from the values displayed.

Remote command:

`[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:ATTenuation` on page 93

Filter

(Higher Symbol Rate slots require R&S SMM-K41)

Selects whether a "Narrow Pulse Shape" or a "Wide Pulse Shape" filter is used for the selected burst type and modulation.

Remote command:

`[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:FILTer:TYPE` on page 94

Multislot Configuration

Enables the previously set multislot mode.

Since multislot involves connecting multiple slots to a single user channel, this configuration is possible for normal (full rate) bursts, normal (8PSK/EDGE) burst and EDGE evolution bursts.

Several multislot groups can be defined within a frame. These groups are highlighted when the frame structure is displayed in the main dialog (see Chapter 3.7, "Mode framed (single)", on page 27).
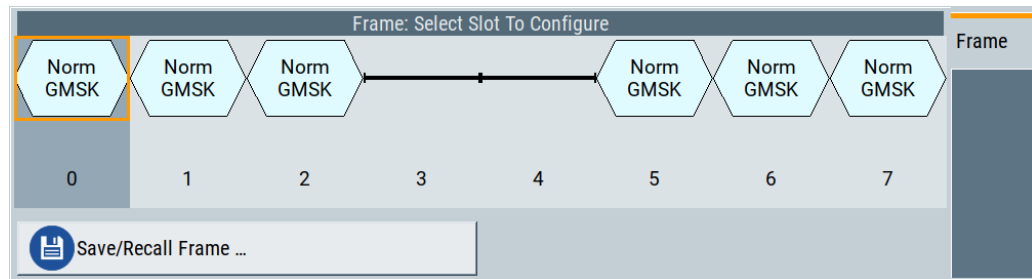
The first slot in a multislot group is the primary slot. This determines the parameters of all the slots in the group. All the slots in a multislot group therefore have identical parameters.

The multislot settings are valid for all the slots in the frames of a multiframe configuration. If slots 1 and 2 are connected, for example, both these slots are connected in all the frames of the multiframe signal.

Remote command:

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:MULTislot<st0>:STATe on page 97

Number of Slots

Defines the number of consecutive slots that are linked to a multislot.

The multislot always starts with the current slot. The value range therefore depends on the current slot index. A maximum of eight slots (slot 0 to slot 7) can be combined: 1 ... (8 - current index).

Remote command:

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:MULTislot<st0>:COUNt on page 94

Burst Fields

Comprises settings for configuring of the individual burst fields.

The available settings depend on the selected Burst Type.

Extended Tail Bits ← Burst Fields

Displays the data content in the "ETail" data field of the access burst.

Extended tail bits fields are 8 bits long and permanently set at 0011 1010.

Remote command:

n.a.

Tail Bits ← Burst Fields

Displays the data content in the "Tail" data field.

The content depends on the "Burst Type":
- Normal (GMSK...), normal (AQPSK...), synchronization, Frequency Correction, dummy and access
  "Tail Bit" field is 3 bits long and permanently set at 000.
- Normal(8PSK/EDGE)
  "Tail Bit" field is 9 bits long and permanently set at 1 1111 1111.
- Normal (16QAM)
  "Tail Bit" field is 12 bits long and permanently set at 0001 0110 0110.
- Normal (32QAM)
  "Tail Bit" field is 15 bits long and permanently set at 111 1001 1100 1110.

Remote command:

n.a.

Data for Data Field of Slot ← Burst Fields

Selects a data source for the DATA field.

If a burst contains multiple DATA fields, these are treated as a continuous field. For example, a pseudo-random sequence is continued without interruption from one DATA field to the next.

The following standard data sources are available:
- "All 0, All 1"
  An internally generated sequence containing 0 data or 1 data.
- "PNxx"
  An internally generated pseudo-random noise sequence.
- "Pattern"
  An internally generated sequence according to a bit pattern.
  Use the "Pattern" box to define the bit pattern.
- "Data List/Select DList"
  A binary data from a data list, internally or externally generated.
  Select "Select DList" to access the standard "Select List" dialog.
  – Select the "Select Data List > navigate to the list file *.dm_iqd > Select" to select an existing data list.
  – Use the "New" and "Edit" functions to create internally new data list or to edit an existing one.
  – Use the standard "File Manager" function to transfer external data lists to the instrument.

See also:
- Section "Modulation Data" in the R&S SMM100A user manual.
- Section "File and Data Management" in the R&S SMM100A user manual.
- Section "Data List Editor" in the R&S SMM100A user manual

Remote command:

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
USER<ch>][:SOURce]:DATA on page 95

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
USER<ch>][:SOURce]:DATA:PATTern on page 97

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
USER<ch>][:SOURce]:DATA:DLISt:CATalog? on page 96

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
USER<ch>][:SOURce]:DATA:DLISt on page 96

Use Stealing Flag ← Burst Fields

Sets the use stealing flag feature. The setting applies to both S fields. If not used, the flag stealing bit is allocated to the data field concerned, which then becomes 58 data bits long instead of 57.

Remote command:

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
USER<ch>]:SFLag:USE on page 98

Stealing Flag ← Burst Fields

Sets a value for the stealing flag feature. The setting applies to both S fields.

Remote command:

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
USER<ch>]:SFLag on page 98

TSC Set ← Burst Fields

Determine whether the GMSK normal burst or VAMOS subchannel uses training sequence TSC set 1 or set 2.

Assign different TSC set to each of the two subchannels to ensure that the training sequences configured for the VAMOS subchannels have a low cross-correlation.

Remote command:

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
USER<ch>][:SOURce]:TSC:SET on page 99

TSC ← Burst Fields

Selects the training sequence code.

There are 8 predefined training sequences to choose from in each case; those for GSM are 26 bits long and those for EDGE are 78 bits.

A user-defined training sequence can be created in the User TSC field and is then also available for selection.

Remote command:

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
USER<ch>][:SOURce]:TSC:SELect on page 98

TSC Pattern ← Burst Fields

Edits selected training sequence.

When a sequence has been changed, the TSC field displays the indication "User".

When a frame/slot is saved, the amended training sequence is also saved.

User-defined training sequences can be used among other things to test the reaction of receivers to interference-laden training sequences (e.g. 1-bit toggle).

Remote command:
[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][: USER<ch>][:SOURce]:TSC:USER on page 99

Ext Training Seq ETSC ← Burst Fields
Selects the extended training sequence code (ETSC) for the synchronization burst.

There is a choice of three predefined, 64-bit extended training sequences. Also, a user-defined extended training sequence can be defined in the User ETSC field and is then also available for selection.

Remote command:
[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][: USER<ch>]:ETSC on page 99

ETSC Pattern ← Burst Fields
Edits selected ETSC for the synchronization burst.

When a sequence has been changed, the "Ext Training Seq ETSC" field also displays "User" as a possible choice.

When a frame/slot is saved, the changed extended training sequence is also saved.

Remote command:
[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][: USER<ch>]:ETSC:USER on page 100

Training Sequence Sync ← Burst Fields
Selects training sequence sync for the "Access" burst.

There is a choice of three predefined, 41-bit training sequences sync. Also, user-defined training sequence sync can be defined in the "User Sync" field and is then also available for selection.

Remote command:
[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][: USER<ch>]:SYNC:SELect on page 100

Sync Pattern ← Burst Fields
Edits the training sequence sync for the access burst.

When a sequence has been changed, the "Training Sequence Sync" field also displays "User" as a possible choice.

When a frame/slot is saved, the amended training sequence sync is also saved.

Remote command:
[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][: USER<ch>]:SYNC:USER on page 100

Fixed ← Burst Fields
Selects the data content of the fixed field in the Frequency Correction burst.

There is a choice of two fixed, 142-bit data contents prescribed by the standard, and a user-defined one.

The user-defined pattern must be 142 bits long.

Remote command:
[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:FCORrection:FIXed on page 101

Fixed Pattern ← Burst Fields
Displays the data content of the fixed field in the Frequency Correction burst when "Fixed Standard" or "Compact" is selected.

Enter the data content of the fixed field in the Frequency Correction burst when "Fixed User" is selected. The pattern is 142 bits long.

Remote command:
[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:FCORrection:FIXed:PATTern on page 101

Mixed ← Burst Fields
Displays the data content of the mixed field in the dummy burst. It contains a fixed, 142-bit data content prescribed by the standard.

Remote command:
[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:DUMMy:MIXed:PATTern? on page 102

Guard ← Burst Fields
Displays the data content of the guard field in binary notation.

A frame contains exactly 1250 bits for normal burst and 1500 for higher symbol rate burst. Hence, the length of the guard fields is different for different slots (see table).

Normal Symbol Rate		
Slot #	0, 4	1 .. 3, 5 .. 7
Guard Length	9 symbol periods	8 symbol periods
Higher Symbol Rate		
Slot #	0, 2, 4, 6	1, 3, 5, 7
Guard Length	11 symbol periods	10 symbol periods

If the field "Ignore 1/4 symbol (slot length 156 symbols) / Ignore 1/2 symbol (slot length 187 symbols)" is enabled, all slots are 156 respectively 187 symbols long. The extra 1/4 resp. 1/2 symbol is omitted. The guard field for the burst always has the same length regardless of the slot index.

For normal burst, a frame is therefore 1248 symbols long instead of 1250.

Respectively, the length of the frame in a higher symbol rate burst is than 1496 symbols long instead of 1500 symbols.

Remote command:
n.a.

Extended Guard ← Burst Fields

Displays the data content of the extended guard field in the access burst.

In order for a frame to contain exactly 1250 symbols as prescribed in the GSM standard, the length of the extended Guard fields is different for different slots:

The field length is 68 bits in slots 1, 2, 3, 5, 6, 7; it is 69 bits in slots 0 and 4.

If the field "Ignore 1/4 symbol (slot length 156 symbols)" is enabled, all slots are 156 symbols long. The extra 1/4 symbol is omitted. The extended guard field for the burst always has the same length regardless of the slot index. A frame is therefore 1248 symbols long in place of 1250.

