R&S®SMCVB-K161
ATSC / ATSC-MH
User Manual

ROHDE & SCHWARZ

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This document describes the following software options:

- R&S®SMCVB-K161 ATSC / ATSC-MH (1434.3831.xx)

This manual describes firmware version FW 4.90.002.xx and later of the R&S®SMCV100B.

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

Contents

1 Welcome to the ATSC / ATSC-MH Option

The R&S SMCVB-K161 is a firmware application that adds functionality to generate signals in accordance with the ATSC / ATSC-MH digital standard.

The R&S SMCVB-K161 option features:

- ATSC / ATSC-MH signal generation

This user manual contains a description of the functionality that the application provides, including remote control operation.

All functions not discussed in this manual are the same as in the base unit and are described in the R&S SMCV100B user manual. The latest version is available at:

www.rohde-schwarz.com/manual/SMCV100B

Installation

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

1.1 Accessing the ATSC / ATSC-MH Dialog

To open the dialog with ATSC / ATSC-MH settings

► In the block diagram of the R&S SMCV100B, select "Baseband > ATSC / ATSC-MH".

A dialog box opens that displays the provided general settings.

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

1.2 Documentation Overview

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

www.rohde-schwarz.com/manual/smcv100b

1.2.1 Getting Started Manual

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

1.2.2 User Manuals and Help

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

- Base unit manual
  Contains the description of all instrument modes and functions. It also provides an introduction to remote control, a complete description of the remote control commands with programming examples, and information on maintenance, instrument interfaces and error messages. Includes the contents of the getting started manual.

- Software option manual
  Contains the description of the specific functions of an option. Basic information on operating the R&S SMCV100B is not included.

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

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

1.2.3 Service Manual

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

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

https://gloris.rohde-schwarz.com

1.2.4 Instrument Security Procedures

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

1.2.5 Printed Safety Instructions

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

1.2.6 Data Sheets and Brochures

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

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

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

1.2.7 Release Notes and Open Source Acknowledgment (OSA)

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

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

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

1.2.8 Application Notes, Application Cards, White Papers, etc.

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

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

1.3 Scope

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

In particular, it includes:

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

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

1.4 Notes on Screenshots

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

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

2 About the ATSC / ATSC-MH Option

ATSC-M/H was adopted as the ATSC A/153 candidate standard on December 1, 2008 under the logo "ATSC mobile DTV".

The ATSC-M/H standard adds mobile reception capability to the conventional ATSC/ 8VSB standard. Like ATSC-A/53, it is based on the VSB modulation method. The higher immunity to interference is achieved by more efficient error protection mechanisms in the baseband and by an expanded training sequence. In addition, it is now considerably easier to set up an SFN due to the cyclic resetting of the trellis encoder. The newly introduced slot structure facilitates the development of energy-saving receivers.

ATSC-M/H uses IP-based MPEG AVC (H.264) video and HE AAC v2 audio (ISO/IEC 14496-3) for source coding.

Since the expanded error protection was inserted before the multiplexer in the preprocessor, at least one program can be transmitted simultaneously in the conventional 8VSB.

The postprocessor must then distinguish between standard and M/H data and handle these two data types separately.

In the R&S SMCV100B, only the postprocessor is implemented, which means that to vary M/H-specific parameters, different transport streams are needed.

2.1 Required Options

The equipment layout for generating ATSC / ATSC-MH signals includes:

- Base unit
- Option Enable Broadcast Standard (R&S SMCVB-K519)
- Option ATSC / ATSC-MH (R&S SMCVB-K161)

3 ATSC-M/H Configuration and Settings

Access:

► Select "Baseband > ATSC-M/H".

The remote commands required to define these settings are described in Chapter 5, "Remote-Control Commands", on page 45.

Settings:

3.1 General Settings

Access:

► Select "Baseband > ATSC-M/H".

This tab provides default settings, "Save/Recall" settings and settings necessary to define the reference point of the vestigial sideband (VSB).

Settings:

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

Remote command:
[:SOURce<hw>]:BB:ATSM:STATe on page 46

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:ATSM:PRESet on page 46

Save/Recall

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

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

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

Remote command:

[:SOURce<hw>]:BB:ATSM:SETTing:CATalog? on page 47

[:SOURce<hw>]:BB:ATSM:SETTing:DELete on page 47

[:SOURce<hw>]:BB:ATSM:SETTing:LOAD on page 47

[:SOURce<hw>]:BB:ATSM:SETTing:STORe on page 47

VSB Frequency

Sets the vestigial sideband (VSB) reference frequency point.

"Center"   Sets the center of the output spectrum to the set RF frequency.
                If an external modulator is used by the digital baseband outputs, the
                modulator's output frequency is also referenced to the spectral center.

"Pilot"   Sets the pilot carrier of the VSB spectrum to the set RF frequency.
                The output frequency of an external modulator is referenced to the
                pilot carrier, even if the baseband outputs are used.

Remote command:

[:SOURce<hw>]:BB:ATSM:FREQuency:VSBFrequency on page 48

3.2 Input Signal Settings

Access:

► Select "Baseband > ATSC-M/H > Input Signal".

The dialog provides access to settings necessary to configure the input signal. Also, it provides physical layer information for external signals and TS signals. For internal test signals, you can configure payload and structure of test packets.

Input signal tasks

The settings allow you to perform the following tasks:

- Selecting an MPEG TS source
- Displaying information about the selected MPEG TS (e.g. data rate)
- Configuring the internal MPEG TS test packets or internal IP test packets

How to: Chapter 4.1, "Configuring the Input Signal", on page 38.

**Settings:**

3.2.1 General Settings

Access:

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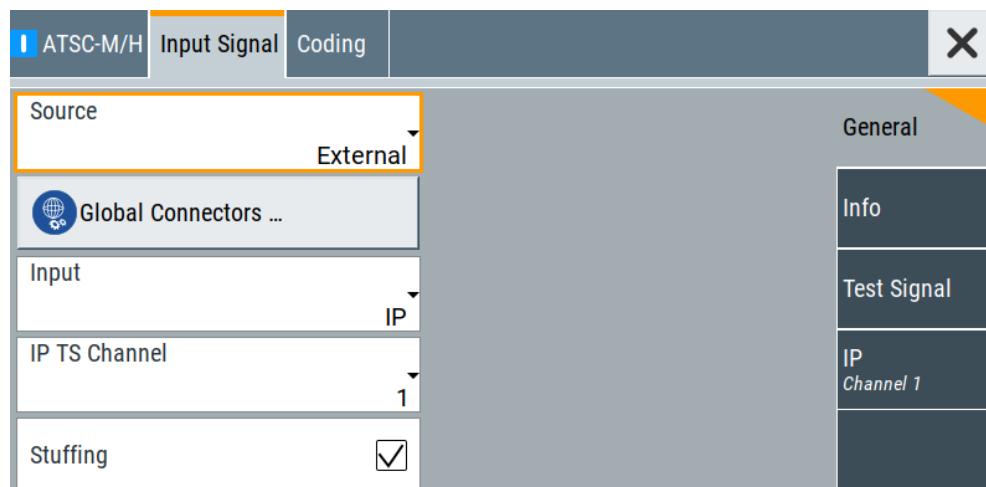
The tab provides general settings necessary to configure the input signal.

Settings:

Source
Sets the modulation source for the input signal.

"External"　　　　Uses a transport stream, that is input at the "TS IN"/"IP Data" inter-
　　　　　　　　　face.

　　　　　　　　　For more information about connecting to the interfaces, see also:
　　　　　　　　　● "TS IN" interface: Section "Configuring the Global Connectors" in
　　　　　　　　　　the R&S SMCV100B user manual.
　　　　　　　　　● "IP Data" interface: Chapter 3.6, "Local IP Data Network Set-
　　　　　　　　　　tings", on page 35.

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

　　　　　　　　　See also:
　　　　　　　　　● Chapter 3.5, "TS Player", on page 26
　　　　　　　　　● Supported TS player file types

"Test Signal"　　Uses an internal test signal as specified in Chapter 3.2.3, "Test Signal
　　　　　　　　　Settings", on page 17.

Remote command:
[:SOURce<hw>]:BB:ATSM:SOURce on page 49

Input
Requires "Source > External".

Sets the external input interface.

"TS IN"　　　　　Input for serial transport stream data. The signal is input at the "User
　　　　　　　　　1" connector.

"IP"　　　　　　　Input for IP-based transport stream data (TSoverIP). The signal is
　　　　　　　　　input at the "IP Data" connector.

Remote command:
[:SOURce<hw>]:BB:ATSM:INPut on page 49

Input Format
Requires "Input > TS IN".

Sets the format of the input signal.

"ASI"　　　　　　ASI format

"SMPTE 310"　　SMPTE 310 format

Remote command:
[:SOURce<hw>]:BB:ATSM:INPut:FORMat on page 49

IP TS Channel
Requires "Input > IP".

Selects the IP-based transport stream (TS) channel. You can select 1 out of 4 IP TS
channels as input at the "IP Data" interface.

To configure a particular channel, see Chapter 3.2.4, "IP Channnel x Settings",
on page 18.

Remote command:
[:SOURce<hw>]:BB:ATSM:INPut:TSCHannel on page 49

Stuffing

Requires "Source > External/TS Player".

Activates stuffing.

Note: Due to the special slot structure, and because the trellis encoder must be reset whenever there are exactly defined data packets, for error-free ATSC-M/H transmission, stuffing must never be enabled. However, to allow transmission of lower-rate data streams, stuffing can be enabled. In the M/H state, however, the warning "M/H structure not found" is displayed cyclically.

"On"   The installed input interface provides the transport stream data rate required for the current modulation parameters (regardless of the input data rate of the external transport stream).

"Off"   The data rate of the transport stream source must match the data rate required for the current modulation parameters.
The value equals the "Max. Useful Data Rate" on page 15.

Remote command:
[:SOURce<hw>]:BB:ATSM:STUFfing on page 50

Test Signal

Requires "Source > Test Signal".

Defines the test signal data.

Note: The test signal contains no ATSC M/H data. Use test signals only for ATSC A/53 (8VSB) compatible receiver testing.

"Test TS Packet"
Standardized packet data used as modulation data in the transport stream.
To configure the packet structure, select the side tab "Test Signal > Test TS Packet". See also "Test TS Packet" on page 17.

"PRBS before Interleaver"
Pure pseudo-random bit sequence (PRBS) data used as modulation data with no packet structure. PRBS data conforms with ITU-T O.151 specification.
To configure the PRBS type, select the side tab "Test Signal > PRBS". See also "PRBS" on page 18.

"PRBS before Trellis"
Pure pseudo-random bit sequence (PRBS) data used as modulation data with no packet structure and interleaving. Modulation data is directly fed to the trellis encoder.

"PRBS before Mapper"
Pure pseudo-random bit sequence (PRBS) data directly fed to the mapper.
Three bits at a time in two's complement are assigned to the stages -7, -5, -3, -1, 1, 3, 5, 7. Subsequent pilot insertion and VSB filtering remain unaffected.

Remote command:
[:SOURce<hw>]:BB:ATSM:TESTsignal on page 53

3.2.2 Info

Access:

► Select "Input Signal > Info".

