R&S®EVSF1000
VHF/UHF Nav/Flight Analyzer
User Manual

1178641002

ROHDE&SCHWARZ
Make ideas real

This document describes the following R&S EVSF1000 models with firmware version 1.50 or later:

- R&S EVSF1000 VHF/UHF nav/drone analyzer (1330.0350K02)
- R&S EVSF1000 (1330.0008.02)

Furthermore, it covers the following options:

- R&S EVSF1-B4 (1330.1404.02)
- R&S EVSF1-Z1 (1330.1410.02)
- R&S EVSF1-Z2 (1330.1427.02)
- R&S EVSG-K1 ILS CRS/CLR analysis (1329.9005.02)
- R&S EVSG-K2 VOR analysis (1329.9011.02)
- R&S EVSG-K3 Marker beacon analysis (1329.9028.02)
- R&S EVSG-K4 GBAS analysis (1329.9034.02)
- R&S EVSG-K5 SCAT-I Analysis (1329.9040.02)
- R&S EVSG-K6 COM analysis (1329.9057.02)
- R&S EVSG1-K7 LF-Analysis (1329.9163.02)
- R&S EVSG-K10 RF spectrum analysis (1329.9063.02)
- R&S EVSG-K11 AF spectrum analysis (1329.9070.02)
- R&S EVSG1-K25 I/Q data streaming (1329.9157.02)

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1178.6410.02 | Version 08 | R&S®EVSF1000

Throughout this manual, products from Rohde & Schwarz are indicated without the ® symbol , e.g. R&S®EVSF1000 is indicated as R&S EVSF1000.

Contents

1 Getting started

Note: the following chapters are identical to those in the printed R&S EVSF1000 Getting Started manual.

1.1 Safety information

The product documentation helps you use the product safely and efficiently. Follow the instructions provided here and in the following chapters.

Intended use

The R&S EVSF1000 is a level and modulation analyzer intended for installation in flight inspection aircraft. It performs measurements on instrument landing systems (ILS), ground-based augmentation systems (GBAS), very high frequency omnidirectional range (VOR) and marker beacon ground stations. It analyzes air traffic control communications (ATC COM) signals measured during startup, maintenance and servicing. The instrument's mechanical and electrical design and high sensitivity make it ideal for state-of-the-art flight inspection.

Use the product only for its designated purpose. Observe the operating conditions and performance limits stated in the data sheet.

Target audience

The R&S EVSF1000 and its documentation is targeted at air navigation service providers (ANSP), ground inspection service providers, national authorities for air traffic control, and manufacturers and airport technicians for ILS, GBAS and VOR ground equipment. Users require basic knowledge of ILS, GBAS and VOR ground equipment, as well as the International Civil Aviation Organization (ICAO) specifications in document 8071, annex 10.

Where do I find safety information?

Safety information is part of the product documentation. It warns you of potential dangers and gives instructions on how to prevent personal injury or damage caused by dangerous situations. Safety information is provided as follows:

- In Chapter 1.1.1, "Safety instructions", on page 5. The same information is provided in many languages as printed "Safety Instructions". The printed "Safety Instructions" are delivered with the product.
- Throughout the documentation, safety instructions are provided when you need to take care during setup or operation.

1.1.1 Safety instructions

Products from the Rohde & Schwarz group of companies are manufactured according to the highest technical standards. To use the products safely, follow the instructions provided here and in the product documentation. Keep the product documentation nearby and offer it to other users.

Use the product only for its intended use and within its performance limits. Intended use and limits are described in the product documentation such as the data sheet, manuals and the printed "Safety Instructions". If you are unsure about the appropriate use, contact Rohde & Schwarz customer service.

Using the product requires specialists or specially trained personnel. These users also need sound knowledge of at least one of the languages in which the user interfaces and the product documentation are available.

Reconfigure or adjust the product only as described in the product documentation or the data sheet. Any other modifications can affect safety and are not permitted.

Never open the casing of the product. Only service personnel authorized by Rohde & Schwarz are allowed to repair the product. If any part of the product is damaged or broken, stop using the product. Contact Rohde & Schwarz customer service at https://www.rohde-schwarz.com/support.

Operating the product

The product is intended for mobile use. The maximum weight of the product is provided in the data sheet. If the product casing is not waterproof, use an adequate weather protection to carry the product outdoors with you.

When using the product in a vehicle or aircraft, make sure that the product is properly secured. If stacking is possible, secure the whole stack of products so that they cannot fall over and cause injury.

Observe the ambient conditions such as altitude, operating temperature and climatic loads; see the data sheet.

Due to their exposed location, mobile communications systems are at risk of damage from lightning. This also poses a risk to persons nearby. Vehicles carrying mobile communications systems require an electrically conductive body, a grounded antenna and also equipotential bonding that includes the cables routed into the vehicle.

Connecting to power

The product runs on DC voltage. For the specifications of the supply voltage for the product, refer to the data sheet. Under normal conditions, contact with DC voltage in this range poses a low risk of electric shock.

Take the following measures for your safety:

- If you connect the product to an external power supply, use one recommended in the product documentation.
- If you connect the product to a battery, observe the safety information delivered with the battery.
- Before switching on the product, ensure that the voltage and frequency indicated on the product match the available power source.
- Only use intact cables and route them carefully so that they cannot be damaged. Also ensure that nobody can trip over loose cables.

Using headphones

Take the following measures to prevent hearing damage. Before using headphones, check the volume and reduce it if necessary. If you monitor varying signal levels, take off the headphones and wait until the signal has settled. Then adjust the volume.

Meaning of safety labels

Safety labels on the product warn against potential hazards.

⚠	Potential hazard Read the product documentation to avoid personal injury or product damage.
⎓	DC - direct current Connect to a DC power supply of the specified voltage range.

1.1.2 Labels on the product

Labels on the casing inform about:

- Personal safety, see "Meaning of safety labels" on page 7
- Product and environment safety, see Table 1-1

Table 1-1: Labels regarding product and environment safety

	Labeling in line with EN 50419 for disposal of electrical and electronic equipment after the product has come to the end of its service life. For more information, see "Disposing electrical and electronic equipment" on page 374.

1.1.3 Warning messages in the documentation

A warning message points out a risk or danger that you need to be aware of. The signal word indicates the severity of the safety hazard and how likely it will occur if you do not follow the safety precautions.

CAUTION

Potentially hazardous situation. Could result in minor or moderate injury if not avoided.

NOTICE

Potential risks of damage. Could result in damage to the supported product or to other property.

1.2 Documentation overview

This section provides an overview of the R&S EVSF1000 user documentation. Unless specified otherwise, you find the documents at:

www.rohde-schwarz.com/manual/EVSF1000

Further documents are available at:

www.rohde-schwarz.com/product/EVSF1000

1.2.1 Getting started manual

Introduces the R&S EVSF1000 and describes how to set up and start working with the product. A printed version is delivered with the instrument.

1.2.2 User manuals and help

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.

The contents of the user manual are also available as online help on the R&S EVSF1000.

1.2.3 Service manual

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

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

1.2.4 Printed safety instructions

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

1.2.5 Data sheets and brochures

The data sheet contains the technical specifications of the R&S EVSF1000. It also lists the firmware applications 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/EVSF1000/

1.2.6 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/EVSF1000.

1.2.7 Calibration certificate

The document is available on https://gloris.rohde-schwarz.com/calcert. You need the device ID of your instrument, which you can find on a label on the rear panel.

1.3 Key features

The R&S EVSF1000 offers the following key features:

- Detailed analysis of ILS, VOR and Marker Beacon ground measurements (based on ICAO Doc. 8071 and ICAO Annex 10)
- Analysis of air traffic control (ATC) communications signals
- High measurement rate, at 100 data records/s
- Two identical signal processing units for parallel measurement of Localizer and Gli-depath
- Compact, robust design (ARINC 404)
- Simple remote operation via standard interfaces
- Software options for specific use cases
- Integrated data recording

1.4 Preparing for use

Here, you can find basic information about setting up the product for the first time.

1.4.1 Unpacking and checking

1. Unpack the R&S EVSF1000 carefully.
2. Retain the original packing material. Use it when transporting or shipping the product later.
3. Using the delivery notes, check the equipment for completeness.

   The instrument comes with the following accessories:
   - Printed Getting Started manual
4. Check the equipment for damage.

   If the delivery is incomplete or equipment is damaged, contact Rohde & Schwarz.

1.4.2 Lifting and carrying

The handle on the front of the R&S EVSF1000 is designed to move, lift or carry the instrument. Do not apply excessive external force to the handle.

1.4.3 Setting up the product

The R&S EVSF1000 was designed for installation in flight inspection aircraft. Even the movement caused by transportation or mobile use does not impair its functioning. You can also set up the R&S EVSF1000 on a benchtop, for example to prepare the R&S EVSF1000 for mobile use.

See also:

- "Intended use" on page 5

1.4.3.1 Mounting the R&S EVSF1000 in a rack

The R&S EVSF1000 is meant for use in a flight inspection plane. Make sure that the product is properly secured. For a stable setup, you can connect the R&S EVSF1000 to an optional installation tray that you insert in the flight inspection rack.

Using the connector plate, you can remove and replace the R&S EVSF1000 quickly and easily. While the tray remains connected to the aircraft permanently, you can remove the R&S EVSF1000 quickly and easily, without having to disconnect all cables from the instrument individually.

This setup requires an R&S EVSF1000 with the following options:

- Slide-in hardware (R&S EVSF1-B4)
- Installation tray with connector (R&S EVSF1-Z1)

The 60 mm perforations allow you to mount external fans to the tray.

To prepare the rack

► **NOTICE!** Insufficient airflow can cause overheating and damage the product.
Design and implement an efficient ventilation concept for the rack.

To mount the R&S EVSF1000 on an installation tray

1. Insert the installation tray into the flight inspection rack. Make sure it lies in the rack straight and securely.
2. Fasten the tray in the rack by inserting 5 mm flat-head screws from the top of the tray through the rack. Use only the indicated perforations for rack-mounting to ensure the mechanical strength of the tray.

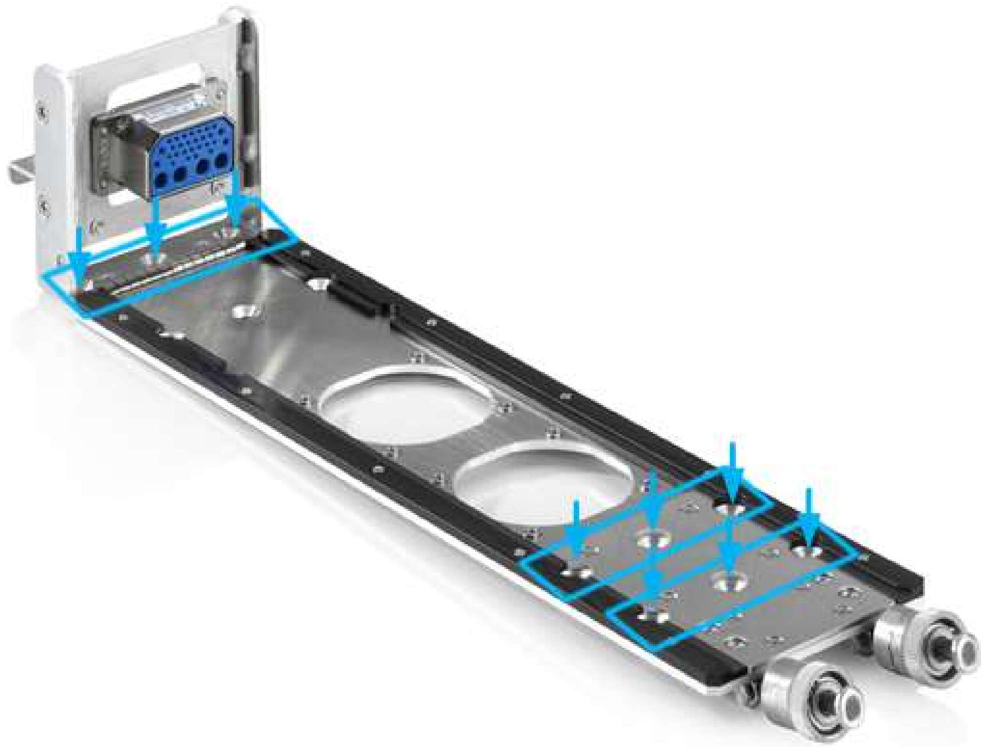


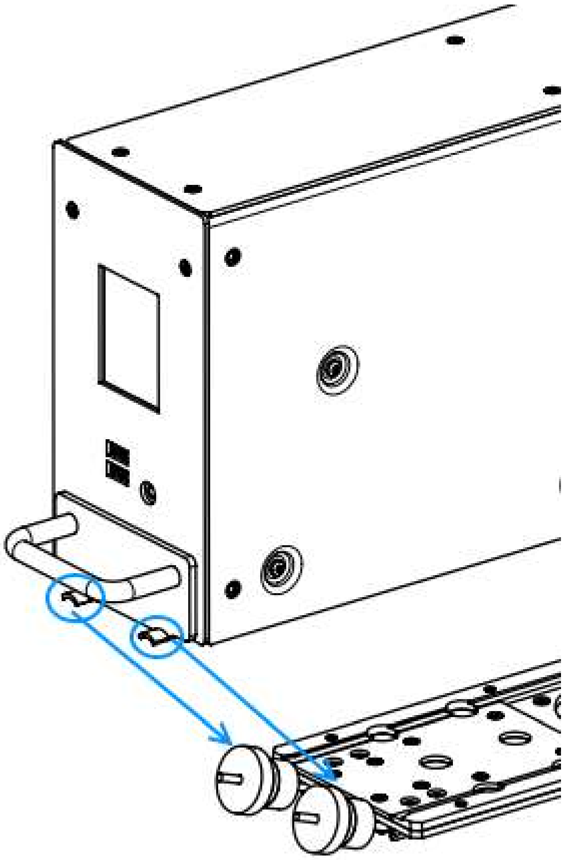
Figure 1-1: Perforations for installation in the rack

   a) Fasten 3 screws through the perforations on the left as shown in Figure 1-1.
   b) Fasten 3 screws through one of the two rows on the right.
   c) Tighten all screws with a tightening torque of 1.2 Nm to secure the tray in the rack.
3. Connect the ARINC connector of the tray to the board power supply and any other devices required for signal input or output, such as the receiving antenna, the GPS receiver, or the PPS signal.
For a description of the pin assignment, see Table 1-2.
4. Place the bottom of the R&S EVSF1000 on top of the installation tray.

5. Insert the ARINC connector of the tray to the female connector on the R&S EVSF1000.

Note: The R&S EVSF1000 does not have a power (On/Off) switch. When you apply voltage to the ARINC connector, the R&S EVSF1000 starts immediately.

6. Make sure the curved offsets of the metal plate on the instrument lay securely on the knobs at the front of the tray.



7. Fasten the knobs on the tray manually by twisting them clock-wise.

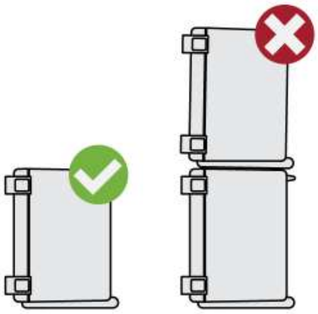
   The instrument is ready for operation.

1.4.3.2 Placing the R&S EVSF1000 on a bench top

To place the R&S EVSF1000 on a bench top

1. Place the product on a stable, flat and level surface.
2. **CAUTION!** The top surface of the product is too small for stacking. If you stack another product on top of the product, the stack can fall over and cause injury.

   If you want to save space, mount several products in a rack.



1.4.4 Connecting to power

The R&S EVSF1000 is equipped with a DC power supply connector on the rear panel of the instrument that can be connected to the board power of an aircraft.

For use outside an aircraft, you can use an optional AC/DC power supply unit.

For safety information, see "Connecting to power" on page 6.

1.4.4.1 Connecting the R&S EVSF1000 to an external DC power source

You can connect the R&S EVSF1000 to an external DC power source, such as the board power of the flight inspection plane or the drone. The power supply must provide a voltage of 11 V DC to 32 V DC.

The R&S EVSF1000 is inline with DO-160G, section 16, category A. For a minimum input of 20 V DC, the R&S EVSF1000 sustains a 200 ms DC power interruption without rebooting.

If the external power supply unit supplies safety extra-low DC voltage (SELV) to the instrument, be sure to meet the requirements for reinforced/double insulation in accordance with DIN/EN/IEC 61010 (UL 3111, CSA C22.2 No. 1010.1) or DIN/EN/IEC

60950 (UL 1950, CSA C22.2 No. 950). Provide current limitation in accordance with DIN EN 61010-1 appendix F2.1.

Connect the R&S EVSF1000 to an external DC power source as follows:

1. Connect a 3-pin XLR connection cable to the Power supply connector on the back of the instrument (see Chapter 1.5.2.1, "Power supply", on page 22).
2. Insert a 3 AT fuse to protect the connection between the instrument and the external DC power source against excessive current. A short-circuit can damage the instrument or power supply unit.
3. Connect the XLR connection cable to the DC power supply.
   If you have to extend the cable, ensure that the entire cable has a cross-section of at least 1.5 mm^2.

The R&S EVSF1000 does not have a power (On/Off) switch. When you apply board power, the R&S EVSF1000 starts immediately.

Disconnecting from power

When you interrupt the supply voltage from a level of 20 V or more, the R&S EVSF1000 continues to work for approximately 300 ms. It is powered by internal backup capacitors, intended to bridge short power failures in an aircraft installation. During this time, the current measurement settings and the latest error log data are saved to the internal flash memory.

► To disconnect the R&S EVSF1000 from power, disconnect the XLR connection cable from the DC power supply.

1.4.4.2 Connecting the R&S EVSF1000 to AC power

If you need to operate the R&S EVSF1000 outside an aircraft, you can use an AC/DC power supply unit, available as an accessory. When connecting to an AC power supply, only use the R&S EVSG1-Z8 Power supply.

Connect the R&S EVSF1000 to AC power as follows:

1. Connect the DC connector on the AC/DC power supply unit to the Power Supply connector on the back of the R&S EVSF1000 (see Chapter 1.5.2.1, "Power supply", on page 22).
2. Plug the AC power cable into the AC/DC power supply connector. Only use the AC power cable delivered with the power supply unit.
   The required ratings are indicated next to the AC power connector and in the power supply unit's data sheet.
3. Plug the AC power cable into a two-pin power outlet with ground contact.

   The green operating LED of the AC/DC power supply connector lights up.

The R&S EVSF1000 does not have a power (On/Off) switch. When you apply voltage to the Power Supply connector, the R&S EVSF1000 starts immediately. The green Power LED on the front panel of the R&S EVSF1000 lights up.

Disconnecting from power

When you interrupt the supply voltage from a level of 20 V or more, the R&S EVSF1000 continues to work for approximately 300 ms. It is powered by internal backup capacitors, intended to bridge short power failures in an aircraft installation. During this time, the current measurement settings and the latest error log data are saved to the internal flash memory.

NOTICE

Risk of losing settings

If the power interruption occurs at a power level under 20 V, the R&S EVSF1000 does not save the settings.

In particular, if you operate the R&S EVSF1000 using an AC/DC power supply and the AC power supply is interrupted, the DC power decreases slowly. In this case, the R&S EVSF1000 detects the power failure too late and cannot save the settings.

To ensure a controlled shutdown:

1. Disconnect the R&S EVSF1000 from the DC power supply.
2. Disconnect the AC power supply.

1.4.5 Starting and shutting down the R&S EVSF1000

The R&S EVSF1000 does not have a power (On/Off) switch. When you apply voltage to the power supply connector, the R&S EVSF1000 starts immediately.

To shut down the R&S EVSF1000, disconnect it from the power supply. Note the information concerning power interruption provided in Chapter 1.4.4, "Connecting to power", on page 13.

1.4.6 Connecting devices for signal input and output

1. Connect the RF input connector (RX1 IN/RX2 IN) with the receiving antenna (see Chapter 1.5.2.2, "RX1 in / RX2 in", on page 23).
2. Connect any other required connectors for input or output, such as GPS or PPS signals (see Chapter 1.5.2.4, "RS-232 GPS", on page 23 and Chapter 1.5.2.5, "PPS in", on page 23).

1.4.7 Connecting to LAN

You can connect the instrument to a LAN for remote operation via a remote device. For details on the connector, see Chapter 1.5.2.3, "LAN (ethernet)", on page 23.

Provided the network administrator has assigned you the appropriate rights and adapted the Windows firewall configuration, you can use the interface, for example:

- To stream measurement data from the R&S EVSF1000 to a connected device
- To access or control the measurement from a remote computer using a VNC client
- To connect external network devices (e.g. printers)

NOTICE

Risk of network failure

Consult your network administrator before performing the following tasks:

- Connecting the instrument to the network
- Configuring the network
- Changing IP addresses
- Exchanging hardware

Errors can affect the entire network.

1. Connect the R&S EVSF1000 to the LAN via the LAN interface on the right panel of the instrument.
2. Start a VNC client on the connected remote device.
3. Enter the IP address of the R&S EVSF1000. The default address is the static IP address `10.255.255.98`. Note that without a DHCP server, the network adapter on the remote device must an use IP address within the same TCP/IP netmask. (Usually, that means only the last number of the IP address differs.)

   The used IP address is indicated in the "Setup" menu on the R&S EVSF1000 display.

When using DHCP, the IP address is assigned to the devices dynamically. In this case, if a dynamic name server (DNS) is available, you can use the permanent instrument name to access the R&S EVSF1000. The default instrument name is `EVSF<serial_number>`, for example, `EVSF1000-123456`. For information on determining the serial number, see Chapter 1.5.2.12, "Device ID", on page 26.

For more information on LAN configuration, see Chapter 8.3, "LAN (remote) settings", on page 211.

1.4.8 Setting up a data link (Wi-Fi) connection

The R&S EVSF1000 can be equipped with an optional data-link-module (Wi-Fi, R&S EVSD1-Z5 Data-link-module (Wi-Fi)). Thus, you can configure the R&S EVSF1000 as a Wi-Fi access point for wireless communication from a remote device.

To connect the optional data-link-module (Wi-Fi)

1. Plug the provided USB-A to USB-C adapter cable in one of the USB-A connectors on the R&S EVSF1000.
2. Connect the other end of the adapter cable in the USB-C connector on the data-link-module (Wi-Fi).
3. Connect the provided data-link antennas to the RP-SMA connectors on the data-link-module (Wi-Fi).

To set up a data link (Wi-Fi) connection

Before you start the R&S EVSF1000, connect the data-link-module (Wi-Fi) to the R&S EVSF1000. Otherwise, the R&S EVSF1000 does not determine the IP information automatically.

1. Switch on the R&S EVSF1000.

   The R&S EVSF1000 is configured as a Wi-Fi access point using a DHCP server. By default, the following settings are defined.

2. Usually, you can access the R&S EVSF1000 using the default IP address and Wi-Fi password without further configuration. The default IP address is `192.168.1.1`. The default Wi-Fi password is `RS<serial_number>`, e.g. `RS123456`. For information on determining the serial number, see Chapter 1.5.2.12, "Device ID", on page 26.
   If necessary, configure the data link information for your network.
   For details, see Chapter 8.4, "Data link (Wi-Fi) settings", on page 215.

1.4.9 Performing an autocalibration

After setting up the R&S EVSF1000, perform an autocalibration to ensure the accuracy of the measurements. After initial setup, it is recommended that you perform an auto-calibration every 2 months or if the difference of the environment temperature changes by more than 10 °C.

If valid data for automatic calibration is not available, the message "UNCAL" is displayed in the status line of the R&S EVSF1000 display.

To perform an autocalibration, you require remote access to the instrument via LAN. For details see Chapter 1.6, "Operating basics", on page 27.

To perform an autocalibration

Before performing an autocalibration, make sure that the instrument has reached its operating temperature (after about 15 minutes of operation; for details, refer to the data sheet).

A message in the status bar ("Instrument warming up...") indicates that the operating temperature has not yet been reached.

During the autocalibration procedure, do not apply any input signal to the R&S EVSF1000.

1. Using the VNC viewer, select [n] > [F8] > [F1]
2. Select "Start Autocal".
3. Press [Enter].

   The "Setup - CAL" display shows the status for each calibration step. When completed, after a few minutes, all entries must have the status "OK".

For more information on autocalibration, see "Auto-Calibration (Cal)" on page 220.

1.5 Instrument tour

1.5.1 Front panel

This chapter describes the front panel, including all function keys and connectors.

Figure 1-2: R&S EVSF1000 - Front panel view

1 = Display
2 = USB connectors
3 = AF Out
4 = Carrying handle

1.5.1.1 Display

The display shows a basic set of measurement and configuration settings, including the currently used IP address for remote access.

1.5.1.2 USB connectors

The front panel provides two female USB connectors (USB-A, 2.0 standard) to connect devices like a memory stick or a USB keyboard.

The memory stick is used to store and reload instrument settings, to perform software updates and to export measurement data.

A standard USB keyboard can be used to configure the basic TCP/IP parameters.

For details, see Chapter 1.6.1, "Basic configuration and status display", on page 27.

1.5.1.3 AF out

Connector for a headset with a 3.5 mm jack plug.

1.5.1.4 Carrying handle

The carrying handle is used to insert and remove the R&S EVSF1000 from the flight inspection rack. You can also lift and carry the instrument by the handle.

1.5.2 Rear panel

Figure 1-3: R&S EVSF1000 - Rear panel view (basic model, without R&S EVSF1-B4 option)

1 = Power Supply
2 = RX2 In
3 = LAN
4 = RS-232 GPS
5 = Device ID with serial number and other labels
6 = PPS In
7 = RX 1 In

If the R&S EVSF1000 is provided with the optional slide-in hardware R&S EVSF1-B4 installed, the rear panel has an ARINC connector instead of the individual connectors. See Chapter 1.5.2.6, "Optional ARINC connector", on page 23.

Figure 1-4: R&S EVSF1000 - Rear panel view with ARINC connector (slide-in option R&S EVSF1-B4)

For the specification of the following interfaces, see the R&S EVSF1000 data sheet.

1.5.2.1 Power supply

XLR connector for an external DC power source (11 V DC to 32 V DC).

For details, refer to "Connecting to power" on page 6 and Chapter 1.4.4, "Connecting to power", on page 13.

1.5.2.2 RX1 in / RX2 in

The RX input connectors are 50 Ω N connectors. Use the RX inputs to connect a receiving antenna (max. +13 dBm) to the R&S EVSF1000 for RF signal input.

1.5.2.3 LAN (ethernet)

Operate the R&S EVSF1000 remotely using the LAN connection (Fast Ethernet). The LAN connection can also be used to stream measurement data (TCP port 8000; for I/Q data: 8001 (RX1) or 8002 (RX2)). The data transfer rate is 100 Mbit/s.

Using a VNC viewer, you can perform hardkey and softkey tasks on the R&S EVSF1000 in a LAN via shortcuts on a remote keyboard.

For details about remote control, see Chapter 9, "Remote commands", on page 228.

1.5.2.4 RS-232 GPS

2-port RS232, 9-pin D-Sub connector for a GPS receiver providing NMEA protocol data. The NMEA protocol data is displayed and stored with the recorded data.

If R&S EVSF1-B4 is installed, the RS-232 GPS interface is integrated in the ARINC connector (see Chapter 1.5.2.6, "Optional ARINC connector", on page 23).

1.5.2.5 PPS in

SMA connector with 1 MΩ impedance. Provides a PPS signal from an external GPS device for precise synchronization during data logging.

If R&S EVSF1-B4 is installed, the PPS In interface is integrated in the ARINC connector (see Chapter 1.5.2.6, "Optional ARINC connector", on page 23).

1.5.2.6 Optional ARINC connector

This connector is available with option R&S EVSF1-B4 only.

Optionally, the R&S EVSF1000 can be provided with an ARINC connector on the rear panel instead of the individual connectors in the standard model (see Figure 1-4). This connector allows you to slide the R&S EVSF1000 out of a flight inspection rack easily without having to disconnect all cables from the instrument individually.

The ARINC connector provides connections to all input and output provided by connectors on the standard R&S EVSF1000, and some additional signals.

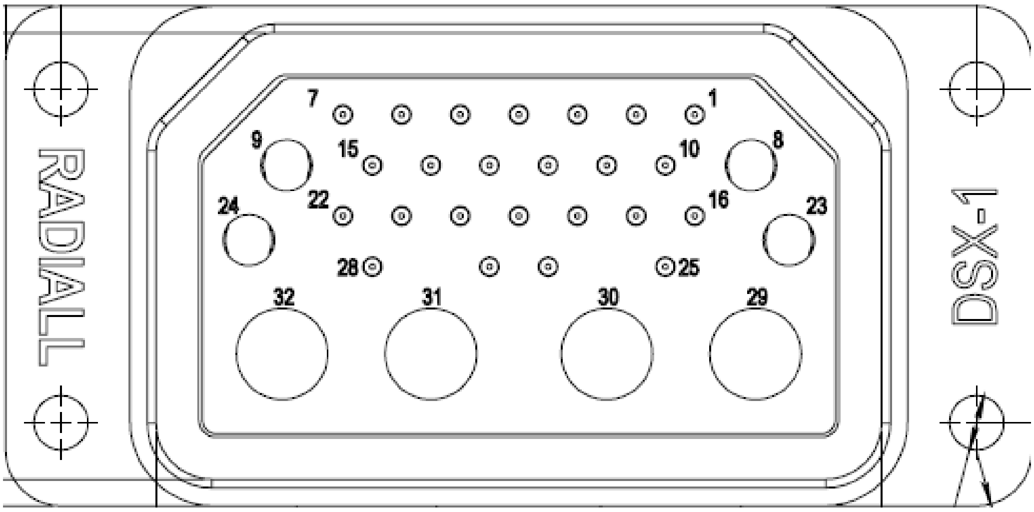


Figure 1-5: Pin assignment of ARINC connector

Table 1-2: Pin assignment of ARINC connector

Pin	Signal	Description	Cable type
1	SPEAKER+/ AUDIO	Speaker/Audio out (AF Out)	single, AWG 20-24
2	SPEAKER-/ AUDIO_GND	Speaker/Audio GND (AF Out)	single, AWG 20-24
3	ADR_SEL_IN	IP-Address-Select	single, AWG 20-24
4	ETH_DO-	LAN (Ethernet)	4x2 twisted paired, AWG 20-24
5	ETH_DI-	LAN (Ethernet)	4x2 twisted paired, AWG 20-24
6	USB_VBUS	USB 5V	2x2 twisted paired, AWG 20-24
7	USB_D+	USB Data+	2x2 twisted paired, AWG 20-24
8	V_DCIN_GND	Power	single, AWG 16-20
9	V_DCIN_+28V	Power	single, AWG 16-20
10	GND	Signal GND	single, AWG 20-24
11	TRIGGER_IN	Trigger-Input	single, AWG 20-24
12	ETH_DO+	LAN (Ethernet)	4x2 twisted paired, AWG 20-24
13	ETH_DI+	LAN (Ethernet)	4x2 twisted paired, AWG 20-24
14	USB_GND	USB GND	2x2 twisted paired, AWG 20-24
15	USB_D-	USB Data-	2x2 twisted paired, AWG 20-24

Pin	Signal	Description	Cable type
16	BB-OUT	Baseband-Output (Demod Out)	RG 316, AWG 20-24
17	GND	Signal GND	single, AWG 20-24
18	PPS_IN	PPS-IN	RG 316, AWG 20-24
19	GPS_5V_SUPPLY	GPS RX/ANT-Supply	single, AWG 20-24
20	GPS_CTS	RS232-GPS	single, AWG 20-24
21	GPS_RTS	RS232-GPS	single, AWG 20-24
22	GPS_TXD	RS232-GPS	single, AWG 20-24
23	V_DCIN_GND	Power	single AWG 16-20
24	V_DCIN_+28V	Power	single AWG 16-20
25	BB-IN	Baseband-Input (LF-IN)	single, AWG 20-24
26	GPS_GND	RS232-GPS	single, AWG 20-24
27	GPS_PPS_IN	RS232-GPS PPS-IN	single, AWG 20-24
28	GPS_RXD	RS232-GPS	single, AWG 20-24
29	RX1 (coaxial inlay)	RX1 Antenna	RG 223/ RG 142/ RG 400, AWG 20-24
30	spare	spare	RG 223/ RG 142/ RG 400, AWG 20-24
31	spare	spare	RG 223/ RG 142/ RG 400, AWG 20-24
32	RX2 (coaxial inlay)	RX2 Antenna	RG 223/ RG 142/ RG 400, AWG 20-24

1.5.2.7 LF in (baseband/low frequency input

This connector is available with option R&S EVSF1-B4 only.

Provides an AF signal or signals with a very low IF (<25 kHz) to the R&S EVSF1000 for further analysis of typical AF parameters. Furthermore, LF input allows for analysis of non-directional beacon (NDB) signals from 190 kHz to 1750 kHz.

When using the R&S EVSF1-Z2, use the BNC connector, 50 Ω/20kΩ.

Analyzing LF input requires option R&S EVSG1-K7 LF-Analysis.

1.5.2.8 Demod out (baseband output)

This connector is available with option R&S EVSF1-B4 only.

Outputs a demodulated (baseband) signal for connected devices, for example an oscilloscope.

When using the R&S EVSF1-Z2, use the BNC connector, 50 Ω/20kΩ.

1.5.2.9 AF out

This connector is available with option R&S EVSF1-B4 only.

Provides AF output to connected headphones or a loudspeaker (optimized for 8 Ω). When using the R&S EVSF1-Z2, audio output is sent to the speaker.

1.5.2.10 Trigger in

This connector is available with option R&S EVSF1-B4 only.

Provides an external trigger for data recording. The voltage level is 3.3 V to 12 V. The typical input impedance is 1 MΩ.

When using the R&S EVSF1-Z2, use the BNC connector, 50 Ω/20kΩ.

1.5.2.11 IP-Address select

This connector is available with option R&S EVSF1-B4 only.

Determines which of two possible IP addresses is used, to distinguish between two instruments in a single rack.

(See "TCP/IP Address" on page 214).

If this pin is not connected, the address configured as "TCP/IP Address 1" is used.

If this pin is connected to ground, the address configured as "TCP/IP Address 2" is used.

1.5.2.12 Device ID

The unique device identifier is provided as a barcode sticker on the rear panel of the R&S EVSF1000.

It consists of the device order number and a serial number.

The serial number is used to define the **default instrument name**, which is:

<Type><variant>-<serial_number>

For example, `EVSF1000-123456`.

The instrument name is required to establish a connection to the instrument in a LAN.

1.5.3 Accessories

Following accessories are available for rack installation:

- Slide-in option (R&S EVSF1-B4)
  Provides an ARINC connector on the rear panel of the R&S EVSF1000 which can be connected to the rack tray (R&S EVSF1-Z1 with connector).
  While the tray remains connected to the aircraft permanently, you can remove the R&S EVSF1000 quickly and easily, without having to connect and disconnect the instrument from the power supply and other devices.
- Installation tray with connector plate (R&S EVSF1-Z1)
  Allows you to mount the instrument in a flight inspection rack securely.
  Using the connector plate, you can remove and replace the R&S EVSF1000 quickly and easily.
- Service adapter (R&S EVSF1-Z2)
  The service adapter combines an ARINC connector with the common connectors provided on the rear panel of a conventional R&S EVSF1000. It allows you to connect a power supply and any other signal input and output devices to a R&S EVSF1000 with the slide-in hardware outside an aircraft.

1.6 Operating basics

The R&S EVSF1000 is designed for flight inspection and is thus optimized for remote operation, via predefined commands. It does not have a graphical user interface for manual interaction.

Nevertheless, the instrument can also be controlled manually, by simulating a user interface on a remotely connected device, and using a connected keyboard. Basic operation and status information is also available on a mini display directly on the R&S EVSF1000.

1.6.1 Basic configuration and status display

To connect to the R&S EVSF1000 from a remote device, you require connection information, such as the IP address. It is also helpful to obtain the operating status of the instrument before connecting to it. This basic information is displayed in the mini display directly on the R&S EVSF1000.

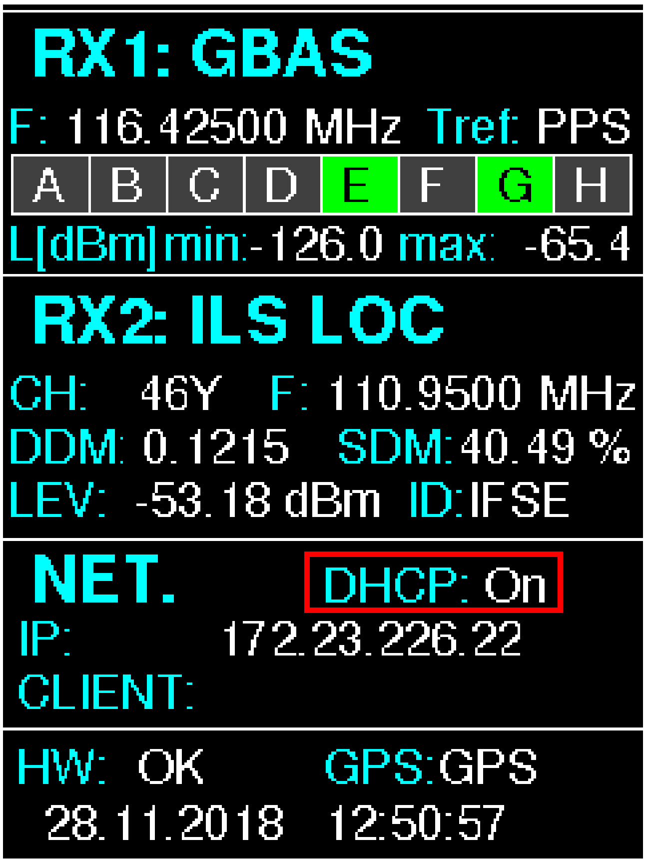


Figure 1-6: R&S EVSF1000 mini display

The following information is displayed in the mini display.

Measurement information for each receiver board (RX1/RX2)

In addition to the current measurement mode, measurement-specific information is provided.

For example, for "ILS LOC" mode (see Chapter 4.1.3, "ILS localizer and glidepath measurements and results", on page 44):

- **"CH"** : Receiver channel
- **"F"** : Receiver frequency
- **"DDM"** : ILS DDM
- **"SDM"** : ILS SDM
- **"LEV"** : Currently measured power level
- **"ID"** : Decoded ID of transmitter

For details on GBAS/SCAT-I measurement information in the status display, see Chapter 6.2, "GBAS/SCAT-I status display", on page 159.

Network settings (NET)

See Chapter 8.3, "LAN (remote) settings", on page 211
- **"DHCP"** : DHCP usage
- **"IP"** : IP address of the R&S EVSF1000
- **"CLIENT"** : IP address of connected client

Operating status of the R&S EVSF1000

See Chapter 8.6, "Instrument configuration and operating status settings", on page 220
- **"HW"** : Hardware status("OK"/"ERROR")
- **"GPS"** : Availability of GPS signal

Current date and time

1.6.2 Basic connection settings

To operate the R&S EVSF1000 from a remote device, you require connection information.

By default, the R&S EVSF1000 is set to use the static IP address `10.255.255.98`. The assigned IP address and DHCP state of the R&S EVSF1000 is provided in the mini display on the front panel.

Use this IP address for the initial connection from a remote device to the R&S EVSF1000.

When using DHCP, the IP address is assigned to the devices dynamically. In this case, if a dynamic name server (DNS) is available, you can use the permanent instrument name to access the R&S EVSF1000. The default instrument name is EVSF<serial_number>, for example, EVSF1000-123456. For information on determining the serial number, see Chapter 1.5.2.12, "Device ID", on page 26.

To change the settings, see Chapter 8.3, "LAN (remote) settings", on page 211.

1.6.3 Manual operation from a VNC viewer

You can operate the R&S EVSF1000 manually from a connected PC using a keyboard.

You merely require a VNC viewer application, of which a variety is available on the Internet free of charge.

Using a VNC viewer application, you simply connect to the instrument, defined by its IP address. The display of the R&S EVSF1000 is shown on the control PC. The keys and other graphical user interface elements are operated using associated keyboard shortcuts on the connected keyboard.

Operation via VNC is not possible during remote control (indicated by "Remote" in the status bar). To switch from remote control to manual operation, press [ESC].

Access to the R&S EVSF1000 via VNC can be protected by a password. In this case, enter *instrument* as the password in the login window.

(See also Chapter 8.3, "LAN (remote) settings", on page 211.)

1.6.3.1 Understanding the display information

The following figure shows a typical screen display for the R&S EVSF1000. All different screen elements are labeled. They are explained in more detail in the following sections.

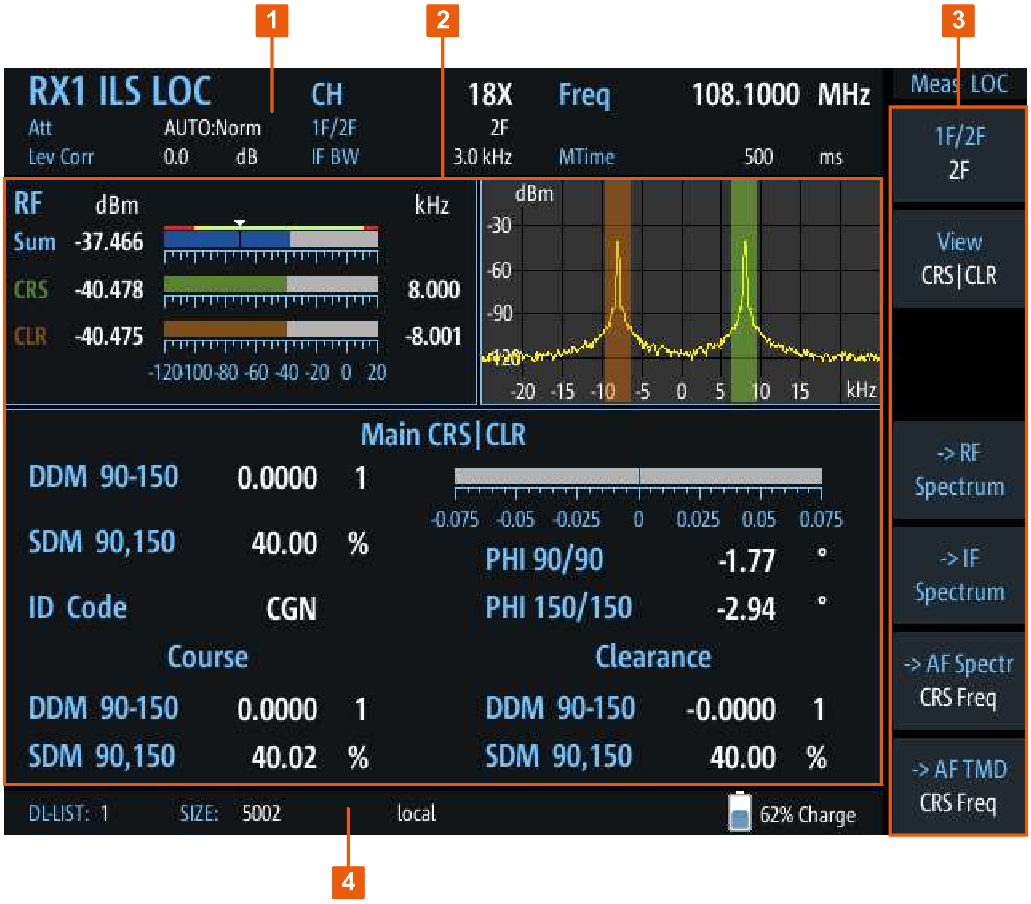


Figure 1-7: R&S EVSF1000 - GUI overview

1 = Measurement settings area (numeric modes only)
2 = Measurement result area
3 = Softkeys to edit settings and activate functions
4 = Status bar

Measurement settings and results area

During a measurement, the available settings are displayed at the top of the screen; the measurement results at the bottom. If a general instrument setting or data management function is selected, the settings and information are displayed in the main part of the screen.

Which settings and results are displayed depends on the current measurement or instrument function. See the following chapters for details:

- Chapter 2, "Measurements and results", on page 37
- Chapter 7, "Data management", on page 198
- Chapter 8, "Common instrument settings", on page 209

Softkeys

Softkeys are virtual function keys whose actual function is defined by the software, depending on the currently selected measurement mode or key, or both.

Sometimes, more functions are available than softkeys can be displayed at the same time. In this case, a second menu of functions is available, indicated by "1/2" and "2/2" beneath the softkeys in the display.

To switch between the two menus of softkey functions, press the "More softkeys" key beneath the softkeys on the front panel of the R&S EVSF1000.

Softkeys can perform a function directly, or open a dialog or submenu with further settings and functions. Some softkeys are directly associated with an input field in the measurement settings area of the window. If the softkey shows a vertical blue line at the edge, you can edit the value of the corresponding setting directly in the measurement settings area of the window. If the blue line is not shown, the setting is read-only. To toggle between the edit mode and read-only mode, select the softkey again.

Figure 1-8: Softkey with an associated input field

Status bar

The status bar at the bottom of the screen contains information on the operating status of the instrument.

- Current list of data recording and size of this list
  (See Chapter 7.2, "Recording measurement data", on page 200)
- Local or remote operation (see Chapter 1.6.4, "Remote control", on page 35)

1.6.3.2 Keyboard commands for operation via a VNC viewer

Keyboard commands (VNC viewer) shows the mapping between the keyboard shortcuts and the interface elements on the R&S EVSF1000.

Table 1-3: Keyboard commands (VNC viewer)

Keyboard	Usage
y	Preset
c	Audio
v	Display
b	Help
n	Setup
m	Mode
z	Undo
r	Redo
PAGE UP	Field right
PAGE DOWN	Field left
x	Screenshot
a	Meas
s	Config
F1	Softkey 1
F2	Softkey 2
F3	Softkey 3
F4	Softkey 4
F5	Softkey 5
F6	Softkey 6
F7	Softkey 7
F8	 Show additional softkeys
k	Trigger
l	Single
ESC	ESC
0	0
1	1
4	4
7	7
q	CH/FREQ
d	MTime

Keyboard	Usage
BACKSPACE	Back
ENTER	Enter
.	.
2	2
5	5
8	8
w	Ampt
F9	Hz
3	3
6	6
9	9
e	BW (Bandwidth)
F10	kHz
F11	MHz
F12	GHz
p	Record
i	Marker

1.6.3.3 Changing settings and activating functions

All functions available on the R&S EVSF1000 can be accessed using the keys on the external keyboard. Some keys provide a softkey menu on the display with further functions and settings.

1. Select a key as described in Table 1-3 to activate a function directly, or to display a softkey menu.

2. Select the key for the setting or function as required.
   If necessary, select [F8] to switch to the second softkey menu.

   The function is activated, or a new window is displayed to view or change specific settings.

3. To set the focus on a specific setting in the displayed window, scroll through the individual settings by pressing the Up and Down arrow keys.

4. Enter a numeric or alphanumeric value as described in Chapter 1.6.3.4, "Entering data", on page 34.
5. Confirm the new setting and remove the focus by pressing [ENTER].

1.6.3.4 Entering data

You enter data in input fields using the external keyboard, as described in Table 1-3.

Entering numeric parameters

If a field requires numeric input, the keypad provides only numbers.

1. Define the parameter value by doing one of the following:
   - Change the currently used parameter value by pressing the Up or Down arrow keys.
   - Enter the parameter value using the keypad.
2. To define the unit, press the corresponding unit key.
   The unit is added to the entry.
3. If the parameter does not require a unit, confirm the entered value by pressing [ENTER] or any of the unit keys.

Entering numbers and (special) characters via the keypad

If a field requires alphanumeric input, use the keypad on the external keyboard. Every alphanumeric key represents several characters and one number. The decimal point key (.) represents special characters, and the sign key (-) toggles between capital and small letters. The assignment of keys to characters is provided in Table 1-4.

1. Press the key once to enter the first possible value.
   All characters available via this key are displayed.
2. To choose another value provided by this key, press the key again, until your desired value is displayed.
3. With every key stroke, the next possible value of this key is displayed. If all possible values have been displayed, the series starts with the first value again. For information on the series, refer to Table 1-4.
4. To change from capital to small letters and vice versa, press the sign key (-).
5. After entering a value, wait for 2 seconds to use the same key again.

Entering a blank

► Press the "0" key for 2 seconds.

Correcting an entry

1. Using the arrow keys, move the cursor to the right of the entry you want to delete.
2. Press the [BACK] key.

The entry to the left of the cursor is deleted.

3. Enter your correction.

Completing the entry

► Press [ENTER].

For numeric values, the default unit is appended to the numeric input. To enter a value using a different unit, select the corresponding key.

Aborting the entry

► Press the [ESC] key.
The previous entry is restored.

Table 1-4: Keys for alphanumeric parameters

Key name (upper inscription)	Series of (special) characters and number provided
7	7 µ Ω ° € ¥ $ ¢
8	A B C 8 Ä ÆÅ Ç
9	D E F 9 É
4	G H I 4
5	J K L 5
6	M N O 6 Ň Ö
1	P Q R S 1
2	T U V 2 Ü
3	W X Y Z 3
0	<blank> 0 – @ + / \ < > = % &
.	. * : _ , ; " ' ? ( ) #
–	<toggles between capital and small letters>

1.6.4 Remote control

You can control the R&S EVSF1000, including data transfer, remotely from another device using the LAN connection (Fast Ethernet).

See Chapter 1.6.2, "Basic connection settings", on page 29.

Remote control is performed using predefined remote commands which are sent from the control device to the R&S EVSF1000. The R&S EVSF1000 can also return queried data to the control device.

For details on the available remote commands, see Chapter 9, "Remote commands", on page 228.

While in remote control, the R&S EVSF1000 display indicates "Remote" in the status bar. During remote control, the instrument is locked for manual operation via VNC. To return to manual operation, press [ESC].

2 Measurements and results

The R&S EVSF1000 provides both numerical and graphical results, depending on the current measurement task.

Different measurement tasks are performed in individual measurement modes, some of which are optional. The individual measurement modes are described in detail in the subsequent chapters of this documentation.

If an optional second receiver board (R&S EVSG-B1 Second Signal Processing Unit) is installed, each receiver board can be configured to perform different measurement tasks. Thus, you can perform two different measurements on the same input signal simultaneously. Then you select the receiver board whose results are displayed in the display settings (see "RX Unit 1 / RX Unit 2" on page 210).

Figure 2-1: Measurement mode selection

Measurement modes with numerical results

The following measurement modes provide numerical results:

- ILS LOC mode - determines localizer signal parameters
- ILS GP mode - determines glidepath signal parameters
- ILS MB mode - determines marker beacon signal parameters
- VOR mode (R&S EVSG-K2 VOR analysis) - determines modulation and signal parameters, as well as voice identifier parameters

- COM (R&S EVSG-K6 COM analysis) - determines signal parameters from VHF/UHF communication channels
- NDB mode (R&S EVSG1-K7 LF-Analysis) - analyzes non-directional beacon signals

Measurement modes with graphical results

The following measurement modes provide graphical results:

- RF Spectrum mode (R&S EVSG-K10 RF spectrum analysis) - displays the power vs. frequency diagram (spectrum) for a variable frequency range of the input signal
- IF Spectrum mode (R&S EVSG-K10 RF spectrum analysis) - displays an enlarged view of the spectrum for a fixed frequency of the input signal
- AF Spectrum mode (R&S EVSG-K11 AF spectrum analysis) - displays the spectrum of a demodulated RF signal with AM components
- AF Time Domain mode (R&S EVSG-K12 Time domain analysis) - displays the frequency vs. time diagram of the input signal, similar to an oscilloscope

Generally, each mode is configured individually. When you switch modes, the most recently defined settings for that mode are applied.

However, graphical results can also be displayed directly from the measurement modes with numeric results. In this case, the settings for the current mode are applied to the graphical results.

If the original measurement mode analyzes multiple carriers, you must select the carrier for which you want to see the graphical results when you switch the mode.

Measurement modes with both numerical and graphical results

The following measurement modes provide both numerical and graphical results:

- R&S EVSG-K4 GBAS analysis - displays measured and decoded information from GBAS/SCAT-I sequences, frames, and slots, and graphical displays for individual slots

Remote commands to retrieve results:

`GETMDEF` on page 230

`GETMEAS` on page 229

`GBAS:GETMDEF` on page 326

`GBAS:GETMEAS` on page 327

Common Numerical Measurement Mode Settings

The following settings are displayed for most numerical measurement modes.

RX board (RX1 | RX2)
The currently active receiver board. See Chapter 3.2, "Receiver board", on page 40.

Measurement mode
The currently active measurement mode on the active receiver board, e.g. "ILS LOC". See Chapter 3.3, "Measurement mode", on page 41.

Channel (CH)
The receiver frequency channel on the active receiver board according to the ICAO frequency list. See "Channel frequency configuration (CH FREQ)" on page 67.

Frequency (FREQ)
The measured frequency on the active receiver board. See "Channel frequency configuration (CH FREQ)" on page 67.

RF attenuation (Att)
The used attenuation mode; see also "RF Mode" on page 69.

Channel definition (1F/2F) - ILS LOC and ILS GP mode only
The ILS Localizer and Glidepath measurements can detect both course and clearance data simultaneously. Alternatively, the individual channels can be measured only, or any one or two user-defined frequencies. By default, a wideband measurement is performed. The displayed measurement results depend on the selected channel and frequency configuration.

See Chapter 4.1.4.2, "Channel and frequency configuration", on page 64.

Level correction (Lev Corr)
The applied level correction by a transducer. See "Transducer Correction" on page 69.

Bandwidth (IF BW)
Bandwidth on which the measurement is performed. Depends on the Channel definition (1F/2F) - ILS LOC and ILS GP mode only. See Chapter 4.1.4.4, "Bandwidth (BW)", on page 69.

Measurement time (MTime)
The duration of a single measurement. See Chapter 4.1.4.6, "Setting the measurement time (MTime)", on page 74.

3 Configuring the input signal and measurement mode

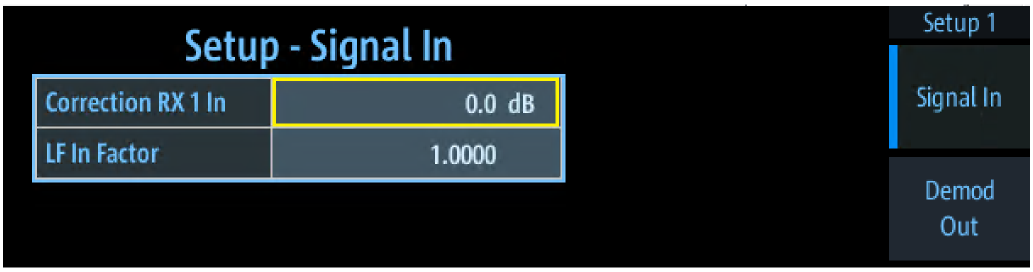
The following settings are common to all measurement modes. They define which data is measured and how, and are indicated at the top of the measurement window.

3.1 Input signal settings

Access VNC: [n] > [F1]

The following settings configure the receiver signal to be measured by the R&S EVSF1000.

For some measurement modes, you can switch the type of signal input. See the description of the individual modes.



Correction RX 1 In/ Correction RX 2 In
Configures the correction of the RX 1/ RX 2 input signal, respectively (in dB).

This value is subtracted from all levels and compensates effects of upstream lines and attenuators.

3.2 Receiver board

If a second receiver board is installed (requires the R&S EVSG-B1 Second Signal Processing Unit option), each receiver board can be configured to perform different measurement tasks.

To select the receiver board via VNC

1. Press the [m] key on the remote keyboard.

2. Press the [PAGE UP] or [PAGE DOWN] keys to toggle between the "RX Unit 1" and "RX Unit 2".
3. Press [Enter] to confirm the selection.

Remote command:

CH on page 234

3.3 Measurement mode

The measurement mode determines the type of signal for which the measurement is performed (see Chapter 2, "Measurements and results", on page 37).

To select a measurement mode via VNC

1. Press the [m] key on the remote keyboard.
2. Select the required measurement mode using the arrow keys.
3. Press [Enter] to confirm the selection.

Remote commands:

MODE_LOC on page 260

MODE_GP on page 260

MODE_MB on page 293

MODE_VOR on page 300

MODE_COM on page 310

MODE_FSCAN on page 338

MODE_IFSPECT on page 343

MODE_FFT on page 348

MODE_SCOPE on page 355

MODE_GBAS on page 324

MODE_NDB on page 333

4 Numeric measurement modes

4.1 ILS localizer and ILS glidepath (GP) modes

Access VNC: [m] > Down arrow key

The ILS Localizer and Glidepath measurements demodulate the AM components of the ILS signal and calculate characteristic parameters such as the modulation depth and frequency or phase for specific components. Furthermore, an FFT is performed on all components of the AF signal. The resulting AF spectrum allows you to measure the required components and their distortions (harmonics).

Using the option R&S EVSG1-K7 LF-Analysis, you can also analyze the AF components of the ILS signal to determine AF parameters of the carrier.

