

# DAB / T-DMB

## Digital Standard for

### R&S<sup>®</sup>Signal Generators

# Operating Manual



1171.5531.12 – 15

This document describes the following software options:

- R&S®SMBV-K53/-K353/-K354  
1415.8154.xx, 1415.8702.02, 1415.8783.02
- R&S®SMU-K53/-K353/-K354  
1400.6209.02, 1408.8652.02, 1408.8717.02
- R&S®AMU-K53  
1402.9957.02
- R&S®SMATE-K53  
1400.6409.02
- R&S®SMJ-K53/-K353/-K354  
1400.6309.02, 1409.3525.02, 1409.3583.02

This manual version corresponds to firmware version:

FW 3.50.082.xx and later of the R&S®SMBV100A

FW 3.20.286.xx and later of the R&S®SMU200A, R&S®SMATE200A, R&S®SMJ100A and R&S®AMU200A

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Subject to change – Data without tolerance limits is not binding.

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Trade names are trademarks of the owners.

The following abbreviations are used throughout this manual: R&S®SMBV100A is abbreviated as R&S SMBV, R&S®SMU200A is abbreviated as R&S SMU, R&S®AMU200A is abbreviated as R&S AMU, R&S®SMATE200A is abbreviated as R&S SMATE, R&S®SMJ100A is abbreviated as R&S SMJ, R&S®WinIQSIM2™ is abbreviated as R&S WinIQSIM2; the license types 02/03/07/11/13/16/12 are abbreviated as xx.

# Contents

<b>1</b>	<b>Preface</b> .....	<b>5</b>
1.1	Documentation Overview.....	5
1.2	Conventions Used in the Documentation.....	6
1.2.1	Typographical Conventions.....	6
1.2.2	Notes on Screenshots.....	7
1.2.3	Naming of Software Options.....	7
<b>2</b>	<b>Introduction</b> .....	<b>8</b>
2.1	DAB Network.....	8
2.2	DAB Transmission System.....	9
2.3	Transport Mechanisms.....	9
2.3.1	Transmission channels.....	10
2.3.2	Transport Modes.....	11
2.4	Pseudo Noise (PN) Scrambling.....	11
2.5	Convolutional Coding.....	11
2.6	Time Interleaving.....	12
<b>3</b>	<b>DAB/T-DMB User Interface</b> .....	<b>13</b>
3.1	General Settings for DAB/T-DMB Signals.....	13
3.2	System Configuration.....	17
3.3	Filter Settings.....	18
3.4	Trigger/Marker/Clock Settings.....	19
3.4.1	Trigger In.....	20
3.4.2	Marker Mode.....	24
3.4.3	Marker Delay.....	25
3.4.4	Clock Settings.....	25
3.4.5	Global Settings.....	27
<b>4</b>	<b>Remote-control commands</b> .....	<b>28</b>
4.1	General Commands.....	29
4.2	System Configuration.....	34
4.3	Filter Settings.....	34
4.4	Trigger Settings.....	38

4.5	Marker Settings.....	41
4.6	Clock Settings.....	45
	<b>List of Commands.....</b>	<b>48</b>
	<b>Index.....</b>	<b>50</b>

# 1 Preface

## 1.1 Documentation Overview

This section provides an overview of the R&S Signal Generator user documentation. You find it on the product page at:

<http://www.rohde-schwarz.com/product/SMBV100A.html> > "Downloads"

### Quick start guide

Introduces the R&S Signal Generator 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.

### Online help

Offers quick, context-sensitive access to the complete information for the base unit and the software options directly on the instrument.

### Operating manual

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 quick start guide manual.
- Software option manual  
Contains the description of the specific functions of an option. Basic information on operating the R&S Signal Generator is not included.

The **online version** of the operating manual provides the complete contents for immediate display on the Internet.

### Service manual

Describes the performance test for checking the rated specifications, module replacement and repair, firmware update, troubleshooting and fault elimination, and contains mechanical drawings and spare part lists.

The service manual is available for registered users on the global Rohde & Schwarz information system (GLORIS, <https://gloris.rohde-schwarz.com>).

**Instrument security procedures manual**

Deals with security issues when working with the R&S Signal Generator in secure areas.

**Basic safety instructions**

Contains safety instructions, operating conditions and further important information. The printed document is delivered with the instrument.

**Data sheet and brochure**

The data sheet contains the technical specifications of the software options, see "Digital Standards for Signal Generators - Data sheet" on the web site. It also lists the options and their order numbers.

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

**Release notes and open source acknowledgment (OSA)**

The release notes of the base units 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 the product page of the base unit, e.g. at:

<http://www.rohde-schwarz.com/product/SMBV100A.html> > "Downloads" > "Firmware"

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

These documents deal with special applications or background information on particular topics, see <http://www.rohde-schwarz.com/appnotes>.

## 1.2 Conventions Used in the Documentation

### 1.2.1 Typographical Conventions

The following text markers are used throughout this documentation:

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

Convention	Description
<a href="#">Links</a>	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by quotation marks.

## 1.2.2 Notes on Screenshots

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

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

## 1.2.3 Naming of Software Options

In this operating manual, we explicitly refer to options required for specific functions of the digital standard.

The name of software options for signal generators vary in the name of the instrument, but the option name is identical. Therefore we use in this manual the placeholder R&S SMx/AMU.

### **Example:**

Naming for an option of the vector signal generator R&S SMBV100A, e.g:

- R&S SMx/AMU-K99, stands for R&S SMBV-K99

The particular software options available for the corresponding instruments are listed on the back of the title page.

## 2 Introduction

The R&S Signal Generator enables you to generate signals in accordance with the Digital Audio Broadcasting (DAB)/Terrestrial Digital Multimedia Broadcasting (T-DMB) standard.



To play back a signal from a waveform file created by the simulation software R&S WinIQSIM2, the corresponding R&S WinIQSIM2 digital standard option must be installed.

The generated signals are compliant with ETSI EN 300 401 standard. Via the user-friendly graphical interface of R&S Signal Generator, you can adjust several DAB signal parameters. You are enabled to generate a signal corresponding to one of the four standard transport modes, Transmission Mode I, II, III or IV. You can also choose to enable or disable channel coding, time interleaving and/or pseudo noise scrambling.

The R&S Signal Generator allows you to choose between different data sources. You can either use some of the predefined data sources (two different pseudo noise sequences, fixed all "0", fixed all "1") or you can use your own ETI (Ensemble Transport Interface) compliant source file. To create an ETI compliant source file, you can for instance use the R&S STI Ensemble Mux DM001 or the R&S ETI Builder. However, the ETI source file must fulfill some prerequisites.

The DAB system is designed for delivery of high-quality digital audio programs and data services for mobile, portable and fixed reception from terrestrial or satellite transmitters in the Very High Frequency (VHF)/Ultra High Frequency (UHF) frequency bands as well as for distribution through cable networks.

The DAB system is designed to provide spectrum and power efficient techniques in terrestrial transmitter network planning, known as the Single Frequency Network (SFN) and the gap-filling technique. The DAB system is suitable for satellite as well as hybrid/mixed terrestrial/satellite broadcasting, using a simple, nearly omni-directional receiving antenna. The DAB system meets the required sharing criteria with other radio communication services.

### 2.1 DAB Network

The figure below illustrates the outline of a DAB network.

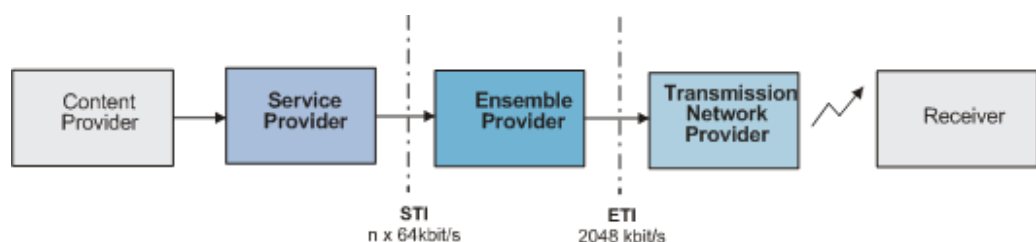


Figure 2-1: DAB network



The DAB network has three main parts: the service or service component provider, the multiplex or ensemble provision and the transmission network provision.

The interfaces between these three blocks are scope of ETSI standards. The STI (Service Transport Interface) is defined to provide a standardized way of transporting DAB service components, service information and control messages in a DAB collection network.

The Ensemble Transport Interface (ETI) links the Multiplexer of the Ensemble Provider with the transmitters of the Transmission Network Provider.

## 2.2 DAB Transmission System

The following block diagram shows the components of the DAB transmission system.

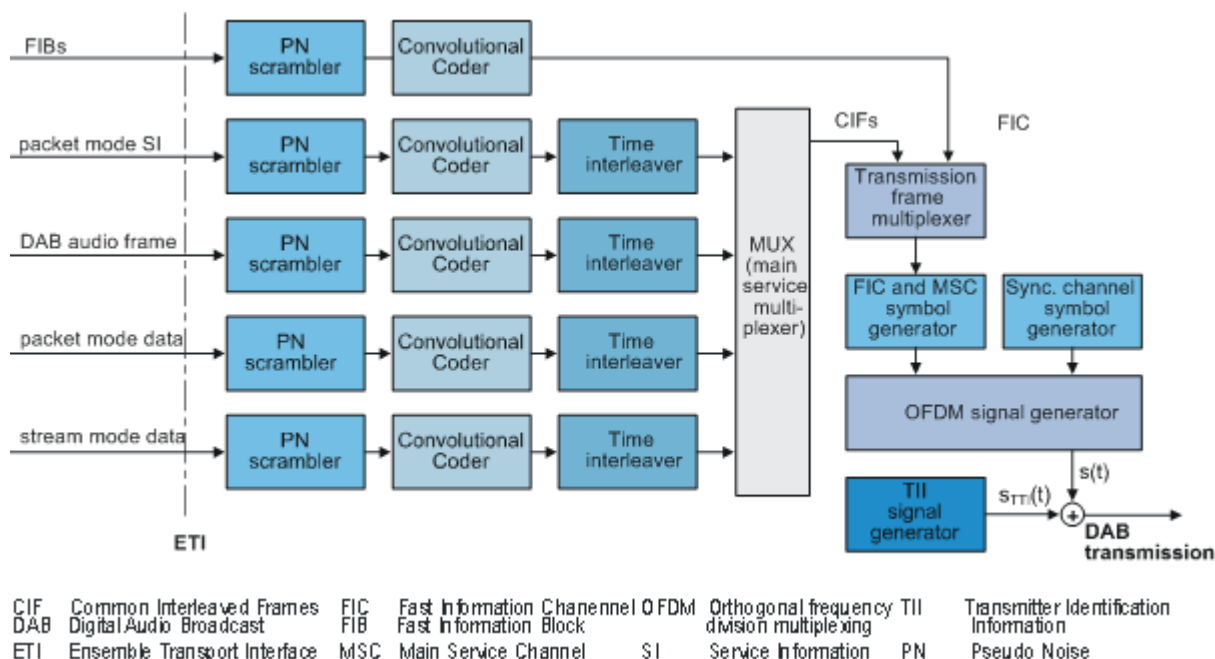


Figure 2-2: Components of the Transmission System DAB

The DAB transmission signal is defined as the sum of two signals; the main signal  $s(t)$  and an optional signal  $s_{TII}(t)$  as illustrated in the figure above.

