

# R&S®SMBVB-K111

## GBAS

### User Manual



1178934902  
Version 08

**ROHDE & SCHWARZ**  
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This document describes the following software option:

- R&S®SMBVB-K111 GBAS (1423.8020.02)

This manual describes firmware version FW 5.30.047.xx and later of the R&S®SMBV100B.

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The following abbreviations are used throughout this manual: R&S®SMBV100B is indicated as R&S SMBVB, R&S®WinIQSIM2™ is abbreviated as R&S WinIQSIM2; the license types 02/03/07/11/13/16/12 are abbreviated as xx.

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# 1 Welcome to the GBAS option

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

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

All functions not discussed in this manual are the same as in the base unit and are described in the R&S SMBV100B user manual. The latest version is available at:

[www.rohde-schwarz.com/manual/SMBV100B](http://www.rohde-schwarz.com/manual/SMBV100B)

## Installation

You can find detailed installation instructions in the delivery of the option or in the R&S SMBV100B service manual.

## 1.1 Key features

The R&S SMBVB-K111 features

- 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 multi-frequency transmission (up to 11 frequency channels simultaneously), for example for adjacent channel emissions measurements
- **Support of GBAS mode:**
  - Configuration of local area augmentation system (LAAS) message blocks
  - 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 (DGNSS) data (message type 1 and 11)
  - Encoding, timing and power settings according to the specification [RTCA DO-246D](#)
- **Support of SCAT-I mode:**
  - Configuration of special category (SCAT-I) message blocks
  - Configuration of GBAS application data, for example the parameters of message type 4, incl. the Final Approach Segment (FAS) data definition data
  - Import of differential global navigation satellite system (DGNSS) data (message type 1 and 11)
  - Encoding, timing and power settings according to the specification [RTCA DO-217](#)

## 1.2 Accessing the GBAS dialog

### To open the dialog with GBAS settings

- ▶ In the block diagram of the R&S SMBV100B, select "Baseband > GBAS".

A dialog box opens that displays the provided general settings.

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

## 1.3 What's new

This manual describes firmware version FW 5.30.047.xx and later of the R&S®SMBV100B.

Compared to the previous version, it provides the new features listed below:

- Time-based triggering, see "[Time Based Trigger](#)" on page 55 and "[Trigger Time](#)" on page 55.
- Editorial changes

## 1.4 Documentation overview

This section provides an overview of the R&S SMBV100B user documentation. Unless specified otherwise, you find the documents at:

[www.rohde-schwarz.com/manual/smbv100b](http://www.rohde-schwarz.com/manual/smbv100b)

### 1.4.1 Getting started manual

Introduces the R&S SMBV100B 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.

### 1.4.2 User manuals and help

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

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

- **Software option manual**  
Contains the description of the specific functions of an option. Basic information on operating the R&S SMBV100B is not included.

The contents of the user manuals are available as help in the R&S SMBV100B. 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.

### 1.4.3 Service manual

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

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

<https://gloris.rohde-schwarz.com>

### 1.4.4 Instrument security procedures

Deals with security issues when working with the R&S SMBV100B in secure areas. It is available for download on the internet.

### 1.4.5 Printed safety instructions

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

### 1.4.6 Data sheets and brochures

The data sheet contains the technical specifications of the R&S SMBV100B. 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/smbv100b](http://www.rohde-schwarz.com/brochure-datasheet/smbv100b)

### 1.4.7 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 software makes use of several valuable open source software packages. An open-source acknowledgment document provides verbatim license texts of the used open source software.

See [www.rohde-schwarz.com/firmware/smbv100b](http://www.rohde-schwarz.com/firmware/smbv100b)

### 1.4.8 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/smbv100b](http://www.rohde-schwarz.com/application/smbv100b)

### 1.4.9 Videos

Find various videos on Rohde & Schwarz products and test and measurement topics on YouTube: <https://www.youtube.com/@RohdeundSchwarz>



On the menu bar, search for your product to find related videos.

HOME VIDEOS SHORTS PLAYLISTS COMMUNITY CHANNELS ABOUT

Figure 1-1: Product search on YouTube

## 1.5 Scope



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

In particular, it includes:

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

For a description of such tasks, see the R&S SMBV100B user manual.



## 1.6 Notes on screenshots

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

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

## 2 About the GBAS option

### 2.1 Required options

The equipment layout for generating GBAS signals includes the options:

- Base unit
- Digital standard GBAS (R&S SMBVB-K111)
- Baseband real-time extension (R&S SMBVB-B520)
- Frequency option (e.g. R&S SMBVB-B103)

### 2.2 About GBAS

The R&S SMBVB-K111 option enables you to define and configure the very high frequency (VHF) Data Broadcast (VDB) Signal-in-Space signal. VDB signals are 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.

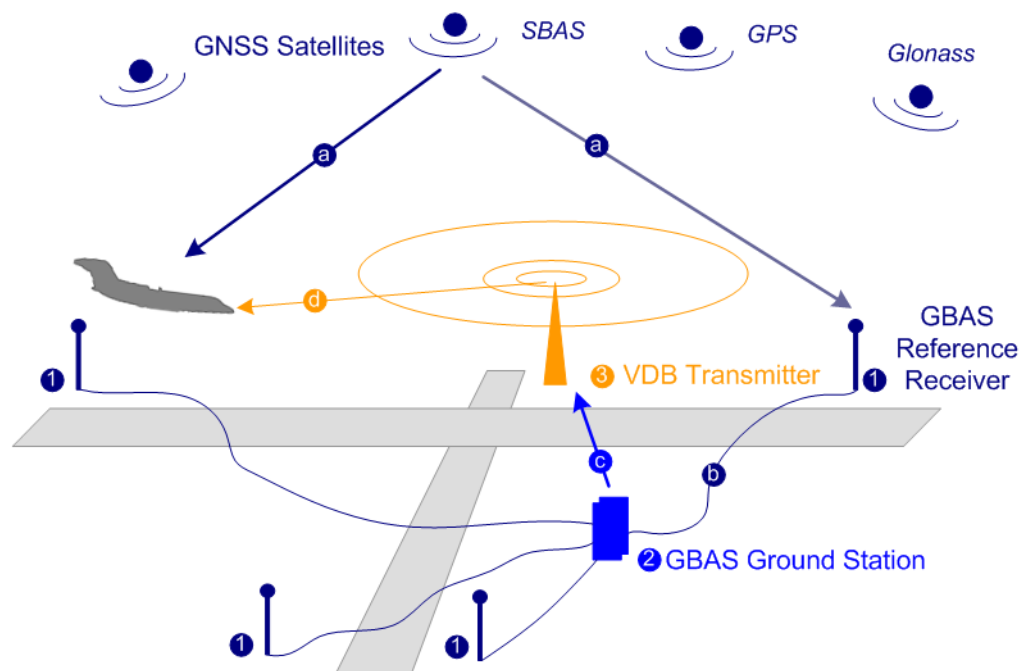
The GBAS is a ground-based augmentation system that could among other things enhance satellite navigation to provide a position estimation of less than 1 meter. The GBAS is intended to improve aircraft safety and to enhance satellite navigation and the full range of precision approach and landing procedures, 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 in [Figure 2-1](#) is a simplified representation of the GBAS three main components:

- The GNSS satellite subsystem
- 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 2-1: 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 SMBV100B 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.

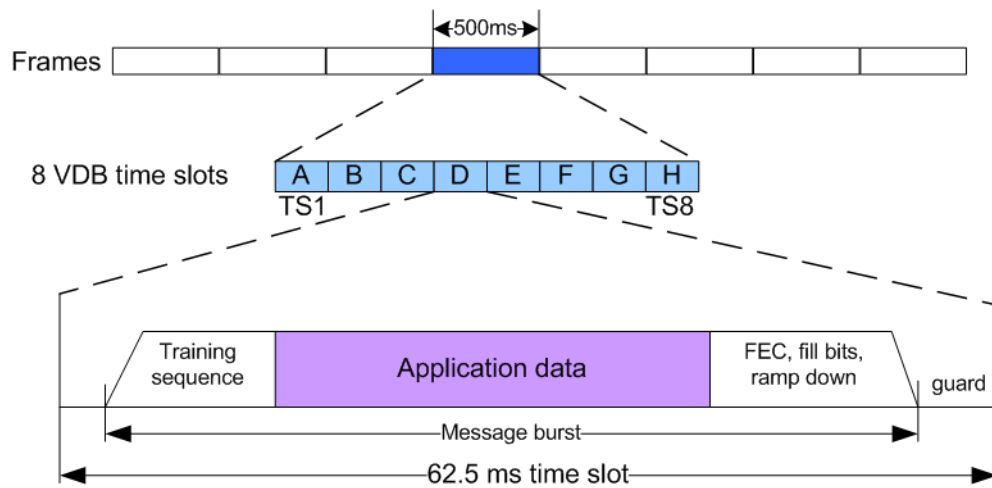
	GBAS ID	FN -5	FN -4	FN -3	FN -2	FN -1	FN 0	FN 1	FN 2	FN 3	FN 4	FN 5
Scheduling												
VDB1 >	TR0											

- Multi-frequency** 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.

	GBAS ID	FN -5	FN -4	FN -3	FN -2	FN -1	FN 0	FN 1	FN 2	FN 3	FN 4	FN 5
Scheduling												
VDB1	TR0											
VDB2	TR1											
VDB3	TR2											
VDB4	TR3											
VDB5	TR4											
VDB6	TR5											
VDB7	TR6											
VDB8	TR7											

**Broadcast timing structure**

The broadcast is a Time Division Multiple Access (TDMA). According to the GBAS specification [RTCA DO-246D](#), 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 2-2](#).



**Figure 2-2: 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 SMBV100B 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 3.4.2, "Scheduling settings"](#), on page 46.

Refer to [Figure 2-3](#) for illustration on how a multi-frequency TDMA scheduling is performed in this implementation.

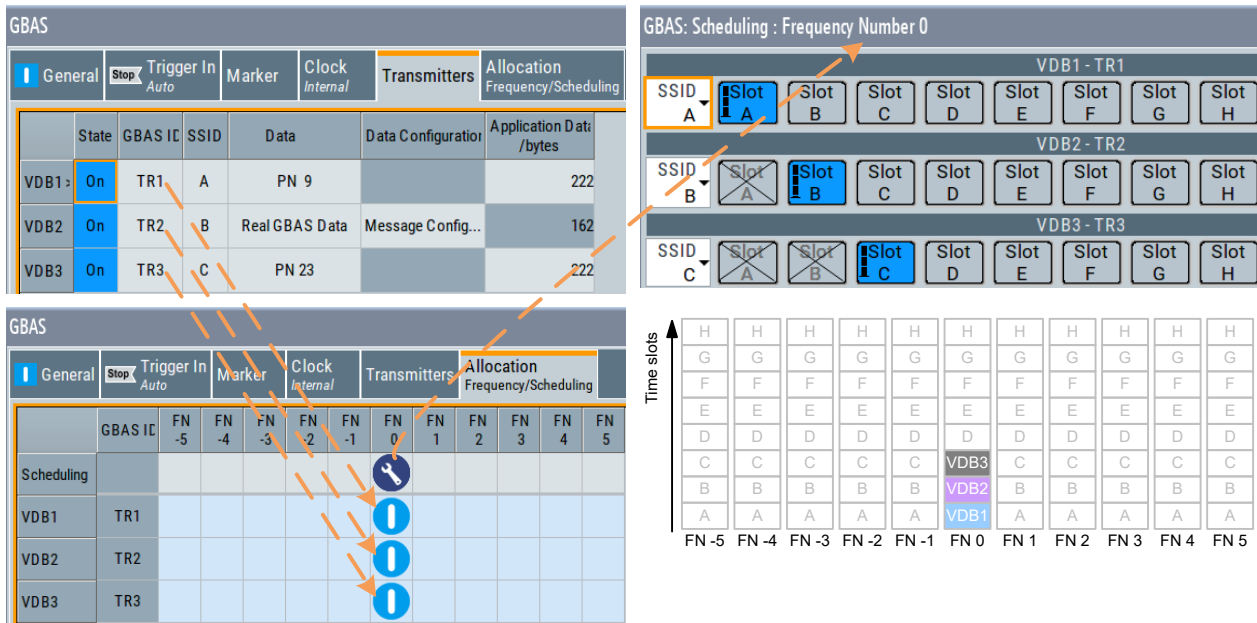


Figure 2-3: Example of a multi-frequency TDMA scheduling

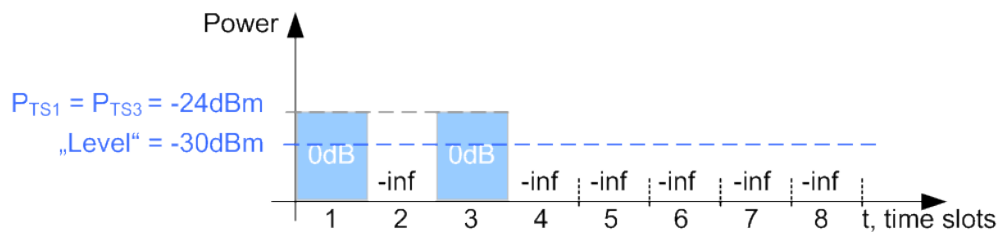
### Power settings

In the R&S SMBV100B, 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** ("GBAS > Allocation > VDB# > Scheduling > Slot A to H > Power")  
Sets the relative power of a VDB per time slot (Slot A to H).
- **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 15 and [Example"Calculating the power per time slot in "Gated Power Mode > On"](#) on page 15 for explanation on how the parameter "Gated Power Mode" influence the calculation.

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

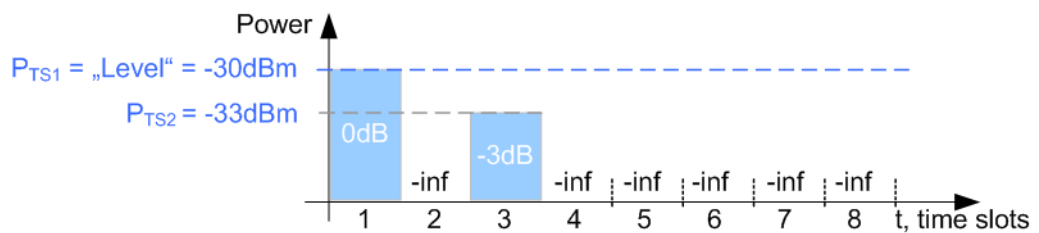
- "Level = - 30 dBm"
- "TS1 > State > On", relative power "TS1 > Pow(dB) = 0 dB"
- "TS3 > State > On", relative power "TS3 > Pow(dB) = 0 dB"
- "TS2/TS4/TS5/TS6/TS7/TS8 > State > Off"  
"TS2/TS4/TS5/TS6/TS7/TS8 > Pow(dB) = -inf"



The absolute power of both scheduled time slots is  $P_{TS1} = P_{TS3} = -24$  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:

- $P_{TS1} = -30$  dBm
- $P_{TS3} = -33$  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 2-1](#) for information on where to find the related settings.

**Table 2-1: Overview of the required message types**

Message type	Description	Related settings
1	Differential corrections 100 sec smoothed pseudoranges	<a href="#">Chapter 3.3.1, "Message type 1 &amp; 11 settings"</a> , on page 22
2	GBAS-related data	<a href="#">Chapter 3.3.2, "Message type 2 settings"</a> , on page 24

Message type	Description	Related settings
4	Final Approach Segment (FAS) construction data	<a href="#">Chapter 3.3.3.2, "FAS data settings"</a> , on page 34
	Terminal Area Path (TAP) construction data	<a href="#">Chapter 3.3.3.3, "TAP data settings"</a> , on page 37
11	Differential corrections 30 sec smoothed pseudoranges	<a href="#">Chapter 3.3.1, "Message type 1 &amp; 11 settings"</a> , on page 22



#### 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 and measurements on conventional ILS ground systems and VOR systems.



## 3 GBAS configuration and settings

Access:

- ▶ Select "Baseband > GBAS".

The remote commands required to define these settings are described in [Chapter 6](#), "Remote-control commands", on page 63.

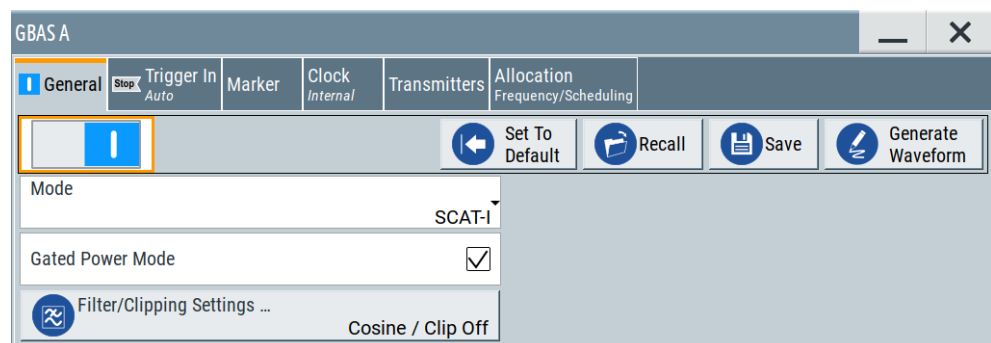
Settings:

- [General settings](#)..... 17
- [Transmitter settings](#).....20
- [Message configuration settings](#).....22
- [Allocation and frequency/scheduling settings](#)..... 44

### 3.1 General settings

Access:

- ▶ Select "Baseband > GBAS > General".



The dialog provides access to the default, "Save/Recall" settings, general GBAS settings and access to dialogs with further settings.

Settings:

- [State](#)..... 17
- [Set to Default](#)..... 18
- [Save/Recall](#)..... 18
- [Generate Waveform](#)..... 18
- [Mode](#)..... 19
- [Gated Power Mode](#)..... 19
- [Filter/Clipping Settings](#)..... 19

**State**

Activates the GBAS standard.

