TETRA Release 2
Digital Standard for R&S®SMW200A
User Manual

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Test & Measurement

User Manual

ROHDE&SCHWARZ

This document describes the following software options:

- R&S®SMW-K68
  1413.4439.02

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The following abbreviations are used throughout this manual: R&S®SMW200A is abbreviated as R&S SMW, R&S®WinIQSIM2 is abbreviated as R&S WinIQSIM2

Contents

1 Preface

1.1 Documentation Overview

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

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

Online Help

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

Getting Started

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

User Manual

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

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

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

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

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

Service Manual

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

Release Notes

The release notes describe the installation of the firmware, new and modified functions, eliminated problems, and last minute changes to the documentation. The corresponding firmware version is indicated on the title page of the release notes. The most recent release notes are available for download from the R&S website, on the R&S SMW product page at http://www.rohde-schwarz.com/product/SMW.html > Downloads > Firmware.

Web Helps

Web helps are provided for the base unit and each additional (software) option. The content of the web helps correspond to the user manuals for the latest product versions.

The web help is an additional file format that offers quick online access. The web helps are not intended for download but rather to access the required information directly form the R&S website.

Web helps are available at the R&S website, on the R&S SMW product page at http://www.rohde-schwarz.com/product/SMW.html > Download > Web Help.

1.2 Conventions Used in the Documentation

1.2.1 Typographical Conventions

The following text markers are used throughout this documentation:

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

Convention	Description
Links	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by quotation marks.

1.2.2 Conventions for Procedure Descriptions

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

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

2 Introduction

The R&S Signal Generator provides you with the ability to generate signals in accordance with the standard Terrestrial Trunked Radio Release 2 (TETRA2) .

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 TETRA2 Configuration and Settings

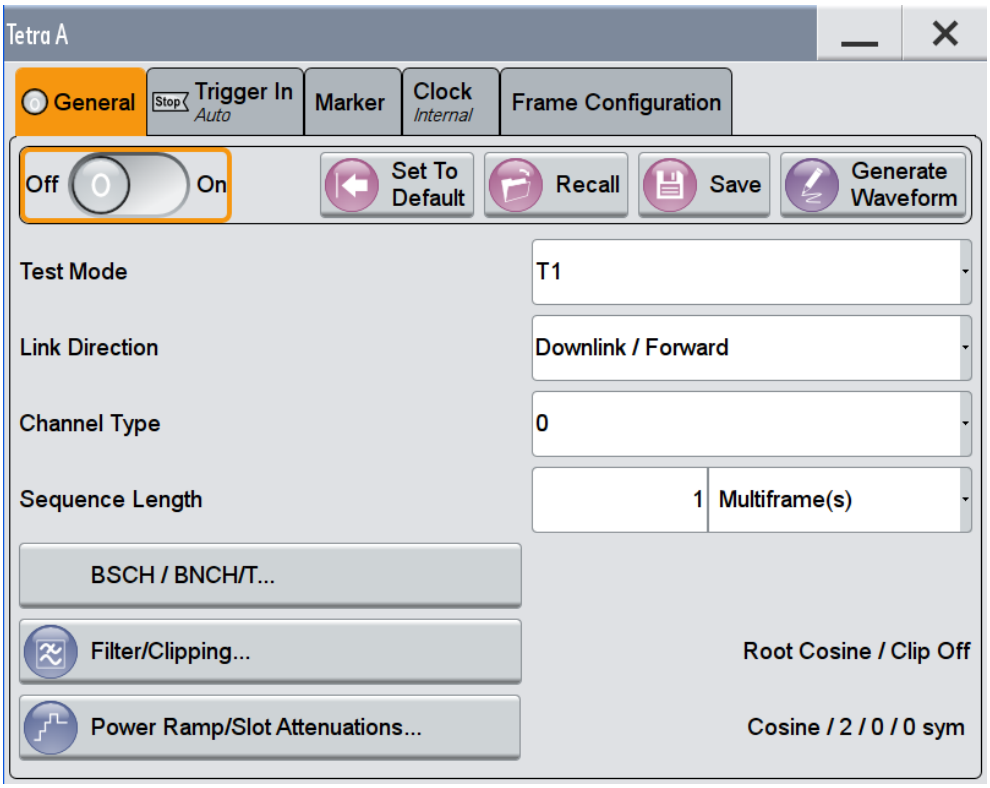
► To access the TETRA2 settings, select "Baseband > TETRA".

The remote commands required to define these settings are described in chapter 4, "Remote Control Commands", on page 39

3.1 General Settings

This dialog provides access to the default, the "Save/Recall" settings and to the settings for selection of a test mode, channel type and link direction.

► To access this dialog select "Baseband > TETRA > General".



This dialog comprises the standard general settings, valid for the signal in both transmission directions.

Provided are the following settings:

State
Enables/disables the TETRA standard.

Enabling this standard disables all the other digital standards and digital modulation modes in the same baseband.

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"	Off
"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 41

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

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

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

Remote command:
[:SOURce<hw>]:BB:TETRa:SETTing:LOAD on page 42
[:SOURce<hw>]:BB:TETRa:SETTing:STORe on page 42
[:SOURce<hw>]:BB:TETRa:SETTing:STORe:FAST on page 43
[:SOURce<hw>]:BB:TETRa:SETTing:CATalog? on page 41
[:SOURce<hw>]:BB:TETRa:SETTing:DELete on page 42

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

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

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

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 40

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 or T2)

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 40

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 43

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 3.10, "Power Ramp Control", on page 36).

The currently selected ramp function and ramp time are displayed.

BSCH / BNCH/T
Accesses the "BSCH / BNCH/T" dialog, 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 3.8, "BSCH / BNCH/T", on page 26.

