

Avionics Standards

Digital Standards for R&S[®]SMBV

Operating Manual



1176860002
Version 08

ROHDE & SCHWARZ
Make ideas real



This document describes the avionics software options.
Described are the following software options:

- R&S®SMBV-K111
1419.2396.xx
- R&S®SMBV-K151
1419.2621.xx
- R&S®SMBV-K152
1419.2664.xx
- R&S®SMBV-K153
1419.2667.xx

This manual describes firmware version 4.15.125.xx and later of the R&S®SMBV100A.

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The following abbreviations are used throughout this manual: R&S®SMBV100A is abbreviated as R&S SMBV, R&S®WinIQSIM2™ is abbreviated as R&S WinIQSIM2

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1 Preface

1.1 About this Manual

This operating manual provides all the information **specific to the Avionics options**. All general instrument functions and settings common to all applications and operating modes are described in the main R&S SMBV operating manual.

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

- **Welcome to the Avionics options R&S SMBV-K111/-K151/-K152/-K1153**
Introduction to and getting familiar with the options
- **About the Avionics options**
Background information on basic terms and principles in the context of the signal generation
- **GBAS/ ILS/ VOR/ DME Configuration and Settings**
A concise description of all functions and settings available to configure signal generation with their corresponding remote control command for the specific standard
- **Remote Control Commands**
Remote commands required to configure and perform signal generation in a remote environment, sorted by tasks
(Commands required to set up the instrument or to perform common tasks on the instrument are provided in the main R&S SMBV operating manual)
Programming examples demonstrate the use of many commands and can usually be executed directly for test purposes
- **Annex**
Reference material
- **List of remote commands**
Alphabetical list of all remote commands described in the manual
- **Index**

Contents and scope

This description assumes R&S SMBV equipped with all available options. Depending on your model and the installed options, some of the functions may not be available on your instrument.

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 usage scenarios.

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

1.2 Documentation Overview

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

www.rohde-schwarz.com/manual/smbv100a

1.2.1 Quick Start Guide Manual

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

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

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

1.2.3 Service Manual

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

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

1.2.4 Instrument Security Procedures

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

1.2.5 Basic Safety Instructions

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

1.2.6 Data Sheets and Brochures

The data sheet contains the technical specifications of the R&S SMBV. 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/smbv100a

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/smbv100a

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/smbv100a.

2 Welcome to the Avionics Options

The GBAS option

The R&S SMBV-K111 is a firmware application that adds functionality to generate signals in accordance with the Ground Based Augmentation System (GBAS).

The most important R&S SMBV-K111 features at a glance:

- Generation of the VHF Data Broadcast (VDB) Signal-in-Space signal transmitted from the GBAS ground subsystem to the airborne subsystem
- User-definable transmission band and support of single and multiple frequency transmission (up to 11 frequency channels simultaneously), for example for adjacent channel emissions measurements
- Configuration of GBAS application data, for example the parameters of message type 2 and 4, incl. the Final Approach Segment (FAS) data definition and Terminal Area Path (TAP) data
- Import of differential Global Navigation Satellite System (GNSS) data (message type 1 and 11)
- Encoding, timing and power settings according to the specification [RTCA DO-246D](#).

Real-time signal changes for the flight navigation standards ILS, VOR and DME

Changing a parameter in the standards causes an instant signal change in the R&S SMBV without a measurement cycle to calculate the RMS value of the baseband signal in order to set the correct RF level. If the standards are switched ON for the first time, or after every subsequent ON/OFF sequence, the measurement cycle will take place to determine the correct RF level. Every subsequent parameter change in the standards is performed without another measurement cycle in order to provide a continuous signal output.

The ILS option

The R&S SMBV-K151 is a firmware application that adds functionality to generate signals in accordance with the ground-based instrument landing system (ILS). It provides lateral and vertical guidance to an aircraft approaching and landing on a runway.

The most important R&S SMBV-K151 features at a glance:

- Generation of glide slope, localizer and marker beacons signals
- Configuration of user definable carrier frequencies or selection of carrier frequencies as defined by ICAO.
- Adjustable COM/ID settings.

The VOR option

The R&S SMBV-K152 is a firmware application that adds functionality to generate signals in accordance with the VHF Omni directional radio range radio navigation system. It is used to determine the aircraft position by receiving radio signals from a network of ground beacons.

The most important R&S SMBV-K152 features at a glance:

- Configuration of user definable carrier frequencies or selection of carrier frequencies as defined by ICAO.
- User-defined position settings.
- Adjustable COM/ID settings.

The DME option

The R&S SMBV-K153 is a firmware application that adds functionality to generate signals in accordance with the distance measuring equipment (DME) for aircraft. It is used to measure the slant range distance between the vessel and a fixed ground-based station.

The most important R&S SMBV-K153 features at a glance:

- Generation of DME interrogation and reply signals.
- Configuration of user definable carrier frequencies or selection of carrier frequencies as defined by ICAO.
- Adjustable COM/ID settings.

This operating 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 software and are described in the R&S SMBV operating manual. The latest version is available at:

www.rohde-schwarz.com/manual/SMBV100A

Installation

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

2.1 Accessing the Avionics Dialog

To open the dialog with Avionics settings

- ▶ In the block diagram of the R&S SMBV, select "Baseband > Avionic Standards" > "GBAS"/"ILS"/"DME"/ "VOR".

A dialog box opens that displays the provided general settings of the selected standard.

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

2.2 Scope



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

In particular, it includes:

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

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

3 About the Avionics Options

The following topics summarize some background information on the related avionics standards. The provided overview information is intended as explanation of the used terms and does not aim to be comprehensive.

Brief overview of the avionics standards

- **Landing systems:** ILS (Instrument Landing System), MLS (Microwave Landing System)
Landing systems are ground-based approach systems that provide precision guidance to an aircraft approaching and (blind) landing on a runway.
- **Radio/Flight navigation systems:** VOR (VHF Omnidirectional Radio), DME (Distance measuring equipment), TACAN (Tactical Air Navigation), ADF (Automatic Direction Finder)
The radio navigation systems are aircraft systems that support the pilots to determine the aircraft positions and stay on course. These systems are more and more obsolete. However, due to security reasons, these flight navigation systems are still in use.
- **Radar systems:** RSR (En Route Surveillance Radar), ASR (Airport Surveillance Radar), PAR (Precision Approach Radar), ASDE (Airport Surface Detection Equipment), SSR (Secondary Surveillance Radar)
Radar systems are divided into two groups, primary (RSR, ASR, PAR and ASDE) and secondary (SSR). The radar systems are used in air traffic control to mainly detect and measure the position of aircraft, i.e. its range and bearing.

3.1 Ground Based Augmentation System (GBAS)

The R&S SMBV-K111 option enables you to define and configure the very high frequency (VHF) Data Broadcast (VDB) Signal-in-Space transmitted from the Ground Based Augmentation System (GBAS) ground subsystem to the airborne subsystem. This implementation is in line with the specification [RTCA DO-246D](#). The instrument generates the GBAS signal at the physical layer and includes configuration of the application data.

The GBAS is a ground based augmentation system that could among other things enhance satellite navigation to provide a position estimation of less than one meter. The GBAS is intended to improve aircraft safety and to enhance satellite navigation and the full range of precision approach and landing procedures, as well as the terminal area operations. GBAS could replace the Instrument Landing System (ILS) and the Microwave Landing System (MLS) in many applications.

GBAS components

The illustration on [Figure 3-1](#) is a simplified representation of the GBAS three main components:

- The GNSS satellite subsystem

Ground Based Augmentation System (GBAS)

- The airborne subsystem
- The GBAS ground subsystem

The ground equipment consists of four reference GNSS receivers at exactly defined positions around the airport, GBAS ground station, and a VHF data broadcast transmitter (VDB).

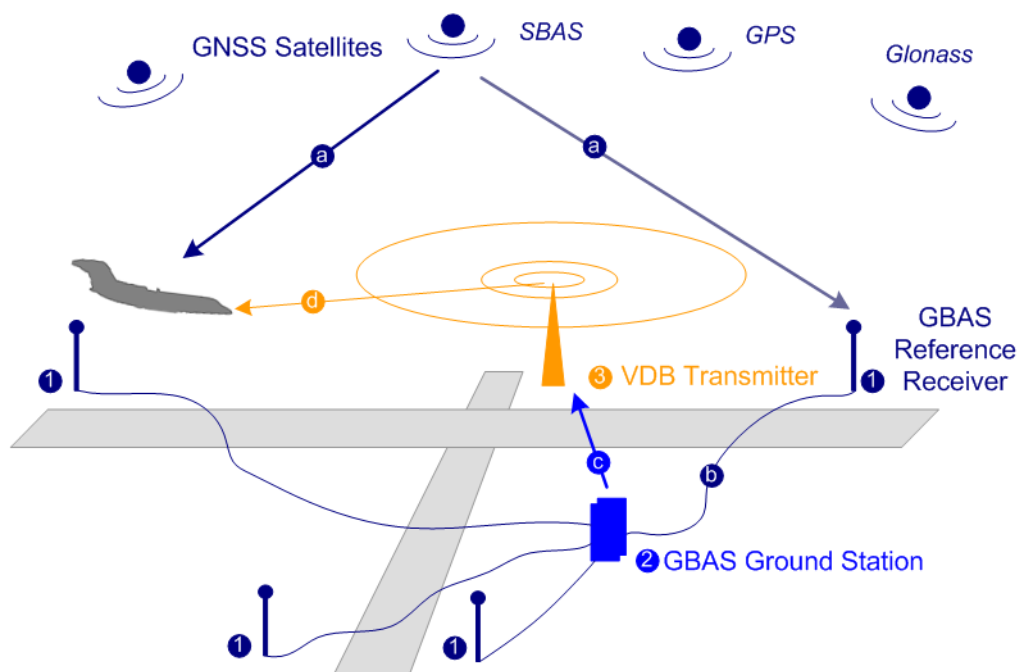


Figure 3-1: GBAS components and signals (simplified representation)

- 1 = GNSS reference receiver
- 2 = GBAS ground station
- 3 = VHF data broadcast (VDB) transmitter
- a = GNSS navigation message
- b = Pseudorange
- c = GBAS Correction message
- d = VDB signal

The GBAS GNSS reference receiver receives the *GNSS navigation message*, performs pseudorange measurements and transmits this information to the GBAS ground station. The GBAS ground station determines errors in the calculated positions, adds additional parameters and approach path information, produces a *GBAS correction message* and sends it the VDB transmitter. The VDB transmitter modulates and encodes this message and *broadcasts* it to the airborne GBAS equipment, for example a GBAS receiver in the airplane. The GBAS equipment in the airplane is a high-precision multimode receiver that evaluates the message and applies corrections parameters to improve the navigation algorithms from GPS.

This list outlines the three signals transmitted between the components which are referred as GBAS Signal-in-Space:

- GNSS satellite to GBAS ground subsystem navigation signal
- GNSS satellite to GBAS airborne subsystem navigation signal
- GBAS ground subsystem to GBAS airborne subsystem VHF data broadcast

This firmware option enables you to generate the VHF data broadcast

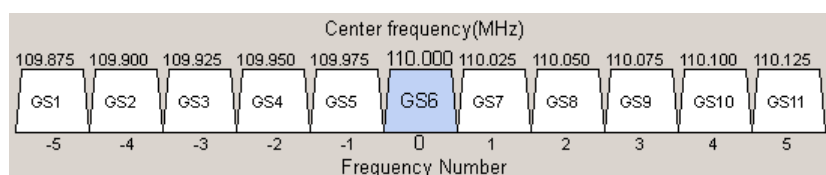
Carrier frequencies and frequency channels

The VHF data broadcast is defined for carrier frequencies within the range of 108.025 MHz to 117.975 MHz and carrier spacing of 25.0 kHz.

The R&S SMBV supports the whole required frequency range; you can modulate the VHF signal on any one of these carrier frequencies. Moreover, this firmware option supports two frequency allocation modes, a single frequency and a multiple frequency transmission.

When you chose the frequency allocation mode, consider the following:

- **Single frequency** mode is suitable to simulate the signal of up to eight VDB transmitters modulated on the same carrier frequency. The signal calculation is fast and optimized for time sensitive applications. This mode is also the choice if the DUT or the analyzing equipment supports single band decoding.
- **Multiple frequency channels** mode is suitable to allocate the VDB transmitters to up to 8 out of 11 adjacent frequency channels. The generated signal is optimized for reduced adjacent and co-channel interference to neighboring systems. The setting time, however, increase significantly compared to the single frequency mode.



The frequency-related settings are split into several dialogs. To allocate the VDB in the frequency domain, set the central frequency ("Status Bar > Frequency"), define the frequency allocation mode ("GBAS > Multiple Frequency Channels") and use the VDB transmitter configuration settings, see "Freq. Num" on page 28.

For step-by-step instruction, refer to [Chapter 9.1, "Generating GBAS Signals with Several Frequency Channels"](#), on page 101.

Broadcast timing structure

The broadcast is a Time Division Multiple Access (TDMA). According to [1], the TDMA timing structure uses a two level hierarchy, composed of 500 ms long frames, each divided into 8 VDB time slots (A - H), see [Figure 3-2](#).

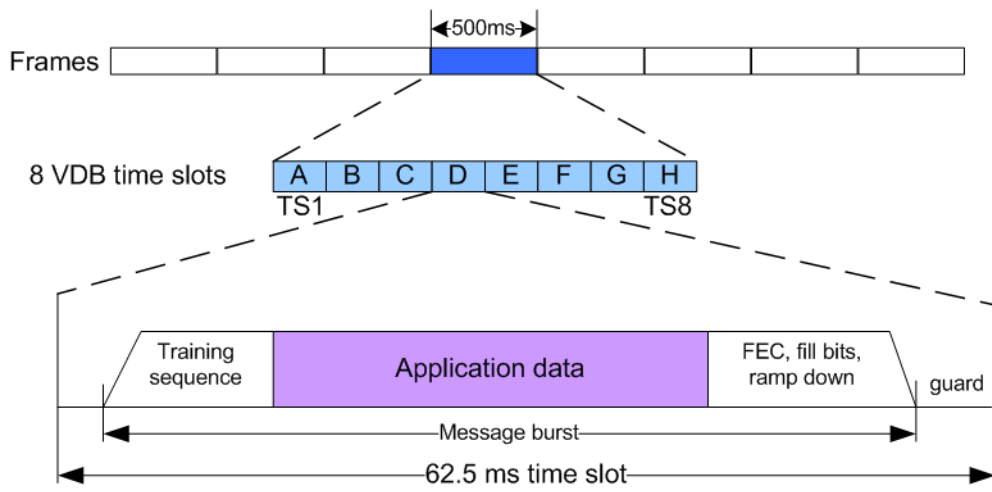


Figure 3-2: TDMA timing structure (simplified representation)

A VDB time slot is the minimum resource that an individual VDB transmitter can use. During one time slot a VDB transmitter transmits exactly one burst.

The GBAS specification [RTCA DO-246D](#) defines the TDMA timing structure, including timing budget of the VDB bursts, burst data contents and message encoding in great details. The R&S SMBV generates the required training sequence, encodes the message according to [RTCA DO-246D](#) and applies the D8PSK modulation automatically, so that you can concentrate on the configuration of the mandatory application data. Optional application data defined in [RTCA DO-246D](#) is beyond the scope of this implementation.

To allocate the VDB in the time domain, use the scheduling settings, see [Chapter 4.3, "Scheduling Settings"](#), on page 30.

Refer to [Figure 3-3](#) for illustration on how a multi-frequency TDMA scheduling is performed in this implementation.

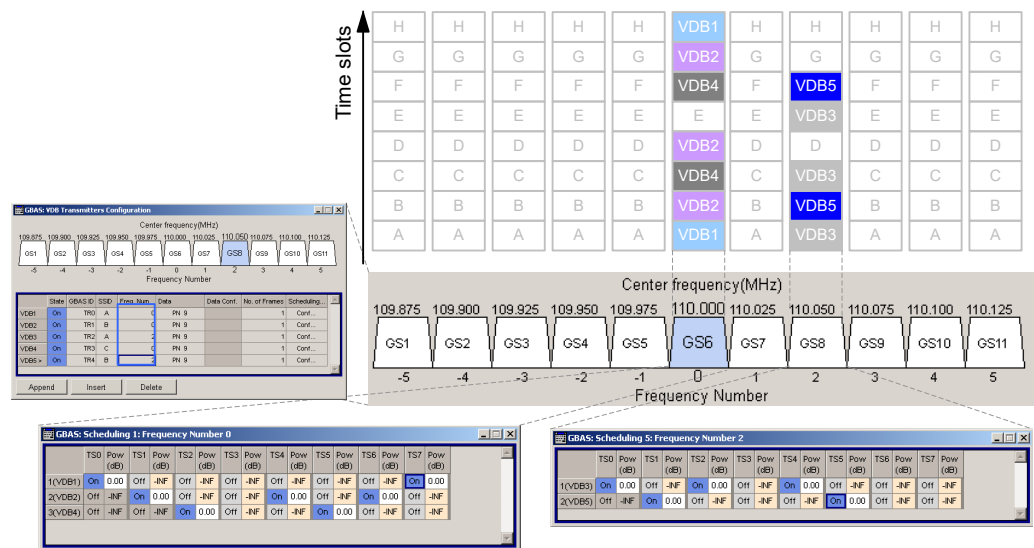


Figure 3-3: Example of a multi frequency TDMA scheduling

For step-by-step instruction, refer to [Chapter 9.3, "Generating a GBAS Signal for VDB Slot Detection"](#), on page 103.

Power settings

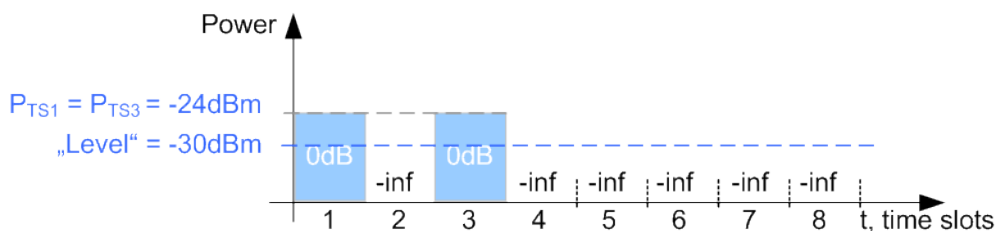
In the R&S SMBV, the following parameters have impact on the signal power of the time slots:

- **RF output power** ("Status Bar > Level")
Defines the RMS level of the generated signal
- **Relative power per time slot** ("GABS > VDB Transmitters Configuration > VDB# > Scheduling > Pow")
Sets the relative power of a VDB per time slot (TS).
- **Power generation mode** ("GBAS > Gated Power Mode")
Defines the way the absolute power of a VDB per time slot is calculated.
The absolute power of a single time slot depends on the power settings of the remaining time slots.
See [Example "Calculating the power per time slot in "Gated Power Mode > Off" on page 17](#) and [Example "Calculating the power per time slot in "Gated Power Mode > On" on page 18](#) for explanation on how the parameter "Gated Power Mode" influence the calculation.

For step-by-step instruction, refer to [Chapter 9.2, "Generating a GBAS Signal for Receiver Sensitivity Tests"](#), on page 102.

Example: Calculating the power per time slot in "Gated Power Mode > Off"

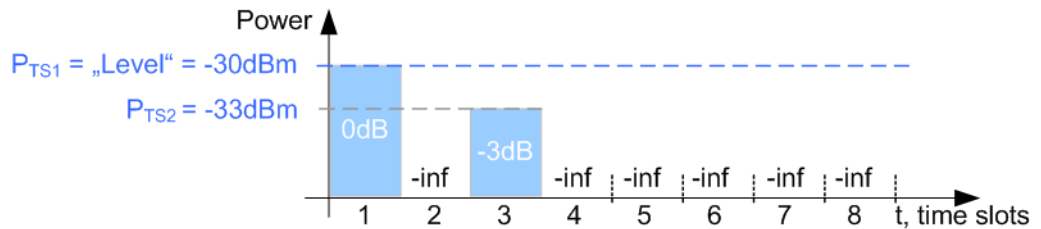
- "Level = - 30 dBm"
- "TS1 > State > On", relative power "TS1 > Pow(dB) = 0 dB"
- "TS3 > State > On", relative power "TS3 > Pow(dB) = 0 dB"
- "TS2/TS4/TS5/TS6/TS7/TS8 > State > Off"
"TS2/TS4/TS5/TS6/TS7/TS8 > Pow(dB) = -inf"



The absolute power of both scheduled time slots is $P_{TS1} = P_{TS3} = -24 \text{ dBm}$.

Example: Calculating the power per time slot in "Gated Power Mode > On"

- "Level = - 30 dBm"
- "TS1 > State > On", relative power "TS1 > Pow(dB) = 0 dB"
- "TS3 > State > On", relative power "TS3 > Pow(dB) = -3 dB"
- "TS2/TS4/TS5/TS6/TS7/TS8 > State > Off"
"TS2/TS4/TS5/TS6/TS7/TS8 > Pow(dB) = -inf"



The absolute power of the scheduled time slots is:

- $P_{TS1} = -30\text{ dBm}$
- $P_{TS3} = -33\text{ dBm}$.

Supported message types

The GBAS specification [RTCA DO-246D](#) defines the following mandatory message types. This implementation supports all required message types. Refer to [Table 3-1](#) for information on where to find the related settings.

Table 3-1: Overview of the required message types

Message type	Description	Related settings
1	Differential corrections 100 sec smoothed pseudoranges	Chapter 4.4.3, "Differential GNSS Parameters" , on page 45
2	GBAS related data	Chapter 4.4.1, "Message Type 2 Parameters" , on page 32
4	Final Approach Segment (FAS) construction data	" FAS Data Set " on page 39
	Terminal Area Path (TAP) construction data	" TAP Data Set " on page 43
11	Differential corrections 30 sec smoothed pseudoranges	Chapter 4.4.3, "Differential GNSS Parameters" , on page 45

For step-by-step instruction, refer to [Chapter 9.4, "Generating a GBAS Signal for Message Format Detection"](#), on page 104.



Rohde&Schwarz solution for radio analysis

If your task requires verifications and measurements of GBAS installations on the ground and in the air, consider to use the R&S®EVS300 ILS/VOR analyzer.

This instrument is a portable level and modulation analyzer. If equipped with the required options, it is capable to perform VHF data link measurements on GBAS as well as measurements on conventional ILS ground systems and VOR systems.

3.2 Instrument Landing System (ILS)

The instrument landing system is used during the landing approach and monitors the correct approach path to the runway.

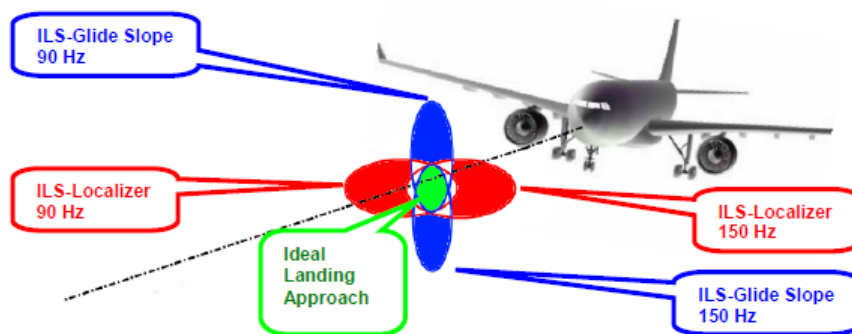


Figure 3-4: Approach navigation using instrument landing system (ILS) [1MA193]

An ILS system consists of three independent subsystems:

- A glide slope for vertical guidance.
- A localizer for horizontal guidance.
- (optional) marker beacons

Glide Slope

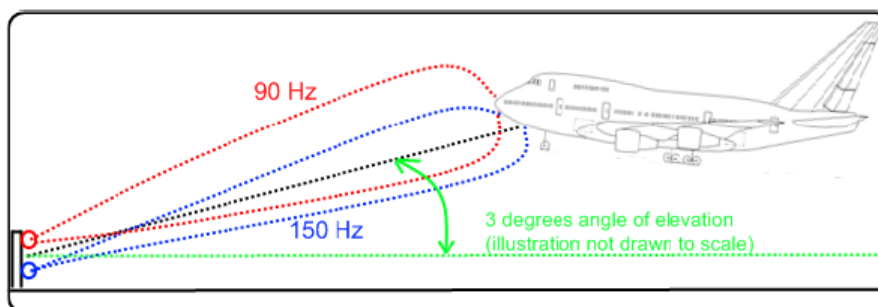
The glide slope transmitter is located near the end of the runway (nearest to the start of the aircraft approach).

Typically, vertically aligned antennas transmit two intersecting main beams on top of one another at carrier frequencies between 329 MHz and 335 MHz. The top beam is usually modulated at 90 Hz and the beam below at 150 Hz [1MA193].

The information on position is provided after demodulation of the beam signals by evaluating the difference in depth of modulation (DDM). The following scenarios are possible:

- Predominance of the 90 Hz beam: the aircraft is too high and must descend
- Predominance of the 150 Hz beam: the aircraft is too low and needs to climb
- The signal strength from both beams is equal: the aircraft is in the center, on the right course.

If there is a predominance of the 90 Hz beam, then the aircraft is too high and must descend. A predominant 150 Hz means that the aircraft is too low and needs to climb.

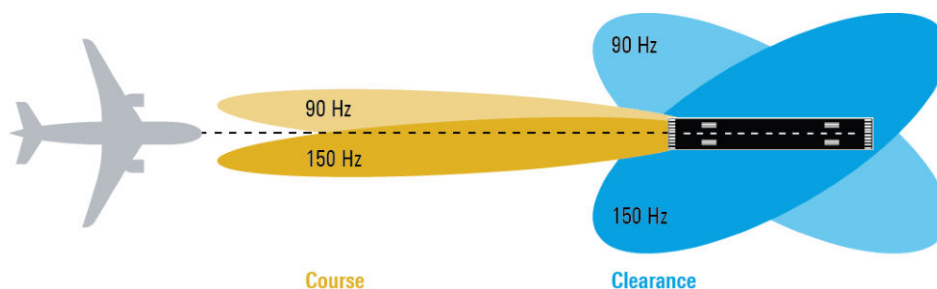


Localizer

The localizer transmitter is located near the end of the runway (nearest to the start of the aircraft approach). Typically, horizontally aligned antennas transmit two intersecting main beams beside one another at carrier frequencies between 108 MHz and 112 MHz. As seen from the approaching aircraft coming in for a landing, the left beam is usually modulated at 90 Hz and the right beam at 150 Hz.[1MA193]

The information on position is provided after demodulation of the beam signals by evaluating the difference in depth of modulation (DDM). The following scenarios are possible:

- Predominance of the 90 Hz beam: the aircraft is too far to the left and must turn to the right
- Predominance of the 150 Hz beam: the aircraft is too far to the right and must turn to the left
- The signal strength from both beams is equal: the aircraft is in the center, on the right course.



Marker Beacons

Marker beacon (MB) receivers are used for a rough distance measurement. They are available only for some ILS installations.[1MA193]

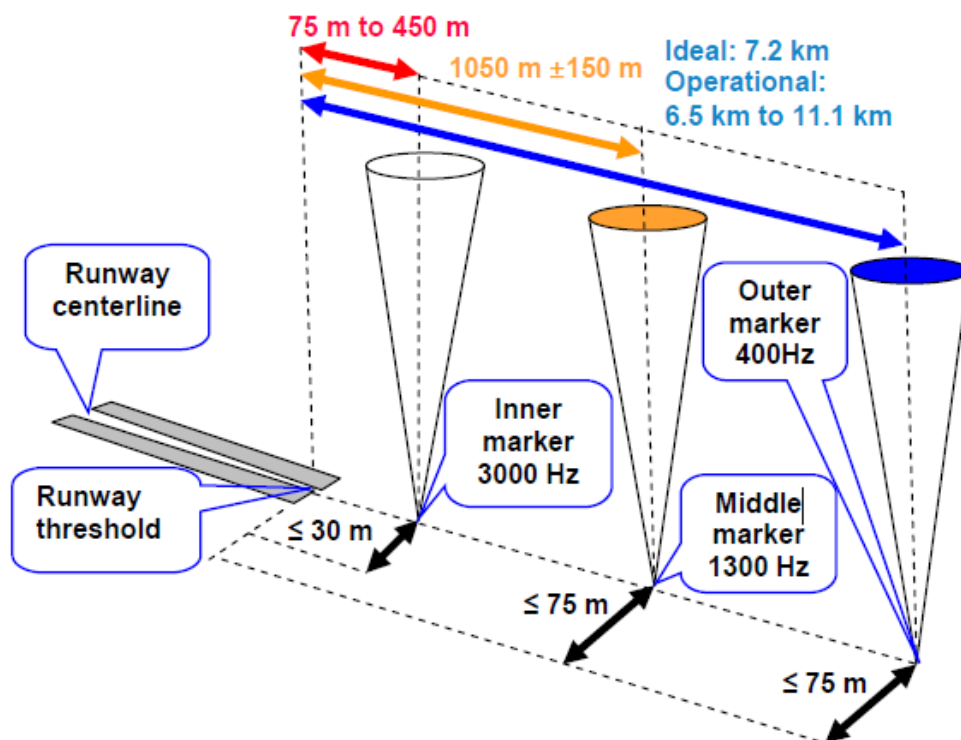


Figure 3-5: Marker beacon placement with respect to runway

Marker beacon receivers decode audio and provide signaling output to identify one of three marker beacons installed near the runway. They transmit a narrow beam width at 75 MHz carrier frequency in a vertical direction. Each of them has a different distinct modulation code to allow the receiver to identify which one it is flying over.[1MA193]

Both visual (color of the marker beacon) and audio tone identification is supported for determining which marker has been flown over. The audio/visual pairing of marker beacons is as follows:

- Outer marker flashes BLUE in the cockpit at 400 Hz (“relaxed” tone).
- Middle marker flashes AMBER in the cockpit at 1300 Hz (“hurried” tone).
- Inner marker flashes WHITE in the cockpit at 3000 Hz (“urgent” tone).

3.3 VHF Omni Directional Radio Range (VOR)

Very high frequency (VHF) omnidirectional radio range (VOR) is used for radio navigation and helps aircraft to determine their position and stay on course.

A VOR system consists of a ground transmission station and a VOR receiver on the board of the aircraft.

The transmitter stations operate at VHF frequencies of 108 MHz to 118 MHz, with the code identification (COM/ID) transmitting on a modulation tone of 1.020 kHz. It emits two types of signals:

- An omnidirectional reference signal (REF) that can consist of two parts:
 - 30 Hz frequency modulated (FM) sine wave on subcarrier 9.96 kHz from amplitude modulation (AM) carrier
 - 1020 Hz AM modulated sine wave morse code
- A directional positioning signal, variable (VAR): 30 Hz AM modulated sine waves with variable phase shift

The position of the aircraft is determined by measuring azimuth as the difference in phase of those two signals. The magnetic north is defined as the reference point, for which both signals are exactly in phase.

3.4 Distance Measurement Equipment (DME)

DME is a radar system used to determine the slant distance of an aircraft (= DME interrogator) to a ground station (= DME transponder). For this purpose, shaped RF double pulses are transmitted by the aircraft to the ground station and, after a defined delay (= reply delay), the ground station sends the pulses back again. The receiver in the aircraft uses the round trip time of the double pulses to determine the distance to the ground station.

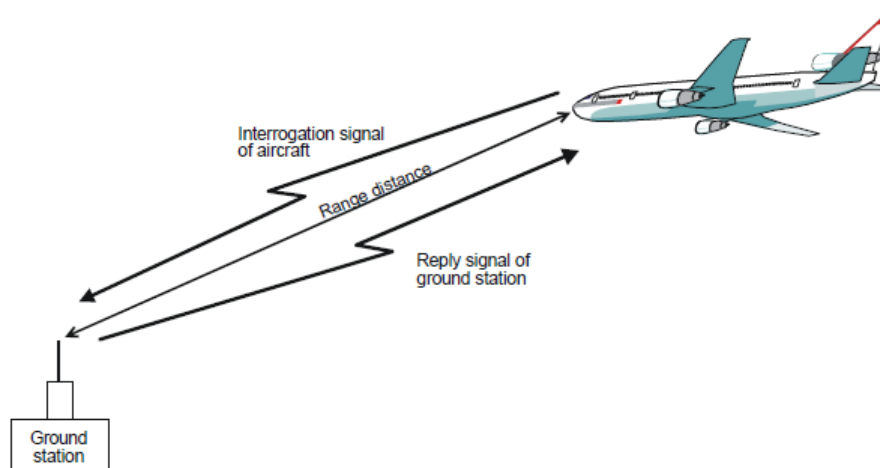


Figure 3-6: DME principle

Most DME ground stations are combined with a VOR system in order to allow an aircraft to determine its precise position relative to this station. The DME channels are paired with the VOR channels and range from 1025 MHz to 1150 MHz for the aircraft transmitter and 962 MHz to 1213 MHz for the ground stations. The frequency delta between received and transmitted signal is always 63 MHz. The channel spacing between the various DME channels is always 1 MHz.

Each channel has two different codings (X and Y) that differ with regard to their pulse spacing. The assignment of a channel and coding to a ground station always remains the same during operation and is determined by the respective national ATC authority.

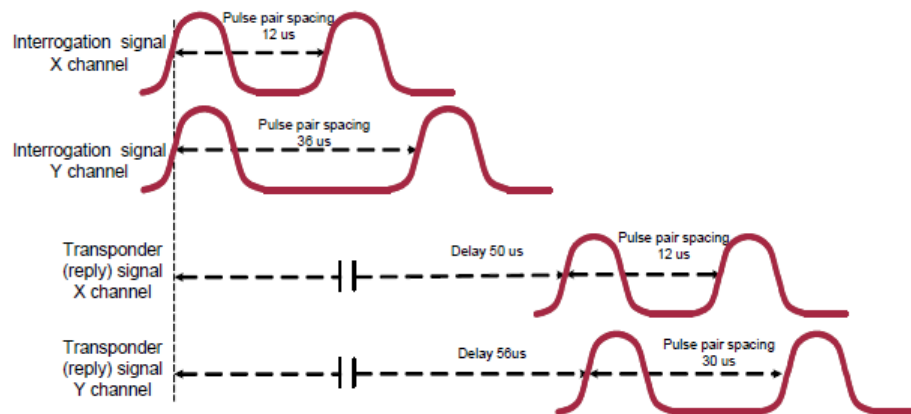


Figure 3-7: Time characteristic of DME signal envelope for X and Y channel

DME Interrogator

The aircraft's DME interrogator sends a sequence of pulses that are received at the ground station and, after a defined delay time, are returned at a different frequency. The frequency offset between the sent and received signal is always 63 MHz. The receiver in the aircraft filters its own pulse sequence out of all received pulses and in this way determines the time difference between the transmitted and received pulse. It then uses this time to calculate the slant range to the ground station. The distance is usually indicated in nautical miles (NM), where 1 NM corresponds to 1852.02 m and a signal round trip time of 12.359 us. As a result, by taking the flight altitude above ground as well as the azimuth angle between the aircraft and ground station (VOR system) into consideration, it is possible to determine the precise position of the aircraft.

DME Transponder

In the receiver, the validity of all received pulses (i.e. the pulse spacing must be consistent with the channel) is checked in the "decoder". A single pulse, for example, is filtered out as an invalid interrogation and no reply to this pulse is sent.

After a valid DME double pulse is received (i.e. after the 2nd pulse is received), the receiver at first does not react to any further interrogations for 60 us (= dead time) to ensure that it does not trigger again to its own transmitted reply. The receiver is therefore not ready to process new interrogation pulses until the reply double pulse has been fully transmitted. All pulse interrogations that are received at the DME ground station during the dead time are not answered. This ensures that the gap between two consecutive pulses is always at least 60 us.

A reply pulse is sent after a defined delay time after a valid interrogation pulse has been received.

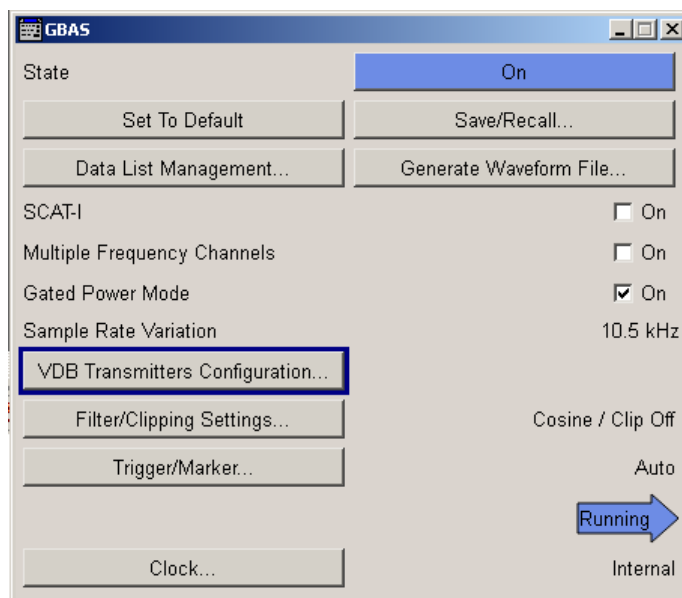
4 GBAS Configuration and Settings

- ▶ To access the GBAS settings, select "Baseband > Avionics > GBAS".

The remote commands required to define these settings are described in [Chapter 10.2, "GBAS Settings"](#), on page 114.

4.1 General Settings

This dialog provides access to the default and the "Save/Recall" settings, as well as to the general settings of the option and the dialogs with further configuration settings. The dialog displays an indication of the selected key parameters.



State

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

Remote command:

`<subsystem>:STATE` on page 112

Set To Default

Calls the default settings. The values of the main parameters are listed in [Chapter C, "Default Settings"](#), on page 215.

Remote command:

`<subsystem>:PRESet` on page 112

Save/Recall

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

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

Remote command:

`<subsystem>:SETTing:CATalog` on page 112

`<subsystem>:SETTing:STORe` on page 113

`<subsystem>:SETTing:STORe:FAST` on page 113

`<subsystem>:SETTing:LOAD` on page 113

`<subsystem>:SETTing:DELeTe` on page 112

Data List Management

Accesses the "Data List Management" dialog. In this dialog you can create and edit a data list.

The instrument stores all data lists as files with the predefined file extension `*.dm_iqd`. You can define the file name and the directory they are stored in.

To use an existing data list as a data source:

- Select "VDB Transmitters Configuration > VDB# > Data Source > Data List" and
- Select "Data Config > Select Data List > navigate to the list file *.dm_iqd > Select".

Generate Waveform File

With enabled signal generation, triggers the instrument to store the current settings as an ARB signal in a waveform file. Waveform files can be further processed by the ARB and/or as a multi-carrier or a multi-segment signal.

The filename and the directory it is stored in are user-definable; the predefined file extension for waveform files is `*.wv`.

Remote command:

`[:SOURce<hw>] :BB:GBAS:WAVEform:CREate` on page 119

SCAT-I

Enables using of SCAT-I header information instead of the default LAAS (GBAS) header.

The modulation and TDMA schemes of both systems are identical; the header start byte is set as listed in [Table 4-1](#).

Table 4-1: Header start byte

Landing system	Header start byte
LAAS (GBAS)	0xAAh
SCAT-I	0x99h

Remote command:

`[:SOURce<hw>] :BB:GBAS:SCATi` on page 119

Multiple Frequency Channels

Enables the configuration of VHF Data Broadcast (VDB) transmissions on more than one frequency channels.

See "[Carrier frequencies and frequency channels](#)" on page 15.

Remote command:

[:SOURce<hw>] :BB:GBAS:MFCHannels on page 119

Gated Power Mode

Enables gated power mode, see "[Power settings](#)" on page 17.

Remote command:

[:SOURce<hw>] :BB:GBAS:GPOW on page 120

Sample Rate Variation/Sample Rate Info

Sets/displays the used sample rate variation. You can set the sample rate value in the "Filter/Clipping Settings" dialog.

This setting can be used for testing the symbol rate tolerance.

The [RTCA DO-246D](#) specification defines a symbol rate of the GBAS data broadcast as 10500 symbols/sec. Because of the used modulation (see [Modulation Type](#)), each symbol defines one of eight states. This results in a nominal bit rate of 31500 bits/s.

Remote command:

[:SOURce<hw>] :BB:GBAS:MSET:SRATe? on page 152

[:SOURce<hw>] :BB:GBAS:SRINfo? on page 120

VDB Transmitters Configuration

Access the "VDB Transmitters Configuration" dialog, see [Chapter 4.2, "VDB Transmitters Configuration Settings"](#), on page 27.

Filter / Clipping

Access to the dialog for setting baseband filtering, clipping and modulation, see [Chapter 4.5, "Filter/Clipping Settings"](#), on page 47.

Trigger/Marker

Accesses the dialog for selecting the trigger source, for configuring the marker signals and for setting the time delay of an external trigger signal, see [Chapter 8.1, "Trigger Settings"](#), on page 90 and [Chapter 8.2, "Marker Settings GBAS"](#), on page 94.

The currently selected trigger source is displayed to the right of the button.

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:GBAS:TRIGger:EXECute on page 196

[:SOURce<hw>] :BB:ILS:TRIGger:EXECute on page 196

[:SOURce<hw>] :BB:VOR:TRIGger:EXECute on page 196

[:SOURce<hw>] :BB:DME:TRIGger:EXECute on page 196

Arm

Stops the signal generation until subsequent trigger event occurs.

Remote command:

[:SOURce<hw>] :BB:GBAS:TRIGger:ARM:EXECute on page 195

[:SOURce<hw>] :BB:ILS:TRIGger:ARM:EXECute on page 195

[:SOURce<hw>] :BB:VOR:TRIGger:ARM:EXECute on page 195

[:SOURce<hw>] :BB:DME:TRIGger:ARM:EXECute on page 195

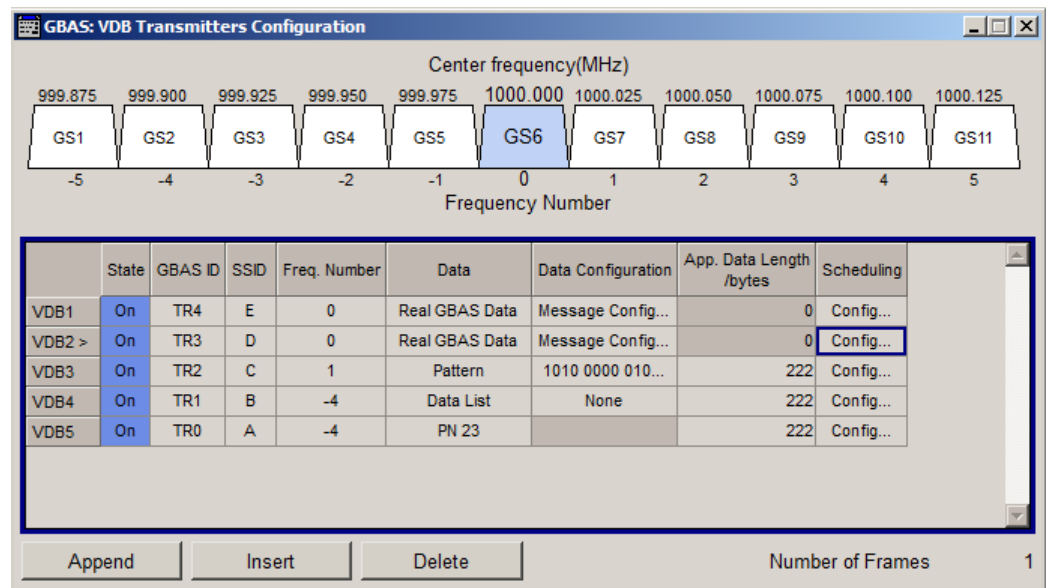
Clock

Accesses the dialog for selecting the clock source, see "Clock" on page 27.

4.2 VDB Transmitters Configuration Settings

To access this dialog:

1. Select "GBAS > Main dialog > VDB Transmitters Configuration".



The dialog comprises the settings, necessary to configure the VHF Data Broadcast (VDB) signals.

The graph visualizes 11 adjacent frequency channels, symmetrically located around the current central frequency. To define the central frequency, set the parameter "Status Bar > Frequency". In the graph, the central frequency is referred as frequency number 0.

The frequency channel of the selected VDB is highlighted.

2. Select "VDB Transmitters Configuration > Append" to add new VDB transmitter.

State

Enables the selected VHF Data Broadcast (VDB) transmitter.

Remote command:

[:SOURce<hw>] :BB:GBAS:VDB<ch>:STATe on page 121

GBAS ID/ SGID

Sets the GBAS ID, that is a four-character (24-bit) alphanumeric field that identifies the ground station broadcasting the message. Permitted are capital letter, numbers and "space".

The SGID setting is available instead of GBAS ID, if "SCAT-I > On".

To identify a ground station, the airborne receiver examines the combination of the GBAS ID and the [SSID /RSID](#).

Remote command:

[:SOURce<hw>] :BB:GBAS:VDB<ch>:GID on page 121

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SGID on page 122

SSID /RSID

Sets the station slot identifier SSID of the ground station.

The RSID setting is available instead of SSID, if "SCAT-I > On".

According to [RTCA DO-246D](#), the SSID is a numeric value from 0 to 7, corresponding to the letter designation (A through H) of the first time slot assigned to a particular ground reference station, where slot A = 0 and slot H = 7. All messages in all time slots employed by a particular ground station use the same SSID.

To identify a ground station, the airborne receiver examines the combination of the ["GBAS ID/ SGID"](#) on page 28 and the SSID.

Remote command:

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SSID on page 122

[:SOURce<hw>] :BB:GBAS:VDB<ch>:RID on page 121

Freq. Num

Sets the frequency number and defines the frequency band the corresponding VDB is using, see ["Carrier frequencies and frequency channels"](#) on page 15.

Remote command:

[:SOURce<hw>] :BB:GBAS:VDB<ch>:FNUMber on page 122

Data/Data Config

Select the data source for the VDB.

The following standard data sources are available:

- "All 0, All 1"
An internally generated sequence containing 0 data or 1 data.
- "PNxx"
An internally generated pseudo-random noise sequence.
- "Pattern"
An internally generated sequence according to a bit pattern.
Use the "Pattern" box to define the bit pattern.
- "Data List/Select DList"
A binary data from a data list, internally or externally generated.
Select "Select DList" to access the standard "Select List" dialog.

