

# R&S®SMCVB-K162

## ATSC 3.0

### User Manual



1179098002

This document describes the following software options:

- R&S®SMCVB-K162  
1434.3854.02

This manual describes firmware version FW 4.70.176.xx and later of the R&S®SMCV100B.

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

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# 1 Preface

## 1.1 About This Manual

This user manual provides all the information **specific to the ATSC 3.0 option R&S SMCVB-K162**. All general instrument functions and settings common to all applications and operating modes are described in the main R&S SMCV100B user manual.

The main focus in this manual is on the provided settings and the tasks required to generate a signal. The following topics are included:

- **Welcome to the ATSC 3.0 option R&S SMCVB-K162**  
Introduction to and getting familiar with the option
- **About the ATSC 3.0**  
Background information on basic terms and principles in the context of the signal generation
- **ATSC 3.0 Configuration and Settings**  
A concise description of all functions and settings available to configure signal generation with their corresponding remote control command
- **Remote Control Commands**  
Remote commands required to configure and perform signal generation in a remote environment, sorted by tasks  
(Commands required to set up the instrument or to perform common tasks on the instrument are provided in the main R&S SMCV100B user manual)  
Programming examples demonstrate the use of many commands and can usually be executed directly for test purposes
- **Glossary**  
Alphabetical list of often used terms and abbreviations and specifications
- **List of remote commands**  
Alphabetical list of all remote commands described in the manual
- **Index**

## 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](http://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 the rated specifications, module replacement and repair, firmware update, troubleshooting and fault elimination, and contains mechanical drawings and spare part lists.

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](http://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](http://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](http://www.rohde-schwarz.com/application/smcv100b)

## 2 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.

### 2.1 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".

### 2.2 Scope



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

In particular, it includes:

- Managing settings and data lists, like storing 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.

## 2.3 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.

## 3 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.

### 3.1 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)

## 4 ATSC 3.0 Configuration and Settings

Access:

- ▶ Select "Baseband > ATSC 3.0".

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

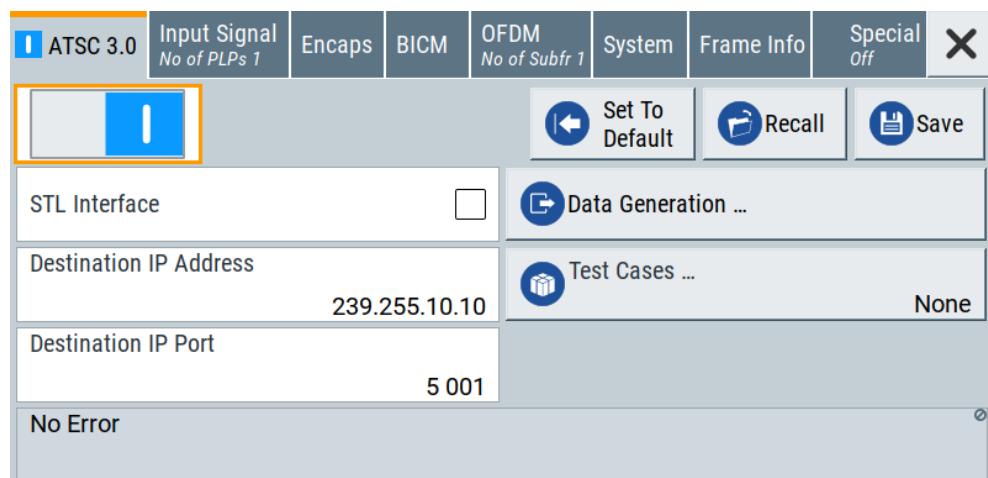
**Settings:**

● General Settings.....	13
● Input Signal Settings.....	16
● Encaps Settings.....	24
● BICM Settings.....	26
● OFDM Settings.....	32
● System Settings.....	39
● Frame Info.....	47
● SFN Settings.....	52
● Special Settings.....	56
● Data Generation Settings.....	58
● Global Connector Settings.....	59
● TS Player.....	60

### 4.1 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:**

<b>State</b>	14
<b>Set To Default</b>	14
<b>Save/Recall</b>	14
<b>STL Interface</b>	14
<b>Destination IP Address</b>	15
<b>Destination IP Port</b>	15
<b>Data Generation</b>	15
<b>Test Cases</b>	15
└ <b>Filter Test Cases</b>	15
<b>Reset Log File</b>	15
<b>Status Info</b>	16

**State**

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

Remote command:

[\[:SOURce<hw>\] :BB:A3TSc:STATE](#) on page 70

**Set To Default**

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

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

Remote command:

[\[:SOURce<hw>\] :BB:A3TSc:PRESet](#) on page 70

**Save/Recall**

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

The filename and the directory, in that the settings are stored, are user-definable; the file extension is however predefined.

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

Remote command:

[\[:SOURce<hw>\] :BB:A3TSc:SETTING:CATalog](#) on page 70  
[\[:SOURce<hw>\] :BB:A3TSc:SETTING:DElete](#) on page 71  
[\[:SOURce<hw>\] :BB:A3TSc:SETTING:LOAD](#) on page 71  
[\[:SOURce<hw>\] :BB:A3TSc:SETTING:STORE](#) on page 71

**STL Interface**

Activates the **STL** interface.

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

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

Remote command:

[**:SOURce<hw>**] [**:BB:A3TSc:INPut:STL:INTerface** on page 75

### **Destination IP Address**

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

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

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

Remote command:

[**:SOURce<hw>**] [**:BB:A3TSc:INPut:DESTination:IP:ADDReSS** on page 74

### **Destination IP Port**

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

The range is restricted to port numbers 0 to 65535.

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

Remote command:

[**:SOURce<hw>**] [**:BB:A3TSc:INPut:DESTination:IP:PORT** on page 74

### **Data Generation**

Accesses the "3.0 Data Generation" tab.

See [Chapter 4.10, "Data Generation Settings", on page 58](#).

### **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 128](#).

### **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 stored to a log file. The log file `ATSC30_STL_Status_Info_TX.txt` is stored to the directory `var/user/log`.

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

Remote command:

[**:SOURce<hw>**] [**:BB:A3TSc:INPut:STL:RESetlog** on page 75

**Status Info**

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

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

Status information is also stored to a log file, see "[Reset Log File](#)" on page 15. To ensure correct behavior, fix occurring errors successively.

Remote command:

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

## 4.2 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

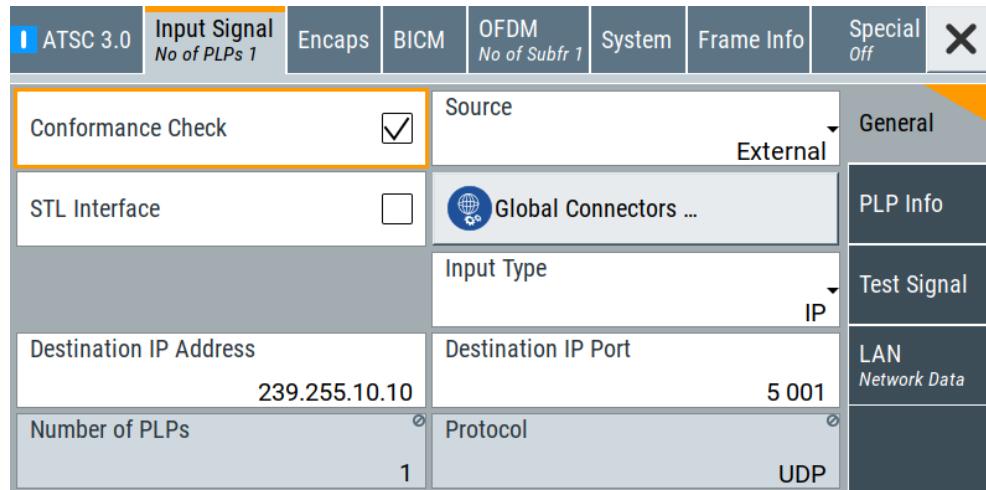
**Settings:**

• <a href="#">General Settings</a> .....	17
• <a href="#">PLP Info</a> .....	20
• <a href="#">Test Signal Settings</a> .....	22
• <a href="#">LAN Network Data Settings</a> .....	24

### 4.2.1 General Settings

Access:

- Select "Input Signal > General".



The tab provides general settings necessary to configure the input signal.

Settings:

Conformance Check.....	17
STL Interface.....	17
Reset Log File.....	18
Number of PLPs.....	18
Source .....	18
Test Signal.....	19
Destination IP Address.....	19
Destination IP Port.....	19
Input Type.....	19
Protocol.....	19

#### Conformance Check

Sets the depth of inspection for the conformance check.

- |       |  |
|-------|--|
| "On"  | Additional in-depth checks are done to ensure that the current configuration meets the conformance criteria of the <a href="#">ATSC A/322</a> PHY layer specification. |
| "Off" | Checks are done to ensure that the current configuration meets the basic conformance criteria of the <a href="#">ATSC A/322</a> PHY layer specification.               |

Remote command:

[[:SOURce<hw>](#)] :BB:A3TSc:INPut:CCHeCk on page 73

#### STL Interface

Activates the [STL](#) interface.

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

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

Remote command:

[\[:SOURce<hw>\]:BB:A3TSc:INPut:STL:INTerface](#) on page 75

### Reset Log File

Requires "STL Interface > On".

Resets the log file.

Status information of the ATSC 3.0 coder as displayed in "Status Info" is stored to a log file. The log file **ATSC30\_STL\_Status\_Info\_TX.txt** is stored to the directory **var/user/log**.

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

Remote command:

[\[:SOURce<hw>\]:BB:A3TSc:INPut:STL:RESetlog](#) on page 75

### Number of PLPs

Displays the number of **PLPs**.

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

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

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

Remote command:

[\[:SOURce<hw>\]:BB:A3TSc:INPut:NPLP?](#) on page 74

### Source

Sets the modulation source for the input signal.

"External"              Uses a transport or IP stream, that is input at the local LAN interface. The "LAN" connector is on the rear panel.  
See section "Connecting to LAN" and "Connecting the Instrument to the Network (LAN)" in the R&S SMCV100B user manual.

"TS Player"              Uses an internal transport stream or an IP stream with TS/IP packet data played from a file. The player requires no option.  
Playing encrypted files with extension **\_c** requires a stream library option R&S SMCVB-KSx.

See also:

- [Chapter 4.12, "TS Player", on page 60](#)
- [Supported TS player file types](#)

"Test Signal"              Requires "STL Interface > Off".  
Uses an internal test signal as specified in [Chapter 4.2.3, "Test Signal Settings", on page 22](#).

Remote command:

[\[:SOURce<hw>\]:BB:A3TSc:SOURce](#) on page 76

**Test Signal**

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

Defines the test signal data.

"Test TS Packet"

Test signal consists of test TS packets. For configuration, see [Chapter 4.2.3, "Test Signal Settings", on page 22](#).

"Test IP Packet"

Test signal consists of test IP packets. For configuration, see [Chapter 4.2.3, "Test Signal Settings", on page 22](#).

Remote command:

[**:SOURce<hw>]:BB:A3TSc:PLP:INPut:TESTsignal** on page 79

**Destination IP Address**

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

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

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

Remote command:

[**:SOURce<hw>]:BB:A3TSc:INPut:DESTination:IP:ADDReSS** on page 74

**Destination IP Port**

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

The range is restricted to port numbers 0 to 65535.

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

Remote command:

[**:SOURce<hw>]:BB:A3TSc:INPut:DESTination:IP:PORT** on page 74

**Input Type**

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

Specifies the input type.

"TS" Transport stream using TSoOverIP

"IP" IP stream with the following content:

- **ROUTE/DASH**
- **MMT**

Remote command:

[**:SOURce<hw>]:BB:A3TSc:INPut:TYPE** on page 75

**Protocol**

Requires one of the following:

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

Displays the used protocol.

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

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

Remote command:

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

## 4.2.2 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.....	20
└ PLP ID.....	20
└ Packet Length .....	20
└ Max. Useful Data Rate / Mbit/s.....	21
└ Measured Data Rate / Mbit/s.....	21
└ Useful Data Rate / Mbit/s.....	21

### PLP <num> table

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

#### PLP ID ← PLP <num> table

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

Editing the parameter requires "STL Interface > Off".

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

Remote command:

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

#### Packet Length ← PLP <num> table

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

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

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

"188"              188 bytes specified packet length.

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

Remote command:

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

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

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

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

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

Remote command:

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

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

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

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

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

For TSoIP 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 77

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

Requires "STL Interface > On".

Displays the computed values of the PLP data rate.

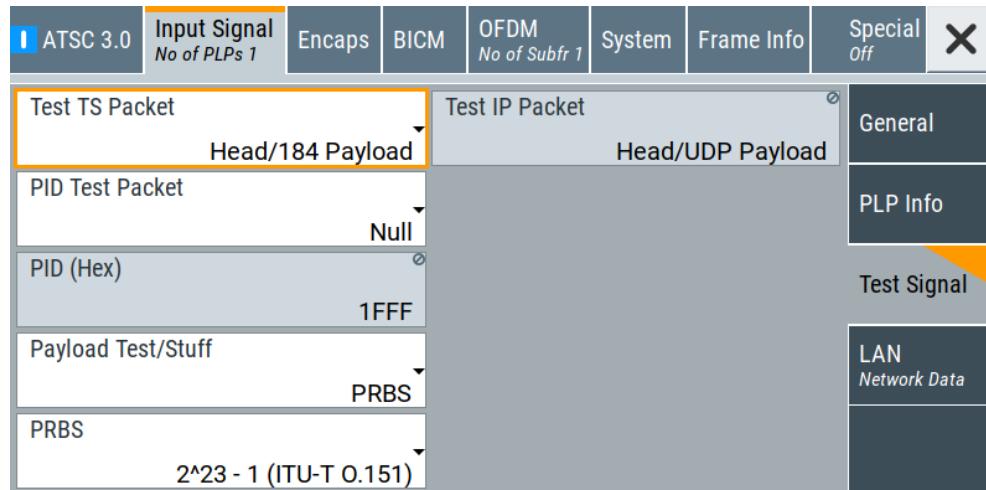
Remote command:

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

### 4.2.3 Test Signal Settings

Access:

- ▶ Select "Input Signal > Test Signal".



The tab provides settings necessary to configure the test signal.

**Settings:**

<a href="#">Test TS Packet</a> .....	22
<a href="#">Test IP Packet</a> .....	22
<a href="#">PID Test Packet</a> .....	23
<a href="#">PID (Hex)</a> .....	23
<a href="#">Payload Test/Stuff</a> .....	23
<a href="#">PRBS</a> .....	23

#### Test TS Packet

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

"Head/184 Payload"

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

"Sync/187 Payload"

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

Remote command:

[[:SOURce<hw>](#)] :BB:A3TSc:TSPacket on page 79

#### Test IP Packet

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

"Head/UDP Payload"

Fixed payload of 1200 bytes.

Remote command:

[[:SOURce<hw>](#)] :BB:A3TSc:IPPPacket on page 79

**PID Test Packet**

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

- |            |   |
|------------|---|
| "Null"     | The header of the test transport stream packets has a fixed setting of null packet header 1FFF (hex). |
| "Variable" | Uses the header value defined with " <a href="#">PID (Hex)</a> " on page 23.                          |

Remote command:

[\[:SOURce<hw>\]:BB:A3TSc:PIDTestpack](#) on page 80

**PID (Hex)**

Sets the [PID](#).

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

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

Remote command:

[\[:SOURce<hw>\]:BB:A3TSc:PID](#) on page 80

**Payload Test/Stuff**

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

The TS packet is a test packet. You can select [PRBS](#) or exclusively data in hexadecimal format as payload.

Remote command:

[\[:SOURce<hw>\]:BB:A3TSc:PAYLoad](#) on page 79

**PRBS**

Sets the length of the PRBS sequence.

