TETRA Release 2 Digital Standard for R&S®Signal Generators

Operating Manual

1173.0843.12 ─ 11

Test & Measurement

Operating Manual

ROHDE&SCHWARZ

This document describes the following software options:

- R&S®SMBV-K68
  1415.8490.xx
- R&S®SMU-K68
  1408.8217.02
- R&S®AMU-K68
  1403.0601.02
- R&S®SMATE-K68
  1404.8664.02
- R&S®SMJ-K68
  1409.3102.02

This manual version corresponds to firmware version:
FW 3.20.281.xx and later of the R&S®SMBV100A
FW 2.20.360.142 and later of the R&S®SMU200A, R&S®SMATE200A, R&S®SMJ100A and R&S®AMU200A

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The following abbreviations are used throughout this manual: R&S®SMBV100A is abbreviated as R&S SMBV, R&S®SMU200A is abbreviated as R&S SMU, R&S®AMU200A is abbreviated as R&S AMU, R&S®SMATE200A is abbreviated as R&S SMATE, R&S®SMJ100A is abbreviated as R&S SMJ, 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 Signal Generator consists of the following parts:

- Online Help system on the instrument,
- "Quick Start Guide" printed manual,
- Documentation CD-ROM with:
  - Online help system (*.chm) as a standalone help,
  - Operating Manuals for base unit and options,
  - Service Manual,
  - Data sheet and specifications,
  - Links to useful sites on the R&S internet.

Online Help

The Online Help is embedded in the instrument's firmware. 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 Signal Generator and all available options.

Quick Start Guide

The Quick Start Guide is delivered with the instrument in printed form and in PDF format on the Documentation CD-ROM. It provides the information needed to set up and start working with the instrument. Basic operations and an example of setup are described. The manual includes also general information, e.g., Safety Instructions.

Operating Manuals

The Operating Manuals are a supplement to the Quick Start Guide. Operating Manuals are provided for the base unit and each additional (software) option.

These manuals are available in PDF format - in printable form - on the Documentation CD-ROM delivered with the instrument. In the Operating Manual for the base unit, all instrument functions are described in detail. Furthermore, it provides an introduction to remote control and a complete description of the remote control commands with programming examples. Information on maintenance, instrument interfaces and error messages is also given.

In the individual option manuals, the specific functions of the 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 Signal Generator is not included in the option manuals.

Service Manual

The Service Manual is available in PDF format - in printable form - on the Documentation CD-ROM delivered with the instrument. It describes how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the instrument by the replacement of modules.

This manual can also be orderd in printed form (see ordering information in the data sheet).

Release Notes

The release notes describe 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 current release notes are provided in the Internet.

Web Help

The web help provides online access to the complete information on operating the R&S Signal Generator 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 on the R&S Signal Generator product page at the Downloads > Web Help area.

Application Notes

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

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.

Convention	Description
`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 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.

1.2.3 Naming of Software Options

In this operating manual, we explicitly refer to options required for specific functions of the digital standard.

The name of software options for signal generators vary in the name of the instrument, but the option name is identical. Therefore we use in this manual the placeholder R&S SMx/AMU.

Example:

Naming for an option of the vector signal generator R&S SMBV100A, e.g:

- R&S SMx/AMU-K99, stands for R&S SMBV-K99

The particular software options available for the corresponding instruments are listed on the back of the title page.

2 Introduction

The R&S SMx/AMU-K68 enables you to to generate signals in accordance with the standard Terrestrial Trunked Radio Release 2 (TETRA2).

To playback a signal from a waveform file created by the simulation software R&S WinIQSIM2, the corresponding R&S WinIQSIM2 digital standard option must be installed.

The following list gives an overview of the main options provided by the R&S Signal Generator for generating an TETRA signal in accordance with ETSI EN 300 392-2.

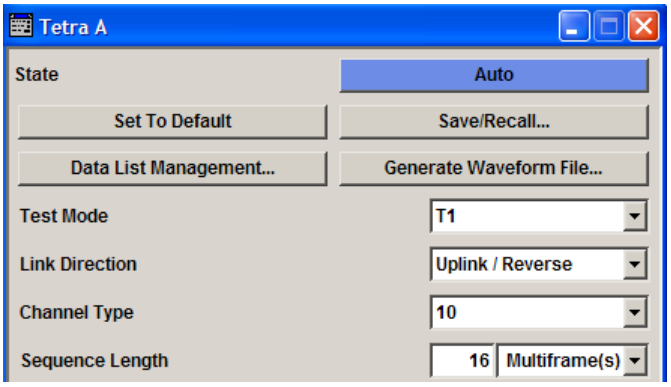
- The TETRA frame (bit stream) is generated according to the selected burst type, i.e. control burst (CB), normal burst (NB) or synchronization burst (SB).
- The frames are generated for the uplink (mobile station [MS] transmitting) or the downlink (base station [BS] transmitting).
- The channel types AACH, BSCH, BNCH, TCH, STCH, SCH as well as the TETRA Release 2 specific channels like SCH-Q, etc. are generated.
- Channel coding including scrambling with system code, base color code, mobile country code and mobile network code is performed for all channels.
- Frame repetition can be selected via sequence length.
- The T1 test signal is generated for the V+D (voice and data) test on MS and BS DUTs.
- Test channel types can be set for the downlink and for the uplink.
- The bit stream can be generated either from pseudo-random sequences (CCITT O. 153) or from user-selectable sequences.
- The R&S Signal Generator calculates the appropriate TETRA2 T1, T2, T3 and T4 signal according to the specifiction.
- Additionaly, user-defined test signal can be generated.

3 User Interface

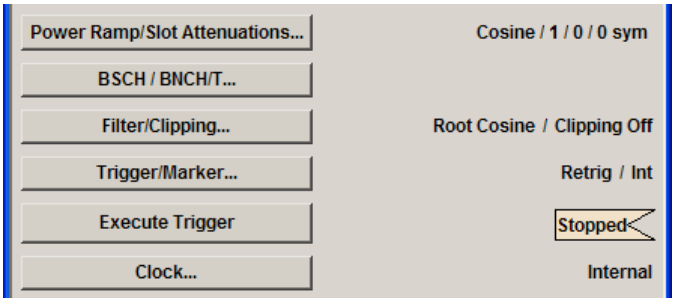
To access the menu for setting the TETRA digital standard, select "Baseband Block > Config > TETRA" or press the MENU key and select "Baseband > TETRA".

The menu is split into three sections for configuring the standard. The choice of transmission direction determines which displays and parameters are made available in the middle section.

The upper section of the menu is where the TETRA digital standard is enabled, the default settings are called, the transmission direction selected and the test mode is set.

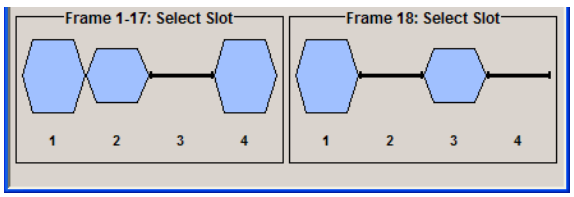


The section for setting the trigger and clock parameters, data list management, or saving and loading a frame and for setting the power ramping and slot attenuation are available for the modes T1, T2, T4 and User.

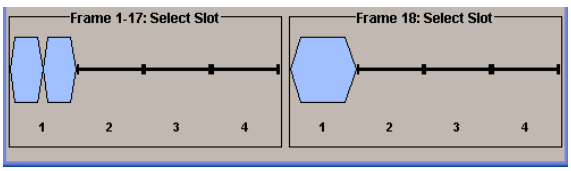


The lower part of the menu displays the chosen frame configuration. In this graphical display you can select the slot that you wish to edit. The frame editor then opens. Slots for frame 1 to 17 and frame 18 can be activated and configured independently.

normal burst:



control burst:



3.1 General Settings

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

Remote command:
`[:SOURce<hw>]:BB:TETRa:STATe` on page 44

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"
Test Mode	T1
Link Direction	Downlink / Forward
Channel Type	0
Sequence Length	1 Multiframe
Power Ramp/Slot Attenuation	cosine/ 2 / 0 / 0sym
Filter/Clipping	Root Cosine / clipping Off
Trigger/Marker	Auto/ Int
Clock	Internal

Remote command:
`[:SOURce<hw>]:BB:TETRa:PRESet` on page 42

Save/Recall
Calls the Save/Recall menu.

From the "Save/Recall" dialog the "Save/Recall Settings" windows for saving and recalling the configurations and the "File Manager" can be called.

TETRA configurations are stored as files with the predefined file extension `*.tetra`. The file name and the directory they are stored in are user-definable.

The complete settings in the TETRA menu are saved and recalled.

"Recall Settings" — Opens the "Recall Settings" window for loading a saved TETRA configuration.
The configuration of the selected (highlighted) file is loaded by pressing the "Select" button.

Remote command:
`[:SOURce<hw>]:BB:TETRa:SETTing:LOAD` on page 42

"Save Settings" Opens the "Save Settings" window for saving the current TETRA signal configuration.
The name of the file is specified in the "File name" entry field. The file is saved by pressing the "Save" button.
The "Fast Save" checkbox determines whether the instrument performs an absolute or a differential storing of the settings. Enable this function to accelerate the saving process by saving only the settings with values different to the default ones. "Fast Save" is not affected by the "Preset" function.

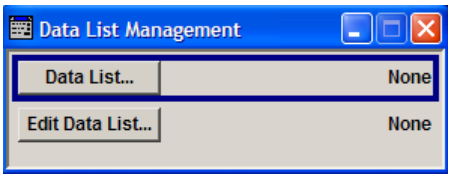
Remote command:
`[:SOURce<hw>]:BB:TETRa:SETTing:STORe` on page 43
`[:SOURce<hw>]:BB:TETRa:SETTing:STORe:FAST` on page 43

"File Manager" Calls the "File Manager" dialog.
The "File Manager" is used to copy, delete and rename files and to create new directories.

Remote command:
`[:SOURce<hw>]:BB:TETRa:SETTing:CATalog?` on page 42

Remote command:
`[:SOURce<hw>]:BB:TETRa:SETTing:DELete` on page 42

Data List Management
Calls the "Data List Management" dialog. This dialog is used to create and edit a data list.



All data lists are stored as files with the predefined file extension `*.dm_iqd`. The file name and the directory they are stored in are user-definable.

The data lists must be selected as a data source from the submenus under the individual function.

Example: Creating and editing the data list

```
SOUR:BB:DM:DLIS:SEL "TETRA"
SOUR:BB:DM:DLIS:DATA 1,1,0,1,0,1,0,1,1,1,1,0,0,0
SOUR:BB:DM:DLIS:DATA:APP 1,1,0,1,0,1,0,1,1,1,1,0,0,0
```

Remote command:
`[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:DATA` on page 50
`[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:DATA:DSELection` on page 51

Generate Waveform File
Opens the submenu for storing the current TETRA signal as ARB signal in a waveform file. This file can be loaded in the "ARB" dialog and processed as multicarrier or multi-segment signal.

The file name is entered in the submenu. The file is stored with the predefined file extension `*.wv`. The file name and the directory it is stored in are user-definable.

Remote command:
`[:SOURce<hw>]:BB:TETRa:WAVeform:CREate` on page 45

Test Mode
Selects the test mode.

Several settings depends on the selected test model.

"T1" Test signal T1 (TETRA wanted signal, phase modulated)
This test mode enables the generation of test signal that comply with the TETRA air interface multiframe, frame and slot structure. The T1 test signal is generated according to EN 300 394-1V3.1.1 and is intended to be the wanted signal transmitted by the test system during frames 1 to 17 in all receiver tests.
The signal is pi/4-DQPSK or pi/8-D8PSK modulated. Frame 18 transmits information for control purposes.
To enable configuration of the T1 signal for different receiver tests, the channel type for the "T1" signal is user-selectable. Channel types 0 to 4, 21, 22 and 25 are available in the Downlink/Forward "Link Direction" and channel types 7 to 11, 21, 23 and 24 for the Uplink/Reverse direction.
The burst types Uplink/Reverse and Downlink/Forward are derived from the channel types. The instrument generates the Tx data for complete multiframes for the V+D service (voice and data). The contents of data fields are automatically inserted according to the burst type. The control block (cb), blocks 1 + 2 (bk), the synchronization block (sb) and the broadcast block (bb) for test signal T1 are generated according to the frame number and the channel type.

"T4" Test signal T4 (TETRA wanted signal, QAM modulated)
The test signal T4 comply with the TETRA air interface multiframe, frame and slot structure. The T4 test signal is intended to be the wanted signal transmitted by the test system during frames 1 to 17 in all receiver tests. Except form frame 18, the signal is 4-QAM, 16-QAM or 64-QAM modulated. Frame 18 transmits information for control purposes and is QAM and phase modulated (QAM + pi/4-DQPSK); the frame is generated according to EN 300 394-1.

"User Defined" Enables the generation of user-defined test signal.

"T2" Test signal T2 (TETRA interfer)
The T2 test signal is phase or QAM modulated, depending on the selected Modulation Type.