Remote command:
n.a.

Slot Marker Definition

Access the dialog for defining the marker signal at slot level. This dialog is described in the Chapter 3.13, "Slot marker definition", on page 57 .

Remote command:
n.a.

3.13 Slot marker definition

1. To access these dialogs select "General > Sequence Mode > Framed (Single) / Framed (Double)".

2. In the " Framed (Single) / Framed (Double) Configuration" tab, select "Frame: Select Slot to configure > Slot... ".

3. In the common tab, select "Burst Type".

4. In the corresponding burst type tab, select "Slot Marker Definition".
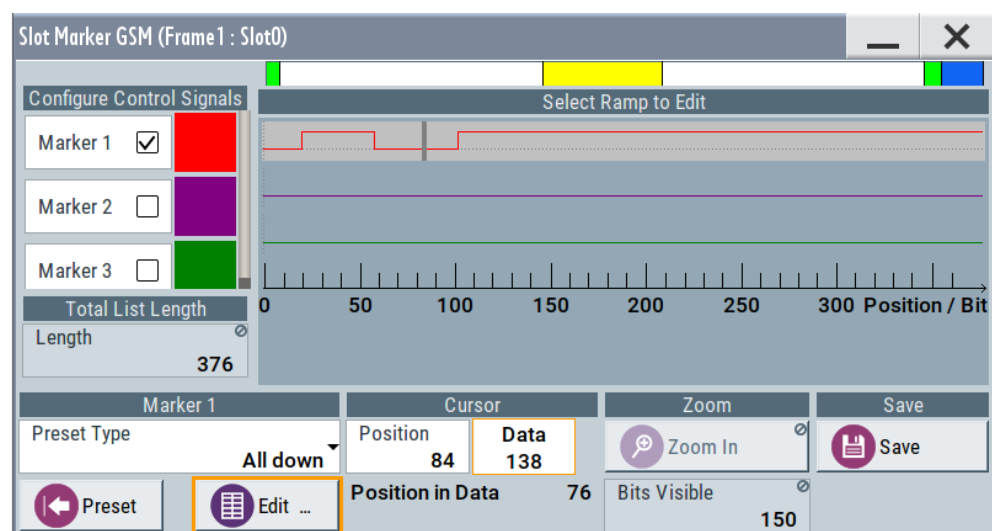
This dialog displays the structure of the slot and comprises the settings for configuring a ramp.

ⓘ The marker signals thus defined take only effect when marker mode "As defined in slot" is selected.

The structure of the selected slot (in the example, synchronization burst) is displayed in the dialog header. The individual fields of the burst are color-coded.

The available marker signals are also color-coded. In the left "Configure Control Signal" section, each individual signal is assigned a color. A check in the checkbox shows the marker for which the "As defined in slot" marker type has been selected.

In the next section, "Select Ramp to Edit", the signal characteristics are graphically displayed.

The ramps can be assigned the exact bit position in the signal by

- The schematic display of the slot above the section.
- The bit scale below the marker/control signal characteristic.
- The display of the current cursor position in the "Cursor" dialog section if the cursor marks the ramp. The field at the selected position in the slot is displayed on the side. The bit position of the cursor within this field is displayed below

The ramps can be set either graphically in the "Select Ramp to Edit" section or in the table of the "Positions Marker x" section. To make the setting easy, a selection of preset ramp characteristics is offered in the "Preset Ramp Marker x" section.

Provided are the following settings:

Configure Control Signal

Displays the color the marker and the Burst Gate signal has been assigned.

Displays whether the "CList" marker mode has been selected for this marker signal, see "Marker Settings".

Displays whether the "As defined in Slot" marker mode has been selected for this marker signal.

The source can be selected here as well and is then used in the associated dialogs.

Note: The burst gate signal is only displayed and cannot be edited.

Remote command:
[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:USER<ch>]:TRIGger:
OUTPut:TAG? on page 102

Select Ramp to Edit

Graphically edit marker signals.

For this purpose, the cursor is set to the position where a ramp is required. The ramp is generated by pressing Enter (e.g. clicking the rotary knob). Any number of ramps can be defined per marker. Each of the generated ramp positions is saved even if the definition of another ramp produces a low/low or high/high transition. The ramps are displayed as dashed lines.

Existing ramps can be shifted after the cursor has been placed on the ramp and Enter has been pressed – it then changes color twice. The ramp is shifted by using the cursor keys or the rotary knob. The new position is determined by pressing Enter again.

Ramps can be deleted with the [BACKSPACE] key after the cursor has been placed on the ramp.

Remote command:
n.a.

Total List Length
Displays the length of the list in bits.

Remote command:
n.a.

Preset Type
Activates presetting for the ramp characteristic of the selected control signal. The presetting is selected with select "Preset Type" and activated with the "Preset" button.

You can select from:

"All Up"	The marker signal is continuously high.
"All Down"	The marker signal is continuously low.
"Ramp Up"	The marker signal contains a ramp from low to high. The ramp is shifted to the center of the displayed signal area and can then be shifted as required.
"Ramp Down"	The marker signal contains a ramp from high to low. The ramp is shifted to the center of the displayed signal area and can then be shifted as required.
"Ramp Up/ Down"	The marker signal contains a ramp from low to high and from high to low. The ramps are symmetrically shifted around the center of the displayed signal area and can then be shifted as required.
"Ramp Down/Up"	The marker signal contains a ramp from high to low and from low to high. The ramps are symmetrically shifted around the center of the displayed signal area and can then be shifted as required.

Remote command:
n.a.

Edit Table
Opens table by using the "Edit Table" button.

The ramps of the selected signal can be edited in the table. When the table is opened, the current configuration of the selected marker/control signal is displayed.

The bit position is specified in the "Ramp Position" column, the high or low signal status in the "Ramp State" column. At the end of the list, there is always a blank row for entering new values.

The changes are accepted in the graphic display after pressing the "Accept" button.

Remote command:
n.a.

Cursor Position
Enters the cursor position.

In the graphic display, the cursor is positioned according to the entry.

Vice versa, graphically shifting the cursor changes the displayed value.

The field at the selected position in the slot is displayed on the side. The bit position of the cursor within this field is displayed below.

Remote command:
n.a.

Zoom In/Visible
Zooms the displayed area of the control list. The designation of the button changes from "Zoom in" to "Zoom out".

With long control lists, the displayed area can be zoomed around the current "Cursor Position".

Parameter "Visible/Bits Visible" determines the number of symbols/bits to be displayed.

Ramps outside the displayed area are not lost by zooming.

Remote command:
n.a.

Save

Saves the settings made in the "Slot Marker" dialog into a file with filename format `GsmMarkSlotDefP<x>F<y>S<z>U<w>.dm_iqc`, where:

- `x` the path number,
- `y` is the Frame number,
- `z` is the Slot number and
- `w` is the User number.

Remote command:
n.a.

4 Remote-control commands

The following commands are required to perform signal generation with the GSM/
EDGE options in a remote environment. We assume that the R&S SMM100A has
already been set up for remote operation in a network as described in the
R&S SMM100A documentation. A knowledge about the remote control operation and
the SCPI command syntax are assumed.

ⓘ **Conventions used in SCPI command descriptions**

For a description of the conventions used in the remote command descriptions, see
section "Remote Control Commands" in the R&S SMM100A user manual.

Common suffixes

The following common suffixes are used in remote commands:

Suffix	Value range	Description
SOURce<hw>	1	available baseband signals
OUTPut<ch>	1 to 3	available markers
FRAMe<di>	[1]|2	• in Frame (Double) mode (`SOURce:BB:GSM:MODE DOUBle`) this suffix defines the frame to which the setting applies • in Frame (Single) mode the keyword `FRAMe` is ignored and can be omitted
SLOT<st0>	0|[1] .. 7	defines the slot to which the setting applies **Note:** SCPI prescribes that suffix 1 is the default state and used when no specific suffix is specified. Therefore, slot 1 (and not slot 0) is selected when no suffix is specified.
SUBChannel<us>	[1]|2	defines the VAMOS subchannel
USER<ch>	[1]|2	defines the half rate user in a half rate mode

The following commands specific to the GSM/EDGE are described here:

4.1　General commands

[:SOURce<hw>]:BB:GSM:SLENgth <SLength>
[:SOURce<hw>]:BB:GSM:FLENgth <FLength>

Sets the sequence length of the generated arbitrary waveform file in number of frames. This parameter applies to GSM modes Single or Double framed.

For GSM mode Framed Double, this command is query only, since the length of the generated ARB file is determined by the parameter Frame Repetition (`[:SOURce<hw>]:BB:GSM:FRAMe<di>:REPetitions`) for both frames:

Sequence Length = Frame Repetition of Frame 1 + Frame Repetition of Frame 2.

For GSM mode (`BB:GSM:MODE`) set to Unframed, the length of the generated ARB file is set in symbols with the command `[:SOURce<hw>]:BB:GSM:SLENgth`.

Parameters:

<FLength>　　　　　　　integer

　　　　　　　　　　　　　Range:　　　1　to　max

Example:　　　　　　`BB:GSM:MODE SING`
　　　　　　　　　　　　　Selects framed single GSM mode.
　　　　　　　　　　　　　`BB:GSM:FLEN 2`
　　　　　　　　　　　　　Sets the sequence length to two frames.
　　　　　　　　　　　　　`BB:GSM:MODE DOUB`
　　　　　　　　　　　　　Selects framed double GSM mode.
　　　　　　　　　　　　　`BB:GSM:FRAM1:REP 2`
　　　　　　　　　　　　　Sets the frame repetition of frame 1 to 2.
　　　　　　　　　　　　　`BB:GSM:FRAM2:REP 1`
　　　　　　　　　　　　　Sets the frame repetition of frame 2 to 1.
　　　　　　　　　　　　　`BB:GSM:FLEN?`
　　　　　　　　　　　　　Queries the sequence length.
　　　　　　　　　　　　　`Response: 3`

Manual operation: See "Sequence Length ARB" on page 41

[:SOURce<hw>]:BB:GSM:FONE <FOne>

A modulating bit stream consisting of consecutive ones is used for inactive slots (according to GSM 05.04).

