R&S®SMW-K40/-K41
GSM/EDGE, EDGE Evolution
User Manual
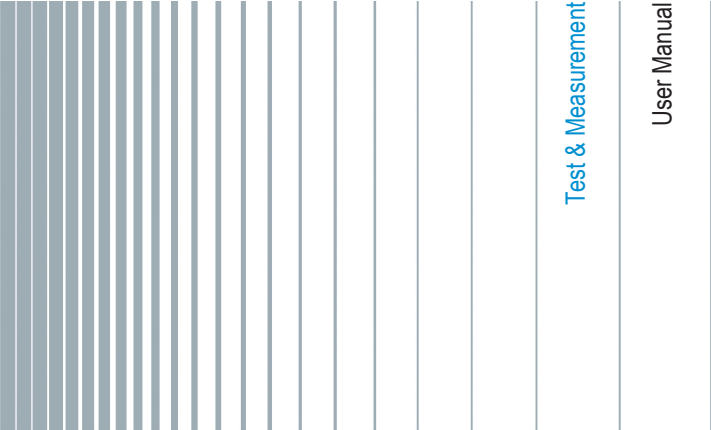
ROHDE & SCHWARZ

This document describes the following software options:

- R&S®SMW-K40/-K41
  1413.3684.xx, 1413.3732.xx

This manual describes firmware version FW 3.20.324.xx and later of the R&S®SMW200A.

The following abbreviations are used throughout this manual: R&S®SMW200A is abbreviated as R&S SMW, 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 Preface

1.1 Documentation Overview

The user documentation for the R&S SMW consists of the following parts:

- Getting Started printed manual
- Online Help system on the instrument, incl. Tutorials
- Documentation CD-ROM with:
    - Getting Started
    - Online help system (Web Help and `*.chm`) as a standalone help
    - User Manuals for base unit and options
    - Service manual
    - Data sheet and product brochure
    - Links to useful sites on the Rohde & Schwarz internet

Online Help

The Online Help is embedded in the software. It offers quick, context-sensitive access to the complete information needed for operation and programming. The online help contains help on operating the R&S SMW and all available options.

Getting Started

The Getting Started is delivered with the instrument in printed form and in PDF format on the documentation CD. It provides the information needed to set up and start working with the instrument. Basic operations and typical signal generation examples are described. Safety information is also included.

This manual is available in several languages. You can download these documents from the Rohde & Schwarz website, on the R&S SMW product page at http://www.rohde-schwarz.com/product/SMW200A.html > Downloads > Manuals.

User Manual

User manuals are provided for the base unit and each additional (software) option.

The User Manual for the base unit is a supplement to the Getting Started manual and provides basic information on operating the R&S SMW in general. In this manual, all instrument functions are described in detail. Furthermore, it provides a complete description of the remote control commands with programming examples. An introduction to remote control is provided, as well as information on maintenance, instrument interfaces and troubleshooting.

In the user manuals for the individual software options, the specific instrument functions of this option are described in detail. For additional information on default settings and parameters, refer to the data sheets. Basic information on operating the R&S SMW is not included in these user manuals.

The user manuals are available in PDF format - in printable form - on the Documentation CD-ROM delivered with the instrument.

All user manuals are also available for download from the Rohde & Schwarz website, on the R&S SMW product page at http://www.rohde-schwarz.com/product/ SMW200A.html > Downloads > Manuals.

Service Manual

The service manual is available in PDF format on the CD delivered with the instrument. It describes how to check compliance with rated specifications, instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the R&S SMW by replacing modules.

Release Notes

The release notes describe the installation of the firmware, new and modified functions, eliminated problems, and last minute changes to the documentation. The corresponding firmware version is indicated on the title page of the release notes.

The latest versions are available for download from the R&S SMW product page, at http://www.rohde-schwarz.com/product/SMW200A.html > Downloads > Firmware.

Web Help

The web help provides online access to the complete information on operating the R&S SMW and all available options, without downloading. The content of the Web Help corresponds to the user manuals for the latest product version.

The web help is available from the R&S SMW product page, at http://www.rohde-schwarz.com/product/SMW200A.html > Downloads > Web Help.

Tutorials

A set of tutorials is embedded in the software. The tutorials offer guided examples and demonstrations on operating the R&S SMW.

Application Notes

Application notes, application cards, white papers and educational notes are further publications that provide more comprehensive descriptions and background information.

A subset of application notes is provided on the documentation CD-ROM delivered with the instrument.

The latest versions are available for download from the Rohde & Schwarz website, at http://www.rohde-schwarz.com/appnotes.

1.2 Conventions Used in the Documentation

1.2.1 Typographical Conventions

The following text markers are used throughout this documentation:

Convention	Description
"Graphical user interface elements"	All names of graphical user interface elements on the screen, such as dialog boxes, menus, options, buttons, and softkeys are enclosed by quotation marks.
KEYS	Key names are written in capital letters.
`File names, commands, program code`	File names, commands, coding samples and screen output are distinguished by their font.
Input	Input to be entered by the user is displayed in italics.
Links	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by quotation marks.

1.2.2 Conventions for Procedure Descriptions

When describing how to operate the instrument, several alternative methods may be available to perform the same task. In this case, the procedure using the touchscreen is described. Any elements that can be activated by touching can also be clicked using an additionally connected mouse. The alternative procedure using the keys on the instrument or the on-screen keyboard is only described if it deviates from the standard operating procedures.

The term "select" may refer to any of the described methods, i.e. using a finger on the touchscreen, a mouse pointer in the display, or a key on the instrument or on a keyboard.

1.2.3 Notes on Screenshots

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

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 Welcome to the GSM/EDGE and EDGE Evolution Digital Standard

The R&S SMW-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 SMW-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 SMW-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 SMW-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.

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 SMW user manual. The latest version is available for download at the product homepage.

Installation

You can find detailed installation instructions in the delivery of the option or in the R&S SMW Service Manual.

2.1 Accessing the GSM/EDGE Dialog

To open the dialog with GSM/EDGE settings

► In the block diagram of the R&S SMW, 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".

2.2 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, this includes:

● Managing settings and data lists, i.e. storing and loading settings, creating and accessing data lists, accessing files in a particular directory, etc.

● Information on regular trigger, marker and clock signals as well as 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 SMW user manual.

3 About this Digital Standard

GSM is a TDMA standard for cellular mobile radio networks and is used worldwide.

Every TDMA frame consists of 8 timeslots (or simply "slots"). Each slot can be separately turned on or off. A maximum of 7 different level attenuation values can be defined and allocated separately to the 8 slots quite independently of one another.

In order 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 as well as 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 time slots 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 time slots with reduced symbol duration (187 or 188 symbols long).

The modulation data is continuously inserted into the chosen slots (in realtime). 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 SMW 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. Additionally, you can use a FSK modulation with configurable span.

- In accordance with the standard, in the case of EDGE slots the 8PSK modulation type is set by default to 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 SMW-K41), the EDGE Evolution slots in a normal burst (NB) are 16QAM or 32QAM modulated at a symbol rate of 270.833 ksymb/s and Gauss linearized filtering. The EDGE Evolution slots in a higher symbol rate bursts (HB) are QPSK, 16QAM or 32QAM modulated at a symbol rate of 325 ksymb/s and spectrally Narrow or Wide Pulse Shape filtering.

- In accordance to VAMOS specifications (option R&S SMW-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.

3.1 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 very low cross-correlation. All mobiles must support TSC set 1, but only mobiles explicitly indicating support for VAMOS must also support TSC set 2.

In the uplink 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.
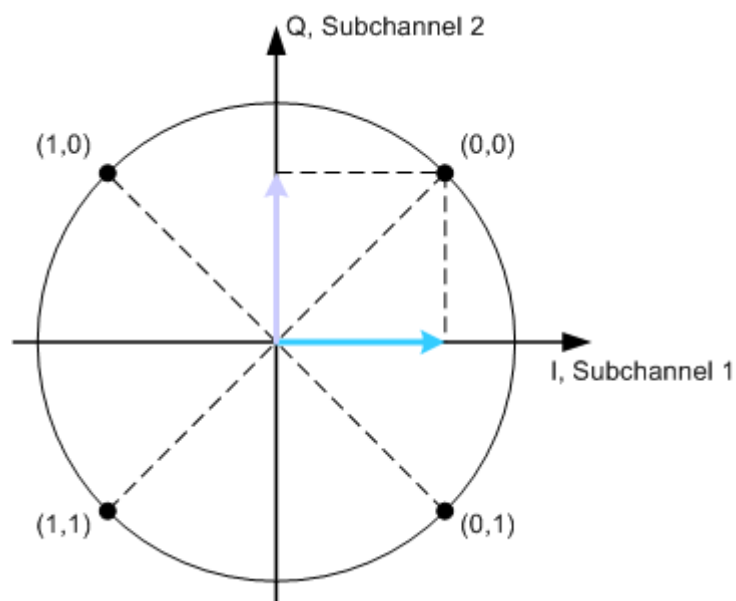

Fig. 3-1: QPSK modulation, sum of both subchannels

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.
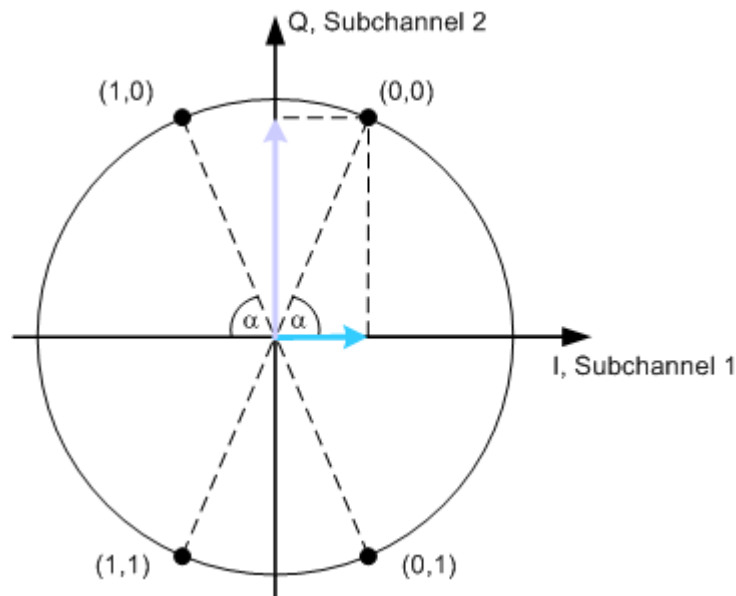

Fig. 3-2: AQPSK modulation, subchannel 2 with higher power level

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 shall be 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.

4 GSM/EDGEConfiguration and Settings

► To access the GSM/EDGE settings, select "Baseband > GSM/EDGE".

The remote commands required to define these settings are described in chapter 5, "Remote-Control Commands", on page 64.

4.1 General Settings

This tab provides access to the default and the "Save/Recall" settings. The selected sequence mode determines the available parameters.
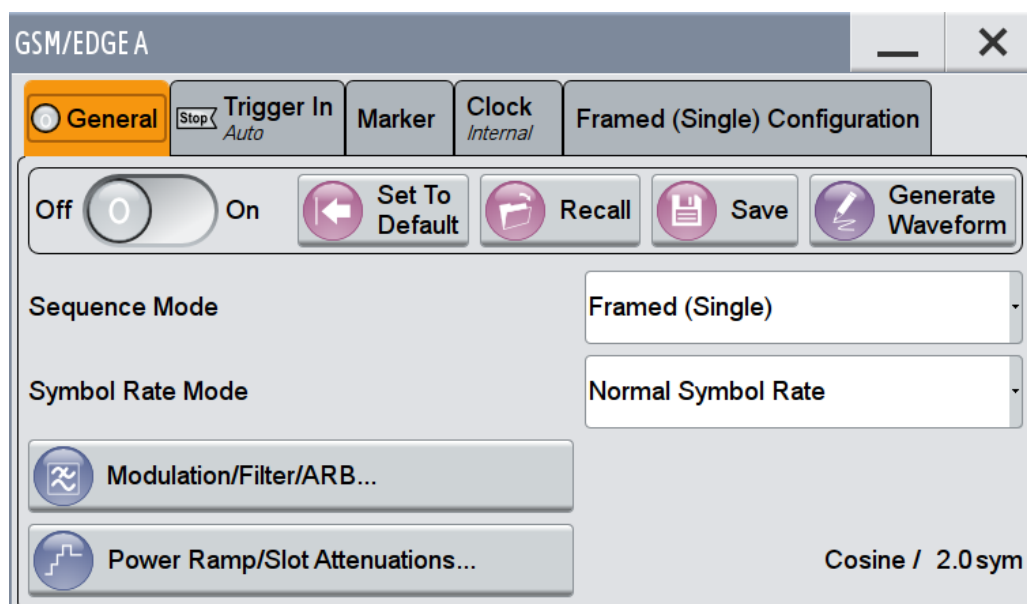
State
Activates the standard and deactivates all the other digital standards and digital modulation modes in the same path.

Remote command:
[:SOURce<hw>]:BB:GSM:STATe on page 71

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 1-7 Configuration	
Slot Level, other settings as slot 0	Off

Remote command:

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

Save/Recall

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

The file name and the directory it is stored in are user-definable; the file extension is however predefined.