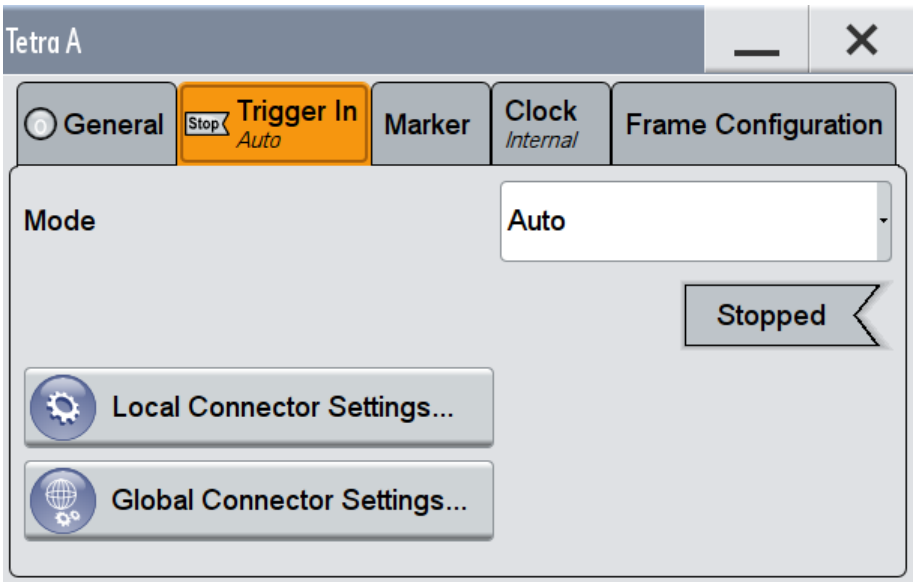
Filter / Clipping
Access to the dialog for setting baseband filtering, clipping and the sequence length of the arbitrary waveform component, see chapter 3.9, "Filter / Clipping Settings", on page 33.

3.2 Trigger Settings

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

This section focuses on the available settings.
For information on how these settings affect the signal, refer to chapter "Basics" in the R&S SMW user manual.

► To access this dialog, select "Baseband > TETRA > Trigger In".



This dialog comprises the settings required for configuring the trigger signal.

Routing and Enabling a Trigger

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

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

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

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

Trigger Mode

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

Note: To enable simultaneous signal generation in all basebands, the trigger settings in the available basebands are coupled in any instrument's configuration involving signal routing with signal addition (e.g. MIMO configuration, routing and summing of basebands and/or streams).

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

- "Auto"
  The signal is generated continuously.
- "Retrigger"
  The signal is generated continuously. A trigger event (internal or external) causes a restart.
- "Armed_Auto"
  The signal is generated only when a trigger event occurs. Then the signal is generated continuously.
  An "Arm" stops the signal generation. A subsequent trigger event (internal with or external) causes a restart.
- "Armed_Retrigger"
  The signal is generated only when a trigger event occurs. Then the signal is generated continuously. Every subsequent trigger event causes a restart.
  An "Arm" stops signal generation. A subsequent trigger event (internal with or external) causes a restart.
- "Single"
  The signal is generated only when a trigger event occurs. Then the signal is generated once to the length specified at "Signal Duration".
  Every subsequent trigger event (internal or external) causes a restart.

Remote command:

`[:SOURce<hw>]:BB:TETRa:TRIGger:SEQuence` on page 69

Signal Duration Unit

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

Remote command:

`[:SOURce<hw>]:BB:TETRa:TRIGger:SLUNit` on page 67

Trigger Signal Duration
Enters the length of the signal sequence to be output in the "Single" trigger mode. The input is expressed in the signal units.

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 67

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 66

Arm
Stops the signal generation until subsequent trigger event occurs.

Remote command:
`[:SOURce<hw>]:BB:TETRa:TRIGger:ARM:EXECute` on page 64

Execute Trigger
For internal trigger source, executes trigger manually.

Remote command:
`[:SOURce<hw>]:BB:TETRa:TRIGger:EXECute` on page 65

Trigger Source
Note: To enable simultaneous signal generation in all basebands, the trigger settings in the available basebands are coupled in any instrument's configuration involving signal routing with signal addition (e.g. MIMO configuration, routing and summing of basebands and/or streams).

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

The following sources of the trigger signal are available:

- "Internal"
  The trigger event is executed manually by the "Execute Trigger".
- "Internal (Baseband A/B)"
  The trigger event is provided by the trigger signal from the other basebands.
- "External Global Trigger 1 / 2"
  The trigger event is the active edge of an external trigger signal provided and configured at the global USER connectors.
- "External Global Clock 1 / 2"
  The trigger event is the active edge of an external global clock signal provided and configured at the global USER connectors.
- "External Local Trigger"

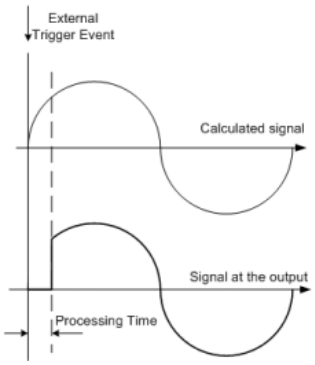
The trigger event is the active edge of an external trigger signal provided and configured at the local T/M/(C) connector.
With coupled trigger settings, the signal has to be provided at the T/M/C 1/2/3 connectors.

- "External Local Clock"
  The trigger event is the active edge of an external local clock signal provided and configured at the local T/M/C connector.
  With coupled trigger settings, the signal has to be provided at the T/M/C 1 connector.