## 2.3 Transport Mechanisms

The DAB system is designed to carry several digital audio signals together with data signals. Audio and data signals are considered to be service components which can be grouped together to form services.

The DAB system transmission frame consists of three different channels:

- Main Service Channel (MSC)

- Fast Information Channel (FIC)
- Synchronization Channel

### 2.3.1 Transmission channels

The MSC is a time-interleaved data channel used to carry the audio and data service components, together with possible supporting and additional data service components. The MSC is divided into a number of sub-channels. Each of the sub-channels is individually convolutionally coded with equal or unequal error protection. Each sub-channel may carry one or more service components.

The FIC is a non time-interleaved data channel with fixed equal error correction. FIC carries information about the organization of the MSC sub-channels, such as information on the multiplex structure and, when necessary, its reconfiguration. Optionally FIC may include service information, conditional access management information and data service.

The Synchronization Channel provides a phase reference and is used internally for demodulator functions such as transmission frame synchronization, automatic frequency control, transmitter identification, and channel state estimation.

The Synchronization channel, the Fast Information Channel and the Main Service Channel form a transmission frame (see Figure 2-3). The MSC occupies the major part of the transmission frame.

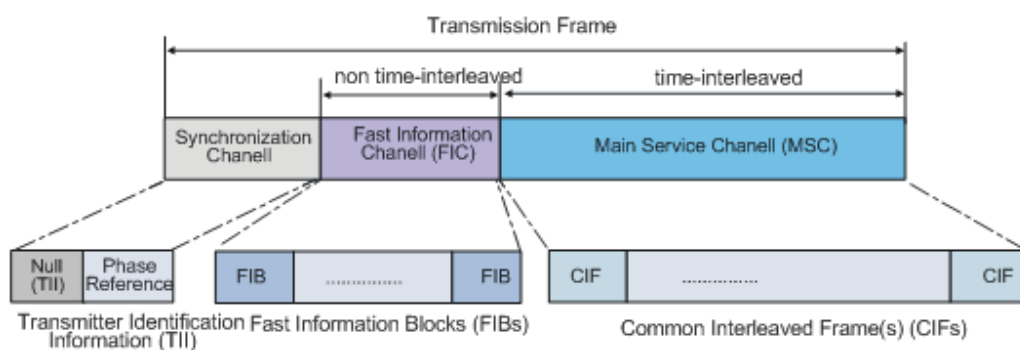


Figure 2-3: DAB transmission frame

Each transmission frame is divided into a sequence of OFDM symbols, each symbol consisting of a number of carriers.

The Fast Information Block (FIB) and the Common Interleaved Frame (CIF) are introduced in order to provide transmission mode independent data transport packages associated with the FIC and MSC respectively.

The data, carried in the MSC, is divided at source into regular 24 ms bursts corresponding to the sub-channel data capacity of each CIF. The CIF contains 55 296 bits, divided at 864 capacity units, 64 bits each.

Fast Information Block (FIB) is a data burst of 256 bits. The sequence of FIBs is carried by the Fast Information Channel FIC. The structure of the FIB is common to all transmission modes.

The synchronization channel symbols comprise the null symbol and the phase reference symbol. The null symbols are also used to allow a limited number of OFDM carriers to convey the Transmitter Identification Information (TII).

### 2.3.2 Transport Modes

Transmission mode is specific set of transmission parameters (e.g. number of carriers, OFDM symbol duration). Four transmission modes (i.e. I, II, III and IV) are defined to allow the system to be used for different network configurations and a range of operating frequencies. Depending on the transport mode, the transmission frame has different organization and length, i.e. the transmission frame is specific to the four transmission modes.

The table below gives the transmission frame duration and the number of FIBs and CIFs which are associated with each transmission frame for the four transport modes.

*Table 2-1: Transmission Mode Characteristics*

Transport Mode	Duration of transmission frame	Number of FIBs per transmission frame	Number of CIFs per transmission frame	Number of carriers	Carrier Spacing
I	96 ms	12	4	1536	1 KHz
II	24 ms	3	1	384	4 KHz
III	24 ms	4	1	192	8 KHz
IV	48 ms	6	2	768	2 KHz

## 2.4 Pseudo Noise (PN) Scrambling

Prior to convolution encoding, the transmitted signal can be scrambled by a modulo-2 addition with a pseudo-random binary sequence (PRBS).

The PRBS polynomial is of degree 9 and specified as  $P(X) = x^9 + x^5 + 1$ .

The initialization word is applied in such a way that the first bit of the PRBS is obtained when the outputs of all shift register stages are set to value "1".

## 2.5 Convolutional Coding

The process of convolution coding is applied at the output of each PN scrambler. The channel encoding process is based on punctured convolutional coding, which allows both equal and unequal error protection. Unequal error protection (UEP) is designed for audio services, equal error protection (EEP) for audio and data services. The sampling frequency is respectively 48 kHz and 24 kHz.

The convolutional coder is a punctured convolution code, based on a mother convolutional code with constraint length 7 and rate 1/4.

The generator polynomials are  $G_1=(1,0,1,1,0,1,1)$ ,  $G_2=(1,1,1,1,0,0,1)$ ,  $G_3=(1,1,0,0,1,0,1)$  and  $G_4=(1,0,1,1,0,1,1)$ .

To avoid the need for additional signaling overhead, the data in the FIC are encoded with fixed, equal channel coding, with a constant 1/3 coding rate.

The puncturing procedures applied for the coding in the MSC is a combination of protection profile and protection level. There are number of permissible protection profiles defined for each of the allowed bit rates. Each protection profile is associated with a protection level. Protection level 1 is the highest level within the same profile.

Error protection	Protection Profile	Bit rate	Protection Level	Code Rate
UEP	four different protection profiles	14 different bit rates	1, 2, 3, 4, 5	0,34..0,75 (64 different data rates - protection level combinations)
EEP	A	Multiples of 8 kbit/s	1-A	1/4
			2-A	3/8
			3-A	1/2
			4-A	3/4
	B	Multiples of 32 kbit/s	1-B	4/9
			2-B	4/7
			3-B	2/3
			4-B	4/5

## 2.6 Time Interleaving

Time interleaving is applied prior to block generation at the output of each convolutional encode contributing to the sub-channels in the MSC. It is not applied to the FIC.

The time interleaving process covers 16 CIFs, 24 ms each. This results in an overall processing delay of 384 ms.

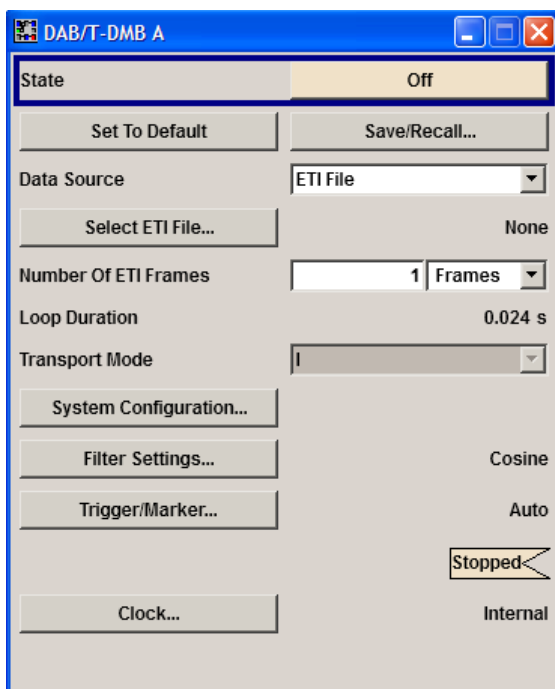
### 3 DAB/T-DMB User Interface



► To access the DAB dialog, select "Baseband > DAB/T-DMB".

#### 3.1 General Settings for DAB/T-DMB Signals

The dialog is split into three main sections for configuring the standard. The upper section is where the DAB digital standard is enabled and reset. In the "Data Source" section, the data source file and the ETI file can be selected and source file relevant parameters can be set. Further buttons open dialogs to configure the system and to set filter, trigger and clock parameters.



**State**

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

Remote command:

```
[ :SOURce<hw> ] :BB:DAB:STATe on page 33
```

**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 "Set to default"
Data Source	PN15
Transport Mode	I
Pseudo Noise Scrambler	On
Coder	On
Interleaver	On
Filter	Cosine
Sample Rate Variation	2.048 MHz
Trigger Mode	Auto
Marker Mode	Frame Start
Clock	Internal

Remote command:

[ :SOURce<hw> ] :BB:DAB:PRESet on page 31



**Save/Recall...**

Calls the Save/Recall menu.

From the "Save/Recall" menu, the "File Select" windows for saving and recalling "DAB" configurations and the "File Manager" is called.

DAB configurations are stored as files with the predefined file extension \* .DAB. The filename and the directory they are stored in are user-definable.

The complete settings in the "DAB" menu are saved and recalled.

"Recall DAB Setting"

Opens the "File Select" window for loading a saved DAB configuration.

The configuration of the selected (highlighted) file is loaded by pressing the "Select" button.

"Save DAB Setting"

Opens the "File Select" window for saving the current DAB signal configuration.

The name of the file is specified in the "Filename" entry field, the directory selected in the "save into" field. The file is saved by pressing the "Save" button.

"File Manager" Calls the "File Manager".

The "File Manager" is used to copy, delete, and rename files and to create directories.