See also, chapter "File and Data Management" in the R&S SMW User Manual.

Remote command:

[:SOURce<hw>]:BB:GSM:SETTing:CATalog? on page 68

[:SOURce<hw>]:BB:GSM:SETTing:LOAD on page 69

[:SOURce<hw>]:BB:GSM:SETTing:STORe on page 69

[:SOURce<hw>]:BB:GSM:SETTing:DELete on page 69

Generate Waveform File…

With enabled signal generation, triggers the instrument to store the current settings as an ARB signal in a waveform file. Waveform files can be further processed by the ARB and/or as a multi carrier or a multi segment signal.

The file name and the directory it is stored in are user-definable; the predefined file extension for waveform files is *.wv.

Remote command:

[:SOURce<hw>]:BB:GSM:WAVeform:CREate on page 71

Sequence Mode

Selects GSM/EDGE mode.

There are three modes available:

- Unframed
  see chapter 4.6, "Mode Unframed", on page 26
- Framed (single)
  see chapter 4.7, "Mode Framed (single)", on page 27
- Framed (double)
  see chapter 4.8, "Mode Framed (double)", on page 29

Remote command:

[:SOURce<hw>]:BB:GSM:MODE on page 67

Symbol Rate Mode

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

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

Remote command:

[:SOURce<hw>]:BB:GSM:SRATe:MODE on page 71

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 SMW-K41 EDGE Evolution

Remote command:
[:SOURce<hw>]:BB:GSM:SMODe on page 70

Modulation/Filter
Access the "Modulation/Filter" dialog, see chapter 4.10, "Modulation/Filter", on page 33.

Remote command:
n.a.

Power Ramping/Slot Attenuations
Access the "Power Ramping/Slot Attenuation" dialog. This dialog is used to set the power ramping parameters and for setting values for the level attenuation in dB, see chapter 4.11, "Power Ramping/Slot Attenuation", on page 43.

The currently selected ramp function and ramp time are displayed.

Remote command:
n.a.

4.2 Trigger Settings

This tab provides access to the settings necessary to select and configure the trigger, like trigger source, mode, trigger delay, trigger suppression, as well as to arm or trigger an internal trigger manually. The current signal generation status is displayed in the header of the tab together with information on the enabled trigger mode. As in the "Marker" and "Clock" tabs, this tab provides also an access to the settings of the related connectors.

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 SMW user manual.

► To access this dialog, select "Baseband > GSM/EDGE > Trigger In".
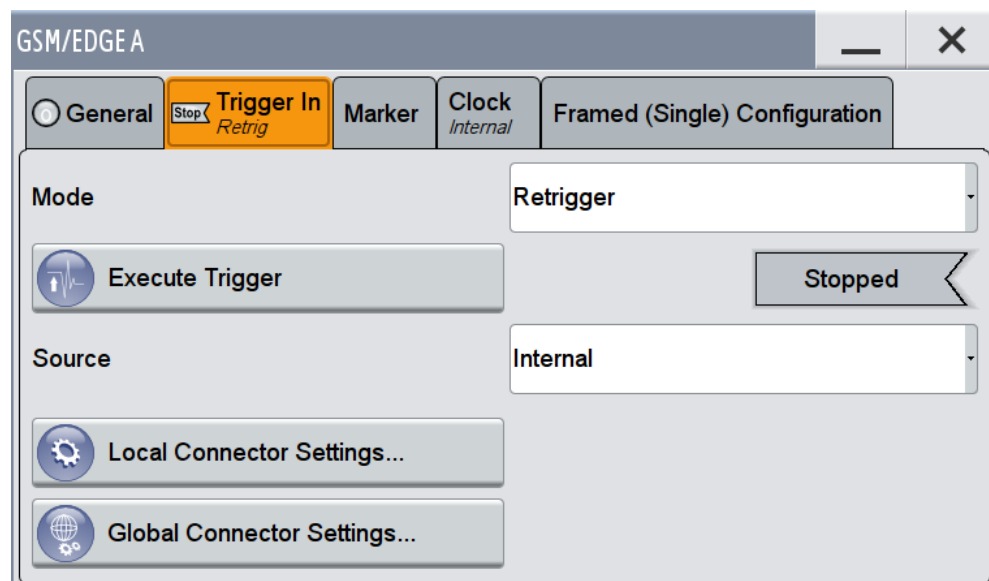
This dialog comprises the settings required for configuring the trigger signal.

Routing and Enabling a Trigger

The provided trigger signals are not dedicated to a particular connector but can be mapped to one or more globally shared USER or local T/M/(C) connectors.

Use the Local and Global Connector Settings to configure the signal mapping as well as the polarity, the trigger threshold and the input impedance of the input connectors.

To route and enable a trigger signal, perform the following *general steps*:

- Define the signal source and the effect of a trigger event, i.e. select the "Trigger In > Mode" and "Trigger In > Source"
- Define the connector, USER or T/M/(C), the selected signal is provided at, i.e. configure the Local and Global Connector Settings.

Trigger Settings Common to All Basebands

To enable simultaneous signal generation in all basebands, the R&S SMW couples the trigger settings in the available basebands in any instrument's configuration involving signal routing with signal addition (e.g. MIMO configuration, routing and summing of basebands and/or streams).

The icon 🔗 indicates that common trigger settings are applied.

You can access and configure the common trigger source and trigger mode settings in any of the basebands. An arm or a restart trigger event applies to all basebands, too. You can still apply different delay to each of the triggers individually.

Trigger Mode ← Trigger Settings Common to All Basebands

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

For more information, refer to chapter "Basics" in the R&S SMW user manual.

- "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 with 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 with 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 85

Signal Duration Unit ← **Trigger Settings Common to All Basebands**
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 89

Trigger Signal Duration ← **Trigger Settings Common to All Basebands**
Enters the length of the signal sequence to be output in the "Single" trigger mode.

Use this parameter to deliberately output part of the signal, an exact sequence of the signal, or a defined number of repetitions of the signal.

Remote command:
[:SOURce<hw>]:BB:GSM:TRIGger:SLENgth on page 89

Running/Stopped ← **Trigger Settings Common to All Basebands**
For 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 88

Arm ← Trigger Settings Common to All Basebands
Stops the signal generation until subsequent trigger event occurs.

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

Execute Trigger ← Trigger Settings Common to All Basebands
For internal trigger source, executes trigger manually.

Remote command:
[:SOURce<hw>]:BB:GSM:TRIGger:EXECute on page 87

Trigger Source ← Trigger Settings Common to All Basebands
The following sources of the trigger signal are available:
- "Internal"
  The trigger event is executed manually by the "Execute Trigger".
- "Internal (Baseband A/B)"
  The trigger event is provided by the trigger signal from the other basebands.
  If common trigger settings are applied, this trigger source is disabled.
- "External Global Trigger 1 / 2"
  The trigger event is the active edge of an external trigger signal provided and con-
  figured at the global USER connectors.
- "External Global Clock 1 / 2"
  The trigger event is the active edge of an external global clock signal provided and
  configured at the global USER connectors.
- "External Local Trigger"
  The trigger event is the active edge of an external trigger signal provided and con-
  figured at the local T/M/(C) connector.
  With coupled trigger settings, the signal has to be provided at the T/M/C 1/2/3 con-
  nectors.
- "External Local Clock"
  The trigger event is the active edge of an external local clock signal provided and
  configured at the local T/M/C connector.
  With coupled trigger settings, the signal has to be provided at the T/M/C 1 connec-
  tor.

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

Sync. Output to External Trigger ← Trigger Settings Common to All Basebands
For an external trigger signal, enables/disables the output of a signal synchronous to
the external trigger event.

"On"   Corresponds to the default state of this parameter.
                  The signal calculation starts simultaneously with the external trigger
                  event but because of the instrument's processing time the first sam-
                  ples are cut off and no signal is output. After elapsing of the internal
                  processing time, the output signal is synchronous to the trigger event.
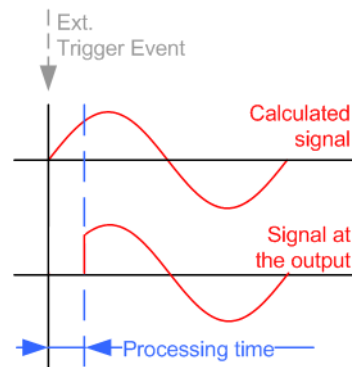
"Off"   The signal output begins after elapsing of the processing time and
                  starts with sample 0, i.e. the complete signal is output.
                  This mode is recommended for triggering of short signal sequences
                  with signal duration comparable with the processing time of the
                  instrument.
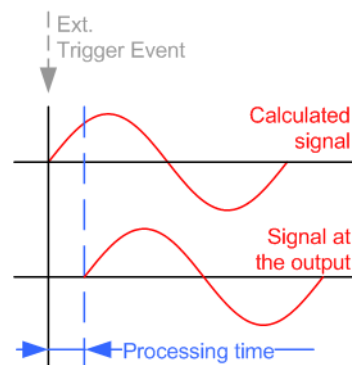
Remote command:
[:SOURce<hw>]:BB:GSM:TRIGger:EXTernal:SYNChronize:OUTPut
on page 87

External Trigger Inhibit ← Trigger Settings Common to All Basebands
For external trigger signal or trigger signal from the other path, sets the duration a new
trigger event subsequent to triggering is suppressed. In "Retrigger" mode for example,
a new trigger event will 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 SMW User Manual.

Remote command:
[:SOURce<hw>]:BB:GSM:TRIGger[:EXTernal]:INHibit on page 91
[:SOURce<hw>]:BB:GSM:TRIGger:OBASeband:INHibit on page 88

Trigger Delay

Delays the trigger event of the signal from:
- the external trigger source
- the other path
- the other basebands (internal trigger), if common trigger settings are used.

Use this setting to:
- synchronize the instrument with the device under test (DUT) or other external devices
- postpone the signal generation start in the basebands compared to each other

For more information, see chapter "Basics on ..." in the R&S SMW User Manual.

Remote command:

[:SOURce<hw>]:BB:GSM:TRIGger[:EXTernal]:DELay on page 91

[:SOURce<hw>]:BB:GSM:TRIGger:OBASeband:DELay on page 88

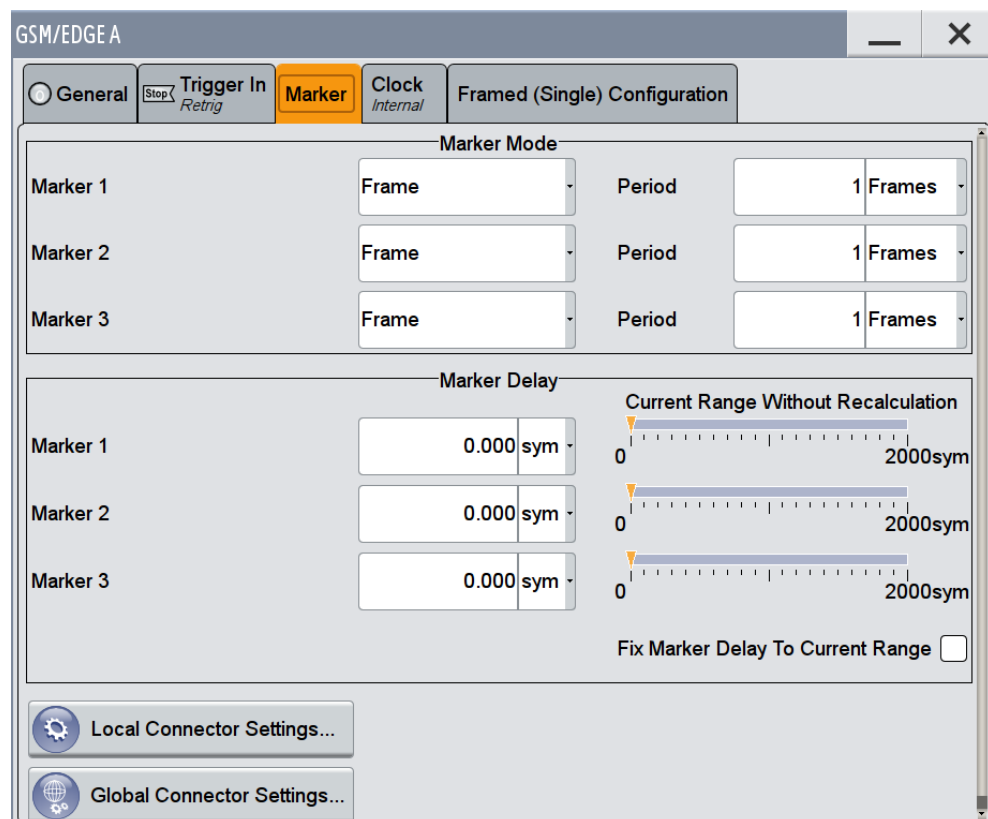## 4.3 Marker Settings

This tab provides an access to the settings necessary to select and configure the marker output signal, like the marker mode or marker delay settings.

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 SMW user manual.

► To access this dialog, select "Baseband > GSM/EDGE > Marker".

This dialog comprises the settings required for configuring the marker.

Routing and Enabling a Marker

The provided marker signals are not dedicated to a particular connector but can be mapped to one or more globally shared USER or local T/M/(C) connectors.