ⓘ ATSC-M/H	**Input Signal**	Coding		✕

Packet Length	⊘
	188

General

Max. Useful Data Rate	⊘
	19.392 659 Mbit/s

Info

Measured Data Rate	⊘
	0.000 Mbit/s

Test Signal

Useful Data Rate	⊘
	0.000 Mbit/s

IP
Channel 1
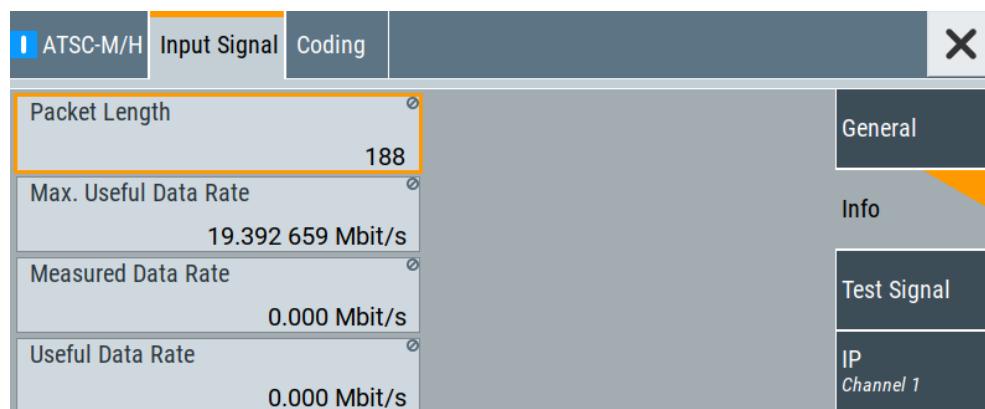
The tab displays information on the input signal.

Settings:

Packet Length

Requires "Source > External".

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 byte packets specified for serial input and parallel input.

"208"   208 byte packets specified for serial input and parallel input.

"Invalid"   Packet length ≠ 188 bytes or 208 bytes, i.e. the length is not as speci-
               fied.

Remote command:

[:SOURce<hw>]:BB:ATSM:PACKetlength? on page 51

Max. Useful Data Rate

Requires "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 TS input interface, that is necessary for the modu-lator.

If "Stuffing > On", the value indicates the maximum useful data rate, that is allowed in the transport stream.

If "Stuffing > Off", the value indicates the transport stream input data rate that is required for the transport stream.

If "Stuffing > On", the value indicates the maximum useful data rate, that is allowed in the transport stream.

If "Stuffing > Off", the value indicates the transport stream input data rate that is required for the transport stream.

Remote command:
[:SOURce<hw>]:BB:ATSM:USEFul[:RATE]:MAX? on page 52

Measured Data Rate

Requires "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 "User 1" connector
- External transport stream including null packets input at "IP Data/LAN" connector (TSoverIP)

The value r_{meas} equals the sum of useful data rate r_{useful} and the rate of null packets r_0:

If "Stuffing > Off", ensure that the measured data rate equals the maximum useful data rate ($r_{meas} = r_{max. useful}$).

If "Stuffing > Off", ensure that $r_{meas} = r_{max. useful}$.

Remote command:
[:SOURce<hw>]:BB:ATSM[:INPut]:DATarate? on page 52

Useful Data Rate

Requires "Source > External/TS Player".

Displays the data rate of useful data r_{useful} of the external transport stream. The data rate is measured at the input of the installed input interface.

Remote command:
[:SOURce<hw>]:BB:ATSM:USEFul[:RATE]? on page 51

3.2.3 Test Signal Settings

Access:

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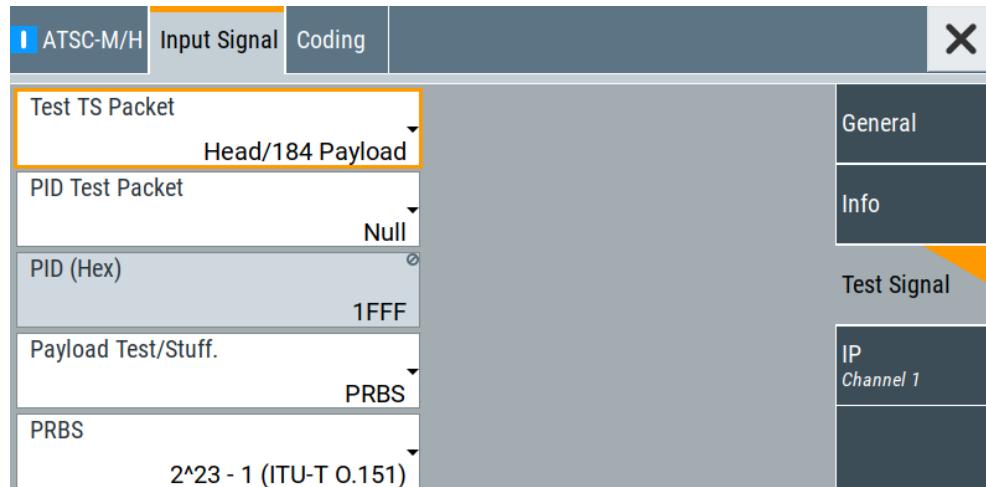
The tab provides settings necessary to configure the input test signal.

Settings:

Test TS Packet

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

"Head/184 Payload"

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

"Sync/187 Payload"

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

Remote command:

[:SOURce<hw>]:BB:ATSM:TSPacket on page 54

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:

[:SOURce<hw>]:BB:ATSM:PIDTestpack on page 54

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:ATSM:PID on page 54

Payload Test/Stuff

Defines the payload area content of the TS packet.

For "Source > Test Signal", the packet is a test packet.

For "Stuffing > On", the packet is a null packet. Null packets are inserted into the external transport stream to adapt the stream data rate.

See also "Measured Data Rate" on page 16.

Remote command:

[:SOURce<hw>]:BB:ATSM:PAYLoad on page 55

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:ATSM:PRBS on page 55

3.2.4 IP Channnel x Settings

Access:

1. Select "Input Signal > General".

2. Select "Source > External"

3. Select "Input > IP"

4. Select "Input Signal > IP Channel x"

Input IP	☐	Alias		General
		Alias 1		
Type		Multicast Address	⊘	Info
	Unicast ▾	226.0.0.0		
Port		IGMPv3 Source Address	⊘	Test Signal
	6 002	0.0.0.0		
➡ Ping Source Address		🌐 Local IP Data Network ...		IP *Channel 1*
Ping Result			⊘	

The tab provides settings necessary to configure IP channel `x`.

You can configure settings for 4 IP channels `x = 1 to 4` individually, see also "Input Signal > General > IP TS Channel".

ⓘ IP channel settings affect input IP data of the local IP data network. The settings are independent from the used broadcast standard configuration.

Saving/recalling a certain IP channel or local IP data network configuration is not possible via the broadcast standard-specific functionality.

Use the global save/recall functionality instead, see section "Saving and Recalling Instrument Settings" in the R&S SMCV100B user manual.

The table below shows the availability of the tab in the broadcast standard configuration.

Table 3-1: IP channel configuration support in broadcast standards

Baseband standard	"IP Channel x"	Baseband standard	"IP Channel x"
"ATSC/ATSC-M/H"	Yes	"T-DMB/DAB"	Yes
"ATSC 3.0"	No	"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

See also:

● Chapter 4.1.1, "How to Apply an External IP Input Signal", on page 38
● Chapter 3.6, "Local IP Data Network Settings", on page 35

Requirements

At your IP source, set the "transport stream packets per internet protocol packet" (TP per IP) parameter as follows:

- If TP packet length = 188 bytes: Set TP per IP to *7* or *6*.
- If TP packet length = 204/208 bytes: Set TP per IP to *6*.

We recommend that youFurthermore, we recommend that you use a separate LAN infrastructure to stream the transport streams via IP to the IP connector of the base-band board. We recommend that you avoid TS packet losses during IP transmission.

Settings:

Input IP

Activates/deactivates the IP input.

Remote command:
`[:SOURce<hw>]:BB:INPut:IP<ch>[:STATe]` on page 56

Alias

Sets a unique name for the IP connection.

The definition of a name is optional but facilitates identification in the measurement views. The name input fits maximum 16 characters in ASCII format.

Remote command:
`[:SOURce<hw>]:BB:INPut:IP<ch>:ALIas` on page 57

Type

Sets the input signal type.

"Unicast"   Analyzes all unicast IP packets that arrive at the specified "Port".

"Multicast"   When an IP address is in the multicast address range, an attempt is made to join a multicast group using IGMP.
Set "Multicast Address" and "Port".

Remote command:
`[:SOURce<hw>]:BB:INPut:IP<ch>:TYPE` on page 57

Multicast Address

Editing requires "Type > Multicast".

Sets the destination IP address (IPv4) of the IP connection.

You can set addresses from "224.0.0.0" to "239.255.255.255".

Remote command:
[:SOURce<hw>]:BB:INPut:IP<ch>:MULticast:ADDRess on page 58

Port
Sets the destination UDP port.

Due to UDP/RTP autosensing, we recommend that you set a port offset of at least 6 between neighboring IP TS channels.

Remote command:
[:SOURce<hw>]:BB:INPut:IP<ch>:PORT on page 57

IGMPv3 Source Address
Requires "Type > Multicast".

Sets the IGMPv3 source address.

If you need to filter the data sent to the multicast address, specify the source address. A source address different from "0.0.0.0" accepts only data originating from the specified IP address.

Remote command:
[:SOURce<hw>]:BB:INPut:IP<ch>:IGMP[:SOURce]:ADDRess on page 58

Ping Source Address
Clicking "Ping Source Address" triggers pinging of the IGMPv3 source address.

If you set a different value from "IGMPv3 Source Address = 0.0.0.0" and click the button, the software checks if the address is reachable.

Remote command:
[:SOURce<hw>]:BB:INPut:IP<ch>:IGMP[:SOURce]:PING on page 58

Ping Result
Displays the result after pinging the source address.

If "Ping Result > Ping: Successful", the source address is available in the network.

If "Ping Result > Ping: Transmit Failed. xxx", the source address is not available in the network. "xxx" can be, e.g. "General Failure". Try another "IGMPv3 Source Address".

Remote command:
[:SOURce<hw>]:BB:INPut:IP<ch>:IGMP[:SOURce]:RESult? on page 58

Local IP Data Network
Accesses local IP data network settings, see Chapter 3.6, "Local IP Data Network Settings", on page 35.

3.3 Coding Settings

Access:

► Select "Baseband > ATSC-M/H > Coding".

The dialog provides settings necessary to configure coding.

Settings:

3.3.1 General Settings

Access:

► Select "Coding > General".
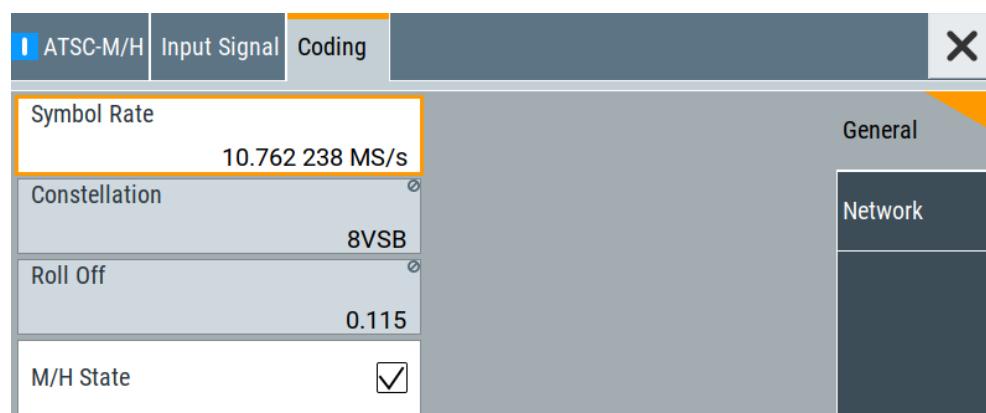
The tab provides access to "General" settings necessary to configure the "Coding".

Settings:

Symbol Rate
Sets the symbol rate.

The specification ATSC A/153 stipulates a symbol rate of 10.762238 MSym/s ± 5 %.

In the transmission spectrum, the symbol rate represents half of the 3 dB bandwidth.

Remote command:
`[:SOURce<hw>]:BB:ATSM:SYMBols[:RATE]` on page 59

Constellation

Displays the constellation.