- Select the "Select Data List > navigate to the list file *.dm_iqd > Select" to select an existing data list.
- Use the "New" and "Edit" functions to create internally new data list or to edit an existing one.
- Use the standard "File Manager" function to transfer external data lists to the instrument.

See also "Main Dialog > Data List Management".

"Real GBAS Data"

Enables you to configure the content of the GBAS messages.
Select "Data Config > Config." to access the provided settings.

Remote command:

[:SOURce<hw>] :BB:GBAS:VDB<ch>:DATA on page 122

[:SOURce<hw>] :BB:GBAS:VDB<ch>:DATA:DSELECTION on page 123

[:SOURce<hw>] :BB:GBAS:VDB<ch>:DATA:PATTERN on page 123

App. Data Length/bytes

Sets the application data length.

For "Data/Data Config > Real GBAS Data", the value of the application data length is not variable but is automatically set and calculated.

Remote command:

[:SOURce<hw>] :BB:GBAS:VDB<ch>:DLENGTH on page 122

No. of Frames

Displays the automatically calculated number of frames of the selected VDB.

Remote command:

[:SOURce<hw>] :BB:GBAS:NOFRAMES? on page 123

Scheduling

Accesses the dialog for configuring the scheduling in the time domain, see [Chapter 4.3, "Scheduling Settings"](#), on page 30.

Append, Insert, Delete

You can configure up to 8 VDB transmitters. Use the appropriate general functions:

"Append" Adds a new row in the table of VDB transmitters.

Remote command:

[:SOURce<hw>] :BB:GBAS:VDB:APPEND on page 120

"Insert" Adds a new row above the currently selected one.

Remote command:

[:SOURce<hw>] :BB:GBAS:VDB<ch>:INSERT on page 121

"Delete" Deletes the selected row.

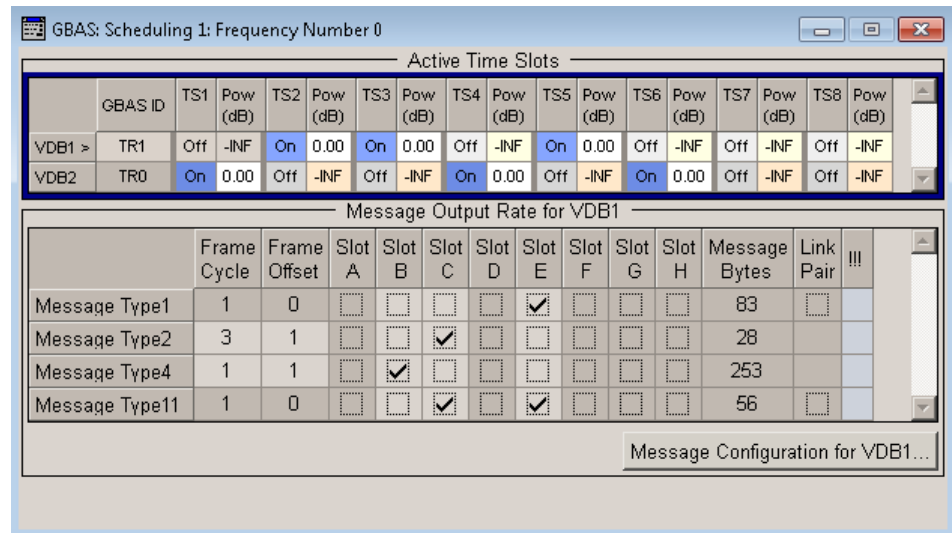
Remote command:

[:SOURce<hw>] :BB:GBAS:VDB<ch>:DELETE on page 121

4.3 Scheduling Settings

To access this dialog:

1. Select "GBAS > Main dialog > VDB Transmitters Configuration".
2. Select "VDB Transmitters Configuration > VDB# > Scheduling > Config"



The dialog comprises the settings, necessary to configure the time domain scheduling of the VDB transmitters on the selected frequency. The transmission is based on TDMA and hence on one particular frequency you can allocate only one VDB transmitter per one time slot (TS).

For more information, see "[Broadcast timing structure](#)" on page 15.

TS0..TS7

Enables the VDB in the corresponding time slot (TS).

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:SCH:TS<st>:STATE](#) on page 124

Pow(dB)

Sets the relative power of a VDB per time slot (TS).

See "[Power settings](#)" on page 17 for more information.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:SCH:TS<st>:POWER](#) on page 124

Frame Cycle

Sets the repetition rate for each message type except for type 1 and type 11.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:SCH:M11T:RFrame?](#) on page 125

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:SCH:M1T:RFrame?](#) on page 125

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M2T:RFRame on page 126

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M4T:RFRame on page 126

Frame Offset

Sets the offset frame related to the first frame.

Remote command:

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M11T:FOFFset? on page 124

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M1T:FOFFset? on page 124

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M2T:FOFFset on page 124

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M4T:FOFFset on page 124

Slot

Assign the slot to the message type.

Remote command:

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M11T:SLOT<di> on page 126

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M11T:SLOT<di>:STATe on page 126

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M1T:SLOT<di> on page 126

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M1T:SLOT<di>:STATe on page 126

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M2T:SLOT<di> on page 126

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M2T:SLOT<di>:STATe on page 126

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M4T:SLOT<di> on page 126

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M4T:SLOT<di>:STATe on page 126

Message Bytes

Shows the total number of bytes per message type.

Remote command:

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M11T:MBYTeS? on page 125

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M1T:MBYTeS? on page 125

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M2T:MBYTeS? on page 125

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M4T:MBYTeS? on page 125

Link Pair

Specifies if the set of measurement blocks is included in a single message or in a linked pair of messages.

Available only for message type 1 and 11.

Remote command:

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M11T:LPAir:STATe on page 125

[:SOURce<hw>] :BB:GBAS:VDB<ch>:SCH:M1T:LPAir:STATe on page 125

!!!

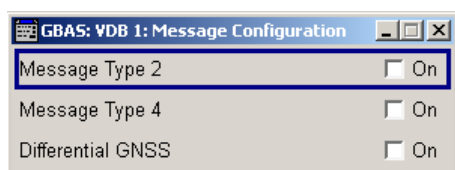
Dsplays if too many bytes per slot are assigned.

If too many bytes per slot are assigned, you can pair messages (message type 1 and 11 only) or deactivate messages in the specific "Slot".

4.4 Message Configuration Settings

To access this dialog:

1. Reference Station Data Selector>Select "GBAS > Main dialog > VDB Transmitters Configuration".
2. Select "VDB Transmitters Configuration > VDB# > Data > Real GBAS Data"
3. Select "Data Config > Msg. Config".



The dialog comprises the settings, necessary to configure the messages of each of the VDB transmitters.

4. Select "Message Configuration > Message Type 2/4 > On" to enable configuration of the particular message.
5. Select "Message Configuration > Differential GNSS > On" to enable the load of a file containing differential GBAS settings.

4.4.1 Message Type 2 Parameters

The dialog comprises the parameters of message type 2, according to [RTCA DO-246D](#), Table 2.14.

Message type 2 carries information on the exact location for which the are referenced as well as other GBAS-related parameters.

Provided are the following settings:

Message Type 2

Enables you to configure the parameters of message type 2, according to [RTCA DO-246D](#), Table 2.14.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:MT2State](#) on page 141

Ground Station Reference Receivers

Selects the number of the GNSS reference receivers installed in this system.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:GSRReceivers](#) on page 135

Ground Station Accuracy Designator

Selects the letter designator indicating the minimum signal-in-space accuracy performance provided by the ground station.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:GSADesignator](#) on page 135

Ground Station Continuity/Integrity Designator

Selects the numerical designator that indicates the operational status of GBAS.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:GCID](#) on page 135

Local Magnetic Variation

Sets the published local magnetic variation at the differential reference point. A positive value represents an east variation (clockwise from true north).

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:LMVariation](#) on page 138

Sigma_vert_iono_gradient

Sets the parameter $\sigma_{\text{vert_iono_gradient}}$, that is the standard deviation of a normal distribution associated with the residual ionospheric uncertainty due to spatial decorrelation.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:SVIGradient](#) on page 145

Refractivity Index

Sets the estimated tropospheric refractivity index N_R at the reference point

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:RFIndex](#) on page 142

Scale Height

Sets the parameter scale height (h_0), used for scaling the tropospheric refractivity as a function of differential altitude.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:SHEight](#) on page 145

Refractivity Uncertainty

Sets the parameter σ_N , that is the standard deviation of a normal distribution associated with the residual tropospheric uncertainty.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:RUNCertainty](#) on page 144

Reference Location Configuration

The coordinates of the ground station reference point are defined in WGS84 coordinates. In this coordinate system, a location is identified by three coordinates, the altitude, the latitude and the longitude. The last two can be displayed in decimal or DMS format. Use the parameter "Position Format" to select the display format.

Table 4-2: Reference location configuration

Parameter	Description
"Position Format"	<p>Sets the format in which the Latitude and Longitude are displayed.</p> <ul style="list-style-type: none"> "DEG:MIN:SEC" The display format is Degree:Minute:Second and Direction, i.e. $XX^{\circ}XX'XX.XX$ Direction, where direction can be North/South and East/West. "Decimal Degree" The display format is decimal degree, i.e. $+/-XX.XXXXX^{\circ}$, where "+" indicates North and East and "-" indicates South and West.
"Altitude"	<p>Sets the altitude of the ground station reference point, that is the height above the ellipsoid (HAE) altitude.</p>

Parameter	Description
"Latitude"	Sets the latitude of the ground station reference point.
"Longitude"	Sets the longitude of the ground station reference point.

Remote command:

To enter the coordinates in Degree:Minute:Second format:

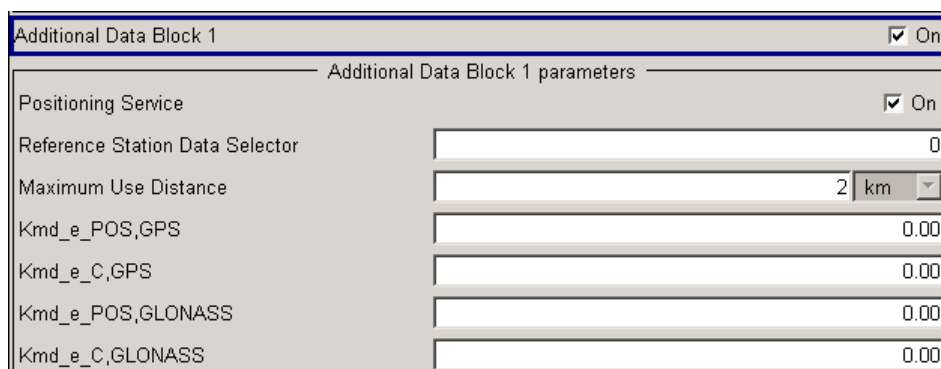
`[:SOURce<hw>] :BB:GBAS:VDB<ch>:MCONfig:LOCation:COORDinates:DMS`
on page 139

To enter the coordinates in decimal degree format

`[:SOURce<hw>] :BB:GBAS:VDB<ch>:MCONfig:LOCation:COORDinates:DECimal` on page 139

Additional Data Block 1

Enables you to configure the additional data block 1.



Remote command:

`[:SOURce<hw>] :BB:GBAS:VDB<ch>:MCONfig:ADB1:STATe` on page 128

Positioning Service ← Additional Data Block 1

Selects if the GBAS positioning service is supported.

Remote command:

`[:SOURce<hw>] :BB:GBAS:VDB<ch>:MCONfig:PSErvice:STATe` on page 141

Reference Station Data Selector ← Additional Data Block 1

Available only if "Positioning Service > On".

Sets the numerical identifier for selecting the ground subsystem.

Remote command:

`[:SOURce<hw>] :BB:GBAS:VDB<ch>:MCONfig:RSDSelector` on page 142

Maximum User Distance ← Additional Data Block 1

Sets the maximum distance from the reference point for which the integrity is assured.

Remote command:

`[:SOURce<hw>] :BB:GBAS:VDB<ch>:MCONfig:MUDistance` on page 140

Kmd_e_POS GPS, CLONASS ← Additional Data Block 1

Sets the ephemeris missed detection parameter (Kmd_e), GBAS positioning service . This is a multiplier considered when calculating the ephemeris error position bound for the GBAS positioning. It is derived from the probability that a detection is missed because of an ephemeris error in a GPS/GLONASS satellite.

Remote command:

[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:KPGPs on page 136

[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:KPGLonass on page 136

Kmd_e_C, GPS/ Kmd_e_C, GLONASS ← Additional Data Block 1

Sets the ephemeris missed detection parameter (Kmd_e), category I precision approach and approach with vertical guidance (APV). This is a multiplier considered when calculating the ephemeris error position bound for the category I precision approach and APV. It is derived from the probability that a detection is missed because of an ephemeris error in a GPS/GLONASS satellite.

Remote command:

[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:KCGLonass on page 136

[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:KCGPs on page 136

Additional Data Block 3

Enables you to configure the parameters of the additional block 3, containing the GBAS approach service type (GAST) D parameters.

Additional Data Block 3		<input checked="" type="checkbox"/> On
Additional Data Block 3 parameters		
Kmd_e_D,GPS	<input type="text" value="0.00"/>	0.00
Kmd_e_D,GLONASS	<input type="text" value="0.00"/>	0.00
Sigma_vert_iono_gradient_D	<input type="text" value="0.000 000 0"/>	mm

Remote command:

[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:ADB3:STATE on page 128

Kmd_e_D, GPS/ Kmd_e_D, GLONASS ← Additional Data Block 3

Sets the ephemeris missed detection parameter (Kmd_e), GAST D. This is a multiplier considered when calculating the ephemeris error position bound for GAST D. It is derived from the probability that a detection is missed because of an ephemeris error in a GPS/GLONASS satellite.

Remote command:

[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:KDGLonass on page 136

[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:KDGP on page 136

Sigma_vert_iono_gradient_ID ← Additional Data Block 3

Sets the standard deviation of a normal distribution connected to the residual ionospheric uncertainty which is caused by spatial decorrelation.

Remote command:

[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:SVID on page 145

Additional Data Block 4

Enables you to configure the parameters of the additional block 4, containing the VDB authentication parameters.

Additional Data Block 4		<input checked="" type="checkbox"/> On
Additional Data Block 4 parameters		
Slot Group Definition	<input type="checkbox"/> A	<input type="checkbox"/> B
	<input type="checkbox"/> C	<input checked="" type="checkbox"/> D
	<input checked="" type="checkbox"/> E	<input checked="" type="checkbox"/> F
	<input checked="" type="checkbox"/> G	<input checked="" type="checkbox"/> H

Remote command:

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:ADB4:STATe` on page 129

Slot Group Definition ← Additional Data Block 4

Specifies which slots are used by the ground station.

Remote command:

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:SGDefinition:A:STATe`
on page 144

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:SGDefinition:B:STATe`
on page 144

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:SGDefinition:C:STATe`
on page 144

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:SGDefinition:D:STATe`
on page 144

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:SGDefinition:E:STATe`
on page 144

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:SGDefinition:F:STATe`
on page 144

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:SGDefinition:G:STATe`
on page 144

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:SGDefinition:H:STATe`
on page 144

4.4.2 Message Type 4 Parameters

To access the settings:

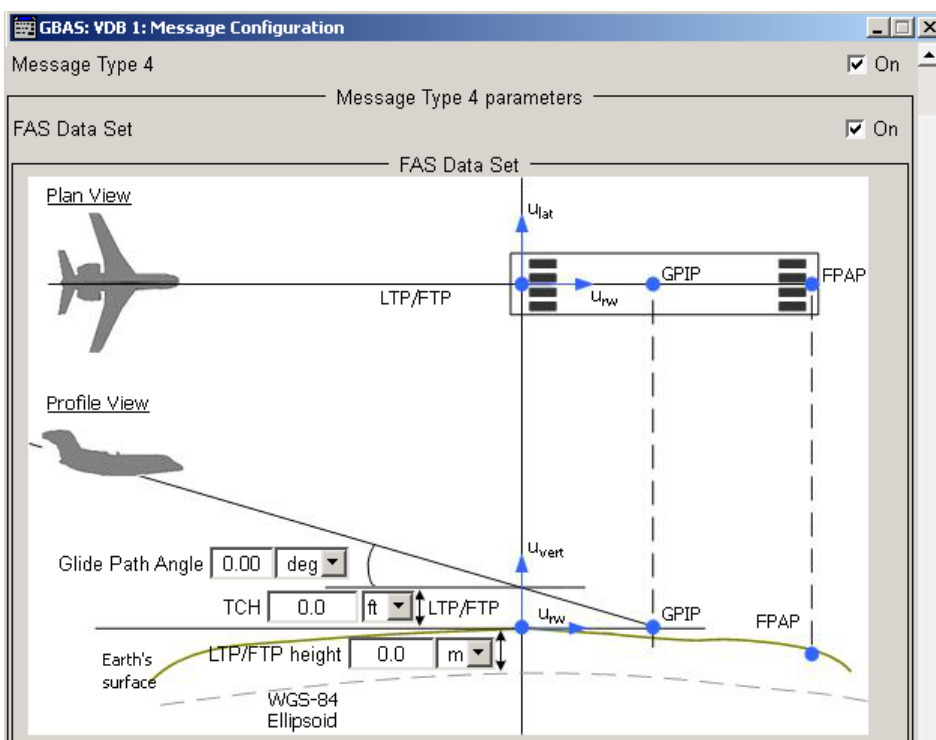
1. Select "GBAS > Main dialog > VDB Transmitters Configuration".
2. Select "VDB Transmitters Configuration > VDB# > Data > Real GBAS Data"
3. Select "Data Config > Msg. Config".
4. Select "Message Configuration > Message Type 4 > On"
5. Enable "FAS Data Set > On"
6. Enable "TAP Data Set > On"

The dialog comprises the parameters of message type 4, according to [RTCA DO-246D](#), Table 2.14.

According to the [RTCA DO-246D](#), the Message Type 4 contains one or more data sets that contain approach data, associated vertical/lateral alert limits, and/or the Terminal Area Path (TAP). With the settings provided in this dialog, you can configure the Final Approach Segment (FAS) data set, the TAP data set or both.

Message Type 4

Enables you to configure the parameters of message type 4, according to [RTCA DO-246D](#), Table 2.18.



Airport ID	KJFK		
Runway Number			13
Runway Letter	L(left)		
Approach Performance Designator	GAST C		
Route Indicator	A		
Reference Path Data Selector			3
Reference Path ID	L13A		
LTP/FTP Location Configuration			
LTP/FTP Position Format	DEG:MIN:SEC		
LTP/FTP Latitude	40 ° 39 ' 22.950 "	North	
LTP/FTP Longitude	73 ° 47 ' 13.830 "	East	
Delta_FPAP Location Configuration			
Delta_FPAP Position Format	Decimal Degree		
Delta_FPAP Latitude	-0.012 650	Degree	
Delta_FPAP Longitude	0.027 897	Degree	
Course Width at Threshold	105.00	m	
Delta_Length Offset	0	m	
FAS Vertical Alert Limit / Approach Status	0.0	m	
FAS Lateral Alert Limit / Approach Status	40.0	m	
TAP Data Set	<input type="checkbox"/> On		
Differential GNSS	<input type="checkbox"/> On		

Remote command:

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MConfig:MT4State` on page 141

FAS Data Set

Enables you to configure the parameters of the Final Approach Segment (FAS) data set.

Provided are the parameters necessary to configure a single precision approach. The FAS path is a line in space that defines the path an airplane follows on its final approach. This line is defined by the Landing Threshold Point/Fictitious Threshold Point (LTP/FTP), Flight Path Alignment Point (FPAP), Threshold Crossing Height (TCH), and the Glide Path Angle (GPA).

The dialog displays also two graphs, a "Plan View" and a "Profile View", to visualize a typical final approach path.

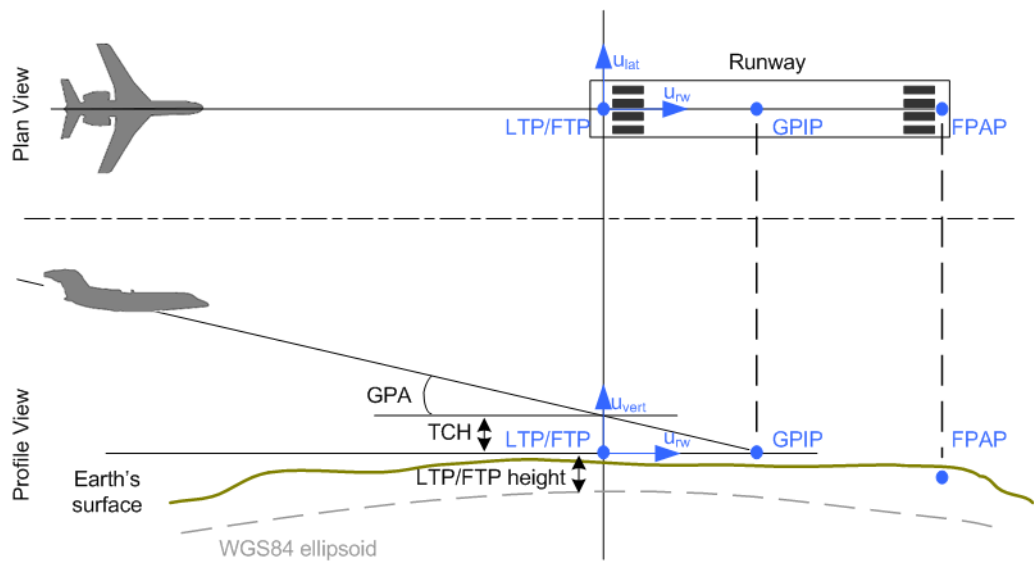


Figure 4-1: Final Approach Segment (FAS) diagram, according to RTCA DO-246D

LTP/FTP = Landing Threshold Point/Fictitious Threshold Point; point at the center of the landing runway, defined by its WGS84 coordinates

GPIP = Glide Path Intercept Point; the point where the final approach path intercepts the local level plane

FPAP = Flight Path Alignment Point; point at the end of the runway that in conjunction with the LTP/FTP defines the geodesic plane of the precision final approach, landing and flight path.

TCH = Threshold Crossing Height

GAP = Glide Path Angle; angle at the TCH that describes the intended angle of descent at the final approach path.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:FDSState](#) on page 134

Plan View/Profile View Parameters ← FAS Data Set

The following parameters define the approach path (see also [Figure 4-1](#)):

"Glide Path Angle"

Sets the angle of the FAS path (glide path) with respect to the horizontal plane tangent to the WGS84 ellipsoid at the LTP/FTP.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:GPANgle](#) on page 135

"TCH"

Sets the threshold crossing height (TCH), that is the height of the FAS path above the LTP/FTP defined in either feet or meters.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:ATCHeight](#) on page 129

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:ATUSelector](#) on page 129

"LTP/FTP Height"

Sets the height of the LTP/FTP above the WGS84 ellipsoid.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:LFLocation:HEIGHT](#)

on page 138

Airport ID ← FAS Data Set

Sets the airport identification as three or four alphanumeric characters used to designate airport facilities. Permitted are upper letters, numbers and "space".

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:AID](#) on page 128

Runway Number ← FAS Data Set

Sets the approach runway number.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:RNUMber](#) on page 142

Runway Letter ← FAS Data Set

Sets the runway letter, to distinguish between parallel runways. The conventional designation is used.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:RLETter](#) on page 142

Approach Performance Designator ← FAS Data Set

Sets the general information about the approach design. The conventional designation is used.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:APDesignator](#) on page 128

Route Indicator ← FAS Data Set

Sets the route indicator, that is a single alphabetic character used to differentiate between multiple approaches to the same runway end. Allowed are the upper case letters, excluding "I" and "O", or the "space" character.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:RUINdicator](#) on page 144

Reference Path Data Selector ← FAS Data Set

Sets the reference path data selector (RPDS), that is a numerical identifier that is unique on a frequency in the broadcast region and used to select the FAS.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:RPDF](#) on page 143

Reference Path ID ← FAS Data Set

Sets the reference path identifier as three or four alphanumeric characters used to designate the reference path.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:RPIF](#) on page 143

LTP/FTP Location Configuration ← FAS Data Set

The coordinates of the LTP/FTP are defined in WGS84 coordinates. In this coordinate system, a location is identified by three coordinates, the altitude, the latitude and the longitude. The last two can be displayed in decimal or DMS format. Use the parameter "Position Format" to select the display format.

Use the parameter [LTP/FTP Height](#) to define the altitude.

Table 4-3: LTP/FTP location configuration

Parameter	Description
"Position Format"	Sets the format in which the Latitude and Longitude are displayed. <ul style="list-style-type: none"> "DEG:MIN:SEC" The display format is Degree:Minute:Second and Direction, i.e. XX°XX'XX.XX" Direction, where direction can be North/South and East/West. "Decimal Degree" The display format is decimal degree, i.e. +/-XX.XXXXX° , where "+" indicates North and East and "-" indicates South and West.
"Latitude"	Sets the latitude of the LTP/FTP in arc seconds.
"Longitude"	Sets the longitude of the LTP/FTP in arc seconds.

Remote command:

To enter the coordinates in Degree:Minute:Second format:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:LFLocation:COORDinates:DMS](#)
on page 137

To enter the coordinates in decimal degree format:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:LFLocation:COORDinates:DECimal](#)
on page 137

Delta_FPAP Location Configuration ← FAS Data Set

The Delta FPAD (Δ FPAD) represents the difference of latitude/longitude of the runway Flight Path Alignment Point (FPAP) from the LTP/FTP.

The Delta FPAD coordinates are defined in WGS84 coordinates. In this coordinate system, a location is identified by three coordinates, the altitude, the latitude and the longitude. The last two can be displayed in decimal or DMS format. Use the parameter "Position Format" to select the display format.

Table 4-4: Delta_FPAP location configuration

Parameter	Description
"Position Format"	Sets the format in which the Latitude and Longitude are displayed. <ul style="list-style-type: none"> "DEG:MIN:SEC" The display format is Degree:Minute:Second and Direction, i.e. XX°XX'XX.XX" Direction, where direction can be North/South and East/West. "Decimal Degree" The display format is decimal degree, i.e. +/-XX.XXXXX° , where "+" indicates North and East and "-" indicates South and West.
"Latitude"	Sets the difference of latitude of the FPAP in arc seconds. Positive values indicate the FPAP latitude north of LTP/FTP latitude.
"Longitude"	Sets the difference of longitude of the FPAP in arc seconds. Positive values indicate the FPAP longitude east of LTP/FTP longitude.

Remote command:

To enter the coordinates in Degree:Minute:Second format:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:DFLocation:COORDinates:DMS](#)
on page 130

To enter the coordinates in decimal degree format:

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:DFLocation:COORDinates:DECimal` on page 130

Course Width at Threshold ← FAS Data Set

Sets the lateral displacement from the path defined by the FAS at the LTP/FTP at which full-scale course deviation indicator (CDI) deflection is attained.

Remote command:

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:CWAThreshold` on page 129

Delta_Length Offset ← FAS Data Set

Sets the parameter delta length (Δ Length) offset, that is the distance from the stop end of the runway to the FPAP.

Remote command:

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:DLOffset` on page 133

FAS Vertical Alert Limit / Approach Status ← FAS Data Set

Sets the value of the broadcast vertical alert limit.

Remote command:

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:FVAA` on page 134

FAS Lateral Alert Limit / Approach Status ← FAS Data Set

Sets the value of the broadcast lateral alert limit.

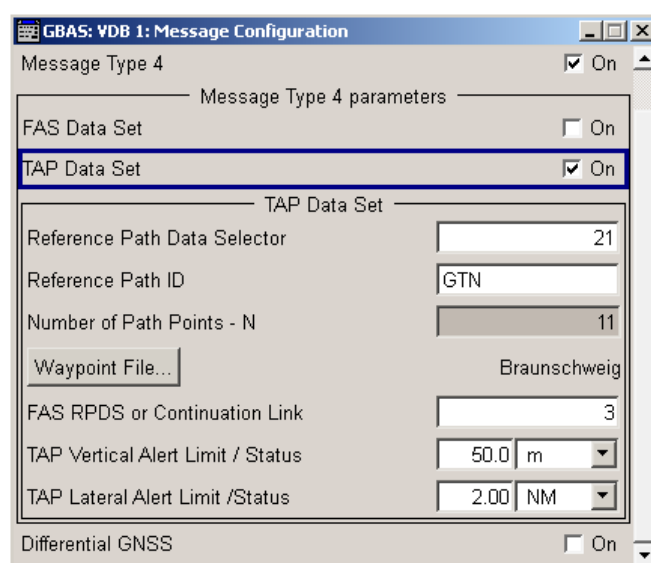
Remote command:

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:FLAA` on page 134

TAP Data Set

Enables you to configure the parameters of the Terminal Area Path (TAP) data set.

A TAP defines the initial fix (IF), track-to-fix (TF) and radius-to-fix (RF) legs and provides additional support for terminal area operations.



Remote command:

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:TDSState` on page 145

Reference Path Data Selector ← TAP Data Set

Sets the reference path data selector, that is a numerical identifier that is unique on a frequency in the broadcast region and used to select the TAP.

Remote command:

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:RPDT` on page 143

Reference Path ID ← TAP Data Set

Sets the reference path identifier as three or four alphanumeric characters used to designate the reference path.

Remote command:

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:RPIT` on page 143

Number of Path Points - N ← TAP Data Set

Indicates the total number of path points included in this TAP.

Remote command:

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:NOPoint` on page 141

Waypoint File ← TAP Data Set

Accesses the "Select Waypoint File" dialog to select predefined or user-defined waypoint files.

A waypoint file is description of a moving scenario, like, for example, a sequence of positions. A waypoint file must have the extension `*.txt` and file format as described in [Chapter D.1, "Waypoint File Format"](#), on page 218.

Use the "Predefined Files" function, to load a predefined file.

Remote command:

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:WAYPoint:PREDefined:CATalog?` on page 146

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:WAYPoint:USER:CATalog?` on page 146

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:WAYPoint:PREDefined:FILE` on page 147

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:WAYPoint:USER:FILE` on page 147

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:WAYPoint:FILE?` on page 147

Predefined Files ← TAP Data Set

Access a list with predefined files.

FAS RPDS or Continuation Link ← TAP Data Set

Sets the FAS reference path data selector (RPDS) or the continuation link. Continuation link is the RPDS for the next segment that is a continuation of the previous segment.

Remote command:

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:FRCLink` on page 134

TAP Vertical Alert Limit / Status ← TAP Data Set

Sets the value of the broadcast vertical alert limit.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:TVAS](#) on page 146

TAP Lateral Alert Limit / Status ← TAP Data Set

Sets the value of the broadcast lateral alert limit.

Remote command:

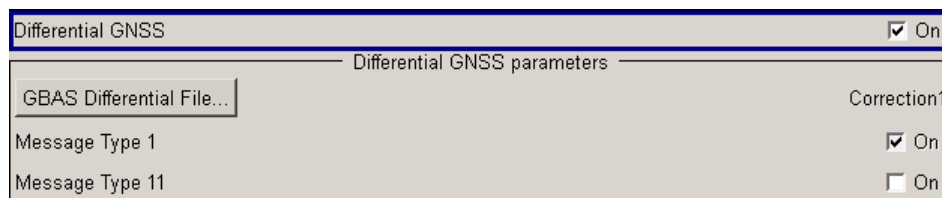
[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:TLAS](#) on page 146

4.4.3 Differential GNSS Parameters

Differential GNSS is an approach that uses known GNSS reference locations to determine channel correction parameters. The retrieved information is transmitted to other GNSS receivers to increase the accuracy of their position information.

To access the settings:

1. Select "GBAS > Main dialog > VDB Transmitters Configuration".
2. Select "VDB Transmitters Configuration > VDB# > Data > Real GBAS Data"
3. Select "Data Config > Msg. Config".
4. Select "Message Configuration > Differential GNSS > On".



The dialog enables you to load a file with GBAS differential data. Per default, the `Correction1.rs_gbas` file is used.

5. Select "GBAS Differential File" and load your user-defined file.
Refer to [Chapter D.2, "GBAS Differential File Format"](#), on page 218 for description of the required file format.

Differential GNSS

Enables the use of differential GNSS data.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:DG:STATE](#) on page 132

Message Type 1

Enables the use of the message type 1, differential GPS corrections.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:DG:M1State](#) on page 131

Message Type 11

Enables the use of the message type 11, C/A-Code L1, L2 delta corrections.

Remote command:

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:DG:M11State` on page 131

GBAS Differential File...

Accesses the "Select Proprietary File" dialog to select a file containing differential GBAS information. The differential GBAS file must have the extension `*.rs_gbas` and file format as described in [Chapter D.2, "GBAS Differential File Format"](#), on page 218.

Use the "Predefined Files" function, to load a predefined file.

Remote command:

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:DG:PREDEFINED:CATalog?`

on page 132

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:DG:USER:CATalog?` on page 132

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:DG:PREDEFINED:FILE`

on page 132

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:DG:USER:FILE` on page 133

`[:SOURCE<hw>] :BB:GBAS:VDB<ch>:MCONfig:DG:FILE?` on page 133

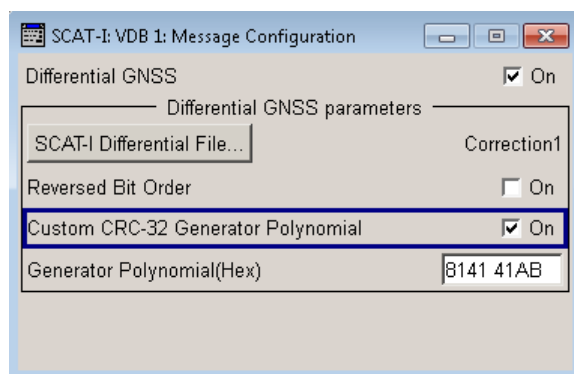
Predefined Files

Access a list with predefined files.

4.4.4 SCAT-I Message Parameters

To access this dialog:

1. Select "GBAS > Main dialog > SCAT-I > On".
2. Select "VDB Transmitters Configuration > VDB# > Data > Real GBAS Data"
3. Select "Data Configuration > Msg. Config".



The dialog comprises the settings, necessary to configure the messages of each of the VDB transmitters.

4. Select "Message Configuration > Differential GNSS > On" to enable the load of a file containing differential GBAS settings.

SCAT-I Differential File...

Accesses the "Select Proprietary File" dialog to select a file containing differential SCAT-I information. The differential SCAT-I file must have the extension *.rs_scatt and file format as described in [Chapter D.2, "GBAS Differential File Format"](#), on page 218.

Use the "Predefined Files" function, to load a predefined file.

Remote command:

`[:SOURce<hw>] :BB:GBAS:VDB<ch>:MCONfig:DG:SPReDEFINED:CATalog`
on page 149

`[:SOURce<hw>] :BB:GBAS:VDB<ch>:MCONfig:DG:SUSer:CATalog` on page 149

`[:SOURce<hw>] :BB:GBAS:VDB<ch>:MCONfig:DG:SPReDEFINED:FILE`
on page 149

`[:SOURce<hw>] :BB:GBAS:VDB<ch>:MCONfig:DG:SUSer:FILE` on page 149

`[:SOURce<hw>] :BB:GBAS:VDB<ch>:MCONfig:DG:SFILE?` on page 148

Reversed Bit Order

Enables the reserved bit order.

Remote command:

`[:SOURce<hw>] :BB:GBAS:VDB<ch>:MCONfig:DG:RBORDER:STATE` on page 148

Custom CRC-32 Generator Polynomial

Enables the custom CRC-32 generator polynomial.

Remote command:

`[:SOURce<hw>] :BB:GBAS:VDB<ch>:MCONfig:DG:RBORDER:STATE` on page 148

Generator Polynomial (Hex)

Sets the value of the generator polynomial.

Remote command:

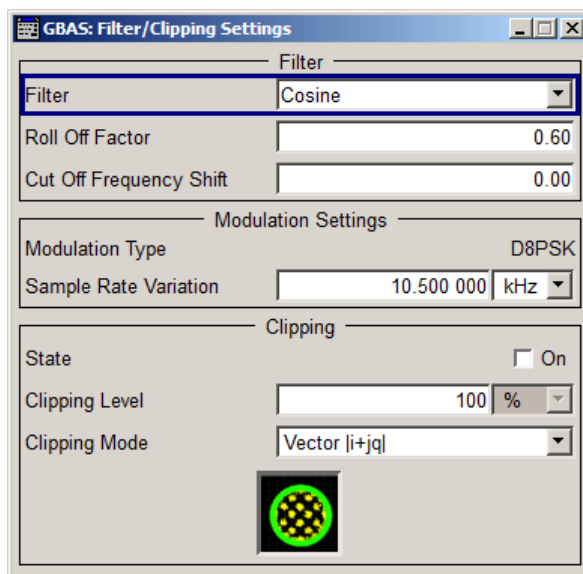
`[:SOURce<hw>] :BB:GBAS:VDB<ch>:MCONfig:DG:GPOLynomial:PATtern`
on page 148

4.5 Filter/Clipping Settings

To access this dialog:

1. Select "Main dialog > Multiple Frequency Channels > Off".

2. Select "Main dialog > Filter/Clipping Settings".



The dialog comprises the settings, necessary to configure the baseband filter and to enable clipping, as well as information on the applied modulation type and sample rate.

4.5.1 Filter Settings

Selection and configuration of baseband filter is enabled in single frequency mode, i.e. "Multiple Frequency Channels > Off"

Provided are the following settings for configuring the baseband filter:

Filter

Selects the baseband filter.

Remote command:

`[:SOURce<hw>] :BB:GBAS:FILTer:TYPE` on page 150

Roll Off Factor or BxT

Sets the filter parameter.

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

The rolloff factor affects the steepness of the filter slopes. A "Rolloff Factor = 0" results in the steepest slopes; values near to 1 make the slopes more flat.

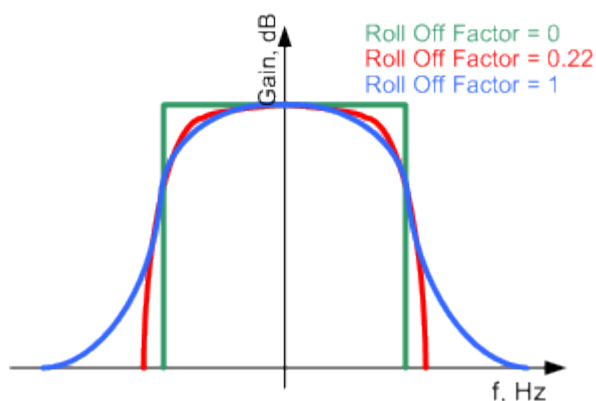


Figure 4-2: Example of the frequency response of a filter with different Roll Off Factors

Remote command:

[:SOURce<hw>] :BB:GBAS:FILTer:PARAmeter:APCO25 on page 150

[:SOURce<hw>] :BB:GBAS:FILTer:PARAmeter:COSine on page 150

[:SOURce<hw>] :BB:GBAS:FILTer:PARAmeter:GAUSS on page 150

[:SOURce<hw>] :BB:GBAS:FILTer:PARAmeter:PGAuss on page 150

[:SOURce<hw>] :BB:GBAS:FILTer:PARAmeter:RCOSine on page 150

[:SOURce<hw>] :BB:GBAS:FILTer:PARAmeter:SPHase on page 150

Cut Off 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:GBAS:FILTer:PARAmeter:LPASS on page 150

[:SOURce<hw>] :BB:GBAS:FILTer:PARAmeter:LPASSEVM on page 150

Cut Off Frequency Shift

(available for filter parameter Cosine only.)

The cutoff frequency is a filter characteristic that defines the frequency at the 3 dB down point. The "Cut Off Frequency Shift" affects this frequency in the way that the filter flanks are "moved" and the transition band increases by "Cut Off Frequency Shift" * "Sample Rate".

- A "Cut Off Frequency Shift" = -1 results in a very narrow-band filter
- Increasing the value up to 1 makes the filter more broad-band
- By "Cut Off Frequency Shift" = 0, the -3 dB point is at the frequency determined by the half of the selected "Sample Rate".

Tip: Use this parameter to adjust the cutoff frequency and reach spectrum mask requirements.

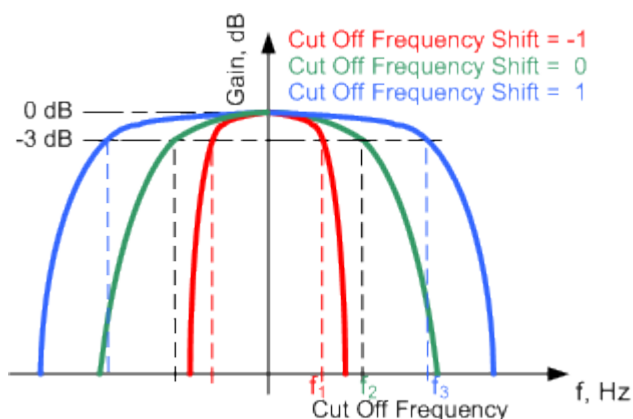


Figure 4-3: Example of the frequency response of a filter with different Cut Off Frequency Shift

Remote command:

`[:SOURce<hw>] :BB:GBAS:FILTer:PARAmeter:COsine:COFS` on page 150

4.5.2 Modulation Settings

Provided are the following settings:

Modulation Type

According to the GBAS standard, symbols are converted to differentially encoded 8 phase shift keyed (D8PSK) carrier phase shifts.

Remote command:

`[:SOURce<hw>] :BB:GBAS:MSET:MTYPE?` on page 152

Sample Rate Variation/Sample Rate Info

Sets/displays the used sample rate variation. You can set the sample rate value in the "Filter/Clipping Settings" dialog.

This setting can be used for testing the symbol rate tolerance.

The [RTCA DO-246D](#) specification defines a symbol rate of the GBAS data broadcast as 10500 symbols/sec. Because of the used modulation (see [Modulation Type](#)), each symbol defines one of eight states. This results in a nominal bit rate of 31500 bits/s.

Remote command:

`[:SOURce<hw>] :BB:GBAS:MSET:SRATE?` on page 152

`[:SOURce<hw>] :BB:GBAS:SRINfo?` on page 120

4.5.3 Clipping Settings

Provided are the following settings:

Clipping State

Switches baseband clipping on and off.

Baseband clipping is a simple and effective way of reducing the crest factor of the signal. Since clipping is done before filtering, the procedure does not influence the spectrum. The EVM however increases.

Remote command:

`[:SOURce<hw>] :BB:GBAS:CLIPping:STATe` on page 151

Clipping Level

Sets the limit for clipping.

This value indicates at what point the signal is clipped. It is specified as a percentage, relative to the highest level. 100% indicates that clipping does not take place.

Remote command:

`[:SOURce<hw>] :BB:GBAS:CLIPping:LEVel` on page 151

Clipping Mode

Selects the clipping method. The dialog displays a graphical illustration on how this two methods work.

- "Vector $| i + jq |$ "
The limit is related to the amplitude $| i + q |$. The I and Q components are mapped together, the angle is retained.
- "Scalar $| i | , | q |$ "
The limit is related to the absolute maximum of all the I and Q values $| i | + | q |$. The I and Q components are mapped separately, the angle changes.

Remote command:

`[:SOURce<hw>] :BB:GBAS:CLIPping:MODE` on page 151

4.6 Global Settings

This section provides access general trigger, clock and mapping settings.

Global Trigger/Clock Settings

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

This dialog is to set the trigger threshold, the input impedance and the polarity of the clock and trigger inputs.

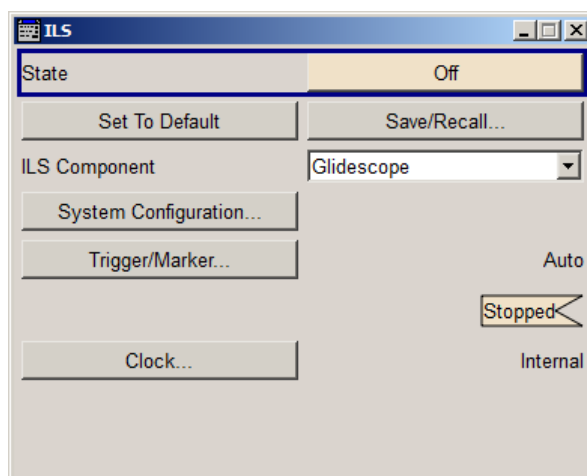
The parameters in this dialog affect all digital modulations and standards, and are described in chapter "Global Trigger/Clock/Input Settings" in the operating manual.

5 ILS Configuration and Settings

- ▶ To access this dialog select "Baseband Block > ILS".

5.1 General Settings

This dialog provides access to the general settings of the ILS standard, like enabling the standard and selecting the ILS component.



Changing a parameter in the ILS standard causes an instant signal change in the R&S SMBV. There is no extra measurement cycle to calculate the RMS value of the baseband signal to set the correct RF level. If the standard is switched ON for the first time, or after every subsequent ON/OFF sequence, the measurement cycle will take place to determine the correct RF level. Every subsequent parameter change in the ILS standard is performed without another measurement cycle to provide a continuous signal output.

State

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

Remote command:

`<subsystem>:STATE` on page 112

Set To Default

Calls the default settings. The values of the main parameters are listed in [Chapter C, "Default Settings"](#), on page 215.

Remote command:

`<subsystem>:PRESet` on page 112

Save/Recall

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

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

Remote command:

`<subsystem>:SETTing:CATalog` on page 112

`<subsystem>:SETTing:STORe` on page 113

`<subsystem>:SETTing:STORe:FAST` on page 113

`<subsystem>:SETTing:LOAD` on page 113

`<subsystem>:SETTing:DELeTe` on page 112

ILS Component

Selects the ILS component.

"Glide slope" Enables the glide slope.

"Localizer" Enables the localizer.

"Marker Beacons"
 Enables the marker beacons.

Remote command:

`[:SOURce<hw>] [:BB] : ILS : TYPE` on page 153

System Configuration

Accesses the "System Configuration" dialog, see:

- [Chapter 5.2, "System Configuration Settings - Glide Slope"](#), on page 54 for the glide slope settings
- [Chapter 5.3, "System Configuration Settings Localizer"](#), on page 58 for the localizer settings
- [Chapter 5.4, "System Configuration Settings Marker Beacons"](#), on page 64 for the marker beacons settings

Trigger/Marker...