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

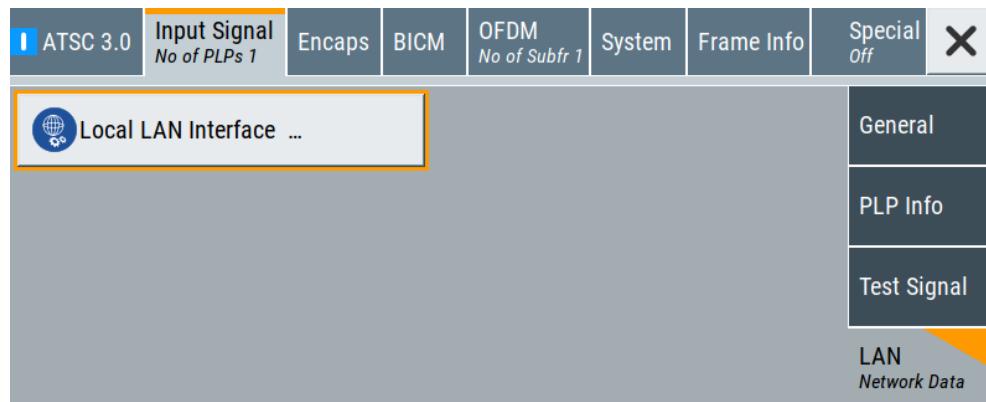
Remote command:

[\[:SOURce<hw>\]:BB:A3TSc:PRBS\[:SEQUence\]](#) on page 80

#### 4.2.4 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](#).....24

##### Local LAN Interface

Accesses the network settings tab.

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

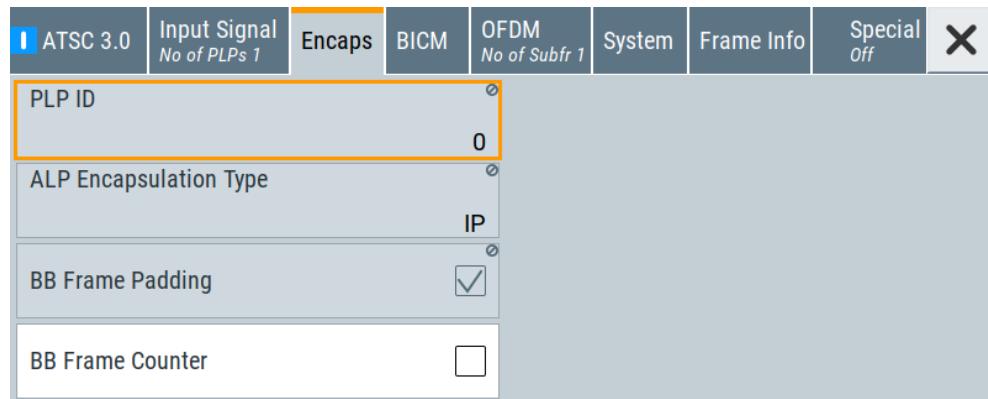
The settings are also relevant for remote access to the R&S SMCV100B. See the chapter "Network Settings" in the R&S SMCV100B user manual.

### 4.3 Encaps Settings

Requires "STL Interface > Off".

Access:

- Select "Baseband > ATSC 3.0 > Encaps".



The tab provides settings necessary to configure encapsulation.

#### Settings:

<b>PLP ID</b>	.....	25
<b>ALP Encapsulation Type</b>	.....	25
<b>BB Frame Padding</b>	.....	25
<b>BB Frame Counter</b>	.....	25

#### PLP ID

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

Editing the parameter requires "STL Interface > Off".

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

Remote command:

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

#### ALP Encapsulation Type

Displays the input source type of ALP encapsulation.

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

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

Remote command:

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

#### BB Frame Padding

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

Remote command:

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

#### BB Frame Counter

Enables/disables the baseband frame counter.

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

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

Remote command:

[**:SOURce<hw> :BB:A3TSc:PLP<ch>:BBFCounter** on page 81

## 4.4 BICM Settings

**Access:**

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

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

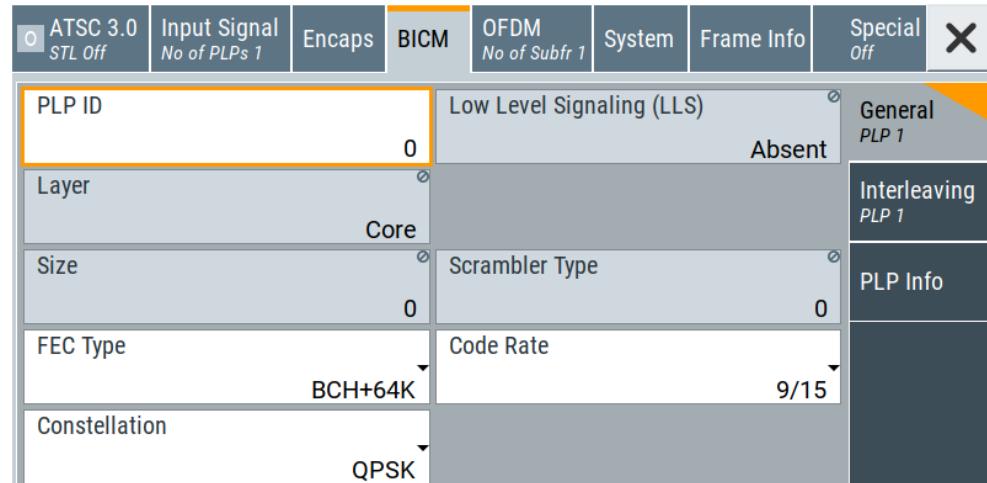
**Settings:**

● General Settings.....	26
● Interleaving Settings.....	29
● PLP Info.....	32

### 4.4.1 General Settings

**Access:**

- ▶ Select "BICM > General".



The tab provides settings necessary to configure the general **BICM** parameters.

**Settings:**

PLP ID.....	27
Low Level Signaling (LLS).....	27
Layer.....	27
LDM Injection Level.....	27
Size.....	27
Scrambler Type.....	27
FEC Type.....	28
Code Rate.....	28
Constellation.....	28

**PLP ID**

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

Editing the parameter requires "STL Interface > Off".

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

Remote command:

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

**Low Level Signaling (LLS)**

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

Remote command:

[ :SOURce<hw> ] :BB:A3TSc:PLP<ch>:LLS? on page 84

**Layer**

Displays the layer, that is used in **LDM**.

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

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

Remote command:

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

**LDM Injection Level**

Requires "Layer > Enhanced".

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

Remote command:

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

**Size**

Displays the number of data cells allocated to the PLP.

Remote command:

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

**Scrambler Type**

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

Further scrambler types are reserved for future use.

Remote command:

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

### FEC Type

Editing the parameter requires "STL Interface > Off".

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

The table below illustrates types and coding.

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

Remote command:

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

### Code Rate

Editing the parameter requires "STL Interface > Off".

Sets the code rate.

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

Remote command:

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

### Constellation

Editing the parameter requires "STL Interface > Off".

Defines the constellation.

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

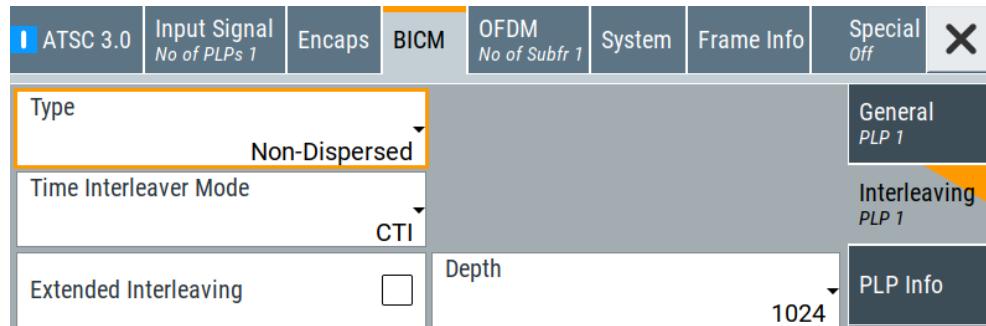
Remote command:

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

## 4.4.2 Interleaving Settings

Access:

- ▶ Select "BICM > Interleaving".



The tab provides settings necessary to configure interleaving.

**Settings:**

Type.....	29
Number of Subslices.....	29
Subslice Interval.....	30
Time Interleaver Mode.....	30
Extended Interleaving.....	30
Depth.....	30
Inter Subframe.....	30
Cell Interleaver.....	31
Number of TI Blocks.....	31
Max. Number of FEC Blocks.....	31
Number of FEC Blocks.....	31

### Type

Defines the [PLP](#) type if the PLP is not an [LDM](#) enhanced layer.

"Non-Dispersed"

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

Fixed setting for "STL Interface > Off".

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

Remote command:

[\[:SOURce<hw>\]:BB:A3TSc:PLP<ch>:TYPE:TYPE](#) on page 87

### Number of Subslices

Requires "Type > Dispersed".

Defines the number of subslices for a dispersed PLP.

Remote command:

[\[:SOURce<hw>\]:BB:A3TSc:PLP<ch>:TYPE:SUBslices](#) on page 87

**Subslice Interval**

Requires "Type > Dispersed".

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

**Example:**

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

Remote command:

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

**Time Interleaver Mode**

Editing the parameter requires "STL Interface > Off".

Sets the time interleaver mode.

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

Remote command:

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

**Extended Interleaving**

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

Editing the parameter requires "STL Interface > Off".

If enabled, increases the time interleaving depth.

Remote command:

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

**Depth**

Requires "Time Interleaver Mode > CTI".

Editing the parameter requires "STL Interface > Off".

Defines the time interleaving depths.

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

Remote command:

[ :SOURce<hw> ] :BB:A3TSc:PLP<ch>:TIL:DEPTH on page 88

**Inter Subframe**

Requires "Time Interleaver Mode > HTI".

Defines the interleaving frame content and mapping.

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

Remote command:

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

#### **Cell Interleaver**

Requires "Time Interleaver Mode > HTI".

Editing the parameter requires "STL Interface > Off".

Enables or disables the interleaver operating at the cell level.

Remote command:

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

#### **Number of TI Blocks**

Requires "Time Interleaver Mode > HTI".

Editing the parameter requires "STL Interface > Off".

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

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

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

Remote command:

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

#### **Max. Number of FEC Blocks**

Requires "Time Interleaver Mode > HTI".

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

Remote command:

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

#### **Number of FEC Blocks**

Requires "Time Interleaver Mode > HTI".

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

Remote command:

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

### 4.4.3 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](#)..... 32

#### 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 32.

## 4.5 OFDM Settings

Access:

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

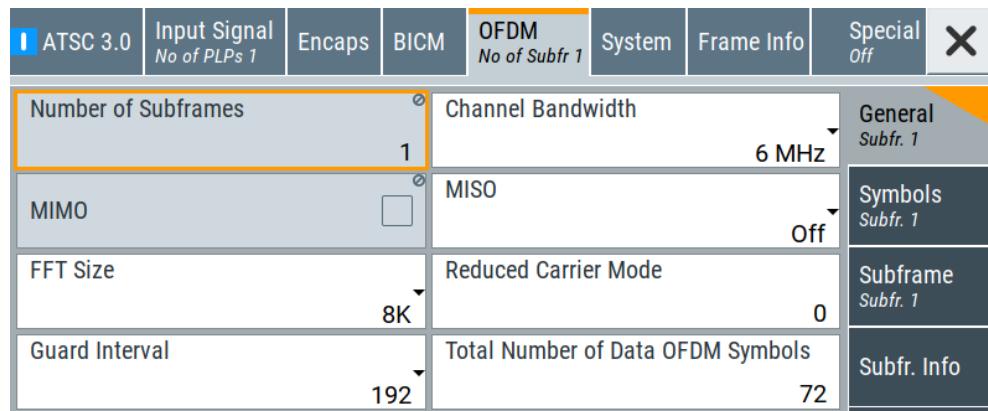
The tab provides settings necessary to configure [OFDM](#) settings of ATSC 3.0 subframes.

**Settings:**

• General Settings.....	33
• Symbols Settings.....	36
• Subframe.....	37
• Subframe Info.....	39

**4.5.1 General Settings****Access:**

- ▶ Select "OFDM > General".



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

**Settings:**

Number of Subframes.....	33
Channel Bandwidth.....	33
MIMO.....	34
MISO.....	34
FFT Size.....	34
Reduced Carrier Mode.....	35
Guard Interval.....	35
Total Number of Data OFDM Symbols.....	35

**Number of Subframes**

Displays the number of subframes within the current frame.

Remote command:

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

**Channel Bandwidth**

Selects the channel bandwidth.

The channel bandwidth correlates with the used bandwidth, that is smaller. See "Used Bandwidth" on page 38.

Remote command:

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

### MIMO

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

Remote command:

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

### MISO

Editing the parameter requires "STL Interface > Off".

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

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

Remote command:

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

### FFT Size

Editing the parameter requires "STL Interface > Off".

Defines the **FFT** size.

#### Note:

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

- ["Guard Interval" on page 35](#)
- ["SISO Pilot Pattern" on page 36](#)

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

Remote command:

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

**Reduced Carrier Mode**

Editing the parameter requires "STL Interface > Off".

Sets a coefficient for reducing the maximum number of carriers.

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

Remote command:

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

**Guard Interval**

Editing the parameter requires "STL Interface > Off".

Sets the guard interval length.

The length is expressed in samples.

**Note:**

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

- "FFT Size" on page 34
- "SISO Pilot Pattern" on page 36

Remote command:

[ :SOURce<hw>] :BB:A3TSc:SUBFrame<ch>:GUARD:INTERval on page 91

**Total Number of Data OFDM Symbols**

Editing the parameter requires "STL Interface > Off".

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

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

**Note:**

The possible setting is restricted depending on the following parameters:

- "FFT Size" on page 34
- "Guard Interval" on page 35
- Maximum allowed frame duration of 5 s

Remote command:

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

## 4.5.2 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	X
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	<input checked="" type="checkbox"/>		Subframe Subfr. 1	
							Subfr. Info	

The tab provides settings necessary to configure OFDM symbols.

**Settings:**

SISO Pilot Pattern.....	36
Pilot Boost Mode.....	36
Subframe Boundary Symbol (First).....	36
Subframe Boundary Symbol (Last).....	37
Subframe Boundary Symbol (Null Cells).....	37
Frequency Interleaver.....	37

### 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 35
- "FFT Size" on page 34

Remote command:

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

### Pilot Boost Mode

Editing the parameter requires "STL Interface > Off".

Sets the power boost mode for the scattered pilots.

Remote command:

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

### Subframe Boundary Symbol (First)

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

Remote command:

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

#### **Subframe Boundary Symbol (Last)**

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

Remote command:

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

#### **Subframe Boundary Symbol (Null Cells)**

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

Remote command:

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

#### **Frequency Interleaver**

Editing the parameter requires "STL Interface > Off".

Enables/disables the frequency interleaver.

Remote command:

[**:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:FIL** on page 93

### **4.5.3 Subframe**

Access:

- ▶ Select "OFDM > Subframe".

ATSC 3.0	Input Signal No of PLPs 1	Encaps	BICM	OFDM No of Subfr 1	System	Frame Info	Special Off	X
	Duration 0 ms			Used Bandwidth 0.000 000 0 MHz			General Subfr. 1	
	Number of PLPs in Subframe 1			PLP IDs in Subframe 0			Symbols Subfr. 1	

The tab displays the subframe information.

**Settings:**

Duration.....	38
Used Bandwidth.....	38
Number of PLPs in Subframe.....	38
PLP IDs in Subframe.....	38

**Duration**

Displays the duration of the subframe.

Remote command:

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

**Used Bandwidth**

Displays the used bandwidth.

The used bandwidth depends on the following:

- "Channel Bandwidth" on page 33
- "FFT Size" on page 34
- "Reduced Carrier Mode" on page 35

Remote command:

[ :SOURce<hw>] :BB:A3TSc:SUBFrame<ch>:USED[:BANDwidth]? on page 95

**Number of PLPs in Subframe**

Editing the parameter requires "STL Interface > Off".

Displays the number of PLPs in the subframe.

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

Remote command:

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

**PLP IDs in Subframe**

Displays all IDs of the PLPs mapped to the subframe. See also "PLP ID" on page 20.

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

Remote command:

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

#### 4.5.4 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 Symt	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](#).....39

##### 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 39.

## 4.6 System Settings

Access:

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

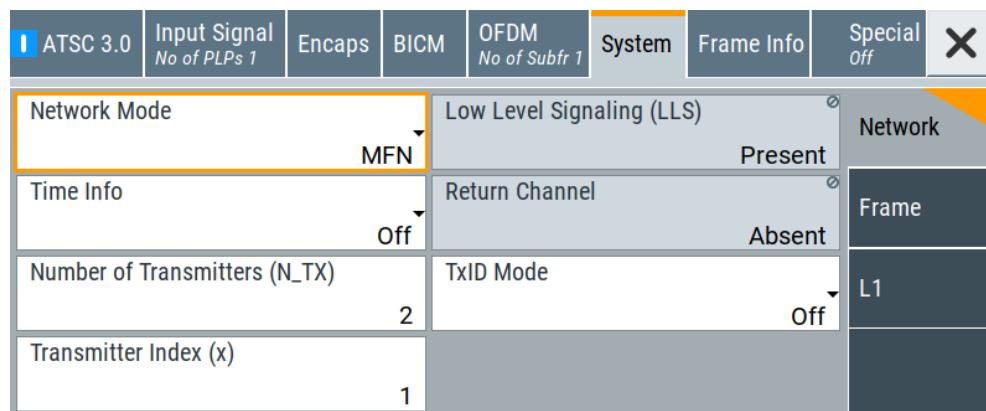
The tab provides settings necessary to configure ATSC 3.0 system parameters.

