

R&S[®]SMCVB-K162

ATSC 3.0

User Manual



1179098002
Version 05

ROHDE & SCHWARZ
Make ideas real



This document describes the following software options:

- R&S®SMCVB-K162 ATSC 3.0 (1434.3854.xx)

This manual describes firmware version FW 5.20.043.xx and later of the R&S®SMCV100B.

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The following abbreviations are used throughout this manual: R&S®SMCV100B is abbreviated as R&S SMCVB, R&S®WinIQSIM2 is abbreviated as R&S WinIQSIM2

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1 Welcome to the ATSC 3.0 option

The R&S SMCVB-K162 is a firmware application that adds functionality to generate signals in accordance with the [ATSC 3.0](#) digital standard.

The R&S SMCVB-K162 option features:

- ATSC 3.0 signal generation

Installation

You can find detailed installation instructions in the delivery of the option or in the R&S SMCV100B service manual.

1.1 Accessing the ATSC 3.0 dialog

To open the dialog with ATSC 3.0 settings

- ▶ In the block diagram of the R&S SMCV100B, select "Baseband > ATSC 3.0".

A dialog box opens that displays the provided general settings.

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

1.2 What's new

This manual describes firmware version FW 5.20.043.xx and later of the R&S®SMCV100B.

Compared to the previous version, it provides information on how to load and play stream library files. See "[To load and play a stream library file](#)" on page 68.

1.3 Documentation overview

This section provides an overview of the R&S SMCV100B user documentation. Unless specified otherwise, you find the documents at:

www.rohde-schwarz.com/manual/smcv100b

1.3.1 Getting started manual

Introduces the R&S SMCV100B and describes how to set up and start working with the product. Includes basic operations, typical measurement examples, and general information, e.g. safety instructions, etc. A printed version is delivered with the instrument.

1.3.2 User manuals and help

Separate manuals for the base unit and the software options are provided for download:

- **Base unit manual**
Contains the description of all instrument modes and functions. It also provides an introduction to remote control, a complete description of the remote control commands with programming examples, and information on maintenance, instrument interfaces and error messages. Includes the contents of the getting started manual.
- **Software option manual**
Contains the description of the specific functions of an option. Basic information on operating the R&S SMCV100B is not included.

The contents of the user manuals are available as help in the R&S SMCV100B. The help offers quick, context-sensitive access to the complete information for the base unit and the software options.

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

1.3.3 Service manual

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

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

<https://gloris.rohde-schwarz.com>

1.3.4 Instrument security procedures

Deals with security issues when working with the R&S SMCV100B in secure areas. It is available for download on the internet.

1.3.5 Printed safety instructions

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

1.3.6 Data sheets and brochures

The data sheet contains the technical specifications of the R&S SMCV100B. It also lists the options and their order numbers and optional accessories.

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

See www.rohde-schwarz.com/brochure-datasheet/smcv100b

1.3.7 Release notes and open source acknowledgment (OSA)

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

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

See www.rohde-schwarz.com/firmware/smcv100b

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

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

See www.rohde-schwarz.com/application/smcv100b

1.3.9 Videos

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

1.4 Scope



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

In particular, it includes:

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

For a description of such tasks, see the R&S SMCV100B user manual.

1.5 Notes on screenshots

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

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

2 About the ATSC 3.0 option

The transmission standard complies with the [ATSC A/322](#) specification. A subset of all possible parameters found in the specification can be set on the R&S SMCV100B.

2.1 Required options

The equipment layout for generating ATSC 3.0 signals includes:

- Base unit
- Option Enable Broadcast Standards (R&S SMCVB-K519)
- Option ATSC 3.0 (R&S SMCVB-K162)

3 ATSC 3.0 configuration and settings

Access:

- ▶ Select "Baseband > ATSC 3.0".

The remote commands required to define these settings are described in [Chapter 5, "Remote-control commands"](#), on page 69.

Settings:

• General settings	12
• Input signal settings	15
• Encaps settings	23
• BICM settings	25
• OFDM settings	31
• System settings	38
• Frame info	46
• SFN settings	51
• Special settings	55
• Data Generation settings	57
• Global connector settings	58
• TS player	58

3.1 General settings

Access:

- ▶ Select "Baseband > ATSC 3.0".

The screenshot displays the ATSC 3.0 configuration interface. At the top, there are several tabs: "ATSC 3.0" (selected), "Input Signal" (No of PLPs 1), "Encaps", "BICM", "OFDM" (No of Subfr 1), "System", "Frame Info", and "Special Off". Below the tabs, there are three buttons: "Set To Default", "Recall", and "Save". The main area contains several fields and buttons:

- "STL Interface" with a checkbox.
- "Destination IP Address" with the value "239.255.10.10".
- "Destination IP Port" with the value "5 001".
- "Data Generation ..." button.
- "Test Cases ..." button with the value "None".
- "No Error" status message.

The "ATSC 3.0" tab provides functionality for calling default settings, save and recall settings and settings to configure the STL interface and IP settings.

Settings:

State.....	13
Set To Default.....	13
Save/Recall.....	13
STL Interface.....	13
Destination IP Address.....	14
Destination IP Port.....	14
Data Generation.....	14
Test Cases.....	14
└ Filter Test Cases.....	14
Reset Log File.....	14
Status Info.....	15

State

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

Remote command:

[:SOURce<hw>] :BB:A3TSc:STATe on page 70

Set To Default

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

Parameter	Value
State	Not affected by the "Set to Default"

Remote command:

[:SOURce<hw>] :BB:A3TSc:PRESet on page 70

Save/Recall

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

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

See also, chapter "File and Data Management" in the R&S SMCV100B user manual.

Remote command:

[:SOURce<hw>] :BB:A3TSc:SETTing:CATalog on page 71

[:SOURce<hw>] :BB:A3TSc:SETTing:DElete on page 71

[:SOURce<hw>] :BB:A3TSc:SETTing:LOAD on page 71

[:SOURce<hw>] :BB:A3TSc:SETTing:STORe on page 71

STL Interface

Activates the STL interface.

"On" Uses the incoming STL stream to configure the modulator for single or multiple PLP transmissions (single or multiple subframes).

"Off" Uses the incoming MPEG transport stream, ROUTE/DASH or MMT stream directly as payload for single PLP transmission (single sub-frame).

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:INPut:STL:INTerface` on page 75

Destination IP Address

Sets the destination IP address of the IP connection for external or internal IP data.

Only multicast IPv4 streaming is supported. Therefore, the address range is restricted to the IPv4 multicast address range, that is 224.0.0.0 to 239.255.255.255.

Note: You can use only IP addresses that are not occupied by the Linux OS or applications, drivers and services running on the R&S SMCV100B.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:INPut:DESTination:IP:ADDRESS` on page 74

Destination IP Port

Sets the destination IP port of the IP connection for external or internal IP data.

The range is restricted to port numbers 0 to 65535.

Note: You can use only IP ports that are not occupied by the Linux OS or applications, drivers and services running on the R&S SMCV100B.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:INPut:DESTination:IP:PORT` on page 74

Data Generation

Accesses the "3.0 Data Generation" tab.

See [Chapter 3.10, "Data Generation settings"](#), on page 57.

Test Cases

Accesses a standard file-select dialog "ATSC 3.0 Test Cases" to select ATSC 3.0 test cases.

For available test cases, see [Chapter A, "ATSC 3.0 test cases"](#), on page 128.

Filter Test Cases ← Test Cases

Filters the test case selection in the dialog "ATSC 3.0 Test Cases".

Reset Log File

Requires "STL Interface > On".

Resets the log file.

Status information of the ATSC 3.0 coder as displayed in "Status Info" is saved to a log file. The log file `ATSC30_STL_Status_Info_TX.txt` is saved to the directory `var/user/log`.

See also, chapter "File and Data Management" in the R&S SMCV100B user manual.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:INPut:STL:RESetlog` on page 75

Status Info

Displays the ATSC 3.0 coder status by an error message. "No Error" implies correct behavior of the coder.

If an error occurs, the error message of the ATSC 3.0 coder is displayed. For example, "Invalid setup (not ATSC 3.0 compliant)" indicates a behavior, that is non-compliant with the ATSC 3.0 standard.

Status information is also saved to a log file, see "[Reset Log File](#)" on page 14. To ensure correct behavior, fix occurring errors successively.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:INPut:STATus?](#) on page 72

3.2 Input signal settings

Access:

- ▶ Select "Baseband > ATSC 3.0 > Input Signal".

The tab provides settings to configure the input signal.

Input signal tasks

The settings allow you to perform the following tasks:

- Selecting an [MPEG TS](#), [ROUTE/DASH](#), [MMT](#) or [STL](#) source
- Displaying information about the selected stream (e.g. data rate)
- Configuring the internal MPEG TS test packets or internal IP test packets

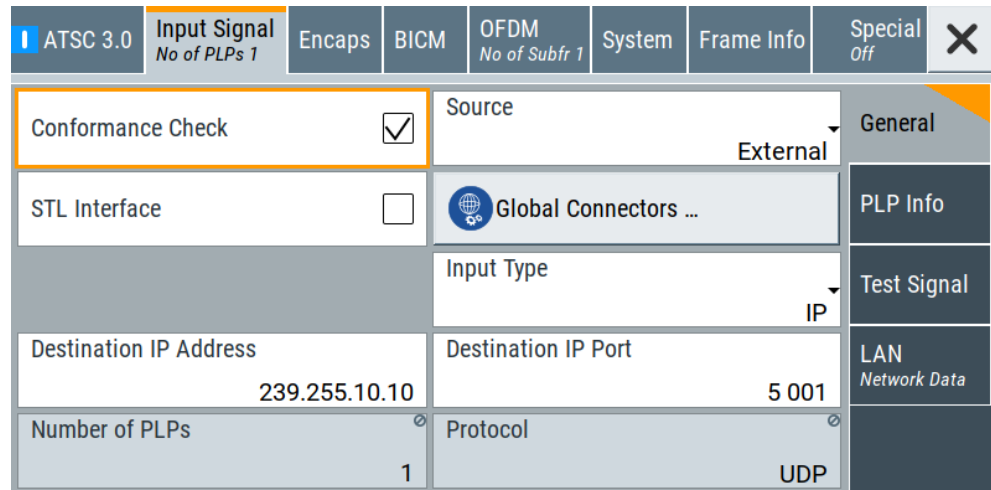
Settings:

- [General settings](#)..... 16
- [PLP info](#)..... 19
- [Test signal settings](#)..... 21
- [LAN network data settings](#)..... 23

3.2.1 General settings

Access:

- ▶ Select "Input Signal > General".



The tab provides general settings to configure the input signal.

Settings:

Conformance Check.....	16
STL Interface.....	16
Reset Log File.....	17
Number of PLPs.....	17
Source.....	17
Test Signal.....	18
Destination IP Address.....	18
Destination IP Port.....	18
Input Type.....	18
Protocol.....	18

Conformance Check

Sets the depth of inspection for the conformance check.

- "On" Additional in-depth checks are done to ensure that the current configuration meets the conformance criteria of the **ATSC A/322** PHY layer specification.
- "Off" Checks are done to ensure that the current configuration meets the basic conformance criteria of the **ATSC A/322** PHY layer specification.

Remote command:

```
[ :SOURce<hw>] :BB:A3TSc:INPut:CCheck on page 73
```

STL Interface

Activates the **STL** interface.

- "On" Uses the incoming STL stream to configure the modulator for single or multiple **PLP** transmissions (single or multiple subframes).
- "Off" Uses the incoming **MPEG** transport stream, **ROUTE/DASH** or **MMT** stream directly as payload for single PLP transmission (single sub-frame).

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:INPut:STL:INTerface` on page 75

Reset Log File

Requires "STL Interface > On".

Resets the log file.

Status information of the ATSC 3.0 coder as displayed in "Status Info" is saved to a log file. The log file `ATSC30_STL_Status_Info_TX.txt` is saved to the directory `var/user/log`.

See also, chapter "File and Data Management" in the R&S SMCV100B user manual.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:INPut:STL:RESetlog` on page 75

Number of PLPs

Displays the number of **PLPs**.

The number resembles the total number of PLPs in the **PHY** layer configuration.

The available number of PLPs depends on the setting of "STL Interface":

- If "STL Interface > Off", the number of PLPs is "1" (single PLP).
- If "STL Interface > On", "1 to 64" PLPs are supported.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:INPut:NPLP?` on page 74

Source

Sets the modulation source for the input signal.

- "External" Uses a transport or IP stream, that is input at the local LAN interface. The "LAN" connector is on the rear panel. See section "Connecting to LAN" and "Connecting the Instrument to the Network (LAN)" in the R&S SMCV100B user manual.
- "TS Player" Uses an internal transport stream or an IP stream with TS/IP packet data played from a file. The player requires no option. Playing encrypted files with extension `_c` requires a stream library option R&S SMCVB-KSx.
- See also:
- [Chapter 3.12, "TS player"](#), on page 58
 - [Supported TS player file types](#)
- "Test Signal" Requires "STL Interface > Off". Uses an internal test signal as specified in [Chapter 3.2.3, "Test signal settings"](#), on page 21.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:SOURce` on page 76

Test Signal

Requires "STL Interface > Off" and "Source > Test Signal".

Defines the test signal data.

"Test TS Packet"

Test signal consists of test TS packets. For configuration, see "[Test TS Packet](#)" on page 21.

"Test IP Packet"

Test signal consists of test IP packets. For configuration, see "[Test IP Packet](#)" on page 21.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:PLP:INPut:TESTsignal` on page 79

Destination IP Address

Sets the destination IP address of the IP connection for external or internal IP data.

Only multicast IPv4 streaming is supported. Therefore, the address range is restricted to the IPv4 multicast address range, that is 224.0.0.0 to 239.255.255.255.

Note: You can use only IP addresses that are not occupied by the Linux OS or applications, drivers and services running on the R&S SMCV100B.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:INPut:DESTination:IP:ADDRESS` on page 74

Destination IP Port

Sets the destination IP port of the IP connection for external or internal IP data.

The range is restricted to port numbers 0 to 65535.

Note: You can use only IP ports that are not occupied by the Linux OS or applications, drivers and services running on the R&S SMCV100B.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:INPut:DESTination:IP:PORT` on page 74

Input Type

Requires "STL Interface > Off" and "Source > External/TS Player".

Specifies the input type.

"TS" Transport stream using TSoverIP

"IP" IP stream with the following content:

- [ROUTE/DASH](#)
- [MMT](#)

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:INPut:TYPE` on page 75

Protocol

Requires one of the following:

- "Source > External"
- "Source > TS Player" and "Input Type > IP"

Displays the used protocol.

"UDP/RTP" Fixed protocol type for "STL Interface > On"

"UDP"	Fixed protocol type for "STL Interface > Off" and "Input Type > IP".
"AUTO"	Fixed protocol type for "Source > External", "STL Interface > Off" and "Input Type > TS". "AUTO" protocol type summarizes "UDP"/"UDP/RTP" support for TSOVERIP.

Remote command:

[:SOURCE<hw>] :BB:A3TSc:INPut:PROToCol? on page 74

3.2.2 PLP info

Access:

- ▶ Select "Input Signal > PLP Info".

	PLP 1
PLP ID	0
Max. Useful Data Rate / Mbit/s	0.000 000
Measured Data Rate / Mbit/s	0.000

The tab displays the "PLP <num>" table, that contains information.

Settings:

PLP <num> table.....	19
L PLP ID.....	19
L Packet Length.....	19
L Max. Useful Data Rate / Mbit/s.....	20
L Measured Data Rate / Mbit/s.....	20
L Useful Data Rate / Mbit/s.....	20

PLP <num> table

Displays individual parameters for each PLP <num>. The table displays information of up to 64 PLPs with <num> ranging from 0 to 63.

PLP ID ← PLP <num> table

Sets the PLP ID. The PLP ID has to be unique.

Editing the parameter requires "STL Interface > Off".

To edit, select "BICM > General > PLP ID".

Remote command:

[:SOURCE<hw>] :BB:A3TSc:PLP<ch>:ID on page 83

Packet Length ← PLP <num> table

Requires "STL Interface > Off", "Source > External" and "Input Type > TS".

Displays the packet length of the external transport stream in bytes.

If the packet length does not match the specified length, the output signal is erroneous. "Packet Length > Invalid" is displayed.

"188" 188 bytes specified packet length.

"Invalid" Packet length does not match the specified length.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:PLP<ch>:PACKetlength?` on page 77

Max. Useful Data Rate / Mbit/s ← PLP <num> table

Requires "STL Interface > Off" and "Source > External/TS Player".

Displays the maximum data rate, that is derived from the current modulation parameter settings.

The value is the optimal value at the TSoverIP or IP input interface, that is necessary for the modulator.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:PLP<ch>:USEFul [:RATE] :MAX?` on page 78

Measured Data Rate / Mbit/s ← PLP <num> table

Requires "STL Interface > Off" and "Source > External".

Displays the measured value of the data rate r_{meas} of one of the following:

- External transport stream including null packets input at "LAN" connector (TSoverIP)
- External IP stream input at "LAN" connector

For TSoverIP input, the value r_{meas} equals the sum of useful data rate r_{useful} and the rate of null packets r_0 :

$$r_{\text{meas}} = r_{\text{useful}} + r_0$$

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:PLP<ch> [:INPut] :DATarate?` on page 77

Useful Data Rate / Mbit/s ← PLP <num> table

Requires "STL Interface > On".

Displays the computed values of the PLP data rate.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:PLP<ch>:USEFul [:RATE] ?` on page 77

3.2.3 Test signal settings

Access:

- ▶ Select "Input Signal > Test Signal".

The tab provides settings to configure the test signal.

Settings:

Test TS Packet.....	21
Test IP Packet.....	21
PID Test Packet.....	22
PID (Hex).....	22
Payload Test/Stuff.....	22
PRBS.....	22

Test TS Packet

Specifies the structure of the test transport stream packet that is fed to the modulator.

"Head/184 Payload"

A sync byte (0x47) followed by three header bytes and 184 payload bytes.

"Sync/187 Payload"

A sync byte (0x47) followed by 187 payload bytes

Remote command:

[:SOURCE<hw>] :BB:A3TSc:TSPacket on page 79

Test IP Packet

Specifies the structure of the test IP packet that is fed to the modulator.

"Head/UDP Payload"

Fixed payload of 1200 bytes.

Remote command:

[:SOURCE<hw>] :BB:A3TSc:IPPacket on page 79

PID Test Packet

If a header is present in the test packet ("Test TS Packet > Head/184 Payload"), you can specify a fixed or variable packet identifier (PID).

"Null" The header of the test transport stream packets has a fixed setting of null packet header 1FFF (hex).

"Variable" Uses the header value defined with "PID (Hex)" on page 22.

Remote command:

[:SOURCE<hw>] :BB:A3TSc:PIDTestpack on page 80

PID (Hex)

Sets the PID.

If "PID Test Packet > Null", "PID (Hex) = 1FFF" is fixed.

If "PID Test Packet > Variable", you can edit the value.

Remote command:

[:SOURCE<hw>] :BB:A3TSc:PID on page 80

Payload Test/Stuff

Defines the payload area content of the TS packet.

The TS packet is a test packet. You can select PRBS or exclusively data in hexadecimal format as payload.

Remote command:

[:SOURCE<hw>] :BB:A3TSc:PAYLoad on page 79

PRBS

Sets the length of the PRBS sequence.

You can select a PRBS 15 or a PRBS 23 sequence as specified by ITU-T O.151.

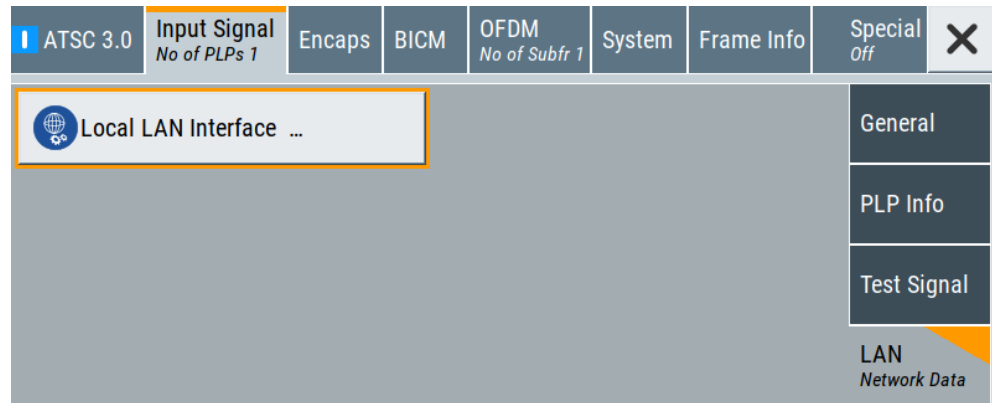
Remote command:

[:SOURCE<hw>] :BB:A3TSc:PRBS [:SEQUENCE] on page 80

3.2.4 LAN network data settings

Access:

- ▶ Select "Input Signal > LAN Network Data > Local LAN Interface".



The tab provides "Local LAN Interface" settings to configure network parameters for IP signals input at the "LAN" connector.

[Local LAN Interface](#).....23

Local LAN Interface

Accesses the network settings tab.

The tab allows you to configure network parameters for IP signal input at the "LAN" connector.

The settings are also relevant for remote access to the R&S SMCV100B. See the chapter "Network Settings" in the R&S SMCV100B user manual.

3.3 Encaps settings

Requires "STL Interface > Off".

Access:

- ▶ Select "Baseband > ATSC 3.0 > Encaps".

ATSC 3.0	Input Signal <i>No of PLPs 1</i>	Encaps	BICM	OFDM <i>No of Subfr 1</i>	System	Frame Info	Special <i>Off</i>	X
PLP ID		0						
ALP Encapsulation Type		IP						
BB Frame Padding		<input checked="" type="checkbox"/>						
BB Frame Counter		<input type="checkbox"/>						

The tab provides settings to configure encapsulation.

Settings:

PLP ID.....	24
ALP Encapsulation Type.....	24
BB Frame Padding.....	24
BB Frame Counter.....	24

PLP ID

Sets the PLP ID. The PLP ID has to be unique.

Editing the parameter requires "STL Interface > Off".

To edit, select "BICM > General > PLP ID".

Remote command:

[:SOURce<hw>] :BB:A3TSc:PLP<ch>:ID on page 83

ALP Encapsulation Type

Displays the input source type of ALP encapsulation.

"IP" Requires "Input Signal > General > Input Type > IP".

"TS" Requires "Input Signal > General > Input Type > TS".

Remote command:

[:SOURce<hw>] :BB:A3TSc:PLP<ch>:ALPType? on page 81

BB Frame Padding

Indicates if baseband frame padding is enabled/disabled for the current PLP.

Remote command:

[:SOURce<hw>] :BB:A3TSc:PLP<ch>:BBFPadding? on page 81

BB Frame Counter

Enables/disables the baseband frame counter.

The counter is initialized to 0 and increments linearly by one for each baseband packet of the current PLP.

Independent counters are used for each PLP. When the counter reaches its maximum value, the next baseband packet counter is reset to zero and the counting process begins again.

Remote command:

[:SOURce<hw>] :BB:A3TSc:PLP<ch>:BBFCOUNTER on page 81

3.4 BICM settings

Access:

- ▶ Select "Baseband > ATSC 3.0 > BICM".

The tab provides settings to configure bit-interleaved coding and modulation (BICM) parameters.

Settings:

- [General settings](#).....25
- [Interleaving settings](#).....28
- [PLP info](#).....31

3.4.1 General settings

Access:

- ▶ Select "BICM > General".

ATSC 3.0 <i>STL Off</i>	Input Signal <i>No of PLPs 1</i>	Encaps	BICM	OFDM <i>No of Subfr 1</i>	System	Frame Info	Special <i>Off</i>	X
PLP ID	0	Low Level Signaling (LLS)		Absent		General PLP 1		
Layer	Core					Interleaving PLP 1		
Size	0	Scrambler Type		0		PLP Info		
FEC Type	BCH+64K	Code Rate		9/15				
Constellation	QPSK							

The tab provides settings to configure the general BICM parameters.