Accesses the dialog for selecting the trigger source, for configuring the marker signals and for setting the time delay of an external trigger signal, see [Chapter 8.1, "Trigger Settings"](#), on page 90 .

The currently selected trigger source is displayed to the right of the button.

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 : GBAS : TRIGger : EXECute` on page 196

`[:SOURce<hw>] : BB : ILS : TRIGger : EXECute` on page 196

`[:SOURce<hw>] : BB : VOR : TRIGger : EXECute` on page 196

`[:SOURce<hw>] : BB : DME : TRIGger : EXECute` on page 196

Arm

Stops the signal generation until subsequent trigger event occurs.

Remote command:

[:SOURce<hw>] :BB:GBAS:TRIGger:ARM:EXECute on page 195

[:SOURce<hw>] :BB:ILS:TRIGger:ARM:EXECute on page 195

[:SOURce<hw>] :BB:VOR:TRIGger:ARM:EXECute on page 195

[:SOURce<hw>] :BB:DME:TRIGger:ARM:EXECute on page 195

Clock...

Accesses the dialog for selecting the clock source, see [Chapter 8.4, "Clock Settings"](#), on page 98.

5.2 System Configuration Settings - Glide Slope

To access this dialog:

1. Select "ILS Component > Glide slope".
2. Select "ILS > System Configuration".

5.2.1 Signal Settings

The dialog comprises the settings, necessary to configure the ILS Glide slope (ILS-GS) modulation signal.

Signal Settings	
Carrier Frequency Mode	User Defined
Carrier Frequency	334.700 000 000 MHz
DDM Polarity	90 Hz - 150 Hz
Mode	Norm
Up Frequency	90.0 Hz
Down Frequency	150.0 Hz
Up/Down Phase	0.00 deg

Carrier Frequency Mode

Sets the mode for the carrier frequency of the signal.

"User Defined" Activates user defined variation of the carrier frequency.

"ICAO" Activates variation in predefined steps according to the standardized ILS-GS transmitting frequencies (see [Chapter B.1, "ILS Channel Frequencies"](#), on page 210). The start value can be selected in the field "ICAO Channel" below.

The selection is effective on both ILS modulations. A change to modulation ILS-GS automatically causes the RF frequency to be adapted to the glide slope value which is coupled to the localizer setting (see [Chapter B.1, "ILS Channel Frequencies"](#), on page 210).

Remote command:

`[:SOURCE<hw>] [:BB] : ILS : LOCALIZER : FREQUENCY : MODE` on page 164

`[:SOURCE<hw>] [:BB] : ILS [:GS | GSLOPE] : FREQUENCY : MODE` on page 156

Carrier Frequency

Available only for "Carrier Frequency Mode > User Defined".

Sets the carrier frequency of the signal.

Remote command:

`[:SOURCE<hw>] [:BB] : ILS [:GS | GSLOPE] : FREQUENCY` on page 156

ICAO Channel

Available only for "Carrier Frequency Mode > ICAO".

Selects the ICAO channel and sets the corresponding transmitting frequency. The ICAO channel settings for ILS-GS and ILS-LOC are coupled.

Refer to [Chapter B, "ICAO Channel Frequencies"](#), on page 210 for an overview of the standard defined ILS transmitting frequencies.

Remote command:

`[:SOURCE<hw>] [:BB] : ILS : LOCALIZER : ICAO : CHANNEL` on page 164

`[:SOURCE<hw>] [:BB] : ILS [:GS | GSLOPE] : ICAO : CHANNEL` on page 156

DDM Polarity

Defines the polarity for DDM calculation (see ["DDM Depth"](#) on page 57).

Remote command:

`[:SOURCE<hw>] [:BB] : ILS [:GS | GSLOPE] : DDM : POLARITY` on page 155

Mode

Selects the operating mode for the ILS (ILS-GS) modulation signal.

"Norm" ILS-GS modulation is active.

"90 Hz" Amplitude modulation of the output signal with the upper lobe signal component (90Hz signal content) of the ILS-GS signal.

The modulation depth of the 90-Hz signal results from the settings of the parameters [Sum of Depth \(SDM\)](#) and [DDM Depth](#) according to:

- "Fly > Down"
 $AM(90\text{ Hz}) = 0.5 \times (\text{SDM} + \text{DDM} \times 100\%)$
- "Fly > Up"
 $AM(90\text{ Hz}) = 0.5 \times (\text{SDM} - \text{DDM} \times 100\%)$

"150 Hz" Amplitude modulation of the output signal with the lower lobe signal component (150-Hz signal content) of the ILS-GS signal.

The modulation depth of the 150-Hz signal results from the settings of parameters **Sum of Depth (SDM)** and **DDM Depth** according to:

- "Fly > Down"
 $AM (150 \text{ Hz}) = 0.5 \times (\text{SDM} + \text{DDM} \times 100\%)$
- "Fly > Up"
 $AM (150 \text{ Hz}) = 0.5 \times (\text{SDM} - \text{DDM} \times 100\%)$

Remote command:

`[:SOURce<hw>] [:BB] : ILS [:GS | GSLope] :MODE` on page 157

Up Frequency

Sets the modulation frequency of the upper antenna lobe.

Remote command:

`[:SOURce<hw>] [:BB] : ILS [:GS | GSLope] :ULObE [:FREQuency]` on page 158

Down Frequency

Sets the modulation frequency of the lower antenna lobe.

Remote command:

`[:SOURce<hw>] [:BB] : ILS [:GS | GSLope] :LLObE [:FREQuency]` on page 156

Up/Down Phase

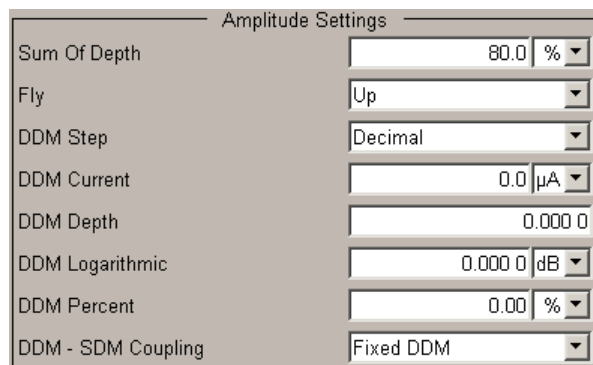
Sets the phase between the modulation signals of the upper and lower antenna lobe. The zero crossing of the lower lobe (150Hz) signal serves as a reference. The angle refers to the period of the signal of the lower antenna lobe.

Remote command:

`[:SOURce<hw>] [:BB] : ILS [:GS | GSLope] :PHASe` on page 157

5.2.2 Amplitude Settings

The dialog comprises the settings, necessary to configure the ILS-GS amplitude.



Sum of Depth (SDM)

Sets the arithmetic sum of the modulation depths of the upper lobe (90Hz) and lower lobe (150Hz) ILS-GS signal contents. The RMS modulation depth of the sum signal depends on the phase setting of both modulation tones.

Remote command:

[:SOURce<hw>] [:BB] : ILS [:GS | GSLope] :SDM on page 157

Fly

Selects the simulation mode for the ILS-GS modulation signal. A change of the setting automatically changes the sign of the DDM value.

This setting simulates the direction in which the pilot has to correct the course.

"Up" The 150-Hz modulation signal is predominant, the DDM value is negative (the airplane is too low, it must climb).

"Down" The 90-Hz modulation signal is predominant, the DDM value is positive (the airplane is too high, it must descend).

Remote command:

[:SOURce<hw>] [:BB] : ILS [:GS | GSLope] :DDM:DIRectioN on page 154

DDM Step

Selects the variation of the DDM values.

"Decimal" Decimal variation according to the current cursor position.

"Predifined" Variation in predefined steps according to the standardized DDM values.

Remote command:

n.a.

DDM Current

Sets the current of the ILS indicating the instrument corresponding to the DDM value. The instrument current is calculated according to:

$$\text{DDM } \mu\text{A} = \text{DDM} \times 857,125 \text{ } \mu\text{A}$$

A variation of the instrument current automatically leads to a variation of the DDM value and the DDM value in dB.

Remote command:

[:SOURce<hw>] [:BB] : ILS [:GS | GSLope] :DDM:CURRent on page 153

DDM Depth

Sets the difference in depth of modulation between the upper lobe (90Hz) and the lower lobe (150Hz) tone of the ILS-GS modulation signal.

The DDM value is calculated with the formula:

- "DDM Polarity > 90 Hz - 150 Hz" (default setting):
DDM = [AM(90 Hz) - AM (150 Hz)] / 100%
- "DDM Polarity > 150 Hz - 90 Hz":
DDM = [AM(150 Hz) - AM (90 Hz)] / 100%

A variation of the DDM value automatically leads to a variation of the value of the instrument current and the DDM value in dB.

Remote command:

[:SOURce<hw>] [:BB] : ILS [:GS | GSLope] :DDM [:DEPTh] on page 155

DDM Logarithmic

Sets the DDM value in dB. The dB value is calculated according to:

$$\text{DDM dB} = 20 \times \text{LOG} [(\text{SDM} + \text{DDM} \times 100\%) / (\text{SDM} - \text{DDM} \times 100\%)]$$

A variation of the value automatically leads to a variation of the DDM value and the instrument current.

Remote command:

`[:SOURCE<hw>] [:BB] :ILS [:GS | GSLope] :DDM:LOGarithmic` on page 154

DDM Percent

Sets the difference in depth of modulation between the upper lobe (90Hz) and the lower lobe (150Hz) tone of the ILS-GS modulation signal.

The DDM value in percent is calculated as follows:

- "DDM Polarity > 90 Hz - 150 Hz" (default setting):
DDM = [AM(90 Hz) - AM (150 Hz)]
- "DDM Polarity > 150 Hz - 90 Hz":
DDM = [AM(150 Hz) - AM (90 Hz)]

A variation of the DDM value automatically leads to a variation of the value of the instrument current and the DDM value in dB.

Remote command:

`[:SOURCE<hw>] [:BB] :ILS [:GS | GSLope] :DDM:PCT` on page 154

DDM - SDM Coupling

Selects if the DDM value is fixed or is changed with a change of sum of modulation depths (SDM, see below).

"Fixed DDM" The absolute DDM value stays constant when the SDM is changed.

"Coupled to SDM"

The absolute DDM value changes when the SDM is changed. The DDM value expressed in dB stays constant.

Remote command:

`[:SOURCE<hw>] [:BB] :ILS [:GS | GSLope] :DDM:COUPling` on page 153

5.3 System Configuration Settings Localizer

To access this dialog,

1. Select "ILS > ILS Component > Localizer".
2. Select "ILS > System Configuration"

5.3.1 Signal Settings

The dialog comprises the settings, necessary to configure the ILS localizer (ILS-LOC) modulation signal.

Signal Settings	
Carrier Frequency Mode	User Defined
Carrier Frequency	108.100 000 000 MHz
DDM Polarity	90 Hz - 150 Hz
Mode	Norm
Left Frequency	90.0 Hz
Right Frequency	150.0 Hz
Left/Right Phase	0.00 deg

Carrier Frequency Mode

Sets the mode for the carrier frequency of the signal.

"User Defined" Activates user defined variation of the carrier frequency.

"ICAO" Activates variation in predefined steps according to the standardized ILS-GS transmitting frequencies (see [Chapter B.1, "ILS Channel Frequencies"](#), on page 210). The start value can be selected in the field "ICAO Channel" below.

The selection is effective on both ILS modulations. A change to modulation ILS-GS automatically causes the RF frequency to be adapted to the glide slope value which is coupled to the localizer setting (see [Chapter B.1, "ILS Channel Frequencies"](#), on page 210).

Remote command:

`[:SOURce<hw>] [:BB] :ILS:LOCalizer:FREQuency:MODE` on page 164

`[:SOURce<hw>] [:BB] :ILS [:GS | GSlope] :FREQuency:MODE` on page 156

Carrier Frequency

Available only for "Carrier Frequency Mode > User Defined".

Sets the carrier frequency of the signal.

Remote command:

`[:SOURce<hw>] [:BB] :ILS:LOCalizer:FREQuency` on page 163

ICAO Channel

Available only for "Carrier Frequency Mode > ICAO".

Selects the ICAO channel and sets the corresponding transmitting frequency. The ICAO channel settings for ILS-GS and ILS-LOC are coupled.

Remote command:

`[:SOURce<hw>] [:BB] :ILS:LOCalizer:ICAO:CHANnel` on page 164

DDM polarity

Defines the polarity for DDM calculation (see ["DDM Depth"](#) on page 62).

Remote command:

`[:SOURce<hw>] [:BB] :ILS:LOCalizer:DDM:POLarity` on page 163

Mode

Selects the operating mode for the ILS-LOC modulation signal.

"Norm" ILS-LOC modulation is active.

- "90 Hz" Amplitude modulation of the output signal with the left lobe (90Hz) signal component of the ILS-LOC signal.
- The modulation depth of the 90Hz signal results from the settings of parameters [Sum of Depth](#) and [DDM Depth](#) according to:
- "Fly > Right"

$$AM(90\text{ Hz}) = 0.5 \times (\text{SDM} + \text{DDM} \times 100\%)$$
 - "Fly > Left"

$$AM(90\text{ Hz}) = 0.5 \times (\text{SDM} - \text{DDM} \times 100\%)$$
- "150 Hz" Amplitude modulation of the output signal with the right lobe (150Hz) signal component of the ILS-LOC signal.
- The modulation depth of the 150Hz signal results from the settings of parameters [Sum of Depth](#) and [DDM Depth](#) according to:
- "Fly" = "Right"

$$AM(150\text{ Hz}) = 0.5 \times (\text{SDM} + \text{DDM} \times 100\%)$$
 - "Fly" = "Left"

$$AM(150\text{ Hz}) = 0.5 \times (\text{SDM} - \text{DDM} \times 100\%)$$

Remote command:

[\[:SOURCE<hw>\]\[:BB\]:ILS:LOCALIZER:MODE](#) on page 165

Left Frequency

Sets the modulation frequency of the antenna lobe arranged at the left viewed from the air plane.

Remote command:

[\[:SOURCE<hw>\]\[:BB\]:ILS:LOCALIZER:LLOBE\[:FREQUENCY\]](#) on page 164

Right Frequency

Sets the modulation frequency of the antenna lobe arranged at the right viewed from the air plane.

Remote command:

[\[:SOURCE<hw>\]\[:BB\]:ILS:LOCALIZER:RLOBE\[:FREQUENCY\]](#) on page 165

Left/Right Phase

Sets the phase between the modulation signals of the left and right antenna lobe. The zero crossing of the right lobe (150Hz) signal serves as a reference. The angle refers to the period of the signal of the right antenna lobe.

Remote command:

[\[:SOURCE<hw>\]\[:BB\]:ILS:LOCALIZER:PHASE](#) on page 165

5.3.2 Amplitude Settings

The dialog comprises the settings, necessary to configure the ILS-LOC amplitude.

Amplitude Settings	
Sum Of Depth	40.0 %
Fly	Left
DDM Step	Decimal
DDM Current	0.0 μ A
DDM Depth	0.000 0
DDM Logarithmic	0.000 0 dB
DDM Percent	0.00 %
DDM - SDM Coupling	Fixed DDM

Sum of Depth

Sets the arithmetic sum of the modulation depths of the left lobe (90Hz) and right lobe (150Hz) ILS-LOC signal contents. The RMS modulation depth of the sum signal depends on the phase setting of both modulation tones. The sum of "Sum of Depth" on page 61 and "Depth" on page 63 must be smaller than 100 PCT.

Remote command:

[\[:SOURCE<hw>\]\[:BB\]:ILS:LOCALIZER:SDM](#) on page 165

Fly

Selects the simulation mode for the ILS-LOC modulation signal. A change of the setting automatically changes the sign of the DDM value.

This setting simulates the direction in which the pilot has to correct the course.

- | | |
|---------|------------------------------------------------------------------------------------------------------------------------------------------|
| "Left" | The 150-Hz modulation signal is predominant, the DDM value is negative (the airplane is too far to the right, it must turn to the left). |
| "Right" | The 90-Hz modulation signal is predominant, the DDM value is positive (the airplane is too far to the left, it must turn to the right). |

Remote command:

[\[:SOURCE<hw>\]\[:BB\]:ILS:LOCALIZER:DDM:DIRection](#) on page 162

DDM Step

Selects the variation step of the DDM values.

- | | |
|--------------|-------------------------------------------------------------------------|
| "Decimal" | Decimal variation according to the current cursor position. |
| "Predifined" | Variation in predefined steps according to the standardized DDM values. |

Remote command:

[\[:SOURCE<hw>\]\[:BB\]:ILS:LOCALIZER:DDM:STEP](#) on page 163

DDM Current

Sets the current of the ILS indicating instrument corresponding to the DDM value. The instrument current is calculated according to:

$$\text{DDM } \mu\text{A} = \text{DDM} \times 967.75 \mu\text{A}$$

A variation of the instrument current automatically leads to a variation of the DDM value and the DDM value in dB.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :ILS:LOCALIZER:DDM:CURRENT](#) on page 161

DDM Depth

Sets the difference in depth of modulation (DDM) between the signal of the left lobe (90 Hz) and the right lobe (150 Hz) of the ILS-LOC modulation signal.

The DDM value in percent is calculated as follows:

- "DDM Polarity > 90 Hz - 150 Hz" (default setting):
DDM = [AM(90 Hz) - AM (150 Hz)] / 100%
- "DDM Polarity > 150 Hz - 90 Hz":
DDM = [AM(150 Hz) - AM (90 Hz)] / 100%

A variation of the DDM value automatically leads to a variation of the DDM value in dB and the value of the instrument current.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :ILS:LOCALIZER:DDM\[:DEPTH\]](#) on page 163

DDM Logarithmic

Sets the DDM value in dB. The dB value is calculated according to:

$$\text{DDM dB} = 20 \times \text{LOG} [(SDM+DDM \times 100\%) / (SDM-DDM \times 100\%)]$$

A variation of the value automatically leads to a variation of the DDM value and the instrument current.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :ILS:LOCALIZER:DDM:LOGARITHMIC](#) on page 162

DDM Percent

Sets the difference in depth of modulation between the signal of the left lobe (90 Hz) and the right lobe (150 Hz).

The DDM value in percent is calculated to formula:

- "DDM Polarity > 90 Hz - 150 Hz" (default setting):
DDM = [AM(90 Hz) - AM (150 Hz)]
- "DDM Polarity > 150 Hz - 90 Hz":
DDM = [AM(150 Hz) - AM (90 Hz)]

A variation of the DDM value automatically leads to a variation of the DDM value in dB and the value of the instrument current.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :ILS:LOCALIZER:DDM:PCT](#) on page 162

DDM - SDM Coupling

Selects if the DDM value is fixed or is changed with a change of sum of modulation depths (SDM, see below).

- | | |
|------------------|-------------------------------------------------------------------------------------------------------|
| "Fixed DDM" | The absolute DDM value stays constant when the SDM is changed. |
| "Coupled to SDM" | The absolute DDM value changes when the SDM is changed. The DDM value expressed in dB stays constant. |

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :ILS:LOCALIZER:DDM:COUPLING](#) on page 161

5.3.3 COM/ID Settings

The dialog comprises the settings, necessary to configure the COM/ID settings available for the ILS-LOC modulation.

State

Enables/disables an additional communication/identification (COM/ID) signal.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :ILS:LOCALIZER:COMID\[:STATE\]](#) on page 161

Show/Hide Details

Reveals the detailed setting options for the COM/ID signal.

Once the details are revealed, the labeling on the button changes to "Hide Details". Use it to hide the detailed setting options display again.

Code

Sets the coding of the COM/ID signal by the international short name of the airport (e.g. MUC for the Munich airport). If no coding is entered, the COM/ID tone is sent uncoded (key down).

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :ILS:LOCALIZER:COMID:CODE](#) on page 158

Frequency

Sets the frequency of the COM/ID signal.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :ILS:LOCALIZER:COMID:FREQUENCY](#) on page 159

Period

Sets the period of the COM/ID signal in seconds.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :ILS:LOCALIZER:COMID:PERIOD](#) on page 160

Depth

Sets the AM modulation depth of the COM/ID signal.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :ILS:LOCALIZER:COMID:DEPTH](#) on page 159

Time Schema

Sets the time schema for the COM/ID signal.

- "Standard"
The set dot length determines the length of the dash, the symbol space and letter space.
- "User"
You can set each length value separately.

Remote command:

[\[:SOURCE<hw>\]\[:BB\]:ILS:LOCALizer:COMid:TSCHEMA](#) on page 161

Dot Length

Sets the length of a Morse dot in seconds.

For "Time Schema > Standard", this value determines also the length of the dash (3xDot length), symbol space (= Dot length) and letter space (3xDot length).

Remote command:

[\[:SOURCE<hw>\]\[:BB\]:ILS:LOCALizer:COMid:DOT](#) on page 159

Symbol Space

Available only for "Time Schema > User".

Sets the length of a symbol space in milliseconds.

Remote command:

[\[:SOURCE<hw>\]\[:BB\]:ILS:LOCALizer:COMid:SYMBOL](#) on page 160

Dash Length

Available only for "Time Schema > User".

Sets the length of a Morse dash in milliseconds.

Remote command:

[\[:SOURCE<hw>\]\[:BB\]:ILS:LOCALizer:COMid:DASH](#) on page 159

Letter Space

Available only for "Time Schema > User".

Sets the length of a letter space in milliseconds.

Remote command:

[\[:SOURCE<hw>\]\[:BB\]:ILS:LOCALizer:COMid:LETTER](#) on page 160

5.4 System Configuration Settings Marker Beacons

To access this dialog:

1. Select "ILS > ILS Component > Marker Beacons".
2. Select "System Configuration".

5.4.1 Signal Settings

This section covers the different signal settings available for the marker beacons modulation.

Signal Settings	
Carrier Frequency Mode	User Defined
Carrier Frequency	75.000 000 000 MHz
Marker Frequency	400 Hz
Marker Depth	95.0 %

Carrier Frequency Mode

Sets the mode for the carrier frequency of the signal.

"User Defined" Activates user defined variation of the carrier frequency.

"Predefined" Activates variation in predefined steps according to the standardized ILS transmitting frequencies .

Remote command:

[\[:SOURCE<hw>\] \[:BB:ILS\]:MBEacon:FREQUENCY:MODE](#) on page 169

Carrier Frequency

Available only for "Carrier Frequency Mode > User Defined".

Sets the carrier frequency of the signal.

Remote command:

[\[:SOURCE<hw>\] \[:BB:ILS\]:MBEacon:FREQUENCY](#) on page 169

Marker Frequency

Sets the modulation frequency of the marker signal.

Remote command:

[\[:SOURCE<hw>\] \[:BB:ILS\]:MBEacon:MARKer:FREQUENCY](#) on page 169

Marker Depth

Sets the modulation depth of the marker signal.

Remote command:

[\[:SOURCE<hw>\] \[:BB:ILS\]:MBEacon\[:MARKer\]:DEPTH](#) on page 169

5.4.2 COM/ID Settings

The dialog comprises the settings, necessary to configure the COM/ID settings available for the ILS marker beacon modulation.

State

Enables/disables an additional communication/identification (COM/ID) signal.

Remote command:

[\[:SOURCE<hw>\] \[:BB:ILS\] :MBEacon:COMid\[:STATe\]](#) on page 168

Show/Hide Details

Reveals the detailed setting options for the COM/ID signal.

Once the details are revealed, the labeling on the button changes to "Hide Details". Use it to hide the detailed setting options display again.

Code

Sets the coding of the COM/ID signal by the international short name of the airport (e.g. MUC for the Munich airport). If no coding is entered, the COM/ID tone is sent uncoded (key down).

Remote command:

[\[:SOURCE<hw>\] \[:BB:ILS\] :MBEacon:COMid:CODE](#) on page 166

Frequency

Sets the frequency of the COM/ID signal.

Remote command:

[\[:SOURCE<hw>\] \[:BB:ILS\] :MBEacon:COMid:FREQuency](#) on page 167

Period

Sets the period of the COM/ID signal in seconds.

Remote command:

[\[:SOURCE<hw>\] \[:BB:ILS\] :MBEacon:COMid:PERiod](#) on page 168

Depth

Sets the AM modulation depth of the COM/ID signal.

Remote command:

[\[:SOURCE<hw>\] \[:BB:ILS\] :MBEacon:COMid:DEPTH](#) on page 167

Time Schema

Sets the time schema for the COM/ID signal.

- "Standard"

The set dot length determines the length of the dash, the symbol space and letter space.

- "User"
You can set each length value separately.

Remote command:

[\[:SOURCE<hw>\] \[:BB:ILS\]:MBeacon:COMid:TSCHEMA](#) on page 168

Dot Length

Sets the length of a Morse dot in seconds.

For "Time Schema > Standard", this value determines also the length of the dash (3xDot length), symbol space (= Dot length) and letter space (3xDot length).

Remote command:

[\[:SOURCE<hw>\] \[:BB:ILS\]:MBeacon:COMid:DOT](#) on page 167

Dash Length

Available only for "Time Schema > User".

Sets the length of a Morse dash in milliseconds.

Symbol Space

Available only for "Time Schema > User".

Sets the length of a symbol space in milliseconds.

Remote command:

[\[:SOURCE<hw>\] \[:BB:ILS\]:MBeacon:COMid:SYMBOL](#) on page 168

Letter Space

Available only for "Time Schema > User".

Sets the length of a letter space in milliseconds.

Remote command:

[\[:SOURCE<hw>\] \[:BB:ILS\]:MBeacon:COMid:LETTER](#) on page 167

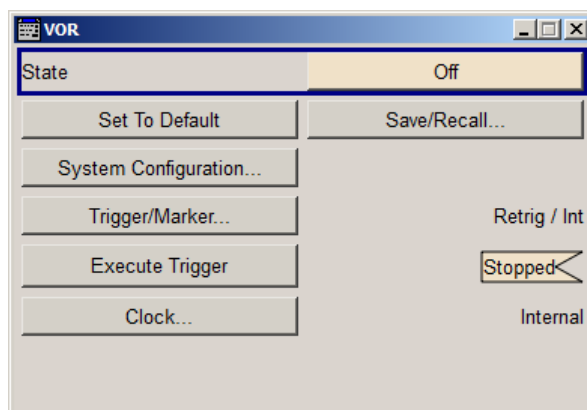
6 VOR Configuration and Settings

- ▶ To access this dialog select "Baseband Block > VOR".

This section contains information about the VOR configuration settings.

6.1 General Settings

This dialog provides access to the general settings of the VOR standard.



Changing a parameter in the VOR standard causes an instant signal change in the R&S SMBV. There is no extra measurement cycle to calculate the RMS value of the baseband signal to set the correct RF level. If the standard is switched ON for the first time, or after every subsequent ON/OFF sequence, the measurement cycle will take place to determine the correct RF level. Every subsequent parameter change in the VOR standard is performed without another measurement cycle to provide a continuous signal output.

State

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

Remote command:

`<subsystem>:STATE` on page 112

Set To Default

Calls the default settings. The values of the main parameters are listed in [Chapter C, "Default Settings"](#), on page 215.

Remote command:

`<subsystem>:PRESet` on page 112

Save/Recall

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

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

Remote command:

`<subsystem>:SETTING:CATalog` on page 112

`<subsystem>:SETTING:STORE` on page 113

`<subsystem>:SETTING:STORE:FAST` on page 113

`<subsystem>:SETTING:LOAD` on page 113

`<subsystem>:SETTING:DELeTe` on page 112

System Configuration

Accesses the "System Configuration" dialog for configuration of the VOR modulation, see [Chapter 6.2, "System Configuration Settings"](#), on page 70.

Trigger/Marker...

Accesses the dialog for selecting the trigger source, for configuring the marker signals and for setting the time delay of an external trigger signal, see [Chapter 8.1, "Trigger Settings"](#), on page 90 .

The currently selected trigger source is displayed to the right of the button.

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:GBAS:TRIGger:EXECute` on page 196

`[:SOURce<hw>] :BB:ILS:TRIGger:EXECute` on page 196

`[:SOURce<hw>] :BB:VOR:TRIGger:EXECute` on page 196

`[:SOURce<hw>] :BB:DME:TRIGger:EXECute` on page 196

Arm

Stops the signal generation until subsequent trigger event occurs.

Remote command:

`[:SOURce<hw>] :BB:GBAS:TRIGger:ARM:EXECute` on page 195

`[:SOURce<hw>] :BB:ILS:TRIGger:ARM:EXECute` on page 195

`[:SOURce<hw>] :BB:VOR:TRIGger:ARM:EXECute` on page 195

`[:SOURce<hw>] :BB:DME:TRIGger:ARM:EXECute` on page 195

Clock...

Accesses the dialog for selecting the clock source, see [Chapter 8.4, "Clock Settings"](#), on page 98.

6.2 System Configuration Settings

To access this dialog:

- ▶ Select "VOR > System Configuration".

6.2.1 Signal Settings

The dialog comprises the settings, necessary to configure the VOR modulation signal.

Signal Settings	
Carrier Frequency Mode	User Defined
Carrier Frequency	108.000 000 000 MHz
Mode	Norm
VAR/REF Frequency	30.0 Hz
VAR Depth	30.0 %
Subcarrier Frequency	9.960 0 kHz
Subcarrier Depth	30.0 %
REF Deviation	480 Hz

Carrier Frequency Mode

Sets the mode for the carrier frequency of the signal.

"User Defined" Activates user defined variation of the carrier frequency.

"ICAO" Activates variation in predefined steps according to the standardized VOR transmitting frequencies (see [Chapter B.2, "VOR Channel Frequencies"](#), on page 210). The start value can be selected in the field "ICAO Channel".

Remote command:

`[:SOURce<hw>] :BB:VOR:FREQuency:MODE` on page 171

Carrier Frequency

Available only for "Carrier Frequency Mode > User Defined".

Sets the carrier frequency of the signal.

Remote command:

`[:SOURce<hw>] :BB:VOR:FREQuency` on page 171

ICAO Channel

Available only for "Carrier Frequency Mode > ICAO".

Selects the ICAO channel and the corresponding transmitting frequency. Refer to [Chapter B.2, "VOR Channel Frequencies"](#), on page 210 for an overview of the standard defined VOR transmitting frequencies.

Remote command:

`[:SOURce<hw>] [:BB] :VOR:ICAO:CHANnel` on page 171

Mode

Selects the operating mode for the VOR modulation signal.

"Norm"	VOR modulation is active.
"Var"	Amplitude modulation of the output signal with the VAR signal component (30Hz signal content) of the VOR signal. The modulation depth corresponds to the value set under "VAR Depth".
"Subcarrier"	Amplitude modulation of the output signal with the unmodulated FM carrier (9960Hz) of the VOR signal. The modulation depth corresponds to the value set under "Subcarrier Depth".
"Subcarrier + FM"	Amplitude modulation of the output signal with the frequency-modulated FM carrier (9960Hz) of the VOR signal. The frequency deviation corresponds to the value set under "REF Deviation", the modulation depth corresponds to the value set under "Subcarrier Depth".

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :VOR:MODE](#) on page 170

VAR/REF Frequency

Sets the frequency of the VAR signal and the REF signal. As the two signals must have the same frequency, the setting is valid for both signals.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :VOR:VAR:FREQUENCY](#) on page 173

VAR Depth

Sets the AM modulation depth of the 30Hz VAR signal.

Note: The sum of "Subcarrier depth", "VAR depth" and "COM/ID > Depth" must be smaller than 100 %.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :VOR:VAR\[:DEPTH\]](#) on page 173

Subcarrier Frequency

Sets the frequency of the FM carrier.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :VOR:SUBCarrier\[:FREQUENCY\]](#) on page 173

Subcarrier Depth

Sets the AM modulation depth of the FM carrier.

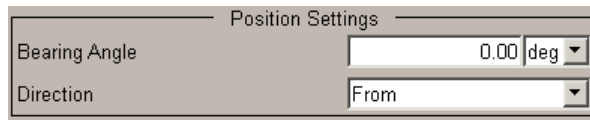
Note: The sum of "Subcarrier depth", "VAR depth" and "COM/ID > Depth" must be smaller than 100 %.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :VOR:SUBCarrier:DEPTH](#) on page 172

6.2.2 Position Settings

The dialog comprises the settings, necessary to configure the different position settings available for the VOR modulation.



The dialog box titled "Position Settings" contains two controls: a text input field for "Bearing Angle" with the value "0.00" and a dropdown menu set to "deg", and a dropdown menu for "Direction" set to "From".

Bearing Angle

Sets the phase angle between the 30Hz VAR signal and the 30Hz reference signal. The orientation of the angle depends on the selected "Direction".

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :VOR\[:BANGLE\]](#) on page 173

Direction

Sets the reference position of the phase information. The angle set under "Bearing Angle" corresponds to the angle between the geographic north and the connection line from beacon to airplane.

"From" Selection of the beacon as a reference position.

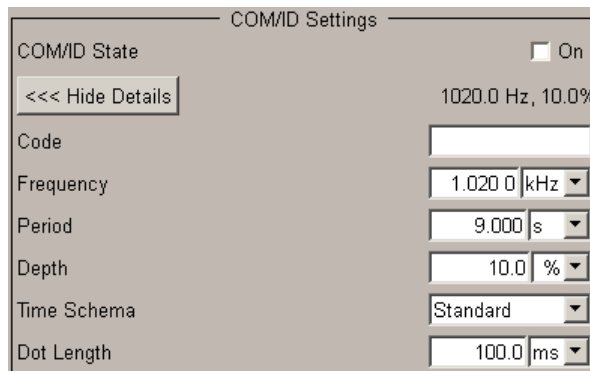
"To" Selection of the airplane position as a reference position.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :VOR\[:BANGLE\]:DIRection](#) on page 174

6.2.3 COM/ID Settings

The dialog comprises the settings, necessary to configure the COM/ID settings available for the VOR modulation.



The dialog box titled "COM/ID Settings" includes a "COM/ID State" checkbox (checked) and a "1020.0 Hz, 10.0%" label. Below is a "<<< Hide Details" button. The settings are: Code (empty), Frequency (1.020 0 kHz), Period (9.000 s), Depth (10.0 %), Time Schema (Standard), and Dot Length (100.0 ms).

State

Enables/disables an additional communication/identification (COM/ID) signal.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :VOR:COMid\[:STATe\]](#) on page 176

Show/Hide Details

Reveals the detailed setting options for the COM/ID signal.

Once the details are revealed, the labeling on the button changes to "Hide Details". Use it to hide the detailed setting options display again.

Code

Sets the coding of the COM/ID signal by the international short name of the airport (e.g. MUC for the Munich airport). If no coding is entered, the COM/ID tone is sent uncoded (key down).

Remote command:

[:SOURce<hw>] [:BB] :VOR:COMid:CODE on page 174

Frequency

Sets the frequency of the COM/ID signal.

Remote command:

[:SOURce<hw>] [:BB] :VOR:COMid:FREQuency on page 175

Period

Sets the period of the COM/ID signal in seconds.

Remote command:

[:SOURce<hw>] [:BB] :VOR:COMid:PERiod on page 176

Depth

Sets the AM modulation depth of the COM/ID signal.

Note: The sum of "Subcarrier depth", "VAR depth" and "COM/ID > Depth" must be smaller than 100 %.

Remote command:

[:SOURce<hw>] [:BB] :VOR:COMid:DEPTH on page 175

Time Schema

Sets the time schema for the COM/ID signal.

- "Standard"
The set dot length determines the length of the dash, the symbol space and letter space.
- "User"
You can set each length value separately.

Remote command:

[:SOURce<hw>] [:BB] :VOR:COMid:TSCHEMA on page 176

Dot Length

Sets the length of a Morse dot in seconds.

For "Time Schema > Standard", this value determines also the length of the dash (3xDot length), symbol space (= Dot length) and letter space (3xDot length).

Remote command:

[:SOURce<hw>] [:BB] :VOR:COMid:DOT on page 175

Dash Length

Available only for "Time Schema > User".

Sets the length of a Morse dash in milliseconds.

Symbol Space

Available only for "Time Schema > User".

Sets the length of a symbol space in milliseconds.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :VOR:COMid:SYMBOL](#) on page 176

Letter Space

Available only for "Time Schema > User".

Sets the length of a letter space in milliseconds.

Remote command:

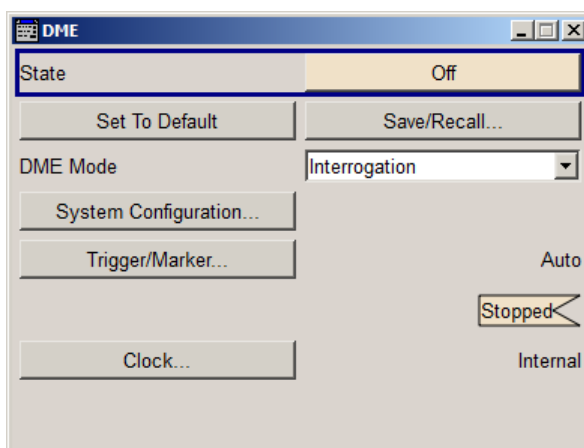
[\[:SOURCE<hw>\] \[:BB\] :VOR:COMid:LETTER](#) on page 175

7 DME Configuration and Settings

- ▶ To access this dialog select "Baseband Block > DME".

7.1 General Settings

This dialog provides access to the general settings of the DME standard, like enabling the standard and selecting the DME mode.



Changing a parameter in the DME standard causes an instant signal change in the R&S SMBV. There is no extra measurement cycle to calculate the RMS value of the baseband signal to set the correct RF level. If the standard is switched ON for the first time, or after every subsequent ON/OFF sequence, the measurement cycle will take place to determine the correct RF level. Every subsequent parameter change in the DME standard is performed without another measurement cycle to provide a continuous signal output.

State

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

Remote command:

`<subsystem>:STATE` on page 112

Set To Default

Calls the default settings. The values of the main parameters are listed in [Chapter C, "Default Settings"](#), on page 215.

Remote command:

`<subsystem>:PRESet` on page 112

Save/Recall

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

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

Remote command:

`<subsystem>:SETTING:CAtalog` on page 112

`<subsystem>:SETTING:STORe` on page 113

`<subsystem>:SETTING:STORe:FAST` on page 113

`<subsystem>:SETTING:LOAD` on page 113

`<subsystem>:SETTING:DELeTe` on page 112

DME Mode

Selects the DME modulation mode. The mode determines the signal type that is simulated. The exact timing of the signal for each mode is determined by the selected X or Y channel.

The timing and shape of the pulses can be freely selected. By default these values are set according to the standard.

"Interrogation" The interrogation signal of the airborne transmitter is simulated.

"Reply" The reply signal of the ground-based transponder is simulated. The trigger is automatically set to external and the default trigger delay either to 50 μ s (channel X) or 56 μ s (channel Y) depending on the selected channel. The interval between the pulse pairs can be set to a fixed value (repetition rate) or to random generation (pulse squitter).

Remote command:

`[:SOURce<hw>] [:BB] :DME:MODE` on page 177

System Configuration

Accesses the "System Configuration" dialog for configuration of the interrogation or reply modulation, see [Chapter 7.2, "System Configuration Settings"](#), on page 77.

Trigger/Marker...

Accesses the dialog for selecting the trigger source, for configuring the marker signals and for setting the time delay of an external trigger signal, see [Chapter 8.1, "Trigger Settings"](#), on page 90 .

The currently selected trigger source is displayed to the right of the button.

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:GBAS:TRIGger:EXECute` on page 196

`[:SOURce<hw>] :BB:ILS:TRIGger:EXECute` on page 196

`[:SOURce<hw>] :BB:VOR:TRIGger:EXECute` on page 196

`[:SOURce<hw>] :BB:DME:TRIGger:EXECute` on page 196

Arm

Stops the signal generation until subsequent trigger event occurs.

Remote command:

[:SOURce<hw>] :BB:GBAS:TRIGger:ARM:EXECute on page 195

[:SOURce<hw>] :BB:ILS:TRIGger:ARM:EXECute on page 195

[:SOURce<hw>] :BB:VOR:TRIGger:ARM:EXECute on page 195

[:SOURce<hw>] :BB:DME:TRIGger:ARM:EXECute on page 195

Clock...

Accesses the dialog for selecting the clock source, see [Chapter 8.4, "Clock Settings"](#), on page 98.

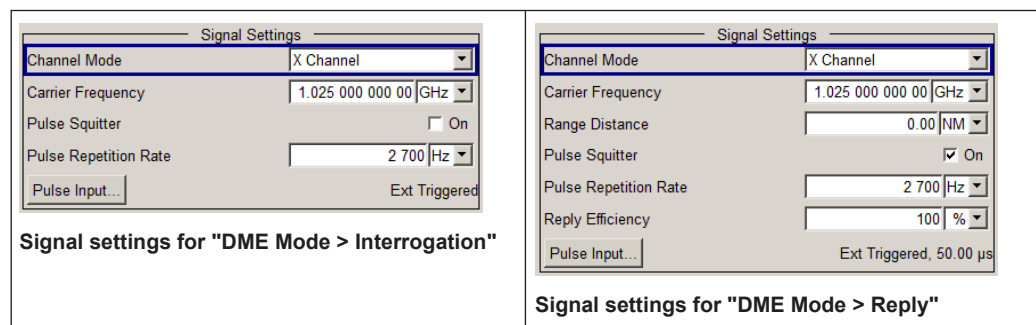
7.2 System Configuration Settings

To access this dialog:

1. Select "DME > DME Mode > Interrogation".
2. Select "System Configuration".

7.2.1 Signal Settings

The dialog comprises the settings, necessary to configure the DME modulation signal.



Channel Mode

Selects the channel that is simulated.

Standard compliant X and Y channels differ in the spacing between the two pulses of the pulse pair and the reply delay of the ground station (see [Chapter B.3, "DME Channel Frequencies"](#), on page 211). ICAO indicates the ICAO channel parameters below for selecting the correct channel.

Table 7-1: Pulse spacing and reply delay

Channel	Pulse spacing interrogation mode	Pulse spacing reply mode	Reply delay 1st pulse	Reply delay 2nd pulse
X	12 μs	12 μs	50 μs	50 μs
Y	36 μs	30 μs	56 μs	50 μs

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:CSUFFIX](#) on page 178

Carrier Frequency

Available only for "Channel Mode > X Channel"/ "Channel Mode > Y Channel".

Sets the carrier frequency of the signal.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:FREQUENCY](#) on page 179

ICAO Channel

Available only for "Channel Mode > ICAO".

Selects the corresponding channel as indicated by ICAO. Refer to [Chapter B.3, "DME Channel Frequencies"](#), on page 211 for an overview of the standard defined DME transmitting frequencies.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:ICAO:CHANNEL](#) on page 179

Range Distance

Available only for "DME Mode > Reply".

Sets the simulated distance between the interrogator and the transponder for reply mode. The distance can be given in nautical miles (NM) or μs . 1 nm is 1852.01 meters and corresponds to a run time of 12.359 μs .

The range distance and the external trigger delay are dependent according to:

"Range Distance" = ("Trigger Delay" – X/Y mode delay)/12.359 $\mu\text{s}/\text{nm}$, where

X mode delay = 50 μs , Y mode delay = 56 μs

Changing one value automatically changes the other value.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:RDISTANCE](#) on page 182

[\[:SOURCE<hw>\] \[:BB\] :DME:RDISTANCE:UNIT](#) on page 182

Pulse Squitter

Enables/disables squitter pulses.

Squitter pulses are random pulse pairs sent by a ground station if the average transmit pulse rate drops to values between 700 pulse pairs per second (pp/s). The squitter pulses ensure that a minimum pulse rate is provided which is crucial for the proper monitoring and adjustment of important pulse parameters of the ground station.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:SQUITTER](#) on page 183

Pulse Repetition Rate

Sets the number of DME pulse pairs per second.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:RATE](#) on page 181

Reply Efficiency

Available only for "DME Mode > Reply".

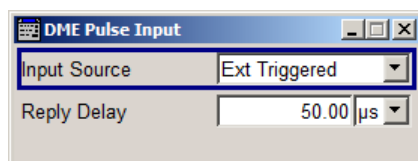
Sets the relation between reply pulse pairs and received trigger signals. For example, with a set efficiency of 50% only every second trigger event leads to the generation of a reply pulse pair.

Remote command:

[\[:SOURce<hw>\] \[:BB\] :DME:ANALysis:EFFiciency?](#) on page 186

Pulse Input

Opens a dialog for configuration of the pulse input settings.

**Input Source ← Pulse Input**

Selects the input of the DME pulses. If "DME Mode > Interrogation" the setting selects the input for the reply pulses of a ground station. For "DME Mode > Reply", the input of the interrogation pulses of an airplane is chosen.

"Ext Triggered"

The pulses are received via the backward [TRIG] connector. Make sure that only the demodulated pulse envelope is input at this connector. If a modulated RF signal is applied, use the "Ext Power Sensor" mode.

"Ext Power Sensor"

The R&S NRP-Z81 power sensor as an input for modulated RF pulses. An external DME signal is fed into a sensor. The 50% voltage point of this signal is used by the R&S NRP-Z81 power sensor sensor to generate the trigger for the R&S SMBV.

Remote command:

[\[:SOURce<hw>\] \[:BB\] :DME:PINPut:SOURce](#) on page 184

Reply Delay ← Pulse Input

Sets the delay between the external trigger and the first DME output pulse (50% voltage point of first pulse).

For "DME Mode > Reply", it simulates the defined delay of the DME transponder and twice the run time of the signal (from interrogator to transponder and back). The delay is a measure of the range distance, thus, the two values are interdependent according to:

Delay = X/Y mode delay + range distance * 12.359 nm/µs, where

X mode delay = 50 us, Y mode delay = 56 us

Changing one value automatically changes the other value.

Remote command:

[\[:SOURce<hw>\] \[:BB\] :DME:PINPut:DELay](#) on page 184

Search Trigger Level ← Pulse Input

Available only for "Trigger Mode > Ext Power Sensor".

Determines the trigger level = 50% voltage point of first pulse of the external DME interrogation signal.

After connecting the R&S NRP-Z81 sensor to the external interrogation signal source, "Search Trigger Level" determines the trigger point. The search function has to be executed with each change of the level of the external DME signal.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:PINPut:TRIGger:SEARch?](#) on page 185

7.2.2 Pulse Settings

The dialog comprises the settings, necessary to configure the pulse settings available for DME interrogation.