**Settings:**

● Network Settings.....	40
● Frame Settings.....	43
● L1 Settings.....	45

**4.6.1 Network Settings****Access:**

- Select "System > Network".



The tab provides network settings.

**Settings:**

Network Mode.....	40
Low Level Signaling (LLS).....	41
Time Info.....	41
Return Channel.....	41
Number of Transmitters (N_TX).....	42
Transmitter Index (x).....	42
TxID Mode.....	42
└ TxID Address.....	42
└ TxID Injection Level.....	42
Broadcast Stream ID (BSID).....	42

**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"	<p>Requires "STL Interface &gt; On".</p> <p>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 "<a href="#">GPS receiver required</a>" on page 40, 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.</p> <p>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.</p>
"MFN"	<p>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.</p>

Remote command:

[\[:SOURce<hw>\]:BB:A3TSc:NETWorkmode](#) on page 97

### Low Level Signaling (LLS)

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

Remote command:

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

### Time Info

Editing the parameter requires "STL Interface > Off".

Configures the time information.

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

Remote command:

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

### Return Channel

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

Remote command:

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

#### **Number of Transmitters (N\_TX)**

Sets the number of transmitters for **MISO** transmission.

Remote command:

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

#### **Transmitter Index (x)**

Sets the transmitter index for **MISO** transmission.

The maximum index equals the set "Number of Transmitters (N\_TX)".

Remote command:

[**:SOURce<hw>]:BB:A3TSc:MISO:IDX** on page 98

#### **TxID Mode**

Sets the Tx ID mode.

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

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

Remote command:

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

#### **TxID Address ← TxID Mode**

Requires "TxID Mode > Manual/Auto".

Sets the transmitter identification address.

Remote command:

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

#### **TxID Injection Level ← TxID Mode**

Requires "TxID Mode > Manual/Auto".

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

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

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

Remote command:

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

#### **Broadcast Stream ID (BSID)**

Requires "Network > L1 > L1 Detail Version > 0", see "["L1 Detail Version"](#) on page 46.

Editing the parameter requires "STL Interface > Off".

Sets the ID of the broadcast stream.

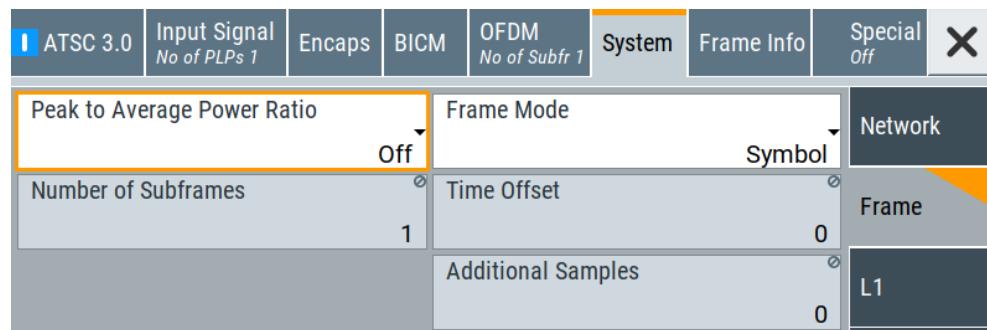
Remote command:

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

## 4.6.2 Frame Settings

Access:

- Select "System > Frame".



The tab provides frame settings.

**Settings:**

Peak To Average Power Ratio.....	43
Number of Subframes.....	43
Frame Mode.....	44
Frame Length.....	44
Excess Samples per Symbol.....	44
Final Excess Samples.....	44
Additional Samples.....	44
Time Offset.....	44

### Peak To Average Power Ratio

Editing the parameter requires "STL Interface > Off".

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

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

Remote command:

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

### Number of Subframes

Displays the number of subframes within the current frame.

Remote command:

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

**Frame Mode**

Editing the parameter requires "STL Interface > Off".

Sets how the frame length is aligned.

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

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

Remote command:

[[:SOURce<hw>\]:BB:A3TSc:FRAMe:MODE](#) on page 101

**Frame Length**

Requires "Frame Mode > Time".

Editing the parameter requires "STL Interface > Off".

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

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

Remote command:

[[:SOURce<hw>\]:BB:A3TSc:FRAMe:LENGth](#) on page 101

**Excess Samples per Symbol**

Requires "Frame Mode > Time".

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

Remote command:

[[:SOURce<hw>\]:BB:A3TSc:FRAMe:EXSYmbol?](#) on page 102

**Final Excess Samples**

Requires "Frame Mode > Time".

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

Remote command:

[[:SOURce<hw>\]:BB:A3TSc:FRAMe:EXFinal?](#) on page 102

**Additional Samples**

Requires "Frame Mode > Symbol".

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

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

Remote command:

[[:SOURce<hw>\]:BB:A3TSc:FRAMe:ADDITIONal\[:SAMPLEs\]?](#) on page 103

**Time Offset**

Requires "Frame Mode > Symbol".

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

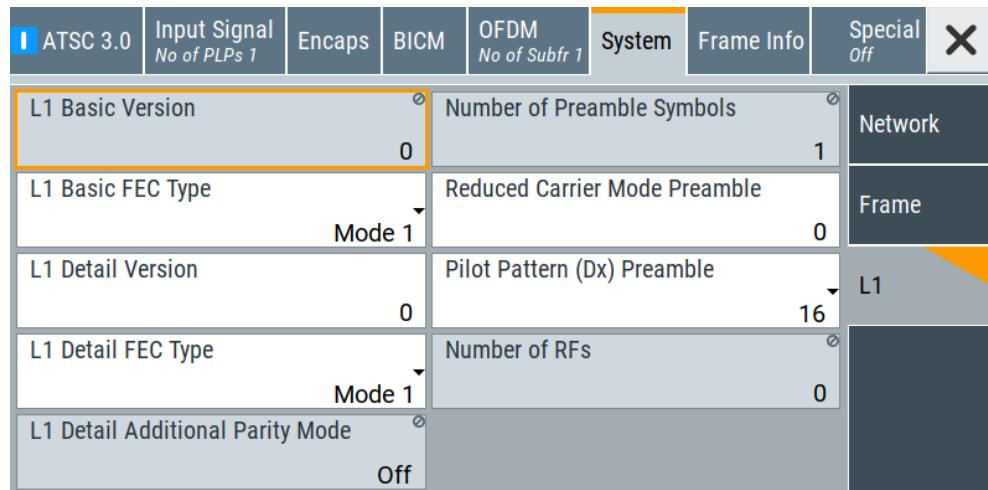
Remote command:

[**:SOURce<hw>]:BB:A3TSc:FRAMe:TIME[:OFFSet]?** on page 102

### 4.6.3 L1 Settings

Access:

- ▶ Select "System > L1".



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

**Settings:**

L1 Basic Version.....	45
L1 Basic FEC Type.....	45
L1 Detail Version.....	46
L1 Detail FEC Type.....	46
L1 Detail Additional Parity Mode.....	46
Number of Preamble Symbols.....	46
Reduced Carrier Mode Preamble.....	46
Pilot Pattern (Dx) Preamble.....	46
Number of RFs.....	47

#### L1 Basic Version

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

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

Remote command:

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

#### L1 Basic FEC Type

Editing the parameter requires "STL Interface > Off".

Defines the protection level of L1 basic signaling.

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

Remote command:

[**:SOURce<hw>]:BB:A3TSc:L:BASic:FECType** on page 104

### **L1 Detail Version**

Editing the parameter requires "STL Interface > Off".

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

Remote command:

[**:SOURce<hw>]:BB:A3TSc:L:DETail:VERSion** on page 105

### **L1 Detail FEC Type**

Editing the parameter requires "STL Interface > Off".

Defines the protection level of L1 detail signaling.

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

Remote command:

[**:SOURce<hw>]:BB:A3TSc:L:DETail:FECType** on page 105

### **L1 Detail Additional Parity Mode**

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

Remote command:

[**:SOURce<hw>]:BB:A3TSc:L:DETail:ADDITIONal[:PARity]?** on page 104

### **Number of Preamble Symbols**

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

Remote command:

[**:SOURce<hw>]:BB:A3TSc:L:NPRreamble[:SYMBols]?** on page 105

### **Reduced Carrier Mode Preamble**

Editing the parameter requires "STL Interface > Off".

Sets a coefficient for reducing the maximum number of carriers.

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

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

Remote command:

[**:SOURce<hw>]:BB:A3TSc:L:CARRier:MODE** on page 104

### **Pilot Pattern (Dx) Preamble**

Editing the parameter requires "STL Interface > Off".

Sets the pilot pattern used for the preamble symbols.

Remote command:

[**:SOURce<hw>]:BB:A3TSc:L:PILot:DX** on page 105

**Number of RFs**

Displays the number of radio frequencies involved in channel bonding.

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

Remote command:

[\[:SOURce<hw>\]:BB:A3TSc:NRF?](#) on page 106

## 4.7 Frame Info

Access:

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

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

**Settings:**

● <a href="#">Frame</a> .....	47
● <a href="#">L1 Signaling</a> .....	48
● <a href="#">Bootstrap</a> .....	49
● <a href="#">Structure</a> .....	51

### 4.7.1 Frame

Access:

- ▶ Select "Frame Info > Frame".



The tab displays frame parameters.

**Settings:**

<a href="#">Frame Duration</a> .....	48
<a href="#">Bootstrap Duration</a> .....	48

**Frame Duration**

Displays the frame duration in ms.

Remote command:

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

**Bootstrap Duration**

Displays the duration of the bootstrap signal in ms.

Remote command:

[\[:SOURce<hw>\]:BB:A3TSc:INFO:BOOTstrap:DURation? on page 106](#)

## 4.7.2 L1 Signaling

Access:

- ▶ Select "Frame Info > L1 Signaling".

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

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

**Settings:**

<a href="#">L1 Basic Bytes</a> .....	48
<a href="#">L1 Detail Bytes</a> .....	48
<a href="#">L1 Basic Cells</a> .....	49
<a href="#">L1 Detail Cells</a> .....	49

**L1 Basic Bytes**

Displays the L1 basic signaling length in bytes.

Remote command:

[\[:SOURce<hw>\]:BB:A3TSc:INFO:L:BASic:BYTeS? on page 107](#)

**L1 Detail Bytes**

Displays the L1 detail signaling length in bytes.

Remote command:

[\[:SOURce<hw>\]:BB:A3TSc:INFO:L:DETaile:BYTeS? on page 108](#)

**L1 Basic Cells**

Displays the L1 basic signaling length in cells.

Remote command:

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

**L1 Detail Cells**

Displays the L1 detail signaling length in cells.

Remote command:

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

### 4.7.3 Bootstrap

Access:

- ▶ Select "Frame Info > Bootstrap".

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

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.....	49
Minor Version.....	49
Min. Time to Next.....	50
Emergency Alert Signaling (EAS).....	50
System Bandwidth.....	50
BSR Coefficient.....	50

**Major Version**

Displays the major version of the bootstrap.

Remote command:

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

**Minor Version**

Displays the minor version of the bootstrap.

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

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

Remote command:

[**:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:MINor?** on page 111

#### **Min. Time to Next**

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

Remote command:

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

#### **Emergency Alert Signaling (EAS)**

Displays the signaling mode for emergency alert.

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

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

"No Emergency"

No emergency alert information is available.

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

Remote command:

[**:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:EAS?** on page 110

#### **System Bandwidth**

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

Remote command:

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

#### **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 16.

"2" 6.912 MHz at 6 MHz system bandwidth

"5" 8.064 MHz at 7 MHz system bandwidth

"8" 9.216 MHz at 8 MHz system bandwidth

Remote command:

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

#### 4.7.4 Structure

Access:

- ▶ Select "Frame Info > Structure".

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

The tab displays preamble symbols structure parameters.

**Settings:**

Preamble Structure.....	51
FFT Size.....	51
Guard Interval.....	51
Pilot Pattern (Dx).....	52
L1 Basic FEC Type.....	52

##### Preamble Structure

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

Remote command:

[ :SOURce<hw> ] :BB:A3TSc:INFO:BOOTstrap:PREamble[:STRUCTure]?  
on page 112

##### FFT Size

Displays the FFT size of the preamble symbols.

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

See "[FFT Size](#)" on page 34.

Remote command:

[ :SOURce<hw> ] :BB:A3TSc:INFO:BOOTstrap:FFT:MODE? on page 110

##### 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 35.

Remote command:

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

#### Pilot Pattern (Dx)

Displays the pilot pattern used for the preamble symbols.

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

See "[Pilot Pattern \(Dx\) Preamble](#)" on page 46.

Remote command:

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

#### 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 45.

Remote command:

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

## 4.8 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.

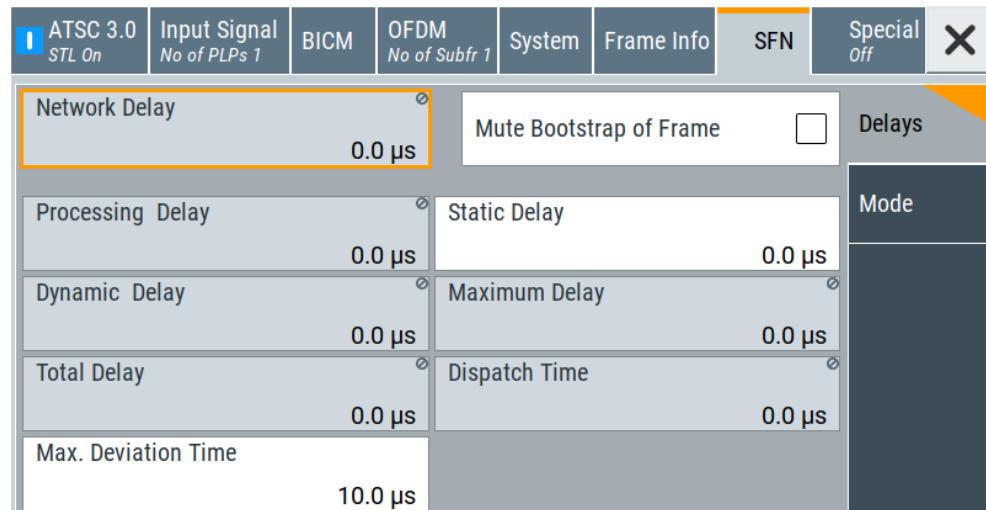
#### Settings

● <a href="#">Delays Settings</a> .....	53
● <a href="#">Mode Settings</a> .....	55

## 4.8.1 Delays Settings

Access:

- Select "SFN > Delays".



The tab provides settings necessary to configure **SFN** delays.

### Settings

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

### Network Delay

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

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

Remote command:

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

### Processing Delay

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

Remote command:

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

**Dynamic Delay**

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

Remote command:

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

**Total Delay**

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

Remote command:

[**:SOURce<hw>**] :BB:A3TSc:DELay:TOTal? on page 116

**Max. Deviation Time**

Sets the maximum permissible delay.

The delay  $\Delta t_{\max}$  depends on the time of emission TOE<sub>timestamp</sub> from timestamp, the static delay  $t_{\text{static}}$  and the actual time of emission TOE<sub>actual</sub> as follows:

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

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

Remote command:

[**:SOURce<hw>**] :BB:A3TSc:DELay:DEViation on page 114

**Static Delay**

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

The static delay is also called User Delay Offset

Remote command:

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

**Maximum Delay**

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

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

Remote command:

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

**Dispatch Time**

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

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

Remote command:

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

**Mute Bootstrap of Frame**

Use the setting for testing SFN operation.