Settings:

PLP ID.....	26
Low Level Signaling (LLS).....	26
Layer.....	26
LDM Injection Level.....	26
Size.....	26
Scrambler Type.....	26
FEC Type.....	27
Code Rate.....	27
Constellation.....	27

PLP ID

Sets the PLP ID. The PLP ID has to be unique.

Editing the parameter requires "STL Interface > Off".

To edit, select "BICM > General > PLP ID".

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:PLP<ch>:ID` on page 83

Low Level Signaling (LLS)

Displays, if low-level signaling is present in the PLP.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:PLP<ch>:LLS?` on page 85

Layer

Displays the layer, that is used in LDM.

"Core" First layer of a 2-layer LDM system. In a non-LDM system, it is the only layer.

"Enhanced" Requires "STL Interface > On".
Second layer of a 2-layer LDM system.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:PLP<ch>:LAYer:LAYer?` on page 84

LDM Injection Level

Requires "Layer > Enhanced".

Displays the enhanced layer injection levels relative to the core PLP in dB.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:PLP<ch>:LAYer:LEVel?` on page 84

Size

Displays the number of data cells allocated to the PLP.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:PLP<ch>:SIZE?` on page 85

Scrambler Type

Displays the scrambler type, that is fixed to "0". The entire baseband packet is scrambled before forward error correction encoding.

Further scrambler types are reserved for future use.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:PLP<ch>:SCRAMbler?](#) on page 85

FEC Type

Editing the parameter requires "STL Interface > Off".

Defines the forward error correction (FEC) used for encoding.

The table below illustrates types and coding.

"FEC Type"	Outer code	Inner code
"BCH+16K"	BCH	16200 bits LDPC
"BCH+64K"	BCH	64800 bits LDPC
"CRC+16K"	CRC	16200 bits LDPC
"CRC+64K"	CRC	64800 bits LDPC
"16K only"	None	16200 bits LDPC
"64K only"	None	64800 bits LDPC

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:PLP<ch>:FECTYPE](#) on page 83

Code Rate

Editing the parameter requires "STL Interface > Off".

Sets the code rate.

You can set code rates "n/15" with n = 2 to 13.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:PLP<ch>:RATE](#) on page 85

Constellation

Editing the parameter requires "STL Interface > Off".

Defines the constellation.

You can set a constellation using QPSK modulation or 16/64/256/1024/4096QAM.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:PLP<ch>:CONSTel](#) on page 83

3.4.2 Interleaving settings

Access:

- ▶ Select "BICM > Interleaving".

ATSC 3.0	Input Signal <i>No of PLPs 1</i>	Encaps	BICM	OFDM <i>No of Subfr 1</i>	System	Frame Info	Special <i>Off</i>	✕
Type							General <i>PLP 1</i>	
Non-Dispersed							Interleaving <i>PLP 1</i>	
Time Interleaver Mode								
CTI								
Extended Interleaving <input type="checkbox"/>								
Depth							PLP Info	
1024								

The tab provides settings to configure interleaving.

Settings:

Type.....	28
Number of Subslices.....	28
Subslice Interval.....	29
Time Interleaver Mode.....	29
Extended Interleaving.....	29
Depth.....	29
Inter Subframe.....	29
Cell Interleaver.....	30
Number of TI Blocks.....	30
Max. Number of FEC Blocks.....	30
Number of FEC Blocks.....	30

Type

Defines the **PLP** type if the PLP is not an **LDM** enhanced layer.

"Non-Dispersed"

All data cells have contiguous logical addresses. Subslicing is not used.

Fixed setting for "STL Interface > Off".

"Dispersed"

Not all data cells have contiguous logical addresses. Subslicing is used.

Remote command:

[:SOURce<hw>] :BB:A3TSc:PLP<ch>:TYPE:TYPE on page 87

Number of Subslices

Requires "Type > Dispersed".

Defines the number of subslices for a dispersed PLP.

Remote command:

[:SOURce<hw>] :BB:A3TSc:PLP<ch>:TYPE:NSUBslices on page 87

Subslice Interval

Requires "Type > Dispersed".

Defines the difference between the lowest data cell index allocated to a subslice and the highest data cell index allocated to the immediately preceding subslice within a dispersed PLP.

Example:

The first data cell of the first subslice has index 100, and the subslice interval is 250. Then the first data cell of the second subslice has index 350 (100 + 250).

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:PLP<ch>:TYPE:SUBSlicE[:INTERval]`
on page 87

Time Interleaver Mode

Editing the parameter requires "STL Interface > Off".

Sets the time interleaver mode.

"Off"	No time interleaving
"CTI"	Convolutional time interleaver
"HTI"	Hybrid time interleaver

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:PLP<ch>:TIL:TIL` on page 88

Extended Interleaving

Requires "Time Interleaver Mode > CTI/HTI" and "General > Constellation > QPSK".

Editing the parameter requires "STL Interface > Off".

If enabled, increases the time interleaving depth.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:PLP<ch>:TIL:EXTended` on page 89

Depth

Requires "Time Interleaver Mode > CTI".

Editing the parameter requires "STL Interface > Off".

Defines the time interleaving depths.

"512/724"	Always selectable.
"887/1024"	Requires "Extended Interleaving > Off".
"1254/1448"	Requires "Extended Interleaving > On".

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:PLP<ch>:TIL:DEPTh` on page 88

Inter Subframe

Requires "Time Interleaver Mode > HTI".

Defines the interleaving frame content and mapping.

- "On" Each interleaving frame contains one time interleaver block and is mapped to multiple subframes.
- "Off" Each interleaving frame is mapped directly to one subframe, and the interleaving frame is composed of one or more time interleaver blocks.
Fixed setting for "STL Interface > Off".

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:PLP<ch>:TIL:INTer?](#) on page 89

Cell Interleaver

Requires "Time Interleaver Mode > HTI".

Editing the parameter requires "STL Interface > Off".

Enables or disables the interleaver operating at the cell level.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:PLP<ch>:TIL:CIL](#) on page 90

Number of TI Blocks

Requires "Time Interleaver Mode > HTI".

Editing the parameter requires "STL Interface > Off".

Defines the number of time interleaver blocks or the number of subframes.

The behavior depends on the setting of "Inter Subframe":

- If "Inter Subframe > On", defines the number of subframes over which cells from one time interleaver (TI) block are carried.
- If "Inter Subframe > Off", defines the number of time interleaver blocks.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:PLP<ch>:TIL:NTIBlocks](#) on page 88

Max. Number of FEC Blocks

Requires "Time Interleaver Mode > HTI".

Displays the maximum number of forward error correction (FEC) blocks per interleaving frame.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:PLP<ch>:TIL:MAXBlocks?](#) on page 89

Number of FEC Blocks

Requires "Time Interleaver Mode > HTI".

Displays the number of forward error correction (FEC) blocks contained in the current interleaving frame.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:PLP<ch>:TIL:BLOCKs?](#) on page 89

3.4.3 PLP info

Access:

- ▶ Select "BICM > PLP Info".

	PLP 1	PLP 2	PLP 3	PLP 4
PLP ID	0	1	2	3
LLS	Absent	Absent	Absent	Absent
Layer	Core	Core	Core	Core
Size	64 800	64 800	86 400	81 000
Scrambler Type	0	0	0	0
FEC Type	BCH+64K	BCH+64K	BCH+64K	BCH+64K
Code Rate	9/15	9/15	9/15	9/15
Constellation	QPSK	16QAM	64QAM	256QAM
Type	Non-Dispersed	Non-Dispersed	Non-Dispersed	Non-Dispersed
TI Mode	HTI	HTI	HTI	HTI
Ext. Interleaving	Off	Off	Off	Off
Inter Subframe	On	On	On	On

The tab displays the "PLP <num>" table, that contains individual **PLP** information of up to 64 PLPs.

To configure BICM parameters for "PLP 1"

You can configure BICM parameters of "PLP 1" for single-PLP transmission:

1. Select "ATSC 3.0 > STL Interface > Off".
2. Select "BICM > General/Interleaving".

Settings:

[PLP <num> table](#)..... 31

PLP <num> table

Displays individual parameters for each PLP <num>. The table displays information of up to 64 PLPs with <num> ranging from 0 to 63.

See "[To configure BICM parameters for "PLP 1"](#)" on page 31.

3.5 OFDM settings

Access:

- ▶ Select "Baseband > ATSC 3.0 > OFDM".

The tab provides settings to configure **OFDM** settings of ATSC 3.0 subframes.

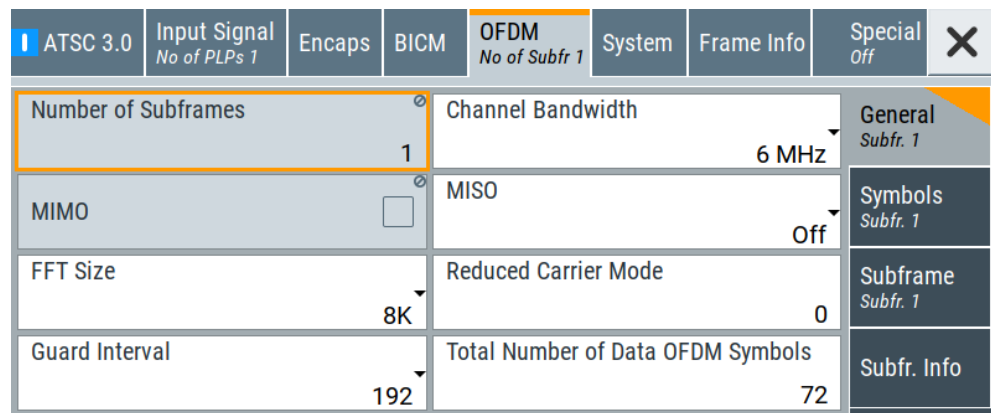
Settings:

- [General settings](#)..... 32
- [Symbols settings](#)..... 35
- [Subframe](#)..... 36
- [Subframe info](#)..... 38

3.5.1 General settings

Access:

- ▶ Select "OFDM > General".



The tab provides to settings to configure the general OFDM settings.

Settings:

- [Number of Subframes](#)..... 32
- [Channel Bandwidth](#)..... 32
- [MIMO](#)..... 33
- [MISO](#)..... 33
- [FFT Size](#)..... 33
- [Reduced Carrier Mode](#)..... 34
- [Guard Interval](#)..... 34
- [Total Number of Data OFDM Symbols](#)..... 34

Number of Subframes

Displays the number of subframes within the current frame.

Remote command:

[:SOURce<hw>] :BB:A3TSc:FRAMe:NSUBframes? on page 101

Channel Bandwidth

Selects the channel bandwidth.

The channel bandwidth correlates with the used bandwidth, that is smaller. See "[Used Bandwidth](#)" on page 37.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:CHANnel\[:BANDwidth\]](#) on page 91

MIMO

Displays whether multiple inputs and multiple outputs (MIMO) are used.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:SUBFrame<ch>:MIMO?](#) on page 92

MISO

Editing the parameter requires "STL Interface > Off".

Defines the multiple inputs and single output (MISO) option.

"Off"	No MISO
"64"	MISO with 64 coefficients
"256"	MISO with 256 coefficients

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:SUBFrame<ch>:MISO](#) on page 92

FFT Size

Editing the parameter requires "STL Interface > Off".

Defines the FFT size.

Note:

Not all possible combinations of the FFT size with the following parameters are allowed:

- ["Guard Interval"](#) on page 34
- ["SISO Pilot Pattern"](#) on page 35

GI pattern	"Guard Interval"	"FFT Size"
GI1_192	"192"	"8K", "16K", "32K"
GI2_384	"384"	"8K", "16K", "32K"
GI3_512	"512"	"8K", "16K", "32K"
GI4_768	"768"	"8K", "16K", "32K"
GI5_1024	"1024"	"8K", "16K", "32K"
GI6_1536	"1536"	"8K", "16K", "32K"
GI7_2048	"2048"	"8K", "16K", "32K"
GI8_2432	"2432"	"16K", "32K"
GI9_3072	"3072"	"16K", "32K"
GI10_3648	"3648"	"16K", "32K"
GI11_4096	"4096"	"16K", "32K"
GI12_4864	"4864"	"32K"

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:SUBFrame<ch>:FFT:MODE](#) on page 91

Reduced Carrier Mode

Editing the parameter requires "STL Interface > Off".

Sets a coefficient for reducing the maximum number of carriers.

The coefficient ("0" to "4") is multiplied by a control unit value that depends on the FFT size used for the subframe. The resulting number is subtracted from the maximum number of carriers.

Remote command:

[:SOURce<hw>] :BB:A3TSc:SUBFrame<ch>:CARRier:MODE on page 91

Guard Interval

Editing the parameter requires "STL Interface > Off".

Sets the guard interval length.

The length is expressed in samples.

Note:

Not all possible combinations of the guard interval with the following parameters are allowed:

- "FFT Size" on page 33
- "SISO Pilot Pattern" on page 35

Remote command:

[:SOURce<hw>] :BB:A3TSc:SUBFrame<ch>:GUARd:INTerval on page 91

Total Number of Data OFDM Symbols

Editing the parameter requires "STL Interface > Off".

Sets the number of data symbols per subframe, including the subframe boundary symbols, excluding the preamble OFDM symbols.

If "FFT Size > 32K", the sum of the total number of data OFDM symbols and the preamble symbols must be integer.

Note:

The possible setting is restricted depending on the following parameters:

- "FFT Size" on page 33
- "Guard Interval" on page 34
- Maximum allowed frame duration of 5 s

Remote command:

[:SOURce<hw>] :BB:A3TSc:SUBFrame<ch>:NDATa on page 92

3.5.2 Symbols settings

Access:

- ▶ Select "OFDM > Symbols".

ATSC 3.0	Input Signal <i>No of PLPs 1</i>	Encaps	BICM	OFDM <i>No of Subfr 1</i>	System	Frame Info	Special <i>Off</i>	✕
SISO Pilot Pattern 32_2		Pilot Boost Mode 4		General <i>Subfr. 1</i>				
Subfr. Boundary Symbol (First) 0		Subfr. Boundary Symbol (Last) 1		Symbols <i>Subfr. 1</i>				
Subfr. Boundary Symbol (Null Cells) 0		Frequency Interleaver <input checked="" type="checkbox"/>		Subframe <i>Subfr. 1</i>				
								Subfr. Info

The tab provides settings to configure OFDM symbols.

Settings:

SISO Pilot Pattern.....	35
Pilot Boost Mode.....	35
Subframe Boundary Symbol (First).....	35
Subframe Boundary Symbol (Last).....	36
Subframe Boundary Symbol (Null Cells).....	36
Frequency Interleaver.....	36

SISO Pilot Pattern

Editing the parameter requires "STL Interface > Off".

Sets the scattered pilot pattern for single input and single output (SISO).

Note:

Not all possible combinations of the pilot pattern with the following parameters are allowed:

- "Guard Interval" on page 34
- "FFT Size" on page 33

Remote command:

[:SOURce<hw>] :BB:A3TSc:SUBFrame<ch>:PILot:SISO on page 93

Pilot Boost Mode

Editing the parameter requires "STL Interface > Off".

Sets the power boost mode for the scattered pilots.

Remote command:

[:SOURce<hw>] :BB:A3TSc:SUBFrame<ch>:PILot:BOOST on page 93

Subframe Boundary Symbol (First)

Defines whether the first symbol of a subframe is a subframe boundary symbol.

Remote command:

[:SOURce<hw>] :BB:A3TSc:SUBFrame<ch>:SBS:FIRSt on page 94

Subframe Boundary Symbol (Last)

Displays whether the last symbol of a subframe is a subframe boundary symbol.

Remote command:

[:SOURce<hw>] :BB:A3TSc:SUBFrame<ch>:SBS:LAST? on page 94

Subframe Boundary Symbol (Null Cells)

Displays the number of null cells in the subframe boundary symbols.

Remote command:

[:SOURce<hw>] :BB:A3TSc:SUBFrame<ch>:SBS:NULL? on page 94

Frequency Interleaver

Editing the parameter requires "STL Interface > Off".

Enables/disables the frequency interleaver.

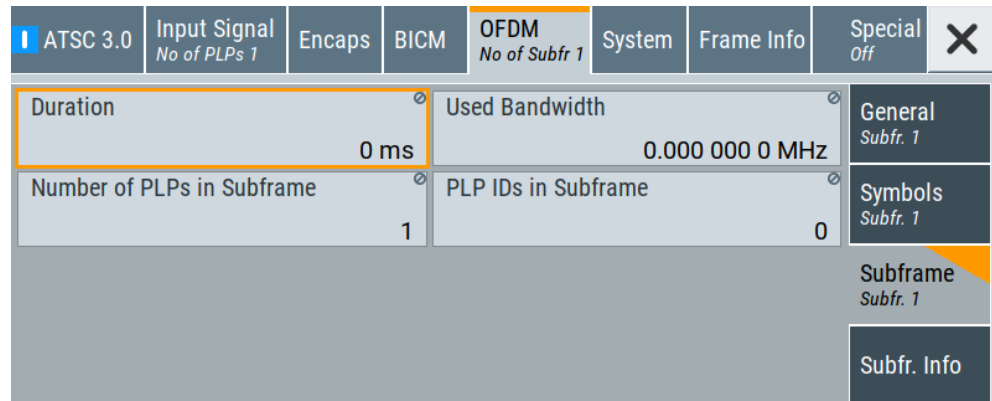
Remote command:

[:SOURce<hw>] :BB:A3TSc:SUBFrame<ch>:FIL on page 94

3.5.3 Subframe

Access:

- ▶ Select "OFDM > Subframe".



The tab displays the subframe information.

Settings:

Duration.....37

Used Bandwidth.....37

Number of PLPs in Subframe.....37

PLP IDs in Subframe.....37

Duration

Displays the duration of the subframe.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:SUBFrame<ch>:DURation?` on page 95

Used Bandwidth

Displays the used bandwidth.

The used bandwidth depends on the following:

- "Channel Bandwidth" on page 32
- "FFT Size" on page 33
- "Reduced Carrier Mode" on page 34

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:SUBFrame<ch>:USED [:BANDwidth] ?` on page 96

Number of PLPs in Subframe

Editing the parameter requires "STL Interface > Off".

Displays the number of PLPs in the subframe.

If "STL Interface > Off", the number of PLPs is restricted to 1.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:SUBFrame<ch>:PLP:NPLP?` on page 96

PLP IDs in Subframe

Displays all IDs of the PLPs mapped to the subframe. See also "PLP ID" on page 19.

If "STL Interface > Off", the PLP with ID "0" is fixed.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:SUBFrame<ch>:PLP:NIDPlp?` on page 96

3.5.4 Subframe info

Access:

- ▶ Select "OFDM > Subfr. Info".

	Subfr. 1	Subfr. 2
MIMO	Off	Off
MISO	Off	Off
FFT Size	16K	32K
Reduced Carrier Mode	0	0
Guard Interval	2048	1024
Tot No of Data OFDM Syml	20	30
SISO	3_4	12_2
Pilot Boost Mode	0	4
SBS (First)	1	1
SBS (Last)	1	1
SBS (Null Cells)	0	3 647
Frequency Interleaver	Off	Off

The tab displays information for individual subframes in a table. You can display information for up to 256 subframes.

To configure parameters for subframe 1

You can configure parameters of "Subframe 1":

1. Select "ATSC 3.0 > STL Interface > Off".
2. Select "BICM > General/Interleaving".

Settings:

[Subframe <num> table](#).....38

Subframe <num> table

Displays individual parameters for each subframe <num>. The table displays information of up to 21 subframes with <num> ranging from 1 to 21.

See "[To configure parameters for subframe 1](#)" on page 38.

3.6 System settings

Access:

- ▶ Select "Baseband > ATSC 3.0 > System".

The tab provides settings to configure ATSC 3.0 system parameters.

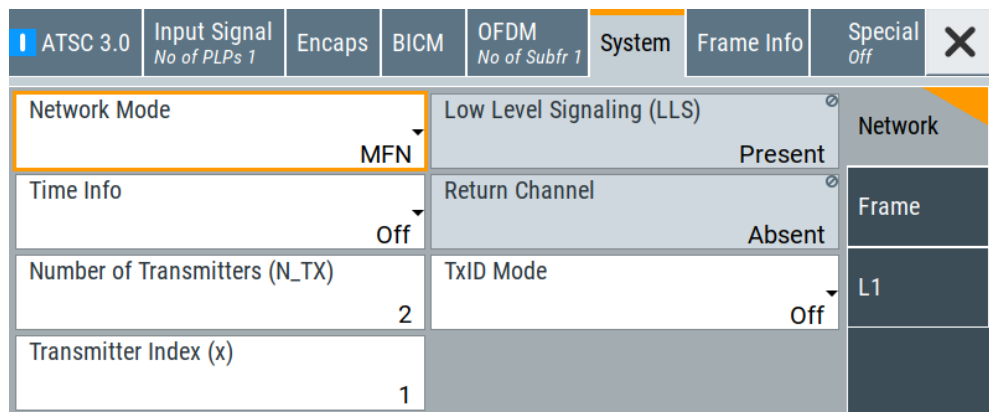
Settings:

- [Network settings](#).....39
- [Frame settings](#).....42
- [L1 settings](#).....44

3.6.1 Network settings

Access:

- ▶ Select "System > Network".



The tab provides network settings.

Settings:

- [Network Mode](#).....39
- [Low Level Signaling \(LLS\)](#).....40
- [Time Info](#).....40
- [Return Channel](#).....40
- [Number of Transmitters \(N_TX\)](#).....41
- [Transmitter Index \(x\)](#).....41
- [TxID Mode](#).....41
 - └ [TxID Address](#).....41
 - └ [TxID Injection Level](#).....41
- [Broadcast Stream ID \(BSID\)](#).....41

Network Mode

Sets the network mode.

Note: GPS receiver required.

Correct SFN synchronization requires a GPS receiver:

- Connect the 1PPS output of the GPS receiver to the "User 2" connector of the R&S SMCV100B.
- Connect the 10 MHz output of the GPS receiver to the "Ref. In" connector of the R&S SMCV100B.

At the R&S SMCV100B, set "RF > Reference Frequency > Reference Frequency > Source > External".

- "SFN" Requires "STL Interface > On".
In a single frequency network (SFN), all transmitters in a network are tuned to the same frequency and have frequency coupling. The frequency is based on the 10 MHz reference output of a GPS receiver. Also, it is necessary to compensate any signal delays that occur in the program data supply. Compensation is done by using a GPS receiver, see also "[GPS receiver required](#)" on page 39, and by inserting timestamps into the STL stream. The maximum delay in the network is set on the broadcast gateway. It represents the maximum delay which can occur in the program data supply at the most remote transmitter in the network.
If a timestamp was received at the SFN transmitter, its modulator measures the dynamic delay in relation to its own received seconds pulse from the local GPS receiver. Using also the processing delay (of the modulator), the RF delay (from modulator to antenna) and the optional static delay, the modulator computes the local delay value. This value expresses the delay which the supplied content stream must undergo to attain data synchronicity in the network. Note that it is critical for the incoming content stream to be identical for all transmitters in the network. That means the incoming content stream is not allowed to change in any way.
- "MFN" In a multiple frequency network (MFN), there is no mandatory coupling between an individual transmitter and the incoming content stream (based on the seconds pulse from a GPS receiver). In addition, the transmitters are not synchronized with one another based on a common reference and output frequency. You can select the modulation parameters of the transmitters involved in the network. In addition, the incoming content stream can be adapted to the data rate requirements of the modulation parameter settings.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:NETWorkmode](#) on page 98

Low Level Signaling (LLS)

Displays, if low-level signaling is present in the system.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:LLS?](#) on page 98

Time Info

Editing the parameter requires "STL Interface > Off".

Configures the time information.

"ms/us/ns" Signaling precision of the timing information.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:TIME](#) on page 99

Return Channel

Displays, if a dedicated return channel (DRC) is present.

Remote command:

[:SOURce<hw>] :BB:A3TSc:RETurn [:CHANnel] ? on page 99

Number of Transmitters (N_TX)

Sets the number of transmitters for MISO transmission.

Remote command:

[:SOURce<hw>] :BB:A3TSc:MISo:NTX on page 98

Transmitter Index (x)

Sets the transmitter index for MISO transmission.