Pulse Shape

Selects the pulse shape.

- "Cos^2" The falling and the rising edge of the pulse are cos^2 shaped.
- "Cos Cos^2" The rising edge is cos shaped and the falling edge is cos^2 shaped.
- "Linear" The falling and the rising edge of the pulse are linearly shaped.
- "Gauss" The pulse has a Gaussian form.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:SHAPE](#) on page 183

Pulse Rise

Sets the rise time of the pulse (10% to 90% of the peak voltage).

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:RISE](#) on page 183

Pulse Width

Sets the pulse width (50% to 50% of peak voltage).

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:WIDTH](#) on page 185

Pulse Fall

Sets the fall time of the pulse (90% to 10% of peak voltage).

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:FALL](#) on page 178

Pulse Spacing

Sets the spacing between the first and second pulse of a pulse pair (the time between the half-voltage points on the leading edge of each pulse).

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:PPS](#) on page 180

Single Pulse

Activates/deactivates generation of a single test pulse.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:SINGLE](#) on page 183

DME Analysis

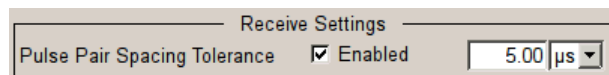
Available only for "DME Mode > Interrogation".

Accesses the "DME Analysis" dialog.

For a description of the available settings, refer to [Chapter 7.2.4, "DME Analysis"](#), on page 82.

7.2.3 Receive Settings

The dialog comprises the settings, necessary to configure the receiving of the pulse.



Pulse Pair Spacing Tolerance

Determines the pulse pair spacing tolerance.

If the spacing is e.g. 12 us, the reply station sees a pulse pair with a spacing of 11.5 to 12.5 us as a valid interrogation pair and responds to it. Otherwise, no reply is generated.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:PPST](#) on page 181

Enabled

Enables the pulse pair spacing tolerance.

If this function is not enabled, the response is sent after the first pulse, without checking whether the second pulse is within the pulse pair spacing tolerance time.

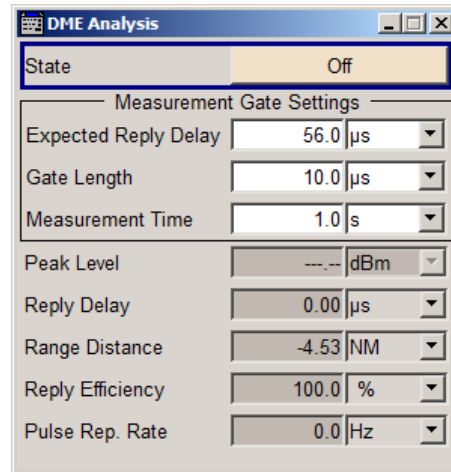
Remote command:

[\[:SOURCE<hw>\] :BB:DME:PPST:ENABLED](#) on page 181

7.2.4 DME Analysis

The settings in this dialog are available only if an R&S NRP-Z81 power sensor is connected to the R&S SMBV.

1. Access:
2. Select "DME > DME Mode > Interrogation".
3. Select "System Configuration > DME Analysis".



The "DME Analysis" dialog comprises the settings to configure the parameters of the reply signal of the ground station transponder.

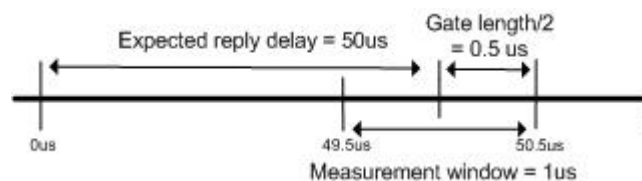
State

Activates the DME analysis. The R&S SMBV generates interrogation pulse pairs and starts an internal counter for time measurement.

The measurement gate settings determine the measurement window (expected reply delay \pm gate length/2). Only reply pulses for which the 50% voltage point of the rising edge of the first pulse is within the measurement window are used to evaluate the delay time and reply efficiency. The delay measurement is averaged within the measurement cycle. The reply efficiency is calculated once for each measurement cycle.

Example:

The gate length is 1 μ s and the expected reply delay is 50 μ s. The measurement window lies in the range between 49.5 μ s and 50.5 μ s. Only pulse pairs are used for the measurement whose 50% voltage point of the rising edge of the first pulse is within this range.



Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:ANALYSIS:STATE](#) on page 189

Expected Reply Delay

Sets the expected reply delay.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:ANALYSIS:GATE:EDELAY](#) on page 187

Gate Length

Sets the gate length for the measurement window.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:ANALYSIS:GATE\[:LENGTH\]](#) on page 187

Measurement Time

Sets the time for the measurement cycle.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:ANALYSIS:GATE:TIME](#) on page 187

Peak Level

Indicates the measured average peak level of all pulse pairs in a measurement cycle.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:ANALYSIS:POWER?](#) on page 188

[\[:SOURCE<hw>\] :BB:DME:ANALYSIS:POWER:OK?](#) on page 188

Range Distance

Indicates the measured average range distance of all valid pulse pairs in a measurement cycle. If there are no valid measurements available in the set measurement window 'invalid' is indicated.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:ANALYSIS:RDISTANCE?](#) on page 189

Reply Delay

Indicates the measured average reply delay of all valid pulse pairs in a measurement cycle. If there are no valid measurements available in the set measurement window 'invalid' is indicated.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:ANALYSIS:TIME?](#) on page 189

[\[:SOURCE<hw>\] :BB:DME:ANALYSIS:TIME:OK?](#) on page 190

Reply Efficiency

Indicates the measured reply efficiency in percent. The measurement is the ratio of the number of measured valid reply pulse pairs to transmitted pulse pairs in a measurement cycle. If there are no valid measurements available in the set measurement window 'invalid' is indicated.

Remote command:

[\[:SOURCE<hw>\] \[:BB\] :DME:ANALYSIS:EFFICIENCY?](#) on page 186

[\[:SOURCE<hw>\] :BB:DME:ANALYSIS:EFFICIENCY:OK?](#) on page 186

Pulse Repetition Rate

Indicates the measured mean pulse repetition rate of the DME ground station.

If there are no valid measurements available in the set measurement window 'invalid' is indicated.

Remote command:

`[:SOURce<hw>] [:BB] :DME:ANALysis:PRRate?` on page 188

`[:SOURce<hw>] :BB:DME:ANALysis:PRRate:OK?` on page 189

7.2.5 COM/ID Settings

To access this dialog:

1. Select "DME > DME Mode > Reply".
2. Select "DME > System Configuration".

The dialog comprises the settings, necessary to configure the COM/ID settings available for the DME reply modulation.

COM/ID State

Enables/disables an additional communication/identification (COM/ID) signal.

The ID signal consists of a regular group of pulses that generates Morse code dots and dashes.

The transmission of the ground signal is interrupted every 40 seconds (ID period) and one ID sequence is transmitted instead. The "key down time" of the ground signal corresponds to the period of transmission for a dot or dash in the Morse code ID sequence (e.g. 100ms for a dot). During the key down times reply pulses are not transmitted, however, they are transmitted between the key down times.

Remote command:

`[:SOURce<hw>] [:BB] :DME:ID [:STATe]` on page 194

Show/Hide Details

Reveals the detailed setting options for the COM/ID signal.

Once the details are revealed, the labeling on the button changes to "Hide Details". Use it to hide the detailed setting options display again.

Pair of Pulse Pairs

Enables the transmission of a pair of pulse pairs during the set "Rate".

The ID signal consists of a regular group of pulses that generates Morse code dots and dashes. To form the regular pulse groups, two pulse pairs are separated by 100 μ s. It is called a pair of pairs. These pair combinations are transmitted at a regular rate of 1350 pairs of pairs, see [Figure 7-1](#). This results in a repetition rate of 1350 Hz, which is an audible tone for an ident.

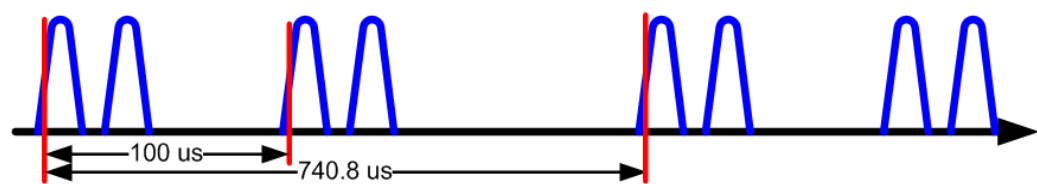


Figure 7-1: Signal with enabled pair of pulse pairs

If the "Pair of Pulse Pairs" is disabled only a single pulse pair is transmitted in the selected "Rate", see [Figure 7-2](#).

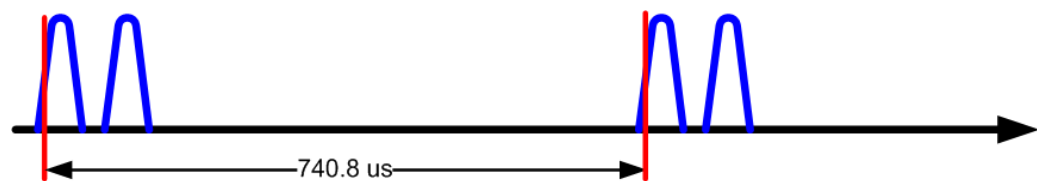


Figure 7-2: Signal with disabled pair of pulse pairs

Remote command:

`[:SOURce<hw>] [:BB] :DME:ID:PPP [:STATe]` on page 192

Pulse Pair Spacing

Sets the value for the pulse pair spacing when "Pair of Pulse Pairs" is enabled.

Remote command:

`[:SOURce<hw>] [:BB] :DME:ID:PPS` on page 193

Code

Sets the coding of the COM/ID signal by the international short name of the airport (e.g. MUC for the Munich airport). If no coding is entered, the COM/ID tone is sent uncoded (key down).

Remote command:

`[:SOURce<hw>] [:BB] :DME:ID:CODE` on page 191

Rate

Sets the pulse repetition rate of the ID sequence.

Remote command:

[:SOURce<hw>] [:BB] :DME:ID:RATE on page 193

Period

Sets the period of the COM/ID signal in seconds.

Remote command:

[:SOURce<hw>] [:BB] :DME:ID:PERiod on page 193

Time Schema

Sets the time schema for the COM/ID signal.

- "Standard"
The set dot length determines the length of the dash, the symbol space and letter space.
- "User"
You can set each length value separately.

Remote command:

[:SOURce<hw>] [:BB] :DME:ID:TSCHEMA on page 194

Dot Length

Sets the length of a Morse dot in seconds.

For "Time Schema > Standard", this value determines also the length of the dash (3xDot length), symbol space (= Dot length) and letter space (3xDot length).

Remote command:

[:SOURce<hw>] [:BB] :DME:ID:DOT on page 192

Dash Length

Available only for "Time Schema > User".

Sets the length of a Morse dash in milliseconds.

Remote command:

[:SOURce<hw>] [:BB] :DME:ID:DASH on page 192

Symbol Space

Available only for "Time Schema > User".

Sets the length of a symbol space in milliseconds.

Remote command:

[:SOURce<hw>] [:BB] :DME:ID:SYMBOL on page 193

Letter Space

Available only for "Time Schema > User".

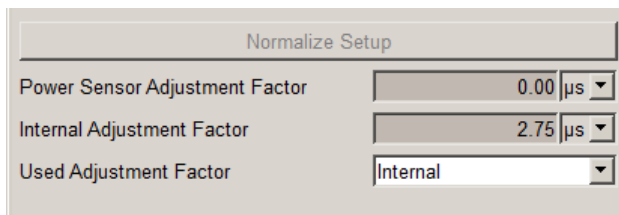
Sets the length of a letter space in milliseconds.

Remote command:

[:SOURce<hw>] [:BB] :DME:ID:LETTER on page 192

7.2.6 Adjustment Factors

The dialog comprises the settings, necessary to normalize the setup when triggering the instrument with a power sensor.



Normalize Setup	
Power Sensor Adjustment Factor	0.00 μs
Internal Adjustment Factor	2.75 μs
Used Adjustment Factor	Internal

To calibrate a measurement setup regarding external pulse input and internal processing delays, the "Normalize Setup" functionality can be used.

For DME operation in combination with a power sensor as input channel, the exact trigger point has to be known to compensate for the pulse shape and the internal delay of the sensor.

As shown in [Figure 7-3](#), the R&S SMBV gets interrogation pulses from an external DUT using the same pulse shape. According to the settings, the R&S SMBV should send a reply pulse pair 50us after receiving the interrogation pulse pair.

To guarantee, that the 50% edge levels are exactly 50us separated from each other, the R&S SMBV has to start the reply pulse before the 50us reply delay period has elapsed.

Using the "Normalize Setup" calibration, an adjustment factor t is measured. This adjustment factor is considered, when generating the reply pulses. The signal output is started earlier to compensate for the trigger point of the sensor. This calibration works best, when both stations use the same pulse shape with the same timing characteristics.

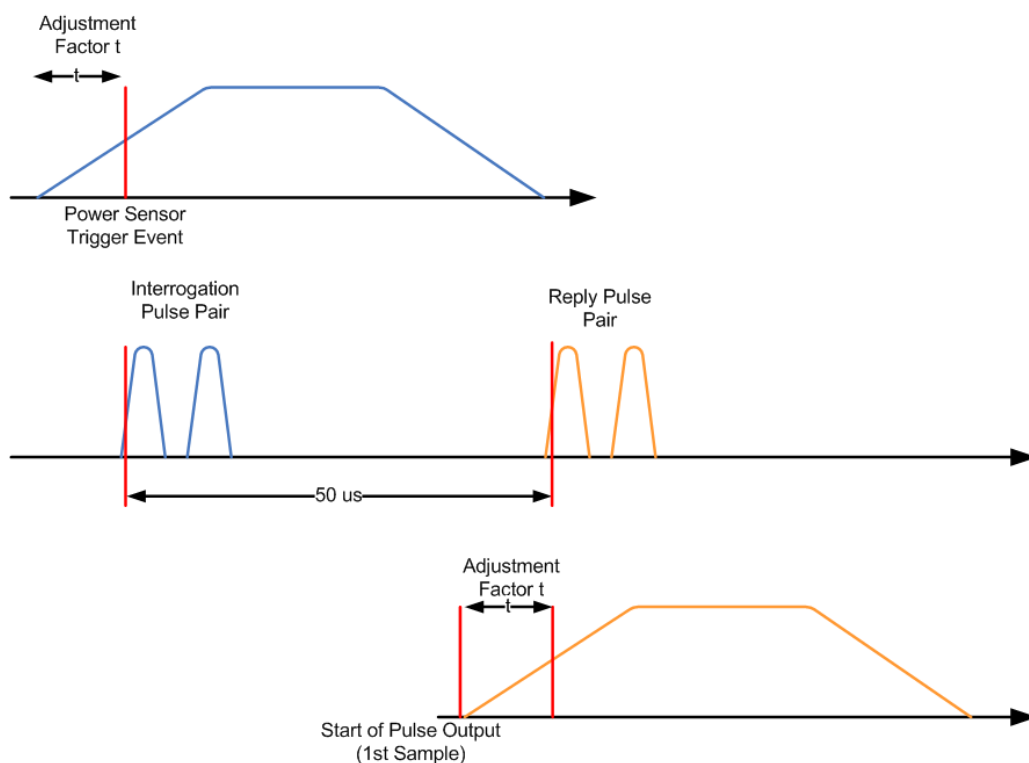


Figure 7-3: Normalize setup

Normalize Setup

Available only if an R&S NRP-Z81 power sensor is connected to the R&S SMBV.

Performs a normalization of the test setup. The delay due to the test setup is measured and then considered in the reply measurements.

Remote command:

`[:SOURCE<hw>] [:BB] :DME:ANALYSIS:NORMALIZE?` on page 188

Power Sensor Adjustment Factor

Displays the power sensor adjustment factor determined during a normalization of the setup.

Remote command:

`[:SOURCE<hw>] [:BB] :DME:ANALYSIS:PSAFACTOR?` on page 190

Internal Adjustment Factor

Displays the internal adjustment factor, the mathematically calculated value of the time, when the pulse reaches its 50% level.

Remote command:

`[:SOURCE<hw>] [:BB] :DME:ANALYSIS:IAFACTOR?` on page 190

Used Adjustment Factor

Selects which internal adjustment factor should be used.

"Internal" The mathematically calculated value of the time, when the pulse reaches its 50% level. The power sensor trigger hysteresis and the small delay from the power sensor trigger output to the R&S SMBV are not considered by the calculation.

"Power Sensor" The adjustment factor measured during a normalization setup.

Remote command:

`[:SOURCE<hw>] [:BB] :DME:ANALYSIS:UAFactor` on page 191

8 Trigger/Marker/Clock Settings

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 Delay" section is where a marker signal delay can be defined, either without restriction or restricted to the dynamic section, i.e., the section in which it is possible to make settings without restarting signal and marker generation.

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.

8.1 Trigger Settings

To access this dialog, select "GBAS >Trigger/Marker..." /"ILS > Trigger..."/"VOR > Trigger..."/"DME >Trigger/Marker...".

This dialog provides access to the settings necessary to select and configure the trigger.

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 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 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:GBAS\[:TRIGger\]:SEQuence](#) on page 199

[\[:SOURce<hw>\]:BB:ILS\[:TRIGger\]:SEQuence](#) on page 199

[\[:SOURce<hw>\]:BB:VOR\[:TRIGger\]:SEQuence](#) on page 199

[\[:SOURce<hw>\]:BB:DME\[:TRIGger\]:SEQuence](#) on page 199

Signal Duration Unit

Available only for R&S SMBV-K111 (GBAS) option.

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

Remote command:

[\[:SOURce<hw>\]:BB:GBAS:TRIGger:SLUNit](#) on page 198

Trigger Signal Duration

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:GBAS:TRIGger:SLENgth](#) on page 197

[\[:SOURce<hw>\]:BB:ILS:TRIGger:SLENgth](#) on page 198

[\[:SOURce<hw>\]:BB:VOR:TRIGger:SLENgth](#) on page 198

[\[:SOURce<hw>\]:BB:DME:TRIGger:SLENgth](#) on page 197

Arm

Stops the signal generation until subsequent trigger event occurs.

Remote command:

[\[:SOURce<hw>\]:BB:GBAS:TRIGger:ARM:EXECute](#) on page 195

[\[:SOURce<hw>\]:BB:ILS:TRIGger:ARM:EXECute](#) on page 195

[\[:SOURce<hw>\]:BB:VOR:TRIGger:ARM:EXECute](#) on page 195

[\[:SOURce<hw>\]:BB:DME:TRIGger:ARM:EXECute](#) on page 195

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:GBAS:TRIGger:RMODE? on page 197

[:SOURce<hw>] :BB:ILS:TRIGger:RMODE? on page 197

[:SOURce<hw>] :BB:VOR:TRIGger:RMODE? on page 197

[:SOURce<hw>] :BB:DME:TRIGger:RMODE? on page 197

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:GBAS:TRIGger:EXECute on page 196

[:SOURce<hw>] :BB:ILS:TRIGger:EXECute on page 196

[:SOURce<hw>] :BB:VOR:TRIGger:EXECute on page 196

[:SOURce<hw>] :BB:DME:TRIGger:EXECute on page 196

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".

- "External"

The trigger event is the active edge of an external trigger signal, supplied at the TRIGGER 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:GBAS:TRIGger:SOURce on page 198

[:SOURce<hw>] :BB:ILS:TRIGger:SOURce on page 198

[:SOURce<hw>] :BB:VOR:TRIGger:SOURce on page 198

[:SOURce<hw>] :BB:DME:TRIGger:SOURce on page 198

Sync. Output to External Trigger

(enabled for Trigger Source External)

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

For R&S SMBV instruments:

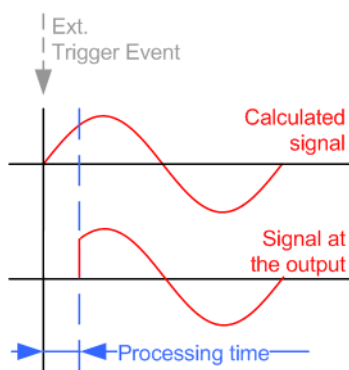
For two or more R&S SMBVs configured to work in a master-slave mode for synchronous signal generation, configure this parameter depending on the provided system trigger event and the properties of the output signal. See below for an overview of the required settings.

Typical Applications

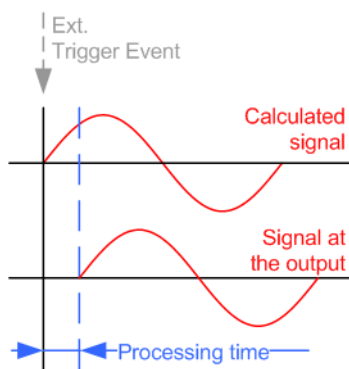
- All instruments are synchronous to the external trigger event

- System Trigger = common External Trigger event for the master and the slave instruments
- "Sync. Output to External Trigger" = ON
- All instruments are synchronous among themselves but starting the signal from first symbol is more important than synchronicity with external trigger event
 - System Trigger = common External Trigger event for the master and the slave instruments
 - "Sync. Output to External Trigger" = OFF
- All instruments are synchronous among themselves
 - System Trigger = internal trigger signal of the master R&S SMBV for the slave instruments
 - "Sync. Output to External Trigger" = 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 output. 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 output. 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:GBAS:TRIGger:EXTernal:SYNChronize:OUTPut`
on page 196

`[:SOURce<hw>] :BB:ILS:TRIGger:EXTernal:SYNChronize:OUTPut`
on page 196

`[:SOURce<hw>] :BB:VOR:TRIGger:EXTernal:SYNChronize:OUTPut`
on page 196

`[:SOURce<hw>] :BB:DME:TRIGger:EXTernal:SYNChronize:OUTPut`
on page 196

Trigger Delay

Delays the trigger event of the signal from:

- The external trigger source

Use this setting to:

- Synchronize the instrument with the device under test (DUT) or other external devices

Remote command:

`[:SOURce<hw>] :BB:GBAS:TRIGger [:EXTernal<ch>] :DELay` on page 198

`[:SOURce<hw>] :BB:ILS:TRIGger [:EXTernal<ch>] :DELay` on page 198

`[:SOURce<hw>] :BB:VOR:TRIGger [:EXTernal<ch>] :DELay` on page 198

`[:SOURce<hw>] :BB:DME:TRIGger [:EXTernal<ch>] :DELay` on page 198

`[:SOURce<hw>] :BB:GBAS:TRIGger:OBASeband:DELay` on page 197

`[:SOURce<hw>] :BB:ILS:TRIGger:OBASeband:DELay` on page 197

`[:SOURce<hw>] :BB:VOR:TRIGger:OBASeband:DELay` on page 197

`[:SOURce<hw>] :BB:DME:TRIGger:OBASeband:DELay` on page 197

Trigger Inhibit

For external trigger signal or trigger signal from the other path, sets the duration with that any following trigger event is suppressed. In "Retrigger" mode, for example, a new trigger event does not cause a restart of the signal generation until the specified inhibit duration does not expire.

Remote command:

`[:SOURce<hw>] :BB:GBAS:TRIGger [:EXTernal<ch>] :INHibit` on page 199

`[:SOURce<hw>] :BB:ILS:TRIGger [:EXTernal<ch>] :INHibit` on page 199

`[:SOURce<hw>] :BB:VOR:TRIGger [:EXTernal<ch>] :INHibit` on page 199

`[:SOURce<hw>] :BB:DME:TRIGger [:EXTernal<ch>] :INHibit` on page 199

`[:SOURce<hw>] :BB:GBAS:TRIGger:OBASeband:INHibit` on page 197

`[:SOURce<hw>] :BB:ILS:TRIGger:OBASeband:INHibit` on page 197

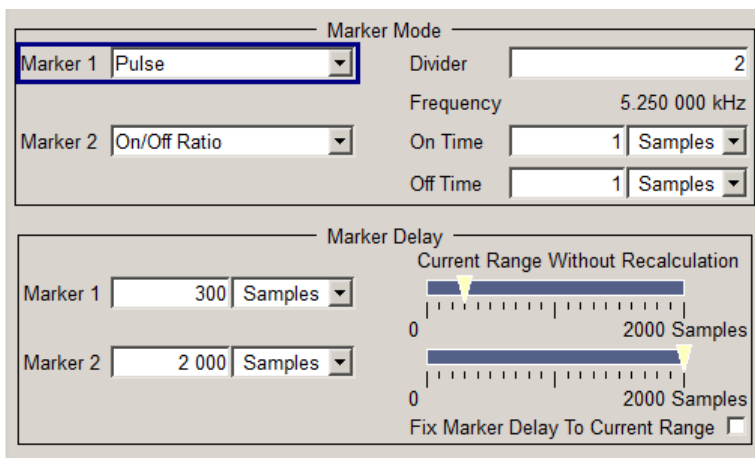
`[:SOURce<hw>] :BB:VOR:TRIGger:OBASeband:INHibit` on page 197

`[:SOURce<hw>] :BB:DME:TRIGger:OBASeband:INHibit` on page 197

8.2 Marker Settings GBAS

The marker settings are available only for option R&S SMBV-K111(GBAS).

This dialog provides access to the settings necessary to select and configure the marker output signal, like the marker mode or marker delay settings.



Marker Mode

Marker configuration for up to two marker channels. The settings are used to select the marker mode defining the shape and periodicity of the markers. The contents of the dialog change with the selected marker mode; the settings are self-explanatory.

- "1PPS" Marker signal for every start of second.
- "Pulse" Regular marker signal.
Enter a divider to define the clock frequency. The software derives the frequency by dividing the sample rate by this divider; the dialog indicates the resulting pulse frequency.

Remote command:

```
[ :SOURce<hw> ] :BB:GBAS:TRIGger:OUTPut<ch>:PULSe:DIVider on page 202
[ :SOURce<hw> ] :BB:GBAS:TRIGger:OUTPut<ch>:PULSe:FREQuency? on page 202
```

- "Pattern" Marker signal that is defined by a 64-bit long pattern.

Remote command:

```
[ :SOURce<hw> ] :BB:GBAS:TRIGger:OUTPut<ch>:PATtern on page 202
```

- "ON/OFF Ratio" Regular marker signal defined by an ON/OFF ratio.
A marker period lasts one ON and OFF cycle.
The "ON Time" and "OFF Time" are each expressed as a number of samples.



Remote command:

```
[ :SOURce<hw> ] :BB:GBAS:TRIGger:OUTPut<ch>:ONTime on page 202
[ :SOURce<hw> ] :BB:GBAS:TRIGger:OUTPut<ch>:OFFTime on page 202
```

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

Remote command:

[:SOURce<hw>] :BB:GBAS:TRIGger:OUTPut<ch>:MODE on page 201

Marker x Delay

Defines the delay between the marker signal at the marker outputs relative to the signal generation start.

"Marker x" For the corresponding marker, sets the delay as a number of samples.

Remote command:

[:SOURce<hw>] :BB:GBAS:TRIGger:OUTPut<ch>:DELaY on page 203

"Current Range without Recalculation"

Displays the dynamic range within which the delay of the marker signals can be set without restarting the marker and the signal.
Move the setting mark to define the delay.

Remote command:

[:SOURce<hw>] :BB:GBAS:TRIGger:OUTPut<ch>:DELaY:MINimum? on page 203

[:SOURce<hw>] :BB:GBAS:TRIGger:OUTPut<ch>:DELaY:MAXimum? on page 203

"Fix marker delay to current range"

Restricts the marker delay setting range to the dynamic range.

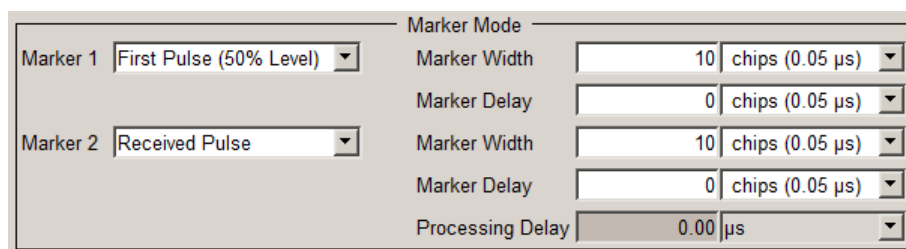
Remote command:

[:SOURce<hw>] :BB:GBAS:TRIGger:OUTPut:DELaY:FIXed on page 203

8.3 Marker Settings DME

The marker settings are available only for options R&S SMBV-K111 /-K153 (DME).

This dialog provides access to the settings necessary to select and configure the marker output signal, like the marker mode or marker delay settings.

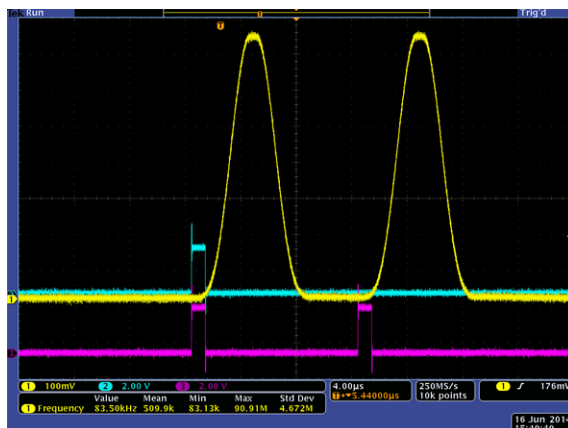


Marker x

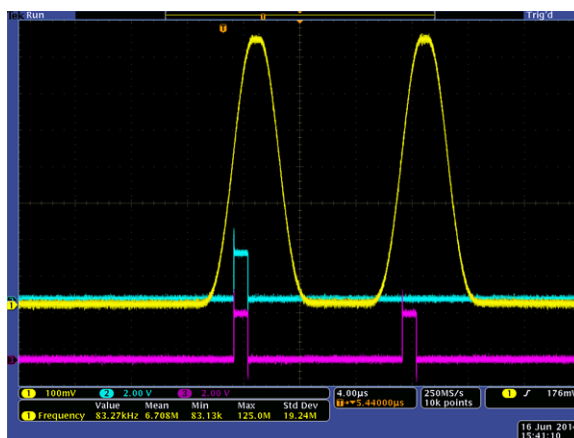
Selects a marker signal for the associated marker channel. The settings are used to select the marker mode defining the shape and periodicity of the markers. The contents of the dialog change with the selected marker mode.

"First Pulse (Start) / Pulse Start"

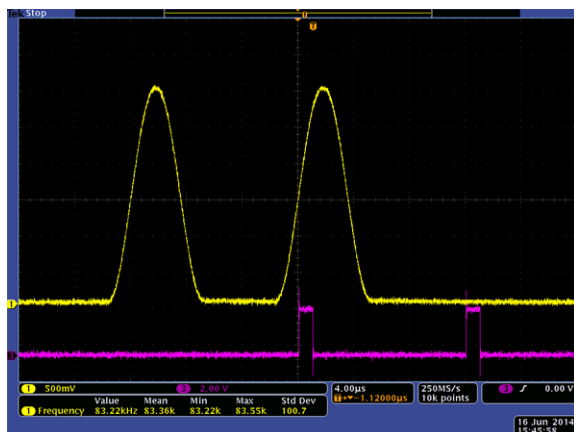
Sets the marker at the beginning of the pulse.

**"First Pulse (50% Level) / Pulse (50% Level)"**

Sets the markers to the point, where the level of the pulse has reached 50%.

**"Received Pulse"**

Sets "Marker 2" on the received pulse.



Remote command:

`[:SOURCE<hw>] [:BB] :DME:MARKER<ch>:MODE` on page 200

Marker Width

Sets the width of the corresponding marker.

Remote command:

`[:SOURce<hw>] [:BB] :DME:MARKer<ch>:WIDTh` on page 201

Marker Delay

Defines the delay between the marker signal at the marker outputs relative to the signal generation start.

Remote command:

`[:SOURce<hw>] [:BB] :DME:MARKer<ch>:DELay` on page 200

Processing Delay

Displays the processing delay, the delay between the position of the markers for the interrogation pulse and the corresponding marker positions for the reply pulse, when "Marker 2" is set to "Received Pulse".

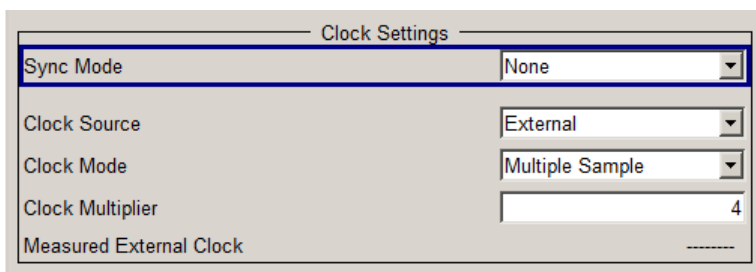
Remote command:

`[:SOURce<hw>] [:BB] :DME:MARKer<ch>:PDELay?` on page 201

8.4 Clock Settings

To access this dialog, select "GBAS > Clock..."/"ILS > Clock..."/"VOR > Clock..."/"DME > Clock...".

This dialog provides access to the settings necessary to select and configure the clock signal, like the clock source and clock mode.

**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:GBAS:CLOCK:SYNChronization:MODE on page 205

[:SOURce<hw>] :BB:ILS:CLOCK:SYNChronization:MODE on page 206

[:SOURce<hw>] :BB:VOR:CLOCK:SYNChronization:MODE on page 206

[:SOURce<hw>] :BB:DME:CLOCK:SYNChronization:MODE on page 205

Set Synchronization Settings

(for R&S SMBV only)

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

Remote command:

[:SOURce<hw>] :BB:GBAS:CLOCK:SYNChronization:EXECute on page 205

[:SOURce<hw>] :BB:ILS:CLOCK:SYNChronization:EXECute on page 205

[:SOURce<hw>] :BB:VOR:CLOCK:SYNChronization:EXECute on page 205

[:SOURce<hw>] :BB:DME:CLOCK:SYNChronization:EXECute on page 205

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".

Remote command:

[:SOURce<hw>] :BB:GBAS:CLOCK:SOURce on page 205

[:SOURce<hw>] :BB:ILS:CLOCK:SOURce on page 205

[:SOURce<hw>] :BB:VOR:CLOCK:SOURce on page 205

[:SOURce<hw>] :BB:DME:CLOCK:SOURce on page 205

Clock Mode

Enters the type of externally supplied clock.

Remote command:

[:SOURce<hw>] :BB:ILS:CLOCK:MODE on page 204

[:SOURce<hw>] :BB:VOR:CLOCK:MODE on page 204

[:SOURce<hw>] :BB:DME:CLOCK:MODE on page 204

[:SOURce<hw>] :BB:GBAS:CLOCK:MODE on page 204

Clock Multiplier

Enters the multiplication factor for clock type "Multiple".

Remote command:

[:SOURce<hw>] :BB:GBAS:CLOCK:MULTiplier on page 204

[:SOURce<hw>] :BB:ILS:CLOCK:MULTiplier on page 204

[:SOURce<hw>] :BB:VOR:CLOCK:MULTIPLIER on page 204

[:SOURce<hw>] :BB:DME:CLOCK:MULTIPLIER on page 204

Measured External Clock

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

Remote command:

CLOCK:INPut:FREQuency?

8.5 Global Settings

This section provides access general trigger, clock and mapping settings.

Global Trigger/Clock Settings

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

This dialog is to set 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.

9 How to Work with the GBAS Option

Testing GBAS receivers can be a challenging task. The main error sources that influence the performance of a GBAS airborne device are typically caused by distortion on the VHF link or mismatch in the application data. The former could be caused by interference, multipath effects as well as ground and/or surface reflections. The latter is usually related to a bias in the differential corrections (message type 1 and 11) and/or mismatch between the TAP/FAS data transmitted on the link and the actually wanted flight path by the air traffic control (ATC) (message type 4).

The following step-by-step instructions demonstrate how to perform some signal generation tasks with the GBAS option and generate signals suitable for GBAS testing. The following sections focus on the R&S SMBV configuration. Necessary configuration in VDB receivers, devices under test (DUT) or other test equipment are beyond the scope of this description.

9.1 Generating GBAS Signals with Several Frequency Channels

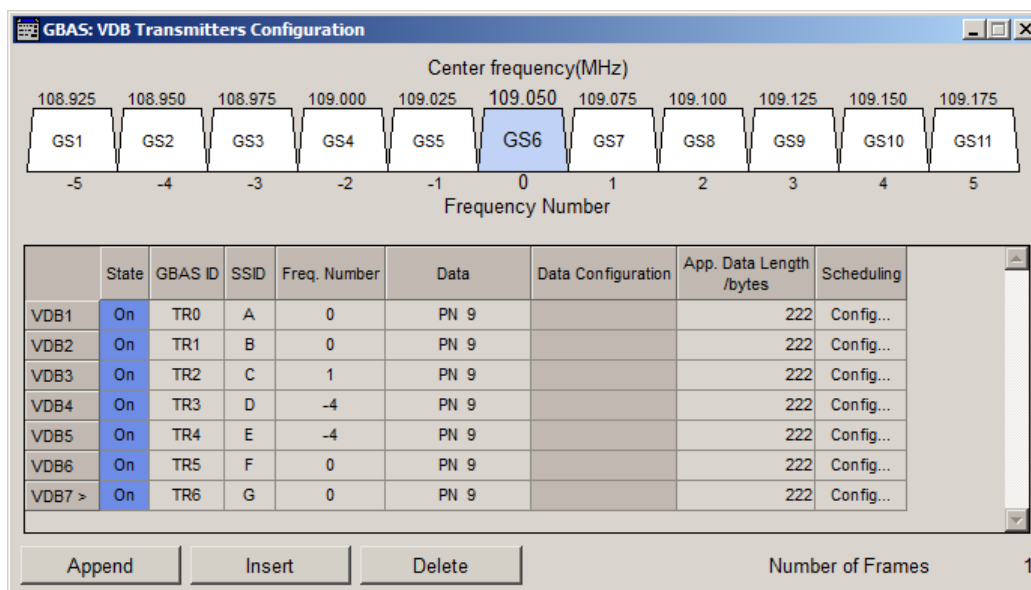
With the R&S SMBV, you can generate simultaneously multiple frequency GBAS signal. Multiple frequency signals are suitable for testing the capability of VDB receivers of tuning frequencies in the frequency range, as specified in [RTCA DO-246D](#).

This example shows how to use the multiple frequency function to generate a GBAS signal, containing GBAS Frequency Channels 39 to 45.

To enable the generation of several frequency channels

1. Calculate the channel number of the central frequency.
 $(39 + 45)/2 = 42$
2. For frequency channel number 42, calculate the channel frequency.
Channel frequency = 108.025 MHz + 42*25 kHz = 109.075 MHz
3. Select "Status Bar > Frequency = 109.075 MHz" to set the center frequency.
4. Select "Baseband > Avionics > GBAS" and select "Multiple Frequency Channels > On".
5. Select "VDB Transmitters Configuration"
The graph confirms the selected center frequency.
The R&S SMBV selects the 10 adjacent frequency channels, symmetrically located around the central one. The central frequency is referred as frequency number 0.
6. Use the "Append" function to enable seven VDBs, VDB#1 to VDB#7.
7. In the VDB table, for each VDB, select different "Feq. Num." to allocated them to different frequency channels.

Generating a GBAS Signal for Receiver Sensitivity Tests



8. Select "GBAS > State > On"

9. Select "RF > State > On"

The R&S SMBV generates a GBAS signal, composed of seven adjacent frequency channels.



The generated GBAS signal is suitable for unwanted emissions measurements, adjacent and co-channels rejections measurements and carrier frequency stability measurements.

9.2 Generating a GBAS Signal for Receiver Sensitivity Tests

Sensitivity tests are essential for the performance of VDB receivers and used to measure their ability to demodulate GBAS signal at low power level. To perform a sensitivity test, it is sufficient to generate a single frequency signal. We use the advantages of the gated power mode and vary the level of the generated GBAS signal. The goal of the test is to find out the signal with the minimum level that the DUT requires to correctly detect the GBAS signal.

To generate a GBAS signal for sensitivity tests

1. Press [PRESET] to set the R&S SMBV to a definite state.
2. Select "Staus Bar > Frequency = 108.4 MHz"
3. Select "Staus Bar > Level = -10 dBm"
4. Select "Baseband > Avionics > GBAS"

5. Select "Gated Power Mode > On"
6. Select "VDB Transmitter Configuration". Use the default configuration and select "VDB#1 > Scheduling > Config".
7. In the "GBAS Scheduling 1" dialog, enable:
 - a) "TS1 > State > On", relative power "TS1 > Pow(dB) = 0 dB"
 - b) "TS3 > State > On", relative power "TS3 > Pow(dB) = -15 dB"
 - c) "TS2/TS4/TS5/TS6/TS7/TS8 > State > Off"
 - d) "TS2/TS4/TS5/TS6/TS7/TS8 > Pow(dB) = -inf"
8. Select "GBAS > State > On"
9. Select "RF > State > On"

The R&S SMBV generates a single frequency signal; the VDB transmission is allocated on two time slots, TS1 and TS3 with different relative power (see also [Example "Calculating the power per time slot in "Gated Power Mode > On""](#) on page 18). The signal is generated at physical layer and the bursts carry arbitrary data (PN9).
10. In the R&S SMBV, vary the relative power of TS3 and measure the received power level at the VDB receiver.

For example, to simulate conditions of weak signal, reduce the relative power down to -60 dBm.
11. Check whether the received signal is correctly decoded.

The sensitivity level of the receiver is the level at that the receiver does not detect any signal on TS3.

9.3 Generating a GBAS Signal for VDB Slot Detection

The goal of VDB slot detection tests is to prove correct detection of all time slots from which each VDB message was received.

To generate a GBAS signal for slot detection tests

1. Press [PRESET] to set the R&S SMBV to a definite state.
2. Select "Staus Bar > Frequency = 110 MHz"
3. Select "Baseband > Avionics > GBAS" and select "Multiple Frequency Channels > Off".
4. Select "VDB Transmitters Configuration"

The graph confirms the selected center frequency.
5. Use the "Append" function to enable three VDBs, VDB#1 to VDB#3.
6. Select "VDB#1 > Scheduling > Config" and allocate VDB#1, VDB#2 and VDB#3 as following:

Generating a GBAS Signal for Message Format Detection

	TS1	Pow (dB)	TS2	Pow (dB)	TS3	Pow (dB)	TS4	Pow (dB)	TS5	Pow (dB)	TS6	Pow (dB)	TS7	Pow (dB)	TS8	Pow (dB)
1(VDB1)	On	0.00	Off	-INF	Off	-INF	Off	-INF	Off	-INF	Off	-INF	Off	-INF	On	0.00
2(VDB2)	Off	-INF	On	0.00	Off	-INF	Off	-INF	On	0.00	Off	-INF	On	0.00	Off	-INF
3(VDB3)	Off	-INF	Off	-INF	On	0.00	Off	-INF	Off	-INF	On	0.00	Off	-INF	Off	-INF

7. Select "GBAS > State > On"
8. Select "RF > State > On"

The signal is generated at physical layer and the bursts carry arbitrary data (PN9). Prove that the VDB receiver detects the correct time slots. For example, the transmission of VDB#2 on frequency channel with 110 MHz carrier frequency and time slots TS2, TS5 and TS7.

9.4 Generating a GBAS Signal for Message Format Detection

Message format detection tests verify if the VDB receiver receives and decodes parameters in the GBAS messages correctly. The generated VDB signal in this example contains real application data. Enabled are GBAS Message Type 2 and Message Type 1.

To generate a GBAS signal for testing of correct message detection

1. Press [PRESET] to set the R&S SMBV to a definite state.
2. Select "Staus Bar > Frequency = 110 MHz"
3. Select "Baseband > Avionics > GBAS" and select "Multiple Frequency Channels > Off".
4. Select "VDB Transmitters Configuration"

The graph confirms the selected center frequency.
5. Select "VDB#1 > Data > Real GBAS Data" and select "Data Config > Message Config".
6. Enable "Message Type 2 > On".

Configure the settings as required. For this example, enable a reference location with coordinates "Altitude = 110m", "Latitude = 48.150 deg" and "Longitude = 11.5833 deg"
7. Enable "Differential GNSS > On" and select "GBAS Differential File > Predefined Files > Correction1"

Generating a GPS and a GBAS Signal for Multi Mode Receiver Tests

GBAS: VDB 1: Message Configuration

Message Type 2 On

Message Type 2 parameters

Ground Station Reference Receivers 3 ref. receivers

Ground Station Accuracy Designator B

Ground Station Continuity/Integrity Designator FAST C

Local Magnetic Variation 58.00 deg

Sigma_vert_iono_gradient 0.000 000 0 mm

Refractivity Index 379

Scale Height 100 m

Refractivity Uncertainty 20

Reference Location Configuration

Position Format Decimal Degree

Altitude 110.00 m

Latitude 48.150 000 deg

Longitude 11.583 300 deg

Message Type 4 On

Differential GNSS On

Differential GNSS parameters

GBAS Differential File... Correction1

8. Select "GBAS > State > On"
9. Select "RF > State > On"
10. At the VDB receiver, verify that:
 - The received values of each parameter are within the allowed value range
 - The received parameters are decoded correctly
 - The VDB messages are discarded if they do not comply to the standards.

9.5 Generating a GPS and a GBAS Signal for Multi Mode Receiver Tests

GBAS airborne receivers are based on the multi mode receiver (MMR) technology. A multi mode receiver consists of a GPS antenna, a VHF antenna and processing equipment and supports simultaneous signal reception of different landing and precision navigation systems, like GPS, GBAS and ILS.

In this example, we use two R&S SMBV to generate a GPS signal and a GBAS signal for MMR testing. The aim of this GBAS test is to measure the resulting (improved) augmentation.

Overview of required relevant options

Instrument#1

- Option GPS (R&S SMBV-K44)
- GNSS global option R&S SMBV-K91 (Extension to 12 Satellites)
- Generation of more than 12 satellites requires additionally GNSS global option R&S SMBV-K96 (Extension to 24 Satellites)
- GNSS Extension for Obscuration Simulation and Automatic Multipath (R&S SMBV-K101)

Instrument#2

- Option GBAS (R&S SMBV-K111)

Connecting and configuring the two R&S SMBV instruments for synchronous signal generation

In this following, only the related settings are discussed. For detailed information on cabling and required configuration, refer to:

- R&S SMBV Operating Manual, section "Synchronous Signal Generation"
 - Application Note 1GP84 "Time Synchronous Signals with Multiple R&S SMBV100A Vector Signal Generators "
- ▶ Connect the instruments to work in master-slave mode, see [Figure 9-1](#).