The value "8VSB" conforms with specification ATSC A/153.

Remote command:
[:SOURce<hw>]:BB:ATSM:CONStel? on page 59

Roll Off

Displays the roll-off factor alpha (α).

The output signals are filtered with an FIR filter. In addition, they are pulse-shaped, yielding a root raised cosine characteristic. A roll-off factor of 0.115 conforms with specification ATSC A/153.

Remote command:
[:SOURce<hw>]:BB:ATSM:ROLLoff? on page 60

M/H State

Enables/disables all ATSC-M/H elements of the FEC together.

"On"   Outputs a signal in accordance with specification ATSC A/153 and the network settings.
              See Chapter 3.3.2, "Network Settings", on page 23.

"Off"   Outputs a signal (8VSB state) in accordance with specification ATSC A/53.

Remote command:
[:SOURce<hw>]:BB:ATSM:STATe on page 46

3.3.2 Network Settings

Access:

► Select "Coding > Network".
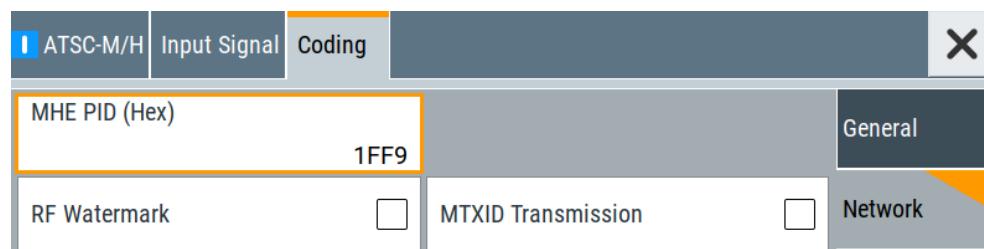
The tab provides network settings necessary to configure the "Coding".

The network settings comply with specification ATSC A/153 and require "Coding > General > M/H State > On".

Settings:

MHE PID (Hex)

Requires "Coding > General > M/H State > On".

Sets the MHE PID of MPEG-2 packets that contain ATSC M/H data. The PID is a four-digit value in hexadecimal format.

Since the packets must be treated separately in the postprocessor, the correct specification is essential. The parameter is important for the M/H transmission.

If you set the wrong PID or if the fed-in data stream does not contain an M/H element, a warning is displayed. An ATSC-M/H receiver cannot lock in on the emitted signal, but the 8VSB standard can still be received.

Remote command:
[:SOURce<hw>]:BB:ATSM:MHEPid on page 61

RF Watermark

Enables/disables the RF watermark.

The standard ATSC A/110 specifies, that you can overlay the RF signal with a watermark. For this purpose, the modulator calculates a specific Kasami sequence from the TX address and the network ID.

The Kasami sequence modulates BPSK and is added to the payload signal as buried spread spectrum. Thus, a unique watermark is provided for each transmitter.

Remote command:
[:SOURce<hw>]:BB:ATSM:WATermark on page 61

TX Address (Hex)

Requires "RF Watermark > On".

Sets the TX address that underlays the RF signal as a watermark.

Remote command:
[:SOURce<hw>]:BB:ATSM:TX:ADDRess on page 61

Network ID (Hex)

Requires "RF Watermark > On".

Sets the network ID for the watermark. The network ID is a three-digit value in hexadecimal format.

Remote command:
[:SOURce<hw>]:BB:ATSM:NETWork:ID on page 62

Bury Ratio

Requires "RF Watermark > On".

Sets the power with that the watermark is added to the payload signal.

The value is expressed in decibel relative to the power of the modulated signal.

"21 dB" to "39 dB"

Sets the bury ratio in 3 dB steps.

Remote command:

[:SOURce<hw>]:BB:ATSM:BURY:RATio on page 62

MTXID Transmission

Enables/disables MTXID transmission.

The transmission of the MTXID in the frame sync signal is a technique for detecting the respective transmitter that is complementary to the RF watermark technique.

The MTXID comprises the transmitter ID and the market ID. The main advantage of this method is that the error vector of the useful signal is not enlarged. Furthermore, the information transmitted in this case is to be used for highly accurate position-finding.

Remote command:

[:SOURce<hw>]:BB:ATSM:TRANsmission on page 62

Transmitter ID (Hex)

Requires "MTXID Transmission > On".

Sets the transmitter ID for the MTXID transmission.

Remote command:

[:SOURce<hw>]:BB:ATSM:MTXid:TID on page 62

Market ID (Hex)

Requires "MTXID Transmission > On".

Sets the market ID for the transmission.

Remote command:

[:SOURce<hw>]:BB:ATSM:MTXid:MID on page 63

3.4 Global Connector Settings

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

See also chapter "Global Connector Settings" in the user manual.

3.5 TS Player

The "TS Player" application allows you to play stream files for simulation of dedicated transport stream (TS) scenarios. Also, the R&S SMCV100B offers stream libraries containing stream files with a wide range of ready-made signals for testing systems with different transmission parameters. For supported file types, see Table 3-2.

Key features

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

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

Required options

The equipment layout for processing stream files includes:

- Base unit, including arbitrary waveform generator (64 MSample ARB memory, 60 MHz RF bandwidth)
- Broadcast standard option for the "TS Player" application (R&S SMCVB-Kxxx)
- Enable Broadcast Standards option (R&S SMCVB-K519)
- Optional stream library option (R&S SMCVB-KSxx)

For more information, see data sheet.

To access and download a stream library file

The steps to access a stream library and to download stream library files is analogous as for waveform libraries. See chapter "How to Work with Waveform Libraries" in the R&S SMCV100B user manual.

For information on the content of a stream library, see the user manual of the stream library at:

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

To access the "TS Player" application

1. Select "Baseband > ATSC-M/H > Input Signal".

2. Select "Source > TS Player".

3. Select "TS Player" button.

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

Support in broadcast standard configuration

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

Baseband standard	"Source > TS Player"	Baseband standard	"Source > TS Player"
"ATSC/ATSC-M/H"	Yes	"T-DMB/DAB"	Yes
"ATSC 3.0"	Yes	"DVB-S"	Yes
"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 5.4, "TSGen Subsystem", on page 63.

Settings:

## 3.5.1 TS Player Settings

Access:

1. Follow the steps in "To access the "TS Player" application" on page 26.

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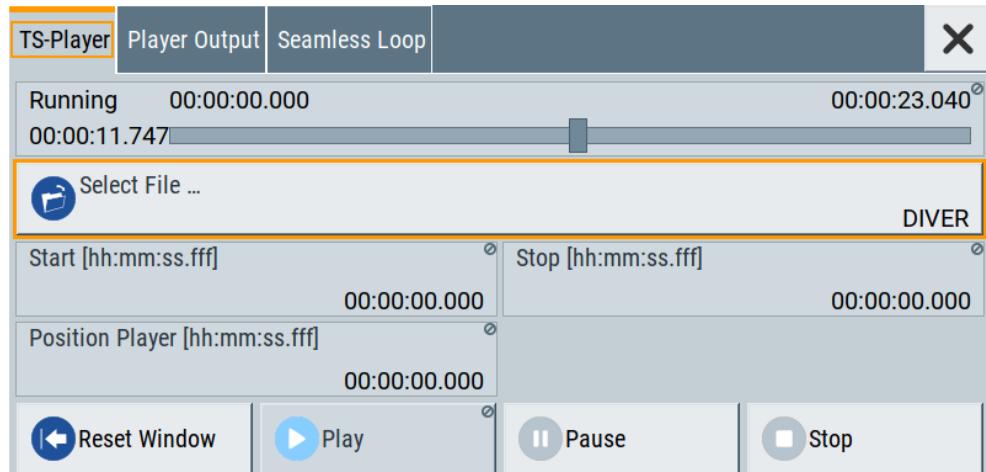
The tab provides settings necessary to configure the general settings of the TS player application.

Settings:

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

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

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

Remote command:
`:TSGen:CONFigure:SEEK:POSition` on page 67

Select File

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

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

The dialog allows you to select user-defined, predefined and recent files. Table 3-2 lists file extensions of supported files.

Table 3-2: Supported TS player file types

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

File extension	Stream libraries	Remark	Option
`*.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`	-	-	-

[1] For T2MI stream files, the data rate of a T2MI file is determined automatically, if the following applies:
- Data rate is not part of the TRP file header information.
- PCR information is not available.
- T2MI TRP file is not encrypted, that means not of type `*.t2mi_c`.
- TRP file has the `*.t2mi` file extension.

Remote command:

`:TSGen:CONFigure:PLAYfile` on page 66

`:TSGen:READ:PLAYfile:LENGth?` on page 70

`:TSGen:READ:FMEMory` on page 70

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 68

Position Player [hh:mm:ss.fff]
Displays the current play position in the file.

Remote command:

`:TSGen:CONFigure:SEEK:POSition` on page 67

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 68

Reset Window

Resets "Start/Stop/Position Player" parameters.

Remote command:

:TSGen:CONFigure:SEEK:RESet on page 68

Play

Plays the selected file.

For supported file types, see Table 3-2.

Remote command:

:TSGen:CONFigure:COMMand<ch> on page 65

Pause

Pauses the player.

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

Remote command:

:TSGen:CONFigure:COMMand<ch> on page 65

Stop

Stops the player and returns to the start position.

Remote command:

:TSGen:CONFigure:COMMand<ch> on page 65

3.5.2 Player Output Settings

Access:

► Select "TS Player > Player Output".

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

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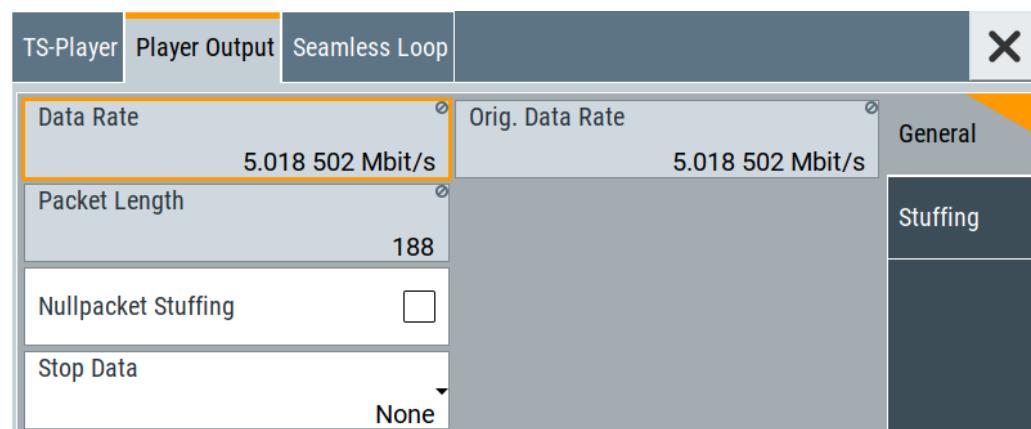
The tab provides settings necessary to configure general player output properties.

Data Rate

Sets the output data rate of the player.

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

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

Remote command:
`:TSGen:CONFigure:TSRate` on page 69

Orig. Data Rate

Displays the calculated original TS data rate.

Remote command:
`:TSGen:READ:ORIGtsrate` on page 70

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 69

Nullpacket Stuffing

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

Enables or disables nullpacket stuffing.

The output data rate of the TS player equals the original data rate. The equality ensures that the time references in the tables of the played TS stream are correct during replay.

"On"   Activate stuffing, if you need a higher rate than the original data rate. Null packets are inserted into the data stream.
To ensure correct time references in the stream tables, activate program clock reference correction ("PCR, DTS/PTS > On").