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

Remote command:

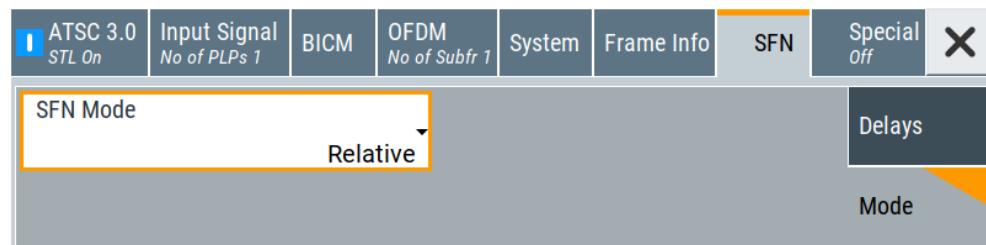
[\[:SOURce<hw>\]:BB:A3TSc:DELay:MUTE \[:BOOTstrap\]](#) on page 115

## 4.8.2 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](#)..... 55

#### SFN Mode

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

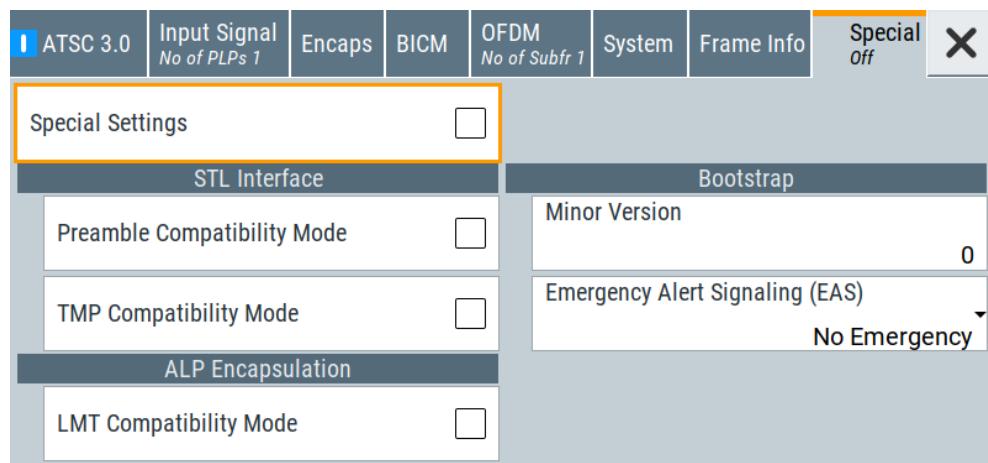
Remote command:

[\[:SOURce<hw>\]:BB:A3TSc:DELay:SFNMode](#) on page 116

## 4.9 Special Settings

Access:

- Select "Baseband > ATSC 3.0 > Special".



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 .....	56
STL On: STL Interface.....	57
└ Preamble Compatibility Mode.....	57
└ TMP Compatibility Mode.....	57
STL Off: Bootstrap.....	57
└ Minor Version.....	57
└ Emergency Alert Signaling (EAS).....	57
STL Off: ALP Encapsulation.....	57
└ LMT Compatibility Mode.....	57

### Special Settings

Enables/disables special settings.

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

Remote command:

[ :SOURce<hw> ] :BB:A3TSc:SPECial:SETTings [ :STATE ] on page 118

**STL On: STL Interface**

Provides compatibility mode settings.

**Preamble Compatibility Mode ← STL On: STL Interface**

Sets how the preamble packet is supported.

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

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

Remote command:

[ :SOURce<hw> ] :BB:A3TSc:SPECial:STL:PREamble on page 119

**TMP Compatibility Mode ← STL On: STL Interface**

Sets how the time & management packet is supported.

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

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

Remote command:

[ :SOURce<hw> ] :BB:A3TSc:SPECial:STL:TMP on page 119

**STL Off: Bootstrap**

Provides settings that characterize the bootstrap signal.

**Minor Version ← STL Off: Bootstrap**

Sets the minor version number of the bootstrap.

If "Special settings > On", the minor version sets "Frame Info > Bootstrap > Minor Version". See "[Minor Version](#)" on page 49.

Remote command:

[ :SOURce<hw> ] :BB:A3TSc:SPECial:BOOTstrap:MINor on page 118

**Emergency Alert Signaling (EAS) ← STL Off: Bootstrap**

Sets the signaling for emergency alert.

If "Special settings > On", the signaling mode sets "Frame Info > Bootstrap > Emergency Alert Signaling (EAS)". See "[Emergency Alert Signaling \(EAS\)](#)" on page 50.

"No Emergency"

No emergency alert information is available.

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

Remote command:

[ :SOURce<hw> ] :BB:A3TSc:SPECial:BOOTstrap:EAS on page 118

**STL Off: ALP Encapsulation**

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

**LMT Compatibility Mode ← STL Off: ALP Encapsulation**

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

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

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

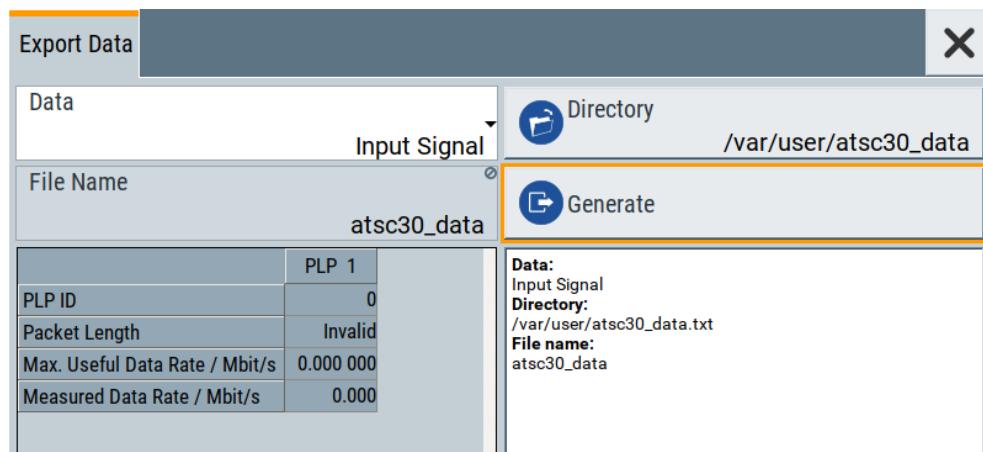
Remote command:

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

## 4.10 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:**

<b>Data</b>	58
<b>File Name</b>	58
<b>Directory</b>	59
<b>Generate</b>	59
<b>File Info panel</b>	59
<b>PLP &lt;num&gt;/Subr. &lt;num&gt; table</b>	59

### 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 32.

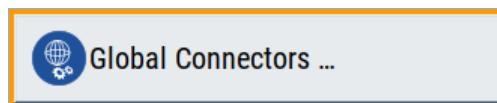
"Subfr. <num>" Requires "Data > Subframing & OFDM".

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 39.

## 4.11 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.

## 4.12 TS Player

### To access the functionality

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.

### Required options

- Enable Broadcast Standards option (R&S SMCVB-K519)
- Optional Stream library option (R&S SMCVB-KS10 to R&S SMCVB-KS20)

### Support in broadcast standard configuration

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
"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 5.10, "TSGen Subsystem", on page 119](#).

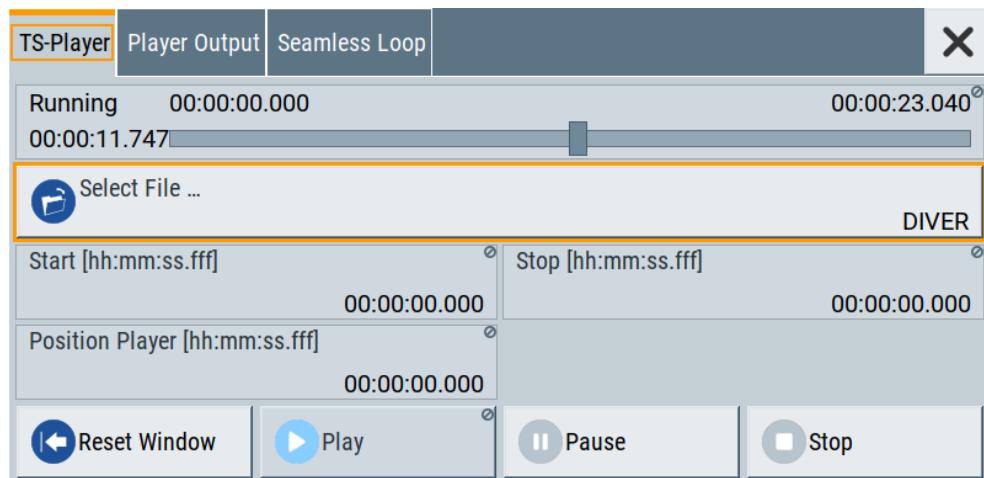
### Settings:

- [TS Player Settings](#)..... 61
- [Player Output](#)..... 64
- [Seamless Loop Settings](#)..... 67

### 4.12.1 TS Player Settings

Access:

- Select "TS Player > TS-Player".



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

#### Settings:

<a href="#">Running/Position Player [hh:mm:ss:fff]</a> .....	61
<a href="#">Select File</a> .....	61
<a href="#">Start [hh:mm:ss.fff]</a> .....	62
<a href="#">Position Player [hh:mm:ss.fff]</a> .....	63
<a href="#">Stop [hh:mm:ss.fff]</a> .....	63
<a href="#">Reset Window</a> .....	63
<a href="#">Play</a> .....	63
<a href="#">Pause</a> .....	63
<a href="#">Stop</a> .....	63

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

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

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

Remote command:

`:TSGen:CONFigure:SEEK:POSITION` on page 124

#### Select File

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

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

The dialog allows you to select user-defined, predefined and recent files. [Table 4-1](#) lists file extensions of supported files.

**Table 4-1: 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 <sup>1)</sup>	-	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	-
*.mpg	-	Unencrypted	-
*.t10	-	-	-

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

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

Remote command:

- [:TSGen:CONFigure:PLAYfile on page 122](#)
- [:TSGen:READ:PLAYfile:LENGTH? on page 126](#)
- [:TSGen:READ:FMEMemory on page 126](#)

#### Start [hh:mm:ss.fff]

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

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

Remote command:

[:TSGen:CONFigure:SEEK:START](#) on page 124

### **Position Player [hh:mm:ss.fff]**

Displays the current play position in the file.

Remote command:

[:TSGen:CONFigure:SEEK:POSITION](#) on page 124

### **Stop [hh:mm:ss.fff]**

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

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

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

Remote command:

[:TSGen:CONFigure:SEEK:STOP](#) on page 124

### **Reset Window**

Resets "Start/Stop/Position Player" parameters.

Remote command:

[:TSGen:CONFigure:SEEK:RESET](#) on page 124

### **Play**

Plays the selected file.

For supported file types, see [Table 4-1](#).

Remote command:

[:TSGen:CONFigure:COMMAND<ch>](#) on page 121

### **Pause**

Pauses the player.

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

Remote command:

[:TSGen:CONFigure:COMMAND<ch>](#) on page 121

### **Stop**

Stops the player and returns to the start position.

Remote command:

[:TSGen:CONFigure:COMMAND<ch>](#) on page 121

## 4.12.2 Player Output

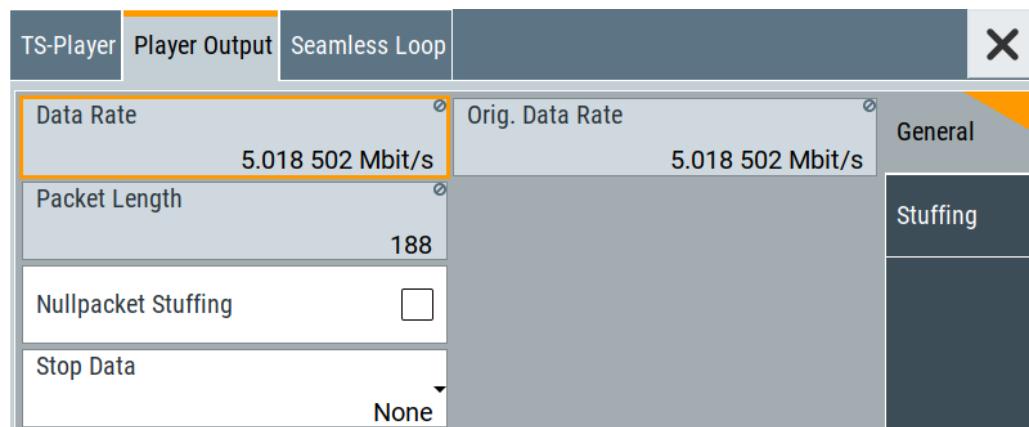
Access:

- ▶ Select "TS Player > Player Output".

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

**Settings:**

### 4.12.2.1 General



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

Data Rate.....	64
Orig. Data Rate.....	64
Packet Length.....	65
Nullpacket Stuffing.....	65
Stop Data.....	65

#### Data Rate

Sets the output data rate of the player.

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

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

Remote command:

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

#### Orig. Data Rate

Displays the calculated original TS data rate.

Remote command:

[:TSGen:READ:ORIGtsrate](#) on page 126

**Packet Length**

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

Displays the packet length of the loaded TS player file.

Remote command:

[:TSGen:CONFigure:TSPacket](#) on page 125

**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.<br>Null packets are inserted into the data stream.<br>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 125

**Stop Data**

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

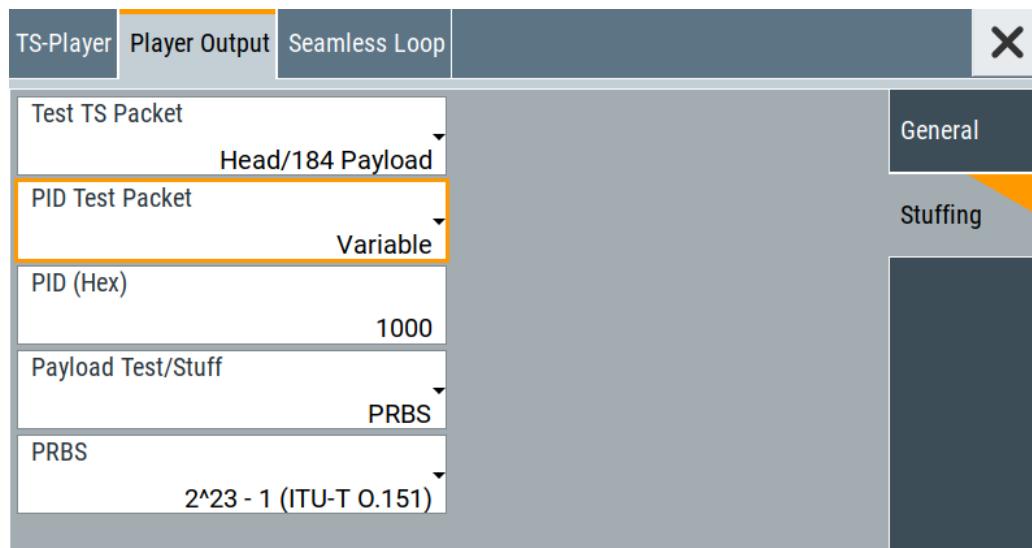
Ensures that a standardized TS data stream is always output at the TS output at the rear of the R&S SMCV100B.

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

Remote command:

[:TSGen:CONFigure:STOPdata](#) on page 125

#### 4.12.2.2 Stuffing



The tab comprises settings necessary to configure stuffing.

#### Settings

Test TS Packet.....	66
PID Test Packet.....	67
PID (Hex).....	67
Payload Test/Stuff.....	67
PRBS.....	67

#### 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 125

**PID Test Packet**

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

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

Remote command:

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

**PID (Hex)**

Sets the [PID](#).

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

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

Remote command:

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

**Payload Test/Stuff**

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

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

Remote command:

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

**PRBS**

Sets the length of the PRBS sequence.

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

Remote command:

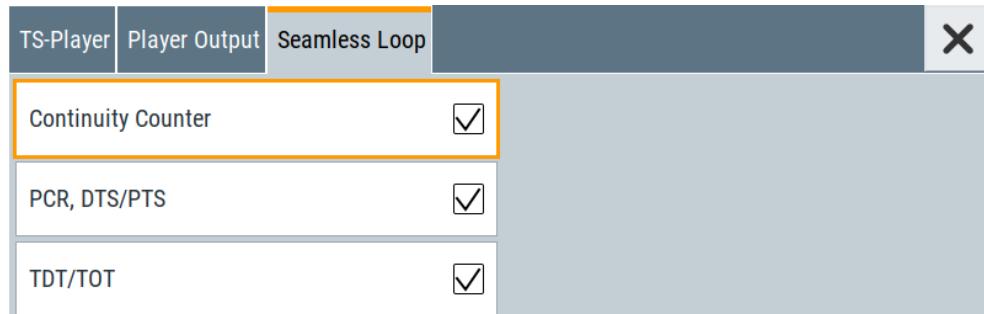
[:TSGen:CONFigure:PRBS\[:SEQUence\]](#) on page 123

### 4.12.3 Seamless Loop Settings

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

Access:

- Select "TS Player > Seamless Loop".