Furthermore, you can use the LF input to measure signals with a very low intermediate frequency (<25 kHz). Such signals are provided as output at test points of a transmitter, for example, for tuning purposes.

Remote command:

`MODE_LOC` on page 260

`MODE_GP` on page 260

4.1.1 Localizer basics

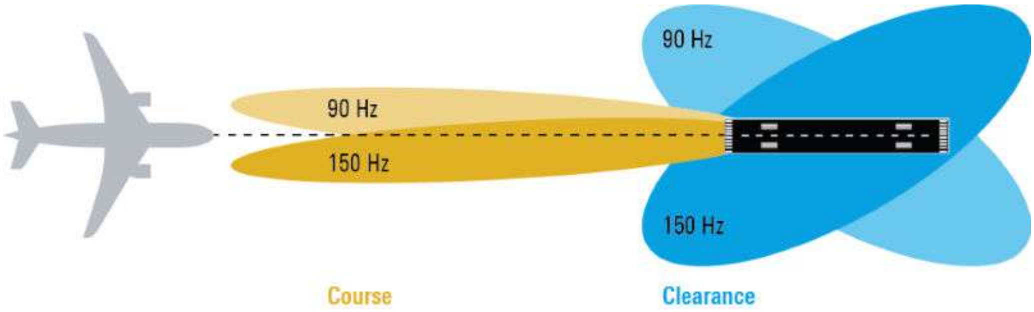
The localizer transmitter is located near the end of the runway (nearest to the start of the aircraft approach). Typically, horizontally aligned antennas transmit two intersecting main beams beside one another at carrier frequencies between 108 MHz and 112 MHz. As seen from the approaching aircraft coming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

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

DDM = m(x90) – m(x150)

The following scenarios are possible:

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



Course and clearance signals

The landing path is divided into the region further away from the runway, referred to as the course, and the runway itself, referred to as the clearance. Localizers are positioned in both areas, however they transmit their ILS signals using different frequencies, one that must travel farther, one for close-up. The frequencies differ only in a few kilohertz. The aircraft always receives both signals, and cannot (and need not) distinguish the two. However, for test purposes, it can be useful to measure the signals individually.

Morse code identification signal

The localizer not only allows the aircraft to determine its position, it also provides identification of the ILS transmitter. The localizer periodically transmits a Morse code at 1020 Hz which uniquely identifies the transmitter. The receiver thus knows that the ILS is operating correctly and that it is receiving the correct signal. The glide slope station does not transmit an identification signal.

4.1.2 Glide slope basics

The following description is taken from the Rohde & Schwarz Application Note 1MA193: "Aeronautical radio navigation measurement solutions".

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

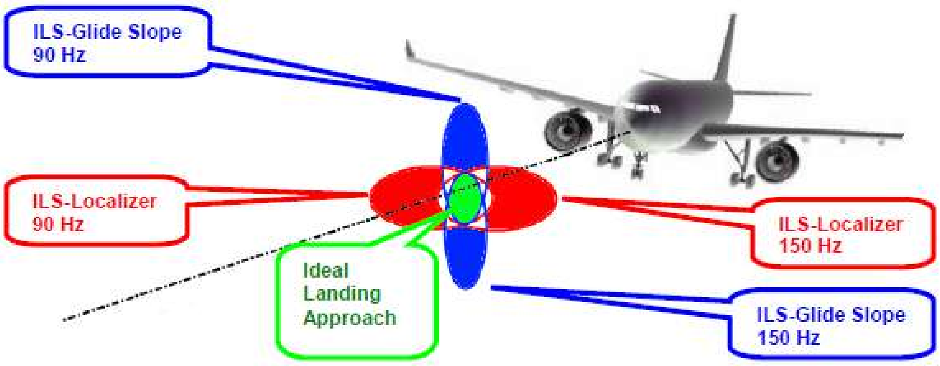


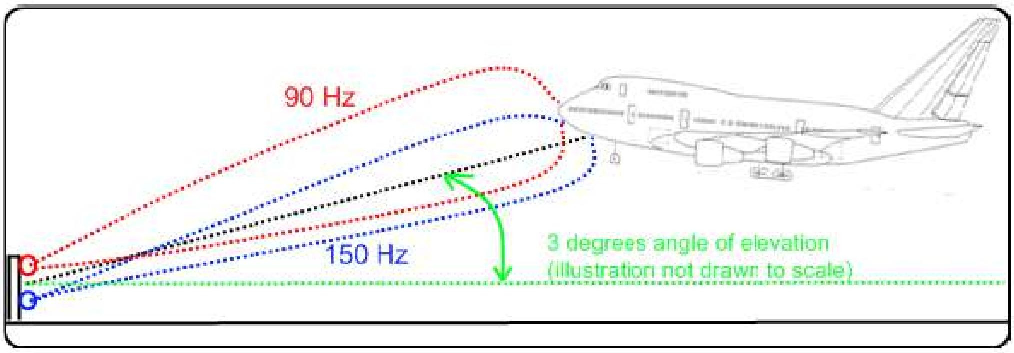
Figure 4-1: Approach navigation using instrument landing system (ILS)

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

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

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

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



4.1.3 ILS localizer and glidepath measurements and results

A single receiver board in the R&S EVSF1000 can measure data at two different receiver frequencies at the same time. Therefore, the ILS Localizer and Glidepath measurements can detect both course and clearance data simultaneously, and display the individual results. Alternatively, the individual channels can be measured only, or any one or two user-defined frequencies. By default, a wideband measurement is performed to obtain an initial overview of the input signal and determine the basic signal characteristics. The displayed measurement results depend on the selected channel and frequency configuration.

Autotune function

An autotune function is available to determine the precise frequencies of the signal components automatically. Thus, the demodulation bandwidth can be selected very precisely. Automatic mode is indicated by "Autotune" in the measurement settings area, followed by the current processing status.

The autotune process consists of the following steps:

1. "Search": the R&S EVSF1000 searches the input signal for peaks. You can define a power threshold that the carrier must exceed to be detected ("Carrier Thresh" on page 67).
2. "Check": the R&S EVSF1000 checks whether the detected peak is a valid ILS signal, based on the detected modulation and S/N ratio.

   A valid signal is indicated by a green DDM measurement result, see "DDM 90-150" on page 55. In the recorded dataset, the STIOCPM status indicates a "V" for valid (see "Status flags" on page 63).
3. - "Auto Lock" option (default): "Lock": the R&S EVSF1000 remains tuned to the valid ILS signal frequency.
     The frequency remains locked until:
     – You switch measurement modes
     – You change the channel or frequency settings
     – You select the Find Carrier function.

     In this case, a new search starts.
   - "Auto Retune" option: "Found": As long as the R&S EVSF1000 determines a valid ILS signal, it remains tuned to that frequency. If the signal becomes invalid at that frequency, the R&S EVSF1000 returns to the "Search" process.

Adapting the frequency in autotune mode

The autotune function sets the measurement filter position such that the detected frequency is in the center of the filter bandwidth. While the frequency is locked, the filter position remains unchanged. If the bandwidth is narrow and the signal frequency changes, e.g. due to changes of the transmitter, the signal may no longer be covered completely by the measurement filter. In this case, the measurement results are distorted. If you assume that the ILS signal frequency has possibly changed, we recommend performing a new search using the Find Carrier function.

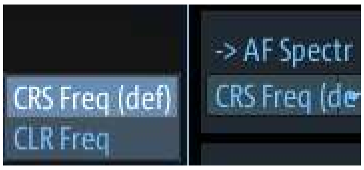
Measurement result views

Due to the large number of different signal parameters, the ILS Localizer and Glidepath measurements provide multiple views for the measurement results.

Switching from numeric to graphical results

You can display graphical results directly from the ILS Localizer or Glidepath mode by selecting the softkey in the "Meas" menu. In this case, the settings for the current measurement are applied to the graphical results.

The graphical results are only available for a single carrier. Thus, when you switch to a graphical measurement mode from an ILS mode, you must select the carrier for which you want to see the graphical results. When you select the softkey, a submenu is displayed to select the carrier.



To return from the graphical results to the ILS Localizer or Glidepath mode, select "Return" ([F7]).

For details on the graphical results, see:

- Chapter 5.1, "R&S EVSG-K10 RF spectrum analysis", on page 125
- Chapter 5.2, "IF spectrum analysis", on page 130
- Chapter 5.3, "R&S EVSG-K11 AF spectrum analysis", on page 134
- Chapter 5.4, "R&S EVSG-K12 Time domain analysis", on page 143

Figure 4-2: ILS Localizer mode main results view

The following settings are displayed in the measurement settings area of the ILS Localizer/ ILS GS mode:

- RX board ("RX1" | "RX2")
  The currently active receiver board. See Chapter 3.2, "Receiver board", on page 40.
- Measurement mode
  The currently active measurement mode on the active receiver board, e.g. "ILS GP". See Chapter 3.3, "Measurement mode", on page 41.
- "CH"
  Receiver frequency channel, see "Channel setup" on page 64
- "Freq"
  Nominal measurement frequency of the RF signal, see "Freq" on page 68.
- RF attenuation ("Att")
  The used attenuation mode; see also "RF Mode" on page 69.
- Frequency selection "1F/2F"
  See "Carrier configuration (1F/2F Config)" on page 65
- "Autotune"
  Status of the automatic carrier selection, see "Autotune function" on page 45
- "Lev Corr"
  Applied level correction, see "Transducer Correction" on page 69
- "IF BW"
  Measurement bandwidth, see Chapter 4.1.4.4, "Bandwidth (BW)", on page 69
- Measurement time ("MTime")
  See Chapter 4.1.4.6, "Setting the measurement time (MTime)", on page 74.

Low frequency (LF In) measurements for ILS signals

Using the option R&S EVSG1-K7 LF-Analysis, you can also analyze the AF components of the ILS signal to determine AF parameters of the carrier.

Furthermore, you can use the LF input to measure signals with a very low intermediate frequency (<25 kHz). Such signals are provided as output at test points of a transmitter, for example, for tuning purposes.

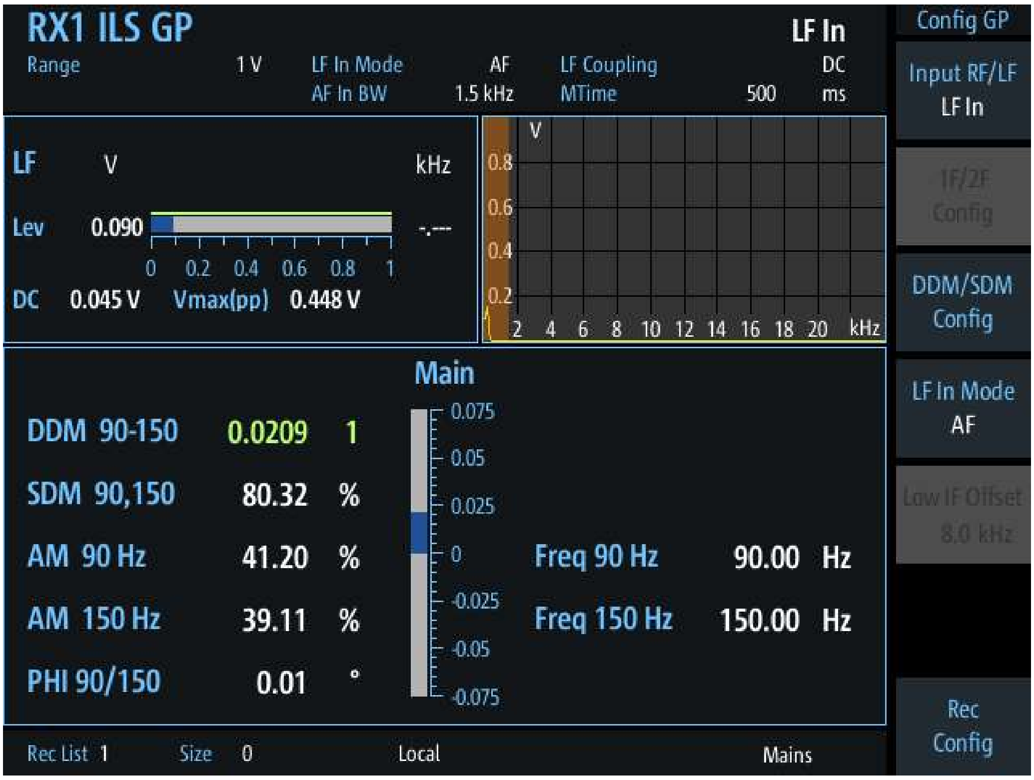


Figure 4-3: AF signal analysis in ILS GP mode

For LF input, the following settings are displayed:

- RX board ("RX1" | "RX2")
  The currently active receiver board. See Chapter 3.2, "Receiver board", on page 40.
- Measurement mode
  The currently active measurement mode on the active receiver board, e.g. "ILS GP". See Chapter 3.3, "Measurement mode", on page 41.
- ("Range")
  Sensitivity of the measurement. See "Range" on page 72.
- LF Input type ("LF In Mode")
  See "LF In Mode" on page 71.
- "LF coupling"
  AC or DC coupling for LF input, see "Coupling" on page 72
- Measurement Bandwidth ("AF In BW")
  Measurement bandwidth for LF input. See "AF In BW" on page 139.
- Resolution bandwidth for LF input ("AF Res BW")
  Resolution bandwidth with which the AF signal measurement is performed. See "IF/AF Bandwidth (Dist/ID)" on page 73.
- Measurement time ("MTime")
  See Chapter 4.1.4.6, "Setting the measurement time (MTime)", on page 74.

Remote command:

VIEW_LLZ on page 270

4.1.3.1 RF level and frequency display

The measured RF power and frequency of the input signal are displayed both numerically and graphically.

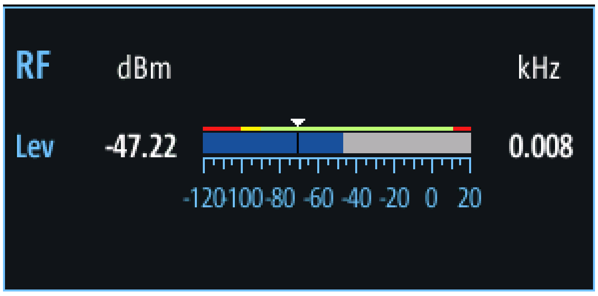


Figure 4-4: RF level display

The following results are provided:

- Numeric power level in dBm ("Lev")
  For measurements on two frequencies: individual and sum power levels
- Measured frequency offset to the nominal frequency in kHz
- Numeric frequency offset of measured power
- Bargraph indicating the power and a color-coded overload state, where:
  – **Red**: overload state, check message
  – **Yellow**: power approaching overload state
  – **Green**: power in a valid range
- If applicable: overload messages

Overload messages

The following messages indicate an overload:

- "RF Overload"
  Overload of the input mixer or of the analog IF path.
- "IF Overload"
  Overload of the IF signal.
- "ADC Overload"
  The dynamic range of the AD-converter is exceeded (clipping).

A combination of these overloads is also possible.

In all cases, set the RF attenuation to normal or low distortion (for RF input), or reduce the input level.

In recorded data lists, overloads are indicated by an **"O"**, see "Status flags" on page 63.

Remote commands to retrieve results:

`LA?` on page 231

`RF?` on page 231

ILS LOC/GS mode:

`FSINGLE` on page 284

`FCRS` on page 284

`FCLR` on page 284

`LCRS` on page 285

`LCLR` on page 285

4.1.3.2 IF spectrum preview

A preview of the measured spectrum (power level vs. frequency) for the IF (intermediate frequency) signal is provided. The center frequency is the nominal channel frequency. The frequency range shows the measured bandwidth. The power range is selected such that the noise level remains visible.

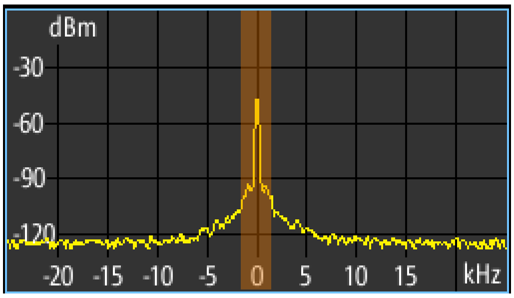


Figure 4-5: IF spectrum preview

This preview spectrum allows you to check if the current measurement settings are appropriate, such as the bandwidth or frequency offsets. For a larger, more detailed spectrum diagram, select one of the graphical Spectrum modes. If you switch to such a mode directly from a numeric measurement mode, the current measurement settings are applied to the spectrum automatically.

4.1.3.3 LF level, frequency, and spectrum display

For LF or low frequency input, the measured AF power and frequency of the input signal are displayed both numerically and graphically.

Figure 4-6: LF level display

The following results are provided:

Lev

Numeric power level in Volt

Remote command:
`LLZ_BB_LEV_V` on page 287

DC

AF mode only: Numeric power level of the DC component in Volt

This value indicates the carrier power level (measured at 0 Hz).

Remote command:
`LLZ_BB_DC_V` on page 287

Vmax(pp)

Maximum peak-to-peak power level in Volt

Remote command:
`LLZ_BB_VMAXPP_V` on page 288

Low IF frequency

Low IF only: Measured frequency offset to the nominal frequency in kHz

Remote command:
`FSINGLE` on page 284

Power bargraph
Bargraph indicating the power (blue) and a color-coded overload state, where:

- **green**: power in a valid range
- **Yellow**: power approaching overload state
- **Red**: overload state, check message

IF spectrum preview
A preview of the measured IF spectrum (power level vs. frequency) for the AF signal is provided. The center frequency is 0 Hz (AF mode) or the IF offset (LF mode). The frequency range shows the measured bandwidth.

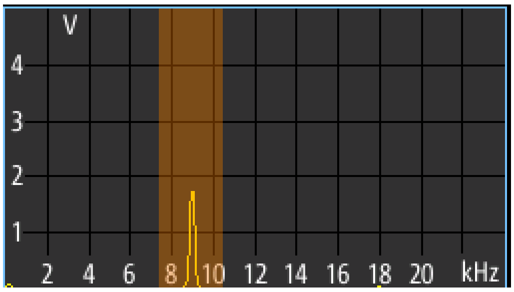


Figure 4-7: IF spectrum preview

Remote command:
`FFT_GETSPECT` on page 354

4.1.3.4 ILS localizer and glidepath main view

The ILS Localizer and Glidepath main view provides the following results:

Figure 4-8: ILS Localizer main view

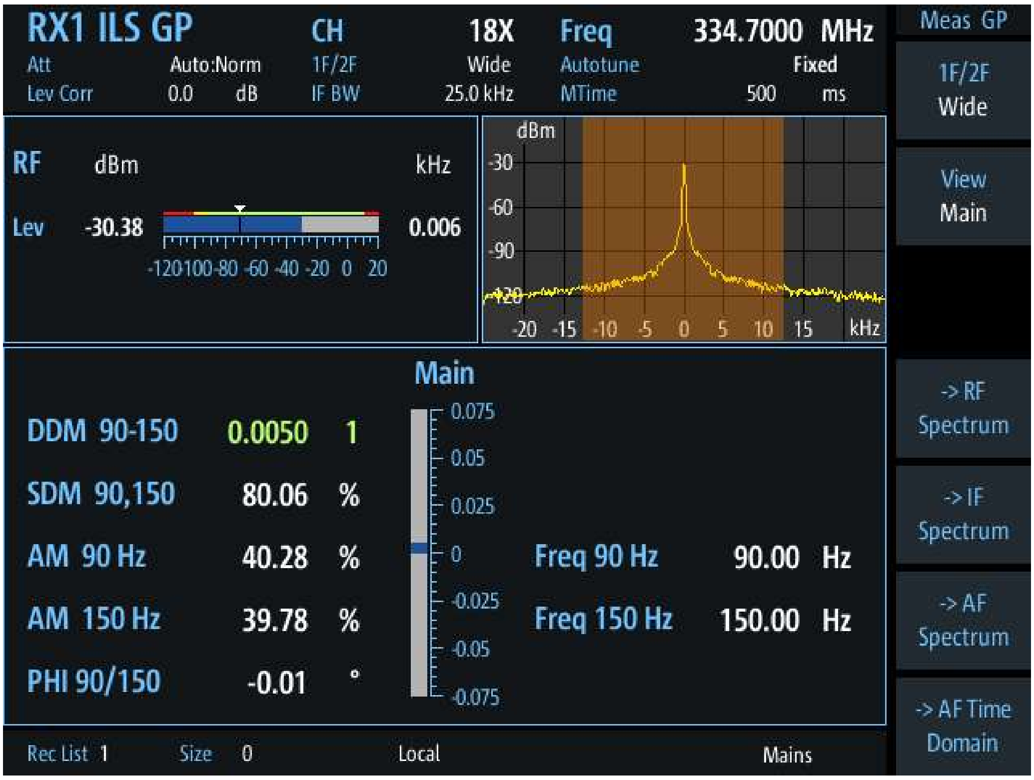


Figure 4-9: ILS Glidepath main view

Figure 4-10: ILS LF Input main view

DDM 90-150

Difference in depth of modulation (DDM) between 90 Hz and 150 Hz AM signal ($m_{90\ Hz}$ – $m_{150\ Hz}$)

Note: The DDM value is also displayed graphically as a bargraph for quick evaluation. A green DDM value indicates that a valid ILS signal has been determined.

Remote command:
`DD0` on page 283
`DD1` on page 283
`DCLR` on page 283
`DCRS` on page 283

SDM 90,150
Sum in Depth of Modulation (SDM); arithmetic sum of the modulation depth of the 90 Hz and the 150 Hz components without any influence of the phase between the components.

Remote command:
SD0 on page 287
SD1 on page 287
SCLR on page 286
SCRS on page 286

AM 90 Hz
AM modulation depth of 90 Hz ILS component

Remote command:
AM2 on page 281
AM2CLR on page 281
AM2CRS on page 281

Freq 90 Hz
AF frequency of 90 Hz ILS component

Remote command:
AF2 on page 280

AM 150 Hz
AM modulation depth of 150 Hz ILS component

Remote command:
AM3 on page 281
AM3CLR on page 281
AM3CRS on page 282

Freq 150 Hz
AF frequency of 150 Hz ILS component

Remote command:
AF3 on page 280

PHI 90/150
Phase angle measurement between 90 Hz and 150 Hz AM signal (90 Hz = reference signal); measurement range: ±60 degrees

Remote command:
PH on page 285

ID Code
Morse-decoded ID with three or four letters.

Remote command:
AC8 on page 280
AC8 on page 304

4.1.3.5 ILS localizer distortion view

The ILS Localizer Dist view comprises all measurement parameters for the determination of the distortion factors for the 90 Hz / 150 Hz signal components.

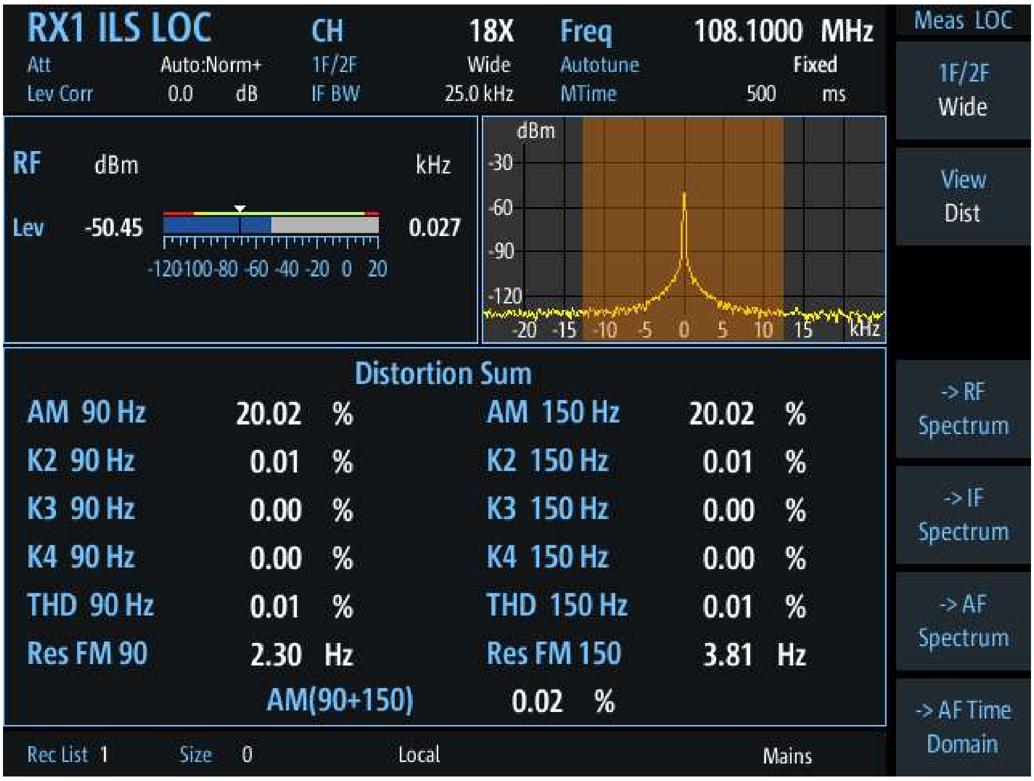


Figure 4-11: ILS Localizer Distortion view

AM 90 Hz

AM modulation depth of 90 Hz ILS component

Remote command:
AM2 on page 281
AM2CLR on page 281
AM2CRS on page 281

K2 90 Hz
Distortion 2nd order, 90 Hz signal

Remote command:
K2_90 on page 284

K3 90 Hz
Distortion 3rd order, 90 Hz signal

Remote command:
K3_90 on page 285

K4 90 Hz
Distortion 4th order, 90 Hz signal

Remote command:
K4_90 on page 285

THD 90 Hz
Total Harmonic Distortion (THD), 90 Hz signal

Remote command:
THD_90 on page 287

Res. FM 90
Residual frequency modulation for 90 Hz signal

Configure the filter using "Res. FM Filt. (ILS only)" on page 70.

Remote command:
RESIDFM_90 on page 286

AM 150 Hz
AM modulation depth of 150 Hz ILS component

Remote command:
AM3 on page 281
AM3CLR on page 281
AM3CRS on page 282

K2 150 Hz
Relative amplitude of an AF signal's second harmonic, calculated as:

<amplitude of second harmonic> / <amplitude of fundamental>

For 90 Hz + 150 Hz:

<mean amplitude of second harmonics> / <mean amplitude of fundamentals>

Remote command:
K2_150 on page 284

K3 150 Hz
Relative amplitude of an AF signal's third harmonic, calculated as:

<amplitude of third harmonic> / <amplitude of fundamental>

For 90 Hz + 150 Hz:

<mean amplitude of third harmonics> / <mean amplitude of fundamentals>

Remote command:
K3_150 on page 284

K4 150 Hz
Relative amplitude of the fourth harmonic for the 150 Hz signal component

Remote command:
K4_150 on page 285

THD 150 Hz
Total Harmonic Distortion (THD) for the 150 Hz signal component

Remote command:
THD_150 on page 287

Res. FM 150
Residual frequency modulation for 150 Hz signal

Remote command:
RESIDFM_150 on page 286

AM (90+150)
Total AM modulation depth of the 90 Hz and the 150 Hz components, taking the phase between the components into account.

Remote command:
AMMOD240 on page 282

4.1.3.6 ILS localizer ID analysis view

The ILS Localizer ID Analysis view provides the following results.

This view is not available for clearance (CLR) signals in two-frequency systems.

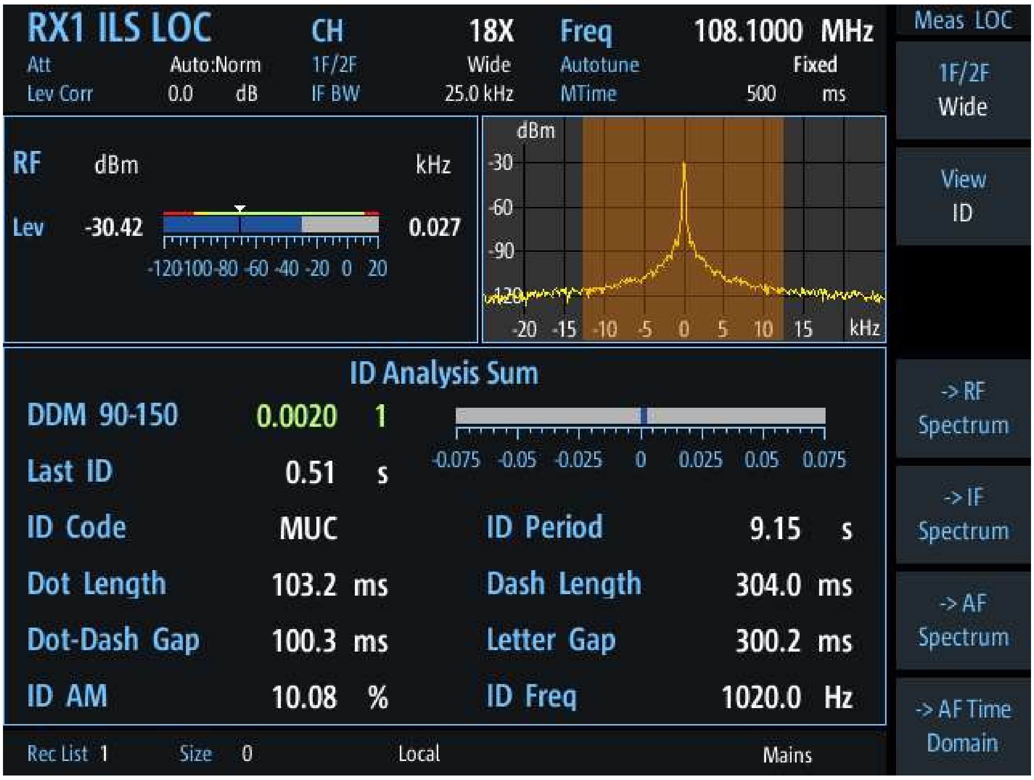


Figure 4-12: ID Analysis view

DDM 90-150

Difference in depth of modulation (DDM) between 90 Hz and 150 Hz AM signal ($m_{90\ Hz}$ – $m_{150\ Hz}$)

Note: The DDM value is also displayed graphically as a bargraph for quick evaluation. A green DDM value indicates that a valid ILS signal has been determined.

Remote command:
`DD0` on page 283
`DD1` on page 283
`DCLR` on page 283
`DCRS` on page 283

Last ID
Time since last ID pulse was measured

Remote command:
LASTID_TIME on page 289

ID Code
Morse-decoded ID with three or four letters.

Remote command:
AC8 on page 280
AC8 on page 304

ID Period
Time between two measured ID pulses

Remote command:
ID_PERIOD on page 289

Dot Length
Length of time a dot is transmitted in the used Morse code in milliseconds.

Remote command:
ID_DOT_LENGTH on page 288

Dash Length
Length of time a dash is transmitted in the used Morse cod in milliseconds.

Remote command:
ID_DASH_LENGTH on page 288

Dot-Dash Gap
Length of time that passes between a transmitted dot and a dash in the used Morse code in milliseconds.

Remote command:
ID_DOTDASH_GAP on page 289

Letter Gap
Length of time that passes between two transmitted letters in the used Morse code in milliseconds.

Remote command:
ID_LETTER_GAP on page 289

ID AM
AM Modulation depth of identifier signal (default: 1020 Hz).

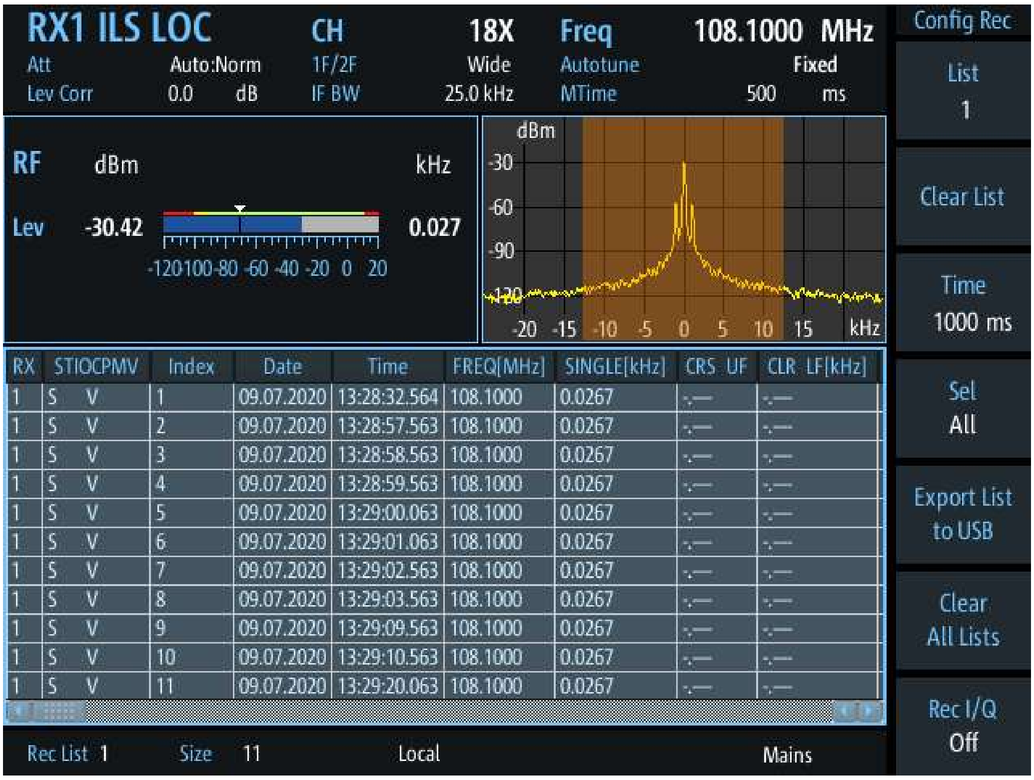
Remote command:
AM8 on page 282
AM8 on page 305

ID Freq
Frequency of the morse signal.

Remote command:
AF8 on page 281
AF8 on page 305

4.1.3.7 ILS localizer recording view

The Recording view displays the recorded data for ILS Localizer measurements from the selected data list (see "List" on page 202). If available, the stored GNSS data from the GNSS receiver is also displayed.



Which measurement results are stored is described in the remote commands, see GETDATADEF on page 366.

The individual measurement results are described in the result views.

Status flags

The "STIOCPMV" value contains status flags, if applicable:

- **S**: Start (started manually)
- **T**: Triggered (externally)
- **I**: Invalid
- **O**: Overload (RF input signal too high)
- **C**: Corrected (includes RF input correction factor)
- **P**: PPS-synced
- **M**: Morse ID available
- **V**: Valid signal (ILS LOC/GP and VOR only)

For details on data logging, see Chapter 7.2, "Recording measurement data", on page 200.

Remote commands to retrieve data:

`GETDATADEF` on page 366

`GETDATASET` on page 366

4.1.4 ILS localizer and glidepath configuration

The following settings are available for the ILS Localizer and Glidepath measurements.

Settings for recording, including trigger settings, are described in Chapter 7.2, "Recording measurement data", on page 200.

4.1.4.1 Configuring the input signal

The ILS modes can analyze RF or LF input. For details on configuring LF input measurements, see Chapter 4.1.4.5, "LF input configuration", on page 71.

Input RF/LF
Access VNC: [s]

Configures the input source for the receiver.

For details on the connectors see Chapter 1.5.2.2, "RX1 in / RX2 in", on page 23.

"RF In" An RF signal is provided from the RX 1 In/RX 2 In connectors on the front of the R&S EVSF1000. They are connected to a receiving antenna (max. +13 dBm). The antenna must correspond to the specified frequency range for the measurement.

"LF In" An AF or low frequency signal is provided at the LF In input connector on the rear side of the R&S EVSF1000.
If both receivers are used, only one of them can be set to analyze input from "LF In".
The LF In connector is only available if R&S EVSF1-B4 is installed.
Analyzing LF input requires option R&S EVSG1-K7 LF-Analysis.

Remote command:
`GS_RFLF_INPUT` on page 278
`LLZ_RFLF_INPUT` on page 268
`VOR_RFLF_INPUT` on page 303
`FFT_RFLF_INPUT` on page 353
`SCOPE_RFLF_INPUT` on page 358
`SETUP:INPUT` on page 234

4.1.4.2 Channel and frequency configuration

The ILS Localizer and Glidepath measurements can detect both course and clearance carriers simultaneously. As an alternative, the individual carriers can be measured only, or any one or two user-defined frequencies. By default, a wideband measurement is performed to obtain an initial overview of the input signal and determine the basic signal characteristics. An autotune function is available to determine the precise frequencies of the signal components automatically. Thus, the demodulation bandwidth can be selected very precisely. The available measurement settings depend on the selected channel and frequency configuration.

Channel setup

Access VNC: [m] > [F1]

1F/2F
Selects the number of frequencies or channels to be measured.

For all frequencies except the wideband measurement, the autotune function automatically determines the measurement frequency (see "CRS/CLR Carr (Autotune function)" on page 65).

"1F" One frequency only is measured, namely the nominal frequency, which is also the center frequency.
The nominal frequency is configured by the Channel frequency configuration (CH FREQ) settings.

"2F" Two frequencies are measured at the same time. Which frequencies are measured is configured by the Channel frequency configuration (CH FREQ) settings.
The numeric results are calculated as the sum of both frequencies. In the RF Level display, the individual carriers are also indicated. In the RF Spectrum preview, both carriers are displayed.

"2F CRS" Both the course and clearance frequencies are measured simultaneously. The results for both frequencies, as well as the sum of both, are displayed in the RF Level display. Both frequencies are displayed in the RF Spectrum preview. The numeric results are displayed for the course frequency. To view the results for the clearance frequency, switch to "2F CLR"

Note: Depending on the ILS system and the country, the course can be the upper or lower frequency (see "Upper Freq" on page 67).

"2F CLR" Both the course and clearance frequencies are measured simultaneously. The results for both frequencies, as well as the sum of both, are displayed in the RF Level display. Both frequencies are displayed in the RF Spectrum preview. The numeric results are displayed for the course frequency. To view the results for the course frequency, switch to "2F CRS".

Note: Depending on the ILS system and the country, the course can be the upper or lower frequency (see "Upper Freq" on page 67).

"Wide" A wideband measurement is performed around the nominal frequency. The frequency range is defined by the IF BW.

Remote command:
`DEMODE_LLZ` on page 261
`DEMODE_GS` on page 271

Carrier configuration (1F/2F Config)

Access VNC: [s] > "F1"

Configures the carriers and frequencies for measurements on a single or two frequencies (not wideband). Which settings are available depends on the "1F/2F" on page 64.

CRS/CLR Carr (Autotune function)
Defines whether the course and clearance carriers are determined automatically or manually.

"Man" Specify the frequencies manually as offsets to either direction of the nominal frequency, see "Course" on page 66 and "Clearance" on page 66.

"Auto Lock" Both carriers are determined automatically at the beginning of the measurement. Once a valid signal has been found, the carrier frequencies remain fixed until you perform a manual change.
Automatic mode is indicated by "Autotune" in the measurement settings area, followed by the current processing status, see "Autotune function" on page 45.
For all carrier measurements (not the wideband measurement), the "Auto Lock" function is enabled by default (see "1F/2F" on page 64).

"Auto Retune" Both carriers are determined automatically at the beginning of the measurement. If the carrier frequency changes, the R&S EVSF1000 starts a new search (retuning).
Automatic mode is indicated by "Autotune" in the measurement settings area, followed by the current processing status, see "Autotune function" on page 45.

Note: Adapting the frequency in autotune mode.
The autotune function sets the measurement filter position such that the detected frequency is in the center of the filter bandwidth. While the frequency is locked, the filter position remains unchanged. If the bandwidth is narrow and the signal frequency changes, e.g. due to changes of the transmitter, the signal may no longer be covered completely by the measurement filter. In this case, the measurement results are distorted. If you assume that the ILS signal frequency has possibly changed, we recommend performing a new search using the Find Carrier function.

Remote command:
Mode:
`LLZ_DEMFREQS_OFFSET_AUTOMAN` on page 266
`GS_DEMFREQS_OFFSET_AUTOMAN` on page 276

Course
Defines the course carrier as a frequency offset from the nominal frequency.

Remote command:
`LLZ_DEMFREQS_OFFSET_UPPERFREQ` on page 267
`GS_DEMFREQS_OFFSET_UPPERFREQ` on page 277

Clearance
Defines the clearance carrier as a frequency offset from the nominal frequency in the opposite direction to the course carrier.

Remote command:
`LLZ_DEMFREQS_OFFSET_LOWERFREQ` on page 267
`GS_DEMFREQS_OFFSET_LOWERFREQ` on page 276

1F Offset
For single frequency measurements only:

Defines an offset of the measured frequency to the nominal frequency.

Remote command:
`LLZ_DEMFREQS_OFFSET_1F` on page 266
`GS_DEMFREQS_OFFSET_1F` on page 276

Find Carrier
For manual carrier determination (CRS/CLR Carr (Autotune function): "MAN"):

Determines the carrier frequencies automatically, but only once. The frequencies do not change automatically if the input signal changes.

For automatic carrier determination ("Autotune"): a new search is performed, see "CRS/CLR Carr (Autotune function)" on page 65.

Note: Adapting the frequency in autotune mode.
The autotune function sets the measurement filter position such that the detected frequency is in the center of the filter bandwidth. While the frequency is locked, the filter position remains unchanged. If the bandwidth is narrow and the signal frequency changes, e.g. due to changes of the transmitter, the signal may no longer be covered completely by the measurement filter. In this case, the measurement results are distorted. If you assume that the ILS signal frequency has possibly changed, we recommend performing a new search using the Find Carrier function.

Remote command:
`LLZ_START_FINDCARRIER` on page 268
`GS_START_FINDCARRIER` on page 278

Carrier Thresh
Defines a threshold for automatic carrier determination. The measured power level must exceed this level before the carrier frequency is adapted.

Remote command:
`GS_CARRIER_THRESHOLD_DB` on page 274
`LLZ_CARRIER_THRESHOLD_DB` on page 264

Upper Freq
The course and clearance carriers are defined as offsets to either side of the center frequency. Which frequency is considered to be the course carrier - the upper or lower frequency - depends on the used standard and the country it is used in. Thus, you can swap the carrier definition if necessary.

Remote command:
`SETUP:UNIT:UPPERFREQ` on page 254

Channel frequency configuration (CH FREQ)

Access VNC: [q]

The channel frequency determines the nominal frequency at which the measurement is performed. For some avionics standards, the channels are associated with specific frequencies. (See Chapter A, "ILS channel frequency list", on page 377 and Chapter B, "VOR channel frequency list", on page 379.)

CH
Sets the receiver frequency channel on the active receiver board according to the ICAO frequency list.

Remote command:
RFCH on page 231

Freq

Sets the nominal frequency for the measurement. By default, this frequency is also assumed to be the center frequency for spectrum displays, unless an offset is defined.

For measurements on two frequencies, the frequencies are defined as offsets to this nominal frequency.

Remote command:
RF on page 231

Step Size

Defines the frequency step size for the rotary knob when setting the frequency.

In many avionics signals, channels are assigned to frequencies with a fixed offset. By setting the step size of the rotary knob to the fixed offset, you can easily scroll through the signal's channel frequencies using the rotary knob. Thus, for example, you can analyze the measurement results for one channel after the other simply by changing the selected channel frequency with the rotary knob.

The default step size for ILS/VOR mode is 50 kHz.

Remote command:
ILS mode:
LLZ_DEFAULT_FREQSTEP on page 264
GS_DEFAULT_FREQSTEP on page 274
VOR mode:
VOR_DEFAULT_FREQSTEP on page 301

4.1.4.3 Ampt

Access VNC: [w]

The following settings define the amplification for the input signal.

RF Att

Determines how the attenuation of the RF signal is defined. Adjust the attenuation such that the measured power level remains in the valid level range (indicated by the green area of the bargraph, see Figure 4-4). Note that the valid level range depends on the selected measurement mode.

"Manual" The RF attenuation mode is specified manually (see "RF Mode" on page 69).

"Auto" The RF attenuation mode is selected automatically.
The signal attenuation is selected automatically according to the signal strength.
This mode works best with clean signals. In difficult receiving conditions, the "Low Noise", "Normal" or "Low Distortion" modes can be more stable.
When monitoring signals with mostly constant signal levels, it is also recommended that you use the "Low Noise", "Normal" or "Low Distortion" mode.

Remote command:
SETATTMODE on page 232
SCOPE_ATTMODE on page 355
FFT_ATTMODE on page 348
IFSPECT_ATTMODE on page 344

RF Mode
Defines the RF attenuation mode to be used.

"Low Noise" 15 dB pre-amplification
Provides a high sensitivity. Suitable when scanning the area for distant signals.

"Norm" 0 dB
Provides a normal sensitivity.

"Low Dist" 15 dB attenuation
Provides a low sensitivity. Suitable when analyzing a nearby signal, to avoid overload due to high-level signals.

Remote command:
SETATTMODE on page 232
FSCAN_ATTMODE on page 339
SCOPE_ATTMODE on page 355
FFT_ATTMODE on page 348
IFSPECT_ATTMODE on page 344
GBAS:ATTMODE on page 321

Transducer Correction
Configures the level correction. The specified value is added to the measured power levels to compensate for an inherent offset by the measurement setup, for example the antenna.

Remote command:
SETUP:EXTERNALATT_RX1 on page 233
SETUP:EXTERNALATT_RX2 on page 233

4.1.4.4 Bandwidth (BW)

Access VNC: [e]

The bandwidth determines the frequency range for which the measurement is performed. Depending on the measurement mode, and whether a wideband or a specific frequency is measured, different settings are available.

IF BW

Specifies the measurement filter bandwidth.

Ensure that the entire input signal lies within the specified bandwidth, particularly for narrow bandwidths.

Note: Adapting the frequency in autotune mode.
The autotune function sets the measurement filter position such that the detected frequency is in the center of the filter bandwidth. While the frequency is locked, the filter position remains unchanged. If the bandwidth is narrow and the signal frequency changes, e.g. due to changes of the transmitter, the signal may no longer be covered completely by the measurement filter. In this case, the measurement results are distorted. If you assume that the ILS signal frequency has possibly changed, we recommend performing a new search using the Find Carrier function.

Remote command:
1F/2F measurements:
`LLZ_DEM_1F2F_BW` on page 266
`GS_DEM_1F2F_BW` on page 275
Wideband measurements:
`LLZ_DEM_WIDE_BW` on page 265
`GS_DEM_WIDE_BW` on page 275

IF BW Dist/ID

Specifies the demodulation filter bandwidth for distortion and ID measurements.

Remote command:
1F/2F measurements:
`LLZ_DEM_ID_BW` on page 265
`GS_DEM_ID_BW` on page 275
Wideband measurements:
`LLZ_DEM_ID_WIDE_BW` on page 265
`GS_DEM_ID_WIDE_BW` on page 275

Res. FM Filt. (ILS only)

Defines the filter type used to determine residual FM (see Chapter 4.1.3.5, "ILS localizer distortion view", on page 57).

"ICAO"	Filter according to ICAO specification
"Narrow"	Narrow filter; the DDM filters used to determine the 90 Hz/ 150 Hz modulation values are used to avoid interference between the signals

Remote command:
`FILTER_LLZ_RESIDFM` on page 267

4.1.4.5 LF input configuration

The ILS Localizer and Glidepath measurements can be performed on common RF or on LF input. LF input can only be analyzed if the R&S EVSG1-K7 LF-Analysis option is installed.

To measure LF input rather than RF input, the following settings are required.

Input RF/LF
Access VNC: [s]

Configures the input source for the receiver.

For details on the connectors see Chapter 1.5.2.2, "RX1 in / RX2 in", on page 23.

"RF In" An RF signal is provided from the RX 1 In/RX 2 In connectors on the front of the R&S EVSF1000. They are connected to a receiving antenna (max. +13 dBm). The antenna must correspond to the specified frequency range for the measurement.

"LF In" An AF or low frequency signal is provided at the LF In input connector on the rear side of the R&S EVSF1000.
If both receivers are used, only one of them can be set to analyze input from "LF In".
The LF In connector is only available if R&S EVSF1-B4 is installed.
Analyzing LF input requires option R&S EVSG1-K7 LF-Analysis.

Remote command:
`GS_RFLF_INPUT` on page 278
`LLZ_RFLF_INPUT` on page 268
`VOR_RFLF_INPUT` on page 303
`FFT_RFLF_INPUT` on page 353
`SCOPE_RFLF_INPUT` on page 358
`SETUP:INPUT` on page 234

LF In Mode
Access VNC: [s]

Determines the type of LF input. Depending on the type of input, the available settings and results can vary.

This setting is only available for LF input (Input: LF).

"AF" Measures the AF signal at 0 Hz.

"Low IF" Measures the ILS signal at a low intermediate frequency, for example from a test point at the transmitter.

Remote command:
LLZ_BB_WIDE1F on page 264
GS_BB_WIDE1F on page 274

Low IF Offset
Access VNC: [s]

Defines the frequency of the low IF input signal, that is: the offset from 0 Hz.

Only available for low IF mode (see "LF In Mode" on page 71).

Remote command:
LLZ_BB_1F_OFFSETKHZ on page 262
GS_BB_1F_OFFSETKHZ on page 272

Range
Access VNC: [w]

Defines the full-scale AF signal level. Define the correct level to avoid clipping and overload.

Switches the range between 1 V and 5 V.

Remote command:
SETUP:BB_IN_RANGE on page 236

Coupling
Access VNC: [w]

Specifies the handling of the DC component of the AF signal.

For low IF signals, AC coupling is always used.

"AC" The DC component of the AF signal is not forwarded.

"DC" The DC component of the AF signal is also forwarded and analyzed.

Remote command:
SETUP:BB_IN_COUPL on page 236

DC Reference
Access VNC: [w]

Defines the reference power in volt for LF input, available for AF signals with AC coupling only. This value is used to determine the modulation depth and corresponds to the DC power of the AF signal.

For AC coupling, the DC power component of the AF signal is not forwarded. Thus, you must define the reference value manually.

Remote command:
LLZ_BB_LFIN_DCOFFSETV on page 263
GS_BB_LFIN_DCOFFSETV on page 273
VOR_BB_LFIN_DCOFFSETV on page 300
FFT_BB_LFIN_DCOFFSETV on page 349
SCOPE_BB_LFIN_DCOFFSETV on page 356

LF In Factor
Access VNC: [w]

Applies a factor to the measured power levels, e.g. to compensate certain effects in the input system.

Remote command:
`SETUP:BB_IN_FACTOR` on page 236

Bandwidth (IF BW/AF In BW)
Access VNC: [e]

Bandwidth with which the LF input is acquired. The default bandwidth is 3 kHz for Low IF measurements. For AF measurements, the default bandwidth is 1.5 kHz.

Remote command:
AF mode:
`LLZ_BB_BW_KHZ` on page 262
`GS_BB_BW_KHZ` on page 272
`VOR_BB_BW_KHZ` on page 300
Low IF mode:
`LLZ_BB_LOWIF_BW_KHZ` on page 263
`GS_BB_LOWIF_BW_KHZ` on page 273

IF/AF Bandwidth (Dist/ID)
Access VNC: [e]

Bandwidth with which the ID analysis and distortion measurement is performed. The default bandwidth is 3 kHz for Low IF measurements. For AF measurements, the default bandwidth is 1.5 kHz.

Remote command:
AF mode:
`LLZ_BB_AF_BW_IDDIST_KHZ` on page 262
`GS_BB_AF_BW_IDDIST_KHZ` on page 272
Low IF mode:
`GS_BB_LOWIF_BW_IDDIST_KHZ` on page 273
`LLZ_BB_LOWIF_BW_IDDIST_KHZ` on page 263

Res. FM Filt.
Access VNC: [e]

Defines the filter type used to determine residual FM (see Chapter 4.1.3.5, "ILS localizer distortion view", on page 57).

"ICAO"	Filter according to ICAO specification
"Narrow"	Narrow filter; the DDM filters used to determine the 90 Hz/ 150 Hz modulation values are used to avoid interference between the signals.

Remote command:
`FILTER_LLZ_RESIDFM` on page 267

4.1.4.6 Setting the measurement time (MTime)

Access VNC: [d]

The measurement time determines the interval at which new measurement results are displayed. Internally, values are captured every 10 ms, that is: 100 per second.

If the defined measurement time is longer, the values captured internally in that interval are averaged and only the average value is displayed.

Note that the measurement time determines the minimum interval for values to be stored during recording (see "Time" on page 203).

Enter the time in milliseconds.

Remote command:

`MEASTIME` on page 231

4.1.4.7 DDM and SDM configuration

The following settings configure the DDM and SDM measurement results.

DDM Unit
Specifies the unit of the DDM display.

1 (dimensionless value) | % | µA

Remote command:
`SETUP:UNIT:DDM` on page 252

SDM Unit
Specifies the unit of the SDM display.

1 (dimensionless value) | % | µA

Remote command:
`SETUP:UNIT:SDM` on page 253

ILS Phase
Specifies the value range in the ILS phase.

Bipolar: -60 … +60° | Unipolar: 0 … 120°

Remote command:
`SETUP:UNIT:ILSPHASE` on page 253

DDM Polarity
Specifies the DDM polarity.

90−150 | 150−90

Remote command:
`SETUP:UNIT:POLARITYDDM` on page 253

DDM Bargr
Configures the scaling of the DDM bargraph.

0.075 | 0.150 | 0.400 (dimensionless)

Remote command:
`SETUP:UNIT:BARGRAPH` on page 252

4.2 R&S EVSG-K3 Marker beacon analysis

Access VNC: [m] > Down arrow key

Remote command:

`MODE_MB` on page 293

4.2.1 Basics on marker beacons

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

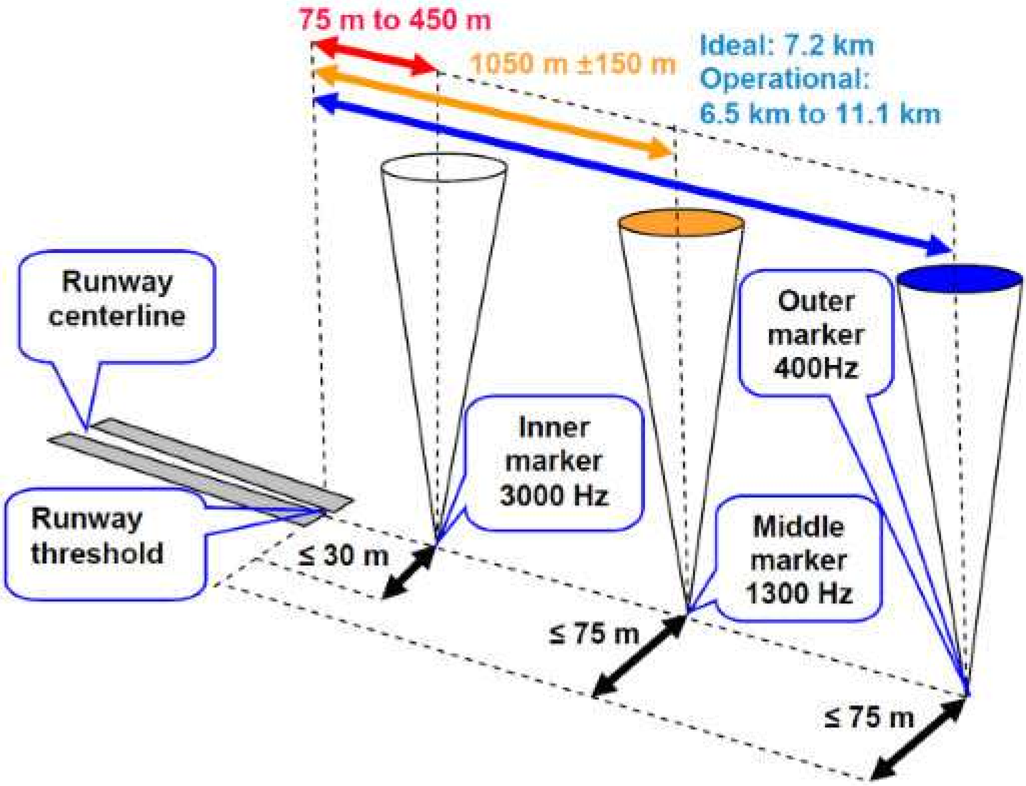


Figure 4-13: Marker beacon placement with respect to runway

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

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

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

4.2.2 ILS marker beacon measurements and results

The ILS Marker Beacon measurement provides multiple views for the measurement results.

You can display graphical results directly from the ILS Marker Beacon mode by selecting the softkey in the "Meas" menu. In this case, the settings for the current measurement are applied to the graphical results.

To return from the graphical results to the ILS Marker Beacon mode, select "Return" ([F7]).

For details on the graphical results, see:

- Chapter 5.1, "R&S EVSG-K10 RF spectrum analysis", on page 125
- Chapter 5.2, "IF spectrum analysis", on page 130
- Chapter 5.3, "R&S EVSG-K11 AF spectrum analysis", on page 134
- Chapter 5.4, "R&S EVSG-K12 Time domain analysis", on page 143

Remote command:

`VIEW_MB` on page 294

4.2.2.1 RF level and frequency display

The measured RF power and frequency of the input signal are displayed both numerically and graphically.