Generating a GPS and a GBAS Signal for Multi Mode Receiver Tests

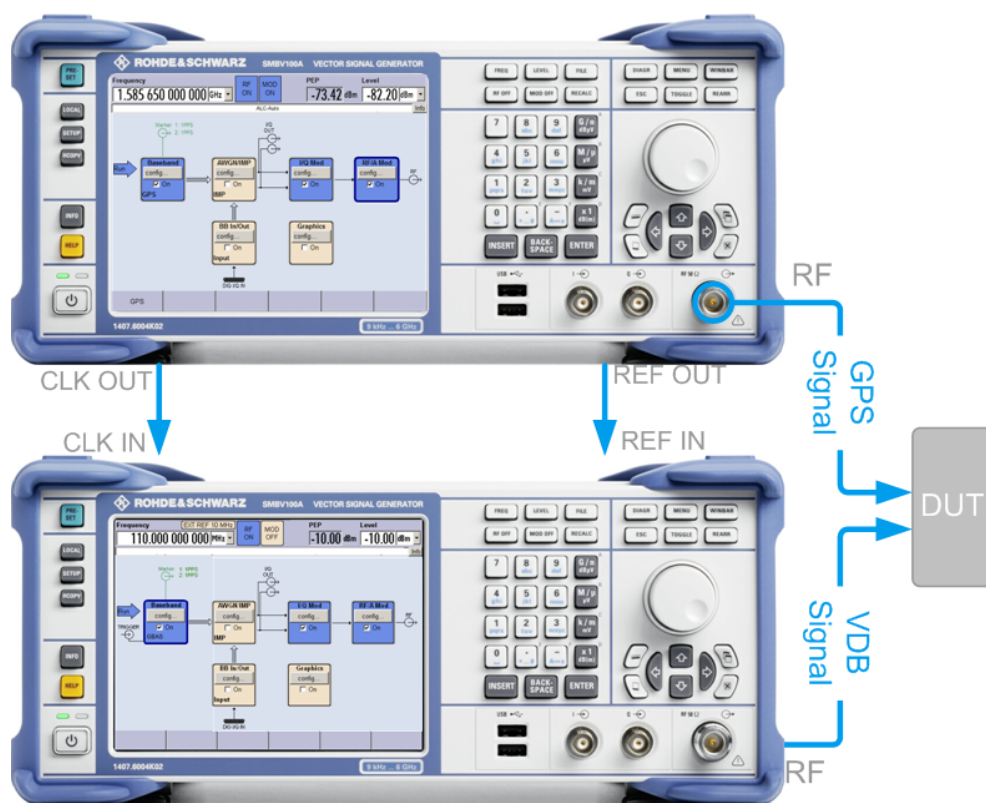


Figure 9-1: Example of test setup

The required steps are beyond the scope of this description. For details, see the proposed reference descriptions.

The first R&S SMBV provides the second one with its system clock, trigger and frequency reference signals.

Generating a GPS signal

To configure the instrument#1 to generate a GPS signal with 12 or more satellites, follow these general guidelines.



For details, see R&S SMBV Satellite Navigation operating manual.

1. Select "Baseband > GPS"
2. Select "GPS > Simulation Mode > Auto Localization"
3. Select "User Environment > Vehicle Type > Aircraft"
4. Select "Localization Data", select "Waypoint/Attitude File" and load a suitable *.xtd file, describing the movement of airplane the DUT is installed in.
5. Select "GPS > Navigation Data > Almanac" and select a suitable file.

6. Open the "GPS > Real Time S.P.O.T." to observe the current satellites constellation.
7. Select "GPS > State > On"
8. Select "RF > State > On"

Generating a GBAS signal

To configure the instrument#2 to generate a GBAS signal, follow the steps described in ["To generate a GBAS signal for testing of correct message detection"](#) on page 104

1. Configure the required reference location
2. Select a suitable "GBAS Differential File" (message type 1), containing ephemeris as well as ionospheric corrections.
3. Select "GBAS > State > On"
4. Select "RF > State > On"
5. In the instrument#1, trigger the signal generation.
6. At the multi mode receiver, measure the resulting bias.
Is the augmentation improved?

The multi mode receiver should calculate the plane position with ideally less error than in the case of a standalone GPS.

The differential GPS correction parameters transmitted by the VHF link (message types 1 and 11) enhance the navigation algorithm and should lead to a better position fix.

Possible extensions

With this test setup, you can simulate different conditions and perform a number of measurements, like:

- Use the AWGN generator of the R&S SMBV and superimpose noise on the generated GBAS signal
- Simulate the GNSS signal in multipath environment
- Use the ephemeris parameters in the navigation message to simulate satellite failure
- Simulate the effects caused by obscuration and multipath on the GNSS signal, like reflections and absorption from different surfaces
- Use the clock correction parameters to simulate satellite clock errors
- Change the ionospheric parameters in the atmospheric message

The full range of GBAS tests includes flight testing. Consider a test setup with two R&S SMBVs, where:

- The first R&S SMBV simulates a GBAS signal with message type 4 corresponding to the Path to be followed (TAP and FAS)
- The second R&S SMBV simulates real time errors in the actual path followed by the airplane when compared to the TAP path the Air Traffic Controller (ATC) is asking for.

Consider a hardware in the loop (HIL) setup with the second R&S SMBV.

10 Remote-Control Commands

The following commands are required to perform signal generation with the Avionics option in a remote environment. We assume that the R&S SMBV has already been set up for remote operation in a network as described in the R&S SMBV 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 SMBV operating manual.

Placeholder <Subsystem>

To simplify the description of the remote control commands, the placeholder <Subsystem> is introduced. Depending on the avionic standard used as an entry standard, replace this placeholder <Subsystem> with for example `SOURce:BB:GBAS` for GBAS.



The replacement of the place holder <Subsystem> is mandatory, i.e. remote control commands containing this placeholder are not recognized and accepted by the instrument.

Example:

SCPI command `<subsystem>:STATe` on page 112:

- Entry Standard = DME
`SOURce:BB:DME:STATe`
- Entry Standard = GBAS
`SOURce:BB:GBAS:STATe`
- Entry Standard = ILS
`SOURce:BB:ILS:STATe`
- Entry Standard = VOR
`SOURce:BB:VOR:STATe`
- Invalid command
`<Subsystem>:STAT`

Common suffixes

The following common suffixes are used in remote commands:

Suffix	Value range	Description
<code>SOURce<hw></code>	1	Available baseband signals
<code>OUTPut<ch></code>	1 .. 2	Available markers R&S SMBV supports two markers
<code>EXTernal<ch></code>	1	External trigger connector

The following commands specific to the Avionics options are described here:

• Primary Settings.....	111
• GBAS Settings.....	114
• ILS Settings.....	152
• VOR Settings.....	169
• DME Settings.....	177
• Trigger Settings.....	194
• Marker Settings DME.....	200
• Marker Settings GBAS.....	201
• Clock Settings.....	204
• Remote Control of the R&S SMBV by the R&S®SMA100A VOR/ILS/DME Com- mands.....	206

10.1 Primary Settings

<subsystem>:STAtE.....	112
[:SOURce<hw>]:BB:DME:STAtE.....	112
[:SOURce<hw>]:BB:GBAS:STAtE.....	112
[:SOURce<hw>]:BB:ILS:STAtE.....	112
[:SOURce<hw>]:BB:VOR:STAtE.....	112
<subsystem>:PRESet.....	112
[:SOURce<hw>]:BB:DME:PRESet.....	112
[:SOURce<hw>]:BB:GBAS:PRESet.....	112
[:SOURce<hw>]:BB:ILS:PRESet.....	112
[:SOURce<hw>]:BB:VOR:PRESet.....	112
<subsystem>:SETTing:CATalog.....	112
[:SOURce<hw>][:BB]:DME:SETTing:CATalog?.....	112
[:SOURce<hw>]:BB:GBAS:SETTing:CATalog?.....	112
[:SOURce<hw>][:BB]:ILS:SETTing:CATalog?.....	112
[:SOURce<hw>]:BB:VOR:SETTing:CATalog?.....	112
<subsystem>:SETTing:DELeTe.....	112
[:SOURce<hw>]:BB:DME:SETTing:DELeTe.....	112
[:SOURce<hw>]:BB:GBAS:SETTing:DELeTe.....	112
[:SOURce<hw>]:BB:ILS:SETTing:DELeTe.....	112
[:SOURce<hw>]:BB:VOR:SETTing:DELeTe.....	112
<subsystem>:SETTing:LOAD.....	113
[:SOURce<hw>]:BB:DME:SETTing:LOAD.....	113
[:SOURce<hw>]:BB:GBAS:SETTing:LOAD.....	113
[:SOURce<hw>]:BB:ILS:SETTing:LOAD.....	113
[:SOURce<hw>]:BB:VOR:SETTing:LOAD.....	113
<subsystem>:SETTing:STORe.....	113
[:SOURce<hw>]:BB:DME:SETTing:STORe.....	113
[:SOURce<hw>]:BB:GBAS:SETTing:STORe.....	113
[:SOURce<hw>]:BB:ILS:SETTing:STORe.....	113
[:SOURce<hw>]:BB:VOR:SETTing:STORe.....	113
<subsystem>:SETTing:STORe:FAST.....	113
[:SOURce<hw>]:BB:DME:SETTing:STORe:FAST.....	113

<code>[:SOURce<hw>]:BB:GBAS:SETTing:STORe:FAST</code>	113
<code>[:SOURce<hw>]:BB:ILS:SETTing:STORe:FAST</code>	113
<code>[:SOURce<hw>]:BB:VOR:SETTing:STORe:FAST</code>	113

<subsystem>:STATe

`[:SOURce<hw>]:BB:DME:STATe <State>`
`[:SOURce<hw>]:BB:GBAS:STATe <State>`
`[:SOURce<hw>]:BB:ILS:STATe <State>`
`[:SOURce<hw>]:BB:VOR:STATe <State>`

Activates/deactivates the VOR modulation.

Parameters:

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

<subsystem>:PRESet

`[:SOURce<hw>]:BB:DME:PRESet`
`[:SOURce<hw>]:BB:GBAS:PRESet`
`[:SOURce<hw>]:BB:ILS:PRESet`
`[:SOURce<hw>]:BB:VOR:PRESet`

Sets all parameters to their default values (*RST values specified for the commands).

<subsystem>:SETTing:CATalog

`[:SOURce<hw>][:BB]:DME:SETTing:CATalog?`
`[:SOURce<hw>]:BB:GBAS:SETTing:CATalog?`
`[:SOURce<hw>][:BB]:ILS:SETTing:CATalog?`
`[:SOURce<hw>]:BB:VOR:SETTing:CATalog?`

Queries the files with the standard settings in the default directory. Listed are files with the file extension *.dme/*.gbas/*.ils/*.vor.

Refer to section "MMEM Subsystem" in the R&S SMBV manual for general information on file handling in the default and specific directories.

Return values:

`<Catalog>` `<filename1>,<filename2>,...`
Returns a string of file names separated by commas.

Usage: Query only

<subsystem>:SETTing:DELeTe

`[:SOURce<hw>]:BB:DME:SETTing:DELeTe <Filename>`
`[:SOURce<hw>]:BB:GBAS:SETTing:DELeTe <Filename>`
`[:SOURce<hw>]:BB:ILS:SETTing:DELeTe <Filename>`
`[:SOURce<hw>]:BB:VOR:SETTing:DELeTe <Filename>`

Deletes the selected file from the default or specified directory. Deleted are files with the file extension *.dme/*.gbas/*.ils/*.vor.

Refer to section "MMEM Subsystem" in the R&S SMBV manual for general information on file handling in the default and specific directories.

Setting parameters:

<Filename> string

Usage: Setting only

<subsystem>:SETTING:LOAD

[[:SOURce<hw>]:BB:DME:SETTING:LOAD <Filename>

[[:SOURce<hw>]:BB:GBAS:SETTING:LOAD <Filename>

[[:SOURce<hw>]:BB:ILS:SETTING:LOAD <Filename>

[[:SOURce<hw>]:BB:VOR:SETTING:LOAD <Filename>

Loads the selected file from the default or the specified directory. Loads files with extension *.dme/*.gbas/*.ils/*.vor.

Refer to section "MMEM Subsystem" in the R&S SMBV manual for general information on file handling in the default and specific directories.

Setting parameters:

<Filename> string

Usage: Setting only

<subsystem>:SETTING:STORE

[[:SOURce<hw>]:BB:DME:SETTING:STORE <Filename>

[[:SOURce<hw>]:BB:GBAS:SETTING:STORE <Filename>

[[:SOURce<hw>]:BB:ILS:SETTING:STORE <Filename>

[[:SOURce<hw>]:BB:VOR:SETTING:STORE <Filename>

Stores the current settings into the selected file; the file extensions *.dme/*.gbas/*.ils/*.vor is assigned automatically.

Refer to section "MMEM Subsystem" in the R&S SMBVoperating manual for general information on file handling in the default and specific directories.

Setting parameters:

<Filename> string

Usage: Setting only

<subsystem>:SETTING:STORE:FAST

[[:SOURce<hw>]:BB:DME:SETTING:STORE:FAST <FastSave>

[[:SOURce<hw>]:BB:GBAS:SETTING:STORE:FAST <Fast>

[[:SOURce<hw>]:BB:ILS:SETTING:STORE:FAST <FastSave>

[[:SOURce<hw>]:BB:VOR:SETTING:STORE:FAST <FastSave>

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:

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

10.2 GBAS Settings

10.2.1 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 (p) 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.

Example: Generating a GBAS signal for sensitivity tests

The following example uses the gated power mode.

```
*RST
SOURCE1:FREQUENCY:CW 108.4MHz
SOURCE1:POWER:LEVEL:IMMEDIATE:AMPLITUDE -10

SOURCE1:BB:GBAS:GPOW ON
SOURCE1:BB:GBAS:VDB1:SCH:TS1:STATE ON
SOURCE1:BB:GBAS:VDB1:SCH:TS1:POWER 0
SOURCE1:BB:GBAS:VDB1:SCH:TS3:STATE ON
SOURCE1:BB:GBAS:VDB1:SCH:TS3:POWER -15
SOURCE1:BB:GBAS:STATE ON
OUTPUT1:STATE ON

// vary (reduce) the relative power of TS3
SOURCE1:BB:GBAS:VDB1:SCH:TS3:POWER -45
```

Example: Generating a GBAS signal for VDB slot detection

The following is an example on how to configure transmission of two VDBs on a common carrier frequency of 100 MHz. VDB#1 and VDB#2 use different timeslots.

```

*RST
SOURCE1:FREQUENCY:CW 110MHz

SOURCE1:BB:GBAS:MFCChannels OFF
// enable 2 VDBs
SOURCE1:BB:GBAS:VDB:APPend
SOURCE1:BB:GBAS:VDB1:SCH:TS1:STATe ON
SOURCE1:BB:GBAS:VDB1:SCH:TS1:POWer 0
SOURCE1:BB:GBAS:VDB1:SCH:TS8:STATe ON
SOURCE1:BB:GBAS:VDB1:SCH:TS8:POWer 0
SOURCE1:BB:GBAS:VDB2:SCH:TS2:STATe ON
SOURCE1:BB:GBAS:VDB2:SCH:TS2:POWer 0
SOURCE1:BB:GBAS:VDB2:SCH:TS5:STATe ON
SOURCE1:BB:GBAS:VDB2:SCH:TS5:POWer 0
SOURCE1:BB:GBAS:VDB2:SCH:TS7:STATe ON
SOURCE1:BB:GBAS:VDB2:SCH:TS7:POWer 0

SOURCE1:BB:GBAS:VDB2:STATe?
// Response: 1
SOURCE1:BB:GBAS:STATe ON
OUTput1:STATe ON
// generate a waveform and store it in the default directory
SOURCE1:BB:GBAS:WAVEform:CREate "gbas_slot_detection"
// store the settings in a file in the default directory
SOURCE1:BB:GBAS:SETTing:STORe:FAST?
// Response: 1
SOURCE1:BB:GBAS:SETTing:STORe "gbas_slot_detection"

```

Example: Generating a GBAS signal for message-format detection

The following is an example on how to generate a VDB signal with real application data and enabled GBAS message type 2 and message type 1.

```

*RST
SOURCE1:FREQUENCY:CW 110MHz

SOURCE1:BB:GBAS:MFCChannels OFF
SOURCE1:BB:GBAS:VDB1:DATA RGDData
SOURCE1:BB:GBAS:VDB1:MCONfig:MT2State ON
SOURCE1:BB:GBAS:VDB1:MCONfig:GSRReceivers GW3R
SOURCE1:BB:GBAS:VDB1:MCONfig:GSADesignator GADB
SOURCE1:BB:GBAS:VDB1:MCONfig:GCID FC
SOURCE1:BB:GBAS:VDB1:MCONfig:LMVariation 58
SOURCE1:BB:GBAS:VDB1:MCONfig:SVIGradient 0
SOURCE1:BB:GBAS:VDB1:MCONfig:RFIndex 379
SOURCE1:BB:GBAS:VDB1:MCONfig:SHEight 100
SOURCE1:BB:GBAS:VDB1:MCONfig:RUNCertainty 20
SOURCE1:BB:GBAS:VDB1:MCONfig:LOCation:COORDinates:DECimal 11.5833, 48.150, 110
SOURCE1:BB:GBAS:VDB1:MCONfig:LOCation:COORDinates:DMS?
// Response: 11,34,59.88,EAST,48,9,0,NORT,110

```

```

SOURCE1:BB:GBAS:VDB1:MCONfig:DG:STATe ON
SOURCE1:BB:GBAS:VDB1:MCONfig:DG:PREDeFined:CATALog?
// Response: Correction1
SOURCE1:BB:GBAS:VDB1:MCONfig:DG:PREDeFined:FILE "Correction1"
SOURCE1:BB:GBAS:VDB1:MCONfig:DG:FILE?
// Response: "Correction1.rs_gbas"

SOURCE1:BB:GBAS:VDB1:SSID?
// Response: A
SOURCE1:BB:GBAS:VDB1:GID?
// REsponse: TR0
SOURCE1:BB:GBAS:VDB1:NOFRames?
// Response: 20
SOURCE1:BB:GBAS:VDB1:FNUMber?
// Response: 0

SOURCE1:BB:GBAS:STATe ON
OUTput1:STATe ON

SOURCE1:BB:GBAS:SETTing:STORe "gbas_msg_fmt_detection"
SOURCE1:BB:GBAS:SETTing:CATALog?
// Response: gbas_msg_fmt_detection,gbas_slot_detection

```

Example: Generating a GBAS signal containing message type 4

The following is an example on how to generate a VDB signal with real application data and enabled GBAS message type 4.

```

*RST
SOURCE1:FREQuency:CW 110MHz

SOURCE1:BB:GBAS:MFChannels OFF
SOURCE1:BB:GBAS:VDB1:DATA RGDData
SOURCE1:BB:GBAS:VDB1:MCONfig:MT4State ON

SOURCE1:BB:GBAS:VDB1:MCONfig:FDSState ON
SOURCE1:BB:GBAS:VDB1:MCONfig:GPANgLe 30
SOURCE1:BB:GBAS:VDB1:MCONfig:ATUSelector MET
SOURCE1:BB:GBAS:VDB1:MCONfig:ATChEighT 1200
SOURCE1:BB:GBAS:VDB1:MCONfig:LFLocatiOn:HEIGHt 103
SOURCE1:BB:GBAS:VDB1:MCONfig:AID KJFK
SOURCE1:BB:GBAS:VDB1:MCONfig:RNUMber 13
SOURCE1:BB:GBAS:VDB1:MCONfig:RLETter LETL
SOURCE1:BB:GBAS:VDB1:MCONfig:APDesignator GC
SOURCE1:BB:GBAS:VDB1:MCONfig:RUINdicator "A"
SOURCE1:BB:GBAS:VDB1:MCONfig:RPDF 3
SOURCE1:BB:GBAS:VDB1:MCONfig:RPIF "L13A"
SOURCE1:BB:GBAS:VDB1:MCONfig:LFLocatiOn:COORdinateS:DECimal -0.012650,0.027897
SOURCE1:BB:GBAS:VDB1:MCONfig:LFLocatiOn:COORdinateS:DMS?
// Response: 73,47,13.83,EAST,40,39,22.95,NORT
SOURCE1:BB:GBAS:VDB1:MCONfig:DFLocatiOn:COORdinateS:DECimal -0.012650, 0.027897

```

```

SOURCE1:BB:GBAS:VDB1:MCONfig:DFLocation:COORDinates:DMS?
// Response: 0,0,45.54,WEST,0,1,40.429,NORT
SOURCE1:BB:GBAS:VDB1:MCONfig:CWAThreshold 105
SOURCE1:BB:GBAS:VDB1:MCONfig:DLOffset 0
SOURCE1:BB:GBAS:VDB1:MCONfig:FVAA 0
SOURCE1:BB:GBAS:VDB1:MCONfig:FLAA 40

SOURCE1:BB:GBAS:VDB1:MCONfig:TDSState ON
SOURCE1:BB:GBAS:VDB1:MCONfig:RPDT 21
SOURCE1:BB:GBAS:VDB1:MCONfig:RPIT "GTN"
SOURCE1:BB:GBAS:VDB1:MCONfig:WAYPoint:PREDefined:CATalog?
// Response: Braunschweig
SOURCE1:BB:GBAS:VDB1:MCONfig:WAYPoint:PREDefined:FILE "Braunschweig"
SOURCE1:BB:GBAS:VDB1:MCONfig:WAYPoint:FILE?
// Response: "Braunschweig.txt"
SOURCE1:BB:GBAS:VDB1:MCONfig:NOPPoint?
// Response: 11
// to query user waypoint files in the default directory
// SOURCE1:BB:GBAS:VDB1:MCONfig:WAYPoint:USER:CATalog?
// Response: gbas_waypoint
SOURCE1:BB:GBAS:VDB1:MCONfig:FRCLink 3
SOURCE1:BB:GBAS:VDB1:MCONfig:TVAS 50
SOURCE1:BB:GBAS:VDB1:MCONfig:TLAS 2

SOURCE1:BB:GBAS:STATe ON
OUTput1:STATe ON

```

Example: Adjusting clock, marker and trigger settings

The following example lists the provided commands:

```

// *****
// Clock settings
// *****
SOURCE1:BB:GBAS:CLOCK:SOURce INTernal

// *****
// Configure and enable standard marker signal
// *****
SOURCE1:BB:GBAS:TRIGger:OUTPut1:MODE RATIO
SOURCE1:BB:GBAS:TRIGger:OUTPut1:ONTime 40
SOURCE1:BB:GBAS:TRIGger:OUTPut1:OFFTime 20

// *****
// Configure and enable signal generation
// *****
SOURCE1:BB:GBAS:TRIGger:SOURce INTernal
SOURCE1:BB:GBAS:TRIGger:SEQuence ARETrigger
SOURCE1:BB:GBAS:STAT ON
SOURCE1:BB:GBAS:TRIGger:EXECute
SOURCE1:BB:GBAS:TRIGger:ARM:EXECute

```

```

SOURce1:BB:GBAS:TRIGger:RMODe?
// Stopped
SOURce1:BB:GBAS:TRIGger:EXECute
SOURce1:BB:GBAS:TRIGger:RMODe?
// Run

```

Example: Querying the default filter, clipping and modulation settings

The following is a general example on working with these settings.

```

SOURce1:BB:GBAS:PRESet

SOURce1:BB:GBAS:SRINfo?
// Response: "10.5 kHz"
SOURce1:BB:GBAS:FILTer:TYPE?
// Response: COS
SOURce1:BB:GBAS:FILTer:PARAmeter:COsine?
// Response: 0.6
SOURce1:BB:GBAS:FILTer:PARAmeter:COsine:COFS?
// Response:0
SOURce1:BB:GBAS:MSET:MTYPE?
// Response: "D8PSK"
SOURce1:BB:GBAS:MSET:SRATE?
// Response: 10500

SOURce1:BB:GBAS:MFChannels ON
SOURce1:BB:GBAS:MSET:SRATE?
// Response: 525000
SOURce1:BB:GBAS:SRINfo?
// Response: "525 kHz"

SOURce1:BB:GBAS:CLIPping:STAtE?
// Response: 0
SOURce1:BB:GBAS:CLIPping:LEVel?
// Response: 100
SOURce1:BB:GBAS:CLIPping:MODE?
// Response: VECTor

```

10.2.2 General Settings

[:SOURce<hw>]:BB:GBAS:VERSion?	118
[:SOURce<hw>]:BB:GBAS:WAVEform:CREate	119
[:SOURce<hw>]:BB:GBAS:SCATI	119
[:SOURce<hw>]:BB:GBAS:MFChannels	119
[:SOURce<hw>]:BB:GBAS:GPOW	120
[:SOURce<hw>]:BB:GBAS:SRINfo?	120

[:SOURce<hw>]:BB:GBAS:VERSion?

Queries the specification according to that the settings are implement.

Return values:

<Version> string

Example:

SOURce1:BB:GBAS:VERSion?
Response: "RTCA DO-246D"

Usage:

Query only

[:SOURce<hw>]:BB:GBAS:WAVEform:CREate <Filename>

With enabled signal generation, triggers the instrument to store the current settings as an ARB signal in a waveform file. Waveform files can be further processed by the ARB and/or as a multi-carrier or a multi-segment signal.

The filename and the directory it is stored in are user-definable; the predefined file extension for waveform files is *.wv.

Setting parameters:

<Filename> string

Example:

See [Example "Generating a GBAS signal for VDB slot detection"](#) on page 114

Usage:

Setting only

Manual operation: See ["Generate Waveform File"](#) on page 25

[:SOURce<hw>]:BB:GBAS:SCATi <SCAT>

Enables using of SCAT-I header information instead of the default LAAS (GBAS) header.

Parameters:

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

Example:

SOURce1:BB:GBAS:SCATi 0

Manual operation: See ["SCAT-I"](#) on page 25

[:SOURce<hw>]:BB:GBAS:MFChannels <MFCh>

Enables the configuration of multiple frequency channels.

Parameters:

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

Example:

See [Example "Generating a GBAS signal for VDB slot detection"](#) on page 114

Manual operation: See ["Multiple Frequency Channels"](#) on page 26

[:SOURce<hw>]:BB:GBAS:GPOW <GPow>

Enables gated power mode.

Parameters:

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

Example: See [Example "Generating a GBAS signal for sensitivity tests"](#) on page 114

Manual operation: See ["Gated Power Mode"](#) on page 26

[:SOURce<hw>]:BB:GBAS:SRInfo?

Queries the used sample rate.

Return values:

<SRInfo> string

Example: See [Example "Querying the default filter, clipping and modulation settings"](#) on page 118

Usage: Query only

Manual operation: See ["Sample Rate Variation/Sample Rate Info"](#) on page 26

10.2.3 VDB Transmission Configuration Settings

[:SOURce<hw>]:BB:GBAS:VDB:APPend.....	120
[:SOURce<hw>]:BB:GBAS:VDB<ch>:INSert.....	121
[:SOURce<hw>]:BB:GBAS:VDB<ch>:DELete.....	121
[:SOURce<hw>]:BB:GBAS:VDB<ch>:STATe.....	121
[:SOURce<hw>]:BB:GBAS:VDB<ch>:RID.....	121
[:SOURce<hw>]:BB:GBAS:VDB<ch>:GID.....	121
[:SOURce<hw>]:BB:GBAS:VDB<ch>:SGID.....	122
[:SOURce<hw>]:BB:GBAS:VDB<ch>:SSID.....	122
[:SOURce<hw>]:BB:GBAS:VDB<ch>:FNUMber.....	122
[:SOURce<hw>]:BB:GBAS:VDB<ch>:DLENgth.....	122
[:SOURce<hw>]:BB:GBAS:VDB<ch>:DATA.....	122
[:SOURce<hw>]:BB:GBAS:VDB<ch>:DATA:DSElction.....	123
[:SOURce<hw>]:BB:GBAS:VDB<ch>:DATA:PATtern.....	123
[:SOURce<hw>]:BB:GBAS:NOFRames?.....	123

[:SOURce<hw>]:BB:GBAS:VDB:APPend

Appends a new VDB to the end of the VDB list.

Example: See [Example "Generating a GBAS signal for VDB slot detection"](#) on page 114

Usage: Event

Manual operation: See ["Append, Insert, Delete"](#) on page 29

[:SOURce<hw>]:BB:GBAS:VDB<ch>:INSert

Inserts a new VDB before the selected one.

Example: See [Example "Generating a GBAS signal for VDB slot detection"](#) on page 114

Usage: Event

Manual operation: See ["Append, Insert, Delete"](#) on page 29

[:SOURce<hw>]:BB:GBAS:VDB<ch>:DELete

Deletes the selected VDB.

Example: See [Example "Generating a GBAS signal for VDB slot detection"](#) on page 114

Usage: Event

Manual operation: See ["Append, Insert, Delete"](#) on page 29

[:SOURce<hw>]:BB:GBAS:VDB<ch>:STATe <VState>

Enables the selected VHF Data Broadcast (VDB) transmitter.

Parameters:

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

Example: See [Example "Generating a GBAS signal for VDB slot detection"](#) on page 114

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

[:SOURce<hw>]:BB:GBAS:VDB<ch>:RID <RIId>

[:SOURce<hw>]:BB:GBAS:VDB<ch>:GID <GIId>

Sets the GBAS ID.

Parameters:

<GIId> string
A four-character (24-bit) alphanumeric field that identifies the ground station broadcasting the message. Permitted are capital letter, numbers and "space".

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Manual operation: See ["GBAS ID/ SGID"](#) on page 28

[[:SOURce<hw>]:BB:GBAS:VDB<ch>:SGID <Sgid>

[[:SOURce<hw>]:BB:GBAS:VDB<ch>:SSID <Ssid>

Sets the Station Slot Identifier SSID of the ground station.

Parameters:

<Ssid> A | B | C | D | E | F | G | H
 *RST: A

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Manual operation: See "[SSID /RSID](#)" on page 28

[[:SOURce<hw>]:BB:GBAS:VDB<ch>:FNUMber <FNum>

Sets the frequency number that the corresponding VDB is using.

Parameters:

<FNum> integer
 Range: -5 to 5
 *RST: 0

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Manual operation: See "[Freq. Num](#)" on page 28

[[:SOURce<hw>]:BB:GBAS:VDB<ch>:DLENGth <DataLen>

Sets the application data length.

Parameters:

<DataLen> integer
 Range: 1 to 65495
 *RST: 222

Manual operation: See "[App. Data Length/bytes](#)" on page 29

[[:SOURce<hw>]:BB:GBAS:VDB<ch>:DATA <Data>

Selects the data source, e.g. a sequence of 0 or 1, a pseudo-random sequence with different length, a pattern or a data list (DLIST).

Parameters:

<Data> ZERO | ONE | PATtern | PN9 | PN11 | PN15 | PN16 | PN20 |
 PN21 | PN23 | DLISt | RGData
 *RST: PN9

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Manual operation: See "[Data/Data Config](#)" on page 28

[:SOURce<hw>]:BB:GBAS:VDB<ch>:DATA:DSElection <DSelection>

Selects the data list for the data source.

Parameters:

<DSelection> string

Example:

```
SOURce1:BB:GBAS:VDB2:DATA DLIST
SOURce1:BB:GBAS:VDB2:DATA:DSElection
"/var/user/gbas_dl.dm_iqd "
```

Manual operation: See "[Data/Data Config](#)" on page 28

[:SOURce<hw>]:BB:GBAS:VDB<ch>:DATA:PATtern <Pattern>

Selects the bit pattern for the data source.

Parameters:

<Pattern> 64 bits
 *RST: #H0,1

Example:

```
SOURce1:BB:GBAS:VDB2:DATA PATtern
SOURce1:BB:GBAS:VDB2:DATA:PATtern #HB8A,12
```

Manual operation: See "[Data/Data Config](#)" on page 28

[:SOURce<hw>]:BB:GBAS:NOFRames?

Queries the number of VD frames.

Return values:

<NOFrame> integer
 Range: 1 to 12500
 *RST: 1

Usage: Query only

Manual operation: See "[No. of Frames](#)" on page 29

10.2.4 Scheduling Settings

[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:TS<st>:STATe	124
[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:TS<st>:POWer	124
[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M11T:FOFFset?	124
[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M1T:FOFFset?	124
[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M2T:FOFFset	124
[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M4T:FOFFset	124
[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M11T:LPAir:STATe	125
[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M1T:LPAir:STATe	125
[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M11T:MBYTes?	125
[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M1T:MBYTes?	125
[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M2T:MBYTes?	125

<code>[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M4T:MBYTes?</code>	125
<code>[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M11T:RFRame?</code>	125
<code>[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M1T:RFRame?</code>	125
<code>[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M2T:RFRame</code>	126
<code>[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M4T:RFRame</code>	126
<code>[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M11T:SLOT<di></code>	126
<code>[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M1T:SLOT<di></code>	126
<code>[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M2T:SLOT<di></code>	126
<code>[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M4T:SLOT<di></code>	126
<code>[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M11T:SLOT<di>:STATE</code>	126
<code>[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M1T:SLOT<di>:STATE</code>	126
<code>[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M2T:SLOT<di>:STATE</code>	126
<code>[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M4T:SLOT<di>:STATE</code>	126

`[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:TS<st>:STATE <State>`

Enables the VDB in the corresponding time slot (TS).

Parameters:

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

Example: See [Example "Generating a GBAS signal for sensitivity tests"](#) on page 114

Manual operation: See "[TS0..TS7](#)" on page 30

`[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:TS<st>:POWER <Power>`

Sets the relative power of a VDB per time slot (TS).

Parameters:

<Power> float
 Range: -21 to 0
 Increment: 0.01
 *RST: 0

Example: See [Example "Generating a GBAS signal for sensitivity tests"](#) on page 114

Manual operation: See "[Pow\(dB\)](#)" on page 30

`[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M11T:FOFFset?`
`[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M1T:FOFFset?`
`[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M2T:FOFFset <Offset>`
`[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M4T:FOFFset <Offset>`

Sets the offset frame related to the first frame.

Parameters:

<Offset> integer
 Range: 0 to 19
 *RST: 0

Manual operation: See "[Frame Offset](#)" on page 31

[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M11T:LPAir:STATe <State>

[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M1T:LPAir:STATe <State>

If enabled, the set of measurement blocks is included in a linked pair of messages instead in a single message.

Parameters:

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

Manual operation: See "[Link Pair](#)" on page 31

[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M11T:MBYTes?

[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M1T:MBYTes?

[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M2T:MBYTes?

[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M4T:MBYTes?

Sets the total number of bytes per message type.

Return values:

<Bytes> integer
 Range: 0 to 5000
 *RST: 0

Usage: Query only

Manual operation: See "[Message Bytes](#)" on page 31

[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M11T:RFRame?

[:SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M1T:RFRame?

Queries the repetition rate for the respective message type.

Return values:

<RepFrame> integer
 Range: 1 to 20
 *RST: 1

Usage: Query only

Manual operation: See "[Frame Cycle](#)" on page 30

```
[ :SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M2T:RFRame <RepFrame>
[ :SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M4T:RFRame <RepFrame>
```

Sets the repetition rate for the respective message type.

Parameters:

```
<RepFrame>          integer
                    Range:    1 to 20
                    *RST:    1
```

Manual operation: See "[Frame Cycle](#)" on page 30

```
[ :SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M11T:SLOT<di> <State>
[ :SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M1T:SLOT<di> <State>
[ :SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M2T:SLOT<di> <State>
[ :SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M4T:SLOT<di> <State>
```

Parameters:

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

Manual operation: See "[Slot](#)" on page 31

```
[ :SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M11T:SLOT<di>:STATe <State>
[ :SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M1T:SLOT<di>:STATe <State>
[ :SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M2T:SLOT<di>:STATe <State>
[ :SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:M4T:SLOT<di>:STATe <State>
```

Enables the slot for the respective message type.

Parameters:

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

Manual operation: See "[Slot](#)" on page 31

10.2.5 Message Configuration

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:AID.....	128
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:APDesignator.....	128
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:ADB1:STATe.....	128
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:ADB3:STATe.....	128
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:ADB4:STATe.....	129
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:ATCHeight.....	129
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:ATUSelector.....	129
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:CWAThreshold.....	129
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DFLocation:COORdinates:DECimal.....	130
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DFLocation:COORdinates:DMS.....	130
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:M11State.....	131
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:M1State.....	131
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:STATe.....	132

[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:PREDefined:CATalog?	132
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:USER:CATalog?	132
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:PREDefined:FILE	132
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:USER:FILE	133
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:FILE?	133
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DLOffset	133
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FDSSState	134
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FLAA	134
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FRCLink	134
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FVAA	134
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:GCID	135
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:GPANgle	135
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:GSADesignator	135
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:GSRReceivers	135
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:KCGLonass	136
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:KCGPs	136
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:KDGLonass	136
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:KDGP	136
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:KPGLonass	136
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:KPGPs	136
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:LFLocation:COORDinates:DECimal	137
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:LFLocation:COORDinates:DMS	137
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:LFLocation:HEIGHT	138
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:LMVariation	138
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:LOCation:COORDinates:DECimal	139
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:LOCation:COORDinates:DMS	139
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:MUDistance	140
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:MT2State	141
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:MT4State	141
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:NOPPoint	141
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:PSERvice:STATE	141
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:RSDSelector	142
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:RFIndex	142
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:RLETter	142
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:RNUMBER	142
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:RPDF	143
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:RPDT	143
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:RPIF	143
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:RPIT	143
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:RUINdicator	144
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:RUNCertainty	144
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SGDefinition:A:STATE	144
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SGDefinition:B:STATE	144
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SGDefinition:C:STATE	144
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SGDefinition:D:STATE	144
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SGDefinition:E:STATE	144
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SGDefinition:F:STATE	144
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SGDefinition:G:STATE	144
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SGDefinition:H:STATE	144
[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SHEight	145

<code>[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SVID</code>	145
<code>[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SVIGradient</code>	145
<code>[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:TDSState</code>	145
<code>[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:TLAS</code>	146
<code>[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:TVAS</code>	146
<code>[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:WAYPoint:PREDefined:CATalog?</code>	146
<code>[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:WAYPoint:USER:CATalog?</code>	146
<code>[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:WAYPoint:PREDefined:FILE</code>	147
<code>[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:WAYPoint:USER:FILE</code>	147
<code>[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:WAYPoint:FILE?</code>	147

`[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:AID <Aid>`

Sets the airport ID.

Parameters:

<Aid> string

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["Airport ID"](#) on page 41

`[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:APDesignator <ApPerDes>`

Sets the approach performance designator.

Parameters:

<ApPerDes> GAB | GC | GCD
*RST: GAB

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["Approach Performance Designator"](#) on page 41

`[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:ADB1:STATE <State>`

Enables the additional data block 1.

Parameters:

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

Manual operation: See ["Additional Data Block 1"](#) on page 35

`[SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:ADB3:STATE <State>`

Enables the additional data block 3.

Parameters:

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

Manual operation: See ["Additional Data Block 3"](#) on page 36

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:ADB4:STATe <State>

Enables the additional data block 4.

Parameters:

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

Manual operation: See ["Additional Data Block 4"](#) on page 37

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:ATCHeighT <Tch>

Sets the approach threshold crossing height.

Parameters:

<Tch> float
 Range: 0 to 1638.35
 Increment: 0.05
 *RST: 0

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["Plan View/Profile View Parameters"](#) on page 40

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:ATUSelector <TchUnit>

Sets the units for the approach TCH, see [\[:SOURce<hw>\]:BB:GBAS:VDB<ch>:MCONfig:ATCHeighT](#).

Parameters:

<TchUnit> FEET | MET
 *RST: FEET

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["Plan View/Profile View Parameters"](#) on page 40

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:CWAThreshoLd <CrWdAtTh>

Sets the course width at threshold.

Parameters:

<CrWdAtTh> float
 Range: 80 to 143.75
 Increment: 0.01
 *RST: 80

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["Course Width at Threshold"](#) on page 43

[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:DFLocation:COORDinates:DECimal <Longitude>, <Latitude>

Defines the coordinates of the Delta FPAD location in decimal format.

Parameters:

<Longitude> float
 Range: -1.0 to 1.0
 Increment: 1E-6
 *RST: 0

<Latitude> float
 Range: -1.0 to 1.0
 Increment: 1E-6
 *RST: 0

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["Delta_FPAP Location Configuration"](#) on page 42

[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:DFLocation:COORDinates:DMS <LongitudeDeg>, <LongitudeMin>, <LongitudeSec>, <LongitudeDir>, <LatitudeDeg>, <LatitudeMin>, <LatitudeSec>, <LatitudeDir>

Defines the coordinates of the Delta FPAD location in degrees, minutes and seconds.

Parameters:

<LongitudeDeg> integer
 Range: 0 to 1.0
 *RST: 0

<LongitudeMin> integer
 Defines the longitude minutes.
 Range: 0 to 59
 *RST: 0

<LongitudeSec>	float Defines the longitude seconds. Range: 0 to 59.999 Increment: 0.001 *RST: 0
<LongitudeDir>	EAST WEST Defines the longitude direction. *RST: EAST
<LatitudeDeg>	integer Defines the latitude degrees. Range: 0 to 1.0 *RST: 0
<LatitudeMin>	integer Defines the latitude minutes. Range: 0 to 59 *RST: 0
<LatitudeSec>	float Defines the latitude seconds. Range: 0 to 59.999 Increment: 0.001 *RST: 0
<LatitudeDir>	NORT ^h SOUT ^h Defines the latitude direction. *RST: NORT

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["Delta_FPAP Location Configuration"](#) on page 42

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:M11State <State>

Enables the use of the message type 11, C/A-Code L1, L2 delta corrections.

Parameters:

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

Manual operation: See ["Meassage Type 11"](#) on page 46

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:M1STate <State>

Enables the use of the message type 1, differential GPS corrections.

Parameters:

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

Manual operation: See ["Meassage Type 1"](#) on page 45

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:STATe <DiffGnssState>

Enables the use of differential GNSS data.

Parameters:

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

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Manual operation: See ["Differential GNSS"](#) on page 45

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:PREDefined:CATalog?
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:USER:CATalog?

Queries the names of the existing user defined/predefined GBAS differential files.

Per default, the instrument stores user-defined files in the `/var/user/` directory. Use the command `M MEM:CDIRectory` to change the default directory to the currently used one.

Only files with extension `*.rs_gbas` are listed.

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Usage: Query only

Manual operation: See ["GBAS Differential File..."](#) on page 46

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:PREDefined:FILE <Filename>

Loads the selected predefined file (extension `*.rs_gbas`).

Setting parameters:

<Filename> string
 Only the file name is required

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Usage: Setting only

Manual operation: See ["GBAS Differential File..."](#) on page 46

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:USER:FILE <Filename>

Loads the selected user-defined file (extension *.rs_gbas).

Per default, the instrument stores user-defined files in the /var/user/ directory. Use the command `M MEM:CDIRectory` to change the default directory to the currently used one.

Setting parameters:

<Filename> string
 For files stored in the default directory, only the file name is required.

Example: SOURce1:BB:GBAS:VDB3:MCONfig:DG:USER:CATalog?
Response: gbas_correction
 SOURce1:BB:GBAS:VDB3:MCONfig:DG:USER:FILE
 "gbas_correction"

Usage: Setting only

Manual operation: See ["GBAS Differential File..."](#) on page 46

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:FILE?

Queries the currently selected GBAS differential file.

Return values:

<Filename> string
 Filename with file extension (*.rs_gbas)

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Usage: Query only

Manual operation: See ["GBAS Differential File..."](#) on page 46

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DLOffset <DelLenOff>

Sets the Delta_Length offset.

Parameters:

<DelLenOff> float
 Range: 0 to 2032
 Increment: 8
 *RST: 0

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Manual operation: See ["Delta_Length Offset"](#) on page 43

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FDSState <Fdss>

Enables the configuration of Final Approach Segment (FAS) data set.

Parameters:

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

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Manual operation: See ["FAS Data Set"](#) on page 39

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FLAA <FasVt>

Sets the value of the broadcast lateral alert limit.

Parameters:

<FasVt> float
 Range: 0 to 50.8
 Increment: 0.2
 *RST: 0

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["FAS Lateral Alert Limit / Approach Status"](#) on page 43

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FRCLink <Rpcl>

Sets the FAS RPDS or continuation link.

Parameters:

<Rpcl> integer
 Range: 0 to 255
 *RST: 0

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["FAS RPDS or Continuation Link"](#) on page 44

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FVAA <Fvaa>

Sets the value of the broadcast vertical alert limit.

Parameters:

<Fvaa> float
 Range: 0 to 25.4
 Increment: 0.1
 *RST: 0

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["FAS Vertical Alert Limit / Approach Status"](#) on page 43

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:GCID <Gcid>

Sets the ground station continuity/integrity designator.

Parameters:

<Gcid> FC | FD
*RST: FC

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Manual operation: See ["Ground Station Continuity/Integrity Designator"](#) on page 33

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:GPANgle <Gpa>

Sets the glide path angle.

Parameters:

<Gpa> float
Range: 0 to 90
Increment: 0.01
*RST: 0

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["Plan View/Profile View Parameters"](#) on page 40

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:GSADesignator <Gsad>

Sets the ground station accuracy designator.

Parameters:

<Gsad> GADA | GADB | GADC
*RST: GADA

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Manual operation: See ["Ground Station Accuracy Designator"](#) on page 33

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:GSRReceivers <Gsrr>

Sets the number of ground station reference receivers.

Parameters:

<Gsrr> GW3R | GW4R | GW2R
 *RST: GW2R

Example:

See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Manual operation: See ["Ground Station Reference Receivers"](#) on page 33

[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:KCGLonass <KmdECGlonass>
[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:KCGPs <KmdECGps>

Sets the ephemeris missed detection parameter (Kmd_e), category I precision approach and approach with vertical guidance (APV). This is a multiplier considered when calculating the ephemeris error position bound for the category I precision approach and APV. It is derived from the probability that a detection is missed because of an ephemeris error in a GPS/GLONASS satellite.