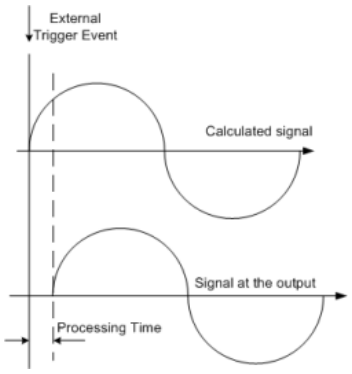
Remote command:
`[:SOURce<hw>]:BB:TETRa:TRIGger:SOURce` on page 67

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

"On" Corresponds to the default state of this parameter.
The signal calculation starts simultaneously with the external trigger event but because of the instrument's processing time the first samples are cut off and no signal is output. After elapsing of the internal processing time, the output signal is synchronous to the trigger event.



"Off" The signal output begins after elapsing of the processing time and starts with sample 0, i.e. the complete signal is output.
This mode is recommended for triggering of short signal sequences with signal duration comparable with the processing time of the instrument.



Remote command:
[:SOURce<hw>]:BB:TETRa:TRIGger[:EXTernal<ch>]:SYNChronize:OUTPut on page 65

External Trigger Delay
For external trigger signal or trigger signal from the other path, sets the trigger signal delay.

One possible application field of this feature is the synchronization of the instrument with the device under test (DUT) or other external devices.

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

Remote command:
[:SOURce<hw>]:BB:TETRa:TRIGger[:EXTernal]:DELay on page 68
[:SOURce<hw>]:BB:TETRa:TRIGger:OBASeband:DELay on page 65

External Trigger Inhibit
For external trigger signal or trigger signal from the other path, sets the duration a new trigger event subsequent to triggering is suppressed. In "Retrigger" mode for example, a new trigger event will not cause a restart of the signal generation until the specified inhibit duration does not expire.

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

Remote command:
[:SOURce<hw>]:BB:TETRa:TRIGger[:EXTernal]:INHibit on page 69
[:SOURce<hw>]:BB:TETRa:TRIGger:OBASeband:INHibit on page 65

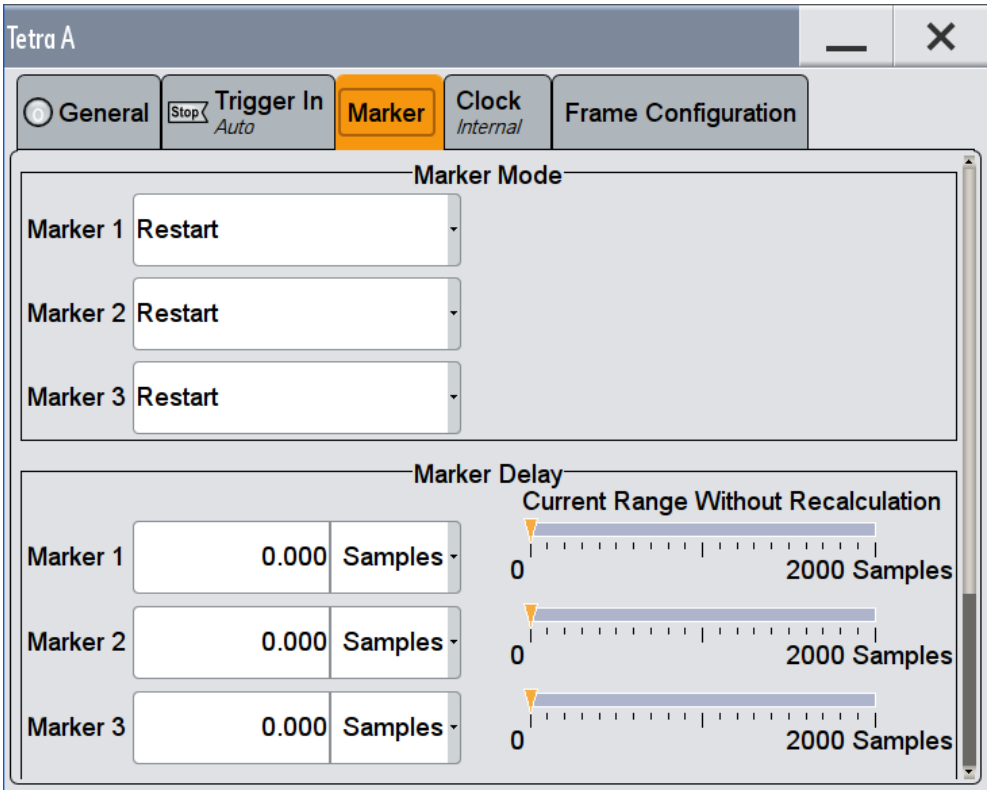
3.3 Marker Settings

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

This section focuses on the available settings.

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

► To access this dialog, select "Baseband > TETRA > Marker".



This dialog comprises the settings required for configuring the marker mode and the marker delay.

Routing and Enabling a Marker

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

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

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

Marker Mode

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

"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 71

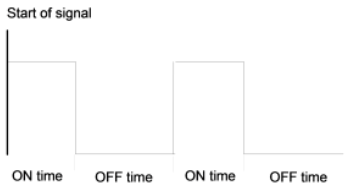
`[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:PULSe:FREQuency?` on page 71

"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 71

"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 71

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

Remote command:

`[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:MODE` on page 70

Marker x Delay

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

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

Remote command:

`[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:DELay` on page 66

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

Remote command:
`[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:DELay:MINimum?`
on page 66
`[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:DELay:MAXimum?`
on page 66

"Fix marker delay to current range"
Restricts the marker delay setting range to the dynamic range.