Activation of the standard disables all the other digital standards and digital modulation modes in the same baseband.

Remote command:

[\[:SOURce<hw>\]:BB:GBAS:STATe](#) on page 72

### Set to Default

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

Parameter	Value
State	Not affected by the "Set to Default"
Mode	GBAS
Gated Power Mode	On
Sample Rate Variation	10.5 kHz
Filter	Cosine
Clipping	Off
Trigger	Auto
Clock	Internal

Remote command:

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

### Save/Recall

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

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

See also, chapter "File and Data Management" in the R&S SMBV100B user manual.

Remote command:

[\[:SOURce<hw>\]:BB:GBAS:SETTing:CATalog?](#) on page 70

[\[:SOURce<hw>\]:BB:GBAS:SETTing:DELeTe](#) on page 71

[\[:SOURce<hw>\]:BB:GBAS:SETTing:LOAD](#) on page 71

[\[:SOURce<hw>\]:BB:GBAS:SETTing:STORe](#) on page 71

### Generate Waveform

With enabled signal generation, triggers the instrument to save the current settings of an arbitrary waveform signal in a waveform file with predefined extension \*.wv. You can define the filename and the directory, in that you want to save the file.

Using the ARB modulation source, you can play back waveform files and/or process the file to generate multi-carrier or multi-segment signals.

Remote command:

[\[:SOURce<hw>\]:BB:GBAS:WAVeform:CREate](#) on page 72

**Mode**

Enables header information for the set GBAS mode, i.e. the corresponding landing system.

The modulation and TDMA schemes of both systems are identical. [Table 3-1](#) lists the set header bytes for each landing system.

**Table 3-1: Header start byte**

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

"GBAS" Enables GBAS (LAAS) header information conforming with specification [RTCA DO-246D](#).

"SCAT-I" Enables SCAT-I header information conforming with specification [RTCA DO-217](#).

Remote command:

[ :SOURce<hw> ] :BB:GBAS:MODE on page 70

**Gated Power Mode**

Activates gated power mode, see ["Power settings"](#) on page 14.

Remote command:

[ :SOURce<hw> ] :BB:GBAS:GPOW on page 69

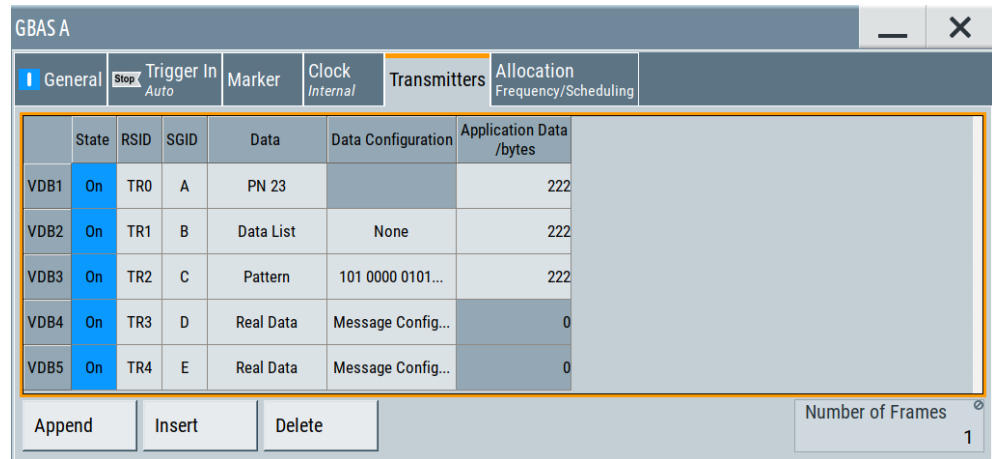
**Filter/Clipping Settings...**

Accesses the dialog for setting baseband filtering, clipping and modulation, see [Chapter 4.1, "Filter/clipping settings"](#), on page 50.

## 3.2 Transmitter settings

Access:

- ▶ Select "GBAS > Transmitters".



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

### Settings

State.....	20
GBAS ID.....	20
SSID.....	21
Data/Data Configuration.....	21
App. Data Length/bytes.....	21
Number of Frames.....	22
Append, Insert, Delete.....	22

### State

Enables the selected VHF Data Broadcast (VDB) transmitter.

Remote command:

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:STATe on page 74

### GBAS ID

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".

To identify a ground station, the airborne receiver examines the combination of the GBAS ID and the **SSID**.

Remote command:

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:GID on page 74

**SSID**

Sets the station slot identifier SSID/RSID of the ground station.

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](#) and the SSID.

Remote command:

`[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:SSID` on page 74

**Data/Data Configuration**

Selects 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:

- Section "Modulation Data" in the R&S SMBV100B user manual.
- Section "File and Data Management" in the R&S SMBV100B user manual.
- Section "Data List Editor" in the R&S SMBV100B user manual

**"Real GBAS Data"**

Enables you to configure the content of the GBAS messages.

Select "Data Config > Message Config..." to access the provided settings.

Remote command:

`[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:DATA` on page 75

`[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:DATA:DSElection` on page 75

`[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:DATA:PATtern` on page 76

**App. Data Length/bytes**

Sets the application data length.

For "Data/Data Configuration > 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 75

### Number of Frames

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

Remote command:

[ :SOURce<hw> ] :BB:GBAS:NOFRames? on page 73

### 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 73

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

Remote command:

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:INSert on page 73

"Delete" Deletes the selected row.

Remote command:

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:DELete on page 73

## 3.3 Message configuration settings

Access:

1. Select "GBAS > Transmitters".
2. Select "VDB# > Data > Real Data".
3. Select "Data Configuration > Message Config...".

The dialog "VDB#: Message Configuration" provides settings to configure message types 1, 2, 4 and 11.

### Settings

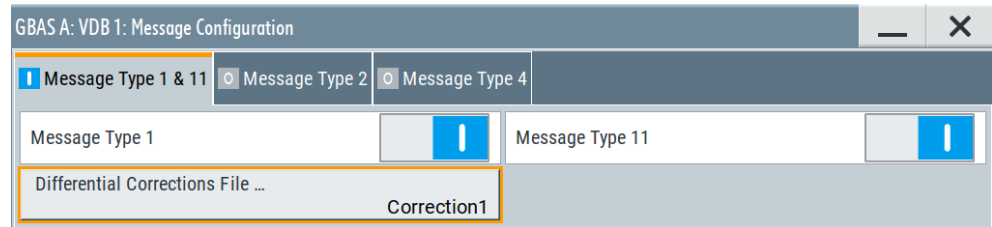
- [Message type 1 & 11 settings](#)..... 22
- [Message type 2 settings](#)..... 24
- [Message type 4 settings](#)..... 32

### 3.3.1 Message type 1 & 11 settings

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.

Access:

1. Select "Data Configuration > Message Config...", see [Chapter 3.3, "Message configuration settings"](#), on page 22.
2. Select "VDB#: Message Configuration > Message Type 1 & 11"



The dialog provides settings to manage GBAS differential data.

For step-by-step description on how to load GBAS differential data, see [Chapter 5.1, "Loading differential GBAS data"](#), on page 62.

## Settings

<a href="#">Message Type 1</a> .....	23
<a href="#">Message Type 11</a> .....	23
<a href="#">Differential Corrections File ...</a> .....	23
<a href="#">Predefined Files</a> .....	24

### Message Type 1

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

Remote command:

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:DG:M1State` on page 79

### Message Type 11

Activates 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 79

### Differential Corrections File ...

Accesses the "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 A.2, "GBAS differential file format"](#), on page 118.

The differential SCAT-I file must have the extension `*.rs_scat` and file format as described in [Chapter A.3, "SCAT-I differential file format"](#), on page 121.

Select "Predefined Files" to load a predefined file.

Remote command:

For "Mode > GBAS":

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:DG:FILE?` on page 82

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:DG:USER:CATalog?` on page 81

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:DG:USER:FILE` on page 81

For "Mode > SCAT-I":

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:DG:SFILE? on page 82

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:DG:SUSer:CATalog on page 81

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:DG:SUSer:FILE on page 80

### Predefined Files

Accesses a list with predefined files.

Remote command:

For "Mode > GBAS":

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:DG:PREDefined:CATalog? on page 81

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:DG:PREDefined:FILE on page 81

For "Mode > SCAT-I":

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:DG:SPReDefined:CATalog on page 81

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:DG:SPReDefined:FILE on page 80

For waypoint files:

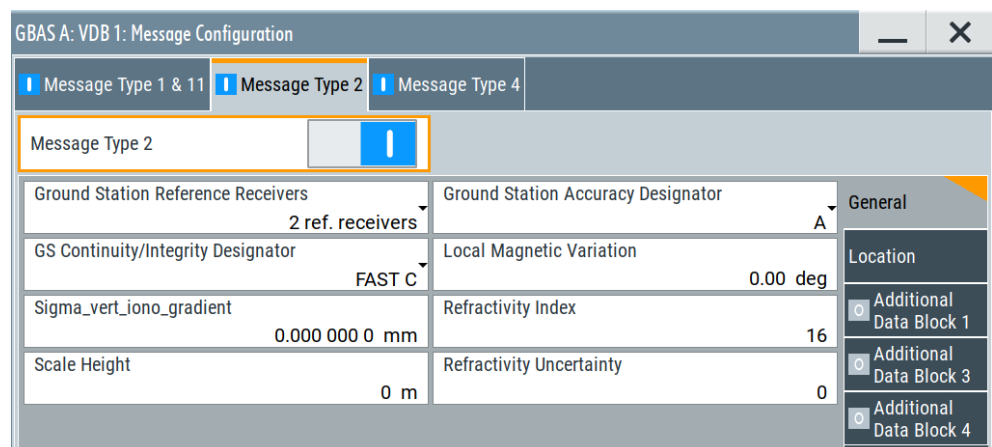
[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:WAYPoint:PREDefined:CATalog? on page 106

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:WAYPoint:PREDefined:FILE on page 106

## 3.3.2 Message type 2 settings

Access:

1. Select "Data Configuration > Message Config...", see [Chapter 3.3, "Message configuration settings"](#), on page 22.
2. Select "VDB#: Message Configuration > Message Type 2"





The dialog provides settings to configure message type 2 parameters according to RTCA DO-246D, Table 2.14.

Message type 2 carries information on the exact location and other GBAS-related parameters.

### Settings

• <a href="#">General settings</a> .....	25
• <a href="#">Location settings</a> .....	27
• <a href="#">Additional data block 1 settings</a> .....	28
• <a href="#">Additional data block 3 settings</a> .....	30
• <a href="#">Additional data block 4 settings</a> .....	31

#### 3.3.2.1 General settings

Access:

1. Select "VDB#: Message Configuration > Message Type 2 > General Settings".
2. Select "Message Type 2 > On"

The dialog provides general settings to configure message type 2 parameter according to RTCA DO-246D, Table 2.14.

### Settings

<a href="#">Message Type 2</a> .....	25
<a href="#">Ground Station Reference Receivers</a> .....	25
<a href="#">Ground Station Accuracy Designator</a> .....	26
<a href="#">GS Continuity/Integrity Designator</a> .....	26
<a href="#">Local Magnetic Variation</a> .....	26
<a href="#">Sigma_vert_iono_gradient</a> .....	26
<a href="#">Refractivity Index</a> .....	26
<a href="#">Scale Height</a> .....	26
<a href="#">Refractivity Uncertainty</a> .....	26

### 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 83

### 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 84

**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 84

**GS 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 84

**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 85

**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 86

**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 85

**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 86

**Refractivity Uncertainty**

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

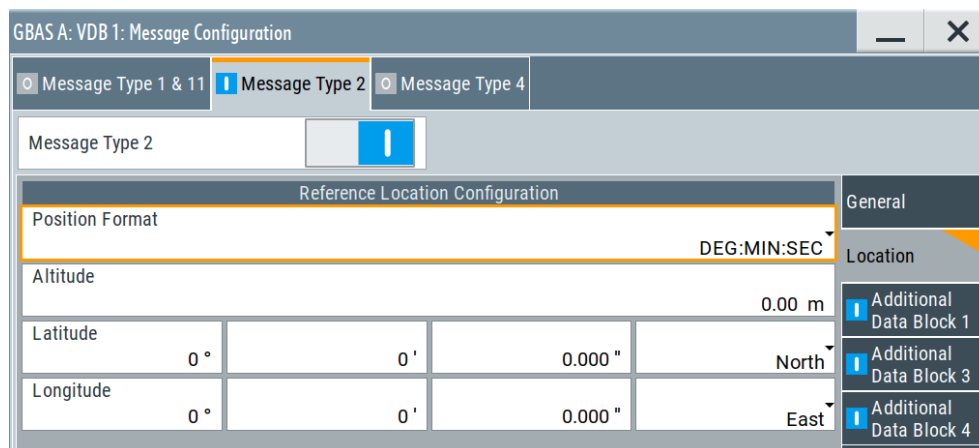
Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:RUNCertainty](#) on page 85

### 3.3.2.2 Location settings

Access:

- ▶ Select "VDB#: Message Configuration > Message Type 2 > Location Settings".



The dialog provides location settings to configure message type 2 parameter according to [RTCA DO-246D](#), Table 2.14.

#### Settings

[Reference Location Configuration](#).....27

#### 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 3-2: Reference location configuration**

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

Remote command:

To specify the position format:

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:LOCation:COORDinates:FORMat on page 90

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

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:LOCation:COORDinates:DMS on page 89

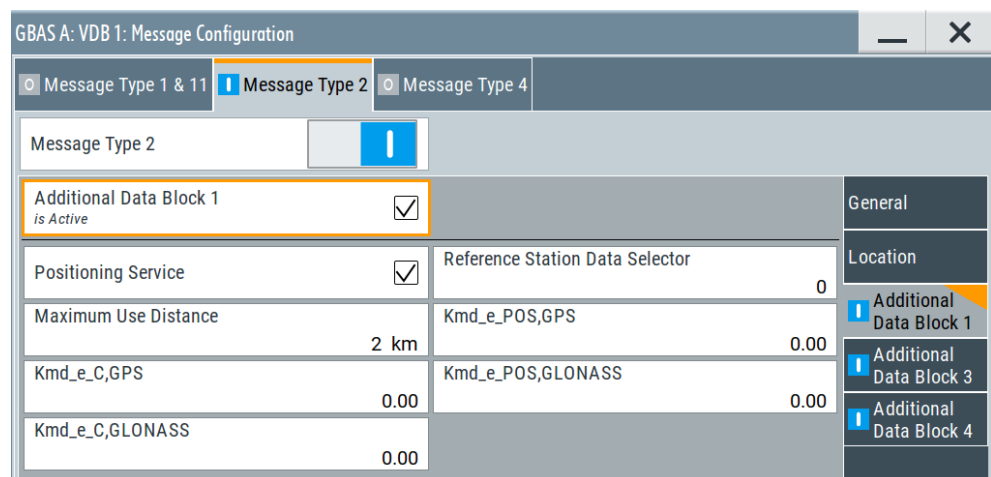
To enter the coordinates in decimal degree format

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:LOCation:COORDinates:DECimal on page 89

### 3.3.2.3 Additional data block 1 settings

Access:

- ▶ Select "VDB#: Message Configuration > Message Type 2 > Additional Data Block 1".



The dialog provides additional data block 1 settings to configure message type 2 parameter according to RTCA DO-246D, Table 2.14.

#### Settings

Additional Data Block 1.....	28
Positioning Service.....	29
Reference Station Data Selector.....	29
Maximum User Distance.....	29
Kmd_e_C,GPS/Kmd_e_C,GLONASS.....	29
Kmd_e_POS,GPS/Kmd_e_POS,GLONASS.....	29

#### 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 83

**Positioning Service**

Selects if the GBAS positioning service is supported.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:PSERvice:STATe](#) on page 87

**Reference Station Data Selector**

Requires "Positioning Service > On".

Sets the numerical identifier for selecting the ground subsystem.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:RSDSelector](#) on page 87

**Maximum User Distance**

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 87

**Kmd\_e\_C,GPS/Kmd\_e\_C,GLONASS**

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 86

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:KCGPs](#) on page 86

**Kmd\_e\_POS,GPS/Kmd\_e\_POS,GLONASS**

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:

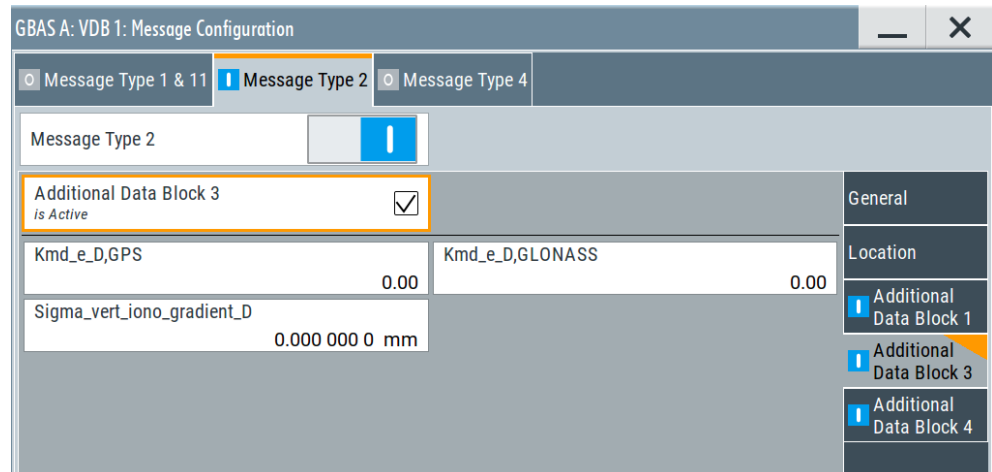
[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:KPGLonass](#) on page 87

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:KPGPs](#) on page 87

### 3.3.2.4 Additional data block 3 settings

Access:

- ▶ Select "VDB#: Message Configuration > Message Type 2 > Additional Data Block 3".