Remote command:

[ :SOURce<hw> ] :BB:DAB:SETTing:CATalog? on page 31

[ :SOURce<hw> ] :BB:DAB:SETTing:LOAD on page 32

[ :SOURce<hw> ] :BB:DAB:SETTing:STORe on page 32

[ :SOURce<hw> ] :BB:DAB:SETTing:DELete on page 32

**Data Source**

Selects the data source to be used to generate the modulation signal.

- "All 0, All 1"      0 or 1 data is generated internally.
- "PN15, PN23"      PRBS data in accordance with the IUT-T with period lengths between  $(2^9-1)$  and  $(2^{23}-1)$  are internally generated.
- "ETI File"          Uses data from an ETI file. The ETI file can be selected via the [Select ETI File](#) button.

Remote command:

[ :SOURce<hw> ] :BB:DAB:DATA on page 29

**Select ETI File**

(Available if "Data Source" is set to "ETI File" only)

One of the following file types can be selected:

- "DAB ETI (\*.eti)"  
ETI (ensemble transport interface) files with extension \*.eti

**Note:**

The ETI File must fulfill the following prerequisites:

- ETI file compliant with ETI (NI, G.703)
- Frame duration 24 ms (48 KHz sampling rate)
- Constant multiplex configuration
- Same stream configuration of all the frames
- 15 streams maximum.

- "DAB Scrambled ETI (\*.xeti)"  
A scrambled ETI file is an encrypted ETI file with an extension \*.xeti.

- "DAB+ (K353) ETI (\*.dabp\_c)"  
R&S SMU, R&S SMJ, and R&S SMBV only  
The processing of DAB+ transport stream files (\*.dabp\_c) requires option R&S SMx-K353.

DAB+ transport files are provided on a DVD. To access these files, use one of the following:

- Transfer the \*.dabp\_c files to the instrument, e.g. use USB flash drive or USB HDD, connect it to the instrument and store the files on the instrument's disc in the `transfer` directory.
- Store the \*.dabp\_c files in a network directory, connect the instrument to the LAN and process the files from the network directory.

For detailed description of the available files, refer to the manual "DAB+ Streams" included in the delivery of the option.

"DAB (K354) ETI (\*.dab\_c)"

R&S SMU, R&S SMJ, and R&S SMBV only

The processing of T-DMB/DAB stream files (\*.dab\_c) requires option R&S SMx-K354.

DAB+ transport files are provided on a DVD. To access these files, use one of the options described above. For detailed description of the available files, refer to the manual "T-DMB/DAB Streams" included in the delivery of the option.

Remote command:

[ :SOURCE<hw> ] :BB:DAB:DATA:DSElection on page 30

#### Number of ETI Frames

This menu option is available only if the data source is set to ETI File. Enters the desired sequence length in form of frames.

Remote command:

[ :SOURCE<hw> ] :BB:DAB:EFRames on page 30

#### Loop Duration

This menu option is available only if the data source is set to ETI File. Displays the sequence length.

Remote command:

[ :SOURCE<hw> ] :BB:DAB:LDURation? on page 31

#### Transport Mode

Selects the transport mode. Selecting of transport mode is only enabled for data source other than ETI files. For ETI data source files, this field is read only. The transport mode is read from the ETI file.

Remote command:

[ :SOURCE<hw> ] :BB:DAB:DATA on page 29

[ :SOURCE<hw> ] :BB:DAB:TMODe on page 33

#### System Configuration...

Calls the "System Configuration" menu for configuring the DAB system.

The menu is described in [Chapter 3.2, "System Configuration"](#), on page 17.

Remote command:

n.a.

#### Filter ...

Calls the menu for setting baseband filtering. The current filter is displayed next to the button.

The menu is described in [Chapter 3.3, "Filter Settings"](#), on page 18

Remote command:

n.a.



**Trigger/Marker/Clock**

Accesses the dialog for selecting the trigger mode and trigger source, for configuring the marker signals and for selecting the clock source. This dialog is described in [Chapter 3.4, "Trigger/Marker/Clock Settings"](#), on page 19.

The currently selected trigger mode and trigger source are displayed next to the button.

Remote command:  
n.a.

**Execute Trigger**

Executes trigger manually.

You can execute the trigger manually only if you select an internal trigger source and a trigger mode other than "Auto".

Remote command:  
[\[:SOURCE<hw>\]:BB:DAB:TRIGger:EXECute](#) on page 38

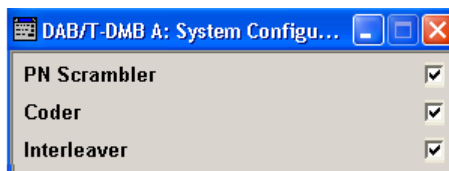
**Arm**

Stops the signal generation until subsequent trigger event occurs.

Remote command:  
[\[:SOURCE<hw>\]:BB:DAB:TRIGger:ARM:EXECute](#) on page 38

## 3.2 System Configuration

The "System Configuration" menu allows configuration of the DAB system.

**PN Scrambler**

Activates/deactivates the PN scrambling.

The data packets of the incoming transport stream are transformed to a Pseudo Random Binary Sequence (PRBS). The scrambling aims to obtain a bit sequence that has a positive effect on the transmitted RF spectrum. This feature is enabled for ETI data source files only.

Remote command:  
[\[:SOURCE<hw>\]:BB:DAB:PNScrambler\[:STATe\]](#) on page 34

**Coder**

If ETI data source files are used, activates/deactivates the coder. The coder applies a reed-solomon error correction code to the PRBS data stream.

If the convolutional encoder is switched off, the number of bits delivered from the coder in enabled state is fetched from the scrambler and therefore from data source. Data framing is not valid.

Remote command:

`[ :SOURce<hw> ] :BB:DAB:CODer [ :STATe ]` on page 34

### Interleaver

Activates/deactivates the convolutional interleaver.

This feature is enabled for ETI data source files only.

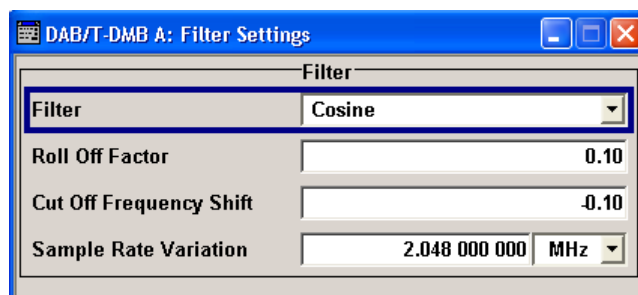
After turning on the standard, the MSC values are not valid during the first 16 CIFs, because of the time interleaver's depth.

Remote command:

`[ :SOURce<hw> ] :BB:DAB:ILEaver [ :STATe ]` on page 34

## 3.3 Filter Settings

- To access this dialog, select "Main Menu > Filter".



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

### Filter

Selects the baseband filter.

Remote command:

`[ :SOURce<hw> ] :BB:DAB:FILTer:TYPE` on page 35

### Rolloff Factor or BxT

Sets the filter parameter.

The filter parameter ("Folloff Factor" or "BxT") depends on the currently selected filter type. This parameter is preset to the default for each of the predefined filters.

Remote command:

`[ :SOURce<hw> ] :BB:DAB:FILTer:PARAMeter:APCO25` on page 35

`[ :SOURce<hw> ] :BB:DAB:FILTer:PARAMeter:COSine` on page 35

`[ :SOURce<hw> ] :BB:DAB:FILTer:PARAMeter:RCOSine` on page 37

`[ :SOURce<hw> ] :BB:DAB:FILTer:PARAMeter:PGAuss` on page 37

[ :SOURce<hw> ] :BB:DAB:FILTer:PARAmeter:GAUSs on page 36

[ :SOURce<hw> ] :BB:DAB:FILTer:PARAmeter:SPHase on page 37

### Cutoff Frequency Shift

Sets the value for the cutoff frequency shift. The cutoff frequency of the cosine filter can be adjusted to reach spectrum mask requirements.

Remote command:

[ :SOURce<hw> ] :BB:DAB:FILTer:PARAmeter:COsine:COFS on page 36

### Cutoff Frequency Factor

Sets the value for the cutoff frequency factor. The cutoff frequency of the filter can be adjusted to reach spectrum mask requirements.

Remote command:

[ :SOURce<hw> ] :BB:DAB:FILTer:PARAmeter:LPASs on page 36

[ :SOURce<hw> ] :BB:DAB:FILTer:PARAmeter:LPASSEVM on page 36

### Sample Rate Variation

Sets the sample rate of the signal.

A variation of this parameter only affects the ARB clock rate; all other signal parameters remain unchanged.

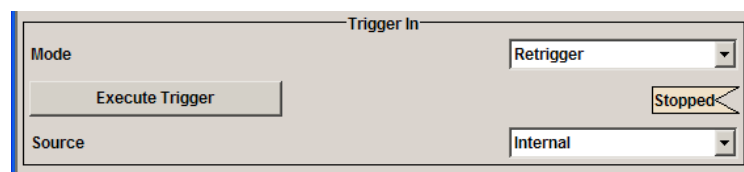
Remote command:

[ :SOURce<hw> ] :BB:DAB:SRATe:VARiatiOn on page 37

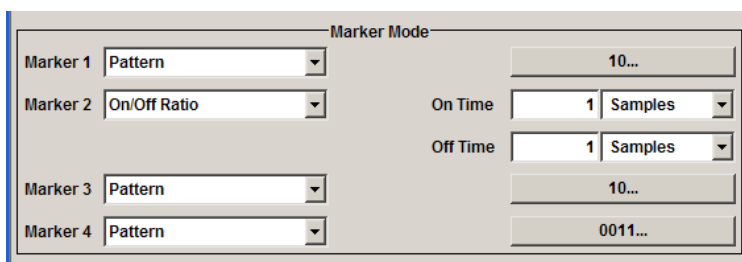
## 3.4 Trigger/Marker/Clock Settings

To access this dialog, select "Main Menu > Trigger/Marker".

The "Trigger In" section is where the trigger for the signal is set. Various parameters are provided for the settings, depending on which trigger source - internal or external - is selected. The status of signal generation ("Running" or "Stopped") is indicated for all trigger modes.