To route and enable a marker signal, perform the following *general steps*:

- Define the shape of the generated marker, i.e. select the "Marker > Mode"
- Define the connector, USER or T/M/(C), the selected signal is output at, i.e. configure the Local and Global Connector Settings.

Marker Mode

Marker configuration for up to 3 marker channels. 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; the settings are self-explanatory.

"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 4.13, "Slot Marker Definition", on page 59.

"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 between 156 and 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, and 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 96
[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:PULSe[:FREQuency]?
on page 96

"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 95

"ON/OFF Period"　　A regular marker signal that is defined by an ON/OFF ratio is generated. A period lasts one ON and OFF cycle.

The "ON Time" and "OFF Time" are each expressed as a number of samples and are set in an input field which opens when ON/OFF ratio is selected.

Remote command:

[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:ONTime on page 95
[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:OFFTime on page 95

Remote command:

[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:MODE on page 94

Marker x Delay
Defines the delay between the marker signal at the marker outputs relative to the signal generation start.

"Marker x"   For the corresponding marker, sets the delay as a number of symbols.

Remote command:

[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:DELay on page 93

"Current Range without Recalculation"

Displays the dynamic range within which the delay of the marker signals can be set without restarting the marker and the signal.
Move the setting mark to define the delay.

Remote command:

[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:DELay:MINimum? on page 93
[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut<ch>:DELay:MAXimum? on page 93

"Fix marker delay to current range"

Restricts the marker delay setting range to the dynamic range.

Remote command:

[:SOURce<hw>]:BB:GSM:TRIGger:OUTPut:DELay:FIXed on page 93
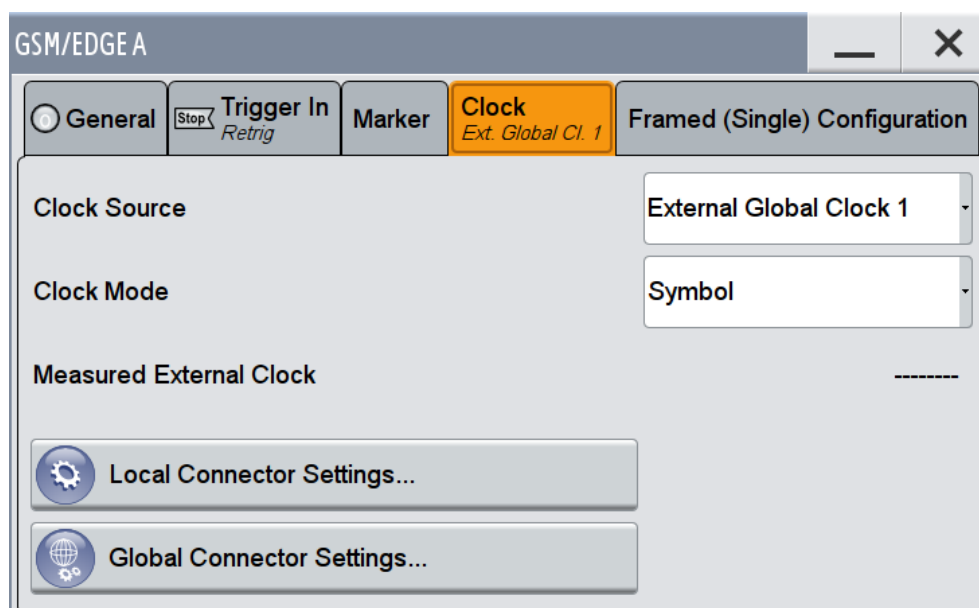
4.4 Clock Settings

This tab provides an access to the settings necessary to select and configure the clock signal, like the clock source and clock mode.

> 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 SMW user manual.

► To access this dialog, select "Baseband > GSM/EDGE > Clock".

This dialog comprises the settings required for configuring the clock.

Defining the Clock

The provided clock signals are not dedicated to a particular connector but can be mapped to one or more globally shared USER and the two local T/M/C connectors.

Use the Local and Global Connector Settings to configure the signal mapping as well as the polarity, the trigger threshold and the input impedance of the input connectors.

To route and enable a trigger signal, perform the following *general steps*:

● Define the signal source, i.e. select the "Clock > Source"

● Define the connector, USER or T/M/C, the selected signal is provided at, i.e. configure the Local and Global Connector Settings.

Clock Source

Selects the clock source.

● "Internal"
  The instrument uses its internal clock reference.

● "External Global Clock 1/2"
  The instrument expects an external clock reference at the global USER connector, as configured in the "Global Connector Settings" dialog.

● "External Local Clock"
  The instrument expects an external clock reference at the local T/M/C connector.

Remote command:

[:SOURce<hw>]:BB:GSM:CLOCk:SOURce on page 85

Clock Mode

Enters the type of externally supplied clock.

Remote command:

[:SOURce<hw>]:BB:GSM:CLOCk:MODE on page 84

Symbol Clock Multiplier

Enters the multiplication factor for clock type "Multiple".

Remote command:

[:SOURce<hw>]:BB:GSM:CLOCk:MULTiplier on page 84

Symbol Clock Divider

Enters the divider for clock type "Fraction".

Remote command:

[:SOURce<hw>]:BB:GSM:CLOCk:DIVider on page 84

Measured External Clock

Provided for permanent monitoring of the enabled and externally supplied clock signal.

Remote command:

CLOCk:INPut:FREQuency?

4.5 Local and Global Connector Settings

Each of the "Trigger In", "Marker" and "Clock" dialogs as well as the "Trigger Marker Clock" dialog provides a quick access to the related local and global connector settings.

For more information, refer to the description R&S SMW User Manual, section "Local and Global Connectors".

4.6 Mode Unframed

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

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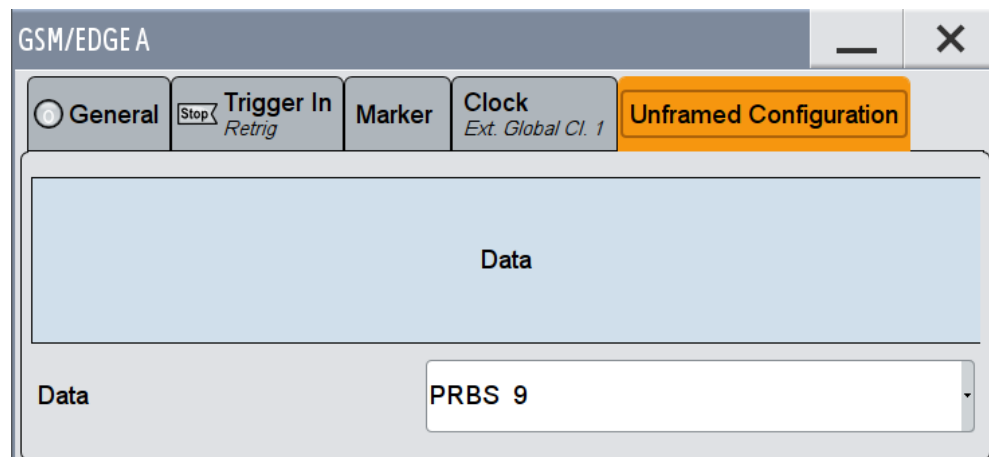
This dialog displays the signal in Unframed mode - no frames, no power ramping.

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 (normal or higher symbol rate) and the modulation (MSK or FSK for GSM, 8PSK EDGE for EDGE and 16QAM EDGE or 32QAM EDGE for EDGE Evolution) 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 SMW user manual.
- section "File and Data Management" in the R&S SMW user manual.
- section "Data List Editor" in the R&S SMW user manual

Remote command:
[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
USER<ch>][:SOURce]:DATA on page 104
[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
USER<ch>][:SOURce]:DATA:PATTern on page 105
[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
USER<ch>][:SOURce]:DATA:DLISt on page 104

4.7 Mode Framed (single)

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

2. Select "Framed (Single) Configuration".
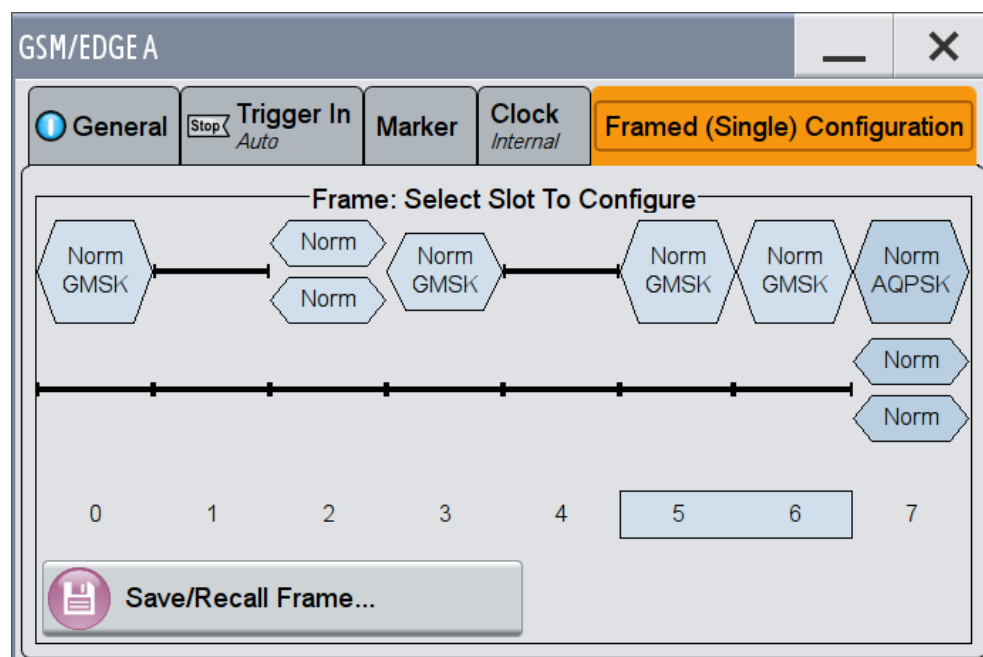
This dialog displays the frame structure and provides access to the dialog for saving and loading a frame structure.

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 4.12, "Burst Editor", on page 46). 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. If multislots have been defined, the banded slots are surrounded by a frame (slots 5 to 7 in the illustration).

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:
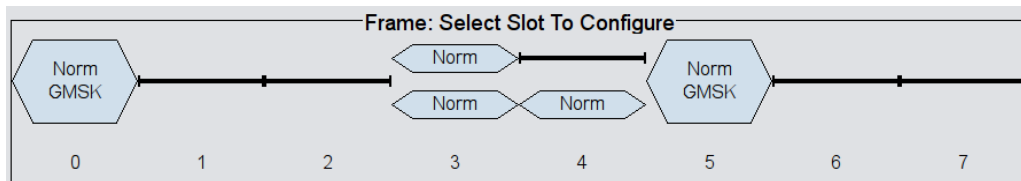
As a result, the following two frames are generated alternately:

● Frame with half rate user 1:
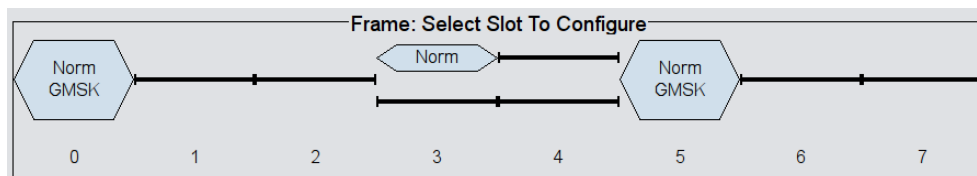
● Frame with half rate user 2
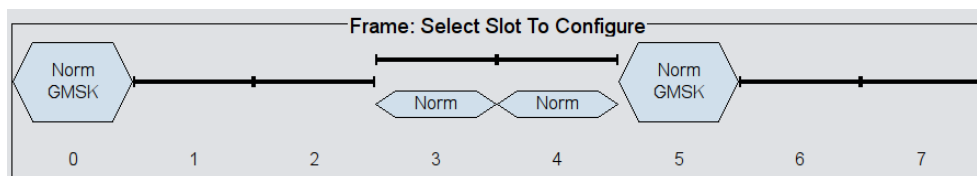
Save/Recall Frame …

Access the "Save/Recall Frame" dialog for selecting of predefined or user defined frames, see chapter 4.9, "Save Recall Frame/Slots", on page 31.

Remote command:
n.a.