The dialog provides additional data block 3 settings to configure message type 2 parameter according to [RTCA DO-246D](#), Table 2.14.

#### Settings

<a href="#">Additional Data Block 3</a> .....	30
<a href="#">Kmd_e_D,GPS/Kmd_e_D,GLONASS</a> .....	30
<a href="#">Sigma_vert_iono_gradient_D</a> .....	30

#### Additional Data Block 3

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

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:ADB3:STATE](#) on page 83

#### Kmd\_e\_D,GPS/Kmd\_e\_D,GLONASS

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 88

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:KDGPs](#) on page 88

#### Sigma\_vert\_iono\_gradient\_D

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

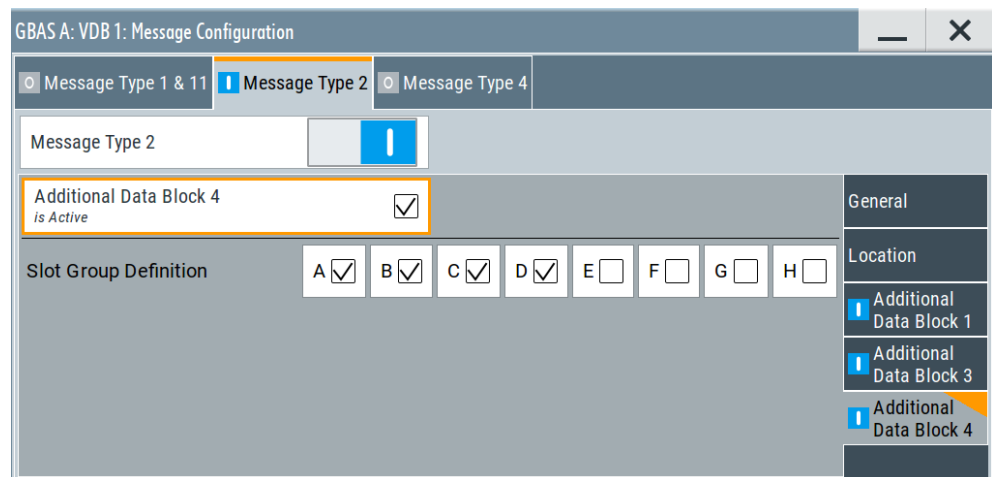
Remote command:

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:SVID on page 88

### 3.3.2.5 Additional data block 4 settings

Access:

- ▶ Select "VDB#: Message Configuration > Message Type 2 > Additional Data Block 4".



The dialog provides additional data block 4 settings to configure message type 2 parameter according to [RTCA DO-246D](#), Table 2.14.

#### Settings

<a href="#">Additional Data Block 4</a> .....	31
<a href="#">Slot Group Definition</a> .....	31

#### Additional Data Block 4

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

Remote command:

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:ADB4:STATe on page 84

#### Slot Group Definition

Specifies which slots are used by the ground station. You can activate slots "A" to "H".

Remote command:

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:SGDefinition:A:STATe  
on page 88

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:SGDefinition:B:STATe  
on page 88

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:SGDefinition:C:STATe  
on page 88

[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:SGDefinition:D:STATE  
on page 88

[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:SGDefinition:E:STATE  
on page 88

[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:SGDefinition:F:STATE  
on page 88

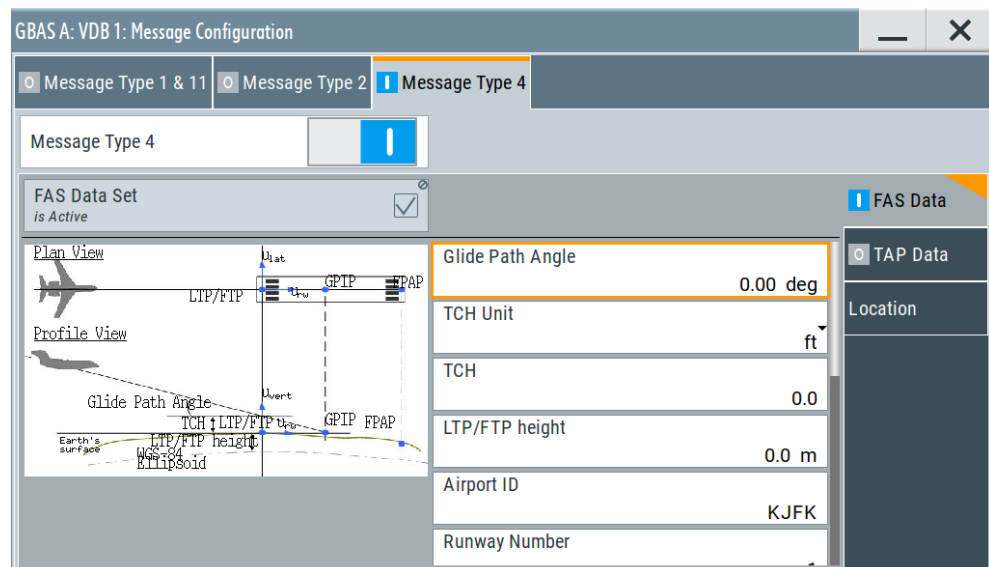
[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:SGDefinition:G:STATE  
on page 89

[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:SGDefinition:H:STATE  
on page 89

### 3.3.3 Message type 4 settings

Access:

1. Select "Data Config > Message Config...", see [Chapter 3.3, "Message configuration settings"](#), on page 22.
2. Select "VDB#: Message Configuration > Message Type 4"



The dialog provides settings to configure message type 4 parameters.

For "Mode > GBAS", the settings conform with specification [RTCA DO-246D](#).

For "Mode > SCAT-I", the settings conform with specification [RTCA DO-217](#).

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).

You can configure the Final Approach Segment (FAS) data set, the TAP data set or both.



TAP data is not available for "Mode > SCAT-I".

### Settings

- [General settings](#)..... 33
- [FAS data settings](#)..... 34
- [TAP data settings](#)..... 37
- [Location settings](#)..... 40

#### 3.3.3.1 General settings

Access:

- ▶ Select "VDB#: Message Configuration > Message Type 4".

The dialog provides general settings to enable message type 4 parameters.

### Settings

- [Message Type 4](#)..... 33

#### Message Type 4

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

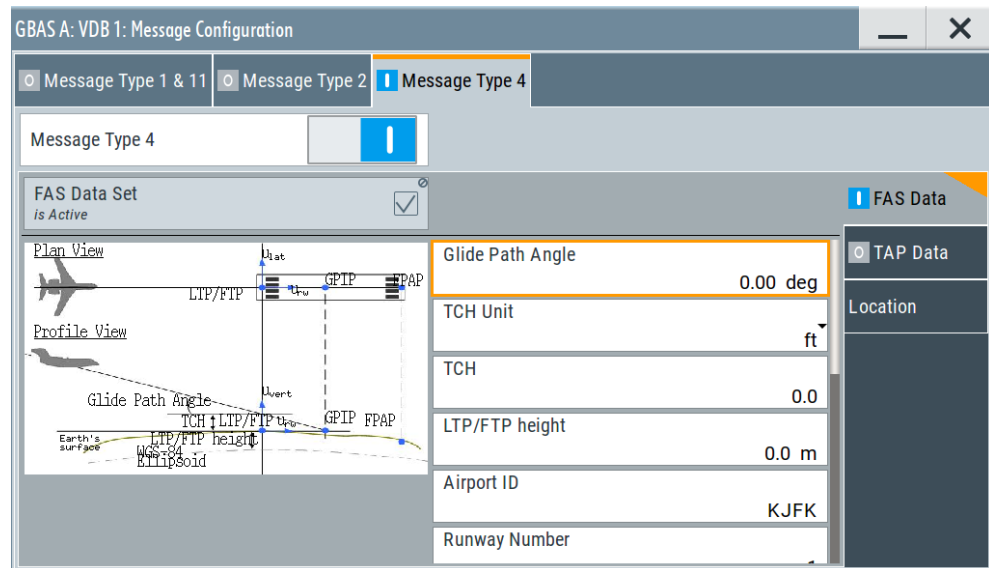
Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:MCONfig:MT4State](#) on page 92

### 3.3.3.2 FAS data settings

Access:

- ▶ Select "VDB#: Message Configuration > Message Type 4 > FAS Data".



The dialog comprises FAS data settings to configure message type 4 parameter according to [RTCA DO-246D](#), Table 2.14.

FAS data is required for both "GBAS" (LAAS) and "SCAT-I" header information modes. Unless stated otherwise, the settings below hold for both modes.

#### Settings

FAS Data Set.....	34
Plan View/Profile View Parameters.....	35
Airport ID.....	36
Runway Number.....	36
Runway Letter.....	36
Approach Performance Designator.....	36
Route Indicator.....	36
Reference Path Data Selector.....	37
Reference Path ID.....	37
Course Width at Threshold.....	37
Delta_Length Offset.....	37
FAS Vertical Alert Limit / Approach Status.....	37
FAS Lateral Alert Limit / Approach Status.....	37

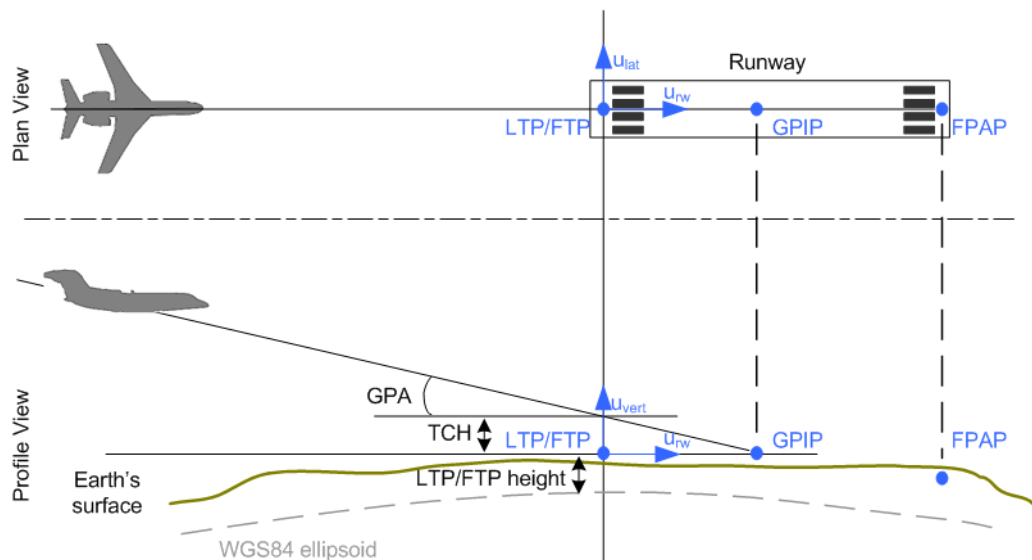
#### FAS Data Set

Requires "Mode > GBAS" (LAAS) header information.

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 3-1: 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

GPIIP = 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 92

### Plan View/Profile View Parameters

Requires "Mode > GBAS" (LAAS) header information.

The following parameters define the approach path (see also [Figure 3-1](#)):

"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 100

- "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 93  
`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:ATUSelector`  
on page 93
- "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 102

**Airport ID**

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:FDB<st>:AID` on page 92

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:AID` on page 92

**Runway Number**

Sets the approach runway number.

Remote command:

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:FDB<st>:RNUMBER` on page 103

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:RNUMBER` on page 103

**Runway Letter**

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

Remote command:

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:FDB<st>:RLETter` on page 102

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:RLETter` on page 102

**Approach Performance Designator**

Requires "Mode > GBAS" (LAAS) header information.

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 93

**Route Indicator**

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:FDB<st>:RUINdicator`

on page 103

`[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:RUINdicator` on page 103

#### Reference Path Data Selector

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:FDB<st>:RPDF` on page 103

`[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:RPDF` on page 103

#### Reference Path ID

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:FDB<st>:RPIF` on page 103

`[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:RPIF` on page 103

#### Course Width at Threshold

Requires "Mode > GBAS" (LAAS) header information.

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 94

#### Delta\_Length Offset

Requires "Mode > GBAS" (LAAS) header information.

Sets the parameter delta length ( $\Delta$ 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 96

#### FAS Vertical Alert Limit / Approach Status

Sets the value of the broadcast vertical alert limit.

Remote command:

`[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:FVAA` on page 99

#### FAS Lateral Alert Limit / Approach Status

Sets the value of the broadcast lateral alert limit.

Remote command:

`[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:FLAA` on page 99

### 3.3.3.3 TAP data settings

Requires "Mode > GBAS" (LAAS) header information.

Access:

- ▶ Select "VDB#: Message Configuration > Message Type 4 > TAP Data".

The dialog comprises TAP data settings to configure message type 4 parameter according to [RTCA DO-246D](#), Table 2.14.

## Settings

TAP Data Set.....	38
Reference Path Data Selector.....	38
Reference Path ID.....	39
Number of Path Points - N.....	39
Waypoint File.....	39
Predefined Files.....	39
FAS RPDS or Continuation Link.....	40
TAP Vertical Alert Limit / Status.....	40
TAP Lateral Alert Limit / Status.....	40

### 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 104

### Reference Path Data Selector

Sets the reference path data selector.

This parameter 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 105

**Reference Path ID**

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 105

**Number of Path Points - N**

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

Remote command:

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:NOPPoint` on page 104

**Waypoint File**

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 A.1, "Waypoint file format"](#), on page 118.

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

Remote command:

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:WAYPoint:PREDefined:CATalog?` on page 106

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:WAYPoint:USER:CATalog?` on page 106

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:WAYPoint:PREDefined:FILE` on page 106

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:WAYPoint:USER:FILE` on page 106

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:WAYPoint:FILE?` on page 107

**Predefined Files**

Accesses a list with predefined files.

Remote command:

For "Mode > GBAS":

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:DG:PREDefined:CATalog?` on page 81

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:DG:PREDefined:FILE` on page 81

For "Mode > SCAT-I":

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:DG:SPRedefined:CATalog?` on page 81

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:DG:SPRedefined:FILE` on page 80

For waypoint files:

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:WAYPoint:PREDefined:CATalog?` on page 106

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:WAYPoint:PREDefined:FILE` on page 106

**FAS RPDS or Continuation Link**

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 104

**TAP Vertical Alert Limit / Status**

Requires "Mode > GBAS" (LAAS) header information.

Sets the value of the broadcast vertical alert limit.

Remote command:

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:TVAS` on page 105

**TAP Lateral Alert Limit / Status**

Requires "Mode > GBAS" (LAAS) header information.

Sets the value of the broadcast lateral alert limit.

Remote command:

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:TLAS` on page 105

**3.3.3.4 Location settings**

Access:

- ▶ Select "VDB#: Message Configuration > Message Type 4 > Location".

The screenshot shows a software window titled "GBAS A: VDB 1: Message Configuration". At the top, there are three tabs: "Message Type 1 & 11", "Message Type 2", and "Message Type 4", with "Message Type 4" selected. Below the tabs, there is a "Message Type 4" label and a vertical bar. The main area is divided into two sections: "LTP/FTP Location Configuration" and "Delta\_FPAP Location Configuration". Each section has a "Position Format" dropdown menu set to "DEG:MIN:SEC". Below each section, there are two rows of input fields: "Latitude" and "Longitude". Each row has four columns: a degree field (0°), a minute field (0'), a second field (0.000"), and a hemisphere field (North for Latitude, East for Longitude). On the right side of the dialog, there are three vertical buttons: "FAS Data", "TAP Data", and "Location", with "Location" highlighted.

The dialog comprises location data settings to configure message type 4 parameter according to [RTCA DO-246D](#), Table 2.14.

For "Mode > GBAS" (LAAS) header information, configure [LTP/FTP Location Configuration](#) and [Delta\\_FPAP Location Configuration](#) settings.



For "Mode > SCAT-I" header information, configure [DP Location Configuration](#) and [Delta\\_DERP Location Configuration](#) settings.

## Settings

<a href="#">LTP/FTP Location Configuration</a> .....	41
<a href="#">Delta_FPAP Location Configuration</a> .....	41
<a href="#">DP Location Configuration</a> .....	42
<a href="#">Delta_DERP Location Configuration</a> .....	43

## LTP/FTP Location Configuration

Requires "Mode > GBAS" (LAAS) header information.

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 3-3: 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"> <li>"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.</li> <li>"Decimal Degree" The display format is decimal degree, i.e. +/-XX.XXXXX°, where "+" indicates North and East and "-" indicates South and West.</li> </ul>
"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 specify the position format:

```
[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:LFLocation:COORDinates:
FORMat on page 102
```

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

```
[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:LFLocation:COORDinates:DMS
on page 101
```

To enter the coordinates in decimal degree format:

```
[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:LFLocation:COORDinates:
DECimal on page 100
```

## Delta\_FPAP Location Configuration

Requires "Mode > GBAS" (LAAS) header information.

The Delta FPAD ( $\Delta$ 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 3-4: Delta\_FPAP 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"> <li>"DEG:MIN:SEC" The display format is Degree:Minute:Second and Direction, i.e. <math>XX^{\circ}XX'XX.XX''</math> Direction, where direction can be North/South and East/West.</li> <li>"Decimal Degree" The display format is decimal degree, i.e. <math>+/-XX.XXXXX^{\circ}</math>, where "+" indicates North and East and "-" indicates South and West.</li> </ul>
"Latitude"	<p>Sets the difference of latitude of the FPAP in arc seconds. Positive values indicate the FPAP latitude north of LTP/FTP latitude.</p>
"Longitude"	<p>Sets the difference of longitude of the FPAP in arc seconds. Positive values indicate the FPAP longitude east of LTP/FTP longitude.</p>

Remote command:

To specify the position format:

```
[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:DFLocation:COORDinates:
FORMat on page 95
```

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

```
[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:DFLocation:COORDinates:DMS
on page 94
```

To enter the coordinates in decimal degree format:

```
[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:DFLocation:COORDinates:
DECimal on page 94
```

### DP Location Configuration

Requires "Mode > SCAT-I" header information.