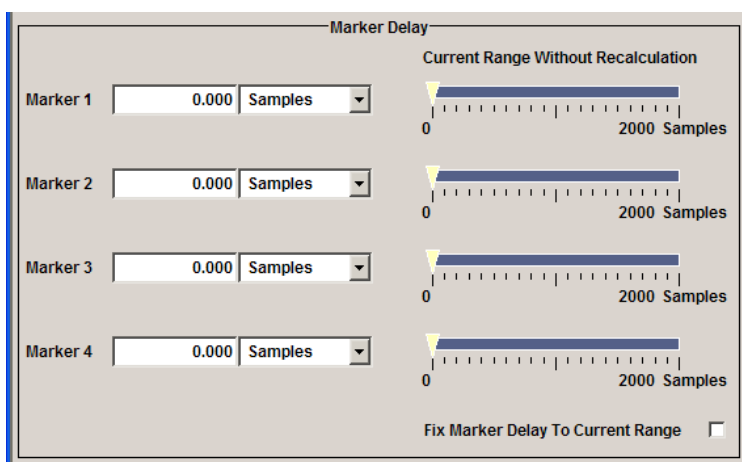


The "Marker Mode" section is where the marker signals at the MARKER output connectors are configured.

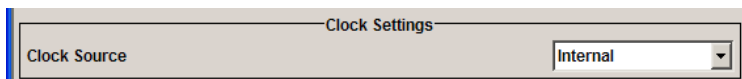


The "Marker" tab is where the marker signals at the MARKER output connectors are configured.

The "Marker Delay" section is where a marker signal delay can be defined.



The "Clock Settings" section is where the clock source is selected and - in the case of an external source - the clock type.



The buttons in the last section lead to submenu for general trigger, clock and mapping settings.



### 3.4.1 Trigger In

The "Trigger In" section is where the trigger for the signal is set. Various parameters are provided for the settings, depending on which trigger source - internal or external - is selected. The status of signal generation ("Running" or "Stopped") is indicated for all trigger modes.

**Trigger Mode**

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

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

Remote command:

[\[:SOURce<hw>\]:BB:DAB\[:TRIGger\]:SEQuence](#) on page 41

**Signal Duration**

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

It is possible to output deliberately just part of the signal, an exact sequence of the signal, or a defined number of repetitions of the signal.

Remote command:

[\[:SOURce<hw>\]:BB:DAB:TRIGger:SLENgth](#) on page 40

**Running/Stopped**

With enabled modulation, displays the status of signal generation for all trigger modes.

- "Running"  
The signal is generated; a trigger was (internally or externally) initiated in triggered mode.
- "Stopped"  
The signal is not generated and the instrument waits for a trigger event.

Remote command:

[\[:SOURce<hw>\]:BB:DAB:TRIGger:RMODe?](#) on page 39

**Arm**

Stops the signal generation until subsequent trigger event occurs.

Remote command:

[\[:SOURce<hw>\]:BB:DAB:TRIGger:ARM:EXECute](#) on page 38

**Execute Trigger**

Executes trigger manually.

You can execute the trigger manually only if you select an internal trigger source and a trigger mode other than "Auto".

Remote command:

[ :SOURce<hw> ] :BB:DAB:TRIGger:EXECute on page 38

**Trigger Source**

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

- "Internal"  
The trigger event is executed by "Execute Trigger".
- "Internal (Baseband A/B)"  
(two-path instruments)  
The trigger event is the trigger signal from the second path
- "External (Trigger 1/2)"  
The trigger event is the active edge of an external trigger signal, supplied at the TRIGGER 1/2 connector.  
Use the "Global Trigger/Clock Settings" dialog to define the polarity, the trigger threshold and the input impedance of the trigger signal.

Remote command:

[ :SOURce<hw> ] :BB:DAB:TRIGger:SOURce on page 40

**Sync. Output to External Trigger**

(enabled for external trigger)

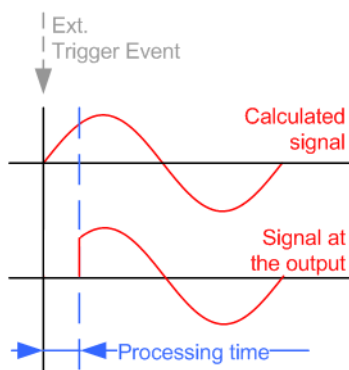
Enables/disables output of the signal synchronous to the external trigger event.

For or two or more R&S SMBVs configured to work in a master-slave mode for synchronous signal generation, configure this parameter depending on the provided system trigger event and the properties of the output signal. See the table below for an overview of the required settings.

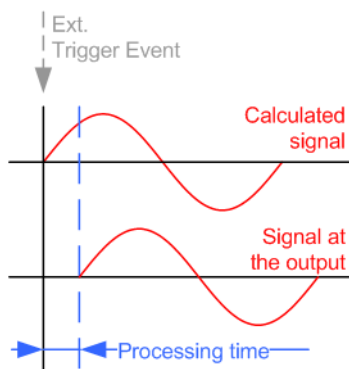
**Table 3-1: Typical applications**

System trigger	Application	"Sync. Output to External Trigger"
Common External Trigger event for the master and the slave instruments	All instruments are synchronous to the external trigger event	On
	All instruments are synchronous among themselves but starting the signal from first symbol is more important than synchronicity with external trigger event	Off
Internal trigger signal of the master R&S SMBV for the slave instruments	All instruments are synchronous among themselves	Off

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



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



Remote command:  
[\[:SOURce<hw>\]:BB:DAB:TRIGger:EXTernal:SYNChronize:OUTPut](#)  
 on page 38

**Trigger Delay**

Enters the length of the signal sequence to be output in the "Single" trigger mode. Use this parameter to output part of the signal deliberately, an exact sequence of the signal, or a defined number of repetitions of the signal.

Remote command:  
[\[:SOURce<hw>\]:BB:DAB:TRIGger\[:EXTernal<ch>\]:DELay](#) on page 40  
[\[:SOURce<hw>\]:BB:DAB:TRIGger:OBASeband:DELay](#) on page 39

**Trigger Inhibit**

Sets the duration for inhibiting a new trigger event subsequent to triggering. The input is to be expressed in samples.

In the "Retrigger" mode, every trigger signal causes signal generation to restart. This restart is inhibited for the specified number of samples.

This parameter is only available on external triggering or on internal triggering via the second path.

For two-path instruments, the trigger inhibit can be set separately for each of the two paths.

Remote command:

[\[:SOURce<hw>\]:BB:DAB:TRIGger\[:EXTeRnal<ch>\]:INHibit](#) on page 40

[\[:SOURce<hw>\]:BB:DAB:TRIGger:OBASeband:INHibit](#) on page 39

**3.4.2 Marker Mode**

The marker output signal for synchronizing external instruments is configured in the marker settings section "Marker Mode".

The R&S SMBV supports only two markers.

**Marker Mode**

Selects a marker signal for the associated MARKER output.

"Restart" A marker signal is generated at the start of each ARB sequence.

"Frame Start" A marker signal is generated at the start of each frame.

"Pulse" A regular marker signal is generated. The pulse frequency is defined by entering a divider. The frequency is derived by dividing the sample rate by the divider. The input box for the divider opens when "Pulse" is selected, and the resulting pulse frequency is displayed below it.

Remote command:

[\[:SOURce<hw>\]:BB:DAB:TRIGger:OUTPut<ch>:PULSe:DIVider](#) on page 44

[\[:SOURce<hw>\]:BB:DAB:TRIGger:OUTPut<ch>:PULSe:FREQuency?](#)

on page 44

"Pattern" A marker signal that is defined by a bit pattern is generated. The pattern has a maximum length of 32 bits and is defined in an input field which opens when pattern is selected.

Remote command:

[\[:SOURce<hw>\]:BB:DAB:TRIGger:OUTPut<ch>:PATTeRn](#) on page 43

"ON/OFF Ratio" A regular marker signal that is defined by an on/off ratio is generated. A period lasts one on and off cycle.



Remote command:

[\[:SOURce<hw>\]:BB:DAB:TRIGger:OUTPut<ch>:ONTime](#) on page 43

[\[:SOURce<hw>\]:BB:DAB:TRIGger:OUTPut<ch>:OFFTime](#) on page 43



Remote command:

[\[:SOURce<hw>\]:BB:DAB:TRIGger:OUTPut<ch>:MODE](#) on page 42

### 3.4.3 Marker Delay

The delay of the signals on the MARKER outputs is set in the "Marker Delay" section.

The R&S SMBV supports only two markers.

#### Marker x Delay

Enters the delay between the marker signal at the marker outputs and the start of the signal.

If the setting "Fix marker delay to dynamic range" is enabled, the setting range is restricted to the dynamic range. In this range, the delay of the marker signals can be set without restarting the marker and signal.

Remote command:

[\[:SOURce<hw>\]:BB:DAB:TRIGger:OUTPut<ch>:DELaY](#) on page 42

#### Current Range without Recalculation

Displays the dynamic range within which the delay of the marker signals can be set without restarting the marker and signal.

The delay can be defined by moving the setting mark.

Remote command:

[\[:SOURce<hw>\]:BB:DAB:TRIGger:OUTPut<ch>:DELaY:MINimum?](#) on page 42

[\[:SOURce<hw>\]:BB:DAB:TRIGger:OUTPut<ch>:DELaY:MAXimum?](#) on page 42

#### Fix marker delay to current range

Restricts the marker delay setting range to the dynamic range. In this range, the delay can be set without restarting the marker and signal.

Remote command:

[\[:SOURce<hw>\]:BB:DAB:TRIGger:OUTPut:DELaY:FIXed](#) on page 41

### 3.4.4 Clock Settings

The clock settings are used to set the clock source and a delay if necessary.

#### Sync. Mode

(for R&S SMBV only)

Selects the synchronization mode.

This parameter is used to enable generation of precise synchronous signals of several connected R&S SMBVs.

**Note:** If several instruments are connected, the connecting cables from the master instrument to the slave one and between each two consecutive slave instruments must have the same length and type. Avoid unnecessary cable length and branching points.

- "None"

The instrument is working in standalone mode.

- "Sync. Master"  
The instrument provides all connected instruments with its synchronization and reference clock signal, also including the trigger signal.
- "Sync. Slave"  
The instrument receives the synchronization and reference clock signal from another instrument working in a master mode.

Remote command:

`[ :SOURce<hw> ] :BB:DAB:CLOCK:SYNChronization:MODE` on page 46

### Set Synchronization Settings

(for R&S SMBV only)

Adjusts the instrument's settings required for the selected synchronization mode.

Remote command:

`[ :SOURce<hw> ] :BB:DAB:CLOCK:SYNChronization:EXECute` on page 46

### Clock Source

Selects the clock source.