4.8 Mode Framed (double)

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

2. Select "Framed (Double) Configuration".
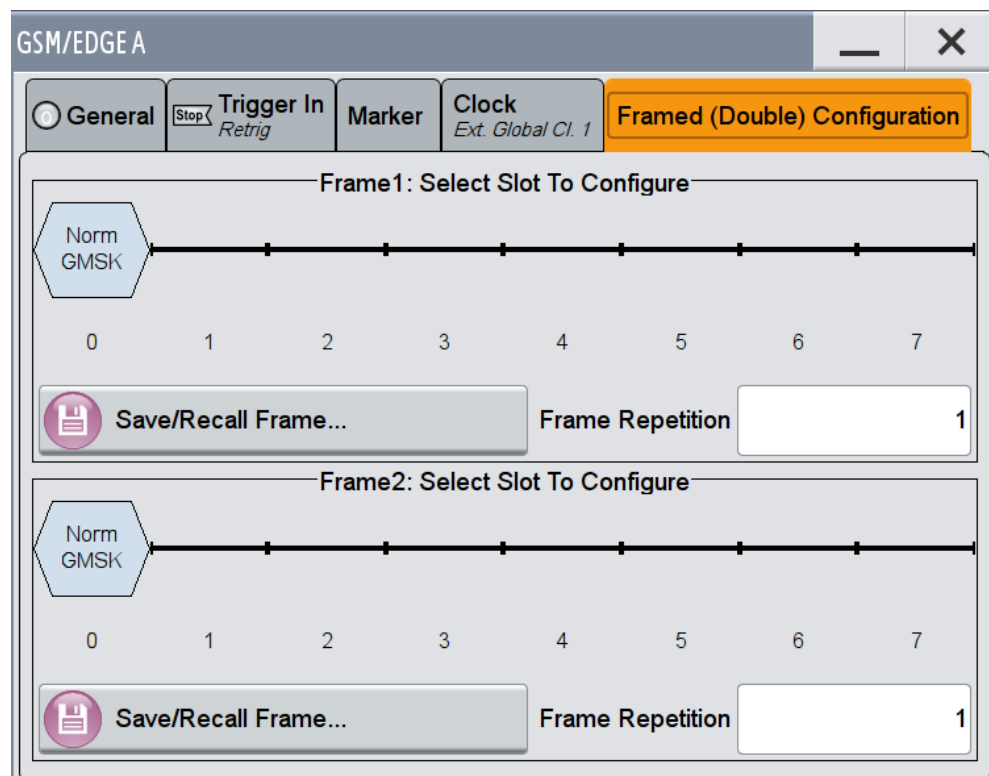
This dialog displays the frame structure and gives access to the dialog for saving and loading a frame structure.

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 2 frames itself), the repetition factor must be a multiple of 2 (see chapter 4.7, "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 (see chapter 4.12, "Burst Editor", on page 46).

Save/Recall Frame …
Provides access to the "Save/Recall Frame" dialog for selecting of predefined or user defined frames, see chapter 4.9, "Save Recall Frame/Slots", on page 31 .

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 66

4.9 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 will cause 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 Frame/Slot

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, num-
ber 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 73

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:PREDefined:LOAD on page 74

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

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
USER<ch>]:PREDefined:LOAD on page 75

Recall User Frame/Slot

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 72

[:SOURce<hw>]:BB:GSM:FRAMe<di>:ULISt:LOAD on page 73

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
USER<ch>]:ULISt:CATalog? on page 75

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
USER<ch>]:ULISt:LOAD on page 76

Save User Frame/Slot

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 73

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
USER<ch>]:ULISt:STORe on page 76

File Manager

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

Remote command:

[:SOURce<hw>]:BB:GSM:FRAMe<di>:ULISt:DELete on page 72

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:ULISt:DELete on page 75

4.10 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.

To access the "Modulation / Filter "settings, perform the following:

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 SMW-K41 (EDGE Evolution).

4.10.1 General Settings

► To access this dialog select "General".
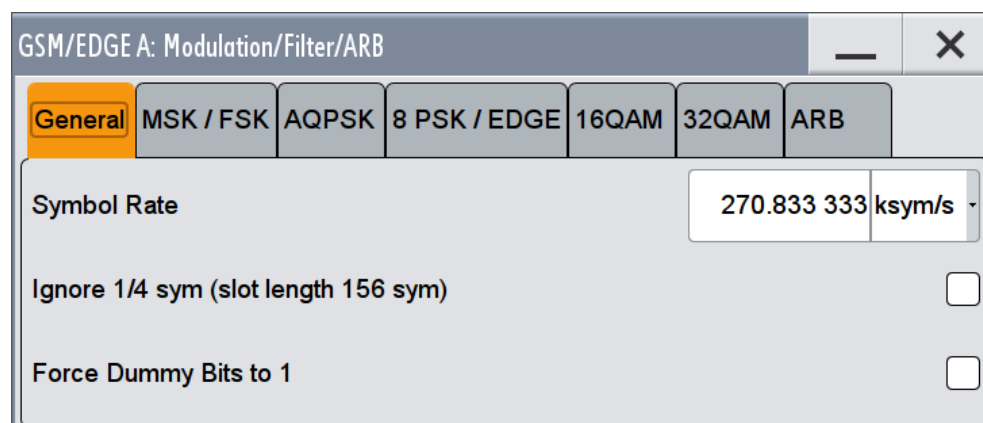
This tab contains the parameters to configure the general modulation settings.

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 70

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 4.12, "Burst Editor", on page 46).

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 then 1496 symbols long instead of 1500 symbols.

Remote command:
[:SOURce<hw>]:BB:GSM:ISLength on page 67
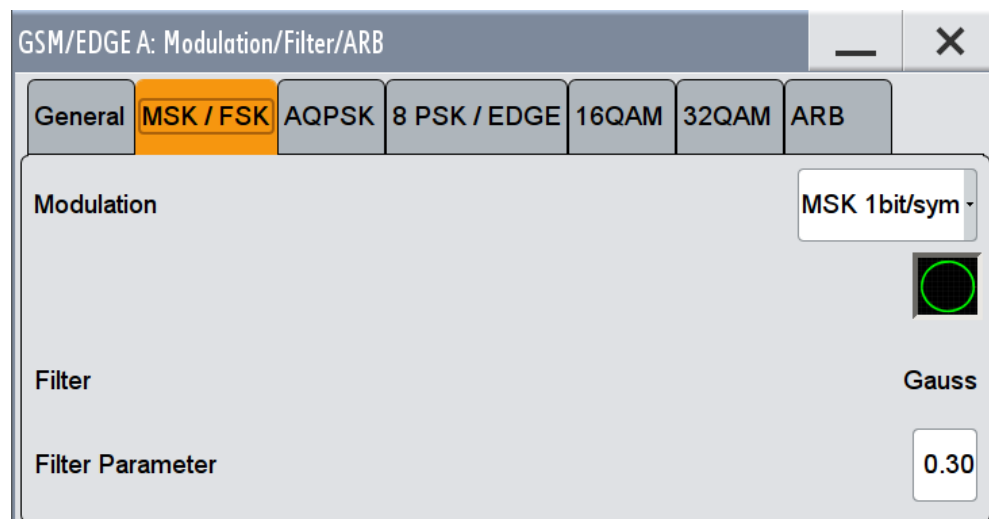
Force Dummy Bits to 1
A modulating bit stream consisting of consecutive ones is used for inactive slots (according to GSM 05.04). If this parameter is disabled, the inactive slots are filled in with 0.

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

4.10.2 MSK/FSK Settings

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

2. Select "MSK/FSK".

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

Modulation Type GSM
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 77

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 77

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 81

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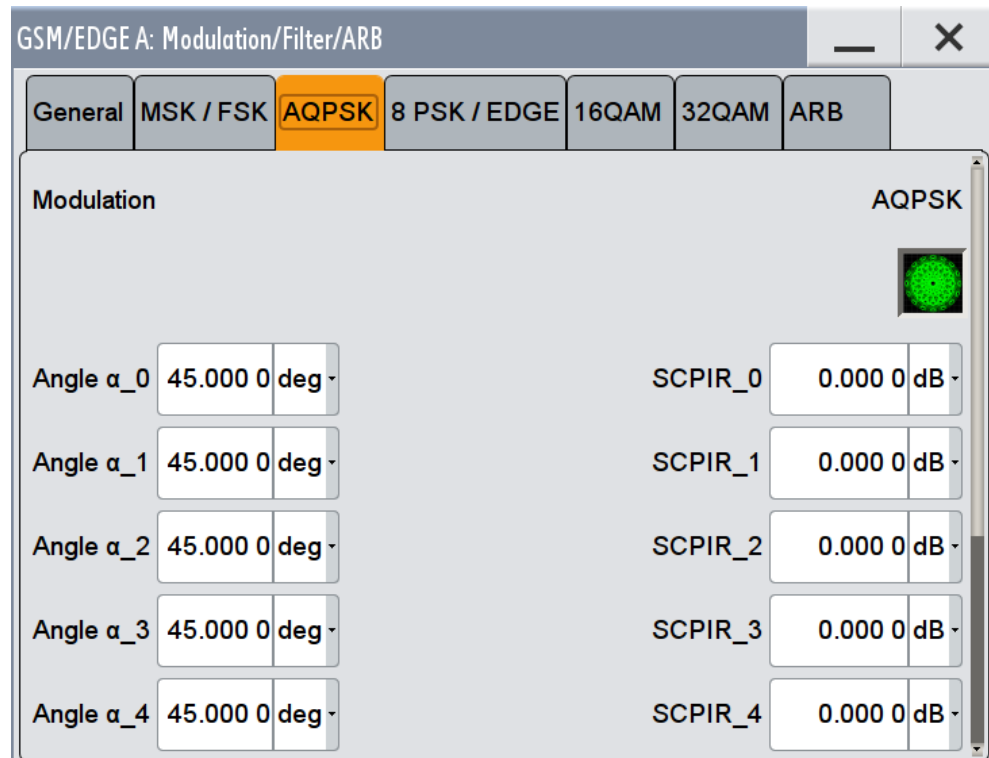Sets the BxT value for the GAUSS filter. The GSM default value is 0.3.

Remote command:
[:SOURce<hw>]:BB:GSM:FILTer:PARameter on page 81

4.10.3 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 SMW-K41 EDGE Evolution).

Modulation AQPSK

Displays the modulation type for the GSM signal. The modulation type is set permanently to AQPSK (see chapter 3.1, "VAMOS (Voice services over Adaptive Multi-user channels on One Slot)", on page 11).

Remote command:

[:SOURce<hw>]:BB:GSM:AQPSk:FORMat? on page 78

Angle alpha_0 ... alpha_7

Sets the angle alpha (see chapter 3.1, "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 80

SCPIR_0 .. 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 shall be chosen such that |SCPIR|≤10dB

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

Remote command:
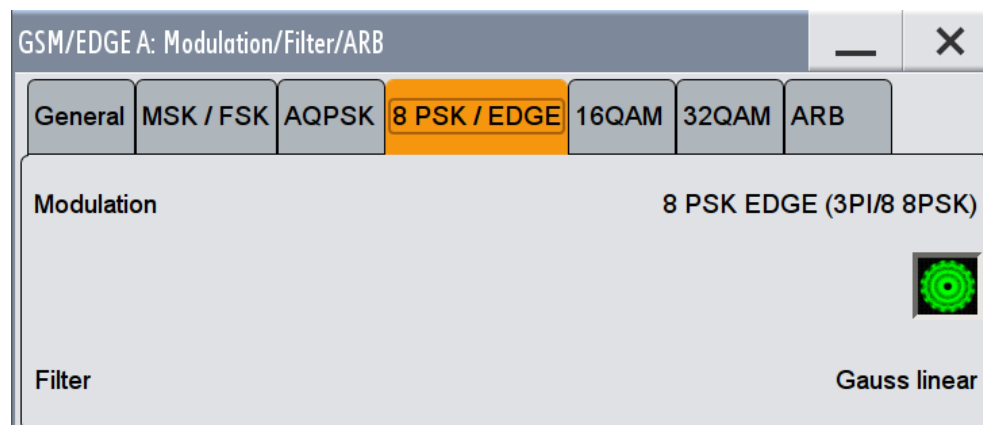[:SOURce<hw>]:BB:GSM:AQPSk:SCPIR<ch0> on page 80

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 82

4.10.4 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 77

Filter
Indicates the filter used for the EDGE signal. The filter is permanently set to GAUSS linearized.
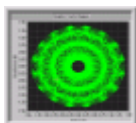
Remote command:
[:SOURce<hw>]:BB:GSM:FILTer:EDGE:TYPE? on page 82

4.10.5 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 SMW-K41 EDGE Evolution)

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 79

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 82

4.10.6 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 SMW-K41 EDGE Evolution)

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 80

Filter
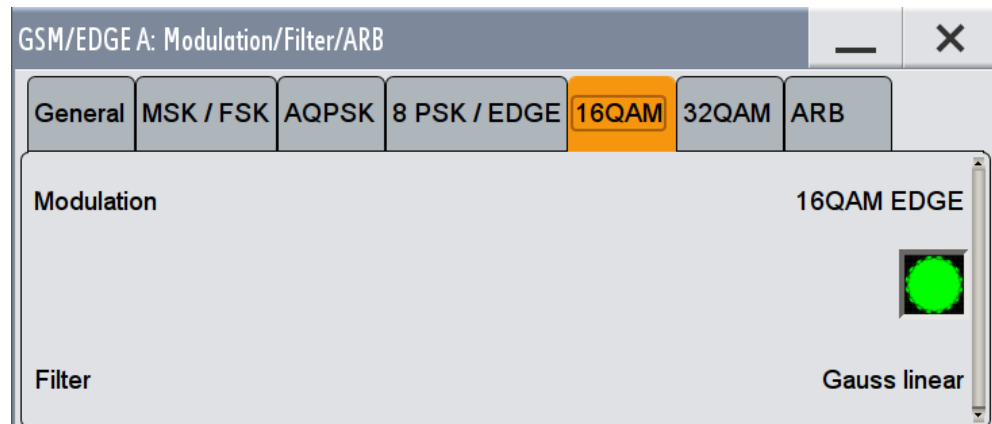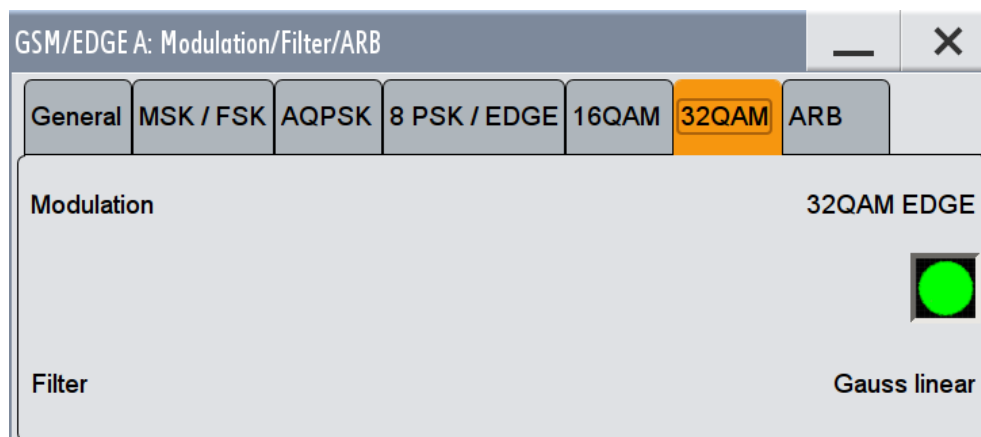
Indicates the filter used for the 32QAM signal. The filter is permanently set to GAUSS linearized.