If this parameter is disabled, the inactive slots are filled in with 0.

Parameters:

<FOne>	1 | ON | 0 | OFF
	*RST: OFF

Example: `BB:GSM:FONE ON`
A modulating bit stream consisting of consecutive ones is used for inactive slots.

Manual operation: See "Force Dummy Bits to 1" on page 33

[:SOURce<hw>]:BB:GSM:FRAMe<di>:REPetitions <Repetitions>

The command defines the number of repetitions for the selected frame in GSM mode Frame (Double).

Parameters:

<Repetitions>	integer
	Range: 1 to 500000
	*RST: 1 / 1

Example: `BB:GSM:MODE DOUB`
selects GSM mode Frame (Double).
`BB:GSM:FRAM2:REP 10`
sets 10 repetitions for frame 2.

Manual operation: See "Frame Repetition" on page 30

[:SOURce<hw>]:BB:GSM:ISLength <ISLength>

Selects constant slot length.

Parameters:

<ISLength>	1 | ON | 0 | OFF
	For normal symbol rate mode:

The command selects whether the 1/4 symbol of a GSM slot is ignored or compensated for by an extra symbol every 4th slot.
For higher symbol rate mode:
The command selects whether the 1/2 symbol of an average slot with a length of 187.5 symbols are ignored or compensated for by an extra symbol every second slot.

ON

In normal symbol rate mode, all slots are 156 symbols long

In higher symbol rate mode, all slots are 187 symbols long

OFF

In normal symbol rate mode, some slots are 157 symbols long

In higher symbol rate mode, some slots are 188 symbols long

*RST: 0

Example:	BB:GSM:SRAT:MODE NSR Selects normal symbol rate mode. BB:GSM:ISL ON Selects a constant length of 156 symbols for all slots.
Manual operation:	See "Ignore 1/4 symbol (slot length 156 sym) / Ignore ½ symbol (slot length 187 sym)" on page 33

[:SOURce<hw>]:BB:GSM:MODE <Mode>

The command selects GSM mode.

Parameters:

<Mode>   UNFRamed | SINGle | DOUBle | MULTiframe

UNFRamed

Modulation signal without slot and frame structure.

SINGle

Modulation signal consisting of one frame.

DOUBle

Modulation signal in which two frames are defined and then combined by some method into a single multiframe signal.

MULTiframe

Multiframe signal.

*RST: SINGle

Example:	BB:GSM:MODE SING sets the "Single Frame" GSM mode. Only the commands for defining a single frame are valid.
Manual operation:	See "Sequence Mode" on page 16

[:SOURce<hw>]:BB:GSM:PRESet

Sets the parameters of the digital standard to their default values (*RST values specified for the commands).

Not affected is the state set with the command SOURce<hw>:BB:GSM:STATe.

Example:	SOURce1:BB:GSM:PRESet
Usage:	Event
Manual operation:	See "Set to Default" on page 15

[:SOURce\<hw>]:BB:GSM:SATTenuation\<ch> \<SAttenuation>

The command sets up to seven different values for level attenuation. The various values are defined by the suffix to `SATTenuation`. These values are used when defining the level attenuation of individual slots with the aid of the command `[:SOURce<hw>]: BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]: ATTenuation`.

Parameters:

\<SAttenuation>	float
	Range: 0 to 70
	Increment: 0.1
	*RST: 0
	Default unit: dB

Example:	`BB:GSM:MODE SING`
	Selects GSM mode Frame (Single).
	`BB:GSM:SLOT1:LEV ATT`
	Sets level attenuation mode for slot 1.
	`BB:GSM:SATT1 12`
	Sets the level attenuation for selection A1 to 12 dB.
	`BB:GSM:SLOT1:ATT A1`
	Sets the level attenuation for slot A1 to 12 dB.

Manual operation:	See "Slot Attenuation A1 to A7" on page 44

[:SOURce\<hw>]:BB:GSM:SETTing:CATalog?

This command reads out the files with GSM settings in the default directory. The default directory is set using command `MMEM:CDIRectory`. Only files with the file extension `*.gsm` are listed.

Return values:

\<Catalog>	string

Example:	`MMEM:CDIR "/var/user/temp/dig_mod`
	Sets the default directory to /var/user/temp/dig_mod.
	`BB:GSM:SETT:CAT?`
	Reads out all the files with GSM settings in the default directory.
	`Response: gsm_1`

Usage:	Query only

Manual operation:	See "Save/Recall" on page 16

[:SOURce\<hw>]:BB:GSM:SETTing:DELete \<Filename>

This command deletes the selected file with GSM settings. The directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. The file extension can be omitted. Only files with the file extension `*.gsm` are deleted.

Setting parameters:

<Filename>	string

Example:	`BB:GSM:SETT:DEL 'gsm_1'` Deletes file `gsm_1`.
Usage:	Setting only
Manual operation:	See "Save/Recall" on page 16

[:SOURce<hw>]:BB:GSM:SETTing:LOAD <Filename>

This command loads the selected file with GSM settings. The directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. The file extension can be omitted. Only files with the file extension `*.gsm` are loaded.

Setting parameters:

<Filename>	string

Example:	`BB:GSM:SETT:LOAD 'gsm_1'` Loads file `gsm_1`
Usage:	Setting only
Manual operation:	See "Save/Recall" on page 16

[:SOURce<hw>]:BB:GSM:SETTing:STORe <Filename>

This command stores the current GSM settings into the selected file. The directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. Only enter the file name. GSM settings are stored as files with the specific file extensions `*.gsm`.

Setting parameters:

<Filename>	string

Example:	`BB:GSM:SETT:STOR 'gsm_1'` Stores the current GSM settings into file `gsm_1`.
Usage:	Setting only
Manual operation:	See "Save/Recall" on page 16

[:SOURce<hw>]:BB:GSM:SMODe <SMode>

Selects the modulation signal for the mode Unframed (`:BB:GSM:MODE UNFR`). The modulation type and filter type are set in accordance with the selection.

The available simulation modes depend on the selected symbol rate:

- Normal Symbol Rate - GSM, EDGE (8PSK), AQPSK, 16QAM and 32QAM
- Higher Symbol Rate - HSR QPSK, HSR 16QAM and HSR 32QAM.

Note:"Higher Symbol Rate" Mode and "Simulation Modes" AQPSK, 16QAM, 32QAM, HSR QPSK, HSR 16QAM and HSR 32QAM are available for instruments equipped with option R&S SMM-K41 only.

Parameters:

<SMode>	GSM | EDGE | N16Qam | N32Qam | HQPSk | H16Qam | H32Qam | AQPSk
	*RST: GSM

Example:	`BB:GSM:MODE UNFR`
	Sets unframed mode.
	`BB:GSM:SRAT:MODE HSR`
	Selects higher symbol rate mode.
	`BB:GSM:SMOD H16Q`
	Selects an HSR 16QAM modulation signal for the Unframed mode.
	`BB:GSM:SRAT:MODE NSR`
	Selects normal symbol rate mode.
	`BB:GSM:SMOD GSM`
	Selects a GSM modulation signal for the Unframed mode.

Options:	R&S SMM-K41 (required for N16Qam | N32Qam | HQPSk | H16Qam | H32Qam | AQPSk)

Manual operation:	See "Simulation Mode" on page 16

[:SOURce<hw>]:BB:GSM:SRATe <SRate>

Sets the symbol clock. Possible units are Hz, kHz, MHz, Sym/s, kSym/s, MSym/s.

Parameters:

<SRate>	float
	Range: 400 to 15000000
	Increment: 0.001
	*RST: 270.833 kSym/s

Example:	`BB:GSM:SRAT 270.9 kHz`
	sets the symbol clock to 270.9 kHz.

Manual operation:	See "Symbol Rate" on page 33

[:SOURce<hw>]:BB:GSM:SRATe:MODE <Mode>

Set the symbol rate mode, i.e. determines whether normal bursts (NB) or higher symbol rate bursts (HB) are generated.

Parameters:

<Mode>	NSRate | HSRate
	*RST: NSRate

Example:	`BB:GSM:SRAT HSR`
	Selects higher symbol rate mode
	`BB:GSM:SRAT?`
	Queries the symbol clock.
	`Response: 325`
Options:	(for instruments equipped with option K41 only)
Manual operation:	See "Symbol Rate Mode" on page 16

[:SOURce<hw>]:BB:GSM:STATe <State>

Activates the standard and deactivates all the other digital standards and digital modulation modes in the same path.

Parameters:

<State>	1 | ON | 0 | OFF
	*RST:　　　0
Example:	`SOURce1:BB:GSM:STATe ON`
Manual operation:	See "State" on page 14

[:SOURce<hw>]:BB:GSM:WAVeform:CREate <Filename>

Creates a waveform using the current settings of GSM/EDGE. The file name is entered with the command. The file is stored with the predefined file extension `*.wv`. The file name and the directory it is stored in are user-definable.

Setting parameters:

<Filename>	string
Example:	`MMEM:CDIR '/var/user/temp/waveform'`
	sets the default directory to /var/user/temp/waveform.
	`BB:GSM:WAV:CRE 'gsm_1'`
	creates the waveform file `gsm.wv` in the default directory.
Usage:	Setting only
Manual operation:	See "Generate Waveform File…" on page 16

4.2　Save/recall frame/slots commands

[:SOURce<hw>]:BB:GSM:FRAMe<di>:ULISt:CATalog?

This command reads out the files with user defined frame settings in the default direc-
tory. The default directory is set using command `MMEM:CDIRectory`. Only files with
the file extension `*.gsm_fu` and `*.gsm_hfu` are listed.