- "Internal"  
The instrument uses its internal clock reference.
- "External"  
The instrument expects an external clock reference at the CLOCK connector.  
The symbol rate must be correctly set to the accuracy specified in the data sheet.  
To change the polarity of the clock input, use the "Global Trigger/Clock Settings".  
In the case of two-path instruments, this selection applies to path A.

Remote command:

`[ :SOURce<hw> ] :BB:DAB:CLOCK:SOURce` on page 46

### Clock Mode

Enters the type of externally supplied clock.

"Sample"            A sample clock is supplied via the CLOCK connector.

"Multiple Sam-    A multiple of the sample clock is supplied via the CLOCK connector.  
ple"                The sample clock is derived internally from it.

Remote command:

`[ :SOURce<hw> ] :BB:DAB:CLOCK:MODE` on page 45

### Clock Multiplier

Enters the multiplication factor for clock type "Multiple".

Remote command:

`[ :SOURce<hw> ] :BB:DAB:CLOCK:MULTIplier` on page 45

### Measured External Clock

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

Remote command:

`CLOCK:INPut:FREQuency?`

### 3.4.5 Global Settings

The buttons in this section lead to dialogs for general trigger, clock and mapping settings.

#### **Global Trigger/Clock Settings**

Calls the "Global Trigger/Clock/Input Settings" dialog.

This dialog is used among other things for setting the trigger threshold, the input impedance and the polarity of the clock and trigger inputs.

The parameters in this dialog affect all digital modulations and standards, and are described in chapter "Global Trigger/Clock/Input Settings" in the Operating Manual.

#### **User Marker / AUX I/O Settings**

Calls the "User Marker AUX I/O Settings" dialog, used to map the connector on the rear of the instruments.

See also "User Marker / AUX I/O Settings" in the Operating Manual.

## 4 Remote-control commands

The following commands are required to perform signal generation with the DAB/T-DMB options in a remote environment. We assume that the R&S Signal Generator has already been set up for remote operation in a network as described in the R&S Signal Generator 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 Signal Generator operating manual.

### Common suffixes

The following common suffixes are used in remote commands:

Suffix	Value range	Description
SOURce<hw>	[1] 2	available baseband signals
OUTPut<ch>	1 .. 4	available markers R&S SMBV supports two markers
EXTernal<ch>	1 2	external trigger connectors

### Placeholder <root>

For commands that read out or save files in the default directory, the default directory is set using command `MMEM:CDIRECTory`. The examples in this description use the place holder `<root>` in the syntax of the command.

- `D:\` - for selecting the internal hard disk of a Windows instrument
- `E:\` - for selecting the memory stick which is inserted at the USB interface of a Windows instrument
- `/var/user/` - for selecting the internal flash card of a Linux instrument
- `/usb/` - for selecting the memory stick which is inserted at the USB interface of a Linux instrument.



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

In particular, this includes:

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

For a description of such tasks, see the R&S Signal Generator operating manual.

The following commands specific to the DAB/T-DMB are described here:

## 4.1 General Commands

This subsystem contains commands for the primary and general settings of the DAB standard.

The commands for setting the system configuration and the TPS parameter bits are described in [Chapter 4.2, "System Configuration"](#), on page 34.

<code>[:SOURce&lt;hw&gt;]:BB:DAB:DATA</code> .....	29
<code>[:SOURce&lt;hw&gt;]:BB:DAB:DATA:DSELECTION</code> .....	30
<code>[:SOURce&lt;hw&gt;]:BB:DAB:EFRAMES</code> .....	30
<code>[:SOURce&lt;hw&gt;]:BB:DAB:ETI:CATALOG?</code> .....	31
<code>[:SOURce&lt;hw&gt;]:BB:DAB:LDURATION?</code> .....	31
<code>[:SOURce&lt;hw&gt;]:BB:DAB:PRESET</code> .....	31
<code>[:SOURce&lt;hw&gt;]:BB:DAB:SETTING:CATALOG?</code> .....	31
<code>[:SOURce&lt;hw&gt;]:BB:DAB:SETTING:DELETE</code> .....	32
<code>[:SOURce&lt;hw&gt;]:BB:DAB:SETTING:LOAD</code> .....	32
<code>[:SOURce&lt;hw&gt;]:BB:DAB:SETTING:STORE</code> .....	32
<code>[:SOURce&lt;hw&gt;]:BB:DAB:SETTING:STORE:FAST</code> .....	33
<code>[:SOURce&lt;hw&gt;]:BB:DAB:STATE</code> .....	33
<code>[:SOURce&lt;hw&gt;]:BB:DAB:TMODE</code> .....	33

---

**`[:SOURce<hw>]:BB:DAB:DATA <Data>`**

Sets the data source.

**Parameters:**

<Data> ALL0 | ALL1 | PN15 | PN23 | ETI  
**ALL0, ALL1**  
 0 or 1 data is generated internally.  
**PN15, PN23**  
 PRBS data in accordance with the IUT-T  
**ETI**  
 Uses data from an ETI file.  
 A file with extension \*.eti must exist.  
 \*RST: PN15

**Example:** BB:DAB:DATA PN15

**Manual operation:** See ["Data Source"](#) on page 15

**[:SOURCE<hw>]:BB:DAB:DATA:DSELECTION <DSelection>**

Selects an existing data list file from the default directory or from the specific directory.  
 For a detailed description on the available types, refer to ["Select ETI File"](#) on page 15.

**Parameters:**

<DSelection> string  
 Filename incl. file extension or complete file path

**Example:**

```
MMEM:CDIR '<root>DAB'
BB:DAB:DATA ETI
BB:DAB:DATA:DSEL 'test.eti'
```

Selects the file `test.eti` as the data source.

This file must be in the directory `<root>DAB` and have the file extension \*.eti.

**Manual operation:** See ["Select ETI File"](#) on page 15

**[:SOURCE<hw>]:BB:DAB:EFRAMES <EFrames>**

If ETI data source files are used, this command sets the sequence length in form of ETI frames.

The allowed minimum value of this parameter depends on the transport mode of the ETI file. For example, for transport mode I with 96 ms transmission frame duration, minimum 4 frames must be selected.

**Parameters:**

<EFrames> float  
 Range: 1 to 10000

**Example:**

```
BB:DAB:DATA ETI
BB:DAB:DATA:DSEL 'test.eti'
BB:DAB:EFR 50
```

**Manual operation:** See ["Number of ETI Frames"](#) on page 16

**[ :SOURce<hw>]:BB:DAB:ETI:CATalog?**

Queries the files with ETI settings in the default directory. Listed are files with the file extension \*.eti.

For general information on file handling in the default and in a specific directory, see section "MMEMory Subsystem" in the R&S SMx/AMU operating manual.

**Return values:**

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

**Example:**

```
MMEM:CDIR '<root>DAB'
BB:DAB:ETI:CAT?
Response: 'test.eti','dab.eti'
```

**Usage:** Query only

**[ :SOURce<hw>]:BB:DAB:LDURation?**

Queries the sequence length of ETI file (loop duration).

**Return values:**

<Lduration> float

**Example:**

```
BB:DAB:LDUR?
```

**Usage:** Query only

**Manual operation:** See "[Loop Duration](#)" on page 16

**[ :SOURce<hw>]:BB:DAB:PRESet**

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

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

**Example:**

```
SOURce1:BB:DAB:PRESet
```

**Usage:** Event

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

**[ :SOURce<hw>]:BB:DAB:SETTing:CATalog?**

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

For general information on file handling in the default and in a specific directory, see section "MMEMory Subsystem" in the R&S SMx/AMU operating manual.

**Return values:**

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

**Example:**

```
MMEM:CDIR '<root>DAB'
BB:DAB:SETT:CAT?
// Response: 'DAB_1','DAB_2'
BB:DAB:SETT:DEL 'DAB_2'
BB:DAB:SETT:LOAD "DAB_1"
BB:DAB:SETT:STOR "DAB"
```

**Usage:** Query only

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

**[ :SOURce<hw>]:BB:DAB:SETTing:DELEte <File>**

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

**Setting parameters:**

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

**Example:** See [\[:SOURce<hw>\]:BB:DAB:SETTing:CATalog?](#) on page 31

**Usage:** Setting only

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

**[ :SOURce<hw>]:BB:DAB:SETTing:LOAD <Load>**

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

**Setting parameters:**

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

**Example:** See [\[:SOURce<hw>\]:BB:DAB:SETTing:CATalog?](#) on page 31

**Usage:** Setting only

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

**[ :SOURce<hw>]:BB:DAB:SETTing:STORe <Store>**

Stores the current settings into the selected file; the file extension (\*.dab) is assigned automatically.

**Setting parameters:**

<Store> string  
Filename or complete file path



- Example:** See [\[:SOURce<hw>\]:BB:DAB:SETTING:CATalog?](#) on page 31
- Usage:** Setting only
- Manual operation:** See ["Save/Recall..."](#) on page 14

#### **[:SOURce<hw>]:BB:DAB:SETTING:STORe:FAST <Fast>**

Determines whether the instrument performs an absolute or a differential storing of the settings.

Enable this function to accelerate the saving process by saving only the settings with values different to the default ones.

**Note:** This function is not affected by the "Preset" function.

**Parameters:**

<Fast>                    0 | 1 | OFF | ON  
 \*RST:                    1

#### **[:SOURce<hw>]:BB:DAB:STATe <State>**

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

**Parameters:**

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

**Example:**                SOURce1:BB:DAB:STATe ON

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

#### **[:SOURce<hw>]:BB:DAB:TMODe <Tmode>**

Selects the transport mode. Depending on the transport mode selected, signal with different sequence length is generated.

For ETI data source, the transport mode is read from the ETI file. This command is query only.

**Parameters:**

<Tmode>                    I | II | III | IV  
 \*RST:                    I

**Example:**                BB:DAB:DATA PN15  
 BB:DAB:TMOD II

**Manual operation:** See ["Transport Mode"](#) on page 16

## 4.2 System Configuration

<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:CODer[:STATe]</a> .....	34
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:ILEaver[:STATe]</a> .....	34
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:PNScrambler[:STATe]</a> .....	34

---

### **[:SOURce<hw>]:BB:DAB:CODer[:STATe] <State>**

For ETI data source, activates/deactivates the coder.

#### **Parameters:**

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

**Example:**            BB:DAB:CODer:STATe OFF

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

---

### **[:SOURce<hw>]:BB:DAB:ILEaver[:STATe] <State>**

For ETI data source, activates/deactivates the interleaver.