The maximum index equals the set "Number of Transmitters (N_TX)".

Remote command:

[:SOURce<hw>] :BB:A3TSc:MISo:IDX on page 99

TxID Mode

Sets the Tx ID mode.

The mode affects the setting of the "TxID Address" and "TxID Injection Level".

"Off"	Disables the Tx ID mode.
"Manual"	Enables user-defined setting of "TxID Address" and "TxID Injection Level [dB]".
"Auto"	Requires "STL Interface > On". Enables user-defined setting of "TxID Address" and displays the "TxID Injection Level [dB]".

Remote command:

[:SOURce<hw>] :BB:A3TSc:TXId:MODE on page 99

TxID Address ← TxID Mode

Requires "TxID Mode > Manual/Auto".

Sets the transmitter identification address.

Remote command:

[:SOURce<hw>] :BB:A3TSc:TXId:ADDRess on page 100

TxID Injection Level ← TxID Mode

Requires "TxID Mode > Manual/Auto".

Sets the injection levels for injecting a TxID signal into the host preamble.

You can minimize the performance degradation of the preamble while maintaining the desired TxID detection performance.

"Off"	Disables Tx ID injection.
"9.0 to 45.0"	Enables Tx ID injection. You can set levels in 3 dB steps ranging from 9.0 dB to 45.0 dB.

Remote command:

[:SOURce<hw>] :BB:A3TSc:TXId:LEVel on page 100

Broadcast Stream ID (BSID)

Requires "Network > L1 > L1 Detail Version > 0", see "L1 Detail Version" on page 45.

Editing the parameter requires "STL Interface > Off".

Sets the ID of the broadcast stream.

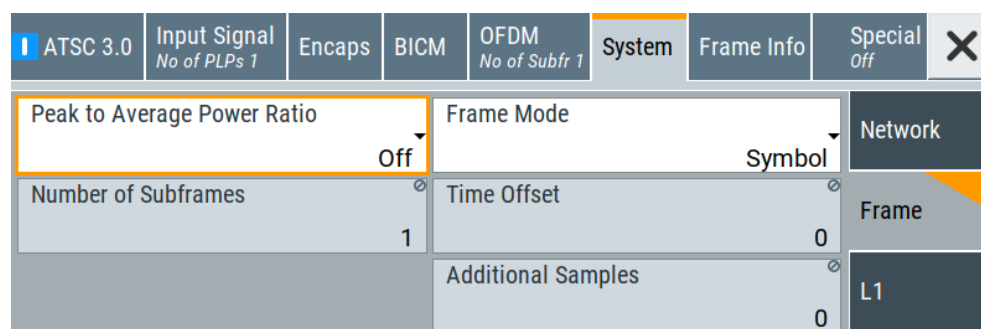
Remote command:

[:SOURce<hw>] :BB:A3TSc:BSID on page 98

3.6.2 Frame settings

Access:

- ▶ Select "System > Frame".



The tab provides frame settings.

Settings:

Peak To Average Power Ratio.....	42
Number of Subframes.....	42
Frame Mode.....	43
Frame Length.....	43
Excess Samples per Symbol.....	43
Final Excess Samples.....	43
Additional Samples.....	43
Time Offset.....	43

Peak To Average Power Ratio

Editing the parameter requires "STL Interface > Off".

Sets the technique to reduce the peak to average power ratio.

"TR" Reserved tones. If enabled, only zeroes are inserted as the values for the TR carriers.

Remote command:

[:SOURce<hw>] :BB:A3TSc:PAPR on page 101

Number of Subframes

Displays the number of subframes within the current frame.

Remote command:

[:SOURce<hw>] :BB:A3TSc:FRAMe:NSUBframes? on page 101

Frame Mode

Editing the parameter requires "STL Interface > Off".

Sets how the frame length is aligned.

"Time" Time-aligned with excess sample distribution to the guard intervals of data payload OFDM symbols.

"Symbol" Symbol-aligned with no excess sample distribution.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:FRAMe:MODE` on page 101

Frame Length

Requires "Frame Mode > Time".

Editing the parameter requires "STL Interface > Off".

Sets the time period measured from the beginning of the first sample of the bootstrap to the end of the final sample of the frame.

You can specify frame lengths with a distance of 5 ms between contiguous length values.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:FRAMe:LENGTh` on page 102

Excess Samples per Symbol

Requires "Frame Mode > Time".

Displays the additional number of excess samples included in the guard interval of each non-preamble OFDM symbol of the post-bootstrap portion.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:FRAMe:EXSYmbol?` on page 102

Final Excess Samples

Requires "Frame Mode > Time".

Displays the excess samples that are inserted immediately following the final OFDM symbol of the final subframe.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:FRAMe:EXFinal?` on page 102

Additional Samples

Requires "Frame Mode > Symbol".

Displays the number of additional samples added at the end of a frame to facilitate sampling clock alignment.

If "STL Interface > Off", the parameter is fixed to "0".

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:FRAMe:ADDITIONal[:SAMPles]?` on page 103

Time Offset

Requires "Frame Mode > Symbol".

Displays the number of sample periods between the nearest preceding or coincident millisecond boundary and the leading edge of the frame.

Remote command:

[:SOURce<hw>] :BB:A3TSc:FRAMe:TIME [:OFFSet] ? on page 103

3.6.3 L1 settings

Access:

- ▶ Select "System > L1".

ATSC 3.0	Input Signal <i>No of PLPs 1</i>	Encaps	BICM	OFDM <i>No of Subfr 1</i>	System	Frame Info	Special <i>off</i>	✕
L1 Basic Version		0		Number of Preamble Symbols		1		Network
L1 Basic FEC Type		Mode 1		Reduced Carrier Mode Preamble		0		Frame
L1 Detail Version		0		Pilot Pattern (Dx) Preamble		16		L1
L1 Detail FEC Type		Mode 1		Number of RFs		0		
L1 Detail Additional Parity Mode		Off						

The tab provides settings to configure common layer 1 (L1) settings.

Settings:

L1 Basic Version.....	44
L1 Basic FEC Type.....	44
L1 Detail Version.....	45
L1 Detail FEC Type.....	45
L1 Detail Additional Parity Mode.....	45
Number of Preamble Symbols.....	45
Reduced Carrier Mode Preamble.....	45
Pilot Pattern (Dx) Preamble.....	45
Number of RFs.....	46

L1 Basic Version

Displays the version of the L1 basic signaling structure that is used for the current frame.

If "STL Interface > Off", the parameter is fixed to "0".

Remote command:

[:SOURce<hw>] :BB:A3TSc:L:BASic:VERSion? on page 104

L1 Basic FEC Type

Editing the parameter requires "STL Interface > Off".

Defines the protection level of L1 basic signaling.

Each categorized mode employs a distinct combination of LDPC code, modulation order, constellation and shortening/puncturing pattern.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:L:BASic:FECType](#) on page 104

L1 Detail Version

Editing the parameter requires "STL Interface > Off".

Sets the version of the L1 detail signaling structure that is used for the current frame.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:L:DETail:VERSion](#) on page 105

L1 Detail FEC Type

Editing the parameter requires "STL Interface > Off".

Defines the protection level of L1 detail signaling.

Each categorized mode employs a distinct combination of LDPC code, modulation order, constellation and shortening/puncturing pattern.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:L:DETail:FECType](#) on page 105

L1 Detail Additional Parity Mode

Displays the L1 detail additional parity mode, that is disabled by default.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:L:DETail:ADDITIONAL\[:PARity\]?](#) on page 105

Number of Preamble Symbols

Displays the total number of OFDM symbols contained in the preamble.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:L:NPReamble\[:SYMBOLs\]?](#) on page 105

Reduced Carrier Mode Preamble

Editing the parameter requires "STL Interface > Off".

Sets a coefficient for reducing the maximum number of carriers.

The coefficient is multiplied by a control unit value that depends on the FFT size used for the preamble. The resulting number is subtracted from the maximum number of carriers. The reduction applies to all preamble symbols except the first preamble symbol of the current frame.

If there is only one preamble symbol, set the value to zero.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:L:CARRier:MODE](#) on page 104

Pilot Pattern (Dx) Preamble

Editing the parameter requires "STL Interface > Off".

Sets the pilot pattern used for the preamble symbols.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:L:PILot:DX](#) on page 106

Number of RFs

Displays the number of radio frequencies involved in channel bonding.

A value of "0" means that channel bonding is not used for the current frame.

Remote command:

[:SOURce<hw>] :BB:A3TSc:NRF? on page 106

3.7 Frame info

Access:

- ▶ Select "Baseband > ATSC 3.0 > Frame Info".

The tab provides settings to configure frame and symbol duration settings.

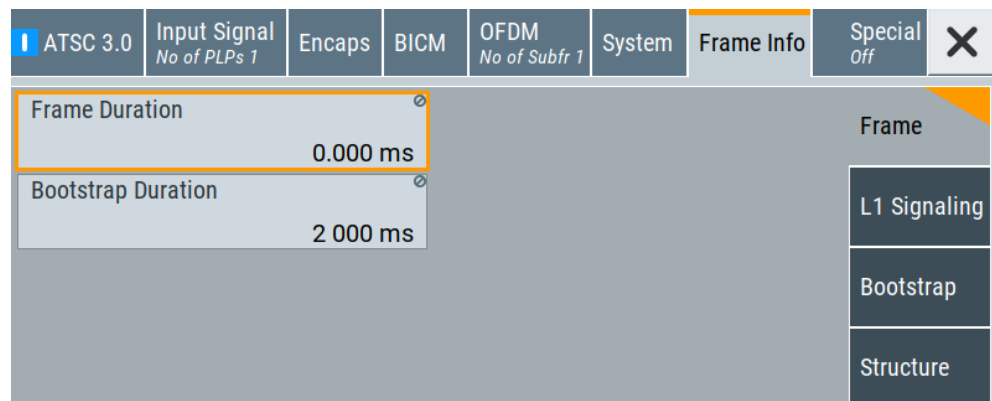
Settings:

- [Frame](#).....46
- [L1 signaling](#).....47
- [Bootstrap](#).....48
- [Structure](#).....50

3.7.1 Frame

Access:

- ▶ Select "Frame Info > Frame".



The tab displays frame parameters.

Settings:

- [Frame Duration](#)..... 47
- [Bootstrap Duration](#)..... 47

Frame Duration

Displays the frame duration in ms.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:INFO:FRAME:DURation?](#) on page 107

Bootstrap Duration

Displays the duration of the bootstrap signal in ms.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:INFO:BOOTstrap:DURation?](#) on page 107

3.7.2 L1 signaling

Access:

- ▶ Select "Frame Info > L1 Signaling".

ATSC 3.0	Input Signal <i>No of PLPs 1</i>	Encaps	BICM	OFDM <i>No of Subfr 1</i>	System	Frame Info	Special <i>Off</i>	✕
L1 Basic Bytes		25 bytes		L1 Basic Cells		69 cells		Frame
L1 Detail Bytes		25 bytes		L1 Detail Cells		0 cells		L1 Signaling
								Bootstrap
								Structure

The tab displays signaling length parameters of the common layer 1 (L1).

Settings:

L1 Basic Bytes.....	47
L1 Detail Bytes.....	47
L1 Basic Cells.....	48
L1 Detail Cells.....	48

L1 Basic Bytes

Displays the L1 basic signaling length in bytes.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:INFO:L:BASic:BYTes?](#) on page 108

L1 Detail Bytes

Displays the L1 detail signaling length in bytes.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:INFO:L:DETail:BYTes?](#) on page 108

L1 Basic Cells

Displays the L1 basic signaling length in cells.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:INFO:L:BASic:CELLs?](#) on page 108

L1 Detail Cells

Displays the L1 detail signaling length in cells.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:INFO:L:DETail:CELLs?](#) on page 108

3.7.3 Bootstrap

Access:

- Select "Frame Info > Bootstrap".

ATSC 3.0	Input Signal <i>No of PLPs 1</i>	Encaps	BICM	OFDM <i>No of Subfr 1</i>	System	Frame Info	Special <i>Off</i>	✕
Major Version	0	Emergency Alert Signaling (EAS)	No Emergency	Frame				
Minor Version	0	System Bandwidth	6 MHz	L1 Signaling				
Min Time to Next	Not Applicable	BSR Coefficient	2	Bootstrap				
				Structure				

The tab displays parameters that characterize the bootstrap signal. The bootstrap signals the information for identifying and initial decoding of the associated signal.

Settings:

Major Version.....	48
Minor Version.....	48
Min. Time to Next.....	49
Emergency Alert Signaling (EAS).....	49
System Bandwidth.....	49
BSR Coefficient.....	49

Major Version

Displays the major version of the bootstrap.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:INFO:BOOTstrap:MAJor?](#) on page 111

Minor Version

Displays the minor version of the bootstrap.

You can change the minor version using the "Special" settings to test the minor version. Changing the minor version requires the following:

- "STL Interface > Off"
- "Special > Special Settings > On"
- "Special > STL Off: Bootstrap > Minor Version ≠ 0"

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:INFO:BOOTstrap:MINor?` on page 111

Min. Time to Next

Displays minimum time interval to the next frame that matches the same major and minor version number of the current frame.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:INFO:BOOTstrap:TIME:NEXT?` on page 112

Emergency Alert Signaling (EAS)

Displays the signaling mode for emergency alert.

You can change the signaling mode using the "Special" settings to test the minor version. Changing the signaling mode requires the following:

- "STL Interface > Off"
- "Special > Special Settings > On"
- "Special > STL Off: Bootstrap > Emergency Alert Signaling (EAS) ≠ No Emergency"

"No Emergency"

No emergency alert information is available.

"Setting 1/2/3" Emergency alert information is available.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:INFO:BOOTstrap:EAS?` on page 110

System Bandwidth

Displays the system bandwidth used for the post-bootstrap portion of the current physical layer frame.

Remote command:

`[:SOURCE<hw>] :BB:A3TSc:INFO:BOOTstrap:BANDwidth?` on page 110

BSR Coefficient

Displays the sample rate used for the post-bootstrap portion of the current physical layer frame.

The displayed value depends on the setting of the STL interface:

- "STL Interface > Off": The value is automatically calculated.
- "STL Interface > On": The value is derived from the input stream data. If the values differ from "2", "6" or "8", an error message is displayed in the status info of the ATSC 3.0 coder. See "Status Info" on page 15.

"2" 6.912 MHz at 6 MHz system bandwidth

"5" 8.064 MHz at 7 MHz system bandwidth

"8" 9.216 MHz at 8 MHz system bandwidth

Remote command:

[:SOURCE<hw>] :BB:A3TSc:INFO:BOOTstrap:BSR:COEFFicient? on page 110

3.7.4 Structure

Access:

- ▶ Select "Frame Info > Structure".

ATSC 3.0	Input Signal <i>No of PLPs 1</i>	Encaps	BICM	OFDM <i>No of Subfr 1</i>	System	Frame Info	Special <i>off</i>	X
Preamble Structure							0	Frame
FFT Size			8K	Guard Interval			192	L1 Signaling
Pilot Pattern (Dx)			16	L1 Basic FEC Type			Mode 1	Bootstrap
								Structure

The tab displays preamble symbols structure parameters.

Settings:

Preamble Structure..... 50

FFT Size..... 50

Guard Interval..... 50

Pilot Pattern (Dx)..... 51

L1 Basic FEC Type..... 51

Preamble Structure

Displays the structure of the preamble symbols following the last bootstrap symbol.

Remote command:

[:SOURCE<hw>] :BB:A3TSc:INFO:BOOTstrap:PREamble[:STRucture]?

on page 112

FFT Size

Displays the FFT size of the preamble symbols.

If "STL Interface > Off", the FFT size equals the value of "OFDM > General > FFT Size".

See "FFT Size" on page 33.

Remote command:

[:SOURCE<hw>] :BB:A3TSc:INFO:BOOTstrap:FFT:MODE? on page 111

Guard Interval

Displays the number of guard interval samples of the preamble symbols.

If "STL Interface > Off", the guard interval equals the value of "OFDM > General > Guard Interval".

See ["Guard Interval"](#) on page 34.

Remote command:

`[:SOURce<hw>] :BB:A3TSc:INFO:BOOTstrap:GUARd:INTerval?` on page 111

Pilot Pattern (Dx)

Displays the pilot pattern used for the preamble symbols.

If "STL Interface > Off", the pilot pattern equals the value of "System > L1 > Pilot Pattern (Dx) Preamble".

See ["Pilot Pattern \(Dx\) Preamble"](#) on page 45.

Remote command:

`[:SOURce<hw>] :BB:A3TSc:INFO:BOOTstrap:PILot:DX?` on page 112

L1 Basic FEC Type

Displays the FEC type used for the L1 basic signaling in the preamble symbol.

If "STL Interface > Off", the L1 basic FEC type equals the value of "System > L1 > L1 Basic FEC Type".

See ["L1 Basic FEC Type"](#) on page 44.

Remote command:

`[:SOURce<hw>] :BB:A3TSc:INFO:BOOTstrap:BASic:FECType?` on page 110

3.8 SFN settings

Requires "STL Interface > On" and "System > Network > Network Mode > SFN".

Access:

- ▶ Select "Baseband > ATSC 3.0 > SFN".

The tab provides settings to configure [SFN](#) parameters.

Settings

- [Delays settings](#).....52
- [Mode settings](#).....54

3.8.1 Delays settings

Access:

- ▶ Select "SFN > Delays".

ATSC 3.0 <i>STL On</i>	Input Signal <i>No of PLPs 1</i>	BICM	OFDM <i>No of Subfr 1</i>	System	Frame Info	SFN	Special <i>Off</i>
Network Delay						Mute Bootstrap of Frame <input type="checkbox"/>	Delays
0.0 µs							
Processing Delay						Static Delay	Mode
0.0 µs						0.0 µs	
Dynamic Delay						Maximum Delay	
0.0 µs						0.0 µs	
Total Delay						Dispatch Time	
0.0 µs						0.0 µs	
Max. Deviation Time							
10.0 µs							

The tab provides settings to configure SFN delays.

Settings

Network Delay.....	52
Processing Delay.....	52
Dynamic Delay.....	53
Total Delay.....	53
Max. Deviation Time.....	53
Static Delay.....	53
Maximum Delay.....	53
Dispatch Time.....	53
Mute Bootstrap of Frame.....	54

Network Delay

Displays the time taken for the signal to travel from the playout center to the input of the signal processing.

The delay depends on the used transmission path. If you use IP fed FEC, the processing time is part of the network delay.

Remote command:

[:SOURce<hw>] :BB:A3TSc:DElay:NETWork? on page 115

Processing Delay

Displays the delay from the modulator input up to the SFN delay (FIFO).

Remote command:

[:SOURce<hw>] :BB:A3TSc:DELaY:PROCEss? on page 116

Dynamic Delay

Displays the transmission delay currently generated by the SFN delay (FIFO).

Remote command:

[:SOURce<hw>] :BB:A3TSc:DELaY:DYNamic? on page 114

Total Delay

Displays the sum of "Processing Delay" and "Dynamic Delay".

Remote command:

[:SOURce<hw>] :BB:A3TSc:DELaY:TOTal? on page 117

Max. Deviation Time

Sets the maximum permissible delay.

The delay Δt_{\max} depends on the time of emission $TOE_{\text{timestamp}}$ from timestamp, the static delay t_{static} and the actual time of emission TOE_{actual} as follows:

$$\Delta t_{\max} = TOE_{\text{timestamp}} + t_{\text{static}} - TOE_{\text{actual}}$$

If the above sum is greater than the "Max. Deviation Time", the SFN delay (FIFO) restarts. The transmit signal is reset and transmission is restarted.

Remote command:

[:SOURce<hw>] :BB:A3TSc:DELaY:DEVIation on page 114

Static Delay

Sets the delay to shift the time of transmission positively or negatively.

The static delay is also called User Delay Offset

Remote command:

[:SOURce<hw>] :BB:A3TSc:DELaY:STATic on page 116

Maximum Delay

Displays the time taken for the signal to travel from the playout center to the transmitter antenna for regular transmission.

The delay is set in the SFN adapter and is the default value for all transmitters in a dynamic SFN.

Remote command:

[:SOURce<hw>] :BB:A3TSc:DELaY:MAXImum? on page 115

Dispatch Time

Displays the time taken for the signal to travel from the playout center to the transmitter antenna for real transmission.

The delay corresponds to the sum of "Maximum Delay" and "Static Delay". The maximum delay represents the default value for all transmitters in an SFN. The static delay represents the transmitter-specific delay.

Remote command:

[:SOURce<hw>] :BB:A3TSc:DELaY:DISPatch? on page 114

Mute Bootstrap of Frame

Use the setting for testing SFN operation.

- "On" Replaces the bootstrap by a null signal (no output power).
- "Off" The setting is fixed for "STL Interface > Off" and "System > Network Mode > MFN".

Remote command:

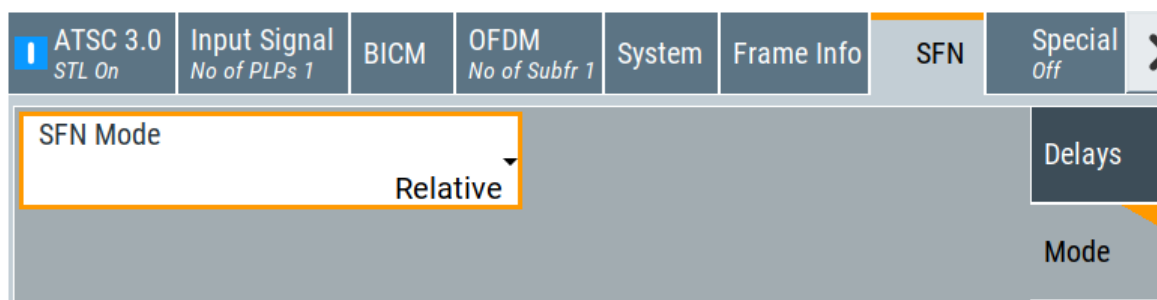
[:SOURce<hw>] :BB:A3TSc:DELay:MUTE [:BOOTstrap] on page 115

3.8.2 Mode settings

Requires "STL Interface > On" and "System > Network > Network Mode > SFN".

Access:

- ▶ Select "Baseband > ATSC 3.0 > SFN".



The tab provides settings to configure the SFN mode.

Settings

SFN Mode..... 54

SFN Mode

Sets the SFN timestamp operation mode, that is fixed to "SFN Mode > Relative".

Remote command:

[:SOURce<hw>] :BB:A3TSc:DELay:SFNMode on page 116

3.9 Special settings

Access:

- ▶ Select "Baseband > ATSC 3.0 > Special".

ATSC 3.0	Input Signal <i>No of PLPs 1</i>	Encaps	BICM	OFDM <i>No of Subfr 1</i>	System	Frame Info	Special <i>Off</i>	X
Special Settings <input type="checkbox"/>								
STL Interface				Bootstrap				
Preamble Compatibility Mode <input type="checkbox"/>				Minor Version 0				
TMP Compatibility Mode <input type="checkbox"/>				Emergency Alert Signaling (EAS) No Emergency				
ALP Encapsulation								
LMT Compatibility Mode <input type="checkbox"/>								

The tab provides settings, that differ from the specification of the broadcast standard.



Settings different from the broadcast standard can be useful for research and development. Applying these settings requires "Special Settings > On".

If you set a parameter different from the specification, the warning icon is displayed to the left of the parameter.

Settings:

Special Settings.....	55
STL On: STL Interface.....	56
L Preamble Compatibility Mode.....	56
L TMP Compatibility Mode.....	56
STL Off: Bootstrap.....	56
L Minor Version.....	56
L Emergency Alert Signaling (EAS).....	56
STL Off: ALP Encapsulation.....	56
L LMT Compatibility Mode.....	56

Special Settings

Enables/disables special settings.

The setting allows you to switch between standard-compliant and user-defined channel coding.

Remote command:

[:SOURce<hw>] :BB:A3TSc:SPECIAL:SETTINGS [:STATe] on page 118

STL On: STL Interface

Provides compatibility mode settings.

Preamble Compatibility Mode ← STL On: STL Interface

Sets how the preamble packet is supported.