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

Remote command:
`:TSGen:CONFigure:STUFfing` on page 69

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 69

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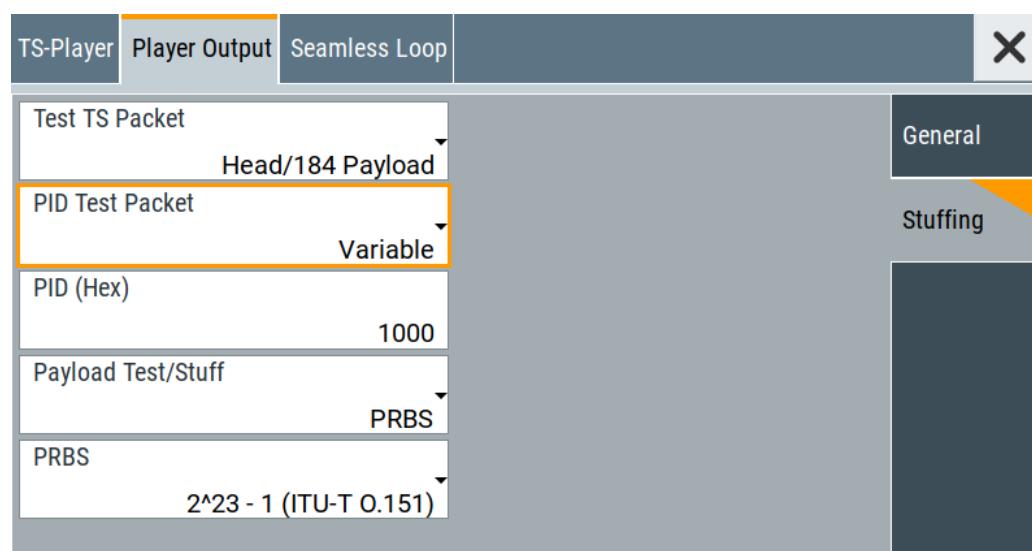
The tab comprises settings necessary to configure stuffing.

Settings

Test TS Packet

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

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

"Sync/187 Payload"
　　　　　A sync byte (0x47) followed by 187 payload bytes.

"Head/200 Payload"

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

"Sync/203 Payload"

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

"Head/204 Payload"

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

"Sync/207 Payload"

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

Remote command:
:TSGen:CONFigure:TSPacket on page 69

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 66

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 65

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 65

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 66

3.5.3 Seamless Loop Settings

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

Access:

► Select "TS Player > Seamless Loop".

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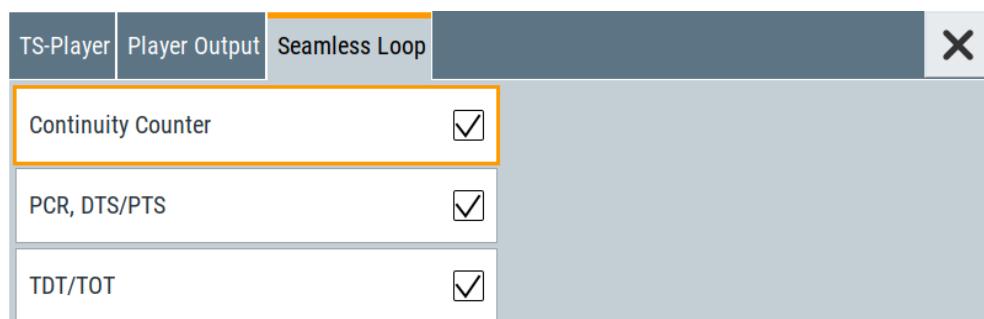
The tab provides settings necessary to configure settings for playing the file in a loop.

Settings:

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

Remote command:
`:TSGen:CONFigure:SEAMless:CC` on page 67

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 67

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 67

3.6 Local IP Data Network Settings

Access:

1. Select "Input Signal > General > Source > External".

2. Select "Input Signal > General > Input > IP"

3. Select "Input Signal > IP Channel x > Local IP Data Network".
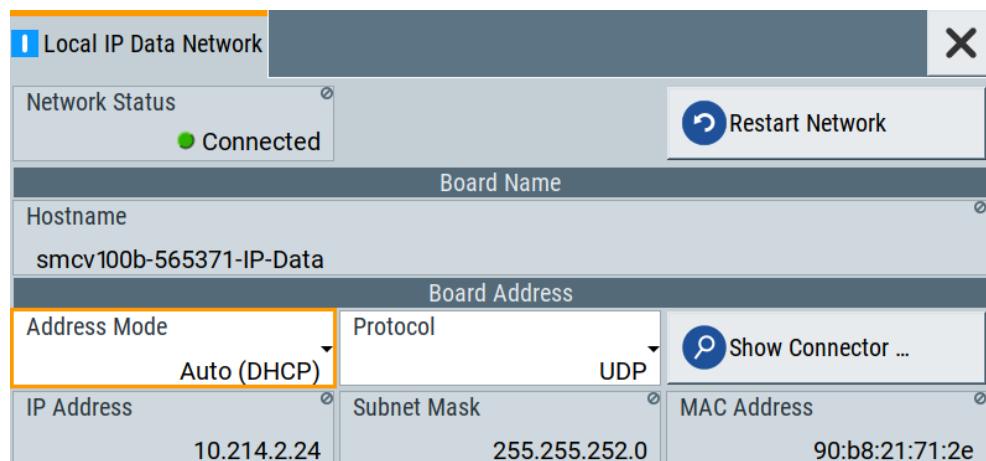
The tab provides access to local IP data settings necessary to configure the board address.

The remote commands necessary to configure local IP data network settings are described in Chapter 5.5, "BCIP Subsystem", on page 71.

How to: Chapter 4.1.1, "How to Apply an External IP Input Signal", on page 38

Settings:

Network Status

Indicates that the instrument is connected to the network.

If the instrument is disconnected, try "Restart Network".

Remote command:

`:SYSTem:COMMunicate:BCIP<hw>:NETWork:STATus` on page 73

Restart Network

Terminates the network connection of the instrument and sets it up again later. You can use this function to fix network problems.

Note: This function restarts only the connection of the instrument to the network. It does not impact the network itself.

Remote command:

`:SYSTem:COMMunicate:BCIP<hw>:NETWork:RESTart` on page 73

Hostname

Displays the hostname.

Displayed is the board name, that is the name of the IP data board of the R&S SMCV100B, e.g. `SMCV100B-123456-IP-Data`.

Each instrument is delivered with an assigned hostname, a logical name which can be used instead of the IP address. With the default network settings, the IP address is allocated by the DHCP server. This address can change each time the instrument is reconnected. Unlike the IP address, the hostname name does not change.

Note:

This function is password-protected. Unlock the protection level 1 to access it.

We recommend that you do not change the default network settings or the hostname to avoid problems with the network connection.

Remote command:

`:SYSTem:COMMunicate:BCIP<hw>:NETWork:COMMon:HOSTname` on page 72

Address Mode

Selects the mode for assigning the IP address.

"Auto (DHCP)"

Assigns the IP address automatically, provided the network supports DHCP.

"Static"   Enables you to assign the IP address manually.

Remote command:
`:SYSTem:COMMunicate:BCIP<hw>:NETWork:IPADdress:MODE` on page 72

IP Address

Displays the IP address of the instrument in the local IP data network.

By default, the R&S SMCV100B is configured to use dynamic TCP/IP configuration and to obtain the whole address information automatically.

If the network does not support DHCP or the attempt does not succeed, the instrument tries to obtain the IP address via Zeroconf (APIPA) protocol. IP addresses assigned via Zeroconf start with the number blocks `169.254.*.*`.

Note: An IP address that is assigned via the Zeroconf protocol although the network requires an IP address assigned via the DHCP server can cause network connection failures.

Remote command:
`:SYSTem:COMMunicate:BCIP<hw>:NETWork:IPADdress` on page 72

Protocol

Sets the protocol type of the input IP data.

The current firmware supports UDP and UDP/RTP.

Remote command:
:SYSTem:COMMunicate:BCIP<hw>:NETWork:PROTocol on page 73

Subnet Mask

Displays the bit group of the subnet in the host identifier.

To assign the subnet mask manually, select "Address Mode > Static".

Remote command:
:SYSTem:COMMunicate:BCIP<hw>:NETWork:IPADdress:SUBNet:MASK
on page 72

Show Connector

Accesses a dialog that displays the physical location of the selected connector on the front/rear panel of the instrument.

MAC Address

Displays the MAC address, a unique identifier of the network adapter in the R&S SMCV100B.

Remote command:
:SYSTem:COMMunicate:BCIP<hw>:NETWork:MACaddress on page 73

4 Performing ATSC / ATSC-MH Signal Generation Tasks

This chapter tells you how to configure the R&S SMCV100B to generate signals for simple receiver tests.

4.1 Configuring the Input Signal

This chapter provides an overview of the different input signals, that the R&S SMCV100B uses as modulation data.

4.1.1 How to Apply an External IP Input Signal

To connect the R&S SMCV100B to local IP data network

1. Connect the IP source to the "IP Data" connector of the R&S SMCV100B.
   See chapter "Connecting to IP Data Interface" in the R&S SMCV100B Getting Started user manual.

2. Select "Input Signal > General > Source > External".

3. Select "Input Signal > General > Input > IP".

4. In the "IP Channel x" side tab, click "Local IP Data Network".

   By default, the R&S SMCV100B assigns the IP address automatically using DHCP ("Address Mode > Auto (DHCP)").

5. If "Network Status > Disconnected", try "Restart Network".
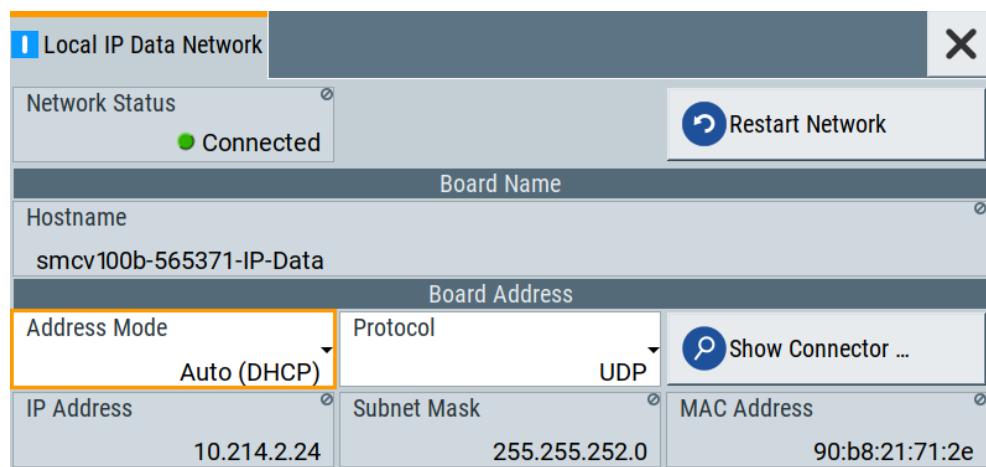
The R&S SMCV100B is connected to the local IP data network.

6. If DHCP does not assign an IP address, assign the IP address manually.
   See chapter "How to Assign the IP Address" in the R&S SMCV100B user manual.

7. Specify the protocol type of the input IP data.
   The current firmware supports UDP and UDP/RTP.

To configure an external IP input signal

The R&S SMCV100B is connected to a local IP data network, see "To connect the R&S SMCV100B to local IP data network" on page 38.

1. Specify general IP input signal properties:

   a) Select "Input Signal > General > Source > External".
   b) Select "Input > IP".
   c) Specify the IP TS Channel, e.g. "IP TS Channel > 1".