"T3" Test sugnal T3 (unmodulated interferer)
The T3 test signal is an unmodulated continuous sinusoidal out-of-band interfering signal.

Remote command:
[:SOURce<hw>]:BB:TETRa:TMODe on page 44

Link Direction
Selects the transmission direction.

This parameter determines the available "Channel Types".

"Downlink/ Forward" The transmission direction selected is from the base station (BS) to the terminal (MS). The signal corresponds to that of a BS.

"Uplink/ Reverse" The transmission direction selected is from MS to the BS. The signal corresponds to that of a terminal.

Remote command:
[:SOURce<hw>]:BB:TETRa:LDIRection on page 41

Channel Type
(for "Test Model" set to T1 or T4)

Determines the channel type.

Remote command:
[:SOURce<hw>]:BB:TETRa:CTYPe on page 40

Modulation Type
(for "Test Model" set to User Defined)

Determines the modulation type, "Phase" or "QAM."

"Phase" The T2 test signal is a pi/4-DQPSK modulated continuous radio signal.

"QAM" The T2 test signal is 4-QAM, 16-QAM or 64-QAM modulated and spans a bandwidth of 25kHz, 50kHz, 100kHz or 150kHz.

Remote command:
[:SOURce<hw>]:BB:TETRa:MTYPe on page 41

Downlink Burst Type
(in Downlink "Link Direction" and for "Test Model" set to T2 or User Defined)

Determines whether a discontinuous or continuous downlink burst type is used.

Remote command:
[:SOURce<hw>]:BB:TETRa:DBTYpe on page 41

Sequence Length
Selects the sequence length of the arbitrary waveform file in the number of multiframes. One multiframe is the minimum sequence length for a T1 signal.

Remote command:
[:SOURce<hw>]:BB:TETRa:SLENgth on page 44

Power Ramp/Slot Attenuations
Calls the "Power Ramp Control" dialog. This dialog is used to set the power ramping parameters and for setting values for the level attenuation in dB (see chapter 3.2, "Power Ramp Control", on page 14).

The currently selected ramp function and ramp time are displayed.

BSCH / BNCH/T
Calls the "BSCH / BNCH/T" dialog. This dialog is used to configure the frequency settings, the scrambling code and the content of the Broadcast Synchronization Channel (BSCH) and the Broadcast Network Channel (BNCH/T) (see chapter 3.3, "BSCH / BNCH/T", on page 16).

Filter/Clipping
Calls the dialog for setting baseband filtering, clipping and modulation settings (seechapter 3.5, "Filter / Clipping Settings", on page 27).

The current settings are displayed.

Trigger/Marker/Clock
(Trigger and clock settings for R&S SMx and R&S AMU instruments only)

Calls the dialog for selecting the trigger source, for configuring the marker signals and for setting the time delay of an external trigger signal, and for selecting the clock source. This dialog is described in chapter 3.6, "Trigger/Marker/Clock Settings", on page 29.

The current settings are displayed.

Execute Trigger
for R&S SMx and R&S AMU instruments only

Executes trigger manually. A manual trigger can be executed only when an internal trigger source and a trigger mode other than "Auto" have been selected.

Remote command:
`[:SOURce<hw>]:BB:TETRa:TRIGger:EXECute` on page 67

Clock
The clock functions ara available for R&S SMx and R&S AMU instruments only.

Slot Selection Graph for Frame 1-17 and Frame 18
Opens the Burst Editor dialog.

3.2 Power Ramp Control

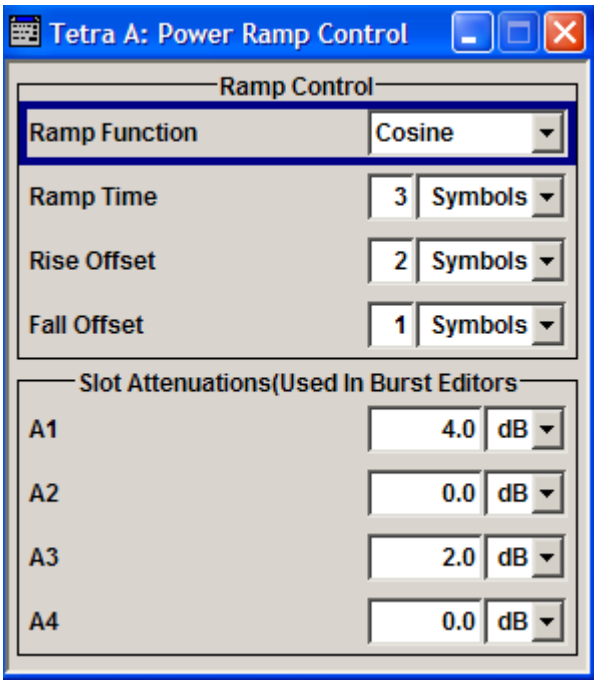
This dialog provides access to the settings for power ramping and slot attenuation.

To access this dialog select "Baseband > TETRA... > Power Ramp/Slot Attenuations...".

This dialog is used to enter the settings for power ramping and level attenuation. The "Slot Attenuations" (used in "Frame Editor") section is used to define four possible val-

ues for level attenuation. These values can be selected from the frame editor for the slot currently being edited.

"Slot Level Full" setting in the frame editor corresponds to 0 dB attenuation.



Provided are the following settings:

Ramp Function
Enters 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:TETRa:PRAMping:RFUNction` on page 45

Ramp Time
Enters the power ramping rise time and fall time for a frame. The setting is expressed in symbols.

The transmitted power must not be switched abruptly at the start and end of a frame, 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:TETRa:PRAMping:RTIMe` on page 46

Rise Offset
Sets the offset in the rising edge of the envelope at the start of a frame. 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:TETRa:PRAMping:ROFFset` on page 46

Fall Offset
Sets the offset in the falling edge of the envelope at the end of a frame. 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:TETRa:PRAMping:FOFFset` on page 45

Slot Attenuation A1 to A4
Enters four different values for level attenuation.

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

The entered value determines the slot output power (slot power = RF power - attenuation). 0 dB attenuation corresponds to "Slot Level" = Full.

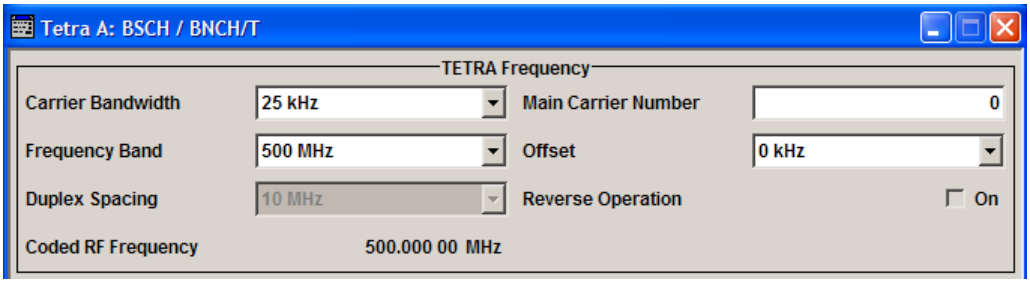
This feature is provided to set a sequence of slots to different levels in order to measure transmission stability.

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

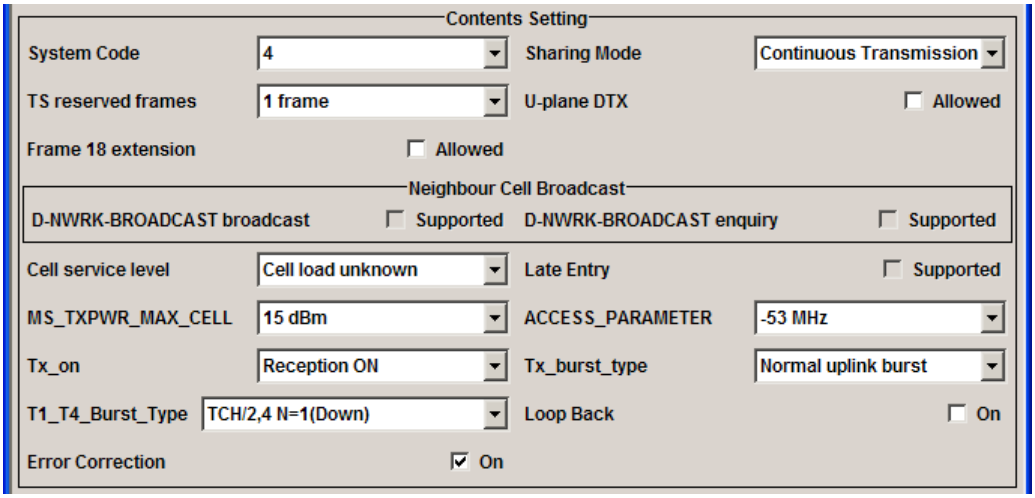
Remote command:
`[:SOURce<hw>]:BB:TETRa:SATTenuation<ch>` on page 46

3.3 BSCH / BNCH/T

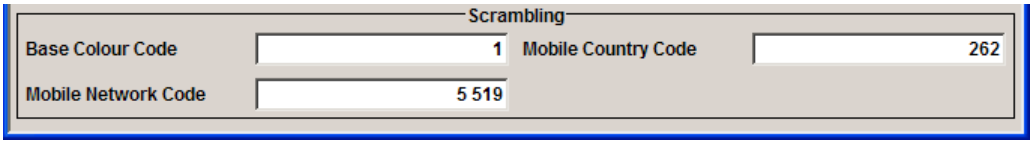
To access this dialog, select "Main dialog > BSCH / BNCH/T". In the "BSCH / BNCH/T" dialog the contents of the Broadcast Synchronization Channel (BSCH) and the Broadcast Network Channel (BNCH/T) are configured. The BSCH and the BNCH are the two possible Broadcast Control Channels (BCCH) that are transmitted in downlink direction only. Hence, the parameters in this dialog provided to configure the content of the channels are enabled only for "Link Direction" set to Downlink/Forward. The "BSCH / BNCH/T" dialog is divided into several sections. The "TETRA Frequency" section comprises of the parameters necessary to set the carrier bandwidth and the frequency band. The section is enabled in both link directions.



The "Contents Setting" section is enabled in downlink direction only. In the downlink mode, a synchronization burst is used to control the MS messages. In this burst, protocol elements are transmitted in BSCH and BNCH. The parameters are used to form the commands for the mobile station.



The "Srcambling" section comprises of the parameters necessary to configure the scrambling sequence.



3.3.1 TETRA Frequency

Provided are the following settings:

Carrier Bandwidth
Selects the carrier bandwidth, i.e. determines the carrier spacing.

The default value for all standard test modes is 25kHz; carrier spacing of 50, 100 and 150 kHz is enabled for "Test Mode" set to User Defined or T4.

Remote command:
`[:SOURce<hw>]:BB:TETRa:BBNCht:CBANdwidth` on page 57

Main Carrier Number
The "Main Carrier Number" divides the TETRA band into carriers with a spacing as set with the parameter "Carrier Bandwidth". The range is 0 to 4095 (12 bits).

The Main Carrier Frequency is calculated as follow:

Main Carrier Frequency, kHz = "Main Carrier Number" * "Carrier Bandwidth"

Remote command:
`[:SOURce<hw>]:BB:TETRa:BBNCht:MCNumber` on page 60

Frequency Band
Sets the "Frequency Band".

This setting has an effect on the calculation of the transmission frequency. The Frequency Band Information is inserted only in the TETRA BSCH protocol channel.

Remote command:
`[:SOURce<hw>]:BB:TETRa:BBNCht:FBANd` on page 59

Offset
Set the "Offset" to shifft the center frequency in the channel spacing. The allowed offsets are +6.25, 0,–6.25 and +12.50 kHz.

Remote command:
`[:SOURce<hw>]:BB:TETRa:BBNCht:OFFSet` on page 61

Duplex Spacing
(for Uplink direction only)

The "Duplex Spacing" and "Reverse Operation" parameters in the BNCH/T indicate the required uplink frequency with respect to the indicated downlink frequency. These parameters are defined in ETSI 300 392-2.

Remote command:
`[:SOURce<hw>]:BB:TETRa:BBNCht:DSPacing` on page 58

Reverse Operation
(for Uplink direction only)

Enables/disables reverse operation.

Reverse operation is used to fix the uplink frequency relative to the downlink frequency. In normal operation, the uplink frequency is lower than the downlink frequency and in reverse operation, the uplink frequency is higher than the downlink frequency.

Remote command:
`[:SOURce<hw>]:BB:TETRa:BBNCht:ROPeration` on page 61

Coded RF Frequency
Displays the resulting RF frequency, calculated from the previous settings. The frequency is calculated from the "Frequency Band", "Main Carrier Number", "Offset", "Duplex Spacing" and "Reverse Operation" and transmitted in message channel BNCH/T when Downlink MS V+D Testing is selected.

The "Coded RF Frequency" is calculated as described in table 3-1.

