R&S®SMCVB-K162
ATSC 3.0
User Manual

1179098002
Version 03

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 4.90.002.xx and later of the R&S®SMCV100B.

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

Contents

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 Documentation Overview

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

www.rohde-schwarz.com/manual/smcv100b

1.2.1 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.

1.2.2 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.

1.2.3 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

1.2.4 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.

1.2.5 Printed Safety Instructions

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

1.2.6 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

1.2.7 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 open-source acknowledgment document provides verbatim license texts of the used open source software.

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

1.2.8 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 Scope

(i) 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.

1.4 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 4, "Remote-Control Commands", on page 67.

Settings:

3.1 General Settings

Access:

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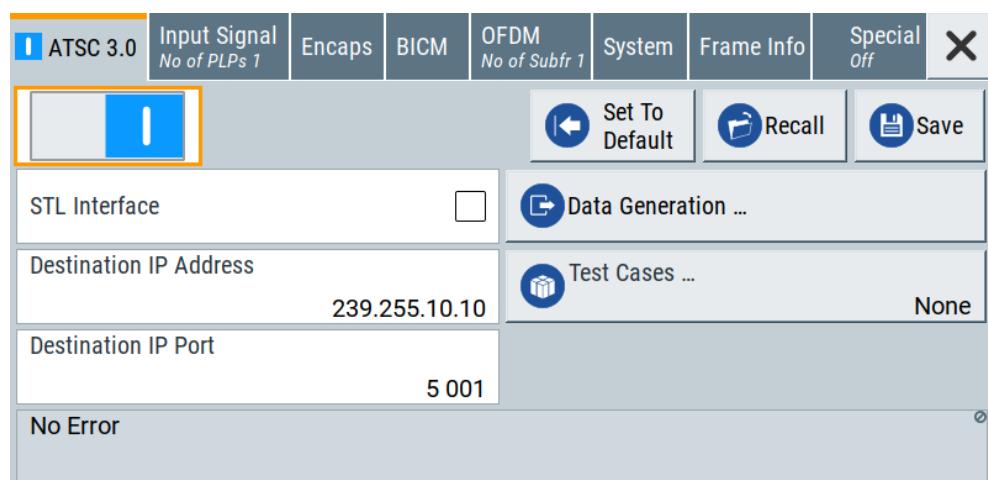
The "ATSC 3.0" tab provides functionality for calling default settings, save and recall settings and settings necessary to configure the STL interface and IP settings.

Settings:

State

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

Remote command:

[:SOURce<hw>]:BB:A3TSc:STATe on page 68

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 68

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 69
[:SOURce<hw>]:BB:A3TSc:SETTing:DELete on page 69
[:SOURce<hw>]:BB:A3TSc:SETTing:LOAD on page 69
[:SOURce<hw>]:BB:A3TSc:SETTing:STORe on page 69

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 73

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 applica-
tions, drivers and services running on the R&S SMCV100B.

Remote command:

[:SOURce<hw>]:BB:A3TSc:INPut:DESTination:IP:ADDRess on page 72

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 72

Data Generation

Accesses the "3.0 Data Generation" tab.

See Chapter 3.10, "Data Generation Settings", on page 56.

Test Cases

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

For available test cases, see Chapter A, "ATSC 3.0 Test Cases", on page 126.

Filter Test Cases ← Test Cases

Filters the test case selection.

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 73

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 13. To ensure correct behavior, fix occurring errors successively.

Remote command:
[:SOURce<hw>]:BB:A3TSc:INPut:STATus? on page 70

3.2 Input Signal Settings

Access:

► Select "Baseband > ATSC 3.0 > Input Signal".

The tab provides settings necessary 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:

3.2.1 General Settings

Access:

► Select "Input Signal > General".
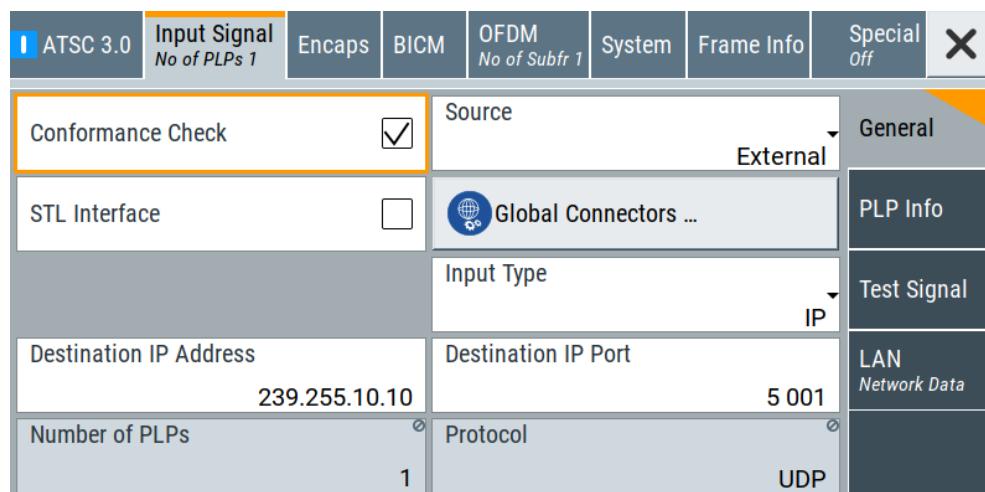
The tab provides general settings necessary to configure the input signal.

Settings:

Conformance Check

Sets the depth of inspection for the conformance check.

"On"   Additional in-depth checks are done to ensure that the current config-
              uration 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 specifica-
              tion.

Remote command:

[:SOURce<hw>]:BB:A3TSc:INPut:CCHeck 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 subframe).

Remote command:

[:SOURce<hw>]:BB:A3TSc:INPut:STL:INTerface on page 73

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 73

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 72

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 57 ● 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 20.

Remote command:

[:SOURce<hw>]:BB:A3TSc:SOURce on page 74

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 Chapter 3.2.3, "Test Signal Settings", on page 20.

"Test IP Packet"

Test signal consists of test IP packets. For configuration, see Chapter 3.2.3, "Test Signal Settings", on page 20.

Remote command:

[:SOURce<hw>]:BB:A3TSc:PLP:INPut:TESTsignal on page 77

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 72

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 72

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 73

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" summarizes "UDP"/"UDP/RTP" support for TSoverIP

Remote command:
[:SOURce<hw>]:BB:A3TSc:INPut:PROTocol? on page 72

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
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 81

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 75

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 76

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:

Remote command:

[:SOURce<hw>]:BB:A3TSc:PLP<ch>[:INPut]:DATarate? on page 75

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 75

3.2.3 Test Signal Settings

Access:

► Select "Input Signal > Test Signal".

| | ATSC 3.0 | **Input Signal** *No of PLPs 1* | Encaps | BICM | OFDM *No of Subfr 1* | System | Frame Info | Special *Off* | ✕ |

| Test TS Packet |
| Head/184 Payload ▾ |

| Test IP Packet ⊘ |
| Head/UDP Payload |

| General |

| PID Test Packet |
| Null ▾ |

| PLP Info |

| PID (Hex) ⊘ |
| 1FFF |

| **Test Signal** |

| Payload Test/Stuff |
| PRBS ▾ |

| LAN *Network Data* |

| PRBS |
| 2^23 - 1 (ITU-T O.151) ▾ |
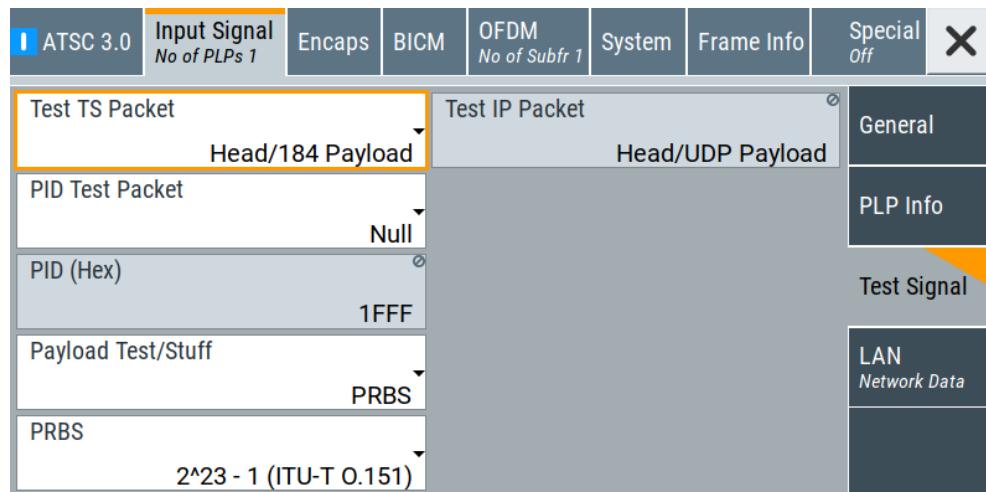
The tab provides settings necessary to configure the test signal.