Remote command:
[:SOURce<hw>]:BB:GSM:FILTer:N32Qam:TYPE? on page 82

4.10.7 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 SMW-K41 EDGE Evolution)

Modulation Type HSR QPSK

(for Higher Symbol Rate only)

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 79

Filter

(for Higher Symbol Rate only)

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 102
[:SOURce<hw>]:BB:GSM:FILTer:HQPSk:TYPE on page 83

4.10.8   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.
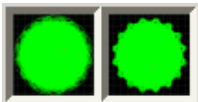
Modulation Type HSR 16QAM
(for Higher Symbol Rate only)

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 78

Filter
(for Higher Symbol Rate only)

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 102
[:SOURce<hw>]:BB:GSM:FILTer:H32Qam:TYPE on page 83

4.10.9 HSR 32QAM Settings

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

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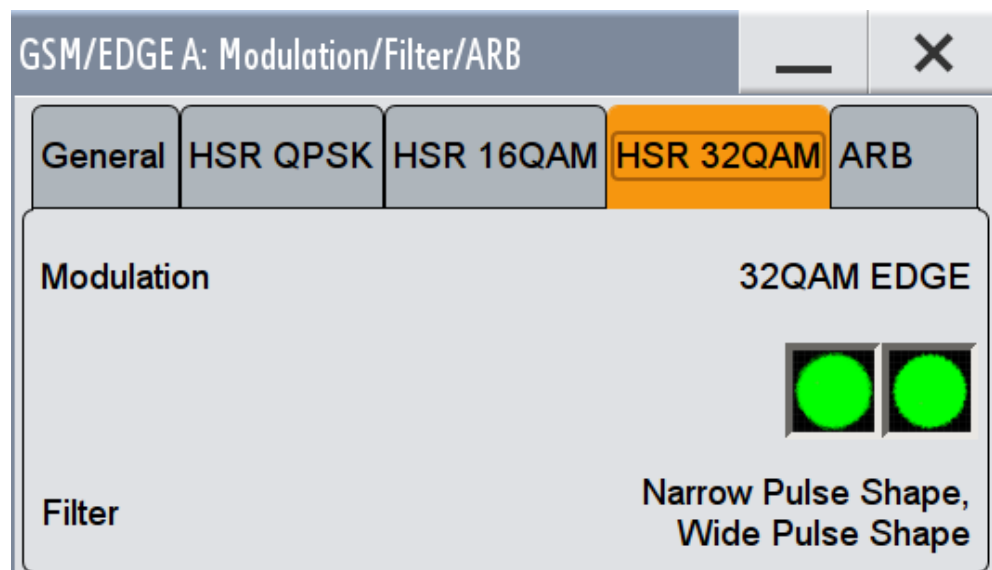
This tab contains the parameters required to configure the HSR 32QAM modulation.

Modulation Type HSR 32QAM

(for Higher Symbol Rate only)

Displays the modulation type for the signal.

The modulation type 32QAM has 5 bits per symbol.

Remote command:
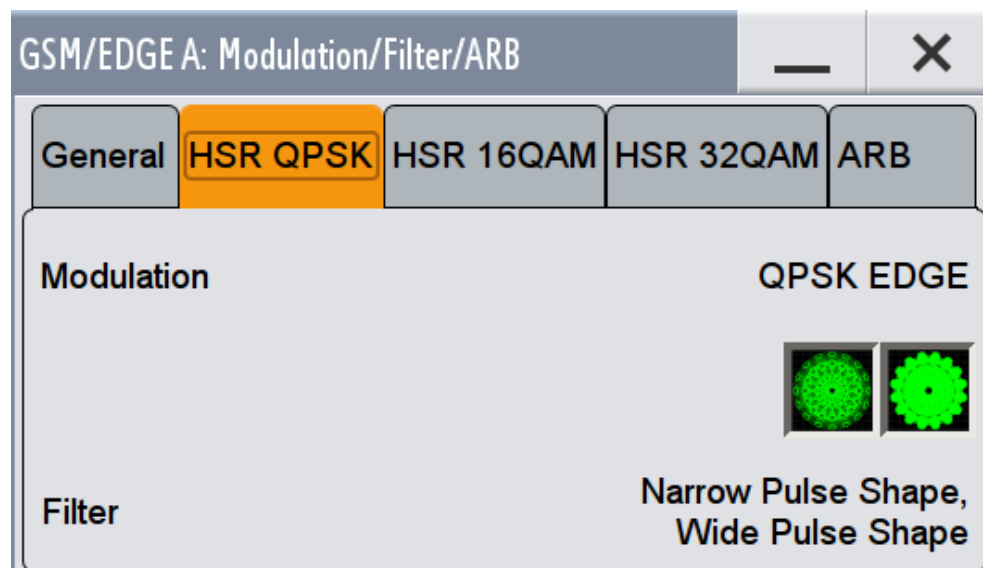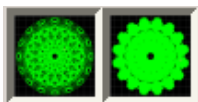
[:SOURce<hw>]:BB:GSM:H32Qam:FORMat? on page 78

Filter

(for Higher Symbol Rate only)

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.

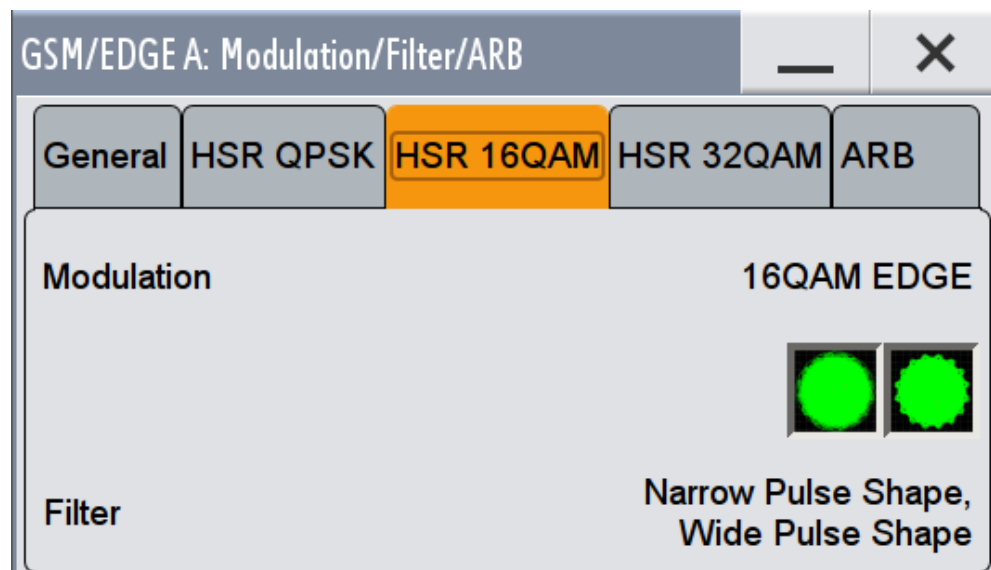Remote command:

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
USER<ch>]:FILTer:TYPE on page 102
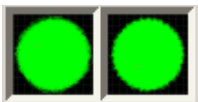[:SOURce<hw>]:BB:GSM:FILTer:H32Qam:TYPE on page 83

4.10.10 ARB Settings

1. To access this dialog 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   2 Frames ▾
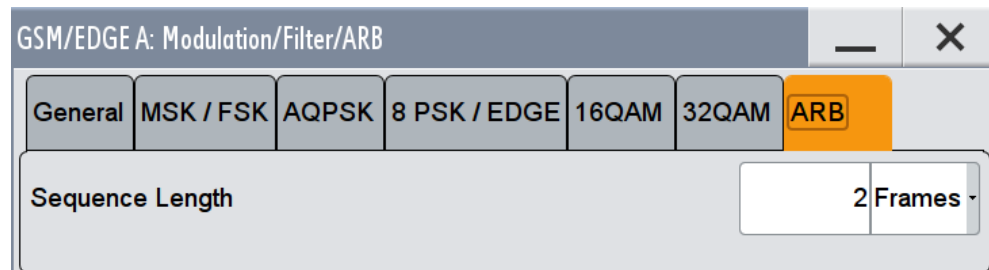
This tab contains the parameters required to configure the ARB waveform component of the signal.

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. It is added to the realtime signal components.

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 65

4.11 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 attenutaion is used for restricting power ramping to the baseband signal.

1. To access this dialog 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.
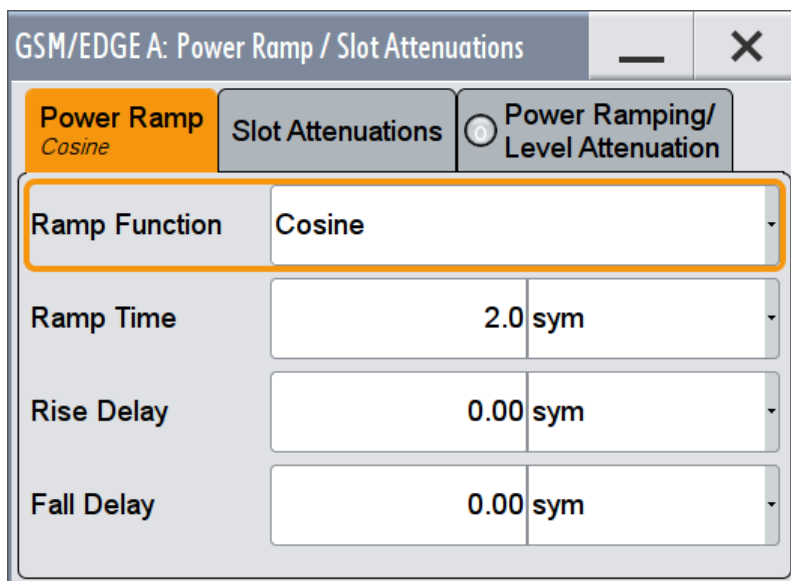
3. Select "Slot Attenuations".
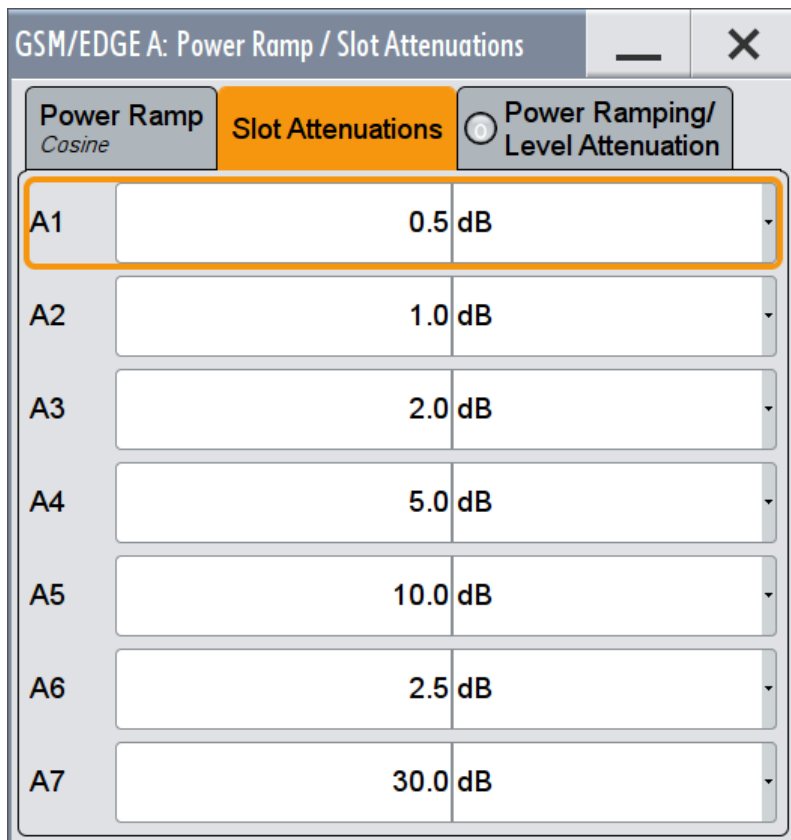
You can define the seven values for level attenuation.