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

**Settings:**

Continuity Counter.....	68
PCR, DTS/PTS.....	68
TDT/TOT.....	68

#### Continuity Counter

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

Remote command:

[:TSGen:CONFigure:SEAMless:CC](#) on page 123

#### PCR, DTS/PTS

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

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

Remote command:

[:TSGen:CONFigure:SEAMless:PCR](#) on page 123

#### TDT/TOT

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

Remote command:

[:TSGen:CONFigure:SEAMless:TT](#) on page 123

## 5 Remote-Control Commands

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



### Conventions used in SCPI command descriptions

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

#### Common suffixes

The following common suffixes are used in the remote commands:

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

#### Programming examples

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

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

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

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

● General Commands.....	70
● Input Signal Commands.....	72
● Encapsulation Commands.....	80
● BICM Commands.....	82
● OFDM and Subframe Commands.....	90
● System Commands.....	96
● Frame Info Commands.....	106
● SFN Delay Commands.....	112
● Special Commands.....	117
● TSGen Subsystem.....	119

## 5.1 General Commands

### Example: Storing current configuration

```
SOURCE1:BB:A3TSc:SETTING:STORe "/var/user/my_atsc30"
*RST
SOURCE1:BB:A3TSc:SETTING:CATalog?
// my_atsc30
SOURCE1:BB:A3TSc:SETTING:LOAD "/var/user/my_atsc30"

SOURCE1:BB:A3TSc:STATe 1
SOURCE1:BB:A3TSc:SETTING:DElete "/var/user/my_atsc30"
```

### Commands

[:SOURce<hw>]:BB:A3TSc:PRESet.....	70
[:SOURce<hw>]:BB:A3TSc:STATe.....	70
[:SOURce<hw>]:BB:A3TSc:SETTING:CATalog.....	70
[:SOURce<hw>]:BB:A3TSc:SETTING:DElete.....	71
[:SOURce<hw>]:BB:A3TSc:SETTING:LOAD.....	71
[:SOURce<hw>]:BB:A3TSc:SETTING:STORe.....	71
[:SOURce<hw>]:BB:A3TSc:INPUT:STATus?.....	72

---

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

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

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

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

**Usage:** Event

**Manual operation:** See ["Set To Default" on page 14](#)

---

#### [: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

**Manual operation:** See ["State" on page 14](#)

---

#### [: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 70](#).

**Manual operation:** See ["Save/Recall"](#) on page 14

**[:SOURce<hw>]:BB:A3TSc:SETTING:DELETED <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 70](#).

**Usage:** Setting only

**Manual operation:** See ["Save/Recall"](#) on page 14

**[: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 70](#).

**Manual operation:** See ["Save/Recall"](#) on page 14

**[:SOURce<hw>]:BB:A3TSc:SETTING:STORE <Atsc30Save>**

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 filename and the directory, in that the settings are stored, are user-definable; the file extension is however predefined.

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

**Parameters:**

<Atsc30Save> string

**Manual operation:** See ["Save/Recall"](#) on page 14

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

Queries the ATSC 3.0 coder status.

**Return values:**

<Status> string

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

**Usage:** Query only

**Manual operation:** See "[Status Info](#)" on page 16

## 5.2 Input Signal Commands

• General Commands.....	72
• PLP Info Commands.....	76
• Test Signal Commands.....	78

### 5.2.1 General Commands

**Example: Configuring general input signal parameters**

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

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

//*****
// Incoming studio transmitter link (STL) stream
//*****
:SOURcel:BB:A3TSc:INPut:STL:INTerface ON
// Input IP stream for single/multiple PLP single/multiple subframe transmission
:SOURcel: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
//*****
:SOURcel:BB:A3TSc:INPut:TYPE?
// TS
:SOURcel:BB:A3TSc:INPut:TYPE IP
:SOURcel:BB:A3TSc:INPut:DESTination:IP:ADDReSS "239.255.10.10"
:SOURcel:BB:A3TSc:INPut:DESTination:IP:PORT 5001

//*****
// Query incoming stream properties
//*****
:SOURcel:BB:A3TSc:INPut:NPLP?
// Response: 1
:SOURcel:BB:A3TSc:INPut:PROTocol?
// Response: UDP
:SOURcel:BB:A3TSc:INPut:STATus?
// Response: no error

```

## Commands

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

---

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

Sets the depth of inspection for the conformance check.

**Parameters:**

<ConfCheck>      0 | 1 | OFF | ON

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

**Manual operation:** See ["Conformance Check"](#) on page 17

**[:SOURce<hw>]:BB:A3TSc:INPut:DESTination:IP:ADDReSS <DestIPAddress>**

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

**Parameters:**

<DestIPAddress> string

Range: 224.0.0.0 to 239..255.255.255

\*RST: 239..255.10.10

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

**Manual operation:** See ["Destination IP Address"](#) on page 15

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

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

**Parameters:**

<DestIPPort> integer

Range: 0 to 65535

\*RST: 5001

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

**Manual operation:** See ["Destination IP Port"](#) on page 15

**[:SOURce<hw>]:BB:A3TSc:INPut:NPLP?**

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

**Return values:**

<NumberPLP> integer

Range: 1 to 64

\*RST: 1

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

**Usage:** Query only

**Manual operation:** See ["Number of PLPs"](#) on page 18

**[:SOURce<hw>]:BB:A3TSc:INPut:PROTocol?**

Displays the used protocol.

**Return values:**

<Protocol> UDP | RTP | AUTO

**UDP**

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

**UDP|RTP**

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

**AUTO**

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

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

**Usage:** Query only

**Manual operation:** See ["Protocol"](#) on page 19

---

**[: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 72](#).

**Manual operation:** See ["STL Interface"](#) on page 14

---

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

Resets the log file.

**Parameters:**

<ResetLogFile> select

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

**Manual operation:** See ["Reset Log File"](#) on page 15

---

**[:SOURce<hw>]:BB:A3TSc:INPut:TYPE <InputType>**

Specifies the input type.

**Parameters:**

<InputType> IP | TS  
\*RST: TS

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

**Manual operation:** See ["Input Type"](#) on page 19

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

Sets the modulation source for the input signal.

**Parameters:**

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

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

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

## 5.2.2 PLP Info Commands

**Example: Querying PLP input properties**

```
SOURCE1:BB:A3TSc:SOURCe EXT
*****
// Incoming IP based ROUTE/DASH or MMT stream
*****
SOURCE1:BB:A3TSc:INPut:TYPE IP
SOURCE1:BB:A3TSc:PLP1:ID?
// Response: 0
SOURCE1:BB:A3TSc:PLP1:USEFUL:RATE:MAX?
// 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

<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:PLP&lt;ch&gt;[:INPut]:DATArate?</a> .....	77
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:PLP&lt;ch&gt;:PACKetlength?</a> .....	77
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:PLP&lt;ch&gt;:USEFUL[:RATE]?</a> .....	77
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:PLP&lt;ch&gt;:USEFUL[:RATE]:MAX?</a> .....	78

---

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

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

- External transport stream including null packets input at "LAN" connector (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 76](#).

**Usage:** Query only

**Manual operation:** See ["Measured Data Rate / Mbit/s"](#) on page 21

---



---

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

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

**Return values:**

<PacketLength>	P188   INValid
	<b>P188</b>
	188 bytes specified packet length.

**INValid**

Packet length does not match the specified length.

\*RST: INValid

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

**Usage:** Query only

**Manual operation:** See ["Packet Length "](#) on page 20

---



---

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

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

**Return values:**

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

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

**Usage:** Query only

**Manual operation:** See ["Useful Data Rate / Mbit/s"](#) on page 21

**[**:SOURce<hw>]:BB:A3TSc:PLP<ch>:USEful[:RATE]:MAX?****

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

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

**Return values:**

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

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

**Usage:**      Query only

**Manual operation:**      See ["Max. Useful Data Rate / Mbit/s" on page 21](#)

### 5.2.3 Test Signal Commands

**Example: Configuring test signal parameters**

```
:SOURcel:BB:A3TSc:SOURce TEST

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

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

## Commands

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

---

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

Defines the test signal data.

**Parameters:**

<TestSignal>	TTSP   TIPP *RST: TTSP
--------------	---------------------------

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

**Manual operation:** See ["Test Signal"](#) on page 19

---

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

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

**Parameters:**

<TestIPPacket>	HUDP
----------------	------

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

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

---

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

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

**Parameters:**

<TSPacket>	S187   H184 *RST: H184
------------	---------------------------

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

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

---

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

Defines the payload area content of the **TS** packet.

**Parameters:**

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

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

**Manual operation:** See "Payload Test/Stuff" on page 23

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

Sets the **PID**.

**Parameters:**

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

**Example:** See Example "Configuring test signal parameters" on page 78.

**Manual operation:** See "PID (Hex)" on page 23

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

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

**Parameters:**

<PIDTestpacket>	VARiable   NULL
	*RST: NULL

**Example:** See Example "Configuring test signal parameters" on page 78.

**Manual operation:** See "PID Test Packet" on page 23

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

Sets the length of the PRBS sequence.

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

**Parameters:**

<PRBS>	P15_1   P23_1
	*RST: P23_1

**Example:** See Example "Configuring test signal parameters" on page 78.

**Manual operation:** See "PRBS" on page 23

## 5.3 Encapsulation Commands

**Example: Configuring encapsulation parameters**

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

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

## Commands

<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:PLP&lt;ch&gt;:ALPType?</a>	81
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:PLP&lt;ch&gt;:BBFCounter</a>	81
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:PLP&lt;ch&gt;:BBFPadding?</a>	81

---

### [\[:SOURce<hw>\]:BB:A3TSc:PLP<ch>:ALPType?](#)

Queries the input source type of ALP encapsulation.

**Return values:**

<ALPEncapsType>	IP   TS
	<b>IP</b>
	Query result for IP-based input via SOURcel:BB:A3TSc:INPut:TYPE IP
	<b>TS</b>
	Query result for serial input via SOURcel:BB:A3TSc:INPut:TYPE TS

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

**Usage:** Query only

**Manual operation:** See ["ALP Encapsulation Type"](#) on page 25

---

### [\[:SOURce<hw>\]: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 80.

**Manual operation:** See ["BB Frame Counter"](#) on page 25

---

### [\[:SOURce<hw>\]:BB:A3TSc:PLP<ch>:BBFPadding?](#)

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

**Return values:**

&lt;BBFramePadding&gt; 0 | 1 | OFF | ON

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

**Usage:** Query only

**Manual operation:** See ["BB Frame Padding"](#) on page 25

## 5.4 BICM Commands

The section contains the commands for configuring BICM.

• <a href="#">General Commands</a> .....	82
• <a href="#">Interleaving Commands</a> .....	86

### 5.4.1 General Commands

#### Example: Configuring general BICM parameters

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

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

//*****
// Query properties for PLP 2
//*****
:SOURcel:BB:A3TSc:PLP2:LLS?
// Response: ABSent
:SOURcel:BB:A3TSc:PLP2:LAYER:LAYER?
// Response: ENHanced
// Second layer of a 2-layer LDM system
:SOURcel:BB:A3TSc:PLP2:LAYER:LEVEL?
// Response: L40
// Injection level of 4.0 dB
:SOURcel:BB:A3TSc:PLP2:SIZE?
// Response: 1314804
:SOURcel:BB:A3TSc:PLP2:SCRambler?
// Response: 0
```

## Commands

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

### [:SOURce<hw>]:BB:A3TSc:PLP<ch>:ID <PLPID>

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

**Parameters:**

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

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

**Manual operation:** See "[PLP ID](#)" on page 20

### [:SOURce<hw>]:BB:A3TSc:PLP<ch>:CONStel <Constellation>

Defines the constellation.

**Parameters:**

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

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

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

### [: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

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

**Parameters:**

&lt;FECType&gt; B16K | B64K | C16K | C64K | O16K | O64K

**Example:** See [Example "Configuring general BICM parameters"](#) on page 82.**Manual operation:** See ["FEC Type"](#) on page 28**[:SOURce<hw>]:BB:A3TSc:PLP<ch>:LAYer:LAYer?**Queries the layer, that is used in [LDM](#).**Return values:**

&lt;Layer&gt; ENHanced | CORE

**Example:** See [Example "Configuring general BICM parameters"](#) on page 82.**Usage:** Query only**Manual operation:** See ["Layer"](#) on page 27**[:SOURce<hw>]:BB:A3TSc:PLP<ch>:LAYer:LEVel?**Queries the enhanced layer injection levels relative to the core [PLP](#) in dB.**Return values:**

&lt;LDMInjLevel&gt; 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&lt;x&gt; with &lt;x&gt;/10 meaning the level in dB

**Example:** L40 means 4.0 dB**Example:** See [Example "Configuring general BICM parameters"](#) on page 82.**Usage:** Query only**Manual operation:** See ["LDM Injection Level"](#) on page 27**[: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 82.

**Usage:** Query only

**Manual operation:** See "[Low Level Signaling \(LLS\)](#)" on page 27

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

Sets the code rate.

**Parameters:**

<CodeRate> R2\_15 | R3\_15 | R4\_15 | R5\_15 | R6\_15 | R7\_15 | R8\_15 | R9\_15 | R10\_15 | R11\_15 | R12\_15 | R13\_15

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

**Manual operation:** See "[Code Rate](#)" on page 28

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

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

**Return values:**

<ScramblerType> integer

Range: 0 to 3

\*RST: 0

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

**Usage:** Query only

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

**[[: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 27

## 5.4.2 Interleaving Commands

### Example: Configure interleaving parameters

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

//*****
// Dispersed PLPs
//*****
:SOURcel:BB:A3TSc:PLP1:TYPE:TYPE?
// Response: DISPerseD
:SOURcel:BB:A3TSc:PLP1:TYPE:NSUBslices?
// Response: 53
:SOURcel:BB:A3TSc:PLP1:TYPE:SUBSlice:INTerval?
// Response: 25151

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

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

//*****
// Time Interleaver = HTI setting
//*****
:SOURcel:BB:A3TSc:PLP1:TIL:TIL HTI
// Sets a hybrid time interleaver.
:SOURcel:BB:A3TSc:PLP1:TIL:INTER?
// Response: 0
// Each interleaving frame is mapped directly to one subframe.
:SOURcel:BB:A3TSc:PLP1:TIL:NTIBlocks 16
// Sets 16 time interleaver blocks.
:SOURcel:BB:A3TSc:PLP1:TIL:MAXBlocks?
// Response: 42
```