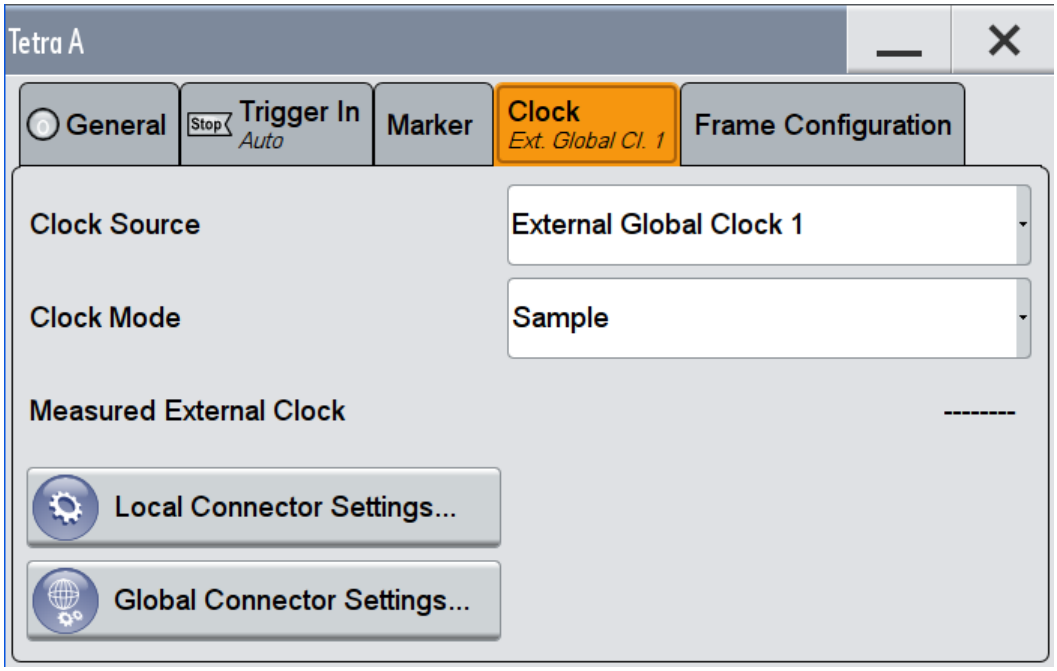
Remote command:
`[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut:DELay:FIXed` on page 66

3.4 Clock Settings

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

This section focuses on the available settings.
For information on how these settings affect the signal, refer to chapter "Basics" in the R&S SMW user manual.

► To access this dialog, select "Baseband >TETRA > Clock".



This dialog comprises the settings required for configuring the clock signal.

Defining the Clock

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

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

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

- Define the signal source, i.e. select the "Clock > Source"
- Define the connector, USER or T/M/C, the selected signal is provided at, i.e. configure the Local and Global Connector Settings.

Clock Source

Selects the clock source.

- "Internal"
  The instrument uses its internal clock reference.
- "External Global Clock 1/2"
  The instrument expects an external clock reference at the global USER connector, as configured in the "Global Connector Settings" dialog.
- "External Local Clock"
  The instrument expects an external clock reference at the local T/M/C connector.

Remote command:

`[:SOURce<hw>]:BB:TETRa:CLOCk:SOURce` on page 64

Clock Mode

Enters the type of externally supplied clock.

Remote command:

`[:SOURce<hw>]:BB:TETRa:CLOCk:MODE` on page 63

Clock Multiplier

Enters the multiplication factor for clock type "Multiple".

Remote command:

`[:SOURce<hw>]:BB:TETRa:CLOCk:MULTiplier` on page 63

Measured External Clock

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

Remote command:

`CLOCk:INPut:FREQuency?`

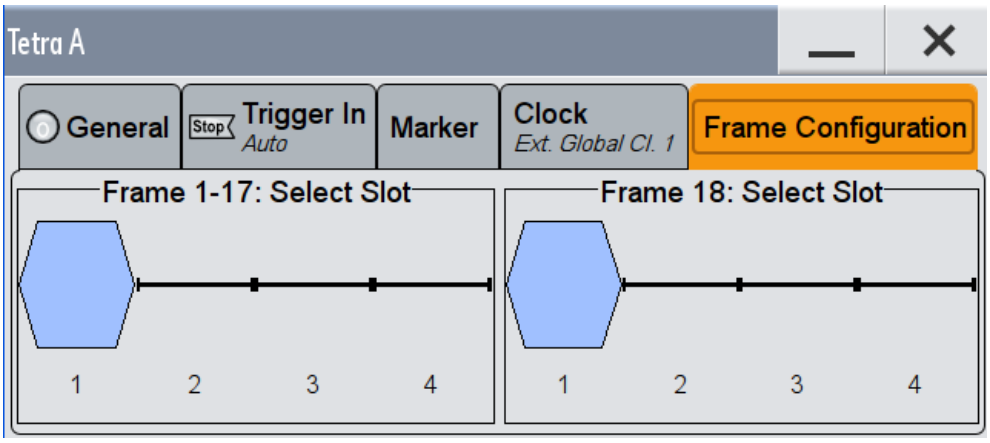
3.5 Local and Global Connector Settings

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

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

3.6 Frame Configuration Settings

1. To access this dialog select "Baseband > TETRA > Frame Configuration".



   In this graphical display you can select the slot that you wish to edit.