Parameters:

<KmdECGps> float
 Range: 0 to 12.75
 Increment: 0.05
 *RST: 0

Manual operation: See ["Kmd_e_C, GPS/ Kmd_e_C, GLONASS"](#) on page 36

[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:KDGLonass <KmdEDGlonass>
[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:KDGPps <KmdEDGps>

Sets the ephemeris missed detection parameter (Kmd_e), GAST D. This is a multiplier considered when calculating the ephemeris error position bound for GAST D. It is derived from the probability that a detection is missed because of an ephemeris error in a GPS/GLONASS satellite.

Parameters:

<KmdEDGps> float
 Range: 0 to 12.75
 Increment: 0.05
 *RST: 0

Manual operation: See ["Kmd_e_D, GPS/ Kmd_e_D, GLONASS"](#) on page 36

[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:KPGLonass <KmdEPosGlonass>
[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:KPGPs <KmdEPosGps>

Sets the ephemeris missed detection parameter (Kmd_e), GBAS positioning service . This is a multiplier considered when calculating the ephemeris error position bound for the GBAS positioning. It is derived from the probability that a detection is missed because of an ephemeris error in a GPS/GLONASS satellite.

Parameters:

<KmdEPosGps> float
 Range: 0 to 12.75
 Increment: 0.05
 *RST: 0

Manual operation: See "[Kmd_e_POS GPS, CLONASS](#)" on page 36

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:LFLocation:COORDinates:DECimal <Longitude>, <Latitude>

Defines the coordinates of the LTP/FTP in decimal format.

Parameters:

<Longitude> float
 Range: -180 to 180
 Increment: 1E-6
 *RST: 0

<Latitude> float
 Range: -90 to 90
 Increment: 1E-6
 *RST: 0

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See "[LTP/FTP Location Configuration](#)" on page 41

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:LFLocation:COORDinates:DMS <LongitudeDeg>, <LongitudeMin>, <LongitudeSec>, <LongitudeDir>, <LatitudeDeg>, <LatitudeMin>, <LatitudeSec>, <LatitudeDir>

Defines the coordinates of the LTP/FTP in degrees, minutes and seconds.

Parameters:

<LongitudeDeg> integer
 Range: 0 to 180
 *RST: 0

<LongitudeMin> integer
 Defines the longitude minutes.
 Range: 0 to 59
 *RST: 0

<LongitudeSec> float
 Defines the longitude seconds.
 Range: 0 to 59.999
 Increment: 0.001
 *RST: 0

<LongitudeDir>	EAST WEST Defines the longitude direction. *RST: EAST
<LatitudeDeg>	integer Defines the latitude degrees. Range: 0 to 90 *RST: 0
<LatitudeMin>	integer Defines the latitude minutes. Range: 0 to 59 *RST: 0
<LatitudeSec>	float Defines the latitude seconds. Range: 0 to 59.999 Increment: 0.001 *RST: 0
<LatitudeDir>	NORTH SOUTH Defines the latitude direction. *RST: NORT

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See "[LTP/FTP Location Configuration](#)" on page 41

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:LFLocation:HEIGHT <LfHeight>

Sets the LTP/FTP height.

Parameters:

<LfHeight>	float Range: -512 to 6041.5 Increment: 0.1 *RST: 0
------------	-------------------------------------------------------------

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See "[Plan View/Profile View Parameters](#)" on page 40

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:LMVariation <Lmv>

Sets the local magnetic variation.

Parameters:

<Lmv> float
 A positive value represents an east variation (clockwise from true north)
 Range: -180 to 180
 Increment: 0.01
 *RST: 0
 Default unit: deg

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Manual operation: See ["Local Magnetic Variation"](#) on page 34

[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:LOCation:COORdinateS:DECimal
 <Longitude>, <Latitude>, <Altitude>

Defines the coordinates of the ground station reference location in decimal format.

Parameters:

<Longitude> float
 Range: -180 to 180
 Increment: 1E-6
 *RST: 0

<Latitude> float
 Range: -90 to 90
 Increment: 1E-6
 *RST: 0

<Altitude> float
 Range: -83886.07 to 83886.07
 Increment: 0.01
 *RST: 0

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Manual operation: See ["Reference Location Configuration"](#) on page 34

[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:LOCation:COORdinateS:DMS
 <LongitudeDeg>, <LongitudeMin>, <LongitudeSec>, <LongitudeDir>,
 <LatitudeDeg>, <LatitudeMin>, <LatitudeSec>, <LatitudeDir>, <Altitude>

Defines the coordinates of the ground station reference location in degrees, minutes and seconds.

Parameters:

<LongitudeDeg> integer
 Range: 0 to 180
 *RST: 0

<LongitudeMin>	integer Defines the longitude minutes. Range: 0 to 59 *RST: 0
<LongitudeSec>	float Defines the longitude seconds. Range: 0 to 59.999 Increment: 0.001 *RST: 0
<LongitudeDir>	EAST WEST Defines the longitude direction. *RST: EAST
<LatitudeDeg>	integer Defines the latitude degrees. Range: 0 to 90 *RST: 0
<LatitudeMin>	integer Defines the latitude minutes. Range: 0 to 59 *RST: 0
<LatitudeSec>	float Defines the latitude seconds. Range: 0 to 59.999 Increment: 0.001 *RST: 0
<LatitudeDir>	NORTH SOUTH Defines the latitude direction. *RST: NORT
<Altitude>	float Defines the height above the ellipsoid (HAE) altitude. Range: -83886.07 to 83886.07 Increment: 0.01 *RST: 0

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Manual operation: See ["Reference Location Configuration"](#) on page 34

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:MUDistance <Distance>

Sets the maximum distance from the reference point for which the integrity is assured.

Parameters:

<Distance> float
 Range: 0 to 510
 Increment: 2
 *RST: 2

Manual operation: See ["Maximum User Distance"](#) on page 35

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:MT2State <Mt2State>

Enables the message type 2 configuration.

Parameters:

<Mt2State> 0 | 1 | OFF | ON
 *RST: 0

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Manual operation: See ["Message Type 2"](#) on page 33

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:MT4State <Mt4State>

Enables the configuration of message type 4.

Parameters:

<Mt4State> 0 | 1 | OFF | ON
 *RST: 0

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["Message Type 4"](#) on page 38

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:NOPPoint <Nofp>

Queries the number of path points - N.

Parameters:

<Nofp> integer
 Range: 2 to 11
 *RST: 2

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["Number of Path Points - N"](#) on page 44

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:PSERvice:STATE <State>

Selects if the GBAS positioning service is supported.

Parameters:

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

Manual operation: See ["Positioning Service"](#) on page 35

[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:RSDSelector <Rsds>

Sets the numerical identifier for selecting the ground subsystem.

Parameters:

<Rsds> integer
 Range: 0 to 48
 *RST: 0

Manual operation: See ["Reference Station Data Selector"](#) on page 35

[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:RFIndex <RefIdx>

Sets the refractivity index.

Parameters:

<RefIdx> integer
 Range: 16 to 781
 *RST: 16

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Manual operation: See ["Refractivity Index"](#) on page 34

[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:RLETter <Rlet>

Sets the runway letter.

Parameters:

<Rlet> NLETter | LETR | LETL | LETC
 *RST: NLETter

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["Runway Letter"](#) on page 41

[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:RNUMber <Rnum>

Sets the runway number.

Parameters:

<Rnum> integer
 Range: 1 to 36
 *RST: 1

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["Runway Number"](#) on page 41

[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:RPDF <Rpdf>

Sets the reference path data selector for FAS.

Parameters:

<Rpdf> integer
 Range: 0 to 48
 *RST: 1

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["Reference Path Data Selector"](#) on page 41

[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:RPDT <Rpdt>

Sets the reference path data selector.

Parameters:

<Rpdt> integer
 Range: 0 to 254
 *RST: 1

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["Reference Path Data Selector"](#) on page 44

[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:RPIF <Rpif>

Sets the reference path identifier for FAS.

Parameters:

<Rpif> string
 Three or four alphanumeric characters

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["Reference Path ID"](#) on page 41

[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:RPIT <Rpit>

Sets the reference path identifier for TAP.

Parameters:

<Rpit> string
Three or four alphanumeric characters

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["Reference Path ID"](#) on page 44

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:RUINdicator <Ruin>

Sets the route indicator.

Parameters:

<Ruin> a single upper case alphabetic character
Allowed are letters, excluding "I" and "O", or the "space" character.

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["Route Indicator"](#) on page 41

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:RUNCertainty <Runc>

Set the refractivity uncertainty.

Parameters:

<Runc> integer
Range: 0 to 255
*RST: 0

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Manual operation: See ["Refractivity Uncertainty"](#) on page 34

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SGDefinition:A:STATE <State>

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SGDefinition:B:STATE <State>

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SGDefinition:C:STATE <State>

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SGDefinition:D:STATE <State>

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SGDefinition:E:STATE <State>

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SGDefinition:F:STATE <State>

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SGDefinition:G:STATE <State>

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SGDefinition:H:STATE <State>

If enabled, the specified slot is assigned for use by the ground station.

Parameters:

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

Manual operation: See ["Slot Group Definition"](#) on page 37

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SHEight <SHeight>

Sets the scale height.

Parameters:

<SHeight> float
 Range: 0 to 25500
 Increment: 100
 *RST: 0
 Default unit: m

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

Manual operation: See ["Scale Height"](#) on page 34

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SVID <Svid>

Sets the standard deviation of a normal distribution connected to the residual ionospheric uncertainty which is caused by spatial decorrelation.

Parameters:

<Svid> float
 Range: 0 to 2.55e-05
 Increment: 0.1e-6
 *RST: 0

Manual operation: See ["Sigma_vert_iono_gradient_ID"](#) on page 36

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:SVIGradient <Svig>

Sets the Sigma_vert_iono_gradient.

Parameters:

<Svig> float
 Range: 0 to 2.55E-05
 Increment: 0.1E-6
 *RST: 0

Example: See [Example "Generating a GBAS signal for message-format detection"](#) on page 115

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

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:TDSState <Tdss>

Enables the configuration of the Terminal Area Path (TAP) data set.

Parameters:

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

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["TAP Data Set"](#) on page 43

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:TLAS <Tlas>

Sets the value of the broadcast lateral alert limit.

Parameters:

<Tlas>	float
Range:	0 to 2.54
Increment:	0.01
*RST:	0

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["TAP Lateral Alert Limit / Status"](#) on page 45

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:TVAS <Tvas>

Sets the value of the broadcast vertical alert limit.

Parameters:

<Tvas>	float
Range:	0 to 127
Increment:	0.5
*RST:	0

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Manual operation: See ["TAP Vertical Alert Limit / Status"](#) on page 45

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:WAYPoint:PREDefined:CATalog?
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:WAYPoint:USER:CATalog?

Queries the names of the existing user defined/predefined waypoint files.

Per default, the instrument stores user-defined files in the `/var/user/` directory. Use the command `MMEM:CDIRectory` to change the default directory to the currently used one.

Only files with extension `*.txt` are listed.

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Usage: Query only

Manual operation: See ["Waypoint File"](#) on page 44

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:WAYPoint:PREDefined:FILE <WpFile>

Loads the selected predefined file (extension *.txt).

Setting parameters:

<WpFile> string
 Only the file name is required

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Usage: Setting only

Manual operation: See "[Waypoint File](#)" on page 44

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:WAYPoint:USER:FILE <Filename>

Loads the selected user-defined file (extension *.txt).

Per default, the instrument stores user-defined files in the /var/user/ directory. Use the command `MMEM:CDIRectory` to change the default directory to the currently used one.

Setting parameters:

<Filename> string
 For files stored in the default directory, only the file name is required.

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Usage: Setting only

Manual operation: See "[Waypoint File](#)" on page 44

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:WAYPoint:FILE?

Queries the currently selected waypoint file.

Return values:

<Filename> string
 Filename with file extension (*.txt)

Example: See [Example "Generating a GBAS signal containing message type 4"](#) on page 116

Usage: Query only

Manual operation: See "[Waypoint File](#)" on page 44

10.2.6 SCAT-I Message Configuration

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:CCGP:STATe.....	148
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:GPOLynomial:PATtern.....	148
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:RBORDER:STATe.....	148
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[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:SPReDEFINED:CATalog.....	149
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[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:SPReDEFINED:FILE.....	149
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:SUSer:FILE.....	149

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:CCGP:STATe <State>

Enables the custom CRC-32 generator polynomial.

Parameters:

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

**[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:GPOLynomial:PATtern
<Pattern>**

Sets the value of the generator polynomial, if the [:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:CCGP:STATe is set to ON.

Parameters:

<Pattern> 32 bits

Manual operation: See "[Generator Polynomial \(Hex\)](#)" on page 47

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:RBORDER:STATe <State>

Enables the reserved bit order.

Parameters:

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

Manual operation: See "[Reversed Bit Order](#)" on page 47

[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:SFILE?

Queries the currently selected SCAT-I differential file.

Return values:

<Filename> string
 Filename with file extension (*.rs_scat)

Usage: Query only

Manual operation: See "[SCAT-I Differential File...](#)" on page 47

**[[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:SPRedefined:CATalog
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:SUSer:CATalog**

Queries the names of the existing user defined/predefined SCAT-I differential files.

Per default, the instrument stores user-defined files in the `/var/user/` directory. Use the command `MMEM:CDIRectory` to change the default directory to the currently used one.

Only files with extension `*.rs_scat` are listed.

Manual operation: See ["SCAT-I Differential File..."](#) on page 47

[[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:SPRedefined:FILE <Filename>

Loads the selected predefined file (extension `*.rs_scat`).

Setting parameters:

<Filename> string
 Only the file name is required

Usage: Setting only

Manual operation: See ["SCAT-I Differential File..."](#) on page 47

[[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:SUSer:FILE <Filename>

Loads the selected user-defined file (extension `*.rs_scat`).

Per default, the instrument stores user-defined files in the `/var/user/` directory. Use the command `MMEM:CDIRectory` to change the default directory to the currently used one.

Setting parameters:

<Filename> string
 For files stored in the default directory, only the file name is required.

Example: SOURce1:BB:GBAS:VDB3:MCONfig:DG:SUSER:CATalog?
 Response: scat_correction
 SOURce1:BB:GBAS:VDB3:MCONfig:DG:SUSER:FILE
 "scat_correction"

Usage: Setting only

Manual operation: See ["SCAT-I Differential File..."](#) on page 47

10.2.7 Filter, Clipping, Modulation Settings

[:SOURce<hw>]:BB:GBAS:FILTer:TYPE.....	150
[:SOURce<hw>]:BB:GBAS:FILTer:PARAmeter:APCO25.....	150
[:SOURce<hw>]:BB:GBAS:FILTer:PARAmeter:COSine.....	150
[:SOURce<hw>]:BB:GBAS:FILTer:PARAmeter:COSine:COFS.....	150

[:SOURce<hw>]:BB:GBAS:FILTer:PARAmeter:GAUSs..... 150
 [:SOURce<hw>]:BB:GBAS:FILTer:PARAmeter:LPASs..... 150
 [:SOURce<hw>]:BB:GBAS:FILTer:PARAmeter:LPASSEVM..... 150
 [:SOURce<hw>]:BB:GBAS:FILTer:PARAmeter:PGAuss..... 150
 [:SOURce<hw>]:BB:GBAS:FILTer:PARAmeter:RCOSine..... 150
 [:SOURce<hw>]:BB:GBAS:FILTer:PARAmeter:SPHase..... 150
 [:SOURce<hw>]:BB:GBAS:CLIPping:STATe..... 151
 [:SOURce<hw>]:BB:GBAS:CLIPping:LEVel..... 151
 [:SOURce<hw>]:BB:GBAS:CLIPping:MODE..... 151
 [:SOURce<hw>]:BB:GBAS:MSET:MTYPe?..... 152
 [:SOURce<hw>]:BB:GBAS:MSET:SRATe?..... 152

[:SOURce<hw>]:BB:GBAS:FILTer:TYPE <Type>

The command selects the filter type.

Parameters:

<Type> RCOSine | COSine | GAUSs | LGAuss | CONE | COF705 |
 COEQualizer | COFequalizer | C2K3x | APCO25 | SPHase |
 RECTangle | PGAuss | LPASs | DIRac | ENPShape |
 EWPSshape | LPASSEVM
 *RST: COSine

Example: See [Example "Querying the default filter, clipping and modulation settings"](#) on page 118

Manual operation: See ["Filter"](#) on page 48

- [:SOURce<hw>]:BB:GBAS:FILTer:PARAmeter:APCO25 <Apco25>
 [:SOURce<hw>]:BB:GBAS:FILTer:PARAmeter:COSine <Cosine>
 [:SOURce<hw>]:BB:GBAS:FILTer:PARAmeter:COSine:COFS <CoFs>
 [:SOURce<hw>]:BB:GBAS:FILTer:PARAmeter:GAUSs <Gauss>
 [:SOURce<hw>]:BB:GBAS:FILTer:PARAmeter:LPASs <LPass>
 [:SOURce<hw>]:BB:GBAS:FILTer:PARAmeter:LPASSEVM <LPassevm>
 [:SOURce<hw>]:BB:GBAS:FILTer:PARAmeter:PGAuss <PGauss>
 [:SOURce<hw>]:BB:GBAS:FILTer:PARAmeter:RCOSine <RCosine>
 [:SOURce<hw>]:BB:GBAS:FILTer:PARAmeter:SPHase <SPHase>

Sets the corresponding filter parameter.

Filter Type	Parameter	Parameter Name	min	max	increment	default
APCO25	roll-off factor	<Apco25>	0.05	0.99	0.01	0.2
COSine	roll-off factor	<Cosine>	0.05	1.00	0.01	0.35
COSine	cut off frequency shift	<CoFs>	-1	1	0.01	0
GAUSs	roll-off factor	<Gauss>	0.15	2.5	0.01	0.3
LPASs	cut off frequency	<LPass>	0.05	2	0.01	0.5
LPASSEVM	cut off frequency	<LPassEvm>	0.05	2	0.01	0.5
PGAuss	roll-off factor	<PGauss>	0.15	2.5	0.01	0.3

Filter Type	Parameter	Parameter Name	min	max	increment	default
RCOSine	roll-off factor	<RCosine>	0.05	1.00	0.01	0.35
SPHase	B x T	<SPhase>	0.15	2.5	0.01	2

Parameters:

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

Example: See [Example "Querying the default filter, clipping and modulation settings"](#) on page 118

Manual operation: See ["Roll Off Factor or BxT"](#) on page 48

[[:SOURce<hw>]:BB:GBAS:CLIPping:STATe <State>

Enables/disable clipping.

Parameters:

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

Example: See [Example "Querying the default filter, clipping and modulation settings"](#) on page 118

Manual operation: See ["Clipping State"](#) on page 50

[[:SOURce<hw>]:BB:GBAS:CLIPping:LEVEl <Level>

Sets the limit for clipping.

Parameters:

<Level> integer
 Range: 1 to 100
 *RST: 100

Example: See [Example "Querying the default filter, clipping and modulation settings"](#) on page 118

Manual operation: See ["Clipping Level"](#) on page 51

[[:SOURce<hw>]:BB:GBAS:CLIPping:MODE <Mode>

Sets the clipping mode.

Parameters:

<Mode> VECTor | SCALar
 *RST: VECTor

Example: See [Example "Querying the default filter, clipping and modulation settings"](#) on page 118

Manual operation: See ["Clipping Mode"](#) on page 51

[:SOURce<hw>]:BB:GBAS:MSET:MTYPE?

Queries the used modulation.

Return values:

<MType> string
 *RST: D8PSK

Example: See [Example "Querying the default filter, clipping and modulation settings"](#) on page 118

Usage: Query only

Manual operation: See ["Modulation Type"](#) on page 50

[:SOURce<hw>]:BB:GBAS:MSET:SRATE?

Queries the used sample rate.

Return values:

<SRate> float
 Range: 10.49E3 to 10.51E3
 Increment: 1E-3
 *RST: 10.5E3

Example: See [Example "Querying the default filter, clipping and modulation settings"](#) on page 118

Usage: Query only

Manual operation: See ["Sample Rate Variation/Sample Rate Info"](#) on page 26

10.3 ILS Settings

The BB:ILS subsystem contains all commands for configuring an ILS signal.

See also [Chapter 10.6, "Trigger Settings"](#), on page 194 and [Chapter 10.9, "Clock Settings"](#), on page 204 for a description of the trigger and clock settings.

10.3.1 General Settings

[\[:SOURce<hw>\]:BB:ILS:TYPE](#)..... 153

[:SOURce<hw>] [:BB] :ILS:TYPE <Type>

Selects the ILS modulation type.

Parameters:

<Type> GS | LOCALize | GSLOpe | MBEacon
*RST: GS

Manual operation: See "ILS Component" on page 53

10.3.2 ILS Glide Slope Settings

[:SOURce<hw>] [:BB] :ILS[:GS GSLOpe]:DDM:COUPling.....	153
[:SOURce<hw>] [:BB] :ILS[:GS GSLOpe]:DDM:CURRent.....	153
[:SOURce<hw>] [:BB] :ILS[:GS GSLOpe]:DDM:DIRectioN.....	154
[:SOURce<hw>] [:BB] :ILS[:GS GSLOpe]:DDM:LOGarithmic.....	154
[:SOURce<hw>] [:BB] :ILS[:GS GSLOpe]:DDM:PCT.....	154
[:SOURce<hw>] [:BB] :ILS[:GS GSLOpe]:DDM:POLarity.....	155
[:SOURce<hw>] [:BB] :ILS[:GS GSLOpe]:DDM:STEP.....	155
[:SOURce<hw>] [:BB] :ILS[:GS GSLOpe]:DDM[:DEPTH].....	155
[:SOURce<hw>] [:BB] :ILS[:GS GSLOpe]:FREQUency.....	156
[:SOURce<hw>] [:BB] :ILS[:GS GSLOpe]:FREQUency:MODE.....	156
[:SOURce<hw>] [:BB] :ILS[:GS GSLOpe]:ICAO:CHANnel.....	156
[:SOURce<hw>] [:BB] :ILS[:GS GSLOpe]:LLOBe[:FREQUency].....	156
[:SOURce<hw>] [:BB] :ILS[:GS GSLOpe]:MODE.....	157
[:SOURce<hw>] [:BB] :ILS[:GS GSLOpe]:PHASe.....	157
[:SOURce<hw>] [:BB] :ILS[:GS GSLOpe]:SDM.....	157
[:SOURce<hw>] [:BB] :ILS[:GS GSLOpe]:ULOBe[:FREQUency].....	158

[:SOURce<hw>] [:BB] :ILS[:GS|GSLOpe]:DDM:COUPling <Coupling>

Selects if the DDM value is fixed or is changed with a change of sum of modulation depths (SDM, see [:SOURce<hw>] [:BB] :ILS[:GS|GSLOpe]:SDM on page 157).

Parameters:

<Coupling> FIXed | SDM
*RST: FIXed

Manual operation: See "DDM - SDM Coupling" on page 58

[:SOURce<hw>] [:BB] :ILS[:GS|GSLOpe]:DDM:CURRent <Current>

Sets the DDM value alternatively as a current by means of the ILS indicating instrument. The instrument current is calculated according to:

$$\text{DDM } \mu\text{A} = \text{DDM} \times 857.1 \text{ } \mu\text{A}$$

A variation of the instrument current automatically leads to a variation of the DDM value and the DDM value in dB.

Parameters:

<Current> float
 Range: -8.57125E-4 to 8.57125E-4
 Increment: 1E-7
 *RST: 0

Manual operation: See "DDM Current" on page 57

[:SOURce<hw>] [:BB] : ILS [:GS | GSLope] : DDM : DIRection <Direction>

Sets the simulation mode for the ILS-GS modulation signal. A change of the setting automatically changes the sign of the DDM value.

Parameters:

<Direction> UP | DOWN
UP
 The 150-Hz modulation signal is predominant, the DDM value is negative (the airplane is too low, it must climb).
DOWN
 The 90-Hz modulation signal is predominant, the DDM value is positive (the airplane is too high, it must descend).
 *RST: UP

Manual operation: See "Fly" on page 57

[:SOURce<hw>] [:BB] : ILS [:GS | GSLope] : DDM : LOGarithmic <Logarithmic>

Sets the depth of modulation value for the ILS-GS in dB.

See also [:SOURce<hw>] [:BB] : ILS [:GS | GSLope] : DDM [:DEPTH] on page 155.

Parameters:

<Logarithmic> float
 Range: -999.9 to 999.9
 Increment: 1E-4
 *RST: 0

Manual operation: See "DDM Logarithmic" on page 57

[:SOURce<hw>] [:BB] : ILS [:GS | GSLope] : DDM : PCT <Pct>

Sets the difference in depth of modulation between the signal of the upper lobe (90 Hz) and the lower lobe (150 Hz). The maximum value equals the sum of the modulation depths of the 90 Hz and the 150 Hz tone.

See also [:SOURce<hw>] [:BB] : ILS [:GS | GSLope] : DDM [:DEPTH] on page 155.

Parameters:

<Pct> float
 Range: -80.0 to 80.0
 Increment: 0.01
 *RST: 0

Manual operation: See "DDM Percent" on page 58

[:SOURce<hw>] [:BB] : ILS [:GS | GSLoPe] : DDM : POLarity <Polarity>

Sets the polarity for DDM calculation (see [:SOURce<hw>] [:BB] : ILS [:GS | GSLoPe] : DDM [:DEPTh]).

The DDM depth calculation depends on the selected polarity:

- Polarity 90 Hz - 150 Hz (default setting):
 $DDM = [AM(90\text{ Hz}) - AM(150\text{ Hz})] / 100\%$
- Polarity 150 Hz - 90 Hz:
 $DDM = [AM(150\text{ Hz}) - AM(90\text{ Hz})] / 100\%$

Parameters:

<Polarity> P90_150 | P150_90
 *RST: P90_150

Manual operation: See "DDM Polarity" on page 55

[:SOURce<hw>] [:BB] : ILS [:GS | GSLoPe] : DDM : STEP <DdmStep>

Sets the variation of the difference in depth of modulation via the rotary knob.

Parameters:

<DdmStep> DECimal | PREDefined
 *RST: DECimal

[:SOURce<hw>] [:BB] : ILS [:GS | GSLoPe] : DDM [:DEPTh] <Depth>

Sets the difference in depth of modulation between the signal of the upper/left lobe (90 Hz) and the lower/right lobe (150 Hz). The maximum value equals the sum of the modulation depths of the 90 Hz and the 150 Hz tone. The following is true:

$$ILS:GS|GSL:DDM:DEPTh = (AM(90Hz) - AM(150Hz)) / 100\%$$

A variation of the DDM value automatically leads to a variation of the DDM value in dB and the value of the instrument current.

Parameters:

<Depth> float
 Range: -0.8 to 0.8
 Increment: 1E-4
 *RST: 0

Manual operation: See "DDM Depth" on page 57

[:SOURce<hw>] [:BB] : ILS [:GS | GSLope] : FREQuency <CarrierFreq>

Sets the carrier frequency if [:SOURce<hw>] [:BB] : ILS [:GS | GSLope] : FREQuency:MODE is set to *USER*.

Parameters:

<CarrierFreq> float
 Range: 100E3 to 6E9
 Increment: 0.01
 *RST: 334.7E6

Manual operation: See "[Carrier Frequency](#)" on page 55

[:SOURce<hw>] [:BB] : ILS [:GS | GSLope] : FREQuency:MODE <Mode>

Sets the carrier frequency mode for the ILS-GS modulation signal.

Parameters:

<Mode> USER | ICAO
 *RST: USER

Manual operation: See "[Carrier Frequency Mode](#)" on page 54

[:SOURce<hw>] [:BB] : ILS [:GS | GSLope] : ICAO:CHANnel <Channel>

Selects the ICAO channel i.e., the ILS-GS transmitting frequency. The RF frequency is set to the value selected here. The ICAO channel settings for ILS-GS and ILS-LOC are coupled.

Parameters:

<Channel> CH18X | CH18Y | CH20X | CH20Y | CH22X | CH22Y | CH24X |
 CH24Y | CH26X | CH26Y | CH28X | CH28Y | CH30X | CH30Y |
 CH32X | CH32Y | CH34X | CH34Y | CH36X | CH36Y | CH38X |
 CH38Y | CH40X | CH40Y | CH42X | CH42Y | CH44X | CH44Y |
 CH46X | CH46Y | CH48X | CH48Y | CH50X | CH50Y | CH52X |
 CH52Y | CH54X | CH54Y | CH56X | CH56Y
 *RST: CH18X

Manual operation: See "[ICAO Channel](#)" on page 55

[:SOURce<hw>] [:BB] : ILS [:GS | GSLope] : LLOBe [:FREQuency] <Frequency>

Sets the modulation frequency of the antenna lobe arranged at the bottom viewed from the air plane for the ILS-GS modulation signal.

Parameters:

<Frequency> float
 Range: 100 to 200
 Increment: 0.05
 *RST: 150

Manual operation: See ["Down Frequency"](#) on page 56

[[:SOURce<hw>]:[:BB]:ILS[:GS|GSLope]:MODE <Mode>

Sets the operating mode for the ILS-GS modulation signal.

Parameters:

<Mode> NORM | ULOBe | LLOBe

NORM

ILS-GS modulation is active.

ULOBe

Amplitude modulation of the output signal with the upper lobe (90Hz) signal component of the ILS-GS signal is active.

LLOBe

Amplitude modulation of the output signal with the lower lobe (150Hz) signal component of the ILS-GS signal is active.

*RST: NORM

Manual operation: See ["Mode"](#) on page 55

[[:SOURce<hw>]:[:BB]:ILS[:GS|GSLope]:PHASe <Phase>

Sets the phase between the modulation signals of the upper and lower antenna lobe of the ILS-GS signal. The zero crossing of the lower lobe (150Hz) signal serves as a reference. The angle refers to the period of the signal of the right antenna lobe.

Parameters:

<Phase> float

Range: -60 to 120

Increment: 0.01

*RST: 0.0

Manual operation: See ["Up/Down Phase"](#) on page 56

[[:SOURce<hw>]:[:BB]:ILS[:GS|GSLope]:SDM <Sdm>

Sets the arithmetic sum of the modulation depths of the upper lobe (90Hz) and lower lobe (150Hz) for the ILS-GS signal contents. The RMS modulation depth of the sum signal depends on the phase setting of both modulation tones.

Parameters:

<Sdm> float

Range: 0 to 100

Increment: 0.1

*RST: 80

Manual operation: See ["Sum of Depth \(SDM\)"](#) on page 56

[:SOURce<hw>] [:BB] :ILS [:GS | GSLope] :ULOBe [:FREQUENCY] <Frequency>

Sets the modulation frequency of the antenna lobe arranged at the top viewed from the air plane (up frequency).

Parameters:

<Frequency>	float
	Range: 60 to 120
	Increment: 0.03
	*RST: 90

Manual operation: See "Up Frequency" on page 56

10.3.3 ILS Localizer Settings

[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:CODE.....	158
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:DASH.....	159
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:DEPTH.....	159
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:DOT.....	159
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:FREQUENCY.....	159
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:LETTer.....	160
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:PERiod.....	160
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:SYMBol.....	160
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:TSCHEMA.....	161
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:STATE.....	161
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:DDM:COUPling.....	161
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:DDM:CURRent.....	161
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:DDM:DIRection.....	162
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:DDM:LOGarithmic.....	162
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:DDM:PCT.....	162
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:DDM:POLarity.....	163
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:DDM:DEPTH.....	163
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:DDM:STEP.....	163
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:FREQUENCY.....	163
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:FREQUENCY:MODE.....	164
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:ICAO:CHANnel.....	164
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:LLOBe [:FREQUENCY].....	164
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:MODE.....	165
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:PHASe.....	165
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:RLOBe [:FREQUENCY].....	165
[:SOURce<hw>] [:BB] :ILS:LOCAlizer:SDM.....	165

[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:CODE <Code>

Sets the coding of the COM/ID signal by the international short name of the airport (e.g. MUC for the Munich airport).

Available only if [:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:TSCHEMA is set to *USER*.

Parameters:

<Code> string

Manual operation: See "[Code](#)" on page 63

[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:DASH <Dash>

Sets the length of a morse dash in seconds.

Available only if `[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:TSCHEMA` is set to *USER*.

Parameters:

<Dash> float
 Range: 0.05 to 1
 Increment: 1E-4
 *RST: 0.3

Manual operation: See "[Dash Length](#)" on page 64

[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:DEPTH <Depth>

Sets the AM modulation depth of the COM/ID signal.

Parameters:

<Depth> float
 Range: 0 to 100
 Increment: 0.1
 *RST: 10

Manual operation: See "[Depth](#)" on page 63

[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:DOT <Dot>

Sets the length of a morse dot in seconds. If the time schema is set to *STD* the length of the dash (3xdot), symbol space (=dot) and letter space (=3xdot) is also determined by this entry.

Parameters:

<Dot> float
 Range: 0.05 to 1
 Increment: 1E-4
 *RST: 0.1

Manual operation: See "[Dot Length](#)" on page 64

[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:FREQUency <Frequency>

Sets the frequency of the COM/ID signal.

Parameters:

<Frequency> float
 Range: 0.1 to 20E3
 Increment: 0.01
 *RST: 1020

Manual operation: See "[Frequency](#)" on page 63

[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:LETTer <Letter>

Sets the length of a letter space in seconds.

Available only if `[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:TSCHEMA` is set to *USER*.

Parameters:

<Letter> float
 Range: 0.05 to 1
 Increment: 1E-4
 *RST: 0.3

Manual operation: See "[Letter Space](#)" on page 64

[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:PERiod <Period>

Sets the period of the COM/ID signal in seconds.

Parameters:

<Period> float
 Range: 0 to 120
 Increment: 1E-3
 *RST: 9

Manual operation: See "[Period](#)" on page 63

[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:SYMBol <Symbol>

Sets the length of the symbol space in seconds.

Available only if `[:SOURce<hw>] [:BB] :ILS:LOCAlizer:COMid:TSCHEMA` is set to *USER*.

Parameters:

<Symbol> float
 Range: 0.05 to 1
 Increment: 1E-4
 *RST: 0.1

Manual operation: See "[Symbol Space](#)" on page 64

[:SOURce<hw>] [:BB] : ILS : LOCalizer : COMid : TSCHEMA <TSchema>

Sets the time schema for the COM/ID signal.

In the standard time schema (STD) the set dot length determines the dash length (= three times the dot length) whereas in the user time schema (USER) all length parameters can be set independently.

Parameters:

<TSchema> STD | USER
 *RST: STD

Manual operation: See ["Time Schema"](#) on page 64

[:SOURce<hw>] [:BB] : ILS : LOCalizer : COMid [:STATE] <State>

Switches on/ off the additional COM/ID signal.

Parameters:

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

Manual operation: See ["State"](#) on page 63

[:SOURce<hw>] [:BB] : ILS : LOCalizer : DDM : COUPling <Coupling>

Selects if the DDM value is fixed or is changed with a change of sum of modulation depths (SDM, see [\[:SOURce<hw> \] \[:BB \] : ILS : LOCalizer : SDM](#) on page 165).

Parameters:

<Coupling> FIXed | SDM
 *RST: FIXed

Manual operation: See ["DDM - SDM Coupling"](#) on page 62

[:SOURce<hw>] [:BB] : ILS : LOCalizer : DDM : CURRent <Current>

Sets the DDM value alternatively as a current by means of the ILS indicating instrument. The instrument current is calculated according to:

$$\text{DDM } \mu\text{A} = \text{DDM} \times 857,1 \mu\text{A}$$

A variation of the instrument current automatically leads to a variation of the DDM value and the DDM value in dB.

Parameters:

<Current> float
 Range: -9.6775E-4 to 9.6775E-4
 Increment: 1E-7
 *RST: 0

Manual operation: See ["DDM Current"](#) on page 61

[:SOURce<hw>] [:BB] :ILS:LOCAlizer:DDM:DIRectioN <Direction>

Sets the simulation mode for the ILS-LOC modulation signal. A change of the setting automatically changes the sign of the DDM value.

Parameters:

<Direction> LEFT | RIGHT

LEFT

The 150-Hz modulation signal is predominant, the DDM value is negative (the airplane is too far to the right, it must turn to the left).

RIGHT

The 90-Hz modulation signal is predominant, the DDM value is positive (the airplane is too far to the left, it must turn to the right).

*RST: LEFT

Manual operation: See "Fly" on page 61

[:SOURce<hw>] [:BB] :ILS:LOCAlizer:DDM:LOGArithmic <Logarithmic>

Sets the depth of modulation value for the ILS-LOC in dB.

See also [\[:SOURce<hw> \] \[:BB \] :ILS:LOCAlizer:DDM\[:DEPTh\]](#) on page 163.

Parameters:

<Logarithmic> float
 Range: -999.9 to 999.9
 Increment: 1E-4
 *RST: 0

Manual operation: See "DDM Logarithmic" on page 62

[:SOURce<hw>] [:BB] :ILS:LOCAlizer:DDM:PCT <Pct>

Sets the difference in depth of modulation between the signal of the left lobe (90 Hz) and the right lobe (150 Hz). The maximum value equals the sum of the modulation depths of the 90 Hz and the 150 Hz tone.

See also [\[:SOURce<hw> \] \[:BB \] :ILS:LOCAlizer:DDM\[:DEPTh\]](#) on page 163.

Parameters:

<Pct> float
 Range: -80.0 to 80.0
 Increment: 0.01
 *RST: 0

Manual operation: See "DDM Percent" on page 62

[:SOURce<hw>] [:BB] : ILS : LOCALizer : DDM : POLarity <Polarity>

Sets the polarity for DDM calculation (see [\[:SOURce<hw> \] \[:BB \] : ILS : LOCALizer : DDM \[:DEPT h \]](#) on page 163).

The DDM depth calculation depends on the selected polarity:

- Polarity 90 Hz - 150 Hz (default setting):
DDM = [AM(90 Hz) - AM (150 Hz)] / 100%
- Polarity 150 Hz - 90 Hz:
DDM = [AM(150 Hz) - AM (90 Hz)] / 100%

Parameters:

<Polarity> P90_150 | P150_90
*RST: P90_150

Manual operation: See ["DDM polarity"](#) on page 59

[:SOURce<hw>] [:BB] : ILS : LOCALizer : DDM [:DEPT h] <Depth>

Sets the difference in depth of modulation between the signal of the upper/left lobe (90 Hz) and the lower/right lobe (150 Hz). The maximum value equals the sum of the modulation depths of the 90 Hz and the 150 Hz tone. The following is true:

$$ILS : LOC : DDM : DEPT h = (AM(90Hz) - AM(150Hz)) / 100\%$$

A variation of the DDM value automatically leads to a variation of the DDM value in dB and the value of the instrument current.

Parameters:

<Depth> float
Range: -0.4 to 0.4
Increment: 1E-4
*RST: 0

Manual operation: See ["DDM Depth"](#) on page 62

[:SOURce<hw>] [:BB] : ILS : LOCALizer : DDM : STEP <DdmStep>

Sets the variation step of the DDM values.

Parameters:

<DdmStep> DECimal | PREDefined
*RST: DECimal

Manual operation: See ["DDM Step"](#) on page 61

[:SOURce<hw>] [:BB] : ILS : LOCALizer : FREQuency <CarrierFreq>

Sets the carrier frequency if [\[:SOURce<hw> \] \[:BB \] : ILS : LOCALizer : FREQuency : MODE](#) is set to *USER*.

Parameters:

<CarrierFreq> float
 Range: 100E3 to 6E9
 Increment: 0.01
 *RST: 108.1E6

Manual operation: See "[Carrier Frequency](#)" on page 59

[[:SOURce<hw>][:BB]:ILS:LOCalizer:FREQuency:MODE <Mode>

Sets the carrier frequency mode for the ILS-LOC modulation signal.

Parameters:

<Mode> USER | ICAO
 *RST: USER

Manual operation: See "[Carrier Frequency Mode](#)" on page 54

[[:SOURce<hw>][:BB]:ILS:LOCalizer:ICAO:CHANnel <Channel>

Selects the ICAO channel i.e., the ILS-LOC transmitting frequency. The RF frequency is set to the value selected here. The ICAO channel settings for ILS-GS and ILS-LOC are coupled.

Parameters:

<Channel> CH18X | CH18Y | CH20X | CH20Y | CH22X | CH22Y | CH24X |
 CH24Y | CH26X | CH26Y | CH28X | CH28Y | CH30X | CH30Y |
 CH32X | CH32Y | CH34X | CH34Y | CH36X | CH36Y | CH38X |
 CH38Y | CH40X | CH40Y | CH42X | CH42Y | CH44X | CH44Y |
 CH46X | CH46Y | CH48X | CH48Y | CH50X | CH50Y | CH52X |
 CH52Y | CH54X | CH54Y | CH56X | CH56Y
 *RST: CH18X

Manual operation: See "[ICAO Channel](#)" on page 55

[[:SOURce<hw>][:BB]:ILS:LOCalizer:LLOBe[:FREQuency] <Frequency>

Sets the modulation frequency of the antenna lobe arranged at the bottom viewed from the air plane for the ILS-LOC modulation signal.

Parameters:

<Frequency> float
 Range: 60 to 120
 Increment: 0.03
 *RST: 90

Manual operation: See "[Left Frequency](#)" on page 60

[[:SOURce<hw>]:[:BB]:ILS:LOCalizer:MODE <Mode>

Sets the operating mode for the ILS-LOC modulation signal.

Parameters:

<Mode> NORM | LLOBe | RLOBe

NORM

ILS-LOC modulation is active.

LLOBe

Amplitude modulation of the output signal with the left lobe (90Hz) signal component of the ILS-LOC signal is active.

RLOBe

Amplitude modulation of the output signal with the right lobe (150Hz) signal component of the ILS-LOC signal is active.

*RST: NORM

Manual operation: See "[Mode](#)" on page 59

[[:SOURce<hw>]:[:BB]:ILS:LOCalizer:PHASe <Phase>

Sets the phase between the modulation signals of the left and right antenna lobe of the ILS-GS signal. The zero crossing of the right lobe (150Hz) signal serves as a reference. The angle refers to the period of the signal of the right antenna lobe.

Parameters:

<Phase> float
 Range: -60 to 120
 Increment: 0.01
 *RST: 0

Manual operation: See "[Left/Right Phase](#)" on page 60

[[:SOURce<hw>]:[:BB]:ILS:LOCalizer:RLOBe[:FREQuency] <Frequency>

Sets the modulation frequency of the antenna lobe arranged at the right viewed from the air plane.

Parameters:

<Frequency> float
 Range: 100 to 200
 Increment: 0.05
 *RST: 150

Manual operation: See "[Right Frequency](#)" on page 60

[[:SOURce<hw>]:[:BB]:ILS:LOCalizer:SDM <Sdm>

Sets the arithmetic sum of the modulation depths of the left lobe (90Hz) and right lobe (150Hz) for the ILS-LOC signal contents. The RMS modulation depth of the sum signal depends on the phase setting of both modulation tones.

Parameters:

<Sdm>	float
	Range: 0 to 100
	Increment: 0.1
	*RST: 40

Manual operation: See "Sum of Depth" on page 61

10.3.4 ILS Marker Beacon Settings

[:SOURce<hw>][:BB:ILS]:MBEacon:COMid:CODE	166
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[:SOURce<hw>][:BB:ILS]:MBEacon[:MARKer]:DEPTH	169

[\[:SOURce<hw>\]\[:BB:ILS\]:MBEacon:COMid:CODE](#) <Code>

Sets the coding of the COM/ID signal by the international short name of the airport (e.g. MUC for the Munich airport).

Parameters:

<Code>	string
--------	--------

Manual operation: See "Code" on page 66

[\[:SOURce<hw>\]\[:BB:ILS\]:MBEacon:COMid:DASH](#) <Dash>

Sets the length of a morse dash in seconds.

Available only if [\[:SOURce<hw>\]\[:BB:ILS\]:MBEacon:COMid:TSCHEMA](#) is set to *USER*.

Parameters:

<Dash>	float
	Range: 0.05 to 1
	Increment: 1E-4
	*RST: 0.3

[:SOURce<hw>] [:BB:ILS] :MBEacon:COMid:DEPTH <Depth>

Sets the AM modulation depth of the COM/ID signal.

Parameters:

<Depth> float
 Range: 0 to 100
 Increment: 0.1
 *RST: 5

Manual operation: See "[Depth](#)" on page 66

[:SOURce<hw>] [:BB:ILS] :MBEacon:COMid:DOT <Dot>

Sets the length of a morse dot in seconds. If the time schema is set to *STD* the length of the dash (3xdot), symbol space (=dot) and letter space (=3xdot) is also determined by this entry.

Parameters:

<Dot> float
 Range: 0.05 to 1
 Increment: 1E-4
 *RST: 0.1

Manual operation: See "[Dot Length](#)" on page 67

[:SOURce<hw>] [:BB:ILS] :MBEacon:COMid:FREQuency <Frequency>

Sets the frequency of the COM/ID signal.

Parameters:

<Frequency> float
 Range: 0.1 to 20E3
 Increment: 0.01
 *RST: 1020

Manual operation: See "[Frequency](#)" on page 66

[:SOURce<hw>] [:BB:ILS] :MBEacon:COMid:LETTer <Letter>

Sets the length of a letter space in seconds.

Available only if `[:SOURce<hw>] [:BB:ILS] :MBEacon:COMid:TSCHEMA` is set to *USER*.

Parameters:

<Letter> float
 Range: 0.05 to 1
 Increment: 1E-4
 *RST: 0.3

Manual operation: See "[Letter Space](#)" on page 67

[:SOURce<hw>] [:BB:ILS] :MBEacon:COMid:PERiod <Period>

Sets the period of the COM/ID signal in seconds.

Parameters:

<Period>	float
	Range: 0 to 120
	Increment: 1E-3
	*RST: 9

Manual operation: See "[Period](#)" on page 66

[:SOURce<hw>] [:BB:ILS] :MBEacon:COMid:SYMBOL <Symbol>

Sets the length of the symbol space in seconds.

Available only if `[:SOURce<hw>] [:BB:ILS] :MBEacon:COMid:TSCHEMA` is set to *USER*.