Settings:

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 77

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 77

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 21.

Remote command:
[:SOURce<hw>]:BB:A3TSc:PIDTestpack on page 78

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 78

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 77

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 78

3.2.4 LAN Network Data Settings

Access:

► Select "Input Signal > LAN Network Data > Local LAN Interface".
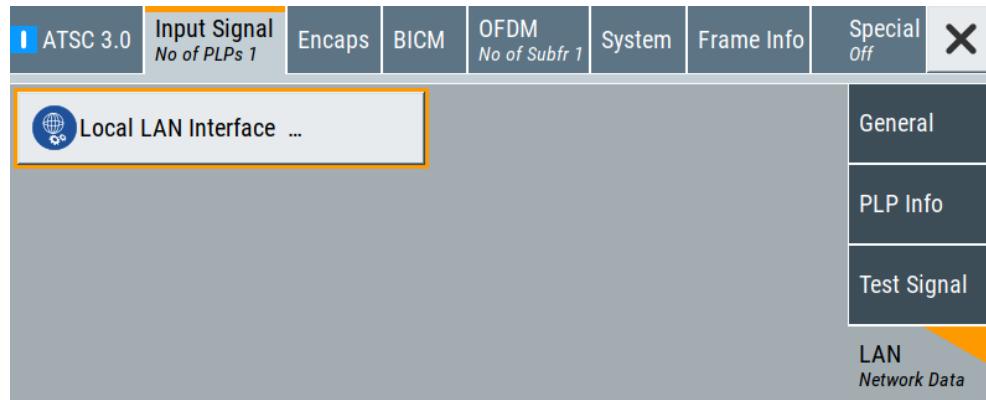
The tab provides "Local LAN Interface" settings necessary to configure network parameters for IP signals input at the "LAN" connector.

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".
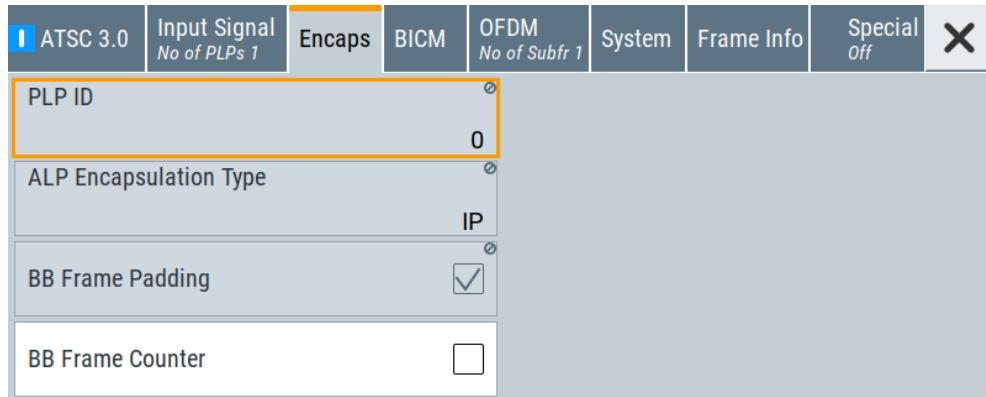
The tab provides settings necessary to configure encapsulation.

Settings:

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 81

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 79

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 79

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 79

3.4 BICM Settings

Access:

► Select "Baseband > ATSC 3.0 > BICM".

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

Settings:

3.4.1 General Settings

Access:

► Select "BICM > General".
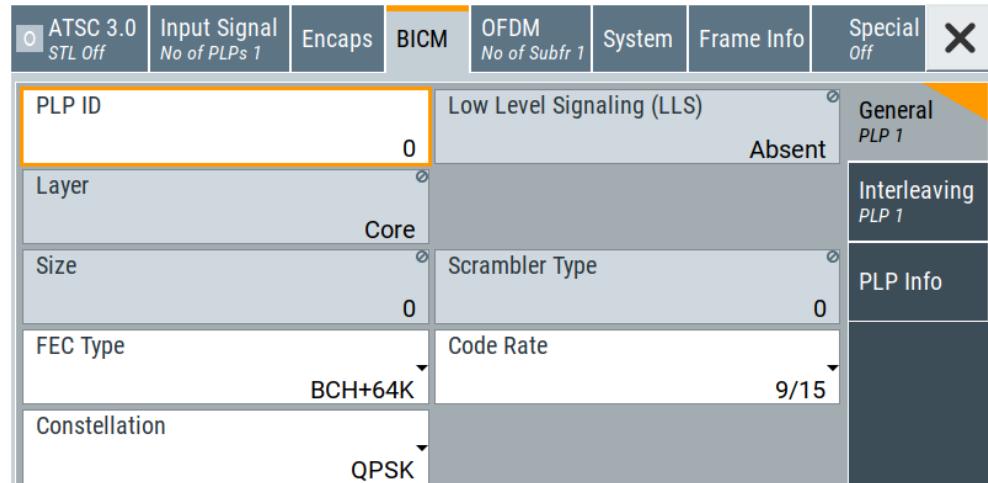
The tab provides settings necessary to configure the general BICM parameters.

Settings:

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 81

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 83

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 82

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 82

Size

Displays the number of data cells allocated to the PLP.

Remote command:

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

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 83

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 81

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 83

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 81

3.4.2 Interleaving Settings

Access:

► Select "BICM > Interleaving".
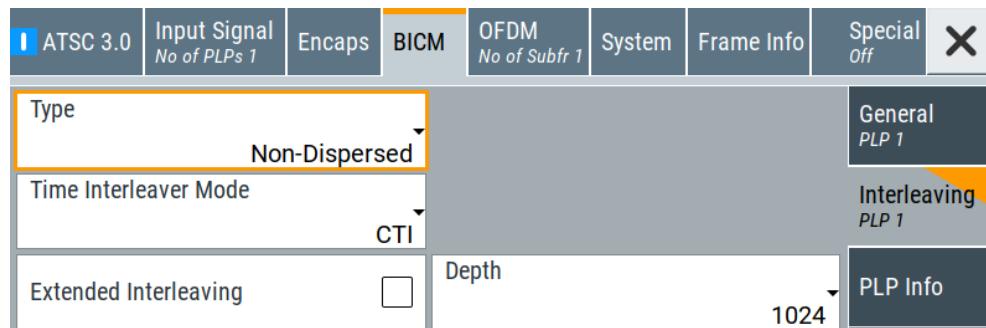
The tab provides settings necessary to configure interleaving.

Settings:

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"　All data cells have contiguous logical addresses. Subslicing is used.

Remote command:

[:SOURce<hw>]:BB:A3TSc:PLP<ch>:TYPE:TYPE on page 85

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 85

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 85

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 86

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 87

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 86

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 87

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 88

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 86

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 87

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 87

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
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 30.

3.5 OFDM Settings

Access:

► Select "Baseband > ATSC 3.0 > OFDM".

The tab provides settings necessary to configure OFDM settings of ATSC 3.0 sub-frames.

Settings:

3.5.1 General Settings

Access:

► Select "OFDM > General".
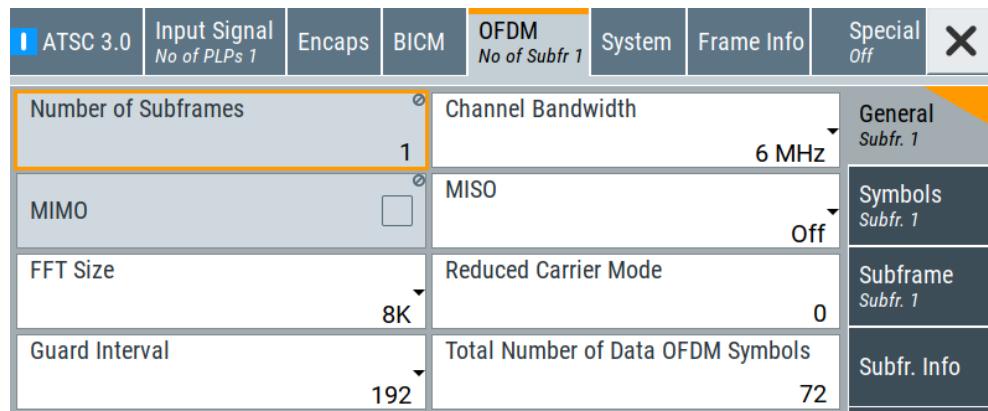
The tab provides to settings necessary to configure the general OFDM settings.