2. In the graphical display, select a slot you wish to edit.

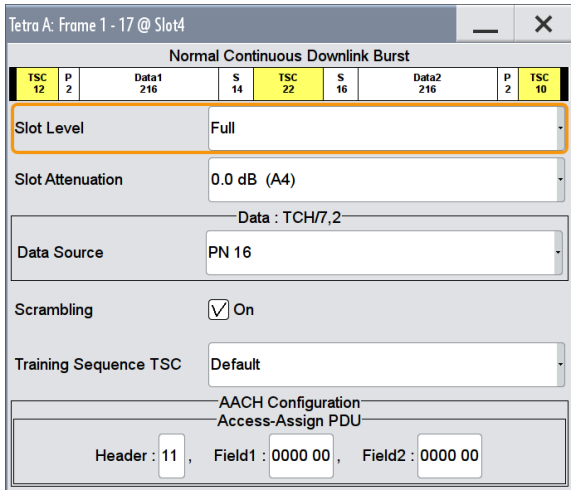
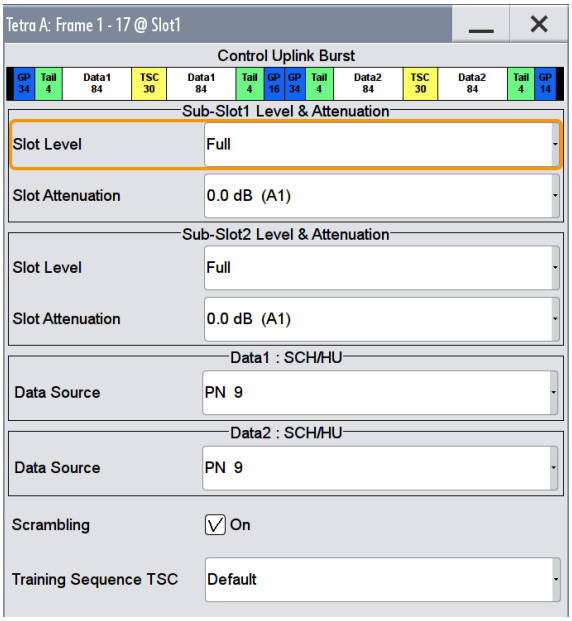
   The corresponding burst editor dialog opens, see chapter 3.7, "Burst Editor", on page 22.

3.7 Burst Editor

► To access this dialog, select "Frame Configuration > Frame: Select Slot > Frame".

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 47

(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 53 for "Slot Level"
`[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SSLevel` on page 53 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 49 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.

You may choose from the following data sources:

"All 0/All 1"	0 data or 1 data is internally generated.
"PRBS"	PRBS data in accordance with the IUT-T with period lengths between 2^9-1 and 2^{23}-1 are internally generated.
"Pattern"	A user-definable bit pattern with a maximum length of 64 bits is internally generated. The bit pattern is defined in the Pattern input box.

Remote command:
`[: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 52

"Data List" Uses data from a programmable data list. The data can be generated internally with the aid of the binary editor in the R&S Signal Generator or externally by the user with the aid of any editor.
Data lists are selected from the "Select List" file dialog.

Remote command:
[: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

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

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 51

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 54

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 54

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

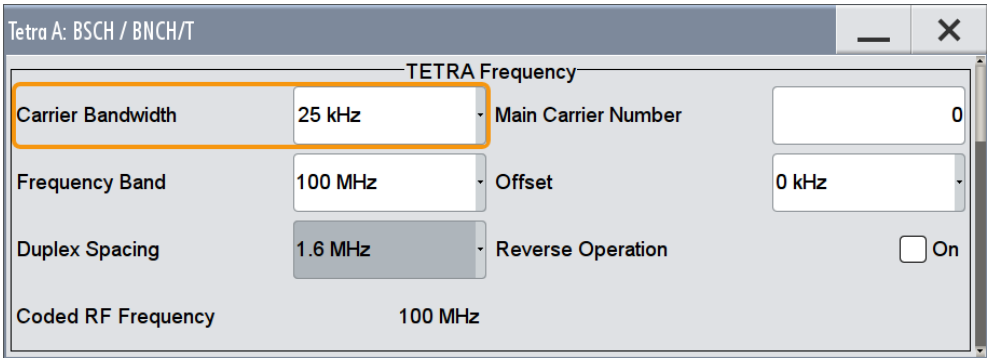
3.8 BSCH / BNCH/T

► To access this dialog select "General > 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.

3.8.1 TETRA Frequency

► To access this dialog select "General > BSCH/BNCH/T > TETRA Frequeuncy"



This section comprises the parameters necessary to set the carrier bandwidth and the frequency band.

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 56

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 59

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 58

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 60

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 57

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 60

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.

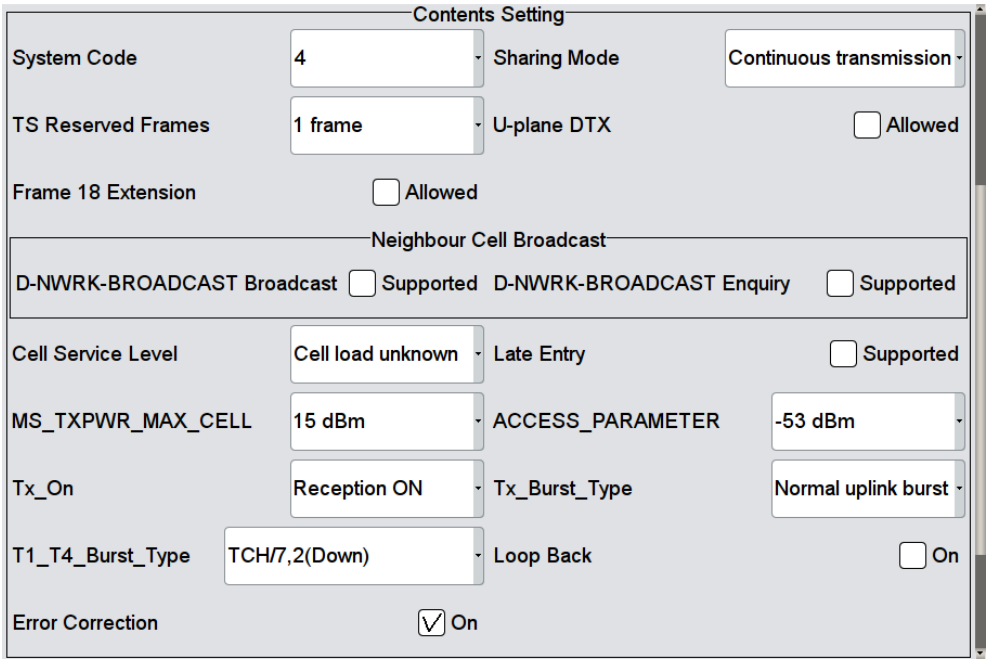
Table 3-1: Calculation of Coded RF Frequency

"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 56

3.8.2 Contents Settings

1. To access this dialog select "General > Link Direction > Downlink/ Forward".
2. Select "BSCH/BNCH/T > Contents Settings".