"On" According to specification ATSC A/324-2016.

"Off" According to specification [ATSC A/324-2018](#) or later.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:SPECIAL:STL:PREamble](#) on page 119

TMP Compatibility Mode ← STL On: STL Interface

Sets how the time & management packet is supported.

"On" According to specification ATSC A/324-2016.

"Off" According to specification [ATSC A/324-2018](#) or later.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:SPECIAL:STL:TMP](#) on page 119

STL Off: Bootstrap

Provides settings that characterize the bootstrap signal.

Minor Version ← STL Off: Bootstrap

Sets the minor version number of the bootstrap.

If "Special settings > On", the minor version sets "Frame Info > Bootstrap > Minor Version". See "[Minor Version](#)" on page 48.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:SPECIAL:BOOTstrap:MINor](#) on page 118

Emergency Alert Signaling (EAS) ← STL Off: Bootstrap

Sets the signaling for emergency alert.

If "Special settings > On", the signaling mode sets "Frame Info > Bootstrap > Emergency Alert Signaling (EAS)". See "[Emergency Alert Signaling \(EAS\)](#)" on page 49.

"No Emergency"

No emergency alert information is available.

"Setting 1/2/3" Emergency alert information is available.

Remote command:

[\[:SOURCE<hw>\]:BB:A3TSc:SPECIAL:BOOTstrap:EAS](#) on page 118

STL Off: ALP Encapsulation

Provides [ALP](#) encapsulation compatibility mode settings.

LMT Compatibility Mode ← STL Off: ALP Encapsulation

Sets how the [LMT](#) signaling is supported.

"On" According to specification ATSC A/330-2016.

"Off" According to specification ATSC A/330-2018 or later.

Remote command:

[:SOURce<hw>] :BB:A3TSc:SPECIAL:ALP:LMT on page 118

3.10 Data Generation settings

Access:

- ▶ Select "Baseband > ATSC 3.0 > Data Generation".

	PLP 1
PLP ID	0
Packet Length	Invalid
Max. Useful Data Rate / Mbit/s	0.000 000
Measured Data Rate / Mbit/s	0.000

Data:
Input Signal
Directory:
/var/user/atsc30_data.txt
File name:
atsc30_data

The "Export Data" tab provides settings to generate data of the ATSC 3.0 signal characteristics. You can generate data for the input signal, BICM and subframing and OFDM and export the data to a file.

Settings:

Data.....	57
File Name.....	57
Directory.....	58
Generate.....	58
File Info panel.....	58
PLP <num>/Subr. <num> table.....	58

Data

Sets the data source, for that the data is generated.

Remote command:

n.a.

File Name

Displays the file name, for which the data is generated.

Remote command:

n.a.

Directory

Accesses the directory of the export data. A standard "File Select" dialog opens.

Remote command:

n.a.

Generate

Triggers export data generation.

Remote command:

n.a.

File Info panel

Displays information on the selected file, such as data source, directory and filename.

PLP <num>/Subr. <num> table

Displays the "PLP Info"/"Subfr. Info" data of the corresponding "Data" source.

"PLP <num>" Requires "Data > Input Signal/BICM".

Displays individual parameters for each PLP <num>. The table displays information of up to 64 PLPs with <num> ranging from 0 to 63. See ["To configure BICM parameters for "PLP 1""](#) on page 31.

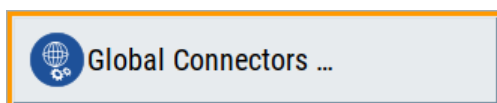
"Subfr. <num>" Requires "Data > Subframing & OFDM".

Displays individual parameters for each subframe <num>. The table displays information of up to 21 subframes with <num> ranging from 1 to 21.

See ["To configure parameters for subframe 1"](#) on page 38.

3.11 Global connector settings

The "Input Signal" dialog, the "Trigger/Marker/Clock" dialog and "Trigger In", "Marker" and "Clock" tabs in "Baseband > ARB/Custom Digital Mod" configuration dialogs provide quick access to the related connector settings. Click the "Global Connectors" button to access the settings.



See also chapter "Global connector settings" in the user manual.

3.12 TS player

The "TS Player" application allows you to play stream files for simulation of dedicated transport stream (TS) scenarios. Also, the R&S SMCV100B offers stream libraries containing stream files with a wide range of ready-made signals for testing systems with different transmission parameters. For supported file types, see [Table 3-1](#).

Key features

The key features for playing stream files with "TS Player" application are:

- Support of numerous broadcast transmission standards
- Streaming of high-quality video contents
- Streaming of high-quality audio contents
- Efficient use with dedicated streams

Required options

The equipment layout for processing files of waveform libraries includes:

- R&S SMCV100B base unit (64 MSample ARB memory, 60 MHz RF bandwidth)
- Broadcast standard option for the "TS Player" application (R&S SMCVB-Kxxx)
- Enable Broadcast Standards option (R&S SMCVB-K519)
- Stream library option (R&S SMCVB-KSxx)

For more information, see data sheet.

To access and download a stream library file

The steps to access a stream library and to download stream library files is analogous as for waveform libraries. See chapter "Installation" in the user manual of the stream library at:

www.rohde-schwarz.com/manual/smcv100b/ksxx-kvxx-stream-and-waveform-libraries-user-manuals-manuals-gb1_78701-972224.html

To access the "TS Player" application

1. Select "Baseband > ATSC 3.0 > Input Signal".
2. Select "Source > TS Player".
3. Select "TS Player" button.

Opens the TS player dialog, where you can load files.

Support in broadcast standard configuration

Various broadcast baseband standards of the R&S SMCV100B support the "TS Player" application. For an overview, see the table below.

Baseband standard	"Source > TS Player"	Baseband standard	"Source > TS Player"
"ATSC/ATSC-M/H"	Yes	"DVB-S"	Yes
"ATSC 3.0"	Yes	"DVB-S2"	Yes
"DTMB"	Yes	"DVB-C"	Yes
"DVB-T"	Yes	"J.83/B"	Yes
"DVB-T2"	Yes	"DRM"	No

Baseband standard	"Source > TS Player"	Baseband standard	"Source > TS Player"
"ISDB-T"	Yes	"Audio AM"	No
"T-DMB/DAB"	Yes	"Audio FM"	No

The remote commands required to define these settings are described in [Chapter 5.10, "TSGen subsystem"](#), on page 119.

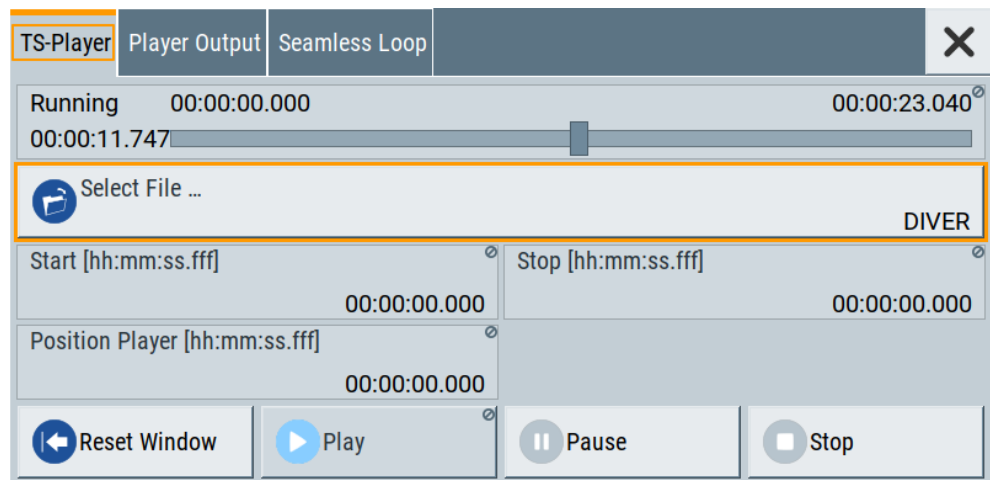
Settings:

- [TS Player settings](#).....60
- [Player output settings](#).....63
- [Seamless loop settings](#).....66

3.12.1 TS Player settings

Access:

1. Follow the steps in ["To access the "TS Player" application"](#) on page 59.
2. Select "TS Player > TS-Player".



The tab provides settings to configure the general settings of the TS player application.

Settings:

- [Running/Position Player \[hh:mm:ss:fff\]](#)..... 61
- [Select File](#)..... 61
- [Start \[hh:mm:ss.fff\]](#)..... 62
- [Position Player \[hh:mm:ss.fff\]](#)..... 62
- [Stop \[hh:mm:ss.fff\]](#)..... 62
- [Reset Window](#)..... 62

Play.....	62
Pause.....	63
Stop.....	63

Running/Position Player [hh:mm:ss:fff]

Displays the current position in time, while playing the file.

You can set an individual position via [Position Player \[hh:mm:ss.fff\]](#).

Remote command:

:TSGen:CONFigure:SEEK:POSition on page 124

Select File

Provides access to the standard "File Select" function of the instrument. The provided navigation possibilities in the dialog are self-explanatory.

See also, chapter "File and Data Management" in the R&S SMCV100B User Manual.

The dialog allows you to select user-defined, predefined and recent files. [Table 3-1](#) lists file extensions of supported files.

Table 3-1: Supported TS player file types

File extension	Stream libraries	Remark	Option
*.atsc_c	ATSC/ATSC & Mobile DTV	Encrypted	R&S SMCVB-KS13
*.dab	T-DMB/DAB	Unencrypted	-
*.dab_c	T-DMB/DAB	Encrypted	R&S SMCVB-KS10
*.dabp_c	DAB+	Encrypted	R&S SMCVB-KS11
*.eti	T-DMB/DAB	Unencrypted	-
*.xeti	T-DMB/DAB	Unencrypted	-
*.emc_c	EMC	Encrypted	R&S SMCVB-KS15
*.isdbt_c	ISDB-T	Encrypted	R&S SMCVB-KS12
*.pcap	-	Captured IPv4 stream for ATSC 3.0 player	-
*.t2mi ¹⁾	-	Unencrypted	-
*.t2mi_c	DVB-T2 MI	Encrypted	R&S SMCVB-KS14
*.t2trp_c	DVB-T2 MI	Encrypted	R&S SMCVB-KS14
*.trp	-	Unencrypted	-
*.trp_c	-	Encrypted Included in various stream libraries	R&S SMCVB-KS12 R&S SMCVB-KS17 R&S SMCVB-KS18 R&S SMCVB-KS19 R&S SMCVB-KS20
*.bin	-	Unencrypted	-
*.ts	-	Unencrypted	-

File extension	Stream libraries	Remark	Option
*.mpg	-	Unencrypted	-
*.t10	-	-	-

1) For T2MI stream files, the data rate of a T2MI file is determined automatically, if the following applies:

- Data rate is not part of the TRP file header information.
- PCR information is not available.
- T2MI TRP file is not encrypted, that means not of type *.t2mi_c.
- TRP file has the *.t2mi file extension.

Remote command:

:TSGen:CONFigure:PLAYfile on page 122

:TSGen:READ:PLAYfile:LENGth? on page 127

:TSGen:READ:FMEMory on page 126

Start [hh:mm:ss.fff]

Sets the start position in the loaded player file. Data which chronologically precedes the start position is not replayed by the player.

The entered time stamp must chronologically always precede the entry under [Stop](#).

Remote command:

:TSGen:CONFigure:SEEK:START on page 124

Position Player [hh:mm:ss.fff]

Displays the current play position in the file.

Remote command:

:TSGen:CONFigure:SEEK:POSition on page 124

Stop [hh:mm:ss.fff]

Sets the end position in the player file. Data which chronologically follows the end position is not replayed by the player.

When the player reaches the "Stop" position, it returns to the "Start" position (continuous play).

The entered time stamp must chronologically always follow the entry under [Play](#).

Remote command:

:TSGen:CONFigure:SEEK:STOP on page 125

Reset Window

Resets "Start/Stop/Position Player" parameters.

Remote command:

:TSGen:CONFigure:SEEK:RESet on page 124

Play

Plays the selected file.

For supported file types, see [Table 3-1](#).

Remote command:

:TSGen:CONFigure:COMManD on page 121

Pause

Pauses the player.

After pausing, you can resume playing the file by clicking "Play" again.

Remote command:

:TSGen:CONFigure:COMManD on page 121

Stop

Stops the player and returns to the start position.

Remote command:

:TSGen:CONFigure:COMManD on page 121

3.12.2 Player output settings

Access:

- ▶ Select "TS Player > Player Output".

The tab provides settings to configure the output of the TS player.

3.12.2.1 General settings

TS-Player	Player Output	Seamless Loop	
Data Rate	5.018 502 Mbit/s	Orig. Data Rate	5.018 502 Mbit/s
Packet Length	188		
Nullpacket Stuffing	<input type="checkbox"/>		
Stop Data	None		

The tab provides settings to configure general player output properties.

Data Rate.....	63
Orig. Data Rate.....	64
Packet Length.....	64
Nullpacket Stuffing.....	64
Stop Data.....	64

Data Rate

Sets the output data rate of the player.

Note: If "Nullpacket Stuffing > Off", we recommend that you set the output data rate equal to the original data rate.

If you want to use a different data rate, activate "Nullpacket Stuffing". The function ensures that the data stream is replayed in the same way as it was recorded. The time references in the tables of the TS stream are also correct during replay.

Remote command:

`:TSGen:CONFigure:TSRate` on page 126

Orig. Data Rate

Displays the calculated original TS data rate.

Remote command:

`:TSGen:READ:ORIGtsrate` on page 126

Packet Length

Requires a *.trp, *.trp_c, *.emc or *.emc_c file loaded into the "TS Player" dialog. *.trp files are previously recorded files.

Displays the packet length of the loaded TS player file.

Remote command:

`:TSGen:CONFigure:PLENght` on page 123

Nullpacket Stuffing

Requires a *.trp, *.trp_c, *.emc or *.emc_c file loaded into the "TS Player" dialog. *.trp files are previously recorded files.

Activates nullpacket stuffing.

By default nullpacket stuffing is deactivated. The output data rate of the TS player equals the original data rate as defined in the TS player file. Equal rates ensure that the time references in the tables of the played TS stream are correct during replay.

- | | |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| "On" | Activate stuffing, if you need a higher rate than the original data rate. Null packets are inserted into the data stream. To ensure correct time references in the stream tables, activate program clock reference correction. See "PCR, DTS/PTS" on page 67. |
| "Off" | Deactivate stuffing, if you want to use the same data rate as the original data rate. |

Remote command:

`:TSGen:CONFigure:STUFFing` on page 125

Stop Data

Requires a *.trp, *.trp_c, *.emc or *.emc_c file loaded into the "TS Player" dialog. *.trp files are previously recorded files.

Ensures that a standardized TS data stream is always output at the TS output at the rear of the R&S SMCV100B.

In pause or stop status, the TS generator generates "test packets", which have data and header parts that can be configured using the [Test TS Packet](#).

Remote command:

`:TSGen:CONFigure:STOPdata` on page 125

3.12.2.2 Stuffing settings

The tab provides settings to configure stuffing.

Settings

Test TS Packet	65
PID Test Packet	66
PID (Hex)	66
Payload Test/Stuff	66
PRBS	66

Test TS Packet

Specifies the structure of the test transport stream packet that is fed to the modulator.

"Head/184 Payload"

A sync byte (0x47) followed by three header bytes and 184 payload bytes.

"Sync/187 Payload"

A sync byte (0x47) followed by 187 payload bytes.

"Head/200 Payload"

A sync byte (0x47) followed by three header bytes and 200 payload bytes.

"Sync/203 Payload"

A sync byte (0x47) followed by 203 payload bytes.

"Head/204 Payload"

A sync byte (0x47) followed by three header bytes and 204 payload bytes.

"Sync/207 Payload"

A sync byte (0x47) followed by 207 payload bytes.

Remote command:

[:TSGen:CONFigure:TSPacket](#) on page 126

PID Test Packet

If a header is present in the test packet ("Test TS Packet > Head/184 Payload"), you can specify a fixed or variable packet identifier (PID).

- "Null" The header of the test transport stream packets has a fixed setting of null packet header 1FFF (hex).
- "Variable" Uses the header value defined with [PID \(Hex\)](#).

Remote command:

[:TSGen:CONFigure:PIDTestpack](#) on page 122

PID (Hex)

Sets the [PID](#).

If "PID Test Packet > Null", "PID (Hex) = 1FFF" is fixed.

If "PID Test Packet > Variable", you can edit the value.

Remote command:

[:TSGen:CONFigure:PID](#) on page 122

Payload Test/Stuff

Defines the payload area content of the [TS](#) packet.

- "PRBS" [PRBS](#) data in accordance with [ITU-T O.151](#)
See also chapter "Internal Modulation Data" in the R&S SMCV100B User Manual.
- "0x00" Exclusively 00 (hex) data
- "0xFF" Exclusively FF (hex) data

Remote command:

[:TSGen:CONFigure:PAYLoad](#) on page 121

PRBS

Sets the length of the PRBS sequence.

You can select a PRBS 15 or a PRBS 23 sequence as specified by [ITU-T O.151](#).

Remote command:

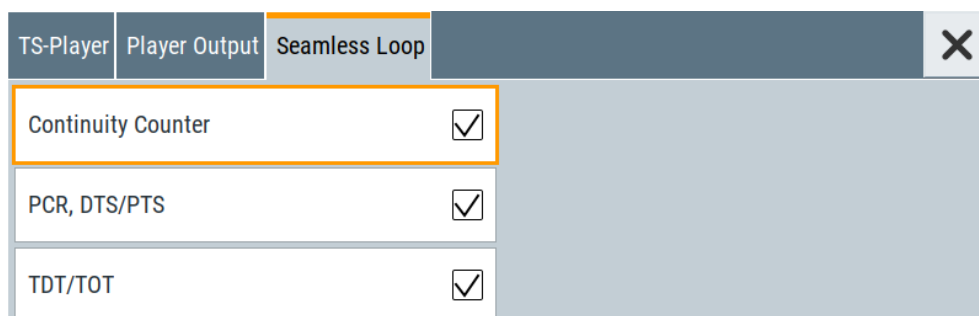
[:TSGen:CONFigure:PRBS\[:SEquence\]](#) on page 123

3.12.3 Seamless loop settings

Displaying the tab requires a *.trp, *.trp_c, *.emc or *.emc_c file loaded into the "TS Player" dialog. *.trp files are previously recorded files.

Access:

- ▶ Select "TS Player > Seamless Loop".



The tab provides settings to configure settings for playing the file in a loop.

Settings:

Continuity Counter.....	67
PCR, DTS/PTS.....	67
TDT/TOT.....	67

Continuity Counter

Activates the correction of the continuity counters in the replayed TS data stream. The correction allows you to decode the stream without interruption when the play file is looping.

Remote command:

:TSGen:CONFigure:SEAMless:CC on page 123

PCR, DTS/PTS

Activates the correction of time stamps in the replayed TS data stream. The correction allows you to decode the stream without interruption when the play file is looping.

If you set "Nullpacket Stuffing = On" and "PCR, DTS/PTS = On", the time stamps in the streams are corrected when nullpackets are inserted into the stream.

Remote command:

:TSGen:CONFigure:SEAMless:PCR on page 123

TDT/TOT

Activates the correction of the time and date table in the replayed TS data stream. The correction allows you to decode the stream without interruption when the play file is looping.

Remote command:

:TSGen:CONFigure:SEAMless:TT on page 124

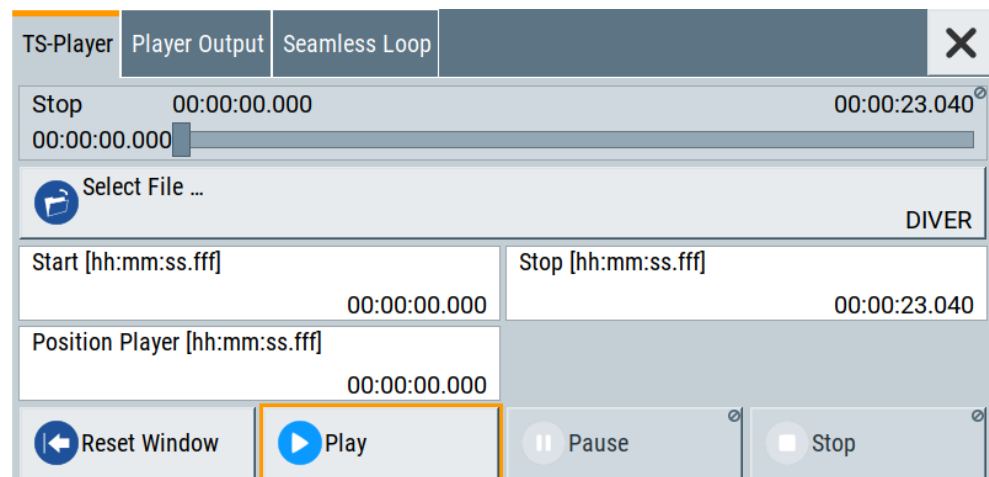
4 Performing ATSC 3.0 signal generation tasks

This chapter tells you how to configure the R&S SMCV100B to generate signals from stream library files.

To load and play a stream library file

1. Load the file from its storage location:
 - External storage device (HDD, memory stick): Load the file from the `/usb/` directory.
 - Internal memory (SSD): Load the file from the user directory `/var/user/`

Note: Library files are encrypted files. Loading the library file at the R&S SMCV100B requires installation of the corresponding library option. See ["Required options"](#) on page 59.
2. To load the file at the R&S SMCV100B, open the "TS Player" application in digital broadcast standard ("`<Broadcast_Standard>`") dialogs:
 - a) Select "Baseband" > "<Broadcast_Standard>" > "Input Signal".
 - b) Select "Source" > "TS Player".
 - c) Select "TS Player" button.
 - d) Select "Select File".
3. To select the file, navigate to the storage location (1).
4. Select "TS-Player" > "Play".



The R&S SMCV100B processes the stream file.

5. Select "<Broadcast_Standard>" > "State" > "On", to activate the baseband signal.
6. In the block diagram, select "RF" > "On".

The stream file is modulated onto the RF carrier and output at the "RF 50 Ω " connector.

5 Remote-control commands

The following commands are required to generate signals with the ATSC 3.0 option in a remote environment. We assume that the R&S SMCV100B has already been set up for remote operation in a network as described in the R&S SMCV100B documentation. A knowledge about the remote control operation and the SCPI command syntax is assumed.



Conventions used in SCPI command descriptions

For a description of the conventions used in the remote command descriptions, see section "Remote-Control Commands" in the R&S SMCV100B user manual.

Common suffixes

The following common suffixes are used in the remote commands:

Suffix	Value range	Description
SOURce<hw>	1	Available baseband signals
PLP<ch>	1 to 64	Available number of PLPs
SUBFrame<ch>	1 to 256	Available number of subframes

Programming examples

This description provides simple programming examples. The purpose of the examples is to present **all** commands for a given task. In real applications, one would rather reduce the examples to an appropriate subset of commands.

The programming examples have been tested with a software tool which provides an environment for the development and execution of remote tests. To keep the example as simple as possible, only the "clean" SCPI syntax elements are reported. Non-executable command lines (e.g. comments) start with two // characters.

At the beginning of the most remote control program, an instrument preset/reset is recommended to set the instrument to a definite state. The commands *RST and SYSTem:PRESet are equivalent for this purpose. *CLS also resets the status registers and clears the output buffer.