   The "IP Channel 1" side tab appears, where you can configure the IP connection for channel 1 and channel-independent local IP network settings.
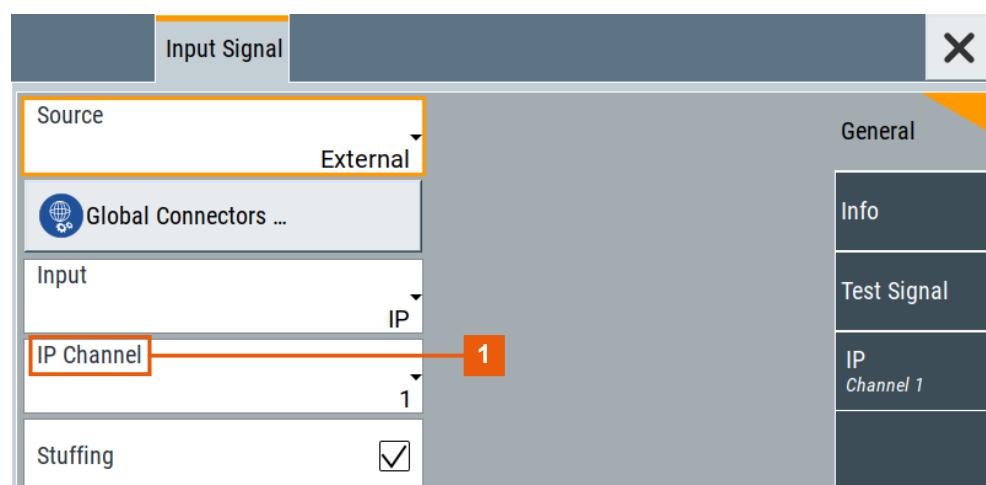
1 = IP channel notation: IP TS Channel

2. Optionally, if supported, activate "Stuffing" to adjust the TS data rate.

3. Specify IP TS channel properties, e.g. for "IP TS Channel > 1":

   a) Define the input type, e.g. "Type > Multicast".
   b) Specify the "Multicast Address", that is the destination IPv4 address of the IP connection.
      Note: Use the destination address also in the IP data source, e.g. a stream program.
   c) Specify the port, that is the destination port of the IP connection.
      Note: Use the destination port also in the IP data source.
   d) Specify the IGMPv3 source address, that is the source IPv4 address of the IP connection.
      A source address different from "0.0.0.0" accepts only data originating from the specified IP address.
   e) Optionally, to check availability of the "IGMPv3 Source Address", click "Ping Source Address"
      ● If "Ping Result > Ping: Successful", the source address is available.
      ● If "Ping Result > Ping: Transmit Failed. Destination Host Unreachable", try another address.
   f) Optionally, specify a name for the IP connection, e.g. "Alias > Service".
   g) Activate the IP channel, select "Input IP > On".
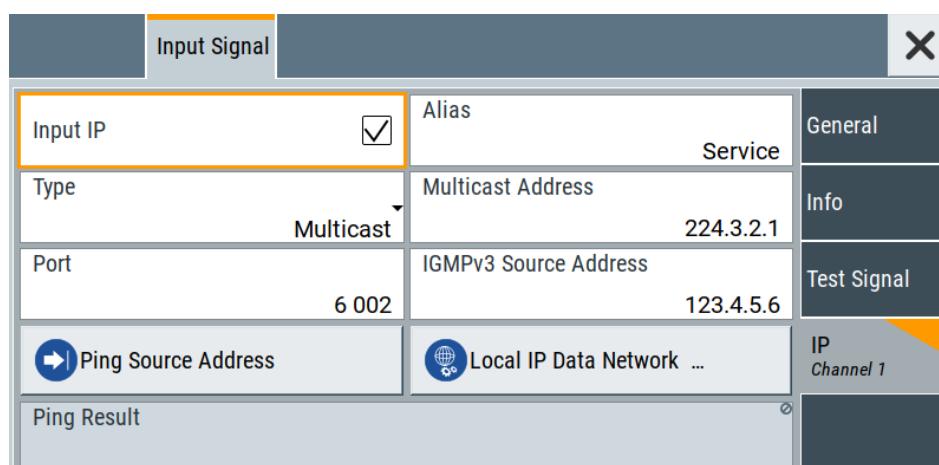
The R&S SMCV100B is prepared for receiving IP TS data, that is input at the "IP Data" connector.

Monitor IP data stream properties in the "Info" side tab, see Chapter 4.2.1, "How to Monitor External IP Input Data", on page 43.

4.1.2 How to Apply an External TS Input Signal

To connect to the external TS input interface

1. Use a double-shielded 75 Ω BNC cable for connection between R&S SMCV100B and the external MPEG TS data source.
   See also Section "Cable selection and electromagnetic interference (EMI)" in the R&S SMCV100B Getting Started user manual.

2. At the R&S SMCV100B, connect the cable to the "User 1" connector.
   The connector is on the rear panel of the R&S SMCV100B.
   How to: Section "To connect to non-screwable connectors (BNC)" in the R&S SMCV100B Getting Started user manual.

To specify the TS input interface at the R&S SMCV100B

The R&S SMCV100B is connected to an MPEG TS data source via the "User 1" connector.

1. Select "Input Signal > General > Source > External".

2. Select "General > Global Connectors".

3. In the "Global Connectors" dialog, configure the "User 1" connector for a TS input signal:

   a) Select "Direction > Input".
   b) Select "Signal > TS".

To configure an external TS input signal

The R&S SMCV100B is prepared for receiving a TS input signal at the "User 1" connector.

1. Specify general TS input signal properties:

   a) Select "Input Signal > General > Source > External".
   b) Select "Input > TS IN".
   c) Specify the format of the input signal:
      ● Select "ASI", if you have a source supporting ASI format.
      ● Select "SMPTE 310", if you have a source supporting SMPTE 310 format.

2. Optionally, activate "Stuffing" to adjust the TS data rate.

You can further specify the payload of the stuffing data, see "Test Signal > Payload Test/Stuff."

Input Signal		✕
Source External ▾		General
🌐 Global Connectors …		Info
Input TS IN ▾		Test Signal
Input Format ASI ▾		
Stuffing ☑		
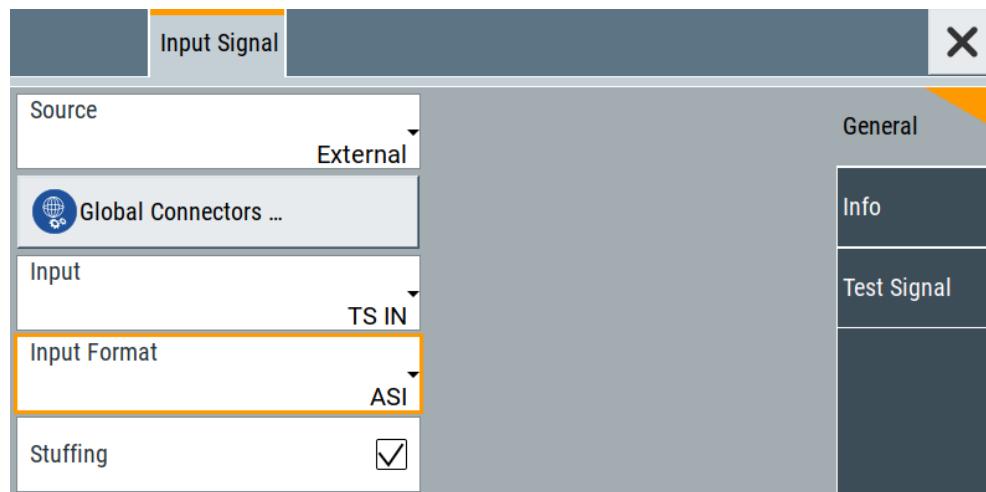
The R&S SMCV100B is prepared for receiving TS data, that is input at the "User 1" connector.

Monitor TS data stream properties in the "Info" side tab, see Chapter 4.2.2, "How to Monitor an External TS Input Signal", on page 44.

4.1.3 How to Generate an Internal TS Signal

To play a TS file with the "TS Player"

1. Select "Input Signal > Source > TS Player".

   The "TS Player" button appears below.

2. Click "TS Player".

   The "TS Player" dialog for playing TS data files opens.

3. Click "Play" to play the default file `DIVER.trp`.
   Playing the file requires no option.

To play a file of stream library with the "TS Player"

1. Download the

2. Select "Input Signal > Source > TS Player".

   The "TS Player" button appears below.

3. Click "TS Player".

   The "TS Player" dialog for playing TS data files opens.

4. Click "Play" to play the default file `DIVER.trp`.

Playing the file requires no option.

4.2 Monitoring the Input Signal

This chapter provides an overview of the different input signals, that the R&S SMCV100B uses as modulation data.

4.2.1 How to Monitor External IP Input Data

The R&S SMCV100B receives external IP input data as described in Chapter 4.1.1, "How to Apply an External IP Input Signal", on page 38.

► Select "Input Signal > Info"
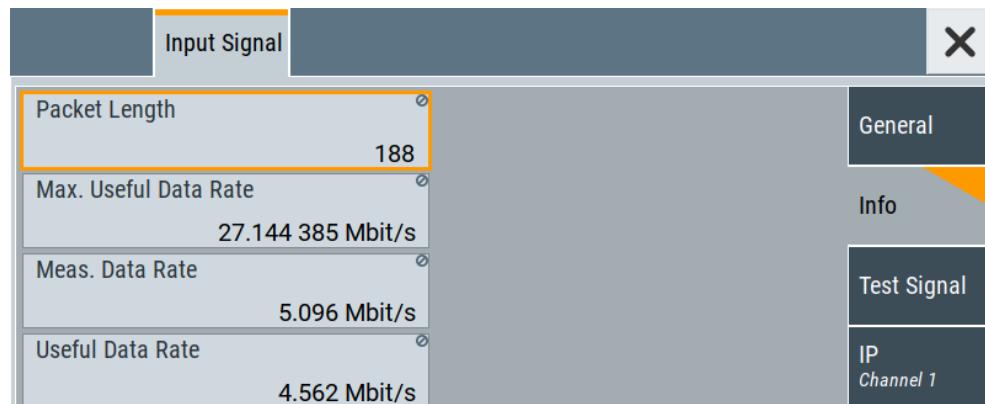
The "Info" side tab displays physical properties of the input IP stream data.

The standard packet length is 188 byte. The maximum useful data rate is specified by the broadcast standard.

The measured data rate is lower and depends on the TS source settings. The useful data rate is lower than the measured data rate due to null packets present in the transport stream.

If "Stuffing > On", the useful data rate can be lower than the maximum useful data rate.

4.2.2 How to Monitor an External TS Input Signal

The R&S SMCV100B receives external TS input data as described in Chapter 4.1.2, "How to Apply an External TS Input Signal", on page 41.

► Select "Input Signal > Info"
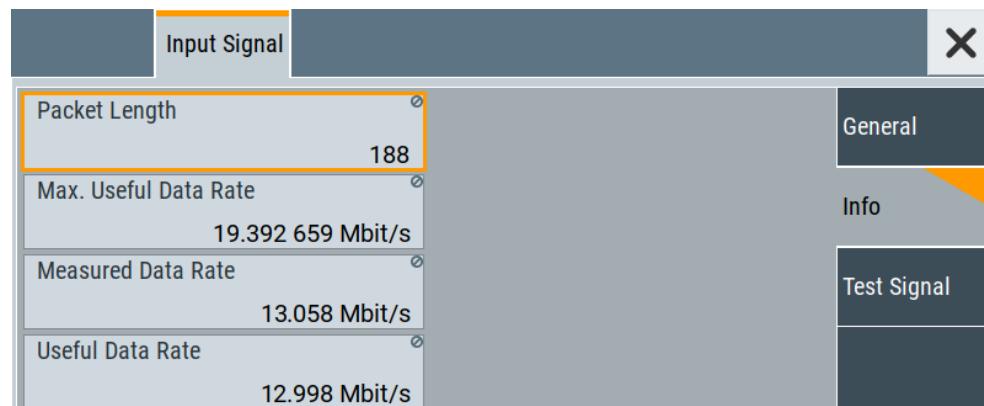
The "Info" side tab displays physical properties of the input TS stream data.