The DP represents the threshold datum point (DP). The point is the tangential point between the horizontal plane and WGS84 ellipsoid.

The DP coordinates are defined in WGS-84 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 3-5: DP location configuration**

Parameter	Description
"Position Format"	Sets the format in which the Latitude and Longitude are displayed. <ul style="list-style-type: none"> <li>"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.</li> <li>"Decimal Degree" The display format is decimal degree, i.e. +/-XX.XXXXX°, where "+" indicates North and East and "-" indicates South and West.</li> </ul>
"Latitude"	Sets the difference of latitude of the DP in arc seconds. Positive values indicate the DP latitude north of TCP latitude.
"Longitude"	Sets the difference of longitude of the DP in arc seconds. Positive values indicate the DP longitude east of TCP longitude.

Remote command:

To specify the position format:

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:FDB<st>:DPLocation:COORdinates:FORMat` on page 99

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

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:FDB<st>:DPLocation:COORdinates:DMS` on page 98

To enter the coordinates in decimal degree format:

`[ :SOURCE<hw> ] :BB:GBAS:VDB<ch>:MCONfig:FDB<st>:DPLocation:COORdinates:DECimal` on page 98

### Delta\_DERP Location Configuration

Requires "Mode > SCAT-I" header information.

Sets the departure end of runway point (DERP) or stop-end point.

This point is typically located on the runway centerline at the end of the runway.

The Delta DERP 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 3-6: Delta\_DERP location configuration**

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

Remote command:

To specify the position format:

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:FDB<st>:DDLocation:COORdinate:s:FORMat on page 97

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

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:FDB<st>:DDLocation:COORdinate:s:DMS on page 96

To enter the coordinates in decimal degree format:

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:MCONfig:FDB<st>:DDLocation:COORdinate:s:DECimal on page 96

### 3.4 Allocation and frequency/scheduling settings

Access:

- ▶ Select "GBAS > Allocation".

This dialog comprises the allocation and scheduling settings of the VDB transmitters and frequency channels.

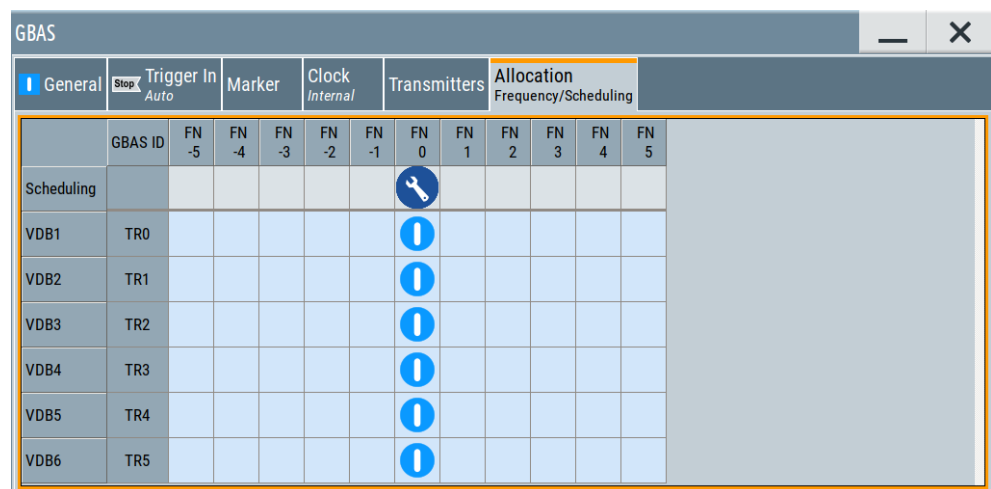
#### Settings

- [Allocation settings](#)..... 44
- [Scheduling settings](#)..... 46

#### 3.4.1 Allocation settings

Access:

- ▶ Select "GBAS > Allocation".



This dialog comprises the settings, necessary to configure the allocation of the VDB transmitters "VDB#" on the selected frequency number "FN#".

#### Allocation table


Comprises the allocation of the VDB transmitters "VDB#" on the selected frequency number "FN#".

There is one table row for each VDB transmitter as configured in [Chapter 3.2, "Transmitter settings"](#), on page 20.

#### Scheduling ← Allocation table

Configure the time domain scheduling of VDB transmitters on the selected frequency number.

Configuration requires, that the VDB transmitter is [mapped](#) to the frequency number.

Access scheduling settings via the icon , see [Chapter 3.4.2, "Scheduling settings"](#), on page 46.

#### FN -5 to 5 ← Allocation table







Displays the frequency number and defines the frequency band the corresponding VDB is using, see ["Carrier frequencies and frequency channels"](#) on page 11.


Remote command:

`[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:FNUMber` on page 74

#### Map VDB# to FN# ← Allocation table


The mapping of the VDB transmitters on frequency numbers "FN -5 to FN 5" is represented as a matrix. Listed are VDB transmitters and their "GBAS ID", as configured in [Chapter 3.2, "Transmitter settings"](#), on page 20.

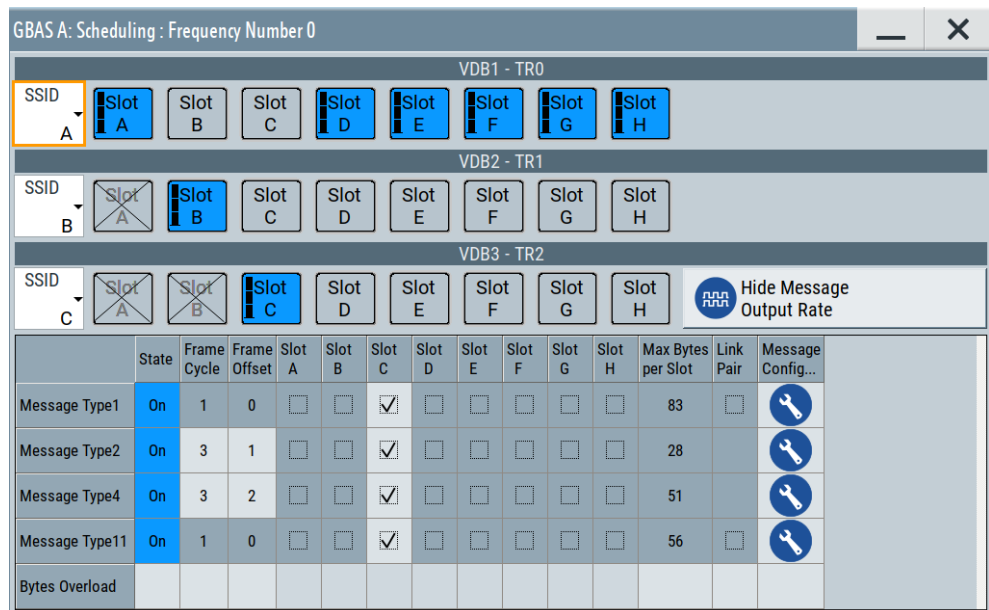
	GBAS ID	FN -5	FN -4	FN -3	FN -2	FN -1	FN 0	FN 1	FN 2	FN 3	FN 4	FN 5
Scheduling												
VDB1 >	TR0											
VDB2	TR1											
VDB3	TR2											
VDB4	TR3											
VDB5	TR4											

A blue matrix element  activates the VDB transmitter "VDB#" on the frequency number "FN#". Activation of one VDB transmitter on more than one frequency number is not possible.

### 3.4.2 Scheduling settings

Access:

1. Select "GBAS > Allocation".
2. Select "Allocation > Allocation Table > Scheduling > Configuration" via the icon .



The dialog provides settings 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 that you can allocate only one VDB transmitter per one time slot ("Slot A" to "Slot H"). For more information, see "[Broadcast timing structure](#)" on page 12.

#### Settings

- SSID.....46
- Slot A to Slot H.....47
  - L State.....47
  - L Power Offset.....47
- Show/Hide Message Output Rate.....47
- Message scheduling table.....47
  - L Frame Cycle.....48
  - L Frame Offset.....48
  - L Slot.....48
  - L Max Bytes per Slot.....48
  - L Link Pair.....48
  - L Bytes Overload > !!!.....49
  - L Message Config.....49

#### SSID

Sets the station slot identifier SSID/RSID of the ground station.

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.

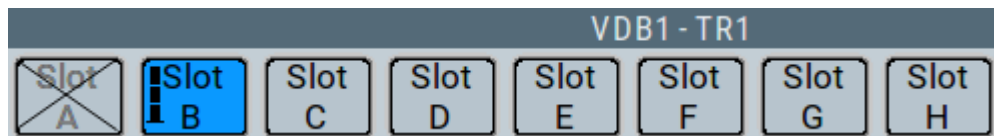
To identify a ground station, the airborne receiver examines the combination of the [GBAS ID](#) and the SSID.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:SSID](#) on page 74

### Slot A to Slot H

Indicates, which VDBs are enabled in the time slots.



The information is color-coded. Icons provide further information:

- Blue: Enabled VDB in the time slot.
- Gray: VDBs are disabled in the time slot.
- Cross out: VDBs are excluded in the time slot, since another VDB is enabled in the time slot.
- Power bar: Reduced height indicates, that the VDB is transmitted with less power. The height of the power bar reflects enabled "Power Offset".

### State ← Slot A to Slot H

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

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:SCH:TS<st>:STATE](#) on page 76

### Power Offset ← Slot A to Slot H

Sets the power offset of a VDB per time slot.

For more information, see ["Power settings"](#) on page 14.

Remote command:

[\[:SOURCE<hw>\]:BB:GBAS:VDB<ch>:SCH:TS<st>:POWER](#) on page 77

### Show/Hide Message Output Rate

Requires [Data/Data Configuration](#) > "Real GBAS Data".

Shows/hides message output details. The details are listed in the [Message scheduling table](#).

### Message scheduling table

Requires [Data/Data Configuration](#) > "Real GBAS Data".

Lists, which message types are enabled on the time slots [Slot A to Slot H](#).

	State	Frame Cycle	Frame Offset	Slot A	Slot B	Slot C	Slot D	Slot E	Slot F	Slot G	Slot H	Max Bytes per Slot	Link Pair	Message Config...
Message Type1	On	1	0	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	83	<input type="checkbox"/>	
Message Type2	On	3	1	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	28		
Message Type4	On	3	2	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	51		
Message Type11	On	1	0	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	56	<input type="checkbox"/>	
Bytes Overload														

**Frame Cycle ← Message scheduling table**

Requires "Message Type 2/4".

Sets the repetition rate.

Remote command:

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:SCH:M11T:RFRame? on page 78

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:SCH:M1T:RFRame? on page 78

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:SCH:M2T:RFRame on page 78

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:SCH:M4T:RFRame on page 78

**Frame Offset ← Message scheduling table**

Sets the frame offset compared to the first frame.

Remote command:

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:SCH:M11T:FOFFset? on page 77

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:SCH:M1T:FOFFset? on page 77

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:SCH:M2T:FOFFset on page 77

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:SCH:M4T:FOFFset on page 77

**Slot ← Message scheduling table**

Assign the slot to the message type.

Remote command:

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:SCH:M11T:SLOT<di>:STATe on page 78

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:SCH:M1T:SLOT<di>:STATe on page 78

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:SCH:M2T:SLOT<di>:STATe on page 79

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:SCH:M4T:SLOT<di>:STATe on page 79

**Max Bytes per Slot ← Message scheduling table**

Shows the total number of bytes per message type.

Remote command:

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:SCH:M11T:MBYTes? on page 77

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:SCH:M1T:MBYTes? on page 77

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:SCH:M2T:MBYTes? on page 78

[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:SCH:M4T:MBYTes? on page 78

**Link Pair ← Message scheduling table**

Requires "Message Type 1/11 > On".



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

Remote command:

`[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:SCH:M11T:LPAir:STATe` on page 77

`[ :SOURce<hw> ] :BB:GBAS:VDB<ch>:SCH:M1T:LPAir:STATe` on page 77

#### **Bytes Overload > !!! ← Message scheduling table**

Displays a warning, 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".

#### **Message Config... ← Message scheduling table**

Accesses the message configuration dialog via the icon .

For accessing the configuration of a specific message, tick the icon in the row, where the corresponding message is.

## 4 Signal generation control

This section lists settings provided for configuring the baseband filter, for defining the signal generation start and for generating signals necessary for synchronization with other instruments.

It covers the following topics:

- [Filter/clipping settings](#).....50
- [Trigger settings](#)..... 53
- [Marker settings](#).....58
- [Clock settings](#).....60
- [Global connectors settings](#).....61

### 4.1 Filter/clipping settings

Access:

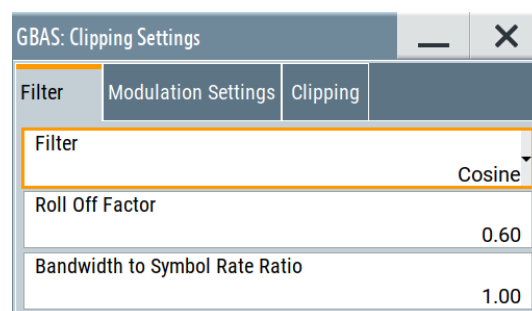
- ▶ Select "General > Filter/Clipping Settings".

The dialog comprises the settings to configure the baseband filter, modulation settings and clipping.

#### 4.1.1 Filter settings

Access:

- ▶ Select "General > Filter/Clipping Settings > Filter".



The dialog provides settings to configure the baseband filter.

#### Settings

- [Filter](#)..... 51
- [Rolloff Factor or BxT](#)..... 51
- [Cut Off Frequency Factor](#).....51
- [Bandwidth to Symbol Rate Ratio](#)..... 51

**Filter**

Selects the baseband filter.

Remote command:

`[ :SOURce<hw> ] :BB:GBAS:FILTer:TYPE` on page 109

**Rolloff 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.

Remote command:

`[ :SOURce<hw> ] :BB:GBAS:FILTer:PARAmeter:APCO25` on page 108

`[ :SOURce<hw> ] :BB:GBAS:FILTer:PARAmeter:COSine` on page 108

`[ :SOURce<hw> ] :BB:GBAS:FILTer:PARAmeter:GAUSs` on page 108

`[ :SOURce<hw> ] :BB:GBAS:FILTer:PARAmeter:PGAuss` on page 108

`[ :SOURce<hw> ] :BB:GBAS:FILTer:PARAmeter:RCOSine` on page 109

`[ :SOURce<hw> ] :BB:GBAS:FILTer:PARAmeter:SPHase` on page 109

**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 108

`[ :SOURce<hw> ] :BB:GBAS:FILTer:PARAmeter:LPASSEVM` on page 108

**Bandwidth to Symbol Rate Ratio**

Requires "Filter > Cosine".

Sets the ratio between filter bandwidth and symbol rate.

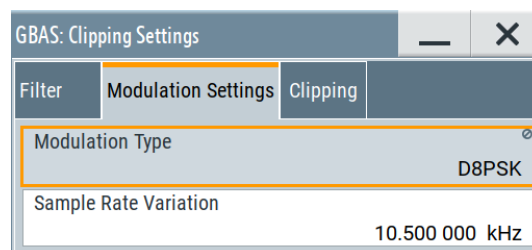
Remote command:

`[ :SOURce<hw> ] :BB:GBAS:FILTer:PARAmeter:COSine:COFS` on page 108

**4.1.2 Modulation settings**

Access:

- ▶ Select "General > Filter/Clipping Settings > Modulation Settings".



The dialog provides settings to check the modulation type and set the sample rate variation.

## Settings

Modulation Type.....	52
Sample Rate Variation/Sample Rate Info.....	52

### Modulation Type

Displays the 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 109

### Sample Rate Variation/Sample Rate Info

Sets the sample rate variation in the "Filter/Clipping Settings > Modulation Settings" dialog.

Displays the set sample rate variation in the "GBAS > General" dialog.

The sample rate variation parameter 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 Sym/s.

With GBAS using D8PSK modulation, each symbol defines one of eight states. This results in a nominal bit rate of 31500 bits/s. See also "[Modulation Type](#)" on page 52.

Remote command:

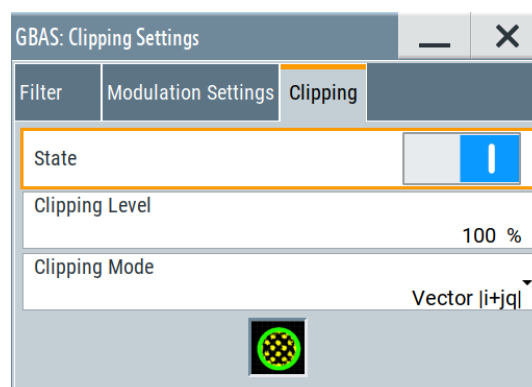
[ :SOURce<hw> ] :BB:GBAS:MSET:SRATE? on page 110

[ :SOURce<hw> ] :BB:GBAS:SRINfo? on page 110

## 4.1.3 Clipping settings

Access:

- ▶ Select "General > Filter/Clipping > Clipping".



The dialog provides settings to configure clipping.

**Settings**

State.....	53
Clipping Level.....	53
Clipping Mode.....	53

**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 to filtering, the procedure does not influence the spectrum. The EVM however increases.

Remote command:

`[ :SOURce<hw> ] :BB:GBAS:CLIPping:STATe` on page 108

**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 108

**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.

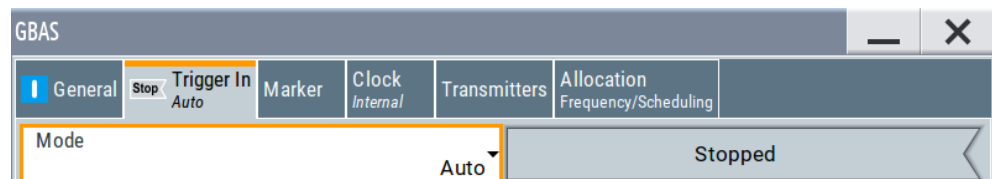
Remote command:

`[ :SOURce<hw> ] :BB:GBAS:CLIPping:MODE` on page 108

## 4.2 Trigger settings

Access:

- ▶ Select "Baseband > GBAS > Trigger In".