Parameters:

<Symbol>	float
	Range: 0.05 to 1
	Increment: 1E-4
	*RST: 0.1

Manual operation: See "[Symbol Space](#)" on page 67

[:SOURce<hw>] [:BB:ILS] :MBEacon:COMid:TSCHEMA <Tschema>

Sets the time schema for the COM/ID signal.

In the standard time schema (STD) the set dot length determines the dash length (= three times the dot length) whereas in the user time schema (USER) all length parameters can be set independently.

Parameters:

<Tschema>	STD USER
	*RST: STD

Manual operation: See "[Time Schema](#)" on page 66

[:SOURce<hw>] [:BB:ILS] :MBEacon:COMid[:STATe] <State>

Switches on/ off the additional COM/ID signal.

Parameters:

<State>	0 1 OFF ON
	*RST: 0

Manual operation: See "[State](#)" on page 66

[:SOURce<hw>] [:BB:ILS] :MBEacon:FREQUency <CarrierFreq>

Sets the carrier frequency for the ILS-MB modulation signal.

Parameters:

<CarrierFreq> float
 Range: 100E3 to 6E9
 Increment: 0.01
 *RST: 75E6

Manual operation: See "[Carrier Frequency](#)" on page 65

[:SOURce<hw>] [:BB:ILS] :MBEacon:FREQUency:MODE <Mode>

Sets the carrier frequency mode of the ILS-MB modulation signal.

Parameters:

<Mode> USER | PREDefined
 *RST: USER

Manual operation: See "[Carrier Frequency Mode](#)" on page 65

[:SOURce<hw>] [:BB:ILS] :MBEacon:MARKer:FREQUency <Frequency>

Sets the modulation frequency of the marker signal for the ILS-MB modulation signal.

Parameters:

<Frequency> integer
 Range: 400 to 3000
 *RST: 0

Manual operation: See "[Marker Frequency](#)" on page 65

[:SOURce<hw>] [:BB:ILS] :MBEacon[:MARKer]:DEPTH <Depth>

Sets the modulation depth of the marker signal for the ILS-MB signal.

Parameters:

<Depth> float
 Range: 0 to 100
 Increment: 0.1
 *RST: 95

Manual operation: See "[Marker Depth](#)" on page 65

10.4 VOR Settings

The BB:VOR subsystem contains all commands for configuring a VOR signal.

See also [Chapter 10.6, "Trigger Settings"](#), on page 194 and [Chapter 10.9, "Clock Settings"](#), on page 204 for a description of the trigger and clock settings.

10.4.1 VOR General Settings

[\[:SOURce<hw>\]\[:BB\]:VOR:MODE.....](#) 170

[\[:SOURce<hw>\]\[:BB\]:VOR:MODE <Mode>](#)

Sets the operating mode for the VOR modulation signal.

Parameters:

<Mode> NORM | VAR | SUBCarrier | FMSubcarrier

NORM

VOR modulation is active.

VAR

Amplitude modulation of the output signal with the variable signal component (30Hz signal content) of the VOR signal.

The modulation depth of the 30 Hz signal can be set with [\[:SOURce<hw>\]\[:BB\]:VOR:VAR\[:DEPTH\]](#).

SUBCarrier

Amplitude modulation of the output signal with the unmodulated FM carrier (9960Hz) of the VOR signal.

The modulation depth of the 30 Hz signal can be set with [\[:SOURce<hw>\]\[:BB\]:VOR:SUBCarrier:DEPTH](#).

FMSubcarrier

Amplitude modulation of the output signal with the frequency modulated FM carrier (9960Hz) of the VOR signal.

The modulation depth of the 30 Hz signal can be set with [\[:SOURce<hw>\]\[:BB\]:VOR:SUBCarrier:DEPTH](#).

The frequency deviation can be set with [\[:SOURce<hw>\]\[:BB\]:VOR:REFERENCE\[:DEVIATION\]](#).

*RST: NORM

Manual operation: See ["Mode"](#) on page 71

10.4.2 VOR System Configuration Settings

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[:SOURce<hw>][:BB]:VOR:FREQuency <CarrierFreq>

Sets the carrier frequency of the signal if [:SOURce<hw>] :BB :VOR :FREQuency :
 MODE is set to *USER*.

Parameters:

<CarrierFreq> float
 Range: 100E3 to 6E9
 Increment: 0.01
 *RST: 108E6

Manual operation: See "[Carrier Frequency](#)" on page 70

[:SOURce<hw>][:BB]:VOR:FREQuency:MODE <Mode>

Sets the frequency mode for the VOR modulation signal.

Parameters:

<Mode> USER | ICAO
 *RST: USER

Manual operation: See "[Carrier Frequency Mode](#)" on page 70

[:SOURce<hw>][:BB]:VOR:ICAO:CHANnel <Channel>

Sets the ICAO channel i.e., the VOR transmitting frequency if [:SOURce<hw>] :BB :
 VOR :FREQuency :MODE is set to *ICAO*. The RF frequency is set to the value selected
 here.

Parameters:

<Channel> CH17X | CH17Y | CH19X | CH19Y | CH21X | CH21Y | CH23X | CH23Y | CH25X | CH25Y | CH27X | CH27Y | CH29X | CH29Y | CH31X | CH31Y | CH33X | CH33Y | CH35X | CH35Y | CH37X | CH37Y | CH39X | CH39Y | CH41X | CH41Y | CH43X | CH43Y | CH45X | CH45Y | CH47X | CH47Y | CH49X | CH49Y | CH51X | CH51Y | CH53X | CH53Y | CH55X | CH55Y | CH57X | CH57Y | CH58X | CH58Y | CH59X | CH59Y | CH70X | CH70Y | CH71X | CH71Y | CH72X | CH72Y | CH73X | CH73Y | CH74X | CH74Y | CH75X | CH75Y | CH76X | CH76Y | CH77X | CH77Y | CH78X | CH78Y | CH79X | CH79Y | CH80X | CH80Y | CH81X | CH81Y | CH82X | CH82Y | CH83X | CH83Y | CH84X | CH84Y | CH85X | CH85Y | CH86X | CH86Y | CH87X | CH87Y | CH88X | CH88Y | CH89X | CH89Y | CH90X | CH90Y | CH91X | CH91Y | CH92X | CH92Y | CH93X | CH93Y | CH94X | CH94Y | CH95X | CH95Y | CH96X | CH96Y | CH97X | CH97Y | CH98X | CH98Y | CH99X | CH99Y | CH100X | CH100Y | CH101X | CH101Y | CH102X | CH102Y | CH103X | CH103Y | CH104X | CH104Y | CH105X | CH105Y | CH106X | CH106Y | CH107X | CH107Y | CH108X | CH108Y | CH109X | CH109Y | CH110X | CH110Y | CH111X | CH111Y | CH112X | CH112Y | CH113X | CH113Y | CH114X | CH114Y | CH115X | CH115Y | CH116X | CH116Y | CH117X | CH117Y | CH118X | CH118Y | CH119X | CH119Y | CH120X | CH120Y | CH121X | CH121Y | CH122X | CH122Y | CH123X | CH123Y | CH124X | CH124Y | CH125X | CH125Y | CH126X | CH126Y

*RST: CH17X

Manual operation: See "[ICAO Channel](#)" on page 70

[[:SOURce<hw>]:[:BB]:VOR:REFErence[:DEVIation] <Deviation>

Sets the frequency deviation of the reference signal on the FM carrier.

Parameters:

<Deviation> integer
 Range: 0 to 960
 *RST: 480
 Default unit: Hz

[[:SOURce<hw>]:[:BB]:VOR:SUBCarrier:DEPTTh <Depth>

Sets the AM modulation depth of the FM carrier.

Parameters:

<Depth> float
 Range: 0 to 100
 Increment: 0.1
 *RST: 30

Manual operation: See ["Subcarrier Depth"](#) on page 71

[:SOURce<hw>] [:BB] :VOR :SUBCarrier [:FREQuency] <Frequency>

Sets the frequency of the FM carrier.

Parameters:

<Frequency>	float
Range:	5E3 to 15E3
Increment:	0.01
*RST:	9.96E3

Manual operation: See ["Subcarrier Frequency"](#) on page 71

[:SOURce<hw>] [:BB] :VOR :VAR :FREQuency <Frequency>

Sets the frequency of the variable and the reference signal. As the two signals must have the same frequency, the setting is valid for both signals.

Parameters:

<Frequency>	float
Range:	10 to 60
Increment:	0.01
*RST:	30

Manual operation: See ["VAR/REF Frequency"](#) on page 71

[:SOURce<hw>] [:BB] :VOR :VAR :DEPT h] <Depth>

Sets the AM modulation depth of the 30Hz variable signal.

Parameters:

<Depth>	float
Range:	0 to 100
Increment:	0.1
*RST:	30

Manual operation: See ["VAR Depth"](#) on page 71

[:SOURce<hw>] [:BB] :VOR [:BANGL e] <BAngle>

Sets the bearing angle between the VAR signal and the reference signal. The orientation of the angle can be set with [\[:SOURce<hw> \] \[:BB \] :VOR \[:BANGL e \] : DIRection](#).

Parameters:

<BAngle>	float
Range:	0 to 360
Increment:	0.01
*RST:	0

Manual operation: See "Bearing Angle" on page 72

[:SOURce<hw>] [:BB] :VOR [:BANGle] :DIRectioN <Direction>

Sets the reference position of the phase information.

Parameters:

<Direction>

FROM | TO

FROM

The bearing angle is measured between the geographic north and the connection line from beacon to airplane.

TO

The bearing angle is measured between the geographic north and the connection line from airplane to beacon.

*RST: FROM

Manual operation: See "Direction" on page 72

10.4.3 VOR COM/ID Settings

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[:SOURce<hw>] [:BB] :VOR :COMid :STATe].	176

[:SOURce<hw>] [:BB] :VOR :COMid :CODE <Code>

Sets the coding of the COM/ID signal by the international short name of the airport (e.g. MUC for the Munich airport).

Parameters:

<Code>

string

Manual operation: See "Code" on page 73

[:SOURce<hw>] [:BB] :VOR :COMid :DASH <Dash>

Sets the length of a morse dash in seconds.

Available only if [:SOURce<hw>] [:BB] :VOR :COMid :TSCHEMA is set to *USER*.

Parameters:

<Dash> float
 Range: 0.05 to 1
 Increment: 1E-4
 *RST: 0.3

[:SOURce<hw>] [:BB] :VOR:COMid:DEPT h <Depth>

Sets the AM modulation depth of the COM/ID signal.

Parameters:

<Depth> float
 Range: 0 to 100
 Increment: 0.1
 *RST: 10

Manual operation: See "[Depth](#)" on page 73

[:SOURce<hw>] [:BB] :VOR:COMid:DOT <Dot>

Sets the length of a morse dot in seconds. If the time schema is set to *STD* the length of the dash (3xdot), symbol space (=dot) and letter space (=3xdot) is also determined by this entry.

Parameters:

<Dot> float
 Range: 0.05 to 1
 Increment: 1E-4
 *RST: 0.1

Manual operation: See "[Dot Length](#)" on page 73

[:SOURce<hw>] [:BB] :VOR:COMid:FREQuency <Frequency>

Sets the frequency of the COM/ID signal.

Parameters:

<Frequency> float
 Range: 0.1 to 20E3
 Increment: 0.01
 *RST: 1020

Manual operation: See "[Frequency](#)" on page 73

[:SOURce<hw>] [:BB] :VOR:COMid:LETTer <Letter>

Sets the length of a letter space in seconds.

Available only if [:SOURce<hw>] [:BB] :VOR:COMid:TSCHema is set to *USER*.

Parameters:

<Letter> float
 Range: 0.05 to 1
 Increment: 1E-4
 *RST: 0.3

Manual operation: See "[Letter Space](#)" on page 74

[:SOURce<hw>] [:BB] :VOR:COMid:PERiod <Period>

Sets the period of the COM/ID signal in seconds.

Parameters:

<Period> float
 Range: 0 to 120
 Increment: 1E-3
 *RST: 9

Manual operation: See "[Period](#)" on page 73

[:SOURce<hw>] [:BB] :VOR:COMid:SYMBol <Symbol>

Sets the length of the symbol space in seconds.

Available only if [:SOURce<hw>] [:BB] :VOR:COMid:TSCHEMA is set to *USER*.

Parameters:

<Symbol> float
 Range: 0.05 to 1
 Increment: 1E-4
 *RST: 0.1

Manual operation: See "[Symbol Space](#)" on page 74

[:SOURce<hw>] [:BB] :VOR:COMid:TSCHEMA <Tschem>

Sets the time schema for the COM/ID signal.

In the standard time schema (STD) the set dot length determines the dash length (= three times the dot length) whereas in the user time schema (USER) all length parameters can be set independently.

Parameters:

<Tschem> STD | USER
 *RST: STD

Manual operation: See "[Time Schema](#)" on page 73

[:SOURce<hw>] [:BB] :VOR:COMid:STATe <State>

Switches on/ off the additional COM/ID signal.

Parameters:

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

Manual operation: See "State" on page 72

10.5 DME Settings

The `BB:DME` subsystem contains all commands for configuring a DME signal.

See also [Chapter 10.6, "Trigger Settings"](#), on page 194 and [Chapter 10.9, "Clock Settings"](#), on page 204 for a description of the trigger and clock settings.

10.5.1 DME General Settings

`[:SOURce<hw>] [:BB] :DME:MODE`..... 177

`[:SOURce<hw>] [:BB] :DME:MODE <Mode>`

Selects the mode of the DME modulation. The mode determines the signal type that is simulated. The exact timing of the signal for each mode is determined by the channel selected with `[:SOURce<hw>] [:BB] :DME:CSUffix`.

Parameters:

<Mode> INTerrogation | REPLY

INTerrogation

The interrogation signal of the airborne transmitter is simulated.

REPLY

The reply signal of the ground based transponder is simulated. The trigger is automatically set to external and the default trigger delay either to 50 us (channel X) or 56 us (channel Y) depending on the selected channel (`[:SOURce<hw>] [:BB] :DME:CSUffix`). The interval between the pulse pairs can be set to a fixed value (repetition rate, `[:SOURce<hw>] [:BB] :DME:RATE`) or to random generation (pulse squitter, `[:SOURce<hw>] [:BB] :DME:SQUitter`). The trigger signal is input via the [PULSE EXT] connector.

*RST: INTerrogation

Manual operation: See "DME Mode" on page 76

10.5.2 DME System Configuration Settings

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`[[:SOURce<hw>]:[:BB]:DME:CSUFFix <CSuffix>`

Sets the channel that is simulated. Standard compliant X and Y channels differ in the spacing between the two pulses of the pulse pair and the delay of the ground station.

Parameters:

`<CSuffix>` X | Y | ICAO
 *RST: X

Manual operation: See "[Channel Mode](#)" on page 77

`[[:SOURce<hw>]:[:BB]:DME:EFFiciency <Efficiency>`

Sets the relation between reply pulse pairs and received trigger signals, e.g. with a set efficiency of 50% only every second trigger event leads to the generation of a reply pulse pair.

Parameters:

`<Efficiency>` integer
 Range: 0 to 100
 *RST: 100

`[[:SOURce<hw>]:[:BB]:DME:FALL <Fall>`

Sets the fall time of the pulse (90% to 10% of peak voltage).

Parameters:

`<Fall>` float
 Range: 0.5E-6 to 20E-6
 Increment: 10E-9
 *RST: 2E-6

Manual operation: See "[Pulse Fall](#)" on page 80

[[:SOURce<hw>]:[:BB]:DME:FREQuency <CarreierFreq>

Sets the carrier frequency of the signal.

Parameters:

<CarreierFreq>	float
Range:	100E3 to 6E9
Increment:	0.01
*RST:	1025E6

Manual operation: See "[Carrier Frequency](#)" on page 78

[[:SOURce<hw>]:[:BB]:DME:ICAO:CHANnel <Channel>

Sets the ICAO channel i.e., the DME transmitting frequency. The RF frequency is set to the value selected here.

Parameters:

<Channel> CH1X | CH1Y | CH2X | CH2Y | CH3X | CH3Y | CH4X | CH4Y | CH5X | CH5Y | CH6X | CH6Y | CH7X | CH7Y | CH8X | CH8Y | CH9X | CH9Y | CH10X | CH10Y | CH11X | CH11Y | CH12X | CH12Y | CH13X | CH13Y | CH14X | CH14Y | CH15X | CH15Y | CH16X | CH16Y | CH17X | CH17Y | CH18X | CH18Y | CH19X | CH19Y | CH20X | CH20Y | CH21X | CH21Y | CH22X | CH22Y | CH23X | CH23Y | CH24X | CH24Y | CH25X | CH25Y | CH26X | CH26Y | CH27X | CH27Y | CH28X | CH28Y | CH29X | CH29Y | CH30X | CH30Y | CH31X | CH31Y | CH32X | CH32Y | CH33X | CH33Y | CH34X | CH34Y | CH35X | CH35Y | CH36X | CH36Y | CH37X | CH37Y | CH38X | CH38Y | CH39X | CH39Y | CH40X | CH40Y | CH41X | CH41Y | CH42X | CH42Y | CH43X | CH43Y | CH44X | CH44Y | CH45X | CH45Y | CH46X | CH46Y | CH47X | CH47Y | CH48X | CH48Y | CH49X | CH49Y | CH50X | CH50Y | CH51X | CH51Y | CH52X | CH52Y | CH53X | CH53Y | CH54X | CH54Y | CH55X | CH55Y | CH56X | CH56Y | CH57X | CH57Y | CH58X | CH58Y | CH59X | CH59Y | CH60X | CH60Y | CH61X | CH61Y | CH62X | CH62Y | CH63X | CH63Y | CH64X | CH64Y | CH65X | CH65Y | CH66X | CH66Y | CH67X | CH67Y | CH68X | CH68Y | CH69X | CH69Y | CH70X | CH70Y | CH71X | CH71Y | CH72X | CH72Y | CH73X | CH73Y | CH74X | CH74Y | CH75X | CH75Y | CH76X | CH76Y | CH77X | CH77Y | CH78X | CH78Y | CH79X | CH79Y | CH80X | CH80Y | CH81X | CH81Y | CH82X | CH82Y | CH83X | CH83Y | CH84X | CH84Y | CH85X | CH85Y | CH86X | CH86Y | CH87X | CH87Y | CH88X | CH88Y | CH89X | CH89Y | CH90X | CH90Y | CH91X | CH91Y | CH92X | CH92Y | CH93X | CH93Y | CH94X | CH94Y | CH95X | CH95Y | CH96X | CH96Y | CH97X | CH97Y | CH98X | CH98Y | CH99X | CH99Y | CH100X | CH100Y | CH101X | CH101Y | CH102X | CH102Y | CH103X | CH103Y | CH104X | CH104Y | CH105X | CH105Y | CH106X | CH106Y | CH107X | CH107Y | CH108X | CH108Y | CH109X | CH109Y | CH110X | CH110Y | CH111X | CH111Y | CH112X | CH112Y | CH113X | CH113Y | CH114X | CH114Y | CH115X | CH115Y | CH116X | CH116Y | CH117X | CH117Y | CH118X | CH118Y | CH119X | CH119Y | CH120X | CH120Y | CH121X | CH121Y | CH122X | CH122Y | CH123X | CH123Y | CH124X | CH124Y | CH125X | CH125Y | CH126X | CH126Y

*RST: CH1X

Manual operation: See "[ICAO Channel](#)" on page 78

[:SOURce<hw>] [:BB] :DME:PPS <Pps>

Sets the spacing between the first and second pulse of a pulse pair (time between half-voltage points on the leading edge of each pulse).

Available only for [:SOURce<hw>] [:BB] :DME:SINGLEOFF

Parameters:

<Pps> float
 Range: 1E-6 to 200E-6
 Increment: 20E-9
 *RST: 12E-6

Manual operation: See "Pulse Spacing" on page 81

[:SOURce<hw>] [:BB] :DME:PPST <SpacTolerance>

Sets the pulse pair spacing tolerance.

You have to enable the pulse pair spacing tolerance with the command [:SOURce<hw>] [:BB] :DME:PPST:ENABled for this value to be considered.

Parameters:

<SpacTolerance> float
 Range: 0 to (200E-6)/2
 Increment: 20E-9
 *RST: 5E-6

Manual operation: See "Pulse Pair Spacing Tolerance" on page 81

[:SOURce<hw>] [:BB] :DME:PPST:ENABled <State>

Enables the pulse pair spacing tolerance.

If this function is not enabled, the response is sent after the first pulse, without checking whether the second pulse is within the pulse pair spacing tolerance time.

You can set the pulse pair spacing tolerance with [:SOURce<hw>] [:BB] :DME:PPST.

Parameters:

<State> 0 | 1 | OFF | ON
 Range: 0

Manual operation: See "Enabled" on page 81

[:SOURce<hw>] [:BB] :DME:RATE <Rate>

If [:SOURce<hw>] [:BB] :DME:MODE is set to *INTerrogation*, sets the pulse repetition rate.

If [:SOURce<hw>] [:BB] :DME:MODE is set to *REPLY*, indicates the mean pulse repetition rate in squitter mode.

Parameters:

<Rate> integer
 Range: 10 to 6000
 *RST: 48

Manual operation: See "Pulse Repetition Rate" on page 78

[:SOURce<hw>] [:BB] :DME:RDISTance <RDistance>

Sets the simulated distance between the interrogator and the transponder for reply mode (:BB :DME :MODE :REPLY).

The distance can be given in nautic miles (NM) or μs with the command [:SOURce<hw>] [:BB] :DME:RDISTance:UNIT.

If the unit is not provided next to the value, the value is considered to be in the current unit (last unit set via GUI or the SCPI). The query always provides the value in the unit set with [:SOURce<hw>] [:BB] :DME:RDISTance:UNIT.

The range distance and the external trigger delay are interdependent according to:

Range distance = (trigger delay – X/Y mode delay)/12.359 $\mu\text{s}/\text{nm}$

(X mode delay = 50 μs , Y mode delay is 56 μs)

Changing one value automatically changes the other value.

Parameters:

<RDistance>	float
Range:	-4.046 (X), -4.531 (Y) to 400
Increment:	0.001
*RST:	0

Example:

SOURce1:BB:DME:RDISTance:UNIT NM

Sets the unit to NM

:SOURce1:BB:DME:RDISTance 1.5NM

Sets the range distance to 1.5 NM

:SOURce1:BB:DME:RDISTance?

Response: 1.5

:SOURce1:BB:DME:RDISTance 20US

Sets the range distance to 20 us

:SOURce1:BB:DME:RDISTance?

Response: 1.618

Manual operation: See "[Range Distance](#)" on page 78

[:SOURce<hw>] [:BB] :DME:RDISTance:UNIT <Unit>

Sets the unit for the range distance that can be defined with the [:SOURce<hw>] [:BB] :DME:RDISTance.

The distance can be given in nautic miles (NM) or μs . 1 nm is 1852.01 meters and corresponds to a run time of 12.359 μs .

Parameters:

<Unit>	US NM
*RST:	NM

Manual operation: See "[Range Distance](#)" on page 78

[[:SOURce<hw>]:[:BB]:DME:RISE <Rise>

Sets the rise time of the pulse (10% to 90% of peak voltage).

Parameters:

<Rise> float
 Range: 0.5E-6 to 20E-6
 Increment: 10E-9
 *RST: 2E-6

Manual operation: See "Pulse Rise" on page 80

[[:SOURce<hw>]:[:BB]:DME:SHAPE <Shape>

Sets the pulse shape.

Parameters:

<Shape> COS2 | LIN | COS | GAUSs
COS2
 The rising edge is cos shaped and the falling edge is cos² shaped.
LIN
 The falling and the rising edge of the pulse are shaped linear.
COS
 The falling and the rising edge of the pulse are cos² shaped.
 *RST: COS2

Manual operation: See "Pulse Shape" on page 80

[[:SOURce<hw>]:[:BB]:DME:SINGLE <Single>

Activates/deactivates generation of a single test pulse.

Parameters:

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

Manual operation: See "Single Pulse" on page 81

[[:SOURce<hw>]:[:BB]:DME:SQUitter <Squitter>

Activates/deactivates the random pulse repetition rate.

The average repetition rate is 2700 pp/s. The pulse spacing is distributed randomly in the range of 60 μ s to about 1500 μ s according to EUROCAE EN-54 6.2.12. The squitter pulses are constantly sent by the ground station in order to ensure proper operation and in order to ease synchronization of the aircraft interrogator to the ground station.

Parameters:

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

Manual operation: See "Pulse Squitter" on page 78

[:SOURce<hw>] [:BB] :DME:PINPut:SOURce <InputSource>

Selects the trigger mode for DME modulation signals.

Parameters:

<InputSource> EXTERNAL | PSENSOR

EXTERNAL

The signals are triggered by an external trigger event. The trigger signal is supplied via the [PULSE EXT] connector.

PSENSOR

The signals are triggered by an external power sensor. This mode is only available if [:SOURce<hw>] [:BB] :DME:MODE on page 177 is set to *INTERrogation*.

*RST: EXTERNAL

Manual operation: See "Input Source" on page 79

[:SOURce<hw>] [:BB] :DME:PINPut:DELay <Delay>

Sets the delay between the external trigger and the first DME output pulse (50% voltage point of first pulse). Available only if [:SOURce<hw>] [:BB] :DME:PINPut:SOURce is set to *EXTERNAL*.

For DME Reply mode this simulates the defined delay of the DME transponder and twice the run time of the signal (from interrogator to transponder and back). The delay is a measure of the range distance, thus, the two values are interdependent according to:

Delay = X/Y mode delay + range distance * 12.359 nm/μs

(X mode delay = 50 μs, Y mode delay is 56 μs)

Changing one value automatically changes the other value.

Parameters:

<Delay> float
 Range: 4E-6 to 5E-3
 Increment: 20E-9
 *RST: 50E-6

Manual operation: See "Reply Delay" on page 79

[:SOURce<hw>] [:BB] :DME:PINPut:TRIGger:LEVel?

Queries the measured trigger threshold.

Return values:

<TriggerLevel> float
 Range: -200 to 200
 Increment: 0.01
 *RST: 0

Usage: Query only

[[:SOURce<hw>][:BB]:DME:PINPut:TRIGger:SEARch?

Determines the trigger level = 50% voltage point of first pulse of the external DME interrogation signal.

This command determines the trigger point after connecting the R&S NRP-Z81 power sensor to the external interrogation signal source. The search function has to be executed with each change of the level of the external DME signal.

Return values:

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

Usage: Query only

Manual operation: See "[Search Trigger Level](#)" on page 80

[[:SOURce<hw>][:BB]:DME:WIDTh <Width>

Sets the pulse width (50% to 50% of peak voltage).

Parameters:

<Width> float
 Range: 1E-6 to 100E-6
 Increment: 20E-9
 *RST: 3.5E-6

Manual operation: See "[Pulse Width](#)" on page 80

10.5.3 DME Analysis Settings

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`[:SOURce<hw>][:BB]:DME:ANALysis:EFFiciency?`

Queries the measured reply efficiency in percent. The measurement is the ratio of the number of measured valid reply pulse pairs to transmitted pulse pairs in a measurement cycle.

Return values:

`<Efficiency>` float
 Range: 0 to 100
 Increment: 0.1
 *RST: 100

Usage: Query only

Manual operation: See ["Reply Efficiency"](#) on page 79

`[:SOURce<hw>][:BB]:DME:ANALysis:EFFiciency:OK?`

Queries if there are valid reply efficiency measurement values available in the set measurement window.

Return values:

`<Ok>` 0 | 1 | OFF | ON
 *RST: 1

Usage: Query only

Manual operation: See ["Reply Efficiency"](#) on page 83

`[:SOURce<hw>][:BB]:DME:ANALysis:GATE:COUNT <Count>`

Sets the number of pulse pairs which are sent from the R&S SMBV (= interrogator) to the ground station in one measurement cycle. Only reply pulses for which the 50% voltage point of the rising edge of the first pulse is within the measurement window are used to evaluate the delay time and reply efficiency.

Parameters:

`<Count>` integer
 Range: 1 to 10000
 Increment: 1
 *RST: 100

[[:SOURce<hw>]:[:BB]:DME:ANALysis:GATE:EDELay <Edelay>

Sets the expected reply delay. The expected reply delay and the gate length determine the measurement window (expected reply delay +/- gate length/2).

Parameters:

<Edelay> float
 Range: 0 to 150E-6
 Increment: 1E-7
 *RST: 50E-6

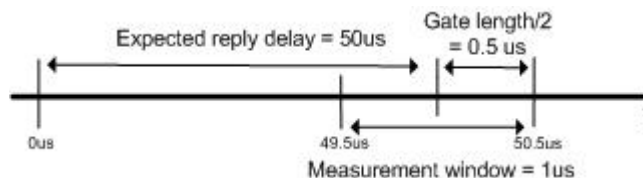
Manual operation: See ["Expected Reply Delay"](#) on page 83

[[:SOURce<hw>]:[:BB]:DME:ANALysis:GATE[:LENGth] <Length>

Sets the gate length for the measurement window.

The measurement gate settings determine the measurement window (expected reply delay +/- gate length/2). Only reply pulses for which the 50% voltage point of the rising edge of the first pulse is within the measurement window are used to evaluate the delay time and reply efficiency. The delay measurement is averaged within the measurement cycle. The reply efficiency is calculated once for each measurement cycle.

The gate length is 1 μ s and the expected reply delay is 50 μ s. The measurement window lies in the range between 49.5 and 50.5 μ s. Only pulse pairs are used for the measurement whose 50% voltage point of the rising edge of the first pulse is within this range.



Parameters:

<Length> integer
 Range: 100E-9 to 326E-6
 Increment: 100E-9
 *RST: 10E-6

Manual operation: See ["Gate Length"](#) on page 83

[[:SOURce<hw>]:[:BB]:DME:ANALysis:GATE:TIME <MeasurementTime>

Sets the DME analysis measurement time.

Parameters:

<MeasurementTime> float
 Range: 0.1 to 20
 Increment: 0.1
 *RST: 1

Manual operation: See ["Measurement Time"](#) on page 83

[[:SOURce<hw>]:[:BB]:DME:ANALysis:NORMAlize?

Performs a normalization of the test setup. The delay due to the test setup is measured and subsequently considered in the reply measurements.

Return values:

<Normalize> 0 | 1 | OFF | ON

Usage: Query only

Manual operation: See ["Normalize Setup"](#) on page 88

[[:SOURce<hw>]:[:BB]:DME:ANALysis:POWER?

Queries the measured average peak level of all valid pulse pairs in a measurement cycle.

Return values:

<Power> float
 Range: -200 to 200
 Increment: 0.01
 *RST: 0

Usage: Query only

Manual operation: See ["Peak Level"](#) on page 83

[[:SOURce<hw>]:BB:DME:ANALysis:POWER:OK?

Queries if there are peak level measurement values available in the set measurement window.

Return values:

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

Usage: Query only

Manual operation: See ["Peak Level"](#) on page 83

[[:SOURce<hw>]:[:BB]:DME:ANALysis:PRRate?

Queries the measured mean pulse repetition rate of the DME ground station. All received pulses of the DME ground station are considered.

Return values:

<Rate> float
 Range: 0 to 10000
 Increment: 0.1
 *RST: 0

Usage: Query only

Manual operation: See ["Pulse Repetition Rate"](#) on page 84

[[:SOURce<hw>]:BB:DME:ANALysis:PRRate:OK?

Queries if there are valid pulse repetition measurement values available in the set measurement window.

Return values:

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

Usage: Query only

Manual operation: See ["Pulse Repetition Rate"](#) on page 84

[[:SOURce<hw>]:[:BB]:DME:ANALysis:RDISTance?

Queries the measured average range distance of all valid pulse pairs in a measurement cycle.

Return values:

<RangeDistance> float

Usage: Query only

Manual operation: See ["Range Distance"](#) on page 83

[[:SOURce<hw>]:[:BB]:DME:ANALysis:STATe <State>

Activates/deactivates the DME analysis. The setting is only available after connecting the R&S NRP-Z81 power sensor.

Parameters:

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

Manual operation: See ["State"](#) on page 82

[[:SOURce<hw>]:[:BB]:DME:ANALysis:TIME?

Queries the measured average reply delay of all valid pulse pairs in a measurement cycle.

Return values:

<Time> float
Range: -1E-3 to 1E-3
Increment: 10E-9
*RST: 0

Usage: Query only

Manual operation: See ["Reply Delay"](#) on page 83

[:SOURce<hw>] :BB:DME:ANALysis:TIME:OK?

Queries if there are valid measurement values available in the set measurement window.

Return values:

<Ok> 0 | 1 | OFF | ON

Usage: Query only

Manual operation: See ["Reply Delay"](#) on page 83

[:SOURce<hw>] :BB:DME:ANALysis:TRIGger:SEARch?

Determines the trigger level = 50% voltage point of first pulse of the external DME interrogation signal.

This command determines the trigger point after connecting the R&S NRP-Z81 power sensor to the external interrogation signal source. The search function has to be executed with each change of the level of the external DME signal.

Return values:

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

Usage: Query only

[:SOURce<hw>] [:BB] :DME:ANALysis:IAFactor?

Queries the internal adjustment factor, the mathematically calculated value of the time, when the pulse reaches its 50% level.

Return values:

<InternalAdjFact> float
Range: 0 to 200
Increment: 10E-9
*RST: 0

Usage: Query only

Manual operation: See ["Internal Adjustment Factor"](#) on page 88

[:SOURce<hw>] [:BB] :DME:ANALysis:PSAFactor?

Queries the power sensor adjustment factor determined during a normalization of the setup. You can normalize the setup with `[:SOURce<hw>] [:BB] :DME:ANALysis: NORMAlize?`.

Return values:

<PowSensAdjFact> float
 Range: 0 to 200
 Increment: 10E-9
 *RST: 0

Usage: Query only

Manual operation: See "[Power Sensor Adjustment Factor](#)" on page 88

[:SOURce<hw>] [:BB] :DME:ANALysis:UAFactor <UsedFactor>

Sets which internal adjustment factor is used.

Parameters:

<UsedFactor> INTERNAL | PSENSor

INTERNAL

The mathematically calculated value of the time, when the pulse reaches its 50% level. Query the internal adjustment factor with [\[:SOURce<hw> \] \[:BB \] :DME:ANALysis:IAFactor?](#)

PSENSor

The adjustment factor measured during a normalization setup. Query the power sensor adjustment factor with [\[:SOURce<hw> \] \[:BB \] :DME:ANALysis:PSAFactor?](#)

*RST: INTERNAL

Manual operation: See "[Used Adjustment Factor](#)" on page 88

10.5.4 DME COM/ID Settings

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[:SOURce<hw>] [:BB] :DME:ID:CODE <Code>

Sets the coding of the COM/ID signal by the international short name of the airport (e.g. MUC for the Munich airport).

Parameters:

<Code> string

Manual operation: See ["Code"](#) on page 85

[:SOURce<hw>] [:BB] :DME:ID:DASH <Dash>

Sets the length of a morse dash in seconds.

Available only if [:SOURce<hw>] [:BB] :DME:ID:TSCHEMA is set to *USER*.

Parameters:

<Dash>	float
	Range: 0.05 to 1
	Increment: 1E-4
	*RST: 0.3

Manual operation: See [" Dash Length"](#) on page 86

[:SOURce<hw>] [:BB] :DME:ID:DOT <Dot>

Sets the length of a morse dot in seconds. If the time schema is set to *STD* the length of the dash (3xdot), symbol space (=dot) and letter space (=3xdot) is also determined by this entry.

Parameters:

<Dot>	float
	Range: 0.05 to 1
	Increment: 1E-4
	*RST: 0.1

Manual operation: See ["Dot Length"](#) on page 86

[:SOURce<hw>] [:BB] :DME:ID:LETTER <Letter>

Sets the length of a letter space in seconds.

Available only if [:SOURce<hw>] [:BB] :DME:ID:TSCHEMA is set to *USER*.

Parameters:

<Letter>	float
	Range: 0.05 to 1
	Increment: 1E-4
	*RST: 0.3

Manual operation: See ["Letter Space"](#) on page 86

[:SOURce<hw>] [:BB] :DME:ID:PPP[:STATE] <PairOfPulsePair>

Sets the state of the pair of pulse pairs for the ID signal generation. When enabled a pair of pulse pairs is transmitted during the set [:SOURce<hw>] [:BB] :DME:ID:RATE.

Parameters:

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

Manual operation: See "Pair of Pulse Pairs" on page 85

[[:SOURce<hw>]:[:BB]:DME:ID:PPS <PulsePairSpacin>

Sets the morse pulse pair spacing.

Parameters:

<PulsePairSpacin> float
 Range: 2E-6 to 300E-6
 Increment: 20E-9
 *RST: 100E-6

Manual operation: See "Pulse Pair Spacing" on page 85

[[:SOURce<hw>]:[:BB]:DME:ID:PERiod <Period>

Sets the period of the COM/ID signal in seconds.

Parameters:

<Period> integer
 Range: 10 to 120
 *RST: 40

Manual operation: See "Period" on page 86

[[:SOURce<hw>]:[:BB]:DME:ID:PRESet

Sets the default settings for the ID signal.

Usage: Event

[[:SOURce<hw>]:[:BB]:DME:ID:RATE <Rate>

Sets the pulse repetition rate of the ID sequence.

Parameters:

<Rate> float
 Range: 100 to 10E3
 Increment: 0.01
 *RST: 1350

Manual operation: See "Rate" on page 85

[[:SOURce<hw>]:[:BB]:DME:ID:SYMBOL <Symbol>

Sets the length of the symbol space in seconds.

Available only if `[:SOURce<hw>] [:BB] :DME:ID:TSCHEMA` is set to *USER*.

Parameters:

<Symbol> float
 Range: 0.05 to 1
 Increment: 1E-4
 *RST: 0.1

Manual operation: See "[Symbol Space](#)" on page 86

`[:SOURce<hw>] [:BB] :DME:ID:TSCHEMA` <TSchema>

Sets the time schema for the COM/ID signal.

In the standard time schema (STD) the set dot length determines the dash length (= three times the dot length) whereas in the user time schema (USER) all length parameters can be set independently.

Parameters:

<TSchema> STD | USER
 *RST: STD

Manual operation: See "[Time Schema](#)" on page 86

`[:SOURce<hw>] [:BB] :DME:ID[:STATE]` <State>

Switches on/ off the additional COM/ID signal.

Parameters:

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

Manual operation: See "[COM/ID State](#)" on page 84

10.6 Trigger Settings

EXTernal<ch>

The numeric suffix to `EXTernal<ch>` distinguishes between the external trigger via the [TRIGGER 1] (suffix 1) and [TRIGGER 2] (suffix 2) connector.

<code>[:SOURce<hw>] :BB:DME:TRIGger:ARM:EXECute</code>	195
<code>[:SOURce<hw>] :BB:GBAS:TRIGger:ARM:EXECute</code>	195
<code>[:SOURce<hw>] :BB:ILS:TRIGger:ARM:EXECute</code>	195
<code>[:SOURce<hw>] :BB:VOR:TRIGger:ARM:EXECute</code>	195
<code>[:SOURce<hw>] :BB:DME:TRIGger:EXECute</code>	196
<code>[:SOURce<hw>] :BB:GBAS:TRIGger:EXECute</code>	196
<code>[:SOURce<hw>] :BB:ILS:TRIGger:EXECute</code>	196
<code>[:SOURce<hw>] :BB:VOR:TRIGger:EXECute</code>	196
<code>[:SOURce<hw>] :BB:DME:TRIGger:EXTernal:SYNChronize:OUTPut</code>	196
<code>[:SOURce<hw>] :BB:ILS:TRIGger:EXTernal:SYNChronize:OUTPut</code>	196

<code>[:SOURce<hw>]:BB:GBAS:TRIGger:EXternal:SYNChronize:OUTPut</code>	196
<code>[:SOURce<hw>]:BB:VOR:TRIGger:EXternal:SYNChronize:OUTPut</code>	196
<code>[:SOURce<hw>]:BB:DME:TRIGger:OBASeband:DElay</code>	197
<code>[:SOURce<hw>]:BB:GBAS:TRIGger:OBASeband:DElay</code>	197
<code>[:SOURce<hw>]:BB:ILS:TRIGger:OBASeband:DElay</code>	197
<code>[:SOURce<hw>]:BB:VOR:TRIGger:OBASeband:DElay</code>	197
<code>[:SOURce<hw>]:BB:DME:TRIGger:OBASeband:INHibit</code>	197
<code>[:SOURce<hw>]:BB:GBAS:TRIGger:OBASeband:INHibit</code>	197
<code>[:SOURce<hw>]:BB:ILS:TRIGger:OBASeband:INHibit</code>	197
<code>[:SOURce<hw>]:BB:VOR:TRIGger:OBASeband:INHibit</code>	197
<code>[:SOURce<hw>]:BB:DME:TRIGger:RMODE?</code>	197
<code>[:SOURce<hw>]:BB:GBAS:TRIGger:RMODE?</code>	197
<code>[:SOURce<hw>]:BB:ILS:TRIGger:RMODE?</code>	197
<code>[:SOURce<hw>]:BB:VOR:TRIGger:RMODE?</code>	197
<code>[:SOURce<hw>]:BB:DME:TRIGger:SLENgth</code>	197
<code>[:SOURce<hw>]:BB:GBAS:TRIGger:SLENgth</code>	197
<code>[:SOURce<hw>]:BB:ILS:TRIGger:SLENgth</code>	198
<code>[:SOURce<hw>]:BB:VOR:TRIGger:SLENgth</code>	198
<code>[:SOURce<hw>]:BB:GBAS:TRIGger:SLUNit</code>	198
<code>[:SOURce<hw>]:BB:DME:TRIGger:SOURce</code>	198
<code>[:SOURce<hw>]:BB:GBAS:TRIGger:SOURce</code>	198
<code>[:SOURce<hw>]:BB:ILS:TRIGger:SOURce</code>	198
<code>[:SOURce<hw>]:BB:VOR:TRIGger:SOURce</code>	198
<code>[:SOURce<hw>]:BB:DME:TRIGger[:EXternal<ch>]:DElay</code>	198
<code>[:SOURce<hw>]:BB:GBAS:TRIGger[:EXternal<ch>]:DElay</code>	198
<code>[:SOURce<hw>]:BB:ILS:TRIGger[:EXternal<ch>]:DElay</code>	198
<code>[:SOURce<hw>]:BB:VOR:TRIGger[:EXternal<ch>]:DElay</code>	198
<code>[:SOURce<hw>]:BB:DME:TRIGger[:EXternal<ch>]:INHibit</code>	199
<code>[:SOURce<hw>]:BB:GBAS:TRIGger[:EXternal<ch>]:INHibit</code>	199
<code>[:SOURce<hw>]:BB:ILS:TRIGger[:EXternal<ch>]:INHibit</code>	199
<code>[:SOURce<hw>]:BB:VOR:TRIGger[:EXternal<ch>]:INHibit</code>	199
<code>[:SOURce<hw>]:BB:DME[:TRIGger]:SEquence</code>	199
<code>[:SOURce<hw>]:BB:GBAS[:TRIGger]:SEquence</code>	199
<code>[:SOURce<hw>]:BB:ILS[:TRIGger]:SEquence</code>	199
<code>[:SOURce<hw>]:BB:VOR[:TRIGger]:SEquence</code>	199

`[:SOURce<hw>]:BB:DME:TRIGger:ARM:EXECute`
`[:SOURce<hw>]:BB:GBAS:TRIGger:ARM:EXECute`
`[:SOURce<hw>]:BB:ILS:TRIGger:ARM:EXECute`
`[:SOURce<hw>]:BB:VOR:TRIGger:ARM:EXECute`

Stops signal generation for trigger modes "Armed_Auto" and "Armed_Retrigger". A subsequent internal or external trigger event restart signal generation.

Example:	<pre>BB:VOR:TRIG:SOUR INT</pre> <p>Sets internal triggering.</p> <pre>BB:VOR:TRIG:SEQ ARET</pre> <p>Sets Armed_Retrigger mode, i.e. every trigger event causes signal generation to restart.</p> <pre>BB:VOR:TRIG:EXEC</pre> <p>Executes a trigger, signal generation is started.</p> <pre>BB:VOR:TRIG:ARM:EXEC</pre> <p>Signal generation is stopped.</p> <pre>BB:VOR:TRIG:EXEC</pre> <p>Executes a trigger, signal generation is started again.</p>
Usage:	Event
Manual operation:	See "Arm" on page 27

```
[ :SOURce<hw>]:BB:DME:TRIGger:EXECute
[:SOURce<hw>]:BB:GBAS:TRIGger:EXECute
[:SOURce<hw>]:BB:ILS:TRIGger:EXECute
[:SOURce<hw>]:BB:VOR:TRIGger:EXECute
```

Executes a trigger. The internal trigger source must be selected using the command `BB:xxx:TRIG:SOUR INT` (where `xxx` stands for `ILS`, `VOR` or `DME`) and a trigger mode other than `AUTO` must be selected using the command `BB:xxx:TRIG:SEQ`.

Usage:	Event
Manual operation:	See "Execute Trigger" on page 26

```
[ :SOURce<hw>]:BB:DME:TRIGger:EXTErnal:SYNChronize:OUTPut <Output>
[:SOURce<hw>]:BB:ILS:TRIGger:EXTErnal:SYNChronize:OUTPut <Output>
[:SOURce<hw>]:BB:GBAS:TRIGger:EXTErnal:SYNChronize:OUTPut <Output>
[:SOURce<hw>]:BB:VOR:TRIGger:EXTErnal:SYNChronize:OUTPut <Output>
```

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

Parameters:	
<Output>	0 1 OFF ON
	ON
	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.
	*RST: 1

Manual operation: See ["Sync. Output to External Trigger"](#) on page 92

```
[:SOURce<hw>]:BB:DME:TRIGger:OBASeband:DELay <Delay>
[:SOURce<hw>]:BB:GBAS:TRIGger:OBASeband:DELay <Delay>
[:SOURce<hw>]:BB:ILS:TRIGger:OBASeband:DELay <Delay>
[:SOURce<hw>]:BB:VOR:TRIGger:OBASeband:DELay <Delay>
```

The command specifies the trigger delay (expressed as a number of samples) for triggering by the trigger signal from the second path.