4.2.3 How to Monitor an Internal TS Player Signal

The R&S SMCV100B receives internal TS input data as described in Chapter 4.1.3, "How to Generate an Internal TS Signal", on page 42.

► Select "Input Signal > Info"
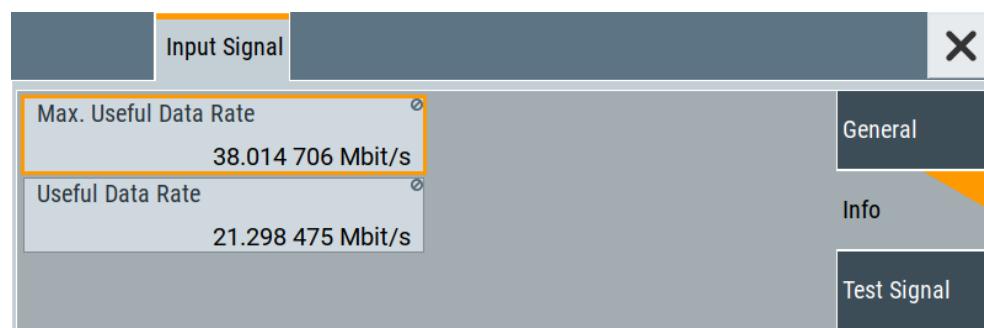
The "Info" side tab displays physical properties of the TS player stream data.

5 Remote-Control Commands

The following commands are required to generate signals with the ATSC / ATSC-MH 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 are assumed.

ⓘ **Conventions used in SCPI command descriptions**

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

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 / ATSC-MH are described here:

5.1 General Commands

Example: Storing current configuration

```
:SOURce1:BB:ATSM:SETTing:STORe "/var/user/my_atscmh"
*RST
:SOURce1:BB:ATSM:SETTing:CATalog?
// Response: my_atscmh
:SOURce1:BB:ATSM:SETTing:LOAD "/var/user/my_atscmh"
:SOURce1:BB:ATSM:FREQuency:VSBFrequency?
// Response: PILot

:SOURce1:BB:ATSM:STATe 1
:SOURce1:BB:ATSM:SETTing:DELete "my_atscmh"
```

Commands

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

Sets the parameters of the digital standard to their default values (`*RST` values speci-
fied for the commands).

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

Example:	See Chapter 5.1, "General Commands", on page 46.
Usage:	Event
Manual operation:	See "Set To Default" on page 11

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

Activates the standard and deactivates all the other digital standards and digital modu-
lation modes in the same path.

Parameters:

<State>	0 | 1 | OFF | ON
	*RST: 0
Example:	See Example "Storing current configuration" on page 46.
Manual operation:	See "State" on page 10

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

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

Return values:

<FileNames>	<filename1>,<filename2>,...
	Returns a string of filenames separated by commas.
Example:	See Chapter 5.1, "General Commands", on page 46.
Usage:	Query only
Manual operation:	See "Save/Recall" on page 11

[:SOURce<hw>]:BB:ATSM:SETTing:DELete <Delete>

Deletes the selected file from the default or the specified directory. Deleated are files with extension `*.atsm`.

Parameters:

<Filename>	"<filename>"
	Filename or complete file path; file extension can be omitted
Example:	See Example "Querying input signal properties" on page 50.
Usage:	Setting only
Manual operation:	See "Save/Recall" on page 11

[:SOURce<hw>]:BB:ATSM:SETTing:LOAD <Recall>

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

Parameters:

<Filename>	"<filename>"
	Filename or complete file path; file extension can be omitted
Example:	See Example "Storing current configuration" on page 46.
Manual operation:	See "Save/Recall" on page 11

[:SOURce<hw>]:BB:ATSM:SETTing:STORe <Save>

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

Parameters:

<Filename>	string
	Filename or complete file path
Example:	See Example "Storing current configuration" on page 46.

Manual operation: See "Save/Recall" on page 11

[:SOURce<hw>]:BB:ATSM:FREQuency:VSBFrequency <VSBFrequency>

Sets the vestigial sideband (VSB) reference frequency point.

Parameters:
<VSBFrequency>   PILot | CENTer

                           *RST: 0

Example: See Example "Storing current configuration" on page 46.

Manual operation: See "VSB Frequency" on page 11

5.2 Input Signal Commands

The section contains the commands for configuring the input signal. It also contains commands for querying IP input information.

For configuring IP channel settings and local IP data network parameters, see:

- Chapter 5.2.4, "IP Subsystem", on page 55
- Chapter 5.5, "BCIP Subsystem", on page 71

Commands

5.2.1 General Commands

Example: Configuring general input signal properties

```
:SOURce1:BB:ATSM:SOURce EXT
:SOURce1:BB:INPut?
// TS
:SOURce1:BB:INPut:FORmat?
// ASI
:SOURce1:BB:INPut IP
:SOURce1:BB:INPut:TSCHannel 2
:SOURce1:BB:ATSM:STUFfing 1
```

Commands

[:SOURce<hw>]:BB:ATSM:SOURce <AtscmhSource>

Sets the modulation source for the input signal.

Parameters:

<AtscmhSource>   EXTernal | TSPLayer | TESTsignal

                       *RST: EXTernal

Example: See Example "Querying input signal properties" on page 50.

Manual operation: See " Source" on page 12

[:SOURce<hw>]:BB:ATSM:INPut <AtscmhInput>

Sets the external input interface.

Parameters:

<AtscmhInput>   TS | IP

                       *RST: TS

Example: See Example "Configuring general input signal properties" on page 48.

Manual operation: See " Input" on page 13

[:SOURce<hw>]:BB:ATSM:INPut:FORMat <InputFormat>

Sets the format of the input signal.

Parameters:

<InputFormat>   ASI | SMPTE

                       *RST: ASI

Example: See Example "Configuring general input signal properties" on page 48.

Manual operation: See "Input Format" on page 13

[:SOURce<hw>]:BB:ATSM:INPut:TSCHannel <TsChannel>

Selects the IP-based transport stream (TS) channel. You can select 1 out of 4 IP TS channels as input at the "IP Data" interface.

To configure a particular channel, see Chapter 3.2.4, "IP Channnel x Settings", on page 18.

Parameters:

<TsChannel>   1 | 2 | 3 | 4

                  *RST: 1

Example: See Example "Configuring general input signal properties"
                  on page 48.

Manual operation: See "IP TS Channel" on page 13

[:SOURce<hw>]:BB:ATSM:STUFfing <Stuffing>

Activates stuffing.

Parameters:

<Stuffing>   0 | 1 | OFF | ON

                  *RST: 1

Example: See Example "Querying input signal properties" on page 50.

Manual operation: See "Stuffing" on page 14

5.2.2 Info Commands

Example: Querying input signal properties

```
:SOURce1:BB:ATSM:SOURce EXT


//************************************************************************************
// Query properties of input signals at TS IN interface.
//************************************************************************************
:SOURce1:BB:ATSM:INPut TS
:SOURce1:BB:ATSM:PACKetlength?
// P188
:SOURce1:BB:ATSM:USEFulf:RATE:MAX?
// 19.392659 MBit/s
:SOURce1:BB:ATSM:USEFulf:RATE?
// 17.654321 MBit/s
:SOURce1:BB:ATSM:INPut:DATArate?
// 18.765432 MBit/s

//************************************************************************************
// Query properties of input signals at IP Data interface.
//************************************************************************************
:SOURce1:BB:ATSM:INPut IP
// You can query input signal properties for one IP TS channel only.
// Query properties for , e.g., IP TS channel 2.
:SOURce1:BB:ATSM:INPut:TSCHannel 2
:SOURce1:BB:ATSM:PACKetlength?
//  P188
:SOURce1:BB:ATSM:USEFulf:RATE:MAX?
// 432.109876 MBit/s
```

```
:SOURce1:BB:ATSM:USEFulf:RATE?
// 400.000000 MBit/s
:SOURce1:BB:ATSM:INPut:DATArate?
// 399.876543 MBit/s

//*******************************************************************************
// Query properties of internal TS player input signals.
//*******************************************************************************
:SOURce1:BB:ATSM:SOURce TSPL
:SOURce1:BB:ATSM:USEFulf:RATE:MAX?
// 19.392659 MBit/s
:SOURce1:BB:ATSM:USEFulf:RATE?
// 17.654321 MBit/s
```

For configuring IP channel settings and local IP data network parameters, see:

- Chapter 5.2.4, "IP Subsystem", on page 55
- Chapter 5.5, "BCIP Subsystem", on page 71

Commands

[:SOURce<hw>]:BB:ATSM:PACKetlength?

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

Return values:

<PacketLength>   P188 | P208 | INValid

P188|P208
188/208 byte packets specified for serial input and parallel input.

INValid
Packet length does not match the specified length.

*RST: INValid

Example: See Example "Querying input signal properties" on page 50.

Usage: Query only

Manual operation: See "Packet Length" on page 15

[:SOURce<hw>]:BB:ATSM:USEFul[:RATE]?

Queries the data rate of useful data r_{useful} of the external transport stream. The data rate is measured at the input of the installed input interface.

Return values:

<UsefullData>   float

                       Range: 0 to 999999999
                       Increment: 0.001
                       *RST: 0

Example: See Example "Querying input signal properties" on page 50.

Usage: Query only

Manual operation: See "Useful Data Rate" on page 16

[:SOURce<hw>]:BB:ATSM: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 TS input interface, that is necessary for the modulator.

Return values:

<MaxUsefull>   float

                       Range: 0 to 999999999
                       Increment: 0.000001
                       *RST: 0

Example: See Example "Querying input signal properties" on page 50.

Usage: Query only

Manual operation: See "Max. Useful Data Rate" on page 15

[:SOURce<hw>]:BB:ATSM[:INPut]:DATarate?

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

- External transport stream including null packets input at "User 1" connector
- External transport stream including null packets input at "IP Data/LAN" connector (TSoverIP)

The value equals the sum of useful data rate r_{meas} and the rate of null packets r_0:

$$r_{meas} = r_{meas} + r_0$$

Return values:

<MeasuredData>   float

                       Range: 0 to 999999999
                       Increment: 0.001
                       *RST: 0

Example: See Example "Querying input signal properties" on page 50.

Usage: Query only

Manual operation: See "Measured Data Rate" on page 16

5.2.3 Test Signal Commands

Example: Configure test signal properties

```
:SOURce1:BB:ATSM:SOURce TEST
:SOURce1:BB:ATSM:TESTsignal TTSP
// Sets a test TS packet as test signal.

//*******************************************************************************
// Alternatively, set more specific test signals with PRBS parts within
// the test packet.
//*******************************************************************************
:SOURce1:BB:ATSM:TESTsignal PBIN
// Sets the PRBS before the interleaver bits.
:SOURce1:BB:ATSM:TESTsignal PBET
// Sets the PRBS before the trellis coder bits.
:SOURce1:BB:ATSM:TESTsignal PBEM
// Sets the PRBS before the mapper bits.

//*******************************************************************************
// Configure test signal properties.
//*******************************************************************************
:SOURce1:BB:ATSM:TSPacket H184
:SOURce1:BB:ATSM:PIDTestpack NULL
:SOURce1:BB:ATSM:PID?
// "8191" in decimal representation
// "1FFF" in hexadecimal representation
:SOURce1:BB:ATSM:PIDTestpack VAR
:SOURce1:BB:ATSM:PID 4607
// corresponds to "11FF" in hexadecimal representation
:SOURce1:BB:ATSM:PAYLoad PRBS
:SOURce1:BB:ATSM:PRBS P23_1
```

Commands

[:SOURce<hw>]:BB:ATSM:TESTsignal <TestSignal>

Defines the test signal data.