This dialog is enabled for 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.This section comprises the parameters necessary to set the carrier bandwidth and the frequency band.

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 30. 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 58

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 61

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 57

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

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

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 56

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 60

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 62

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 62

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 55

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 61

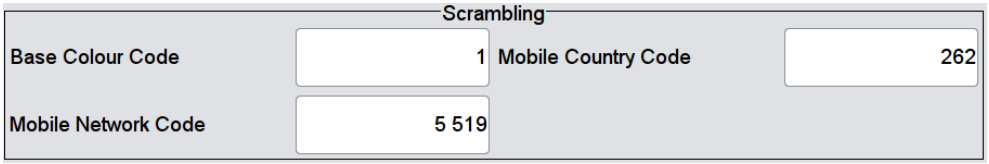
Loop Back
Enables/disables loop back for test purposes.

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 58

3.8.3 Scrambling

► To access this dialog select "General > BSCH/BNCH/T > 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 55

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.

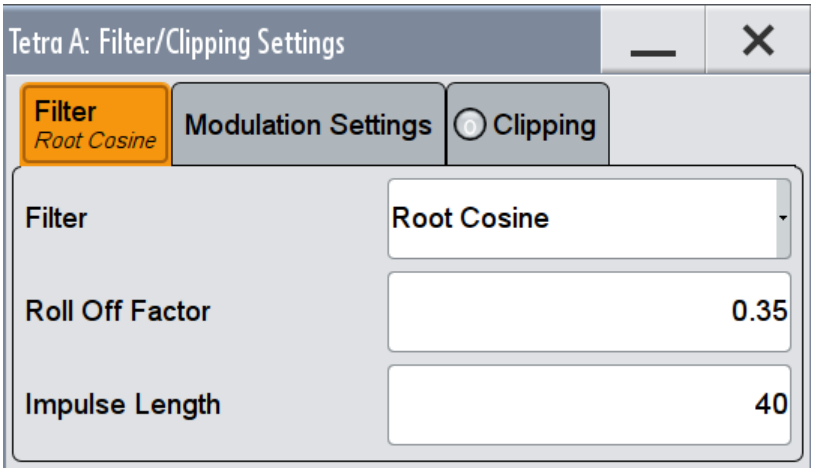
The MCC is the number of the country in which the unit is operated.

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

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

3.9 Filter / Clipping Settings

► To access this dialog select "General >Filter/Clipping".



The dialog comprises the settings, necessary to configure the baseband filter and to enable clipping.

The dialog comprises the settings, necessary to configure the baseband filter and to enable clipping.

3.9.1 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 74

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 73
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:RCOSine on page 73
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:PGAuss on page 73
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:GAUSs on page 73
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:SPHase on page 73
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:APCO25 on page 73

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 74

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.

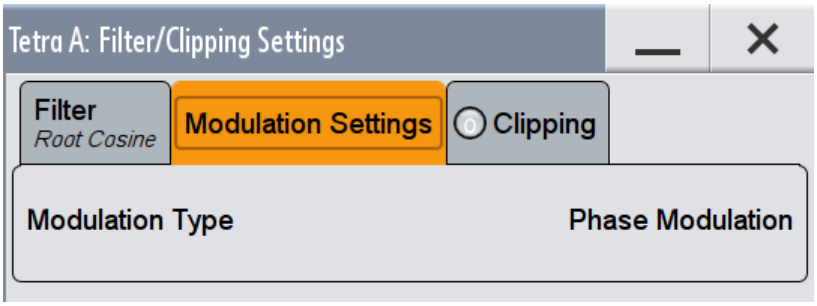
Remote command:
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:LPASs on page 73
[:SOURce<hw>]:BB:TETRa:FILTer:PARameter:LPASSEVM on page 73

Impulse Length
Sets the number of filter tabs.

Remote command:
[:SOURce<hw>]:BB:TETRa:FILTer:ILENgth on page 73

3.9.2 Modulation Settings

► To access this dialog select "General > Filter/Clipping > Modulation".



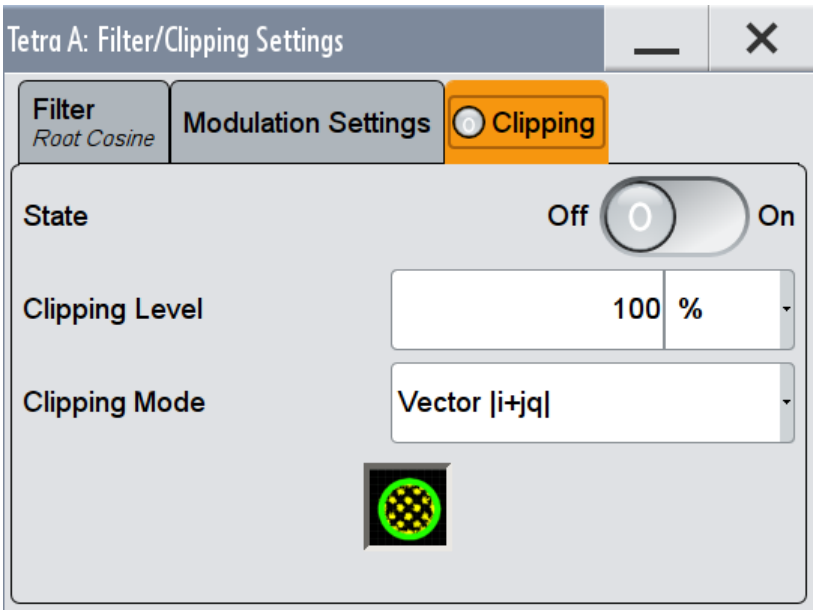
Provided are the following settings:

Modulation Type
Displays the modulation type as selected with the paramteter "Modulation Type" in the "General Settings".