Parameters:

```
<Delay>          float
                  Range:    0 samples to 2^32-1 samples
                  Increment: 1 sample
                  *RST:     0 samples
```

Manual operation: See ["Trigger Delay"](#) on page 94

```
[:SOURce<hw>]:BB:DME:TRIGger:OBASeband:INHibit <Inhibit>
[:SOURce<hw>]:BB:GBAS:TRIGger:OBASeband:INHibit <Inhibit>
[:SOURce<hw>]:BB:ILS:TRIGger:OBASeband:INHibit <Inhibit>
[:SOURce<hw>]:BB:VOR:TRIGger:OBASeband:INHibit <Inhibit>
```

Specifies the number of samples by which a restart is to be inhibited following a trigger event. This command applies only for triggering by the second path.

Parameters:

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

Manual operation: See ["Trigger Inhibit"](#) on page 94

```
[:SOURce<hw>]:BB:DME:TRIGger:RMODE?
[:SOURce<hw>]:BB:GBAS:TRIGger:RMODE?
[:SOURce<hw>]:BB:ILS:TRIGger:RMODE?
[:SOURce<hw>]:BB:VOR:TRIGger:RMODE?
```

Queries the current status of signal generation for all trigger modes modulation on.

Return values:

```
<RunMode>       STOP | RUN
                  *RST:    STOP
```

Usage: Query only

Manual operation: See ["Running/Stopped"](#) on page 91

```
[:SOURce<hw>]:BB:DME:TRIGger:SLENgth <SeqLength>
[:SOURce<hw>]:BB:GBAS:TRIGger:SLENgth <Slength>
```

**[[:SOURce<hw>]:BB:ILS:TRIGger:SLENgth <SeqLength>
[:SOURce<hw>]:BB:VOR:TRIGger:SLENgth <SeqLength>**

The command defines the length of the signal sequence to be output in the "Single" trigger mode (SOUR:BB:xxx:SEQ SING, where xxx stands for ILS, VOR or DME). The input is made in terms of samples.

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

Parameters:

<SeqLength> integer
 Range: 1 samples to 2³²-1 samples
 *RST: 100

Manual operation: See ["Trigger Signal Duration"](#) on page 91

[[:SOURce<hw>]:BB:GBAS:TRIGger:SLUNit <Slunit>

Sets the units the trigger sequence length is expressed in.

Parameters:

<Slunit> SEQuence | SAMPlE
 *RST: SEQuence

Manual operation: See ["Signal Duration Unit"](#) on page 91

**[[:SOURce<hw>]:BB:DME:TRIGger:SOURce <TriggerSource>
[:SOURce<hw>]:BB:GBAS:TRIGger:SOURce <Source>
[:SOURce<hw>]:BB:ILS:TRIGger:SOURce <TriggerSource>
[:SOURce<hw>]:BB:VOR:TRIGger:SOURce <TriggerSource>**

Selects the trigger source.

Parameters:

<TriggerSource> INTernal|EXTernal
 INTernal
 Manual trigger or *TRG.
 EXTernal
 Trigger signal on the TRIGGER connector.
 *RST: INTernal

Manual operation: See ["Trigger Source"](#) on page 92

**[[:SOURce<hw>]:BB:DME:TRIGger[:EXTernal<ch>]:DELay <Delay>
[:SOURce<hw>]:BB:GBAS:TRIGger[:EXTernal<ch>]:DELay <Delay>
[:SOURce<hw>]:BB:ILS:TRIGger[:EXTernal<ch>]:DELay <Delay>
[:SOURce<hw>]:BB:VOR:TRIGger[:EXTernal<ch>]:DELay <Delay>**

Sets the trigger delay.

Parameters:

<Delay> float
 Range: 0 to 65535
 Increment: 0.01
 *RST: 0

Example:

BB:VOR:TRIG:SOUR EXT
 Selects an external trigger.
 BB:VOR:TRIG:EXT:DEL 50
 Sets a delay of 50 symbols for the trigger.

Manual operation: See ["Trigger Delay"](#) on page 94

[:SOURce<hw>]:BB:DME:TRIGger[:EXternal<ch>]:INHibit <Inhibit>
[:SOURce<hw>]:BB:GBAS:TRIGger[:EXternal<ch>]:INHibit <Inhibit>
[:SOURce<hw>]:BB:ILS:TRIGger[:EXternal<ch>]:INHibit <Inhibit>
[:SOURce<hw>]:BB:VOR:TRIGger[:EXternal<ch>]:INHibit <Inhibit>

Specifies the number of samples by which a restart is to be inhibited following an external trigger event.

Parameters:

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

Example:

BB:VOR:TRIG:SOUR EXT
 Selects an external trigger.
 BB:VOR:TRIG:EXT:INH 200
 Sets a restart inhibit for 200 samples following a trigger event.

Manual operation: See ["Trigger Inhibit"](#) on page 94

[:SOURce<hw>]:BB:DME[:TRIGger]:SEQUence <TriggerMode>
[:SOURce<hw>]:BB:GBAS[:TRIGger]:SEQUence <Sequence>
[:SOURce<hw>]:BB:ILS[:TRIGger]:SEQUence <TriggerMode>
[:SOURce<hw>]:BB:VOR[:TRIGger]:SEQUence <TriggerMode>

Selects the trigger mode.

Parameters:

<TriggerMode> AUTO | RETRigger | AAUTo | ARETRigger | SINGLE

AUTO

The modulation signal is generated continuously.

RETRigger

The modulation signal is generated continuously. A trigger event (internal or external) causes a restart.

AAUTO

The modulation signal is generated only when a trigger event occurs. After the trigger event the signal is generated continuously. Signal generation is stopped with command `SOUR:BB:xxx:TRIG:ARM:EXEC` (xxx stands for ILS, VOR or DME) and started again when a trigger event occurs.

ARETrigger

The modulation signal is generated only when a trigger event occurs. The device automatically toggles to `RETRigger` mode. Every subsequent trigger event causes a restart. Signal generation is stopped with command `SOUR:BB:xxx:TRIG:ARM:EXEC` and started again when a trigger event occurs.

SINGLE

The modulation signal is generated only when a trigger event occurs. Then the signal is generated once to the length specified with command `SOUR:BB:xxx:TRIG:SLen`. Every subsequent trigger event causes a restart.

*RST: AUTO

Manual operation: See "[Trigger Mode](#)" on page 90

10.7 Marker Settings DME

<code>[:SOURce<hw>][:BB]:DME:MARKer<ch>:DELAy</code>	200
<code>[:SOURce<hw>][:BB]:DME:MARKer<ch>:MODE</code>	200
<code>[:SOURce<hw>][:BB]:DME:MARKer<ch>:PDELAy?</code>	201
<code>[:SOURce<hw>][:BB]:DME:MARKer<ch>:WIDTh</code>	201

`[:SOURce<hw>][:BB]:DME:MARKer<ch>:DELAy <Delay>`

Sets the delay between the marker signal at the marker outputs relative to the signal generation start.

Parameters:

<Delay> integer
 Range: 0 to 127
 *RST: 0

Manual operation: See "[Marker Delay](#)" on page 98

`[:SOURce<hw>][:BB]:DME:MARKer<ch>:MODE <Mode>`

Sets the mode for the selected marker.

Parameters:

<Mode> FPStart | FP50P | PStart | P50P | PRECeived
 FPStart: first pulse start

FP50: first pulse 50%
 PStart: pulse start
 P50: pulse 50%
 PRECeived: received pulse
 *RST: PStart

Manual operation: See "[Marker x](#)" on page 96

[[:SOURce<hw>]:[:BB]:DME:MARKer<ch>]:PDELay?

Queries the marker processing delay, internally measured value. This command is available only for "Marker 2".

Return values:

<ProcessedDelay> float
 Range: 0 to 1
 Increment: 10E-9
 *RST: 0

Usage: Query only

Manual operation: See "[Processing Delay](#)" on page 98

[[:SOURce<hw>]:[:BB]:DME:MARKer<ch>]:WIDTh <Width>

Sets the width of the corresponding marker in chips (0.05us).

Parameters:

<Width> integer
 Range: 1 to 127
 *RST: 10

Manual operation: See "[Marker Width](#)" on page 98

10.8 Marker Settings GBAS

Provided are the following commands:

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

Defines the signal for the selected marker output.

Parameters:

<Mode> PULSe | REStart | PATtern | RATio | TRIGger | PPS
 *RST: PPS

Example: See [Example "Adjusting clock, marker and trigger settings"](#) on page 117

Manual operation: See "[Marker Mode](#)" on page 95

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

Defines the bit pattern used to generate the marker signal *PATTern*.

Parameters:

<Pattern> 64 bits
 *RST: #H2,2

Example: SOURce1:BB:GBAS:TRIGger:OUTPut1:MODE PATTern
 SOURce1:BB:GBAS:TRIGger:OUTPut1:PATTern
 #H5670,15

Manual operation: See "[Marker Mode](#)" on page 95

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

Sets the divider for Pulse marker mode (*PULSe*).

Parameters:

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

Example: SOURce1:BB:GBAS:MSET:SRATe?
 Response: 10500
 SOURce1:BB:GBAS:TRIGger:OUTPut2:MODE PULSe
 SOURce1:BB:GBAS:TRIGger:OUTPut2:PULSe:DIVider 4
 SOURce1:BB:GBAS:TRIGger:OUTPut2:PULSe:
 FREQuency?
 Response: 2625
 2625 = 10500/4

Manual operation: See "[Marker Mode](#)" on page 95

[[:SOURce<hw>]:BB:GBAS:TRIGger:OUTPut<ch>:PULSe:FREQuency?

Queries the pulse frequency of the pulsed marker signal *PULSe*.

Return values:

<Frequency> float
 Range: 2 to 1024
 Increment: 1E-3
 *RST: 2

Usage: Query only

Manual operation: See "[Marker Mode](#)" on page 95

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

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

Sets the number of symbols in a period (ON time + OFF time) for marker *RATio*

Parameters:

<OffTime> integer
 Range: 1 to 16777215
 *RST: 1

Example: See [Example "Adjusting clock, marker and trigger settings"](#) on page 117

Manual operation: See ["Marker Mode"](#) on page 95

[:SOURce<hw>]:BB:GBAS:TRIGger:OUTPut<ch>:DELay <Delay>

Sets the marker delay.

Parameters:

<Delay> float
 Range: 0 to 16777215
 Increment: 1E-3
 *RST: 0

Example: SOURce1:BB:GBAS:TRIGger:OUTPut1:DELay?

Manual operation: See ["Marker x Delay"](#) on page 96

[:SOURce<hw>]:BB:GBAS:TRIGger:OUTPut<ch>:DELay:MINimum?
[:SOURce<hw>]:BB:GBAS:TRIGger:OUTPut<ch>:DELay:MAXimum?

Queries the minimum/maximum marker delay for fixed marker delay setting.

Return values:

<Maximum> float
 Range: 0 to max
 Increment: 1E-3
 *RST: 2000

Example: SOURce1:BB:GBAS:TRIGger:OUTPut1:DELay:MAXimum?

Usage: Query only

Manual operation: See ["Marker x Delay"](#) on page 96

[:SOURce<hw>]:BB:GBAS: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:GBAS:TRIGger:OUTPut1:DELay:FIXed?

Manual operation: See ["Marker x Delay"](#) on page 96

10.9 Clock Settings

<code>[:SOURce<hw>]:BB:DME:CLOCK:MODE</code>	204
<code>[:SOURce<hw>]:BB:GBAS:CLOCK:MODE</code>	204
<code>[:SOURce<hw>]:BB:ILS:CLOCK:MODE</code>	204
<code>[:SOURce<hw>]:BB:VOR:CLOCK:MODE</code>	204
<code>[:SOURce<hw>]:BB:DME:CLOCK:MULTIPLIER</code>	204
<code>[:SOURce<hw>]:BB:GBAS:CLOCK:MULTIPLIER</code>	204
<code>[:SOURce<hw>]:BB:ILS:CLOCK:MULTIPLIER</code>	204
<code>[:SOURce<hw>]:BB:VOR:CLOCK:MULTIPLIER</code>	204
<code>[:SOURce<hw>]:BB:DME:CLOCK:SOURce</code>	205
<code>[:SOURce<hw>]:BB:GBAS:CLOCK:SOURce</code>	205
<code>[:SOURce<hw>]:BB:ILS:CLOCK:SOURce</code>	205
<code>[:SOURce<hw>]:BB:VOR:CLOCK:SOURce</code>	205
<code>[:SOURce<hw>]:BB:DME:CLOCK:SYNChronization:EXECute</code>	205
<code>[:SOURce<hw>]:BB:GBAS:CLOCK:SYNChronization:EXECute</code>	205
<code>[:SOURce<hw>]:BB:ILS:CLOCK:SYNChronization:EXECute</code>	205
<code>[:SOURce<hw>]:BB:VOR:CLOCK:SYNChronization:EXECute</code>	205
<code>[:SOURce<hw>]:BB:DME:CLOCK:SYNChronization:MODE</code>	205
<code>[:SOURce<hw>]:BB:GBAS:CLOCK:SYNChronization:MODE</code>	205
<code>[:SOURce<hw>]:BB:ILS:CLOCK:SYNChronization:MODE</code>	206
<code>[:SOURce<hw>]:BB:VOR:CLOCK:SYNChronization:MODE</code>	206

```
[:SOURce<hw>]:BB:DME:CLOCK:MODE <MOde>
[:SOURce<hw>]:BB:GBAS:CLOCK:MODE <MOde>
[:SOURce<hw>]:BB:ILS:CLOCK:MODE <MOde>
[:SOURce<hw>]:BB:VOR:CLOCK:MODE <MOde>
```

Sets the type of externally supplied clock.

Parameters:

```
<MOde>          CHIP | MCHip
                *RST:    CHIP
```

Manual operation: See "Clock Mode" on page 99

```
[:SOURce<hw>]:BB:DME:CLOCK:MULTIPLIER <Multiplier>
[:SOURce<hw>]:BB:GBAS:CLOCK:MULTIPLIER <Multiplier>
[:SOURce<hw>]:BB:ILS:CLOCK:MULTIPLIER <Multiplier>
[:SOURce<hw>]:BB:VOR:CLOCK:MULTIPLIER <Multiplier>
```

Note: This command is available for clock source "External" and in clock mode "Multiple Sample" only.

The command specifies the multiplier for clock type "Multiplied"

(`BB:xxx:CLOCK:MODE MSAMpLe`) in the case of an external clock source, where `xxx` stands for ILS, VOR or DME.

Parameters:

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

Example:

BB:xxx:CLOCK:SOURce EXTernal
 Selects the external clock source.
 BB:xxx:CLOCK:MODE MSAMple
 Selects clock type "Multiplied", i.e. the supplied clock has a rate which is a multiple of the sample rate.
 BB:xxx:CLOCK:MULTIplier 12
 The multiplier for the external clock rate is 12.

Manual operation: See ["Clock Multiplier"](#) on page 99

[:SOURce<hw>]:BB:DME:CLOCK:SOURce <Source>
[:SOURce<hw>]:BB:GBAS:CLOCK:SOURce <Source>
[:SOURce<hw>]:BB:ILS:CLOCK:SOURce <Source>
[:SOURce<hw>]:BB:VOR:CLOCK:SOURce <Source>

Parameters:

<Source> INTernal | EXTernal
INTernal
 The internal clock reference is used.
EXTernal
 The external clock reference is supplied to the [CLOCK] connector.
 *RST: INTernal

Manual operation: See ["Clock Source"](#) on page 99

[:SOURce<hw>]:BB:DME:CLOCK:SYNChronization:EXECute
[:SOURce<hw>]:BB:GBAS:CLOCK:SYNChronization:EXECute
[:SOURce<hw>]:BB:ILS:CLOCK:SYNChronization:EXECute
[:SOURce<hw>]:BB:VOR:CLOCK:SYNChronization:EXECute

Performs automatically adjustment of the instrument's settings required for the synchronization mode, set with the command `BB:xxx:CLOCK:SYNC:MODE`, where `xxx` stands for `ILS`, `VOR` or `DME`.

Example:

BB:xxx:CLOCK:SYNC:MODE MAST
 The instrument is configured to work as a master one.
 BB:xxx:CLOCK:SYNC:EXEC
 All synchronization's settings are adjusted accordingly.

Usage: Event

Manual operation: See ["Set Synchronization Settings"](#) on page 99

[:SOURce<hw>]:BB:DME:CLOCK:SYNChronization:MODE <Mode>
[:SOURce<hw>]:BB:GBAS:CLOCK:SYNChronization:MODE <Mode>

Remote Control of the R&S SMBV by the R&S®SMA100A VOR/ILS/DME Commands

[:SOURce<hw>]:BB:ILS:CLOCK:SYNChronization:MODE <Mode>
[:SOURce<hw>]:BB:VOR: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 synchronization (including the trigger signal) and reference clock signal.

SLAVe

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

*RST: NONE

Manual operation: See "[Sync. Mode](#)" on page 98

10.10 Remote Control of the R&S SMBV by the R&S®SMA100A VOR/ILS/DME Commands

You can use the VOR/ILS and DME command sets of the R&S®SMA100A to remote control the corresponding Avionics option of the R&S SMBV.

Accept are all commands that configure functions implemented in both instruments.

R&S SMBV does not support the following commands:

- [:SOURce] : ILS [:GS | GSLope] : SOURce INT, EX
- [:SOURce] : ILS : LOCALizer : SOURce INT, EXT
- [:SOURce] : VOR : SOURce INT, EXT
- : CALibration : DME [: MEASure]
- [:SOURce] : DME : ECHO
- [:SOURce] : DME : ECHO : ATTenuation
- [:SOURce] : DME : ECHO : DELay
- [:SOURce] : DME : TRIGger AUTO | EGATe
- [:SOURce] : DME : TRIGger : GPOLarity
- [:SOURce] : DME : TRIGger : IMPedance
- [:SOURce] : DME : TRIGger : SLOPe

Remote Control of the R&S SMBV by the R&S®SMA100A VOR/ILS/DME Commands

<code>[:SOURce<hw>]:ILS:GS GSLope:PRESet</code>	207
<code>[:SOURce<hw>]:ILS:GS GSLope:STATe</code>	207
<code>[:SOURce<hw>]:ILS:LOCalizer:PRESet</code>	207
<code>[:SOURce<hw>]:ILS:LOCalizer:STATe</code>	207
<code>[:SOURce<hw>]:MBEacon:PRESet</code>	207
<code>[:SOURce<hw>]:MBEacon:STATe</code>	207
<code>[:SOURce<hw>]:VOR:PRESet</code>	207
<code>[:SOURce<hw>]:VOR:STATe</code>	207
<code>[:SOURce<hw>]:DME:STATe</code>	207
<code>[:SOURce<hw>]:DME:PRESet</code>	207
<code>[:SOURce<hw>]:DME:ANALysis:EFFiciency:OK</code>	207
<code>[:SOURce<hw>]:DME:ANALysis:EFFiciency:STATe</code>	207
<code>[:SOURce<hw>]:DME:ANALysis:POWER:OK</code>	207
<code>[:SOURce<hw>]:DME:ANALysis:POWER:STATe</code>	207
<code>[:SOURce<hw>]:DME:ANALysis:PRRate:OK</code>	207
<code>[:SOURce<hw>]:DME:ANALysis:PRRate:STATe</code>	207
<code>[:SOURce<hw>]:DME:ANALysis:TIME:OK</code>	207
<code>[:SOURce<hw>]:DME:ANALysis:TIME:STATe</code>	207
<code>[:SOURce<hw>]:DME:LOWemission</code>	207

```

[:SOURce<hw>]:ILS:GS|GSLope:PRESet
[:SOURce<hw>]:ILS:GS|GSLope:STATe <State>
[:SOURce<hw>]:ILS:LOCalizer:PRESet
[:SOURce<hw>]:ILS:LOCalizer:STATe <State>
[:SOURce<hw>]:MBEacon:PRESet
[:SOURce<hw>]:MBEacon:STATe <State>
[:SOURce<hw>]:VOR:PRESet
[:SOURce<hw>]:VOR:STATe <State>
[:SOURce<hw>]:DME:STATe <State>
[:SOURce<hw>]:DME:PRESet
[:SOURce<hw>]:DME:ANALysis:EFFiciency:OK <State>
[:SOURce<hw>]:DME:ANALysis:EFFiciency:STATe <State>
[:SOURce<hw>]:DME:ANALysis:POWER:OK <State>
[:SOURce<hw>]:DME:ANALysis:POWER:STATe <State>
[:SOURce<hw>]:DME:ANALysis:PRRate:OK <State>
[:SOURce<hw>]:DME:ANALysis:PRRate:STATe <State>
[:SOURce<hw>]:DME:ANALysis:TIME:OK <State>
[:SOURce<hw>]:DME:ANALysis:TIME:STATe <State>
[:SOURce<hw>]:DME:LOWemission <State>

```

All these functions are always enabled in R&S SMBV. The commands are supported only for compatibility with R&S®SMA100A.

The query result is always 1.

Parameters:

```

<State>          1
                  *RST:    1

```

Annex

A Morse Code Settings

The COM/ID tone is sent according to the selected code (see [Table A-1](#)). The length of the Morse code can be varied. For selected standard time scheme, the selected dot length determines the setting of all other length parameters of the Morse code (dash length, symbol space and letter space) . For selected user time scheme, all length parameters of the code can be set independently. If no coding is entered, the COM/ID tone is sent uncoded (key down).



The following values are default values:

- A dot (.) has a tone duration of 100 ms
- A dash (-) has a tone duration of 300ms
- The time between two tones is 100ms
- The time between two letters is 300ms

After each word, a word space is entered. The word repetition rate is 7 words/minute. As the word length can vary between 900 ms and 4500 ms the word space between the words varies accordingly.

Example:

ID code = MUC

The word length =

$(300+100+300)+300+(100+100+100+100+300)+300+(300+100+100+100+300+100+100) = 3100$ ms

Table A-1: Morse code

Letter	Morse code	Letter	Morse code
A	.-	N	-. .
B	-... .	O	---
C	-.-. .	P	.-.-.
D	-.. .	Q	-.-. .
E	.	R	.-. .
F	..-. .	S
G	--. .	T	- .
H	U	...-
I	.. .	V	...-
J	.-.- .	W	.-.-
K	-. .-	X	-.-. .

Letter	Morse code	Letter	Morse code
L	.-...	Y	-.-.-
M	--	Z	--...

B ICAO Channel Frequencies

In the following chapter the standardized transmitting frequencies for the ILS, DME and VOR standards are listed.

B.1 ILS Channel Frequencies

The individual values in the table are:

- **Ch. No.** = ICAO channel number
- **LOC Freq.** = ILS Localizer transmitting frequency (MHz)
- **GS Freq.** = ILS GS frequency (MHz)

Table B-1: Standardized ILS-GS and ILS-LOC transmitting frequencies (MHz) and the associated ICAO channels

Ch. No.	LOC Freq.	GS Freq.	Ch. No.	LOC Freq.	GS Freq.	Ch. No.	LOC Freq.	GS Freq.
18X	108.10	334.70	32X	109.50	332.60	46X	110.90	330.80
18Y	108.15	334.55	32Y	109.55	332.45	46Y	110.95	330.65
20X	108.30	334.10	34X	109.70	333.20	48X	111.10	331.70
20Y	108.35	333.95	34Y	109.75	333.05	48Y	111.15	331.55
22X	108.50	329.90	36X	109.90	333.80	50X	111.30	332.30
22Y	108.55	329.75	36Y	109.95	333.65	50Y	111.35	332.15
24X	108.70	330.50	38X	110.10	334.40	52X	111.50	332.90
24Y	108.75	330.35	38Y	110.15	334.25	52Y	111.55	332.75
26X	108.90	329.30	40X	110.30	335.00	54X	111.70	333.50
26Y	108.95	329.15	40Y	110.35	334.85	54Y	111.75	333.35
28X	109.10	331.40	42X	110.50	329.60	56X	111.90	331.10
28Y	109.15	331.25	42Y	110.55	329.45	56Y	111.95	330.95
30X	109.30	332.00	44X	110.70	330.20			
30Y	109.35	331.85	44Y	110.75	330.05			

B.2 VOR Channel Frequencies

The individual values in the table cells are:

- **Ch. No.** = ICAO channel number
- **VOR Freq.** = VOR Interrogation frequency (MHz)

Table B-2: Standardized VOR transmitting frequencies (MHz) and the associated ICAO channels

Ch. No.	VOR Freq.	Ch. No.	VOR Freq.	Ch. No.	VOR Freq.	Ch. No.	VOR Freq.	Ch. No.	VOR Freq.	Ch. No.	VOR Freq.
17X	108.00	45X	110.80	75X	112.80	89X	114.20	103X	115.60	117X	117.00
17Y	108.05	45Y	110.85	75Y	112.85	89Y	114.25	103Y	115.65	117Y	117.05
19X	108.20	47X	111.00	76X	112.90	90X	114.30	104X	115.70	118X	117.10
19Y	108.25	47Y	111.05	76Y	112.95	90Y	114.35	104Y	115.75	118Y	117.15
21X	108.40	49X	111.20	77X	113.00	91X	114.40	105X	115.80	119X	117.20
21Y	108.45	49Y	111.25	77Y	113.05	91Y	114.45	105Y	115.85	119Y	117.25
23X	108.60	51X	111.40	78X	113.10	92X	114.50	106X	115.90	120X	117.30
23Y	108.65	51Y	111.45	78Y	113.15	92Y	114.55	106Y	115.95	120Y	117.35
25X	108.80	53X	111.60	79X	113.20	93X	114.60	107X	116.00	121X	117.40
25Y	108.85	53Y	111.65	79Y	113.25	93Y	114.65	107Y	116.05	121Y	117.45
27X	109.00	55X	111.80	80X	113.30	94X	114.70	108X	116.10	122X	117.50
27Y	109.05	55Y	111.85	80Y	113.35	94Y	114.75	108Y	116.15	122Y	117.55
29X	109.20	57X	112.00	81X	113.40	95X	114.80	109X	116.20	123X	117.60
29Y	109.25	57Y	112.05	81Y	113.45	95Y	114.85	109Y	116.25	123Y	117.65
31X	109.40	58X	112.10	82X	113.50	96X	114.90	110X	116.30	124X	117.70
31Y	109.45	58Y	112.15	82Y	113.55	96Y	114.95	110Y	116.35	124Y	117.75
33X	109.60	59X	112.20	83X	113.60	97X	115.00	111X	116.40	125X	117.80
33Y	109.65	59Y	112.25	83Y	113.65	97Y	115.05	111Y	116.45	125Y	117.85
35X	109.80	70X	112.30	84X	113.70	98X	115.10	112X	116.50	126X	117.90
35Y	109.85	70Y	112.35	84Y	113.75	98Y	115.15	112Y	116.55	126Y	117.95
37X	110.00	71X	112.40	85X	113.80	99X	115.20	113X	116.60		
37Y	110.05	71Y	112.45	85Y	113.85	99Y	115.25	113Y	116.65		
39X	110.20	72X	112.50	86X	113.90	100X	115.30	114X	116.75		
39Y	110.25	72Y	112.55	86Y	113.95	100Y	115.35	114Y	116.75		
41X	110.40	73X	112.60	87Y	114.00	101X	115.40	115X	116.80		
41Y	110.45	73Y	112.65	87Y	114.05	101Y	115.45	115Y	116.85		
43X	110.60	74X	112.70	88X	114.10	102X	115.50	116X	116.90		
43Y	110.65	74Y	112.75	88Y	114.15	102Y	115.55	116Y	116.95		

B.3 DME Channel Frequencies

The individual values in the table are:

- **Ch. No.** = ICAO channel number
- **VOR Freq.** = VOR interrogation frequency
- **DME Interrog. Freq.** = DME interrogation frequency (MHz)
- **DME Reply Freq.** = DME reply frequency (MHz)

Table B-3: Standardized DME transmitting frequencies (MHz) and the associated ICAO channels for interrogation and reply

Ch. No.	VOR Freq.	DME Interrog. Freq.	DME Reply Freq.	Ch. No.	VOR Freq.	DME Interrog. Freq.	DME Reply Freq.	Ch. No.	VOR Freq.	DME Interrog. Freq.	DME Reply Freq.
1X		1025	962	43X	110.60	1067	1004	85X	113.80	1109	1172
1Y		1025	1088	43Y	110.65	1067	1130	85Y	113.85	1109	1046
2X		1026	963	44X	110.70	1068	1005	86X	113.90	1110	1173
2Y		1026	1089	44Y	110.75	1068	1131	86Y	113.95	1110	1047
3X		1027	964	45X	110.80	1069	1106	87X	114.00	1111	1174
3Y		1027	1090	45Y	110.85	1069	1132	87Y	114.05	1111	1048
4X		1028	965	46X	110.90	1070	1007	88X	114.10	1112	1175
4Y		1028	1091	46Y	110.95	1070	1133	88Y	114.15	1112	1049
5X		1029	966	47X	111.00	1071	1008	89X	114.20	1113	1176
5Y		1029	1092	47Y	111.05	1071	1134	89Y	114.25	1113	1050
6X		1030	967	48X	111.10	1072	1009	90X	114.30	1114	1177
6Y		1030	1093	48Y	111.15	1072	1135	90Y	114.35	1114	1051
7X		1031	968	49X	111.20	1073	1010	91X	114.40	1115	1178
7Y		1031	1094	49Y	111.25	1073	1136	91Y	114.45	1115	1052
8X		1032	969	50X	111.30	1074	1011	92X	114.50	1116	1179
8Y		1032	1095	50Y	111.35	1074	1137	92Y	114.55	1116	1053
9X		1033	970	51X	111.40	1075	1012	93X	114.60	1117	1180
9Y		1033	1096	51Y	111.45	1075	1138	93Y	114.65	1117	1054
10X		1034	971	52X	111.50	1076	1013	94X	114.70	1118	1181
10Y		1034	1097	52Y	111.55	1076	1139	94Y	114.75	1118	1055
11X		1035	972	53X	111.60	1077	1014	95X	114.80	1119	1182
11Y		1035	1098	53Y	111.65	1077	1140	95Y	114.85	1119	1056
12X		1036	973	54X	111.70	1078	1015	96X	114.90	1120	1183
12Y		1036	1099	54Y	111.75	1078	1141	96Y	114.95	1120	1057
13X		1037	974	55X	111.80	1079	1016	97X	115.00	1121	1184
13Y		1037	1100	55Y	111.85	1079	1142	97Y	115.05	1121	1058
14X		1038	975	56X	111.90	1080	1017	98X	115.10	1122	1185
14Y		1038	1101	56Y	111.95	1080	1143	98Y	115.15	1122	1059
15X		1039	976	57X	112.00	1081	1018	99X	115.20	1123	1186
15Y		1039	1102	57Y	112.05	1081	1144	99Y	115.25	1123	1060
16X		1040	977	58X	112.10	1082	1019	100X	115.30	1124	1187
16Y		1040	1103	58Y	112.15	1082	1145	100Y	115.35	1124	1061
17X	108.00	1041	978	59X	112.20	1083	1020	101X	115.40	1125	1188
17Y	108.05	1041	1104	59Y	112.25	1083	1146	101Y	115.45	1125	1062
18X	108.10	1042	979	60X		1084	1021	102X	115.50	1126	1189
18Y	108.15	1042	1105	60Y		1084	1147	102Y	115.55	1126	1063

DME Channel Frequencies

Ch. No.	VOR Freq.	DME Interrog. Freq.	DME Reply Freq.	Ch. No.	VOR Freq.	DME Interrog. Freq.	DME Reply Freq.	Ch. No.	VOR Freq.	DME Interrog. Freq.	DME Reply Freq.
19X	108.20	1043	980	61X		1085	1022	103X	115.60	1127	1190
19Y	108.25	1043	1106	61Y		1085	1148	103Y	115.65	1127	1064
20X	108.30	1044	981	62X		1086	1023	104X	115.70	1128	1191
20Y	108.35	1044	1107	62Y		1086	1149	104Y	115.75	1128	1065
21X	108.40	1045	982	63X		1087	1024	105X	115.80	1129	1192
21Y	108.45	1045	1108	63Y		1087	1150	105Y	115.85	1129	1066
22X	108.50	1046	983	64X		1088	1151	106X	115.90	1130	1193
22Y	108.55	1046	1109	64Y		1088	1025	106Y	115.95	1130	1067
23X	108.60	1047	984	65X		1089	1152	107X	116.00	1131	1194
23Y	108.65	1047	1110	65Y		1089	1026	107Y	116.05	1131	1068
24X	108.70	1048	985	66X		1090	1153	108X	116.10	1132	1195
24Y	108.75	1048	1111	66Y		1090	1027	108Y	116.15	1132	1069
25X	108.80	1049	986	67X		1091	1154	109X	116.20	1133	1196
25Y	108.85	1049	1112	67Y		1091	1028	109Y	116.25	1133	1070
26X	108.90	1050	987	68X		1092	1155	110X	116.30	1134	1197
26Y	108.95	1050	1113	68Y		1092	1029	110Y	116.35	1134	1071
27X	109.00	1051	988	69X		1093	1156	111X	116.40	1135	1198
27Y	109.05	1051	1114	69Y		1093	1030	111Y	116.45	1135	1072
28X	109.10	1052	989	70X	112.30	1094	1157	112X	116.50	1136	1199
28Y	109.15	1052	1115	70Y	112.35	1094	1031	112Y	116.55	1136	1073
29X	109.20	1053	990	71X	112.40	1095	1158	113X	116.60	1137	1200
29Y	109.25	1053	1116	71Y	112.45	1095	1032	113Y	116.65	1137	1074
30X	109.30	1054	991	72X	112.50	1096	1159	114X	116.70	1138	1201
30Y	109.35	1054	1117	72Y	112.55	1096	1033	114Y	116.75	1138	1075
31X	109.40	1055	992	73X	112.60	1097	1160	115X	116.80	1139	1202
31Y	109.45	1055	1118	73Y	112.65	1097	1034	115Y	116.85	1139	1076
32X	109.50	1056	993	74X	112.70	1098	1161	116X	116.90	1140	1203
32Y	109.55	1056	1119	74Y	112.75	1098	1035	116Y	116.95	1140	1077
33X	109.60	1057	994	75X	112.80	1099	1162	117X	117.00	1141	1204
33Y	109.65	1057	1120	75Y	112.85	1099	1036	117Y	117.05	1141	1078
34X	109.70	1058	995	76X	112.90	1100	1163	118X	117.10	1142	1205
34Y	109.75	1058	1121	76Y	112.95	1100	1037	118Y	117.15	1142	1079
35X	109.80	1059	996	77X	113.00	1101	1164	119X	117.20	1143	1206
35Y	109.85	1059	1122	77Y	113.05	1101	1038	119Y	117.25	1143	1080
36X	109.90	1060	997	78X	113.10	1102	1165	120X	117.30	1144	1207
36Y	109.95	1060	1123	78Y	113.15	1102	1039	120Y	117.35	1144	1081

DME Channel Frequencies

Ch. No.	VOR Freq.	DME Interrog. Freq.	DME Reply Freq.	Ch. No.	VOR Freq.	DME Interrog. Freq.	DME Reply Freq.	Ch. No.	VOR Freq.	DME Interrog. Freq.	DME Reply Freq.
37X	110.00	1061	998	79X	113.20	1103	1166	121X	117.40	1145	1208
37Y	110.05	1061	1124	79Y	113.25	1103	1040	121Y	117.45	1145	1082
38X	110.10	1062	999	80X	113.30	1104	1167	122X	117.50	1146	1209
38Y	110.15	1062	1125	80Y	113.35	1104	1041	122Y	117.55	1146	1083
39X	110.20	1063	1000	81X	113.40	1105	1168	123X	117.60	1147	1210
39Y	110.25	1063	1126	81Y	113.45	1105	1042	123Y	117.65	1147	1084
40X	110.30	1064	1001	82X	113.50	1106	1169	124X	117.70	1148	1211
40Y	110.35	1064	1127	82Y	113.55	1106	1043	124Y	117.75	1148	1085
41X	110.40	1065	1002	83X	113.60	1107	1170	125X	117.80	1149	1212
41Y	110.45	1065	1128	83Y	113.65	1107	1044	125Y	117.85	1149	1086
42X	110.50	1066	1003	84X	113.70	1108	1171	126X	117.90	1150	1213
42Y	110.55	1066	1129	84Y	113.75	1108	1045	126Y	117.95	1150	1087

C Default Settings

In the following chapter the standard default settings for the Avionic standards are listed. The preset value of each parameter is specified also in the description of the corresponding remote command.

C.1 GBAS

The default settings for the GBAS standard are:

Parameter	Value
State	Not affected by "Set to Default"
Filter, Clipping	Cosine, Clipping Off
Trigger	Internal, Auto
Clock	Internal
Multiple Frequency Channels	Off
Sample Rate	10.5 KHz

C.2 ILS

The default settings for the ILS standard are:

Table C-1: Glide slope default settings

Parameter	Value
State	Not affected by Set to default
Sum of Depth	80 Percent
Fly	Up
DDM	0
Mode	Norm
Up Frequency	90 Hz
Down Frequency	150 Hz
Up/Down Phase	0 deg
COM/ID State	Off
COM/ID Frequency	1020 kHz
COM/ID Depth	10 percent

Table C-2: Localizer default settings

Parameter	Value
State	Not affected by Set to default
Sum of Depth	40 Percent
Fly	Up
DDM	0
Mode	Norm
Left frequency	90 Hz
Right Frequency	150 Hz
Left/Right Phase	0 deg
COM/ID State	Off
COM/ID Frequency	1020 kHz
COM/ID Period	9 s
COM/ID Depth	10 percent

Table C-3: Marker Beacon default settings

Parameter	Value
State	Not affected by Set to default
Marker frequency	400 Hz
Marker Depth	95 %
COM/ID State	Off
COM/ID Frequency	1020 kHz
COM/ID Period	9 s
COM/ID Depth	10 percent
Rf frequency	75 MHz

C.3 DME

The default settings for the DME standard are:

Table C-4: Default settings for the DME standard

Parameter	Value
General Parameters	
State	Not affected by Set to default
DME Mode	Interrogation
Signal Settings	

Parameter	Value
Channel Mode	X Channel
Carrier Frequency	1.025 000 000 000 GHz
Pulse Squitter	Off
Pulse Repetition Rate	48 Hz
Pulse Settings	
Pulse Shape	Cos ²
Pulse Rise	2.00 μs
Pulse Width	3.50 μs
Pulse Fall	2.00 μs
Pulse Spacing	12.00 μs
Single Pulse	Off
Receive Settings	
Pulse Pair Spacing Tolerance	1.00 μs

C.4 VOR

The default settings for the VOR standard are:

Table C-5: VOR default settings

Parameter	Value
State	Not affected by Set to default
Carrier Frequency Mode	User Defined
Carrier Frequency	108.000 000 000 MHz
Mode	Norm
VAR/REF Frequency	30.0 Hz
VAR Depth	30.0 %
Subcarrier Frequency	9.960 0 kHz
Subcarrier Depth	30. 0%
REF Deviation	480 Hz
Bearing Angle	0.00 deg
Direction	From
COM/ID State	Off

D Supported File Formats

The R&S SMBV supports the following file formats:

- Waypoint files, see [Chapter D.1, "Waypoint File Format"](#), on page 218.
- Files with GBAS differential data, see [Chapter D.2, "GBAS Differential File Format"](#), on page 218.
- Files with SCAT-I differential data, see [Chapter D.3, "SCAT-I Differential File Format"](#), on page 220.

These files use predefined file extensions and file structure.

D.1 Waypoint File Format

The waypoint files use the file extension `*.txt`. The file format is a list of coordinates (longitude, latitude, altitude) and a respective resolution in milliseconds (see [Example "Contents of the predefined waypoint file Braunschweig.txt"](#) on page 218).

Example: Contents of the predefined waypoint file Braunschweig.txt

The resolution command at the beginning of the format specifies the sampling interval to be used for the WGS84 geodetic coordinates list. The resolution gives the time (in ms) between two consecutive waypoints.

```
RESOLUTION: 10000
10.48270840370976, 52.32054084253119, 1200
10.48782531447518, 52.32057768227161, 1100
10.49064540739393, 52.32038679250167, 1000
10.49541991083499, 52.32019512664971, 900
10.50027587576012, 52.32000536916035, 800
10.50535314978533, 52.3200431506525, 700
10.50926768002483, 52.32002989881414, 600
10.51213496693413, 52.31984142364868, 500
10.51596247360969, 52.31963813345246, 400
10.52023872584375, 52.31964325051492, 300
10.52435479286515, 52.31930292486343, 200
10.52746875803649, 52.31913528562811, 100
```

D.2 GBAS Differential File Format

The GBAS differential files are proprietary files with file extension `*.rs_gbas`. The file contains the required information for message type 1, as defined in the GBAS specification [RTCA DO-246D](#).

See [Example "Contents of the predefined GBAS differential file Correction1.rs_gbas"](#) on page 219 for an example of the file format.

Example: Contents of the predefined GBAS differential file Correction1.rs_gbas

```

<reference1>
  <general>
    <property refcoord="11.5833,48.15,110"/>
  </general>
  <dgnsrecord>
    <property modifiedzcount="215.1"/>
    <property measurementtype="0"/>
    <property ephemeriscrc="0xECF0"/>
    <dgnsvector data="G1,4,311.49,-1.20"/>
    <dgnsvector data="G3,16,81.6,3.41"/>
    <dgnsvector data="G4,110,65,-1.1"/>
    <dgnsvector data="G10,21,6.31,-0.51"/>
    <dgnsvector data="R6,61,5.85,-0.41"/>
    <dgnsvector data="S125,126,212.15,9.41"/>
  </dgnsrecord>
  <dgnsrecord>
    <property modifiedzcount="225.1"/>
    <property measurementtype="0"/>
    <property ephemeriscrc="0xEFF0"/>
    <dgnsvector data="G1,4,311.49,-1.20"/>
    <dgnsvector data="G3,16,81.6,3.41"/>
    <dgnsvector data="G4,110,65,-1.1"/>
    <dgnsvector data="G10,21,6.31,-0.51"/>
    <dgnsvector data="R6,61,5.85,-0.41"/>
    <dgnsvector data="S125,126,212.15,9.41"/>
  </dgnsrecord>
  <dgnsrecord>
    <property modifiedzcount="235.1"/>
    <property measurementtype="0"/>
    <property ephemeriscrc="0xBCF0"/>
    <dgnsvector data="G1,4,311.49,-1.20"/>
    <dgnsvector data="G3,16,81.6,3.41"/>
    <dgnsvector data="G4,110,65,-1.1"/>
    <dgnsvector data="G10,21,6.31,-0.51"/>
    <dgnsvector data="R6,61,5.85,-0.41"/>
    <dgnsvector data="S125,126,212.15,9.41"/>
  </dgnsrecord>
</reference1>

```

The [Format of *.rs_gbas file](#) describes the used tags and parameters.

Table D-1: Format of *.rs_gbas file

Container	Tag name	Parameter	Description
<reference1>			
<general>			
	<property>	<refcoord>	longitude, latitude and altitude of the reference point
<dgnsrecord>	one <dgnsrecord> per measurements		

Container	Tag name	Parameter	Description
	<property>	<modifiedzcount>	modified z-count for the record (s)
		<measurementtype>	measurement type
		<ephemeriscrc>	ephemeris CRC
	<dgncssvector>	<data>	One <dgncssvector> per each of the N measurement blocks: <GNSS_Standard><SVID>,<Issue of Data (IOD)>,<Pseudorange Correction (PRC) in (m)>,<Range Rate Correction (RRC) in (m/s)>,<Sigma_pr_gnd (SPR)>,<B1>,<B2>,<B3>,<B4> GNSS_Standard=G for GPS, R for Glonass and S for SBAS

D.3 SCAT-I Differential File Format

The SCAT-I differential files are proprietary files with file extension *.rs_scatt. The file contains the required information for message type 1, as defined in the GBAS specification [RTCA DO-246D](#).

See [Contents of the predefined SCAT-I differential file Correction2.rs_scatt](#) for an example of the file format.

Example: Contents of the predefined SCAT-I differential file Correction2.rs_scatt

```
<reference1>
  <general>
    <property refcoord="89.9908,35.0495,500"></property>
  </general>
  <dgncssrecord>
    <property modifiedzcount="606.0"></property>
    <dgncssvector data="G1,188,-4.89,-0.000"></dgncssvector>
    <dgncssvector data="G7,188,-3.68,-0.000"></dgncssvector>
    <dgncssvector data="G8,188,-5.42,0.002"></dgncssvector>
    <dgncssvector data="G9,188,-5.63,-0.002"></dgncssvector>
    <dgncssvector data="G11,188,-6.89,-0.002"></dgncssvector>
    <dgncssvector data="G13,188,-7.62,-0.002"></dgncssvector>
    <dgncssvector data="G16,188,-5.21,0.002"></dgncssvector>
    <dgncssvector data="G21,188,-5.37,0.002"></dgncssvector>
    <dgncssvector data="G26,188,-7.43,-0.002"></dgncssvector>
    <dgncssvector data="G28,188,-4.21,0.000"></dgncssvector>
    <dgncssvector data="G29,188,-6.44,0.002"></dgncssvector>
    <dgncssvector data="G31,188,-4.43,0.000"></dgncssvector>
  </dgncssrecord>
</reference1>
```

The [Format of *.rs_scatt file](#) describes the used tags and parameters.

Table D-2: Format of *.rs_scat file

Container	Tag name	Parameter	Description
<reference1>			
<general>			
	<property>	<refcoord>	longitude, latitude and altitude of the reference point
<dgnsrecord>			one <dgnsrecord> per measurements
	<property>	<modifiedzcount>	modified z-count for the record (s)
	<dgnsvector>	<data>	One <dgnsvector> per each of the N measurement blocks: <GNSS_Standard><SVID>,<Issue of Data (IOD)>,<Pseudorange Correction (PRC) in (m)>,<Range Rate Correction (RRC) in (m/s)> ,<Sigma_pr_gnd (SPR)>,<B1>,<B2>,<B3>,<B4> GNSS_Standard=G for GPS, R for Glonass and S for SBAS

Glossary: Specifications and References

Symbols

1MA193: 1MA193_0e Application Note, "Aeronautical radio navigation measurement solutions"

R

RTCA DO-246D: "GNSS-Based Precision Approach Local Area Augmentation System (LAAS) Signal-in-Space Interface Control Document (ICD)"

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