Parameters:

<TestSignal>	TTSP | PBIN | PBET | PBEM

TTSP
Test TS packet with standardized packet data used as modulation data in the transport stream.

PBIN

PRBS before interleaver.

Pure pseudo-random bit sequence (PRBS) data used as modulation data with no packet structure. PRBS data conforms with ITU-T O.151 specification.

PBET

PRBS before trellis.

Pure pseudo-random bit sequence (PRBS) data used as modulation data with no packet structure and interleaving. Modulation data is directly fed to the trellis encoder.

PBEM

PRBS before mapper

Pure pseudo-random bit sequence (PRBS) data directly fed to the mapper.

Three bits at a time in two's complement are assigned to the stages -7, -5, -3, -1, 1, 3, 5, 7. Subsequent pilot insertion and VSB filtering remain unaffected.

*RST: TTSP

Example:	See Example "Configure test signal properties" on page 53.
Manual operation:	See "Test Signal" on page 14

[:SOURce<hw>]:BB:ATSM:TSPacket <TsPacket>

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

Parameters:

<TsPacket>	H184 | S187
	*RST: H184
Example:	See Example "Configure test signal properties" on page 53.
Manual operation:	See "Test TS Packet" on page 17

[:SOURce<hw>]:BB:ATSM:PIDTestpack <PIDTestpack>

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:

<PIDTestpack>	NULL | VARiable
	*RST: NULL
Example:	See Example "Configure test signal properties" on page 53.
Manual operation:	See "PID Test Packet" on page 17

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

Sets the PID.

Parameters:

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

Example: See Example "Configure test signal properties" on page 53.

Manual operation: See "PID (Hex)" on page 18

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

Defines the payload area content of the TS packet.

Parameters:

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

Example: See Example "Configure test signal properties" on page 53.

Manual operation: See "Payload Test/Stuff" on page 18

[:SOURce<hw>]:BB:ATSM:PRBS <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>	P23_1 | P15_1
	*RST: P23_1

Example: See Example "Configure test signal properties" on page 53.

Manual operation: See "PRBS" on page 18

5.2.4 IP Subsystem

The SOURce:BB:INPut:IP subsystem contains the commands for configuring input IP data from a local IP data network.

To configure local IP data network parameters, see Chapter 5.5, "BCIP Subsystem", on page 71.

Common suffixes

The following common suffixes are used in the SOURce:BB:INPut:IP remote commands:

Suffix	Value range	Description
IP<ch>	1 to 4	IP channel number

Example: Configure IP channel 2 properties

```
// Use the data from IP channel 2 as input for modulation data.
:SOURce1:BB:INPut:IP2:STATe ON
// Specify alias as "Alias 2".
:SOURce1:BB:INPut:IP2:ALIas "Alias 2"


//************************************************************************************
// Define Unicast properties.
//************************************************************************************
:SOURce1:BB:INPut:IP2:TYPe UNI
// Local IP data interface is configured for Unicast reception
:SOURce1:BB:INPut:IP2:PORT 6002


//************************************************************************************
// Define Multicast properties.
//************************************************************************************
:SOURce1:BB:INPut:IP2:TYPe MULT
// Local IP data interface is configured for Multicast reception
:SOURce1:BB:INPut:IP2:MULTicast:ADDRess?
// Response: "226.0.0.0"
:SOURce1:BB:INPut:IP2:IGMP:SOURce:ADDRess?
// Response: "0.0.0.0"
:SOURce1:BB:INPut:IP2:IGMP:SOURce:ADDRess "192.168.10.1"
:SOURce1:BB:INPut:IP2:IGMP:SOURce:PING
:SOURce1:BB:INPut:IP2:IGMP:SOURce:RESult?
// Response: "Ping: Successful"
```

Commands

[:SOURce<hw>]:BB:INPut:IP<ch>[:STATe] <Alias>

Activates/deactivates the "IP Channel x" as IP input.

Specify the current IP TS Channel with the command
`SOURce1:BB:DigStd:INPut:TSCHannel`. DigStd stands for the IP TS Channel in the corresponding broadcast standard.

Parameters:

<Alias>   0 | 1 | OFF | ON

                   *RST: 0

Example: See Example "Configure IP channel 2 properties" on page 56.

Manual operation: See "Input IP" on page 20

[:SOURce<hw>]:BB:INPut:IP<ch>:ALIas <Alias>

Specifies an alias, i.e. name for the IP connection.

Parameters:

<Alias>   string

Example: See Example "Configure IP channel 2 properties" on page 56.

Manual operation: See "Alias" on page 20

[:SOURce<hw>]:BB:INPut:IP<ch>:PORT <Port>

Sets the port of the input IP data at the "IP Data" connector.

Parameters:

<Port>   integer

                           Range: 0 to 65535
                           *RST: 6002

Example: See Example "Configure IP channel 2 properties" on page 56.

Manual operation: See "Port" on page 21

[:SOURce<hw>]:BB:INPut:IP<ch>:TYPE <Type>

Sets the IP input type.

Parameters:

<Type>   UNIcast | MULTicast

                           UNIcast
                           Analyzes all unicast IP packets that arrive at the specified port.
                           See `[:SOURce<hw>]:BB:INPut:IP<ch>:PORT` on page 57.

                           MULTicast
                           When an IP address is in the multicast address range, an
                           attempt is made to join a multicast group using IGMP. Set multi-
                           cast address and port.
                           See:
                           `[:SOURce<hw>]:BB:INPut:IP<ch>:MULticast:ADDRess`
                           on page 58
                           `[:SOURce<hw>]:BB:INPut:IP<ch>:PORT` on page 57

                           *RST: UNIcast

Example: See Example "Configure IP channel 2 properties" on page 56.

Manual operation: See "Type" on page 20

[:SOURce<hw>]:BB:INPut:IP<ch>:MULticast:ADDRess

Sets the destination IP address (IPv4) of the IP connection.

Parameters:

<Address>   string

                                  Range: 224.0.0.0 to 239.255.255.255

Example: See Example "Configure IP channel 2 properties" on page 56.

Manual operation: See "Multicast Address" on page 20

[:SOURce<hw>]:BB:INPut:IP<ch>:IGMP[:SOURce]:ADDRess

Specifies the IGMP source address of the network.

Parameters:

<Address>   string

Example: See Example "Configure IP channel 2 properties" on page 56.

Manual operation: See "IGMPv3 Source Address" on page 21

[:SOURce<hw>]:BB:INPut:IP<ch>:IGMP[:SOURce]:PING

Triggers pinging of the IGMP source address in the local IP data network. Query the result via `[:SOURce<hw>]:BB:INPut:IP<ch>:IGMP[:SOURce]:RESult?` on page 58.

Example: See Example "Configure IP channel 2 properties" on page 56.

Usage: Event

Manual operation: See "Ping Source Address" on page 21

[:SOURce<hw>]:BB:INPut:IP<ch>:IGMP[:SOURce]:RESult?

Queries the result of pinging the IGMP source address.

See `[:SOURce<hw>]:BB:INPut:IP<ch>:IGMP[:SOURce]:PING` on page 58.

Return values:

<PingResult>   string

                                  Returns ping messages.

Example: See Example "Configure IP channel 2 properties" on page 56.

Usage: Query only

Manual operation: See "Ping Result" on page 21

5.3 Coding Commands

5.3.1 General Commands

Example: Configure general coding properties

```
:SOURce1:BB:ATSM:SYMBols:RATE 11300000
:SOURce1:BB:ATSM:CONstel?
// 8VSB
:SOURce1:BB:ATSM:ROLLof?
// R115
:SOURce1:BB:ATSM:MHSTate 1
```

[:SOURce<hw>]:BB:ATSM:SYMBols[:RATE] <SymbolRate>

Sets the symbol rate.

Parameters:

<SymbolRate>   integer

                   Range: 10224126 to 11300350
                   *RST: 10762238

Example: See Example "Configure general coding properties" on page 59.

Manual operation: See "Symbol Rate" on page 22

[:SOURce<hw>]:BB:ATSM:CONStel?

Displays the constellation.

Return values:

<Constellation>   VSB8

                     *RST: VSB8

Example: See Example "Configure general coding properties" on page 59.

Usage: Query only

Manual operation: See "Constellation" on page 23

[:SOURce<hw>]:BB:ATSM:ROLLoff?

Queries the roll-off factor alpha (α).

Return values:

<RollOff>	R115
	*RST: R115

Example: See Example "Configure general coding properties" on page 59.

Usage: Query only

Manual operation: See "Roll Off" on page 23

[:SOURce<hw>]:BB:ATSM:MHSTate <MHState>

Enables/disableses all ATSC-M/H elements of the FEC.

Parameters:

<MHState>   0 | 1 | OFF | ON

                        ON
                        ATSC-M/H-compliant output signal

                        OFF
                        8VSB state, output signal complies with the ATSC digital television standard (A/53)

                        *RST: 1

Example: See Example "Configure coding network properties" on page 60.

5.3.2 Network Commands

Example: Configure coding network properties

```
:SOURce1:BB:ATSM:MHEPid 8181
// Corresponds to MHE PID "1FF9" in hexadecimal representation.

//********************************************************************************
// Activate and configure RF watermark properties.
//********************************************************************************
:SOURce1:BB:ATSM:WATermark 1
:SOURce1:BB:ATSM:TX:ADDRess 4095
// Corresponds to a Tx address of "00FF" in hexadecimal representation.
:SOURce1:BB:ATSM:NETwork:ID 0
// Corresponds to a network address of "0000" in hexadecimal representation.
:SOURce1:BB:ATSM:BURY:RATio DB33

//********************************************************************************
// Activate and configure MTXID transmission properties.
//********************************************************************************
:SOURce1:BB:ATSM:TRANsmission 1
```

```
:SOURce1:BB:ATSM:MTXid:TID 0
// Corresponds to a transmitter ID of "0000" in hexadecimal representation.
:SOURce1:BB:ATSM:MTXid:MID 1
// Corresponds to a market ID of "0001" in hexadecimal representation.
```

[:SOURce<hw>]:BB:ATSM:MHEPid <MhePID>

Sets the MHE PID of MPEG-2 packets that contain ATSC M/H data. The PID is a four-digit value in hexadecimal format.

Parameters:

<MhePID>   integer

                    Range: 0 to 8191
                    *RST: 8185

Example: See Example "Configure coding network properties" on page 60.

Manual operation: See " MHE PID (Hex)" on page 24

[:SOURce<hw>]:BB:ATSM:WATermark <Watermark>

Enables/disables the RF watermark.

Parameters:

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

Example: See Example "Configure coding network properties" on page 60.

Manual operation: See " RF Watermark" on page 24

[:SOURce<hw>]:BB:ATSM:TX:ADDRess <TxAddr>

Sets the TX address that underlays the RF signal as a watermark.

Parameters:

<TxAddr>   integer

                    Range: 0 to 4095
                    *RST: 0

Example: See Example "Configure coding network properties" on page 60.

Manual operation: See "TX Address (Hex)" on page 24

[:SOURce<hw>]:BB:ATSM:NETWork:ID <NetwID>

Sets the network ID for the watermark. The network ID is a three-digit value in hexa-decimal format.

Parameters:

<NetwID>   integer

Range: 0 to 4095
*RST: 0

Example: See Example "Configure coding network properties" on page 60.

Manual operation: See "Network ID (Hex)" on page 24

[:SOURce<hw>]:BB:ATSM:BURY:RATio <MarketID>

Sets the power with that the watermark is added to the payload signal.

Parameters:

<MarketID>   DB21 | DB24 | DB27 | DB30 | DB33 | DB36 | DB39

*RST: DB30

Example: See Example "Configure coding network properties" on page 60.

Manual operation: See "Bury Ratio" on page 25

[:SOURce<hw>]:BB:ATSM:TRANsmission <Transmission>

Enables/disables MTXID transmission.