Settings:

Number of Subframes

Displays the number of subframes within the current frame.

Remote command:

[:SOURce<hw>]:BB:A3TSc:FRAMe:NSUBframes? on page 99

Channel Bandwidth

Selects the channel bandwidth.

The channel bandwidth correlates with the used bandwidth, that is smaller. See "Used Bandwidth" on page 36.

Remote command:

[:SOURce<hw>]:BB:A3TSc:CHANnel[:BANDwidth] on page 89

MIMO

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

Remote command:

[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:MIMO? on page 90

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 90

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 33
- "SISO Pilot Pattern" on page 34

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 89

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 89

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 32
- "SISO Pilot Pattern" on page 34

Remote command:

[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:GUARd:INTerval on page 89

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 32
- "Guard Interval" on page 33
- Maximum allowed frame duration of 5 s

Remote command:

[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:NDATa on page 90

3.5.2 Symbols Settings

Access:

► Select "OFDM > Symbols".

| ⓘ ATSC 3.0 | Input Signal _No of PLPs 1_ | Encaps | BICM | **OFDM** _No of Subfr 1_ | System | Frame Info | Special _Off_ | ✕ |

SISO Pilot Pattern ▾ 32_2	Pilot Boost Mode 4	General _Subfr. 1_
Subfr. Boundary Symbol (First) 0	Subfr. Boundary Symbol (Last) ⊘ 1	**Symbols** _Subfr. 1_
Subfr. Boundary Symbol (Null Cells) ⊘ 0	Frequency Interleaver ☑	Subframe _Subfr. 1_
		Subfr. Info

The tab provides settings necessary to configure OFDM symbols.

Settings:

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 33
● "FFT Size" on page 32

Remote command:
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:PILot:SISO on page 91

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 91

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 92

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 92

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 92

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 92

3.5.3 Subframe

Access:

► Select "OFDM > Subframe".

The tab displays the subframe information.

Settings:

Duration

Displays the duration of the subframe.

Remote command:

[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:DURation? on page 93

Used Bandwidth

Displays the used bandwidth.

The used bandwidth depends on the following:
- "Channel Bandwidth" on page 31
- "FFT Size" on page 32
- "Reduced Carrier Mode" on page 33

Remote command:

[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:USED[:BANDwidth]? on page 94

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 94

PLP IDs in Subframe

Displays all IDs of the PLPs mapped to the subframe. See also "PLP ID" on page 18.

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

Remote command:

[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:PLP:NIDPlp? on page 94

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 Symb	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...37

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 37.

3.6 System Settings

Access:

► Select "Baseband > ATSC 3.0 > System".

The tab provides settings necessary to configure ATSC 3.0 system parameters.

Settings:

- Network Settings...38
- Frame Settings...41
- L1 Settings..43

3.6.1 Network Settings

Access:

► Select "System > Network".

The tab provides network settings.

Settings:

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 38, 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 96

Low Level Signaling (LLS)
Displays, if low-level signaling is present in the system.

Remote command:
[:SOURce<hw>]:BB:A3TSc:LLS? on page 96

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 97

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

Remote command:
[:SOURce<hw>]:BB:A3TSc:RETurn[:CHANnel]? on page 97

Number of Transmitters (N_TX)
Sets the number of transmitters for MISO transmission.

Remote command:
[:SOURce<hw>]:BB:A3TSc:MISo:NTX on page 96

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 97

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 97

TxID Address ← TxID Mode
Requires "TxID Mode > Manual/Auto".

Sets the transmitter identification address.

Remote command:
[:SOURce<hw>]:BB:A3TSc:TXId:ADDRess on page 98

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 98

Broadcast Stream ID (BSID)
Requires "Network > L1 > L1 Detail Version > 0", see "L1 Detail Version" on page 44.

Editing the parameter requires "STL Interface > Off".

Sets the ID of the broadcast stream.

Remote command:

[:SOURce<hw>]:BB:A3TSc:BSID on page 96

3.6.2 Frame Settings

Access:

► Select "System > Frame".
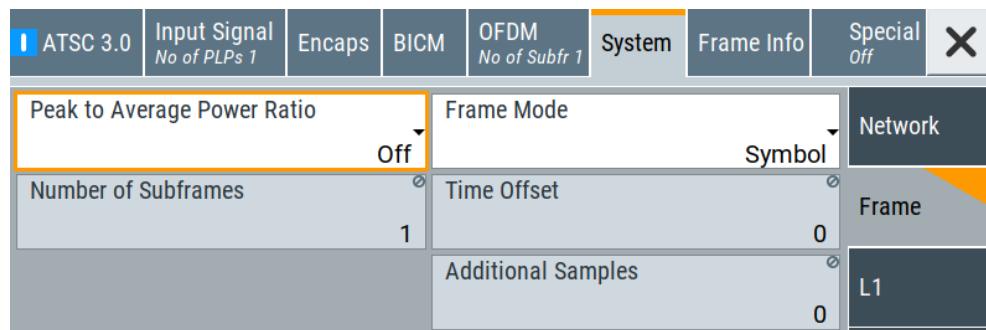
The tab provides frame settings.

Settings:

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 99

Number of Subframes

Displays the number of subframes within the current frame.

Remote command:

[:SOURce<hw>]:BB:A3TSc:FRAMe:NSUBframes? on page 99

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 100

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 100

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 100

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 100

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 101

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 101

3.6.3 L1 Settings

Access:

► Select "System > L1".
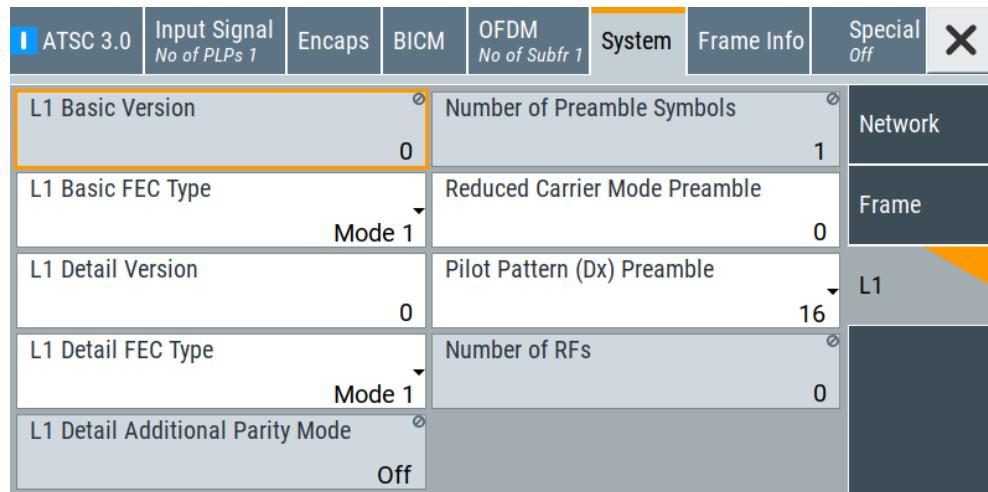
The tab provides settings necessary to configure common layer 1 (L1) settings.

Settings:

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 102

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 102

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 103

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 103

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 103

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 103

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 102

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 104

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 104

3.7 Frame Info

Access:

► Select "Baseband > ATSC 3.0 > Frame Info".

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

Settings:

3.7.1 Frame

Access:

► Select "Frame Info > Frame".

The tab displays frame parameters.

Settings:

Frame Duration

Displays the frame duration in ms.

Remote command:

[:SOURce<hw>]:BB:A3TSc:INFO:FRAMe:DURation? on page 105

Bootstrap Duration

Displays the duration of the bootstrap signal in ms.

Remote command:

[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:DURation? on page 105

3.7.2 L1 Signaling

Access:

► Select "Frame Info > L1 Signaling".

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

Settings:

L1 Basic Bytes

Displays the L1 basic signaling length in bytes.

Remote command:

[:SOURce<hw>]:BB:A3TSc:INFO:L:BASic:BYTes? on page 106

L1 Detail Bytes

Displays the L1 detail signaling length in bytes.