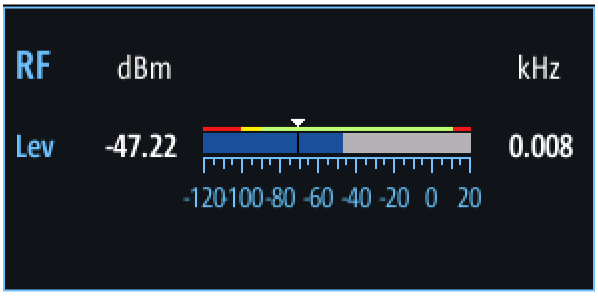


Figure 4-14: RF level display

The following results are provided:

- Numeric power level in dBm ("Lev")
  For measurements on two frequencies: individual and sum power levels
- Measured frequency offset to the nominal frequency in kHz
- Numeric frequency offset of measured power
- Bargraph indicating the power and a color-coded overload state, where:
  – **Red**: overload state, check message
  – **Yellow**: power approaching overload state
  – **Green**: power in a valid range

- If applicable: overload messages

Overload messages

The following messages indicate an overload:

- "RF Overload"
  Overload of the input mixer or of the analog IF path.
- "IF Overload"
  Overload of the IF signal.
- "ADC Overload"
  The dynamic range of the AD-converter is exceeded (clipping).

A combination of these overloads is also possible.

In all cases, set the RF attenuation to normal or low distortion (for RF input), or reduce the input level.

In recorded data lists, overloads are indicated by an **"O"**, see "Status flags" on page 63.

Remote commands to retrieve results:

`LA?` on page 231

`RF?` on page 231

`FMEAS` on page 295

4.2.2.2 IF spectrum preview

A preview of the measured spectrum (power level vs. frequency) for the IF (intermediate frequency) signal is provided. The center frequency is the nominal channel frequency. The frequency range shows the measured bandwidth. The power range is selected such that the noise level remains visible.

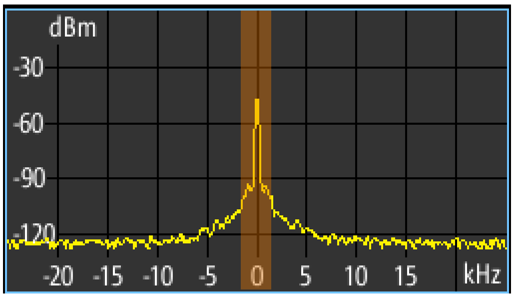
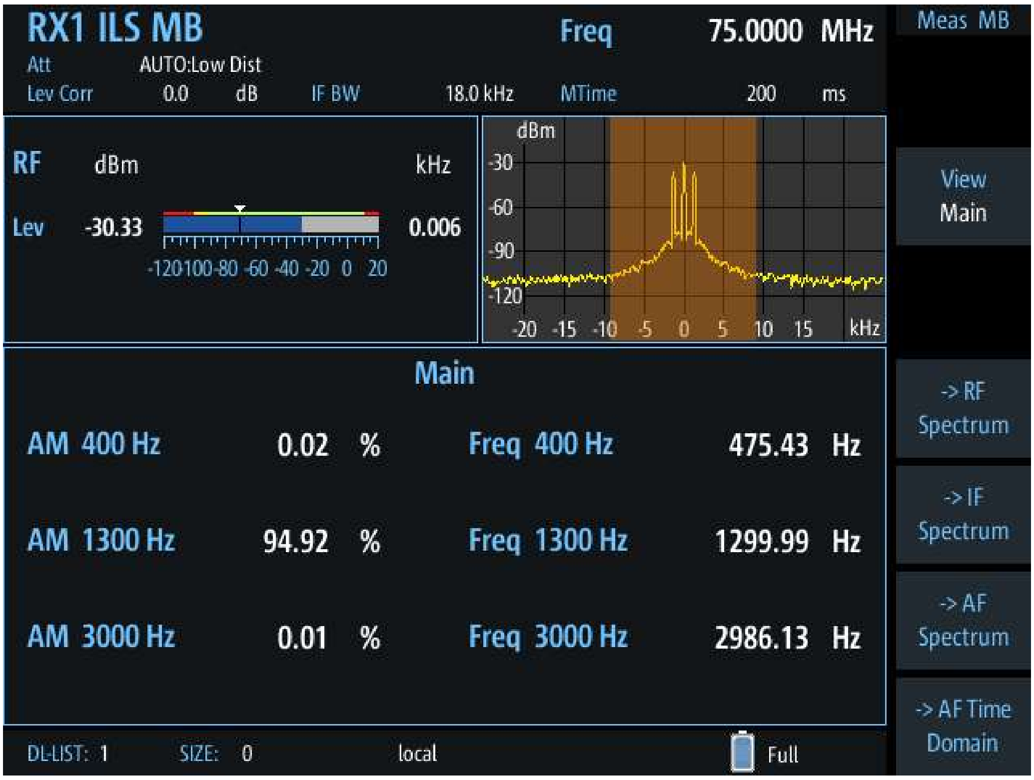


Figure 4-15: IF spectrum preview

This preview spectrum allows you to check if the current measurement settings are appropriate, such as the bandwidth or frequency offsets. For a larger, more detailed spectrum diagram, select one of the graphical Spectrum modes. If you switch to such a mode directly from a numeric measurement mode, the current measurement settings are applied to the spectrum automatically.

4.2.2.3 ILS marker beacon main view

The ILS Marker Beacon Main view provides the following results:



AM 400 Hz
AM modulation depth of the 400-Hz component

Remote command:
AM6 on page 296

Freq 400 Hz
Measured frequency of the 400-Hz component

Remote command:
AF6 on page 295

AM 1300 Hz
AM modulation depth of the 1300-Hz component

Remote command:
AM5 on page 296

Freq 1300 Hz
Measured frequency of the 1300-Hz component

Remote command:
AF5 on page 295

AM 3000 Hz
AM modulation depth of the 3000-Hz component

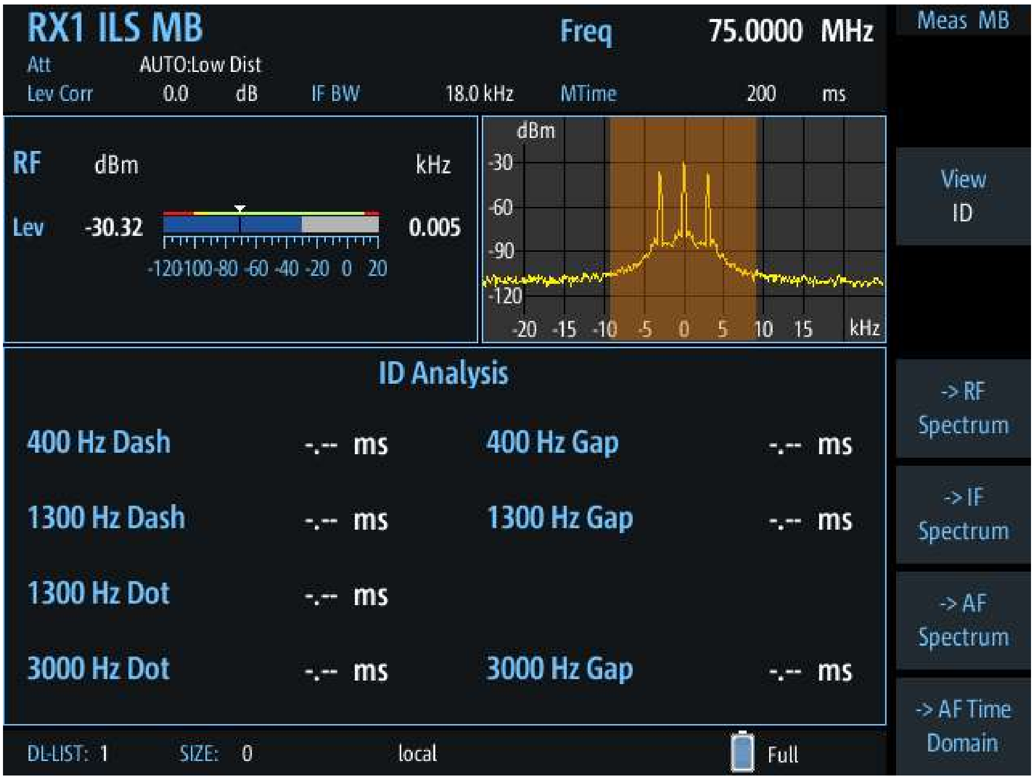
Remote command:
AM4 on page 295

Freq 3000 Hz
Measured frequency of the 3000-Hz component

Remote command:
AF4 on page 295

4.2.2.4 ILS marker beacon ID analysis

Displays the results of the marker beacon signal id analysis.



400 Hz Dash
Displays the length of a dash for the outer marker (in ms).

Remote command:
`ID_F400_DASHLEN` on page 296

400 Hz Gap
Displays the gap between two dashes for the outer marker (in ms).

Remote command:
`ID_F400_GAP` on page 297

1300 Hz Dash
Displays the length of a dash for the middle marker (in ms).

Remote command:
`ID_F1300_DASHLEN` on page 297

1300 Hz Dot
Displays the length of a dot for the middle marker (in ms).

Remote command:
`ID_F1300_DOTLEN` on page 297

1300 Hz Gap
Displays the gap between dot and dash for the middle marker (in ms).

Remote command:
`ID_F1300_GAP` on page 297

3000 Hz Dot
Displays the length of a dot for the inner marker (in ms).

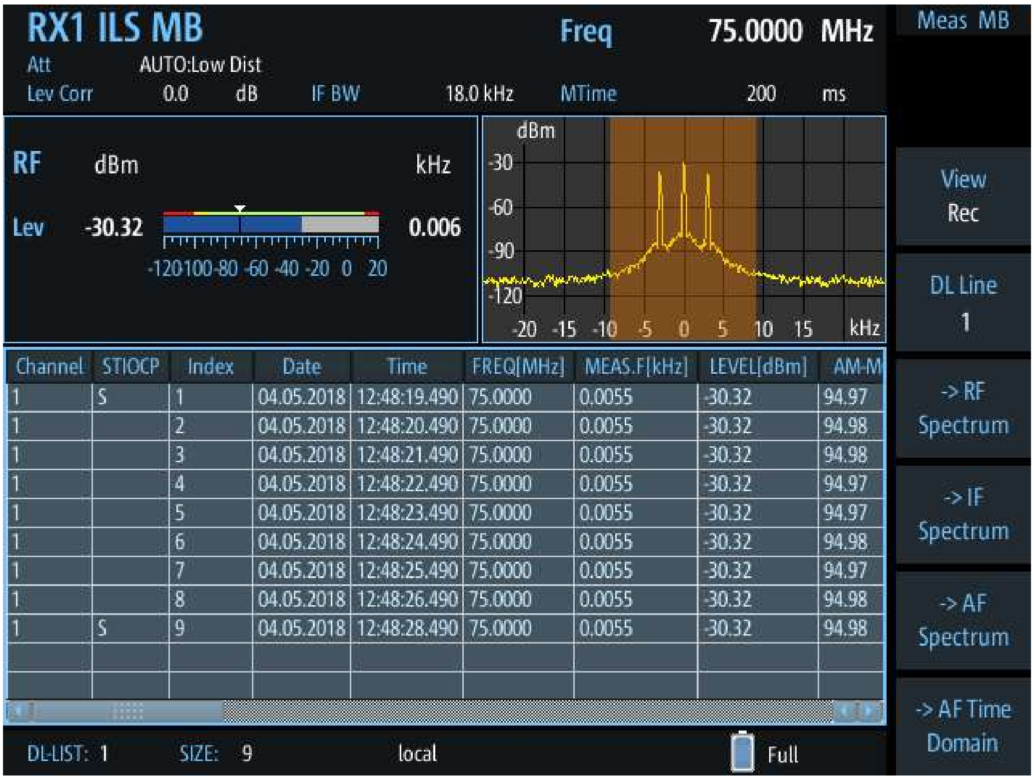
Remote command:
`ID_F3000_DOTLEN` on page 297

3000 Hz Gap
Displays the gap between two dashes for the inner marker (in ms).

Remote command:
`ID_F3000_GAP` on page 298

4.2.2.5 ILS marker beacon recording view

The Recording view displays the recorded data for ILS Localizer measurements from the selected data list (see "List" on page 202). If available, the stored GNSS data from the GNSS receiver is also displayed.



Which measurement results are stored is described in the remote commands, see `GETDATADEF` on page 366.

The individual measurement results are described in the other ILS Marker Beacon result views.

For details on data logging, see Chapter 7.2, "Recording measurement data", on page 200.

Status flags

The "STIOCPMV" value contains status flags, if applicable:

- **S**: Start (started manually)
- **T**: Triggered (externally)
- **I**: Invalid
- **O**: Overload (RF input signal too high)
- **C**: Corrected (includes RF input correction factor)
- **P**: PPS-synced
- **M**: Morse ID available
- **V**: Valid signal (ILS LOC/GP and VOR only)

4.2.3 Configuring ILS marker beacon measurements

The following settings are available for the ILS Marker Beacon measurement.

Settings for recording, including trigger settings, are described in Chapter 7.2, "Recording measurement data", on page 200.

For the mapping of hard- and softkey commands to keyboard commands using VNC, see Table 1-3.

4.2.3.1 Setting the receiver frequency

Access VNC: [q]

The receiver frequency determines the nominal frequency at which the measurement is performed.

Freq
Sets the nominal frequency for the measurement.

Remote command:
`RF` on page 231

Step Size
Defines the frequency step size for the rotary knob when setting the frequency.

The default step size for ILS MB mode is 50 kHz.

4.2.3.2 Ampt

Access VNC: [w]

The following settings define the amplification for the input signal.

RF Att
Determines how the attenuation of the RF signal is defined. Adjust the attenuation such that the measured power level remains in the valid level range (indicated by the green area of the bargraph, see Figure 4-4). Note that the valid level range depends on the selected measurement mode.

"Manual" The RF attenuation mode is specified manually (see "RF Mode" on page 69).

"Auto" The RF attenuation mode is selected automatically.
The signal attenuation is selected automatically according to the signal strength.
This mode works best with clean signals. In difficult receiving conditions, the "Low Noise", "Normal" or "Low Distortion" modes can be more stable.
When monitoring signals with mostly constant signal levels, it is also recommended that you use the "Low Noise", "Normal" or "Low Distortion" mode.

Remote command:
SETATTMODE on page 232
SCOPE_ATTMODE on page 355
FFT_ATTMODE on page 348
IFSPECT_ATTMODE on page 344

RF Mode

Defines the RF attenuation mode to be used.

"Low Noise" 15 dB pre-amplification
Provides a high sensitivity. Suitable when scanning the area for distant signals.

"Norm" 0 dB
Provides a normal sensitivity.

"Low Dist" 15 dB attenuation
Provides a low sensitivity. Suitable when analyzing a nearby signal, to avoid overload due to high-level signals.

Remote command:
SETATTMODE on page 232
FSCAN_ATTMODE on page 339
SCOPE_ATTMODE on page 355
FFT_ATTMODE on page 348
IFSPECT_ATTMODE on page 344
GBAS:ATTMODE on page 321

Transducer Correction

Configures the level correction. The specified value is added to the measured power levels to compensate for an inherent offset by the measurement setup, for example the antenna.

Remote command:
SETUP:EXTERNALATT_RX1 on page 233
SETUP:EXTERNALATT_RX2 on page 233

4.2.3.3 Setting the measurement time (MTime)

Access VNC: [d]

The measurement time determines the interval at which new measurement results are displayed. Internally, values are captured every 10 ms, that is: 100 per second.

If the defined measurement time is longer, the values captured internally in that interval are averaged and only the average value is displayed.

Note that the measurement time determines the minimum interval for values to be stored during recording (see "Time" on page 203).

Enter the time in milliseconds.

Remote command:

MEASTIME on page 231

4.3 R&S EVSG-K2 VOR analysis

Access VNC: [m] > Down arrow key

If the optional R&S EVSG-K2 VOR analysis is installed, signals from VOR systems can be analyzed with the R&S EVSF1000.

Remote command:

MODE_VOR on page 300

4.3.1 VOR basics

Some background knowledge on basic terms and principles used in VOR measurements is provided here for a better understanding of the required configuration settings.

4.3.1.1 VHF omnidirectional radio range (VOR)

Very high frequency (VHF) omnidirectional radio range (VOR) is a radio navigation system for short and medium distance navigation. The VOR radio navigation aid supplies the aircraft with directional information, angle information relative to the magnetic north from the site of the beacon. Thus, it helps aircraft to determine their position and stay on course. The range covered by a VOR station is ideally a circle around the VOR station with a radius depending on the flight altitude.

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

Ground transmitter

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

- An omnidirectional reference signal (REF) that can consist of two parts:
  - 30 Hz frequency modulated (FM) sine wave on subcarrier 9.96 kHz from amplitude modulation (AM) carrier

  – 1020 Hz AM modulated sine wave Morse code
- A directional positioning signal, variable (VAR): 30 Hz AM modulated sine waves with variable phase shift

VOR receiver

The VOR receiver obtains the directional information by measuring the phase difference of two 30 Hz signals transmitted by the beacon. A conventional VOR station (CVOR) transmits with a rotating antenna. From the rotation, a sine wave AM signal arises in the receiver, whose phase position depends on the present angle of rotation. The rotation frequency of the antenna sets the modulation frequency at 30 Hz.

Instead of using a rotating antenna, DVOR stations (Doppler) divide the circumference of the antenna into 48 or 50 segments, covering each segment by its own antenna. Each antenna transmits the unmodulated subcarrier from one antenna to the next, so that the signal completes the round trip 30 times per second.

To determine the radial, the phase difference to a reference phase must be measured. This reference phase must be independent of the rotation of the antenna. Thus, it is modulated with a frequency deviation of 480 Hz in FM onto a secondary carrier with 9.96 kHz. It is then emitted over a separate antenna with a round characteristic.

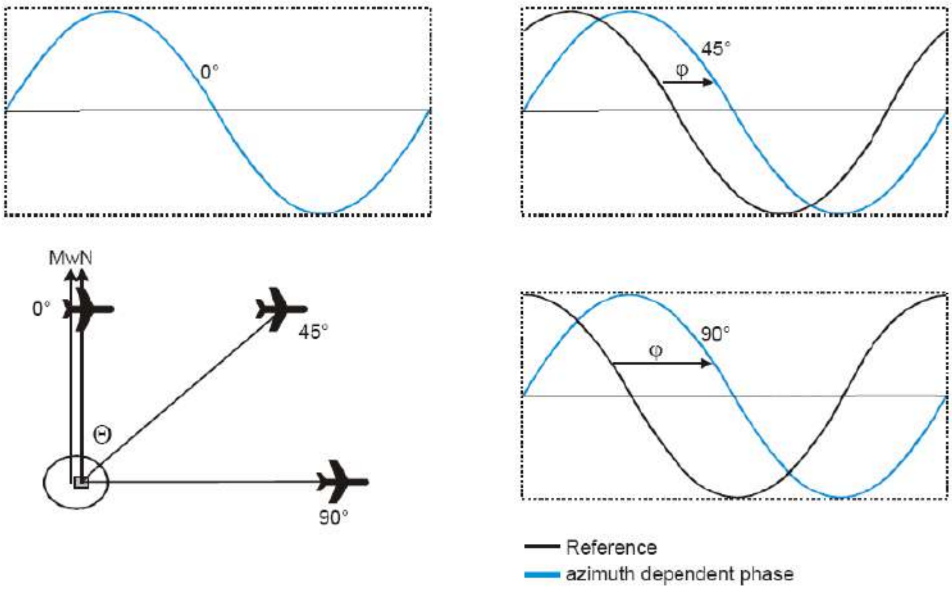


Figure 4-16: Basics of the VOR phase angles (Φ) depending on the azimuth angle (Θ)

The frequency modulated secondary carrier for the reference phase is itself again modulated in AM on the RF carrier of the VOR station. In addition to the signals necessary for navigation, a Morse code with 1020 Hz can be transmitted on the VOR carrier. Also, speech in the usual AF from 300 Hz to 3.3 kHz can be transmitted. Often the voice channel of a VOR station is used for the transmission of ATIS (Automatic Terminal Information Service) messages. The Morse code can be used to identify the VOR station, similar to the "Morse code identification signal" on page 43 in the ILS signal.

The spectrum of a VOR signal is therefore composed of the carrier and three modulated components.

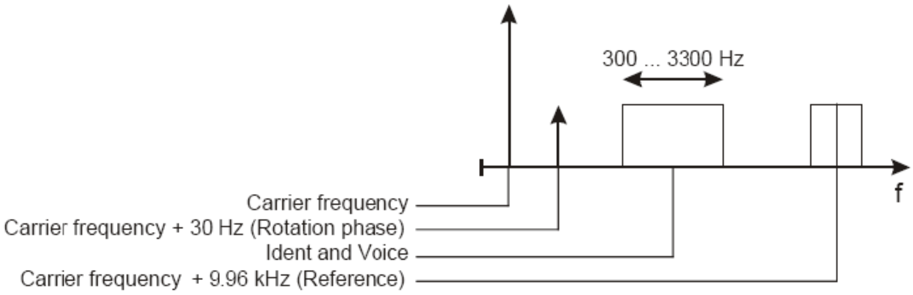


Figure 4-17: Example of the VOR Spectrum

The identical modulation degree m = 0.3 for all three components was selected in ICAO annex-10 [63] such that the total signal still contains 10% modulation reserve. The carrier is therefore not suppressed at any time. The 9960 Hz reference carrier is FM modulated with 480 Hz deviation. The VOR signal generation as under ICAO is shown below.

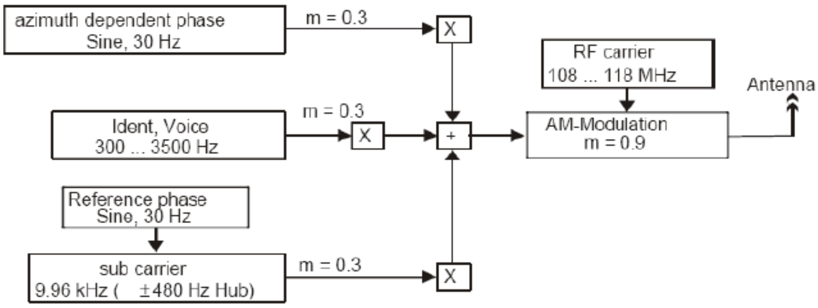


Figure 4-18: Basics of the VOR signal generation

4.3.1.2 VOR demodulator

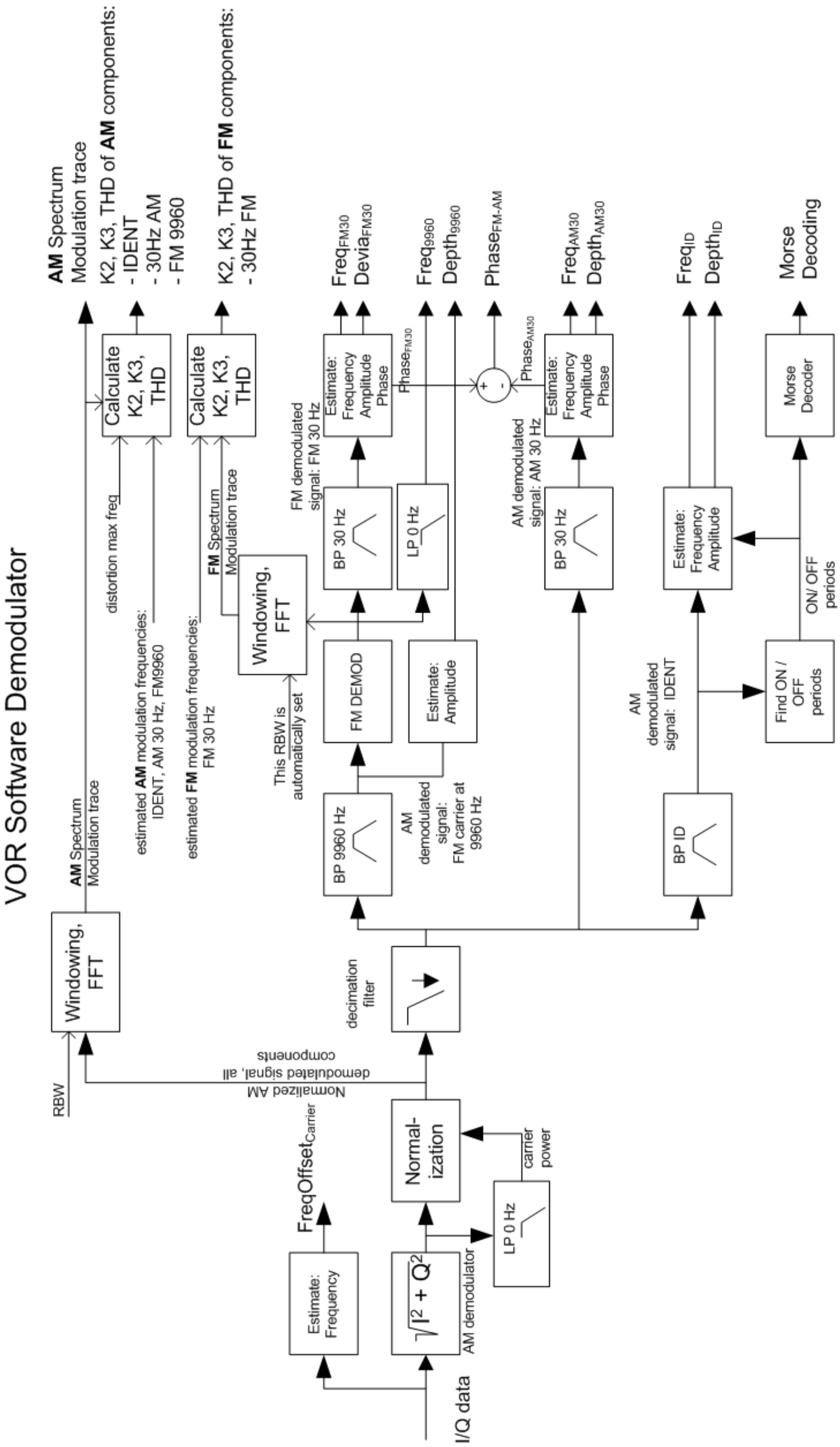


Figure 4-19: Block diagram of the VOR software demodulator

The VOR signal contains three AM modulated components that must be separated in a first step:

- Rotational signal (30 Hz)
- Identification/voice part (300 Hz to 4 kHz)
- FM modulated carrier (9960 Hz ± 700 Hz)

To obtain the AM depth, a lowpass filter must calculate the mean carrier power, while suppressing all other signal components. The mean carrier power is then used to normalize the instantaneous magnitude of the I/Q signal. The result is the AM modulation depth signal vs. time. The three AM components are separated using bandpass filters covering the individual frequency ranges.

A Morse decoder detects and decodes the ON and OFF periods in the identifier signal.

The separated FM modulated carrier is passed through an FM demodulator. The FM carrier frequency (nominal 9960 Hz) is calculated as the average output value of the FM demodulator. To obtain the 30 Hz reference signal, the FM demodulator output is filtered by the same narrow 30 Hz bandpass as the 30 Hz AM rotational component. FM deviation is calculated using the estimated magnitude of the 30 Hz reference signal.

The azimuth is calculated as the phase difference of the 30 Hz reference signal and the 30 Hz rotational signal.

VOR distortion

In the VOR software demodulator two kinds of signals are analyzed regarding distortions:

- AM Distortion: The AM modulation depth vs time signal is processed by an FFT, with a user-defined resolution bandwidth. The trace is displayed in the "Modulation Spectrum" display. The K2, K3 and THD results of the AM components are calculated based on the FFT trace and the estimated modulation frequencies.
- FM Distortion: The FM modulation depth vs time signal is processed by an FFT, using a resolution bandwidth automatically set by the application. You cannot view the resulting trace. The K2, K3 and THD results of the FM components are calculated based on the FFT trace and the estimated modulation frequencies.

AM modulation depth

To obtain the AM depth, a lowpass filter must calculate the mean carrier power, while suppressing all other signal components. The mean carrier power is then used to normalize the instantaneous magnitude of the I/Q signal. The result is the AM modulation depth signal versus time. It is then used to calculate the following AM modulation depths:

- $Depth_{9960}$: AM modulation depth of the FM carrier, typically at 9960 Hz
- $Depth_{AM30}$: AM modulation depth of the 30 Hz rotational signal
- $Depth_{ID}$: AM modulation depth of the identification/voice signal

FM modulation depth

The FM deviation $Devia_{FM30}$ (typically 480 Hz) is calculated by estimating the magnitude of the FM demodulated 30 Hz reference signal.

Azimuth (phase difference at 30 hz)

The phases of both the 30 Hz FM and 30 Hz AM signal are estimated at exactly the same time instant. The azimuth (Phase FM-AM) is calculated as the phase difference between the two.

AF frequencies

In the VOR demodulator the AF frequencies are calculated:

- $Freq_{AM30}$: 30 Hz Rotational-signal (AM)
- $Freq_{FM30}$: 30 Hz Reference-signal (FM)
- $Freq_{ID}$: voice / identification; From 300 Hz to 4 kHz, typically 1020 Hz
- $Freq_{9960}$: The carrier frequency of the FM carrier, typically 9960 Hz; Calculated as mean value of the FM demodulator output

4.3.1.3 Phase notation in VOR measurements

In VOR measurements, the phase can be provided using two different notations, indicated in the following illustration:

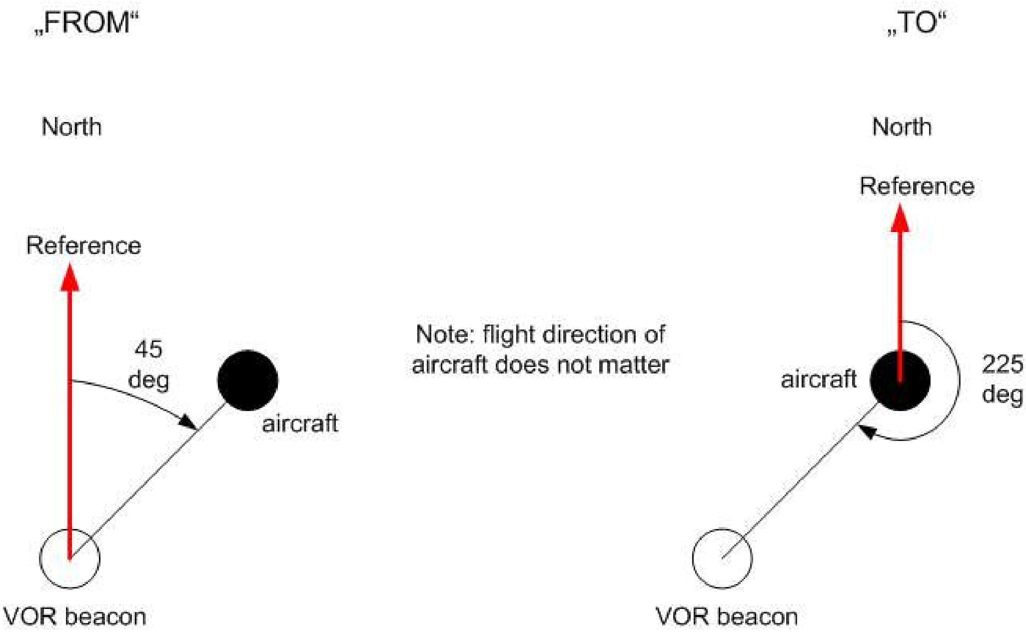


Figure 4-20: Phase notation in VOR measurements

Phase is always counted counter-clockwise, starting at the reference.

The reference depends on the selected notation:

- **FROM**: North direction at the VOR beacon

- **TO**: North direction at the receiver/ aircraft

To convert one notation to the other, use the following equation:

$Phase_{TO} = Phase_{FROM} + 180\ deg$

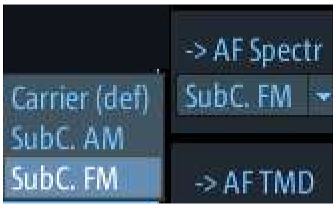
4.3.2 VOR measurements and results

The VOR measurement provides multiple views for the measurement results.

Switching from numeric to graphical results

You can display graphical results directly from the VOR mode by selecting the softkey in the "Meas" menu. In this case, the settings for the current measurement are applied to the graphical results.

The graphical results are only available for a single carrier. Thus, when you switch to a graphical measurement mode from VOR mode, you must select the carrier for which you want to see the graphical results. When you select the softkey, a submenu is displayed to select the carrier.



You can select one of the following carriers:

- Main carrier, AM demodulated
- Subcarrier, AM demodulated (AM component)
- Subcarrier, FM demodulated (FM component)

To return from the graphical results to the VOR mode, select "Return" ([F7]).

For details on the graphical results, see:

- Chapter 5.1, "R&S EVSG-K10 RF spectrum analysis", on page 125
- Chapter 5.2, "IF spectrum analysis", on page 130
- Chapter 5.3, "R&S EVSG-K11 AF spectrum analysis", on page 134
- Chapter 5.4, "R&S EVSG-K12 Time domain analysis", on page 143

Remote command:

`VIEW_VOR` on page 300

4.3.2.1 RF level and frequency display

The measured RF power and frequency of the input signal are displayed both numerically and graphically.

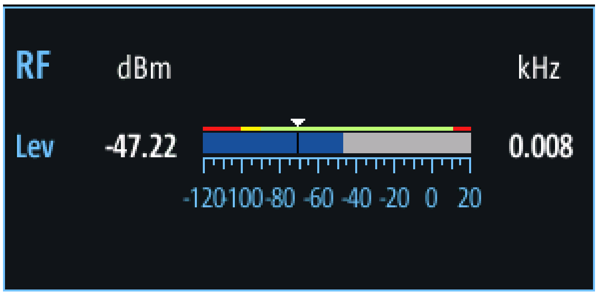


Figure 4-21: RF level display

The following results are provided:

- Numeric power level in dBm ("Lev")
  For measurements on two frequencies: individual and sum power levels
- Measured frequency offset to the nominal frequency in kHz
- Numeric frequency offset of measured power
- Bargraph indicating the power and a color-coded overload state, where:
  – **Red**: overload state, check message
  – **Yellow**: power approaching overload state
  – **Green**: power in a valid range
- If applicable: overload messages

Overload messages

The following messages indicate an overload:

- "RF Overload"
  Overload of the input mixer or of the analog IF path.
- "IF Overload"
  Overload of the IF signal.
- "ADC Overload"
  The dynamic range of the AD-converter is exceeded (clipping).

A combination of these overloads is also possible.

In all cases, set the RF attenuation to normal or low distortion (for RF input), or reduce the input level.

In recorded data lists, overloads are indicated by an **"O"**, see "Status flags" on page 63.

Remote commands to retrieve results:

LA? on page 231

RF? on page 231

FMEAS on page 307

4.3.2.2 IF spectrum preview

A preview of the measured spectrum (power level vs. frequency) for the IF (intermediate frequency) signal is provided. The center frequency is the nominal channel frequency. The frequency range shows the measured bandwidth. The power range is selected such that the noise level remains visible.

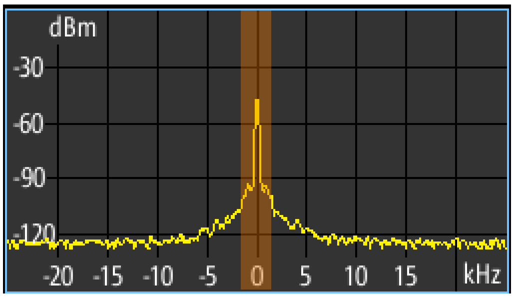
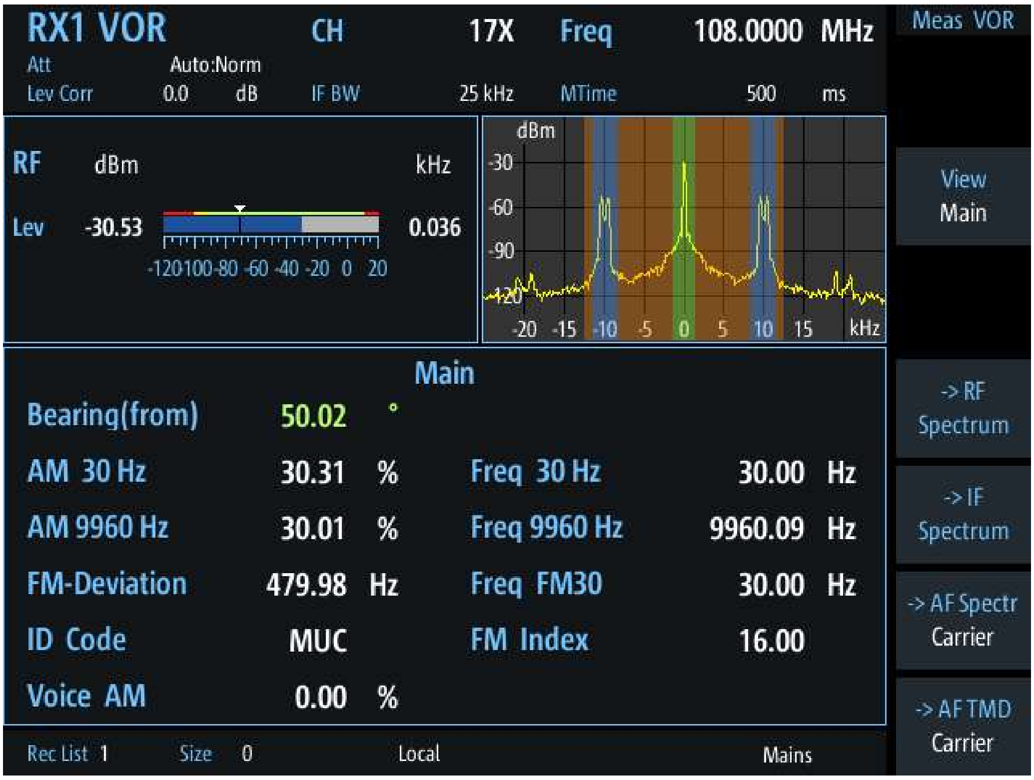


Figure 4-22: IF spectrum preview

This preview spectrum allows you to check if the current measurement settings are appropriate, such as the bandwidth or frequency offsets. For a larger, more detailed spectrum diagram, select one of the graphical Spectrum modes. If you switch to such a mode directly from a numeric measurement mode, the current measurement settings are applied to the spectrum automatically.

4.3.2.3 VOR main view

Displays the main measurement results.



Bearing (from)

Phase between both 30-Hz signals (direction of the R&S EVSF1000 in relation to the ground station).

A green bearing value indicates that a valid VOR signal has been determined.

Remote command:

BE on page 306

AM 30 Hz

AM modulation depth of 30 Hz AM rotational signal

Remote command:

AM0 on page 305

AM 9960 Hz

AM modulation depth of 9.96 kHz subcarrier

Remote command:
`AM1` on page 305

FM-Deviation
FM frequency deviation of 30 Hz subcarrier

Remote command:
`FM0` on page 306

ID Code
Morse-decoded ID with three or four letters.

Remote command:
`AC8` on page 280
`AC8` on page 304

Voice AM
AM-Modulation depth of the voice signal (in the range 300 Hz to 3000 Hz, identifier notched).

Remote command:
`AM9` on page 306

Freq 30 Hz
AF frequency of 30 Hz AM rotational signal

Remote command:
`AF0` on page 304

Freq 9960 Hz
Mean carrier frequency of the FM modulated subcarrier, typically at 9.96 kHz

Remote command:
`AF1` on page 305

Freq FM30
AF frequency of the 30 Hz reference signal

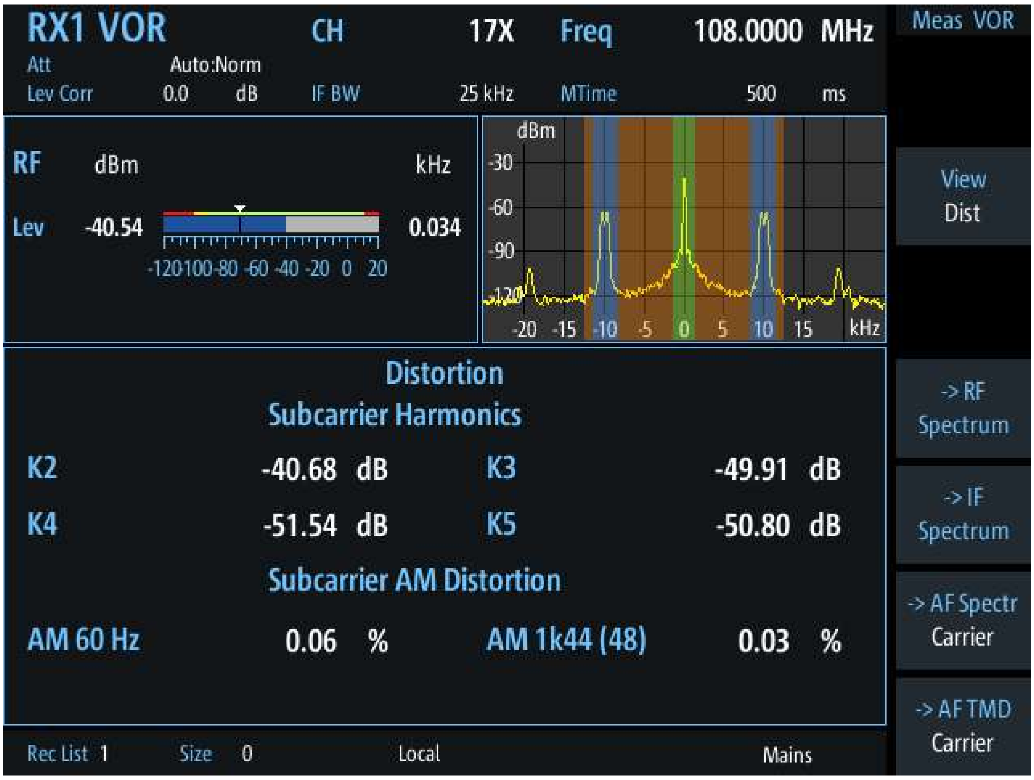
Remote command:
`AF2` on page 305

FM Index
FM frequency deviation of 30 Hz subcarrier

Remote command:
`FM1` on page 306

4.3.2.4 VOR distortion view

This view comprises all measurement parameters for the determination of the distortion factors in the VOR mode.



Subcarrier Harmonics

Measures the distortions (up to 5th order) of the subcarrier harmonics.

"K2" Distortion 2nd order

"K3" Distortion 3rd order

"K4" Distortion 4th order

"K5" Distortion 5th order

Remote command:
SUBCARR_K2 on page 307
SUBCARR_K3 on page 307
SUBCARR_K4 on page 308
SUBCARR_K5 on page 308

Subcarrier AM Distortion

Measures the AM distortion of the subcarrier. During signal generation, different unwanted AM components appear. Depending on the number of segments used by the antenna, different results are displayed in the "Distortion" view (see "No. of Segm" on page 101). Note that in the data recording, all results are included, not only those displayed in the "Distortion" view.

"AM 60 Hz" Displays the AM distortion at a modulation frequency of 60 Hz

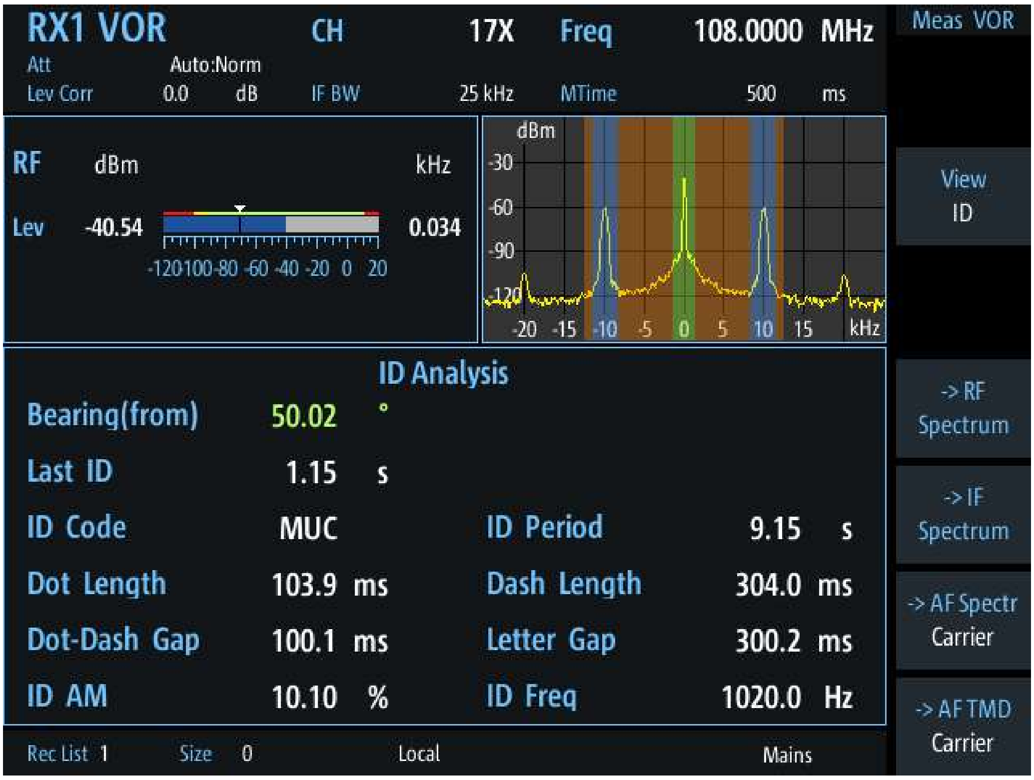
"AM 1k44(48)" Displays the AM distortion at 1440 Hz (48 segments * 30 Hz).

"AM 1k50(50)" Displays the AM distortion at 1500 Hz (50 segments * 30 Hz).

Remote command:
SUBCARR_AM1K44 on page 307
SUBCARR_AM1K50 on page 307
SUBCARR_AM60HZ on page 307

4.3.2.5 VOR ID analysis view

Displays the results of a morse signal analysis (optional).



Bearing (from)

Phase between both 30-Hz signals (direction of the R&S EVSF1000 in relation to the ground station).

A green bearing value indicates that a valid VOR signal has been determined.

Remote command:
BE on page 306

Last ID
Time since last ID pulse was measured

Remote command:
LASTID_TIME on page 289

ID Code
Morse-decoded ID with three or four letters.

Remote command:
AC8 on page 280
AC8 on page 304

ID Period
Time between two measured ID pulses

Remote command:
ID_PERIOD on page 289

Dot Length
Length of time a dot is transmitted in the used Morse code in milliseconds.

Remote command:
ID_DOT_LENGTH on page 288

Dash Length
Length of time a dash is transmitted in the used Morse cod in milliseconds.

Remote command:
ID_DASH_LENGTH on page 288

Dot-Dash Gap
Length of time that passes between a transmitted dot and a dash in the used Morse code in milliseconds.

Remote command:
ID_DOTDASH_GAP on page 289

Letter Gap
Length of time that passes between two transmitted letters in the used Morse code in milliseconds.

Remote command:
ID_LETTER_GAP on page 289

ID AM
AM Modulation depth of identifier signal (default: 1020 Hz).

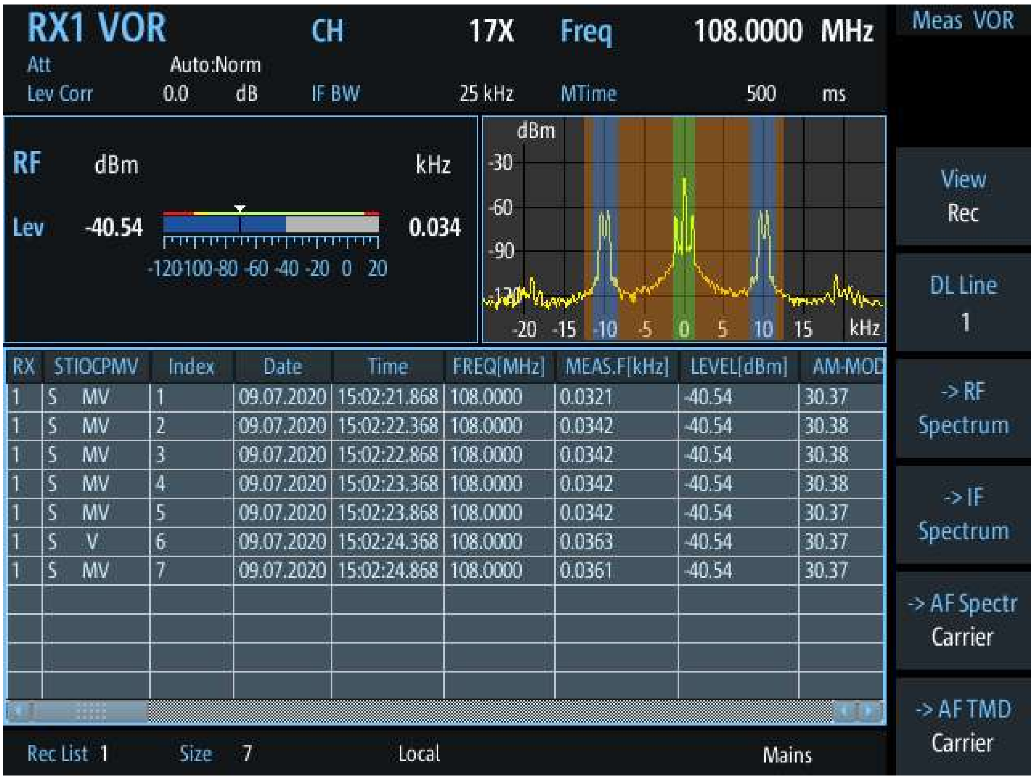
Remote command:
AM8 on page 282
AM8 on page 305

ID Freq
Frequency of the morse signal.

Remote command:
`AF8` on page 281
`AF8` on page 305

4.3.2.6 VOR recording view

The Recording view displays the recorded data for VOR measurements from the selected data list (see "List" on page 202). If available, the stored GNSS data from the GNSS receiver is also displayed.



Which measurement results are stored is described in the remote commands, see `GETDATADEF` on page 366.

The individual measurement results are described in the other result views.

For details on data logging, see Chapter 7.2, "Recording measurement data", on page 200.

Status flags

The "STIOCPMV" value contains status flags, if applicable:

- **S**: Start (started manually)
- **T**: Triggered (externally)
- **I**: Invalid
- **O**: Overload (RF input signal too high)
- **C**: Corrected (includes RF input correction factor)
- **P**: PPS-synced
- **M**: Morse ID available
- **V**: Valid signal (ILS LOC/GP and VOR only)

Remote commands for retrieving results:

`GETDATADEF` on page 366

`GETDATASET` on page 366

4.3.3 Configuring VOR measurements

The following settings are available for VOR measurements.

Settings for recording, including trigger settings, are described in Chapter 7.2, "Recording measurement data", on page 200.

VOR measurements on LF input

Using the option R&S EVSG1-K7 LF-Analysis, you can also analyze the AF components of the VOR signal to determine AF parameters of the carrier.

Furthermore, you can use the LF input to measure signals with a very low intermediate frequency (<25 kHz). Such signals are provided as output at test points of a transmitter, for example, for tuning purposes.

For details on configuring a VOR measurement on LF input, see Chapter 4.1.4.5, "LF input configuration", on page 71.

For the mapping of hard- and softkey commands to keyboard commands using VNC, see Table 1-3.

4.3.3.1 General measurement configuration

Access VNC: [s]

Input RF/LF
Access VNC: [s]

Configures the input source for the receiver.

For details on the connectors see Chapter 1.5.2.2, "RX1 in / RX2 in", on page 23.

"RF In" An RF signal is provided from the RX 1 In/RX 2 In connectors on the front of the R&S EVSF1000. They are connected to a receiving antenna (max. +13 dBm). The antenna must correspond to the specified frequency range for the measurement.

"LF In" An AF or low frequency signal is provided at the LF In input connector on the rear side of the R&S EVSF1000.
If both receivers are used, only one of them can be set to analyze input from "LF In".
The LF In connector is only available if R&S EVSF1-B4 is installed.
Analyzing LF input requires option R&S EVSG1-K7 LF-Analysis.

Remote command:
`GS_RFLF_INPUT` on page 278
`LLZ_RFLF_INPUT` on page 268
`VOR_RFLF_INPUT` on page 303
`FFT_RFLF_INPUT` on page 353
`SCOPE_RFLF_INPUT` on page 358
`SETUP:INPUT` on page 234

Signal Direction
Defines the reference for phase notation (see Chapter 4.3.1.3, "Phase notation in VOR measurements", on page 90).

"From" North direction at the VOR beacon

"To" North direction at the receiver/ aircraft

Remote command:
`SETUP:UNIT:VORDIRECTION` on page 254

No. of Segm
Selects the number of used antenna segments for which the AM distortion results are displayed. See also "VOR receiver" on page 86. Note that the data recording always includes all results.

48 The antenna contains 48 segments, the subcarrier has a modulation frequency of 1440 Hz. (Result: "AM1k44 (48)")

50 The antenna contains 50 segments, the subcarrier has a modulation frequency of 1500 Hz. (Result: "AM 1k50(50)")

Freq Offset
Defines a fixed frequency offset from the carrier.

Remote command:
`VOR_DEMFREQS_OFFSET` on page 302

4.3.3.2 Channel frequency configuration (CH FREQ)

Access VNC: [q]

The channel frequency determines the nominal frequency at which the measurement is performed. For some avionics standards, the channels are associated with specific frequencies. (See Chapter A, "ILS channel frequency list", on page 377 and Chapter B, "VOR channel frequency list", on page 379.)

CH
Sets the receiver frequency channel on the active receiver board according to the ICAO frequency list.

Remote command:
`RFCH` on page 231

Freq
Sets the nominal frequency for the measurement. By default, this frequency is also assumed to be the center frequency for spectrum displays, unless an offset is defined.

For measurements on two frequencies, the frequencies are defined as offsets to this nominal frequency.

Remote command:
`RF` on page 231

Step Size
Defines the frequency step size for the rotary knob when setting the frequency.

In many avionics signals, channels are assigned to frequencies with a fixed offset. By setting the step size of the rotary knob to the fixed offset, you can easily scroll through the signal's channel frequencies using the rotary knob. Thus, for example, you can analyze the measurement results for one channel after the other simply by changing the selected channel frequency with the rotary knob.

The default step size for ILS/VOR mode is 50 kHz.

Remote command:
ILS mode:
`LLZ_DEFAULT_FREQSTEP` on page 264
`GS_DEFAULT_FREQSTEP` on page 274
VOR mode:
`VOR_DEFAULT_FREQSTEP` on page 301

4.3.3.3 Ampt

Access VNC: [w]

The following settings define the amplification for the input signal.

RF Att

Determines how the attenuation of the RF signal is defined. Adjust the attenuation such that the measured power level remains in the valid level range (indicated by the green area of the bargraph, see Figure 4-4). Note that the valid level range depends on the selected measurement mode.

"Manual" The RF attenuation mode is specified manually (see "RF Mode" on page 69).

"Auto" The RF attenuation mode is selected automatically.
The signal attenuation is selected automatically according to the signal strength.
This mode works best with clean signals. In difficult receiving conditions, the "Low Noise", "Normal" or "Low Distortion" modes can be more stable.
When monitoring signals with mostly constant signal levels, it is also recommended that you use the "Low Noise", "Normal" or "Low Distortion" mode.

Remote command:
`SETATTMODE` on page 232
`SCOPE_ATTMODE` on page 355
`FFT_ATTMODE` on page 348
`IFSPECT_ATTMODE` on page 344

RF Mode

Defines the RF attenuation mode to be used.

"Low Noise" 15 dB pre-amplification
Provides a high sensitivity. Suitable when scanning the area for distant signals.

"Norm" 0 dB
Provides a normal sensitivity.

"Low Dist" 15 dB attenuation
Provides a low sensitivity. Suitable when analyzing a nearby signal, to avoid overload due to high-level signals.

Remote command:
`SETATTMODE` on page 232
`FSCAN_ATTMODE` on page 339
`SCOPE_ATTMODE` on page 355
`FFT_ATTMODE` on page 348

IFSPECT_ATTMODE on page 344
GBAS:ATTMODE on page 321

Transducer Correction
Configures the level correction. The specified value is added to the measured power levels to compensate for an inherent offset by the measurement setup, for example the antenna.

Remote command:
SETUP:EXTERNALATT_RX1 on page 233
SETUP:EXTERNALATT_RX2 on page 233

4.3.3.4 Bandwidth (BW)

Access VNC: [e]

IF BW
Determines the frequency range for which the measurement is performed on the IF signal.

Ensure that the entire input signal lies within the specified bandwidth, particularly for narrow bandwidths.

Remote command:
VOR_DEM_BW on page 301

AM30 BW
Defines the filter bandwidth with which the 30 Hz AM rotational signal is demodulated.

Remote command:
VOR_DEM_AM_BW on page 301

FM BW
Defines the filter bandwidth with which the 30 Hz reference signal is demodulated.