The following commands specific to the ATSC 3.0 are described here:

- [General commands](#).....70
- [Input signal commands](#).....72
- [Encapsulation commands](#).....80
- [BICM commands](#).....82
- [OFDM and subframe commands](#).....90
- [System commands](#).....96
- [Frame info commands](#).....106
- [SFN delay commands](#).....112
- [Special commands](#).....117
- [TSGen subsystem](#).....119

5.1 General commands

Example: Saving current configuration

```
SOURce1:BB:A3TSc:SETTing:STORe "/var/user/my_atsc30"
// Saves the file "my_atsc30.a3tsc" in the directory as above.
```

```
*RST
```

```
SOURce1:BB:A3TSc:SETTing:CATalog?
// Response: "my_atsc30"
SOURce1:BB:A3TSc:SETTing:LOAD "/var/user/my_atsc30"
SOURce1:BB:A3TSc:STATe 1
SOURce1:BB:A3TSc:SETTing:DELeTe "/var/user/my_atsc30"
```

Commands

[:SOURce<hw>]:BB:A3TSc:PRESet	70
[:SOURce<hw>]:BB:A3TSc:STATe	70
[:SOURce<hw>]:BB:A3TSc:SETTing:CATalog	71
[:SOURce<hw>]:BB:A3TSc:SETTing:DELeTe	71
[:SOURce<hw>]:BB:A3TSc:SETTing:LOAD	71
[:SOURce<hw>]:BB:A3TSc:SETTing:STORe	71
[:SOURce<hw>]:BB:A3TSc:INPut:STATus?	72

[:SOURce<hw>]:BB:A3TSc:PRESet

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

Not affected is the state set with the command `SOURce<hw>:BB:A3TSc:STATe`.

Example: See [Example "Saving current configuration"](#) on page 70.

Usage: Event

Manual operation: See ["Set To Default"](#) on page 13

[:SOURce<hw>]:BB:A3TSc:STATe <State>

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

Parameters:

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

Example: See [Example "Saving current configuration"](#) on page 70.

Manual operation: See ["State"](#) on page 13

[:SOURce<hw>]:BB:A3TSc:SETTing:CATalog

Queries the files with settings in the default directory. Listed are files with the file extension *.a3tsc.

Return values:

<FileNames> <filename1>,<filename2>,...
Returns a string of filenames separated by commas.

Example: See [Example "Saving current configuration"](#) on page 70.

Manual operation: See ["Save/Recall"](#) on page 13

[:SOURce<hw>]:BB:A3TSc:SETTing:DELeTe <Delete>

Deletes the selected file from the default or the specified directory. Deleted are files with extension *.a3tsc.

Setting parameters:

<Delete> "<filename>"
Filename or complete file path; file extension can be omitted

Example: See [Example "Saving current configuration"](#) on page 70.

Usage: Setting only

Manual operation: See ["Save/Recall"](#) on page 13

[:SOURce<hw>]:BB:A3TSc:SETTing:LOAD <Atsc30Recall>

Loads the selected file from the default or the specified directory. Loaded are files with extension *.a3tsc.

Parameters:

<Filename> "<filename>"
Filename or complete file path; file extension can be omitted

Example: See [Example "Saving current configuration"](#) on page 70.

Manual operation: See ["Save/Recall"](#) on page 13

[:SOURce<hw>]:BB:A3TSc:SETTing:STORe <Atsc30Save>

Saves the current settings into the selected file; the file extension (*.a3tsc) is assigned automatically.

Parameters:

<Filename> string
Filename or complete path

Example: See [Example "Saving current configuration"](#) on page 70.

Manual operation: See ["Save/Recall"](#) on page 13

[:SOURce<hw>]:BB:A3TSc:INPut:STATus?

Queries the ATSC 3.0 coder status.

Return values:

<Status> string

Example: See [Example "Configuring general input signal parameters"](#) on page 72.

Usage: Query only

Manual operation: See ["Status Info"](#) on page 15

5.2 Input signal commands

- [General commands](#).....72
- [PLP info commands](#).....76
- [Test signal commands](#).....78

5.2.1 General commands

Example: Configuring general input signal parameters

```
SOURce1:BB:A3TSc:SOURce EXT
SOURce1:BB:A3TSc:INPut:CCheck ON

//*****
// Incoming MPEG-2, ROUTE/DASH, MMT stream
//*****
SOURce1:BB:A3TSc:INPut:STL:INterface ON
// Input IP content stream for direct single PLP single subframe transmission.

//*****
// Incoming studio transmitter link (STL) stream
//*****
SOURce1:BB:A3TSc:INPut:STL:INterface ON
// Input IP stream for single/multiple PLP single/multiple subframe transmission.
SOURce1:BB:A3TSc:INPut:STL:RESetlog
```

Example: Configuring local LAN parameters

```
//*****
// Check the connection of the R&S SMCV100B in the LAN
//*****
SYSTem:COMMunicate:NETWork:STATus?
// Response: "1"
SYSTem:PROTect1:STATe OFF,123456
```



```

SYSTem:COMMunicate:NETWork:IPADdress:MODE STAT
SYSTem:COMMunicate:NETWork:IPADdress "10.113.0.104"
SYSTem:COMMunicate:NETWork:IPADdress:DNS "10.0.2.166"
SYSTem:COMMunicate:NETWork:COMMon:HOSTname?
// Response: "SMCV100B-102030"
SYSTem:COMMunicate:NETWork:COMMon:WORKgroup "instrument"
SYSTem:COMMunicate:NETWork:COMMon:DOMain "rsint.net"
SYSTem:COMMunicate:NETWork:IPADdress:GATeway "10.113.0.1"
SYSTem:COMMunicate:NETWork:IPADdress:SUBNet:MASK "255.255.252.0"
SYSTem:COMMunicate:NETWork:MACaddress?
// Response: "08 00 27 a3 a1 70"
SYSTem:PROTection1:STATe ON

//*****
// Prepare for IP based MPEG-2, ROUTE/DASH, MMT stream input
//*****
SOURce1:BB:A3TSc:INPut:TYPE?
// Response: "TS"
SOURce1:BB:A3TSc:INPut:TYPE IP
SOURce1:BB:A3TSc:INPut:DESTination:IP:ADDRess"239.255.10.10"
SOURce1:BB:A3TSc:INPut:DESTination:IP:PORT 5001

//*****
// Query incoming stream properties
//*****
SOURce1:BB:A3TSc:INPut:NPLP?
// Response: "1"
SOURce1:BB:A3TSc:INPut:PROTOcol?
// Response: "UDP"
SOURce1:BB:A3TSc:INPut:STATUs?
// Response: "no error"

```

Commands

[:SOURce<hw>]:BB:A3TSc:INPut:CCheck.....	73
[:SOURce<hw>]:BB:A3TSc:INPut:DESTination:IP:ADDRess.....	74
[:SOURce<hw>]:BB:A3TSc:INPut:DESTination:IP:PORT.....	74
[:SOURce<hw>]:BB:A3TSc:INPut:NPLP?.....	74
[:SOURce<hw>]:BB:A3TSc:INPut:PROTOcol?.....	74
[:SOURce<hw>]:BB:A3TSc:INPut:STL:INTerface.....	75
[:SOURce<hw>]:BB:A3TSc:INPut:STL:RESetlog.....	75
[:SOURce<hw>]:BB:A3TSc:INPut:TYPE.....	75
[:SOURce<hw>]:BB:A3TSc:SOURce.....	76

[:SOURce<hw>]:BB:A3TSc:INPut:CCheck <ConfCheck>

Sets the depth of inspection for the conformance check.

Parameters:

<ConfCheck> 1 | ON | 0 | OFF

Example: See [Example"Configuring general input signal parameters"](#) on page 72.

Manual operation: See ["Conformance Check"](#) on page 16

[:SOURCE<hw>]:BB:A3TSc:INPut:DESTination:IP:ADDRESS <DestIPAddress>

Sets the destination IP address of the IP connection for external or internal IP data.

Parameters:

<DestIPAddress> string
 Range: 224.0.0.0 to 239..255.255.255
 *RST: 239..255.10.10

Example: See [Example"Configuring local LAN parameters"](#) on page 72.

Manual operation: See ["Destination IP Address"](#) on page 14

[:SOURCE<hw>]:BB:A3TSc:INPut:DESTination:IP:PORT <DestIPPort>

Sets the destination IP port of the IP connection for external or internal IP data.

Parameters:

<DestIPPort> integer
 Range: 0 to 65535
 *RST: 5001

Example: See [Example"Configuring local LAN parameters"](#) on page 72.

Manual operation: See ["Destination IP Port"](#) on page 14

[:SOURCE<hw>]:BB:A3TSc:INPut:NPLP?

Queries the number of PLPs, that is the total number of the PHY layer configuration.

Return values:

<NumberPLP> integer
 Range: 1 to 64
 *RST: 1

Example: See [Example"Configuring general input signal parameters"](#) on page 72.

Usage: Query only

Manual operation: See ["Number of PLPs"](#) on page 17

[:SOURCE<hw>]:BB:A3TSc:INPut:PROTOcol?

Displays the used protocol.

Return values:

<Protocol> UDP | RTP | AUTO

UDP

Protocol type for IP-based stream ([ROUTE](#), [DASH](#) or [MMT](#)) with deactivated [STL](#) interface.

UDP|RTP

Protocol type for IP-based STL stream with activated STL interface.

AUTO

Protocol type is UDP or UDP/RTP for IP-based transport stream (TSoverIP) with deactivated STL interface.

Example: See [Example"Configuring local LAN parameters"](#) on page 72.

Usage: Query only

Manual operation: See ["Protocol"](#) on page 18

[:SOURCE<hw>]:BB:A3TSc:INPut:STL:INTErface <STLInterface>

Activates the [STL](#) interface.

Parameters:

<STLInterface> 1 | ON | 0 | OFF

Example: See [Example"Configuring general input signal parameters"](#) on page 72.

Manual operation: See ["STL Interface"](#) on page 13

[:SOURCE<hw>]:BB:A3TSc:INPut:STL:RESetlog

Resets the log file.

Parameters:

<ResetLogFile> select

Example: See [Example"Configuring general input signal parameters"](#) on page 72.

Manual operation: See ["Reset Log File"](#) on page 14

[:SOURCE<hw>]:BB:A3TSc:INPut:TYPE <InputType>

Specifies the input type.

Parameters:

<InputType> IP | TS
*RST: TS

Example: See [Example"Configuring local LAN parameters"](#) on page 72.

Manual operation: See ["Input Type"](#) on page 18

[:SOURce<hw>]:BB:A3TSc:SOURce <Source>

Sets the modulation source for the input signal.

Parameters:

<Source> EXTernal | TSPLayer | TESTsignal
*RST: EXTernal

Example: See [Example "Configuring general input signal parameters"](#) on page 72.

Manual operation: See ["Source"](#) on page 17

5.2.2 PLP info commands

Example: Querying PLP input properties

```
SOURce1:BB:A3TSc:SOURce EXT
```

```
//*****
// Incoming IP based ROUTE/DASH or MMT stream
//*****
SOURce1:BB:A3TSc:INPut:TYPE IP
SOURce1:BB:A3TSc:PLP1:ID?
// Response: "0"
SOURce1:BB:A3TSc:PLP1:USEFul:RATE:MAX?
// Response in Bit/s: "19392659"
SOURce1:BB:A3TSc:PLP1:INPut:DATArate?
// Response in Bit/s: "18765432"

//*****
// Incoming IP based MPEG-2 stream (TSoverIP)
//*****
SOURce1:BB:A3TSc:INPut:TYPE TS
SOURce1:BB:A3TSc:PLP1:ID?
// Response: "0"
SOURce1:BB:A3TSc:PLP1:PACKetlength?
// Response: "P188"
SOURce1:BB:A3TSc:PLP1:USEFul:RATE:MAX?
// Response in Bit/s: "19392659"
SOURce1:BB:A3TSc:PLP1:INPut:DATArate?
// Response in Bit/s: "18765432"
```

Commands

[:SOURce<hw>]:BB:A3TSc:PLP<ch>[:INPut]:DATArate?	77
[:SOURce<hw>]:BB:A3TSc:PLP<ch>:PACKetlength?	77
[:SOURce<hw>]:BB:A3TSc:PLP<ch>:USEFul[:RATE]?	77
[:SOURce<hw>]:BB:A3TSc:PLP<ch>:USEFul[:RATE]:MAX?	78

[[:SOURce<hw>]:BB:A3TSc:PLP<ch>][:INPut]:DATarate?

Queries the measured value of the data rate of one of the following:

- External transport stream including null packets input at "LAN" connector (TS-over-IP)
- External IP stream input at "LAN" connector

Return values:

<MeasuredDR> float
 Range: 0 to 999999999
 Increment: 1
 *RST: 0

Example: See [Example"Querying PLP input properties"](#) on page 76.

Usage: Query only

Manual operation: See ["Measured Data Rate / Mbit/s"](#) on page 20

[[:SOURce<hw>]:BB:A3TSc:PLP<ch>]:PACKetlength?

Queries the packet length of the external transport stream in bytes.

Return values:

<PacketLength> P188 | INValid
P188
 188 bytes specified packet length.
INValid
 Packet length does not match the specified length.
 *RST: INValid

Example: See [Example"Querying PLP input properties"](#) on page 76.

Usage: Query only

Manual operation: See ["Packet Length"](#) on page 19

[[:SOURce<hw>]:BB:A3TSc:PLP<ch>]:USEFul[:RATe]?

Queries the computed values of the [PLP](#) data rate.

Return values:

<UsefulDR> float
 Range: 0 to 999999999
 Increment: 1
 *RST: 0

Example: See [Example"Querying PLP input properties"](#) on page 76.

Usage: Query only

Manual operation: See ["Useful Data Rate / Mbit/s"](#) on page 20

[:SOURce<hw>]:BB:A3TSc:PLP<ch>:USEFul[:RATe]:MAX?

Queries the maximum data rate, that is derived from the current modulation parameter settings.

The value is the optimal value at the TSoVerIP or IP input interface, that is necessary for the modulator.

Return values:

<MaxUsefulDR> float
 Range: 0 to 999999999
 Increment: 1
 *RST: 0

Example: See [Example "Querying PLP input properties"](#) on page 76.

Usage: Query only

Manual operation: See ["Max. Useful Data Rate / Mbit/s"](#) on page 20

5.2.3 Test signal commands

Example: Configuring test signal parameters

```
SOURce1:BB:A3TSc:SOURce TEST

//*****
// Set test IP packets as test signal.
//*****
SOURce1:BB:A3TSc:PLP1:INPut:TESTsignal TIPP
SOURce1:BB:A3TSc:IPPacket?
// Response: "HUdp"
//*****
// Set test TS packets as test signal.
//*****
SOURce1:BB:A3TSc:PLP1:INPut:TESTsignal TTSP
SOURce1:BB:A3TSc:TSPacket H184

//*****
// Specify more test signal properties.
//*****
SOURce1:BB:A3TSc:PIDTestpack NULL
SOURce1:BB:A3TSc:PID?
// Response in decimal representation: "8191"
// Response in hexadecimal representation: "1FFF"
SOURce1:BB:A3TSc:PIDTestpack VAR
SOURce1:BB:A3TSc:PID 4607
// Corresponds to "11FF" in hexadecimal representation.
SOURce1:BB:A3TSc:PAYLoad PRBS
SOURce1:BB:A3TSc:PRBS:SEQuence P23_1
```

Commands

[:SOURce<hw>]:BB:A3TSc:PLP:INPut:TESTsignal	79
[:SOURce<hw>]:BB:A3TSc:IPPacket	79
[:SOURce<hw>]:BB:A3TSc:TSPacket	79
[:SOURce<hw>]:BB:A3TSc:PAYLoad	79
[:SOURce<hw>]:BB:A3TSc:PID	80
[:SOURce<hw>]:BB:A3TSc:PIDTestpack	80
[:SOURce<hw>]:BB:A3TSc:PRBS[:SEQuence]	80

[:SOURce<hw>]:BB:A3TSc:PLP:INPut:TESTsignal <TestSignal>

Defines the test signal data.

Parameters:

<TestSignal> TTSP | TIPP
 *RST: TTSP

Example: See [Example"Configuring test signal parameters"](#) on page 78.

Manual operation: See ["Test Signal"](#) on page 18

[:SOURce<hw>]:BB:A3TSc:IPPacket <TestIPPacket>

Specifies the structure of the test IP packet that is fed to the modulator.

Parameters:

<TestIPPacket> HUDP

Example: See [Example"Configuring test signal parameters"](#) on page 78.

Manual operation: See ["Test IP Packet"](#) on page 21

[:SOURce<hw>]:BB:A3TSc:TSPacket <TSPacket>

Specifies the structure of the test transport stream packet that is fed to the modulator.

Parameters:

<TSPacket> S187 | H184
 *RST: H184

Example: See [Example"Configuring test signal parameters"](#) on page 78.

Manual operation: See ["Test TS Packet"](#) on page 21

[:SOURce<hw>]:BB:A3TSc:PAYLoad <Payload>

Defines the payload area content of the TS packet.

Parameters:

<Payload> H00 | HFF | PRBS
 *RST: PRBS

Example: See [Example"Configuring test signal parameters"](#) on page 78.

Manual operation: See ["Payload Test/Stuff"](#) on page 22

[:SOURce<hw>]:BB:A3TSc:PID <PID>

Sets the [PID](#).

Parameters:

<PID> integer
 Range: #H0000 to #H1FFF
 *RST: #H1FFF

Example: See [Example"Configuring test signal parameters"](#) on page 78.

Manual operation: See ["PID \(Hex\)"](#) on page 22

[:SOURce<hw>]:BB:A3TSc:PIDTestpack <PIDTestpacket>

If a header is present in the test packet ("Test TS Packet > Head/184 Payload"), you can specify a fixed or variable packet identifier (PID).

Parameters:

<PIDTestpacket> VARIable | NULL
 *RST: NULL

Example: See [Example"Configuring test signal parameters"](#) on page 78.

Manual operation: See ["PID Test Packet"](#) on page 22

[:SOURce<hw>]:BB:A3TSc:PRBS[:SEQUence] <PRBS>

Sets the length of the PRBS sequence.

You can select a PRBS 15 or a PRBS 23 sequence as specified by [ITU-T O.151](#).

Parameters:

<PRBS> P15_1 | P23_1
 *RST: P23_1

Example: See [Example"Configuring test signal parameters"](#) on page 78.

Manual operation: See ["PRBS"](#) on page 22

5.3 Encapsulation commands

Example: Configuring encapsulation parameters

```
SOURce1:BB:A3TSc:PLP1:ID?
// Response: 0
```



```

SOURCE1:BB:A3TSc:PLP1:ALPType?
// Response: "TS"
// For encapsulation of MPEG-2 transport stream.
// Response: "IP"
// For encapsulation of ROUTE/DAHS or MMT IP stream.
SOURCE1:BB:A3TSc:PLP1:BBFPadding?
// Response: "1"
// Baseband frame padding is enabled for PLP 1.

```

Commands

[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:ALPType?	81
[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:BBFCounter	81
[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:BBFPadding?	81

[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:ALPType?

Queries the input source type of ALP encapsulation.

Return values:

<ALPEncapsType> IP | TS

IP

Query result for IP-based input via

SOURCE1:BB:A3TSc:INPut:TYPe IP

TS

Query result for serial input via

SOURCE1:BB:A3TSc:INPut:TYPe TS

Example: See [Example "Configuring encapsulation parameters"](#) on page 80.

Usage: Query only

Manual operation: See ["ALP Encapsulation Type"](#) on page 24

[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:BBFCounter <BBFrameCounter>

Enables/disables the baseband frame counter.

The counter is initialized to 0 and increments linearly by one for each baseband packet of the current PLP.

Parameters:

<BBFrameCounter> 1 | ON | 0 | OFF

Example: See [Example "Configuring encapsulation parameters"](#) on page 80.

Manual operation: See ["BB Frame Counter"](#) on page 24

[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:BBFPadding?

Queries, if baseband frame padding is enabled/disabled for the current PLP.

Return values:

<BBFramePadding> 1 | ON | 0 | OFF

Example:

See [Example "Configuring encapsulation parameters"](#) on page 80.

Usage:

Query only

Manual operation: See ["BB Frame Padding"](#) on page 24

5.4 BICM commands

The section contains the commands for configuring BICM.

- [General commands](#).....82
- [Interleaving commands](#).....86

5.4.1 General commands

Example: Configuring general BICM parameters

```
//*****
// Set PLP ID for PLP 1.
//*****
SOURCEl:BB:A3TSc:PLP1:ID 1

//*****
// Set coding and constellation for PLP 1.
//*****
SOURCEl:BB:A3TSc:PLP1:FECType B64K
SOURCEl:BB:A3TSc:PLP1:RATE R9_15
SOURCEl:BB:A3TSc:PLP1:CONStel T4096

//*****
// Query properties for PLP 2.
// If STL Interface = Off you can only set/query PLP1 parameters.
// If STL Interface = On you can query parameters of all PLPs, no setting.
//*****
SOURCEl:BB:A3TSc:INPut:STL:INTErface?
// Response: "0"

SOURCEl:BB:A3TSc:PLP2:LLS?
// Response: "ABSent"
SOURCEl:BB:A3TSc:PLP2:LAYer:LAYer?
// Response: "ENHanced"
// Second layer of a 2-layer LDM system
SOURCEl:BB:A3TSc:PLP2:LAYer:LEVel?
// Response: "L40"
// Injection level of 4.0 dB
SOURCEl:BB:A3TSc:PLP2:SIZE?
```

```
// Response: "1314804"
SOURCE1:BB:A3TSc:PLP2:SCRambler?
// Response: "0"
```

Commands

[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:ID	83
[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:CONStel	83
[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:FECType	83
[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:LAYer:LAYer?	84
[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:LAYer:LEVel?	84
[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:LLS?	85
[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:RATE	85
[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:SCRambler?	85
[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:SIZE?	85

[\[:SOURCE<hw>\]:BB:A3TSc:PLP<ch>:ID](#) <PLPID>

Sets the PLP ID. The PLP ID has to be unique.

Parameters:

<PLPID> integer
 Range: 0 to 63
 *RST: 0

Example: See [Example"Configuring general BICM parameters"](#) on page 82.

Manual operation: See ["PLP ID"](#) on page 19

[\[:SOURCE<hw>\]:BB:A3TSc:PLP<ch>:CONStel](#) <Constellation>

Defines the constellation.

Parameters:

<Constellation> T4 | T16 | T64 | T256 | T1024 | T4096
 T4
 QPSK
 T16|T64|T256|T1024|T4096
 16/64/256/1024/4096QAM

Example: See [Example"Configuring general BICM parameters"](#) on page 82.

Manual operation: See ["Constellation"](#) on page 27

[\[:SOURCE<hw>\]:BB:A3TSc:PLP<ch>:FECType](#) <FECType>

Defines the forward error correction (FEC) used for encoding.

The table below illustrates types and coding.

<FEC Type>	Outer code	Inner code
B16K	BCH	16200 bits LDPC
B64K	BCH	64800 bits LDPC
C16K	CRC	16200 bits LDPC
C64K	CRC	64800 bits LDPC
O16K	None	16200 bits LDPC
O64K	None	64800 bits LDPC

Parameters:

<FECType> B16K | B64K | C16K | C64K | O16K | O64K

Example: See [Example"Configuring general BICM parameters"](#) on page 82.

Manual operation: See ["FEC Type"](#) on page 27

[<SOURce<hw>]:BB:A3TSc:PLP<ch>:LAYer:LAYer?

Queries the layer, that is used in LDM.

Return values:

<Layer> ENHanced | CORE

Example: See [Example"Configuring general BICM parameters"](#) on page 82.

Usage: Query only

Manual operation: See ["Layer"](#) on page 26

[<SOURce<hw>]:BB:A3TSc:PLP<ch>:LAYer:LEVel?

Queries the enhanced layer injection levels relative to the core PLP in dB.

Return values:

<LDMInjLevel> L00 | L05 | L10 | L15 | L20 | L25 | L30 | L35 | L40 | L45 | L50 | L60 | L70 | L80 | L90 | L100 | L110 | L120 | L130 | L140 | L150 | L160 | L170 | L180 | L190 | L200 | L210 | L220 | L230 | L240 | L250

Level L<x> with <x>/10 meaning the level in dB

Example: L40 means 4.0 dB

Example: See [Example"Configuring general BICM parameters"](#) on page 82.

Usage: Query only

Manual operation: See ["LDM Injection Level"](#) on page 26

[:SOURce<hw>]:BB:A3TSc:PLP<ch>:LLS?

Displays, if low-level signaling is present in the [PLP](#).

Return values:

<LowLevelSignal> ABSent | PRESent

Example: See [Example "Configuring general BICM parameters"](#) on page 82.