Return values:

<Catalog>   string

Example: `MMEM:CDIR "/var/user/temp/frames"`
                         Sets the default directory to /var/user/temp/frames.
                         `BB:GSM:FRAM:ULIS:CAT?`
                         Reads out all the files with user defined frame settings in the
                         default directory.
                         `Response: 'NB_all'`
                         The file `NB_all` with a user defined frame setting is available.

Usage: Query only

Manual operation: See "Recall User Files" on page 31

[:SOURce<hw>]:BB:GSM:FRAMe<di>:ULISt:DELete <Filename>

This command deletes the selected file with user defined frame settings. The directory
is set using command `MMEM:CDIRectory`. A path can also be specified, in which
case the files in the specified directory are read. The file extension can be omitted.
Only files with the file extension `*.gsm_fu` and `*.gsm_hfu` are deleted.

Setting parameters:

<Filename>   string

Example: `BB:GSM:FRAM:ULIS:DEL 'NB_all'`
                         Deletes file `NB_all`.

Usage: Setting only

Manual operation: See "File Manager" on page 31

[:SOURce<hw>]:BB:GSM:FRAMe<di>:ULISt:LOAD <Filename>

This command loads the selected file with user defined frame settings. The directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. The file extension can be omitted. Only files with the file extension `*.gsm_fu` and `*.gsm_hfu` are loaded.

Setting parameters:

<Filename>	string
Example:	`BB:GSM:FRAM:ULIS:LOAD 'NB_all'` Loads file `NB_all`.
Usage:	Setting only
Manual operation:	See "Recall User Files" on page 31

[:SOURce<hw>]:BB:GSM:FRAMe<di>:ULISt:STORe <Filename>

This command stores the current frame settings into the selected file. The directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. Only enter the file name. User Standards are stored as files with the specific file extensions `*.gsm_fu` and `*.gsm_hfu`.

Setting parameters:

<Filename>	string
Example:	`BB:GSM:FRAM:ULIS:STOR 'EDGE_all'` Stores the current frame settings into file `EDGE_all`.
Usage:	Setting only
Manual operation:	See "Save User Files" on page 31

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:PREDefined:CATalog?

This command reads out the files with predefined frame settings. The directory is pre-set, therefore a path cannot be specified.

Return values:

<Catalog>	string

Example:	`BB:GSM:FRAM:PRED:CAT?`
	reads out all the files with predefined frame settings.
	`Response: 'Edge0, EdgeAll, GsmEdge, NormalBurst0, NormalBurstAll'`
	the file names of the files with the predefined frame settings are returned

Usage:	Query only
Manual operation:	See "Recall Predefined Files" on page 30

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:PREDefined:LOAD <Filename>

This command loads the selected file with predefined frame settings. The directory is pre-set, therefore a path cannot be specified.

Setting parameters:

<Filename>   string

Example: `BB:GSM:MODE SING`
                              selects GSM mode Frame (Single).
                              `BB:GSM:SRAT:MODE NSR`
                              selects normal symbol rate.
                              `BB:GSM:FRAM:PRED:LOAD 'Edge0'`
                              loads file Edge0 with the predefined frame setting Edge Burst in Slot 0.

Usage: Setting only

Manual operation: See "Recall Predefined Files" on page 30

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
        USER<ch>]:PREDefined:CATalog?

This command reads out the files with predefined slot settings. The directory is preset, therefore a path cannot be specified.

The numeric suffixes in all key words are irrelevant for this command.

Return values:

<Catalog>   string

Example: `BB:GSM:SLOT:PRED:CAT?`
                              reads out all the files with predefined frame settings.
                              `Response: GSM_NB_PN9_TSC0,EDGE_NB_PN9_TSC0`
                              the files `GSM_NB_PN9_TSC0` and `EDGE_NB_PN9_TSC0` are available.

Usage: Query only

Manual operation: See "Recall Predefined Files" on page 30

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
        USER<ch>]:PREDefined:LOAD <Filename>

This command loads the selected file with predefined slot settings. The directory is pre-set, therefore a path cannot be specified.

Setting parameters:

<Filename>   string

Example: `BB:GSM:SLOT:PRED:LOAD 'GSM_NB_PN9_TSC0'`
                              loads the settings of file `GSM_NB_PN9_TSC0` for slot 1 in frame 1.

Usage: Setting only

Manual operation: See "Recall Predefined Files" on page 30

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][: USER<ch>]:ULISt:CATalog?

This command reads out the files with user defined slot settings in the default directory. The default directory is set using command `MMEM:CDIRectory`. Only files with the file extension `*.gsm_slu` and `*.gsm_hslu` are listed.

Return values:

<Catalog>	string

Example:	`MMEM:CDIR '/var/user/temp/slots`
	Sets the default directory to /var/user/temp/slots.
	`BB:GSM:SLOT:ULIS:CAT?`
	Reads out all the files with user defined slot settings in the default directory.
	`Response: 'test_01'`
	The file `test_01` with a user defined slot setting is available.

Usage:	Query only

Manual operation:	See "Recall User Files" on page 31

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][: USER<ch>]:ULISt:DELete <Filename>

This command deletes the selected file with user defined slot settings. The directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. The file extension can be omitted. Only files with the file extension `*.gsm_slu` and `*.gsm_hslu` are deleted.

Setting parameters:

<Filename>	string

Example:	`BB:GSM:SLOT:ULIS:DEL 'NB'`
	Deletes file `NB`.

Usage:	Setting only

Manual operation:	See "File Manager" on page 31

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][: USER<ch>]:ULISt:LOAD <Filename>

This command loads the selected file with user defined slot settings. The directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. The file extension can be omitted. Only files with the file extension `*.gsm_slu` and `*.gsm_hslu` are loaded.

Setting parameters:

<Filename>	string

Example:	`BB:GSM:SLOT:ULIS:LOAD 'NB'`
	Loads file `NB`.
Usage:	Setting only
Manual operation:	See "Recall User Files" on page 31

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][: USER<ch>]:ULISt:STORe <Filename>

This command stores the current slot settings into the selected file. The directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. Only enter the file name. User slots are stored as files with the specific file extensions `*.gsm_slu` and `*.gsm_hslu`.

Setting parameters:

<Filename>	string

Example:	`BB:GSM:SLOT:ULIS:STOR 'EDGE'`
	Stores the current slot settings into file `EDGE`.
Usage:	Setting only
Manual operation:	See "Save User Files" on page 31

4.3 Modulation/filter commands

4.3.1 Modulation commands

[:SOURce<hw>]:BB:GSM:FORMat <Format>

The command selects the modulation type.

Parameters:

<Format>	MSK	FSK2
	*RST: MSK

Example: `BB:GSM:FORM FSK2`
selects the GSM modulation type FSK.

Manual operation: See "Modulation" on page 34

[:SOURce<hw>]:BB:GSM:EDGE:FORMat?

The command queries the modulation type in the case of EDGE. The modulation type is permanently set to 8PSK.

Return values:

<Format>   P8EDge

     *RST: P8EDge

Example: `BB:GSM:EDGE:FORM?`
queries the modulation type.
`Response: "P8ED"`

Usage: Query only

Manual operation: See "Modulation Type EDGE" on page 36

[:SOURce<hw>]:BB:GSM:FSK:DEViation <Deviation>

Sets the modulation deviation when `:BB:GSM:FORMat FSK2` is selected.

The range of values depends on the symbol rate (`:BB:GSM:SRATe`). The maximum deviation is 10 MHz.

Parameters:

<Deviation>   float

     Range: 0.1xf(symb) to 1.5xf(symb);(10MHz)
     Increment: 0.1
     *RST: 67708.3333
     Default unit: Hz

Example: `BB:GSM:FORM FSK2`
selects the GSM modulation type GFSK.
`BB:GSM:FSK:DEV 37.6 kHz`
sets the FSK deviation to 37.6 kHz.

Manual operation: See "FSK Deviation" on page 34

[:SOURce<hw>]:BB:GSM:AQPSk:FORMat?

The command queries the modulation type. The modulation type is permanently set to AQPSK.

Return values:

<Format>   AQPSk

     *RST: AQPSk

Example:	`BB:GSM:AQPS:FORM?`
	queries the modulation type.
	`Response: "AQPSk"`
Usage:	Query only
Options:	R&S SMM-K41
Manual operation:	See "Modulation AQPSK" on page 35

[:SOURce<hw>]:BB:GSM:H16Qam:FORMat?

The command queries the modulation type.

Return values:

<Format>	QAM16EDge
	*RST: QAM16EDge
Example:	`BB:GSM:SRAT:MODE HSR`
	selects higher symbol rate mode.
	`BB:GSM:H16Q:FORM?`
	queries the modulation type.
	`Response: "QAM16ED"`
Usage:	Query only
Options:	(for Higher Symbol Rate and instruments equipped with option K41 only)
Manual operation:	See "Modulation Type HSR 16QAM" on page 40

[:SOURce<hw>]:BB:GSM:H32Qam:FORMat?

The command queries the modulation type.

Return values:

<Format>	QAM32EDge
	*RST: QAM32EDge
Example:	`BB:GSM:SRAT:MODE HSR`
	selects higher symbol rate mode.
	`BB:GSM:H32Q:FORM?`
	queries the modulation type.
	`Response: QAM32ED`
Usage:	Query only
Options:	(for Higher Symbol Rate and instruments equipped with option K41 only)
Manual operation:	See "Modulation Type HSR 32QAM" on page 40

[:SOURce<hw>]:BB:GSM:HQPSk:FORMat?

The command queries the modulation type.

Return values:

<Format>	QEDGe
	*RST: QEDGe

Example: `BB:GSM:SRAT:MODE HSR`
selects higher symbol rate mode.
`BB:GSM:HQPS:FORM?`
queries the modulation type.
`Response: QQDG`

Usage: Query only

Options: (for Higher Symbol Rate and instruments equipped with option K41 only)

Manual operation: See "Modulation Type HSR QPSK" on page 39

[:SOURce<hw>]:BB:GSM:N16Qam:FORMat?