Remote command:
VOR_DEM_FM_BW on page 302

Bear.Filt.
Defines the filter type used to determine the bearing angle.

"Narrow"	For small input levels
"Wide"	Faster; used in previous software releases

Remote command:
VOR_DEM_BEARFILTER on page 301

4.3.3.5 Setting the measurement time (MTime)

Access VNC: [d]

The measurement time determines the interval at which new measurement results are displayed. Internally, values are captured every 10 ms, that is: 100 per second.

If the defined measurement time is longer, the values captured internally in that interval are averaged and only the average value is displayed.

Note that the measurement time determines the minimum interval for values to be stored during recording (see "Time" on page 203).

Enter the time in milliseconds.

Remote command:

`MEASTIME` on page 231

4.4 R&S EVSG-K6 COM analysis

Access VNC: [m] > Down arrow key

If the R&S EVSG-K6 COM analysis option is installed, signals from VHF/UHF communication channels can be analyzed with the R&S EVSF1000. Very high frequency (VHF) and ultrahigh frequency (UHF) communication is used for air traffic control (ATC COM), for example.

The COM mode can be used to analyze both the civil aircraft band and military frequencies, with channels spaced at 25 kHz or 8.33 kHz.

The R&S EVSF1000 can perform COM measurements on signals containing one or two carriers (see Chapter 4.1.4.2, "Channel and frequency configuration", on page 64). It assumes a 1000 Hz test tone is being sent.

Remote command:

`MODE_COM` on page 310

4.4.1 COM measurement results

The COM measurement provides the following results. For measurements on two frequencies, the results for the individual frequencies and the sum of both are displayed.

You can display graphical results directly from the COM mode by selecting the softkey in the "Meas" menu. In this case, the settings for the current measurement are applied to the graphical results.

To return from the graphical results to the COM mode, select "Return" ([F7]).

For details on the graphical results, see:

- Chapter 5.1, "R&S EVSG-K10 RF spectrum analysis", on page 125
- Chapter 5.2, "IF spectrum analysis", on page 130
- Chapter 5.3, "R&S EVSG-K11 AF spectrum analysis", on page 134
- Chapter 5.4, "R&S EVSG-K12 Time domain analysis", on page 143

Remote command:

`MODE_COM` on page 310

4.4.1.1 RF level and frequency display

The measured RF power and frequency of the input signal are displayed both numerically and graphically.

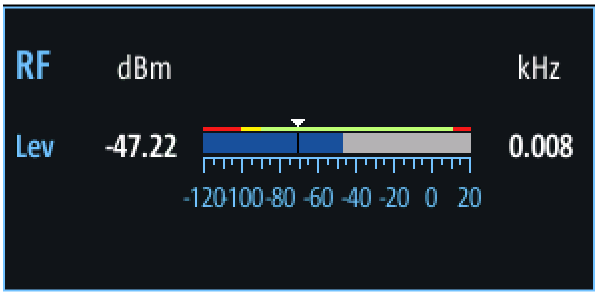


Figure 4-23: RF level display

The following results are provided:

- Numeric power level in dBm ("Lev")
  For measurements on two frequencies: individual and sum power levels
- Measured frequency offset to the nominal frequency in kHz
- Numeric frequency offset of measured power
- Bargraph indicating the power and a color-coded overload state, where:
  – **Red**: overload state, check message
  – **Yellow**: power approaching overload state
  – **Green**: power in a valid range
- If applicable: overload messages

Overload messages

The following messages indicate an overload:

- "RF Overload"
  Overload of the input mixer or of the analog IF path.
- "IF Overload"
  Overload of the IF signal.
- "ADC Overload"
  The dynamic range of the AD-converter is exceeded (clipping).

A combination of these overloads is also possible.

In all cases, set the RF attenuation to normal or low distortion (for RF input), or reduce the input level.

In recorded data lists, overloads are indicated by an **"O"**, see "Status flags" on page 63.

Remote commands to retrieve results:

`LA?` on page 231

`RF?` on page 231

COM mode:

`GET_MEASFREQ` on page 315

`GET_TX1_MEASFREQ` on page 318

`GET_TX2_MEASFREQ` on page 320

`GET_TX1_LEVEL` on page 318

`GET_TX2_LEVEL` on page 319

4.4.1.2 IF spectrum preview

A preview of the measured spectrum (power level vs. frequency) for the IF (intermediate frequency) signal is provided. The center frequency is the nominal channel frequency. The frequency range shows the measured bandwidth. The power range is selected such that the noise level remains visible.

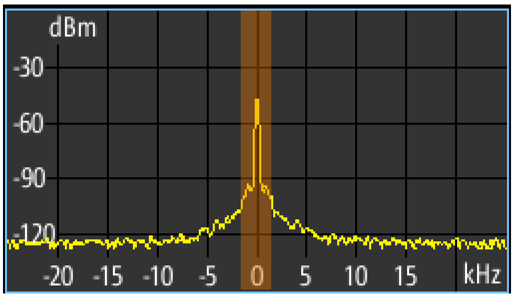


Figure 4-24: IF spectrum preview

This preview spectrum allows you to check if the current measurement settings are appropriate, such as the bandwidth or frequency offsets. For a larger, more detailed spectrum diagram, select one of the graphical Spectrum modes. If you switch to such a mode directly from a numeric measurement mode, the current measurement settings are applied to the spectrum automatically.

4.4.1.3 COM main view

The COM Main view provides the following measurement results for the 1 kHz/ 1.2 kHz test tone (see "Tone Freq." on page 112):

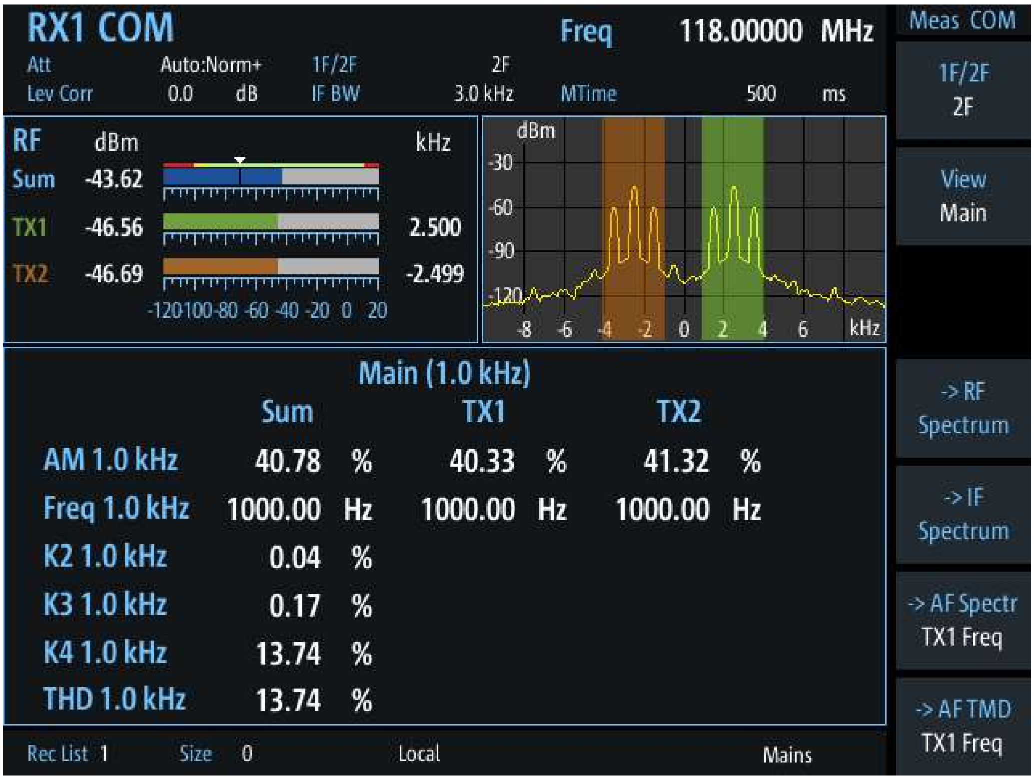


Figure 4-25: COM Main view

You can display graphical results directly from the COM mode by selecting the softkey in the "Meas" menu. In this case, the settings for the current measurement are applied to the graphical results.

To return from the graphical results to the COM mode, select "Return" ([F7]).

For details on the graphical results, see:

- Chapter 5.1, "R&S EVSG-K10 RF spectrum analysis", on page 125
- Chapter 5.2, "IF spectrum analysis", on page 130
- Chapter 5.3, "R&S EVSG-K11 AF spectrum analysis", on page 134
- Chapter 5.4, "R&S EVSG-K12 Time domain analysis", on page 143

Remote command:

VIEW_COM on page 310

AM 1.0 kHz/ 1.2 kHz

Displays the AM modulation of a 1 kHz/ 1.2 kHz test tone at the individual carrier frequencies and for both carriers together.

Remote command:

GET_ONE_AMMOD_1_0 on page 315
GET_TX1_AMMOD_1_0 on page 317
GET_TX2_AMMOD_1_0 on page 319
GET_ONE_AMMOD_1_2 on page 315
GET_TX1_AMMOD_1_2 on page 317
GET_TX2_AMMOD_1_2 on page 319

Freq 1.0 kHz/ 1.2 kHz

Displays the demodulated frequency of the 1 kHz/ 1.2 kHz AM test tone at the individual carrier frequencies and for both carriers together.

Remote command:

GET_ONE_AMFREQ _1_0 on page 315
GET_TX1_AMFREQ_1_0 on page 317
GET_TX2_AMFREQ_1_0 on page 319
GET_ONE_AMFREQ_1_2 on page 315
GET_TX1_AMFREQ_1_2 on page 317
GET_TX2_AMFREQ_1_2 on page 319

K2 1.0 kHz/ 1.2 kHz

Distortion 2nd order, 1.0 kHz/ 1.2 kHz signal

Remote command:

GET_K2_1K0 on page 314
GET_K2_1K2 on page 314

K3 1.0 kHz/ 1.2 kHz

Distortion 3rd order, 1.0 kHz/ 1.2 kHz signal

Remote command:

GET_K3_1K0 on page 314
GET_K3_1K2 on page 314

K4 1.0 kHz/ 1.2 kHz

Distortion 4th order, 1.0 kHz/ 1.2 kHz signal

Remote command:
`GET_K4_1K0` on page 314
`GET_K4_1K2` on page 315

THD 1.0 kHz/ 1.2 kHz
Total Harmonic Distortion (THD), 1.0 kHz/ 1.2 kHz signal

Remote command:
`GET_THD_1K0` on page 316
`GET_THD_1K2` on page 317

4.4.1.4 COM recording view

The Recording view displays the recorded data for COM measurements from the selected data list (see "List" on page 202). If available, the stored GNSS data from the GNSS receiver is also displayed.

Which measurement results are stored is described in the remote commands, see `GETDATADEF` on page 366.

The individual measurement results are described in Chapter 4.4.1.3, "COM main view", on page 108.

For details on data logging see Chapter 7.2, "Recording measurement data", on page 200.

Status flags

The "STIOCPMV" value contains status flags, if applicable:

- **S**: Start (started manually)
- **T**: Triggered (externally)
- **I**: Invalid
- **O**: Overload (RF input signal too high)
- **C**: Corrected (includes RF input correction factor)
- **P**: PPS-synced
- **M**: Morse ID available
- **V**: Valid signal (ILS LOC/GP and VOR only)

4.4.2 COM configuration

In this view, the measurements settings available for the currently active mode, can be configured.

4.4.2.1 Channel and frequency configuration

The ILS Localizer and Glidepath measurements can detect both course and clearance carriers simultaneously. Alternatively, the individual carriers can be measured only, or any one or two user-defined frequencies. By default, a wideband measurement is performed. The available measurement settings depend on the selected channel and frequency configuration.

Channel setup

Access VNC: [a] > [F1]

1F/2F

Selects the number of frequencies or channels to be measured.

"1F" One frequency only is measured, namely the nominal frequency, which is also the center frequency.
The nominal frequency is configured by the Freq settings.

"2F" Two frequencies are measured at the same time. Which frequencies are measured is configured by the Freq settings.
The numeric results are calculated as the sum of both frequencies. In the RF Level display, the individual carriers are also indicated. In the RF Spectrum preview, both carriers are displayed.

Remote command:
COM_1F2F_MEASMODE on page 311

Carrier configuration

Access VNC: [s] > "F1"

Configures the carriers and frequencies for measurements on a single or two frequencies. Which settings are available depends on the measurements on the "1F/2F" on page 111.

TX1 Offset/TX2 Offset
The two carriers are defined as offsets to either side of the nominal tone frequency. "TX1 Offset" defines the upper carrier with a positive offset to the tone frequency. "TX2 Offset" defines the lower carrier with a negative offset to the tone frequency.

Remote command:
AMFREQ_OFFSET_TX1 on page 310
AMFREQ_OFFSET_TX2 on page 310

Tone Freq.
The nominal tone frequency used to measure all results for both carriers.

Remote command:
COM_TONEFREQ_1K01K2 on page 312

Channel frequency configuration (CH FREQ)

Access VNC: [q]

The carrier frequency determines the nominal frequency at which the measurement is performed.

Freq
Sets the nominal frequency for the measurement. By default, this frequency is also assumed to be the center frequency for spectrum displays, unless an offset is defined.

For measurements on two frequencies, the frequencies are defined as offsets to this nominal frequency.

Remote command:
RF on page 231

Step Size

Defines the frequency step size for the rotary knob when setting the frequency.

The default step size for COM mode is 8.33 kHz.

4.4.2.2 Ampt

Access VNC: [w]

The following settings define the amplification for the input signal.

RF Att

Determines how the attenuation of the RF signal is defined. Adjust the attenuation such that the measured power level remains in the valid level range (indicated by the green area of the bargraph, see Figure 4-4). Note that the valid level range depends on the selected measurement mode.

"Manual" The RF attenuation mode is specified manually (see "RF Mode" on page 69).

"Auto" The RF attenuation mode is selected automatically.
The signal attenuation is selected automatically according to the signal strength.
This mode works best with clean signals. In difficult receiving conditions, the "Low Noise", "Normal" or "Low Distortion" modes can be more stable.
When monitoring signals with mostly constant signal levels, it is also recommended that you use the "Low Noise", "Normal" or "Low Distortion" mode.

Remote command:
`SETATTMODE` on page 232
`SCOPE_ATTMODE` on page 355
`FFT_ATTMODE` on page 348
`IFSPECT_ATTMODE` on page 344

RF Mode

Defines the RF attenuation mode to be used.

"Low Noise" 15 dB pre-amplification
Provides a high sensitivity. Suitable when scanning the area for distant signals.

"Norm" 0 dB
Provides a normal sensitivity.

"Low Dist" 15 dB attenuation
Provides a low sensitivity. Suitable when analyzing a nearby signal, to avoid overload due to high-level signals.

Remote command:
SETATTMODE on page 232
FSCAN_ATTMODE on page 339
SCOPE_ATTMODE on page 355
FFT_ATTMODE on page 348
IFSPECT_ATTMODE on page 344
GBAS:ATTMODE on page 321

Transducer Correction
Configures the level correction. The specified value is added to the measured power levels to compensate for an inherent offset by the measurement setup, for example the antenna.

Remote command:
SETUP:EXTERNALATT_RX1 on page 233
SETUP:EXTERNALATT_RX2 on page 233

4.4.2.3 Bandwidth (BW)

Access VNC: [e]

The bandwidth determines the filter width with which the measurement is performed. The wider the filter, the less measurement time is required, but also the less sensitive the frequency results.

BW 1F BW 2F
Specifies the filter bandwidth for the single or both carriers.

Remote command:
COM_DEMOD_BW_1F on page 311
COM_DEMOD_BW_2F on page 311

4.4.2.4 Setting the measurement time (MTime)

Access VNC: [d]

The measurement time determines the interval at which new measurement results are displayed. Internally, values are captured every 10 ms, that is: 100 per second.

If the defined measurement time is longer, the values captured internally in that interval are averaged and only the average value is displayed.

Note that the measurement time determines the minimum interval for values to be stored during recording (see "Time" on page 203).

Enter the time in milliseconds.

Remote command:

MEASTIME on page 231

4.5 Non-directional beacon mode

Access VNC: [m] > Down arrow key

Using the LF IN connector and the R&S EVSG1-K7 LF-Analysis option, the R&S EVSF1000 can analyze non-directional beacon signals.

Remote command:

MODE_NDB on page 333

4.5.1 Basics on Non-Directional beacons

Non-directional beacons (NDBs) transmit a signal at a specific carrier frequency, but without a specific direction. NDBs used for aviation transmit signals at frequencies between 190 kHz and 1750 kHz, according to ICAO annex 10 (see [3]). Each beacon is identified by a morse code, which is transmitted at either 400 Hz or 1020 Hz. Due to the low transmission frequency, NDBs are useful particularly for middle distance navigation.

4.5.2 NDB measurement and results

Due to the large number of different signal parameters, the NDB measurement provides multiple views for the measurement results.

You can display graphical results directly from the NDB mode by selecting the softkey in the "Meas" menu. In this case, the settings for the current measurement are applied to the graphical results.

To return from the graphical results to the NDB mode, select "Return" ([F7]).

For details on the graphical results, see:

- Chapter 5.3, "R&S EVSG-K11 AF spectrum analysis", on page 134
- Chapter 5.4, "R&S EVSG-K12 Time domain analysis", on page 143

Remote command:

VIEW_NDB on page 335

4.5.2.1 RF level, frequency and IF spectrum display

The measured RF power and frequency of the LF input signal is displayed both numerically and graphically.

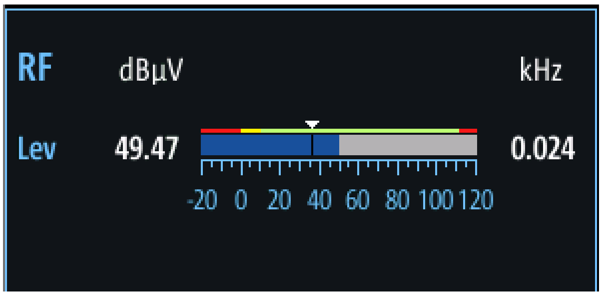


Figure 4-26: RF level display

The following results are provided:

- Numeric power level in dBµV or dBm ("Lev")
- Measured frequency offset to the tuned carrier frequency in kHz
- Bargraph indicating the power (blue) and a color-coded overload state, where:
  - **red**: overload state, check message
  - **yellow**: power approaching overload state
  - **green**: power in a valid range
- If applicable: "ADC Overload" message
  The dynamic range of the A/D-converter is exceeded (clipping).

IF Spectrum

A preview of the measured spectrum (power level vs. frequency) for the IF (intermediate frequency) signal is provided. The center frequency corresponds to the tuned carrier frequency. The frequency range shows the measured bandwidth. The amplitude range displays the entire dynamic range.

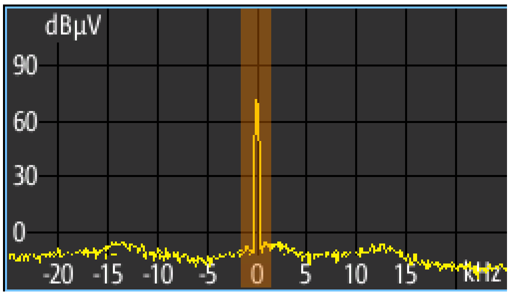


Figure 4-27: IF spectrum preview

Remote commands to retrieve results:

RF? on page 231

LA? on page 231

4.5.2.2 NDB ID analysis

Displays the results of the NDB signal id analysis. The ID can be analyzed at 400 Hz or 1020 Hz, see "ID Freq" on page 122.

Last ID
Time since last ID pulse was measured

Remote command:
`LASTID_TIME` on page 289

Carr Lev Change
Variance in power level during ID transmission.

Remote command:
`NDB_CARLEV_CHANGE` on page 336

ID Code
Morse-decoded ID with three or four letters.

Remote command:
`ID_CODE` on page 336

ID Period
Time between two measured ID pulses

Remote command:
`ID_PERIOD` on page 289

Dot Length
Length of time a dot is transmitted in the used Morse code in milliseconds.

Remote command:
`ID_DOT_LENGTH` on page 288

Dash Length
Length of time a dash is transmitted in the used Morse cod in milliseconds.

Remote command:
`ID_DASH_LENGTH` on page 288

Dot-Dash Gap
Length of time that passes between a transmitted dot and a dash in the used Morse code in milliseconds.

Remote command:
`ID_DOTDASH_GAP` on page 289

Letter Gap
Length of time that passes between two transmitted letters in the used Morse code in milliseconds.

Remote command:
`ID_LETTER_GAP` on page 289

ID AM
AM Modulation depth of identifier signal.

Remote command:
`NDB_AMMOD` on page 336

ID Freq
Frequency of the morse signal.

Remote command:
`NDB_AMFREQ` on page 336

4.5.2.3 NDB distortion view

The NDB Dist view comprises the distortion factors for the beacon ID. The ID can be analyzed at 400 Hz or 1020 Hz, see "ID Freq" on page 122.

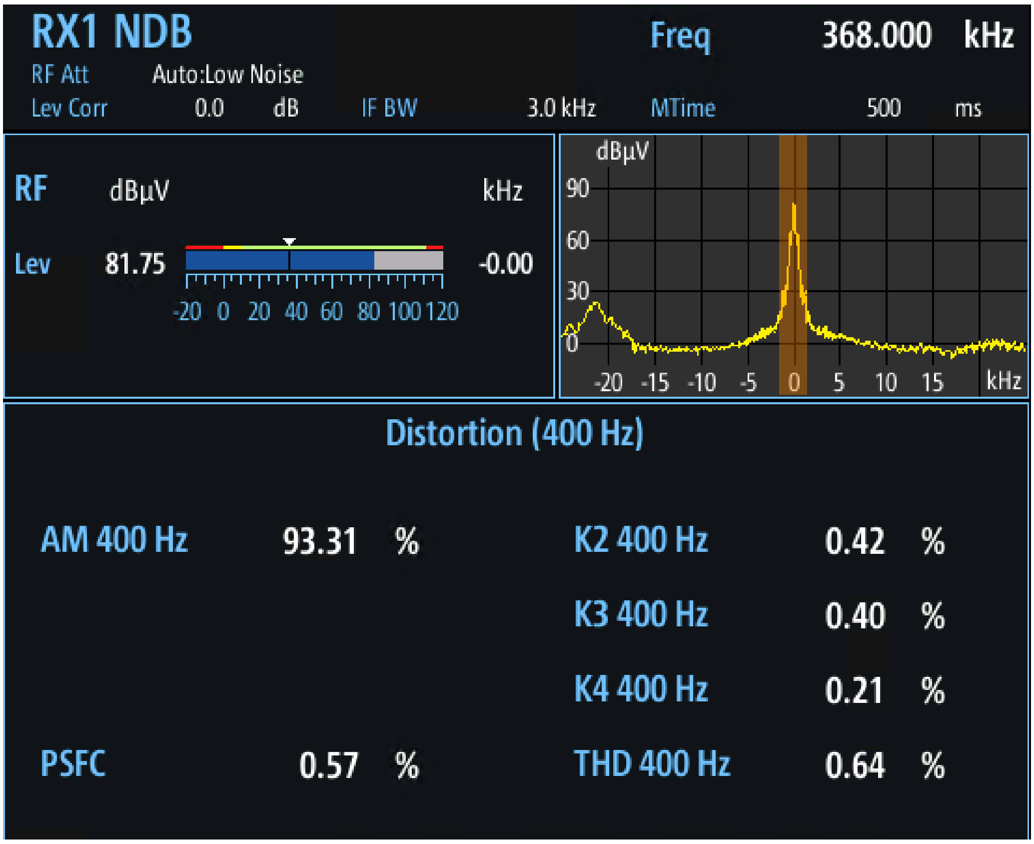


Figure 4-28: NDB Distortion view

AM 400/1020 Hz

AM modulation depth of 400/1020 Hz beacon ID.

Remote command:

`NDB_AMMOD` on page 336

K2 400/1020 Hz

Distortion 2nd order, 400/1020 Hz beacon ID

Remote command:

`NDB_K2_PCT` on page 337

K3 400/1020 Hz

Distortion 3rd order, 400/1020 Hz beacon ID

Remote command:

`NDB_K3_PCT` on page 337

K4 400/1020 Hz
Distortion 4th order, 400/1020 Hz beacon ID

Remote command:
`NDB_K4_PCT` on page 337

Unwanted AM 30 to 120 Hz
Measures spurs in the antenna switching range.

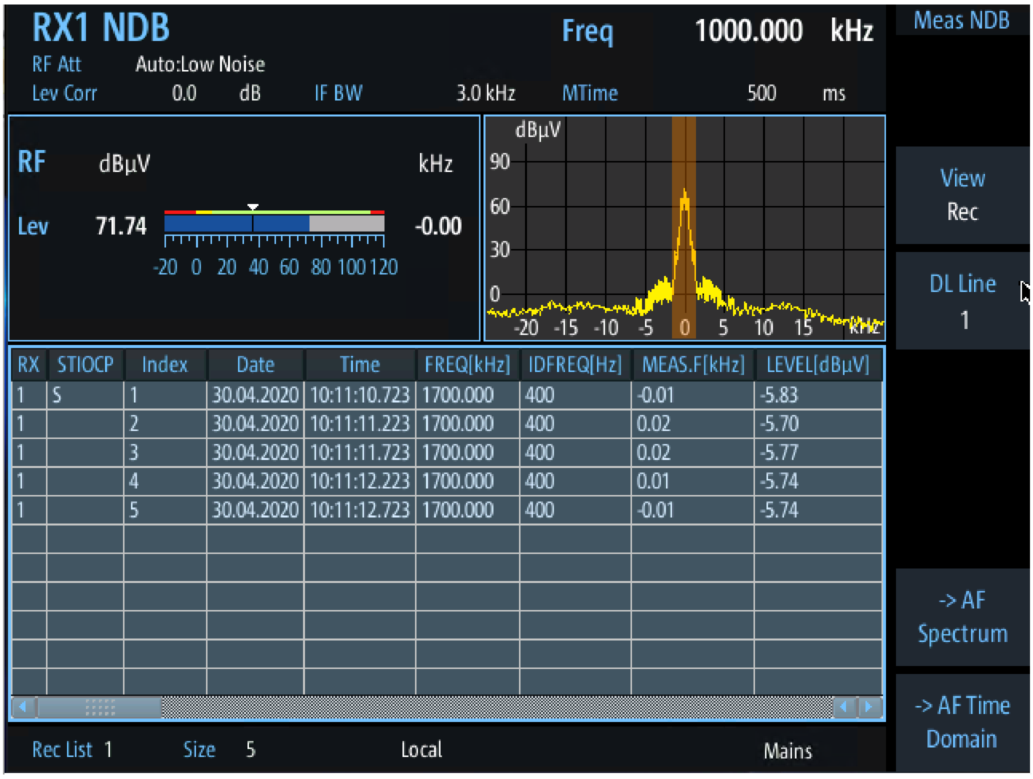
Remote command:
`NDB_POWSUPPL_FC` on page 337

THD 400/1020 Hz
Total Harmonic Distortion (THD), 400/1020 Hz beacon ID

Remote command:
`NDB_THD_PCT` on page 337

4.5.2.4 NDB recording view

The Recording view displays the recorded data for NDB measurements from the selected data list (see "List" on page 202).



Which measurement results are stored is described in the remote commands, see `GETDATADEF` on page 366.

The individual measurement results are described in the other NDB result views.

For details on data logging, see Chapter 7.2, "Recording measurement data", on page 200.

Status flags

The "STIOCPMV" value contains status flags, if applicable:

- **S**: Start (started manually)
- **T**: Triggered (externally)
- **I**: Invalid
- **O**: Overload (RF input signal too high)
- **C**: Corrected (includes RF input correction factor)
- **P**: PPS-synced
- **M**: Morse ID available
- **V**: Valid signal (ILS LOC/GP and VOR only)

4.5.3 Configuring NDB measurements

NDB measurements are always performed on LF input, using AC coupling. They require the R&S EVSG1-K7 LF-Analysis option.

The following settings are configurable for the NDB measurement.

Settings for recording, including trigger settings, are described in Chapter 7.2, "Recording measurement data", on page 200.

For the mapping of hard- and softkey commands to keyboard commands using VNC, see Table 1-3.

4.5.3.1 General measurement settings

Access VNC: [s]

Some general settings are available for NDB measurements.

Level Unit

Switches the unit for all level displays in NDB measurement results between dBµV (default) and dBm.

Remote command:
NDB_UNIT_LEVEL on page 335

ID Freq
The NDB ID can be analyzed at 400 Hz or 1020 Hz.

Remote command:
NDB_IDFREQ_400_1020 on page 336

4.5.3.2 Receiver frequency

Access VNC: [q]

The receiver frequency determines the nominal frequency at which the measurement is performed.

Freq
Sets the nominal frequency for the measurement.

Remote command:
RF on page 231

Step Size
Defines the frequency step size for the rotary knob when setting the frequency.

The default step size for NDB mode is 1.0 kHz.

Remote command:
NDB_DEFAULT_FREQSTEP on page 333

4.5.3.3 Amplitude

Access VNC: [w]

The following settings define the amplification for the input signal.

RF Att
Determines how the attenuation of the RF signal is defined. Adjust the attenuation such that the measured power level remains in the valid level range (indicated by the green area of the bargraph, see Chapter 4.5.2.1, "RF level, frequency and IF spectrum display", on page 116). Note that the valid level range depends on the selected measurement mode.

"Manual" The RF attenuation mode is specified manually (see "RF Mode" on page 69).

"Auto" The RF attenuation mode is selected automatically.
The signal attenuation is selected automatically according to the signal strength.
This mode works best with clean signals. In difficult receiving conditions, the "Low Noise", "Normal" or "Low Distortion" modes can be more stable.
When monitoring signals with mostly constant signal levels, it is also recommended that you use the "Low Noise", "Normal" or "Low Distortion" mode.

Remote command:
SETATTMODE on page 232

RF Mode
Defines the RF attenuation mode to be used.

"Low Noise" 15 dB pre-amplification
Provides a high sensitivity. Suitable when scanning the area for distant signals.

"Norm" 0 dB
Provides a normal sensitivity.

"Low Dist" 15 dB attenuation
Provides a low sensitivity. Suitable when analyzing a nearby signal, to avoid overload due to high-level signals.

Remote command:
SETATTMODE on page 232

LF Imp.
Switches the impedance for the LF input between 50 Ω and 20 kΩ.

For an impedance of 20 kΩ, the level is indicated as the voltage of the EMF (no-load voltage). The unit is automatically set to "dBµV(EMF)".

Remote command:
NDB_LFIN_IMPEDANCE on page 334

Transducer Correction
Configures the level correction. The specified value is added to the measured power levels to compensate for an inherent offset by the measurement setup, for example the antenna.

Remote command:
NDB_EXTERNALATT_LFIN on page 334

4.5.3.4 Setting the bandwidth

Access VNC: [e]

The bandwidth determines the frequency range for which the measurement is performed. Depending on the measurement mode, and whether a wideband or a specific frequency is measured, different settings are available.

IF BW
Demodulation bandwidth used for level and modulation measurement.

Remote command:
`NDB_DEM_ID_BW` on page 333

IF BW Dist
Specifies the IF filter bandwidth for audio and distortion measurements.

Remote command:
`NDB_DEM_DIST_BW` on page 334

4.5.3.5 Setting the measurement time (MTime)

Access VNC: [d]

The measurement time determines the interval at which new measurement results are displayed. Internally, values are captured every 10 ms, that is: 100 per second.

If the defined measurement time is longer, the values captured internally in that interval are averaged and only the average value is displayed.

Note that the measurement time determines the minimum interval for values to be stored during recording (see "Time" on page 203).

Enter the time in milliseconds.

Remote command:

`MEASTIME` on page 231

5 Graphic measurement modes

5.1 R&S EVSG-K10 RF spectrum analysis

Access VNC: [m] > Down arrow key

The RF Spectrum mode displays the power vs. frequency diagram (spectrum) for a user-defined frequency range of the input signal. This diagram is useful to obtain an overview of the entire input signal. The RF Spectrum requires the R&S EVSG-K10 RF spectrum analysis option.

The x-axis displays the absolute measured frequency in Hz. The y-axis displays the measured power levels in dBm.

Marker functions allow you to analyze specific details in the spectrum.

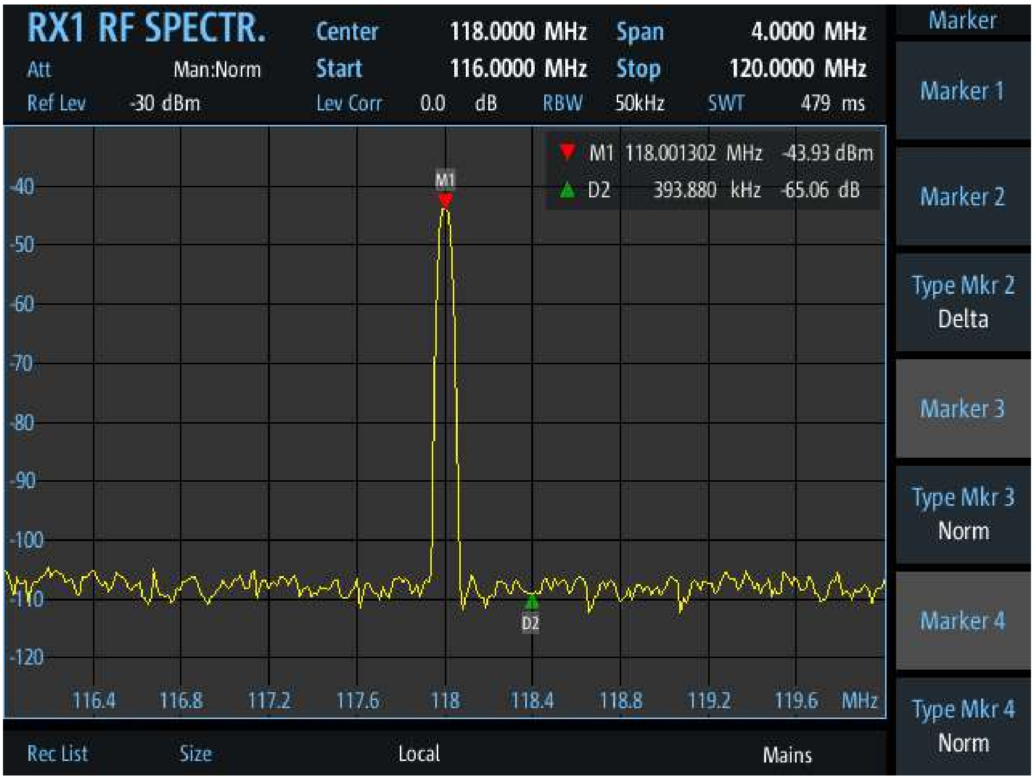


Figure 5-1: RF Spectrum

Generally, each mode is configured individually. When you switch modes, the most recently defined settings for that mode are applied.

However, graphical results can also be displayed directly from the measurement modes with numeric results. In this case, the settings for the current mode are applied to the graphical results.

If the original measurement mode analyzes multiple carriers, you must select the carrier for which you want to see the graphical results when you switch the mode.

The following settings are displayed in the measurement settings area of the RF spectrum:

- RX board ("RX1" | "RX2")
  The currently active receiver board. See Chapter 3.2, "Receiver board", on page 40.
- Measurement mode
  The currently active measurement mode on the active receiver board, e.g. "RF Spectrum". See Chapter 3.3, "Measurement mode", on page 41.
- Frequency range
  "Center", "Span", "Start", "Stop"
  The swept frequency range, see Chapter 5.1.1, "Configuring the frequency range", on page 126.
- RF attenuation ("Att")
  The used attenuation mode; see also "RF Mode" on page 69.
- Reference level ("Ref Lev")
  The maximum expected power level, see "Ref Level" on page 128.
- Level correction ("Lev Corr")
  The applied level correction by a transducer. See "Transducer Correction" on page 69.
- Resolution Bandwidth ("RBW")
  Resolution bandwidth with which the measurement is performed. See "Resolution Bandwidth (RBW Mode/Res BW)" on page 127.

Remote command to select RF Spectrum mode:

`MODE_FSCAN` on page 338

Remote command to retrieve trace results:

`FSCAN_GETSPECT` on page 342

5.1.1 Configuring the frequency range

Access VNC: [q]

The following settings configure the frequency range of the spectrum, that is: the x-axis.

Define the frequency range to be displayed using one of the following methods:

- Center + Span: the center frequency is displayed in the center of the x-axis, with half the span to either side
- Start + Stop: the x-axis starts with the start frequency and ends with the stop frequency

Center

Configures the center frequency. The configured value is displayed as "Center" in the measurement settings area.

Remote command:
`FSCAN_FREQCENTER` on page 339

Span

Configures the frequency span, which must be at least 100 kHz. The configured value is displayed as "Span" in the measurement settings area.

Remote command:
`FSCAN_FREQSPAN` on page 339

Start

Configures the start frequency of the x-axis. The configured value is displayed as "Start" in the measurement settings area.

Remote command:
`FSCAN_FREQSTART` on page 340

Stop

Configures the stop frequency of the x-axis. The configured value is displayed as "Stop" in the measurement settings area.

Remote command:
`FSCAN_FREQSTOP` on page 340

5.1.2 Configuring the bandwidth

Access VNC: [e] > "F1"

Resolution Bandwidth (RBW Mode/Res BW)

Defines the resolution bandwidth (RBW) of the spectrum. The resolution bandwidth defines the minimum frequency separation at which the individual components of a spectrum can be distinguished. Small values result in high precision, as the distance between two distinguishable frequencies is small. Higher values decrease the precision, but increase measurement speed.

The RBW can be determined automatically by the R&S EVSF1000, or manually.

AUTO mode	The RBW is determined automatically according to the sweep time and frequency range.
Manual mode	Select a predefined fixed value manually.

Remote command:
`FSCAN_RESBW_AUTO` on page 341
`FSCAN_RES_BW` on page 341

5.1.3 Configuring the amplitude (y-axis)

Access VNC: [w]

The amplitude settings configure the y-axis of the spectrum.

Ref Level
The reference level determines the maximum power level displayed in the spectrum. Adjust the reference level as close as possible to the highest expected power level to avoid overload at the RF input or signal clipping.

Remote command:
`FSCAN_REFLEVEL` on page 340

Y-Range
Determines the displayed power level range on the y-axis of the spectrum. The range starts at the specified Ref Level at the top of the diagram.

RF Mode
Defines the RF attenuation mode to be used.

"Low Noise"	15 dB pre-amplification Provides a high sensitivity. Suitable when scanning the area for distant signals.
"Norm"	0 dB Provides a normal sensitivity.
"Low Dist"	15 dB attenuation Provides a low sensitivity. Suitable when analyzing a nearby signal, to avoid overload due to high-level signals.

Remote command:
`SETATTMODE` on page 232
`FSCAN_ATTMODE` on page 339
`SCOPE_ATTMODE` on page 355
`FFT_ATTMODE` on page 348
`IFSPECT_ATTMODE` on page 344
`GBAS:ATTMODE` on page 321

Transducer Correction
Configures the level correction. The specified value is added to the measured power levels to compensate for an inherent offset by the measurement setup, for example the antenna.

Remote command:
`SETUP:EXTERNALATT_RX1` on page 233
`SETUP:EXTERNALATT_RX2` on page 233

5.1.4 Configuring the trace

Access VNC: [a]

Trace settings determine how the display values are calculated from the measured values.

Trace mode
Defines the update mode for subsequent traces.

"Clear/Write" Overwrite mode (default): the trace is overwritten by each sweep

"Average" The average is determined over several sweeps
The Average Count determines the number of averaging procedures.

"Max Hold" The maximum value is determined over several sweeps and displayed. The R&S EVSF1000 saves each trace point in the trace memory only if the new value is greater than the previous one.
The Average Count determines the number of sweeps to evaluate.

"RMS" The RMS value for each trace point over several sweeps is determined and displayed.
The Average Count determines the number of sweeps to evaluate.

Remote command:
`FFT_TRACEMODE` on page 353
`IFSPECT_TRACE_MODE` on page 346
`FSCAN_TRACE_MODE` on page 341

Average Count
Determines the number of sweeps over which trace evaluation is performed (e.g. averaging or maxhold).

Remote command:
`FFT_TRACE_AVRGCOUNT` on page 354
`IFSPECT_TRACE_AVRGCOUNT` on page 346
`FSCAN_TRACE_AVRGCOUNT` on page 342

5.2 IF spectrum analysis

Access VNC: [m] > Down arrow key

IF Spectrum mode displays the measured power vs frequency spectrum for a (small) span around the center frequency of the input signal. This diagram is useful to perform detailed analysis on the signal around the center frequency. This mode requires the R&S EVSG-K10 RF spectrum analysis option.

The x-axis displays the frequency offset to the nominal RF frequency in Hz. The y-axis displays the measured power levels in dBm.

Marker functions allow you to analyze specific details in the spectrum.

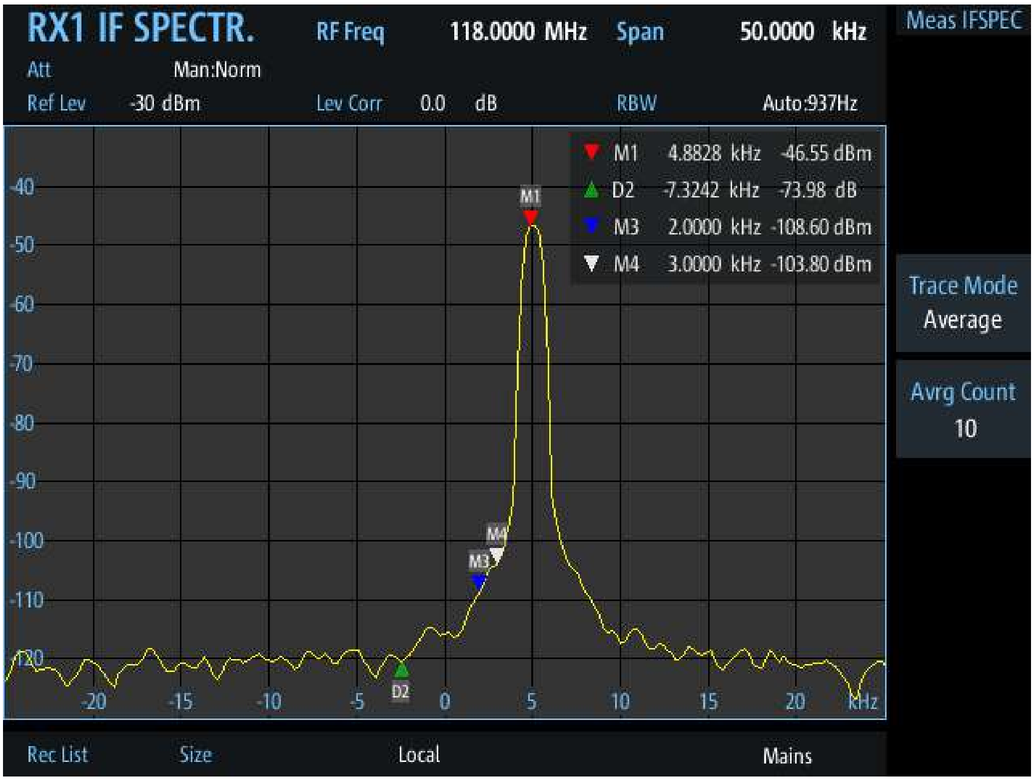


Figure 5-2: IF Spectrum

Generally, each mode is configured individually. When you switch modes, the most recently defined settings for that mode are applied.

However, graphical results can also be displayed directly from the measurement modes with numeric results. In this case, the settings for the current mode are applied to the graphical results.

If the original measurement mode analyzes multiple carriers, you must select the carrier for which you want to see the graphical results when you switch the mode.

The following settings are displayed in the measurement settings area of the RF spectrum:

- RX board ("RX1" | "RX2")
  The currently active receiver board. See Chapter 3.2, "Receiver board", on page 40.
- Measurement mode
  The currently active measurement mode on the active receiver board, e.g. "RF Spectrum". See Chapter 3.3, "Measurement mode", on page 41.
- Frequency range ("RF Freq", "Span")
  The swept frequency range, see "RF Freq" on page 131.
- Reference level ("Ref Lev")
  The maximum expected power level, see "Ref Level" on page 132.
- Level correction ("Lev Corr")
  The applied level correction by a transducer. See "Transducer Correction" on page 69.
- Resolution Bandwidth ("RBW")
  Resolution bandwidth with which the measurement is performed. See "RBW" on page 132.

Remote command to select RF Spectrum mode:

`MODE_IFSPECT` on page 343

Remote command to retrieve trace results:

`IFSPECT_GETSPECT` on page 347

5.2.1 Configuring the frequency range

Access VNC: [q]

The following settings configure the frequency range of the spectrum, that is: the x-axis.

RF Freq

Configures the center frequency. The configured value is displayed as "RF Freq" in the measurement settings area.

Remote command:
`IFSPECT_FREQRF` on page 344

Span

Configures the frequency span, which must be at least 100 kHz. The span is distributed evenly to the left and right of the "RF Freq" on page 131. The configured value is displayed as "Span" in the measurement settings area.

Remote command:
`IFSPECT_FREQ_SPAN` on page 344

5.2.2 Configuring the bandwidth

Access VNC: [e] > "F1"

RBW

Defines the resolution bandwidth (RBW) of the spectrum. The resolution bandwidth defines the minimum frequency separation at which the individual components of a spectrum can be distinguished. Small values result in high precision, as the distance between two distinguishable frequencies is small. Higher values decrease the precision, but increase measurement speed.

The RBW can be determined automatically by the R&S EVSF1000, or manually.

AUTO mode	The RBW is determined automatically according to the sweep time and frequency range.
Manual mode	Select a predefined fixed value manually.

Remote command:
`IFSPECT_RES_BW` on page 345
`IFSPECT_RESBW_AUTO` on page 345

5.2.3 Configuring the amplitude (Y-Axis)

Access VNC: [w]

The amplitude settings configure the y-axis of the spectrum.

Ref Level

The reference level determines the maximum power level displayed in the spectrum. Set the reference level as close as possible to the highest expected power level to avoid overload at the RF input or signal clipping.

Remote command:
`IFSPECT_REFLEVEL` on page 345

Y-Range

Determines the displayed power level range on the y-axis of the spectrum. The range starts at the specified Ref Level at the top of the diagram.

RF Att
Determines how the attenuation of the RF signal is defined. Adjust the attenuation such that the measured power level remains in the valid level range (indicated by the green area of the bargraph, see Figure 4-4). Note that the valid level range depends on the selected measurement mode.

"Manual" The RF attenuation mode is specified manually (see "RF Mode" on page 69).

"Auto" The RF attenuation mode is selected automatically.
The signal attenuation is selected automatically according to the signal strength.
This mode works best with clean signals. In difficult receiving conditions, the "Low Noise", "Normal" or "Low Distortion" modes can be more stable.
When monitoring signals with mostly constant signal levels, it is also recommended that you use the "Low Noise", "Normal" or "Low Distortion" mode.

Remote command:
SETATTMODE on page 232
SCOPE_ATTMODE on page 355
FFT_ATTMODE on page 348
IFSPECT_ATTMODE on page 344

RF Mode
Defines the RF attenuation mode to be used.

"Low Noise" 15 dB pre-amplification
Provides a high sensitivity. Suitable when scanning the area for distant signals.

"Norm" 0 dB
Provides a normal sensitivity.

"Low Dist" 15 dB attenuation
Provides a low sensitivity. Suitable when analyzing a nearby signal, to avoid overload due to high-level signals.

Remote command:
SETATTMODE on page 232
FSCAN_ATTMODE on page 339
SCOPE_ATTMODE on page 355
FFT_ATTMODE on page 348
IFSPECT_ATTMODE on page 344
GBAS:ATTMODE on page 321

Transducer Correction
Configures the level correction. The specified value is added to the measured power levels to compensate for an inherent offset by the measurement setup, for example the antenna.

Remote command:
SETUP:EXTERNALATT_RX1 on page 233
SETUP:EXTERNALATT_RX2 on page 233

5.2.4 Configuring the trace

Access VNC: [a]

Trace settings determine how the display values are calculated from the measured values.

Trace mode

Defines the update mode for subsequent traces.

"Clear/Write" Overwrite mode (default): the trace is overwritten by each sweep

"Average" The average is determined over several sweeps
The Average Count determines the number of averaging procedures.

"Max Hold" The maximum value is determined over several sweeps and displayed. The R&S EVSF1000 saves each trace point in the trace memory only if the new value is greater than the previous one.
The Average Count determines the number of sweeps to evaluate.

"RMS" The RMS value for each trace point over several sweeps is determined and displayed.
The Average Count determines the number of sweeps to evaluate.

Remote command:
`FFT_TRACEMODE` on page 353
`IFSPECT_TRACE_MODE` on page 346
`FSCAN_TRACE_MODE` on page 341

Average Count

Determines the number of sweeps over which trace evaluation is performed (e.g. averaging or maxhold).

Remote command:
`FFT_TRACE_AVRGCOUNT` on page 354
`IFSPECT_TRACE_AVRGCOUNT` on page 346
`FSCAN_TRACE_AVRGCOUNT` on page 342

5.3 R&S EVSG-K11 AF spectrum analysis

Access VNC: [m] > Down arrow key

AF Spectrum mode displays the spectrum of a demodulated RF signal with AM components. This mode requires the R&S EVSG-K11 AF spectrum analysis option.

The x-axis displays the absolute measured frequency in kHz. The y-axis displays the modulation depth in dB.

Marker functions allow you to analyze specific details in the spectrum.

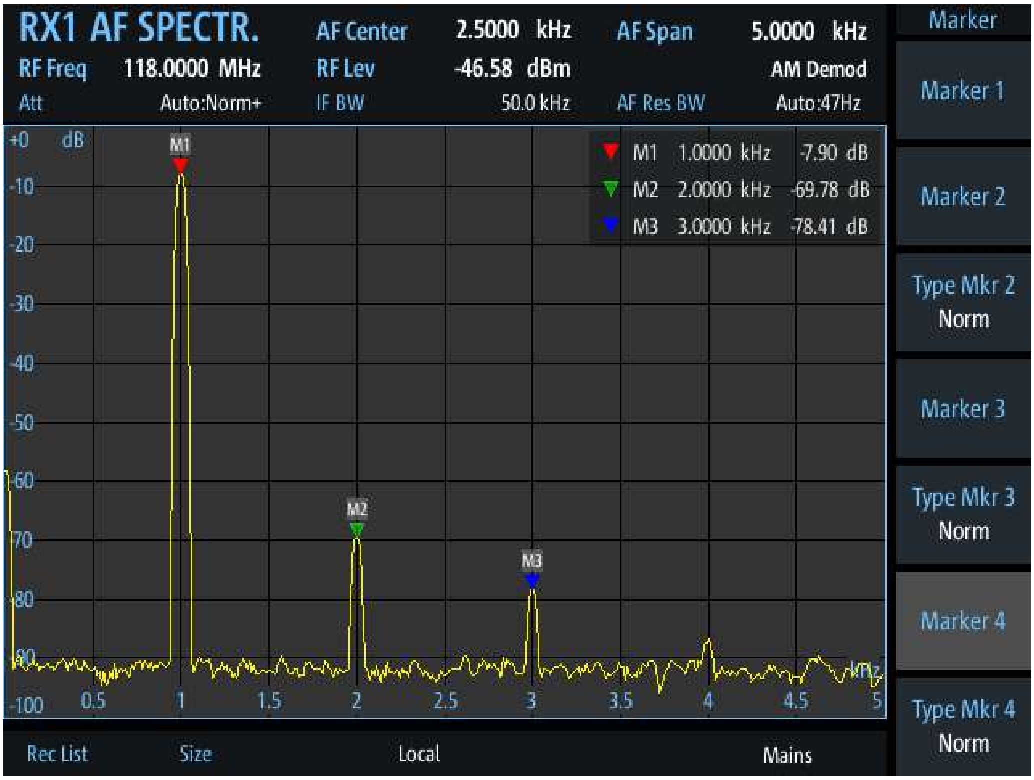


Figure 5-3: AF Spectrum for RF input

The following settings are displayed in the measurement settings area of the RF spectrum:

- RX board ("RX1" | "RX2")
  The currently active receiver board. See Chapter 3.2, "Receiver board", on page 40.
- Measurement mode
  The currently active measurement mode on the active receiver board, e.g. "AF Spectrum". See Chapter 3.3, "Measurement mode", on page 41.
- "RF Freq"
  Nominal measurement frequency of the RF signal, see "RF Freq" on page 138.
- "RF Lev"
  The measured level of the RF signal
- Frequency range
  "AF Center", "AF Span", "AF Start", "AF Stop"
  The swept frequency range, see Chapter 5.1.1, "Configuring the frequency range", on page 126.
- RF attenuation ("Att")
  The used attenuation mode; see also "RF Mode" on page 69.
- Resolution Bandwidth ("RBW")
  Resolution bandwidth with which the measurement is performed. See "Resolution Bandwidth (RBW Mode/Res BW)" on page 127.

- For ILS or VOR signals: the modulation of the selected carrier ("AM Demod", "VOR Subc. AM", "VOR Subc. FM"), see "Switching from numeric to graphical results" on page 91

AF Spectrum for LF input

Using option R&S EVSG1-K7 LF-Analysis, you can also analyze LF input (AF signals only) in the AF Spectrum mode. In this case, the y-axis displays the modulation depth in volt.

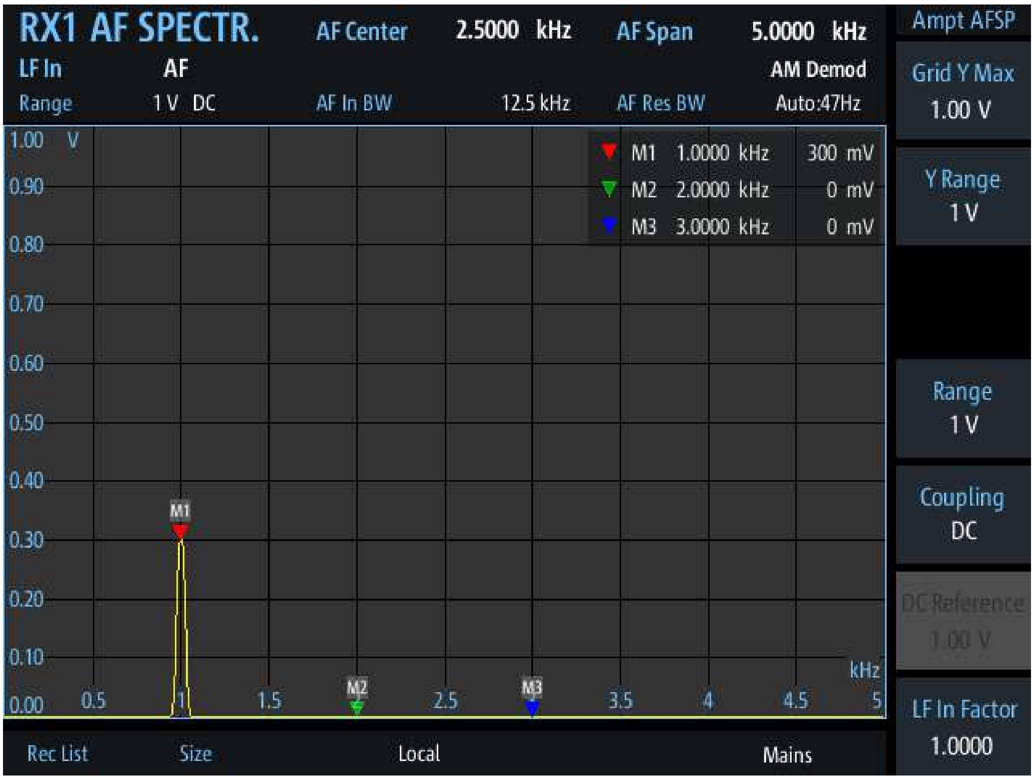


Figure 5-4: AF Spectrum for LF input

For LF input, the following settings are displayed:

- RX board ("RX1" | "RX2")
  The currently active receiver board. See Chapter 3.2, "Receiver board", on page 40.
- Measurement mode
  The currently active measurement mode on the active receiver board, e.g. "AF Spectrum". See Chapter 3.3, "Measurement mode", on page 41.
- Frequency range
  "AF Center", "AF Span", "AF Start", "AF Stop"
  The swept frequency range, see Chapter 5.3.2, "Configuring the frequency range", on page 138.
- LF Input type ("LF In")
  Only AF signals can be analyzed as LF input in AF Spectrum mode. See "Input RF/LF" on page 63.

- ("Range")
  Sensitivity of the measurement. See "Range" on page 72.
- Measurement Bandwidth ("AF In BW")
  Measurement bandwidth for LF input. See "AF In BW" on page 139.
- Resolution bandwidth for LF input ("AF Res BW")
  Resolution bandwidth with which the AF signal measurement is performed. See Chapter 5.3.3, "Configuring the bandwidth", on page 139.
- For ILS or VOR signals: the modulation of the selected carrier ("AM Demod", "AM Demod Offset" (low IF mode), "VOR Subc. AM", "VOR Subc. FM"), see "Switching from numeric to graphical results" on page 91

Generally, each mode is configured individually. When you switch modes, the most recently defined settings for that mode are applied.