Usage: Query only

Manual operation: See ["Low Level Signaling \(LLS\)"](#) on page 26

[:SOURce<hw>]:BB:A3TSc:PLP<ch>:RATE <CodeRate>

Sets the code rate.

Parameters:

<CodeRate> R2_15 | R3_15 | R4_15 | R5_15 | R6_15 | R7_15 | R8_15 |
R9_15 | R10_15 | R11_15 | R12_15 | R13_15

Example: See [Example "Configuring general BICM parameters"](#) on page 82.

Manual operation: See ["Code Rate"](#) on page 27

[:SOURce<hw>]:BB:A3TSc:PLP<ch>:SCRambler?

Queries the scrambler type, that is fixed to "0". The entire baseband packet is scrambled before forward error correction encoding.

Return values:

<ScramblerType> integer
Range: 0 to 3
*RST: 0

Example: See [Example "Configuring general BICM parameters"](#) on page 82.

Usage: Query only

Manual operation: See ["Scrambler Type"](#) on page 26

[:SOURce<hw>]:BB:A3TSc:PLP<ch>:SIZE?

Queries the number of data cells allocated to the PLP.

Return values:

<Size> integer
Range: 0 to 16777215
*RST: 0

Usage: Query only

Manual operation: See "Size" on page 26

5.4.2 Interleaving commands

Example: Configure interleaving parameters

```
//*****
// Non-dispersed PLPs
//*****
SOURCE1:BB:A3TSc:PLP1:TYPE:TYPE?
// Response: "NONDispersed"

//*****
// Dispersed PLPs
//*****
SOURCE1:BB:A3TSc:PLP1:TYPE:TYPE?
// Response: "DISPersed"
SOURCE1:BB:A3TSc:PLP1:TYPE:NSUBSlices?
// Response: "53"
SOURCE1:BB:A3TSc:PLP1:TYPE:SUBSslice:INTerval?
// Response: "25151"

//*****
// Time Interleaver = OFF setting
//*****
SOURCE1:BB:A3TSc:PLP1:TIL:TIL OFF
// Sets time interleaver off.

//*****
// Time Interleaver = CTI setting
//*****
SOURCE1:BB:A3TSc:PLP1:TIL:TIL CTI
// Sets a convolutional time interleaver.
SOURCE1:BB:A3TSc:PLP1:CONStellation?
// Response: "T4"
// T4 means QPSK. For this constellation, you can enable extended interleaving:
SOURCE1:BB:A3TSc:PLP1:TIL:EXTended ON
// Extended interleaving allows for increased interleaving depth:
SOURCE1:BB:A3TSc:PLP1:TIL:DEPTh?
// Response: "D1448"

//*****
// Time Interleaver = HTI setting
//*****
SOURCE1:BB:A3TSc:PLP1:TIL:TIL HTI
// Sets a hybrid time interleaver.
SOURCE1:BB:A3TSc:PLP1:TIL:INTer?
// Response: "0"
// Each interleaving frame is mapped directly to one subframe.
SOURCE1:BB:A3TSc:PLP1:TIL:NTIBlocks 16
```

```
// Sets 16 time interleaver blocks.
SOURCE1:BB:A3TSc:PLP1:TIL:MAXBlocks?
// Response: "42"
SOURCE1:BB:A3TSc:PLP1:TIL:BLOCks?
// Response: "42"
SOURCE1:BB:A3TSc:PLP1:TIL:CIL ON
```

Commands

<code>[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:TYPE:TYPE</code>	87
<code>[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:TYPE:NSUBSlices</code>	87
<code>[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:TYPE:SUBSLICE[:INTERVAL]</code>	87
<code>[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:TIL:TIL</code>	88
<code>[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:TIL:NTIBlocks</code>	88
<code>[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:TIL:DEPTH</code>	88
<code>[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:TIL:EXTENDED</code>	89
<code>[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:TIL:INTER?</code>	89
<code>[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:TIL:BLOCks?</code>	89
<code>[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:TIL:MAXBlocks?</code>	89
<code>[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:TIL:CIL</code>	90

`[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:TYPE:TYPE <Type>`

Defines the **PLP** type if the PLP is not an **LDM** enhanced layer.

Parameters:

<Type> DISPersed | NONDispersed

Example: See [Example"Configure interleaving parameters"](#) on page 86.

Manual operation: See ["Type"](#) on page 28

`[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:TYPE:NSUBSlices <NumberSubslices>`

Defines the number of subslices for a dispersed PLP.

Parameters:

<NumberSubslices> integer

Range: 1 to 16384

*RST: 2

Example: See [Example"Configure interleaving parameters"](#) on page 86.

Manual operation: See ["Number of Subslices"](#) on page 28

`[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:TYPE:SUBSLICE[:INTERVAL] <SubsliceInterva>`

Defines the difference between the lowest data cell index allocated to a subslice and the highest data cell index allocated to the immediately preceding subslice within a dispersed PLP.

Parameters:

<SubsliceInterva> integer
 Range: 0 to 16777215
 *RST: 1

Example: See [Example"Configure interleaving parameters"](#) on page 86.

Manual operation: See ["Subslice Interval"](#) on page 29

[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:TIL:TIL <TimeInterMode>

Sets the time interleaver mode.

Parameters:

<TimeInterMode> OFF | CTI | HTI
 *RST: CTI

Example: See [Example"Configure interleaving parameters"](#) on page 86.

Manual operation: See ["Time Interleaver Mode"](#) on page 29

[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:TIL:NTIBlocks <NumberTIBlocks>

Defines the number of time interleaver blocks or the number of subframes.

The behavior depends on the setting of [\[:SOURCE<hw>\]:BB:A3TSc:PLP<ch>:TIL:INTER?](#) on page 89:

- If enabled, defines the number of subframes over which cells from one time interleaver (TI) block are carried.
- If disabled, defines the number of time interleaver blocks.

Parameters:

<NumberTIBlocks> integer
 Range: 1 to 16
 *RST: 1

Example: See [Example"Configure interleaving parameters"](#) on page 86.

Manual operation: See ["Number of TI Blocks"](#) on page 30

[:SOURCE<hw>]:BB:A3TSc:PLP<ch>:TIL:DEPTH <Depth>

Defines the time interleaving depths.

Parameters:

<Depth> D512 | D724 | D887 | D1024 | D1254 | D1448
D1448|D1254
 Require extended interleaving, e.g. for PLP 1:
 SOURCE1:BB:A3TSc:PLP1:TIL:EXTENDED ON
 *RST: D1024

Example: See [Example"Configure interleaving parameters"](#) on page 86.

Manual operation: See ["Depth"](#) on page 29

[:SOURce<hw>]:BB:A3TSc:PLP<ch>:TIL:EXTended <ExtendedInter>

If enabled, increases the time interleaving depth.

Parameters:

<ExtendedInter> 1 | ON | 0 | OFF

Example: See [Example"Configure interleaving parameters"](#) on page 86.

Manual operation: See ["Extended Interleaving"](#) on page 29

[:SOURce<hw>]:BB:A3TSc:PLP<ch>:TIL:INTer?

Defines the interleaving frame content and mapping.

Return values:

<InterSubframe> 1 | ON | 0 | OFF

ON

Each interleaving frame contains one time interleaver block and is mapped to multiple subframes.

OFF

Each interleaving frame is mapped directly to one subframe, and the interleaving frame is composed of one or more time interleaver blocks.

Example: See [Example"Configure interleaving parameters"](#) on page 86.

Usage: Query only

Manual operation: See ["Inter Subframe"](#) on page 29

[:SOURce<hw>]:BB:A3TSc:PLP<ch>:TIL:BLOCKs?

Queries the number of [FEC](#) blocks contained in the current interleaving frame.

Return values:

<NumberFECBlocks> string

Example: See [Example"Configure interleaving parameters"](#) on page 86.

Usage: Query only

Manual operation: See ["Number of FEC Blocks"](#) on page 30

[:SOURce<hw>]:BB:A3TSc:PLP<ch>:TIL:MAXBlocks?

Queries the maximum number of [FEC](#) blocks per interleaving frame.

Return values:

<FECBlocksMax> integer
 Range: 1 to 4096
 *RST: 1

Example: See [Example"Configure interleaving parameters"](#) on page 86.

Usage: Query only

Manual operation: See ["Max. Number of FEC Blocks"](#) on page 30

[:SOURce<hw>]:BB:A3TSc:PLP<ch>:TIL:CIL <CellInterleaver>

Enables or disables the interleaver operating at the cell level.

Parameters:

<CellInterleaver> 1 | ON | 0 | OFF

Example: See [Example"Configure interleaving parameters"](#) on page 86.

Manual operation: See ["Cell Interleaver"](#) on page 30

5.5 OFDM and subframe commands

The section contains the commands for configuring [OFDM](#) symbols and subframing.

- [General commands](#).....90
- [Symbol commands](#).....93
- [Subframe info commands](#).....95

5.5.1 General commands

Example: Configuring general OFDM and subframing parameters

```
SOURce1:BB:A3TSc:FRAMe:NSUBframes?
// Response: "8"
// The frame consists of 8 subframes.

SOURce1:BB:A3TSc:CHANnel:BANDwidth BW_7
// Query the used bandwidth in MHz.
SOURce1:BB:A3TSc:SUBFrame1:USED:BANDwidth?
// Response: "6804246.1"
SOURce1:BB:A3TSc:SUBFrame1:MIMO?
// Response: "OFF"
SOURce1:BB:A3TSc:SUBFrame1:MISO C256
SOURce1:BB:A3TSc:SUBFrame1:FFT:MODE M8K
SOURce1:BB:A3TSc:SUBFrame1:GUARd:INTerval G192
SOURce1:BB:A3TSc:SUBFrame1:NDATa 72
```

Commands

[:SOURce<hw>]:BB:A3TSc:CHANnel[:BANDwidth]	91
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:CARRier:MODE	91
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:FFT:MODE	91
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:GUARd:INTerval	91
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:MIMO?	92
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:MISO	92
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:NDATa	92

[\[:SOURce<hw>\]:BB:A3TSc:CHANnel\[:BANDwidth\]](#) <ChannelBW>

Selects the channel bandwidth.

Parameters:

<ChannelBW> BW_6 | BW_7 | BW_8
 *RST: BW_6

Example: See [Example"Configuring general OFDM and subframing parameters"](#) on page 90.

Manual operation: See ["Channel Bandwidth"](#) on page 32

[\[:SOURce<hw>\]:BB:A3TSc:SUBFrame<ch>:CARRier:MODE](#) <RedCarrierMode>

Sets a coefficient for reducing the maximum number of carriers.

Parameters:

<RedCarrierMode> integer
 Range: 0 to 4
 *RST: 0

Example: See [Example"Configuring general OFDM and subframing parameters"](#) on page 90.

Manual operation: See ["Reduced Carrier Mode"](#) on page 34

[\[:SOURce<hw>\]:BB:A3TSc:SUBFrame<ch>:FFT:MODE](#) <FFTMode>

Defines the FFT size.

Parameters:

<FFTMode> M16K | M8K | M32K | M8K | M16K | M32K
 *RST: M8K

Example: See [Example"Configuring general OFDM and subframing parameters"](#) on page 90.

Manual operation: See ["FFT Size"](#) on page 33

[\[:SOURce<hw>\]:BB:A3TSc:SUBFrame<ch>:GUARd:INTerval](#) <GuardInterval>

Sets the guard interval length.

Parameters:

<GuardInterval> G192 | G384 | G512 | G768 | G1024 | G1536 | G2048 | G2432 | G3072 | G3648 | G4096 | G4864
 *RST: G192

Example:

See [Example"Configuring general OFDM and subframing parameters"](#) on page 90.

Manual operation: See ["Guard Interval"](#) on page 34

[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:MIMO?

Displays whether multiple inputs and multiple outputs (MIMO) are used.

Return values:

<MIMO> OFF | ON | 1 | 0 | 0 | 1 | OFF | ON

Example:

See [Example"Configuring general OFDM and subframing parameters"](#) on page 90.

Usage:

Query only

Manual operation: See ["MIMO"](#) on page 33

[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:MISO <MISO>

Defines the multiple inputs and single output (MISO) option.

Parameters:

<MISO> OFF | C64 | C256

Example:

See [Example"Configuring general OFDM and subframing parameters"](#) on page 90.

Manual operation: See ["MISO"](#) on page 33

[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:NDATA <TotNumData>

Sets the number of data symbols per subframe, including the subframe boundary symbols, excluding the preamble OFDM symbols.

Parameters:

<TotNumData> integer
 Range: 1 to 2048
 *RST: 72

Example:

See [Example"Configuring general OFDM and subframing parameters"](#) on page 90.

Manual operation: See ["Total Number of Data OFDM Symbols"](#) on page 34

5.5.2 Symbol commands

Example: Configuring OFDM symbol parameters per subframe

```
SOURce1:BB:A3TSc:SUBFrame1:GUARd:INTerval G192

SOURce1:BB:A3TSc:SUBFrame1:PILOt:SISO SP32_2
SOURce1:BB:A3TSc:SUBFrame1:PILOt:BOOSt 4
SOURce1:BB:A3TSc:SUBFrame1:SBS:FIRSt 1
SOURce1:BB:A3TSc:SUBFrame1:SBS:LAST?
// Response: "1"
SOURce1:BB:A3TSc:SUBFrame1:SBS:NULL?
// Response: "633"
SOURce1:BB:A3TSc:SUBFrame1:FIL ON
```

Commands

[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:PILOt:SISO	93
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:PILOt:BOOSt	93
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:FIL	94
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:SBS:FIRSt	94
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:SBS:LAST?	94
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:SBS:NULL?	94

[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:PILOt:SISO <SISPPilotPat>

Sets the scattered pilot pattern for single input and single output (SISO).

Parameters:

```
<SISPPilotPat> SP32_4 | SP32_2 | SP24_4 | SP16_4 | SP3_2 | SP3_4 |
SP4_2 | SP4_4 | SP6_2 | SP6_4 | SP8_2 | SP8_4 | SP12_2 |
SP12_4 | SP16_2 | SP24_2 | SP3_2 | SP3_4 | SP4_2 | SP4_4 |
SP6_2 | SP6_4 | SP8_2 | SP8_4 | SP12_2 | SP12_4 | SP16_2 |
SP16_4 | SP24_2 | SP24_4 | SP32_2 | SP32_4
*RST: SP32_2
```

Example: See [Example "Configuring OFDM symbol parameters per sub-frame"](#) on page 93.

Manual operation: See ["SISO Pilot Pattern"](#) on page 35

[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:PILOt:BOOSt <PilotBoostMode>

Sets the power boost mode for the scattered pilots.

Parameters:

```
<PilotBoostMode> integer
Range: 0 to 4
*RST: 4
```

Example: See [Example "Configuring OFDM symbol parameters per sub-frame"](#) on page 93.

Manual operation: See ["Pilot Boost Mode"](#) on page 35

[:SOURCE<hw>]:BB:A3TSc:SUBFrame<ch>:FIL <FreqInterleaver>

Enables/disables the frequency interleaver.

Parameters:

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

Example: See [Example"Configuring OFDM symbol parameters per sub-frame"](#) on page 93.

Manual operation: See ["Frequency Interleaver"](#) on page 36

[:SOURCE<hw>]:BB:A3TSc:SUBFrame<ch>:SBS:FIRSt <SubfrFirst>

Defines whether the first symbol of a subframe is a subframe boundary symbol.

Parameters:

<SubfrFirst> integer
Range: 0 to 1
*RST: 0

Example: See [Example"Configuring OFDM symbol parameters per sub-frame"](#) on page 93.

Manual operation: See ["Subframe Boundary Symbol \(First\)"](#) on page 35

[:SOURCE<hw>]:BB:A3TSc:SUBFrame<ch>:SBS:LAST?

Queries whether the last symbol of a subframe is a subframe boundary symbol.

Return values:

<SubfrLast> integer
Range: 0 to 1
*RST: 0

Example: See [Example"Configuring OFDM symbol parameters per sub-frame"](#) on page 93.

Usage: Query only

Manual operation: See ["Subframe Boundary Symbol \(Last\)"](#) on page 36

[:SOURCE<hw>]:BB:A3TSc:SUBFrame<ch>:SBS:NULL?

Queries the number of null cells in the subframe boundary symbols.

Return values:

<SubfrNullCells> integer
 Range: 0 to 8191
 *RST: 0

Example: See [Example "Configuring OFDM symbol parameters per sub-frame"](#) on page 93.

Usage: Query only

Manual operation: See ["Subframe Boundary Symbol \(Null Cells\)"](#) on page 36

5.5.3 Subframe info commands

Example: Querying subframe information

```
// Query the subframe length in ms.
SOURCE1:BB:A3TSc:SUBFrame1:DURation?
// Response: "0.282666666666667"

// Query the used bandwidth of the subframe in MHz.
SOURCE1:BB:A3TSc:SUBFrame1:USED:BANDwidth?
// Response: "5.832421"
SOURCE1:BB:A3TSc:SUBFrame1:PLP:NPLP?
// Response: "2"
SOURCE1:BB:A3TSc:SUBFrame1:PLP:NIDPlp?
// Response: "0,1"
// PLPs with IDs 0 to 1 are mapped to subframe 1.
```

Commands

[:SOURCE<hw>]:BB:A3TSc:SUBFrame<ch>:DURation?	95
[:SOURCE<hw>]:BB:A3TSc:SUBFrame<ch>:USED[:BANDwidth]?	96
[:SOURCE<hw>]:BB:A3TSc:SUBFrame<ch>:PLP:NPLP?	96
[:SOURCE<hw>]:BB:A3TSc:SUBFrame<ch>:PLP:NIDPlp?	96

[:SOURCE<hw>]:BB:A3TSc:SUBFrame<ch>:DURation?

Queries the duration of the subframe.

Return values:

<Duration> float
 Range: 0 to 9999.999
 Increment: 0.001
 *RST: 0

Example: See [Example "Querying subframe information"](#) on page 95.

Usage: Query only

Manual operation: See ["Duration"](#) on page 37

[:SOURCE<hw>]:BB:A3TSc:SUBFrame<ch>:USED[:BANDwidth]?

Queries the used bandwidth per subframe.

Return values:

<UsedBW> integer
 Range: 0 to 9.9999999
 *RST: 0

Example: See [Example"Querying subframe information"](#) on page 95.

Usage: Query only

Manual operation: See ["Used Bandwidth"](#) on page 37

[:SOURCE<hw>]:BB:A3TSc:SUBFrame<ch>:PLP:NPLP?

Queries the number of PLPs in the subframe.

Return values:

<NumPLPsSubfr> integer
 Range: 1 to 64
 *RST: 1

Example: See [Example"Querying subframe information"](#) on page 95.

Usage: Query only

Manual operation: See ["Number of PLPs in Subframe"](#) on page 37

[:SOURCE<hw>]:BB:A3TSc:SUBFrame<ch>:PLP:NIDPlp?

Queries all IDs of the PLPs mapped to the subframe.

Return values:

<PLPIDsSubfr> string

Example: See [Example"Querying subframe information"](#) on page 95.

Usage: Query only

Manual operation: See ["PLP IDs in Subframe"](#) on page 37

5.6 System commands

The section contains the commands for configuring the ATSC 3.0 system.

- [Network commands](#)..... 97
- [Frame commands](#)..... 100
- [L1 commands](#)..... 103

5.6.1 Network commands

Example: Configuring network parameters

```
//*****
// Configure multi frequency network properties.
//*****
SOURCE1:BB:A3TSc:NETWorkmode MFN

SOURCE1:BB:A3TSc:TIME MSEC
SOURCE1:BB:A3TSc:LLS?
// Response: "ABSent"
SOURCE1:BB:A3TSc:RETurn:CHANnel?
// Response: "ABSent"
SOURCE1:BB:A3TSc:MISO:NTX 4
SOURCE1:BB:A3TSc:MISO:IDX 4
SOURCE1:BB:A3TSc:TXId:MODE MAN
SOURCE1:BB:A3TSc:TXId:ADDRess 8191
SOURCE1:BB:A3TSc:TXId:LEVel L450
SOURCE1:BB:A3TSc:L:DETail:VERSion?
// Response: "0"
SOURCE1:BB:A3TSc:L:DETail:VERSion 1
// You can set the broadcast stream ID.
SOURCE1:BB:A3TSc:BSID 1234

//*****
// Configure single frequency network (SFN) properties.
//*****
SOURCE1:BB:A3TSc:INPut:STL:INTerface ON
// SFN is only possible in STL operation mode.
SOURCE1:BB:A3TSc:NETWorkmode SFN

SOURCE1:BB:A3TSc:TIME?
// Response: "OFF"
SOURCE1:BB:A3TSc:LLS?
// Response: "ABSent"
SOURCE1:BB:A3TSc:RETurn:CHANnel?
// Response: "ABSent"
SOURCE1:BB:A3TSc:MISO:NTX 4
SOURCE1:BB:A3TSc:MISO:IDX 4
SOURCE1:BB:A3TSc:TXId:MODE MAN
SOURCE1:BB:A3TSc:TXId:ADDRess 8191
SOURCE1:BB:A3TSc:TXId:LEVel L450
```

For single frequency network delays and mode commands, see [Chapter 5.8, "SFN delay commands"](#), on page 112.

Commands

<code>[:SOURce<hw>]:BB:A3TSc:NETWorkmode</code>	98
<code>[:SOURce<hw>]:BB:A3TSc:BSID</code>	98
<code>[:SOURce<hw>]:BB:A3TSc:LLS?</code>	98
<code>[:SOURce<hw>]:BB:A3TSc:MISo:NTX</code>	98
<code>[:SOURce<hw>]:BB:A3TSc:MISo:IDX</code>	99
<code>[:SOURce<hw>]:BB:A3TSc:RETurn[:CHANnel]?</code>	99
<code>[:SOURce<hw>]:BB:A3TSc:TIME</code>	99
<code>[:SOURce<hw>]:BB:A3TSc:TXId:MODE</code>	99
<code>[:SOURce<hw>]:BB:A3TSc:TXId:ADDResS</code>	100
<code>[:SOURce<hw>]:BB:A3TSc:TXId:LEVel</code>	100

`[:SOURce<hw>]:BB:A3TSc:NETWorkmode <NetworkMode>`

Sets the network mode.

Parameters:

<NetworkMode> MFN | SFN

Example: See [Example "Configuring network parameters"](#) on page 97.

Manual operation: See ["Network Mode"](#) on page 39

`[:SOURce<hw>]:BB:A3TSc:BSID <BroadcastStrID>`

Sets the ID of the broadcast stream.

Parameters:

<BroadcastStrID> integer
 Range: 0 to 65535
 *RST: 0

Example: See [Example "Configuring network parameters"](#) on page 97.

Manual operation: See ["Broadcast Stream ID \(BSID\)"](#) on page 41

`[:SOURce<hw>]:BB:A3TSc:LLS?`

Queries, if low-level signaling is present or absent.

Return values:

<LowLevelSign> ABSent | PRESent

Example: See [Example "Configuring network parameters"](#) on page 97.

Usage: Query only

Manual operation: See ["Low Level Signaling \(LLS\)"](#) on page 40

`[:SOURce<hw>]:BB:A3TSc:MISo:NTX <NumTransmitters>`

Sets the number of transmitters for MISO transmission.

Parameters:

<NumTransmitters> integer
 Range: 2 to 4
 *RST: 2

Example: See [Example"Configuring network parameters"](#) on page 97.

Manual operation: See ["Number of Transmitters \(N_TX\)"](#) on page 41

[:SOURce<hw>]:BB:A3TSc:MISo:IDX <TransmitterIdx>

Sets the transmitter index for MISO transmission.

Parameters:

<TransmitterIdx> integer
 Range: 1 to 4
 *RST: 1

Example: See [Example"Configuring network parameters"](#) on page 97.

Manual operation: See ["Transmitter Index \(x\)"](#) on page 41

[:SOURce<hw>]:BB:A3TSc:RETurn[:CHANnel]?

Queries, if a dedicated return channel (DRC) is present or absent.

Return values:

<ReturnChannel> ABSent | PRESent

Example: See [Example"Configuring network parameters"](#) on page 97.