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

3.9.3 Clipping Settings

► To access this dialog select "General > Filter/Clipping > Clipping".



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 73

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 72

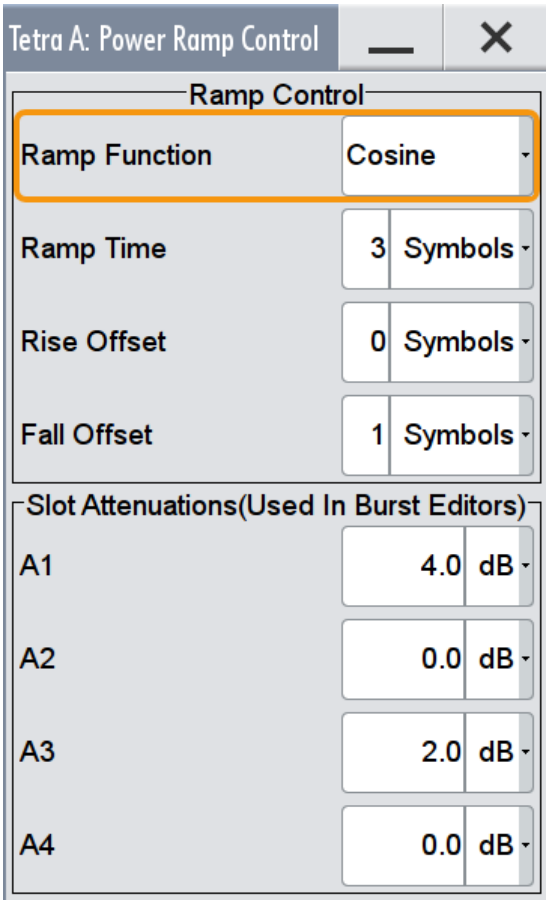
Clipping Mode
Selects the clipping method. A graphic illustration of the way in which these two methods work is given in the dialog.

- "Vector | i + q |"
  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 72

3.10 Power Ramp Control

► To access this dialog select "General >Power Ramp/Slot Attenuations".



This dialog comprises the settings for configuring the power ramping and level attenuation.The "Slot Attenuations" (used in "Frame Editor") section is used to define four possible values 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 45

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

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 SMW has already been set up for remote operation in a network as described in the R&S SMW documentation. A knowledge about the remote control operation and the SCPI command syntax are assumed.

Common Suffixes

The following common suffixes are used in remote commands:

Suffix	Value range	Description
`SOURce<hw>`	[1] .. 4	available baseband signals
`OUTPut<ch>`	[1] .. 3	available markers
`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

Basic tasks that are also performed in the base unit in the same way are not described here.

For a description of such tasks, see the R&S SMW User Manual.

In particular, this includes:

- Managing settings and data lists, i.e. storing and loading settings, creating and accessing data lists, etc.
- Information on regular trigger, marker and clock signals as well as filter settings, if appropriate.
- General instrument configuration, e.g. checking the system configuration, configuring networks and remote operation
- Using the common status registers

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 12

[: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 12

[: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 12

[: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 12

[: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 '/var/user/temp/tetra'`
sets the default directory to /var/user/temp/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 '/var/user/temp/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 '/var/user/temp/tetra'`
sets the default directory to /var/user/temp/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 '/var/user/temp/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 '/var/user/temp/tetra_t1_dl'`
`MMEM:CDIR '/var/user/temp/tetra'`
sets the default directory to /var/user/temp/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 multiframes. One multiframe is the minimum sequence length for a T1 signal.

Parameters:
<SLength> float
Range: 1 to 53687
*RST: 3

Example: `BB:TETR:SLEN 51500`

Manual operation: See "Sequence Length" on page 12

[: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: 400.000 sym/s to 15000000.000 sym/s
*RST: 2.400000 ksym/s
Default unit: sym/s

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

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

Enables/disables the TETRA standard.

Enabling this standard disables all the other digital standards and digital modulation modes.

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

Example: `BB:TETR:STAT ON`

Manual operation: See "State" on page 9

[: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 11

[: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 "/var/user/temp/tetra_waveform"`

Usage: Setting only

Manual operation: See "Generate Waveform File" on page 10

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> float

Range: 0 to 4
*RST: 0

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

Manual operation: See "Fall Offset" on page 38

[: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 37

[: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> float

Range: -4 to 0
*RST: 0

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

Manual operation: See "Rise Offset" on page 38

[: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> float

Range: 1 to 32
*RST: 1

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

Manual operation: See "Ramp Time" on page 37

[: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: 0.0 to 50.0
*RST: 0.0

Example: `BB:TETR:SATT1 30`

Manual operation: See "Slot Attenuation A1 to A4" on page 38

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 23

[: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 25

[: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> 6 bit hex value

Range: #B000000,6 to #B111111,6
*RST: #B000011,6

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> 6 bit hex value

Range: #B000000,6 to #B111111,6
*RST: #B000011,6

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> integer

Range: #B00,2 to #B11,2
*RST: #B00,2

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: PN9

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

Manual operation: See "Data Source" on page 24

[: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> <bit pattern>

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 Source" on page 24

[: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

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 52.