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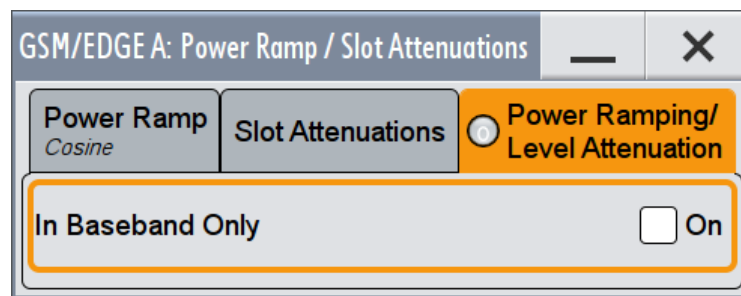
Enable the provided parameter to restrict power ramping to the baseband signal.

Ramp Function

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 gives rise to a more favorable spectrum than the Linear setting.

Remote command:

[:SOURce<hw>]:BB:GSM:PRAMp:SHAPe on page 98

Ramp Time

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

The transmitted power must not be switched 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 99

Rise Delay

Sets the offset in the rising edge of the envelope at the start of a burst. A positive value gives rise to 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 98

Fall Delay

Sets the offset in the falling edge of the envelope at the end of a burst. A positive value gives rise to 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 97

Slot Attenuation A1 to A7

Sets the seven different values for level attenuation.

The burst editor can be used to set the level attenuation for the 8 slots to one of these predefined values independently of one another.

The ability to set a sequence of slots purposely to different levels (loud - soft - loud) in order to measure transmission stability is a requirement of measurement recommendation 11.21 in the latest GSM version 8.6.09.

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 68

Baseband 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 bursted 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 an two-path instrument. The RF paths having separate frequency and level settings, the remaining attenuation to be effected in the baseband would have to be different for the two paths and is therefore not possible.

              ● When a bursted 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 of an two-path instrument. Blanking in the RF paths is not suitable, because the RF section would not only blank the bursted signal of the first baseband but also the continuous signal of the second baseband or the noise signal.

Remote command:
[:SOURce<hw>]:BB:GSM:PRAMp:BBONly[:STATe] on page 97

4.12 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.

To access the burst / slot settings, perform the following:

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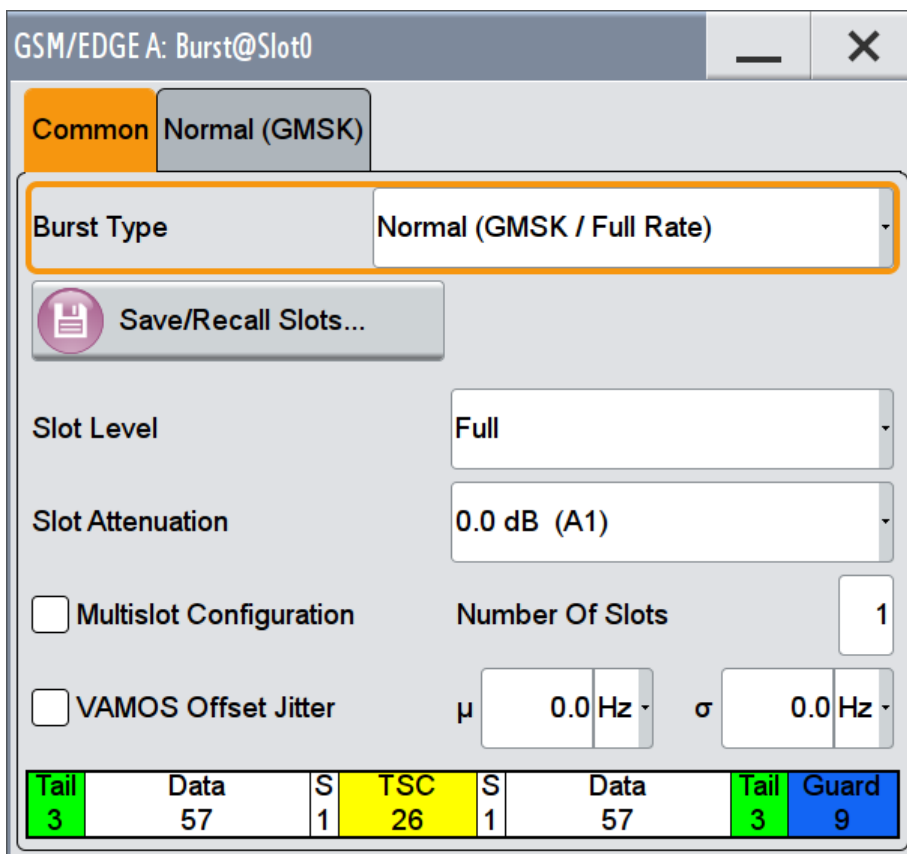
This dialog contains the parameters for configuring a burst slot. The graph shows the structure of the current burst type.

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 SMW-K41 (EDGE Evolution).

Burst Type

Selects the burst type.

The burst types available depend on the selected "Symbol Rate Mode". The symbole 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 SMW-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.) and half rate user 2 is transmitted in the frames with an odd index (frames 1, 3, etc.)
> See alsochapter 4.7, "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 3.1, "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 subchannel 2.

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

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

"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 in order to synchronize with the carrier frequency 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 modulation 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, in order to determine the timing advance. It is used for syn-
                  chronizing with the base station.

ETail	Synch	Data	Tail	EGuard
8	41	36	3	69

"All Data
(GMSK)"   (Normal Symbol Rate)
                  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	Guard
148	9

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

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

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

Data	Guard
444	27

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

Data	Guard
592	36

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

Data	Guard
740	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. a HSR QPSK burst carries 2x(2*69) = 276 encrypted bits.

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

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

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

"HSR (32QAM)"   (Higher Symbol Rate)
Selects a higher symbol rate burst with 32QAM modulation scheme (5 bits per symbol).
A 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.
A HSR All_Data QPSK burst carries 2x177 = 354 encrypted bits.

Data 354	Guard 22

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

Data 708	Guard 44

"HSR All Data (32QAM)"   (Higher Symbol Rate)
A 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 100

Save-Recall Slots
Accesses the "Save/Recall Slot" dialog with standard "File Select" and file management functions, see chapter 4.9, "Save Recall Frame/Slots", on page 31.

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 3-2. 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 may select from the values displayed.

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

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 101

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 may select from the values displayed.

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

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

Selects whether a Narrow Pulse Shape or a Wide Pulse Shape filter should be use 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 102

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.

A number of multislot groups can be defined within a frame. These are highlighted when the frame structure is displayed in the main dialog (see chapter 4.7, "Mode Framed (single)", on page 27).
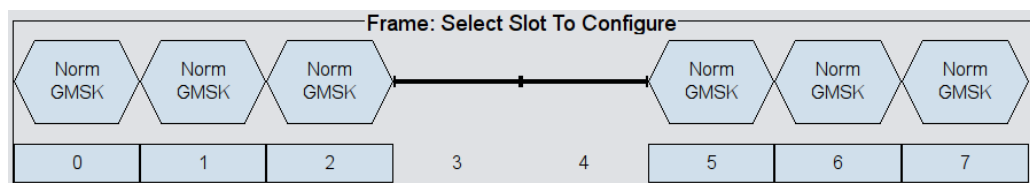
The first slot in a multislot group is the master slot. This determines the parameters of all the slots in the group. All the slots in a multislot group therefore have identical parameters.

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 106

Number of Slots

Defines the number of consecutive slots that will be 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 8 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 102

VAMOS Offset Jitter

Enables/disables the simulation of a timing jitter for GMSK bursts.

The test specification 3GPP TS 45.005, Annex Q5 defines that for uplink tests in VAMOS mode, both interference and sensitivity limited cases are specified for VAMOS subchannel 1 that is offset in time and frequency with respect to VAMOS subchannel 2. If this parameter is activated, the instrument applys a timing offset (jitter) with randomly selected value in the range of -1, 0 or 1 symbol period. The timing offset changes between the bursts; within a burst, the instrument keeps the time and frequency offsets constant.

Use the frequency offset parameters μ and σ to define the required gaussian frequency jitter.

Remote command:
[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>:VOJitter on page 103

Frequency offset parameters: sigma, u

If VAMOS Offset Jitter is enabled, sets the frequency offset parameters μ and σ required to define the random function for the frequency offset.

Table 4-1: Frequency offset parameters

Frequency Band	850/900	1800	1900
μ	45 Hz	90 Hz	95 Hz
σ	10 Hz	17 Hz	17 Hz

Remote command:
[:SOURce<hw>]:BB:GSM:FOFFset:MEAN on page 103
[:SOURce<hw>]:BB:GSM:FOFFset:STANdard on page 103

Burst Fields

Comprises settings for configuring of the individual burst fields.

The available settings depends 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, and for instance 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 SMW user manual.
- section "File and Data Management" in the R&S SMW user manual.
- section "Data List Editor" in the R&S SMW user manual

Remote command:

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>][:SOURce]:DATA on page 104

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>][:SOURce]:DATA:PATTern on page 105

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>][:SOURce]:DATA:DLISt:CATalog? on page 105

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>][:SOURce]:DATA:DLISt on page 104

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 106

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 106

Training Sequence Set ← **Burst Fields**
Determine whether the GMSK normal burst or VAMOS subchannel uses TSC set 1 or set 2.

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

Remote command:
[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][: USER<ch>][:SOURce]:TSC:SET on page 107

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 107

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 107

Ext Training Seq ETSC ← **Burst Fields**
Selects the Extended Training Sequence Code for the Synchronization burst.

There is a choice of three predefined, 64-bit extended training sequences. Additionally 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 108

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 108

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. Additionally 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 109

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 109

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. The "User" data content can also be selected. This pattern can be edited in the Fixed Pattern field and must likewise be 142 bits long.

Remote command:

`[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:USER<ch>]:FCORrection:FIXed` on page 109

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 110

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 110

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

In order for a frame to contain exactly 1250 bits for normal burst and 1500 for higher symbol rate burst as prescribed in the GSM standard, 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 ½ symbol (slot length 187 symbols)" is enabled, all slots are 156 respectively 187 symbols long. The extra 1/4 resp. 1/2 symbols 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 then 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 and 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

Remote command:
n.a.

4.13 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 efffect 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 check box 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 means of

- 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 pre-set 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 will then be 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 111

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 on the rotary knob). Any number of ramps can be defined per marker. Each of the generated ramp positions will be 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 by means of 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 by means of 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 subsequently 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 subsequently 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 subsequently 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 subsequently 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.

GSM A (S4) Positions - Marker 1			
	Ramp Position	**Ramp State**	
1	0	Low	
2	20	High	
3	58	Low	
4	80	Low	
5	102	High	
6	176	Low	
7	178	Low	
8			

Accept

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 will change 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/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 file name 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.

5 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 SMW has already been set up for remote operation in a network as described in the R&S SMW 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 SMW user manual.

Common Suffixes

The following common suffixes are used in remote commands:

Suffix	Value range	Description
ENTity<ch>	1 .. 4	entity in a multiple entity configuration with separate base-bad sources ENTity3|4 require option R&S SMW-K76
SOURce<hw>	[1]|4	available baseband signals only SOURce1 possible, if the keyword ENTity is used
OUTPut<ch>	1 .. 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

> **Using SCPI command aliases for advanced mode with multiple entities**
>
> You can address multiple entities configurations by using the SCPI commands starting with the keyword SOURce or the alias commands starting with the keyword ENTity.
>
> Note that the meaning of the keyword SOURce<hw> changes in the second case.
>
> For details, see section "SCPI Command Aliases for Advanced Mode with Multiple Entities" in the R&S SMW user manual.

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

5.1 Primary 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 framded.

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 2 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 43

[: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>   0 | 1 | OFF | ON
                     *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 34

[: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 31

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

Selects constant slot length.

For Normal Symbol Rate mode, the command selects whether the 1/4 symbol of a GSM slot (length = 156.25 symbols) will be ignored (ON) or compensated for by an extra symbol every 4th slot (OFF). When ON is selected, all slots are 156 symbols long. When OFF is selected, some slots are 157 symbols long.

For Higher Symbol Rate mode, the command selects whether the 1/2 symbol of a average slot with a length of 187.5 symbols will be ignored (ON) or compensated for by an extra symbol every secend slot (OFF). When ON is selected, all slots are 187 symbols long. When OFF is selected, some slots are 188 symbols long.