#### **Parameters:**

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

**Example:**            BB:DAB:ILE:STAT ON

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

---

### **[:SOURce<hw>]:BB:DAB:PNScrambler[:STATe] <State>**

For ETI data source, activates/deactivates the PN scrambler.

#### **Parameters:**

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

**Example:**            BB:DAB:PNSc:STAT ON

**Manual operation:** See "[PN Scrambler](#)" on page 17

## 4.3 Filter Settings

<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:FILTer:TYPE</a> .....	35
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:FILTer:PARAmeter:APCO25</a> .....	35
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:FILTer:PARAmeter:COSSine</a> .....	35
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:FILTer:PARAmeter:COSSine:COFS</a> .....	36
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:FILTer:PARAmeter:GAUSS</a> .....	36
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:FILTer:PARAmeter:LPASS</a> .....	36

<code>[:SOURce&lt;hw&gt;]:BB:DAB:FILTer:PARAmeter:LPASSEVM</code> .....	36
<code>[:SOURce&lt;hw&gt;]:BB:DAB:FILTer:PARAmeter:PGAuss</code> .....	37
<code>[:SOURce&lt;hw&gt;]:BB:DAB:FILTer:PARAmeter:RCOSine</code> .....	37
<code>[:SOURce&lt;hw&gt;]:BB:DAB:FILTer:PARAmeter:SPHase</code> .....	37
<code>[:SOURce&lt;hw&gt;]:BB:DAB:SRATe:VARiation</code> .....	37

---

### `[:SOURce<hw>]:BB:DAB:FILTer:TYPE <Type>`

Selects the filter type.

#### Parameters:

<Type>                   RCOSine | COSine | GAUSSs | LGAuss | CONE | COF705 |  
 COEQUALizer | COFEQUALizer | C2K3x | APCO25 | SPHase |  
 RECTangle | PGAuss | LPASs | DIRac | ENPShape |  
 EWPSHape | LPASSEVM  
 \*RST:               GAUSSs (if layer mode OFDM), COSine (if layer  
 mode CCK or PBCC)

**Example:**               `BB:DAB:FILT:TYPE RCOS`

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

---

### `[:SOURce<hw>]:BB:DAB:FILTer:PARAmeter:APCO25 <Apco25>`

Sets the rolloff factor for filter type APCO25.

#### Parameters:

<Apco25>               float  
 Range:               0.05 to 0.99  
 Increment:           0.01  
 \*RST:               0.2

**Example:**               `BB:DAB:FILT:PAR:APCO25 0.2`

**Manual operation:**   See "[Rolloff Factor or BxT](#)" on page 18

---

### `[:SOURce<hw>]:BB:DAB:FILTer:PARAmeter:COSine <Cosine>`

Sets the rolloff factor for the cosine filter type.

#### Parameters:

<Cosine>               float  
 Range:               0 to 1  
 Increment:           0.01  
 \*RST:               0.1

**Example:**               `BB:DAB:FILT:PAR:COS 0.35`

**Manual operation:**   See "[Rolloff Factor or BxT](#)" on page 18

---

**[:SOURce<hw>]:BB:DAB:FILTer:PARAmeter:COsine:COFS <Cofs>**

Sets the cutoff frequency shift value for the cosine filter type.

**Parameters:**

<Cofs> float  
 Range: -1 to 1  
 Increment: 0.01  
 \*RST: -0.1

**Example:** BB:DAB:FILT:PAR:COs:COFS 0.35

**Manual operation:** See "[Cutoff Frequency Shift](#)" on page 19

---

**[:SOURce<hw>]:BB:DAB:FILTer:PARAmeter:GAUSs <Gauss>**

Sets the BxT for the gauss filter type.

**Parameters:**

<Gauss> float  
 Range: 0.15 to 2.5  
 Increment: 0.01  
 \*RST: 0.5

**Example:** BB:DAB:FILT:PAR:GAUS 0.5

**Manual operation:** See "[Rolloff Factor or BxT](#)" on page 18

---

**[:SOURce<hw>]:BB:DAB:FILTer:PARAmeter:LPASs <LPass>**

Sets the cutoff frequency factor for the lowpass filter (ACP opt) type.

**Parameters:**

<LPass> float  
 Range: 0.05 to 2.0  
 Increment: 0.01  
 \*RST: 0.5

**Example:** BB:DAB:FILT:PAR:LPAS 0.5

**Manual operation:** See "[Cutoff Frequency Factor](#)" on page 19

---

**[:SOURce<hw>]:BB:DAB:FILTer:PARAmeter:LPASSEVM <LPassevm>**

Sets the cutoff frequency factor for the lowpass filter (EVM opt) type.

**Parameters:**

<LPassevm> float  
 Range: 0.05 to 2.0  
 Increment: 0.01  
 \*RST: 0.5

**Example:** BB:DAB:FILT:PAR:LPASSEVM 0.5

**Manual operation:** See ["Cutoff Frequency Factor"](#) on page 19

**[:SOURce<hw>]:BB:DAB:FILTer:PARAmeter:PGAuss <PGauss>**

Sets the BxT for the pure gauss filter type.

**Parameters:**

<PGauss>	float
Range:	0.15 to 2.5
Increment:	0.01
*RST:	0.5

**Example:** BB:DAB:FILT:PAR:GAUS 0.5

**Manual operation:** See ["Rolloff Factor or BxT"](#) on page 18

**[:SOURce<hw>]:BB:DAB:FILTer:PARAmeter:RCOSine <RCosine>**

Sets the rolloff factor for the root cosine filter type.

**Parameters:**

<RCosine>	float
Range:	0 to 1
Increment:	0.01
*RST:	0.22

**Example:** BB:DAB:FILT:PAR:RCOS 0.22

**Manual operation:** See ["Rolloff Factor or BxT"](#) on page 18

**[:SOURce<hw>]:BB:DAB:FILTer:PARAmeter:SPHase <SPHase>**

Sets the BxT for the split phase filter type.

**Parameters:**

<SPHase>	float
Range:	0.15 to 2.5
Increment:	0.01
*RST:	2

**Example:** BB:DAB:FILT:PAR:SPH 0.5

**Manual operation:** See ["Rolloff Factor or BxT"](#) on page 18

**[:SOURce<hw>]:BB:DAB:SRATe:VARiAtion <Variation>**

Enters the output sample rate.

A variation of this parameter only affects the ARB clock rate, all other signal parameters remain unchanged. If the sampling rate in the frame configuration menu is changed, this parameter is reset to the chosen sampling rate.

**Parameters:**

<Variation> float  
 Range: 4E2 to 3E6  
 Increment: 0.001  
 \*RST: 2.048E6

**Example:** BB:DAB:SRAT:VAR 40 MHz

**Manual operation:** See "[Sample Rate Variation](#)" on page 19

## 4.4 Trigger Settings

<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:ARM:EXECute</a> .....	38
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:EXECute</a> .....	38
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:EXTernal:SYNChronize:OUTPut</a> .....	38
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:OBASeband:DELay</a> .....	39
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:OBASeband:INHibit</a> .....	39
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:RMODE?</a> .....	39
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:SLENgth</a> .....	40
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:SOURce</a> .....	40
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger[:EXTernal&lt;ch&gt;]:DELay</a> .....	40
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger[:EXTernal&lt;ch&gt;]:INHibit</a> .....	40
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB[:TRIGger]:SEQUence</a> .....	41

---

### **[:SOURce<hw>]:BB:DAB:TRIGger:ARM:EXECute**

Stops signal generation; a subsequent trigger event restarts signal generation.

**Example:** BB:DAB:TRIG:ARM:EXEC

**Usage:** Event

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

---

### **[:SOURce<hw>]:BB:DAB:TRIGger:EXECute**

Executes a trigger.

**Example:** BB:DAB:TRIG:SOUR INT  
 BB:DAB:TRIG:SEQ RETR  
 BB:DAB:TRIG:EXEC

**Usage:** Event

**Manual operation:** See "[Execute Trigger](#)" on page 17

---

### **[:SOURce<hw>]:BB:DAB:TRIGger:EXTernal:SYNChronize:OUTPut <Output>**

Enables/disables output of the signal synchronous to the external trigger event.

**Parameters:**

<Output> 0 | 1 | OFF | ON  
 \*RST: 1

**Example:**

```
BB:DAB:TRIG:SOUR EXT
BB:DAB:TRIG:EXT:SYNC:OUTP ON
```

**Manual operation:** See ["Sync. Output to External Trigger"](#) on page 22

**[:SOURce<hw>]:BB:DAB:TRIGger:OBASband:DELay <Delay>**

Specifies the trigger delay (expressed as a number of samples) for external triggering.

**Parameters:**

<Delay> float  
 Range: 0 to 65535  
 \*RST: 0

**Example:**

```
BB:DAB:TRIG:SOUR OBAS
BB:DAB:TRIG:DEL 50
```

**Manual operation:** See ["Trigger Delay"](#) on page 23

**[:SOURce<hw>]:BB:DAB:TRIGger:OBASband:INHibit <Inhibit>**

For triggering via the other path, specifies the duration by which a restart is inhibited.

**Parameters:**

<Inhibit> integer  
 Range: 0 to 67108863  
 \*RST: 0

**Example:**

```
BB:DAB:TRIG:SOUR OBAS
BB:DAB:TRIG:INH 200
```

**Manual operation:** See ["Trigger Inhibit"](#) on page 24

**[:SOURce<hw>]:BB:DAB:TRIGger:RMODe?**

Queries the signal generation status.

**Return values:**

<Rmode> STOP | RUN

**Example:**

```
BB:DAB:TRIG:SOUR EXT
BB:DAB:TRIG:MODE ARET
BB:DAB:TRIG:RMOD?
Response: RUN
```

**Usage:** Query only

**Manual operation:** See ["Running/Stopped"](#) on page 21

---

**[:SOURce<hw>]:BB:DAB:TRIGger:SLENgth <SLength>**

Defines the length of the signal sequence that is output in the `SINGLE` trigger mode.

**Parameters:**

<SLength>            integer  
                          Range:     1 to 10000  
                          \*RST:     1

**Example:**            SOURce1:BB:DAB:TRIGger:SEquence SING  
                          SOURce1:BB:DAB:TRIGger:SLENgth 200

**Manual operation:** See "[Signal Duration](#)" on page 21

---

**[:SOURce<hw>]:BB:DAB:TRIGger:SOURce <Source>**

Selects the trigger source:

- `INTernal`: manual trigger or \*TRG.
- `EXTernal|BEXTernal`: trigger signal on the TRIGGER 1/2 connector.
- `OBASeband`: trigger signal from the other path

**Parameters:**

<Source>            INTernal|OBASeband|BEXTernal|EXTernal  
                          \*RST:     INTernal

**Example:**            SOURce1:BB:DAB:TRIGger:SOURce EXTernal  
                          Sets external triggering via the TRIGGER 1 connector.