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: PN9

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> <bit pattern>

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 23

[: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 23

[: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> integer

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

Manual operation: See "TSC User Defined" on page 25

[: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 31

[: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> float

Range: 1 to 63
*RST: 1

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

Manual operation: See "Base Colour Code" on page 32

[: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 27

[: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 28

[: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 30

[: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 30

[: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 30

[: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 28

[: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 31

[: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 27

[: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 30

[: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 32

[: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 31

[: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> float

Range: 0 to 1023

*RST: 262

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

Manual operation: See "Mobile Country Code" on page 33

[: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> float

Range: 0 to 4095

*RST: 0

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

Manual operation: See "Main Carrier Number" on page 27

[: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> float

Range: 0 to 16383

*RST: 5519

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

Manual operation: See "Mobile Network Code" on page 33

[: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 30

[: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 28

[: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 28

[: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 29

[: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 30

[: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 31

[: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 29

[: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 31

[: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 31

[: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 30

4.5 Trigger/Marker/Clock Settings

This section lists the relevant remote control commands.

4.5.1 Clock Settings

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

Enters the type of externally supplied clock.

Parameters:

<Mode> SAMPle | MSAMple
*RST: SAMPle

Example: `BB:TETR:CLOC:MODE SAMP`

Manual operation: See "Clock Mode" on page 21

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

Enters the multiplication factor for clock type Multiple (`[:SOURce<hw>]:BB:TETRa:CLOCk:MODE` on page 63).

Parameters:

<Multiplier> float
Range: 1 to 64
*RST: 4

Example:
```
BB:TETR:CLOC:MODE MULT
BB:TETR:CLOC:MULT 12
```

Manual operation: See "Clock Multiplier" on page 21

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

Selects the clock source.

Parameters:

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

INTernal
The instrument uses its internal clock reference

EGC1|EGC2
External global clock

ELCLock
External local clock

*RST: INTernal

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

Manual operation: See "Clock Source" on page 21

4.5.2 Trigger Settings

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

[: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 15

[: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 15

[: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 16

[: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

*RST: 0

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

Manual operation: See "External Trigger Delay" on page 17

[: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> float

Range: 0 to 2^32-1

*RST: 0

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

Manual operation: See "External Trigger Inhibit" on page 17

[: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 "Marker x Delay" on page 19

[: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
*RST: 0

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

Manual operation: See "Marker x Delay" on page 19

[: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

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 "Marker x Delay" on page 19

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

Queries the status of signal generation for all trigger modes.

Parameters:
<RMode> STOP | RUN

Example: BB:TETR:TRIG:RMOD?

Manual operation: See "Running/Stopped" on page 15

[: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 67. 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> float

Range: 1 to 7000
*RST: 1.0

Example: `BB:TETR:TRIG:SLEN 100`

Manual operation: See "Trigger Signal Duration" on page 15

[: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

Example: `BB:TETR:TRIG:SLUN MFRame`

Manual operation: See "Signal Duration Unit" on page 14

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

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

Parameters:

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

INTernal
Internal

INTA | INTB
Internal trigger from the other baseband

EGT1 | EGT2
External global trigger

EGC1 | EGC2
External global clock

ELTRigger
External local trigger

ELCLock
External local clock

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

*RST: INTernal

Example: `BB:TETR:TRIG:SOUR INT`
selects an internal trigger source.

Manual operation: See "Trigger Source" on page 15

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

Specifies the trigger delay (expressed as a number of samples) for external triggering. The value affects all external trigger signals.

Parameters:

<Delay> float

Range: 0.0 to 65535.0
*RST: 0.0

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

Manual operation: See "External Trigger Delay" on page 17

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

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

Parameters:

<Inhibit> float

Range: 0 to 67108863
*RST: 0

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

Manual operation: See "External Trigger Inhibit" on page 17

[: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 14

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

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 71.

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 71 and `[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:OFFTime` on page 71 is generated.

*RST: RESTart

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

Manual operation: See "Marker Mode" on page 18

[: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> float
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 18

[: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 70). 0 is marker off, 1 is marker on.

Parameters:
<Pattern> 64-bit pattern

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

Manual operation: See "Marker Mode" on page 18

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

The command sets the divider for the pulsed marker signal (`[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:MODE` on page 70).

Parameters:
<Divider> float
Range: 2 to 1024
*RST: 2

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

Manual operation: See "Marker Mode" on page 18

[: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 70).

Return values:
<Frequency> float

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 18

4.6 Filter/Clipping Settings

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

Sets the limit for clipping.

Parameters:
<Level> float
Range: 1 to 100
Increment: 1
*RST: 100
Default unit: PCT

Example: BB:TETR:CLIP:LEV 25

Manual operation: See "Clipping Level" on page 36

[: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 36

[: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 35

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

Sets the impulse length (number of filter tabs).

Parameters:

<ILength> float
Range: 2 to 40
*RST: 20

Example: `BB:TETR:FILT:ILEN 20`

Manual operation: See "Impulse Length" on page 34

[: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> Range: 0.05 to 0.99
*RST: 0.2

<Cosine> Range: 0.0 to 1.0

<Gauss> Range: 0.15 to 2.5

<Lpass> Range: 0.05 to 2.0

<LPassEvm> float
Range: 0.05 to 2
Increment: 0.01
*RST: 0.5

<Pgauss> Range: 0.15 to 2.5

<Rcosine> Range: 0.0 to 1.0

<Sphase> Range: 0.15 to 2.5

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

Manual operation: See "Roll Off Factor or BxT" on page 34

[: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
*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 34

[: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: COSine

Example:
```
BB:TETR:FILT:TYPE GAUS
```

Manual operation: See "Filter" on page 34

List of Commands

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