This tab provides settings to select and configure the trigger, like trigger source, trigger mode and trigger delays, and to arm or trigger an internal trigger manually. The header of the tab displays the status of the trigger signal and trigger mode. As in the tabs "Marker" and "Clock", this tab provides also access to the settings of the related connectors.

### Routing and activating a trigger signal

1. Define the effect of a trigger event and the trigger signal source.
  - a) Select "Trigger In" > "Mode".
  - b) Select "Trigger In" > "Source".
2. For external trigger signals, define the connector for signal input. See [Chapter 4.5, "Global connectors settings"](#), on page 61.  
You can map trigger signals to one or more User x connectors.  
Global connectors settings allow you to configure the signal mapping, the polarity, the trigger threshold and the input impedance of the input connectors.
3. Activate baseband signal generation. In the block diagram, set "Baseband" > "On".  
The R&S SMBV100B starts baseband signal generation after the configured trigger event.

### About baseband trigger signals

This section focuses on the available settings.

For information on how these settings affect the signal, refer to section "Basics on ..." in the R&S SMBV100B user manual.

#### Settings:

<a href="#">Mode</a> .....	54
<a href="#">Signal Duration Unit</a> .....	55
<a href="#">Signal Duration</a> .....	55
<a href="#">Time Based Trigger</a> .....	55
<a href="#">Trigger Time</a> .....	55
<a href="#">Running/Stopped</a> .....	56
<a href="#">Arm</a> .....	56
<a href="#">Execute Trigger</a> .....	56
<a href="#">Source</a> .....	56
<a href="#">Sync. Output to External Trigger/Sync. Output to Trigger</a> .....	57
<a href="#">External Inhibit/Trigger Inhibit</a> .....	57
<a href="#">External Delay/Trigger Delay</a> .....	58

#### 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 111

### Signal Duration Unit

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 113

### Signal Duration

Requires trigger "Mode" > "Single".

Enters the length of the trigger signal sequence.

Use this parameter, for example, for the following applications:

- To output the trigger signal partly.
- To output a predefined sequence of the trigger signal.

Remote command:

[\[:SOURce<hw>\]:BB:GBAS:TRIGger:SLENgth](#) on page 113

### Time Based Trigger

Requires trigger "Mode" > "Armed Auto"/"Single".

Activates time-based triggering with a fixed time reference.

The R&S SMBV100B triggers signal generation when its operating system time ("Current Time") matches a specified time trigger ("Trigger Time"). As trigger source, you can use an internal trigger or an external global trigger.

How to: Chapter "Time-based triggering" in the R&S SMBV100B user manual.

Remote command:

[\[:SOURce<hw>\]:BB:GBAS:TRIGger:TIME\[:STATe\]](#) on page 113

### Trigger Time

Requires trigger "Mode" > "Armed Auto"/"Single".

Sets date and time for a time-based trigger signal.

Set a trigger time that is later than the "Current Time". The current time is the operating system time of the R&S SMBV100B. If you set an earlier trigger time than the current time, time-based triggering is not possible.

How to: Chapter "Time-based triggering" in the R&S SMBV100B user manual.

"Date" Sets the date of the time-based trigger in format YYYY-MM-DD.

Remote command:

[\[:SOURce<hw>\]:BB:GBAS:TRIGger:TIME:DATE](#) on page 112

"Time" Sets the time of the time-based trigger in format hh:mm:ss.

Remote command:

[\[:SOURce<hw>\]:BB:GBAS:TRIGger:TIME:TIME](#) on page 112

### 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 111

### Arm

Stops the signal generation until subsequent trigger event occurs.

Remote command:

[\[:SOURce<hw>\]:BB:GBAS:TRIGger:ARM:EXECute](#) on page 114

### Execute Trigger

For internal trigger source, executes trigger manually.

Remote command:

[\[:SOURce<hw>\]:BB:GBAS:TRIGger:EXECute](#) on page 114

### Source

The following sources of the trigger signal are available:

- "Internal"  
The trigger event is executed manually by the "Execute Trigger".
- "External Global Trigger"  
The trigger event is the active edge of an external trigger signal provided and configured at the User x connectors.
- "Baseband Sync In"  
In primary-secondary instrument mode, secondary instruments are triggered by the active edge of the synchronization signal.

How to: ["Routing and activating a trigger signal"](#) on page 54

Remote command:

[\[:SOURce<hw>\]:BB:GBAS:TRIGger:SOURce](#) on page 111



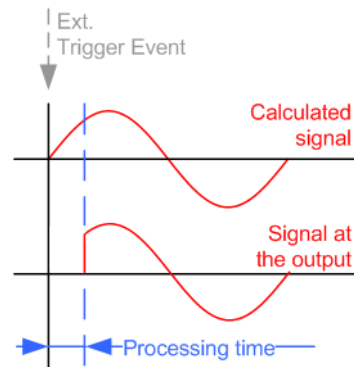
**Sync. Output to External Trigger/Sync. Output to Trigger**

Enables signal output synchronous to the trigger event.

- "On"

Corresponds to the default state of this parameter.

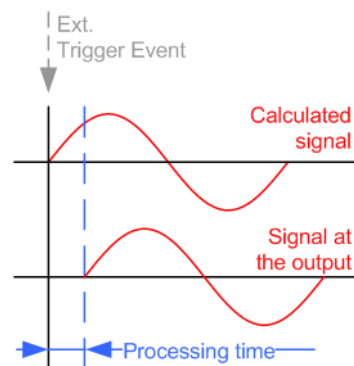
The signal calculation starts simultaneously with the trigger event. Because of the processing time of the instrument, the first samples are cut off and no signal is output. After elapsing of the internal processing time, the output signal is synchronous to the trigger event.



- "Off"

The signal output begins after elapsing of the processing time. Signal output starts with sample 0. The complete signal is output.

This mode is recommended for triggering of short signal sequences. Short sequences are sequences with signal duration comparable with the processing time of the instrument.



In primary-secondary instrument mode, this setting ensures that once achieved, synchronization is not lost if the baseband signal sampling rate changes.

Remote command:

```
[ :SOURce<hw> ] :BB:GBAS:TRIGger:EXTernal:SYNChronize:OUTPut
```

on page 114

**External Inhibit/Trigger Inhibit**

Applies for external trigger signal.

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.

For more information, see chapter "Basics" in the R&S SMBV100B user manual.

Remote command:

`[ :SOURce<hw> ] :BB:GBAS:TRIGger [ :EXTernal ] :INHibit` on page 115

### External Delay/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
- Compensate delays and align the signal generation start in multi-instrument setup

For more information, see chapter "Basics on ..." in the R&S SMBV100B user manual.

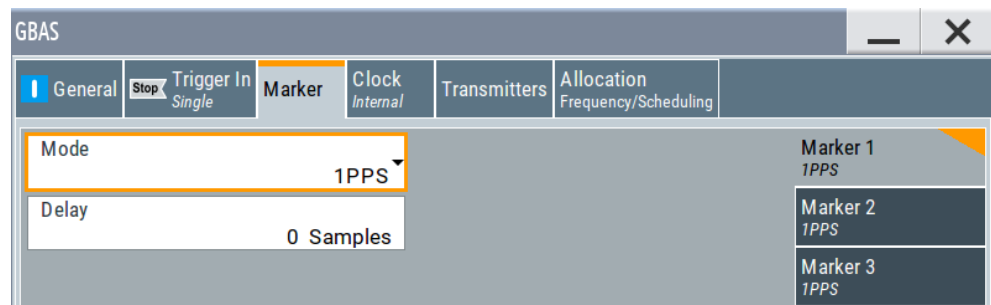
Remote command:

`[ :SOURce<hw> ] :BB:GBAS:TRIGger [ :EXTernal ] :DELay` on page 114

## 4.3 Marker settings

Access:

- ▶ Select "Baseband" > "GBAS" > "Marker".



This tab provides settings to select and configure the marker output signal including marker mode and marker delay.

### Routing and activating a marker signal

1. To define the signal shape of an individual marker signal "x", select "Marker" > "Marker x" > "Mode".
2. Optionally, define the connector for signal output. See [Chapter 4.5, "Global connectors settings"](#), on page 61.  
You can map marker signals to one or more User x connectors.
3. Activate baseband signal generation. In the block diagram, set "Baseband" > "On".  
The R&S SMBV100B adds the marker signal to the baseband signal. Also, R&S SMBV100B outputs this signal at the configured User x connector.

### About marker output signals

This section focuses on the available settings.

For information on how these settings affect the signal, refer to section "Basics on ..." in the R&S SMBV100B user manual.

#### Settings:

Mode.....	59
Delay.....	60

#### Mode

Marker configuration for up to 3 markers. 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.

How to: "[Routing and activating a marker signal](#)" on page 58

"1PPS"	Marker signal for every start of second.
"Restart"	The generated marker signal is a single "On" pulse. The rising edge of this pulse is generated at the signal generation start as well as at each subsequent signal restart time. Use this marker mode to monitor the effects of the selected trigger, e.g. trigger causing restarts of the signal generation.
"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: <a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:TRIGger:OUTPut&lt;ch&gt;:PULSe:DIVider</a> on page 116 <a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:TRIGger:OUTPut&lt;ch&gt;:PULSe:FREQuency?</a> on page 117
"Pattern"	Marker signal is a pattern with a length of maximum 64 bits.  Remote command: <a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:TRIGger:OUTPut&lt;ch&gt;:PATtern</a> on page 116
"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 116  
[\[:SOURce<hw>\]:BB:GBAS:TRIGger:OUTPut<ch>:OFFTime](#) on page 116

Remote command:

[ :SOURce<hw> ] :BB:GBAS:TRIGger:OUTPut<ch>:MODE on page 115

### Delay

Delays the marker signal at the marker output relative to the signal generation start.

Variation of the parameter "Marker x" > "Delay" causes signal recalculation.

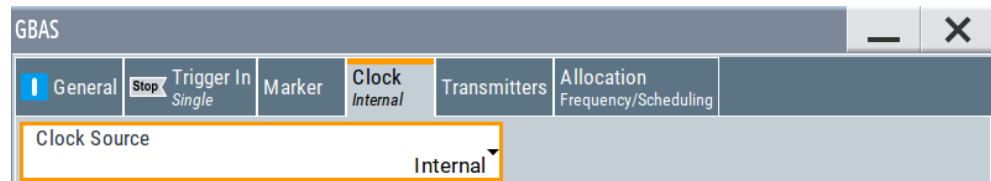
Remote command:

[ :SOURce<hw> ] :BB:GBAS:TRIGger:OUTPut<ch>:DELay on page 115

## 4.4 Clock settings

Access:

- ▶ Select "Baseband" > "GBAS" > "Clock".



This tab provides access to the settings necessary to select and configure the clock signal, like the clock source and clock mode.

### Defining the clock

1. Select "Clock" > "Source" to define the source of clock signal.
2. For external clock signals, define the connector for signal input. See [Chapter 4.5, "Global connectors settings"](#), on page 61.  
You can map clock signals to one or more User x connectors.  
Global connectors settings allow you to configure the signal mapping, the polarity, the trigger threshold and the input impedance of the input connectors.
3. Activate baseband signal generation. In the block diagram, set "Baseband" > "On".  
The R&S SMBV100B starts baseband signal generation with a symbol rate that equals the clock rate.

### About clock signals

This section focuses on the available settings.

For information on how these settings affect the signal, refer to section "Basics on ..." in the R&S SMBV100B user manual.

**Settings:**

<a href="#">Clock Source</a> .....	61
<a href="#">Clock Mode</a> .....	61

**Clock Source**

Selects the clock source.

- "Internal"  
The instrument uses its internal clock reference.

How to: "[Defining the clock](#)" on page 60

Remote command:

[\[:SOURce<hw>\]:BB:GBAS:CLOCK:SOURce](#) on page 117

**Clock Mode**

Sets the type of externally supplied clock.

Remote command:

[\[:SOURce<hw>\]:BB:GBAS:CLOCK:MODE](#) on page 117

## 4.5 Global connectors settings

Accesses a dialog to configure global connectors.

The button is available in the following dialogs or tabs:

- "Trigger / Marker / Clock" dialog that is accessible via the "TMC" block in the block diagram.
- "Trigger In", "Marker" and "Clock" tabs that are accessible via the "Baseband" block in the block diagram.



See also chapter "Global connectors settings" in the user manual.

## 5 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 and 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).

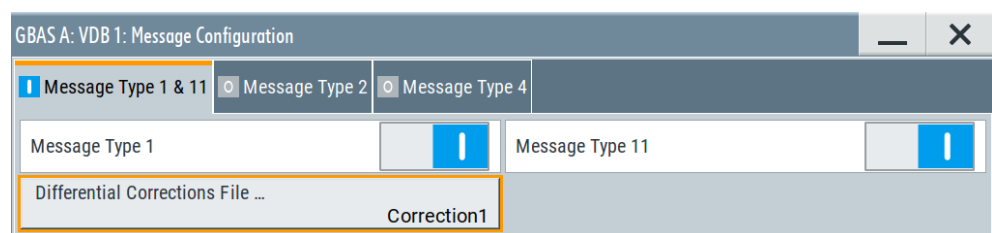
The following step-by-step instructions demonstrate how to perform some signal generation tasks with the GBAS option and generate signals suitable for GBAS testing. The following sections focus on the R&S SMBV100B configuration. Necessary configuration in VDB receivers, devices under test (DUT) or other test equipment are beyond the scope of this description.

### 5.1 Loading differential GBAS data

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.

Access:

1. Select "Data Config > Message Config...", see [Chapter 3.3, "Message configuration settings"](#), on page 22.
2. Select "VDB#:Message Configuration > Message Type 1 & 11", see [Chapter 3.3.1, "Message type 1 & 11 settings"](#), on page 22
3. Enable "Message Type 1" or "Message Type 11".



This dialog comprises settings to manage GBAS differential data.

4. To load a file, select "Differential Corrections File".  
In the "Proprietary File > Predefined Files" dialog, the `Correction1.rs_gbas` file is selected per default.
5. Alternatively, select "Differential Corrections File" and load or user-defined file in the "Proprietary File > User Files" dialog.  
See [Chapter A.2, "GBAS differential file format"](#), on page 118 for description of the required file format.

## 6 Remote-control commands

The following commands are required to perform signal generation with the GBAS option in a remote environment. We assume that the R&S SMBV100B has already been set up for remote operation in a network as described in the R&S SMBV100B 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 SMBV100B user manual.

### Common Suffixes

The following common suffixes are used in remote commands:

Suffix	Value range	Description
SOURce<hw>	1	available baseband signals
OUTPut<ch>	1 to 3	available markers
VDB<ch>	1 to 8	VDB transmitter
TS<st>	1 to 8	time slot

The following commands specific to the GBAS are described here:

- [Programming examples](#)..... 63
- [General commands](#).....69
- [Transmitter commands](#)..... 72
- [Scheduling commands](#).....76
- [Message configuration commands](#)..... 79
- [Filter/clipping/modulation commands](#).....107
- [Trigger commands](#).....110
- [Marker commands](#).....115
- [Clock commands](#)..... 117

### 6.1 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: Configuring GBAS general settings

The following example provides information on GBAS general settings.

```
// Query GBAS mode and corresponding GBAS specification.
SOURCE1:BB:GBAS:MODE?
// Response: "GBAS"
SOURCE1:BB:GBAS:VERSion?
// Response: "RTCA DO-246D"
SOURCE1:BB:GBAS:MODE SCAT
SOURCE1:BB:GBAS:VERSion?
// Response: "RTCA DO-217"

// Save the current configuration.
SOURCE1:BB:GBAS:SETTing:STORe "/var/user/my_gbas"
*RST
SOURCE1:BB:GBAS:SETTing:CATalog?
// Response: "my_gbas"
SOURCE1:BB:GBAS:SETTing:LOAD "/var/user/my_gbas"

SOURCE1:BB:GBAS:STATe 1
SOURCE1:BB:GBAS:SETTing:DELeTe "my_gbas"
```

### 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
// Query the corresponding GBAS version.
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
// 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
SOURcel:FREQuency:CW 110MHz

SOURcel:BB:GBAS:VDB:APPend
SOURcel:BB:GBAS:VDB1:SCH:TS1:STATe ON
SOURcel:BB:GBAS:VDB1:SCH:TS1:POWer 0
SOURcel:BB:GBAS:VDB1:SCH:TS8:STATe ON
SOURcel:BB:GBAS:VDB1:SCH:TS8:POWer 0
SOURcel:BB:GBAS:VDB2:SCH:TS2:STATe ON
SOURcel:BB:GBAS:VDB2:SCH:TS2:POWer 0
SOURcel:BB:GBAS:VDB2:SCH:TS5:STATe ON
SOURcel:BB:GBAS:VDB2:SCH:TS5:POWer 0
SOURcel:BB:GBAS:VDB2:SCH:TS7:STATe ON
SOURcel:BB:GBAS:VDB2:SCH:TS7:POWer 0

SOURcel:BB:GBAS:VDB2:STATe?
// Response: "1"
SOURcel:BB:GBAS:STATe ON
OUTput1:STATe ON
// Generate a waveform and save it in the default directory.
SOURcel:BB:GBAS:WAVeform:CREate "gbas_slot_detection"
// Save the settings in a file in the default directory.
SOURcel: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
SOURcel:FREQuency:CW 110MHz