Parameters:

<ISLength>	0 | 1 | OFF | ON
	*RST: OFF
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 34

[: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 15

[: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 14

[: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 60 dB
> Increment: 0.01 dB
> *RST: 0 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 12dB`
	sets the level attenuation for selection A1 to 12 dB.
	`BB:GSM:SLOT1:ATT A1`
	sets the level attenuation for slot 1 to 12 dB.
Manual operation:	See "Slot Attenuation A1 to A7" on page 45

[: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` will be 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 15

[: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 may be omitted. Only files with the file extension `*.gsm` will be 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 15

[: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 may be omitted. Only files with the file extension `*.gsm` will be 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 15

[: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 the file name has to be entered. 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 15

[: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 SMW-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 a 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 SMW-K41 (required for N16Qam | N32Qam | HQPSk | H16Qam | H32Qam | AQPSk)
Manual operation:	See "Simulation Mode" on page 15

[: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 a normal bursts (NB) or higher symbol rate bursts (HB) will be 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 15

[: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>

0 | 1 | OFF | ON

*RST: 0

Example: SOURce1:BB:GSM:STATe ON

Manual operation: See "State" on page 13

[: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 15

5.2 Save Recall Frame/Slots

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

This command reads out the files with user defined frame settings in the default directory. The default directory is set using command `MMEM:CDIRectory`. Only files with the file extension `*.gsm_fu` and `*.gsm_hfu` will be 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 Frame/Slot" on page 32

[: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 may be omitted. Only files with the file extension `*.gsm_fu` and `*.gsm_hfu` will be 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 33

[: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 may be omitted. Only files with the file extension *.gsm_fu and *.gsm_hfu will be 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 Frame/Slot" on page 32

[: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 the file name has to be entered. 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 Frame/Slot" on page 32

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

This command reads out the files with predefined frame settings. The directory is preset, 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 Frame/Slot" on page 31

[: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 Frame/Slot" on page 31

[: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 Frame/Slot" on page 31

[: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 Frame/Slot" on page 31

[: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` will be 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 Frame/Slot" on page 32

[: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 may be omitted. Only files with the file extension `*.gsm_slu` and `*.gsm_hslu` will be 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 33

**[: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 may be omitted. Only files with the file extension `*.gsm_slu` and `*.gsm_hslu` will be loaded.

Setting parameters:

<Filename>	string

Example:	`BB:GSM:SLOT:ULIS:LOAD 'NB'`
	loads file `NB`.

Usage:	Setting only

Manual operation:	See "Recall User Frame/Slot" on page 32

**[: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 the file name has to be entered. 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 Frame/Slot" on page 32

5.3 Modulation/Filter Settings

5.3.1 Modulation Settings

[: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 Type GSM" on page 35

[: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 37

[: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 35

[: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 SMW-K41

Manual operation: See "Modulation AQPSK" on page 36

[: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 41

[: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 42

[: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 40

[: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 38

[: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 39

[: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 SMW-K41
Manual operation:	See "Angle alpha_0 ... alpha_7" on page 36

[: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 shall be 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 SMW-K41

Manual operation: See "SCPIR_0 .. SCPIR_7" on page 36

5.3.2 Filter Settings

[: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 35

[: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 SMW-K41

Manual operation: See "Filter" on page 37

[: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 38

[: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 39

[: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 41

[: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 40

5.4 Clock Settings

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

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

Sets the type of externally supplied clock.

Parameters:

<Mode>   SYMBol | MSYMbol | FSYMbol
                                *RST: SYMBol

Manual operation: See "Clock Mode" on page 25

[:SOURce<hw>]:BB:GSM:CLOCk:MULTiplier <Multiplier>

Specifies the multiplier for clock type multiple in the case of an external clock source.

Parameters:

<Multiplier>   integer

                                Range: 1 to 64
                                Increment: 1
                                *RST: 4

Example: `SOURce1:BB:GSM:CLOCk:SOURce EGC1`
                         selects the external clock source.
                         `SOURce1:BB:GSM:CLOCk:MODE MSYM`
                         selects clock type
                         `SOURce1:BB:GSM:CLOCk:MULTiplier 12`
                         the multiplier for the external clock rate is 12.

Manual operation: See "Symbol Clock Multiplier" on page 25

[:SOURce<hw>]:BB:GSM:CLOCk:DIVider <Divider>

Sets the divider for clock type "Fractional Symbols" (`:BB:GSM:CLOCk:MODE FSYM`) in the case of an external clock source.

For two-path instruments, the only numerical suffix allowed for SOURce is 1, since the external clock source is permanently allocated to path A.

Parameters:

<Divider>   integer

                                Range: 1 to 65536
                                *RST: 4

Example: `BB:GSM:CLOC:SOUR EXT`
                         selects the external clock source.
                         `BB:GSM:CLOC:MODE FSYM`
                         selects clock type "Fractional Symbols", i.e. the supplied clock
                         has a rate which is a fraction of the symbol rate.
                         `BB:GSM:CLOC:DIV 2`
                         the divider for the external clock rate is 2.

Manual operation: See "Symbol Clock Divider" on page 25

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

The command selects the clock source.

Parameters:

<Source>   INTernal | EGC1 | EGC2 | ELCLock | EXTernal

INTernal
The instrument uses its internal clock reference

EGC1|EGC2
External global clock

ELCLock
External local clock

EXTernal
`EXTernal = EGC1`
Setting only; provided for backward compatibility with other R&S signal generators.

*RST: INTernal

Example: `BB:GSM:CLOC:SOUR INT`
selects an internal clock reference.
`BB:GSM:CLOC:MODE SYMB`
specifies that a symbol clock is supplied via the respective clock connector.

Manual operation: See "Clock Source" on page 25

5.5 Trigger Settings

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

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

The command selects the trigger mode.

Parameters:

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

AUTO
The frames are generated continuously.

RETRigger
The frames are generated continuously. A trigger event (internal or external) causes a restart.

AAUTo
The frames are generated only when a trigger event occurs. After the trigger event the signal is generated continuously. Signal generation is stopped with command
SOUR:BB:GSM:TRIG:ARM:EXEC and started again when a trigger event occurs.

ARETrigger
The frames are generated only when a trigger event occurs. The device automatically toggles to RETRIG mode. Every subsequent trigger event causes a restart. Signal generation is stopped with command SOUR:BB:GSM:TRIG:ARM:EXEC and started again when a trigger event occurs.

SINGle
The signal is generated only when a trigger event occurs. After the trigger event the signal is generated once to the set sequence length (SOUR:BB:GSM:TRIG:SLEN). Every subsequent trigger event causes a restart.

*RST: AUTO

Example: BB:GSM:SEQ AAUT
sets the "Armed_auto" trigger mode; the device waits for the first trigger (e.g. with *TRG) and then generates the frames continuously.

Manual operation: See "Trigger Mode" on page 17

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

The command stops signal generation for trigger modes Armed_Auto and Armed_Retrigger. A subsequent internal or external trigger event restarts signal generation.

Example: BB:GSM:TRIG:SOUR INT
sets internal triggering.
BB:GSM:TRIG:SEQ ARET
sets Armed_Retrigger mode, i.e. every trigger event causes signal generation to restart.
BB:GSM:TRIG:EXEC
executes a trigger, signal generation is started.
BB:GSM:TRIG:ARM:EXEC
signal generation is stopped.
BB:GSM:TRIG:EXEC
executes a trigger, signal generation is started again.

| **Usage:** | Event |
| **Manual operation:** | See "Arm" on page 19 |

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

The command executes a trigger. The internal trigger source must be selected using the command `:BB:GSM:TRIGger:SOURce INTernal` and a trigger mode other than AUTO must be selected using the command `:BB:GSM:SEQ`.

Example:	`BB:GSM:TRIG:SOUR INT`
	sets internal triggering.
	`BB:GSM:SEQ RETR`
	sets Retrigger mode, i.e. every trigger event causes signal generation to restart.
	`BB:GSM:TRIG:EXEC`
	executes a trigger.
Usage:	Event
Manual operation:	See "Execute Trigger" on page 19

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

(enabled for "Trigger Source" External)

Enables/disables output of the signal synchronous to the external trigger event.

Parameters:

<Output>	0 | 1 | OFF | ON
	ON
	The signal calculation starts simultaneously with the external trigger event but because of the instrument's processing time the first samples are cut off and no signal is outputted. 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 and starts with sample 0, i.e. the complete signal is outputted. This mode is recommended for triggering of short signal sequences with signal duration comparable with the processing time of the instrument.
	*RST: ON
Example:	`BB:GSM:TRIG:SOUR EXT`
	sets external triggering.
	`BB:GSM:TRIG:EXT:SYNC:OUTP ON`
	enables synchrounous output to external trigger
Manual operation:	See "Sync. Output to External Trigger" on page 19

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

Specifies the trigger delay (expressed as a number of symbols) for triggering by the signal from the second path.

Parameters:

<Delay>	float
	Range:　　0 to 16777215
	Increment:　0.01
	*RST:　　　0

Example:	BB:GSM:TRIG:SOUR OBAS
	sets for path A the internal trigger executed by the signal from the second path (path B).
	BB:GSM:TRIG:OBAS:DEL 200
	sets a delay of 200 symbols for the trigger.

Manual operation:　　See "Trigger Delay" on page 21

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

The command specifies the number of symbols by which a restart is to be inhibited following a trigger event. This command applies only for triggering by the second path.

Parameters:

<Inhibit>	integer
	Range:　　0 Symbols to 2^32-1 (67 108 863) Symbols
	Increment:　1 Symbol
	*RST:　　　0 Symbols

Example:	BB:GSM:TRIG:SOUR OBAS
	sets for path A the internal trigger executed by the signal from the second path (path B).
	BB:GSM:TRIG:OBAS:INH 200
	sets a restart inhibit for 200 symbols following a trigger event.

Manual operation:　　See "External Trigger Inhibit" on page 20

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

The command queries the status of frame generation for all trigger modes with GSM/ EDGE modulation on.

Return values:

<RMode>   STOP | RUN

                         RUN

                         the GSM/EDGE signal is generated. A trigger event occurred in
                         the triggered mode.

                         STOP

                         the GSM/EDGE signal is not generated. A trigger event did not
                         occur in the triggered modes, or signal generation was stopped
                         by the command `:BB:GSM:TRIG:ARM:EXECute` (armed trig-
                         ger modes only).

Example: `BB:GSM:TRIG:SOUR EXT`
                         sets external triggering.
                         `BB:GSM:TRIG:MODE ARET`
                         selects the Armed_Retrigger mode.
                         `BB:GSM:TRIG:RMOD?`
                         queries the status of frame generation.
                         `Response: RUN`
                         the frame is generated, an external trigger was executed.

Usage: Query only

Manual operation: See "Running/Stopped" on page 18

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

Sets the length of the signal sequence to be output in the "Single" trigger mode. The
unit is defined with command `SOUR:BB:GSM:TRIG:SLUNit`. It is possible to output
deliberately just part of a frame, an exact sequence of a frame, or a defined number of
repetitions of a frame.

Parameters:

<SLength>   integer

                         Range: 1 to max
                         *RST: 1

Example: `BB:GSM:SEQ SING`
                         sets trigger mode Single.
                         `BB:GSM:TRIG:SLUN SYMB`
                         sets unit symbol for the entry of signal duration.
                         `BB:GSM:TRIG:SLEN 200`
                         sets signal duration of 200 symbols. 200 symbols will be output
                         after the next trigger event.

Manual operation: See "Trigger Signal Duration" on page 18

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

The command defines the unit for the entry of the length of the signal sequence
(`SOUR:BB:GSM:TRIG:SLEN`) to be output in the "Single" trigger mode
(`SOUR:BB:GSM:SEQ SING`).

Parameters:

<SLunit>   FRAMe | SYMBol

                         *RST: FRAMe

Example: BB:GSM:SEQ SING
                         sets trigger mode Single.
                         BB:GSM:TRIG:SLUN FRAM
                         sets unit frame for the entry of signal duration.
                         BB:GSM:TRIG:SLEN 2
                         sets signal duration of 2 frames. The current frame will be output
                         twice after the next trigger event.

Manual operation: See "Signal Duration Unit" on page 18

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

The command selects the trigger source.

Parameters:

<Source>   INTB | INTernal | OBASeband | EGT1 | EGT2 | EGC1 | EGC2 |
                         ELTRigger | INTA | ELCLock | BEXTernal | EXTernal

                         INTernal
                         Internal

                         INTA | INTB
                         Internal trigger from the other baseband

                         EGT1 | EGT2
                         External global trigger

                         EGC1 | EGC2
                         External global clock

                         ELTRigger
                         External local trigger

                         ELCLock
                         External local clock

                         OBASeband|BEXTernal|EXTernal
                         Provided only for backward compatibility with other R&S signal
                         generators.
                         The R&S SMW accepts these values und maps them automati-
                         cally as follow:
                         EXTernal = EGT1, BEXTernal = EGT2, OBASeband = INTA or
                         INTB (depending on the current baseband)

                         *RST: INTernal

Example: BB:GSM:TRIG:SOUR INT
                         sets internal triggering.

Manual operation: See "Trigger Source" on page 19

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

Sets the trigger delay.

Parameters:

<Delay>   float

                           Range: 0 to 16777215
                           Increment: 0.01
                           *RST: 0
                           Default unit: samples

Example: `BB:GSM:TRIG:SOUR EXT`
selects an external trigger.
`BB:GSM:TRIG:EXT:DEL 50`
sets a delay of 50 symbols for the trigger.

Manual operation: See "Trigger Delay" on page 21

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

Specifies the number of samples by which a restart is to be inhibited following an external trigger event.