```
:SOURce1:BB:A3TSc:PLP1:TIL:BLOCs?
// Response: "42"
:SOURce1:BB:A3TSc:PLP1:TIL:CIL ON
```

## Commands

[:SOURce<hw>]:BB:A3TSc:PLP<ch>:TYPE:TYPE.....	87
[:SOURce<hw>]:BB:A3TSc:PLP<ch>:TYPE:NSUBslices.....	87
[:SOURce<hw>]:BB:A3TSc:PLP<ch>:TYPE:SUBSlice[:INTerval].....	87
[:SOURce<hw>]:BB:A3TSc:PLP<ch>:TIL:TIL.....	88
[:SOURce<hw>]:BB:A3TSc:PLP<ch>:TIL:NTIBlocks.....	88
[:SOURce<hw>]:BB:A3TSc:PLP<ch>:TIL:DEPTh.....	88
[:SOURce<hw>]:BB:A3TSc:PLP<ch>:TIL:EXTended.....	89
[:SOURce<hw>]:BB:A3TSc:PLP<ch>:TIL:INTer?.....	89
[:SOURce<hw>]:BB:A3TSc:PLP<ch>:TIL:BLOCs?.....	89
[:SOURce<hw>]:BB:A3TSc:PLP<ch>:TIL:MAXBlocks?.....	89
[:SOURce<hw>]:BB:A3TSc:PLP<ch>:TIL:CIL.....	90

### [:SOURce<hw>]:BB:A3TSc:PLP<ch>:TYPE:TYPE <Type>

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

**Parameters:**

<Type>           DISPersed | NONDispersed

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

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

### [:SOURce<hw>]:BB:A3TSc:PLP<ch>:TYPE:NSUBslices <NumberSubslices>

Defines the number of subslices for a dispersed PLP.

**Parameters:**

<NumberSubslices>   integer

Range:       1 to 16384  
\*RST:       2

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

**Manual operation:** See "[Number of Subslices](#)" on page 29

### [:SOURce<hw>]:BB:A3TSc:PLP<ch>:TYPE:SUBSlice[:INTerval] <SubsliceInterva>

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

**Parameters:**

<SubsliceInterva>   integer

Range:       0 to 16777215  
\*RST:       1

- Example:** See [Example "Configure interleaving parameters" on page 86](#).
- Manual operation:** See ["Subslice Interval"](#) on page 30

**[[:SOURce<hw>](#)]:BB:A3TSc:PLP<ch>:[TIL:TIL](#) <TimeInterMode>**

Sets the time interleaver mode.

**Parameters:**

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

- Example:** See [Example "Configure interleaving parameters" on page 86](#).
- Manual operation:** See ["Time Interleaver Mode"](#) on page 30

**[[:SOURce<hw>](#)]:BB:A3TSc:PLP<ch>:[TIL:NTIBlocks](#) <NumberTIBlocks>**

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

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

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

**Parameters:**

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

- Example:** See [Example "Configure interleaving parameters" on page 86](#).
- Manual operation:** See ["Number of TI Blocks"](#) on page 31

**[[: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:  
SOURcel:BB:A3TSc:PLP1:TIL:EXTended ON  
\*RST: D1024

- Example:** See [Example "Configure interleaving parameters" on page 86](#).
- Manual operation:** See ["Depth"](#) on page 30

---

[: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 86](#).

**Manual operation:** See ["Extended Interleaving"](#) on page 30

---



---

[: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 86](#).

**Usage:** Query only

**Manual operation:** See ["Inter Subframe"](#) on page 30

---



---

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

Queries the number of **FEC** blocks contained in the current interleaving frame.

**Return values:**

<NumberFECBlocks> string

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

**Usage:** Query only

**Manual operation:** See ["Number of FEC Blocks"](#) on page 31

---



---

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

Queries the maximum number of **FEC** blocks per interleaving frame.

**Return values:**

<FECBlocksMax> integer

Range: 1 to 4096

\*RST: 1

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

**Usage:** Query only

**Manual operation:** See "Max. Number of FEC Blocks" on page 31

**[: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 86.

**Manual operation:** See "Cell Interleaver" on page 31

## 5.5 OFDM and Subframe Commands

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

• General Commands.....	90
• Symbol Commands.....	92
• Subframe Info Commands.....	95

### 5.5.1 General Commands

#### Example: Configuring general OFDM and subframing parameters

```
:SOURcel:BB:A3TSc:FRAME:NSUBframes?
// Response: 8
// The frame consists of 8 subframes.

:SOURcel:BB:A3TSc:CHANnel:BANDwidth BW_7
// Query the used bandwidth in MHz.
:SOURcel:BB:A3TSc:SUBFrame1:USED:BANDwidth?
// Response: 6804246.1
:SOURcel:BB:A3TSc:SUBFrame1:MIMO?
// Response: OFF
:SOURcel:BB:A3TSc:SUBFrame1:MISO C256
:SOURcel:BB:A3TSc:SUBFrame1:FFT:MODE M8K
:SOURcel:BB:A3TSc:SUBFrame1:GUARD:INTerval G192
:SOURcel:BB:A3TSc:SUBFrame1:NData 72
```

#### Commands

[:SOURce<hw>]:BB:A3TSc:CHANnel[:BANDwidth].....	91
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:CARRier:MODE.....	91
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:FFT:MODE.....	91
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:GUARD:INTerval.....	91

[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:MIMO?	92
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:MISO	92
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:NDATA	92

---

#### [:SOURce<hw>]:BB:A3TSc:CHANnel[:BANDwidth] <ChannelBW>

Selects the channel bandwidth.

**Parameters:**

<ChannelBW>	BW_6   BW_7   BW_8
	*RST: BW_6

**Example:** See [Example "Configuring general OFDM and subframing parameters" on page 90](#).

**Manual operation:** See ["Channel Bandwidth" on page 33](#)

---

#### [:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:CARRier:MODE <RedCarrierMode>

Sets a coefficient for reducing the maximum number of carriers.

**Parameters:**

<RedCarrierMode>	integer
	Range: 0 to 4
	*RST: 0

**Example:** See [Example "Configuring general OFDM and subframing parameters" on page 90](#).

**Manual operation:** See ["Reduced Carrier Mode" on page 35](#)

---

#### [:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:FFT:MODE <FFTMode>

Defines the [FFT](#) size.

**Parameters:**

<FFTMode>	M16K   M8K   M32K   M8K   M16K   M32K
	*RST: M8K

**Example:** See [Example "Configuring general OFDM and subframing parameters" on page 90](#).

**Manual operation:** See ["FFT Size" on page 34](#)

---

#### [:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:GUARD:INTerval <GuardInterval>

Sets the guard interval length.

**Parameters:**

<GuardInterval>	G192   G384   G512   G768   G1024   G1536   G2048   G2432   G3072   G3648   G4096   G4864
	*RST: G192

**Example:** See [Example "Configuring general OFDM and subframing parameters" on page 90](#).

**Manual operation:** See ["Guard Interval"](#) on page 35

#### [**:SOURce<hw>]:BB:A3TSc:SUFFrame<ch>:MIMO?**

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

**Return values:**

<MIMO> OFF | ON | 1 | 0 | 0 | 1 | OFF | ON

**Example:** See [Example "Configuring general OFDM and subframing parameters" on page 90](#).

**Usage:** Query only

**Manual operation:** See ["MIMO"](#) on page 34

#### [**:SOURce<hw>]:BB:A3TSc:SUFFrame<ch>:MISO <MISO>**

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

**Parameters:**

<MISO> OFF | C64 | C256

**Example:** See [Example "Configuring general OFDM and subframing parameters" on page 90](#).

**Manual operation:** See ["MISO"](#) on page 34

#### [**:SOURce<hw>]:BB:A3TSc:SUFFrame<ch>:NDATa <TotNumData>**

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

**Parameters:**

<TotNumData> integer

Range: 1 to 2048

\*RST: 72

**Example:** See [Example "Configuring general OFDM and subframing parameters" on page 90](#).

**Manual operation:** See ["Total Number of Data OFDM Symbols"](#) on page 35

## 5.5.2 Symbol Commands

### Example: Configuring OFDM symbol parameters per subframe

```
:SOURcel:BB:A3TSc:SUFFrame1:GUARd:INTerval G192
```

```
:SOURcel:BB:A3TSc:SUBFrame1:PILot:SISO SP32_2
:SOURcel:BB:A3TSc:SUBFrame1:PILot:BOOST 4
:SOURcel:BB:A3TSc:SUBFrame1:SBS:FIRST 1
:SOURcel:BB:A3TSc:SUBFrame1:SBS:LAST?
// Response: 1
:SOURcel:BB:A3TSc:SUBFrame1:SBS:NULL?
// Response: 633
:SOURcel:BB:A3TSc:SUBFrame1:FIL ON
```

## Commands

[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:PILot:SISO.....	93
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:PILot:BOOST.....	93
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:FIL.....	93
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:SBS:FIRSt.....	94
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:SBS:LAST?.....	94
[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:SBS:NULL?.....	94

### [:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:PILot:SISO <SISPPilotPat>

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

#### Parameters:

<SISPPilotPat>	SP32_4   SP32_2   SP24_4   SP16_4   SP3_2   SP3_4   SP4_2   SP4_4   SP6_2   SP6_4   SP8_2   SP8_4   SP12_2   SP12_4   SP16_2   SP24_2   SP3_2   SP3_4   SP4_2   SP4_4   SP6_2   SP6_4   SP8_2   SP8_4   SP12_2   SP12_4   SP16_2   SP16_4   SP24_2   SP24_4   SP32_2   SP32_4 *RST: SP32_2
----------------	---

**Example:** See [Example "Configuring OFDM symbol parameters per sub-frame"](#) on page 92.

**Manual operation:** See ["SISO Pilot Pattern"](#) on page 36

### [:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:PILot:BOOSt <PilotBoostMode>

Sets the power boost mode for the scattered pilots.

#### Parameters:

<PilotBoostMode>	integer Range: 0 to 4 *RST: 4
------------------	-------------------------------------

**Example:** See [Example "Configuring OFDM symbol parameters per sub-frame"](#) on page 92.

**Manual operation:** See ["Pilot Boost Mode"](#) on page 36

### [: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 92.

**Manual operation:** See ["Frequency Interleaver"](#) on page 37

**[: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 92.

**Manual operation:** See ["Subframe Boundary Symbol \(First\)"](#) on page 36

**[: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 92.

**Usage:** Query only

**Manual operation:** See ["Subframe Boundary Symbol \(Last\)"](#) on page 37

**[:SOURce<hw>]:BB:A3TSc:SUBFrame<ch>:SBS:NULL?**

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

**Return values:**

<SubfrNullCells> integer  
 Range: 0 to 8191  
 \*RST: 0

**Example:** See [Example "Configuring OFDM symbol parameters per sub-frame"](#) on page 92.

**Usage:** Query only

**Manual operation:** See ["Subframe Boundary Symbol \(Null Cells\)"](#) on page 37

### 5.5.3 Subframe Info Commands

#### Example: Querying subframe information

```
// Query the subframe length in ms.  
:SOURcel:BB:A3TSc:SUBFrame1:DURation?  
// Response: 0.2826666666666667  
  
// Query the used bandwidth of the subframe in MHz.  
:SOURcel:BB:A3TSc:SUBFrame1:USED:BANDwidth?  
// Response: 5.832421  
:SOURcel:BB:A3TSc:SUBFrame1:PLP:NPLP?  
// Response: 2  
:SOURcel:BB:A3TSc:SUBFrame1:PLP:NIDPlp?  
// Response: "0,1"  
// PLPs with IDs 0 to 1 are mapped to subframe 1
```

#### Commands

<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:SUBFrame&lt;ch&gt;:DURation?</a>	95
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:SUBFrame&lt;ch&gt;:USED[:BANDwidth]?</a>	95
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:SUBFrame&lt;ch&gt;:PLP:NPLP?</a>	96
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:SUBFrame&lt;ch&gt;:PLP:NIDPlp?</a>	96

#### [\[:SOURce<hw>\]:BB:A3TSc:SUBFrame<ch>:DURation?](#)

Queries the duration of the subframe.

##### Return values:

<Duration>	float
	Range: 0 to 9999.999
	Increment: 0.001
	*RST: 0

**Example:** See [Example "Querying subframe information" on page 95](#).

**Usage:** Query only

**Manual operation:** See ["Duration"](#) on page 38

#### [\[:SOURce<hw>\]:BB:A3TSc:SUBFrame<ch>:USED\[:BANDwidth\]?](#)

Queries the used bandwidth per subframe.

##### Return values:

<UsedBW>	integer
	Range: 0 to 9.9999999
	*RST: 0

**Example:** See [Example "Querying subframe information" on page 95](#).

**Usage:** Query only

**Manual operation:** See "Used Bandwidth" on page 38

#### [**:SOURce<hw>]:BB:A3TSc:SUFFrame<ch>:PLP:NPLP?**

Queries the number of PLPs in the subframe.

**Return values:**

<NumPLPsSubfr> integer

Range: 1 to 64

\*RST: 1

**Example:** See Example "Querying subframe information" on page 95.

**Usage:** Query only

**Manual operation:** See "Number of PLPs in Subframe" on page 38

#### [**:SOURce<hw>]:BB:A3TSc:SUFFrame<ch>:PLP:NIDPlp?**

Queries all IDs of the PLPs mapped to the subframe.

**Return values:**

<PLPIDsSubfr> string

**Example:** See Example "Querying subframe information" on page 95.

**Usage:** Query only

**Manual operation:** See "PLP IDs in Subframe" on page 38

## 5.6 System Commands

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

● <a href="#">Network Commands</a> .....	96
● <a href="#">Frame Commands</a> .....	100
● <a href="#">L1 Commands</a> .....	103

### 5.6.1 Network Commands

**Example: Configuring network parameters**

```
//*****
// Configure multi frequency network properties.
//*****
:SOURcel:BB:A3TSc:NETWorkmode MFN

:SOURcel:BB:A3TSc:TIME MSEC
:SOURcel:BB:A3TSc:LLS?
// Response: ABSent
```

```

:SOURcel:BB:A3TSc:RETurn:CHANnel?
// Response: ABSent
:SOURcel:BB:A3TSc:MISO:NTX 4
:SOURcel:BB:A3TSc:MISO:IDX 4
:SOURcel:BB:A3TSc:TXId:MODE MAN
:SOURcel:BB:A3TSc:TXId:ADDRess 8191
:SOURcel:BB:A3TSc:TXId:LEVel L450
:SOURcel:BB:A3TSc:L:DETail:VERSion?
// Response: 0
:SOURcel:BB:A3TSc:L:DETail:VERSion 1
// You can set the broadcast stream ID
:SOURcel:BB:A3TSc:BSID 1234

//*****
// Configure single frequency network properties.
//*****

:SOURcel:BB:A3TSc:INPut:STL:INTerface ON
// SFN only possible in STL operation mode
:SOURcel:BB:A3TSc:NETWorkmode SFN

:SOURcel:BB:A3TSc:TIME?
// Response: OFF
:SOURcel:BB:A3TSc:LLS?
// Response: ABSent
:SOURcel:BB:A3TSc:RETurn:CHANnel?
// Response: ABSent
:SOURcel:BB:A3TSc:MISO:NTX 4
:SOURcel:BB:A3TSc:MISO:IDX 4
:SOURcel:BB:A3TSc:TXId:MODE MAN
:SOURcel:BB:A3TSc:TXId:ADDRess 8191
:SOURcel:BB:A3TSc:TXId:LEVel L450

```

For single frequency network delays and mode commands, see [Chapter 5.8, "SFN Delay Commands", on page 112](#).

## Commands

<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:NETWorkmode</a> .....	97
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:BSID</a> .....	98
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:LLS?</a> .....	98
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:MISO:NTX</a> .....	98
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:MISO:IDX</a> .....	98
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:RETurn[:CHANnel]?</a> .....	99
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:TIME</a> .....	99
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:TXId:MODE</a> .....	99
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:TXId:ADDRess</a> .....	99
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:TXId:LEVel</a> .....	100

---

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

Sets the network mode.

**Parameters:**

<NetworkMode> MFN | SFN

**Example:** See [Example "Configuring network parameters" on page 96](#).

**Manual operation:** See ["Network Mode"](#) on page 40

---

**[: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 96](#).

**Manual operation:** See ["Broadcast Stream ID \(BSID\)"](#) on page 42

---

**[: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 96](#).

**Usage:** Query only

**Manual operation:** See ["Low Level Signaling \(LLS\)"](#) on page 41

---

**[: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 96](#).

**Manual operation:** See ["Number of Transmitters \(N\\_TX\)"](#) on page 42

---

**[: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 96](#).

**Manual operation:** See ["Transmitter Index \(x\)" on page 42](#)

---

**[: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 96](#).

**Usage:** Query only

**Manual operation:** See ["Return Channel" on page 41](#)

---

**[: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 96](#).

**Manual operation:** See ["Time Info" on page 41](#)

---

**[: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 96](#).

**Manual operation:** See ["TxID Mode" on page 42](#)

---

**[: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 96](#).

**Manual operation:** See ["TxID Address" on page 42](#)

**[**: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 96](#).

**Manual operation:** See ["TxID Injection Level"](#) on page 42

## 5.6.2 Frame Commands

**Example: Configuring frame parameters**

```
:SOURcel:BB:A3TSc:FRAMe:SUBframes?
// Response: 1
// 1 subframe per frame

:SOURcel:BB:A3TSc:PAPR TR
:SOURcel:BB:A3TSc:FRAMe:MODE SYMB
:SOURcel:BB:A3TSc:FRAMe:TIME:OFFset?
// Response: 4608
:SOURcel:BB:A3TSc:FRAMe:ADDITIONal:SAMPles?
// Response: 0