The command queries the modulation type.

Return values:

<Format>	QAM16EDge
	*RST: QAM16EDge

Example: `BB:GSM:SRAT:MODE NSR`
selects normal symbol rate mode.
`BB:GSM:N16Q:FORM?`
queries the modulation type.
`Response: QAM16ED`

Usage: Query only

Options: (for instruments equipped with option K41 only)

Manual operation: See "Modulation Type 16QAM" on page 37

[:SOURce<hw>]:BB:GSM:N32Qam:FORMat?

The command queries the modulation type.

Return values:

<Format>	QAM32EDge
	*RST: QAM32EDge

Example: `BB:GSM:SRAT:MODE NSR`
selects normal symbol rate mode.
`BB:GSM:N32Q:FORM?`
queries the modulation type.
`Response: QAM32ED`

Usage:	Query only
Options:	(for instruments equipped with option K41 only)
Manual operation:	See "Modulation Type 32QAM" on page 38

[:SOURce<hw>]:BB:GSM:AQPSk:ANGLe<ch0> <Angle>

Sets the angle alpha.

Parameters:

<Angle>	float	
	Range:	0.0001 to 89.9999
	Increment:	0.0001
	*RST:	45

Example:	`BB:GSM:AQPS:ANGL5 50`
Options:	R&S SMM-K41
Manual operation:	See "Angle alpha_0 ... alpha_7" on page 35

[:SOURce<hw>]:BB:GSM:AQPSk:SCPIR<ch0> <Scpir>

Sets the Subchannel Power Imbalance Ratio (SCPIR). It is related to the angle α as follows:

$SCPIR = 20 * log_{10}(tan\ α)\ dB$,

where the value of α is chosen such that |SCPIR|≤10dB.

Parameters:

<Scpir>	float	
	Range:	-115.1625 to 115.1625
	Increment:	0.0001
	*RST:	0

Example:	`BB:GSM:AQPS:SCPIR5 –10`
	`BB:GSM:AQPS:ANGL5?`
	`Response: 17.5484`
Options:	R&S SMM-K41
Manual operation:	See "SCPIR_0 to SCPIR_7" on page 36

4.3.2 Filter commands

[:SOURce<hw>]:BB:GSM:FILTer:TYPE?

The command sets the filter type GAUSs. This is the only possible selection in the case of digital standard GSM.

Return values:

<Type>	GAUSs
	*RST: GAUSs

Example:	BB:GSM:FILT:TYPE GAUS
	sets the filter type GAUSS.

Usage:	Query only

Manual operation:	See "Filter" on page 34

[:SOURce<hw>]:BB:GSM:FILTer:PARameter <Parameter>

The command sets the filter parameter. For Gaussian filter the BxT is the product of the bandwidth and the symbol duration. The default value for GSM modulation is 0.3 and for Gauss Linearized (EDGE), BT = 0.3.

Parameters:

<Parameter>	float	
	Range:	0.15 to 2.5
	Increment:	0.01
	*RST:	0.3

Example:	BB:GSM:FILT:PAR 0.4
	sets the BT value to 0.4.

Manual operation:	See "Filter Parameter" on page 35

[:SOURce<hw>]:BB:GSM:FILTer:AQPSK:TYPE?

Queries the filter type for AQPSK modulation. The filter is permanently set to GAUSS linearized.

Return values:

<Type>	LGAuss
	*RST: LGAuss

Usage:	Query only

Options:	R&S SMM-K41

Manual operation:	See "Filter" on page 36

[:SOURce<hw>]:BB:GSM:FILTer:EDGE:TYPE?

The command sets the filter type LGAuss. This is the only possible selection in the case of digital standard GSM EDGE.

Return values:

<Type>   LGAuss

                            *RST: LGAuss

Example: BB:GSM:FILT:EDGE:TYPE LGA
                            sets the filter type Gauss linearized.

Usage: Query only

Manual operation: See "Filter" on page 37

[:SOURce<hw>]:BB:GSM:FILTer:N16Qam:TYPE?

Queries filter for 16QAM signal. The filter is permanently set to GAUSS linearized.

Return values:

<Type>   LGAuss

Example: BB:GSM:FILT:N16Q:TYPE?
                            queries the filter type.
                            Response: LGA

Usage: Query only

Options: K41

Manual operation: See "Filter" on page 37

[:SOURce<hw>]:BB:GSM:FILTer:N32Qam:TYPE?

Queries filter for 32QAM signal. The filter is permanently set to GAUSS linearized.

Return values:

<Type>   LGAuss

Example: BB:GSM:FILT:N32Q:TYPE?
                            queries the filter type.
                            Response: LGA

Usage: Query only

Options: K41

Manual operation: See "Filter" on page 38

[:SOURce<hw>]:BB:GSM:FILTer:H16Qam:TYPE <Type>

Sets the filter for HSR 16QAM signal.

Parameters:

<Type>   ENPShape | EWPShape

                      *RST: ENPShape

Example: BB:GSM:FILT:H16Q:TYPE ENPS

[:SOURce<hw>]:BB:GSM:FILTer:H32Qam:TYPE <Type>

Sets the filter for HSR 32QAM signal.

Parameters:

<Type>   ENPShape | EWPShape

                      *RST: ENPShape

Example: BB:GSM:FILT:H32Q:TYPE ENPS

Manual operation: See "Filter" on page 40
                      See "Filter" on page 40

[:SOURce<hw>]:BB:GSM:FILTer:HQPSk:TYPE <Type>

Sets the filter for HSR QPSK signal.

Parameters:

<Type>   ENPShape | EWPShape

                      *RST: ENPShape

Example: BB:GSM:FILT:HQPS:TYPE ENPS

Manual operation: See "Filter" on page 39

4.4 Clock commands

This section lists the remote control commands, necessary to configure the clock.

[:SOURce<hw>]:BB:GSM:CLOCk:SOURce <Source>

Selects the clock source:

- INTernal: Internal clock reference

- ELCLock: External local clock

- EXTernal = ELCLock: Setting only
  Provided for backward compatibility with other Rohde & Schwarz signal generators

Parameters:

<Source>   INTernal

                      *RST: INTernal

Example: SOURce1:BB:GSM:CLOCk:SOURce INT

Manual operation: See "Clock Source" on page 25

4.5 Trigger commands

Example: Trigger configuration

```
SOURce1:BB:GSM:TRIGger:SOURce INTernal
SOURce1:BB:GSM:TRIGger:SEQuence ARETrigger
SOURce1:BB:GSM:STAT ON
SOURce1:BB:GSM:TRIGger:EXECute
SOURce1:BB:GSM:TRIGger:ARM:EXECute
SOURce1:BB:GSM:TRIGger:RMODe?
// stopped
SOURce1:BB:GSM:TRIGger:EXECute
SOURce1:BB:GSM:TRIGger:RMODe?
// run

// SOURce1:BB:GSM:TRIGger:SEQuence SING
// SOURce1:BB:GSM:TRIGger:SLUNit FRAMe
// SOURce1:BB:GSM:TRIGger:SLENgth 2

// SOURce1:BB:GSM:TRIGger:SEQuence ARET
// SOURce1:BB:GSM:TRIGger:SOURce EGT1
// SOURce1:BB:GSM:TRIGger:EXTernal:SYNChronize:OUTPut 1
// SOURce1:BB:GSM:TRIGger:EXTernal:INHibit 100
// SOURce1:BB:GSM:TRIGger:EXTernal:DELay 10
```

[:SOURce<hw>]:BB:GSM[:TRIGger]:SEQuence <Sequence>

Selects the trigger mode:

- `AUTO` = auto
- `RETRigger` = retrigger
- `AAUTo` = armed auto

- `ARETrigger` = armed retrigger
- `SINGle` = single

Parameters:

<Sequence>   AUTO | RETRigger | AAUTo | ARETrigger | SINGle

                    *RST: AUTO

Example: See Example"Trigger configuration" on page 82

Manual operation: See "Mode" on page 18

[:SOURce<hw>]:BB:GSM:TRIGger:ARM:EXECute

Stops signal generation; a subsequent trigger event restarts signal generation.

Example: See Example"Trigger configuration" on page 82

Usage: Event

Manual operation: See "Arm" on page 20

[:SOURce<hw>]:BB:GSM:TRIGger:EXECute

Executes a trigger.

Example: See Example"Trigger configuration" on page 82

Usage: Event

Manual operation: See "Execute Trigger" on page 20

[:SOURce<hw>]:BB:GSM:TRIGger:EXTernal:SYNChronize:OUTPut <Output>

Enables signal output synchronous to the trigger event.

Parameters:

<Output>   1 | ON | 0 | OFF

                    *RST: 1

Example: See Example"Trigger configuration" on page 82

Manual operation: See "Sync. Output to External Trigger/Sync. Output to Trigger"
on page 20

[:SOURce<hw>]:BB:GSM:TRIGger:RMODe?

Queries the signal generation status.

Return values:

<RMode>   STOP | RUN

Example: See Example"Trigger configuration" on page 82

Usage: Query only

Manual operation:　　　See "Running/Stopped" on page 19

[:SOURce<hw>]:BB:GSM:TRIGger:SLENgth <SLength>

Defines the length of the signal sequence that is output in the `SINGle` trigger mode.

Parameters:

<SLength>　　　　　　　integer

　　　　　　　　　　　　Range:　　1 to max
　　　　　　　　　　　　*RST:　　 1

Example:　　　　　　　See Example"Trigger configuration" on page 82

Manual operation:　　　See "Signal Duration" on page 19

[:SOURce<hw>]:BB:GSM:TRIGger:SLUNit <SLunit>

Defines the unit for the entry of the signal sequence length.