**Manual operation:** See "[Trigger Source](#)" on page 22

---

**[:SOURce<hw>]:BB:DAB:TRIGger[:EXTernal<ch>]:DELay <Delay>**

Specifies the trigger delay (expressed as a number of samples) for external triggering.

**Parameters:**

<Delay>            float  
                          Range:     0.0 to 65535.0  
                          Increment: 0.01  
                          \*RST:     0.0

**Example:**            BB:DAB:TRIG:SOUR EXT  
                          BB:DAB:TRIG:DEL 50

**Manual operation:** See "[Trigger Delay](#)" on page 23

---

**[:SOURce<hw>]:BB:DAB:TRIGger[:EXTernal<ch>]:INHibit <Inhibit>**

Specifies the number of samples by which a restart is to be inhibited following a trigger event. This command applies only in the case of external triggering.



**Parameters:**

<Inhibit> integer  
 Range: 0 to 67108863  
 \*RST: 0

**Example:**

BB:DAB:TRIG:SOUR EXT1  
 BB:DAB:TRIG:INH 200

**Manual operation:** See ["Trigger Inhibit"](#) on page 24

**[:SOURce<hw>]:BB:DAB[:TRIGger]:SEQUence <Sequence>**

Selects the trigger mode:

- AUTO = auto
- RETRigger = retrigger
- AAUTO = armed auto
- ARETrigger = armed retrigger
- SINGLE = single

**Parameters:**

<Sequence> AUTO | RETRigger | AAUTO | ARETrigger | SINGLE  
 \*RST: AUTO

**Example:**

BB:DAB:SEQ AAUT

**Manual operation:** See ["Trigger Mode"](#) on page 21

## 4.5 Marker Settings

<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:OUTPut:DELay:FIXed</a> .....	41
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:OUTPut&lt;ch&gt;:DELay</a> .....	42
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:OUTPut&lt;ch&gt;:DELay:MAXimum?</a> .....	42
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:OUTPut&lt;ch&gt;:DELay:MINimum?</a> .....	42
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:OUTPut&lt;ch&gt;:MODE</a> .....	42
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:OUTPut&lt;ch&gt;:OFFTime</a> .....	43
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:OUTPut&lt;ch&gt;:ONTime</a> .....	43
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:OUTPut&lt;ch&gt;:PATTern</a> .....	43
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:OUTPut&lt;ch&gt;:PULSe:DIVider</a> .....	44
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:OUTPut&lt;ch&gt;:PULSe:FREQUency?</a> .....	44

**[:SOURce<hw>]:BB:DAB:TRIGger:OUTPut:DELay:FIXed <Fixed>**

Restricts the marker delay setting range to the dynamic range.

**Parameters:**

<Fixed> 0 | 1 | OFF | ON  
 \*RST: 0

**Example:**

```
SOURce1:BB:DAB:TRIGger:OUTPut:DElay:FIXed 1
// restricts the marker signal delay
SOURce1:BB:DAB:TRIGger:OUTPut:DElay:MINimum?
// 0
SOURce1:BB:DAB:TRIGger:OUTPut:DElay:MAXimum?
// 2000
SOURce1:BB:DAB:TRIGger:OUTPut:DElay 1600
// delays the marker signal output
```

**Manual operation:** See ["Fix marker delay to current range"](#) on page 25

**[ :SOURce<hw>]:BB:DAB:TRIGger:OUTPut<ch>:DElay <Delay>**

Defines the delay between the signal on the marker outputs and the start of the signals.

**Parameters:**

<Delay> float  
 Range: 0 to  $2^{32}-1$ samples  
 \*RST: 0

**Example:** See [\[:SOURce<hw>\]:BB:DAB:TRIGger:OUTPut:DElay:FIXed](#) on page 41

**Manual operation:** See ["Marker x Delay"](#) on page 25

**[ :SOURce<hw>]:BB:DAB:TRIGger:OUTPut<ch>:DElay:MAXimum?**  
**[ :SOURce<hw>]:BB:DAB:TRIGger:OUTPut<ch>:DElay:MINimum?**

Queries the min/max marker delay.

**Return values:**

<Minimum> float  
 Range: 0 to max

**Example:** See [\[:SOURce<hw>\]:BB:DAB:TRIGger:OUTPut:DElay:FIXed](#) on page 41

**Usage:** Query only

**Manual operation:** See ["Current Range without Recalculation"](#) on page 25

**[ :SOURce<hw>]:BB:DAB:TRIGger:OUTPut<ch>:MODE <Mode>**

Defines the signal for the selected marker output.

**Parameters:**

<Mode> REStart | FRAMe | PULSe | PATTern | RATio | TRIGger

**REStart**

A marker signal is generated at the start of every sequence length loop. Restart mode is available only for ETI data source.

**FRAMe**

A marker signal is generated at the start of every frame.

**PULSe**

A marker pulse is generated continuously according to the frequency and frequency divider.

**PATTern**

A marker signal is generated according to the selected bit pattern. Each bit represents a sample and can be switched on or off.

**RATio**

A regular marker signal that is defined by an on/off ratio is generated. A period lasts one on and off cycle.

**TRIGger**

A received internal or external trigger signal is output at the marker connector.

\*RST: FRAMe

**Example:**

BB:DAB:TRIG:OUTP:MODE FRAME

**Manual operation:** See "[Marker Mode](#)" on page 24

**[ :SOURce<hw> ]:BB:DAB:TRIGger:OUTPut<ch>:OFFTime <OffTime>**

**[ :SOURce<hw> ]:BB:DAB:TRIGger:OUTPut<ch>:ONTime <OnTime>**

Sets the number of samples in a period (ON time + OFF time) during which the marker signal in setting `SOURce:BB:DAB:TRIGger:OUTPut:MODE RATio` on the marker outputs is ON.

**Parameters:**

<OnTime> integer

Range: 1 to 16777215

\*RST: 1

**Example:**

BB:DAB:TRIG:OUTP2:ONT 2000

sets an ON time of 2000 samples for marker 2.

**Manual operation:** See "[Marker Mode](#)" on page 24

**[ :SOURce<hw> ]:BB:DAB:TRIGger:OUTPut<ch>:PATTern <Pattern>**

Defines the bit pattern used to generate the marker signal.

**Parameters:**

<Pattern> 64 bits

**Example:** `BB:DAB:TRIG:OUTP:PATT #H39FE0000,32`  
sets the bit pattern.  
`BB:DAB:TRIG:OUTP:MODE PATT`  
activates the marker signal according to a bit pattern of the corresponding marker.

**Manual operation:** See "[Marker Mode](#)" on page 24

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

Sets the divider for the pulsed marker signal in the setting `SOURce:BB:DAB:TRIGger:OUTPut:MODE PULSe`. The pulse frequency is derived by dividing the symbol rate by the divider.

**Parameters:**

<Divider> integer  
Range: 2 to 1024  
\*RST: 2

**Example:** `BB:DAB:TRIG:OUTP2:PULS:DIV 2`  
sets the divider for corresponding marker signal to the value 2.  
`BB:DAB:TRIG:OUTP2:FREQ?`  
queries the resulting pulse frequency of the marker signal.  
Response:  
66 000  
the resulting pulse frequency is 66kHz.

**Manual operation:** See "[Marker Mode](#)" on page 24

**[ :SOURce<hw>]:BB:DAB:TRIGger:OUTPut<ch>:PULSe:FREQUency?**

Queries the pulse frequency of the pulsed marker signal in the setting `:BB:DAB:TRIGger:OUTPut:MODE PULSe`. The pulse frequency is derived by dividing the symbol rate by the divider. The divider is defined with command `:BB:DAB:TRIG:OUTP:PULS:DIV`.

**Return values:**

<Frequency> float  
Range: 0.0 to max

**Example:** `BB:DAB:TRIG:OUTP2:PULS:DIV 2`  
sets the divider for the corresponding marker signal to the value 2.  
`BB:DAB:TRIG:OUTP2:MODE PULS`  
enables the pulsed marker signal.  
`BB:DAB:TRIG:OUTP2:FREQ?`  
queries the resulting pulse frequency of the marker signal.  
Response: "66 000"  
the resulting pulse frequency is 66kHz.

**Usage:** Query only

**Manual operation:** See "Marker Mode" on page 24

## 4.6 Clock Settings

<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:CLOCK:MODE.....</a>	45
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:CLOCK:MULTIPLIER.....</a>	45
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:CLOCK:SOURce.....</a>	46
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:CLOCK:SYNChronization:EXECute.....</a>	46
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:CLOCK:SYNChronization:MODE.....</a>	46

---

### **[:SOURce<hw>]:BB:DAB:CLOCK:MODE <Mode>**

Enters the type of externally supplied clock (BB:DAB:CLOCK:SOURce EXTernal). When MSAM mode is used, a multiple of the sample clock is supplied and the clock is derived internally from it. The multiplier is entered with the command BB:DAB:CLOCK:MULTIPLIER.

For two-path instruments, the only numerical suffix allowed for SOURce is 1, since the external clock source is permanently allocated to path A.

**Parameters:**

<Mode>                   SAMPLE | MSAMple  
 \*RST:                   SAMPLE

**Example:**               BB:DAB:CLOC:MODE MSAM  
 sets the type of externally supplied clock.

**Manual operation:** See "Clock Mode" on page 26

---

### **[:SOURce<hw>]:BB:DAB:CLOCK:MULTIPLIER <Multiplier>**

Specifies the multiplier for clock type "Multiple Sample" (BB:DAB:CLOCK:MODE MSAMp) in the case of an external clock source.

For two-path instruments, the only numerical suffix allowed for SOURce is 1, since the external clock source is permanently allocated to path A.

**Parameters:**

<Multiplier>           integer  
 Range:                1 to 64  
 Increment:           1  
 \*RST:                 4

**Example:**               BB:DAB:CLOC:SOUR EXT  
 selects the external clock source.  
 BB:DAB:CLOC:MODE MSAM  
 selects clock type "Multiple Sample", i.e. the supplied clock has a rate which is a multiple of the sample rate.  
 BB:DAB:CLOC:MULT 12  
 the multiplier for the external clock rate is 12.