Parameters:

<Inhibit>   integer

                           Range: 0 to 21.47*symbRate
                           *RST: 0

Example: `BB:GSM:TRIG:SOUR EXT`
selects an external trigger.
`BB:GSM:TRIG:EXT:INH 200`
sets a restart inhibit for 200 samples following a trigger event.

Manual operation: See "External Trigger Inhibit" on page 20

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

The command specifies the trigger delay (expressed as a number of symbols) for external triggering via the clock input.

This command applies only if external clock source (`BB:GSM:CLOC:SOUR EXT`) and trigger source external clock (`BB:GSM:TRIG:SOUR CLOC`) are selected.

For two-path instruments, this command applies only for baseband path A.

Parameters:

<Delay>   float

                           Range: 0 Symbols to $2^{16}-1$ Symbols
                           Increment: 1 Symbol
                           *RST: 0 Symbols

Example: `BB:GSM:CLOC:SOUR EXT`

selects the external clock source.

`BB:GSM:TRIG:SOUR ECL`

selects an external trigger by means of the external clock.

`BB:GSM:TRIG:EXT:CLOC:DEL 200`

sets a delay of 200 symbols for the trigger.

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

The command specifies the number of symbols by which a restart is to be inhibited following a trigger event. This command applies only if external clock source (`BB:GSM:CLOC:SOUR EXT`) and trigger source external clock (`BB:GSM:TRIG:SOUR CLOC`) is selected.

For two-path instruments, this command applies only for baseband path A.

Parameters:

<Inhibit>   integer

Range: 0 Symbols to 2^26-1 (67 108 863) Symbols
Increment: 1 Symbol
*RST: 0 Symbols

Example: `BB:GSM:CLOC:SOUR EXT`

selects the external clock source.

`BB:GSM:TRIG:SOUR ECL`

selects an external trigger by means of the external clock.

`BB:GSM:TRIG:EXT:CLOC:INH 200`

sets a restart inhibit for 200 symbols following a trigger event.

5.6 Marker Settings

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

[:SOURce\<hw\>]:BB:GSM:TRIGger:OUTPut:DELay:FIXed \<Fixed\>

The command restricts the marker delay setting range to the dynamic range. In this range the delay can be set without restarting the marker and signal. If a delay is entered in setting ON but is outside this range, the maximum possible delay is set and an error message is generated.

The numeric suffix in OUTPut has no significance for this command, since the setting always affects every marker.

Parameters:

\<Fixed\>   0 | 1 | OFF | ON

                             *RST: OFF

Example: `BB:GSM:TRIG:OUTP:DEL:FIX ON`
                             restricts the marker signal delay setting range to the dynamic range.

Manual operation: See "Marker x Delay" on page 23

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

Sets the delay between the signal on the marker outputs and the start of the frame/slot, expressed in terms of symbols.

Command `:BB:GSM:TRIGger:OUTPut:DELay:FIXed` can be used to restrict the range of values to the dynamic range, i.e. the range within which a delay of the marker signals can be set without restarting the marker and signal.

Parameters:

\<Delay\>   float

                             Range: 0 to 16777215
                             Increment: 1E-3
                             *RST: 0

Example: `BB:GSM:TRIG:OUTP:DEL 16`
                             sets a delay of 16 symbolsfor the corresponding marker signal.

Manual operation: See "Marker x Delay" on page 23

[:SOURce\<hw\>]:BB:GSM:TRIGger:OUTPut\<ch\>:DELay:MINimum?
[:SOURce\<hw\>]:BB:GSM:TRIGger:OUTPut\<ch\>:DELay:MAXimum?

Queries the maximum marker delay for setting `:BB:GSM:TRIGger:OUTPut:DELay:FIXed ON`.

Return values:

\<Maximum\>   float

                             Range: 0 to max
                             Increment: 1E-3
                             *RST: 2000

Example:	`BB:GSM:TRIG:OUTP:DEL:FIX ON`
	restricts the marker signal delay setting range to the dynamic range.
	`BB:GSM:TRIG:OUTP:DEL:MAX`
	queries the maximum of the dynamic range.
	`Response: '2000'`
	the maximum for the marker delay setting is 2000 symbols.

Usage:	Query only
Manual operation:	See "Marker x Delay" on page 23

[: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

As defined in slots
The marker defined in the burst editor is used.

SLOT
A slot clock with the slot period specified using command `SOUR:BB:GSM:TRIG:OUTP:PER:SLOT` 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 between 156 and 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, and at 157 symbols it is 0.580 ms.

FRAMe
A frame clock with the frame period specified using command `SOUR:BB:GSM:TRIG:OUTP:PER:FRAM` 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 pulsed marker signal is generated. The pulse frequency

PATTern
A marker signal is generated with the aid of a user-definable bit pattern. The bit pattern is entered with the aid of command `SOURce:BB:GSM:TRIGg:OUTP:PATT`. The bit pattern is a maximum of 32 bits long.

RATio
A regular marker signal corresponding to the Time Off / Time On specifications in the commands `SOUR:BB:GSM:TRIGge:OUTP:OFFT` and `SOUR:BB:GSM:TRIGg:OUTP:ONT` is generated.

*RST: FRAMe

Example:	BB:GSM:TRIG:OUTP2:MODE PULS
	selects the pulsed marker for the corresponding marker signal.

Manual operation:	See "Marker Mode" on page 22

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

The command sets the number of symbols in a period (ON time + OFF time) during which the marker signal in setting `SOURce:BB:GSM:TRIGger:OUTPut:MODE RATio` on the marker outputs is OFF.

Parameters:

\<OffTime>	integer	
	Range:	1 Symbol to 2^24-1 Symbols
	Increment:	1 Symbol
	*RST:	1 Symbol

Example:	BB:GSM:TRIG:OUTP2:OFFT 20
	sets an OFF time of 20 symbols for marker signal 2.

Manual operation:	See "Marker Mode" on page 22

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

Defines the bit pattern used to generate the marker signal in the setting `SOURce:BB:GSM:TRIGger:OUTPut:MODE PATTern 0` is marker off, 1 is marker on. The pattern has a maximum length of 64 bits.

Parameters:

\<Pattern>	64 bits

Example:	BB:GSM:TRIG:OUTP2:PATT #H81,8
	sets a bit pattern.
	BB:GSM:TRIG:OUTP2:MODE PATT
	activates the marker signal according to a bit pattern for the corresponding marker signal.

Manual operation:	See "Marker Mode" on page 22

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

The command sets the repetition rate for the slot clock at the marker outputs.

Parameters:

\<Slot>	integer	
	Range:	1 Slot to 2^26-1 Slots
	Increment:	1 Slot
	*RST:	1 Slot

Example: `BB:GSM:TRIG:OUTP2:MODE SLOT`
sets the slot clock for the corresponding marker signal.
`BB:GSM:TRIG:OUTP2:PER:SLOT 16`
sets a period of 16 slots, i.e. the marker signal is repeated every 16th slot.

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

The command sets the repetition rate for the frame clock at the marker outputs.

Parameters:

<Frame>   integer

                       Range: 1 Frame to $2^{26}-1$ Frames
                       Increment: 1 Frame
                       *RST: 1 Frame

Example: `BB:GSM:TRIG:OUTP2:MODE FRAM`
sets the frame clock for the corresponding marker signal.
`BB:GSM:TRIG:OUTP2:PER 16`
sets a period of 16 frames, i.e. the marker signal is repeated every 16th frame.

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

The command sets the divider for the pulsed marker signal in the setting `SOURce:BB:GSM:TRIGger:OUTPut:MODE PULSe`. The pulse frequency is derived by dividing the symbol rate by the divider.

Parameters:

<Divider>   integer

                       Range: 2 to 2^{10}
                       Increment: 1
                       *RST: 2

Example: `BB:GSM:TRIG:OUTP2:PULS:DIV 2`
sets the divider for the corresponding marker signal to the value 2.
`BB:GSM:TRIG:OUTP2:FREQ?`
queries the resulting pulse frequency of the marker signal.
`Response: 66 000`
the resulting pulse frequency is 66 kHz.

Manual operation: See "Marker Mode" on page 22

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

The command queries the pulse frequency of the pulsed marker signal in the setting `SOUR:BB:GSM:TRIG:OUTP:MODE PULS`. The pulse frequency is derived by dividing the symbol rate by the divider. The divider is defined with command `SOUR:BB:GSM:TRIG:OUTP:PULS:DIV`.

Return values:

<Frequency>	float

Example: `BB:GSM:TRIG:OUTP:PULS:DIV 4`

sets the divider for the corresponding marker signal to the value 4.

`BB:GSM:TRIG:OUTP:MODE PULS`

enables the pulsed marker signal.

`BB:GSM:TRIG:OUTP:PULS:FREQ?`

queries the resulting pulse frequency for the marker signal.

`Response: 33 000`

the resulting pulse frequency is 33 kHz.

Usage: Query only

Manual operation: See "Marker Mode" on page 22

5.7 Power Ramping/Slot Attenuation

[: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>	0 | 1 | OFF | ON
	*RST: 0

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

selects power ramping in the baseband only.

Manual operation: See "Baseband Only" on page 46

[: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 gives rise to a ramp delay and a negative value advances the ramp. The setting is expressed in symbols.

Parameters:

<FDelay>   float

                               Range: -9 Symbols to 9 Symbols
                               Increment: 1 Symbol
                               *RST: 0 Symbols

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 45

[: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 gives rise to a ramp delay and a negative value advances the ramp. The setting is expressed in symbols.

Parameters:

<RDelay>   float

                               Range: -9 Symbols to 9 Symbols
                               Increment: 1 Symbol
                               *RST: 0 Symbols

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 45

[: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 45

[: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 should be stretched when the transmitted power is turned on and off.

Parameters:

<Time>   float

                                Range: 0.3 Symbols to 16.0 Symbols
                                Increment: 0.1 Symbols
                                *RST: 5.0 Symbols

Example: BB:GSM:PRAM:TIME 6

                                sets the duration of the switching operation to 6 symbols.

Manual operation: See "Ramp Time" on page 45

5.8 Burst Editor

[: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 GSM (ADATa), All Data EDGE (AEDGe), All
                              Data AQPSK (AAQPSk), All Data 16QAM (A16Qam), All Data
                              32QAM (A32Qam), HSR All Data QPSK (HAQPsk), HSR All Data
                              16QAM (HA16Qam) and HSR All Data 32QAM (HA32Qam) are
                              not defined in the standard.

                              *RST: NORMal

Example: BB:GSM:SLOT:TYPE DUMM
                              selects DUMMY burst type for slot 1.

Options: R&S SMW-K41 (required for Higher Symbol Rate Mode, higher
                              order modulation schemes (16QAM and 32QAM) and AQPSK
                              modulation).

Manual operation: See "Burst Type" on page 48

[: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 52

[: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` will be 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 to 12 dB.

Manual operation: See "Slot Attenuation" on page 52

[: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 51

[: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 should be use 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 SMW-K41

Manual operation:	See "Filter" on page 40

[: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 8 slots.

`BB:GSM:MULT0:STAT ON`

switches the multislot configuration on.

Manual operation: See "Number of Slots" on page 53

[:SOURce\<hw\>]:BB:GSM[:FRAMe\<di\>]:SLOT\<st0\>:VOJitter \<State\>

Enables/disables the simulation of a timing jitter for GMSK bursts.

Parameters:

\<State\>   0 | 1 | OFF | ON

                 *RST: 0

Example: `SOURce1:BB:GSM:FRAMe1:SLOT2:VOJitter ON`

Manual operation: See "VAMOS Offset Jitter" on page 53

[:SOURce\<hw\>]:BB:GSM:FOFFset:MEAN \<MeanFreqOffset\>

Sets the frequency offset parameter μ.

Parameters:

\<MeanFreqOffset\>   float

                 Range: 0 to 9999.9
                 Increment: 0.1
                 *RST: 0

Manual operation: See "Frequency offset parameters: sigma, u" on page 53

[:SOURce\<hw\>]:BB:GSM:FOFFset:STANdard \<StandardFreqOff\>

Sets the frequency offset parameter σ.

Parameters:

\<StandardFreqOff\>   float

                 Range: 0 to 9999.9
                 Increment: 0.1
                 *RST: 0

Manual operation: See "Frequency offset parameters: sigma, u" on page 53

[: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, and 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

[: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 inter-
                     ruption from one DATA field to the next.

Manual operation: See "Data" on page 26

**[: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
will be 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 55

**[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][:
    USER<ch>][:SOURce]:DATA:PATTern** <Pattern>

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>   64 bits

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

[: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 config-
uration this setting applies to the slots in all frames.

Parameters:

\<State\>	0 | 1 | OFF | ON
	*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 8 slots.
	`BB:GSM:MULT0:STAT ON`
	switches the multislot configuration on.

Manual operation:	See "Multislot Configuration" on page 52

**[: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 56

**[: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\>	0 | 1 | OFF | ON
	*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 56

[: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 56

[: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 "Training Sequence Set" on page 56

[: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 56

[: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 56

[: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 57

[: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 57

[: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 57

[: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 57

[:SOURce<hw>]:BB:GSM[:FRAMe<di>]:SLOT<st0>[:SUBChannel<us>][: USER<ch>]:FCORrection:FIXed:PATTern <Pattern>

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>	142 bits
	*RST: 0

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 57

[: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 58

5.9 Slot Marker Definition

[: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 60

List of Commands

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