Parameters:

<SLunit>　　　　　　　　FRAMe | SYMBol

　　　　　　　　　　　　*RST:　　　FRAMe

Example:　　　　　　　See Example"Trigger configuration" on page 82

Manual operation:　　　See "Signal Duration Unit" on page 19

[:SOURce<hw>]:BB:GSM:TRIGger:SOURce <Source>

Selects the trigger signal source and determines the way the triggering is executed.
Provided are:

- Internal triggering by a command (`INTernal`)
- External trigger signal via one of the local or global connectors
  - `EGT1|EGT2`: External global trigger
  - `EGC1|EGC2`: External global clock
- In primary-secondary instrument mode, the external baseband synchronization signal (`BBSY`)
- `OBASeband|BEXTernal|EXTernal`: Setting only
  Provided only for backward compatibility with other Rohde & Schwarz signal generators.
  The R&S SMM100A accepts these values and maps them automatically as follows:
  `EXTernal = EGT1, BEXTernal = EGT2, OBASeband = INTA`

Parameters:

<Source>　　　　　　　　INTernal|EGT1|EGT2|EGC1|EGC2|EXTernal|BBSY

　　　　　　　　　　　　*RST:　　　INTernal

Example:　　　　　　　See Example"Trigger configuration" on page 82

Manual operation:　　　See "Source" on page 20

[:SOURce\<hw>]:BB:GSM:TRIGger[:EXTernal]:DELay \<Delay>

Sets the trigger delay.

Parameters:

\<Delay>	float
	Range: 0 to 2147483647
	Increment: 0.01
	*RST: 0
	Default unit: samples

Example: See Example"Trigger configuration" on page 82.

Manual operation: See "External Delay/Trigger Delay" on page 22

[:SOURce\<hw>]:BB:GSM:TRIGger[:EXTernal]:INHibit \<Inhibit>

Specifies the duration by which a restart is inhibited.

Parameters:

\<Inhibit>	integer
	Range: 0 to 21.47*symbRate
	*RST: 0

Example: See Example"Trigger configuration" on page 82.

Manual operation: See "External Inhibit/Trigger Inhibit" on page 21

[:SOURce\<hw>]:BB:GSM:TRIGger:TIME:DATE \<Year>, \<Month>, \<Day>

Sets the date for a time-based trigger signal. For trigger modes single or armed auto, you can activate triggering at this date via the following command:

```
SOURce<hw>:BB:<DigStd>:TRIGger:TIME:STATe
```

`<DigStd>` is the mnemonic for the digital standard, for example, `ARB`. Time-based triggering behaves analogously for all digital standards that support this feature.

Parameters:

\<Year>	integer
	Range: 1980 to 9999
\<Month>	integer
	Range: 1 to 12
\<Day>	integer
	Range: 1 to 31

Example: See example "Configure a time-based trigger signal" in the subchapter "Trigger Commands" of the chapter "SOURce:BB:ARB subsystem" in the R&S SMM100A user manual.

Manual operation: See "Trigger Time" on page 20

[:SOURce<hw>]:BB:GSM:TRIGger:TIME:TIME <Hour>, <Minute>, <Second>

Sets the time for a time-based trigger signal. For trigger modes single or armed auto, you can activate triggering at this time via the following command:

`SOURce<hw>:BB:<DigStd>:TRIGger:TIME:STATe`

`<DigStd>` is the mnemonic for the digital standard, for example, `ARB`. Time-based triggering behaves analogously for all digital standards that support this feature.

Parameters:

<Hour>   integer

                                Range: 0 to 23

<Minute>   integer

                                Range: 0 to 59

<Second>   integer

                                Range: 0 to 59

Example: See example "Configure a time-based trigger signal" in the sub-chapter "Trigger Commands" of the chapter "SOURce:BB:ARB subsystem" in the R&S SMM100A user manual.

Manual operation: See "Trigger Time" on page 20

[:SOURce<hw>]:BB:GSM:TRIGger:TIME[:STATe] <State>

Activates time-based triggering with a fixed time reference. If activated, the R&S SMM100A triggers signal generation when its operating system time matches a specified time.

Specify the trigger date and trigger time with the following commands:

`SOURce<hw>:BB:<DigStd>:TRIGger:TIME:DATE`

`SOURce<hw>:BB:<DigStd>:TRIGger:TIME:TIME`

`<DigStd>` is the mnemonic for the digital standard, for example, `ARB`. Time-based triggering behaves analogously for all digital standards that support this feature.

Parameters:

<State>   1 | ON | 0 | OFF

                                *RST: 0

Example: See example "Configure a time-based trigger signal" in the sub-chapter "Trigger Commands" of the chapter "SOURce:BB:ARB subsystem" in the R&S SMM100A user manual.

Manual operation: See "Time Based Trigger" on page 19

4.6 Marker commands

Example: Marker configuration

```
SOURce1:BB:GSM:TRIGger:OUTPut1:MODE PULS
// sets a pulse marker
SOURce1:BB:GSM:TRIGger:OUTPut1:PULSe:DIVider 2
SOURce1:BB:GSM:TRIGger:OUTPut1:PULSe:FREQuency?

SOURce1:BB:GSM:TRIGger:OUTPut1:MODE PATTern
// sets a bit pattern marker
SOURce1:BB:GSM:TRIGger:OUTPut1:PATTern #H2,2

SOURce1:BB:GSM:TRIGger:OUTPut1:MODE RAT
SOURce1:BB:GSM:TRIGger:OUTPut1:ONTime 1
SOURce1:BB:GSM:TRIGger:OUTPut1:OFFTime 1
// defines the on/off ratio
```

[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:MODE <Mode>

Defines the signal for the selected marker output.

Parameters:

<Mode>	SDEF	FRAMe	SLOT	PULSe	PATTern	RATio
	SDEF
	As defined in slots
	The marker defined in the burst editor is used.
	*RST: FRAMe
Example:	See Example"Marker configuration" on page 87
Manual operation:	See "Mode" on page 23

[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:ONTime <OnTime>
[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:OFFTime <OffTime>

Sets the duration during which the marker output is on or off.

Parameters:

<OffTime>   integer

                           Range: 1 to 16777215
                           *RST: 1

Example: See Example"Marker configuration" on page 87

Manual operation: See "Mode" on page 23

[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:PATTern <Pattern>, <BitCount>

Defines the bit pattern used to generate the marker signal.

Parameters:

<Pattern>   numeric

                           *RST: #H2

<BitCount>   integer

                           Range: 1 to 64
                           *RST: 2

Example: See Example"Marker configuration" on page 87

Manual operation: See "Mode" on page 23

[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:PERiod:SLOT <Slot>

Sets the repetition rate for the slot clock at the marker outputs.

Parameters:

<Slot>   integer

                           Range: 1 to 8
                           *RST: 1

Example: `SOURce1:BB:GSM:TRIGger:OUTPut2:MODE SLOT`

                           `SOURce1:BB:GSM:TRIGger:OUTPut2:PERiod:SLOT 16`

[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:PERiod[:FRAMe] <Frame>

Sets the repetition rate for the frame clock at the marker outputs.

Parameters:

<Frame>   integer

                           Range: 1 to 67108863
                           *RST: 1

Example: `SOURce1:BB:GSM:TRIGger:OUTPut2:MODE FRAM`

                           `SOURce1:BB:GSM:TRIGger:OUTPut2:PERiod:SLOT 16`

[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:PULSe:DIVider <Divider>

Sets the divider for the pulsed marker signal.

Parameters:

<Divider>   integer

                          Range: 2 to 1024
                          *RST: 2

Example: See Example"Marker configuration" on page 87

Manual operation: See "Mode" on page 23

[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:PULSe[:FREQuency]?

Queries the pulse frequency of the pulsed marker signal `PULSe`.

Return values:

<Frequency>   float

Example: See Example"Marker configuration" on page 87

Usage: Query only

Manual operation: See "Mode" on page 23

[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:DELay <Delay>

Defines the delay between the signal on the marker outputs and the start of the signals.

Parameters:

<Delay>   float

                          Range: 0 to 16777215
                          Increment: 1
                          *RST: 0
                          Default unit: Samples

Example: See Example"Marker configuration" on page 87

Manual operation: See "Delay" on page 24

4.7 Power ramping/slot attenuation commands

[:SOURce<hw>]:BB:GSM:PRAMp:BBONly[:STATe] <State>

Note: This command is available for instruments with RF output only.

Selects power ramping in the baseband only or mixed power ramping in the baseband and the RF section. The "ON" setting is mandatory if, with power ramping active, only the baseband signal is output (I/Q outputs), or, in case of two-path instruments, if a baseband signal is applied to two RF paths (RF A and RF B).

Only then can a signal with a defined, predictable level be output.

Parameters:

<State>	1 | ON | 0 | OFF
	*RST: 0

Example: `BB:GSM:PRAM:BBON ON`

selects power ramping in the baseband only.

Manual operation: See "In Baseband Only" on page 44

[:SOURce<hw>]:BB:GSM:PRAMp:FDELay <FDelay>

The command sets the offset in the Falling edge of the ramp envelope at the end of a slot. A positive value causes a ramp delay and a negative value advances the ramp. The setting is expressed in symbols.

Parameters:

<FDelay>	float
	Range: -9 to 9
	Increment: 0.01
	*RST: 0
	Default unit: symbol

Example: `BB:GSM:PRAM:FDEL -1`

Sets an advance of 1 symbol in the falling edge of the envelope at the end of the slot.

Manual operation: See "Fall Delay" on page 44

[:SOURce<hw>]:BB:GSM:PRAMp:RDELay <RDelay>

The command sets the offset in the Rising edge of the ramp envelope at the start of a slot. A positive value causes a ramp delay and a negative value advances the ramp. The setting is expressed in symbols.

Parameters:

<RDelay>	float
	Range: -9 to 9
	Increment: 0.01
	*RST: 0
	Default unit: symbol

Example: `BB:GSM:PRAM:RDEL -1`

Sets an advance of 1 symbol in the rising edge of the envelope at the start of the slot.

Manual operation: See "Rise Delay" on page 44

[:SOURce<hw>]:BB:GSM:PRAMp:SHAPe <Shape>

The command sets the edge shape of the ramp envelope.