Remote command:

[:SOURce<hw>]:BB:A3TSc:INFO:L:DETail:BYTes? on page 106

L1 Basic Cells

Displays the L1 basic signaling length in cells.

Remote command:

[:SOURce<hw>]:BB:A3TSc:INFO:L:BASic:CELLs? on page 106

L1 Detail Cells

Displays the L1 detail signaling length in cells.

Remote command:

[:SOURce<hw>]:BB:A3TSc:INFO:L:DETail:CELLs? on page 107

3.7.3 Bootstrap

Access:

► Select "Frame Info > Bootstrap".

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

Displays the major version of the bootstrap.

Remote command:

[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:MAJor? on page 109

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 > Specifal Settings > On"
- "Special > STL Off. Bootstrap > Minor Version ≠ 0"

Remote command:
[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:MINor? on page 109

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 110

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 > Specifal 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 108

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 108

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 14.

"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 108

3.7.4 Structure

Access:

► Select "Frame Info > Structure".

The tab displays preamble symbols structure parameters.

Settings:

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 110

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 32.

Remote command:

[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:FFT:MODE? on page 109

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 33.

Remote command:
[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:GUARd:INTerval? on page 109

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 44.

Remote command:
[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:PILot:DX? on page 110

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 43.

Remote command:
[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:BASic:FECType? on page 108

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 necessary to configure SFN parameters.

Settings

3.8.1 Delays Settings

Access:

► Select "SFN > Delays".

The tab provides settings necessary to configure SFN delays.

Settings

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 114

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 114

Dynamic Delay

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

Remote command:

[:SOURce<hw>]:BB:A3TSc:DELay:DYNamic? on page 113

Total Delay

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

Remote command:

[:SOURce<hw>]:BB:A3TSc:DELay:TOTal? on page 115

Max. Deviation Time

Sets the maximum permissible delay.

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

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

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 112

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 114

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 113

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 112

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 113

3.8.2 Mode Settings

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

Access:

► Select "Baseband > ATSC 3.0 > SFN".

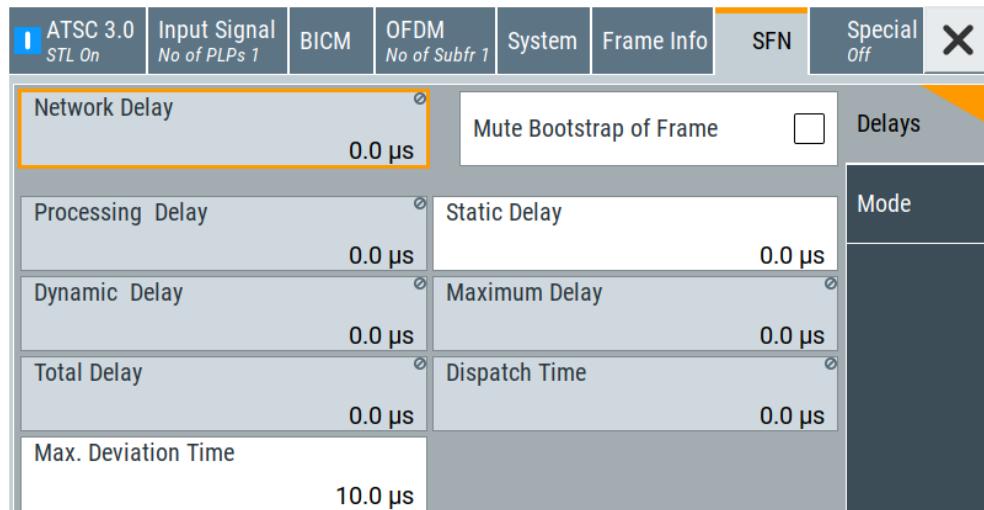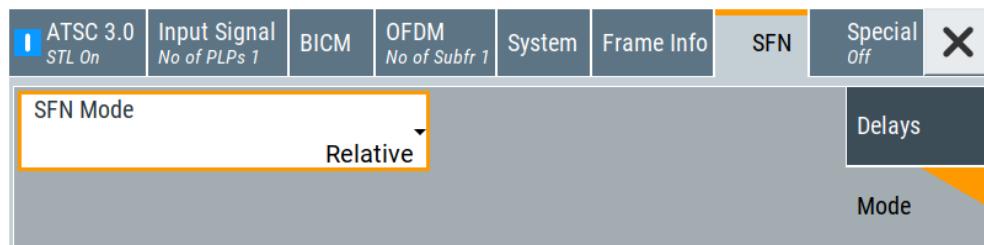The tab provides settings necessary to configure the SFN mode.

Settings

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 114

3.9 Special Settings

Access:

► Select "Baseband > ATSC 3.0 > Special".

| ATSC 3.0 | Input Signal No of PLPs 1 | Encaps | BICM | OFDM No of Subfr 1 | System | Frame Info | Special Off | ✕ |

| Special Settings | ☐ |

| STL Interface | | Bootstrap |

| Preamble Compatibility Mode | ☐ | Minor Version | 0 |

| TMP Compatibility Mode | ☐ | Emergency Alert Signaling (EAS) | No Emergency |

| ALP Encapsulation |

| LMT Compatibility Mode | ☐ |
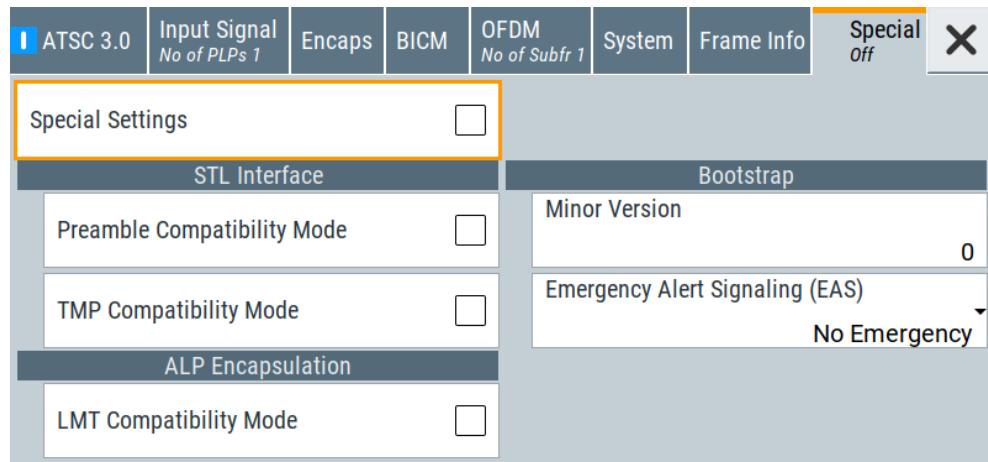
The tab provides settings, that differ from the specification of the broadcast standard.

ⓘ 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 left to the parameter.

Settings:

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 116

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 117

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 117

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 47.

Remote command:

[:SOURce<hw>]:BB:A3TSc:SPECial:BOOTstrap:MINor on page 117

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 48.

"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 116

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 116

3.10 Data Generation Settings

Access:

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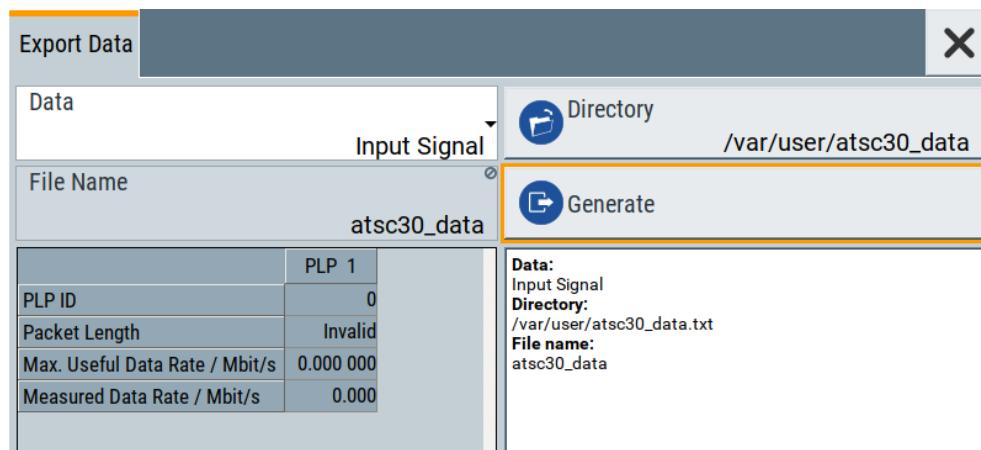
The "Export Data" tab provides settings to generate data of the ATSC 3.0 signal characteristics. You can generate data for the input signal, BICM and subframing and OFDM and export the data to a file.