However, graphical results can also be displayed directly from the measurement modes with numeric results. In this case, the settings for the current mode are applied to the graphical results.

If the original measurement mode analyzes multiple carriers, you must select the carrier for which you want to see the graphical results when you switch the mode.

Remote command to select RF Spectrum mode:

`MODE_FFT` on page 348

Remote command to retrieve trace results:

`FFT_GETSPECT` on page 354

5.3.1 Configuring the input signal

The AF Spectrum mode can display graphical results for RF or LF input.

Input RF/LF
Access VNC: [s]

Configures the input source for the receiver.

For details on the connectors see Chapter 1.5.2.2, "RX1 in / RX2 in", on page 23.

"RF In" An RF signal is provided from the RX 1 In/RX 2 In connectors on the front of the R&S EVSF1000. They are connected to a receiving antenna (max. +13 dBm). The antenna must correspond to the specified frequency range for the measurement.

"LF In" An AF or low frequency signal is provided at the LF In input connector on the rear side of the R&S EVSF1000.
If both receivers are used, only one of them can be set to analyze input from "LF In".
The LF In connector is only available if R&S EVSF1-B4 is installed.
Analyzing LF input requires option R&S EVSG1-K7 LF-Analysis.

Remote command:
`GS_RFLF_INPUT` on page 278
`LLZ_RFLF_INPUT` on page 268
`VOR_RFLF_INPUT` on page 303
`FFT_RFLF_INPUT` on page 353
`SCOPE_RFLF_INPUT` on page 358
`SETUP:INPUT` on page 234

5.3.2 Configuring the frequency range

Access VNC: [q]

The following settings configure the frequency range of the spectrum, that is: the x-axis.

Define the frequency range to be displayed using one of the following methods:
- AF Center + AF Span: the center frequency is displayed in the center of the x-axis, with half the span to either side
- AF Start + AF Stop: the x-axis starts with the start frequency and ends with the stop frequency

RF Freq
Configures the nominal frequency of the RF input signal. The configured value is displayed as "RF Freq" in the measurement settings area.

Remote command:
`FFT_FREQRF` on page 351

AF Center
Configures the center frequency for the demodulated AM signal components. The configured value is displayed as "AF Center" in the measurement settings area.

Remote command:
`FFT_FREQ_CENTER` on page 350

AF Span
Configures the frequency span, which must be at least 100 kHz. The configured value is displayed as "AF Span" in the measurement settings area.

Remote command:
FFT_FREQ_SPAN on page 350

AF Start
Configures the start frequency of the x-axis. The configured value is displayed as "AF Start" in the measurement settings area.

Remote command:
FFT_FREQ_START on page 350

AF Stop
Configures the stop frequency of the x-axis. The configured value is displayed as "AF Stop" in the measurement settings area.

Remote command:
FFT_FREQSTOP on page 350

5.3.3 Configuring the bandwidth

Access VNC: [e] > "F1"

RBW
Defines the resolution bandwidth (RBW) of the spectrum. The resolution bandwidth defines the minimum frequency separation at which the individual components of a spectrum can be distinguished. Small values result in high precision, as the distance between two distinguishable frequencies is small. Higher values decrease the precision, but increase measurement speed.

The RBW can be determined automatically by the R&S EVSF1000, or manually.

AUTO mode	The RBW is determined automatically according to the sweep time and frequency range.
Manual mode	Select a predefined fixed value manually.

Remote command:
FFT_RESBW_AUTO on page 352
FFT_RESBW_FIX_KHZ on page 352

IF BW
Defines the IF demodulation bandwidth for RX input in "AF Spectrum" mode.

Remote command:
FFT_IF_BW_KHZ on page 352

AF In BW
Access VNC: [e]

Bandwidth with which the LF input is measured.

Remote command:
`SCOPE_BB_AF_BW_KHZ` on page 356
`FFT_BB_AF_BW_KHZ` on page 349

IF BW AM
Defines the IF demodulation bandwidth for the AM component of LF input.

This function is only available for AM carrier input, which cannot be selected directly in "AF Spectrum" mode. However, it becomes available when you do one of the following:

- Switch to the AF spectrum from "ILS LOC" or "ILS GP" mode in low IF mode
- Switch to the AF spectrum from "VOR" mode for LF input, selecting the AM demodulated subcarrier (see "Switching from numeric to graphical results" on page 91).

Remote command:
`FFT_BB_IF_BW_KHZ` on page 349

5.3.4 Configuring the amplitude (Y-Axis) for RF input

Access VNC: [w]

The amplitude settings configure the y-axis of the spectrum. For the AF Spectrum, the modulation depth of the AM signal components is displayed on the y-axis.

The following settings are available for RF input.

Y-Range
Determines the displayed modulation depth range on the y-axis of the spectrum.

Remote command:
`FFT_GRID_YRANGE_DB` on page 351

RF Att
Determines how the attenuation of the RF signal is defined. Adjust the attenuation such that the measured power level remains in the valid level range (indicated by the green area of the bargraph, see Figure 4-4). Note that the valid level range depends on the selected measurement mode.

"Manual" The RF attenuation mode is specified manually (see "RF Mode" on page 69).

"Auto" The RF attenuation mode is selected automatically.
The signal attenuation is selected automatically according to the signal strength.
This mode works best with clean signals. In difficult receiving conditions, the "Low Noise", "Normal" or "Low Distortion" modes can be more stable.
When monitoring signals with mostly constant signal levels, it is also recommended that you use the "Low Noise", "Normal" or "Low Distortion" mode.

Remote command:
`SETATTMODE` on page 232
`SCOPE_ATTMODE` on page 355
`FFT_ATTMODE` on page 348
`IFSPECT_ATTMODE` on page 344

RF Mode

Defines the RF attenuation mode to be used.

"Low Noise" 15 dB pre-amplification
Provides a high sensitivity. Suitable when scanning the area for distant signals.

"Norm" 0 dB
Provides a normal sensitivity.

"Low Dist" 15 dB attenuation
Provides a low sensitivity. Suitable when analyzing a nearby signal, to avoid overload due to high-level signals.

Remote command:
`SETATTMODE` on page 232
`FSCAN_ATTMODE` on page 339
`SCOPE_ATTMODE` on page 355
`FFT_ATTMODE` on page 348
`IFSPECT_ATTMODE` on page 344
`GBAS:ATTMODE` on page 321

5.3.5 Configuring the amplitude (Y-Axis) for LF input

Access VNC: [w]

The amplitude settings configure the y-axis of the spectrum. The following settings are available for LF input.

Grid Y Max

Defines the maximum displayed value of the y-axis.

Y Range

Determines the displayed modulation depth range on the y-axis of the spectrum.

Remote command:
`FFT_GRID_YRANGE_V` on page 351

Grid Unit

Access VNC: [s]

Switches the unit of the y-axis between V and % for LF input (see Chapter 5.4.1, "Configuring the input signal", on page 146).

Range

Access VNC: [w]

Defines the full-scale AF signal level. Define the correct level to avoid clipping and overload.

Switches the range between 1 V and 5 V.

Remote command:
`SETUP:BB_IN_RANGE` on page 236

Coupling

Access VNC: [w]

Specifies the handling of the DC component of the AF signal.

For low IF signals, AC coupling is always used.

"AC"	The DC component of the AF signal is not forwarded.
"DC"	The DC component of the AF signal is also forwarded and analyzed.

Remote command:
`SETUP:BB_IN_COUPL` on page 236

DC Reference

Access VNC: [w]

Defines the reference power in volt for LF input, available for AF signals with AC coupling only. This value is used to determine the modulation depth and corresponds to the DC power of the AF signal.

For AC coupling, the DC power component of the AF signal is not forwarded. Thus, you must define the reference value manually.

Remote command:
`LLZ_BB_LFIN_DCOFFSETV` on page 263
`GS_BB_LFIN_DCOFFSETV` on page 273
`VOR_BB_LFIN_DCOFFSETV` on page 300
`FFT_BB_LFIN_DCOFFSETV` on page 349
`SCOPE_BB_LFIN_DCOFFSETV` on page 356

LF In Factor
Access VNC: [w]

Applies a factor to the measured power levels, e.g. to compensate certain effects in the input system.

Remote command:
`SETUP:BB_IN_FACTOR` on page 236

5.3.6 Configuring the trace

Access VNC: [a]

Trace settings determine how the display values are calculated from the measured values.

Trace mode
Defines the update mode for subsequent traces.

"Clear/Write"	Overwrite mode (default): the trace is overwritten by each sweep
"Average"	The average is determined over several sweeps The Average Count determines the number of averaging procedures.
"Max Hold"	The maximum value is determined over several sweeps and displayed. The R&S EVSF1000 saves each trace point in the trace memory only if the new value is greater than the previous one. The Average Count determines the number of sweeps to evaluate.
"RMS"	The RMS value for each trace point over several sweeps is determined and displayed. The Average Count determines the number of sweeps to evaluate.

Remote command:
`FFT_TRACEMODE` on page 353
`IFSPECT_TRACE_MODE` on page 346
`FSCAN_TRACE_MODE` on page 341

Average Count
Determines the number of sweeps over which trace evaluation is performed (e.g. averaging or maxhold).

Remote command:
`FFT_TRACE_AVRGCOUNT` on page 354
`IFSPECT_TRACE_AVRGCOUNT` on page 346
`FSCAN_TRACE_AVRGCOUNT` on page 342

5.4 R&S EVSG-K12 Time domain analysis

Access VNC: [m] > Down arrow key

The AF Time Domain mode displays the modulation vs. time diagram of the demodulated RF signal, similar to an oscilloscope.

This mode requires the R&S EVSG-K12 Time domain analysis option.

The x-axis displays the measurement time. The y-axis displays the modulation depth in percent.

Marker functions allow you to analyze specific details in the spectrum.

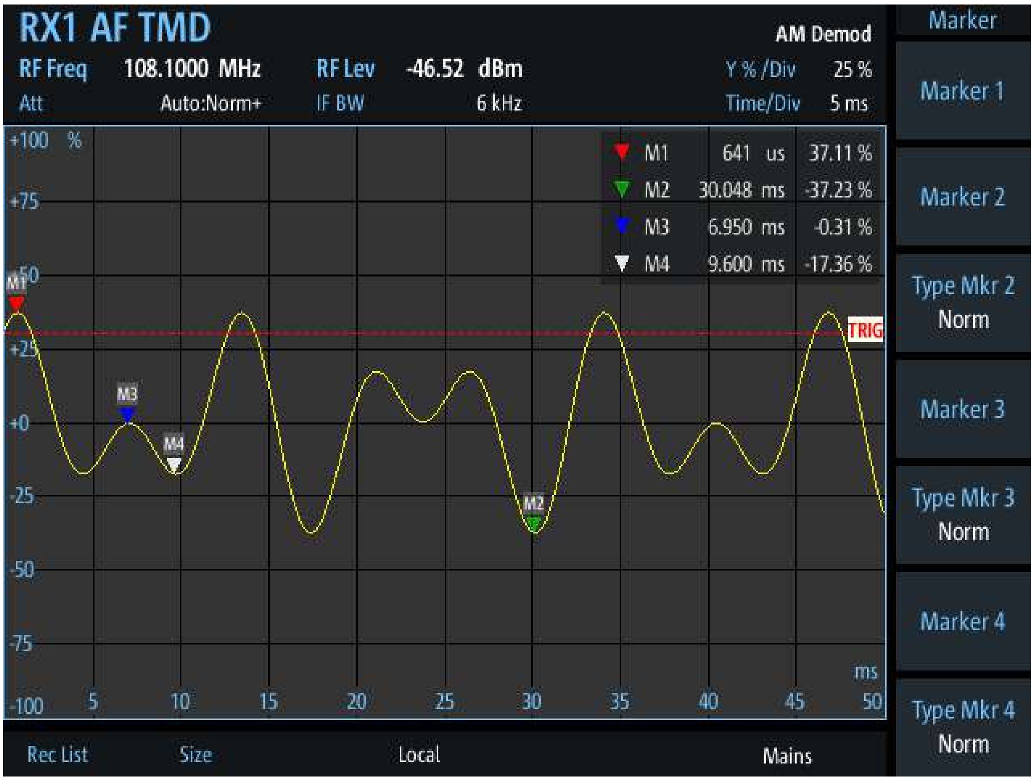


Figure 5-5: AF Time Domain Mode of an ILS signal with DDM = 0,0 %

Generally, each mode is configured individually. When you switch modes, the most recently defined settings for that mode are applied.

However, graphical results can also be displayed directly from the measurement modes with numeric results. In this case, the settings for the current mode are applied to the graphical results.

If the original measurement mode analyzes multiple carriers, you must select the carrier for which you want to see the graphical results when you switch the mode.

The following settings are displayed in the measurement settings area of the RF spectrum:

- RX board ("RX1" | "RX2")
  The currently active receiver board. See Chapter 3.2, "Receiver board", on page 40.
- Measurement mode

The currently active measurement mode on the active receiver board, e.g. "AF Spectrum". See Chapter 3.3, "Measurement mode", on page 41.

- "RF Freq"
  Nominal measurement frequency of the RF signal, see "RF Freq" on page 138.
- "RF Lev"
  The measured level of the RF signal
- RF attenuation ("Att")
  The used attenuation mode; see also "RF Mode" on page 69.
- Y-axis scaling ("Y % / Div")
  Range per y-axis division. See "Y % /Div" on page 147.
- X-axis scaling ("Time / Div")
  Time per x-axis division. See "Time/Div" on page 150.

AF Time Domain for LF input

Using option R&S EVSG1-K7 LF-Analysis, you can also analyze LF input (AF signals only) in the AF Time Domain mode. In this case, the power vs. time diagram is displayed.

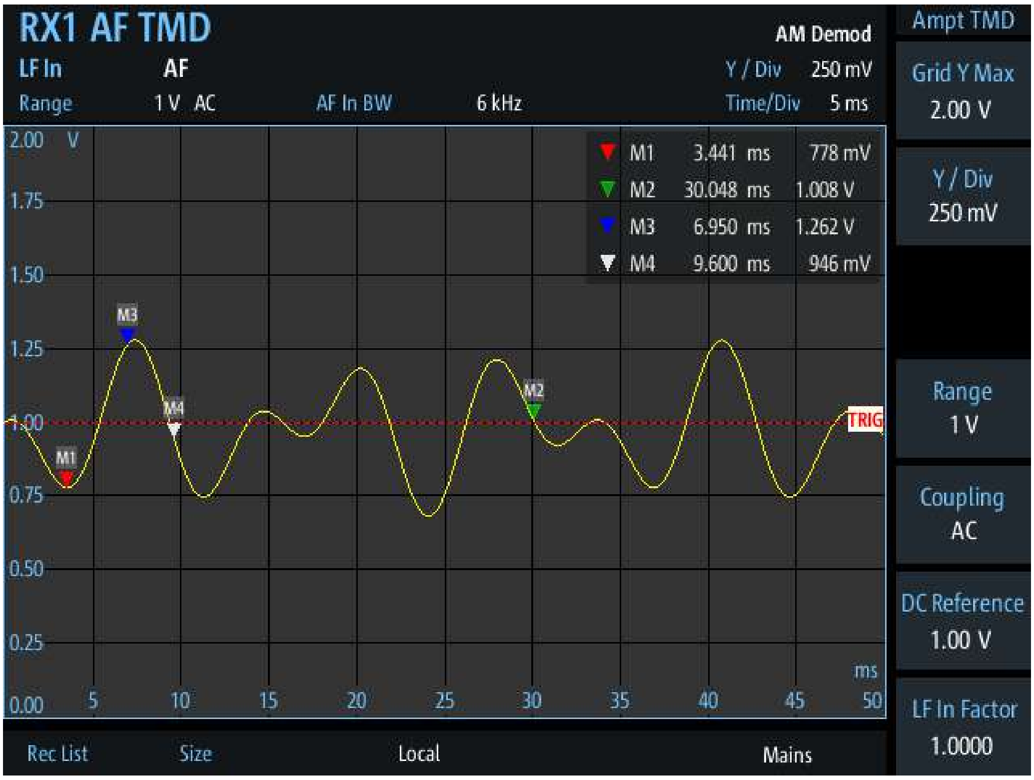


Figure 5-6: AF Time Domain Mode of an ILS signal from LF input

For LF input, the following settings are displayed:

- RX board ("RX1" | "RX2")
  The currently active receiver board. See Chapter 3.2, "Receiver board", on page 40.
- Measurement mode

The currently active measurement mode on the active receiver board, e.g. "AF Time Domain". See Chapter 3.3, "Measurement mode", on page 41.

- LF Input type ("LF In)"
  Only AF signals can be analyzed as LF input in AF Time Domain mode. See "Input RF/LF" on page 63.
- ("Range")
  Sensitivity of the measurement. See "Range" on page 72.
- Measurement Bandwidth ("AF In BW")
  Measurement bandwidth for LF input. See "AF In BW" on page 139.
- Y-axis scaling ("Y % / Div")
  Range per y-axis division. See Chapter 5.4.4, "Configuring the amplitude (Y-Axis) for LF input", on page 148.
- X-axis scaling ("Time / Div")
  Time per x-axis division. See "Time/Div" on page 150.

Remote command to select AF time domain mode:

`MODE_SCOPE` on page 355

Remote command to retrieve trace results:

`SCOPE_GETMEAS` on page 360

5.4.1 Configuring the input signal

The AF Time Domain mode can display graphical results for RF or LF input.

Input RF/LF
Access VNC: [s]

Configures the input source for the receiver.

For details on the connectors see Chapter 1.5.2.2, "RX1 in / RX2 in", on page 23.

"RF In" An RF signal is provided from the RX 1 In/RX 2 In connectors on the front of the R&S EVSF1000. They are connected to a receiving antenna (max. +13 dBm). The antenna must correspond to the specified frequency range for the measurement.

"LF In" An AF or low frequency signal is provided at the LF In input connector on the rear side of the R&S EVSF1000.
If both receivers are used, only one of them can be set to analyze input from "LF In".
The LF In connector is only available if R&S EVSF1-B4 is installed.
Analyzing LF input requires option R&S EVSG1-K7 LF-Analysis.

Remote command:
`GS_RFLF_INPUT` on page 278
`LLZ_RFLF_INPUT` on page 268
`VOR_RFLF_INPUT` on page 303
`FFT_RFLF_INPUT` on page 353

SCOPE_RFLF_INPUT on page 358
SETUP:INPUT on page 234

5.4.2 Configuring the frequency range and bandwidth

The following settings configure the measured RF frequency or bandwidth of the time domain measurement.

RF Freq

Access VNC: [q]

Configures the nominal frequency of the RF input signal. The configured value is displayed as "RF Freq" in the measurement settings area.

Remote command:
SCOPE_FREQRF on page 357

IF BW

Defines the bandwidth with which the RX input is measured.

Remote command:
SCOPE_IF_BW_KHZ on page 357
LF input:
SCOPE_BB_IF_BW_KHZ on page 356

AF In BW

Access VNC: [e]

Bandwidth with which the LF input is measured.

Remote command:
SCOPE_BB_AF_BW_KHZ on page 356
FFT_BB_AF_BW_KHZ on page 349

5.4.3 Configuring the amplitude (Y-Axis) for RF input

Access VNC: [w]

The amplitude settings configure the y-axis of the spectrum. The following settings are available for RF input.

Y % /Div

Defines the value range displayed in each division of the y-axis. The full y-axis range is eight times this value.

RF Att

Determines how the attenuation of the RF signal is defined. Adjust the attenuation such that the measured power level remains in the valid level range (indicated by the green area of the bargraph, see Figure 4-4). Note that the valid level range depends on the selected measurement mode.

"Manual" The RF attenuation mode is specified manually (see "RF Mode" on page 69).

"Auto" The RF attenuation mode is selected automatically.
The signal attenuation is selected automatically according to the signal strength.
This mode works best with clean signals. In difficult receiving conditions, the "Low Noise", "Normal" or "Low Distortion" modes can be more stable.
When monitoring signals with mostly constant signal levels, it is also recommended that you use the "Low Noise", "Normal" or "Low Distortion" mode.

Remote command:
`SETATTMODE` on page 232
`SCOPE_ATTMODE` on page 355
`FFT_ATTMODE` on page 348
`IFSPECT_ATTMODE` on page 344

RF Mode

Defines the RF attenuation mode to be used.

"Low Noise" 15 dB pre-amplification
Provides a high sensitivity. Suitable when scanning the area for distant signals.

"Norm" 0 dB
Provides a normal sensitivity.

"Low Dist" 15 dB attenuation
Provides a low sensitivity. Suitable when analyzing a nearby signal, to avoid overload due to high-level signals.

Remote command:
`SETATTMODE` on page 232
`FSCAN_ATTMODE` on page 339
`SCOPE_ATTMODE` on page 355
`FFT_ATTMODE` on page 348
`IFSPECT_ATTMODE` on page 344
`GBAS:ATTMODE` on page 321

5.4.4 Configuring the amplitude (Y-Axis) for LF input

Access VNC: [w]

The amplitude settings configure the y-axis of the spectrum. The following settings are available for LF input.

Grid Y Max

Defines the maximum value of the y-axis.

Y % /Div

Defines the value range displayed in each division of the y-axis. The full y-axis range is eight times this value.

Grid Unit

Access VNC: [s]

Switches the unit of the y-axis between V and % for LF input (see Chapter 5.4.1, "Configuring the input signal", on page 146).

Range

Access VNC: [w]

Defines the full-scale AF signal level. Define the correct level to avoid clipping and overload.

Switches the range between 1 V and 5 V.

Remote command:
`SETUP:BB_IN_RANGE` on page 236

Coupling

Access VNC: [w]

Specifies the handling of the DC component of the AF signal.

For low IF signals, AC coupling is always used.

"AC" The DC component of the AF signal is not forwarded.

"DC" The DC component of the AF signal is also forwarded and analyzed.

Remote command:
`SETUP:BB_IN_COUPL` on page 236

DC Reference

Access VNC: [w]

Defines the reference power in volt for LF input, available for AF signals with AC coupling only. This value is used to determine the modulation depth and corresponds to the DC power of the AF signal.

For AC coupling, the DC power component of the AF signal is not forwarded. Thus, you must define the reference value manually.

Remote command:
LLZ_BB_LFIN_DCOFFSETV on page 263
GS_BB_LFIN_DCOFFSETV on page 273
VOR_BB_LFIN_DCOFFSETV on page 300
FFT_BB_LFIN_DCOFFSETV on page 349
SCOPE_BB_LFIN_DCOFFSETV on page 356

LF In Factor
Access VNC: [w]

Applies a factor to the measured power levels, e.g. to compensate certain effects in the input system.

Remote command:
SETUP:BB_IN_FACTOR on page 236

5.4.5 Configuring the measurement time

Access VNC: [d] > "F1"

Time/Div
Defines the time range displayed in each division of the x-axis. The full x-axis range, that is: the total measurement time, is eight times this value.

Remote command:
SCOPE_TIMEDIV_RF on page 358

5.4.6 Configuring the trigger

Access VNC: [k]

The trigger determines how often and when a new measurement is performed.

Performing a single sweep
To perform a single sweep, press [Single] (VNC: [L]).

Trigger mode
Determines how the trigger is evaluated.

"Norm" Each time a trigger event occurs, a measurement is performed.

"Auto" Each time a trigger event occurs, a measurement is performed.
If no trigger event occurs during a predefined waiting period, a measurement is performed without a trigger. This setting helps you determine the required trigger level.

"Single" When the trigger event occurs, a single measurement is performed.

Trigger Source
Determines how often and when a new sweep is performed.

"Ext." A measurement is performed each time a trigger signal from a connected external trigger device is received. The trigger device must be connected to the "Trigger In" connector on the rear panel of the R&S EVSF1000.

"Level" A measurement is performed when the input signal reaches the defined trigger level.

Trigger Edge
For external triggering, this setting defines whether a measurement is performed when the positive (rising) or negative (falling) edge of the trigger signal is received. Select the key repeatedly to toggle between the two settings.

Remote command:
`SCOPE_TRIGSLOPE` on page 359

Trigger Level
For the Trigger Source = "Level", this value specifies the level in percent the input signal must reach to trigger a measurement.

Remote command:
`SCOPE_TRIGLEVEL_RFPCT` on page 359

5.4.7 Configuring the trace

Access VNC: [a]

Trace settings determine how the display values are calculated from the measured values.

Trace mode
Defines the update mode for subsequent traces.

"Clear/Write" Overwrite mode (default): the trace is overwritten by each sweep

"Average" The average is determined over several sweeps
The Average Count determines the number of averaging procedures.

"Max Hold" The maximum value is determined over several sweeps and displayed. The R&S EVSF1000 saves each trace point in the trace memory only if the new value is greater than the previous one.
The Average Count determines the number of sweeps to evaluate.

"RMS" The RMS value for each trace point over several sweeps is determined and displayed.
The Average Count determines the number of sweeps to evaluate.

Remote command:
`FFT_TRACEMODE` on page 353
`IFSPECT_TRACE_MODE` on page 346
`FSCAN_TRACE_MODE` on page 341

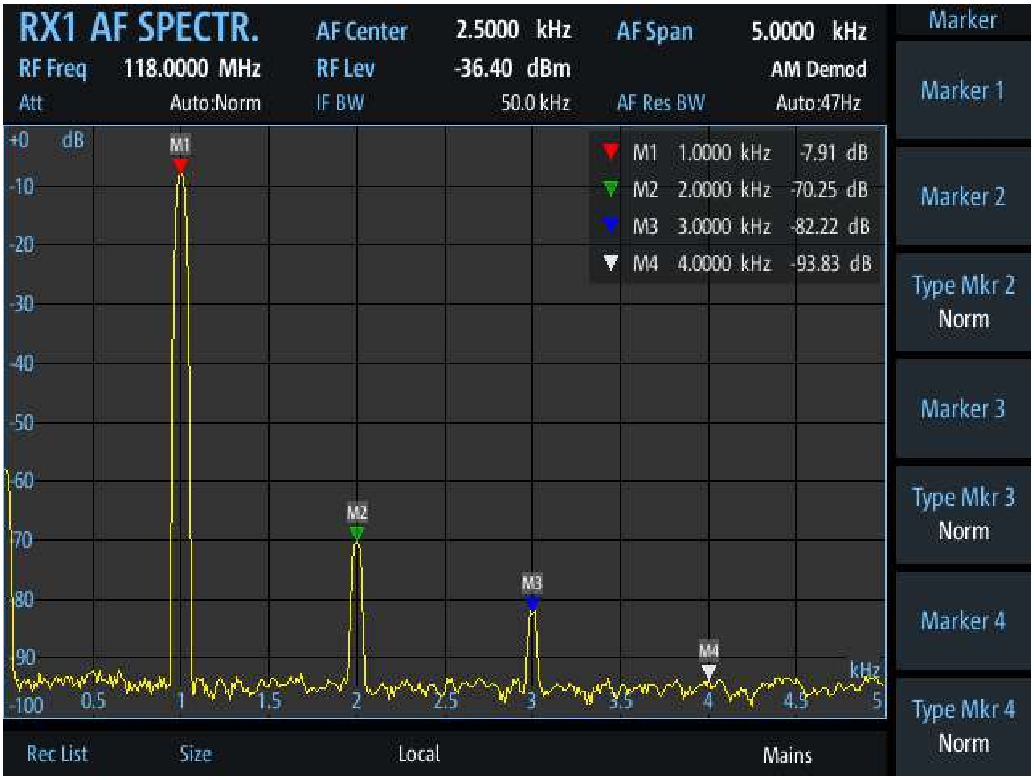
Average Count
Determines the number of sweeps over which trace evaluation is performed (e.g. averaging or maxhold).

Remote command:
`FFT_TRACE_AVRGCOUNT` on page 354
`IFSPECT_TRACE_AVRGCOUNT` on page 346
`FSCAN_TRACE_AVRGCOUNT` on page 342

5.5 Using markers in the graphical displays

Marker functions allow you to analyze specific details in the spectrum or time domain diagrams.

Active markers are displayed as colored triangles in the spectrum at the position they were placed. The exact position (frequency or time) and measured level at that position is indicated in the marker box in the upper right-hand corner of the diagram. Active markers are indicated by a highlighted softkey.



Up to four markers can be active at the same time. Markers 2 to 4 can be either normal markers or delta markers. A normal marker indicates the absolute signal value at the defined position in the diagram. A delta marker indicates the value of the marker relative to marker 1.

Activating/Deactivating a marker
Access VNC: [i] > "F1"- "F4"

To activate a marker, select the corresponding softkey. An active marker is highlighted.

To select a marker that is already active, for example to move its position (see "Moving a marker to a peak in the diagram" on page 153), select the softkey again. A selected (editable) marker is highlighted orange.

To deactivate an active marker, select the marker until the highlighting is no longer displayed.

Marker type (Type Mrk <2-4>) ← Activating/Deactivating a marker
Determines the type of marker results.

"Normal" A normal marker indicates the absolute value at the defined position in the diagram.

"Delta" A delta marker defines the value of the marker relative to marker 1 (which is always of type "normal").

Deactivating all markers
Access VNC: [j] > "F1"

Deactivates all markers in the diagram.

Moving a marker to a peak in the diagram
Access VNC: [o] > "F1" / "F2"

Sets the currently active and selected marker (indicated in the softkey) to the highest or next-highest peak detected in the diagram. If no marker is active or selected, this function has no effect. To select a marker, see "Activating/Deactivating a marker" on page 153.

Adapting the center frequency to the current marker position
Access VNC: [o] > "F3"

Sets the center frequency of the spectrum to the position of the currently active and selected marker (indicated in the softkey). The spectrum is updated to the new frequency range. The span is maintained.

If no marker is active or selected, this function has no effect. To select a marker, see "Activating/Deactivating a marker" on page 153.

Relative Unit (for AF spectrum only)
Determines the unit for relative markers in the AF Spectrum diagram. Percentage and dB values are available.

6 GBAS/SCAT-I mode

Access VNC: [m] > Down arrow key

The R&S EVSG-K4 GBAS analysis/R&S EVSG-K5 SCAT-I Analysis options are firmware applications that add functionality to perform GBAS and SCAT-I analysis on the R&S EVSF1000.

The R&S EVSG-K4 GBAS analysis option enables you to receive and analyze the very high frequency (VHF) data broadcast (VDB) signal-in-space transmitted from a ground-based augmentation system (GBAS) ground subsystem to the airborne subsystem. This implementation is in line with the specification ICAO AN10 Vol1 [3] and RTCA DO-246 [1] (see Chapter C, "References", on page 381).

Similarly, using option R&S EVSG-K5 SCAT-I Analysis, data from special category I (SCAT-I) systems can be received and analyzed. The main difference is the content of the message data. This implementation is in line with the specification ICAO AN10 Vol1 [3] and RTCA DO-217 [2] (see Chapter C, "References", on page 381).

The R&S EVSG-K4 GBAS analysis/R&S EVSG-K5 SCAT-I Analysis applications feature:

- Receiving GBAS signal data from a GBAS ground station in a frequency range between 108.025 MHz and 117.950 MHz with a channel spacing of 25 kHz
- Receiving SCAT-I signal data from a SCAT-I ground station in a frequency range between 108.025 MHz and 117.950 MHz with a channel spacing of 25 kHz
- Analyzing the RF characteristics, signal strength and frequency accuracy of the GBAS/SCAT-I signal
- Demodulating, decoding and displaying GBAS/SCAT-I signal data
- Analyzing up to 8 time slots or individual time slot details in the GBAS/SCAT-I signal data
- Analyzing individual Final Approach Segment (FAS) data blocks
- Logging and storing up to 9999 lists of received GBAS/SCAT-I signal data

We strongly recommend that you provide a PPS signal for reference. Without PPS synchronization, signal timing and slot positions are possibly not correct.

For details, see Chapter 6.1.4, "Time slot synchronization via PPS", on page 158.

6.1 Basics on GBAS and SCAT-I analysis

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

6.1.1 GBAS specifics

GBAS is a ground-based augmentation system that can enhance satellite navigation. 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 components

The illustration in Figure 6-1 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).

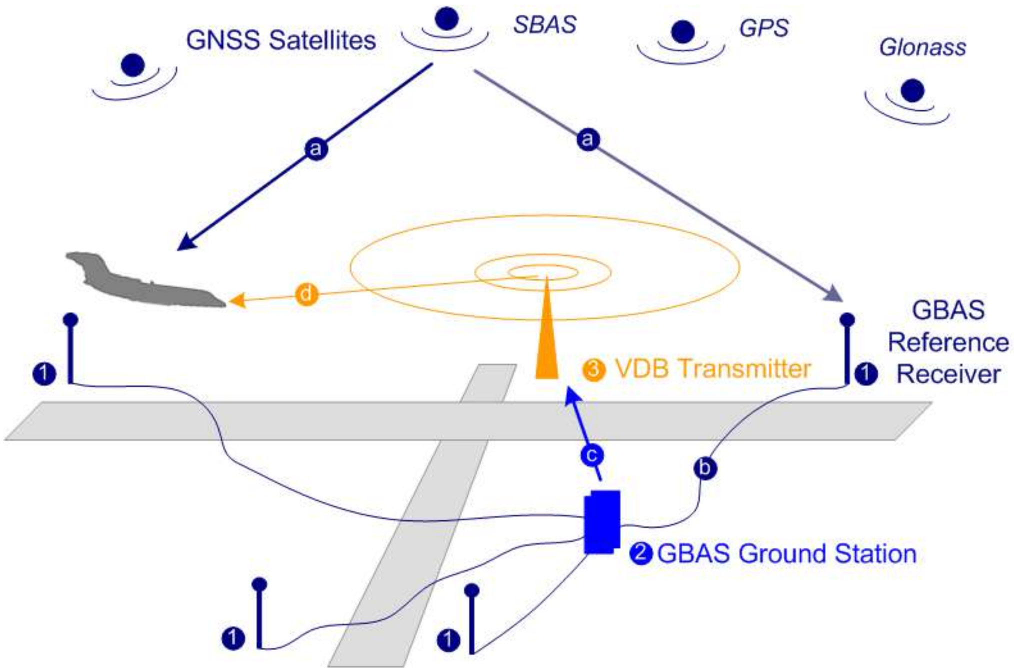


Figure 6-1: GBAS components and signals (simplified representation)

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 receivers receive the *GNSS navigation message*, perform pseudorange measurements and transmit 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 correction parameters to improve the navigation algorithms from GPS.

This list outlines the three signals transmitted between the components and referred to 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

Carrier frequencies and frequency channels

The VHF data broadcast is defined for carrier frequencies within the range of 108.025 MHz to 117.950 MHz and carrier spacing of 25.0 kHz.

6.1.2 Broadcast timing structure

The broadcast is a Time Division Multiple Access (TDMA). According to [1], the TDMA timing structure uses a two level hierarchy, composed of 500 ms long frames, each divided into 8 VDB time slots (A - H), see Figure 6-2.

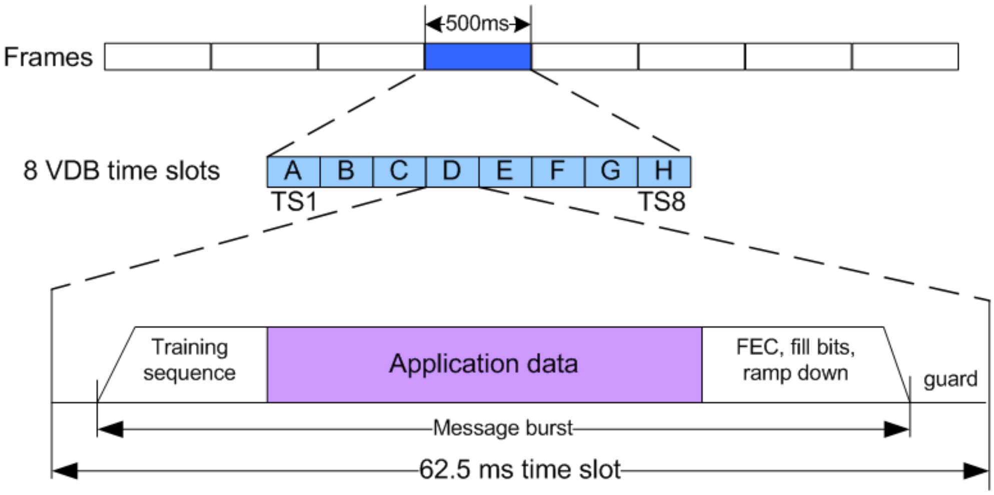


Figure 6-2: TDMA timing structure (simplified representation)

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 [1] defines the TDMA timing structure, including timing budget of the VDB bursts, burst data contents and message encoding in great details. The R&S EVSF1000 receives the required training sequence, decodes the message according to [1] and demodulates the D8PSK modulated data automatically.

6.1.3 Final approach segment (FAS) construction data

According to the standard [1], 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).

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).

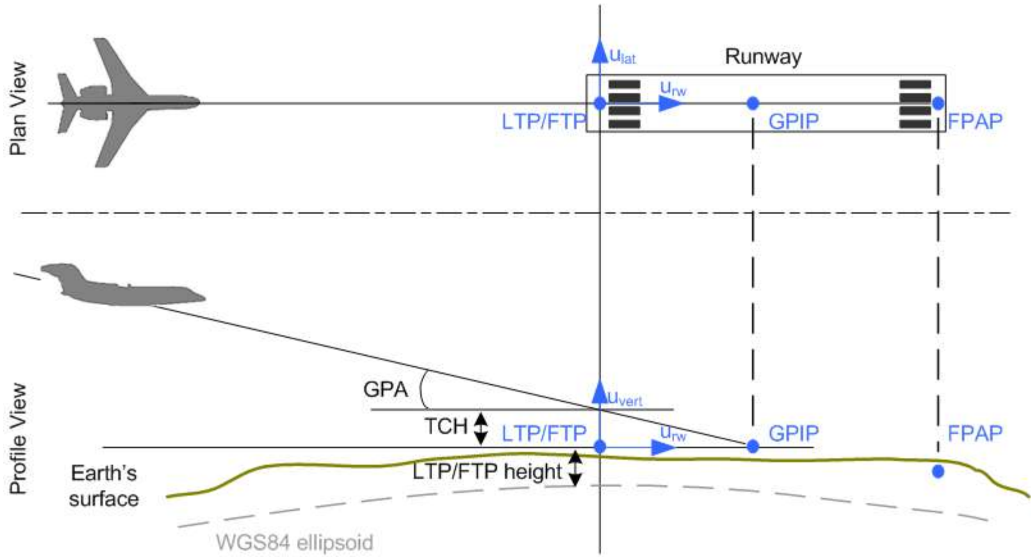


Figure 6-3: Final Approach Segment (FAS) diagram, according to [1]

LTP/FTP = Landing Threshold Point/Fictitious Threshold Point; point at the center of the landing runway, defined by its WGS84 coordinates
GPIP = Glide Path Intercept Point; the point where the final approach path intercepts the local level plane
FPAP = Flight Path Alignment Point; point at the end of the runway that in conjunction with the LTP/FTP defines the geodesic plane of the precision final approach, landing and flight path.
TCH = Threshold Crossing Height
GPA = Glide Path Angle; angle at the TCH that describes the intended angle of descent at the final approach path.

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.

6.1.4 Time slot synchronization via PPS

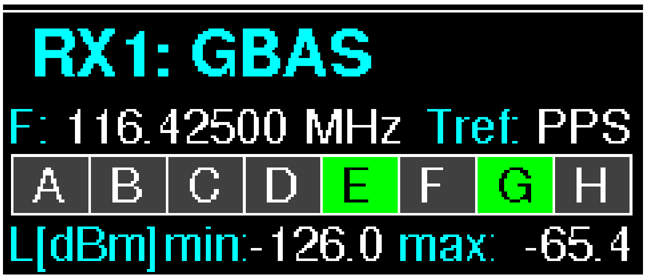
The GBAS/SCAT-I signal is synchronous to the PPS signal of the GNSS system. With the help of this synchronization, the GBAS/SCAT-I signal is assigned to eight time slots (twice a second).

If the R&S EVSF1000 finds a valid PPS signal at its selected trigger connector, the status line of the display indicates "PPS Locked". In this case, the R&S EVSF1000 can analyze the GBAS/SCAT-I signal and detect the individual GBAS time slots.

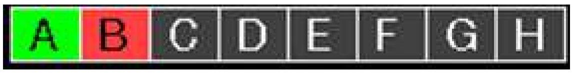
If no valid PPS signal is detected, the R&S EVSF1000 still analyzes the GBAS/SCAT-I signal and tries to synchronize to the GBAS/SCAT-I burst raster. In this case, the status line of the display indicates "Burst Locked". Without PPS synchronization, signal timing and slot positions are possibly not correct.

6.2 GBAS/SCAT-I status display

The basic measurement information is displayed in the mini display directly on the R&S EVSF1000 (see also Chapter 1.6.1, "Basic configuration and status display", on page 27).



For GBAS/SCAT-I mode, the following measurement information is displayed:

- **"F"**: The channel frequency that determines the carrier frequency at which the measurement is performed. See "Frequency (Freq)" on page 160.
- **"Tref"**: Time reference; indicates the status of the PPS signal from an external GNSS device (see "Time reference status (Time Ref.)" on page 161)
  - **"PPS"**:
    A GNSS receiver or a valid signal is available at the PPS-In,Trigger-In, or RS232-GPS connector.
  - **"Unlk"**:
    No valid signal available at the PPS-In or Trigger-In connector. GBAS/SCAT-I signals cannot be detected correctly.
- 

  The burst status is indicated by the color of the slot cell (see also "Status" on page 163):
  - **Green**: The status is "OK". The received burst passed the cyclic redundancy check (CRC).
  - **Red**: An error occurred. The received burst did not pass the cyclic redundancy check (CRC).
  - **Gray**: No burst received.
- **"L[dBm]min"** : Minimum burst level average in the current frame (see "Burst Level Average (Av [dBm])" on page 163)
- **"L[dBm]max"** : Maximum burst level average in the current frame (see "Burst Level Average (Av [dBm])" on page 163)

6.3 GBAS / SCAT-I measurement information

The following measurement information is displayed in all GBAS / SCAT-I views.

RX board (RX1 | RX2)

The currently active receiver board. See Chapter 3.2, "Receiver board", on page 40.

Measurement mode

The currently active measurement mode on the active receiver board; in this case: "GBAS" (for both GBAS and SCAT-I modes). See Chapter 3.3, "Measurement mode", on page 41.

Frame

The currently selected frame for which the results are displayed. The most recent frame is referred to as T, previous frames are T minus 1 (T-1), T-2, to T-39.

Slot

The currently selected slot for which the results are displayed. The slots are labeled A, B, C, D, E, F, G, H.

Frequency (Freq)

The channel frequency that determines the carrier frequency at which the measurement is performed.

The VHF data broadcast is defined for carrier frequencies within the range of 108.025 MHz to 117.950 MHz with a channel spacing of 25 kHz.

Remote command:
`GBAS:FREQRF` on page 323

RF attenuation (Att)

The used attenuation mode; see also "RF Mode" on page 176.

Level correction (Lev Corr)

The applied level correction by a transducer. See "Transducer Correction" on page 69.

Bandwidth (IF BW)

Bandwidth on which the measurement is performed. The default bandwidth is 16.8 kHz. For GBAS/SCAT-I measurements, the complete bandwidth is 25 kHz.

See also "IF Filter" on page 176.

Time reference status (Time Ref.)
Indicates the status of the PPS signal from an external GNSS device.

"PPS Locked" A GNSS receiver or a valid signal is available at the PPS-In,Trigger-In, or RS232-GPS connector.

"Burst Locked" No valid PPS signal available at any input connector, but a valid GBAS/SCAT-I burst raster was found. Signal timing and slot positions are possibly not correct.

"Unlocked" No valid signal available at any input connector, and no valid GBAS/SCAT-I burst raster was found. GBAS/SCAT-I signals cannot be detected correctly.

Remote command:
`GBAS:PPSLOCKED?` on page 330

Display Update Status (Mode)
Indicates whether the display is updated or not.

Note: Data recording and streaming continue regardless of the display update status.

"Run" Display is updated continuously.

"Pause" Display is temporarily not updated.

Remote command:
`GBAS:BUFFER_RUNPAUSE` on page 322

6.4 GBAS / SCAT-I measurement views and results

The GBAS/SCAT-I measurement provides both numerical and graphical results in various views.

Remote command:

`GBAS:SCREENVIEW` on page 324

6.4.1 Sequence view

Access: [Meas] > "View" > "Sequence"

The "Sequence" view is the default view in GBAS/SCAT-I mode and provides an overview of the GBAS/SCAT-I transmissions over time. Each frame contains 8 TDMA slots (see also Chapter 6.1.2, "Broadcast timing structure", on page 157). Six sequential frames are displayed at a time, in a table with one column for each slot and one row per frame. You can scroll through all available frames using the rotary knob or the Frame and Slot functions.

In the "Sequence" view, the data from the last 40 frames is available. The data is stored in a so-called *ring buffer*. When the ring buffer is full, the next data set overwrites the first data set, that is: the oldest. Thus, the most recent 40 data sets are available. The most recently received frame is referred to as T. Each previous frame is referred to as T minus 1 (T-1), T-2 etc. Every 500 ms, a new frame is inserted, overwriting the frame T-39, and becomes the new frame T. Thus, the display is updated every 500 ms. To freeze the current display for evaluation, you can pause the table update (see "Run/Pause" on page 175). Data recording and streaming, however, continue as usual. When updating is resumed, all frames in the table are updated.

Results for a single frame or slot

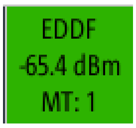
The currently selected frame and slot are indicated by a dotted rectangle in the table.

To view the details for a particular frame or slot, turn the rotary knob to scroll through the slots and frames. When the required slot or frame is selected, select the view you want to see the slot results in.

For more details, see:

- Chapter 6.4.2, "Frame view", on page 163
- Chapter 6.4.3, "Burst view", on page 167
- Chapter 6.4.4, "Constellation view", on page 170
- Chapter 6.4.5, "Message view", on page 171

For each slot in each displayed frame, the following information is provided in the corresponding table cell (for a valid GBAS burst, if available).



GBAS ID

4-character identifier of the ground station broadcasting the message. If there is more than one message inside the burst, the first GBAS ID is displayed.

Remote command:
`GBAS:GBASID?` on page 326

Burst Level Average (Av [dBm])

Arithmetic average of the burst power level measured over the period of the synchronization and ambiguity resolution field of the burst.

If no burst was detected, the arithmetic average of the noise power is displayed.

Remote command:
`LA?` on page 323

Application Data (App. Dat.)

Detected message types (MT) in the burst

Example: "MT:1,2": messages of type 1 and 2 detected

Status

The burst status is indicated by the color of the slot cell:

Green	The status is "OK". The received burst passed the cyclic redundancy check (CRC).
Red	An error occurred. The received burst did not pass the cyclic redundancy check (CRC).
Gray	No burst received.

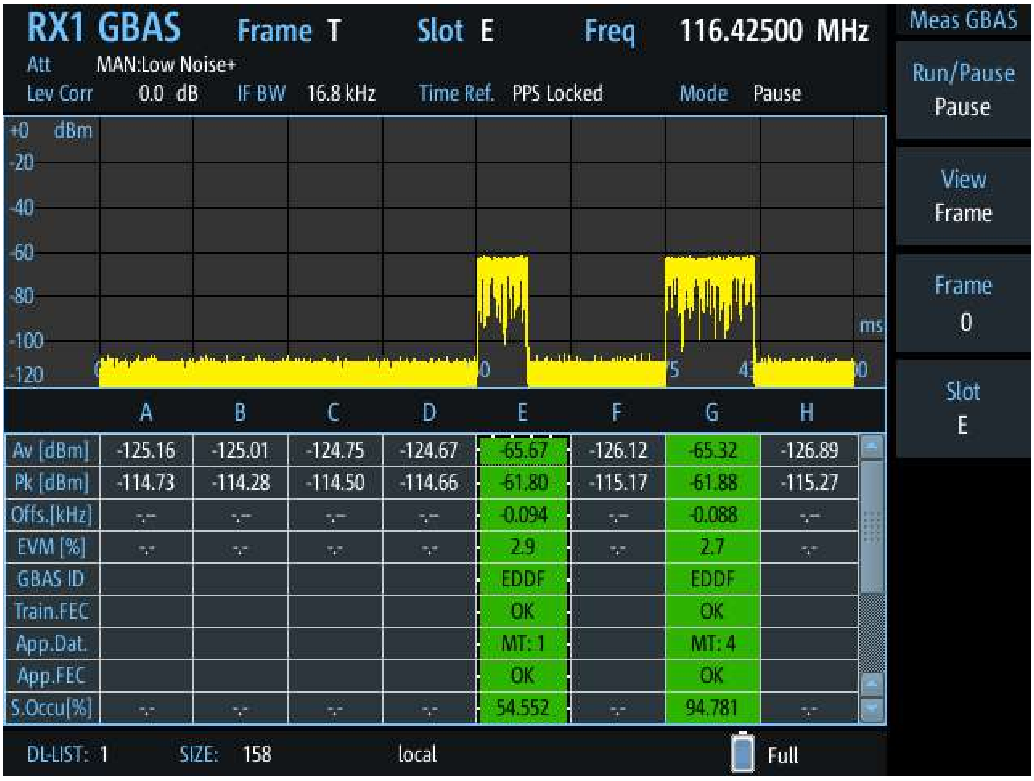
6.4.2 Frame view

Access: [Meas] > "View" > "Frame"

To use the available spectrum most efficiently, despite the low data rate, GBAS transmissions use the Time Division Mulitple Access (TDMA) method (see also Chapter 6.1.2, "Broadcast timing structure", on page 157). Thus, multiple GBAS bursts, even from different transmitters, can be sent in a single frame. To do so, the transmitters must adhere to the time slots strictly. Nevertheless, time delays can occur during transmission. The GBAS "Frame" view allows you to measure the time behavior of the slots precisely.

As opposed to the "Sequence" view, the "Frame" view displays the results of a single frame only. By default, the most recently measured frame T is displayed. To display the results for a different frame, use the Frame function.

The display is updated each time a complete frame has been measured, that is: every 500 ms. To freeze the current display for evaluation, you can pause the view update (see "Run/Pause" on page 175). Data recording and streaming, however, continue as usual. When updating is resumed, the displayed results in the view are updated.

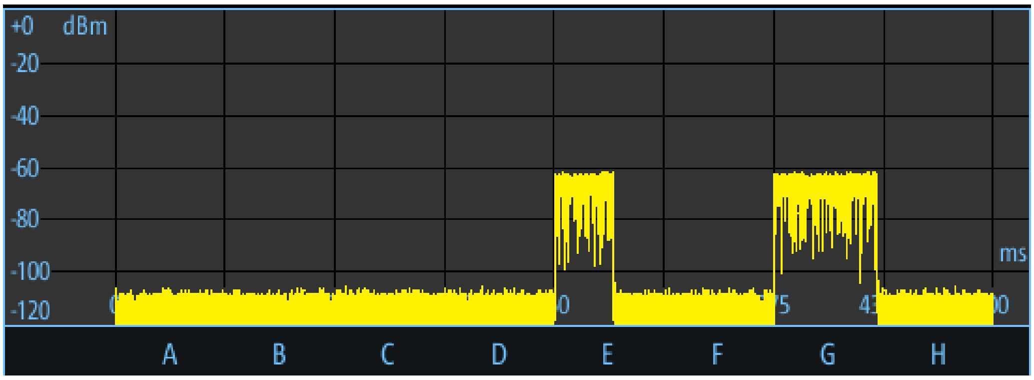


The "Frame" view contains two different displays:

- Chapter 6.4.2.1, "Frame power vs. time diagram", on page 164
- Chapter 6.4.2.2, "Frame results table", on page 165

6.4.2.1 Frame power vs. time diagram

The power vs. time diagram displays the measured power per time, normalized to the PPS signal. The fixed slot grid defined by the PPS (reference) signal is indicated by vertical lines in the diagram. In addition to the time in milliseconds, the slot label A to H is indicated on the x-axis. The time axis always starts at 0 seconds or 500 milliseconds.



The measured power is indicated for a range of -120 dBm to 0 dBm on the y-axis.

6.4.2.2 Frame results table

In the frame results table, the details for each slot in the selected frame are displayed, one slot per column. The currently selected slot is indicated by a dotted rectangle in the frame results table. If a slot timing error or a signal level error occurs, the slot is highlighted red.

	A	B	C	D	E	F	G	H
Train.FEC					OK		OK	
App.Dat.					MT: 1		MT: 4	
App.FEC					OK		OK	
S.Occu[%]	-.-	-.-	-.-	-.-	54.552	-.-	94.781	-.-
BER					0.0e+00		0.0e+00	
Valid B.					110		110	
Failed B.					0		0	
Sync.[µs]					576.0		576.0	
Overload								

To scroll through the parameters in the table for a single slot, use the arrow keys up and down.

Burst Level Average (Av [dBm])
Arithmetic average of the burst power level measured over the period of the synchronization and ambiguity resolution field of the burst.

If no burst was detected, the arithmetic average of the noise power is displayed.

Remote command:
`LA?` on page 323

Slot Level Peak (Pk [dBm])
Highest measured power level in the slot in dBm

Remote command:
`GBAS:PEAKLEV?` on page 330

Carrier frequency offset (Offs. [kHz])
Offset of the measured carrier frequency from the nominal frequency

Remote command:
`GBAS:FMEAS?` on page 323

EVM RMS
Error vector magnitude RMS in percent.

Indicates the quality of the transmitted symbols in relation to the ideal constellation point. The EVM normalization reference is the mean constellation power.

Remote command:
`GBAS:EVM?` on page 325
For baseband input also:
`GBAS:EVM_ANGLE_NORM` on page 322

GBAS ID
4-character identifier of the ground station broadcasting the message. If there is more than one message inside the burst, the first GBAS ID is displayed.

Remote command:
`GBAS:GBASID?` on page 326

Training Sequence FEC (Train. FEC)
Training sequence status based on the FEC

"OK"	Training sequence correct
"NOK"	Training sequence not valid, no bits corrected
<x>	Number of corrected bits in the training sequence

Application Data (App. Dat.)
Detected message types (MT) in the burst

Example: "MT:1,2": messages of type 1 and 2 detected

Application FEC (App. FEC)
Application data status based on the FEC

"OK"	Application data correct
"NOK"	Application data not valid, no bits corrected
<x>	Number of corrected bits in the application data

Slot Occupancy (S.Occu [%])
The percentage of the available bits in the slot that contain burst data, calculated as:

*<bits_burst> / 1968.75 bits *100 %*

Bit error rate (BER) before FEC
Bit error rate (BER) before forward error correction (FEC). The Training Sequence FEC (Train. FEC) and the Application FEC (App. FEC) are used to detect the bit errors.

Calculated as:

<bits_ok> / <bits_error>

To reset the BER value, use the Reset BER function.

Remote command:
`GBAS:GBASBER?` on page 326

Valid Bursts (Valid B.)
Number of received bursts that passed the cyclic redundancy check (CRC) and are thus considered valid.

To reset the value, use the Reset BER function.

Failed Bursts (Failed B.)
Number of received bursts that did not pass the cyclic redundancy check (CRC) and are thus considered invalid.

To reset the value, use the Reset BER function.

Sync. Sequence (Sync. [us])
Position of the synchronization sequence within the burst in µs.

Overload
Indicates a power overload at any of the input connectors, which can account for inaccurate results. If an overload occurs, an error message is also displayed in the measurement information in all GBAS / SCAT-I views.

"OK"	No overload
"RF Ovld"	Input signal too high
"IF Ovld"	IF signal too high
"ADC Ovld"	ADC input signal too high

6.4.3 Burst view

Access: [Meas] > "View" > "Burst view"

The "Burst" view is similar to the "Frame" view. However, the "Burst" view displays the results for an individual slot.