Table 3-1: Calculation of Coded RF Frequency

"Link Direction"	"Reverse Operation"	"Coded RF Frequency", MHz
Downlink	-	Downlink Coded RF Frequency = "Frequency Band" + ("Main Carrier Number"* "Carrier Bandwidth") + "Offset"
Uplink	Off (Normal operation)	Uplink Coded RF Frequency = Downlink Coded RF Frequency - "Duplex Spacing"
	On	Uplink Coded RF Frequency = Downlink Coded RF Frequency + "Duplex Spacing"

Remote command:
`[:SOURce<hw>]:BB:TETRa:BBNCht:CRFRequency?` on page 57

3.3.2 Contents Settings

The "Contents Setting" section is enabled in downlink direction only.

Provided are the following settings.

System Code
Indicate whether the system is a TETRA V+D system or whether this is a Direct Mode transmission.

Remote command:
`[:SOURce<hw>]:BB:TETRa:BBNCht:SCODe` on page 61

TS reserved frames
Determines the number of frames reserved over two multiframes period.

The way this field is processed, depends on the selected "Sharing Mode" on page 20. If MCCH sharing is indicated, the TS reserved frames field shall indicate which frames are reserved in this mode of operation. For the other values of sharing mode, the contents of the TS reserved frames field shall be ignored.

Remote command:
`[:SOURce<hw>]:BB:TETRa:BBNCht:TRFRames` on page 62

Frame 18 extension
Enables/disables the frame 18 extension element, i.e. indicates whether an MS is allowed to receive downlink information on all slots of the frame 18. If extension is allowed, only MSs which are capable of receiving consecutive slots are able to perform this function.

Remote command:
`[:SOURce<hw>]:BB:TETRa:BBNCht:FEEXtension` on page 59

Sharing Mode
The sharing mode field indicates whether the BS is using continuous transmission, carrier sharing, MCCH sharing or traffic carrier sharing.

Remote command:
`[:SOURce<hw>]:BB:TETRa:BBNCht:SMODe` on page 62

U-plane DTX
The "U-plane DTX" element indicates whether or not the BS supports discontinuous traffic transmission by the MS.

Remote command:
`[:SOURce<hw>]:BB:TETRa:BBNCht:UPDTx` on page 63

D-NWRK-BROADCAST broadcast
Enables/disables support of the D-NWRK-BROADCAST PDU.

Remote command:
`[:SOURce<hw>]:BB:TETRa:BBNCht:DNBBroadcast` on page 58

D-NWRK-BROADCAST enquiry
Enables/disables support of the D-NWRK-BROADCAST enquiry.

Remote command:
`[:SOURce<hw>]:BB:TETRa:BBNCht:DNBenquiry` on page 58

Cell service level
Sets the cell service level information element, i.e. define the level of service a MS may receive in a cell. It may relate to the traffic loading in a cell.

The following service levels are supported:
- "Cell load unknown"
- "Low cell load"
- "Medium cell load"
- "High cell load"

Remote command:
`[:SOURce<hw>]:BB:TETRa:BBNCht:CSLevel` on page 57

MS_TXPWR_MAX_CELL
Sets the protocol information on the maximum transmission power for the mobile station. Allowed are values from 15 dBm to 45 dBm in 5 dB steps.

The MS_TXPWR_MAX_CELL paramer is used for cell selection and reselection, and for power adjustments.

Remote command:
`[:SOURce<hw>]:BB:TETRa:BBNCht:MTMCell` on page 61

Tx_on
Determines the value of the Tx_on parameter, i.e. selects the test mode the MS operates in, "Reception ON" or "Transmission ON".

This parameter is neccessary for the generation of test signal T1 or T4 transmitted by the test system.

"Transmission ON" The mobile station is requested to transmit.

"Reception ON" The mobile station is requested to recept.

Remote command:
[:SOURce<hw>]:BB:TETRa:BBNCht:TXON on page 63

T1_T4_Burst_Type
Sets the value of the special parameter T1_T4_Burst_Type, i.e. determines the logical channel the BS is expecting to receive.

Remote command:
[:SOURce<hw>]:BB:TETRa:BBNCht:TTBType on page 63

Error Correction
Enables/disables error correction.

Remote command:
[:SOURce<hw>]:BB:TETRa:BBNCht:ECORrection on page 58

Late Entry
Sets the value of the late entry supported information element, used to indicate to the MS whether or not late entry can be supported by the cell.

Remote command:
[:SOURce<hw>]:BB:TETRa:BBNCht:LENTry on page 59

ACCESS_PARAMETER
Sets the value of the ACCESS_PARAMETER information field. This parameter is used for subsequent power adjustments for the mobile station.

This protocol information field can takes values from -53 dBm to -23 dBm in 2 dB steps.

Remote command:
[:SOURce<hw>]:BB:TETRa:BBNCht:APARameter on page 56

Tx_burst_type
Sets the parameter Tx_burst_type and determines whether the MS under test transmit either a normal uplink burst or control uplink burst.

"Normal uplink burst" The mobile station should transmit using normal uplink burst.

"Control uplink burst" The mobile station should transmit using control uplink burst.

Remote command:
[:SOURce<hw>]:BB:TETRa:BBNCht:TBTYpe on page 62

Loop Back
Enables/disables loop back for test purposes.

If enabled, the mobile station should set up a loop and return the data when requested by the Tx_burst_type.

Remote command:
[:SOURce<hw>]:BB:TETRa:BBNCht:LBACk on page 59

3.3.3 Scrambling

The "Srcambling" section comprises of the parameters necessary to configure the scrambling sequence.

The scrambling code is a 24-bit field composed of the Mobile Country Code (MCC) and Mobile Network Code (MNC) and is calculated as defined in EN 300 392. The MCC and MNC is a part of the MLE information contained within the SYNC PDU broadcast by the BS on the BSCH. The upper MAC adds to this a 6-bit color code which is contained in the SYNC PDU. The combination of MCC, MNC and color code make up the scrambling code which the upper MAC passes to the lower MAC via the TMV-SAP. This scrambling code corresponds to the extended color code used for scrambling and descrambling in the lower MAC. The scrambling code corresponds to the 30-bit extended color code e(1), e(2),..., e(30).

Table 3-2: Building of scarmbling code

"Mobile Country Code (MCC)"	"Mobile Network Code (MNC)"	"Colour Code"
10 bits	14 bits	6 bits
e(1) - e(10)	e(11) - e(24)	e(25) - e(30)
e(1) = msb[1)] of MCC	e(11) = msb of MNC	e(25) = msb of Colour Code
[1)]Most Significant Bit		

Base Colour Code
Sets the colour code.

The base color code is the number of subscriber group in a network.

See table 3-2 for information on how the scrambling code is calculated.

Remote command:
[:SOURce<hw>]:BB:TETRa:BBNCht:BCCode on page 56

Mobile Network Code
Sets the Mobile Network Code (MNC).

The MNC is the number of the TETRA network operator.

See table 3-2 for information on how the scrambling code is calculated.

Remote command:
[:SOURce<hw>]:BB:TETRa:BBNCht:MNCode on page 60

Mobile Country Code
Sets the Mobile Country Code.

The MCC is the number of the country in which the unit is operated.

See table 3-2 for information on how the scrambling code is calculated.

Remote command:
[:SOURce<hw>]:BB:TETRa:BBNCht:MCCode on page 60

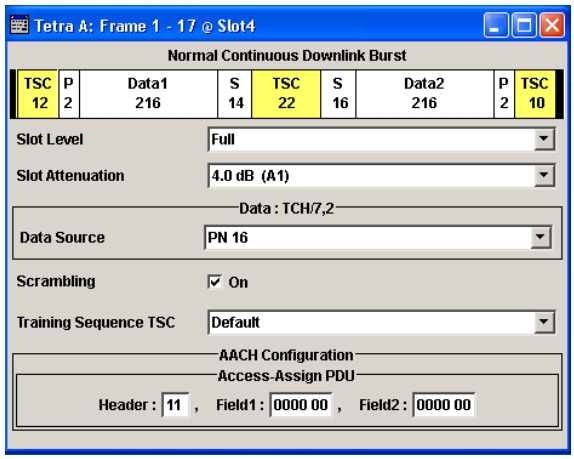
3.4 Burst Editor

► To access the frame editor, select a slot from the graphical display in the TETRA main dialog.

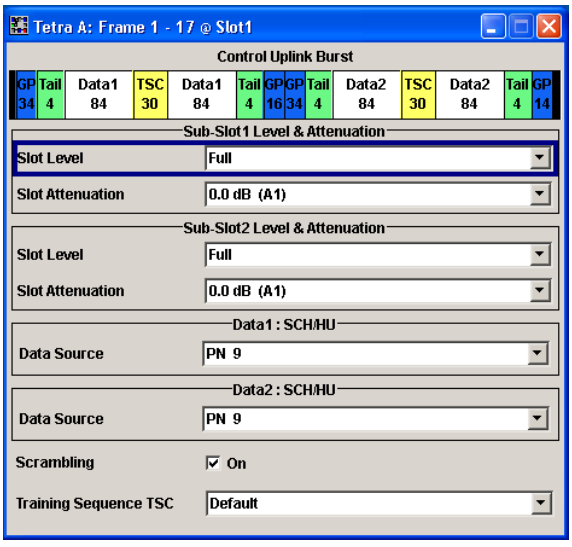
At the top of the dialog the structure of the current burst type for the selected slot is displayed. Individual fields of the frame are color-coded:

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

normal burst:



control burst:



The rest of the dialog displays the data contained in fields predefined by the standard for the current burst type. Data fields with variable content can be edited.

The following sections list all possible settings and displays for the various burst types. If a setting applies only to a particular burst type, this is mentioned for the parameter concerned.

T2 Burst Type
Selects the burst type for "Test Mode T2".

Remote command:
[:SOURce<hw>]:BB:TETRa:SCONfiguration:SLOT<st>:LDIRection<ch>:TBTYpe on page 48

(Sub-)Slot Level
Sets the level for the selected (sub-)slot.

Sub-slots are used by control bursts only.

"Off" Attenuation is maximum. The (sub-)slot is inactive.

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

"Attenuated" Level is reduced by the level attenuation set in "(Sub-)Slot Attenuation".

Remote command:
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SLEVel on page 54 for "Slot Level"
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SSLevel on page 54 for "Sub-Slot Level".

(Sub-)Slot Attenuation
Selects the level attenuation for the "(Sub-)Slot Level" attenuated setting.

Sub-slots are used by control bursts only.

Use the Power Ramp Control dialog to define four different values for level attenuation.

Remote command:
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:BSATtenuation on page 50 for "Slot-Attenuation".
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SSATtenuation on page 50 for "Sub-Slot Attenuation".

Use Coded T1/T4 Data
Enables/disables auto coding of the data.

If enabled, the selection of the data source is disabled.

Remote command:
[:SOURce<hw>]:BB:TETRa:SCONfiguration:SLOT<st>:UBBNch on page 48

Data Source
Selects a data source for the "Data" field.

The data source for both channels can be defined separately, i.e. each (sub-)slot has its own data source.

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 "Main Dialog > Data List Management".

Remote command:
`[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:DATA` on page 50
`[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SDATa` on page 52
`[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:DATA:DSELection` on page 51
`[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SDATa:SDSelection` on page 53
`[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:DATA:DPATtern` on page 51
`[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SDATa:SDPattern` on page 53

Logical Channel Type
Selects the logical channel type.

Tha available channels depend on the selected "Test Mode" and "Link Direction".

Remote command:
`[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:LCTYpe` on page 52

Scrambling
Enables/disables auto scrambling.

Remote command:
`[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SCRambling` on page 52

Training Sequence
Determines whether the default or a user-defined training sequence (TSC) is used.

A user-defined training sequence can be created in the field "TSC User Defined".

Remote command:
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:TSOurce on page 55

TSC User Defined
Enters a user-defined TSC. The length of the training sequences depends on the burst type. The first user bit is equivalent to the first bit of the training sequence. All further will be inserted successively.

Remote command:
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:TPATtern on page 55

AACH-Q Mode
(enabled for Frame 1- 17)

Sets the AACH-Q Mode element that indicates whether the Access-Assign PDU follows in the AACH-Q.

The AACH-Q (Access Assignment Channel, QAM) channel is present on all transmitted downlink slots (except slots containing BLCH-Q) and is used to indicate on each QAM physical channel the assignment of the uplink and downlink slots.

"Access-Assign PDU" The value of the AACH-Q Mode element is set to 0, i.e. contents of Access-Assign PDU are present.
The Access-Assign PDU is used to convey information about the downlink slot in which it appears and also the access rights for the corresponding (same-numbered) uplink slot.
The fields of the "Access-Assign PDU" are defined with the corresponding parameters.

"Reserved Element" The value shall be set to all zeros.

Remote command:
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:AMODe on page 48

Access-Assign PDU
(enabled for Frame 1- 17)

Enables configuration of the Access-Assign PDU content.

"Header" Sets the value for the information element Header.

Remote command:
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:APHeader on page 49

"Field1" Sets the value for the information element Field 1.