:SOURcel:BB:A3TSc:FRAMe:MODE TIME
// Set the frame length in ms.
:SOURcel:BB:A3TSc:FRAMe:LENGTH 150
:SOURcel:BB:A3TSc:FRAMe:EXSYmbol?
// Response: 4736
:SOURcel:BB:A3TSc:FRAMe:EXFinal?
// Response: 0
```

**Commands**

<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:PAPR</a> .....	101
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:FRAMe:SUBframes?</a> .....	101
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:FRAMe:MODE</a> .....	101
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:FRAMe:LENGTH</a> .....	101
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:FRAMe:EXSYmbol?</a> .....	102
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:FRAMe:EXFinal?</a> .....	102
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:FRAMe:TIME[:OFFSet?]</a> .....	102
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:FRAMe:ADDITIONal[:SAMPles?]</a> .....	103

---

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

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

**Parameters:**

<PAPR> OFF | TR

**Example:** See [Example "Configuring frame parameters" on page 100](#).

**Manual operation:** See ["Peak To Average Power Ratio" on page 43](#)

---

## [:SOURce&lt;hw&gt;]:BB:A3TSc:FRAMe:NSubframes?

Queries the number of subframes.

**Return values:**

<NumSubframes> integer  
Range: 1 to 256  
\*RST: 1

**Example:** See:

[Example "Configuring general OFDM and subframing parameters" on page 90](#)

[Example "Configuring frame parameters" on page 100](#)

**Usage:** Query only

**Manual operation:** See ["Number of Subframes" on page 33](#)

---

## [:SOURce&lt;hw&gt;]:BB:A3TSc:FRAMe:MODE &lt;FrameMode&gt;

Sets how the frame length is aligned.

**Parameters:**

<FrameMode> TIME | SYMBol  
\*RST: SYMBol

**Example:** See [Example "Configuring frame parameters" on page 100](#).

**Manual operation:** See ["Frame Mode" on page 44](#)

---

## [:SOURce&lt;hw&gt;]:BB:A3TSc:FRAMe:LENGth &lt;FrameLength&gt;

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

**Parameters:**

<FrameLength> integer  
Range: 50 to 5000  
Increment: 5  
\*RST: 50

**Example:** See [Example "Configuring frame parameters" on page 100](#).

**Manual operation:** See "Frame Length" on page 44

---

**[:SOURce<hw>]:BB:A3TSc:FRAMe:EXSYmbol?**

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

**Return values:**

<ExcessSymbol> integer  
Range: 0 to 8191  
\*RST: 0

**Example:** See [Example "Configuring frame parameters"](#) on page 100.

**Usage:** Query only

**Manual operation:** See "Excess Samples per Symbol" on page 44

---

**[:SOURce<hw>]:BB:A3TSc:FRAMe:EXFinal?**

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

**Return values:**

<FinalExcSamples> integer  
Range: 0 to 32767  
\*RST: 0

**Example:** See [Example "Configuring frame parameters"](#) on page 100.

**Usage:** Query only

**Manual operation:** See "Final Excess Samples" on page 44

---

**[:SOURce<hw>]:BB:A3TSc:FRAMe:TIME[:OFFSet]?**

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

**Return values:**

<TimeOffset> integer  
Range: 0 to 65535  
\*RST: 0

**Example:** See [Example "Configuring frame parameters"](#) on page 100.

**Usage:** Query only

**Manual operation:** See "Time Offset" on page 44

**[**:SOURce<hw>]:BB:A3TSc:FRAMe:ADDITIONal[:SAMPLEs]?****

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

**Return values:**

<AddSamples>	integer
	Range: 0 to 127
	*RST: 0

**Example:** See [Example "Configuring frame parameters" on page 100](#).

**Usage:** Query only

**Manual operation:** See ["Additional Samples"](#) on page 44

### 5.6.3 L1 Commands

**Example: Configuring L1 parameters**

```
// Editing some L1 parameters requires disabling STL interface.
:SOURcel:BB:A3TSc:INPut:STL:INTerface 0

:SOURcel:BB:A3TSc:L:BASic:VERSION?
// Response: 0
:SOURcel:BB:A3TSc:L:NPRreamble:SYMBols?
// Response: 1
:SOURcel:BB:A3TSc:L:BASic:FECType MOD1
:SOURcel:BB:A3TSc:L:CARRier:MODE 0
:SOURcel:BB:A3TSc:L:PILot:DX D16
:SOURcel:BB:A3TSc:L:DETail:VERSion 0
:SOURcel:BB:A3TSc:L:DETail:FECType MOD1
:SOURcel:BB:A3TSc:L:DETail:ADDITIONal:PARity?
// Response: OFF
:SOURcel:BB:A3TSc:NRF?
// Response: 0
```

**Commands**

[ <b>:SOURce&lt;hw&gt;]:BB:A3TSc:L:BASic:FECType</b> .....	104
[ <b>:SOURce&lt;hw&gt;]:BB:A3TSc:L:BASic:VERSion</b> .....	104
[ <b>:SOURce&lt;hw&gt;]:BB:A3TSc:L:CARRier:MODE</b> .....	104
[ <b>:SOURce&lt;hw&gt;]:BB:A3TSc:L:DETail:ADDITIONal[:PARity]</b> ?.....	104
[ <b>:SOURce&lt;hw&gt;]:BB:A3TSc:L:DETail:FECType</b> .....	105
[ <b>:SOURce&lt;hw&gt;]:BB:A3TSc:L:DETail:VERSion</b> .....	105
[ <b>:SOURce&lt;hw&gt;]:BB:A3TSc:L:NPRreamble[:SYMBols]</b> ?.....	105
[ <b>:SOURce&lt;hw&gt;]:BB:A3TSc:L:PILot:DX</b> .....	105
[ <b>:SOURce&lt;hw&gt;]:BB:A3TSc:NRF</b> ?.....	106

---

[:SOURce<hw>]:BB:A3TSc:L:BASic:FECType <L1BasicFECType>

Defines the protection level of L1 basic signaling.

**Parameters:**

<L1BasicFECType> MOD1 | MOD2 | MOD3 | MOD4 | MOD5  
                   \*RST:       MOD1

**Example:** See [Example "Configuring L1 parameters" on page 103](#).

**Manual operation:** See ["L1 Basic FEC Type"](#) on page 45

---



---

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

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

**Return values:**

<L1BasicVersion> integer  
                   Range:     0 to 7  
                   \*RST:     0

**Example:** See [Example "Configuring L1 parameters" on page 103](#).

**Usage:** Query only

**Manual operation:** See ["L1 Basic Version"](#) on page 45

---



---

[:SOURce<hw>]:BB:A3TSc:L:CARRier:MODE <RedCarrModePre>

Sets a coefficient for reducing the maximum number of carriers.

**Parameters:**

<RedCarrModePre> integer  
                   Range:     0 to 4  
                   \*RST:     0

**Example:** See [Example "Configuring L1 parameters" on page 103](#).

**Manual operation:** See ["Reduced Carrier Mode Preamble"](#) on page 46

---



---

[:SOURce<hw>]:BB:A3TSc:L:DETail:ADDITIONal[:PARity]?

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

**Return values:**

<L1DetailAddPar> OFF | K1 | K2

**Example:** See [Example "Configuring L1 parameters" on page 103](#).

**Usage:** Query only

**Manual operation:** See ["L1 Detail Additional Parity Mode"](#) on page 46

---

[:SOURce<hw>]:BB:A3TSc:L:DETail:FECType <L1DetailFECType>

Defines the protection level of L1 detail signaling.

**Parameters:**

<L1DetailFECType> MOD1 | MOD2 | MOD3 | MOD4 | MOD5 | MOD6 | MOD7  
 \*RST: MOD1

**Example:** See [Example "Configuring L1 parameters" on page 103](#).

**Manual operation:** See ["L1 Detail FEC Type"](#) on page 46

---



---

[:SOURce<hw>]:BB:A3TSc:L:DETail:VERSion <L1DetailVers>

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

**Parameters:**

<L1DetailVers> integer  
 Range: 0 to 15  
 \*RST: 0

**Example:** See [Example "Configuring L1 parameters" on page 103](#).

**Manual operation:** See ["L1 Detail Version"](#) on page 46

---



---

[:SOURce<hw>]:BB:A3TSc:L:NPRamble[:SYMBols]?

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

**Return values:**

<NumPreSymb> integer  
 Range: 1 to 8  
 \*RST: 1

**Example:** See [Example "Configuring L1 parameters" on page 103](#).

**Usage:** Query only

**Manual operation:** See ["Number of Preamble Symbols"](#) on page 46

---



---

[:SOURce<hw>]:BB:A3TSc:L:PILot:DX <PilotPatPre>

Sets the pilot pattern used for the preamble symbols.

**Parameters:**

<PilotPatPre> D3 | D4 | D6 | D8 | D12 | D16 | D24 | D32  
 \*RST: D16

**Example:** See [Example "Configuring L1 parameters" on page 103](#).

**Manual operation:** See ["Pilot Pattern \(Dx\) Preamble"](#) on page 46

**[**:SOURce<hw>]:BB:A3TSc:NRF?****

Queries the number of radio frequencies involved in channel bonding.

**Return values:**

<NumRFs>      integer

**0**

Channel bonding is not used for the current frame.

Range:      0 to 1

\*RST:      0

**Example:**      See [Example "Configuring L1 parameters" on page 103](#).

**Usage:**      Query only

**Manual operation:**      See ["Number of RFs"](#) on page 47

## 5.7 Frame Info Commands

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

• <a href="#">General Commands</a> .....	106
• <a href="#">L1 Signaling Commands</a> .....	107
• <a href="#">Bootstrap Commands</a> .....	109

### 5.7.1 General Commands

**Example: Querying general frame information**

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

**Commands**

<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:INFO:BOOTstrap:DURation?</a> .....	106
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:INFO:FRAMe:DURation?</a> .....	107

**[**:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:DURation?****

Queries the duration of the bootstrap signal in ms.

**Return values:**

<Duration>      float

Range:      2.000 to 2.000

Increment:      0.001

\*RST:      2.000

**Example:** See [Example "Querying general frame information"](#) on page 106.

**Usage:** Query only

**Manual operation:** See "[Bootstrap Duration](#)" on page 48

#### [**:SOURce<hw>]:BB:A3TSc:INFO:FRAMe:DURation?**

Queries the frame duration in ms.

**Return values:**

<Duration>	float
	Range: 0 to 9999.999
	Increment: 0.001
	*RST: 0

**Example:** See [Example "Querying general frame information"](#) on page 106.

**Usage:** Query only

**Manual operation:** See "[Frame Duration](#)" on page 48

## 5.7.2 L1 Signaling Commands

### Example: Querying L1 signaling parameters

```
:SOURcel:BB:A3TSc:INFO:L:BASic:BYTes?
// Response: 25
:SOURcel:BB:A3TSc:INFO:L:BASic:CELLs?
// Response: 3820
:SOURcel:BB:A3TSc:INFO:L:DETail:BYTes?
// Response: 25
:SOURcel:BB:A3TSc:INFO:L:DETail:CELLs?
// Response: 2787
```

### Commands

[ <b>:SOURce&lt;hw&gt;]:BB:A3TSc:INFO:L:BASic:BYTes?</b> .....	107
[ <b>:SOURce&lt;hw&gt;]:BB:A3TSc:INFO:L:BASic:CELLs?</b> .....	108
[ <b>:SOURce&lt;hw&gt;]:BB:A3TSc:INFO:L:DETail:BYTes?</b> .....	108
[ <b>:SOURce&lt;hw&gt;]:BB:A3TSc:INFO:L:DETail:CELLs?</b> .....	108

#### [**:SOURce<hw>]:BB:A3TSc:INFO:L:BASic:BYTes?**

Queries the L1 basic signaling length in bytes.

**Return values:**

<BasicBytes>	integer
	Range: 25 to 25
	*RST: 25

- Example:** See [Example "Querying L1 signaling parameters" on page 107.](#)
- Usage:** Query only
- Manual operation:** See ["L1 Basic Bytes"](#) on page 48
- 

**[**:SOURce<hw>]:BB:A3TSc:INFO:L:BASIC:CELLs?****

Queries the L1 basic signaling length in cells.

**Return values:**

<BasicCells>	integer
	Range: 69 to 3820
	*RST: 69

- Example:** See [Example "Querying L1 signaling parameters" on page 107.](#)
- Usage:** Query only
- Manual operation:** See ["L1 Basic Cells"](#) on page 49
- 

**[**:SOURce<hw>]:BB:A3TSc:INFO:L:DETaIl:BYTeS?****

Queries the L1 detail signaling length in bytes.

**Return values:**

<DetailedBytes>	integer
	Range: 25 to 8191
	*RST: 25

- Example:** See [Example "Querying L1 signaling parameters" on page 107.](#)
- Usage:** Query only
- Manual operation:** See ["L1 Detail Bytes"](#) on page 48
- 

**[**:SOURce<hw>]:BB:A3TSc:INFO:L:DETaIl:CELLs?****

Queries the L1 detail signaling length in cells.

**Return values:**

<DetailCells>	integer
	Range: 0 to 5242887
	*RST: 0

- Example:** See [Example "Querying L1 signaling parameters" on page 107.](#)
- Usage:** Query only
- Manual operation:** See ["L1 Detail Cells"](#) on page 49

### 5.7.3 Bootstrap Commands

#### Example: Querying bootstrap parameters

```
// Query major and minor version.  
:SOURcel:BB:A3TSc:INFO:BOOTstrap:MAJor?  
// Response: 0  
:SOURcel:BB:A3TSc:INFO:BOOTstrap:MINor?  
// Response: 0  
:SOURcel:BB:A3TSc:INFO:BOOTstrap:TIME:NEXT?  
// Response: N150  
// Minimum time interval to the next frame is 150 ms.  
:SOURcel:BB:A3TSc:INFO:BOOTstrap:EAS?  
// Response: NOEMergency  
:SOURcel:BB:A3TSc:INFO:BOOTstrap:BANDwidth?  
// Response: BW_6  
:SOURcel:BB:A3TSc:INFO:BOOTstrap:BSR:COEFFcient?  
// Response: 2  
  
:SOURcel:BB:A3TSc:INFO:BOOTstrap:PREamble:STRucture?  
// Response: 40  
:SOURcel:BB:A3TSc:INFO:BOOTstrap:FFT:MODE?  
// Response: M8K  
:SOURcel:BB:A3TSc:INFO:BOOTstrap:PIlot:DX?  
// Response: D3  
:SOURcel:BB:A3TSc:INFO:BOOTstrap:GUARD:INTerval?  
// Response: G192  
:SOURcel:BB:A3TSc:INFO:BOOTstrap:BASIC:FECType?  
// Response: MOD1
```

#### Commands

<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:INFO:BOOTstrap:BANDwidth?</a>	109
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:INFO:BOOTstrap:BASIC:FECType?</a>	110
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:INFO:BOOTstrap:BSR:COEFFcient?</a>	110
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:INFO:BOOTstrap:EAS?</a>	110
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:INFO:BOOTstrap:FFT:MODE?</a>	110
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:INFO:BOOTstrap:GUARD:INTerval?</a>	111
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:INFO:BOOTstrap:MAJor?</a>	111
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:INFO:BOOTstrap:MINor?</a>	111
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:INFO:BOOTstrap:PIlot:DX?</a>	111
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:INFO:BOOTstrap:PREamble[STRucture]?</a>	112
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:INFO:BOOTstrap:TIME:NEXT?</a>	112

---

#### [\[:SOURce<hw>\]:BB:A3TSc:INFO:BOOTstrap:BANDwidth?](#)

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

##### Return values:

<FrameInfoBW>      BW\_6 | BW\_7 | BW\_8 | BW8G

- Example:** See [Example "Querying bootstrap parameters" on page 109](#).
- Usage:** Query only
- Manual operation:** See ["System Bandwidth"](#) on page 50

**[[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:BASic:FECType?]**

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

**Return values:**

<L1BasicFECType> MOD1 | MOD2 | MOD3 | MOD4 | MOD5 | MOD6 | MOD7

- Example:** See [Example "Querying bootstrap parameters" on page 109](#).
- Usage:** Query only
- Manual operation:** See ["L1 Basic FEC Type"](#) on page 52

**[[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:BSR:COEFFicient?]**

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

**Return values:**

<BSRCoefficient>	integer
	Range: 0 to 127
	*RST: 2

- Example:** See [Example "Querying bootstrap parameters" on page 109](#).
- Usage:** Query only
- Manual operation:** See ["BSR Coefficient"](#) on page 50

**[[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:EAS?]**

Queries the signaling mode for emergency alert.

**Return values:**

<EAS> NOEMergency | SET1 | SET2 | SET3

- Example:** See [Example "Querying bootstrap parameters" on page 109](#).
- Usage:** Query only
- Manual operation:** See ["Emergency Alert Signaling \(EAS\)"](#) on page 50

**[[: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 109](#).

**Usage:** Query only

**Manual operation:** See "[FFT Size](#)" on page 51

#### **[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:GUARd:INTerval?**

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

**Return values:**

<GuardInterval>	G192   G384   G512   G768   G1024   G1536   G2048   G2432   G3072   G3648   G4096   G4864
-----------------	--

**Example:** See [Example "Querying bootstrap parameters"](#) on page 109.

**Usage:** Query only

**Manual operation:** See "[Guard Interval](#)" on page 51

#### **[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:MAJor?**

Queries the major version of the bootstrap.

**Return values:**

<Major>	integer Range: 0 to 0 *RST: 0
---------	-------------------------------------

**Example:** See [Example "Querying bootstrap parameters"](#) on page 109.

**Usage:** Query only

**Manual operation:** See "[Major Version](#)" on page 49

#### **[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:MINor?**

Queries the minor version of the bootstrap.

**Return values:**

<Minor>	integer Range: 0 to 7 *RST: 0
---------	-------------------------------------

**Example:** See [Example "Querying bootstrap parameters"](#) on page 109.

**Usage:** Query only

**Manual operation:** See "[Minor Version](#)" on page 49

#### **[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:PILOT:DX?**

Queries the pilot pattern used for the preamble symbols.

**Return values:**

<PilotPattern>	D3   D4   D6   D8   D12   D16   D24   D32
----------------	---

- Example:** See [Example "Querying bootstrap parameters" on page 109](#).
- Usage:** Query only
- Manual operation:** See ["Pilot Pattern \(Dx\)" on page 52](#)

### **[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:PREamble[:STRucture]?**

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

**Return values:**

<PreStructure>	integer
	Range: 0 to 255
	*RST: 0

- Example:** See [Example "Querying bootstrap parameters" on page 109](#).
- Usage:** Query only
- Manual operation:** See ["Preamble Structure" on page 51](#)

### **[:SOURce<hw>]:BB:A3TSc:INFO:BOOTstrap:TIME:NEXT?**

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

**Return values:**

<MinTimetoNext>	N50   N100   N150   N200   N250   N300   N350   N400   N500   N600   N700   N800   N900   N1000   N1100   N1200   N1300   N1400   N1500   N1600   N1700   N1900   N2100   N2300   N2500   N2700   N2900   N3300   N3700   N4100   N4500   N4900   N5300   NOTapplicable
-----------------	---

- Example:** See [Example "Querying bootstrap parameters" on page 109](#).
- Usage:** Query only
- Manual operation:** See ["Min. Time to Next" on page 50](#)

## 5.8 SFN Delay Commands

The section contains the commands for configuring single frequency network delays.

**Example: Configuring single frequency network delay parameters**