Settings:

Data

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" tab 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 30.

"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 37.

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 con-

taining 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 stream files includes:

- Base unit, including arbitrary waveform generator (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)
- Optional 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 "How to Work with Waveform Libraries" in the R&S SMCV100B user manual.

For information on the content of a stream library, see 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	"T-DMB/DAB"	Yes
"ATSC 3.0"	Yes	"DVB-S"	Yes

Baseband standard	"Source > TS Player"	Baseband standard	"Source > TS Player"
"DTMB"	Yes	"DVB-S2"	Yes
"DVB-T"	Yes	"DRM"	No
"DVB-T2"	Yes	"Audio AM"	No
"ISDB-T"	Yes	"Audio FM"	No

The remote commands required to define these settings are described in Chapter 4.10, "TSGen Subsystem", on page 117.

Settings:

3.12.1 TS Player Settings

Access:

1. Follow the steps in "To access the "TS Player" application" on page 58.

2. Select "TS Player > TS-Player".
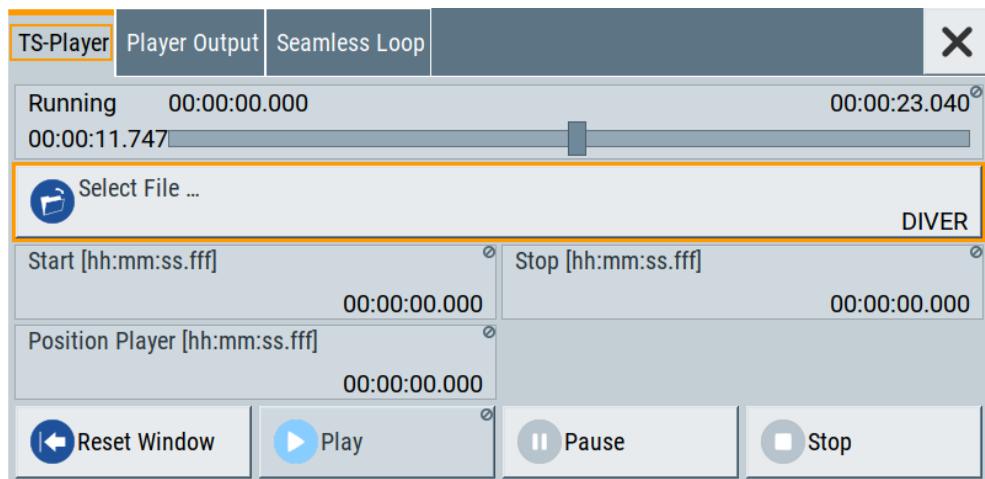
The tab provides settings necessary to configure the general settings of the TS player application.

Settings:

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 122

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 120

`:TSGen:READ:PLAYfile:LENGth?` on page 125

`:TSGen:READ:FMEMory` on page 124

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 122

Position Player [hh:mm:ss.fff]

Displays the current play position in the file.

Remote command:

`:TSGen:CONFigure:SEEK:POSition` on page 122

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 123

Reset Window

Resets "Start/Stop/Position Player" parameters.

Remote command:

`:TSGen:CONFigure:SEEK:RESet` on page 122

Play

Plays the selected file.

For supported file types, see Table 3-1.

Remote command:
:TSGen:CONFigure:COMMand<ch> on page 119

Pause

Pauses the player.

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

Remote command:
:TSGen:CONFigure:COMMand<ch> on page 119

Stop

Stops the player and returns to the start position.

Remote command:
:TSGen:CONFigure:COMMand<ch> on page 119

3.12.2 Player Output Settings

Access:

► Select "TS Player > Player Output".

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

3.12.2.1 General Settings
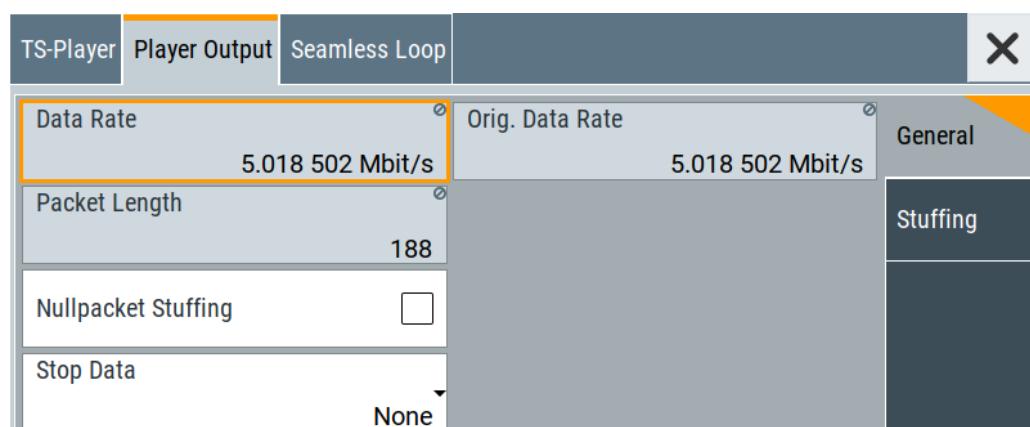
The tab provides settings necessary to configure general player output properties.

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 124

Orig. Data Rate
Displays the calculated original TS data rate.

Remote command:
`:TSGen:READ:ORIGtsrate` on page 124

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:TSPacket` on page 124

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

Enables or disables nullpacket stuffing.

The output data rate of the TS player equals the original data rate. The equality ensures 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 ("PCR, DTS/PTS > On").

"Off"   Deactivate stuffing, if you want to use the same data rate as the original data rate.

Remote command:
`:TSGen:CONFigure:STUFfing` on page 123

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 123

3.12.2.2 Stuffing Settings
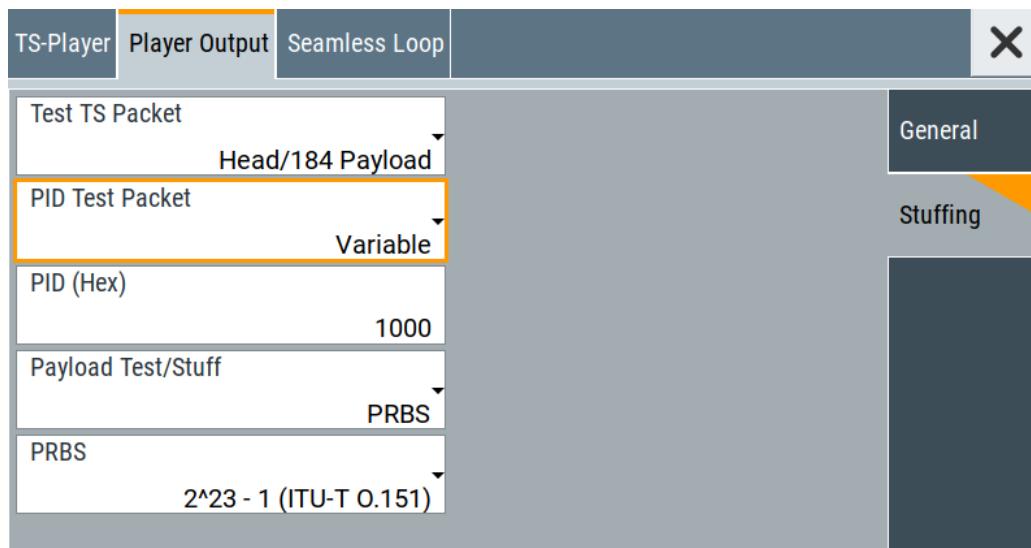
The tab comprises settings necessary to configure stuffing.

Settings

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) 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) followed by 207 payload bytes.

Remote command:

:TSGen:CONFigure:TSPacket on page 124

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 120

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 120

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 120

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 121

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".