Usage: Query only

Manual operation: See ["Return Channel"](#) on page 40

[:SOURce<hw>]:BB:A3TSc:TIME <TimeInfo>

Configures the time information.

Parameters:

<TimeInfo> MSEC | USEC | NSEC | OFF
 *RST: OFF

Example: See [Example"Configuring network parameters"](#) on page 97.

Manual operation: See ["Time Info"](#) on page 40

[:SOURce<hw>]:BB:A3TSc:TXId:MODE <TxIDMode>

Sets the Tx ID mode.

The mode affects the setting of the "TxID Address" and "TxID Injection Level".

Parameters:

<TxIDMode> MANual | AUTo | OFF
 *RST: OFF

Example: See [Example"Configuring network parameters"](#) on page 97.

Manual operation: See ["TxID Mode"](#) on page 41

[:SOURce<hw>]:BB:A3TSc:TXId:ADDRess <TxIDAddress>

Sets the transmitter identification address.

Parameters:

<TxIDAddress> integer
 Range: 0 to 8191
 *RST: 0

Example: See [Example"Configuring network parameters"](#) on page 97.

Manual operation: See ["TxID Address"](#) on page 41

[:SOURce<hw>]:BB:A3TSc:TXId:LEVel <TxIDInjLevel>

Sets the injection levels for injecting a TxID signal into the host preamble.

Parameters:

<TxIDInjLevel> OFF | L450 | L420 | L390 | L360 | L330 | L300 | L270 | L240 |
 L210 | L180 | L150 | L120 | L90
 Level L<x> with <x> meaning the level in dB
 *RST: OFF

Example: L270 means 27.0 dB

Example: See [Example"Configuring network parameters"](#) on page 97.

Manual operation: See ["TxID Injection Level"](#) on page 41

5.6.2 Frame commands

Example: Configuring frame parameters

```
SOURce1:BB:A3TSc:FRAMe:NSUBframes?
// Response: "1"
// 1 subframe per frame

SOURce1:BB:A3TSc:PAPR TR
SOURce1:BB:A3TSc:FRAMe:MODE SYMB
SOURce1:BB:A3TSc:FRAMe:TIME:OFFset?
// Response: "4608"
SOURce1:BB:A3TSc:FRAMe:ADDITIONal:SAMPles?
// Response: "0"
```

```

SOURCE1:BB:A3TSc:FRAME:MODE TIME
// Set the frame length in ms.
SOURCE1:BB:A3TSc:FRAME:LENGTh 150
SOURCE1:BB:A3TSc:FRAME:EXSYmbol?
// Response: "4736"
SOURCE1:BB:A3TSc:FRAME:EXFInal?
// Response: "0"

```

Commands

[:SOURCE<hw>]:BB:A3TSc:PAPR.....	101
[:SOURCE<hw>]:BB:A3TSc:FRAME:NSUBframes?.....	101
[:SOURCE<hw>]:BB:A3TSc:FRAME:MODE.....	101
[:SOURCE<hw>]:BB:A3TSc:FRAME:LENGTh.....	102
[:SOURCE<hw>]:BB:A3TSc:FRAME:EXSYmbol?.....	102
[:SOURCE<hw>]:BB:A3TSc:FRAME:EXFInal?.....	102
[:SOURCE<hw>]:BB:A3TSc:FRAME:TIME[:OFFSet]?.....	103
[:SOURCE<hw>]:BB:A3TSc:FRAME:ADDItional[:SAMPles]?.....	103

[:SOURCE<hw>]:BB:A3TSc:PAPR <PAPR>

Sets the technique to reduce the peak to average power ratio.

Parameters:

<PAPR> OFF | TR

Example: See [Example"Configuring frame parameters"](#) on page 100.

Manual operation: See ["Peak To Average Power Ratio"](#) on page 42

[:SOURCE<hw>]:BB:A3TSc:FRAME:NSUBframes?

Queries the number of subframes.

Return values:

<NumSubframes> integer
 Range: 1 to 256
 *RST: 1

Example: See:
 [Example"Configuring general OFDM and subframing parameters"](#) on page 90
 [Example"Configuring frame parameters"](#) on page 100

Usage: Query only

Manual operation: See ["Number of Subframes"](#) on page 32

[:SOURCE<hw>]:BB:A3TSc:FRAME:MODE <FrameMode>

Sets how the frame length is aligned.

Parameters:

<FrameMode> TIME | SYMBol
 *RST: SYMBol

Example: See [Example"Configuring frame parameters"](#) on page 100.

Manual operation: See ["Frame Mode"](#) on page 43

[:SOURce<hw>]:BB:A3TSc:FRAME:LENGth <FrameLength>

Sets the time period measured from the beginning of the first sample of the bootstrap to the end of the final sample of the frame.

Parameters:

<FrameLength> integer
 Range: 50 to 5000
 Increment: 5
 *RST: 50

Example: See [Example"Configuring frame parameters"](#) on page 100.

Manual operation: See ["Frame Length"](#) on page 43

[:SOURce<hw>]:BB:A3TSc:FRAME:EXSYmbol?

Queries the additional number of excess samples included in the guard interval of each non-preamble [OFDM](#) symbol of the post-bootstrap portion.

Return values:

<ExcessSymbol> integer
 Range: 0 to 8191
 *RST: 0

Example: See [Example"Configuring frame parameters"](#) on page 100.

Usage: Query only

Manual operation: See ["Excess Samples per Symbol"](#) on page 43

[:SOURce<hw>]:BB:A3TSc:FRAME:EXFinal?

Queries the excess samples that are inserted immediately following the final OFDM symbol of the final subframe.

Return values:

<FinalExcSamples> integer
 Range: 0 to 32767
 *RST: 0

Example: See [Example"Configuring frame parameters"](#) on page 100.

Usage: Query only

Manual operation: See ["Final Excess Samples"](#) on page 43

[:SOURce<hw>]:BB:A3TSc:FRAME:TIME[:OFFSet]?

Queries the number of sample periods between the nearest preceding or coincident millisecond boundary and the leading edge of the frame.

Return values:

<TimeOffset> integer
 Range: 0 to 65535
 *RST: 0

Example: See [Example "Configuring frame parameters"](#) on page 100.

Usage: Query only

Manual operation: See ["Time Offset"](#) on page 43

[:SOURce<hw>]:BB:A3TSc:FRAME:ADDITIONal[:SAMPles]?

Queries the number of additional samples added at the end of a frame to facilitate sampling clock alignment.

Return values:

<AddSamples> integer
 Range: 0 to 127
 *RST: 0

Example: See [Example "Configuring frame parameters"](#) on page 100.

Usage: Query only

Manual operation: See ["Additional Samples"](#) on page 43

5.6.3 L1 commands

Example: Configuring L1 parameters

```
// Editing some L1 parameters requires disabling STL interface.
SOURce1:BB:A3TSc:INPut:STL:INTerface 0

SOURce1:BB:A3TSc:L:BASic:VERSion?
// Response: "0"
SOURce1:BB:A3TSc:L:NPReamble:SYMBOLs?
// Response: "1"
SOURce1:BB:A3TSc:L:BASic:FECType MOD1
SOURce1:BB:A3TSc:L:CARRier:MODE 0
SOURce1:BB:A3TSc:L:PILot:DX D16
SOURce1:BB:A3TSc:L:DETail:VERSion 0
SOURce1:BB:A3TSc:L:DETail:FECType MOD1
SOURce1:BB:A3TSc:L:DETail:ADDITIONal:PARity?
// Response: "OFF"
SOURce1:BB:A3TSc:NRF?
// Response: "0"
```

Commands

[:SOURCE<hw>]:BB:A3TSc:L:BASic:FECType	104
[:SOURCE<hw>]:BB:A3TSc:L:BASic:VERSion?	104
[:SOURCE<hw>]:BB:A3TSc:L:CARRier:MODE	104
[:SOURCE<hw>]:BB:A3TSc:L:DETail:ADDITIONal[:PARity]?	105
[:SOURCE<hw>]:BB:A3TSc:L:DETail:FECType	105
[:SOURCE<hw>]:BB:A3TSc:L:DETail:VERSion	105
[:SOURCE<hw>]:BB:A3TSc:L:NPReamble[:SYMBOLs]?	105
[:SOURCE<hw>]:BB:A3TSc:L:PILot:DX	106
[:SOURCE<hw>]:BB:A3TSc:NRF?	106

[\[:SOURCE<hw>\]:BB:A3TSc:L:BASic:FECType <L1BasicFECType>](#)

Defines the protection level of L1 basic signaling.

Parameters:

<L1BasicFECType> MOD1 | MOD2 | MOD3 | MOD4 | MOD5
*RST: MOD1

Example: See [Example"Configuring L1 parameters"](#) on page 103.

Manual operation: See ["L1 Basic FEC Type"](#) on page 44

[\[:SOURCE<hw>\]:BB:A3TSc:L:BASic:VERSion?](#)

Queries the version of the L1 basic signaling structure that is used for the current frame.

Return values:

<L1BasicVersion> integer
Range: 0 to 7
*RST: 0

Example: See [Example"Configuring L1 parameters"](#) on page 103.

Usage: Query only

Manual operation: See ["L1 Basic Version"](#) on page 44

[\[:SOURCE<hw>\]:BB:A3TSc:L:CARRier:MODE <RedCarrModePre>](#)

Sets a coefficient for reducing the maximum number of carriers.

Parameters:

<RedCarrModePre> integer
Range: 0 to 4
*RST: 0

Example: See [Example"Configuring L1 parameters"](#) on page 103.

Manual operation: See ["Reduced Carrier Mode Preamble"](#) on page 45

[[:SOURCE<hw>]:BB:A3TSc:L:DETail:ADDITIONal[:PARity]]?

Queries the L1 detail additional parity mode, that is disabled by default.

Return values:

<L1DetailAddPar> OFF | K1 | K2

Example: See [Example"Configuring L1 parameters"](#) on page 103.

Usage: Query only

Manual operation: See "[L1 Detail Additional Parity Mode](#)" on page 45

[[:SOURCE<hw>]:BB:A3TSc:L:DETail:FECType <L1DetailFECType>

Defines the protection level of L1 detail signaling.

Parameters:

<L1DetailFECType> MOD1 | MOD2 | MOD3 | MOD4 | MOD5 | MOD6 | MOD7
*RST: MOD1

Example: See [Example"Configuring L1 parameters"](#) on page 103.

Manual operation: See "[L1 Detail FEC Type](#)" on page 45

[[:SOURCE<hw>]:BB:A3TSc:L:DETail:VERSion <L1DetailVers>

Sets the version of the L1 detail signaling structure that is used for the current frame.

Parameters:

<L1DetailVers> integer
Range: 0 to 15
*RST: 0

Example: See [Example"Configuring L1 parameters"](#) on page 103.

Manual operation: See "[L1 Detail Version](#)" on page 45

[[:SOURCE<hw>]:BB:A3TSc:L:NPReamble[:SYMBOLs]]?

Queries the total number of OFDM symbols contained in the preamble.

Return values:

<NumPreSymb> integer
Range: 1 to 8
*RST: 1

Example: See [Example"Configuring L1 parameters"](#) on page 103.

Usage: Query only

Manual operation: See "[Number of Preamble Symbols](#)" on page 45

[:SOURce<hw>]:BB:A3TSc:L:PILot:DX <PilotPatPre>

Sets the pilot pattern used for the preamble symbols.

Parameters:

<PilotPatPre> D3 | D4 | D6 | D8 | D12 | D16 | D24 | D32
 *RST: D16

Example: See [Example "Configuring L1 parameters"](#) on page 103.

Manual operation: See ["Pilot Pattern \(Dx\) Preamble"](#) on page 45

[:SOURce<hw>]:BB:A3TSc:NRF?

Queries the number of radio frequencies involved in channel bonding.

Return values:

<NumRFs> integer
 0
 Channel bonding is not used for the current frame.
 Range: 0 to 1
 *RST: 0

Example: See [Example "Configuring L1 parameters"](#) on page 103.

Usage: Query only

Manual operation: See ["Number of RFs"](#) on page 46

5.7 Frame info commands

The section contains the commands for querying frame and bootstrap information.

- [General commands](#)..... 106
- [L1 signaling commands](#)..... 107
- [Bootstrap commands](#)..... 109

5.7.1 General commands

Example: Querying general frame information

```
SOURce1:BB:A3TSc:INFO:FRAMe:DURation?
// Response in s: "0.179093"
SOURce1:BB:A3TSc:INFO:BOOTstrap:DURation?
// Response in s: "0.002"
```

Commands

[\[:SOURce<hw>\]:BB:A3TSc:INFO:BOOTstrap:DURation?](#)..... 107
[\[:SOURce<hw>\]:BB:A3TSc:INFO:FRAMe:DURation?](#)..... 107

[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:DURation?

Queries the duration of the bootstrap signal in ms.

Return values:

<Duration> float
 Range: 2.000 to 2.000
 Increment: 0.001
 *RST: 2.000

Example: See [Example"Querying general frame information"](#) on page 106.

Usage: Query only

Manual operation: See ["Bootstrap Duration"](#) on page 47

[:SOURce<hw>]:BB:A3TSc:INFO:FRAMe:DURation?

Queries the frame duration in ms.

Return values:

<Duration> float
 Range: 0 to 9999.999
 Increment: 0.001
 *RST: 0

Example: See [Example"Querying general frame information"](#) on page 106.

Usage: Query only

Manual operation: See ["Frame Duration"](#) on page 47

5.7.2 L1 signaling commands

Example: Querying L1 signaling parameters

```
SOURce1:BB:A3TSc:INFO:L:BASic:BYTes?
// Response: "25"
SOURce1:BB:A3TSc:INFO:L:BASic:CELLs?
// Response: "3820"
SOURce1:BB:A3TSc:INFO:L:DETail:BYTes?
// Response: "25"
SOURce1:BB:A3TSc:INFO:L:DETail:CELLs?
// Response: "2787"
```

Commands

[:SOURce<hw>]:BB:A3TSc:INFO:L:BASic:BYTes?	108
[:SOURce<hw>]:BB:A3TSc:INFO:L:BASic:CELLs?	108
[:SOURce<hw>]:BB:A3TSc:INFO:L:DETail:BYTes?	108
[:SOURce<hw>]:BB:A3TSc:INFO:L:DETail:CELLs?	108

[[:SOURce<hw>]:BB:A3TSc:INFO:L:BASic:BYTes?

Queries the L1 basic signaling length in bytes.

Return values:

<BasicBytes>	integer
Range:	25 to 25
*RST:	25

Example: See [Example"Querying L1 signaling parameters"](#) on page 107.

Usage: Query only

Manual operation: See "[L1 Basic Bytes](#)" on page 47

[[:SOURce<hw>]:BB:A3TSc:INFO:L:BASic:CELLs?

Queries the L1 basic signaling length in cells.

Return values:

<BasicCells>	integer
Range:	69 to 3820
*RST:	69

Example: See [Example"Querying L1 signaling parameters"](#) on page 107.

Usage: Query only

Manual operation: See "[L1 Basic Cells](#)" on page 48

[[:SOURce<hw>]:BB:A3TSc:INFO:L:DETail:BYTes?

Queries the L1 detail signaling length in bytes.

Return values:

<DetailedBytes>	integer
Range:	25 to 8191
*RST:	25

Example: See [Example"Querying L1 signaling parameters"](#) on page 107.

Usage: Query only

Manual operation: See "[L1 Detail Bytes](#)" on page 47

[[:SOURce<hw>]:BB:A3TSc:INFO:L:DETail:CELLs?

Queries the L1 detail signaling length in cells.

Return values:

<DetailCells>	integer
Range:	0 to 5242887
*RST:	0

- Example:** See [Example "Querying L1 signaling parameters"](#) on page 107.
- Usage:** Query only
- Manual operation:** See ["L1 Detail Cells"](#) on page 48

5.7.3 Bootstrap commands

Example: Querying bootstrap parameters

```
// Query major and minor version.
SOURCE1:BB:A3TSc:INFO:BOOTstrap:MAJor?
// Response: "0"
SOURCE1:BB:A3TSc:INFO:BOOTstrap:MINor?
// Response: "0"
SOURCE1:BB:A3TSc:INFO:BOOTstrap:TIME:NEXT?
// Response: "N150"
// Minimum time interval to the next frame is 150 ms.
SOURCE1:BB:A3TSc:INFO:BOOTstrap:EAS?
// Response: "NOEMergency"
SOURCE1:BB:A3TSc:INFO:BOOTstrap:BANDwidth?
// Response: "BW_6"
SOURCE1:BB:A3TSc:INFO:BOOTstrap:BSR:COEfficient?
// Response: "2"

SOURCE1:BB:A3TSc:INFO:BOOTstrap:PREamble:STRucture?
// Response: "40"
SOURCE1:BB:A3TSc:INFO:BOOTstrap:FFT:MODE?
// Response: "M8K"
SOURCE1:BB:A3TSc:INFO:BOOTstrap:PILot:DX?
// Response: "D3"
SOURCE1:BB:A3TSc:INFO:BOOTstrap:GUARd:INTerval?
// Response: "G192"
SOURCE1:BB:A3TSc:INFO:BOOTstrap:BASic:FECType?
// Response: "MOD1"
```

Commands

[:SOURCE<hw>]:BB:A3TSc:INFO:BOOTstrap:BANDwidth?	110
[:SOURCE<hw>]:BB:A3TSc:INFO:BOOTstrap:BASic:FECType?	110
[:SOURCE<hw>]:BB:A3TSc:INFO:BOOTstrap:BSR:COEfficient?	110
[:SOURCE<hw>]:BB:A3TSc:INFO:BOOTstrap:EAS?	110
[:SOURCE<hw>]:BB:A3TSc:INFO:BOOTstrap:FFT:MODE?	111
[:SOURCE<hw>]:BB:A3TSc:INFO:BOOTstrap:GUARd:INTerval?	111
[:SOURCE<hw>]:BB:A3TSc:INFO:BOOTstrap:MAJor?	111
[:SOURCE<hw>]:BB:A3TSc:INFO:BOOTstrap:MINor?	111
[:SOURCE<hw>]:BB:A3TSc:INFO:BOOTstrap:PILot:DX?	112
[:SOURCE<hw>]:BB:A3TSc:INFO:BOOTstrap:PREamble[:STRucture]?	112
[:SOURCE<hw>]:BB:A3TSc:INFO:BOOTstrap:TIME:NEXT?	112

[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:BANDwidth?

Queries the system bandwidth used for the post-bootstrap portion of the current physical layer frame.

Return values:

<FrameInfoBW> BW_6 | BW_7 | BW_8 | BW8G

Example: See [Example"Querying bootstrap parameters"](#) on page 109.

Usage: Query only

Manual operation: See ["System Bandwidth"](#) on page 49

[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:BASic:FECType?

Queries the FEC type used for the L1 basic signaling in the preamble symbol.

Return values:

<L1BasicFECType> MOD1 | MOD2 | MOD3 | MOD4 | MOD5 | MOD6 | MOD7

Example: See [Example"Querying bootstrap parameters"](#) on page 109.

Usage: Query only

Manual operation: See ["L1 Basic FEC Type"](#) on page 51

[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:BSR:COEFFicient?

Queries the sample rate used for the post-bootstrap portion of the current physical layer frame.

Return values:

<BSRCoefficient> integer
 Range: 0 to 127
 *RST: 2

Example: See [Example"Querying bootstrap parameters"](#) on page 109.

Usage: Query only

Manual operation: See ["BSR Coefficient"](#) on page 49

[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:EAS?

Queries the signaling mode for emergency alert.

Return values:

<EAS> NOEMergency | SET1 | SET2 | SET3

Example: See [Example"Querying bootstrap parameters"](#) on page 109.

Usage: Query only

Manual operation: See ["Emergency Alert Signaling \(EAS\)"](#) on page 49

[[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:FFT:MODE?

Queries the FFT size of the preamble symbols.

Return values:

<FFTMd> M8K | M16K | M32K

Example: See [Example "Querying bootstrap parameters"](#) on page 109.

Usage: Query only

Manual operation: See ["FFT Size"](#) on page 50

[[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:GUARd:INTerval?

Queries the number of guard interval samples of the preamble symbols.

Return values:

<GuardInterval> G192 | G384 | G512 | G768 | G1024 | G1536 | G2048 | G2432 |
G3072 | G3648 | G4096 | G4864

Example: See [Example "Querying bootstrap parameters"](#) on page 109.

Usage: Query only

Manual operation: See ["Guard Interval"](#) on page 50

[[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:MAJor?

Queries the major version of the bootstrap.

Return values:

<Major> integer
Range: 0 to 0
*RST: 0

Example: See [Example "Querying bootstrap parameters"](#) on page 109.

Usage: Query only

Manual operation: See ["Major Version"](#) on page 48

[[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:MINor?

Queries the minor version of the bootstrap.

Return values:

<Minor> integer
Range: 0 to 7
*RST: 0

Example: See [Example "Querying bootstrap parameters"](#) on page 109.

Usage: Query only

Manual operation: See ["Minor Version"](#) on page 48

[[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:PILot:DX?

Queries the pilot pattern used for the preamble symbols.

Return values:

<PilotPattern> D3 | D4 | D6 | D8 | D12 | D16 | D24 | D32

Example: See [Example"Querying bootstrap parameters"](#) on page 109.

Usage: Query only

Manual operation: See ["Pilot Pattern \(Dx\)"](#) on page 51

[[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:PREAmble[:STRUcture]?

Queries the structure of the preamble symbols following the last bootstrap symbol.

Return values:

<PreStructure> integer
Range: 0 to 255
*RST: 0

Example: See [Example"Querying bootstrap parameters"](#) on page 109.

Usage: Query only

Manual operation: See ["Preamble Structure"](#) on page 50

[[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:TIME:NEXT?

Queries minimum time interval to the next frame that matches the same major and minor version number of the current frame.

Return values:

<MinTimetoNext> N50 | N100 | N150 | N200 | N250 | N300 | N350 | N400 | N500 |
N600 | N700 | N800 | N900 | N1000 | N1100 | N1200 | N1300 |
N1400 | N1500 | N1600 | N1700 | N1900 | N2100 | N2300 |
N2500 | N2700 | N2900 | N3300 | N3700 | N4100 | N4500 |
N4900 | N5300 | NOTapplicable

Example: See [Example"Querying bootstrap parameters"](#) on page 109.

Usage: Query only

Manual operation: See ["Min. Time to Next"](#) on page 49

5.8 SFN delay commands

The section contains the commands for configuring single frequency network delays.

Example: Configuring single frequency network delay parameters

```

//*****
// Activate SFN network mode.
//*****
SOURCE1:BB:A3TSc:INPut:STL:INTErface ON

// Query the SFN mode.
SOURCE1:BB:A3TSc:DElay:SFNMode?
// Response: "RELative"

// Query the network delay in s.
SOURCE1:BB:A3TSc:DElay:NETwork?
// Response: "0.149506"

SOURCE1:BB:A3TSc:NETworkmode SFN
// Query the processing delay in s.
SOURCE1:BB:A3TSc:DElay:PROcess?
// Response: "0.100187"

// Query the dynamic delay in s.
SOURCE1:BB:A3TSc:DElay:DYNamic?
// Response: "0.350307"

// Query the total delay in s, that is the sum of processing and dynamic delay.
SOURCE1:BB:A3TSc:DElay:TOTAL?
// Response: "0.450494"

// Set a maximum permissible delay of, e.g., 10 µs.
SOURCE1:BB:A3TSc:DElay:DEViation 0.000010

// Set a static delay of, e.g., -10 µs.
SOURCE1:BB:A3TSc:DElay:STATic -0.000010
// The start of transmission is shifted to 10 µs earlier.

// Query the maximum delay in s.
SOURCE1:BB:A3TSc:DElay:MAXimum?
// Response: "2.6"

// Query the dispatch time in s, that is the sum of maximum and static delay.
SOURCE1:BB:A3TSc:DElay:DISPatch?
// Response: "2.59999"

// Replace the bootstrap signal by a null signal (no output power).
SOURCE1:BB:A3TSc:DElay:MUTE:BOOTstrap ON

```

Commands

[:SOURCE<hw>]:BB:A3TSc:DElay:DEViation	114
[:SOURCE<hw>]:BB:A3TSc:DElay:DISPatch?	114
[:SOURCE<hw>]:BB:A3TSc:DElay:DYNamic?	114
[:SOURCE<hw>]:BB:A3TSc:DElay:MAXImum?	115

<code>[:SOURce<hw>]:BB:A3TSc:DElay:MUTE[:BOOTstrap]</code>	115
<code>[:SOURce<hw>]:BB:A3TSc:DElay:NETWork?</code>	115
<code>[:SOURce<hw>]:BB:A3TSc:DElay:PROcess?</code>	116
<code>[:SOURce<hw>]:BB:A3TSc:DElay:SFNMode</code>	116
<code>[:SOURce<hw>]:BB:A3TSc:DElay:STATic</code>	116
<code>[:SOURce<hw>]:BB:A3TSc:DElay:TOTal?</code>	117

`[:SOURce<hw>]:BB:A3TSc:DElay:DEVIation <Deviation>`

Sets the maximum permissible delay.