SOURcel:BB:GBAS:VDB1:DATA RGDData
SOURcel:BB:GBAS:VDB1:MCONfig:MT2State ON
SOURcel:BB:GBAS:VDB1:MCONfig:GSRReceivers GW3R
SOURcel:BB:GBAS:VDB1:MCONfig:GSADesignator GADB
SOURcel:BB:GBAS:VDB1:MCONfig:GCID FC
SOURcel:BB:GBAS:VDB1:MCONfig:LMVariation 58
SOURcel:BB:GBAS:VDB1:MCONfig:SVIGradient 0
SOURcel:BB:GBAS:VDB1:MCONfig:RFIndex 379
SOURcel:BB:GBAS:VDB1:MCONfig:SHEight 100
SOURcel:BB:GBAS:VDB1:MCONfig:RUNCertainty 20
SOURcel:BB:GBAS:VDB1:MCONfig:LOCation:COORdinateS:DECimal 11.5833, 48.150, 110
SOURcel:BB:GBAS:VDB1:MCONfig:LOCation:COORdinateS:FORMat DMS
SOURcel:BB:GBAS:VDB1:MCONfig:LOCation:COORdinateS:DMS?
// Response: "11,34,59.88,EAST,48,9,0,NORT,110"

SOURcel:BB:GBAS:VDB1:MCONfig:DG:STATe ON
SOURcel:BB:GBAS:VDB1:MCONfig:DG:PREDeFined:CATalog?
// Response: "Correction1"
SOURcel: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: Configuring GBAS message type 2 parameters

The following is an example on how to generate a VDB signal with real application data and enabled GBAS Message Type 2.

```

SOURCE1:BB:GBAS:VDB1:MCONfig:MT2State 0
SOURCE1:BB:GBAS:VDB1:MCONfig:GSRReceivers GW2R
SOURCE1:BB:GBAS:VDB1:MCONfig:GSADesignator GADA
SOURCE1:BB:GBAS:VDB1:MCONfig:GCID FC
SOURCE1:BB:GBAS:VDB1:MCONfig:LMVariation 0
SOURCE1:BB:GBAS:VDB1:MCONfig:SVIGradient 0
SOURCE1:BB:GBAS:VDB1:MCONfig:RFINdex 16
SOURCE1:BB:GBAS:VDB1:MCONfig:SHEight 0
SOURCE1:BB:GBAS:VDB1:MCONfig:RUNCertainty 0

// Configure additional data block 1.
SOURCE1:BB:GBAS:VDB1:MCONfig:ADB1:STATe 1
SOURCE1:BB:GBAS:VDB1:MCONfig:PSErvice:STATe 1
SOURCE1:BB:GBAS:VDB1:MCONfig:RSDSelector 1
SOURCE1:BB:GBAS:VDB1:MCONfig:MUDistance 2
SOURCE1:BB:GBAS:VDB1:MCONfig:KPGPs 0
SOURCE1:BB:GBAS:VDB1:MCONfig:KCGPs 0
SOURCE1:BB:GBAS:VDB1:MCONfig:KPGLonass 0
SOURCE1:BB:GBAS:VDB1:MCONfig:KCGLonass 0

// Configure additional data block 3.
SOURCE1:BB:GBAS:VDB1:MCONfig:ADB3:STATe 1
SOURCE1:BB:GBAS:VDB1:MCONfig:KDGPps 0
SOURCE1:BB:GBAS:VDB1:MCONfig:KDGLonass 0
SOURCE1:BB:GBAS:VDB1:MCONfig:SVID 0

// Configure additional data block 4.
SOURCE1:BB:GBAS:VDB1:MCONfig:ADB4:STATe 1

```

```

SOURCE1:BB:GBAS:VDB1:MCONfig:SGDefinition:A:STATe 1
SOURCE1:BB:GBAS:VDB1:MCONfig:SGDefinition:B:STATe 1
SOURCE1:BB:GBAS:VDB1:MCONfig:SGDefinition:C:STATe 1

// Set the reference location.
SOURCE1:BB:GBAS:VDB1:MCONfig:LOCation:COORdinateS:DECimal 11.5833, 48.150, 110
SOURCE1:BB:GBAS:VDB1:MCONfig:LOCation:COORdinateS:FORMat DMS
SOURCE1:BB:GBAS:VDB1:MCONfig:LOCation:COORdinateS:DMS?
// Response: "11,34,59.88,EAST,48,9,0,NORT,11"
SOURCE1:BB:GBAS:VDB1:MCONfig:MT2State 1

```

### 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:VDB1:DATA RGDatA
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:FORMat DMS
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:FORMat DMS
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"
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: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

```

## 6.2 General commands

<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:GPOW.....</a>	69
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:MODE.....</a>	70
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:PRESet.....</a>	70
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:SETTing:CATalog?.....</a>	70
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:SETTing:DELeTe.....</a>	71
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:SETTing:LOAD.....</a>	71
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:SETTing:STORe.....</a>	71
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:STATe.....</a>	72
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VERSion?.....</a>	72
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:WAVeform:CREate.....</a>	72

---

### **[:SOURce<hw>]:BB:GBAS:GPOW <GPow>**

Enables gated power mode.

#### **Parameters:**

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

**Example:** See [Example "Generating a GBAS signal for sensitivity tests"](#) on page 64.

**Manual operation:** See ["Gated Power Mode"](#) on page 19

#### **[ :SOURce<hw> ]:BB:GBAS:MODE <SCAT>**

Sets the GBAS mode.

Select between GBAS (LAAS) header information or SCAT-I header information.

**Parameters:**

<SCAT> GBAS | SCAT  
\*RST: GBAS

**Example:** See [Example "Configuring GBAS general settings"](#) on page 64.

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

#### **[ :SOURce<hw> ]:BB:GBAS:PRESet**

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

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

**Example:** See [Example "Configuring GBAS general settings"](#) on page 64.

**Example:** See [Example "Generating a GBAS signal for sensitivity tests"](#) on page 64.

**Usage:** Event

**Manual operation:** See ["Set to Default"](#) on page 18

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

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

**Return values:**

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

**Example:** See [Example "Configuring GBAS general settings"](#) on page 64.

**Example:** See [Example "Generating a GBAS signal for message-format detection"](#) on page 65.

**Usage:** Query only

**Manual operation:** See ["Save/Recall"](#) on page 18

---

**[:SOURce<hw>]:BB:GBAS:SETTING:DELeTe <Filename>**

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

**Setting parameters:**

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

**Example:**            See [Example"Configuring GBAS general settings"](#) on page 64.

**Example:**            See [Example"Generating a GBAS signal for message-format detection"](#) on page 65.

**Usage:**              Setting only

**Manual operation:** See ["Save/Recall"](#) on page 18

---

**[:SOURce<hw>]:BB:GBAS:SETTING:LOAD <Filename>**

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

**Setting parameters:**

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

**Example:**            See [Example"Configuring GBAS general settings"](#) on page 64.

**Example:**            See [Example"Generating a GBAS signal for message-format detection"](#) on page 65.

**Usage:**              Setting only

**Manual operation:** See ["Save/Recall"](#) on page 18

---

**[:SOURce<hw>]:BB:GBAS:SETTING:STORe <Filename>**

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

**Setting parameters:**

<Filename>            "<filename>"  
 Filename or complete file path

**Example:**            See [Example"Configuring GBAS general settings"](#) on page 64.

**Example:**            See [Example"Generating a GBAS signal for message-format detection"](#) on page 65.

**Usage:**              Setting only

**Manual operation:** See ["Save/Recall"](#) on page 18

**[[:SOURce<hw>]:BB:GBAS:STATe <State>**

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

**Parameters:**

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

**Example:** See [Example "Configuring GBAS general settings"](#) on page 64.

**Example:** See [Example "Generating a GBAS signal for sensitivity tests"](#) on page 64.

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

**[[:SOURce<hw>]:BB:GBAS:VERSion?**

Queries the GBAS specification version that corresponds to the set GBAS mode.

**Return values:**

<Version> string

**Example:** See [Example "Configuring GBAS general settings"](#) on page 64.

**Usage:** Query only

**[[:SOURce<hw>]:BB:GBAS:WAVEform:CREate <Filename>**

With enabled signal generation, triggers the instrument to save the current settings of an arbitrary waveform signal in a waveform file with predefined extension \*.wv. You can define the filename and the directory, in that you want to save the file.

Using the ARB modulation source, you can play back waveform files and/or process the file to generate multi-carrier or multi-segment signals.

**Setting parameters:**

<Filename> string

**Example:** See [Example "Generating a GBAS signal for VDB slot detection"](#) on page 64.

**Usage:** Setting only

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

## 6.3 Transmitter commands

[[:SOURce<hw>]:BB:GBAS:NOFRames?.....	73
[[:SOURce<hw>]:BB:GBAS:VDB:APPend.....	73
[[:SOURce<hw>]:BB:GBAS:VDB<ch>:INSert.....	73
[[:SOURce<hw>]:BB:GBAS:VDB<ch>:DELete.....	73
[[:SOURce<hw>]:BB:GBAS:VDB<ch>:STATe.....	74



<code>[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:RID</code> .....	74
<code>[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:GID</code> .....	74
<code>[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SGID</code> .....	74
<code>[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SSID</code> .....	74
<code>[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:FNUMber</code> .....	74
<code>[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:DLEnGth</code> .....	75
<code>[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:DATA</code> .....	75
<code>[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:DATA:DSElectIon</code> .....	75
<code>[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:DATA:PATtern</code> .....	76

---

#### `[:SOURce<hw>]:BB:GBAS:NOFRames?`

Queries the number of VDB frames.

##### Return values:

<code>&lt;NOFrame&gt;</code>	integer
	Range: 1 to 12500
	*RST: 1

**Usage:** Query only

**Manual operation:** See ["Number of Frames"](#) on page 22

---

#### `[: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 64.

**Usage:** Event

**Manual operation:** See ["Append, Insert, Delete"](#) on page 22

---

#### `[: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 64.

**Usage:** Event

**Manual operation:** See ["Append, Insert, Delete"](#) on page 22

---

#### `[:SOURce<hw>]:BB:GBAS:VDB<ch>:DELete`

Deletes the selected VDB.

**Example:** See [Example "Generating a GBAS signal for VDB slot detection"](#) on page 64.

**Usage:** Event

**Manual operation:** See ["Append, Insert, Delete"](#) on page 22

---

**[ :SOURce<hw>]:BB:GBAS:VDB<ch>:STATe** <VState>

Enables the selected VHF Data Broadcast (VDB) transmitter.

**Parameters:**

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

**Example:** See [Example "Generating a GBAS signal for VDB slot detection"](#) on page 64.

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

---

**[ :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 65.

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

---

**[ :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 65.

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

---

**[ :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 65.

**Manual operation:** See ["FN -5 to 5"](#) on page 45

**[:SOURce<hw>]:BB:GBAS:VDB<ch>:DLEnGth <DataLen>**

Sets the application data length.

**Parameters:**

<DataLen> integer  
 Range: 1 to 65495  
 \*RST: 222

**Example:** See [Example"Generating a GBAS signal for message-format detection"](#) on page 65.

**Manual operation:** See ["App. Data Length/bytes"](#) on page 21

**[: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 65.

**Manual operation:** See ["Data/Data Configuration"](#) on page 21

**[: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 Configuration"](#) on page 21

---

```
[ :SOURce<hw>]:BB:GBAS:VDB<ch>:DATA:PATtern <Pattern>, <BitCount>
```

Selects the bit pattern for the data source.

**Parameters:**

```
<Pattern>          numeric
                   *RST:      #H0

<BitCount>        integer
                   Range:     1 to 64
                   *RST:      1
```

**Example:**               : SOURce1:BB:GBAS:VDB2:DATA PATtern  
                          : SOURce1:BB:GBAS:VDB2:DATA: PATtern #HB8A,12

**Manual operation:**   See ["Data/Data Configuration"](#) on page 21

## 6.4 Scheduling commands

<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:TS&lt;st&gt;:STATe.....</a>	76
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:TS&lt;st&gt;:POWER.....</a>	77
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:M11T:LPAir:STATe.....</a>	77
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:M1T:LPAir:STATe.....</a>	77
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:M11T:FOFFset?.....</a>	77
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:M1T:FOFFset?.....</a>	77
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:M2T:FOFFset.....</a>	77
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:M4T:FOFFset.....</a>	77
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:M11T:MBYTes?.....</a>	77
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:M1T:MBYTes?.....</a>	77
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:M2T:MBYTes?.....</a>	78
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:M4T:MBYTes?.....</a>	78
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:M11T:RFRame?.....</a>	78
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:M1T:RFRame?.....</a>	78
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:M2T:RFRame.....</a>	78
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:M4T:RFRame.....</a>	78
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:M11T:SLOT&lt;di&gt;:STATe.....</a>	78
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:M1T:SLOT&lt;di&gt;:STATe.....</a>	78
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:M2T:SLOT&lt;di&gt;:STATe.....</a>	79
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:SCH:M4T:SLOT&lt;di&gt;:STATe.....</a>	79

---

```
[ :SOURce<hw>]:BB:GBAS:VDB<ch>:SCH:TS<st>:STATe <State>
```

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

**Parameters:**

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

**Example:**               See [Example"Generating a GBAS signal for VDB slot detection"](#)  
                          on page 64.

**Manual operation:** See ["State"](#) on page 47

---

```
[ :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 VDB slot detection"](#) on page 64.

**Manual operation:** See ["Power Offset"](#) on page 47

---

```
[ :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> 1 | ON | 0 | OFF  
 \*RST: 0

**Example:** See [Example"Generating a GBAS signal for VDB slot detection"](#) on page 64.

**Manual operation:** See ["Link Pair"](#) on page 48

---

```
[ :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

**Example:** See [Example"Generating a GBAS signal for VDB slot detection"](#) on page 64.

**Manual operation:** See ["Frame Offset"](#) on page 48

---

```
[ :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

**Example:** See [Example "Generating a GBAS signal for VDB slot detection"](#) on page 64.

**Usage:** Query only

**Manual operation:** See ["Max Bytes per Slot"](#) on page 48

**[[: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

**Example:** See [Example "Generating a GBAS signal for VDB slot detection"](#) on page 64.

**Usage:** Query only

**Manual operation:** See ["Frame Cycle"](#) on page 48

**[[: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

**Example:** See [Example "Generating a GBAS signal for VDB slot detection"](#) on page 64.

**Manual operation:** See ["Frame Cycle"](#) on page 48

**[[: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>                    1 | ON | 0 | OFF  
\*RST:                    0

**Example:**                See [Example"Generating a GBAS signal for VDB slot detection"](#) on page 64.

**Manual operation:**    See ["Slot"](#) on page 48

## 6.5 Message configuration commands

### 6.5.1 Message type 1 and 11 commands

<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:MCONfig:DG:M11State</a> .....	79
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:MCONfig:DG:M1State</a> .....	79
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:MCONfig:DG:STATe</a> .....	80
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:VDB&lt;ch&gt;:MCONfig:DG:SPRedefined:FILE</a> .....	80
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---

**[[: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>                    1 | ON | 0 | OFF  
\*RST:                    0

**Example:**                See [Example"Generating a GBAS signal for message-format detection"](#) on page 65.

**Manual operation:**    See ["Message Type 11"](#) on page 23

---

**[[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:M1State <State>**

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

**Parameters:**

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

**Example:** See [Example "Generating a GBAS signal for message-format detection"](#) on page 65.

**Manual operation:** See ["Message Type 1"](#) on page 23

**[ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:STATE <DiffGnssState>**

Enables the use of differential GNSS data.

**Parameters:**

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

**Example:** See [Example "Generating a GBAS signal for message-format detection"](#) on page 65.

**[ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:SPRedefined:FILE <Filename>**

Loads the selected predefined file (extension \*.rs\_scatt).

**Setting parameters:**

<Filename> string  
 Only the file name is required

**Usage:** Setting only

**Manual operation:** See ["Predefined Files"](#) on page 24

**[ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:SUSer:FILE <Filename>**

Loads the selected user-defined file (extension \*.rs\_scatt).

Per default, the instrument saves 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 saved 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 ["Differential Corrections File ..."](#) on page 23



---

```
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:SPReDefined:CATalog
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:SUSer:CATalog
[: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/SCAT-I differential files.

Per default, the instrument saves user-defined files in the `/var/user/` directory. Use the command `:MMEM:CDIRectory` to change the default directory to the currently used one.

For GBAS differential files, files with extension `*.rs_gbas` are listed.

For SCAT-I differential files, files with extension `*.rs_scat` are listed.