Parameters:

<Shape>   LINear | COSine

LINear
The transmitted power rises and falls linear fashion.

COSine
The transmitted power rises and falls in the shape of a cosine.

*RST: COSine

Example: BB:GSM:PRAM:SHAP LIN

sets a cosine-shaped rise and fall to the edge.

Manual operation: See "Ramp Function" on page 43

[:SOURce<hw>]:BB:GSM:PRAMp:TIME <Time>

The command sets the edge slope of the ramp envelope. This specifies the number of symbols over which the switching operation is stretched when the transmitted power is turned on and off.

Parameters:

<Time>   float

Range: 0.3 to 16
Increment: 0.1
*RST: 2
Default unit: symbol

Example: BB:GSM:PRAM:TIME 6

Sets the duration of the switching operation to six symbols.

Manual operation: See "Ramp Time" on page 43

4.8 Burst editor commands

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>:TYPE <Type>

Selects the burst (slot) type.

Parameters:

<Type>   NORMal | HALF | EDGE | SYNC | FCORrection | DUMMy | ACCess | ADATa | AEDGe | N16Qam | N32Qam | A16Qam | A32Qam | HQPSk | H16Qam | H32Qam | HAQPsk | HA16Qam | HA32Qam | NAFF | NAFH | NAHH | AAQPsk

N16Qam | N32Qam
Normal 16QAM | Normal 32QAM

HQPSk | H16Qam | H32Qam
HSR QPSK | HSR 16QAM | HSR 32QAM

NAFF | NAFH | NAHH
Normal AQPSK Full rate - Full rate | Normal AQPSK Full rate - Half rate | Normal AQPSK Half rate - Half rate

Axxxxx (All Data)
The types All Data xxx are not defined in the standard.

*RST: NORMal

Example:	`BB:GSM:SLOT:TYPE DUMM` Selects dummy burst type for slot 1.
Options:	Higher symbol rate mode, higher order modulation schemes (16QAM and 32QAM) and AQPSK require R&S SMM-K41.
Manual operation:	See "Burst Type" on page 47

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:LEVel <Level>

The command defines the power control level of the selected slot.

Parameters:

<Level>	OFF | ATT | FULL
	OFF The slot is inactive.
	ATT The power is reduced by the amount defined using `:BB:GSM:SLOT:ATT`.
	FULL Full power as specified by the level setting.
	*RST: Slot 0: FULL; Slots 1...7: OFF
Example:	`BB:GSM:SLOT2:LEV FULL` selects power control level Full Power for slot 2.
Manual operation:	See "Slot Level" on page 51

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:ATTenuation <Attenuation>

The command selects one of seven possible values for the level attenuation. This value defines by how much the power of the selected slot with power control level `:BB:GSM:SLOT:LEV ATT` is reduced in relation to the normal output power (attribute `...:LEVEL FULL`). The seven possible values are set using the command `:SOURce:BB:GSM:SATTenuation<n>`.

Parameters:

<Attenuation>	A1 | A2 | A3 | A4 | A5 | A6 | A7

Example:	`BB:GSM:MODE SING`
	Selects GSM mode Frame (Single).
	`BB:GSM:SLOT1:LEV ATT`
	Sets level attenuation mode for slot 1.
	`BB:GSM:SATT1 12dB`
	Sets the level attenuation for selection A1 to 12 dB.
	`BB:GSM:SLOT1:ATT A1`
	Sets the level attenuation for slot 0 dB to 12 dB.

Manual operation:	See "Slot Attenuation" on page 51

[:SOURce\<hw>]:BB:GSM[:FRAMe\<di>]:SLOT\<st0>[:SUBChannel\<us>][: USER\<ch>]:SCPIRatio \<SCPIRatio>

The command selects one of eight possible values for the SCPIR. The eight possible values are set using the command `[:SOURce<hw>]:BB:GSM:AQPSk:SCPIR<ch0>`.

Parameters:

\<SCPIRatio>   SCPIR7 | SCPIR6 | SCPIR5 | SCPIR4 | SCPIR3 | SCPIR2 | SCPIR1 | SCPIR0

                     *RST: SCPIR0

Example: `BB:GSM:AQPS:SCPIR5 -10`

                     `BB:GSM:SLOT:SUBC2:SCPIR SCPIR5`

Manual operation: See "SCPIR" on page 50

[:SOURce\<hw>]:BB:GSM[:FRAMe\<di>]:SLOT\<st0>[:SUBChannel\<us>][: USER\<ch>]:FILTer:TYPE \<Type>

Selects whether a Narrow Pulse Shape or a Wide Pulse Shape filter is used for the selected burst type and modulation.

Parameters:

\<Type>   ENPShape | EWPShape

                     *RST: ENPShape

Example: `BB:GSM:SRAT:MODE HSR`

                     Selects higher symbol rate mode.

                     `BB:GSM:FRAM1:SLOT1:TYPE H16Q`

                     Selects HSR 16QAM burst type for slot 1.

                     `BB:GSM:FRAM1:SLOT1:FILT:TYPE EWPS`

                     Selects Wide Pulse Shape filter for slot 1.

Options: R&S SMM-K41

Manual operation: See "Filter" on page 39

                        See "Filter" on page 40

                        See "Filter" on page 40

                        See "Filter" on page 51

[:SOURce\<hw>]:BB:GSM[:FRAMe\<di>]:MULTislot\<st0>:COUNt \<Count>

Sets the number of slots combined in a multislot. Since multislot involves connecting multiple slots to a single user channel, this configuration is possible for Normal (Full Rate) bursts Normal (8PSK / EDGE) burst (`SOUR:BB:GSM:FRAM:SLOT:TYPE NORM|EDGE`) and EDGE Evolution bursts.

The suffix in `MULTislot` defines the first slot in a multislot group. In a multiframe configuration, this setting applies to the slots in all frames.

Parameters:

<Count>   integer

                              Range: 1 to 7
                              *RST: 1

Example: `BB:GSM:MODE SING`
                              Selects GSM mode Frame (Single).
                              `BB:GSM:SLOT0:TYPE NORM`
                              Selects the NORMal burst type for slot 0.
                              `... SLOT1 ... SLOT7`
                              Selects burst type for slots 1 to 7 correspondingly.
                              `BB:GSM:MULT0:COUN 8`
                              Defines a multislot from all eight slots.
                              `BB:GSM:MULT0:STAT ON`
                              Switches the multislot configuration on.

Manual operation: See "Number of Slots" on page 52

**[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
    USER<ch>][:SOURce]:DATA** <Data>

The command defines the data source for the DATA fields in the burst. This command is valid only when burst types that contain data fields are selected. If a burst contains multiple DATA fields, these are treated as a continuous field. For instance, data such as a pseudo-random sequence is continued without interruption from one DATA field to the next.

In "GSM Mode Unframed", this command defines the data source for the unframed signal. The suffix in `:SLOT` has to be set to 0 (`BB:GSM:SLOT0:DATA`).

Parameters:

<Data>   ALL0 | ALL1 | PATTern | PN9 | PN11 | PN15 | PN16 | PN20 |
                              PN21 | PN23 | DLISt

                              PNxx
                              The pseudo-random sequence generator is used as the data source. There is a choice of different lengths of random sequence.

                              DLISt
                              A data list is used. The data list is selected with the aid of command `SOURce:BB:GSM:SLOT:DATA:DLISt`.

                              ALL0 | ALL1
                              Internal 0 or 1 data is used.

                              PATTern
                              Internal data is used. The bit pattern for the data is defined with the aid of command `:SOURce:BB:GSM:SLOT:DATA:PATTern`.

                              *RST: PN9

Example:	`BB:GSM:SLOT2:TYPE NORM`
	Selects NORMAL burst type for slot 2.
	`BB:GSM:SLOT2:DATA PN15`
	Selects internal PRBS data with period length $2^{15}-1$ as the data source for the DATA fields in the burst. The pseudo-random sequence is continued without interruption from one DATA field to the next.
Manual operation:	See "Data" on page 26
	See "Data for Data Field of Slot" on page 53

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][: USER<ch>][:SOURce]:DATA:DLISt <DList>

The command selects a data list. This command is only valid for bursts with DATA fields. This data list is only used if it is set as the data source with the aid of command `:BB:GSM:SLOT:DATA DLIS`.

Parameters:

<DList>	string
Example:	`BB:GSM:SLOT2:TYPE NORM`
	selects NORMAL burst type for slot 2.
	`BB:GSM:SLOT2:DATA DLIS`
	selects internal data lists as the data source for DATA fields.
	`BB:GSM:SLOT2:DATA:DLIS 'test'`
	selects the test data list. The data list is continued without interruption from one DATA field to the next.
Manual operation:	See "Data" on page 26
	See "Data for Data Field of Slot" on page 53

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][: USER<ch>][:SOURce]:DATA:DLISt:CATalog?

This command reads out the data list files in the default directory. The default directory is set using command `MMEM:CDIRectory`. Only files with the file extension `*.dm_iqd` are listed.

Return values:

<Catalog>	string
Example:	`MMEM:CDIR '/var/user/temp/dlist_gsm'`
	Sets the default directory to /var/user/temp/dlist_gsm.
	`BB:GSM:SLOT2:DATA:DLIS:CAT?`
	Queries the available data lists in /var/user/temp/dlist_gsm.
	`Response: 'test_01','test_02'`
	Data lists `test_01` and `test_02` are available in /var/user/temp/dlist_gsm.
Usage:	Query only
Manual operation:	See "Data for Data Field of Slot" on page 53

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][: USER<ch>][:SOURce]:DATA:PATTern <Pattern>, <BitCount>

Sets the data pattern for the internal data when PATTern is selected as the data source. The length depends on the length of the data fields in the selected burst type.