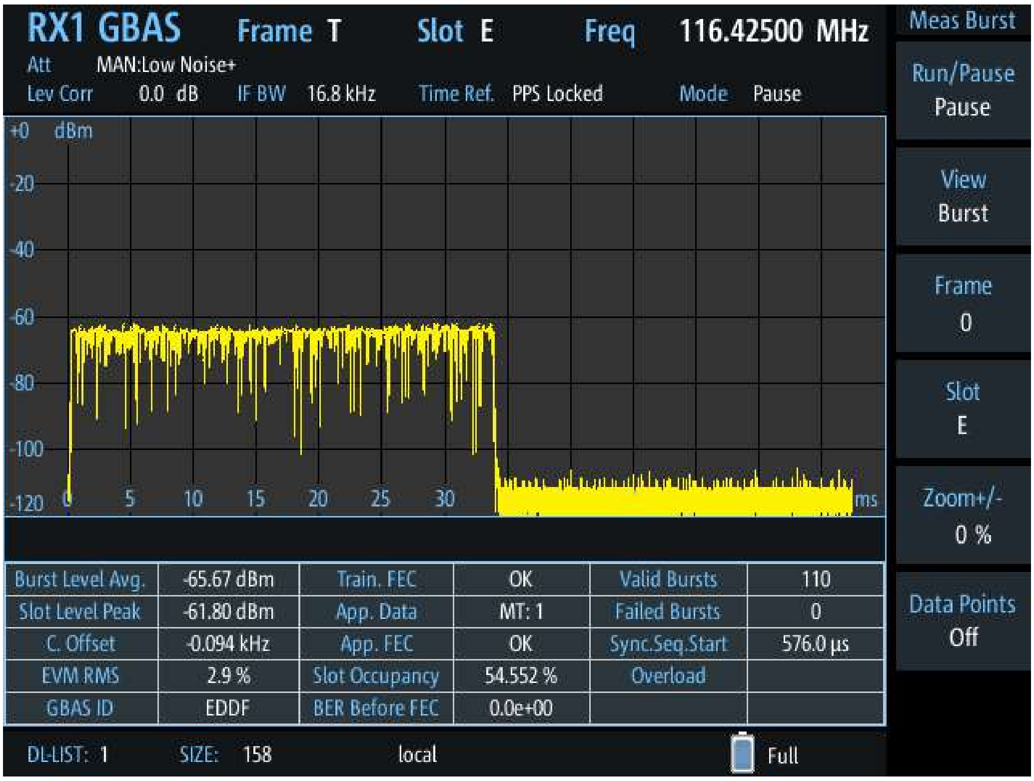


Figure 6-4: Example for a "Burst" view with a diagram and result table

By default, the first slot (A) from the most recently measured frame T is selected. To display the results for a different slot, use the Frame and Slot functions.

The display is updated each time a complete slot has been measured, that is: every 62.5 ms. To freeze the current display for evaluation, you can pause the view update (see "Run/Pause" on page 175). Data recording and streaming, however, continue as usual. When updating is resumed, the displayed results in the view are updated.

The "Burst" view contains two different displays:

- Chapter 6.4.3.1, "Slot power vs. time diagram", on page 168
- Chapter 6.4.3.2, "Slot results table", on page 169

6.4.3.1 Slot power vs. time diagram

A power vs. time diagram displays the measured power in the slot per time, normalized to the PPS signal. The x-axis shows the time in milliseconds. It always starts at 0 seconds or a multiple of 62.5 milliseconds. The default range is 62.5 milliseconds. If a TDMA timing error occurs, the GBAS/SCAT burst can exceed the displayed time range.

The measured power is indicated for a range of -120 dBm to 0 dBm on the y-axis.

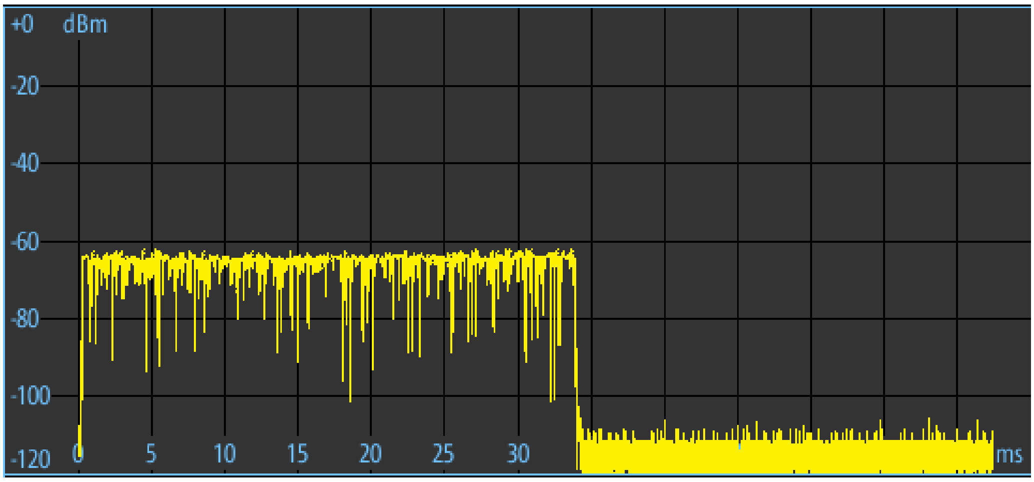


Figure 6-5: Power vs. time diagram for a slot in Burst view

The following functions are available for the slot power vs. time diagram:

Zoom +/ Zoom -
Changes the time range displayed in the diagram to view more details in a slot ("Zoom +") or outside of the slot ("Zoom -").

Data points
Shows or hides dots in the diagram indicating the measured data points.

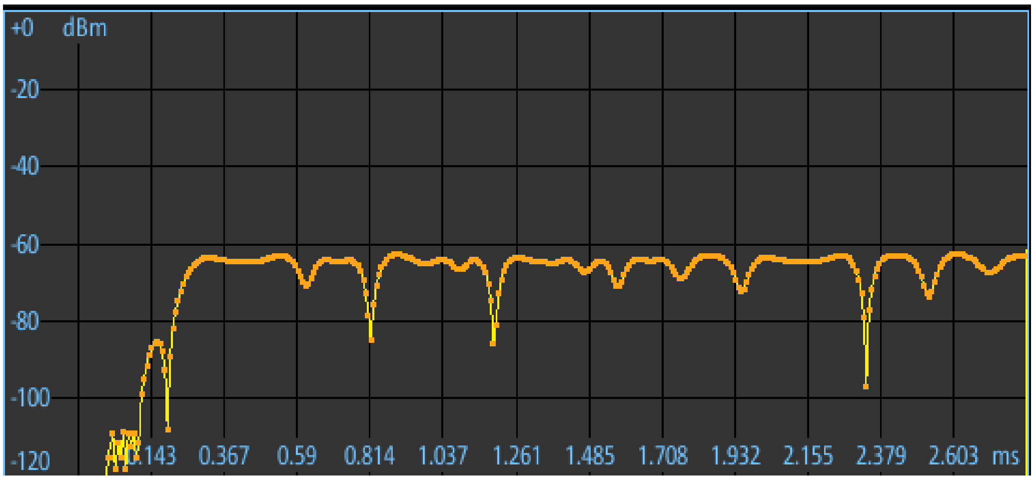


Figure 6-6: Power vs. time diagram with highlighted data points

6.4.3.2 Slot results table

In the slot results table, the slot details for the selected slot are displayed. The results are the same as those displayed in the Frame results table.

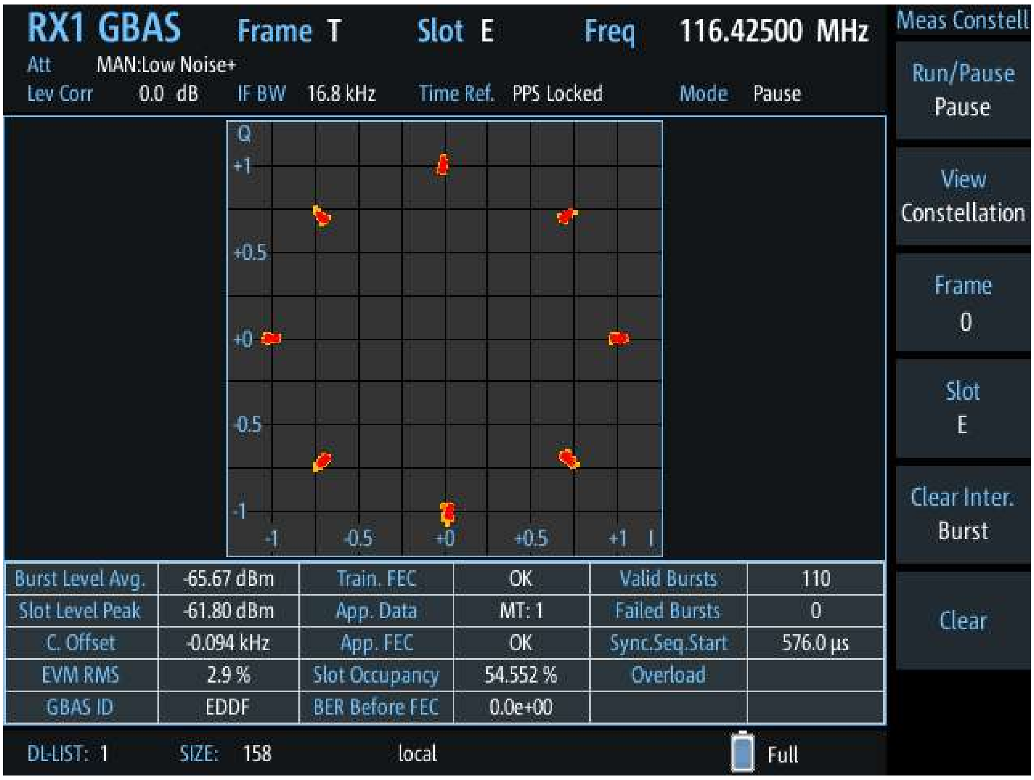
Burst Level Avg.	-65.67 dBm	Train. FEC	OK	Valid Bursts	110
Slot Level Peak	-61.80 dBm	App. Data	MT: 1	Failed Bursts	0
C. Offset	-0.094 kHz	App. FEC	OK	Sync.Seq.Start	576.0 µs
EVM RMS	2.9 %	Slot Occupancy	54.552 %	Overload	
GBAS ID	EDDF	BER Before FEC	0.0e+00		

If no valid burst is detected in the slot, the slot results table shows only the measured noise level.

6.4.4 Constellation view

Access: [Meas] > "View" > "Constell. view"

The "Constellation" view consists of a constellation diagram and the measured values for the individual slot (see Chapter 6.4.2.2, "Frame results table", on page 165).



The constellation diagram shows the in-phase and quadrature components of the received D8PSK symbols in the slot. The in-phase components (I) are displayed on the x-axis, the quadrature (Q) components on the y-axis.

The eight ideal constellation points for D8PSK modulation are indicated by red dots.

The following functions are available for the constellation diagram:

Clear Inter.

Determines the interval after which the constellation diagram is cleared automatically.

"Off"	(Default:) All constellation points from all bursts are displayed in the same diagram, no automatic clearance.
"Burst"	After each burst, the diagram is cleared and a new constellation diagram is displayed.

Clear

Clears all points from previous bursts in the constellation diagram and starts a new diagram.

6.4.5 Message view

Access: [Meas] > "View" > "Message view"

The "Message" view shows the messages received during a single slot or burst. In addition to the message itself, the header and footer are analyzed. If the burst contains multiple messages, they are listed in the table one after the other.

The data is interpreted from the received burst bitstream according to rules and data definitions configured in XML files. You can configure the information provided in the "Message" view table using the message xml interface (see Chapter 6.6, "Message XML interface", on page 178).

For each type of data content, a separate row is displayed with the following information:

- "Data content": textual description of the type of information
- "Bits": number of bits from the burst bitstream that were evaluated to obtain the information
- "Value": result of the interpreted bits
- "Binary representation": the raw data in the evaluated bits

Use the arrow keys and the rotary knob to scroll through the table.

6.4.6 Recording view

Access: [Meas] > "View" > "Rec."

The Recording view displays the recorded data for GBAS/SCAT-I measurements from the selected data list (see "List" on page 202). If available, the stored GNSS data from the GNSS receiver is also displayed.

The individual measurement results are described in Chapter 6.4.2.2, "Frame results table", on page 165.

Recording GBAS/SCAT-I measurement results

When recording data in GBAS/SCAT-I mode, one record is stored for each slot, with a duration of 62.5 ms. The record contains measurement values and message data. Recording is continued even if the display update is temporarily stopped (by the "Pause" function, see "Run/Pause" on page 175). Start and stop recording from any measurement view using the [Record] key. Record only the selected and currently displayed slot or frame using the [Single] key.

You can define which data is stored; see Chapter 7.2.3, "Recording settings", on page 202.

For details on data logging, see Chapter 7.2, "Recording measurement data", on page 200.

Status flags

The "STIOCPMV" value contains status flags, if applicable:

- **S**: Start (started manually)
- **T**: Triggered (externally)
- **I**: Invalid
- **O**: Overload (RF input signal too high)
- **C**: Corrected (includes RF input correction factor)
- **P**: PPS-synced
- **M**: Morse ID available
- **V**: Valid signal (ILS LOC/GP and VOR only)

The following functions are available to configure the "Recording" view.

DL Line

Selects a particular line (record) in the data recording file.

-> Rec. Burst View / -> Rec. Const. View / -> Rec. Msg. View

Displays the selected data record in detail in the selected view. Message view is only available if message data was stored in the data record.

To return to the "Recording" view, select "-> Return".

6.5 GBAS/ SCAT-I measurement configuration

The following settings are available for GBAS/ SCAT-I measurements.

Settings for recording are described in Chapter 7.2, "Recording measurement data", on page 200.

6.5.1 View configuration

The following functions are available to configure the GBAS/ SCAT-I views except for the "Recording" view.

Access VNC: [A]

Run/Pause
Stops and resumes the display update. Data recording and streaming continue as usual. When updating is resumed, the display reflects the latest results again.

View
Switches between
- Sequence view
- Frame view
- Burst view
- Constellation view
- Message view
- Recording view

Frame
Selects the frame to be displayed in the power vs. time diagram and at the top of the results table. By changing the frame number, for example using the rotary knob, you can scroll through the frames in the table and through the most recent 40 frames in the diagram.

Slot
Selects the slot to be displayed in the power vs. time diagram and at the top of the results table. By changing the slot name, for example using the rotary knob, you can scroll through the slots in the table and in the diagram.

Remote command:
GBAS:SEQN_SLOT on page 324

6.5.2 Frequency configuration

Access VNC: [Q] > [F2]

Frequency (Freq)
The channel frequency that determines the carrier frequency at which the measurement is performed.

The VHF data broadcast is defined for carrier frequencies within the range of 108.025 MHz to 117.950 MHz with a channel spacing of 25 kHz.

Remote command:
GBAS:FREQRF on page 323

6.5.3 Amplitude configuration

Access VNC: [w]

The following settings define the amplification for the input signal.

RF Att
Determines whether the RF attenuation is defined automatically or manually.

"Manual" Select the RF Mode manually.
For signals with mostly constant signal levels, it is recommended that you select the optimal mode manually.

"Auto" The optimal mode is selected automatically according to the input signal strength.
In difficult receiving conditions, for example the presence of high-level interferers or areas with strong multi-path conditions, selecting the suitable attenuation mode manually can lead to more stable measurement results.
If the R&S EVSF1000 has to adapt the attenuation frequently, indicated by a frequent clicking noise from the attenuator, spikes can occur in the trace.

Remote command:
`GBAS:ATTMODE AUTO`, see `GBAS:ATTMODE` on page 321

RF Mode
Defines the RF attenuation mode to be used.

"Low Noise" 15 dB pre-amplification
Provides a high sensitivity. Suitable when scanning the area for distant signals.

"Norm" 0 dB
Provides a normal sensitivity.

"Low Dist" 15 dB attenuation
Provides a low sensitivity. Suitable when analyzing a nearby signal, to avoid overload due to high-level signals.

Remote command:
`GBAS:ATTMODE` on page 321

6.5.4 Bandwidth configuration

Access VNC: [e]

IF Filter
The IF filter determines the bandwidth on which the measurement is performed. The default filter bandwidth is 16.8 kHz. For GBAS/SCAT-I measurements, the complete channel bandwidth is 25 kHz.

6.5.5 General configuration

Access VNC: [S]

PPS SRC
Source of the PPS signal required as a time reference

"PPS SMA"	Signal provided at the PPS In connector
"PPS GPS"	Signal provided at the RS232-GPS connector

Export xml
Exports the internal message type xml definition to a connected USB storage device (see Chapter 6.6, "Message XML interface", on page 178).

Exporting the xml definition is useful to create a customized definition without having to start from an empty file.

Import xml
Imports a customized message type xml definition from a connected USB storage device to the R&S EVSF1000 (see Chapter 6.6, "Message XML interface", on page 178).

Note that this definition is only used if you set DEC DEF to "Custom".

DEC DEF
Determines which message type xml definition that the decoder uses.

"Default"	Uses the definition stored internally on the R&S EVSF1000
"Custom"	Uses the imported definition (see "Import xml" on page 177).

Reset BER
Resets the values for the following measurement results:

- "Bit error rate (BER) before FEC" on page 167
- "Valid Bursts (Valid B.)" on page 167
- "Failed Bursts (Failed B.)" on page 167

Remote command:
`GBAS:RESETBER` on page 330

EVM Mode
Determines the mode of EVM calculation for baseband input in "GBAS" mode.

"ANGLE"	Only angle deviations are considered in EVM calculation.
"NORM"	Both angle and amplitude deviation are considered in EVM calculation.

Remote command:
`GBAS:EVM_ANGLE_NORM` on page 322

6.6 Message XML interface

The R&S EVSG-K4 GBAS analysis / R&S EVSG-K5 SCAT-I Analysis options receive and analyze VDB GBAS transmissions according to ICAO AN10 Vol1 [3] and RTCA DO-246 [1]. Analysis includes physical measurement values such as level, frequency or EVM. The results can be displayed or recorded. A bitstream is also provided with each transmission (*burst*). The bitstream contains the digital information required by a GNSS receiver for its calculations. To display this information in human-readable format, the bitstream needs to be interpreted as described in the document.

The R&S EVSG-K4 GBAS analysis / R&S EVSG-K5 SCAT-I Analysis options provide a special parser that transforms the data efficiently, controlled by a set of XML files. The XML files contain the rules and data definitions for conversion and are loaded during runtime. The converted, human-readable data is then displayed in the "Message" view (see Chapter 6.4.5, "Message view", on page 171).

You can edit the XML control files with any text editor to obtain specific outputs, for example, or to accommodate the output to changes in the specifications. However, a good knowledge of the ICAO AN10 Vol1 [3] and RTCA DO-217 [2] specifications is essential to understand the transformation process.

The R&S EVSF1000 provides a default set of XML files for an initial message type definition. These files are stored internally on the instrument. You can export the files to a USB storage device and import the customized files back to the R&S EVSF1000 (see "Import xml" on page 177).

To customize the "Message" view results

1. Connect a USB storage device to the R&S EVSF1000.
2. Select [Config] > "Export xml".

   The required file structure and files are stored on the storage device.
3. Edit the files as required. See the descriptions below for more information.
4. Select [Config] > "Import xml".

   The edited files are stored on the R&S EVSF1000.
5. Select [Config] > "DEC DEF" > "Custom".

   The R&S EVSF1000 decoder uses the edited, imported message definition and displays the defined results in the "Message" view.

6.6.1 General processing

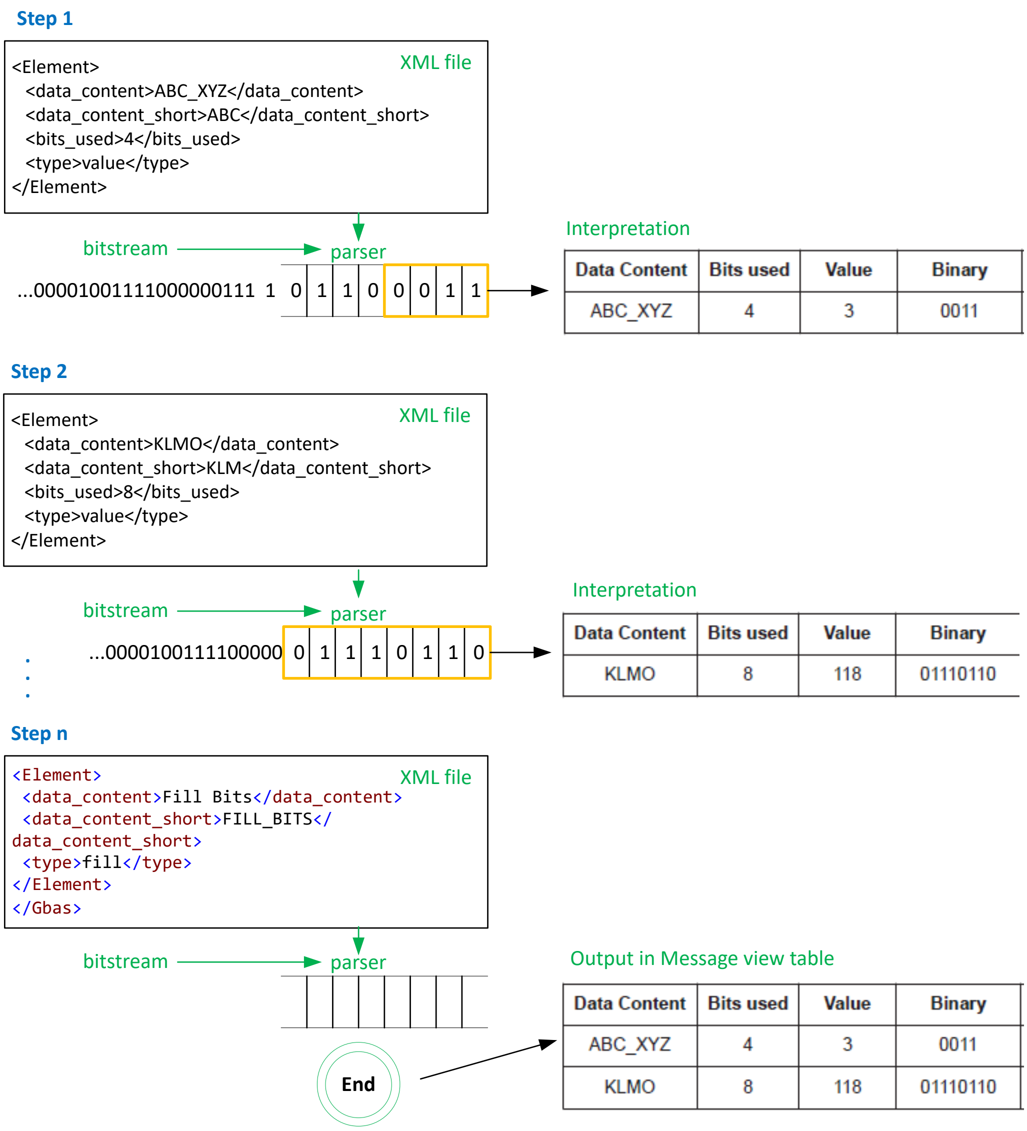
The parser in the GBAS/SCAT-I application uses the first message control XML file as instructions for processing. As input, it receives a bitstream from the GBAS burst in the input signal.

The general process of interpreting the bitstream consists of the following steps:

1. The parser applies the first instruction on the leading bits of the bitstream, which usually produces a value or text as output.
2. The parser applies the next instruction on the subsequent bits of the bitstream.

   As a result, either an output is produced, or further instructions are provided. Further instructions can be provided in additional XML files, or depend on the current bitstream value, or on a previous value (see "Control elements" on page 181).
3. The parser continues to process the instructions as defined in the XML file, applying them to the subsequent, not-yet-processed bits of the bitstream.
4. When the end of the last XML file has been processed, the parser stops.

   The converted, human-readable data is displayed in the "Message" view.



6.6.2 Output elements and control elements

Different types of elements are supported to interpret all existing values in a GBAS burst. However, the types are generic and can be configured to handle other values, as well.

Many elements simply convert a binary value in the bitstream to human-readable output for the "Message" view table. Conversion in this case can consist of various different instructions, such as:

- Comparing bitstrings and providing a check result
- Converting binary values to decimal values
- Converting binary values to text descriptions

For different instructions, you must define different element types.

Example: Interpretation of a "fixed"-type element

The `fixed`-type element expects a certain number of bits to have a specific value. If the incoming bitstream matches, the result value is `OK`, otherwise it is `NOK`.

The result of the interpretation on the R&S EVSF1000 is a table similar to the examples in DO246, in this case:

Table 6-1: Output in Message view table

Data Content	Bits used	Value	Binary
Power stabilization	15	OK	000000000000000
Sync. and ambiguity resolution	48	OK	0100011111011111 1000110001110110 0000011110010000

All available element types are described in Chapter 6.6.4, "Format description of elements", on page 185.

Control elements

Each GBAS burst can contain one or more messages. The messages have different message types with different content. The content of the same message type can depend on certain parameters which are only known during runtime. Therefore, control elements such as a case-dependent branch to a further XML file are supported.

Example: Case-dependent processing

This example shows how the parser is directed to different instructions, which are stored in additional XML files, depending on the determined message type:

```
<Element>
   <data_content>Message</data_content>
   <data_content_short>MSG</data_content_short>
   <type>link_sel</type>
   <link_sel>MTI</link_sel>
   <link_case>
   <value>1</value>
   <link>GbasMsgType1.xml</link>
   </link_case>
   <link_case>
   <value>2</value>
   <link>GbasMsgType2.xml</link>
   </link_case>
   <link_case>
   <value>4</value>
   <link>GbasMsgType4.xml</link>
   </link_case>
</Element>
```

The additional XML files have the same format and supported elements. They can branch to even more files, there is no limit to how deeply the files are nested.

Further control elements implement loops which repeat sequences for several repetitions ("for"-loop) or while there is enough data left ("while"-loop).

Control elements can also contain references to previous elements, that is: to results obtained in previous instruction steps. References are defined using the element's unique identifier, which is a mandatory part of each element.

Using links and loops, the parser can navigate through the entire bitstream.

Parser results

The result of the interpreted bitstream is a comma-separated list of values which is displayed in the "Message" view (see Chapter 6.4.5, "Message view", on page 171).

Recording GBAS data

When you record and export the results of a GBAS measurement, all measured values and the bitstream for each record are stored as a comma-separated list. This basic CSV file contains a data link for each record in the list. The link points to a further CSV file which contains all human-readable texts for that record. All data files for the current recording are stored in a subdirectory that is exported together with the basic CSV file. The file with the human-readable text values contains the data that is displayed in the "Message" view.

Example:

One row of data from the basic CSV file for list number 20 (`gbas_rx1_list20.csv`):

```
1,,3,18.09.2018,14:29:57.844,D,108.0000,0.000,-8.15,-4.63,-,7.0,CMJ ,NOK,4,NOK,
0.0e+00,882,-.-,-.-,-.-,20.553,481.0,00° 00.00000000' N,00° 00.00000000' E,0.00,0.00,
--.--.----,--.--.--.---,0,NO GPS,NO GPS,--,--,--,MAN:Norm,0,1 82 30 00 55 05 4B 30 20
 3A 94 0F F0 40 60 30 F2 98 C0 C8 40 28 E0 61 47 5D 48 09 7B C9 00 AD D8 33 3C BF 34
 07 40 AA 81 34 80 26 00 B2 15 A5 45 26 13 94 08 F0 40 60 30 86 90 A8 04 70 28 E0 3D
 83 ED 48 38 C5 E9 00 4B D8 DF 46 40 3C 21 BF 8C 81 B4 80 26 00 EB 05 B2 F5 26 13 D9
 7F C0 EA A1 A4 3D 54 89 D8 00 00 ,=HYPERLINK("gbas_rx1_list20/MSG000003_D.csv")
```

Extract of data file `gbas_rx1_list20/MSG000003_D.csv`:

```
Name,Type,bits used,Value,Unit,binary
Power Stabilization,fixed,15,OK,,000000000000000
Sync. and Amb. Resolution,fixed,48,OK,,010001111101111110001100011101100000011110010000
```

Table 6-2: Output in Message view table

Data Content	Bits used	Value	Binary
Power stabilization	15	OK	000000000000000
Sync. and ambiguity resolution	48	OK	010001111101111110001100011101100000011110010000

6.6.3 XML file format description

The GBAS/SCAT-I message interpretation files comprise at least the following XML files:

- **`Burst.xml`**: describes the basic structure of a message and is identical for all messages.
  This is the basic (root) file for interpretation.
- **`GbasMsgBlock.xml`**: describes the LAAS message block.
  This file is referred to by `Burst.xml` and can refer to further XML files.
- **`GbasMsgType<x>.xml`**: describes each message type in an individual file.
  These files are referred to by `Burst.xml` and can refer to further XML files.

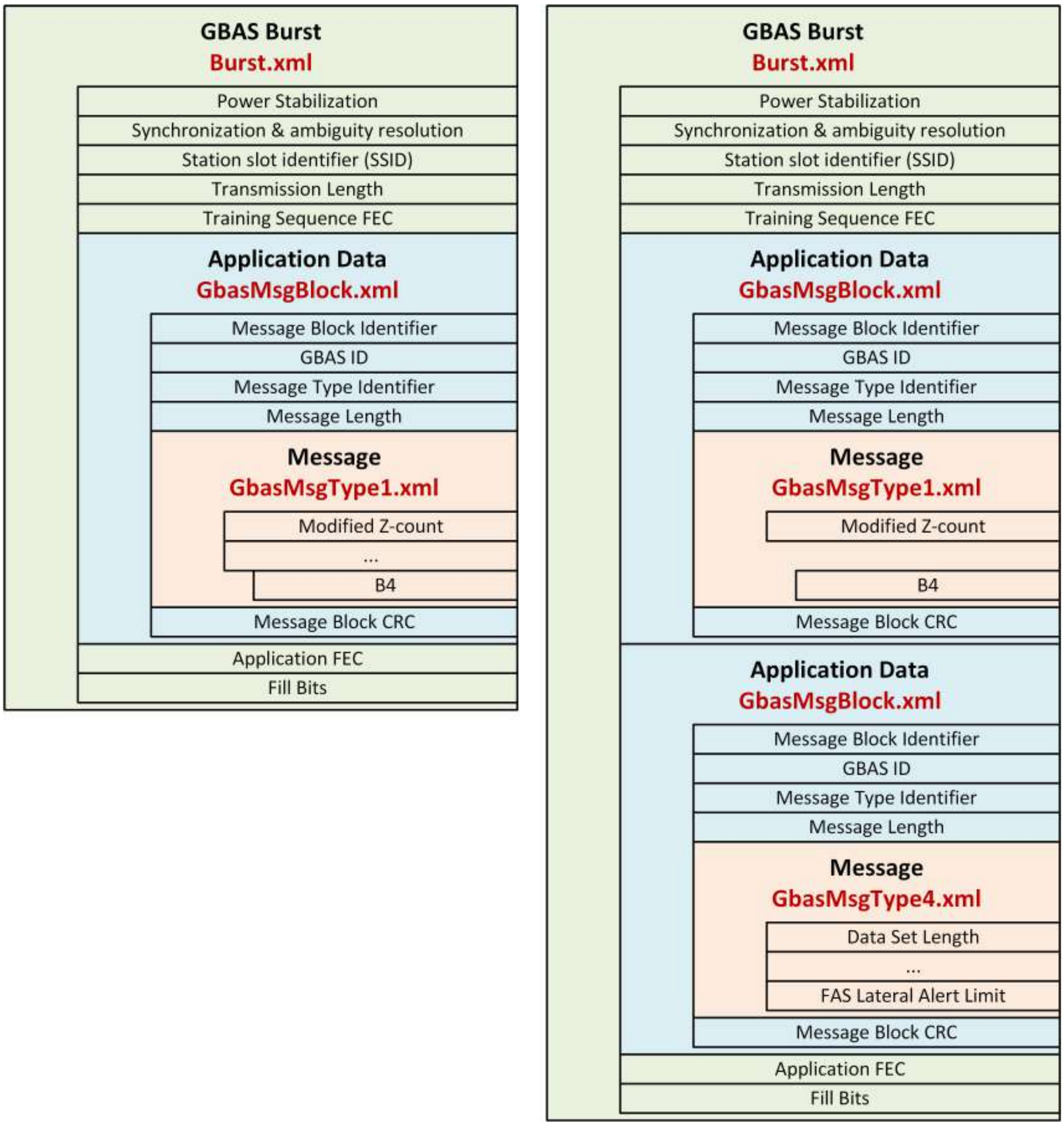


Figure 6-7: Examples for xml message interpretation files; left: message type 1; right: message types 1 and 4

The GBAS/SCAT-I option provides XML files for all currently supported GBAS/SCAT-I message types, as shown in Table 6-3.

Table 6-3: Provided XML files for GBAS/SCAT-I message types

Message type	Description	Reference
GBAS-MT1	Pseudo-range corrections – 100 second smoothed pseudo-ranges.	ICAO AN10 Vol1 / RTCA DO-246
GBAS-MT2	GBAS-related data.	ICAO AN10 Vol1 / RTCA DO-246
GBAS-MT4	Final approach segment (FAS) data.	ICAO AN10 Vol1 / RTCA DO-246
GBAS-MT11	Pseudo-range corrections – 30 second smoothed pseudo-ranges.	ICAO AN10 Vol1 / RTCA DO-246
SCAT-I-MT1		RTCA DO-217
SCAT-I-MT4		RTCA DO-217

Burst.xml

Each GBAS bitstream consists of several elements. The first elements are the same for all bursts:

- Power stabilization (15 bits)
- Synchronicity & ambiguity resolution (48 bits)
- SSID (3 bits)
- Transmission length (17 bits)
- ...

This general information is provided in the `Burst.xml` file, which is the start file for conversion. The root element in this file is `<Gbas>`, which means the file starts with `<Gbas>` and ends with `</Gbas>`.

Within the `<Gbas>` element, a definition for each subelement (`<Element>`) is provided.

Example: Element definition in burst.xml file

```
<Gbas>
   <Element>
   <data_content>Power Stabilization</data_content>
   <data_content_short>POW_STAB</data_content_short>
   <bits>000000000000000</bits>
   <type>fixed</type>
   </Element>
   <Element>
   <data_content>Sync. and Amb. Resolution</data_content>
   <data_content_short>SYNC_AMB_RES</data_content_short>
   <bits>000010011111000000110111000110001111101111100010</bits>
   <type>fixed</type>
   </Element>
   ...
</Gbas>
```

The format of the individual elements is described in the following sections.

6.6.4 Format description of elements

Different types of elements are supported to interpret all existing values in a GBAS burst. However, the types are generic can be configured to handle other values, as well.

Each `<Element>` in the XML file must have the following subelements:

Table 6-4: Mandatory subelements

Name	Description
`<data_content>`	Text that describes the content, usually the description from the DO246 document
`<data_content_short>`	A short description or unique keyword used to reference the element. Select the name carefully - changing the name later can cause errors in the functionality of other elements
`<type>`	Determines how the parser processes the element

The element type determines how the data is interpreted. Depending on the `<type>`, further elements can be mandatory.

6.6.5 Output elements

6.6.5.1 Unsigned type

Interprets the value in a given number of bits as an unsigned (positive) integer value in decimal format

Table 6-5: Mandatory subelements

Name	Description
`<bits_used>`	Static number of bits

Table 6-6: Optional subelements

Name		Description
<resolution>		Determines the resolution of the element contents, e.g. a result value. The value is multiplied with the <resolution> factor to obtain the output result. Note that the number of decimals of the <resolution> factor also defines the number of decimals in the result. (Default: 1)
<unit>		Additional unit which is appended to the result
<special>		Special text that is provided as a result instead of using the value and resolution
	<value>	Actual result value
	<name>	Provided result text

Example:

```
<Element>
   <data_content>Source Availability Duration</data_content>
   <data_content_short>SRC_DUR</data_content_short>
   <bits_used>8</bits_used>
   <type>unsigned</type>
   <special>   <value>254</value>   <name>&gt;2540</name>   </special>
   <special>   <value>255</value>   <name>not   provided</name>   </special>
   <resolution>10</resolution>
   <unit>s</unit>
</Element>
```

6.6.5.2 Signed type

Interprets the value in a given number of bits as a signed integer value in decimal format

Table 6-7: Mandatory subelements

Name	Description
<bits_used>	Static number of bits

Table 6-8: Optional subelements

Name	Description
<resolution>	Determines the resolution of the element contents, e.g. a result value. The value is multiplied with the <resolution> factor to obtain the output result. Note that the number of decimals of the <resolution> factor also defines the number of decimals in the result. (Default: 1)
<unit>	Additional unit which is appended to the result
<special>	Special text that is provided as a result instead of using the value and resolution

Name		Description
	<value>	Actual result value
	<name>	Provided result text

Example:

```
<Element>
   <data_content>Pseudorange  Correction  (PRC)</data_content>
   <data_content_short>PRC</data_content_short>
   <bits_used>16</bits_used>
   <type>signed</type>
   <resolution>0.01</resolution>
   <unit>m</unit>
</Element>
```

6.6.5.3 Longitude type

Like a signed value, but output is formatted in <degree>-<minute>-<second> format, with "E" = East for positive and "W" = West for negative values

Table 6-9: Mandatory subelements

Name	Description
<bits_used>	Static number of bits

Table 6-10: Optional subelements

Name		Description
<resolution>		Determines the resolution of the element contents, e.g. a result value. The value is multiplied with the <resolution> factor to obtain the output result. Note that the number of decimals of the <resolution> factor also defines the number of decimals in the result. (Default: 1)
<unit>		Additional unit which is appended to the result
<special>		Special text that is provided as a result instead of using the value and resolution
	<value>	Actual result value
	<name>	Provided result text

Example:

```
<Element>
   <data_content>Longitude</data_content>
   <data_content_short>Long</data_content_short>
   <bits_used>32</bits_used>
   <type>long</type>
   <resolution>0.0005</resolution>
</Element>
```

Table 6-11: Output in Message view table

Data Content	Bits used	Value	Binary
Longitude	32	W93°25'13.0000"	11010111111010001000101010110000

6.6.5.4 Latitude type

Like a signed value, but output is formatted in degree-minute-second format, with "E" = East for positive and "W" = West for negative values

Table 6-12: Mandatory subelements

Name	Description
`<bits_used>`	Static number of bits

Table 6-13: Optional subelements

Name		Description
`<resolution>`		Determines the resolution of the element contents, e.g. a result value. The value is multiplied with the <resolution> factor to obtain the output result. Note that the number of decimals of the <resolution> factor also defines the number of decimals in the result. (Default: 1)
`<unit>`		Additional unit which is appended to the result
`<special>`		Special text that is provided as a result instead of using the value and resolution
	`<value>`	Actual result value
	`<name>`	Provided result text

Example:

```
<Element>
   <data_content>Latitude</data_content>
   <data_content_short>Lat</data_content_short>
   <bits_used>32</bits_used>
   <type>lat</type>
   <resolution>0.0005</resolution>
</Element>
```

Table 6-14: Output in Message view table

Data Content	Bits used	Value	Binary
Latitude	32	N45°40'32.0000"	00010011100110100001000100000000

6.6.5.5 Id type

Decodes the unique airport ID which consists of 4 characters, coded in 24 bits.

Example:

```
<Element>
   <data_content>GBAS ID</data_content>
   <data_content_short>GBAS_ID</data_content_short>
   <type>id</type>
   </Element>
```

6.6.5.6 Fixed type

The `fixed`-type element expects a certain number of bits to have a specific value. If the incoming bitstream matches, the result value is `OK`, otherwise it is `NOK`.

Table 6-15: Mandatory subelements

Name	Description
`<bits>`	Binary bitstream content made of 0 and 1

Example:

```
<Element>
   <data_content>Reserved and Zero</data_content>
   <data_content_short>Zeroes</data_content_short>
   <bits>00000</bits>
   <type>fixed</type>
</Element>
```

6.6.5.7 Value type

Binary data without evaluation. Used to document content when a numerical interpretation does not make sense.

Table 6-16: Mandatory subelements

Name	Description
`<bits_used>`	Static number of bits

Example:

```
<Element>
   <data_content>Ephemeris   CRC   LSB</data_content>
   <data_content_short>EPH_CRC_LSB</data_content_short>
   <bits_used>8</bits_used>
   <type>value</type>
</Element>
```

6.6.5.8 FEC type

Binary data without evaluation.

Table 6-17: Mandatory subelements

Name	Description
`<bits_used>`	Static number of bits

Example:

```
<Element>
   <data_content>Ephemeris   CRC   LSB</data_content>
   <data_content_short>EPH_CRC_LSB</data_content_short>
   <bits_used>8</bits_used>
   <type>value</type>
</Element>
```

6.6.5.9 CRC type

Calculates a checksum and compares it with the given value. Evaluates to `OK` or `NOK`.

Table 6-18: Mandatory subelements

Name	Description
`<bits_used>`	Static number of bits
`<start>`	Reference (`<data_content_short>`) to the element at which the checksum calculation starts

Example:

```
<Element>
   <data_content>Message Block CRC</data_content>
   <data_content_short>MSG_B_CRC</data_content_short>
   <bits_used>32</bits_used>
   <start>MBI</start>
   <type>crc</type>
</Element>
```

Table 6-19: Output in Message view table

Data Content	Bits used	Value	Binary
Message Block CRC	32	OK	11100000011100100001110100100100

6.6.5.10 List type

Converts different integer values to text output

Requires a `<list>` subelement for each pair of `<name>` and `<value>`.

Table 6-20: Mandatory subelements

Name		Description
`<bits_used>`		Static number of bits
`<list>`		Pair of `<name>` and <value> subelements; Multiple `<list>` elements allowed
	`<name>`	Provided result text
	`<value>`	Result value (integer) For last entry in list also `default`; Default applies if no other case does

Example:

```
<Element>
   <data_content>Message Block Identifier</data_content>
   <data_content_short>MBI</data_content_short>
   <bits_used>8</bits_used>
   <type>list</type>
       <list>
           <name>normal</name>
           <value>170</value>
       </list>
       <list>
           <name>test</name>
           <value>255</value>
       </list>
       <list>
           <name>invalid   MBI</name>
           <value>default</value>
       </list>
</Element>
```

6.6.5.11 Enum type

Converts each different result value to an output text. Requires an <enum> subelement for each possible result value. If there are undefined values, use the `list` type.

Table 6-21: Mandatory subelements

Name		Description
<bits_used>		Static number of bits
<enum>		Texts to be output for specific number values; Multiple <enum> elements allowed and required The number of <enum> subelements must equal the number of possible results for the number of <bits_used>. Number values are implicitly defined as the order number of the <enum> subelement and start at 0.
	<name>	Provided result text

Example:

```
<Element>
   <data_content>Ground   Station   Accuracy   Designator</data_content>
   <data_content_short>GStAccDes</data_content_short>
   <bits_used>2</bits_used>
   <type>enum</type>
   <enum> <name>A</name>    </enum>
   <enum> <name>B</name>    </enum>
   <enum> <name>C</name>    </enum>
   <enum> <name>spare</name></enum>
</Element>
```

6.6.5.12 Dummy type

No evaluation, but the binary content is documented, and the parser continues with the next element.

Can be used when there are unknown contents whose length is known.

Table 6-22: Mandatory subelements

Name	Description
<Length>	Previous element (<data_content_short>) that contains the length of the unknown elements in bit.
<Start>	Previous element (<data_content_short>) after which the length count starts

Example:

Example for a dummy that reads additional MT2 block without further definition.

```
<Element>
   <data_content>Unknown Additional Block</data_content>
   <data_content_short>UnBlk</data_content_short>
   <type>dummy</type>
   <Length>AddBlkLen</Length>
   <Start>AddBlkLen</Start>
</Element>
```

6.6.6 Control elements

6.6.6.1 Link_sel type

Depending on the result of the selected element, processing continues with the specified element or subprocess.

Requires a <link_sel> and one or more <link_case> subelements.

Table 6-23: Mandatory subelements

Name	Description
<link_sel>	Reference (<data_content_short>) to a previous element whose value determines further processing; If no <link_sel> subelement is provided and only one <link_case> subelement, processing always continues with the referenced element.
<link_case>	Possible case of further processing

Name		Description
	`<value>`	Integer value or `default` If the value of the `<link_sel>` subelement corresponds to this value, processing continues with this `<link_case>`. Default applies if no other case does
	`<link>` | `<sub>`	Reference to the element (`<data_content_short>`) or a file with which processing continues Subprocess containing further elements to be processed

Example: Link selector with files and a default value

```
<Element>
   <data_content>Message</data_content>
   <data_content_short>MSG</data_content_short>
   <type>link_sel</type>
   <link_sel>MTI</link_sel>
   <link_case><value>1</value><link>GbasMsgType1.xml</link></link_case>
   <link_case><value>2</value><link>GbasMsgType2.xml</link></link_case>
   <link_case><value>4</value><link>GbasMsgType4.xml</link></link_case>
   <link_case><value>default</value><link>GbasMsgTypeX.xml</link></link_case>
</Element>
```

Example: Link selector with a direct link

With only one link and no decisive value, processing continues with the given file.

```
<Element>
   <data_content>Message Block Header</data_content>
   <data_content_short>MB_HEAD</data_content_short>
   <type>link_sel</type>
   <link_case>
   <link>GbasMsgBlock.xml</link>
   </link_case>
</Element>
```

Example: Link selector with subdefinitions

```
<Element>
  <data_content>Additional Data Block</data_content>
  <data_content_short>AddBlk</data_content_short>
  <type>link_sel</type>
  <link_sel>AddBlkNum</link_sel>
     <link_case>
     <value>2</value>
     <sub>
        <Element>
          <data_content>Channel Number</data_content>
          <data_content_short>ChNum</data_content_short>
          <bits_used>16</bits_used>
          <type>unsigned</type>
        </Element>
        <Element>
          <data_content>Delta Latitude</data_content>
          <data_content_short>DLat</data_content_short>
          <bits_used>8</bits_used>
          <type>signed</type>
          <resolution>0.2</resolution>
          <unit>°</unit>
        </Element>
…
      </link_case>
      <link_case>
      <value>3</value>
      <sub>
         <Element>
          <data_content>K md e D GPS</data_content>
          <data_content_short>KmdeDGps</data_content_short>
          <bits_used>8</bits_used>
          <type>unsigned</type>
          <resolution>0.05</resolution>
          <unit></unit>
        </Element>
        <Element>
          <data_content>K md e D GLONASS</data_content>
          <data_content_short>KmdeDGlo</data_content_short>
          <bits_used>8</bits_used>
          <type>unsigned</type>
          <resolution>0.05</resolution>
          <unit></unit>
        </Element>
…
     </link_case>
</Element>
```

6.6.6.2 Loop type

Repeats the included elements for a given number of times;

Table 6-24: Mandatory subelements

Name	Description
`<NUM>`	Only for type `loop`: Reference to the element (`<data_content_short>`) whose value determines the number of processing repetitions
`<loop>`	Only for type `loop`: Subprocess containing further elements to be processed within a loop

Example:

Abbreviated example for a loop over the MT1-satellites:

```
<Element>
   <data_content>Measurement   Block</data_content>
   <data_content_short>MSG_BLK</data_content_short>
   <type>loop</type>
   <NUM>NOF_M</NUM>
   <Loop>
   <Element>
   <data_content>Ranging   Source   ID</data_content>
   <data_content_short>Z_COUNT</data_content_short>
   <bits_used>8</bits_used>
   <type>unsigned</type>
   <resolution>1</resolution>
   </Element>
   <Element>
   <data_content>Issue   of   Data   (IOD)</data_content>
   ...   </Element>
   </Loop>
</Element>
```

6.6.6.3 While type

Repeats the included elements while there are enough bits left to proceed;

Table 6-25: Mandatory subelements

Name	Description
`<BitsLeft>`	Number of bits required at the end of the loop to perform the next cycle (minimum+1 required); otherwise loop is finished
`<TrLen>`	Previous element that contains the transmission length in bit. Sometimes the transmission length is provided in bytes; in this case, make sure the resolution of that previous element is set to 8 to convert its value to bits
`<TrStart>`	Previous element at which the transmission length begins to count bits
`<loop>`	Subprocess containing further elements to be processed within a loop

Example:

Example of a "while" loop that repeats the message block as long as there are more than 48 bits left:

```
<Element>
   <data_content>Message   Block</data_content>
   <data_content_short>MSG_BLOCK</data_content_short>
   <type>while</type>
   <BitsLeft>48</BitsLeft>
   <TrLen>TRANS_L</TrLen>
   <TrStart>MSG_BLOCK</TrStart>
   <Loop>
        <Element>
        <data_content>Message   Block   Header</data_content>
        <data_content_short>MB_HEAD</data_content_short>
        <type>link_sel</type>
        <link_case>
          <link>GbasMsgBlock.xml</link>
        </link_case>
        </Element>
   </Loop>
</Element>
```

6.6.7 Auxiliary elements

6.6.7.1 Fill type

Used for the transmission end. It determines the number of bits that are left in the data stream. This number is usually 0. Otherwise the `<fill>` element indicates how many bits are still available at the end of the transmission.

Example:

```
<Element>
   <data_content>Fill Bits</data_content>
   <data_content_short>FILL_BITS</data_content_short>
   <type>fill</type>
</Element>
```

7 Data management

The R&S EVSF1000 allows you to store and load measurement settings, and export measurement data for analysis later. Finally, you can store the measurement results displayed on the screen.

7.1 Storing and recalling measurement settings (preset)

Possibly you would like to restore or repeat a measurement you performed under specific conditions on the R&S EVSF1000. Or you would like to troubleshoot a measurement and require a defined instrument state to detect the precise cause of the error. In these cases, you can store and recall instrument and measurement settings. You can store and recall up to 20 different settings, referred to as *UserPresets*, on the instrument.

Settings stored in a UserPreset

In each UserPreset, the following current settings are stored:

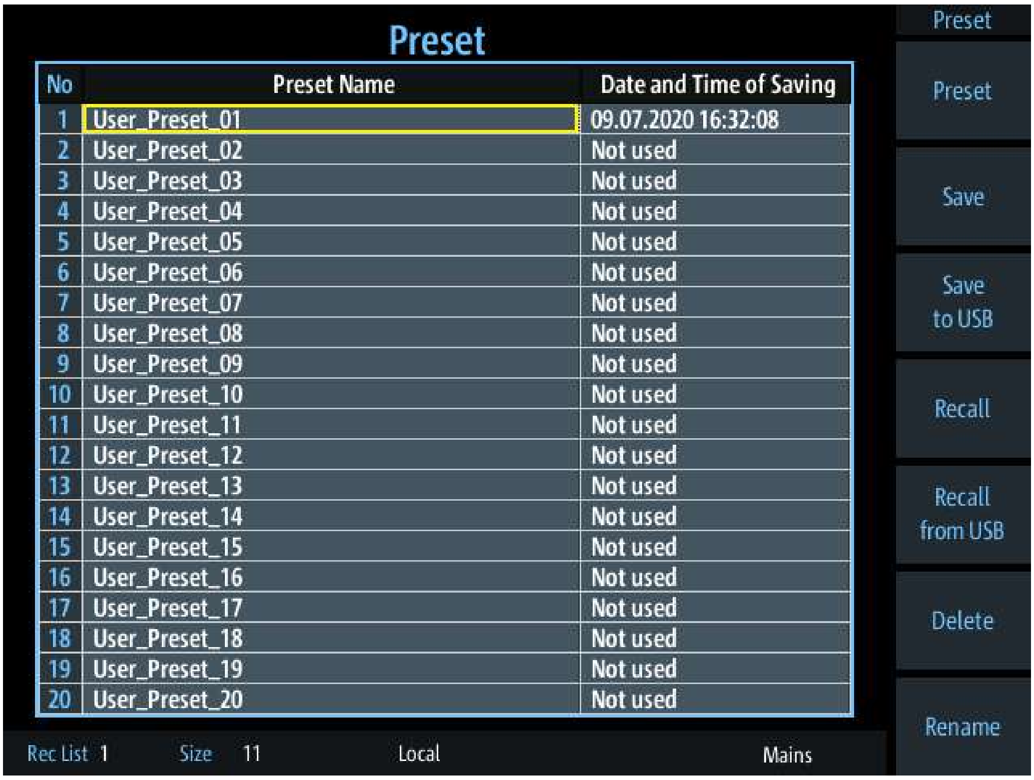
- All measurement settings (see Chapter 2, "Measurements and results", on page 37)
- All general instrument settings except for the network settings (see Chapter 8, "Common instrument settings", on page 209)
- Date and time of storage

The list of UserPresets and the corresponding functions are available in the [Preset] menu.

7.1.1 Storage and recall functions

VNC access: [y]

For each stored UserPreset, the storage date and time are indicated in the "Preset" window. Empty UserPresets are indicated as "not used".



Use the arrow keys to scroll through the UserPresets.

While the "Preset" view is displayed, audio and display settings are not available. Return to a measurement view first ([a]).

Preset

When delivered, the R&S EVSF1000 has a default configuration. You can restore this defined initial state at any time as a known starting point for measurements. Presetting is often recommendable as a first step in troubleshooting when unusual measurement results arise.

Two different preset functions are available, the "simple" preset and the "Factory Preset".

The "simple" preset function retains the instrument's IP address and host name, and all stored data.

Factory Preset ← Preset
VNC access: [y]

The default configuration is restored, except for the instrument's IP address and host name. All stored data is deleted!

Remote command:
`FACTORY_PRESET` on page 250

Save
Stores the current measurement settings in the selected UserPreset under the specified name, together with the current date and time.

If the selected UserPreset already contained settings before, they are overwritten.

Save to USB
Stores the current measurement settings under the specified name on a connected USB storage device, together with the current date and time.

The default name is `User_Preset_<no.>.evsfpreset`, where `<no.>` is a consecutive number. The file name can be edited. The files are stored to the subdirectory `EVSF1000_PRESETS`.

Recall
Overwrites the current measurement settings by the settings stored in the selected UserPreset.

Recall from USB
Overwrites the current measurement settings by the settings stored in the selected UserPreset on a connected USB storage device.

Delete
Deletes the settings and the name assigned to the selected UserPreset.

Rename
Renames the selected UserPreset.

7.2 Recording measurement data

During a measurement with the R&S EVSF1000, the input signal is captured and various results are calculated and displayed on the screen (see Chapter 2, "Measurements and results", on page 37). These results can also be stored in data lists, which can be exported as `.csv` files for further investigation.

Data is stored continuously for all measurements that are performed after recording is started and until it is stopped. The data for each recording session is stored to a file internally. The file name is defined by the following syntax:

`<measmode>_<rx_board>_list<no.>.csv`

Where:

- **<measmode>**: the used measurement mode

- **<rx_board>**: the used receiver board (rx1, rx2)
- **list<no.>**: the used data list

7.2.1 GNSS data synchronization

Together with the measurement results, the GNSS data at the time of signal input is also stored, if available (see Chapter 8.7, "GNSS configuration", on page 225). Storing GNSS data is useful to synchronize specific measurement results with the precise time and location of the input signal. However, signal transmission via the RS232 serial connection can cause delays in the stored GNSS time as opposed to the actual time of input. Therefore, it is useful to synchronize the stored GNSS data to the PPS signal also provided by the GNSS receiver.

7.2.2 I/Q data recording and streaming

Optionally, the raw, unprocessed I/Q data can also be stored with the data recording. In this case, the I/Q data is stored as a separate file with the same file name as the data list, but the extension `.iq`. This feature requires the R&S EVSG1-K25 I/Q data streaming option.

I/Q data is stored with a sample rate of 125000 samples per second. I and Q values are stored with 32 bit each, in little endian and signed integer format. The I/Q data level is aligned to the RF input signal of the R&S EVSF1000. That is: 0 dBm correspond to a magnitude value of 0x10000000 (hexadecimal). Each sample requires 8 bytes of storage, which adds up to 1 MB per second. The I/Q data files can become very large. After 33 minutes, they exceed 2 GB, meaning they can no longer be stored on a FAT-formatted USB storage device. In this case, you require a storage device with a linux file system, e.g. ext4. Also consider the limitations of the internal storage device. When using two RX boards simultaneously, the storage is filled up twice as quickly.

I/Q data can also be streamed during the measurement using the LAN interface of the R&S EVSF1000 (TCP port 8001 (RX1) or 8002 (RX2)). Simply connect a TCP/IP client to the port and the data is streamed immediately. The format is the same as for recording.

Example:

```
netcat 172.23.226.22 8001 > File1.iq
```

Starts streaming I/Q data from the RX1 input to a file named `File1.iq`.

You can use the I/Q data to analyze the signal in external software, for example, or to reproduce the signal on a signal generator.

7.2.3 Recording settings

Access VNC: [s] > [F7]

(For numeric measurement modes only)

Recording GBAS/SCAT-I measurement results

In GBAS/SCAT-I mode, one record is stored for each slot, in a time interval of 62.5 ms, as long as recording is active. Triggering is not supported. Recording is continued even if the display update is temporarily stopped (by the "Pause" function).

Start and stop recording from any measurement view using the [Record] key.

Record the selected and currently displayed slot or frame only using the [Single] key.

The record contains measurement values and the message bitstream for the slot. All records are stored in a CSV file. This basic CSV file contains a data link for each record in the list. The link points to a further CSV file which contains all human-readable texts for that record. All data files for the current recording are stored in a subdirectory that is exported together with the basic CSV file.

See also "Recording GBAS data" on page 182.

List

Selects a specific data set list (1 to 999, the list number is shown in the softkey).

Remote command:
`SETACTIVELIST` on page 365
`GETACTIVELIST` on page 361

Clear List

Deletes all entries in the current list.

Remote command:
`CLEARACTIVELIST` on page 361

Time
Specifies how often an entry is appended to the data list. Enter the time in milliseconds.