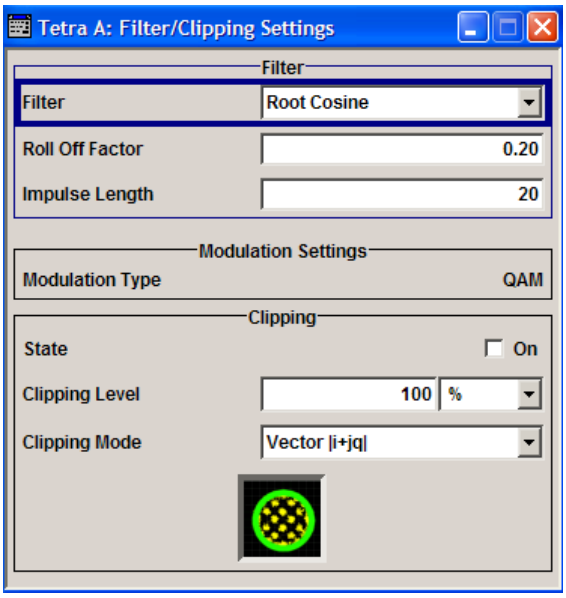
Remote command:
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:APF1 on page 49

"Field2" Sets the value for the information element Fieled 2.

Remote command:
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:APF2 on page 49

3.5 Filter / Clipping Settings

► To access this dialog, select "Main dialog > Filter/Clipping/ARB Settings".



The dialog contains the settings required to configure the baseband filter and to enable clipping.

3.5.1 Filter Settings

Provided are the following settings for configuring the baseband filter:

Filter
Selects the baseband filter.

Remote command:
[:SOURce<hw>]:BB:TETRa:FILTer:TYPE on page 76

Roll Off Factor or BxT
Sets the filter parameter.

The filter parameter offered ("Roll Off Factor" or "BxT") depends on the currently selected filter type. This parameter is preset to the default for each of the predefined filters.

Remote command:
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:COSine on page 75
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:RCOSine on page 75
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:PGAuss on page 75
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:GAUSs on page 75
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:SPHase on page 75
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:APCO25 on page 75

Cut Off Frequency Shift
(available for filter parameter Cosine only)

Sets the value for the cut off frequency shift. The cut off frequency of the cosine filter can be adjusted to reach spectrum mask requirements.

The value range is -1.0 to 1.0.

Remote command:
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:COSine:COFS on page 76

Cut Off Frequency Factor
Sets the value for the cut off frequency factor. The cut off frequency of the filter can be adjusted to reach spectrum mask requirements.

Remote command:
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:LPASs on page 75
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:LPASSEVM on page 75

3.5.2 Modulation Settings

Provided are the following settings:

Modulation Type
Displays the modulation type as selected with the parameter "Modulation Type" in the "Main Menu".

Remote command:
[:SOURce<hw>]:BB:TETRa:MTYPe on page 41

3.5.3 Clipping Settings

Provided are the following settings:

Clipping State
Switches baseband clipping on and off.

Baseband clipping is a very simple and effective way of reducing the crest factor of the signal. Since clipping is done prior to filtering, the procedure does not influence the spectrum. The EVM however increases.

Remote command:
[:SOURce<hw>]:BB:TETRa:CLIPping:STATe on page 74

Clipping Level
Sets the limit for clipping.

This value indicates at what point the signal is clipped. It is specified as a percentage, relative to the highest level. 100% indicates that clipping does not take place.

Remote command:
[:SOURce<hw>]:BB:TETRa:CLIPping:LEVel on page 74

Clipping Mode
Selects the clipping method. A graphic illustration of the way in which these two methods work is given in the dialog.

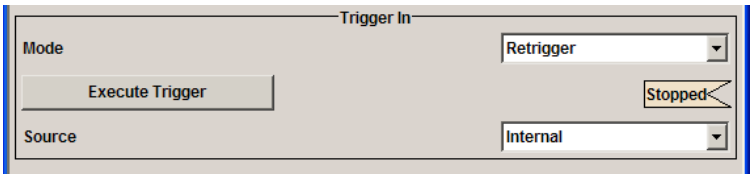
- "Vector | i + jq |"
  The limit is related to the amplitude | i + q |. The I and Q components are mapped together, the angle is retained.
- "Scalar | i | , | q |"
  The limit is related to the absolute maximum of all the I and Q values | i | + | q |. The I and Q components are mapped separately, the angle changes.

Remote command:
[:SOURce<hw>]:BB:TETRa:CLIPping:MODE on page 74

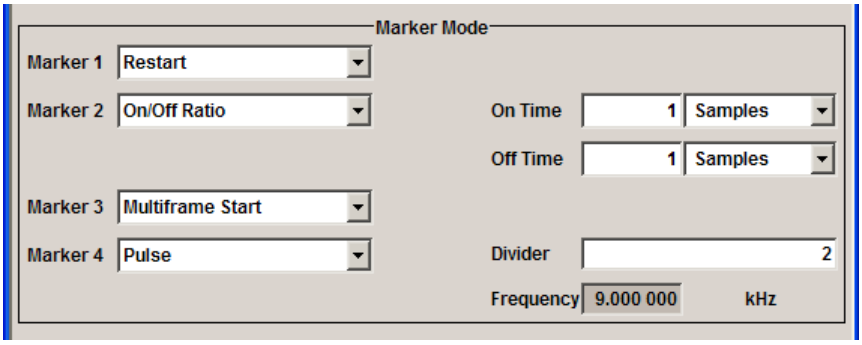
3.6 Trigger/Marker/Clock Settings

To access this dialog, select "Main Menu > Trigger/Marker".

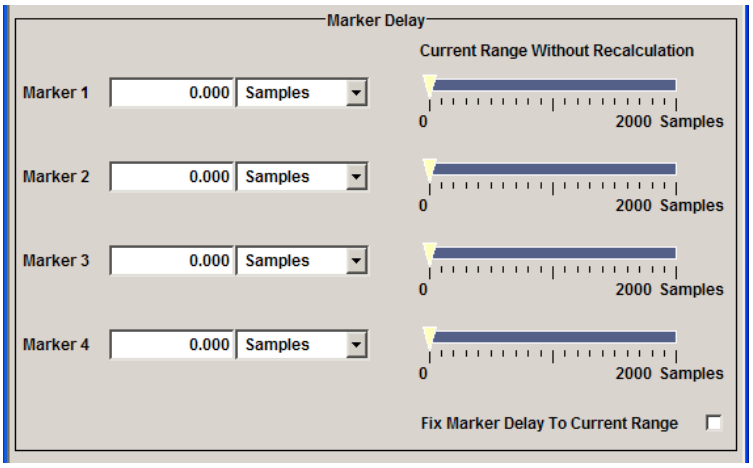
The "Trigger In" section is where the trigger for the signal is set. Various parameters will be provided for the settings, depending on which trigger source - internal or external - is selected. The current status of signal generation ("Running" or "Stopped") is indicated for all trigger modes.



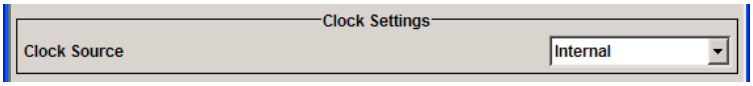
The "Marker Mode" section is where the marker signals at the "Marker" output connectors are configured.



The "Marker Delay" section is where a marker signal delay can be defined, either without restriction or restricted to the dynamic section, i.e., the section in which it is possible to make settings without restarting signal and marker generation.



The "Clock Settings" section is where the clock source is selected and - in the case of an external source - the clock type.



The buttons in the last section lead to submenu for general trigger, clock and mapping settings.

3.6.1 Trigger Settings

The "Trigger In" section is where the trigger for the signal is set. Various parameters will be provided for the settings, depending on which trigger source - internal or external - is selected. The current status of signal generation ("Running" or "Stopped") is indicated for all trigger modes.

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

- "Auto"
  The signal is generated continuously.
- "Retrigger"
  The signal is generated continuously. A trigger event (internal or external) causes a restart.
- "Armed_Auto"
  The signal is generated only when a trigger event occurs. Then the signal is generated continuously.
  An "Arm" stops the signal generation. A subsequent trigger event (internal 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:TETRa:TRIGger:SEQuence` on page 71

Signal Duration Unit
Defines the unit for the entry of the length of the signal sequence to be output in the "Single" trigger mode.

Available units are sequence length (SL) and multiframe.

Remote command:
`[:SOURce<hw>]:BB:TETRa:TRIGger:SLUNit` on page 69

Signal Duration
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:TETRa:TRIGger:SLENgth` on page 69

Running/Stopped
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:TETRa:TRIGger:RMODe on page 69

Arm
For trigger modes "Armed Auto" and "Armed Retrigger", stops the signal generation until subsequent trigger event occurs.

Remote command:
[:SOURce<hw>]:BB:TETRa:TRIGger:ARM:EXECute on page 66

Execute Trigger
for R&S SMx and R&S AMU instruments only

Executes trigger manually. A manual trigger can be executed only when an internal trigger source and a trigger mode other than "Auto" have been selected.

Remote command:
[:SOURce<hw>]:BB:TETRa:TRIGger:EXECute on page 67

Trigger Source
Selects trigger source. This setting is effective when a trigger mode other than "Auto" has been selected.

- "Internal"
  The trigger event is executed by "Execute Trigger".
- "Internal (Baseband A/B)"
  (two-path instruments)
  The trigger event is the trigger signal from the second path
- "External (Trigger 1/2)"
  The trigger event is the active edge of an external trigger signal, supplied at the TRIGGER 1/2 connector.
  Use the "Global Trigger/Clock Settings" dialog to define the polarity, the trigger threshold and the input impedance of the trigger signal.

Remote command:
[:SOURce<hw>]:BB:TETRa:TRIGger:SOURce on page 70

Sync. Output to External Trigger
(enabled for Trigger Source External)

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

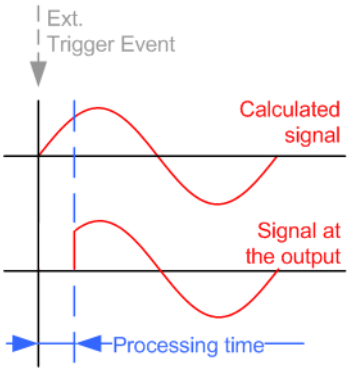
For R&S SMBV instruments:

For or two or more R&S SMBVs configured to work in a master-slave mode for synchronous signal generation, configure this parameter depending on the provided system trigger event and the properties of the output signal. See table 3-3 for an overview of the required settings.

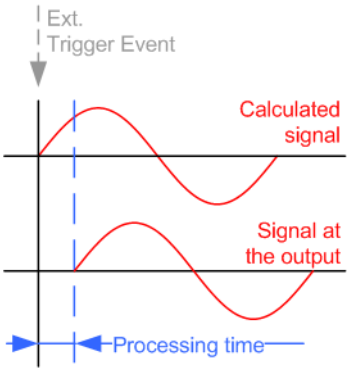
Table 3-3: Typical Applications

System Trigger	Application	"Sync. Output to External Trigger"
Common External Trigger event for the master and the slave instruments	All instruments are synchronous to the external trigger event	ON
	All instruments are synchronous among themselves but starting the signal from first symbol is more important than synchronicity with external trigger event	OFF
Internal trigger signal of the master R&S SMBV for the slave instruments	All instruments are synchronous among themselves	OFF

"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 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.



Remote command:
[:SOURce<hw>]:BB:TETRa:TRIGger[:EXTernal<ch>]:SYNChronize:OUTPut on page 67

Trigger Delay
Delays the trigger event of the signal from:
- the external trigger source
- the other path

Use this setting to:
- synchronize the instrument with the device under test (DUT) or other external devices

Remote command:
[:SOURce<hw>]:BB:TETRa:TRIGger[:EXTernal<ch>]:DELay on page 70
[:SOURce<hw>]:BB:TETRa:TRIGger:OBASeband:DELay on page 67

Trigger Inhibit
Sets the duration for inhibiting a new trigger event subsequent to triggering. The input is to be expressed in samples.

In the "Retrigger" mode, every trigger signal causes signal generation to restart. This restart is inhibited for the specified number of samples.

This parameter is only available on external triggering or on internal triggering via the second path.

For two-path instruments, the trigger inhibit can be set separately for each of the two paths.

Remote command:
[:SOURce<hw>]:BB:TETRa:TRIGger[:EXTernal<ch>]:INHibit on page 70
[:SOURce<hw>]:BB:TETRa:TRIGger:OBASeband:INHibit on page 67

3.6.2 Marker Mode Settings

The marker output signal for synchronizing external instruments is configured in the "Marker Settings" section "Marker Mode".

The R&S SMBV supports only two markers.

Marker Mode
Selects a marker signal for the associated "MARKER" output.

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

"Slot Start " A marker signal is generated at the start of each slot.

"Frame Start" A marker signal is generated at the start of each frame.

"Multiframe Start" A marker signal is generated at the start of each multiframe.

"Hyperframe Start" A marker signal is generated at the start of each hyperframe.

"Pulse" A regular marker signal is generated. 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.