TS-Player	Player Output	Seamless Loop		✕
Continuity Counter		☑		
PCR, DTS/PTS		☑		
TDT/TOT		☑		
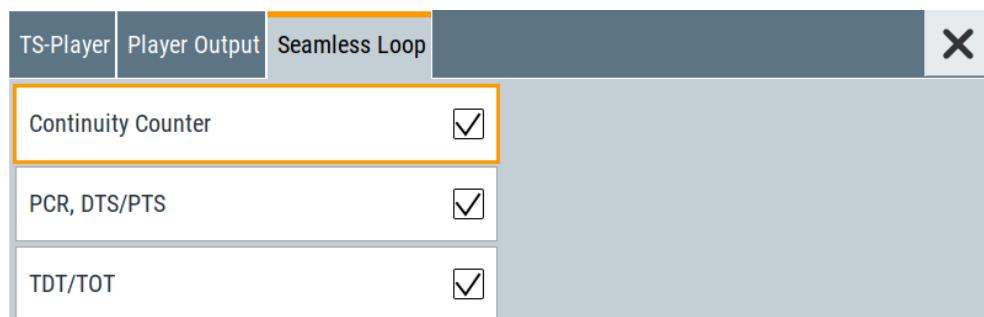
The tab provides settings necessary to configure settings for playing the file in a loop.

Settings:

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 121

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 121

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 122

4 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:

4.1 General Commands

Example: Storing 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

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 "Storing current configuration" on page 68.
Usage:	Event
Manual operation:	See "Set To Default" on page 12

[: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>	0 | 1 | OFF | ON
	*RST: 0
Example:	See Example "Storing current configuration" on page 68.
Manual operation:	See "State" on page 12

[: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 "Storing current configuration" on page 68.
Manual operation:	See "Save/Recall" on page 12

[: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 "Storing current configuration" on page 68.
Usage:	Setting only
Manual operation:	See "Save/Recall" on page 12

[: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 "Storing current configuration" on page 68.
Manual operation:	See "Save/Recall" on page 12

[: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 "Storing current configuration" on page 68.
Manual operation:	See "Save/Recall" on page 12

[: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 70.
Usage:	Query only
Manual operation:	See "Status Info" on page 14

4.2 Input Signal Commands

4.2.1 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?
// 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?
// "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?
// 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 <ConfCheck>

Sets the depth of inspection for the conformance check.

Parameters:
<ConfCheck>   0 | 1 | OFF | ON

Example: See Example "Configuring general input signal parameters"
                         on page 70.

Manual operation: See "Conformance Check" on page 15

[: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 70.

Manual operation: See "Destination IP Address" on page 13

[: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 70.

Manual operation: See "Destination IP Port" on page 13

[: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 70.

Usage: Query only

Manual operation: See "Number of PLPs" on page 16

[: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 70.
Usage:	Query only
Manual operation:	See "Protocol" on page 17

[:SOURce<hw>]:BB:A3TSc:INPut:STL:INTerface <STLInterface>

Activates the STL interface.

Parameters:

<STLInterface>	0	1	OFF	ON
Example:	See Example "Configuring general input signal parameters" on page 70.
Manual operation:	See "STL Interface" on page 12

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

Resets the log file.

Parameters:

<ResetLogFile>	select
Example:	See Example "Configuring general input signal parameters" on page 70.
Manual operation:	See "Reset Log File" on page 13

[: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 70.	
Manual operation:	See " Input Type" on page 17	

[: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 70.

Manual operation: See " Source " on page 16

4.2.2 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?
// 19392659 Bit/s
:SOURce1:BB:A3TSc:PLP1:INPut:DATArate?
// 18765432 Bit/s

//*********************************************************************************
// 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?
// 19392659 Bit/s
:SOURce1:BB:A3TSc:PLP1:INPut:DATArate?
// 18765432 Bit/s
```

Commands

[: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 (TSo-verIP)
- 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 74.
Usage:	Query only
Manual operation:	See "Measured Data Rate / Mbit/s" on page 19

[: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 74.
Usage:	Query only
Manual operation:	See " Packet Length " on page 18

[: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 74.
Usage:	Query only
Manual operation:	See "Useful Data Rate / Mbit/s" on page 19

[: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 74.

Usage: Query only

Manual operation: See "Max. Useful Data Rate / Mbit/s" on page 19

4.2.3 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?
// "8191" in decimal representation
// "1FFF" in hexadecimal representation
: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 <TestSignal>

Defines the test signal data.

Parameters:

<TestSignal>   TTSP | TIPP

                                   *RST: TTSP

Example: See Example "Configuring test signal parameters" on page 76.

Manual operation: See "Test Signal" on page 17

[: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 76.

Manual operation: See "Test IP Packet" on page 20

[: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 76.

Manual operation: See "Test TS Packet" on page 20

[: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 76.

Manual operation: See "Payload Test/Stuff" on page 21

[: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 76.

Manual operation: See "PID (Hex)" on page 21

[: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 76.

Manual operation: See "PID Test Packet" on page 21

[: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 76.

Manual operation: See "PRBS" on page 21

4.3 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?

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 78.
Usage:	Query only
Manual operation:	See "ALP Encapsulation Type" on page 23

[: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>	0 | 1 | OFF | ON

Example:	See Example "Configuring encapsulation parameters" on page 78.
Manual operation:	See "BB Frame Counter" on page 23

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

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

Return values:

<BBFramePadding>   0 | 1 | OFF | ON

Example: See Example "Configuring encapsulation parameters" on page 78.

Usage: Query only

Manual operation: See "BB Frame Padding" on page 23

4.4 BICM Commands

The section contains the commands for configuring BICM.

4.4.1 General Commands

Example: Configuring general BICM parameters

```
//*******************************************************************************
// Set PLP ID for PLP 1.
//*******************************************************************************
:SOURce1:BB:A3TSc:PLP1:ID 1

//*******************************************************************************
// Set coding and constellation for PLP 1.
//*******************************************************************************
:SOURce1:BB:A3TSc:PLP1:FECType B64K
:SOURce1:BB:A3TSc:PLP1:RATE R9_15
:SOURce1: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.
//*******************************************************************************
:SOURce1:BB:A3TSc:INPut:STL:INTerface?
// Response: 0

:SOURce1:BB:A3TSc:PLP2:LLS?
// Response: ABSent
:SOURce1:BB:A3TSc:PLP2:LAYer:LAYer?
// Response: ENHanced
// Second layer of a 2-layer LDM system
:SOURce1:BB:A3TSc:PLP2:LAYer:LEVel?
// Response: L40
// Injection level of 4.0 dB
```