**Manual operation:** See ["Clock Multiplier"](#) on page 26

---

**[ :SOURCE<hw> ] : BB : DAB : CLOCK : SOURCE <Source>**

Selects the clock source.

For two-path instruments, selecting EXTERNAL is only possible for path A, since the external clock source is permanently allocated to path A.

**Parameters:**

<Source>                    INTernal | EXTernal

**INTernal**

The internal clock reference is used.

**EXTernal**

The external clock reference is supplied to the CLOCK connector. Commands :BB:DAB:CLOCK:MODE and :MULTIPLIER are used to enter the type of the external clock.

\*RST:            INTernal

**Example:**

BB:DAB:CLOCK:SOURCE EXT

selects the external clock source. The clock is supplied via the CLOCK connector.

BB:DAB:CLOCK:MODE MSAM

selects clock type "Multiple Sample", i.e. the supplied clock has a rate which is a multiple of the sample rate.

BB:DAB:CLOCK:MULT 12

the multiplier for the external clock rate is 12.

**Manual operation:** See ["Clock Source"](#) on page 26

---

**[ :SOURCE<hw> ] : BB : DAB : CLOCK : SYNCHRONIZATION : EXECUTE**

Performs automatic adjustment of the instrument's settings required for the synchronization mode, set with the command BB:DAB:SYNC:MODE.

**Example:**

BB:DAB:CLOCK:SYNC:MODE MAST

the instrument is configured to work as a master one.

BB:DAB:CLOCK:SYNC:EXEC

all synchronization's settings are adjusted accordingly.

**Usage:**                    Event

**Manual operation:** See ["Set Synchronization Settings"](#) on page 26

---

**[ :SOURCE<hw> ] : BB : DAB : CLOCK : SYNCHRONIZATION : MODE <Mode>**

Selects the synchronization mode

This parameter is used to enable generation of very precise synchronous signal of several connected R&S SMBVs.

**Note:** If several instruments are connected, the connecting cables from the master instrument to the slave one and between each two consecutive slave instruments must have the same length and type. Avoid unnecessary cable length and branching points.

**Parameters:**

<Mode>

NONE | MASTer | SLAVe

**NONE**

The instrument is working in stand-alone mode.

**MASTer**

The instrument provides all connected instrument with its synchronisation (including the trigger signal) and reference clock signal.

**SLAVe**

The instrument receives the synchronisation and reference clock signal from another instrument working in a master mode.

\*RST: NONE

**Example:**

BB:DAB:CLOC:SYNC:MODE MAST

the instrument is configured to work as a master one.

**Manual operation:** See "[Sync. Mode](#)" on page 25

## List of Commands

[SOURce<hw>]:BB:DAB:CLOCK:MODE.....	45
[SOURce<hw>]:BB:DAB:CLOCK:MULTIPLIER.....	45
[SOURce<hw>]:BB:DAB:CLOCK:SOURce.....	46
[SOURce<hw>]:BB:DAB:CLOCK:SYNCHRONIZATION:EXECUTE.....	46
[SOURce<hw>]:BB:DAB:CLOCK:SYNCHRONIZATION:MODE.....	46
[SOURce<hw>]:BB:DAB:CODER[:STATE].....	34
[SOURce<hw>]:BB:DAB:DATA.....	29
[SOURce<hw>]:BB:DAB:DATA:DSELECTION.....	30
[SOURce<hw>]:BB:DAB:EFRAMES.....	30
[SOURce<hw>]:BB:DAB:ETI:CATALOG?.....	31
[SOURce<hw>]:BB:DAB:FILTER:PARAMETER:APCO25.....	35
[SOURce<hw>]:BB:DAB:FILTER:PARAMETER:COSINE.....	35
[SOURce<hw>]:BB:DAB:FILTER:PARAMETER:COSINE:COFS.....	36
[SOURce<hw>]:BB:DAB:FILTER:PARAMETER:GAUSS.....	36
[SOURce<hw>]:BB:DAB:FILTER:PARAMETER:LPASS.....	36
[SOURce<hw>]:BB:DAB:FILTER:PARAMETER:LPASSEVM.....	36
[SOURce<hw>]:BB:DAB:FILTER:PARAMETER:PGAUSS.....	37
[SOURce<hw>]:BB:DAB:FILTER:PARAMETER:RCOSINE.....	37
[SOURce<hw>]:BB:DAB:FILTER:PARAMETER:SPHASE.....	37
[SOURce<hw>]:BB:DAB:FILTER:TYPE.....	35
[SOURce<hw>]:BB:DAB:ILEAVER[:STATE].....	34
[SOURce<hw>]:BB:DAB:LDURATION?.....	31
[SOURce<hw>]:BB:DAB:PNSCRAMBLER[:STATE].....	34
[SOURce<hw>]:BB:DAB:PRESET.....	31
[SOURce<hw>]:BB:DAB:SETTING:CATALOG?.....	31
[SOURce<hw>]:BB:DAB:SETTING:DELETE.....	32
[SOURce<hw>]:BB:DAB:SETTING:LOAD.....	32
[SOURce<hw>]:BB:DAB:SETTING:STORE.....	32
[SOURce<hw>]:BB:DAB:SETTING:STORE:FAST.....	33
[SOURce<hw>]:BB:DAB:SRATE:VARIATION.....	37
[SOURce<hw>]:BB:DAB:STATE.....	33
[SOURce<hw>]:BB:DAB:TMODE.....	33
[SOURce<hw>]:BB:DAB:TRIGGER:ARM:EXECUTE.....	38
[SOURce<hw>]:BB:DAB:TRIGGER:EXECUTE.....	38
[SOURce<hw>]:BB:DAB:TRIGGER:EXTERNAL:SYNCHRONIZE:OUTPUT.....	38
[SOURce<hw>]:BB:DAB:TRIGGER:OBASBAND:DELAY.....	39
[SOURce<hw>]:BB:DAB:TRIGGER:OBASBAND:INHIBIT.....	39
[SOURce<hw>]:BB:DAB:TRIGGER:OUTPUT:DELAY:FIXED.....	41
[SOURce<hw>]:BB:DAB:TRIGGER:OUTPUT<ch>:DELAY.....	42
[SOURce<hw>]:BB:DAB:TRIGGER:OUTPUT<ch>:DELAY:MAXIMUM?.....	42
[SOURce<hw>]:BB:DAB:TRIGGER:OUTPUT<ch>:DELAY:MINIMUM?.....	42
[SOURce<hw>]:BB:DAB:TRIGGER:OUTPUT<ch>:MODE.....	42
[SOURce<hw>]:BB:DAB:TRIGGER:OUTPUT<ch>:OFFTIME.....	43
[SOURce<hw>]:BB:DAB:TRIGGER:OUTPUT<ch>:ONTIME.....	43
[SOURce<hw>]:BB:DAB:TRIGGER:OUTPUT<ch>:PATTERN.....	43
[SOURce<hw>]:BB:DAB:TRIGGER:OUTPUT<ch>:PULSE:DIVIDER.....	44
[SOURce<hw>]:BB:DAB:TRIGGER:OUTPUT<ch>:PULSE:FREQUENCY?.....	44



[[:SOURCE<hw>]:BB:DAB:TRIGger:RMODE?.....	39
[[:SOURCE<hw>]:BB:DAB:TRIGger:SLENgth.....	40
[[:SOURCE<hw>]:BB:DAB:TRIGger:SOURce.....	40
[[:SOURCE<hw>]:BB:DAB:TRIGger[:EXTernal<ch>]:DELay.....	40
[[:SOURCE<hw>]:BB:DAB:TRIGger[:EXTernal<ch>]:INHibit.....	40
[[:SOURCE<hw>]:BB:DAB[:TRIGger]:SEQuence.....	41

# Index

<b>A</b>		Measured external clock .....	26
Activate DAB Standard .....	13	<b>N</b>	
Application cards .....	6	Number of ETI Frames .....	16
Application notes .....	6	Nyquist filter .....	18
Arm trigger .....	17, 21	<b>O</b>	
<b>B</b>		Online help .....	5
B x T .....	18	Online manual .....	5
Baseband filter .....	18	Open File Manager .....	14
Brochure .....	6	Open source acknowledgment .....	6
<b>C</b>		Operating manual .....	5
Clock Mode .....	26	OSA .....	6
Clock Multiplier .....	26	<b>P</b>	
Clock Source .....	26	PN Scrambler .....	17
Coder .....	17	<b>Q</b>	
Conventions		Quick start guide .....	5
SCPI commands .....	28	<b>R</b>	
Current range without recalculation .....	25	Recall Configuration .....	14
Cut Off Frequency Shift .....	19	Recall DAB Settings .....	14
Cutoff frequency factor .....	19	Release notes .....	6
<b>D</b>		Roll Off .....	18
DAB+ streams .....	15	Running .....	21
Data sheet .....	6	<b>S</b>	
Data Source .....	15	Safety instructions .....	6
Deactivate DAB Standard .....	13	Sample rate	
Default Settings .....	13	Variation .....	19
Divider .....	24	Save Configuration .....	14
Documentation overview .....	5	Save DAB Settings .....	14
<b>E</b>		Select ETI File .....	15
Execute trigger .....	17, 22	Service manual .....	5
<b>F</b>		Set synchronization settings .....	26
File manger .....	14	Set Synchronization Settings .....	46
Filter parameter .....	18	Set to Default .....	13
Filter Type .....	18	Signal duration .....	21
Filtering settings .....	18	Standard Settings .....	13
Fix marker delay to current range .....	25	State .....	13
<b>G</b>		Stop	
Global Trigger/Clock Settings .....	27	Signal generation .....	17, 21
<b>I</b>		Stopped .....	21
Interleaver .....	18	Sync. output to external trigger .....	22
<b>L</b>		Synchronization mode .....	25
Load DAB Settings .....	14	Synchronization Mode .....	46
Loop duration .....	16	<b>T</b>	
<b>M</b>		Transport files .....	15
Marker .....	17	Transport Mode .....	16
Marker Mode .....	24	Trigger .....	17, 22
Marker x Delay .....	25	Trigger Delay .....	23
		Trigger inhibit .....	24
		Trigger Mode	
		Armed .....	21
		Auto .....	21

Retrigger .....	21
Single .....	21
Trigger Source .....	22

**U**

User Marker / AUX I/O Settings .....	27
--------------------------------------	----

**W**

White papers .....	6
--------------------	---