Parameters:

<Pattern>	numeric	
	*RST:	#H0

<BitCount>	integer	
	Range:	1 to 64
	*RST:	1

Example: BB:GSM:SLOT2:TYPE ACC
selects the Access burst type for slot 2. This burst type contains a 36-bit data field.
BB:GSM:SLOT2:DATA PATT
selects Pattern as the data source.
BB:GSM:SLOT2:DATA:PATT #H801FA,20
generates the data for the data field in the burst.

Manual operation: See "Data" on page 26
See "Data for Data Field of Slot" on page 53

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:MULTislot<st0>:STATe <State>

Switches the multislot configuration on.

The suffix in MULTislot defines the first slot in a multislot group. In a multiframe configuration, this setting applies to the slots in all frames.

Parameters:

<State>	1 | ON | 0 | OFF	
	*RST:	0

Example: BB:GSM:MODE DOUB
Selects GSM mode Frame (Double).
BB:GSM:SLOT0:TYPE NORM
Selects the NORMal burst type for slot 0.
... SLOT1 ... SLOT7
Selects burst type for slots 1 to 7 correspondingly.
BB:GSM:MULT0:COUN 8
Defines a multislot from all eight slots.
BB:GSM:MULT0:STAT ON
Switches the multislot configuration on.

Manual operation: See "Multislot Configuration" on page 51

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
USER<ch>]:SFLag <SFlag>

The command sets the Stealing Flag state (only for Normal
burst :BB:GSM:SLOT:TYPE NORM).

Parameters:

<SFlag>   0 | 1

                       *RST: 0

Example: BB:GSM:SLOT2:TYPE NORM
                       selects NORMAL burst type for slot 2.
                       BB:GSM:SLOT2:SFL 1
                       sets Stealing Flags for slot 2 to the value 1.

Manual operation: See "Stealing Flag" on page 54

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
USER<ch>]:SFLag:USE <Use>

The command enables or disables the use of Stealing Flags. If not used, the Stealing
Flags bits are allocated to the DATA fields (only for Normal
burst :BB:GSM:SLOT:TYPE NORM).

Parameters:

<Use>   1 | ON | 0 | OFF

                       *RST: ON

Example: BB:GSM:SLOT2:TYPE NORM
                       selects NORMAL burst type for slot 2.
                       BB:GSM:SLOT2:SFL 1
                       sets Stealing Flags for slot 2 to the value 1.
                       BB:GSM:SLOT2:SFL:USE ON
                       enables the use of Stealing Flags for slot 2.

Manual operation: See "Use Stealing Flag" on page 54

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
USER<ch>][:SOURce]:TSC:SELect <Select>

The command selects the training sequence code. The values specified in GSM 5.02
are T0...T7. When USER is selected, the value specified with the aid of
the ...:TSC:USER command described next is used.

Parameters:

<Select>   T0 | T1 | T2 | T3 | T4 | T5 | T6 | T7 | USER

                       *RST: T0

Example: `BB:GSM:MODE SING`
                      selects Single Frame mode.
                      `BB:GSM:SLOT2:TYPE NORM`
                      selects Normal burst for slot 2.
                      `BB:GSM:SLOT2:TSC:SEL T3`
                      selects training sequence code T3 for slot 2.

Manual operation: See "TSC" on page 54

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][: USER<ch>][:SOURce]:TSC:SET <Set>

Sets the TSC set for the corresponding GMSK normal burst or VAMOS subchannel, user and slot.

Parameters:

<Set>   SET1 | SET2
                      *RST: SET1

Example: `BB:GSM:SLOT2:SUBC2:USER2:TSC:SET SET2`

Manual operation: See "TSC Set" on page 54

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][: USER<ch>][:SOURce]:TSC:USER <User>

The command specifies the user-defined training sequence code. This code is used if the USER parameter is set with the aid of the `[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>][:SOURce]:TSC:SELect` command. The length is 26 bits for `:BB:GSM:SLOT:TYPE NORMal` and 78 bits for `:BB:GSM:SLOT:TYPE EDGE`.

Parameters:

<User>   integer

                      Range: #B0,1 to #B111 ,1...26/78 bits
                      *RST: #H0970897

Example: `BB:GSM:SLOT3:TSC:USER #H3FFFFFF`
                      enters the user-defined training sequence for slot 3.

Manual operation: See "TSC Pattern" on page 54

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][: USER<ch>]:ETSC <Etsc>

The command selects an extended training sequence for the Synchronization burst. There is a choice of three predefined sequences `STANdard | CTS | COMPact` and, if defined, a `USER` sequence (only for selection of burst type `:BB:GSM:SLOT:TYPE SYNC`).

Parameters:

<Etsc>   STANdard | CTS | COMPact | USER

Example: `BB:GSM:SLOT:TYPE SYNC`
                          Selects Synchronization burst for slot 1.
                          `BB:GSM:SLOT:ETSC CTS`
                          Selects the extended training sequence CTS.

Manual operation: See "Ext Training Seq ETSC" on page 55

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
      USER<ch>]:ETSC:USER <User>

(only for selection of burst type `:BB:GSM:SLOT:TYPE SYNC`)

The command selects an extended training sequence for the Synchronization burst
USER sequence.

Parameters:
<User>   integer

Example: `BB:GSM:SLOT:TYPE SYNC`
                          Selects Synchronization burst for slot 1.
                          `BB:GSM:SLOT:ETSC USER`
                          Selects the extended training sequence User.
                          `BB:GSM:SLOT:ETSC:USER #H5a5a5a5a5a5a5a5a,64`
                          Sets the ETSC.

Manual operation: See " ETSC Pattern" on page 55

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
      USER<ch>]:SYNC:SELect <Select>

The command selects a training sequence (SYNC sequence) for the Access burst
(only for burst type selection `:BB:GSM:SLOT:TYPE ACC`).

Parameters:
<Select>   T0 | T1 | T2 | USER
                          *RST: T0

Example: `BB:GSM:SLOT1:TYPE ACC`
                          selects Access burst for slot 1.
                          `BB:GSM:SLOT1:SYNC:SEL T1`
                          selects Sync sequence T1.

Manual operation: See "Training Sequence Sync" on page 55

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
      USER<ch>]:SYNC:USER <User>

The command outputs the bit pattern of the User Sync sequence for the Access burst.
The length is 64 bits. Superfluous bits are truncated on input. Missing bits are filled
with 0. The command is valid only for selection `:BB:GSM:SLOT:SYNC:SEL USER` and
for burst type selection `:BB:GSM:SLOT:TYPE ACC`.

Parameters:

<User>	integer
	Range: #B0,1 to #B111...,41
	*RST: Bit pattern from T0

Example: `BB:GSM:SLOT1:TYPE ACC`
selects Access burst for slot 1.
`BB:GSM:SLOT1:SYNC:SEL USER`
selects the User Sync sequence.
`BB:GSM:SLOT1:SYNC:USER #HFFFFFFFFFFF0,41`
enters the User Sync sequence.

Manual operation: See "Sync Pattern" on page 55

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][: USER<ch>]:FCORrection:FIXed <Fixed>

The command selects the content of the `FIXED` field for the Frequency Correction burst. There is a choice of two predefined sequences `STANdard` and `COMPact` and, if defined, a `USER` sequence (only for burst type selection `:BB:GSM:SLOT:TYPE FCORrection`).

Parameters:

<Fixed>	STANdard | COMPact | USER
	*RST: STANdard

Example: `BB:GSM:SLOT:TYPE FCOR`
selects Frequency Correction burst for slot 1.
`BB:GSM:SLOT:FCOR:FIX COMP`
selects content type COMPact for the Fixed field.

Manual operation: See "Fixed" on page 55

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][: USER<ch>]:FCORrection:FIXed:PATTern <Pattern>, <BitCount>

Sets the bit pattern of the FIXED field for the Frequency Correction burst. The length is 142 bits. Superfluous bits are truncated on input. Missing bits are filled with 0. The command is valid only for the selection `:BB:GSM:SLOT:FCOR:FIX USER` and for burst type selection `:BB:GSM:SLOT:TYPE FCOR`.

Parameters:

<Pattern>	numeric
	*RST: #H00000000000000000000000000000000000
<BitCount>	integer
	Range: 142 to 142
	*RST: 142

Example:	`BB:GSM:SLOT:TYPE FCOR`
	selects Synchronization burst for slot 1.
	`BB:GSM:SLOT:FCOR:FIX USER`
	selects content type USER for the Fixed field.
	`BB:GSM:SLOT:FCOR:FIX:PATT #B0,142`
	enters the content of the field.

Manual operation:	See "Fixed Pattern" on page 56

**[:SOURce\<hw\>]:BB:GSM[:FRAMe\<di\>]:SLOT\<st0\>[:SUBChannel\<us\>][:
     USER\<ch\>]:DUMMy:MIXed:PATTern?**

This command outputs the bit pattern of the Mixed field of the Dummy burst. The contents of the Mixed field is fixed and specified by the standard, the length is 142 bits.

Return values:

\<Pattern\>	142 bits

Example:	`BB:GSM:SLOT1:TYPE DUMM`
	selects Dummy burst for slot 1.
	`BB:GSM:SLOT1:DUMM:MIX:PATT?`
	outputs the bit pattern of the Mixed field.
	`Response:`

Usage:	Query only
Manual operation:	See "Mixed" on page 56

4.9 Slot marker definition commands

**[:SOURce\<hw\>]:BB:GSM[:FRAMe\<di\>]:SLOT\<st0\>[:USER\<ch\>]:TRIGger:
     OUTPut:TAG?**

The command queries the content of the specified marker in the selected file.

Suffix:

\<di\>	\<di\>
\<st0\>	0|[1] .. 7
\<ch\>	\<di\>

Parameters:

\<Tag\>	string

Example:	`BB:GSM:FRAM:SLOT0:UER1:TRIG:OUTP:TAG? "MARKER LIST 1"`
	queries the content of the marker list 1.
	`Response: 0:1;59:0;64:1,70:0`

Usage:	Query only
Manual operation:	See "Configure Control Signal" on page 58

List of commands

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