Note that the minimum spacing between two values is defined by the availability of measurement result values (see Chapter 4.1.4.6, "Setting the measurement time (MTime)", on page 74). If more values are available than are stored, that is: "Time" > Setting the measurement time (MTime), the calculated values are averaged to obtain only the required number of results.

In GBAS/SCAT-I mode, one record is stored for each slot, in a time interval of 62.5 ms, as long as recording is active. The time interval cannot be edited.

Data selection (Sel, not GBAS/SCAT-I mode)
By default, the whole data set is recorded. You can configure the scope of the data to be displayed and exported. For details on the individual data sets, see the remote command (`SELECTLISTPARAM` on page 364).

"All"	Includes all EVSF1000 and R&S EVS300 values.
"Full"	Compatible to R&S EVS300.
"Medium"	A reduced set of values
"Short"	A minimum set of values

Remote command:
`SELECTLISTPARAM` on page 364

Data selection (Select, GBAS/SCAT-I mode only)
By default, the whole data set for every slot is recorded. You can configure the scope of the data to be displayed and exported. For details on the individual data sets, see the remote command (`GBAS:GETMEAS` on page 327).

Parameter ← Data selection (Select, GBAS/SCAT-I mode only)
Defines which parameters are stored for each slot.

"All"	Includes all EVSF1000 and R&S EVS300 values
"Full"	Compatible to R&S EVS300
"Medium"	A reduced set of values
"Short"	A minimum set of values
"Raw"	Only the decoded, non-interpreted measurement values from the bitstream in binary format

Remote command:
`GBAS:GETMEAS` on page 327

Msg Log ← Data selection (Select, GBAS/SCAT-I mode only)
Defines which message information is stored for each slot.

"All"	All message data (human-readable + bitstream) is stored (default).
"TXT"	Only the human-readable, interpreted message values are stored.
"RAW HEX"	Only the decoded, non-interpreted message data from the bitstream in binary format is stored.

"None" Message data is not included in the slot data record.

Remote command:
GBAS:MSG_TOLOGG on page 329

Graph Log ← Data selection (Select, GBAS/SCAT-I mode only)
Defines whether graphical information such as the time domain and constellation values are stored.

Remote command:
GBAS:GRAPH_TOLOGG on page 329

Slot <x> Log ← Data selection (Select, GBAS/SCAT-I mode only)
Activates or deactivates data recording for the corresponding slot.

To toggle between the slots A to D and slots E to H in the menu, press the "More softkeys" key.

Export List to USB
Exports the data list to a connected USB storage device.

Remote command:
SAVEACTIVELIST2USB on page 364

Clear All Lists
Deletes all entries in all data lists.

Remote command:
CLEARALLLISTS on page 363

Rec IQ
If enabled, the raw, unprocessed I/Q data is also recorded. This feature requires the R&S EVSG1-K25 I/Q data streaming option.

I/Q data is stored as a separate file with the same file name as the data list, but the extension `.iq`. Furthermore, the data list contains two additional entries:

"IQSamples": indicates how many samples the data set includes; depending on the measurement time this number can vary.

"IQPosition": indicates the starting position of the data set within the I/Q data file

Remote command:
RECIQ on page 363

7.2.4 Activating and triggering data recording

By default, data is recorded in a specific time interval (see "Time" on page 203) as long as recording is active. Alternatively, you can use an external trigger, if available, to determine when data is stored. For example, you can store data at regular distances during a moving measurement, based on a rotary position transducer.

Recording GBAS/SCAT-I measurement results

In GBAS/SCAT-I mode, one record is stored for each slot, in a time interval of 62.5 ms, as long as recording is active. Triggering is not supported. Recording is continued even if the display update is temporarily stopped (by the "Pause" function).

Starting and Stopping Recording

Access VNC: [p]

When you press the key, data is recorded to the selected list, indicated in the status bar ("Rec List"). The number of data sets that the list currently contains is indicated as "Size". How often and when a new data set is entered in the list depends on the "Trigger Source" on page 205.

If enabled, raw, unprocessed I/Q data is also recorded to a separate file (see "Rec IQ" on page 204).

Trigger Source

Access VNC: [k] > "F2"

Determines how often and when a new data set is entered in the list during recording.

"Time" Data is stored in regular time intervals, defined by "Time" on page 203.

"Ext." Data is stored each time a trigger signal from a connected external trigger device is received. The trigger device must be connected to the "Trigger In" connector on the rear panel of the R&S EVSF1000.

Offset

Access VNC: [k] > "F4"

Defines an offset to the specified trigger event before data storage is actually started.

Trigger Edge

Access VNC: [k] > "F5"

For external triggering, this setting defines whether data is stored when the positive (rising) or negative (falling) edge of the trigger signal is received. Select the key repeatedly to toggle between the two settings.

Input

Access VNC: [k] > "F7"

Determines which input triggers data storage or defines the GNSS PPS synchronization source.

"PPS GPS" Signal provided at the RS232-GPS or GNSS connector

"PPS SMA" Signal provided at the PPS In connector

Remote command:
PPSSMA_TRIG_SOURCE? on page 235

Recording a single data record (GBAS/SCAT-I mode only)
Access: [Single]

Records the selected and currently displayed slot or frame only.

This function is only available for GBAS/SCAT-I mode (R&S EVSG-K4 GBAS analysis/R&S EVSG-K5 SCAT-I Analysis).

7.2.5 Viewing recorded data

The "Recording" view displays the recorded data for the current measurement mode from the selected data file (see "List" on page 202).

The following functions are available in the "Recording" view for all modes.

DL Line
Selects a particular line (record) in the data recording file.

7.2.6 Analyzing recorded I/Q data

Optionally, raw, unprocessed I/Q data is recorded to a separate file during recording (see "Rec IQ" on page 204).

Additional information on the I/Q data is stored in the CSV data list, indicating where in the `.iq` file the I/Q data for a specific data set starts and how many samples it contains. You can use this information to synchronize the raw I/Q data with the evaluated measurement data for each data set.

You can also use the stored I/Q data to reproduce the measured signal on a signal generator. Using the R&S ARB Toolbox, for example, you can convert the `.iq` data file to a `.wv` file.

To convert the .iq data file to a .wv file

1. In the R&S ARB Toolbox, right-click the `.iq` data file.
2. Select "Convert" > "Convert from Data".
3. Select the following settings for the data format:
   - "File Type": "Binary"
   - "Data format": "Integer"
   - "Endianness": "Little-Endian (x86)"
   - "Precision": "32 Bit"
   - "Signedness": "Signed (Two's Complement)"
4. Define the clock rate as *125 kHz*.

7.2.7 Exporting measurement data

After recording measurement data, you can export the `CSV` files with the results for further investigation.

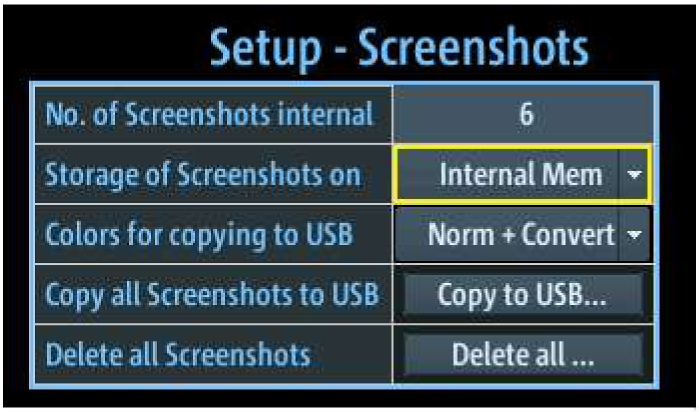
To export measurement data

1. Connect the storage device to the USB connector on the instrument.
2. In the "Recording" settings, select "Export List to USB".

7.3 Creating and storing screenshots

Access: [Setup] > "Screenshots"

You can create a screenshot of the current display on the R&S EVSF1000 at any time during operation. Creating screenshots is useful to document measurement results, for example.



Creating a Screenshot
Access VNC: [x]

When you create a screenshot, the display is stored as a graphic file on the instrument (until it is explicitly deleted). It can be copied to a USB memory device later (see Exporting Screenshots to a USB device). Internally, the screenshot files are named "Screenshot_", followed by a consecutive number.

If a USB device is connected to the R&S EVSF1000 when the screenshot is created, the screenshot is stored there directly as a `.PNG` file. A dialog box with the default file name is displayed. To change the name of the file on the USB device, click in the name field and overwrite the default name. Note, however, that the file is also stored internally, and the file name remains unchanged. Thus, if you export all screenshots to a USB device later, the same screenshot is stored with the internal name again.

The Number of Screenshots indicated in the "Setup - Screenshots" window is increased after each new screenshot.

Number of Screenshots
Indicates the number of screenshots currently stored on the instrument.

Storage of screenshots on
Specifies the location of the screenshots to be saved.

"Internal mem"	The screenshots are stored in the internal memory (default setting).
"Internal + USB"	The screenshots are stored in the internal memory and on a connected USB device.
"USBstick"	The screenshots are stored directly on a connected USB device.

Colors for copying to USB
If the screenshots are stored to a USB device, you can specify the colors used for the screenshot.

"Normal"	The screenshot is stored as shown on the screen.
"Converted"	The screenshot is stored with inverted colors, that is: black text on a white background for better legibility on paper.
"Norm + Convert"	Default: two screenshots are stored, one as shown on the screen, one with inverted colors.

Exporting Screenshots to a USB device
All internally stored screenshots on the R&S EVSF1000 are stored as `.PNG` files in the main directory of the connected USB device. The file name is defined by the following syntax:

`EVSx_<date>_<time>[_converted].png`

where the `_converted` suffix is only applied to screenshots with inverted colors.

Deleting all Screenshots Stored on the R&S EVSF1000
All screenshots stored on the R&S EVSF1000 are deleted irrevocably.

Once the screenshots have been stored to an external memory device, you can delete them from the instrument. Otherwise you copy them again each time you create new screenshots and want to store them to a USB device.

8 Common instrument settings

Common instrument settings are applied regardless of which measurement mode is selected.

All common instrument settings can be configured via remote commands (see Table 1-3) or using a remote keyboard via VNC.

For the mapping of hard- and softkey commands to keyboard commands using VNC, see Table 1-3.

Configuring screenshots is described in Chapter 7, "Data management", on page 198.

Configuring the signal input is described in Chapter 3.1, "Input signal settings", on page 40.

8.1 Audio output settings

Access VNC: [c]

(Not in "Preset" view.)

Audio output is available at the headphones connector on the front panel of the R&S EVSF1000.

For example, the demodulated identifier in ILS mode is output as a 1020 Hz morse signal.

AF Volume

Defines the volume of the AF output at the loudspeaker or the headphones connector. Enter a percentage value (0 % to 100 %).

Remote command:

`SETUP:VOLUME` on page 238

Squelch

Defines the level threshold below which the demodulated data is set to 0. This is useful, for example, to avoid demodulation noise during transmission breaks.

This setting is only relevant for numeric measurement modes.

The squelch level is an absolute value.

The current squelch level is indicated numerically on the softkey and graphically on the bargraph indicator.

Remote command:
SQUELCH on page 239

Demod
Selects between AM / FM modulation for receiver signals.

Audio BW
Frequency range to be output to the speaker or headphones.

"Full"	Full bandwidth is output
"Voice (def)"	Voice frequencies (> 3 kHz) filtered out
"ID Notch"	ID frequency (1020 Hz) filtered out
"V/ID Notch"	Voice and ID frequencies filtered out

Remote command:
SETUP:AUDIOBW on page 237

Speaker
Enables or disables AF output at the loudspeaker on the rear panel of the R&S EVSF1000.

Remote command:
SETUP:SPEAKER on page 238

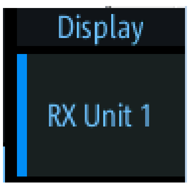
KB Beep
Enables or disables a tone when a key on the keyboard is pressed. This is useful as feedback during operation in a noisy environment.

8.2 Display

Access VNC: [v]

(Not in "Preset" view.)

Some general settings are available for the VNC display of the R&S EVSF1000.



RX Unit 1 / RX Unit 2
Select the receiver board whose settings and results are displayed. The currently selected receiver board is indicated by a vertical blue line on the softkey.

This setting is only available if a second receiver board is installed (requires the R&S EVSG-B1 Second Signal Processing Unit option, see Chapter 3.2, "Receiver board", on page 40).

While two different measurements can be performed simultaneously using two receiver boards, the results can only be displayed for one board at a time. Use this function to toggle between the two measurements.

Remote command:
CH on page 234

Level View

Configure the display of power levels.

"Digits" The level value is displayed numerically, as digits.

"Bargraph" The level value is displayed graphically, as a bargraph.

Remote command:
SETUP:UNIT:BARGRAPH on page 252

Zoom

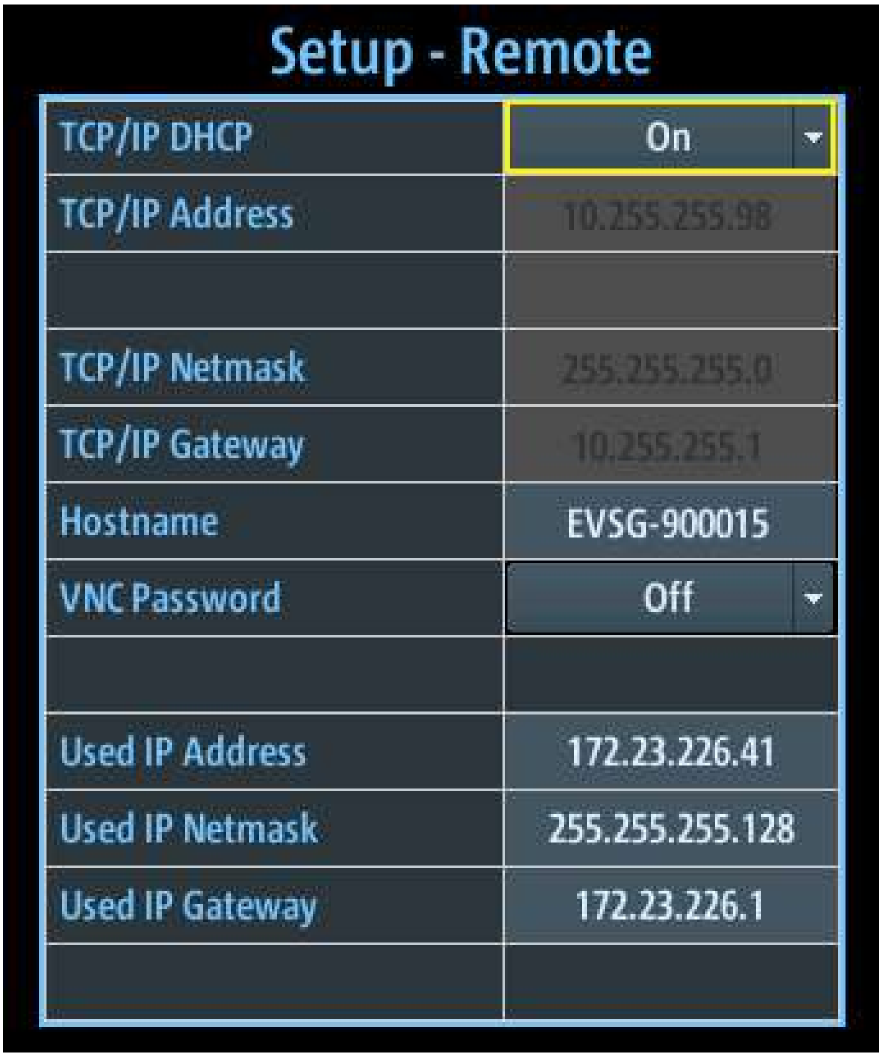
This command is available in LOC, GS, VOR and COM modes.

If enabled, the most important measurement parameters are displayed enlarged for better readability.

8.3 LAN (remote) settings

Access VNC: [n] > [F4]

The following settings are required to operate the R&S EVSF1000 in a LAN, for example from a controller PC.



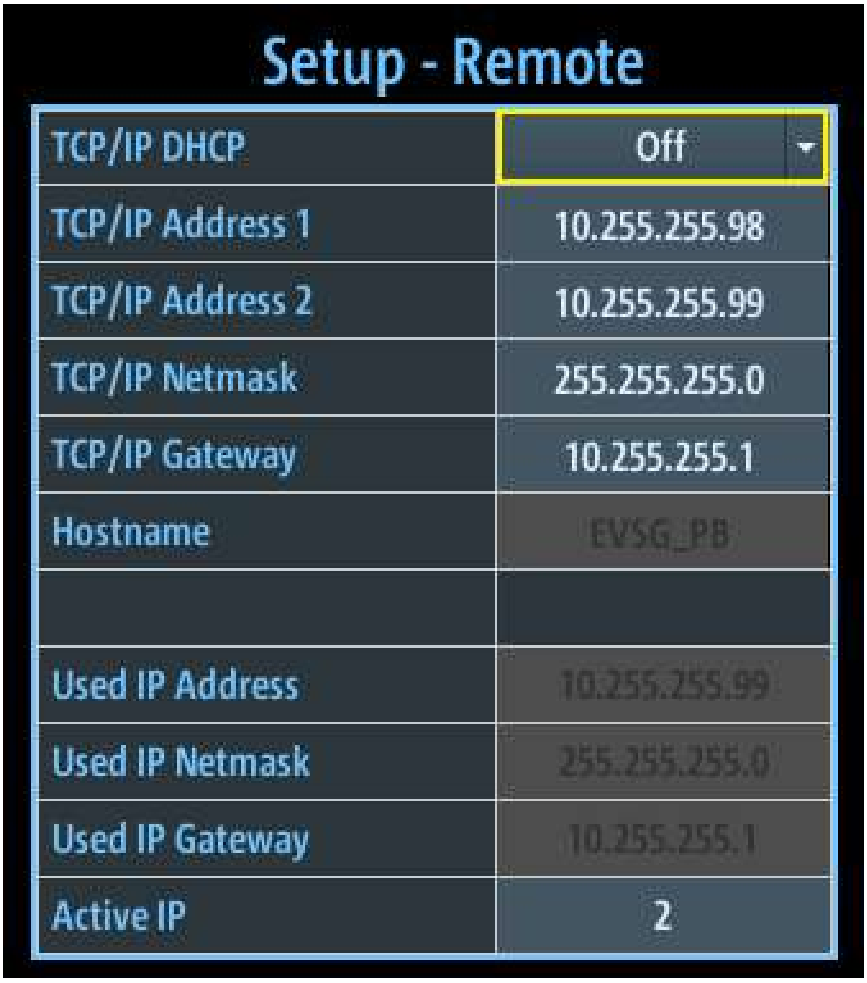


Figure 8-1: R&S EVSF1000 with R&S EVSF1-B4 option

TCP/IP DHCP

If the network supports dynamic TCP/IP configuration using the Dynamic Host Configuration Protocol (DHCP), all address information is assigned to the instrument automatically. In this case, the TCP/IP parameters are not editable. The currently used settings are indicated as Used IP Address, Used IP Netmask, Used IP Gateway.

If the network does not support DHCP, you must set the addresses manually.

By default, the instrument is configured to use a static IP address, that is: DHCP is disabled.

If DHCP is disabled, remote devices must use an IP address within the same TCP/IP Netmask as the instrument. (Usually, that means only the last number of the IP address differs.)

To toggle this setting via the remote keyboard, press the [Tab] key.

The DHCP setting is shown on the instrument's mini display (see Chapter 1.6.1, "Basic configuration and status display", on page 27).

Note: When a DHCP server is used, a new IP address can be assigned each time you restart the instrument. You must determine this address on the instrument itself. Thus, when using a DHCP server, it is recommended that you use the permanent instrument name, which determines the address via the DNS server, if available (see "Hostname" on page 215).

TCP/IP Address

Unique address of the instrument in the network. The currently assigned IP address and submask are indicated next to the setting. The default address is 10.255.255.98.

The IP address consists of four number blocks separated by dots. Each block contains values between 0 and 255.

To change the IP address via the remote keyboard, press the [INS] key and enter the new address.

The IP address is shown on the instrument's mini display (see Chapter 1.6.1, "Basic configuration and status display", on page 27).

If the R&S EVSF1-B4 option is installed, you can configure two different IP addresses. Depending on the "IP-Address Select" input, one or the other is used (see Chapter 1.5.2.11, "IP-Address select", on page 26). The mini display indicates the currently used address.

Example:

`172.17.40.139`

Example: With R&S EVSF1-B4 option

With the configuration shown in Figure 8-1, if the "IP-Address Select" (pin 3) of the ARINC connector is connected to ground, the address configured as "TCP/IP Address 2" is used: `10.255.255.99`.

TCP/IP Netmask

The subnet mask consists of four number blocks separated by dots. Each block contains values between 0 and 255.

Example:

`255.255.255.0`

TCP/IP Gateway

The gateway consists of four number blocks separated by dots. Each block contains values between 0 and 255.

Example:

`192.168.1.1`

This setting is only required if the R&S EVSF1000 is installed in a network and the instrument needs to communicate with other connected devices. For simple 1:1 connections between the instrument and control PC, the setting is irrelevant.

Hostname
Unique instrument name in the network, as an alternative to the unique IP address.

Each instrument is delivered with an assigned instrument name, but this name can be changed.

The default instrument name is a non-case-sensitive string with the following syntax:

EVSF<serial_number>

For example, `EVSF1000-123456`.

For information on determining the serial number, see Chapter 1.5.2.12, "Device ID", on page 26.

Use the keypad to enter the name, see Table 1-4.

Remote command:
`GETHOSTNAME` on page 245

VNC Password
Enables or disables the requirement of a password to access the instrument remotely via VNC.

After enabling the use of a password, you must reboot the R&S EVSF1000 before it becomes active.

The password for VNC access is *instrument*. It cannot be changed.

Used IP Address
If TCP/IP DHCP is activated, the assigned IP address is displayed.

Used IP Netmask
If TCP/IP DHCP is activated, the assigned netmask is displayed.

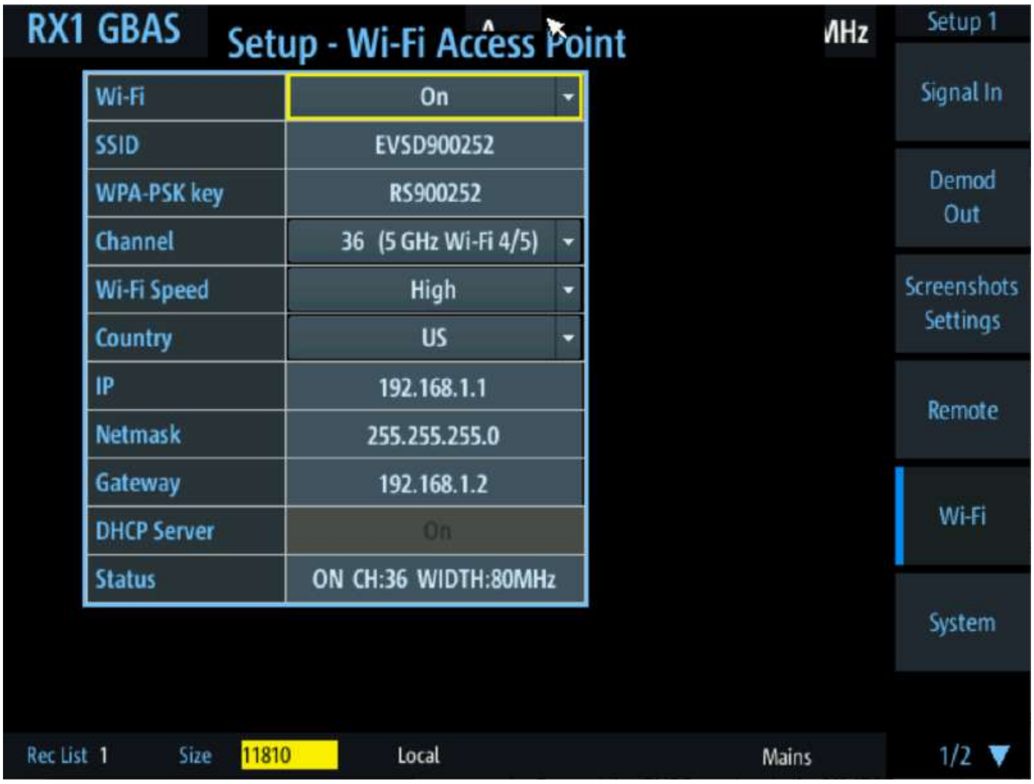
Used IP Gateway
If TCP/IP DHCP is activated, the assigned gateway address is displayed.

8.4 Data link (Wi-Fi) settings

Access VNC: [n] > [F5]

The R&S EVSF1000 can be equipped with an optional R&S EVSD1-Z5 Data-link-module (Wi-Fi). Thus, you can configure the R&S EVSF1000 as a Wi-Fi access point for wireless communication from a remote device.

The following settings configure the R&S EVSF1000 as a Wi-Fi access point.



Wi-Fi

Enables or disables a data connection via the optional Wi-Fi interface.

Remote command:
`WIFI:ONOFF` on page 248

SSID

Service set identifier, the name of the Wi-Fi. The default name is `EVSF<serial number>`.

Note: Enter the ID using the (number) keypad on the external keyboard as described in "Entering numbers and (special) characters via the keypad" on page 34.

Remote command:
`WIFI:SSID` on page 247

WPA-PSK Key

Wi-Fi password. Consists of minimum 8 characters.

The default Wi-Fi password is RS<serial_number>, e.g. RS123456.

For information on determining the serial number, see Chapter 1.5.2.12, "Device ID", on page 26.

Note: Enter the key using the (number) keypad on the external keyboard as described in "Entering numbers and (special) characters via the keypad" on page 34.

Remote command:
`WIFI:WPAPSK` on page 247

Channel

Wi-Fi channel.

The frequency range and the supported Wi-Fi standard for the selected channel are indicated for reference.

Supported channels:

1,2,3,4,5,6,7,8,9,10,11,12,13,36,40, 44, 48, 52, 56, 60,64, 100, 104, 108, 112, 116, 120, 124,128,132, 136,140,149,153,157,161,165

Default: 1

Remote command:
`WIFI:CHANNEL` on page 248

Wi-Fi Speed

Determines the used Wi-Fi data rate.

"Low"	(Default:) Uses 20 MHz bandwidth. Data transfer is less susceptible to distortion.
"High"	Uses 80 MHz bandwidth, if available. Guard interval is reduced to increase the data rate. Data transfer becomes more susceptible to distortion.

Remote command:
`WIFI:SPEED` on page 249

Country

Country code of the country the drone is operated in. National legislations support different channels, bandwidths etc. for Wi-Fi communication. If you select a channel or bandwidth that is not supported by the selected country, an error message is displayed in the Status information.

Remote command:
`WIFI:COUNTRY` on page 249

IP

Unique address of the instrument in the network. The currently assigned IP address and submask are indicated next to the setting. The default address is 192.168.1.1.

The IP address consists of four number blocks separated by dots. Each block contains values between 0 and 255.

To change the IP address via the remote keyboard, press the [INS] key and enter the new address.

Example:

`172.17.40.139`

Remote command:
`WIFI:IP` on page 247

Netmask
The subnet mask consists of four number blocks separated by dots. Each block contains values between 0 and 255.

Example:

`255.255.255.0`

Remote command:
`WIFI:NETMASK` on page 247

Gateway
The gateway consists of four number blocks separated by dots. Each block contains values between 0 and 255.

Example:

`192.168.1.1`

Remote command:
`WIFI:GATEWAY` on page 248

DHCP server
Indicates that a DHCP server is used. The IP address and subnet mask of the connected devices are obtained automatically from the DHCP server.

Status
Indicates the status of the Wi-Fi connection.

"ON" Wi-Fi access point is running. In addition, the following information is indicated:
"CH:"<used channel number> "WIDTH:"<used channel bandwidth>
The used channel number can differ from the selected Channel, if a signal is detected elsewhere (dynamic frequency selection).

"OFF" Wi-Fi access point not (yet) running successfully.

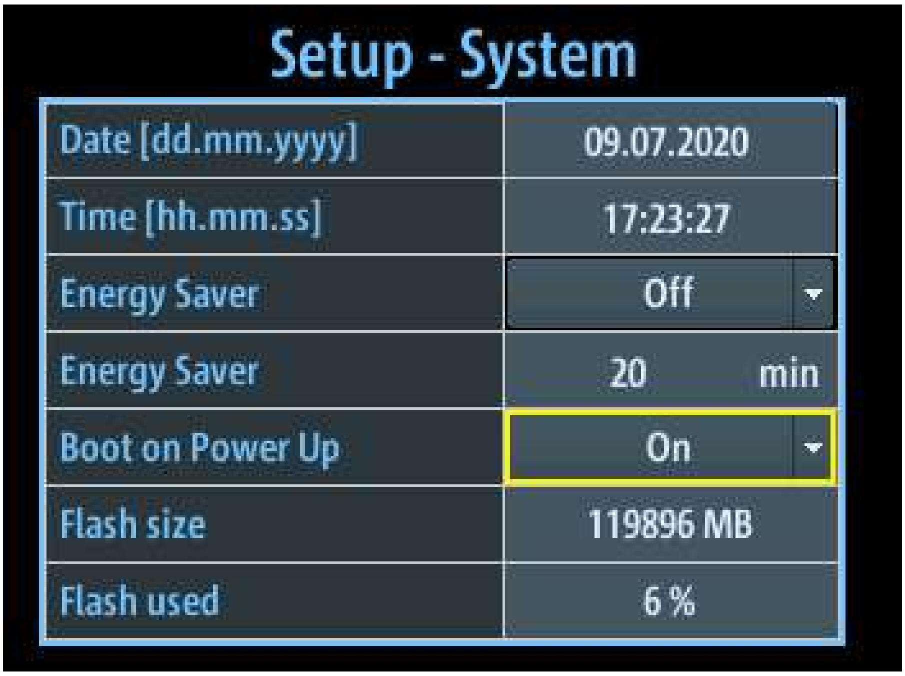
Additional information indicates the reason for the error.
- None: Wi-Fi is disabled
- "CONFIG": Configuration is in progress
- "NO HW": Wi-Fi adapter not installed or not supported on instrument
- "AP ERROR": Access point could not be started, e.g. because selected Channel is not supported.

Remote command:
WIFI:STATUS on page 250

8.5 System settings

Access VNC: [n] > [F6]

The following settings configure the general instrument system.



Date
Sets the date of the internal clock in the format `dd.mm.yyyy`.

Example:

`10.05.2017`

Remote command:
SETUP:DATE on page 251

Time
Sets the time of the internal clock in the format `hh.mm.ss`.

Example:

12.08.23

Remote command:
`SETUP:TIME` on page 251

Boot on Power Up
Automatically switches on the R&S EVSF1000 when it is connected to an external power supply (if not in operation already). This setting cannot be changed on the R&S EVSF1000.

Remote command:
`SETUP:BOOTONPOWERUP` on page 250

Flash size / Flash used
Indicates the size of the flash memory in the R&S EVSF1000, and the percentage currently in use.

8.6 Instrument configuration and operating status settings

The following settings concern the instrument operating status, and hardware and software configuration.

Auto-Calibration (Cal)
Access VNC: [n] > [F8] > [F1]

Autocalibration corrects changes in the attenuation characteristics of the internal RF signal paths (on both receiver boards, if available) using an internal calibration signal. These changes can occur due to the aging process or temperature drifts. The calibration optimizes the accuracy of the level measurements.

The "Setup - CAL" display shows the status for each calibration step for the most recent calibration. The first line of the result table indicates the date and time of the auto-calibration, and the temperature during the autocalibration.

Note: Start the instrument at least 15 minutes before starting autocalibration to ensure that the instrument has reached its operating temperature (for details, refer to the data sheet).
During the auto-calibration procedure, do not apply any input signal to the R&S EVSF1000.

To start the auto-calibration, select "Start Autocal " and press the [Enter] key.

The auto-calibration procedure is ready after a few minutes and in the result table, all entries must have the status "OK".

Figure 8-2: Successful auto-calibration

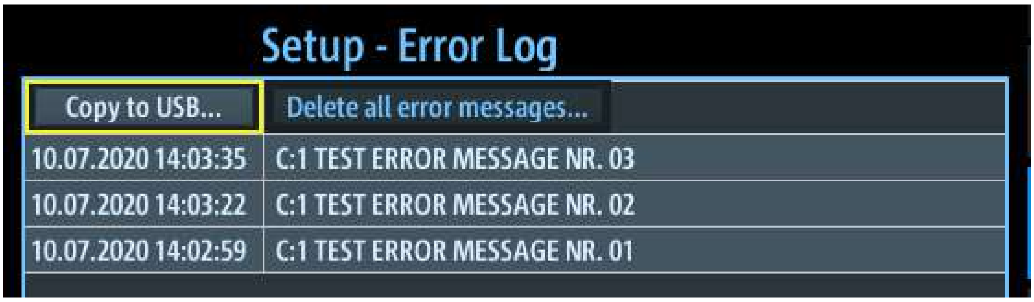
If an error occurs during the auto-calibration process, switch the instrument off and on again and repeat the auto-calibration process. If the error still exists, contact the Rohde & Schwarz service.

It is recommended that you perform an autocalibration every 2 months or if the difference of the environment temperature changes by more than 10 °C.

Remote command:
AUTOKALSTATUS on page 257
KALSCREEN on page 257
STARTKAL on page 257
GETKALSTATUS on page 257

Error Log
Access VNC: [n] > [F8] > [F2]

The last 100 instrument status messages or errors displayed in the status bar during operation of the R&S EVSF1000 are also stored in an error log file on the instrument. Thus, if problems occur, you can check the error log for irregular behavior or failures.



Remote command:
GETERRORLOG on page 255

Copy to USB ← Error Log
Copies all entries in the error log to a text file on a connected USB device. The default file name is `EVSx_errorlog_<datetime>.txt`.

This file is useful if problems occur and you need support. Send the copied error file to the Rohde & Schwarz support center for troubleshooting.

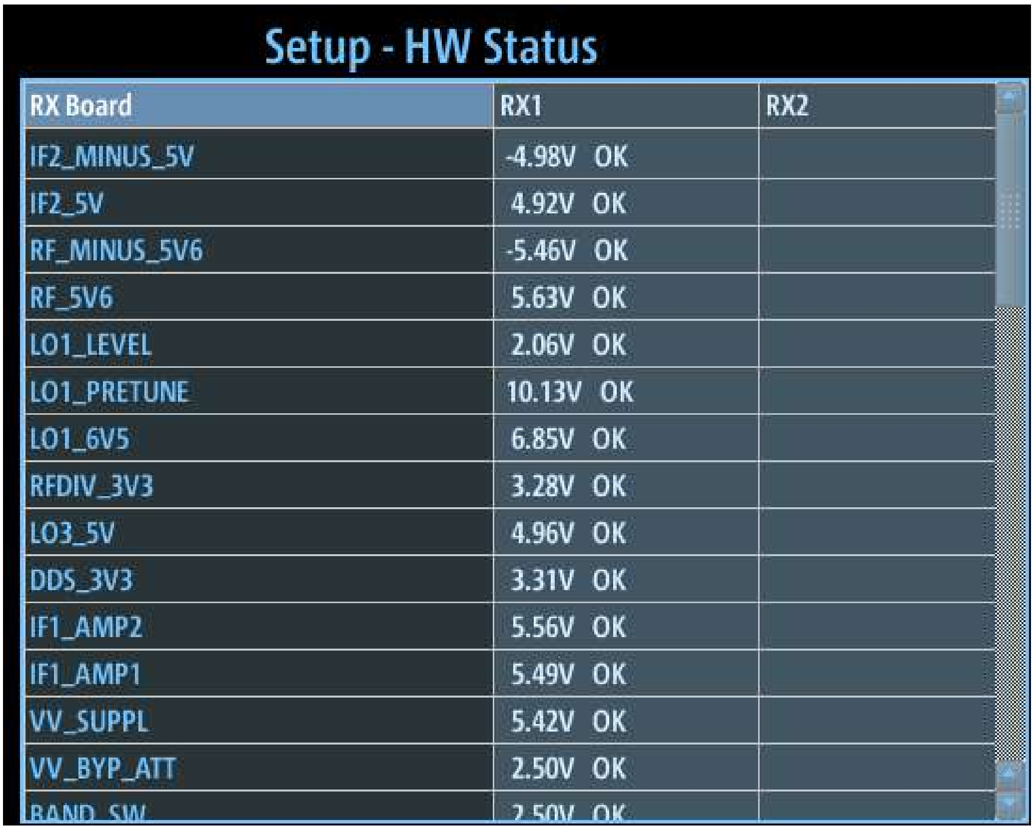
Delete all error messages ← Error Log
Deletes all entries in the error log irrevocably.

Remote command:
CLEARERRORLOG on page 255

HW Status
Access VNC: [n] > [F8] > [F3]

The hardware status overview provides information on the current operating status of the individual hardware components in the R&S EVSF1000, such as test voltages and temperatures.

The values are provided individually for RX1 and RX2 boards.



Setup - HW Status

RX Board	RX1	RX2
IF2_MINUS_5V	-4.98V OK	
IF2_5V	4.92V OK	
RF_MINUS_5V6	-5.46V OK	
RF_5V6	5.63V OK	
LO1_LEVEL	2.06V OK	
LO1_PRETUNE	10.13V OK	
LO1_6V5	6.85V OK	
RFDIV_3V3	3.28V OK	
LO3_5V	4.96V OK	
DDS_3V3	3.31V OK	
IF1_AMP2	5.56V OK	
IF1_AMP1	5.49V OK	
VV_SUPPL	5.42V OK	
VV_BYP_ATT	2.50V OK	
BAND_SW	2.50V OK	

The test voltages are measured continuously, internally, and checked against defined limit values. If one of the test voltages exceeds the tolerance for more than 10 s, the following measures are taken by the R&S EVSF1000:

- An error message is created in the error log (see "Error Log" on page 221).
- The measured test voltage is indicated in red.
- "UNCAL" is displayed in the measurement window, indicating the measured values are possibly invalid.

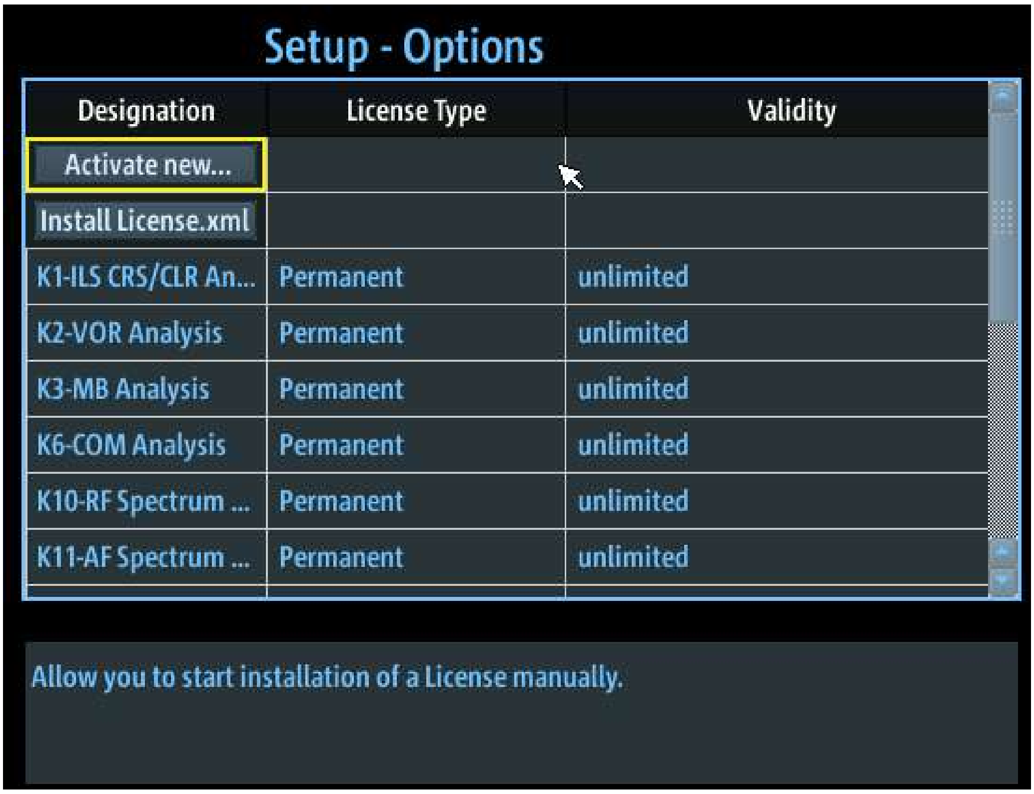
The "UNCAL" message is displayed until you switch off the instrument and switch it back on again. If the message appears again, contact the Rohde & Schwarz support center. See Chapter 12, "Contacting customer support", on page 376.

Remote command:
`GETUNCAL` on page 230
`BI?` on page 255
`GETTEMP` on page 255

Installed Options
Access VNC: [n] > [F8] > [F4]

Displays a table with the currently installed option keys.

For all purchased R&S EVSF1000 options, a license key is provided by Rohde & Schwarz.



To activate a new option key, select "Activate new..." and enter the number of the license key.

Alternatively, select "Install license.xml" to install a license from the main directory of a connected USB device.

The following information is displayed in the Options table:

"Designation"	Specifies the name of the license key.
"License Type"	The license type can be permanent or limited to a temporary duration.
"Validity"	For temporary licenses, the validity is indicated. If the expiry date has passed, the license becomes invalid.

Additional information on the selected option is displayed below the table.

Remote command:
GETOPTIONS on page 255

Inventory
Access VNC: [n] > [F5]

The hardware and software inventory list provides information on the hardware version of the instrument (integrated modules, options etc.) and on the currently installed software versions. Additionally installed software options are provided in the Installed Options list.

For each piece of hardware, the identification number, serial number and revision are provided in the inventory list. For each software item, the installed version number is provided.

Setup - Inventory

Hardware	Ident No.	Revision	Serial No.
EVSG	1329.8009.02	01.00	900015
Datasheet	01.00		
EVSG_K	1329.8009K02	01.00	900015
MAINBOARD	1329.8050.02	05.00	101018
RX_BOARD	1329.8015.02	04.08	101006
Battery Board	1329.8121.02	03.00	101059
Software	Ident No.	Version	
Release	1329.8650	01.40 BETA12	SW Update
EVSG SW		01.38I	
Build:	Jul 10 2020 11:44:00		
ILS/VOR FPGA Version		00.49.08	
GBAS FPGA Version		00.09.01*	

Remote command:
`INV?` on page 256
`VER?` on page 256

SW Update ← Inventory
Updates the R&S EVSF1000 software using an update file on a connected USB device.

The R&S EVSF1000 automatically searches the USB device for new software. The update file has the extension `.evs` and must be located in the main directory of the USB device. The search can take a few seconds.

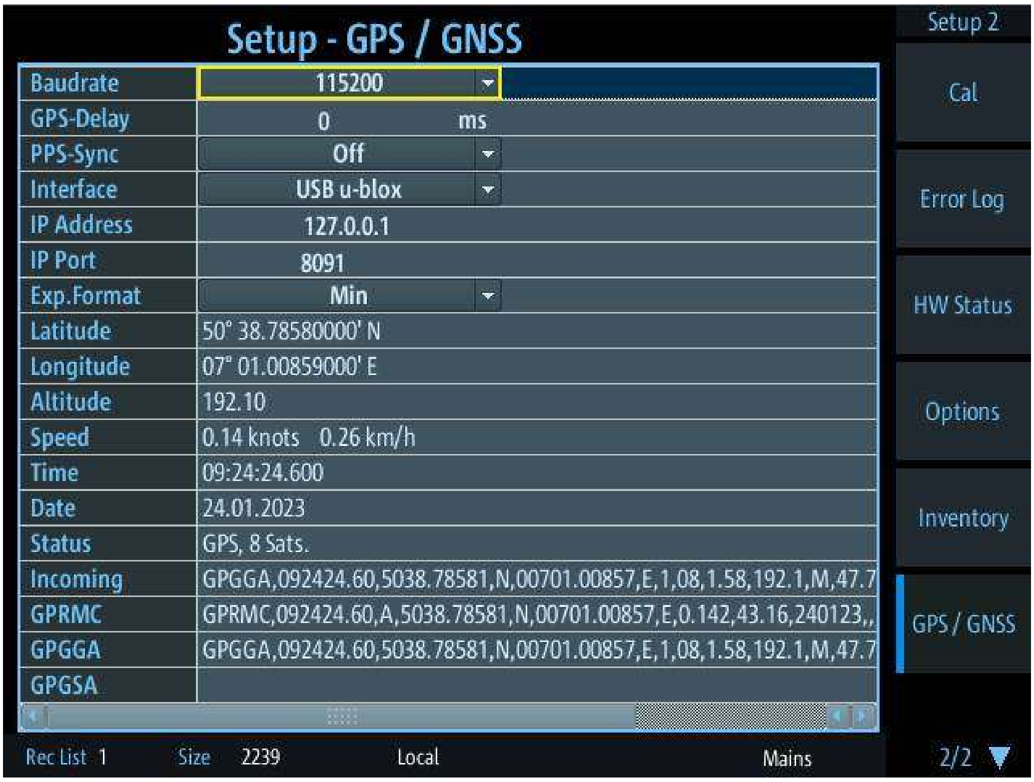
When the software has been found, press the [ENTER] key to confirm the message to install the software.

Note: Never remove the USB device or switch off the instrument during a software update. Otherwise, an undefined software state can be the result.

8.7 GNSS configuration

Access VNC: [n] > [F8] > [F6]

If a GNSS receiver is connected to the R&S EVSF1000, the basic GNSS receiver settings are displayed here.



Baudrate

Specifies the baudrate of the GNSS signal. The following values are supported:

4800 | 9600 | 19200 | 38400 | 57600 | 115200 | 230400

Remote command:

`SETUP:GPS_BAUDRATE` on page 242

GPS-Delay

Specifies a delay between the received GNSS time and the actual time. This value corrects the delay of the transmission of GNSS coordinates via a serial interface. Supported values are from -300 ms to +1000 ms.

Remote command:

`SETUP:SETGPSDELAY` on page 243

PPS-Sync

Activates/deactivates synchronization between the GNSS time in the stored data sets and the PPS signal provided by the GNSS receiver.

Note: PPS input recommended. We strongly recommend that you connect the PPS signal of the GNSS receiver to the "PPS In" connector of the R&S EVSF1000.

Although it is possible to store data on the R&S EVSF1000 without the PPS signal connected, the stored data can be assigned to the actual GNSS time incorrectly.
For details, see Chapter 7.2.1, "GNSS data synchronization", on page 201.

"OFF"	No PPS synchronization is performed.
"PPS_IN rise"	Stored GNSS time is synchronized to the rising edge of the incoming PPS signal.
"PPS_IN fall"	Stored GNSS time is synchronized to the falling edge of the incoming PPS signal.
"RS232 rise"	Stored GNSS time is synchronized to the rising edge of the incoming GNSS signal.
"RS232 fall"	Stored GNSS time is synchronized to the falling edge of the incoming GNSS signal.

Remote command:
`SETUP:PPS_SYNC` on page 243

Interface
Determines the interface used to connect a GNSS receiver.

"RS-232"	(See Chapter 1.5.2.4, "RS-232 GPS", on page 23)
"USB"	Chapter 1.5.1.2, "USB connectors", on page 20
"USB u-blox"	Chapter 1.5.1.2, "USB connectors", on page 20
"TCP/IP"	GNSS data provided from specified IP address. Define the "IP Address" and "IP Port" at which the signal is provided.

Remote command:
`SETUP:SETGPSINTERFACE` on page 241

Exp. Format
Export format for the GNSS data output by the data logger.

"Min"	(Default:) Minutes, seconds, degrees
"Decimal"	Decimal format

9 Remote commands

Using the LAN connection (Fast Ethernet), you can operate nearly all device functions and transfer measurement data remotely from a PC or network.

Connect a terminal client, e.g. "putty" (https://www.putty.org) to the R&S EVSF1000 using the TCP port 8000. The required commands are simple text commands, not SCPI-conform. Use any line-based command tool, such as telnet, to send commands to the R&S EVSF1000.

Only one remote session can be active. A new attempt to establish a connection disconnects the current active session.

Channel addressing

To address one of two independent RX boards by remote control, the R&S EVSF1000 uses *Direct Addressing*.

- Direct Addressing
  To address an RX board directly, any command can be preceded by the prefix `@1` or `@2` followed by the command.
  Example: Set frequency of RX board 1
  `@1 RF108100`
  Example: Get DDM from RX board 2
  `@2 DD0`

9.1 Common instrument and measurement setup

The following commands are required to configure general instrument and measurement settings that are independent of the measurement mode.

9.1.1 Common measurement settings

The following commands are required for all measurements.

GETMEAS <result type>,<RX-board>

This command outputs the current measurement result for one or both RX-boards. Several measurement result types are defined.

Parameters:

<result type> Outputs the measurement result as one of the listed types.

FULL
EVS300 compatibility mode

ALL
All values of the current measurement mode are sent as comma-separated text, using actual units.

MEDIUM
A fixed selection of parameters is exported.

SHORT
A short, fixed selection of parameters is exported.

<RX-Board> Output measurement result for the selected RX board.

1
RX board 1 selected

2
RX board 2 selected

1+2
Both RX boards selected

Return values:

<results> Measurement result.

<State> **READY.**
The command was executed successfully.

Example: `GETMEAS FULL,1+2`

GETMDEF <ParamSel>,<RX-board>

This command outputs the header columns for data provided by `GETMEAS`.

Parameters:

<ParamSel> Determines which parameter selection is output.

FULL
EVS300 compatibility mode

ALL
All values of the current measurement mode are sent as comma-separated text, using actual units.

MEDIUM
A fixed selection of parameters is exported.

SHORT
A short, fixed selection of parameters is exported.

<RX-Board> Selects the RX board for which results are exported.

1
RX board 1 selected

2
RX board 2 selected

1+2
Both RX boards selected

Return values:

<Results> Comma-separated list of header data for the selected results.

<State> **READY.**
The command was executed successfully.

GETUNCAL <State>

Indicates whether an `UNCAL` condition has occurred on the instrument. This condition either indicates the calibration data is invalid, or it is caused by a hardware error.

The "UNCAL" condition remains active until you switch off the instrument and switch it back on again. If the message appears again, contact the Rohde & Schwarz support center. See Chapter 12, "Contacting customer support", on page 376.

Parameters:

<State> **OK**
Instrument is calibrated correctly and no errors occurred.

UNCAL
Instrument calibration invalid or an error has occurred.

Manual operation: See "HW Status" on page 222

LA?

This command queries the RF signal level in numeric measurement modes.

Return values:

<signal level> RF signal level

Default unit: dBm

Usage: Query only

MEASTIME?
MEASTIME <Time>

This command gets or sets the measurement time for "ILS LOC"," ILS GP", "ILS MB", "VOR" and "COM" mode.

Parameters:

<Time> Measurement time

Default unit: ms

Return values:

<State> **READY.**
The command was executed successfully.

RF?
RF

This command sets RF frequency. All values are interpreted with one digit behind the decimal point, for example, RF 108700.5 in numeric measurement modes.

Parameters:

<freq> RF frequency

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Freq" on page 68
See "Freq" on page 83
See "Freq" on page 112
See "Freq" on page 122

RFCH <Channel>

This command sets the receiver frequency channel on the active receiver board according to the ICAO frequency list, or returns the currently defined channel.

Parameters:

<Channel> The specified ICAO-channel for the measurement. See Chapter A, "ILS channel frequency list", on page 377.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "CH" on page 67

SETATTMODE

This command selects the attenuation of the active mode ("ILS LOC"," ILS GP", "ILS MB", "VOR" or "COM" mode).

Parameters:

<Attenuation> Select the attenuation type from the listed ones.

AUTO
The RF attenuation mode is selected automatically.

LN
(Low Noise) 15 dB pre-amplification
Provides a high sensitivity. Suitable when scanning the area for distant signals.

NORM
0 dB
Provides a normal sensitivity.

LD
(Low Dist) 15 dB attenuation
Provides a low sensitivity. Suitable when analyzing a nearby signal, to avoid overload due to high-level signals.

Return values:

<State> **READY.**
Command was executed successfully.

Manual operation: See "RF Att" on page 68
See "RF Mode" on page 69
See "RF Att" on page 122
See "RF Mode" on page 123

SETUP:DEMODAMFM <Mode>

Gets or sets the audio demodulation mode.

Parameters:

<Mode> AM | FM

Return values:

<State> **READY.**
The command was executed successfully.

SETUP:DEMOD_OUT_AGC <Mode>

Determines whether the level for demodulation output is automatically corrected using the automatic gain control (AGC).

Parameters:

<Mode>	OFF | ON

Return values:

<State>	**READY.** The command was executed successfully.

SETUP:DEMOD_OUT_COUPLING <Mode>

Gets or sets the coupling type for Demodulation-Out mode.

Parameters:

<Mode>	AC | DC

Return values:

<State>	**READY.** The command was executed successfully.

SETUP:EXTERNALATT_RX1?
SETUP:EXTERNALATT_RX1 <Attenuation>

Gets or sets the external attenuation of "RX1 IN".

Parameters:

<Attenuation>	External attenuation Default unit: dB

Return values:

<State>	**READY.** The command was executed successfully.

Manual operation: See "Transducer Correction" on page 69

SETUP:EXTERNALATT_RX2?
SETUP:EXTERNALATT_RX2 <Attenuation>

Gets or sets the external attenuation of "RX2 IN".

Parameters:

<Attenuation>	External attenuation Default unit: dB

Return values:

<State>	**READY.** The command was executed successfully.

Manual operation: See "Transducer Correction" on page 69

9.1.2 Signal input

The following commands are required to configure the signal input.

CH?
CH <RX board>

This command selects the active RX-board.

Parameters:

<RX board>
: **1**
Select the RX-board 1.
: **2**
Select the RX-board 2.

Return values:

<State>
: **READY.**
The command was executed successfully.

Manual operation: See "RX Unit 1 / RX Unit 2" on page 210

GETNRPTYPE

Gets the type of a connected NRP power sensor.

Return values:

<String>
: Type of NRP power sensor.

GETNRPPOW

Gets the current NRP power sensor level.

Return values:

<level>
: Power sensor level
Default unit: dBm

SETUP:INPUT?
SETUP:INPUT <Channel>,<Input>

This command selects the input source for channel 1 and 2.

Parameters:

<Channel>
: **1**
Selects channel 1

2
Selects channel 2

<Input> **RF**
RF input at the front side

BB
Baseband input at the rear side
Baseband input is only available if the R&S EVSF1-B4 option (ARINC connector) is installed.

Return values:
<State> **READY.**
The command was executed successfully.

Example: `SETUP:INPUT 1, RF`

Manual operation: See "Input RF/LF" on page 63

9.1.3 Trigger settings

The following command is required to configure basic trigger settings.

PPSSMA_TRIG_SOURCE? <Source>

Gets or sets the external trigger event source for "ILS LOC", "ILS GP", "ILS MB", "VOR" and "COM" modes, or defines the PPS synchronization source.

Return values:
<Source> **PPS SMA**
Signal provided at the PPS In connector

PPS GPS
Signal provided at the RS232-GPS or GNSS connector

<State> **READY.**
The command was executed successfully.

Manual operation: See "Input" on page 205

9.1.4 Baseband input

The following commands are required to configure baseband input.

They are only available if options R&S EVSF1-B4 and R&S EVSG1-K7 LF-Analysis are installed.

SETUP:BB_IN_COUPL?
SETUP:BB_IN_COUPL <Coupling>

Gets or sets the coupling for the baseband (LF In) input.

Parameters:

<Coupling> **<AC | DC>**
Coupling for baseband input.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Coupling" on page 72

SETUP:BB_IN_FACTOR? <Value>
SETUP:BB_IN_FACTOR <Value>

Gets or sets a compensation factor for the baseband (LF In) input power.

Parameters:

<Value> Factor to be applied to the measured LF power.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "LF In Factor" on page 73

SETUP:BB_IN_RANGE?
SETUP:BB_IN_RANGE <Sensitvity>

Gets or sets sensitivity range for the baseband (LF In) input.

Parameters:

<Sensitvity> **100_MV**
Sets 100 mV.

5V
Sets 5 V.

1V
Sets 1 V.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Range" on page 72

9.1.5 Audio, demodulation and output configuration

The following commands are required to configure various types of output.

SETUP:AUDIOBW <output volume>

This command specifies the bandwidth for audio output.

Parameters:

<output volume> FULL | VOICE | ID_NOTCH | V_ID_NOTCH

FULL
Full bandwidth is output

VOICE
Voice frequencies (> 3 kHz) output

ID_NOTCH
ID frequency (1020 Hz) output

V_ID_NOTCH
Voice and ID frequencies output

Range: 0 to 100
*RST: VOICE
Default unit: %

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Audio BW" on page 210

SETUP:DDM_RANGE_LLZ <Channel>,<Range>

This command selects a predefined DDM range. This command is active for analog output in ILS localizer mode.

Parameters:

<Channel> **1**
Selects input source for channel 1.

2
Selects input source for channel 2.

<Range> Range: 1 to 4

Return values:

<State>	**READY.** The command was executed successfully.