Remote command:
`[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:PULSe:DIVider` on page 73
`[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:PULSe:FREQuency?` on page 73

"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:TETRa:TRIGger:OUTPut<ch>:PATTern` on page 73

"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:TETRa:TRIGger:OUTPut<ch>:ONTime` on page 72
`[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:OFFTime` on page 72

Remote command:
`[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:MODE` on page 71

3.6.3 Marker Delay Settings

The delay of the signals on the MARKER outputs is set in the"Marker Delay" section.

The R&S SMBV supports only two markers.

Marker x Delay
Enters the delay between the marker signal at the marker outputs and the start of the frame or slot.

The input is expressed as a number of symbols. If the setting "Fix marker delay to dynamic range" is enabled, the setting range is restricted to the dynamic range. In this range the delay of the marker signals can be set without restarting the marker and signal.

Remote command:
`[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:DELay` on page 68

Current Range without Recalculation
Displays the dynamic range within which the delay of the marker signals can be set without restarting the marker and signal.

The delay can be defined by moving the setting mark.

Remote command:
`[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:DELay:MINimum?`
on page 68
`[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:DELay:MAXimum?`
on page 68

Fix marker delay to current range
Restricts the marker delay setting range to the dynamic range. In this range the delay can be set without restarting the marker and signal.

Remote command:
`[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut:DELay:FIXed` on page 68

3.6.4 Clock Settings

The Clock Settings are used to set the clock source.

Sync. Mode
(for R&S SMBV only)

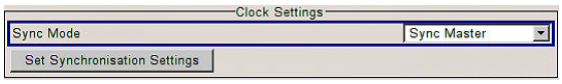
Selects the synchronization mode.

This parameter is used to enable generation of very precise synchronous signal of several connected R&S SMBVs.

Note: If several instruments are connected, the connecting cables from the master instrument to the slave one and between each two consecutive slave instruments must have the same length and type.
Avoid unnecessary cable length and branching points.

"None" The instrument is working in stand-alone mode.

"Sync. Master" The instrument provides all connected instrument with its synchronisation (including the trigger signal) and reference clock signal.



"Sync. Slave" The instrument receives the synchronisation and reference clock signal from another instrument working in a master mode.

Remote command:
[:SOURce<hw>]:BB:TETRa:CLOCk:SYNChronization:MODE on page 65

Set Synchronization Settings
(for R&S SMBV only)

Performs automatically adjustment of the instrument's settings required for the synchronization mode, selected with the parameter "Synchronization Mode".

Remote command:
[:SOURce<hw>]:BB:TETRa:CLOCk:SYNChronization:EXECute on page 65

Clock Source
Selects the clock source.

"Internal" The internal clock reference is used to generate the symbol clock.

"External" The external clock reference is fed in as the symbol clock or multiple thereof via the CLOCK connector.
The symbol rate must be correctly set to an accuracy of +/-2 % (see data sheet).
The polarity of the clock input can be changed with the aid of "Global Trigger/Clock Settings".
In the case of two-path instruments this selection applies to path A.

Remote command:
[:SOURce<hw>]:BB:TETRa:CLOCk:SOURce on page 65

Clock Mode
Enters the type of externally supplied clock.

"Sample" A sample clock is supplied via the CLOCK connector.

"Multiple Sample" A multiple of the sample clock is supplied via the CLOCK connector; the sample clock is derived internally from this.

Remote command:
[:SOURce<hw>]:BB:TETRa:CLOCk:MODE on page 64

Clock Multiplier
Enters the multiplication factor for clock type "Multiple".

Remote command:
[:SOURce<hw>]:BB:TETRa:CLOCk:MULTiplier on page 64

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

Remote command:
`CLOCk:INPut:FREQuency?`

3.7 Global Settings

The buttons in this section lead to dialogs for general trigger, clock and mapping settings.

Global Trigger/Clock Settings
Calls the "Global Trigger/Clock/Input Settings" dialog.

This dialog is used among other things for setting the trigger threshold, the input impedance and the polarity of the clock and trigger inputs.

The parameters in this dialog affect all digital modulations and standards, and are described in chapter "Global Trigger/Clock/Input Settings" in the Operating Manual.

User Marker / AUX I/O Settings
Calls the "User Marker AUX I/O Settings" dialog, used to map the connector on the rear of the instruments.

See also "User Marker / AUX I/O Settings" in the Operating Manual.

4 Remote Control Commands

The following commands are required to perform signal generation with the TETRA options in a remote environment. We assume that the R&S Signal Generator has already been set up for remote operation in a network as described in the R&S Signal Generator 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 Signal Generator operating manual.

Common Suffixes

The following common suffixes are used in remote commands:

Suffix	Value range	Description
SOURce<hw>	[1]|2	available baseband signals
OUTPut<ch>	1 .. 4	available markers R&S SMBV supports two markers
EXTernal<ch>	1|2	external trigger connectors
TMODe<di>	1...4	The numeric suffix to TMODe distinguishes between the test modes: • TMODe1 = Test Mode 1 • TMODe2 = Test Mode 4 • TMODe3 = User Defined • TMODe4 = Test Mode 2
SLOT<st>	1...8	The numeric suffix to SLOT distinguishes between the slot numbers: • SLOT<1..4> = Slots#1 .. Slot#4 in Frame 1..17 • SLOT<5..8> = Slots#1 .. Slot#4 in Frame 18
LDIRection<ch>	1...2	The numeric suffix to LDIRection distinguishes between the link directions: • LDIRection1 = Downlink • LDIRection2 = Uplink

Placeholder <root>

For commands that read out or save files in the default directory, the default directory is set using command MMEM:CDIRectory. The examples in this description use the place holder <root> in the syntax of the command.

- D:\ - for selecting the internal hard disk of a Windows instrument
- E:\ - for selecting the memory stick which is inserted at the USB interface of a Windows instrument
- /var/user/ - for selecting the internal flash card of a Linux instrument

- `/usb/` - for selecting the memory stick which is inserted at the USB interface of a Linux instrument.

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 configuring networks and remote operation
- Using the common status registers

For a description of such tasks, see the R&S Signal Generator operating manual.

The following commands specific to the TETRA are described here:

4.1 Primary Settings

[:SOURce<hw>]:BB:TETRa:CTYPe <CType>

(for "Test Model" set to T1 or T4)

Determines the channel type.

Parameters:

<CType> CH0 | CH1 | CH2 | CH3 | CH4 | CH7 | CH8 | CH9 | CH10 | CH11 | CH21 | CH22 | CH23 | CH24 | CH25 | CH26 | CH27

*RST: CH0

Example: `BB:TETR:CTYP CH2`

Manual operation: See "Channel Type" on page 13

[:SOURce<hw>]:BB:TETRa:DBTYpe <DBType>

(in Downlink "Link Direction" and for "Test Model" set to T2 or User Defined)

Determines whether a discontinuous or continuous downlink burst type is used.

Parameters:

<DBType> CONTinuous | DCONtinuous

*RST: CONTinuous

Example: `BB:TETR:DBTY CONT`

Manual operation: See "Downlink Burst Type" on page 13

[:SOURce<hw>]:BB:TETRa:LDIRection <LDirection>

Selects the transmission direction.

This parameter determines the available "Channel Types".

Parameters:

<LDirection> DOWN | UP

DOWN
The transmission direction selected is from the base station (BS) to the terminal (MS). The signal corresponds to that of a BS.

UP
The transmission direction selected is from MS to the BS. The signal corresponds to that of a terminal.

*RST: DOWN

Example: `BB:TETR:LDIR UP`

Manual operation: See "Link Direction" on page 13

[:SOURce<hw>]:BB:TETRa:MTYPe <MType>

(for "Test Model" set to User Defined)

Determines the modulation type, "Phase" or "QAM."

Parameters:

<MType> PHASe | QAM

PHASe
The T2 test signal is a pi/4-DQPSK modulated continuous radio signal.

QAM
The T2 test signal is 4-QAM, 16-QAM or 64-QAM modulated and spans a bandwidth of 25kHz, 50kHz, 100kHz or 150kHz.

*RST: PHASe

Example: `BB:TETR:MTYP QAM`

Manual operation: See "Modulation Type" on page 13

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

Calls the default settings.

Example: `BB:TETR:PRES`

Usage: Event

Manual operation: See "Set to Default" on page 10

[:SOURce<hw>]:BB:TETRa:SETTing:CATalog?

Reads out the files with TETRA settings in the default directory. The default directory is set using command `MMEM:CDIRectory`. Only files with the file extension `*.tetra` will be listed.

Return values:

<Catalog> string

Example: `MMEM:CDIR '<root>tetra'`
sets the default directory to <root>tetra.
`BB:TETR:SETT:CAT?`
reads out all the files with TETRA settings in the default directory.
`Response: 'tetra_t1_dl'`
the file "`tetra_t1_dl`" is available.

Usage: Query only

Manual operation: See "Save/Recall" on page 10

[:SOURce<hw>]:BB:TETRa:SETTing:DELete <Filename>

This command deletes the selected file with TETRA settings in the specified directory. The file extension may be omitted. Only files with the file extension `*.tetra` will be deleted.

Setting parameters:

<Filename> <file name>

Example: `BB:TETR:SETT:DEL '<root>tetra_t1_dl'`

Usage: Setting only

Manual operation: See "Save/Recall" on page 10

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

Loads the selected file with TETRA settings in the specified directory. The file extension may be omitted. Only files with the file extension `*.tetra` will be loaded.

Setting parameters:

<Filename> <file name>

Example: `MMEM:CDIR '<root>tetra'`
sets the default directory to <root>tetra.
`BB:TETR:SETT:CAT?`
reads out all the files with TETRA settings in the default directory.
`Response: 'tetra_t1_dl'`
the file `tetra_t1_dl` is available.
`BB:TETR:SETT:LOAD '<root>tetra_t1_dl'`

Usage: Setting only

Manual operation: See "Save/Recall" on page 10

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

Stores the current TETRA settings into the selected file in the specified directory. The file extension may be omitted. TETRA settings are stored as files with the specific file extensions `*.tetra`.

Setting parameters:

<Filename> <file name>

Example: `BB:TETR:SETT:STOR '<root>tetra_t1_dl'`
`MMEM:CDIR '<root>tetra'`
sets the default directory to <root>tetra.
`BB:TETR:SETT:CAT?`
reads out all the files with TETRA settings in the default directory.
`Response: 'tetra_t1_dl'`
the file "`tetra_t1_dl`" is available.

Usage: Setting only

Manual operation: See "Save/Recall" on page 10

[:SOURce<hw>]:BB:TETRa:SETTing:STORe:FAST <Fast>

Determines whether the instrument performs an absolute or a differential storing of the settings.

Enable this function to accelerate the saving process by saving only the settings with values different to the default ones.

Note: This function is not affected by the "Preset" function.

Parameters:

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

Manual operation: See "Save/Recall" on page 10

[:SOURce<hw>]:BB:TETRa:SLENgth <SLength>

Selects the sequence length of the arbitrary waveform file in the number of multi-frames. One multiframe is the minimum sequence length for a T1 signal.

Parameters:

<SLength> integer

Range: 1 to depends on carrier bandwidth
*RST: 1

Example: `BB:TETR:SLEN 51500`

Manual operation: See "Sequence Length" on page 13

[:SOURce<hw>]:BB:TETRa:SRATe:VARiation <Variation>

Sets the symbol rate of the signal. A variation of this parameter only affects the ARB clock rate; all other signal parameters remain unchanged.

Parameters:

<Variation> float

Range: 400 to 15E6
Increment: 0.001
*RST: 18000

Example: `BB:TETR:SRAT:VAR?`
queries the symbol rate of the signal.

[:SOURce<hw>]:BB:TETRa: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:TETRa:STATe ON`

Manual operation: See "State" on page 10

[:SOURce<hw>]:BB:TETRa:TMODe <Tmode>

Selects the test mode.

Several settings depends on the selected test mode.

Parameters:

<Tmode> T1 | T4 | USER | T2 | T3

*RST: T1

Example: `BB:TETR:TMOD T3`

Manual operation: See "Test Mode" on page 12

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

Opens the submenu for storing the current TETRA signal as ARB signal in a waveform file. This file can be loaded in the "ARB" dialog and processed as multicarrier or multi-segment signal.

The file name is entered in the submenu. 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: `BB:TETR:WAV:CRE "<root>tetra_waveform"`

Usage: Setting only

Manual operation: See "Generate Waveform File" on page 12

4.2 Power Ramp Settings

[:SOURce<hw>]:BB:TETRa:PRAMping:FOFFset <FOffset>

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

Parameters:

<FOffset> integer

Range: 0 to 4
*RST: 0

Example: `BB:TETR:PRAM:FOFF 10`

Manual operation: See "Fall Offset" on page 16

[:SOURce<hw>]:BB:TETRa:PRAMping:RFUNction <RFunction>

Enters the form of the transmitted power during the switching operation, i.e. the shape of the rising and falling edges of the envelope.

Parameters:

<RFunction> LINear | COSine

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.