**Example:** See [Example "Generating a GBAS signal for message-format detection"](#) on page 65.

**Usage:** Query only

**Manual operation:** See ["Differential Corrections File ..."](#) on page 23

---

```
[: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 65.

**Usage:** Setting only

**Manual operation:** See ["Predefined Files"](#) on page 24

---

```
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DG:USER:FILE <Filename>
```

Loads the selected user-defined file (extension `*.rs_gbas`).

Per default, the instrument saves 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 saved 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 "Differential Corrections File ..." on page 23

#### **[: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 65.

**Usage:** Query only  
**Manual operation:** See "Differential Corrections File ..." on page 23

#### **[: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)

**Example:** :SOURce1:BB:GBAS:VDB1:MCONfig:DG:SFILE?  
 "Correction1.rs\_scat"

**Usage:** Query only  
**Manual operation:** See "Differential Corrections File ..." on page 23

## 6.5.2 Message type 2 commands

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---

#### [ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:MT2State <Mt2State>

Enables the message type 2 configuration.

##### Parameters:

<Mt2State>            1 | ON | 0 | OFF  
 \*RST:                0

**Example:**            See [Example "Generating a GBAS signal for message-format detection"](#) on page 65.

**Manual operation:**    See ["Message Type 2"](#) on page 25

---

#### [ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:ADB1:STATe <State>

Enables the additional data block 1.

##### Parameters:

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

**Example:**            See [Example "Configuring GBAS message type 2 parameters"](#) on page 66.

**Manual operation:**    See ["Additional Data Block 1"](#) on page 28

---

#### [ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:ADB3:STATe <State>

Enables the additional data block 3.

##### Parameters:

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

**Example:** See [Example"Configuring GBAS message type 2 parameters"](#) on page 66.

**Manual operation:** See ["Additional Data Block 3"](#) on page 30

**[[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:ADB4:STATe <State>**

Enables the additional data block.

**Parameters:**

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

**Example:** See [Example"Configuring GBAS message type 2 parameters"](#) on page 66.

**Manual operation:** See ["Additional Data Block 4"](#) on page 31

**[[: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 65.

**Manual operation:** See ["GS Continuity/Integrity Designator"](#) on page 26

**[[: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 65.

**Manual operation:** See ["Ground Station Accuracy Designator"](#) on page 26

**[[: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 65.

**Manual operation:** See ["Ground Station Reference Receivers"](#) on page 25

**[ :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 65.

**Manual operation:** See ["Local Magnetic Variation"](#) on page 26

**[ :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 65.

**Manual operation:** See ["Refractivity Index"](#) on page 26

**[ :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 65.

**Manual operation:** See ["Refractivity Uncertainty"](#) on page 26

---

**[[: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 65.

**Manual operation:**    See ["Scale Height"](#) on page 26

---

**[[: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 65.

**Manual operation:**    See ["Sigma\\_vert\\_iono\\_gradient"](#) on page 26

---

**[[: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

**Example:**                    See [Example"Configuring GBAS message type 2 parameters"](#) on page 66.

**Manual operation:**    See ["Kmd\\_e\\_C,GPS/Kmd\\_e\\_C,GLONASS"](#) on page 29

---

```
[: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
```

**Example:** See [Example"Configuring GBAS message type 2 parameters"](#) on page 66.

**Manual operation:** See ["Kmd\\_e\\_POS,GPS/Kmd\\_e\\_POS,GLONASS"](#) on page 29

---

```
[: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
```

**Example:** See [Example"Configuring GBAS message type 2 parameters"](#) on page 66.

**Manual operation:** See ["Maximum User Distance"](#) on page 29

---

```
[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:PSERvice:STATE <State>
```

Selects if the GBAS positioning service is supported.

**Parameters:**

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

**Example:** See [Example"Configuring GBAS message type 2 parameters"](#) on page 66.

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

---

```
[: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

**Example:** See [Example"Configuring GBAS message type 2 parameters"](#) on page 66.

**Manual operation:** See ["Reference Station Data Selector"](#) on page 29

**[ :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

**Example:** See [Example"Configuring GBAS message type 2 parameters"](#) on page 66.

**Manual operation:** See ["Kmd\\_e\\_D,GPS/Kmd\\_e\\_D,GLONASS"](#) on page 30

**[ :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

**Example:** See [Example"Configuring GBAS message type 2 parameters"](#) on page 66.

**Manual operation:** See ["Sigma\\_vert\\_iono\\_gradient\\_D"](#) on page 30

**[ :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> 1 | ON | 0 | OFF  
\*RST: 0

**Example:** See [Example"Configuring GBAS message type 2 parameters"](#) on page 66.

**Manual operation:** See ["Slot Group Definition"](#) on page 31

**[[: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 65.

**Manual operation:** See ["Reference Location Configuration"](#) on page 27

**[[: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 65.

**Manual operation:** See ["Reference Location Configuration"](#) on page 27

---

```
[ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:LOCation:COORdinateS:FORMat
<Format>
```

Sets the format in which the latitude and longitude are set.

**Parameters:**

<Format> DMS | DECimal  
 \*RST: DMS

**Example:**

See [Example "Generating a GBAS signal for message-format detection"](#) on page 65.

**Manual operation:**

See ["Reference Location Configuration"](#) on page 27

### 6.5.3 Message type 4 commands

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---

#### `[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:MT4State <Mt4State>`

Enables the configuration of message type 4.

##### Parameters:

`<Mt4State>`            1 | ON | 0 | OFF  
 \*RST:                0

**Example:**            See [Example "Generating a GBAS signal containing message type 4"](#) on page 67.

**Manual operation:**    See ["Message Type 4"](#) on page 33

---

#### `[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FDSSState <Fdss>`

Enables the configuration of Final Approach Segment (FAS) data set.

##### Parameters:

`<Fdss>`                1 | ON | 0 | OFF  
 \*RST:                1

**Example:**            See [Example "Generating a GBAS signal containing message type 4"](#) on page 67.

**Manual operation:**    See ["FAS Data Set"](#) on page 34

---

#### `[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FDB<st>:AID <AId>`

#### `[: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 67.

**Manual operation:** See ["Airport ID"](#) on page 36

---

**[ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:APDesignator <ApPerDes>**

Requires "Mode > GBAS" (LAAS) header information.

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 67.

**Manual operation:** See ["Approach Performance Designator"](#) on page 36

---

**[ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FDB<st>:ATCHeight <Tch>**

**[ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:ATCHeight <Tch>**

Requires "Mode > GBAS" (LAAS) header information.

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 67.

**Manual operation:** See ["Plan View/Profile View Parameters"](#) on page 35

---

**[ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:ATUSelector <TchUnit>**

Requires "Mode > GBAS" (LAAS) header information.

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 67.

**Manual operation:** See ["Plan View/Profile View Parameters"](#) on page 35

---

**[[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:CWAThreshold <CrWdAtTh>**

Requires "Mode > GBAS" (LAAS) header information.

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 67.

**Manual operation:** See ["Course Width at Threshold"](#) on page 37

---

**[[: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 67.

**Manual operation:** See ["Delta\\_FPAP Location Configuration"](#) on page 41

---

**[[: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>	NORTH   SOUTH Defines the latitude direction. *RST: NORT

**Example:** See [Example"Generating a GBAS signal containing message type 4"](#) on page 67.

**Manual operation:** See ["Delta\\_FPAP Location Configuration"](#) on page 41

---

**[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:DFLocation:COORDinates:  
FORMat <Format>**

Sets the format in which the latitude and longitude are set.

**Parameters:**

<Format>	DMS   DECimal *RST: DMS
----------	----------------------------

**Example:** See [Example"Generating a GBAS signal containing message type 4"](#) on page 67.

**Manual operation:** See ["Delta\\_FPAP Location Configuration"](#) on page 41

---

**[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:DLOffset <DelLenOff>**

Requires "Mode > GBAS" (LAAS) header information.

Sets the delta length offset.

**Parameters:**

<DelLenOff>	float
	Range: 0 to 2032
	Increment: 8
	*RST: 0

**Example:** See ["Example"Generating a GBAS signal containing message type 4"](#) on page 67.

**Manual operation:** See ["Delta\\_Length Offset"](#) on page 37

---

**[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:FDB<st>:DDLlocation:COORDinates:DECimal <Longitude>, <Latitude>**

Defines the coordinates of the Delta DERP location in decimal format.

**Parameters:**

<Longitude>	string
	Range: -0.182045 to 0.182045
	Increment: 1E-6
	*RST: 0
<Latitude>	string
	Range: -0.091023 to 0.091023
	Increment: 1E-6
	*RST: 0

**Example:**

```
:SOURCE1:BB:GBAS:VDB1:MCON:FDB1:DDL:COOR:
DECimal -0.012652,0.027897
:SOURCE1:BB:GBAS:VDB1:MCON:FDB1:DDL:COOR:FORMat
DMS
:SOURCE1:BB:GBAS:VDB1:MCON:FDB1:DDL:COOR:DMS?
// Response: 0,0,45.547,WEST,0,1,40.429,NORT
```

**Manual operation:** See ["Delta\\_DERP Location Configuration"](#) on page 43

---

**[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:FDB<st>:DDLlocation:COORDinates:DMS <LongitudeDeg>, <LongitudeMin>, <LongitudeSec>, <LongitudeDir>, <LatitudeDeg>, <LatitudeMin>, <LatitudeSec>, <LatitudeDir>**

Defines the coordinates of the Delta DERP location in degrees, minutes and seconds.



**Parameters:**

<LongitudeDeg>	integer	Range: 0 to 0
		*RST: 0
<LongitudeMin>	integer	Range: 0 to 10
		*RST: 0
<LongitudeSec>	float	Range: 0 to 55.358
		Increment: 0.001
		*RST: 0
<LongitudeDir>	select	
		*RST: EAST
<LatitudeDeg>	integer	Range: 0 to 0
		*RST: 0
<LatitudeMin>	integer	Range: 0 to 5
		*RST: 0
<LatitudeSec>	float	Range: 0 to 27.679
		Increment: 0.001
		*RST: 0
<LatitudeDir>	select	
		*RST: NORT

**Example:** See [\[:SOURce<hw>\]:BB:GBAS:VDB<ch>:MCONfig:FDB<st>:DDLocation:COORDinates:DECimal](#) on page 96.

**Manual operation:** See ["Delta\\_DERP Location Configuration"](#) on page 43

**[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FDB<st>:DDLocation:COORDinates:FORMat <Format>**

Sets the format in which the latitude and longitude are set.

**Parameters:**

<Format>	DMS   DECimal
	*RST: DMS

**Example:** See [\[:SOURce<hw>\]:BB:GBAS:VDB<ch>:MCONfig:FDB<st>:DDLocation:COORDinates:DECimal](#) on page 96.

**Manual operation:** See ["Delta\\_DERP Location Configuration"](#) on page 43

---

**[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FDB<st>:DPLocation:  
COORdinates:DECimal <Longitude>, <Latitude>**

**Parameters:**

<Longitude> float  
 Range: -180 to 180  
 Increment: 1E-6  
 \*RST: 0

<Latitude> float  
 Range: -90 to 90  
 Increment: 1E-6  
 \*RST: 0

**Example:**

```
:SOURce1:BB:GBAS:VDB1:MCON:FDB1:DPL:COOR:
DECimal -0.012652,0.027897
:SOURce1:BB:GBAS:VDB1:MCON:FDB1:DPL:COOR:FORMat
DMS
:SOURce1:BB:GBAS:VDB1:MCON:FDB1:DPL:COOR:DMS?
// Response: 0,0,45.547,WEST,0,1,40.429,NORT
```

**Manual operation:** See "[DP Location Configuration](#)" on page 42

---

**[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FDB<st>:DPLocation:  
COORdinates:DMS <LongitudeDeg>, <LongitudeMin>, <LongitudeSec>,  
<LongitudeDir>, <LatitudeDeg>, <LatitudeMin>, <LatitudeSec>, <LatitudeDir>**

**Parameters:**

<LongitudeDeg> integer  
 Range: 0 to 180  
 \*RST: 0

<LongitudeMin> integer  
 Range: 0 to 59  
 \*RST: 0

<LongitudeSec> float  
 Range: 0 to 59.999  
 Increment: 0.001  
 \*RST: 0

<LongitudeDir> select  
 \*RST: EAST

<LatitudeDeg> integer  
 Range: 0 to 90  
 \*RST: 0

<LatitudeMin> integer  
 Range: 0 to 59  
 \*RST: 0

<LatitudeSec>	float
	Range: 0 to 59.999
	Increment: 0.001
	*RST: 0
<LatitudeDir>	select
	*RST: NORT

**Example:** See [\[:SOURce<hw>\]:BB:GBAS:VDB<ch>:MCONfig:FDB<st>:DPLocation:COORDinates:DECimal](#) on page 98.

**Manual operation:** See ["DP Location Configuration"](#) on page 42

**[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FDB<st>:DPLocation:COORDinates:FORMat <Format>**

Sets the format in which the latitude and longitude are set.

**Parameters:**

<Format>	DMS   DECimal
	*RST: DMS

**Example:** See [\[:SOURce<hw>\]:BB:GBAS:VDB<ch>:MCONfig:FDB<st>:DPLocation:COORDinates:DECimal](#) on page 98.

**Manual operation:** See ["DP Location Configuration"](#) on page 42

**[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FLAA <FasVt>**

Requires "Mode > GBAS" (LAAS) header information.

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 67.

**Manual operation:** See ["FAS Lateral Alert Limit / Approach Status"](#) on page 37

**[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FVAA <Fvaa>**

Requires "Mode > GBAS" (LAAS) header information.

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 67.

**Manual operation:** See ["FAS Vertical Alert Limit / Approach Status"](#) on page 37

```
[ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FDB<st>:GPANgle <Gpa>
[: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 67.

**Manual operation:** See ["Plan View/Profile View Parameters"](#) on page 35

```
[ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:LFLocation:COORdinate:
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 67.

**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 67.

**Manual operation:** See ["LTP/FTP Location Configuration"](#) on page 41

---

**[ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:LFLocation:COORdinates:  
FORMat <Format>**

Sets the format in which the latitude and longitude are set.

**Parameters:**

<Format>                    DMS | DECimal  
\*RST:                    DMS

**Example:**                    See [Example "Generating a GBAS signal containing message type 4"](#) on page 67.

**Manual operation:**    See "[LTP/FTP Location Configuration](#)" on page 41

---

**[ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:LFLocation:HEIGHt <LfHeight>**

Requires "Mode > GBAS" (LAAS) header information.

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 67.

**Manual operation:**    See "[Plan View/Profile View Parameters](#)" on page 35

---

**[ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:NFDBlocks <Nfdb>**

Requires "Mode > SCAT-I" header information.

Sets the number of FAS data blocks.

**Parameters:**

<Nfdb>                    integer  
Range:                    1 to 5  
\*RST:                    1

**Example:**                    :SOURce1:BB:GBAS:VDB1:MCONfig:NFDBlocks 1  
Sets 1 FAS data block.

---

**[ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FDB<st>:RLETter <Rlet>  
[ :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 67.

**Manual operation:** See ["Runway Letter"](#) on page 36

```
[ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FDB<st>:RNUMber <Rnum>
[: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 67.

**Manual operation:** See ["Runway Number"](#) on page 36

```
[ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FDB<st>:RPDF <Rpdf>
[: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 67.

**Manual operation:** See ["Reference Path Data Selector"](#) on page 37

```
[ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FDB<st>:RPIF <Rpif>
[: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 67.

**Manual operation:** See ["Reference Path ID"](#) on page 37

```
[ :SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:FDB<st>:RUINdicator <Ruin>
[: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 67.

**Manual operation:** See ["Route Indicator"](#) on page 36

**[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:TDSState <Tdss>**

Requires "Mode > GBAS" (LAAS) header information.

Enables the configuration of the Terminal Area Path (TAP) data set.

**Parameters:**

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

**Example:** See [Example"Generating a GBAS signal containing message type 4"](#) on page 67.

**Manual operation:** See ["TAP Data Set"](#) on page 38

**[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:FRCLink <Rpcl>**

Requires "Mode > GBAS" (LAAS) header information.

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 67.

**Manual operation:** See ["FAS RPDS or Continuation Link"](#) on page 40

**[:SOURCE<hw>]:BB:GBAS:VDB<ch>:MCONfig:NOPPoint <Nofp>**

Requires "Mode > GBAS" (LAAS) header information.

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 67.



**Manual operation:** See ["Number of Path Points - N"](#) on page 39

---

**[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:RPDT <Rpdt>**

Requires "Mode > GBAS" (LAAS) header information.

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 67.

**Manual operation:** See ["Reference Path Data Selector"](#) on page 38

---

**[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:RPIT <Rpit>**

Requires "Mode > GBAS" (LAAS) header information.

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 67.

**Manual operation:** See ["Reference Path ID"](#) on page 39

---

**[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:TLAS <Tlas>**

Requires "Mode > GBAS" (LAAS) header information.

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 67.

**Manual operation:** See ["TAP Lateral Alert Limit / Status"](#) on page 40

---

**[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:TVAS <Tvas>**

Requires "Mode > GBAS" (LAAS) header information.

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 67.

**Manual operation:** See ["TAP Vertical Alert Limit / Status"](#) on page 40

**[ :SOURce<hw> ] :BB:GBAS:VDB<ch> :MCONfig:WAYPoint:PREDefined:CATalog?  
 [ :SOURce<hw> ] :BB:GBAS:VDB<ch> :MCONfig:WAYPoint:USER:CATalog?**

Requires "Mode > GBAS" (LAAS) header information.

Queries the names of the existing user defined/predefined waypoint files.

Per default, the instrument saves 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 67.

**Usage:** Query only

**Manual operation:** See ["Waypoint File"](#) on page 39

**[ :SOURce<hw> ] :BB:GBAS:VDB<ch> :MCONfig:WAYPoint:PREDefined:FILE  
 <WpFile>**

Requires "Mode > GBAS" (LAAS) header information.

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 67.

**Usage:** Setting only

**Manual operation:** See ["Predefined Files"](#) on page 24  
 See ["Waypoint File"](#) on page 39

**[ :SOURce<hw> ] :BB:GBAS:VDB<ch> :MCONfig:WAYPoint:USER:FILE <Filename>**

Requires "Mode > GBAS" (LAAS) header information.

Loads the selected user-defined file (extension \*.txt).

Per default, the instrument saves 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 saved in the default directory, only the file name is required.

**Example:** See [Example "Generating a GBAS signal containing message type 4"](#) on page 67.

**Usage:** Setting only

**Manual operation:** See ["Waypoint File"](#) on page 39

**[:SOURce<hw>]:BB:GBAS:VDB<ch>:MCONfig:WAYPoint:FILE?**

Requires "Mode > GBAS" (LAAS) header information.

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 67.

**Usage:** Query only

**Manual operation:** See ["Waypoint File"](#) on page 39

## 6.6 Filter/clipping/modulation commands

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[:SOURce<hw>]:BB:GBAS:FILTer:PARAmeter:PGAuss.....	108
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---

#### **[:SOURce<hw>]:BB:GBAS:CLIPping:STATE <State>**

Enables/disable clipping.

##### **Parameters:**

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

**Example:**                See [Example"Querying the default filter, clipping and modulation settings"](#) on page 68.

**Manual operation:**    See ["State"](#) on page 53

---

#### **[: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 68.

**Manual operation:**    See ["Clipping Level"](#) on page 53

---

#### **[: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 68.

**Manual operation:**    See ["Clipping Mode"](#) on page 53

---

**[: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	bandwidth to symbol rate ratio	<CoFs>	-2	2	0.01	1.00
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
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 68.