```
:SOURce1:BB:A3TSc:PLP2:SIZE?
// Response: 1314804
:SOURce1:BB:A3TSc:PLP2:SCRambler?
// Response: 0
```

Commands

[: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 80.

Manual operation: See "PLP ID" on page 18

[: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 80.

Manual operation: See "Constellation" on page 26

[: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 80.

Manual operation: See "FEC Type" on page 26

[: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 80.

Usage: Query only

Manual operation: See "Layer" on page 25

[: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 80.

Usage: Query only

Manual operation: See "LDM Injection Level" on page 25

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

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

Return values:

<LowLevelSignali>   ABSent | PRESent

Example: See Example "Configuring general BICM parameters"
on page 80.

Usage: Query only

Manual operation: See "Low Level Signaling (LLS)" on page 25

[: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 80.

Manual operation: See "Code Rate" on page 26

[: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 80.

Usage: Query only

Manual operation: See "Scrambler Type" on page 25

[: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 25

4.4.2 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:SUBSlice: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

[: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 84.

Manual operation: See "Type" on page 27

[: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 84.

Manual operation: See "Number of Subslices" on page 27

[: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 84.

Manual operation: See "Subslice Interval" on page 28

[: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 84.

Manual operation: See "Time Interleaver Mode" on page 28

[: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 87:

- If enabled, defines the number of subframes over which cells from one time inter-leaver (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 84.

Manual operation: See "Number of TI Blocks" on page 29

[: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 84.

Manual operation: See "Depth" on page 28

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

If enabled, increases the time interleaving depth.

Parameters:
<ExtendedInter>   0 | 1 | OFF | ON

Example: See Example "Configure interleaving parameters" on page 84.

Manual operation: See "Extended Interleaving" on page 28

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

Defines the interleaving frame content and mapping.

Return values:
<InterSubframe>   0 | 1 | OFF | ON

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 84.

Usage: Query only

Manual operation: See "Inter Subframe" on page 28

[: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 84.

Usage: Query only

Manual operation: See "Number of FEC Blocks" on page 29

[: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 84.
Usage:	Query only
Manual operation:	See "Max. Number of FEC Blocks" on page 29

[:SOURce<hw>]:BB:A3TSc:PLP<ch>:TIL:CIL <CellInterleaver>

Enables or disables the interleaver operating at the cell level.

Parameters:

<CellInterleaver>	0 | 1 | OFF | ON

Example:	See Example "Configure interleaving parameters" on page 84.
Manual operation:	See "Cell Interleaver" on page 29

4.5 OFDM and Subframe Commands

The section contains the commands for configuring OFDM symbols and subframing.

4.5.1 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] <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 88.

Manual operation: See "Channel Bandwidth" on page 31

[: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 88.

Manual operation: See "Reduced Carrier Mode" on page 33

[: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 88.

Manual operation: See "FFT Size" on page 32

[: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 88.
Manual operation:	See "Guard Interval" on page 33

[: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 88.
Usage:	Query only
Manual operation:	See "MIMO" on page 32

[: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 88.
Manual operation:	See "MISO" on page 32

[: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 88.
Manual operation:	See "Total Number of Data OFDM Symbols" on page 33

4.5.2 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 <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 subframe" on page 91.
Manual operation:	See "SISO Pilot Pattern" on page 34

[: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 subframe" on page 91.

Manual operation: See "Pilot Boost Mode" on page 34

[: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 91.

Manual operation: See "Frequency Interleaver" on page 35

[: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 91.

Manual operation: See "Subframe Boundary Symbol (First)" on page 34

[: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 91.

Usage: Query only

Manual operation: See "Subframe Boundary Symbol (Last)" on page 35

[: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 subframe" on page 91.

Usage: Query only

Manual operation: See "Subframe Boundary Symbol (Null Cells)" on page 35

4.5.3 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?

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 93.

Usage: Query only

Manual operation: See "Duration" on page 36

[: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 93.

Usage: Query only

Manual operation: See "Used Bandwidth" on page 36

[: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 93.

Usage: Query only

Manual operation: See "Number of PLPs in Subframe" on page 36

[: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 93.

Usage: Query only

Manual operation: See "PLP IDs in Subframe" on page 36

4.6 System Commands

The section contains the commands for configuring the ATSC 3.0 system.

4.6.1 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 4.8, "SFN Delay Commands", on page 111.

Commands

[:SOURce<hw>]:BB:A3TSc:NETWorkmode <NetworkMode>

Sets the network mode.

Parameters:

<NetworkMode>   MFN | SFN

Example: See Example "Configuring network parameters" on page 95.

Manual operation: See "Network Mode" on page 38

[: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 95.

Manual operation: See "Broadcast Stream ID (BSID)" on page 40

[: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 95.

Usage: Query only

Manual operation: See "Low Level Signaling (LLS)" on page 39

[: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 95.

Manual operation: See "Number of Transmitters (N_TX)" on page 40

[: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 95.

Manual operation: See "Transmitter Index (x)" on page 40

[: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 95.

Usage: Query only

Manual operation: See "Return Channel" on page 39

[: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 95.

Manual operation: See "Time Info" on page 39

[: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 95.
Manual operation:	See "TxID Mode" on page 40

[:SOURce<hw>]:BB:A3TSc:TXId:ADDRess <TxIDAdress>

Sets the transmitter identification address.

Parameters:

<TxIDAdress>	integer
	Range: 0 to 8191
	*RST: 0

Example:	See Example "Configuring network parameters" on page 95.
Manual operation:	See "TxID Address" on page 40

[: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 95.
Manual operation:	See "TxID Injection Level" on page 40

4.6.2 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 <PAPR>

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

Parameters:

<PAPR>	OFF | TR

Example: See Example "Configuring frame parameters" on page 98.

Manual operation: See "Peak To Average Power Ratio" on page 41

[: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 88
Example "Configuring frame parameters" on page 98

Usage: Query only

Manual operation: See "Number of Subframes" on page 31

[: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 98.

Manual operation: See "Frame Mode" on page 42

[: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 98.

Manual operation: See "Frame Length" on page 42

[: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 98.

Usage: Query only

Manual operation: See "Excess Samples per Symbol" on page 42

[: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 98.

Usage:	Query only
Manual operation:	See "Final Excess Samples" on page 42

[: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 98.
Usage:	Query only
Manual operation:	See "Time Offset" on page 42

[: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 98.
Usage:	Query only
Manual operation:	See "Additional Samples" on page 42

4.6.3 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 <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 101.

Manual operation: See "L1 Basic FEC Type" on page 43

[: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 101.

Usage: Query only

Manual operation: See "L1 Basic Version" on page 43

[: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 101.

Manual operation:　　See "Reduced Carrier Mode Preamble" on page 44

[: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 101.

Usage:　　　　　Query only

Manual operation:　　See "L1 Detail Additional Parity Mode" on page 44

[: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 101.

Manual operation:　　See "L1 Detail FEC Type" on page 44

[: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 101.

Manual operation:　　See "L1 Detail Version" on page 44

[: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 101.

Usage:　　　　　Query only

Manual operation: See "Number of Preamble Symbols" on page 44

[: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 101.

Manual operation: See "Pilot Pattern (Dx) Preamble" on page 44

[: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 101.

Usage: Query only

Manual operation: See "Number of RFs" on page 45

4.7 Frame Info Commands

The section contains the commands for querying frame and bootstrap information.

4.7.1 General Commands

Example: Querying general frame information