*RST: COSine

Example: `BB:TETR:PRAM:RFUN LIN`

Manual operation: See "Ramp Function" on page 15

[:SOURce<hw>]:BB:TETRa:PRAMping:ROFFset <ROffset>

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

Parameters:

<ROffset> integer

Range: -4 to 0
*RST: 0

Example: `BB:TETR:PRAM:ROFF 6`

Manual operation: See "Rise Offset" on page 16

[:SOURce<hw>]:BB:TETRa:PRAMping:RTIMe <Rtime>

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

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

Parameters:

<Rtime> integer

Range: 1 to 13|16, depends on test mode
*RST: 2

Example: `BB:TETR:PRAM:RTIM 25`

Manual operation: See "Ramp Time" on page 15

[:SOURce<hw>]:BB:TETRa:SATTenuation<ch> <Sattenuation>

Enters four different values for level attenuation.

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

The entered value determines the slot output power (slot power = RF power - attenuation). 0 dB attenuation corresponds to "Slot Level" = Full.

This feature is provided to set a sequence of slots to different levels in order to measure transmission stability.

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

Parameters:

<Sattenuation> float

Range: 0 to 50
Increment: 0.1
*RST: 0

Example: `BB:TETR:SATT1 30`

Manual operation: See "Slot Attenuation A1 to A4" on page 16

4.3 Slot Configuration Settings

[:SOURce<hw>]:BB:TETRa:SCONfiguration:SLOT<st>:LDIRection<ch>:TBTYpe <TbType>

Selects the burst type for "Test Mode T2".

Parameters:

<TbType> NCDB | SCDB | NDDB | SDDB | ND4 | ND16 | ND64 | NUB | CUB | NU4 | NU16 | NU64 | CU4 | CU16 | CU64 | RAB

*RST: NCDB

Example:
```
BB:TETR:SCON:SLOT3:LDIR1:TBTY NCDB
```

Manual operation: See "T2 Burst Type" on page 24

[:SOURce<hw>]:BB:TETRa:SCONfiguration:SLOT<st>:UBBNch <Ubbnch>

Enables/disables auto coding of the data.

If enabled, the selection of the data source is disabled.

Parameters:

<Ubbnch> 0 | 1 | OFF | ON

*RST: OFF

Example:
```
SOURce:BB:TETRa:TMODe USER
SOURce:BB:TETRa:LDIRection DOWN
SOURce:BB:TETRa:SCONfiguration:SLOT1:UBBNch ON
```

Manual operation: See "Use Coded T1/T4 Data" on page 24

[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:AMODe <AMode>

(enabled for Frame 1- 17)

Sets the AACH-Q Mode element that indicates whether the Access-Assign PDU follows in the AACH-Q.

The AACH-Q (Access Assignment Channel, QAM) channel is present on all transmitted downlink slots (except slots containing BLCH-Q) and is used to indicate on each QAM physical channel the assignment of the uplink and downlink slots.

Parameters:

<AMode> AAPDu | RELement

AAPDu
The value of the AACH-Q Mode element is set to 0, i.e. contents of Access-Assign PDU are present.
The Access-Assign PDU is used to convey information about the downlink slot in which it appears and also the access rights for the corresponding (same-numbered) uplink slot.
The fields of the "Access-Assign PDU" are defined with the corresponding parameters.

RELement
The value shall be set to all zeros.

*RST: AAPDu

Example: `BB:TETR:SCON:TMOD1:SLOT2:LDIR1:AMOD REL`

Manual operation: See "AACH-Q Mode" on page 26

[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:APF1 <Apf1>

Sets the value for the information element Field 1 of the Access-Assign PDU.

Parameters:

<Apf1> 8 bits

Example: `BB:TETR:SCON:TMOD2:SLOT3:LDIR1:APF1 #B000000,6`

Manual operation: See "Access-Assign PDU" on page 26

[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:APF2 <Apf2>

Sets the value for the information element Field 2 of the Access-Assign PDU.

Parameters:

<Apf2> 8 bits

Example: `BB:TETR:SCON:TMOD2:SLOT3:LDIR1:APF2 #B000000,6`

Manual operation: See "Access-Assign PDU" on page 26

[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:APHeader <ApHeader>

Sets the value for the information element Header 0f the Access-Assign PDU.

Parameters:

<ApHeader> 8 bits

Example: `BB:TETR:SCON:TMOD3:SLOT5:LDIR1:APH #B01,2`

Manual operation: See "Access-Assign PDU" on page 26

[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:BSATtenuation <BsAttenuation>

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

Parameters:

<BsAttenuation> A1 | A2 | A3 | A4

*RST: A1

Example:
```
BB:TETR:SCON:TMOD1:SLOT3:LDIR1:BSAT A1
```

Manual operation: See "(Sub-)Slot Attenuation" on page 24

[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SSATtenuation <SSATtenuation>

Sets the attenuation for the second sub-slot in a control burst.

Parameters:

<SSATtenuation> A1 | A2 | A3 | A4

*RST: A1

Example:
```
BB:TETR:SCON:TMOD1:SLOT3:LDIR2:SSAT A1
```

Example:
```
BB:TETR:LDIR UP
BB:TETR:CTYP CH11
```
Selects a control burst.
```
BB:TETR:SCON:TMOD1:SLOT3:LDIR2:BSAT A1
BB:TETR:SCON:TMOD1:SLOT3:LDIR2:SSAT A1
```
Sets the attenuation of the first and second sub-slot.

Manual operation: See "(Sub-)Slot Attenuation" on page 24

[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:DATA <Data>

Defines the data source for the DATA fields in the burst.

Parameters:

<Data> PATTern | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | DLISt | ALL0 | ALL1 | PN09

ALL0|ALL1|
Internal 0 or 1 data is used.

PATT
Internal data is used. The bit pattern for the data is defined with the aid of command `[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:DATA:DPATtern` on page 51.

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<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:DATA:DSELection` on page 51.

*RST: PN09

Example: `BB:TETR:SCON:TMOD1:SLOT2:LDIR1:DATA PN23`

Manual operation: See "Data List Management" on page 11

[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:DATA:DPATtern <DPattern>

Selects the data pattern with a maximum length of 64 bits for the internal data when PATTern is selected as the data source (`[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:DATA` on page 50).

Parameters:

<DPattern> 64 bits

*RST: #H0,1

Example:
```
BB:TETR:SCON:TMOD1:SLOT2:LDIR1:DATA PATT
BB:TETR:SCON:TMOD1:SLOT2:LDIR1:DATA:DPAT #H3F,8
```

Manual operation: See "Data Source" on page 24

[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:DATA:DSELection <DSelection>

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 `[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:DATA` on page 50.

Parameters:

<DSelection> <data list name>

Example:
```
BB:TETR:SCON:TMOD1:SLOT2:LDIR1:DATA DLIS
BB:TETR:SCON:TMOD1:SLOT2:LDIR1:DATA:DSEL
'dl_tetra_t2_ul'
```

Manual operation: See "Data List Management" on page 11

[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:LCTYpe <LcType>

Selects the logical channel type.

Tha available channels depend on the selected Test Mode and Link Direction.

Parameters:

<LcType> T72 | T48 | T24 | TCHF | TCHH | STCH | SSTCh | SCHF | T108 | SP8F | SSHD | BSHD | SBNCh | BBNCh | S8HD | D4H | D16H | D64H | D64M | D16U | D64U | B4H | B16H | B64H | B64M | B16U | B64U | SSHU | S8HU | S4S8 | S8S4 | U4H | U16H | U64H | U64M | U16U | U64U | H4H | H16H | H64H | H64M | H16U | H64U | SQRA | D4U | U4U

*RST: T72|D4H

Example:
```
BB:TETR:SCON:TMOD2:SLOT3:LDIR1:LCTY T72
```

Manual operation: See "Logical Channel Type" on page 25

[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SCRambling <Scrambling>

Enables/disables auto scrambling.

Parameters:

<Scrambling> 0 | 1 | OFF | ON

*RST: ON

Example:
```
BB:TETR:SCON:TMOD2:SLOT3:LDIR1:SCR ON
```

Manual operation: See "Scrambling" on page 25

[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SDATa <SData>

Defines the data source for the DATA fields in the burst.

Parameters:

<SData> PATTern | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | DLISt | ALL0 | ALL1 | PN09

ALL0|ALL1|
Internal 0 or 1 data is used.

PATT
Internal data is used. The bit pattern for the data is defined with the aid of command `[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SDATa:SDPattern` on page 53.

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<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SDATa:SDSelection` on page 53.

*RST: PN09

Example: `BB:TETR:SCON:TMOD4:SLOT2:LDIR2:SDAT PN23`

Manual operation: See "Data Source" on page 24

[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SDATa:SDPattern <SdPattern>

Selects the data pattern with a maximum length of 64 bits for the internal data when PATTern is selected as the data source (`[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SDATa` on page 52).

Parameters:

<SdPattern> 64 bits

*RST: #H0,1

Example:
```
BB:TETR:SCON:TMOD4:SLOT2:LDIR2:SDAT PATT
BB:TETR:SCON:TMOD4:SLOT2:LDIR2:SDAT:SDP #H3F,8
```

Manual operation: See "Data Source" on page 24

[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SDATa:SDSelection <SdSelection>

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 `[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SDATa` on page 52.

Parameters:

<SdSelection> <data list name>

Example:
```
BB:TETR:SCON:TMOD4:SLOT2:LDIR2:SDAT DLIS
BB:TETR:SCON:TMOD4:SLOT2:LDIR2:SDAT:SDS
'dl_tetra_t4_ul_2'
```

Manual operation: See "Data Source" on page 24

[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SLEVel <SLevel>

Sets the level for the selected slot.

Parameters:

<SLevel> OFF | ATTenuated | FULL

OFF
Attenuation is maximum. The slot is inactive.

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

FULL
The level corresponds to the level indicated in the display.

*RST: FULL

Example:
```
BB:TETR:SCON:TMOD1:SLOT3:LDIR1:SLEV FULL
```

Manual operation: See "(Sub-)Slot Level" on page 24

[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SSLevel <SSLevel>

Sets the level for the second sub-slot.

Parameters:

<SSlevel> OFF | ATTenuated | FULL

OFF
Attenuation is maximum. The slot is inactive.

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

FULL
The level corresponds to the level indicated in the display.

*RST: FULL

Example:
```
BB:TETR:LDIR UP
BB:TETR:CTYP CH11
```
Selects a control burst.
```
BB:TETR:SCON:TMOD1:SLOT3:LDIR2:SLEV FULL
BB:TETR:SCON:TMOD1:SLOT3:LDIR2:SSLevel FULL
```
Sets the level of the first and second sub-slot.

Manual operation: See "(Sub-)Slot Level" on page 24

[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:TPATtern <TPattern>

Enters a user-defined TSC. The length of the training sequences depends on the burst type. The first user bit is equivalent to the first bit of the training sequence. All further will be inserted successively.

Parameters:

<TPattern> 96 bits

*RST: #H000000000000000000000000,96

Example:
```
BB:TETR:SCON:TMOD1:SLOT2:LDIR1:TPAT
```

Manual operation: See "TSC User Defined" on page 26

[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:TSOurce <TSource>

Determines whether the default or a user-defined training sequence (TSC) is used.

A user-defined training sequence can be created in the field "TSC User Defined".

Parameters:

<TSource> DEFault | UDEFined

*RST: DEFault

Example:
```
BB:TETR:SCON:TMOD1:SLOT2:LDIR1:TSO DEF
```

Manual operation: See "Training Sequence" on page 25

4.4 BSCH / BNCH/T Settings

[:SOURce<hw>]:BB:TETRa:BBNCht:APARameter <AParameter>

Sets the value of the ACCESS_PARAMETER information field. This parameter is used for subsequent power adjustments for the mobile station.

This protocol information field can takes values from -53 dBm to -23 dBm in 2 dB steps.

Parameters:

<AParameter> AP53 | AP51 | AP49 | AP47 | AP45 | AP43 | AP41 | AP39 | AP37 | AP35 | AP33 | AP31 | AP29 | AP27 | AP25 | AP23

*RST: AP53

Example: `BB:TETR:BBNC:APAR AP31`

Manual operation: See "ACCESS_PARAMETER" on page 21

[:SOURce<hw>]:BB:TETRa:BBNCht:BCCode <Bccode>

Sets the colour code.

The base color code is the number of subscriber group in a network.

See table 3-2 for information on how the scrambling code is calculated.

Parameters:

<Bccode> integer

Range: 1 to 63
*RST: 1

Example: `BB:TETR:BBNC:BCC 55`

Manual operation: See "Base Colour Code" on page 22

[:SOURce<hw>]:BB:TETRa:BBNCht:CBANdwidth <CBandwidth>

Selects the carrier bandwidth, i.e. determines the carrier spacing.

The default value for all standard test modes is 25kHz; carrier spacing of 50, 100 and 150 kHz is enabled for "Test Mode" set to User Defined or T4.

Parameters:

<CBandwidth> C25 | C50 | C100 | C150

*RST: C25

Example: `BB:TETR:BBNC:CBAN C25`

Manual operation: See "Carrier Bandwidth" on page 17

[:SOURce<hw>]:BB:TETRa:BBNCht:CRFRequency?