**Manual operation:** See ["Rolloff Factor or BxT"](#) on page 51

**[[: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 68.

**Manual operation:** See ["Filter"](#) 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 68.

**Usage:** Query only

**Manual operation:** See ["Modulation Type"](#) on page 52

**[: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 68.

**Usage:** Query only

**Manual operation:** See ["Sample Rate Variation/Sample Rate Info"](#) on page 52

**[: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 68.

**Usage:** Query only

**Manual operation:** See ["Sample Rate Variation/Sample Rate Info"](#) on page 52

## 6.7 Trigger commands

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<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:TRIGger:RMODE?</a> .....	111
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:TRIGger:TIME:DATE</a> .....	112
<a href="#">[:SOURce&lt;hw&gt;]:BB:GBAS:TRIGger:TIME:TIME</a> .....	112
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---

### `[:SOURce<hw>]:BB:GBAS[:TRIGger]:SEQUence <Sequence>`

Selects the trigger mode.

#### Parameters:

<Sequence>            AUTO | RETRigger | AAUTo | ARETRigger | SINGLE  
\*RST:                AUTO

**Example:**            See [Example"Adjusting clock, marker and trigger settings"](#)  
on page 68.

**Manual operation:**    See ["Mode"](#) on page 54

---

### `[:SOURce<hw>]:BB:GBAS:TRIGger:SOURce <Source>`

Selects the trigger signal source and determines the way the triggering is executed.  
Provided are:

- Internal triggering by a command (INTernal)
- External trigger signal via one of the User x connectors  
EGT1: External global trigger
- In primary-secondary instrument mode, the external baseband synchronization signal (BBSY)
- EXTErnal: Setting only  
Provided only for backward compatibility with other Rohde & Schwarz signal generators.  
The R&S SMBV100B accepts this value and maps it automatically as follows:  
EXTErnal = EGT1

#### Parameters:

<Source>                INTernal | EGT1 | EXTErnal | EGC1 | BBSY  
\*RST:                INTernal

**Example:**            See [Example"Adjusting clock, marker and trigger settings"](#)  
on page 68.

**Manual operation:**    See ["Source"](#) on page 56

---

### `[:SOURce<hw>]:BB:GBAS:TRIGger:RMODE?`

Queries the status of signal generation.

#### Return values:

<RMode>                STOP | RUN  
\*RST:                STOP

**Example:**                   :SOURce1:BB:GBAS:TRIGger:SOURce EXTernal  
                               :SOURce1:BB:GBAS:TRIGger:SEQuence ARETrigger  
                               :SOURce1:BB:GBAS:TRIGger:RMODE?  
                               // Response: RUN

**Usage:**                    Query only

**Manual operation:**    See ["Running/Stopped"](#) on page 56

**[:SOURce<hw>]:BB:GBAS:TRIGger:TIME:DATE <Year>, <Month>, <Day>**

Sets the date for a time-based trigger signal. For trigger modes single or armed auto, you can activate triggering at this date via the following command:

```
SOURce<hw>:BB:<DigStd>:TRIGger:TIME:STATe
```

<DigStd> is the mnemonic for the digital standard, for example, ARB. Time-based triggering behaves analogously for all digital standards that support this feature.

**Parameters:**

<Year>	integer	
	Range:	1980 to 9999
<Month>	integer	
	Range:	1 to 12
<Day>	integer	
	Range:	1 to 31

**Example:**                    See example "Configure a time-based trigger signal" in the sub-chapter "Trigger Commands" of the chapter "SOURce:BB:ARB subsystem" in the R&S SMBV100B user manual.

**Manual operation:**    See ["Trigger Time"](#) on page 55

**[:SOURce<hw>]:BB:GBAS:TRIGger:TIME:TIME <Hour>, <Minute>, <Second>**

Sets the time for a time-based trigger signal. For trigger modes single or armed auto, you can activate triggering at this time via the following command:

```
SOURce<hw>:BB:<DigStd>:TRIGger:TIME:STATe
```

<DigStd> is the mnemonic for the digital standard, for example, ARB. Time-based triggering behaves analogously for all digital standards that support this feature.

**Parameters:**

<Hour>	integer	
	Range:	0 to 23
<Minute>	integer	
	Range:	0 to 59
<Second>	integer	
	Range:	0 to 59



**Example:** See example "Configure a time-based trigger signal" in the sub-chapter "Trigger Commands" of the chapter "SOURce:BB:ARB subsystem" in the R&S SMBV100B user manual.

**Manual operation:** See ["Trigger Time"](#) on page 55

**[:SOURce<hw>]:BB:GBAS:TRIGger:TIME[:STATe] <State>**

Activates time-based triggering with a fixed time reference. If activated, the R&S SMBV100B triggers signal generation when its operating system time matches a specified time.

Specify the trigger date and trigger time with the following commands:

```
SOURce<hw>:BB:<DigStd>:TRIGger:TIME:DATE
```

```
SOURce<hw>:BB:<DigStd>:TRIGger:TIME:TIME
```

<DigStd> is the mnemonic for the digital standard, for example, ARB. Time-based triggering behaves analogously for all digital standards that support this feature.

**Parameters:**

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

**Example:** See example "Configure a time-based trigger signal" in the sub-chapter "Trigger Commands" of the chapter "SOURce:BB:ARB subsystem" in the R&S SMBV100B user manual.

**Manual operation:** See ["Time Based Trigger"](#) on page 55

**[:SOURce<hw>]:BB:GBAS:TRIGger:SLENgth <Slength>**

Defines the signal sequence length.

**Parameters:**

<Slength>                integer  
Range:                    1 to 4294967295  
\*RST:                    5250

**Example:**                :SOURce1:BB:GBAS:TRIGger:SLUNit SEquence  
                              :SOURce1:BB:GBAS:TRIGger:SLENgth 10

**Manual operation:** See ["Signal Duration"](#) on page 55

**[:SOURce<hw>]:BB:GBAS:TRIGger:SLUNit <Slunit>**

Sets the units the trigger sequence length is expressed in.

**Parameters:**

<Slunit>                   SEQUENCE | SAMPLE  
\*RST:                    SEQUENCE

**Example:**                :SOURce1:BB:GBAS:TRIGger:SLUNit SEquence

**Manual operation:** See ["Signal Duration Unit"](#) on page 55

---

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

Stops the signal generation until subsequent trigger event occurs.

**Example:** See [Example"Adjusting clock, marker and trigger settings"](#) on page 68.

**Usage:** Event

**Manual operation:** See ["Arm"](#) on page 56

---

**[:SOURce<hw>]:BB:GBAS:TRIGger:EXECute**

Executes trigger manually.

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

**Example:** See [Example"Adjusting clock, marker and trigger settings"](#) on page 68.

**Usage:** Event

**Manual operation:** See ["Execute Trigger"](#) on page 56

---

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

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

**Parameters:**

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

**Example:** SOURce1:BB:GBAS:TRIGger:EXTernal:SYNChronize:  
OUTPut ON

**Manual operation:** See ["Sync. Output to External Trigger/Sync. Output to Trigger"](#) on page 57

---

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

Sets the trigger delay.

**Parameters:**

<Delay> float  
Range: 0 to 2147483647  
Increment: 0.01  
\*RST: 0

**Example:** SOURce1:BB:GBAS:TRIGger:EXTernal:DELay 100

**Manual operation:** See ["External Delay/Trigger Delay"](#) on page 58

---

**[:SOURce<hw>]:BB:GBAS:TRIGger[:EXternal]:INHibit <Inhibit>**

Specifies the number of symbols by which a restart is to be inhibited following a trigger event.

**Parameters:**

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

**Example:**                    SOURce1:BB:GBAS:TRIGger:EXternal:INHibit 100

**Manual operation:**    See ["External Inhibit/Trigger Inhibit"](#) on page 57

## 6.8 Marker commands

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---

**[:SOURce<hw>]:BB:GBAS:TRIGger:OUTPut<ch>:DELay <Delay>**

Sets the marker delay.

**Parameters:**

<Delay>                    float  
                                  Range:        0 to 16777215  
                                  Increment:   1  
                                  \*RST:        0

**Example:**                    :SOURce1:BB:GBAS:TRIGger:OUTPut1:DELay 1600  
 Sets the a marker delay of 1600 samples.

**Manual operation:**    See ["Delay"](#) on page 60

---

**[: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 68.

**Manual operation:**    See ["Mode"](#) on page 59

---

```
[: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 68.

**Manual operation:** See ["Mode"](#) on page 59

---

```
[:SOURce<hw>]:BB:GBAS:TRIGger:OUTPut<ch>:PATTern <Pattern>, <BitCount>
```

Defines the bit pattern used to generate the marker signal `PATTern`.

**Parameters:**

```
<Pattern>          numeric
                    *RST:    #H2

<BitCount>        integer
                    Range:    1 to 64
                    *RST:    2
```

**Example:**

```
:SOURce1:BB:GBAS:TRIGger:OUTPut1:MODE PATTern
:SOURce1:BB:GBAS:TRIGger:OUTPut1:PATTern
#H5670,15
```

**Manual operation:** See ["Mode"](#) on page 59

---

```
[: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 ["Mode"](#) on page 59

**[ :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 "Mode" on page 59

## 6.9 Clock commands

[ :SOURce<hw>]:BB:GBAS:CLOCK:SOURce.....	117
[ :SOURce<hw>]:BB:GBAS:CLOCK:MODE.....	117

**[ :SOURce<hw>]:BB:GBAS:CLOCK:SOURce <Source>**

Selects the clock source.

- INTernal: Internal clock reference.

**Parameters:**

<Source> INTernal  
 \*RST: INTernal

**Example:** See [Example "Adjusting clock, marker and trigger settings"](#) on page 68.

**Manual operation:** See "[Clock Source](#)" on page 61

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

Sets the type of the external clock.

**Parameters:**

<Mode> MSAMple | SAMPlE  
 \*RST: SAMPlE

**Manual operation:** See "[Clock Mode](#)" on page 61

# Annex

## A Supported file formats

The R&S SMBV100B supports the following file formats:

- Waypoint files, see [Chapter A.1, "Waypoint file format"](#), on page 118.
- Files with GBAS differential data, see [Chapter A.2, "GBAS differential file format"](#), on page 118.
- Files with SCAT-I differential data, see [Chapter A.3, "SCAT-I differential file format"](#), on page 121.

These files use predefined file extensions and file structure.

### A.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 118).

**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
```

### A.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](#).

**Example: Predefined GBAS differential file Correction1.rs\_gbas**

The R&S SMBV100B expects GBAS differential data structured and tagged as in the example of the file format [Example"Predefined GBAS differential file Correction1.rs\\_gbas"](#) on page 119 below.

All parameters and tags within the file format are mandatory.

```
<reference1>
  <general>
    <property refcoord="11.5833,48.15,110"/>
  </general>
  <dgnsrecord>
    <property modifiedzcount="215.1"/>
    <property ephemerisdecorrelation1="0x00">
    <property ephemerisdecorrelation11="0x00">
    <property sourceavailabilityduration="0xFF">
    <property measurementtype="0"/>
    <property ephemeriscrc="0xECF0"/>
    <dgnsvector crc="" data="G1,4,311.49,-1.20"/>
    <dgnsvector crc="" data="G3,16,81.6,3.41"/>
    <dgnsvector crc="" data="G4,110,65,-1.1"/>
    <dgnsvector crc="" data="G10,21,6.31,-0.51"/>
    <dgnsvector crc="" data="R6,61,5.85,-0.41"/>
    <dgnsvector crc="" data="S125,126,212.15,9.41"/>
  </dgnsrecord>
  <dgnsrecord>
    <property modifiedzcount="225.1"/>
    <property ephemerisdecorrelation1="0x00">
    <property ephemerisdecorrelation11="0x00">
    <property sourceavailabilityduration="0xFF">
    <property measurementtype="0"/>
    <property ephemeriscrc="0xEFF0"/>
    <dgnsvector crc="" data="G1,4,311.49,-1.20"/>
    <dgnsvector crc="" data="G3,16,81.6,3.41"/>
    <dgnsvector crc="" data="G4,110,65,-1.1"/>
    <dgnsvector crc="" data="G10,21,6.31,-0.51"/>
    <dgnsvector crc="" data="R6,61,5.85,-0.41"/>
    <dgnsvector crc="" data="S125,126,212.15,9.41"/>
  </dgnsrecord>
  <dgnsrecord>
    <property modifiedzcount="235.1"/>
    <property ephemerisdecorrelation1="0x00">
    <property ephemerisdecorrelation11="0x00">
    <property sourceavailabilityduration="0xFF">
    <property measurementtype="0"/>
    <property ephemeriscrc="0xBCF0"/>
    <dgnsvector crc="" data="G1,4,311.49,-1.20"/>
    <dgnsvector crc="" data="G3,16,81.6,3.41"/>
    <dgnsvector crc="" data="G4,110,65,-1.1"/>
    <dgnsvector crc="" data="G10,21,6.31,-0.51"/>
```

```

    <dgncsvector crc="" data="R6,61,5.85,-0.41"/>
    <dgncsvector crc="" data="S125,126,212.15,9.41"/>
  </dgncsrecord>
</reference1>

```

The [Format of \\*.rs\\_gbas file](#) describes the used tags and parameters. The differential GNSS vector <dgncsvector> supports message type 1 and message type 11 <data>.

**Table A-1: Format of \*.rs\_gbas file**

Container	Tag name	Parameter	Description	
<reference1>				
<general>				
	<property>	<refcoord>	Longitude, latitude and altitude of the reference point	
<dgncsrecord>			One <dgncsrecord> per measurement	
	<property>	<modifiedzcount>	Modified z-count for one or more records	
		<ephemerisdecorrelation1>	Ephemeris decorrelation for message type 1 Characterizes the impact of residual ephemeris errors due to spatial decorrelation. If the parameter is omitted, the default value "0" is transmitted.	
		<ephemerisdecorrelation11>	Ephemeris decorrelation for message type 11 Characterizes the impact of residual ephemeris errors due to spatial decorrelation. If the parameter is omitted, the default value "0" is transmitted.	
		<sourceavailabilityduration>	Specifies the predicted duration, for that corrections for the ranging source are expected to remain available, relative to the modified z-count for the first measurement block.  If the parameter is omitted, transmitted is "0xFF" to indicate that duration information is <i>not</i> provided.	
		<measurementtype>	Measurement type	
		<ephemeriscrc>	Ephemeris CRC	
	<dgncsvector>			One <dgncsvector> per each of the N measurement blocks:
		<crc>		The CRC keyword tag is mandatory, the content can be empty: <crc>=""
		<data>		<GNSS_Standard: G for GPS, R for Glonass and S for SBAS><SVID>, <Issue of Data (IOD)>, <Pseudorange Correction (PRC_100/PRC_30 for MT 1/11) in m>, <Range Rate Correction (RRC_100/RRC_30 for MT 1/11) in m/s>, <Sigma_pr_gnd_100 (SPR_100)>, <Sigma_pr_gnd_30 (SPR_30)>, <B1>,<B2>,<B3>,<B4>



## A.3 SCAT-I differential file format

The SCAT-I differential files are proprietary files with file extension \*.rs\_scat. The file contains the required information for message type 1, as defined in the GBAS specification [RTCA DO-217](#).

### Example: Predefined SCAT-I differential file Correction1.rs\_scat

The R&S SMBV100B expects GBAS differential data structured and tagged as in the example of the file format [Example"Predefined SCAT-I differential file Correction1.rs\\_scat"](#) on page 121 below.

All parameters and tags within the file format are in conformance with the GBAS specification [RTCA DO-217](#).

```
<reference1>
  <general>
    <property refcoord="11.5833,48.15,110"></property>
  </general>
  <dgnsrecord>
    <property modifiedzcount="215.1"></property>
    <dgnsvector data="G1,4,311.49,-1.20"></dgnsvector>
    <dgnsvector data="G3,16,81.6,3.41"></dgnsvector>
    <dgnsvector data="G4,110,65,-1.1"></dgnsvector>
    <dgnsvector data="G10,21,6.31,-0.51"></dgnsvector>
  </dgnsrecord>
  <dgnsrecord>
    <property modifiedzcount="225.1"></property>
    <dgnsvector data="G1,4,311.49,-1.20"></dgnsvector>
    <dgnsvector data="G3,16,81.6,3.41"></dgnsvector>
    <dgnsvector data="G4,110,65,-1.1"></dgnsvector>
    <dgnsvector data="G10,21,6.31,-0.51"></dgnsvector>
  </dgnsrecord>
  <dgnsrecord>
    <property modifiedzcount="235.1"></property>
    <dgnsvector data="G1,4,311.49,-1.20"></dgnsvector>
    <dgnsvector data="G3,16,81.6,3.41"></dgnsvector>
    <dgnsvector data="G4,110,65,-1.1"></dgnsvector>
    <dgnsvector data="G10,21,6.31,-0.51"></dgnsvector>
  </dgnsrecord>
</reference1>
```

The [Format of \\*.rs\\_scat file](#) describes the used tags and parameters.

**Table A-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

Container	Tag name	Parameter	Description
	<property>	<modifiedzcount>	Modified z-count for the record (s)
	<dgssvector>		One <dgssvector> per each of the N measurement blocks:
		<crc>	The CRC keyword tag is mandatory, the content can be empty: <crc>=""
		<data>	<GNSS_Standard: G for GPS, R for GLONASS and S for SBAS><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>

## Glossary: Specifications and references

### R

**RTCA DO-217:** "Minimum Aviation System Performance Standards DGNSS Instrument Approach System: Special Category 1 (SCAT-1)"

**RTCA DO-246D:** "GNSS-Based Precision Approach Local Area Augmentation System (LAAS) Signal-in-Space Interface Control Document (ICD)"

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