```
:SOURce1:BB:A3TSc:INFO:FRAMe:DURation?
// Response: 0.179093 s
:SOURce1:BB:A3TSc:INFO:BOOTstrap:DURation?
// Response: 0.002 s
```

Commands

[: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 104.
Usage:	Query only
Manual operation:	See "Bootstrap Duration" on page 46

[: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 104.
Usage:	Query only
Manual operation:	See "Frame Duration" on page 46

4.7.2 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?

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 105.

Usage: Query only

Manual operation: See "L1 Basic Bytes" on page 46

[: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 105.

Usage: Query only

Manual operation: See "L1 Basic Cells" on page 47

[: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 105.

Usage: Query only

Manual operation: See "L1 Detail Bytes" on page 46

[: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 105.

Usage: Query only

Manual operation: See "L1 Detail Cells" on page 47

4.7.3 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?

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 107.
Usage:	Query only
Manual operation:	See "System Bandwidth" on page 48

[: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 107.
Usage:	Query only
Manual operation:	See "L1 Basic FEC Type" on page 50

[: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 107.
Usage:	Query only
Manual operation:	See "BSR Coefficient" on page 48

[: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 107.

Usage: Query only

Manual operation: See "Emergency Alert Signaling (EAS)" on page 48

[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:FFT:MODE?

Queries the FFT size of the preamble symbols.

Return values:

<FFTMode>	M8K | M16K | M32K

Example: See Example "Querying bootstrap parameters" on page 107.

Usage: Query only

Manual operation: See "FFT Size" on page 49

[: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 107.

Usage: Query only

Manual operation: See "Guard Interval" on page 49

[: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 107.

Usage: Query only

Manual operation: See "Major Version" on page 47

[: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 107.
Usage:	Query only
Manual operation:	See "Minor Version" on page 47

[: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 107.
Usage:	Query only
Manual operation:	See "Pilot Pattern (Dx)" on page 50

[: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 107.
Usage:	Query only
Manual operation:	See "Preamble Structure" on page 49

[: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 107.
Usage:	Query only

Manual operation: See "Min. Time to Next" on page 48

4.8 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 <Deviation>

Sets the maximum permissible delay.

Parameters:

<Deviation>	float
	Range: 1.0 to 500.0
	Increment: 0.1
	*RST: 10
	Default unit: μs

Example: See Example "Configuring single frequency network delay parameters" on page 111.

Manual operation: See "Max. Deviation Time" on page 52

[: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:

<Dispatch>	float
	Range: -1000000.0 to 6000000.0
	Increment: 0.1
	*RST: 0
	Default unit: μs

Example: See Example "Configuring single frequency network delay parameters" on page 111.

Usage: Query only

Manual operation: See "Dispatch Time" on page 52

[:SOURce<hw>]:BB:A3TSc:DELay:DYNamic?

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

Return values:

<Dynamic>   float

Range: -16000000.0 to 6000000.0
Increment: 0.1
*RST: 0
Default unit: µs

Example: See Example "Configuring single frequency network delay parameters" on page 111.

Usage: Query only

Manual operation: See "Dynamic Delay" on page 52

[: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: µs

Example: See Example "Configuring single frequency network delay parameters" on page 111.

Usage: Query only

Manual operation: See "Maximum Delay" on page 52

[:SOURce<hw>]:BB:A3TSc:DELay:MUTE[:BOOTstrap] <MuteBootstrap>

If enabled, replaces the bootstrap by a null signal (no output power).

Parameters:

<MuteBootstrap>   0 | 1 | OFF | ON
*RST: Off

Example: See Example "Configuring single frequency network delay parameters" on page 111.

Manual operation: See "Mute Bootstrap of Frame" on page 52

[: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: µs

Example: See Example "Configuring single frequency network delay parameters" on page 111.

Usage: Query only

Manual operation: See "Network Delay" on page 51

[: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 111.

Usage: Query only

Manual operation: See "Processing Delay" on page 51

[: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 111.

Manual operation: See "SFN Mode" on page 53

[:SOURce<hw>]:BB:A3TSc:DELay:STATic <Static>

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

Parameters:

<Static>   float

                    Range: -1000000.0 to 1000000.0
                    Increment: 0.1
                    *RST: 0
                    Default unit: µs

Example: See Example "Configuring single frequency network delay parameters" on page 111.

Manual operation: See "Static Delay" on page 52

[: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 111.

Usage: Query only

Manual operation: See "Total Delay" on page 52

4.9 Special Commands

The section contains commands to configure settings, that deviate 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] <SpecialSettings>

Enables/disables special settings.

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

Parameters:

<SpecialSettings>   0 | 1 | OFF | ON

Example: See Example "Configuring special settings" on page 115.

Manual operation: See " Special Settings " on page 54

[:SOURce<hw>]:BB:A3TSc:SPECial:ALP:LMT <LMTCompMode>

Sets how the LMT signaling is supported.

Parameters:

<LMTCompMode>   0 | 1 | OFF | ON

Example: See Example "Configuring special settings" on page 115.

Manual operation: See "LMT Compatibility Mode" on page 55

[: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 115.

Manual operation: See "Emergency Alert Signaling (EAS)" on page 55

[: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 115.

Manual operation: See "Minor Version" on page 55

[:SOURce<hw>]:BB:A3TSc:SPECial:STL:PREamble <PreCompMode>

Sets how the preamble packet is supported.

Parameters:

<PreCompMode>   0 | 1 | OFF | ON

Example: See Example "Configuring special settings" on page 115.

Manual operation: See "Preamble Compatibility Mode" on page 55

[:SOURce<hw>]:BB:A3TSc:SPECial:STL:TMP <TMPCompMode>

Sets how the time & management packet is supported.

Parameters:

<TMPCompMode>   0 | 1 | OFF | ON

Example: See Example "Configuring special settings" on page 115.

Manual operation: See "TMP Compatibility Mode" on page 55

4.10 TSGen Subsystem

The TSGen subsystem contains the commands for configuring the TS player.

Example: Play 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: Configure and monitor 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:PIDTestpack VAR
:TSGen:CONFigure:PID 8100
// Corresponds to a PID = 1FA4 in hexadecimal format.
:TSGen:CONFigure:PAYLoad PRBS
:TSGen:CONFigure:PRBS:SEQuence P23_1


//*************************************************************************************
// Monitor TS player output data.
//*************************************************************************************
:TSGen:CONFigure:COMMand STOP
// TSRate can only be changed if player is in stop mode
```

```
:TSGen:CONFigure:TSRate 350E6 // net data rate = 350 MBit/s
:TSGen:CONFigure:COMMand PLAY

:TSGen:CONFigure:PLENgth?
// Response: P188 // packet length = 188 byte
:TSGen:READ:ORIGtsrate?
// Response: 5018502 bit/s
```

Example: Configure seamless loop parameters

```
:TSGen:CONFigure:SEAMless:CC ON
:TSGen:CONFigure:SEAMless:PCR OFF
:TSGen:CONFigure:SEAMless:TT ON
```

Commands

:TSGen:CONFigure:COMMand<ch>

Triggers playing, pausing and stopping of the TS player file selected with `:TSGen: CONFigure:PLAYfile`.

Setting parameters:

<PlayerStatus>	STOP | PLAY | PAUSe
	*RST:　　　STOP

Example:	See Example "Play a TS player file" on page 117.
Usage:	Event
Manual operation:	See "Play" on page 61

: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 "Configure and monitor TS player output" on page 118.
Manual operation:	See "Payload Test/Stuff" on page 65

: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 "Configure and monitor TS player output" on page 118.
Manual operation:	See "PID (Hex)" on page 65

:TSGen:CONFigure:PIDTestpack <PIDTestpack>

Sets the PID, if :TSGen:CONFigure:TSPacket is H184|H200|H204.

Parameters:

<PIDTestpack>	VARiable | NULL
	*RST: NULL

Example:	See Example "Configure and monitor TS player output" on page 118.
Manual operation:	See "PID Test Packet" on page 65

:TSGen:CONFigure:PLAYfile <PlayFile>

Specifies the file path and filename of the TS player file.

Parameters:

<PlayFile>	string

Example:	See Example "Play a TS player file" on page 117.

Manual operation: See "Select File" on page 60

:TSGen:CONFigure:PLENgth <PLength>

Queries the packet length of the loaded file.

Parameters:

<PLength>   P188 | P204 | P208 | INV

                    *RST: INV

Example: See Example "Configure and monitor TS player output"
                    on page 118.

:TSGen:CONFigure:PRBS[:SEQuence] <PRBS>

Sets the length of the PRBS sequence.

Parameters:

<PRBS>   P15_1 | P23_1

                    *RST: P23_1

Example: See Example "Configure and monitor TS player output"
                    on page 118.

Manual operation: See "PRBS" on page 65

: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>   0 | 1 | OFF | ON

                    *RST: 0

Example: See Example "Configure seamless loop parameters"
                    on page 119.

Manual operation: See "Continuity Counter" on page 66

: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>   0 | 1 | OFF | ON

                    *RST: 0

Example: See Example "Configure seamless loop parameters"
                    on page 119.

Manual operation: See "PCR, DTS/PTS" on page 66

: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>   0 | 1 | OFF | ON

                        *RST: 0

Example: See Example "Configure seamless loop parameters" on page 119.

Manual operation: See "TDT/TOT" on page 66

: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 "Play a TS player file" on page 117.

Manual operation: See "Running/Position Player [hh:mm:ss:fff]" on page 60

:TSGen:CONFigure:SEEK:RESet

Resets the following parametets to their default state:

- :TSGen:CONFigure:SEEK:STARt on page 122
- :TSGen:CONFigure:SEEK:STOP on page 123

Example: See Example "Play a TS player file" on page 117.

Manual operation: See "Reset Window" on page 61

: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 "Play a TS player file" on page 117.

Manual operation: See "Start [hh:mm:ss.fff]" on page 61

: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 "Play a TS player file" on page 117.

Manual operation: See "Stop [hh:mm:ss.fff]" on page 61

: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 "Configure and monitor TS player output" on page 118.

Manual operation: See "Stop Data" on page 63

:TSGen:CONFigure:STUFfing <Stuffing>

Enables or disables nullpacket stuffing.

Parameters:

<Stuffing>	0	1	OFF	ON

*RST: 0

Example: See Example "Configure and monitor TS player output" on page 118.

Manual operation: See "Nullpacket Stuffing" on page 63

: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 "Configure and monitor TS player output"
                         on page 118.

Manual operation: See "Packet Length" on page 63

:TSGen:CONFigure:TSRate <TSRate>

Sets the output data rate of the player.

Parameters:

<TSRate>   integer

                         Range: 1 to 35E7
                         *RST: 5018502

Example: See Example "Configure and monitor TS player output"
                         on page 118.

Manual operation: See "Data Rate" on page 62

:TSGen:READ:FMEMory <FMemory>

Queries the file size of the TS player file.

Parameters:

<FMemory>   integer

                         Range: 0 to 10
                         *RST: 0

Example: See Example "Configure and monitor TS player output"
                         on page 118.

Manual operation: See "Select File" on page 60

:TSGen:READ:ORIGtsrate <ORIGtsrate>

Displays the calculated original TS data rate.

Parameters:

<ORIGtsrate>	integer

Range: 1 to 350000000
*RST: 5018502

Example: See Example "Configure and monitor TS player output" on page 118.

Manual operation: See "Orig. Data Rate" on page 63

:TSGen:READ:PLAYfile:LENGth?

Queries calculated original loop time.

Return values:

<Length>	integer

Range: 0 to 100
*RST: 0

Example: See Example "Configure and monitor TS player output" on page 118.

Usage: Query only

Manual operation: See "Select File" on page 60

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

List of commands

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