Parameters:

<Transmission>   0 | 1 | OFF | ON

*RST: 0

Example: See Example "Configure coding network properties" on page 60.

Manual operation: See " MTXID Transmission" on page 25

[:SOURce<hw>]:BB:ATSM:MTXid:TID <TransmitterID>

Sets the transmitter ID for the MTXID transmission.

Parameters:

<TransmitterID>   integer

Range: 0 to 31
*RST: 0

Example: See Example "Configure coding network properties" on page 60.

Manual operation: See " Transmitter ID (Hex)" on page 25

[:SOURce<hw>]:BB:ATSM:MTXid:MID <MarketID>

Sets the market ID for the transmission.

Parameters:

<MarketID>   integer

                  Range: 0 to 511
                  *RST: 0

Example: See Example "Configure coding network properties" on page 60.

Manual operation: See " Market ID (Hex)" on page 25

5.4 TSGen Subsystem

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

Example: Play a TS player file

```
//********************************************************************************
// Select a file, e.g. a user-defined setting.
//********************************************************************************
:TSGen:CONFigure:PLAYfile "/var/user/my_test_player_test.trp"
// Selects the file "my_test_player_test" with extension *.trp.


//********************************************************************************
// Within the file, define a section, that you want to play.
// You can set start/stop position for a maximum section length of 10 hours.
//********************************************************************************
:TSGen:CONFigure:SEEK:STARt 60000 // milliseconds
// Section start is after one minute from the original file start.
// The first minute is ignored.
:TSGen:CONFigure:SEEK:STOP 120000 // milliseconds
// Section stop is after one minute from the original file start.
// The total section length is one minute.

//********************************************************************************
// Navigate to a certain position within the file/section of the file.
//********************************************************************************
:TSGen:CONFigure:SEEK:POSition 100000 // milliseconds
// The current player position of file/section of the file is at 1 minute 40 seconds.

//********************************************************************************
// Reset play-related settings
//********************************************************************************
:TSGen:CONFigure:SEEK:RESet

//********************************************************************************
// Pause, stop, play the file.
//********************************************************************************
:TSGen:CONFigure:COMMand PAUS
```

```
// Pauses playing the file.
:TSGen:CONFigure:COMMand STOP
// Stops playing the file.
:TSGen:CONFigure:COMMand PLAY
// Activates playing the file.
```

Example: Configure and monitor TS player output

```
//****************************************************************************
// Configure general and stuffing parameters of the TS player output.
//****************************************************************************
:TSGen:CONFigure:STUFfing ON
:TSGen:CONFigure:STOPdata TTSP
:TSGen:CONFigure:TSPacket H184
//:TSGen:CONFigure:PIDTestpacket VAR
:TSGen:CONFigure:PIDTestpack VAR
:TSGen:CONFigure:PID 8100
// Corresponds to a PID = 1FA4 in hexadecimal format.
:TSGen:CONFigure:PAYLoad PRBS
:TSGen:CONFigure:PRBS:SEQuence P23_1


//****************************************************************************
// Monitor TS player output data.
//****************************************************************************
:TSGen:CONFigure:COMMand STOP
// TSRate can only be changed if player is in stop mode
:TSGen:CONFigure:TSRate 350E6 // net data rate = 350 MBit/s
:TSGen:CONFigure:COMMand PLAY

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

Example: Configure seamless loop parameters

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

Commands

:TSGen:CONFigure:COMMand<ch>

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

Setting parameters:

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

Example:	See Example "Play a TS player file" on page 63.
Usage:	Event
Manual operation:	See "Play" on page 30

: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 64.
Manual operation:	See "Payload Test/Stuff" on page 33

: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 64.

Manual operation:　　See "PID (Hex)" on page 33

: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 64.

Manual operation:　　See "PID Test Packet" on page 33

: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 63.

Manual operation:　　See "Select File" on page 28

:TSGen:CONFigure:PLENgth <PLength>

Queries the packet length of the loaded file.

Parameters:

<PLength>　　　　　　P188 | P204 | P208 | INV

　　　　　　　　　　*RST:　　　　INV

Example:　　　　　　See Example "Configure and monitor TS player output"
　　　　　　　　　　　on page 64.

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

Sets the length of the PRBS sequence.

Parameters:

<PRBS>　　　　　　　P15_1 | P23_1

　　　　　　　　　　*RST:　　　　P23_1

Example: See Example "Configure and monitor TS player output"
                               on page 64.

Manual operation: See "PRBS" on page 33

: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 64.

Manual operation: See "Continuity Counter" on page 34

: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 64.

Manual operation: See "PCR, DTS/PTS" on page 34

: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 64.

Manual operation: See "TDT/TOT" on page 34

: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 63.

Manual operation: See "Running/Position Player [hh:mm:ss:fff]" on page 28

:TSGen:CONFigure:SEEK:RESet

Resets the following parametets to their default state:

- :TSGen:CONFigure:SEEK:STARt on page 68
- :TSGen:CONFigure:SEEK:STOP on page 68

Example: See Example "Play a TS player file" on page 63.

Manual operation: See "Reset Window" on page 30

: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 63.

Manual operation: See "Start [hh:mm:ss.fff]" on page 29

: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 63.

Manual operation: See "Stop [hh:mm:ss.fff]" on page 29

: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 64.
Manual operation:	See "Stop Data" on page 32

: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 64.
Manual operation:	See "Nullpacket Stuffing" on page 31

: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 64.
Manual operation:	See "Packet Length" on page 31

: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 64.
Manual operation:	See "Data Rate" on page 31

: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 64.
Manual operation:	See "Select File" on page 28

: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 64.
Manual operation:	See "Orig. Data Rate" on page 31

: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 64.
Usage:	Query only
Manual operation:	See "Select File" on page 28

5.5 BCIP Subsystem

The `SYSTem:COMMunicate:BCIP` subsystem contains the commands for configuring local IP data network parameters.

Common suffixes

The following common suffixes are used in the remote commands:

Suffix	Value range	Description
BCIP<hw>	1	Available local IP LAN interfaces

Example: Retrieving information on local network-related settings

```
//********************************************************************************
// Monitor IP interface 1 local network status.
//********************************************************************************
:SYSTem:COMMunicate:BCIP1:NETWork:STATus?
// Response: "0"
// The instrument is diconnected from the local IP network.
:SYSTem:COMMunicate:BCIP1:NETWork:RESTart
:SYSTem:COMMunicate:BCIP1:NETWork:STATus?
// Response: "1"

//********************************************************************************
// Query local IP data network properties.
//********************************************************************************
:SYSTem:COMMunicate:BCIP1:NETWork:COMMon:HOSTname?
// Response: "SMCV100B-123456-IP-Data"
:SYSTem:COMMunicate:BCIP1:NETWork:IPADdress:MODE STAT
:SYSTem:COMMunicate:BCIP1:NETWork:IPADdress "10.113.0.104"
:SYSTem:COMMunicate:BCIP1:NETWork:IPADdress:SUBNet:MASK "255.255.252.0"
:SYSTem:COMMunicate:BCIP1:NETWork:MACaddress?
// Response: "00 90 B8 21 89 F8"
:SYSTem:COMMunicate:BCIP1:NETWork:PROTocol?
// Response: "UDP"
```

Commands

:SYSTem:COMMunicate:BCIP<hw>:NETWork:COMMon:HOSTname <Hostname>

Sets an individual hostname for the vector signal generator.

Note: We recommend that you do not change the hostname to avoid problems with the network connection. If you change the hostname, be sure to use a unique name.

Parameters:

<Hostname>   string

Example: See Example "Retrieving information on local network-related settings" on page 71.

Manual operation: See "Hostname" on page 36

:SYSTem:COMMunicate:BCIP<hw>:NETWork:IPADdress

Sets the IP address.

Parameters:

<IpAddress>   string

                        Range: 0.0.0.0 to 255.255.255.255
                        *RST: 0.0.0.0

Example: See Example "Retrieving information on local network-related settings" on page 71.

Manual operation: See "IP Address" on page 36

:SYSTem:COMMunicate:BCIP<hw>:NETWork:IPADdress:MODE <IPMode>

Selects manual or automatic setting of the IP address.

Parameters:

<IPMode>   AUTO | STATic

                        *RST: AUTO

Example: See Example "Retrieving information on local network-related settings" on page 71.

Manual operation: See "Address Mode" on page 36

:SYSTem:COMMunicate:BCIP<hw>:NETWork:IPADdress:SUBNet:MASK

Sets the subnet mask.

Parameters:

<Mask>   string

                        Range: 0.0.0.0 to 255.255.255.255
                        *RST: 0.0.0.0

Example: See Example "Retrieving information on local network-related settings" on page 71.

Manual operation: See "Subnet Mask" on page 37

:SYSTem:COMMunicate:BCIP<hw>:NETWork:MACaddress <MACAddress>

Queries the MAC address of the network adapter.

Parameters:
<MACAddress>   string

                     Range: 00:00:00:00:00:00 to ff:ff:ff:ff:ff:ff

Example: See Example "Retrieving information on local network-related
                     settings" on page 71.

Manual operation: See "MAC Address" on page 37

:SYSTem:COMMunicate:BCIP<hw>:NETWork:PROTocol <Protocol>

Specifies the network protocol.

Parameters:
<Protocol>   UDP

                     *RST: UDP

Example: See Example "Retrieving information on local network-related
                     settings" on page 71.

Manual operation: See "Protocol" on page 37

:SYSTem:COMMunicate:BCIP<hw>:NETWork:RESTart

Triggers a restart of the network.

Example: See Example "Retrieving information on local network-related
                     settings" on page 71.

Usage: Event

Manual operation: See "Restart Network" on page 36

:SYSTem:COMMunicate:BCIP<hw>:NETWork:STATus <NetworkStatus>

Queries the network connection state.

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

                     *RST: n.a. (no preset. default: 0)

Example: See Example "Retrieving information on local network-related
                     settings" on page 71.

Manual operation: See "Network Status" on page 35

Glossary: Abbreviations

A

ASI: Asynchronous Serial Interface

ATSC: Advanced Television System Committee
https://www.atsc.org/

ATSC-M/H: Advanced Television System Committee - Mobile/Handheld
See also ATSC.

B

BPSK: Binary Phase-Shift Keying

D

DHCP: Dynamic Host Configuration Protocol

F

FEC: Forward Error Correction

FIR: Finite Impulse Response

I

IGMP: Internet Group Management Protocol

IGMPv3: Internet Group Management Protocol version 3

M

MAC: Media Access Control

MHE: M/H Encapsulation

MPEG: Moving Picture Experts Group
https://mpeg.chiariglione.org/

MTXID: Market and Transmitter ID

P

PID: Packet Identifier

PRBS: Pseudo-Random Bit Sequence

R

RTP: Real-time Transport Protocol

S

SFN: Single-frequency Network

SMPTE: Society of Motion Picture and Television Engineers
https://www.smpte.org/

T

TCP: Transmission Control Protocol

TS: Transport Stream

U

UDP: User Datagram Protocol

V

VSB: Vestigial Sideband Modulation

Glossary: Specifications

A

ATSC A/53: ATSC Digital Television Standard A/53, Parts 1 – 6
https://www.atsc.org/standard/a53-atsc-digital-television-standard/

ATSC A/110: ATSC Standard for Transmitter Synchronization
https://www.atsc.org/standard/a1102011-atsc-standard-for-transmitter-synchronization/

ATSC A/153: ATSC Mobile DTV Standard A/153, Parts 1 – 10
https://www.atsc.org/standard/a153-atsc-mobile-dtv-standard-parts-1-10/

I

ITU-T O.151: ITU-T Recommendation O.151
https://www.itu.int/rec/T-REC-O.151-199210-I/en

List of commands

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