```
//*****
// Activate SFN network mode.
//*****
:SOURcel:BB:A3TSc:INPut:STL:INTerface ON
:SOURcel:BB:A3TSc:NETWorkmode SFN
```

```

// Query the SFN mode.
:SOURcel:BB:A3TSc:DELay:SFNMode?
// Response: RELative

// Query the network delay in s.
:SOURcel:BB:A3TSc:DELay:NETwork?
// Response: 0.149506

// Query the processing delay in s.
:SOURcel:BB:A3TSc:DELay:PROcess?
// Response: 0.100187

// Query the dynamic delay in s.
:SOURcel:BB:A3TSc:DELay:DYNamic?
// Response: 0.350307

// Query the total delay in s, that is the sum of processing and dynamic delay.
:SOURcel:BB:A3TSc:DELay:TOTal?
// Response: 0.450494

// Set a maximum permissible delay of, e.g., 10 µs.
:SOURcel:BB:A3TSc:DELay:DEViation 0.000010

// Set a static delay of, e.g., -10 µs.
:SOURcel:BB:A3TSc:DELay:STATIC -0.000010
// The start of transmission is shifted to 10 µs earlier.

// Query the maximum delay in s.
:SOURcel:BB:A3TSc:DELay:MAXimum?
// Response: 2.6

// Query the dispatch time in s, that is the sum of maximum and static delay.
:SOURcel:BB:A3TSc:DELay:DISPatch?
// Response: 2.59999

// Replace the bootstrap signal by a null signal (no output power).
:SOURcel:BB:A3TSc:DELay:MUTE:BOOTstrap ON

```

## Commands

<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:DELay:DEViation</a> .....	114
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:DELay:DISPatch?</a> .....	114
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:DELay:DYNamic?</a> .....	114
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:DELay:MAXimum?</a> .....	115
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:DELay:MUTE[:BOOTstrap]</a> .....	115
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:DELay:NETwork?</a> .....	115
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:DELay:PROcess?</a> .....	116
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:DELay:STATic</a> .....	116
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:DELay:TOTal?</a> .....	116

---

[: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: $\mu$ s

**Example:** See [Example "Configuring single frequency network delay parameters" on page 112](#).

**Manual operation:** See ["Max. Deviation Time"](#) on page 54

---

[: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: $\mu$ s

**Example:** See [Example "Configuring single frequency network delay parameters" on page 112](#).

**Usage:** Query only

**Manual operation:** See ["Dispatch Time"](#) on page 54

---

[: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: $\mu$ s

**Example:** See [Example "Configuring single frequency network delay parameters" on page 112](#).

**Usage:** Query only

**Manual operation:** See ["Dynamic Delay"](#) on page 54

---

**[**: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:  $\mu$ s

**Example:** See [Example "Configuring single frequency network delay parameters" on page 112](#).

**Usage:** Query only

**Manual operation:** See "[Maximum Delay](#)" on page 54

---

**[**: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 112](#).

**Manual operation:** See "[Mute Bootstrap of Frame](#)" on page 54

---

**[**:SOURce<hw>]:BB:A3TSc:DELay:NETWork?****

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

**Return values:**

<Network> float  
Range: 0.0 to 5000000.0  
Increment: 0.1  
\*RST: 0  
Default unit:  $\mu$ s

**Example:** See [Example "Configuring single frequency network delay parameters" on page 112](#).

**Usage:** Query only

**Manual operation:** See "[Network Delay](#)" on page 53

---

**[**: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: $\mu$ s

**Example:** See [Example "Configuring single frequency network delay parameters" on page 112](#).

**Usage:** Query only

**Manual operation:** See "[Processing Delay](#)" on page 53

---

**[**: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 112](#).

**Manual operation:** See "[SFN Mode](#)" on page 55

---

**[**: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: $\mu$ s

**Example:** See [Example "Configuring single frequency network delay parameters" on page 112](#).

**Manual operation:** See "[Static Delay](#)" on page 54

---

**[**: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:  $\mu$ s

**Example:** See [Example "Configuring single frequency network delay parameters" on page 112.](#)

**Usage:** Query only

**Manual operation:** See "[Total Delay](#)" on page 54

## 5.9 Special Commands

The section contains commands to configure settings, that deviate from the broadcast standard specification.

**Example: Configuring special settings**

```
:SOURcel: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.  

:SOURcel:BB:A3TSc:SPECial:STL:PREamble ON  

:SOURcel:BB:A3TSc:SPECial:STL:TMP ON  

//*****  

// Special settings, if STL Interface is turned off.  

//*****  

// For ALP encapsulation compatibility modes.  

:SOURcel:BB:A3TSc:SPECial:ALP:LMT ON  

// For special bootstrap settings.  

:SOURcel:BB:A3TSc:SPECial:BOOTstrap:MINor 7  

:SOURcel:BB:A3TSc:SPECial:BOOTstrap:EAS SET3  

// Apply special settings.  

:SOURcel:BB:A3TSc:SPECial:SETTings:STATE ON
```

**Commands**

<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:SPECial:SETTings[:STATE]</a> .....	118
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:SPECial:ALP:LMT</a> .....	118
<a href="#">[:SOURce&lt;hw&gt;]:BB:A3TSc:SPECial:BOOTstrap:EAS</a> .....	118

[:SOURce<hw>]:BB:A3TSc:SPECial:BOOTstrap:MINor.....	118
[:SOURce<hw>]:BB:A3TSc:SPECial:STL:PREamble.....	119
[:SOURce<hw>]:BB:A3TSc:SPECial:STL:TMP.....	119

---

### **[:SOURce<hw>]:BB:A3TSc:SPECial:SETTings[:STATe] <SpecialSettings>**

Enables/disables special settings.

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

**Parameters:**

<SpecialSettings> 0 | 1 | OFF | ON

**Example:** See [Example "Configuring special settings" on page 117](#).

**Manual operation:** See "[Special Settings](#)" on page 56

---

### **[: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 117](#).

**Manual operation:** See "[LMT Compatibility Mode](#)" on page 57

---

### **[:SOURce<hw>]:BB:A3TSc:SPECial:BOOTstrap:EAS <EAS>**

Sets the signaling for emergency alert.

**Parameters:**

<EAS> SET3 | SET2 | NOEMergency | SET1 | NOEMergency | SET1 |  
SET2 | SET3  
\*RST: NOEMergency

**Example:** See [Example "Configuring special settings" on page 117](#).

**Manual operation:** See "[Emergency Alert Signaling \(EAS\)](#)" on page 57

---

### **[:SOURce<hw>]:BB:A3TSc:SPECial:BOOTstrap:MINor <MinoVers>**

Sets the minor version number of the bootstrap.

**Parameters:**

<MinoVers> integer  
Range: 0 to 7  
\*RST: 0

**Example:** See [Example "Configuring special settings" on page 117](#).

**Manual operation:** See "[Minor Version](#)" on page 57

**[: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 117](#).

**Manual operation:** See ["Preamble Compatibility Mode" on page 57](#)

**[: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 117](#).

**Manual operation:** See ["TMP Compatibility Mode" on page 57](#)

## 5.10 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:PLENgh?
// 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
```

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### :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 119.

**Usage:** Event

**Manual operation:** See "Play" on page 63

### :TSGen:CONFigure:PAYLoad <PayLoad>

Determines the payload of the test packet. Also influences the payload of the generated stuffing packets while the TS player is running.

**Parameters:**

<PayLoad>	HFF   H00   PRBS
*RST:	PRBS

**Example:** See Example "Configure and monitor TS player output" on page 120.

**Manual operation:** See "Payload Test/Stuff" on page 67

---

**: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 120.

**Manual operation:** See "[PID \(Hex\)](#)" on page 67

---

**: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 120.

**Manual operation:** See "[PID Test Packet](#)" on page 67

---

**: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 119.

**Manual operation:** See "[Select File](#)" on page 61

---

**:TSGen:CONFigure:PLENgt <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 120.

---

**: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 120.

**Manual operation:** See ["PRBS"](#) on page 67

---

**: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 120.

**Manual operation:** See ["Continuity Counter"](#) on page 68

---

**: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 120.

**Manual operation:** See ["PCR, DTS/PTS"](#) on page 68

---

**: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 120.

**Manual operation:** See "[TDT/TOT](#)" on page 68

---

**: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 119.

**Manual operation:** See "[Running/Position Player \[hh:mm:ss:fff\]](#)" on page 61

---

**:TSGen:CONFigure:SEEK:RESet**

Resets the following parameters to their default state:

- [:TSGen:CONFigure:SEEK:START](#) on page 124
- [:TSGen:CONFigure:SEEK:STOP](#) on page 124

**Example:** See [Example "Play a TS player file"](#) on page 119.

**Manual operation:** See "[Reset Window](#)" on page 63

---

**: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 119.

**Manual operation:** See "[Start \[hh:mm:ss.fff\]](#)" on page 62

---

**:TSGen:CONFigure:SEEK:STOP <Stop>**

Sets an individual stop time.

You can select a value in a 10-hour range.

**Parameters:**

<Stop> float  
 Range: 0 to 36000000  
 Increment: 0.1  
 \*RST: 23040.2

**Example:** See [Example "Play a TS player file" on page 119](#).

**Manual operation:** See "[Stop \[hh:mm:ss.fff\]](#)" on page 63

**: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 120](#).

**Manual operation:** See "[Stop Data](#)" on page 65

**: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 120](#).

**Manual operation:** See "[Nullpacket Stuffing](#)" on page 65

**: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 120](#).

**Manual operation:** See "[Packet Length](#)" on page 65

---

**:TSGen:CONFigure:TSRate <TSRate>**

Sets the output data rate of the player.

**Parameters:**

<TSRate>	integer
	Range: 1 to 35E7
	*RST: 5018502

**Example:** See [Example "Configure and monitor TS player output"](#) on page 120.

**Manual operation:** See "[Data Rate](#)" on page 64

---

**: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 120.

**Manual operation:** See "[Select File](#)" on page 61

---

**: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 120.

**Manual operation:** See "[Orig. Data Rate](#)" on page 64

---

**:TSGen:READ:PLAYfile:LENGTH?**

Queries calculated original loop time.

**Return values:**

<Length>	integer
	Range: 0 to 100
	*RST: 0

**Example:** See [Example "Configure and monitor TS player output"](#) on page 120.

**Usage:** Query only

**Manual operation:** See ["Select File"](#) on page 61

## Annex

### A ATSC 3.0 Test Cases

Test case type	Test case	Remark
P1S1	ATSC30_VV_xyz	33 test cases, xyz = 001 to 033
P1S2	ATSC30_VV_xyz	28 test cases, xyz = 034 to 061
P1S3	ATSC30_VV_xyz	4 test cases, xyz = 062 to 065
P1S4	ATSC30_VV_xyz	4 test cases, xyz = 066 to 069
P1S5	ATSC30_VV_xyz	68 test cases, xyz = 100 to 167
P1S6	ATSC30_VV_xyz	12 test cases, xyz = 170 to 181
P1S7	ATSC30_VV_xyz	3 test cases, xyz = 190 to 192
P1S8	ATSC30_VV_xyz	4 test cases, xyz = 196 to 199
P2S1	ATSC30_VV_xyz	24 test cases, xyz = 200 to 223
P2S2	ATSC30_VV_xyz	21 test cases, xyz = 224 to 244
P2S3	ATSC30_VV_xyz	36 test cases, xyz = 245 to 280
P6S1	ATSC30_VV_xyz	4 test cases, xyz = 600, 603, 604, 605

# Glossary: Abbreviations

## A

**ALP:** ATSC 3.0 Link Layer Protocol

**ATSC:** Advanced Television System Committee  
<https://www.atsc.org/>

## B

**BCH:** Bose Chaudhuri Hocquenghem coding

**BICM:** Bit-Interleaved Coding and Modulation

## C

**CRC:** Cyclic Redundancy Check

## D

**DASH:** Dynamic Adaptive Streaming over HTTP

## F

**FEC:** Forward Error Correction

**FFT:** Fast Fourier Transform

**FIFO:** First In First Out

## L

**LDM:** Layered Division Multiplexing

**LDPC:** Low-Density Parity Check

**LMT:** Link Mapping Table

## M

**MFN:** Multiple frequency Network

**MIMO:** Multiple Input Multiple Output

**MISO:** Multiple Input Single Output

**MMT:** MPEG Media Transport

**MPEG:** Moving Picture Experts Group  
<https://mpeg.chiariglione.org/>

**O**

**OFDM:** Orthogonal Frequency-Division Multiplexing

**P**

**PHY:** Physical Layer

**PID:** Packet Identifier

**PLP:** Physical Layer Pipe

**PRBS:** Pseudo-Random Bit Sequence as specified by [ITU-T O.151](#)

**Q**

**QAM:** Quadrature Amplitude Modulation

**QPSK:** Quaternary Phase Shift Keying

**R**

**ROUTE:** Real-time Object delivery over Unidirectional Transport

**S**

**SFN:** Single frequency Network

**SISO:** Single Input Single Output

**SMPTE:** Society of Motion Picture and Television Engineers  
<https://www.smpte.org/>

**STL:** Studio Transmitter Link

**T**

**TS:** Transport Stream

# Glossary: Specifications

## A

**ATSC 3.0:** Advanced Television System Committee Standard 3.0  
<https://www.atsc.org/standards/atsc-3-0-standards/>

**ATSC A/322:** ATSC Standard: Physical Layer Protocol (A/322)  
E.g., version A/322-2016: <https://www.atsc.org/atsc-30-standard/a3222016-physical-layer-protocol/>

**ATSC A/324-2018:** ATSC Standard: Scheduler / Studio to Transmitter Link  
<https://www.atsc.org/wp-content/uploads/2018/01/A324-2018-Scheduler-STL-2.pdf>

**ATSC A/330-2019:** ATSC Standard: Link-Layer Protocol (A/330)  
<https://www.atsc.org/wp-content/uploads/2016/10/A330-2019a-Link-Layer-Protocol.pdf>

## I

**ITU-T O.151:** ITU-T Recommendation O.151  
<https://www.itu.int/rec/T-REC-O.151-199210-I/en>

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