Displays the resulting RF frequency, calculated from the previous settings. The frequency is calculated from the "Frequency Band", "Main Carrier Number", "Offset", "Duplex Spacing" and "Reverse Operation" and transmitted in message channel BNCH/T when Downlink MS V+D Testing is selected.

The "Coded RF Frequency" is calculated as described in table 3-1.

Return values:

<CrFrequency> float

Range: 0 to 1000

Example: `BB:TETR:BBNC:CRFR?`

Usage: Query only

Manual operation: See "Coded RF Frequency" on page 18

[:SOURce<hw>]:BB:TETRa:BBNCht:CSLevel <CSLevel>

Sets the cell service level information element, i.e. define the level of service a MS may receive in a cell. It may relate to the traffic loading in a cell.

Parameters:

<CSLevel> CLUNknown | LCLoad | MCLoad | HCLoad

CLUNknown
Cell load unknown

LCLoad
Low cell load

MCLoad
Medium cell load

HCLoad
High cell load

*RST: CLUNknown

Example: `BB:TETR:BBNC:CSL LCL`

Manual operation: See "Cell service level" on page 20

[:SOURce<hw>]:BB:TETRa:BBNCht:DNBBroadcast <DnbBroadcast>

Enables/disables support of the D-NWRK-BROADCAST PDU.

Parameters:
<DnbBroadcast> 0 | 1 | OFF | ON
*RST: OFF

Example: `BB:TETR:BBNC:DNBB ON`

Manual operation: See "D-NWRK-BROADCAST broadcast" on page 20

[:SOURce<hw>]:BB:TETRa:BBNCht:DNBenquiry <DnbEnquiry>

Enables/disables support of the D-NWRK-BROADCAST enquiry.

Parameters:
<DnbEnquiry> 0 | 1 | OFF | ON
*RST: OFF

Example: `BB:TETR:BBNC:DNB ON`

Manual operation: See "D-NWRK-BROADCAST enquiry" on page 20

[:SOURce<hw>]:BB:TETRa:BBNCht:DSPacing <DSpacing>

(for Uplink direction only)

The "Duplex Spacing" and "Reverse Operation" parameters in the BNCH/T indicate the required uplink frequency with respect to the indicated downlink frequency. These parameters are defined in ETSI 300 392-2.

Parameters:
<DSpacing> DS0 | DS1 | DS2 | DS3 | DS4 | DS5 | DS6 | DS7
*RST: DS0

Example: `BB:TETR:BBNC:DSP DS2`

Manual operation: See "Duplex Spacing" on page 18

[:SOURce<hw>]:BB:TETRa:BBNCht:ECORrection <ECorrection>

Enables/disables error correction.

Parameters:
<ECorrection> 0 | 1 | OFF | ON
*RST: ON

Example: `BB:TETR:BBNC:ECOR ON`

Manual operation: See "Error Correction" on page 21

[:SOURce<hw>]:BB:TETRa:BBNCht:FBANd <FBand>

Sets the Frequency Band.

This setting has an effect on the calculation of the transmission frequency. The Frequency Band Information is inserted only in the TETRA BSCH protocol channel.

Parameters:

<FBand> F100 | F200 | F300 | F400 | F500 | F600 | F700 | F800 | F900

*RST: F100

Example: `BB:TETR:BBNC:FBAN F700`

Manual operation: See "Frequency Band" on page 18

[:SOURce<hw>]:BB:TETRa:BBNCht:FEEXtension <FeExtension>

Enables/disables the frame 18 extension element, i.e. indicates whether an MS is allowed to receive downlink information on all slots of the frame 18. If extension is allowed, only MSs which are capable of receiving consecutive slots are able to perform this function.

Parameters:

<FeExtension> 0 | 1 | OFF | ON

*RST: OFF

Example: `BB:TETR:BBNC:FEEX ON`

Manual operation: See "Frame 18 extension" on page 19

[:SOURce<hw>]:BB:TETRa:BBNCht:LBACk <LBack>

Enables/disables loop back for test purposes.

If enabled, the mobile station should set up a loop and return the data when requested by the Tx_burst_type.

Parameters:

<LBack> 0 | 1 | OFF | ON

*RST: OFF

Example: `BB:TETR:BBNC:LBAC ON`

Manual operation: See "Loop Back" on page 21

[:SOURce<hw>]:BB:TETRa:BBNCht:LENTry <LEntry>

Sets the value of the late entry supported information element, used to indicate to the MS whether or not late entry can be supported by the cell.

Parameters:

<LEntry> 0 | 1 | OFF | ON

*RST: OFF

Example: `BB:TETR:BBNC:LENT ON`

Manual operation: See "Late Entry" on page 21

[:SOURce<hw>]:BB:TETRa:BBNCht:MCCode <Mccode>

Sets the Mobile Country Code.

The MCC is the number of the country in which the unit is operated.

See table 3-2 for information on how the scrambling code is calculated.

Parameters:

<Mccode> integer

Range: 0 to 1023
*RST: 262

Example: `BB:TETR:BBNC:MCC 900`

Manual operation: See "Mobile Country Code" on page 22

[:SOURce<hw>]:BB:TETRa:BBNCht:MCNumber <Mcnumber>

The "Main Carrier Number" divides the TETRA band into carriers with a spacing as set with the parameter "Carrier Bandwidth". The range is 0 to 4095 (12 bits).

The Main Carrier Frequency is calculated as follow:

Main Carrier Frequency, kHz = "Main Carrier Number" * "Carrier Bandwidth"

Parameters:

<Mcnumber> integer

Range: 0 to 4095
*RST: 0

Example: `BB:TETR:BBNC:MCN 2300`

Manual operation: See "Main Carrier Number" on page 18

[:SOURce<hw>]:BB:TETRa:BBNCht:MNCode <Mncode>

Sets the Mobile Network Code (MNC).

The MNC is the number of the TETRA network operator.

See table 3-2 for information on how the scrambling code is calculated.

Parameters:

<Mncode> integer

Range: 0 to 16383
*RST: 5519

Example: `BB:TETR:BBNC:MNC 230`

Manual operation: See "Mobile Network Code" on page 22

[:SOURce<hw>]:BB:TETRa:BBNCht:MTMCell <MtmCell>

Sets the protocol information on the maximum transmission power for the mobile station. Allowed are values from 15 dBm to 45 dBm in 5 dB steps.

The MS_TXPWR_MAX_CELL paramer is used for cell selection and reselection, and for power adjustments.

Parameters:

<MtmCell> M15 | M20 | M25 | M30 | M35 | M40 | M45

*RST: M15

Example: `BB:TETR:BBNC:MTMC M25`

Manual operation: See "MS_TXPWR_MAX_CELL" on page 20

[:SOURce<hw>]:BB:TETRa:BBNCht:OFFSet <Offset>

Set the "Offset" to shifft the center frequency in the channel spacing. The allowed offsets are +6.25, 0,–6.25 and +12.50 kHz.

Parameters:

<Offset> ZERO | P625 | M625 | P125

*RST: ZERO

Example: `BB:TETR:BBNC:OFFS P125`

Manual operation: See "Offset" on page 18

[:SOURce<hw>]:BB:TETRa:BBNCht:ROPeration <ROperation>

(for Uplink direction only)

Enables/disables reverse operation.

Reverse operation is used to fix the uplink frequency relative to the downlink frequency. In normal operation, the uplink frequency is lower than the downlink frequency and in reverse operation, the uplink frequency is higher than the downlink frequency.

Parameters:

<ROperation> 0 | 1 | OFF | ON

*RST: OFF

Example: `BB:TETR:BBNC:ROP ON`

Manual operation: See "Reverse Operation" on page 18

[:SOURce<hw>]:BB:TETRa:BBNCht:SCODe <SCode>

Indicate whether the system is a TETRA V+D system or whether this is a Direct Mode transmission.

Parameters:

<SCode> S0 | S1 | S2 | S3 | S4 | S5 | S6 | S7

*RST: S4

Example: `BB:TETR:BBNC:SCOD S3`

Manual operation: See "System Code" on page 19

[:SOURce<hw>]:BB:TETRa:BBNCht:SMODe <SMode>

The sharing mode field indicates whether the BS is using continuous transmission, carrier sharing, MCCH sharing or traffic carrier sharing.

Parameters:

<SMode> CTRansmission | CSHaring | MSHaring | TCSHaring

*RST: CTRansmission

Example: `BB:TETR:BBNC:SMOD CSHaring`

Manual operation: See "Sharing Mode" on page 20

[:SOURce<hw>]:BB:TETRa:BBNCht:TBTYpe <TbType>

Sets the parameter Tx_burst_type and determines whether the MS under test transmit either a normal uplink burst or control uplink burst.

Parameters:

<TbType> NUB | CUB

NUB
The mobile station should transmit using normal uplink burst.

CUB
The mobile station should transmit using control uplink burst.

*RST: NUB

Example: `BB:TETR:BBNC:TBTY NUB`

Manual operation: See "Tx_burst_type" on page 21

[:SOURce<hw>]:BB:TETRa:BBNCht:TRFRames <TrFrames>

Determines the number of frames reserved over two multiframes period.

The way this field is processed, depends on the selected `[:SOURce<hw>]:BB:TETRa:BBNCht:SMODe`. If MCCH sharing is indicated, the TS reserved frames field shall indicate which frames are reserved in this mode of operation. For the other values of sharing mode, the contents of the TS reserved frames field shall be ignored.

Parameters:

<TrFrames> F1 | F2 | F3 | F4 | F6 | F9 | F12 | F18

*RST: F1

Example: `BB:TETR:BBNC:TRFR F2`

Manual operation: See "TS reserved frames" on page 19

[:SOURce<hw>]:BB:TETRa:BBNCht:TTBType <TtbType>

Sets the value of the special parameter T1_T4_Burst_Type, i.e. determines the logical channel the BS is expecting to receive.

Parameters:

<TtbType> T72F | T72S | SFD | BSHD | T24D | RSV1 | RSV2 | T72U | SFU | SSTCh | T24U | SSCH | RSV3 | RSBurst | RSSBurst | TPTD | TPTU | T48D | T48U | TSCD | TSCU | T108 | SPHD | SPHU | SPF | SQHU | SQU | SQD | SQRA

*RST: T72F

Example: `BB:TETR:BBNC:TTBT T48D`

Manual operation: See "T1_T4_Burst_Type" on page 21

[:SOURce<hw>]:BB:TETRa:BBNCht:TXON <TxOn>

Determines the value of the Tx_on parameter, i.e. selects the test mode the MS operates in, "Reception ON" or "Transmission ON".

This parameter is neccessary for the generation of test signal T1 or T4 transmitted by the test system.

Parameters:

<TxOn> RON | TON

RON
The mobile station is requested to recept.

TON
The mobile station is requested to transmit.

*RST: RON

Example: `BB:TETR:BBNC:TXON RON`

Manual operation: See "Tx_on" on page 20

[:SOURce<hw>]:BB:TETRa:BBNCht:UPDTx <UpDtx>

The "U-plane DTX" element indicates whether or not the BS supports discontinuous traffic transmission by the MS.

Parameters:

<UpDtx> 0 | 1 | OFF | ON

*RST: OFF

Example: `BB:TETR:BBNC:UPDT ON`

Manual operation: See "U-plane DTX" on page 20

4.5 Trigger/Marker/Clock Settings

This section lists the relevant remote control commands.

The trigger, clock, and marker delay functions are available for R&S SMx and R&S AMU instruments only.

4.5.1 Clock Settings

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

Sets the type of externally supplied clock.

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:

<Mode> SAMPle | MSAMple

*RST: SAMPle

Example: `SOURce1:BB:TETRa:CLOCk:MODE SAMple`

Manual operation: See "Clock Mode" on page 37

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

Sets the multiplier for clock type Multiplied (`[:SOURce<hw>]:BB:TETRa:CLOCk:MODE` on page 64).

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:

<Multiplier> integer

Range: 1 to 64

*RST: 4

Example: `SOURce1:BB:TETRa:CLOCk:SOURce EXTernal`
selects the external clock source.
`SOURce1:BB:TETRa:CLOCk:MODE MULTiplied`
selects clock type multiplied, i.e. the supplied clock has a rate which is a multiple of the chip rate.
`SOURce1:BB:TETRa:CLOCk:MULTiplier 12`
the multiplier for the external clock rate is 12.

Manual operation: See "Clock Multiplier" on page 37

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

Selects the clock source.

For two-path instruments, selecting `EXTernal` is only possible for path A, since the external clock source is permanently allocated to path A. Selection `AINternal` is only possible for path B.

Parameters:

<Source> INTernal | EXTernal | AINTernal

INTernal
The internal clock reference is used to generate the symbol clock.

EXTernal
The external clock reference is supplied to the CLOCK connector.

AINTernal
The clock source of path A is used for path B.

*RST: INTernal

Example:
```
BB:TETR:CLOC:SOUR INT
```
selects an internal clock reference.