Parameters:

<code><Deviation></code>	float
	Range: 1.0 to 500.0
	Increment: 0.1
	*RST: 10
	Default unit: μ s

Example: See [Example "Configuring single frequency network delay parameters"](#) on page 113.

Manual operation: See ["Max. Deviation Time"](#) on page 53

`[:SOURce<hw>]:BB:A3TSc:DElay:DISPatch?`

Queries the time taken for the signal to travel from the playout center to the transmitter antenna for real transmission.

Return values:

<code><Dispatch></code>	float
	Range: -1000000.0 to 6000000.0
	Increment: 0.1
	*RST: 0
	Default unit: μ s

Example: See [Example "Configuring single frequency network delay parameters"](#) on page 113.

Usage: Query only

Manual operation: See ["Dispatch Time"](#) on page 53

`[:SOURce<hw>]:BB:A3TSc:DElay:DYNamic?`

Queries the transmission delay currently generated by the SFN delay (FIFO).

Return values:

<code><Dynamic></code>	float
	Range: -16000000.0 to 6000000.0
	Increment: 0.1
	*RST: 0
	Default unit: μ s

Example: See [Example"Configuring single frequency network delay parameters"](#) on page 113.

Usage: Query only

Manual operation: See ["Dynamic Delay"](#) on page 53

[:SOURce<hw>]:BB:A3TSc:DELay:MAXImum?

Queries the time taken for the signal to travel from the playout center to the transmitter antenna for regular transmission.

Return values:

<MaximumDelay> float
 Range: 0.0 to 5000000.0
 Increment: 0.1
 *RST: 0
 Default unit: μ s

Example: See [Example"Configuring single frequency network delay parameters"](#) on page 113.

Usage: Query only

Manual operation: See ["Maximum Delay"](#) on page 53

[:SOURce<hw>]:BB:A3TSc:DELay:MUTE[:BOOTstrap] <MuteBootstrap>

If enabled, replaces the bootstrap by a null signal (no output power).

Parameters:

<MuteBootstrap> 1 | ON | 0 | OFF
 *RST: Off

Example: See [Example"Configuring single frequency network delay parameters"](#) on page 113.

Manual operation: See ["Mute Bootstrap of Frame"](#) on page 54

[:SOURce<hw>]:BB:A3TSc:DELay:NETWork?

Queries the time taken for the signal to travel from the playout center to the input of the signal processing.

Return values:

<Network> float
 Range: 0.0 to 5000000.0
 Increment: 0.1
 *RST: 0
 Default unit: μ s

Example: See [Example"Configuring single frequency network delay parameters"](#) on page 113.

Usage: Query only
Manual operation: See ["Network Delay"](#) on page 52

[:SOURce<hw>]:BB:A3TSc:DElay:PROcEss?

Queries the delay from the modulator input up to the SFN delay (FIFO).

Return values:

<Process> float
 Range: 0.0 to 10000000.0
 Increment: 0.1
 *RST: 0
 Default unit: µs

Example: See [Example"Configuring single frequency network delay parameters"](#) on page 113.

Usage: Query only
Manual operation: See ["Processing Delay"](#) on page 52

[:SOURce<hw>]:BB:A3TSc:DElay:SFNMode <SFNMode>

Sets the SFN timestamp operation mode, that is fixed to relative timestamp mode.

Parameters:

<SFNMode> ABSolute | RELative
 *RST: RELative

Example: See [Example"Configuring single frequency network delay parameters"](#) on page 113.

Manual operation: See ["SFN Mode"](#) on page 54

[:SOURce<hw>]:BB:A3TSc:DElay:STATic <Static>

Sets the delay to shift the time of transmission positively or negatively.

Parameters:

<Static> float
 Range: -10000000.0 to 10000000.0
 Increment: 0.1
 *RST: 0
 Default unit: µs

Example: See [Example"Configuring single frequency network delay parameters"](#) on page 113.

Manual operation: See ["Static Delay"](#) on page 53

[:SOURce<hw>]:BB:A3TSc:DELay:TOTal?

Queries the sum of processing delay and dynamic delay.

Return values:

<TotalDelay> float
 Range: -6000000.0 to 6000000.0
 Increment: 0.1
 *RST: 0
 Default unit: µs

Example: See [Example "Configuring single frequency network delay parameters"](#) on page 113.

Usage: Query only

Manual operation: See ["Total Delay"](#) on page 53

5.9 Special commands

The section contains commands to configure settings. Enable special settings to test deviations from the broadcast standard specification.

Example: Configuring special settings

```
SOURce1:BB:A3TSc:SPECIAL:SETTINGS:STATE?
// Response: "0"
// Special settings are disabled to conform with the broadcast standard.
// Enable special settings to test deviations from the standard.

//*****
// Special settings, if STL Interface is turned on.
//*****
// Settings for STL interface compatibility modes.
SOURce1:BB:A3TSc:SPECIAL:STL:PREamble ON
SOURce1:BB:A3TSc:SPECIAL:STL:TMP ON

//*****
// Special settings, if STL Interface is turned off.
//*****
// For ALP encapsulation compatibility modes.
SOURce1:BB:A3TSc:SPECIAL:ALP:LMT ON
// For special bootstrap settings.
SOURce1:BB:A3TSc:SPECIAL:BOOTstrap:MINor 7
SOURce1:BB:A3TSc:SPECIAL:BOOTstrap:EAS SET3

// Apply special settings.
SOURce1:BB:A3TSc:SPECIAL:SETTINGS:STATE ON
```

Commands

[:SOURce<hw>]:BB:A3TSc:SPECIal:SETTings[:STATe]	118
[:SOURce<hw>]:BB:A3TSc:SPECIal:ALP:LMT	118
[:SOURce<hw>]:BB:A3TSc:SPECIal:BOOTstrap:EAS	118
[:SOURce<hw>]:BB:A3TSc:SPECIal:BOOTstrap:MINor	118
[:SOURce<hw>]:BB:A3TSc:SPECIal:STL:PREamble	119
[:SOURce<hw>]:BB:A3TSc:SPECIal:STL:TMP	119

[\[:SOURce<hw>\]:BB:A3TSc:SPECIal:SETTings\[:STATe\]](#) <SpecialSettings>

Enables/disables special settings.

The setting allows you to switch between standard-compliant and user-defined channel coding.

Parameters:

<SpecialSettings> 1 | ON | 0 | OFF

Example: See [Example"Configuring special settings"](#) on page 117.

Manual operation: See ["Special Settings"](#) on page 55

[\[:SOURce<hw>\]:BB:A3TSc:SPECIal:ALP:LMT](#) <LMTCompMode>

Sets how the [LMT](#) signaling is supported.

Parameters:

<LMTCompMode> 1 | ON | 0 | OFF

Example: See [Example"Configuring special settings"](#) on page 117.

Manual operation: See ["LMT Compatibility Mode"](#) on page 56

[\[:SOURce<hw>\]:BB:A3TSc:SPECIal:BOOTstrap:EAS](#) <EAS>

Sets the signaling for emergency alert.

Parameters:

<EAS> SET3 | SET2 | NOEMergency | SET1 | NOEMergency | SET1 | SET2 | SET3

*RST: NOEMergency

Example: See [Example"Configuring special settings"](#) on page 117.

Manual operation: See ["Emergency Alert Signaling \(EAS\)"](#) on page 56

[\[:SOURce<hw>\]:BB:A3TSc:SPECIal:BOOTstrap:MINor](#) <MinoVers>

Sets the minor version number of the bootstrap.

Parameters:

<MinoVers> integer
 Range: 0 to 7
 *RST: 0

Example: See [Example"Configuring special settings"](#) on page 117.

Manual operation: See ["Minor Version"](#) on page 56

[:SOURCE<hw>]:BB:A3TSc:SPECIAL:STL:PREamble <PreCompMode>

Sets how the preamble packet is supported.

Parameters:

<PreCompMode> 1 | ON | 0 | OFF

Example: See [Example"Configuring special settings"](#) on page 117.

Manual operation: See ["Preamble Compatibility Mode"](#) on page 56

[:SOURCE<hw>]:BB:A3TSc:SPECIAL:STL:TMP <TMPCompMode>

Sets how the time & management packet is supported.

Parameters:

<TMPCompMode> 1 | ON | 0 | OFF

Example: See [Example"Configuring special settings"](#) on page 117.

Manual operation: See ["TMP Compatibility Mode"](#) on page 56

5.10 TSGen subsystem

The TSGen subsystem contains the commands for configuring the TS player.

Example: Playing a TS player file

```
//*****
// Select a file, e.g. a user-defined setting.
//*****
TSGen:CONFigure:PLAYfile "/var/user/my_test_player_test.trp"
// Selects the file "my_test_player_test" with extension *.trp.

//*****
// Within the file, define a section, that you want to play.
// You can set start/stop position for a maximum section length of 10 hours.
//*****
TSGen:CONFigure:SEEK:START 60000 // milliseconds
// Section start is after one minute from the original file start.
// The first minute is ignored.
TSGen:CONFigure:SEEK:STOP 120000 // milliseconds
```

```

// Section stop is after one minute from the original file start.
// The total section length is one minute.

//*****
// Navigate to a certain position within the file/section of the file.
//*****
TSGen:CONFigure:SEEK:POSition 100000 // milliseconds
// The current player position of file/section of the file is at 1 minute 40 seconds.

//*****
// Reset play-related settings
//*****
TSGen:CONFigure:SEEK:RESet

//*****
// Pause, stop, play the file.
//*****
TSGen:CONFigure:COMManD PAUS
// Pauses playing the file.
TSGen:CONFigure:COMManD STOP
// Stops playing the file.
TSGen:CONFigure:COMManD PLAY
// Activates playing the file.

```

Example: Configuring and monitoring TS player output

```

//*****
// Configure general and stuffing parameters of the TS player output.
//*****
TSGen:CONFigure:STUFFing ON
TSGen:CONFigure:STOPdata TTSP
TSGen:CONFigure:TSPacket H184
TSGen:CONFigure:PIDTestpacket VAR
TSGen:CONFigure:PID 8100
// Corresponds to a PID = 1FA4 in hexadecimal representation.
TSGen:CONFigure:PAYLoad PRBS
TSGen:CONFigure:PRBS:SEQuence P23_1

//*****
// Monitor TS player output data.
//*****
// You can only change the data rate, if you stop the TS player.
TSGen:CONFigure:COMManD STOP
TSGen:CONFigure:TSRate 350E6
// Corresponds to a net data rate of 350 MBit/s.
TSGen:CONFigure:COMManD PLAY

TSGen:CONFigure:PLENght?
// Response: "P188"
// Packet length is 188 bytes.
TSGen:READ:ORIGtsrate?
// Response in bit/s: "5018502"

```


Example: Configuring seamless loop parameters

```
TSGen:CONFigure:SEAMless:CC ON
TSGen:CONFigure:SEAMless:PCR OFF
TSGen:CONFigure:SEAMless:TT ON
```

Commands

:TSGen:CONFigure:COMMand.....	121
:TSGen:CONFigure:PAYLoad.....	121
:TSGen:CONFigure:PID.....	122
:TSGen:CONFigure:PIDTestpack.....	122
:TSGen:CONFigure:PLAYfile.....	122
:TSGen:CONFigure:PLENght.....	123
:TSGen:CONFigure:PRBS[:SEQuence].....	123
:TSGen:CONFigure:SEAMless:CC.....	123
:TSGen:CONFigure:SEAMless:PCR.....	123
:TSGen:CONFigure:SEAMless:TT.....	124
:TSGen:CONFigure:SEEK:POSition.....	124
:TSGen:CONFigure:SEEK:RESet.....	124
:TSGen:CONFigure:SEEK:STARt.....	124
:TSGen:CONFigure:SEEK:STOP.....	125
:TSGen:CONFigure:STOPdata.....	125
:TSGen:CONFigure:STUFFing.....	125
:TSGen:CONFigure:TSPacket.....	126
:TSGen:CONFigure:TSRate.....	126
:TSGen:READ:FMEMory.....	126
:TSGen:READ:ORIGtsrate.....	126
:TSGen:READ:PLAYfile:LENGth?.....	127

:TSGen:CONFigure:COMMand <PlayerStatus>

Triggers playing, pausing and stopping of the TS player file selected with **:TSGen:CONFigure:PLAYfile**.

Parameters:

```
<PlayerStatus>  STOP | PAUSE | PLAY | RESet
                *RST:  STOP
```

Example: See [Example "Playing a TS player file"](#) on page 119.

Manual operation: See ["Play"](#) on page 62
 See ["Pause"](#) on page 63
 See ["Stop"](#) on page 63

:TSGen:CONFigure:PAYLoad <PayLoad>

Determines the payload of the test packet. Also influences the payload of the generated stuffing packets while the TS player is running.

Parameters:

<PayLoad> HFF | H00 | PRBS
 *RST: PRBS

Example: See [Example"Configuring and monitoring TS player output"](#) on page 120.

Manual operation: See ["Payload Test/Stuff"](#) on page 66

:TSGen:CONFigure:PID <PID>

The available values depend on the settings of [:TSGen:CONFigure:PIDTestpack](#).

If [:TSGen:CONFigure:PIDTestpack](#) is set to NULL,
 then [:TSGen:CONFigure:PID](#) is 1FFF (hex).

Otherwise the values are variable.

Parameters:

<PID> integer
 Range: 0 to 8191
 *RST: 8191

Example: See [Example"Configuring and monitoring TS player output"](#) on page 120.

Manual operation: See ["PID \(Hex\)"](#) on page 66

:TSGen:CONFigure:PIDTestpack <PIDTestpack>

Sets the PID, if [:TSGen:CONFigure:TSPacket](#) is H184 | H200 | H204.

Parameters:

<PIDTestpack> VARIable | NULL
 *RST: NULL

Example: See [Example"Configuring and monitoring TS player output"](#) on page 120.

Manual operation: See ["PID Test Packet"](#) on page 66

:TSGen:CONFigure:PLAYfile <PlayFile>

Specifies the file path and filename of the TS player file.

Parameters:

<PlayFile> string

Example: See [Example"Playing a TS player file"](#) on page 119.

Manual operation: See ["Select File"](#) on page 61

:TSGen:CONFigure:PLENght <PLength>

Queries the packet length of the loaded file.

Parameters:

<PLength> P188 | P204 | P208 | INV
*RST: INV

Example: See [Example"Configuring and monitoring TS player output"](#) on page 120.

Manual operation: See ["Packet Length"](#) on page 64

:TSGen:CONFigure:PRBS[:SEQuence] <PRBS>

Sets the length of the PRBS sequence.

Parameters:

<PRBS> P15_1 | P23_1
*RST: P23_1

Example: See [Example"Configuring and monitoring TS player output"](#) on page 120.

Manual operation: See ["PRBS"](#) on page 66

:TSGen:CONFigure:SEAMless:CC <CC>

Activates the correction of the continuity counters in the replayed TS data stream. The correction allows you to decode the stream without interruption when the play file is looping.

Parameters:

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

Example: See [Example"Configuring seamless loop parameters"](#) on page 121.

Manual operation: See ["Continuity Counter"](#) on page 67

:TSGen:CONFigure:SEAMless:PCR <PCR>

Activates the correction of time stamps in the replayed TS data stream. The correction allows you to decode the stream without interruption when the play file is looping.

Parameters:

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

Example: See [Example"Configuring seamless loop parameters"](#) on page 121.

Manual operation: See ["PCR, DTS/PTS"](#) on page 67

:TSGen:CONFigure:SEAMless:TT <TT>

Activates the correction of the time and date table in the replayed TS data stream. The correction allows you to decode the stream without interruption when the play file is looping.

Parameters:

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

Example: See [Example"Configuring seamless loop parameters"](#) on page 121.

Manual operation: See ["TDT/TOT"](#) on page 67

:TSGen:CONFigure:SEEK:POSition <Position>

Sets the position, that is the current playing time position.

You can select a value in a 10-hour range.

Parameters:

<Position> float
Range: 0 to 36000000
Increment: 0.1
*RST: 0

Example: See [Example"Playing a TS player file"](#) on page 119.

Manual operation: See ["Running/Position Player \[hh:mm:ss.fff\]"](#) on page 61
See ["Position Player \[hh:mm:ss.fff\]"](#) on page 62

:TSGen:CONFigure:SEEK:RESet

Resets the following parameters to their default state:

- [:TSGen:CONFigure:SEEK:START](#) on page 124
- [:TSGen:CONFigure:SEEK:STOP](#) on page 125

Example: See [Example"Playing a TS player file"](#) on page 119.

Usage: Event

Manual operation: See ["Reset Window"](#) on page 62

:TSGen:CONFigure:SEEK:START <Start>

Sets an individual start time.

You can select a value in a 10-hour range.

Parameters:

<Start> float
 Range: 0 to 36000000
 Increment: 0.1
 *RST: 0

Example: See [Example"Playing a TS player file"](#) on page 119.

Manual operation: See ["Start \[hh:mm:ss.fff\]"](#) on page 62

:TSGen:CONFigure:SEEK:STOP <Stop>

Sets an individual stop time.

You can select a value in a 10-hour range.

Parameters:

<Stop> float
 Range: 0 to 36000000
 Increment: 0.1
 *RST: 23040.2

Example: See [Example"Playing a TS player file"](#) on page 119.

Manual operation: See ["Stop \[hh:mm:ss.fff\]"](#) on page 62

:TSGen:CONFigure:STOPdata <StopData>

Ensures that a standardized TS data stream is always output at the TS output at the rear of the R&S SMCV100B.

Parameters:

<StopData> TTSP | NONE
 *RST: NONE

Example: See [Example"Configuring and monitoring TS player output"](#) on page 120.

Manual operation: See ["Stop Data"](#) on page 64

:TSGen:CONFigure:STUFFing <Stuffing>

Activates nullpacket stuffing.

Parameters:

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

Example: See [Example"Configuring and monitoring TS player output"](#) on page 120.

Manual operation: See ["Nullpacket Stuffing"](#) on page 64

:TSGen:CONFigure:TSPacket <TSPaket>

Sets the structure of the generated test packets in pause or stop status.

Parameters:

<TSPaket> H184 | H200 | H204 | S187 | S203 | S207
S187|S203|S207
 A sync byte (0x47) followed by 187/203/207 payload bytes.
H184|H200|H204
 A sync byte (0x47) followed by three header bytes and
 184/200/204 payload bytes.
 *RST: H184

Example: See [Example"Configuring and monitoring TS player output"](#)
on page 120.

Manual operation: See "[Test TS Packet](#)" on page 65

:TSGen:CONFigure:TSRate <TSRate>

Sets the output data rate of the player.

Parameters:

<TSRate> integer
 Range: 1 to 35E7
 *RST: 5018502

Example: See [Example"Configuring and monitoring TS player output"](#)
on page 120.

Manual operation: See "[Data Rate](#)" on page 63

:TSGen:READ:FMEMemory <FMemory>

Queries the file size of the TS player file.

Parameters:

<FMemory> integer
 Range: 0 to 10
 *RST: 0

Example: See [Example"Configuring and monitoring TS player output"](#)
on page 120.

Manual operation: See "[Select File](#)" on page 61

:TSGen:READ:ORIGtsrate <ORIGtsrate>

Displays the calculated original TS data rate.

Parameters:

<ORIGtrate> integer
Range: 1 to 350000000
*RST: 5018502

Example: See [Example"Configuring and monitoring TS player output"](#) on page 120.

Manual operation: See ["Orig. Data Rate"](#) on page 64

:TSGen:READ:PLAYfile:LENGth?

Queries calculated original loop time.

Return values:

<Length> integer
Range: 0 to 100
*RST: 0

Example: See [Example"Configuring and monitoring TS player output"](#) on page 120.

Usage: Query only

Manual operation: See ["Select File"](#) on page 61

Annex

A ATSC 3.0 test cases

Test case type	Test case	Remark
P1S1	ATSC30_VV_xyz	33 test cases, xyz = 001 to 033
P1S2	ATSC30_VV_xyz	28 test cases, xyz = 034 to 061
P1S3	ATSC30_VV_xyz	4 test cases, xyz = 062 to 065
P1S4	ATSC30_VV_xyz	4 test cases, xyz = 066 to 069
P1S5	ATSC30_VV_xyz	68 test cases, xyz = 100 to 167
P1S6	ATSC30_VV_xyz	12 test cases, xyz = 170 to 181
P1S7	ATSC30_VV_xyz	3 test cases, xyz = 190 to 192
P1S8	ATSC30_VV_xyz	4 test cases, xyz = 196 to 199
P2S1	ATSC30_VV_xyz	24 test cases, xyz = 200 to 223
P2S2	ATSC30_VV_xyz	21 test cases, xyz = 224 to 244
P2S3	ATSC30_VV_xyz	36 test cases, xyz = 245 to 280
P6S1	ATSC30_VV_xyz	4 test cases, xyz = 600, 603, 604, 605

Glossary: Abbreviations

A

ALP: ATSC 3.0 Link Layer Protocol

ATSC: Advanced Television System Committee
<https://www.atsc.org/>

B

BCH: Bose Chaudhuri Hocquenghem coding

BICM: Bit-Interleaved Coding and Modulation

C

CRC: Cyclic Redundancy Check

D

DASH: Dynamic Adaptive Streaming over HTTP

F

FEC: Forward Error Correction

FFT: Fast Fourier Transform

FIFO: First In First Out

L

LDM: Layered Division Multiplexing

LDPC: Low-Density Parity Check

LMT: Link Mapping Table

M

MFN: Multiple frequency Network

MIMO: Multiple Input Multiple Output

MISO: Multiple Input Single Output

MMT: MPEG Media Transport

MPEG: Moving Picture Experts Group
<https://mpeg.chiariglione.org/>

O

OFDM: Orthogonal Frequency-Division Multiplexing

P

PHY: Physical Layer

PID: Packet Identifier

PLP: Physical Layer Pipe

PRBS: Pseudo-Random Bit Sequence as specified by [ITU-T O.151](#)

Q

QAM: Quadrature Amplitude Modulation

QPSK: Quaternary Phase Shift Keying

R

ROUTE: Real-time Object delivery over Unidirectional Transport

S

SFN: Single frequency Network

SISO: Single Input Single Output

SMPTE: Society of Motion Picture and Television Engineers
<https://www.smpte.org/>

STL: Studio Transmitter Link

T

TS: Transport Stream

Glossary: Specifications

A

ATSC 3.0: Advanced Television System Committee Standard 3.0

<https://www.atsc.org/standards/atsc-3-0-standards/>

ATSC A/322: ATSC Standard: Physical Layer Protocol (A/322)

E.g., version A/322-2016: <https://www.atsc.org/atsc-30-standard/a3222016-physical-layer-protocol/>

ATSC A/324-2018: ATSC Standard: Scheduler / Studio to Transmitter Link

<https://www.atsc.org/wp-content/uploads/2018/01/A324-2018-Scheduler-STL-2.pdf>

ATSC A/330-2019: ATSC Standard: Link-Layer Protocol (A/330)

<https://www.atsc.org/wp-content/uploads/2016/10/A330-2019a-Link-Layer-Protocol.pdf>

I

ITU-T O.151: ITU-T Recommendation O.151

<https://www.itu.int/rec/T-REC-O.151-199210-I/en>

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