Manual operation: See "Clock Source " on page 37

[:SOURce<hw>]:BB:TETRa:CLOCk:SYNChronization:EXECute

(for R&S SMBV only)

Performs automatically adjustment of the instrument's settings required for the synchronization mode (`[:SOURce<hw>]:BB:TETRa:CLOCk:SYNChronization:MODE` on page 65).

Example:
```
BB:TETR:CLOC:SYNC:MODE SLAV
BB:TETR:CLOC:SYNC:EXEC
```

Usage: Event

Manual operation: See "Set Synchronization Settings " on page 37

[:SOURce<hw>]:BB:TETRa:CLOCk:SYNChronization:MODE <Mode>

(for R&S SMBV only)

Selects the synchronization mode.

This parameter is used to enable generation of very precise synchronous signal of several connected R&S SMBVs.

Note: If several instruments are connected, the connecting cables from the master instrument to the slave one and between each two consecutive slave instruments must have the same length and type. Avoid unnecessary cable length and branching points.

Parameters:

<Mode> NONE | MASTer | SLAVe

NONE
The instrument is working in stand-alone mode.

MASTer
The instrument provides all connected instrument with its synchronisation (including the trigger signal) and reference clock signal.

SLAVe
The instrument receives the synchronisation and reference clock signal from another instrument working in a master mode.

*RST: NONE

Example: `BB:TETR:CLOC:SYNC:MODE MAST`

Manual operation: See "Sync. Mode" on page 36

4.5.2 Trigger Settings

The numeric suffix to `OUTPut` distinguishes between the available markers.

Only two markers are available for the R&S SMBV, i.e. the allowed values for the suffix are 1 or 2.

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

(for Armed_Auto nd Armed_Retrigger trigger modes)

Stops signal generation. Signal generation can be restarted by a new trigger (internally or externally).

Example: `BB:TETR:TRIG:ARM:EXEC`

Usage: Event

Manual operation: See "Arm " on page 32

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

Executes trigger manually. A manual trigger can be executed only when an internal trigger source and a trigger mode other than "Auto" have been selected.

Example: `BB:TETR:TRIG:EXEC`

Usage: Event

Manual operation: See "Execute Trigger" on page 14

[:SOURce<hw>]:BB:TETRa:TRIGger[:EXTernal<ch>]: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

*RST: ON

Example: `BB:TETR:TRIG:SYNC:OUTP ON`

Manual operation: See "Sync. Output to External Trigger" on page 32

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

(two-path instruments only)

Specifies the trigger delay for triggering by the trigger signal from the second path.

Parameters:

<Delay> float

Range: 0 to 65535
Increment: 0.01
*RST: 0

Example: BB:TETR:TRIG:OBAS:DEL 100

Manual operation: See "Trigger Delay" on page 34

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

This command applies only for triggering by the second path.

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

Parameters:

<Inhibit> integer

Range: 0 to 67108863
*RST: 0

Example:
```
BB:TETR:TRIG:SOUR OBAS
BB:TETR:TRIG:OBAS:INH 50
```

Manual operation: See "Trigger Inhibit" on page 34

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

Restricts the marker delay setting range to the dynamic range. In this range the delay can be set without restarting the marker and signal.

Parameters:

<Fixed> 0 | 1 | OFF | ON

*RST: OFF

Example:
```
BB:TETR:TRIG:OUTP:DEL:FIX ON
```

Manual operation: See "Fix marker delay to current range " on page 36

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

Enters the delay between the marker signal at the marker outputs and the start of the frame or slot.

Parameters:

<Delay> float

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

Example:
```
BB:TETR:TRIG:OUTP1:DEL 1600
```

Manual operation: See "Marker x Delay" on page 36

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

Queries the dynamic range within which the delay of the marker signals can be set without restarting the marker and signal.

Return values:

<Maximum> float

Range: 0 to 16777215
Increment: 0.001
*RST: 2000

Example: BB:TETR:TRIG:OUTP:DEL:FIX ON
BB:TETR:TRIG:OUTP:DEL:MAX?
Response: 2000
BB:TETR:TRIG:OUTP:DEL:MIN?

Usage: Query only

Manual operation: See "Current Range without Recalculation" on page 36

[:SOURce<hw>]:BB:TETRa:TRIGger:RMODe <RMode>

Queries the status of signal generation for all trigger modes.

Parameters:
<RMode> STOP | RUN
*RST: STOP

Example: BB:TETR:TRIG:RMOD?

Manual operation: See "Running/Stopped" on page 31

[:SOURce<hw>]:BB:TETRa:TRIGger:SLENgth <Slength>

Defines the length of the signal sequence to be output in the "Single" trigger mode. The unit of the entry is defined with the command [:SOURce<hw>]:BB:TETRa:TRIGger:SLUNit on page 69. It is then possible to output deliberately just part of the signal, an exact sequence of the signal, or a defined number of repetitions of the signal.

Parameters:
<Slength> integer
Range: 1 to 7000
*RST: 1

Example: BB:TETR:TRIG:SLEN 100

Manual operation: See "Signal Duration " on page 31

[:SOURce<hw>]:BB:TETRa:TRIGger:SLUNit <SlUnit>

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

Available units are sequence length (SL) and multiframe.

Parameters:
<SlUnit> SEQuence | MFRame
*RST: SEQuence

Example: BB:TETR:TRIG:SLUN MFRame

Manual operation: See "Signal Duration Unit" on page 31

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

Selects the trigger source.

Parameters:

<Source> INTernal|OBASeband|BEXTernal|EXTernal

INTernal
manual trigger or *TRG.
EXTernal|BEXTernal
trigger signal on the TRIGGER 1/2 connector.
OBASeband
trigger signal from the other path

*RST: INTernal

Example: SOURce1:BB:TETRa:TRIGger:SOURce EXTernal
sets external triggering via the TRIGGER 1 connector.

Manual operation: See "Trigger Source" on page 32

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

Sets the trigger signal delay in samples on external triggering and enables shifting of the complete signal by a time offset equal to the trigger delay.

This enables the instrument to be synchronized with the device under test or other external devices.

Parameters:

<Delay> float

Range: 0.0 to 65535
Increment: 0.01
*RST: 0.0

Example: BB:TETR:TRIG:DEL 100

Manual operation: See "Trigger Delay" on page 34

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

Sets the duration for inhibiting a new trigger event subsequent to triggering.

Parameters:

<Inhibit> integer

Range: 0 to 67108863
*RST: 0

Example: BB:TETR:TRIG:EXT1:INH 50

Manual operation: See "Trigger Inhibit" on page 34

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

Selects trigger mode.

The trigger mode determines the effect of a trigger on the signal generation.

Parameters:

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

AUTO
The signal is generated continuously.

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

AAUTo
The signal is generated only when a trigger event occurs. Then the signal is generated continuously.
Command `[:SOURce<hw>]:BB:TETRa:TRIGger:ARM:EXECute` stops signal generation. A subsequent trigger event (internal or external) causes a restart.

ARETrigger
The signal is generated only when a trigger event occurs. Then the signal is generated continuously. Every subsequent trigger event causes a restart.

ARETrigger
The signal is generated only when a trigger event occurs. Then the signal is generated continuously. Every subsequent trigger event causes a restart.

*RST: AUTO

Example: `BB:TETR:TRIG:SEQ AUTO`

Manual operation: See "Trigger Mode" on page 31

4.5.3 Marker Settings

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

Defines the signal for the selected marker output.

Parameters:

<Mode> RESTart | SSTart | FSTart | MFSTart | HFSTart | PULSe | PATTern | RATio | TRIGger

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

SSTart
A marker signal is generated at the start of each slot.

FSTart
A marker signal is generated at the start of each frame.

MFSTart
A marker signal is generated at the start of each multiframe.

HFSTart
A marker signal is generated at the start of each hyperframe.

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.

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 with the command `[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:PATTern` on page 73.

RATio
A marker signal corresponding to the Time Off / Time On specifications in the commands `[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:ONTime` on page 72 and `[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:OFFTime` on page 72 is generated.

TRIGger
A received internal or external trigger signal is output at the marker connector.

*RST: RESTart

Example: `BB:TETR:TRIG:OUTP2:MODE SST`

Manual operation: See "Marker Mode" on page 35

[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:ONTime <Ontime>
[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:OFFTime <Offtime>

Sets the number of symbols in a period (ON time + OFF time) during which the marker signal On/Off Ratio on the marker outputs is OFF.

Parameters:

<Offtime> integer

Range: 1 to 16777215
*RST: 1

Example:
```
BB:TETR:TRIG:OUTP2:MODE RAT
BB:TETR:TRIG:OUTP2:ONT 20
BB:TETR:TRIG:OUTP2:OFF 20
```

Manual operation: See "Marker Mode" on page 35

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

Defines the bit pattern used to generate the marker signal (`[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:MODE` on page 71). 0 is marker off, 1 is marker on.

Parameters:

<Pattern> 64 bits

*RST: #H2,2

Example:
```
BB:TETR:TRIG:OUTP2:MODE PATT
BB:TETR:TRIG:OUTP2:PATT #H1,4
```

Manual operation: See "Marker Mode" on page 35

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

Sets the divider for the pulsed marker signal (`[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:MODE` on page 71).

Parameters:

<Divider> integer

Range: 2 to 1024
*RST: 2

Example:
```
BB:TETR:TRIG:OUTP2:PULS:DIV 2
```

Manual operation: See "Marker Mode" on page 35

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

Queries the pulse frequency of the pulsed marker signal (`[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:MODE` on page 71).

Return values:

<Frequency> float

Increment: 0.001

Example:
```
BB:TETR:TRIG:OUTP2:MODE PULS
BB:TETR:TRIG:OUTP2:PULS:DIV 4
BB:TETR:TRIG:OUTP2:PULS:FREQ?
```
Response: 600.000 Hz

Usage: Query only

Manual operation: See "Marker Mode" on page 35

4.6 Filter/Clipping Settings

[:SOURce<hw>]:BB:TETRa:CLIPping:LEVel <Level>

Sets the limit for clipping.

Parameters:

<Level> integer

Range: 1 to 100
*RST: 100
Default unit: PCT

Example: `BB:TETR:CLIP:LEV 25`

Manual operation: See "Clipping Level" on page 29

[:SOURce<hw>]:BB:TETRa:CLIPping:MODE <Mode>

Selects the clipping method.

Parameters:

<Mode> VECTor | SCALar

*RST: VECTor

Example: `BB:TETR:CLIP:MODE SCAL`

Manual operation: See "Clipping Mode" on page 29

[:SOURce<hw>]:BB:TETRa:CLIPping:STATe <State>

Switches baseband clipping on and off.

Parameters:

<State> 0 | 1 | OFF | ON

*RST: OFF

Example: `BB:TETR:CLIP:STAT ON`

Manual operation: See "Clipping State" on page 28

[:SOURce<hw>]:BB:TETRa:FILTer:ILENgth <ILength>

Sets the impulse length (number of filter tabs).

Parameters:

<ILength> integer

Range: 2 to 100
*RST: 40

[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:COSine <Cosine>
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:GAUSs <Gauss>
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:LPASs <LPass>
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:LPASSEVM <LPassEvm>
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:PGAuss <PGauss>
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:RCOSine <RCosine>
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:SPHase <SPhase>
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:APCO25 <Apco25>

Sets the filter parameter.

Parameters:

<Apco25> float

Range: 0.05 to 0.99
Increment: 0.01
*RST: 0.2

<Cosine> float

Range: 0.0 to 1.0
Increment: 0.01
*RST: 0.1

<Gauss> float

Range: 0.15 to 2.5
Increment: 0.01
*RST: 0.5

<LPass> float

Range: 0.05 to 2.0
Increment: 0.01
*RST: 0.5

<PGauss> float

Range: 0.15 to 2.5
Increment: 0.01
*RST: 0.5

<RCosine> float

Range: 0 to 1
Increment: 0.01
*RST: 0.35

<SPhase> float

Range: 0.15 to 2.5
Increment: 0.01
*RST: 2

Example:
```
BB:TETR:FILT:TYPE APCO25
BB:TETR:FILT:PAR:APCO25 0.1
```

Manual operation: See "Roll Off Factor or BxT" on page 27

[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:COSine:COFS <Cofs>

Sets the value for the cut off frequency shift. The cut off frequency of the cosine filter can be adjusted to reach spectrum mask requirements.

Parameters:

<Cofs> float

Range: -1 to 1
Increment: 0.01
*RST: -0.1

Example:
```
BB:TETR:FILT:TYPE COS
BB:TETR:FILT:PAR:COS:COFS 0.5
```

Manual operation: See "Cut Off Frequency Shift" on page 28

[:SOURce<hw>]:BB:TETRa:FILTer:TYPE <Type>

Sets the baseband filter.

Parameters:

<Type> RCOSine | COSine | GAUSs | LGAuss | CONE | COF705 | COEQualizer | COFequalizer | C2K3x | APCO25 | SPHase | RECTangle | PGAuss | LPASs | DIRac | ENPShape | EWPShape

*RST: RCOSine

Example:
```
SOURce1:BB:TETRa:FILTer:TYPE GAUS
```

Manual operation: See "Filter" on page 27

List of Commands

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