SETUP:DDM_RANGE_GS <Channel>,<Range>

This command selects a predefined DDM range. The command is active for analog output in ILS glidepath mode.

Parameters:

<Channel>	**1** Selects input source for channel 1. **2** Selects input source for channel 2.
<Range>	Range: 1 to 4

Return values:

<State>	**READY.** The command was executed successfully.

SETUP:SPEAKER <State>

This command activates/deactivates the speaker.

The speaker function is not available for the R&S EVSF1000

Parameters:

<State>	ON | OFF

Return values:

<State>	**READY.** The command was executed successfully.

Manual operation: See "Speaker" on page 210

SETUP:VOLUME <output volume>

This command specifies the AF output volume.

Parameters:

<output volume>	Range: 0 to 100 Default unit: %

Return values:

<State>	**READY.** The command was executed successfully.

Manual operation: See "AF Volume" on page 209

SQUELCH?
SQUELCH <Level>

This command gets or sets the squelch level of the active mode ("ILS LOC"," ILS GP", "ILS MB", "VOR" or "COM" mode).

Parameters:

<Level>	Squelch level of active mode Default unit: dBm

Return values:

<State>	**READY.** The command was executed successfully.

Manual operation: See "Squelch" on page 209

9.1.6 GNSS data

The following commands are required to configure and retrieve GNSS data.

GETGPSGPBOD

This command requests the last incoming GPBOD message from the GNSS receiver.

Return values:

<message> The last incoming GPBOD message.

GETGPSGPGGA

This command requests the last incoming GPGGA message from the GNSS receiver.

Parameters:

<message> The last incoming GPGGA message.

GETGPSGPGLL

This command requests the last incoming GPGLL message from the GNSS receiver.

Return values:

<message> The last incoming GPGLL message.

GETGPSGPHDT

This command requests the last incoming GPHDT message from the GNSS receiver.

Return values:

<message> The last incoming GPHDT message.

GETGPSGPRMC

This command requests the last incoming GPRMC message from the GNSS receiver.

Parameters:

<message> The last incoming GPRMC message.

GETGPSGPGSA

This command requests the last incoming GPGSA message from the GNSS receiver.

Return values:

<message> The last incoming GPGSA message.

GETGPSGPGSV

This command requests the last incoming GPGSV message from the GNSS receiver.

Return values:

<message> The last incoming GPGSV message.

GETGPSGPTRF

This command requests the last incoming GPTRF message from the GNSS receiver.

Return values:

<message> The last incoming GPTRF message.

GETGPSGPVBW

This command requests the last incoming GPVBW message from the GNSS receiver.

Return values:

<message> The last incoming GPVBW message.

GETGPSGPVTG

This command requests the last incoming GPVTG message from the GNSS receiver.

Return values:

<message> The last incoming GPVTG message.

GETGPSGPXTE

This command requests the last incoming GPXTE message from the GNSS receiver.

Return values:

<message> The last incoming GPXTE message.

GETGPSGPZDA

This command requires the last incoming GPZDA message from the GNSS receiver.

Return values:

<message> The last incoming GPZDA message.

SETUP:SETGPSINTERFACE <Connector>

Determines the interface used to connect a GNSS receiver.

Parameters:

<Connector>

RS_232
RS-232 interface

USB
USB interface

USB_UBLOX
USB u-blox interface

TCPIP
GNSS data provided from IP address specified using `SETUP:GPS_IP_AD` and `SETUP:GPS_IP_PORT`.

*RST: RS_232

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Interface" on page 227

GETGPSUNDULATION

Gets the undulation.

Return values:

<string>

SETUP:GPS_BAUDRATE? <Baudrate>
SETUP:GPS_BAUDRATE <Baudrate>

This command sets or returns the baud rate.

NOTE: Make sure to use a valid GNSS baud rate.

Parameters:

<Baudrate> 4800 | 9600 | 19200 | 38400 | 57600 | 115200 | 230400
Possible baud rates

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Baudrate" on page 226

SETUP:GPS_IP_AD <IPAddress>

Defines the IP address of a GNSS receiver connected via TCP/IP.

Parameters:

<IPAdress> TCP/IP address between 0.0.0.0 and 0.255.255.255

Return values:

<State> **READY.**
The command was executed successfully.

Example: `SETUP:GPS_IP_AD 10.0.2.166`

SETUP:GPS_IP_PORT <IPPort>

Defines the IP port of a GNSS receiver connected via TCP/IP.

Parameters:

<IPPort> TCP/IP port

Return values:

<State> **READY.**
The command was executed successfully.

Example: `SETUP:GPS_IP_PORT 8000`

SETUP:SETGPSDELAY <Delay>

This command specifies the GNSS delay compensation.

NOTE: This setting has no effect when using PPS synchronization.

Parameters:

<Delay> Specify the delay compensation. Default is 100 ms.

Range: -500 to +500
Default unit: ms

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "GPS-Delay" on page 226

SETUP:PPS_SYNC?
SETUP:PPS_SYNC <synchronization>

Gets or sets the PPS synchronization for the instrument.

Parameters:

<Synchronization> **OFF**
No PPS synchronization is performed.

PPS_IN_RISE
Stored GNSS time is synchronized to the rising edge of the incoming PPS signal.

PPS_IN_FALL
Stored GNSS time is synchronized to the falling edge of the incoming PPS signal.

RS232_RISE
Stored GNSS time is synchronized to the rising edge of the incoming GNSS signal.

RS232_FALL
Stored GNSS time is synchronized to the falling edge of the incoming GNSS signal.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "PPS-Sync" on page 226

SETUP:GPSREF <Latitude>,<Longitude>

By default, the reference point for GNSS information is automatically taken from the position of the built-in GNSS antenna of the R&S EVSF1000. However, it can be changed manually to any other position using this command.

Parameters:

<Latitude> <degrees><minutes><direction>

Latitude of the reference point in degrees, minutes (decimal format) and direction (S | N)

<Longitude> <degrees><minutes><direction>

Longitude of the reference point in degrees, minutes (decimal format) and direction (W | E)

Example: `SETUP:GPSREF 89°44.123456789S,23°55.123456789S`

SETUP:REFLAT?
SETUP:REFLAT <Latitude>

Gets or sets the latitude of the GNSS reference point.

Parameters:

<Latitude> GNSS reference point latitude

Return values:

<State> **READY.**
The command was executed successfully.

SETUP:REFLONG?
SETUP:REFLONG <Longitude>

Gets or sets the longitude of the GNSS reference point.

Parameters:

<Longitude> GNSS reference point longitude.

Return values:

<State> **READY.**
The command was executed successfully.

SETUP:TIMESYNC?
SETUP:TIMESYNC <Source>

Defines or queries the time source with which the R&S EVSF1000 clock is synchronized. If the R&S EVSF1000 clock differs from the selected synchronization source time by more than 1000 ms, the R&S EVSF1000 clock is adjusted accordingly.

Parameters:

<Source> **OFF**
No synchronization is performed for the internal R&S EVSF1000 clock.

GPS
Synchronization with a connected GNSS (see the main R&S EVSF1000 User Manual).

Example: `SETUP:TIMESYNC OFF`

9.1.7 Network settings and remote operation

The following commands are required to configure network settings and remote operation.

GETHOSTNAME

This command returns the host name of the instrument.

Return values:
<hostname>

Manual operation: See "Hostname" on page 215

LO

This command sets the R&S EVSF1000 back to local control.

Return values:
<State> **READY.**
The command was executed successfully.

Usage: Setting only

MLOC

The `MLOC` command is identical to the `LO` command.

Return values:
<State> **READY.**
The command was executed successfully.

RLC <State>
REMOTELOCK <State>

This command deactivates/activates local operation by keyboard.

Parameters:

<State>

ON
If set, no local operation by keyboard is possible.

OFF
The R&S EVSF1000 must be set to "OFF”" or must be restarted to activate local operation by keyboard.

Return values:

<State>

READY.
The command was executed successfully.

SETUP:NTPSERVER?
SETUP:NTPSERVER <IPAdress>

Defines the IP address of the NTP server used for time synchronization of the internal R&S EVSF1000 clock (see `SETUP:TIMESYNC` on page 244).

Parameters:

<IPAdress> TCP/IP address between 0.0.0.0 and 0.255.255.255

Example:
```
SETUP:TIMESYNC NTP
SETUP:NTPSERVER 10.0.2.166
```

Usage: Setting only

9.1.8 Wi-Fi commands

The following commands are required to configure and control the optional R&S EVSD1-Z5 Data-link-module (Wi-Fi).

WIFI:SSID <ID>

Defines the service set identifier, the name of the Wi-Fi.

Parameters:
<ID> *RST: EVSD<serial number>

Return values:
<State> **READY.**
The command was executed successfully.

Manual operation: See "SSID" on page 216

WIFI:WPAPSK <Password>

Defines the Wi-Fi password.

Parameters:
<Password> *RST: RS<serial number>

Return values:
<State> **READY.**
The command was executed successfully.

Manual operation: See "WPA-PSK Key" on page 217

WIFI:IP <IPAddress>

Unique address of the instrument in the network.

Parameters:
<IPAddress> Four number blocks separated by dots. Each block contains values between 0 and 255.
*RST: 192.168.1.1

Return values:
<State> **READY.**
The command was executed successfully.

Manual operation: See "IP" on page 217

WIFI:NETMASK <Mask>

Defines the Wi-Fi subnet mask.

Parameters:
<Mask> Four number blocks separated by dots. Each block contains values between 0 and 255.
*RST: 255.255.255.0

Return values:
<State> **READY.**
The command was executed successfully.

Manual operation: See "Netmask" on page 218

WIFI:GATEWAY <Address>

Wi-Fi gateway address

Parameters:

<Address> Four number blocks separated by dots. Each block contains values between 0 and 255.

*RST: 192.168.1.2

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Gateway" on page 218

WIFI:ONOFF?
WIFI:ONOFF <State>

Enables or disables a data connection via the optional Wi-Fi interface.

Parameters:

<State> ON | OFF

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Wi-Fi" on page 216

WIFI:CHANNEL?
WIFI:CHANNEL <Channel>

Wi-Fi channel

Parameters:

<Channel> 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 36 | 40 | 44 | 48 | 52 | 56 | 60 | 64 | 100 | 104 | 108 | 112 | 116 | 120 | 124 | 128 | 132 | 136 | 140 | 149 | 153 | 157 | 161 | 165

*RST: 1

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Channel" on page 217

WIFI:SPEED?
WIFI:SPEED <DataRate>

Determines the used Wi-Fi data rate.

Parameters:

<DataRate>

LOW
(Default:) Uses 20 MHz bandwidth. Data transfer is less susceptible to distortion.

HIGH
Uses 80 MHz bandwidth, if available. Guard interval is reduced to increase the data rate. Data transfer becomes more susceptible to distortion.

*RST: LOW

Return values:

<State>

READY.
The command was executed successfully.

Manual operation: See "Wi-Fi Speed" on page 217

WIFI:COUNTRY?
WIFI:COUNTRY <Code>

Country code

Parameters:

<Code>

00 | AD | AE | AF | AI | AL | AM | AN | AR | AS | AT | AU | AW | AZ | BA | BB | BD | BE | BF | BG | BH | BL | BM | BN | BO | BR | BS | BT | BY | BZ | CA | CF | CH | CI | CL | CN | CO | CR | CU | CX | CY | CZ | DE | DK | DM | DO | DZ | EC | EE | EG | ES | ET | EI | FM | FR | GB | GD | GE | GF | GH | GL | GP | GR | GT | GU | GY | HK | HN | HR | HT | HU | ID | IE | IL | IN | IR | IS | IT | JM | JO | JP | KE | KH | KN | KP | KR | KW | KY | KZ | LB | LC | LI | LK | LS | LT | LU | LV | MA | MC | MD | ME | MF | MH | MK | MN | MO | MP | MQ | MR | MT | MU | MV | MW | MX | MY | NG | NI | NL | NO | NP | NZ | OM | PA | PE | PF | PG | PH | PK | PL | PM | PR | PT | PW | PY | QA | RE | RO | RS | RU | RW | SA | SE | SG | SI | SK | SN | SR | SV | SY | TC | TD | TG | TH | TN | TR | TT | TW | TZ | UA | UG | US | UY | UZ | VC | VE | VI | VN | VU | WF | WS | YE | YT | ZA | ZW

Return values:

<State>

READY.
The command was executed successfully.

Manual operation: See "Country" on page 217

WIFI:STATUS <Status>

Indicates the status of the Wi-Fi connection.

Parameters:

<Status>

ON
Wi-Fi access point is running.

OFF
Wi-Fi access point not (yet) running successfully. Additional information indicates the reason for the error. See "Status" on page 218.

Return values:

<State>

READY.
The command was executed successfully.

Manual operation: See "Status" on page 218

9.1.9 System settings

The following commands are required to configure basic system settings.

FACTORY_PRESET

This command restores the factory default settings. The IP-settings and Data logger lists are not modified.

Return values:

<State>

READY.
The command was executed successfully.

Manual operation: See "Factory Preset" on page 200

SETUP:BOOTONPOWERUP <State>

If power is applied to the instrument, it can be started immediately.

Parameters:

<State>

ON
The R&S EVSF1000 is started immediately after power is applied to the instrument.

Return values:

<State>

READY.
The command was executed successfully.

Example: `SETUP:BOOTONPOWERUP ON`

Manual operation: See "Boot on Power Up" on page 220

SETUP:DATE <Date>

This command sets the instrument date.

Parameters:
<Date> DD.MM.YYYY

Return values:
<State> **READY.**
The command was executed successfully.

Manual operation: See "Date" on page 219

SETUP:TIME <Time>

This command sets the instrument time.

Parameters:
<Time> HH:MM:SS

Return values:
<State> **READY.**
The command was executed successfully.

Manual operation: See "Time" on page 219

WAIT4EXE <State>

Sets the behavior of the status message "READY.".

Parameters:
<State> **ON**
The "READY." message is delayed until every command is executed.
OFF
The "READY." message is returned as soon as a command is syntactically accepted.

Return values:
<State> **READY.**
The command was executed successfully.

9.1.10 Result display settings

The following commands are required to configure the result displays for measurements.

SETUP:UNIT:BARGRAPH?
SETUP:UNIT:BARGRAPH <MesDe>

This command sets the representation of bar graph.

Parameters:

<MesDe> **ILSPHASE**
Sets the MesDe parameter as ILSPHASE.

Cockpit
Sets the MesDe parameter as Cockpit.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "DDM Bargr" on page 75
See "Level View" on page 211

SETUP:UNIT:DDM?
SETUP:UNIT:DDM <Unit>

This command sets the DDM unit.

Parameters:

<Unit> **1**
Sets DDM unit as dimensionless.

uA
Sets DDM unit as µA.

PCT
Sets DDM unit as percentage.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "DDM Unit" on page 74

SETUP:UNIT:ILSPHASE?
SETUP:UNIT:ILSPHASE <ILS phase>

This command gets or sets the ILS phase representation.

Parameters:

<ILS phase> **BIPOLAR**
The phase is represented as bipolar, if between -60...+60.

UNIPOLAR
The phase is represented as unipolar, if between 0...+120.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "ILS Phase" on page 74

SETUP:UNIT:POLARITYDDM?
SETUP:UNIT:POLARITYDDM <Value>

This command gets or sets the DDM polarity.

The phase is represented as unipolar, if between 0...+120.

Parameters:

<Value> **90-150**
Sets DDM polarity as 90-150.

150-90
Sets DDM polarity as 150-90.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "DDM Polarity" on page 74

SETUP:UNIT:SDM?
SETUP:UNIT:SDM <Unit>

This command sets the SDM unit.

Parameters:

<Unit> **1**
Sets SDM unit as dimensionless.

uA
Sets SDM unit as µA.

PCT
Sets SDM unit as percentage.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "SDM Unit" on page 74

SETUP:UNIT:UPPERFREQ?
SETUP:UNIT:UPPERFREQ <Upper frequency>

This command gets or sets the upper frequency to course or clearance (while the lower frequency is always vice versa).

Parameters:

<Upper frequency> **CRS**
Sets the upper frequency to course.
CRL
Sets the upper frequency to clear.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Upper Freq" on page 67

SETUP:UNIT:VORDIRECTION?
SETUP:UNIT:VORDIRECTION <Direction>

This command gets or sets the VOR direction point of view.

Parameters:

<Direction> **from | to**
Sets the VOR direction point of view as "from" or "to".

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Signal Direction" on page 101

9.1.11 Retrieving instrument information

The following commands are required to retrieve information on the instrument and operation status.

BI?

This command returns built-in-test information.

Return values:
<BI-Info>

Usage: Query only

Manual operation: See "HW Status" on page 222

CLEARERRORLOG

This command clears the error log.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Delete all error messages" on page 222

GETERRORLOG
SETUP:GETERRORLOG

Returns the error log.

Return values:

<string> Entries of the error log

GETOPTIONS

This command returns a list of installed and available options.

Return values:

<list of options> Examples: ILS CRS/CLR Analysis, VOR Analysis, MB Analysis, ...

Manual operation: See "Installed Options" on page 223

GETTEMP

This command queries the temperatures of the main and RX boards.

Return values:

<temperature> Temperature value of the main and boards.

Manual operation: See "HW Status" on page 222

***IDN?**

This command queries the instrument identification.

Return values:
<Instrument Identification>

Usage: Query only

INV?

This command queries the inventory that contains, among other information, serial numbers of device and boards.

Return values:
<Inv-Info>

Usage: Query only

Manual operation: See "Inventory" on page 224

OPTIONGETCHECKED

Check if all options are available.

Return values:
<Option State>

true
The option is available.

false
The option is not available.

Example:
```
OPTIONGETCHECKED
K1=true,K2=true,K3=true,K4=false
```

SAVEDATA

This command stores the current settings in the flash memory. The settings are normally stored during shutdown. However, if the R&S EVSF1000 restarts after a power interruption, it does not remember the settings. Use this function sparingly for essential settings that you want to avoid losing by all means. Each write process to the flash causes additional wear.

Return values:
<State>

READY.
The command was executed successfully.

VER?

This command queries SW version.

Return values:
<sw-version>

Usage: Query only

Manual operation: See "Inventory" on page 224

9.1.12 Calibration

The following commands are required to perform and analyze calibration.

AUTOKALSTATUS

This command gets the auto-calibration (Autocal) status and date for the RX boards.

Manual operation: See "Auto-Calibration (Cal)" on page 220

AUTOKALSTATUS_EXTENDED

This command gets the extended autocal state for RX boards.

Return values:
<State> Extended autocal state

GETKALSTATUS

This command shows the current task of auto-calibration.

Return values:
Status Current task of auto-calibration.

Manual operation: See "Auto-Calibration (Cal)" on page 220

KALSCREEN

This command shows the auto-calibration ("Setup - Cal") screen.

Return values:
<State> **READY.**
Command was executed successfully.

Manual operation: See "Auto-Calibration (Cal)" on page 220

STARTKAL

This command launches autocalibration for current RX-board.

The command returns immediately, while the calibration takes several minutes. To find out when the calibration is ready, use the `GETKALSTATUS` command.

Return values:
<State> **READY.**
The command was executed successfully.

Manual operation: See "Auto-Calibration (Cal)" on page 220

9.1.13 Deprecated commands

The following commands are maintained for compatibility with former Rohde & Schwarz analyzers only. For new remote control programs, use the following commands:

- `MODE_LOC` on page 260
- `MODE_LOC` on page 260
- `MODE_GP` on page 260
- `MODE_MB` on page 293
- `MODE_VOR` on page 300
- `MODE_COM` on page 310
- `MODE_FSCAN` on page 338
- `MODE_IFSPECT` on page 343
- `MODE_FFT` on page 348
- `MODE_SCOPE` on page 355

M?

This command queries the current active mode.

Return values:

<ActiveMode>

ILS_LOC
ILS Localizer mode

ILS_GP
ILS Glide Path mode

MB
Marker Beacon mode

VOR
VHF omnidirectional radio range mode (R&S EVSG-K2 VOR analysis)

COM
COM mode (R&S EVSG-K6 COM analysis)

FSCAN
RF spectrum mode (R&S EVSG-K10 RF spectrum analysis)

IFSPECTRUM
IF spectrum mode (R&S EVSG-K10 RF spectrum analysis)

FFT
AF Spectrum mode (R&S EVSG-K11 AF spectrum analysis)

SCOPE
AF Time Domain mode (R&S EVSG-K12 Time domain analysis)

GBAS
GBAS/SCAT-I mode (R&S EVSG-K4 GBAS analysis / R&S EVSG-K5 SCAT-I Analysis)

NDB
Non-directional beacon mode (R&S EVSG1-K7 LF-Analysis)

Usage: Query only

MB

This command switches the instrument to the "ILS MB" mode.

Return values:

<State> **READY.**
The command was executed successfully.

MI

This command switches the instrument to the "ILS LOC" mode.

Return values:

<State> **READY.**
The command was executed successfully.

MV

This command switches the instrument to the "VOR" mode.

Return values:

<State> **READY.**
The command was executed successfully.

9.2 ILS localizer (LOC) and glidepath (GP) modes

The following commands are required to configure and perform measurements in the ILS Localizer and Glidepath modes.

9.2.1 Configuring the ILS LOC and GP modes

The following commands are required to activate the modes.

MODE_LOC

The `MODE_LOC` command is identical to the `MI` command.

For description, see `MI` on page 259.

MODE_GP

This command switches the instrument to the "ILS GP" mode.

Return values:

<State> **READY.**
The command was executed successfully.

9.2.2 Configuring ILS localizer measurements

The following commands are required to configure ILS Loc measurements

DEMODE_LLZ?
DEMODE_LLZ <1F/2F mode>

Gets or sets the 1F/2F mode in "ILS LOC" mode.

Parameters:

<1F/2F mode>

1F
ILS system with one carrier. The nominal frequency is the carrier frequency.

2F
ILS system with two carriers. The carrier frequencies (Course and Clearance) are above and below the nominal frequency (in a distance of a few kHz).

2F_CRS
Course of an ILS system (depending on the ILS system, it can be the upper or lower carrier frequency).

2F_CLR
Clearance of an ILS system (depending on the ILS system, it can be the upper or lower carrier frequency).

WIDE
In the wideband mode, 1-frequency and 2-frequency systems can be analyzed. Both carriers are inside one filter and can be demodulated together.
Note: In this mode, there is no configuration and display of the carrier offset.

Return values:
<State> **READY.**
The command was executed successfully.

Manual operation: See "1F/2F" on page 64

LLZ_BB_1F_OFFSETKHZ? <Offset>
LLZ_BB_1F_OFFSETKHZ <Offset>

This command gets or sets the frequency of the low IF signal for LF input in "ILS LOC" mode.

Parameters:
<Offset> Offset of the low IF signal from 0 Hz.
Default unit: kHz

Return values:
<State> **READY.**
The command was executed successfully.

Manual operation: See "Low IF Offset" on page 72

LLZ_BB_AF_BW_IDDIST_KHZ? <Bandwidth>
LLZ_BB_AF_BW_IDDIST_KHZ <Bandwidth>

This command gets or sets the demodulator bandwidth for LF input (AF mode) for ID and distortion measurement in "ILS LOC" mode.

Parameters:
<Bandwidth> 0_5KHZ | 1_5KHZ | 3KHZ | 5KHZ
Bandwidth
Default unit: kHz

Return values:
<State> **READY.**
The command was executed successfully.

Manual operation: See "IF/AF Bandwidth (Dist/ID)" on page 73

LLZ_BB_BW_KHZ? <Bandwidth>
LLZ_BB_BW_KHZ <Bandwidth>

This command gets or sets the demodulator bandwidth for LF input (AF mode) in "ILS LOC" mode.

Parameters:

<Bandwidth> 0.5KHZ | 1.5KHZ | 3KHZ | 5KHZ | 9KHZ | 12.5KHZ | 18KHZ | 25KHZ

Bandwidth

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Bandwidth (IF BW/AF In BW)" on page 73

LLZ_BB_LFIN_DCOFFSETV? <DCOffset>
LLZ_BB_LFIN_DCOFFSETV <Power>

This command gets or sets the reference power for LF input (AF signals only) in "ILS LOC" mode. This value is used to determine the modulation depth and corresponds to the DC power of the AF signal.

Parameters:

<Power> Reference DC power of the AF signal

Default unit: V

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "DC Reference" on page 72

LLZ_BB_LOWIF_BW_IDDIST_KHZ? <Bandwidth>
LLZ_BB_LOWIF_BW_IDDIST_KHZ <Bandwidth>

This command gets or sets the demodulator bandwidth for LF input (low IF mode) for ID and distortion measurement in "ILS LOC" mode.

Parameters:

<Bandwidth> 0_5KHZ | 1_5KHZ | 3KHZ | 5KHZ

Bandwidth

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "IF/AF Bandwidth (Dist/ID)" on page 73

LLZ_BB_LOWIF_BW_KHZ? <Bandwidth>
LLZ_BB_LOWIF_BW_KHZ <Bandwidth>

This command gets or sets the demodulator bandwidth for LF input (low IF mode) in "ILS LOC" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ | 18KHZ | 25KHZ | 36KHZ | 50KHZ

Bandwidth

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Bandwidth (IF BW/AF In BW)" on page 73

LLZ_BB_WIDE1F? <1F mode>
LLZ_BB_WIDE1F <1F mode>

Determines the type of LF input. Depending on the type of input, the available settings and results can vary.

Parameters:

<1F mode> **AF**
Measures the AF signal at 0 Hz.

IF
Measures the signal at a low intermediate frequency, for example from a test point at the transmitter.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "LF In Mode" on page 71

LLZ_CARRIER_THRESHOLD_DB?
LLZ_CARRIER_THRESHOLD_DB <Threshold>

Gets or sets the carrier threshold in "ILS LOC" mode.

Parameters:

<Threshold> Carrier threshold

Default unit: dB

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Carrier Thresh" on page 67

LLZ_DEFAULT_FREQSTEP? <StepSize>
LLZ_DEFAULT_FREQSTEP <StepSize>

Gets or sets the default RF frequency step size in "ILS LOC" mode.

Parameters:

<StepSize> 8.33_KHZ | 12.5_KHZ | 25_KHZ | 50_KHZ

*RST: 50_KHZ

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Step Size" on page 68

LLZ_DEM_ID_BW?
LLZ_DEM_ID_BW <Bandwidth>

Gets or sets the demodulator bandwidth for ID and distortion measurement in "ILS LOC" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "IF BW Dist/ID" on page 70

LLZ_DEM_ID_WIDE_BW? <Bandwidth>
LLZ_DEM_ID_WIDE_BW <Bandwidth>

Gets or sets the WIDE demodulator bandwidth for ID and distortion analysis in "ILS LOC" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ | 18KHZ | 25KHZ | 36KHZ | 50KHZ

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "IF BW Dist/ID" on page 70

LLZ_DEM_WIDE_BW?
LLZ_DEM_WIDE_BW <Bandwidth>

Gets or sets the WIDE demodulator bandwidth in "ILS LOC" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ | 18KHZ | 25KHZ | 36KHZ | 50KHZ

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "IF BW" on page 70

LLZ_DEM_1F2F_BW?
LLZ_DEM_1F2F_BW <Bandwidth>

Gets or Sets the 1F2F demodulator bandwidth in "ILS LOC" mode.

Parameters:
<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ

Return values:
<State> **READY.**
The command was executed successfully.

Manual operation: See "IF BW" on page 70

LLZ_DEMFREQS_OFFSET_1F?
LLZ_DEMFREQS_OFFSET_1F <Freq. Offset>

Gets or sets the demodulator 1F frequency offset in "ILS LOC" mode.

Parameters:
<Freq. Offset> Frequency offset

Default unit: kHz

Return values:
<State> **READY.**
The command was executed successfully.

Manual operation: See "1F Offset" on page 66

LLZ_DEMFREQS_OFFSET_AUTOMAN?
LLZ_DEMFREQS_OFFSET_AUTOMAN <Mode>

Gets or sets the mode of the demodulator frequency offset in "ILS LOC" mode.

Parameters:
<Mode> **AUTO_LOCK**
Sets the demodulator frequency offset automatically. Once a valid signal has been found, the carrier frequencies remain fixed until you perform a manual change.

AUTO_RETUNE
Sets the demodulator frequency offset automatically. If the carrier frequency changes, the R&S EVSF1000 starts a new search (retuning).

MANUAL
Sets the demodulator frequency offset manually.

Return values:
<State> **READY.**
The command was executed successfully.

Manual operation: See "CRS/CLR Carr (Autotune function)" on page 65

LLZ_DEMFREQS_OFFSET_LOWERFREQ?
LLZ_DEMFREQS_OFFSET_LOWERFREQ <Freq. Offset>

Gets or Sets the demodulator lower frequency offset in "ILS LOC" mode.

Parameters:

<Freq. Offset> Lower frequency offset

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Clearance" on page 66

LLZ_DEMFREQS_OFFSET_UPPERFREQ?
LLZ_DEMFREQS_OFFSET_UPPERFREQ <Freq. Offset>

Gets or Sets the demodulator upper frequency offset in "ILS LOC" mode.

Parameters:

<Freq. Offset> Upper frequency offset

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Course" on page 66

LLZ_ID_STAT?
LLZ_ID_STAT <State>

Enables or disables the ID statistics calculation in ILS Localizer measurements.

Parameters:

<State> **ON**
The ID code is determined as the most probable code based on the previous decoding results.

OFF
The most recently decoded ID is used.

FILTER_LLZ_RESIDFM?
FILTER_LLZ_RESIDFM <Bandwidth>

Defines or queries the filter type used to determine residual FM

Return values:

<Bandwidth> **ICAO**
Filter according to ICAO specification

NARROW
Narrow filter; the DDM filters used to determine the 90 Hz/150 Hz modulation values are used to avoid interference between the signals

*RST: ICAO

Example: `FILTER_LLZ_RESIDFM NARROW`

Manual operation: See "Res. FM Filt. (ILS only)" on page 70
See "Res. FM Filt." on page 73

LLZ_RFLF_INPUT? <Input>
LLZ_RFLF_INPUT <Input>

Configures the input source for the receiver in "ILS LOC" mode.

Parameters:

<Input>

RX_IN
RF input from RX 1 In/RX 2 In connectors on the front of the R&S EVSF1000

LF_IN
An AF or low frequency signal is provided at the LF In input connector on the rear side of the R&S EVSF1000.

Return values:

<State>

READY.
The command was executed successfully.

Manual operation: See "Input RF/LF" on page 63

LLZ_START_FINDCARRIER

Starts to search for a carrier in "ILS LOC" mode.

Return values:

<State>

READY.
The command was executed successfully.

Manual operation: See "Find Carrier" on page 67

LLZ_TRIG_EDGE? <TrigEdge>
LLZ_TRIG_EDGE <TrigEdge>

Gets or sets whether triggering occurs when the signal rises to the trigger level or falls down to it in "ILS LOC" mode.

Parameters:

<TrigEdge> POSITIVE | NEGATIVE

POSITIVE
Triggers when the signal rises to the trigger level

NEGATIVE
Triggers when the signal falls down to the trigger level

Return values:

<State> **READY.**
The command was executed successfully.

LLZ_TRIG_SOURCE? <TrigSource>
LLZ_TRIG_SOURCE <TrigSource>

Gets or sets the trigger source in "ILS LOC" mode.

Parameters:

<TrigSource> OFF | TIME | EXT

OFF
Free run mode, no trigger used

TIME
time trigger

EXT
external trigger

Return values:

<State> **READY.**
The command was executed successfully.

VIEW_GS?
VIEW_GS <View type>

Gets or sets the view in "ILS GP" mode. See Chapter 4.1.3, "ILS localizer and glide-path measurements and results", on page 44 for details.

Parameters:

<View type> **MAIN**
Main view

CRS|CLR
Course or clearance view

DIST
Distortion view

REC
Recording view

Return values:

<State> **READY.**
The command was executed successfully.

VIEW_LLZ?
VIEW_LLZ <View type>

Gets or sets the view in "ILS LOC" mode. See Chapter 4.1.3, "ILS localizer and glide-path measurements and results", on page 44 for details.

Parameters:

<View type>

MAIN
Main view

CRS|CLR
Course or clearance view

DIST
Distortion view

ID
ID Analysis view

REC
Recording view

Return values:

<State>

READY.
The command was executed successfully.

9.2.3 Configuring ILS glidepath measurements

The following commands are required to configure ILS GP measurements

DEMODE_GS?
DEMODE_GS <1F/2F mode>

Gets or sets the 1F/2F mode in "ILS GP" mode.

Parameters:

<1F/2F mode>

1F
ILS system with one carrier. The nominal frequency is the carrier frequency.

2F
ILS system with two carriers. The carrier frequencies (Course and Clearance) are above and below the nominal frequency (in a distance of a few kHz).

2F_CRS
Course of an ILS system (depending on the ILS system, it can be the upper or lower carrier frequency).

2F_CLR
Clearance of an ILS system (depending on the ILS system, it can be the upper or lower carrier frequency).

WIDE
In the wideband mode, 1-frequency and 2-frequency systems can be analyzed. Both carriers are inside one filter and can be demodulated together.
Note: In this mode, there is no configuration and display of the carrier offset.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "1F/2F" on page 64

GS_BB_1F_OFFSETKHZ? <Offset>
GS_BB_1F_OFFSETKHZ <Offset>

This command gets or sets the offset of the AF signal for LF input in "ILS GS" mode.

Parameters:

<Offset> Offset of the AF signal from 0 Hz.

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Low IF Offset" on page 72

GS_BB_AF_BW_IDDIST_KHZ? <Bandwidth>
GS_BB_AF_BW_IDDIST_KHZ <Bandwidth>

This command gets or sets the demodulator bandwidth for LF input (AF mode) for ID and distortion measurement in "ILS GP" mode.

Parameters:

<Bandwidth> 0_5KHZ | 1_5KHZ | 3KHZ | 5KHZ

Bandwidth

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "IF/AF Bandwidth (Dist/ID)" on page 73

GS_BB_BW_KHZ? <Bandwidth>
GS_BB_BW_KHZ <Bandwidth>

This command gets or sets the bandwidth for LF input in "ILS GP" mode.

Parameters:

<Bandwidth> 0.5KHZ | 1.5KHZ | 3KHZ | 5KHZ | 9KHZ | 12.5KHZ | 18KHZ | 25KHZ

Bandwidth

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Bandwidth (IF BW/AF In BW)" on page 73

GS_BB_LFIN_DCOFFSETV? <DCOffset>
GS_BB_LFIN_DCOFFSETV <DCOffset>

This command gets or sets the reference power for LF input (AF signals only) in "ILS GS" mode. This value is used to determine the modulation depth and corresponds to the DC power of the AF signal.

Parameters:

<Power> Reference DC power of the AF signal.
Default unit: V

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "DC Reference" on page 72

GS_BB_LOWIF_BW_IDDIST_KHZ? <Bandwidth>
GS_BB_LOWIF_BW_IDDIST_KHZ <Bandwidth>

This command gets or sets the demodulator bandwidth for LF input (low IF mode) for ID and distortion measurement in "ILS GP" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ
Bandwidth
Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "IF/AF Bandwidth (Dist/ID)" on page 73

GS_BB_LOWIF_BW_KHZ? <Bandwidth>
GS_BB_LOWIF_BW_KHZ <Bandwidth>

This command gets or sets the demodulator bandwidth for LF input (low IF mode) in "ILS GP" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ | 18KHZ | 25KHZ | 36KHZ | 50KHZ
Bandwidth
Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Bandwidth (IF BW/AF In BW)" on page 73

GS_BB_WIDE1F? <1F mode>
GS_BB_WIDE1F <1F mode>

Determines the type of LF input in "ILS GP" mode. Depending on the type of input, the available settings and results can vary.

Parameters:

<1F mode>

AF
Measures the AF signal at 0 Hz.

IF
Measures the signal at a low intermediate frequency, for example from a test point at the transmitter.

Return values:

<State>

READY.
The command was executed successfully.

Manual operation: See "LF In Mode" on page 71

GS_CARRIER_THRESHOLD_DB?
GS_CARRIER_THRESHOLD_DB <Threshold>

Gets or sets the carrier threshold in "ILS GP" mode.

Parameters:

<Threshold>

Carrier threshold

Default unit: dB

Return values:

<State>

READY.
The command was executed successfully.

Manual operation: See "Carrier Thresh" on page 67

GS_DEFAULT_FREQSTEP? <StepSize>
GS_DEFAULT_FREQSTEP <StepSize>

Gets or sets the default RF frequency step size in "ILS GP" mode.

Parameters:

<StepSize>

8.33_KHZ | 12.5_KHZ | 25_KHZ | 50_KHZ

*RST: 50_KHZ

Return values:

<State>

READY.
The command was executed successfully.

Manual operation: See "Step Size" on page 68

GS_DEM_1F2F_BW?
GS_DEM_1F2F_BW <Bandwidth>

Gets or Sets the 1F2F demodulator bandwidth in "ILS GP" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ
Demodulator bandwidth

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "IF BW" on page 70

GS_DEM_ID_BW?
GS_DEM_ID_BW <Bandwidth>

Gets or sets the ID demodulator Bandwidth in "ILS GP" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "IF BW Dist/ID" on page 70

GS_DEM_ID_WIDE_BW? <Bandwidth>
GS_DEM_ID_WIDE_BW <Bandwidth>

Gets or sets the WIDE demodulator bandwidth for ID and distortion analysis in "ILS GP" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ | 18KHZ | 25KHZ | 36KHZ | 50KHZ

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "IF BW Dist/ID" on page 70

GS_DEM_WIDE_BW?
GS_DEM_WIDE_BW <Bandwidth>

Gets or sets the WIDE demodulator bandwidth in "ILS GP" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ | 18KHZ | 25KHZ | 36KHZ | 50KHZ

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "IF BW" on page 70

GS_DEMFREQS_OFFSET_AUTOMAN?
GS_DEMFREQS_OFFSET_AUTOMAN <Mode>

Gets or sets the mode of the demodulator frequency offset in "ILS GP" mode.

Parameters:

<Mode> **AUTO_LOCK**
Sets the demodulator frequency offset automatically. Once a valid signal has been found, the carrier frequencies remain fixed until you perform a manual change.

AUTO_RETUNE
Sets the demodulator frequency offset automatically. If the carrier frequency changes, the R&S EVSF1000 starts a new search (retuning).

MANUAL
Sets the demodulator frequency offset manually.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "CRS/CLR Carr (Autotune function)" on page 65

GS_DEMFREQS_OFFSET_1F?
GS_DEMFREQS_OFFSET_1F <Freq. Offset>

Gets or sets the demodulator 1F frequency offset in "ILS GP" mode.

Parameters:

<Freq. Offset> Frequency offset

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "1F Offset" on page 66

GS_DEMFREQS_OFFSET_LOWERFREQ?
GS_DEMFREQS_OFFSET_LOWERFREQ <Freq. Offset>

Gets or Sets the demodulator lower frequency offset in "ILS GP" mode.

Parameters:

<Freq. Offset> Lower frequency offset

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Clearance" on page 66

GS_DEMFREQS_OFFSET_UPPERFREQ?
GS_DEMFREQS_OFFSET_UPPERFREQ <Freq. Offset>

Gets or Sets the demodulator upper frequency offset in "ILS GP" mode.

Parameters:

<Freq. Offset> Upper frequency offset

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Course" on page 66

GS_ID_STAT?
GS_ID_STAT <State>

Enables or disables the ID statistics calculation for ILS glidepath measurements.

Parameters:

<State> **ON**
The ID code is determined as the most probable code based on the previous decoding results.

OFF
The most recently decoded ID is used.

FILTER_GS_RESIDFM?
FILTER_GS_RESIDFM <Bandwidth>

Defines or queries the filter type used to determine residual FM in "ILS GP" mode

Return values:

<Bandwidth> **ICAO**
Filter according to ICAO specification

NARROW
Narrow filter; the DDM filters used to determine the 90 Hz/ 150 Hz modulation values are used to avoid interference between the signals

*RST: ICAO

Example: `FILTER_GS_RESIDFM NARROW`

GS_RFLF_INPUT? <Input>
GS_RFLF_INPUT <Input>

Configures the input source for the receiver in "ILS GP" mode.

Parameters:

<Input>

RX_IN
RF input from RX 1 In/RX 2 In connectors on the front of the R&S EVSF1000

LF_IN
An AF or low frequency signal is provided at the LF In input connector on the rear side of the R&S EVSF1000.

Return values:

<State>

READY.
The command was executed successfully.

Manual operation: See "Input RF/LF" on page 63

GS_START_FINDCARRIER

Starts to search for a carrier in "ILS GP" mode.

Return values:

<State>

READY.
The command was executed successfully.

Manual operation: See "Find Carrier" on page 67

GS_TRIG_EDGE? <TrigEdge>
GS_TRIG_EDGE <TrigEdge>

Gets or sets whether triggering occurs when the signal rises to the trigger level or falls down to it in "ILS GP" mode.

Parameters:

<TrigEdge>

POSITIVE | NEGATIVE

POSITIVE
Triggers when the signal rises to the trigger level

NEGATIVE
Triggers when the signal falls down to the trigger level

Return values:

<State>

READY.
The command was executed successfully.

GS_TRIG_SOURCE? <TrigSource>
GS_TRIG_SOURCE <TrigSource>

Gets or sets the trigger source in "ILS GP" mode.

Parameters:

<TrigSource> OFF | TIME | EXT

OFF
Free run mode, no trigger used

TIME
Time trigger

EXT
External trigger

Return values:

<State> **READY.**
The command was executed successfully.

9.2.4 Retrieving ILS loc and GP results

The following commands are required to retrieve results for ILS Loc or GP measurements

Useful commands for retrieving results described elsewhere:

- GETDATADEF on page 366
- GETDATASET on page 366
- LA? on page 231
- RF on page 231
- FFT_GETSPECT on page 354

Remote commands exclusive to ILS Loc and GP results:

AC8

This command queries the code of identifier, LLZ only.

Return values:

<[CODE]> AC8 value of the identifier

Manual operation: See "ID Code" on page 56

AF2

This command queries the AF frequency of 90 Hz signal.

Return values:

<[Hz]> AF2 value of the frequency

Manual operation: See "Freq 90 Hz" on page 56

AF3

This command queries the AF frequency of 150 Hz signal.

Return values:

<[Hz]> AF3 value of the frequency

Manual operation: See "Freq 150 Hz" on page 56

AF8

This command queries the AF frequency of the identifier, LLZ only.

Return values:

<[Hz]> AF8 value of the frequency

Manual operation: See "ID Freq" on page 61

AM2

This command shows the AM modulation depth of 90 Hz signal.

Return values:

<[%]> AM modulation depth value of 90 Hz

Manual operation: See "AM 90 Hz" on page 56

AM2CLR

This command shows the AM modulation depth of 90 Hz clearance signal.

Return values:

<[%]> AM modulation depth value of 90 Hz clearance signal

Manual operation: See "AM 90 Hz" on page 56

AM2CRS

This command shows the AM modulation depth of 90 Hz course signal.

Return values:

<[%]> AM modulation depth value of 90 Hz course signal

Manual operation: See "AM 90 Hz" on page 56

AM3

This command shows the AM modulation depth of 150 Hz signal.

Return values:

<[%]> AM modulation depth value of 150 Hz

Manual operation: See "AM 150 Hz" on page 56

AM3CLR

This command shows the AM modulation depth of 150 Hz clearance signal.

Return values:

<[%]> AM modulation depth value of 150 Hz clearance signal

Manual operation: See "AM 150 Hz" on page 56

AM3CRS

This command shows the AM modulation depth of 150 Hz course signal.

Return values:

<[%]> AM modulation depth value of 150 Hz course signal

Manual operation: See "AM 150 Hz" on page 56

AM8

This command queries the AM modulation of identifier, LLZ only.

Return values:

<[%]> AM8 value of the identifier

Manual operation: See "ID AM" on page 61

AM9

This command queries the AM modulation of voice, LLZ only.

Return values:

<[%]> AM9 value of voice

AMMOD240

This command queries the AM modulation depth of 90 + 150 = 240 Hz signal.

Return values:

<[%]> AM modulation depth

Manual operation: See "AM (90+150)" on page 59

GS_BB_DC_V

This command queries the measured DC power level in Volt for LF input (AF mode) in "ILS GP" mode.

Return values:

<Power> Measured DC power of the AF signal

Default unit: V

GS_BB_LEV_V

This command queries the measured power level in Volt for LF input in "ILS GP" mode.

Return values:

<Power> Measured power of the LF input

Default unit: V

GS_BB_LEV_V

This command queries the maximum peak-to-peak power level in Volt for LF input in "ILS GP" mode.

Return values:

<Power> Maximum peak-to-peak power of the LF input

Default unit: V

DCLR

This command queries the current DDM Clearance value.

Return values:

DDM_CLR [1] DDM Clearance Value (dimensionless)

Manual operation: See "DDM 90-150" on page 55

DCRS

This command queries the current DDM Course value.

Return values:

DDM_CRS [1] DDM Course Value (dimensionless)

Manual operation: See "DDM 90-150" on page 55

DD0

This command queries the current DDM value.

Return values:

<DDM [1]> DDM value (dimensionless)

Manual operation: See "DDM 90-150" on page 55

DD1

This command queries the current DDM value.

Return values:

DDM [µA] DDM value (µA)

Manual operation: See "DDM 90-150" on page 55

FCLR

This command queries the current frequency Clearance value.

Return values:

<[Hz]> RF Clearance frequency in Hz.

Example:
```
FCRS
-8000.3Hz
```

FCRS

This command queries the current frequency Course value.

Return values:

<[Hz]> RF Course frequency in Hz.

Example:
```
FCRS
8000.2Hz
```

FSINGLE

This command queries the current frequency Single value.

Parameters:

<[Hz]> RF Single Frequency in Hz

Manual operation: See "Low IF frequency" on page 51

K2_150

This command queries the K2 distortion parameter of 150 Hz signal.

Return values:

<[%]> K2 distortion value of 150 Hz signal

Manual operation: See "K2 150 Hz" on page 58

K2_90

This command queries the K2 distortion parameter of 90 Hz signal.

Return values:

<[%]> K2 distortion value of 90 Hz signal

Manual operation: See "K2 90 Hz" on page 58

K3_150

This command queries the K3 distortion parameter of 150 Hz signal.

Return values:

<[%]> K3 distortion value of 150 Hz signal

Manual operation: See "K3 150 Hz" on page 59

K3_90

This command queries the K3 distortion parameter of 90 Hz signal.

Return values:

<[%]> K3 distortion value of 90 Hz signal

Manual operation: See "K3 90 Hz" on page 58

K4_90

This command queries the K4 distortion parameter of 90 Hz signal.

Return values:

<[%]> K4 distortion value of 90 Hz signal

Manual operation: See "K4 90 Hz" on page 58

K4_150

This command queries the K4 distortion parameter of 150 Hz signal.

Return values:

<[%]> K4 distortion value of 150 Hz signal

Manual operation: See "K4 150 Hz" on page 59

LCLR

This command queries the current Clearance Level value.

Return values:

<[dBm]> Clearance Level value in dBm

LCRS

This command queries the current Course Level value.

Return values:

<[dBm]> Course Level value in dBm

PH

Phase shift between 90 Hz/150 Hz.

Return values:

<[°]> Phase shift

Manual operation: See "PHI 90/150" on page 56

PH_90_90

Phase shift between 90 Hz/90 Hz.

Return values:

<[°]>	Phase shift

PH_150_150

Phase shift between 150 Hz/150 Hz.

Return values:

<[°]>	Phase shift

RESIDFM_90

This command queries the residual FM distortion parameter of 90 Hz signal.

Return values:

<[%]>	Residual FM distortion value of 90 Hz signal
Manual operation:	See "Res. FM 90" on page 58

RESIDFM_150

This command queries the residual FM distortion parameter of 150 Hz signal.

Return values:

<[%]>	Residual FM distortion value of 150 Hz signal
Manual operation:	See "Res. FM 150" on page 59

SCLR

This command queries the current SDM Clearance value.

Return values:

SDM_CLR [1]	SDM Clearance Value (dimensionless)
Manual operation:	See "SDM 90,150" on page 56

SCRS

This command queries the current SDM Course value.

Return values:

SDM_CRS [1]	SDM Course Value (dimensionless)
Manual operation:	See "SDM 90,150" on page 56

SD0

This command queries the current SDM value.

Return values:

SDM [1] SDM value (dimensionless)

Manual operation: See "SDM 90,150" on page 56

SD1

This command queries the current SDM value.

Return values:

SDM [µA] SDM value (µA)

Manual operation: See "SDM 90,150" on page 56

THD_150

This command queries the THD distortion parameter of 150 Hz signal.

Return values:

<[%]> THD distortion value of 150 Hz signal

Manual operation: See "THD 150 Hz" on page 59

THD_90

This command queries the THD distortion parameter of 90 Hz signal.

Return values:

<[%]> THD distortion value of 90 Hz signal

Manual operation: See "THD 90 Hz" on page 58

LLZ_BB_DC_V

This command queries the measured DC power level in Volt for LF input (AF mode) in "ILS LOC" mode.

Return values:

<Power> Measured DC power of the AF signal

Default unit: V

Manual operation: See "DC" on page 51

LLZ_BB_LEV_V

This command queries the measured power level in Volt for LF input in "ILS LOC" mode.

Return values:

<Power> Measured power of the LF input

Default unit: V

Manual operation: See "Lev" on page 51

LLZ_BB_VMAXPP_V

This command queries the maximum peak-to-peak power level in Volt for LF input in "ILS LOC" mode.

Return values:

<Power> Maximum peak-to-peak power of the LF input

Default unit: V

Manual operation: See "Vmax(pp)" on page 51

9.2.5 Retrieving ID results

The following commands are required to retrieve ILS Loc identifier results.

ID_DASH_LENGTH

Queries the length of time a dash is transmitted in the used Morse code in "ILS LOC" mode

Return values:

<Time> Dash time of ID signal

Default unit: ms

Manual operation: See "Dash Length" on page 61

ID_DOT_LENGTH

Queries the length of time a dot is transmitted in the used Morse code in "ILS LOC" mode

Return values:

<Time> Dot time of ID signal

Default unit: ms

Manual operation: See "Dot Length" on page 61

ID_DOTDASH_GAP

Queries the length of time that passes between a transmitted dot and a dash in the used Morse code in "ILS LOC" mode.

Return values:

<Time> Dot-Dash gap time of ID signal

Default unit: ms

Manual operation: See "Dot-Dash Gap" on page 61

ID_LETTER_GAP

Queries the length of time that passes between two transmitted letters in the used Morse code in "ILS LOC" mode.

Return values:

<Time> Letter gap time of ID signal

Default unit: ms

Manual operation: See "Letter Gap" on page 61

ID_PERIOD

Queries the periodic time between two measured ID pulses in "ILS LOC" mode.

Return values:

<Time> Periodic time between two ID pulses.

Default unit: s

Manual operation: See "ID Period" on page 61

LASTID_TIME

Queries the time since last valid ID pulse was measured in "ILS LOC" mode.

Return values:

<Time> Time since last valid ID pulse

Default unit: s

Manual operation: See "Last ID" on page 61

9.2.6 Deprecated commands

The following commands are maintained for compatibility with former Rohde & Schwarz analyzers only. For new remote control programs, use the commands described in Chapter 9.2.1, "Configuring the ILS LOC and GP modes", on page 260 and Chapter 9.12, "Data management", on page 360.

MEASMODE?
MEASMODE <Measurement mode>

This command sets the current LLZ or GS measurement mode and the associated threshold distortion values.

Parameters:

<Measurement mode>

CRS+CLR_MOD
Sets the Course and Clearance measurement mode.

COURSE_MOD
Sets the Course measurement mode.

CLEAR_MOD
Sets the Clearance measurement mode.

CRS|CLR_MOD
Sets Course or Clearance measurement mode.

SINGLE_MOD
Sets single frequency measurement mode.

WIDEBAND_MOD
Sets wideband frequency measurement mode.

CRS+CLR_THD
Sets the Course and Clearance THD distortion value.

COURSE_THD
Sets the Course THD distortion value.

CLEAR_THD
Sets the Clearance THD distortion value.

SINGLE_THD
Sets single frequency THD distortion value.

WIDEBAND_THD
Sets wideband frequency THD distortion value.

Return values:

<State>

READY.
The command was executed successfully.

LLZ

This command switches the mode to the "ILS LOC" mode. The `LLZ` command is identical to the `MODE_LOC` command.

Parameters:

<State> **READY.**
The command was executed successfully.

GS

This command switches the mode to the "ILS GP" mode. The `GS` command is identical to the `MODE_GP` command.

Parameters:

<State> **READY.**
The command was executed successfully.

FA0

This command stops the continuous output that was started with FA1, FA2, FA4, FA5, STREAM.

Return values:

<State> **READY.**
The command was executed successfully.

FA1

This command activates the continuous output of DDM /level measurement results. The output rate is defined by the current measurement time. Values are separated by a TAB (ASC 09) DDM [1] RF level [dBm].

The command FA0 stops the output.

Return values:

<State> **READY.**
The command was executed successfully.

FA2

This command activates the continuous repetition of a set of values. The output rate is defined by the current measurement time.

All values are transmitted as integer values, multiplied with a constant factor:

- DDM [1], Multiplier: 10000
- RF level [dBm], Multiplier: 10
- AM-Mod90 [%], Multiplier: 100
- AM-Mod150 [%], Multiplier: 100

The command FA0 stops the output.

Return values:

<State> **READY.**
The command was executed successfully.

FA3

The same output format as FA2 on page 291, but the values are only transmitted when triggered by another FA3 command. Note that this behavior is different from EVS200, where the trigger is an arbitrary ASCI character.

Return values:

<State>	**READY.** The command was executed successfully.

FA4

The same as FA1 on page 291, but output is preceded by a timestamp.

Return values:

<State>	**READY.** The command was executed successfully.

FA5

The same as FA1 on page 291, but output is preceded by the time in ms since the FA5 is started.

The command FA0 stops the output.

Return values:

<State>	**READY.** The command was executed successfully.

9.3 ILS marker beacon (MB) mode

The following commands are required to configure and perform measurements in the ILS Marker beacon mode.

9.3.1 Configuring ILS MB measurements

The following commands are required to configure ILS MB measurements.

MODE_MB

The `MODE_MB` command is identical to the `MB` command.

For description, see MB on page 259.

MB_DEFAULT_FREQSTEP? <StepSize>
MB_DEFAULT_FREQSTEP <StepSize>

Gets or sets the default RF frequency step size in "ILS MB" mode.

Parameters:

<StepSize> 8.33_KHZ | 12.5_KHZ | 25_KHZ | 50_KHZ

*RST: 50_KHZ

Return values:

<State> **READY.**
The command was executed successfully.

MB_DEM_BW?
MB_DEM_BW <Bandwidth>

Gets or sets the demodulator bandwidth in "ILS MB" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ | 18KHZ | 25KHZ | 36KHZ | 50KHZ

Demodulator bandwidth

Return values:

<State> **READY.**
The command was executed successfully.

VIEW_MB?
MB_TRIG_EDGE? <TrigEdge>
MB_TRIG_EDGE <TrigEdge>

Gets or sets whether triggering occurs when the signal rises to the trigger level or falls down to it in "ILS MB" mode.

Parameters:

<TrigEdge> POSITIVE | NEGATIVE

POSITIVE
Triggers when the signal rises to the trigger level

NEGATIVE
Triggers when the signal falls down to the trigger level

Return values:
<State> **READY.**
The command was executed successfully.

MB_TRIG_SOURCE? <TrigSource>
MB_TRIG_SOURCE <TrigSource>

Gets or sets the trigger source in "ILS MB" mode.

Parameters:
<TrigSource> OFF | TIME | EXT

OFF
Free run mode, no trigger used

TIME
Time trigger

EXT
External trigger

Return values:
<State> **READY.**
The command was executed successfully.

VIEW_MB <View type>

This command selects a view type for the MB mode.

Parameters:
<View type> **MAIN | DIST | LOG**
Available views for the MB mode.

Return values:
<State> **READY.**
The command was executed successfully.

9.3.2 Retrieving ILS MB results

The following commands are required to retrieve results from ILS MB measurements.

Useful commands for retrieving results described elsewhere:

- `GETDATADEF` on page 366
- `GETDATASET` on page 366

Remote commands exclusive to ILS MB results:

FMEAS

This command queries the measured value of RF frequency.

Return values:
<kHz> Provides the value of measured RF frequency in kHz.

AF4

This command queries the AF frequency of 3000 Hz signal.

Return values:
<Hz> Provides the AF4 frequency in Hz.

Manual operation: See "Freq 3000 Hz" on page 80

AF5

This command queries the AF frequency of 1300 Hz signal.

Return values:
<Hz> Provides the AF5 frequency in Hz.

Manual operation: See "Freq 1300 Hz" on page 80

AF6

This command queries the AF frequency of 400 Hz signal.

Return values:
<Hz> Provides the AF6 frequency in Hz.

Manual operation: See "Freq 400 Hz" on page 79

AF7

This command queries the AF frequency of the identifier.

Return values:
<Hz> Provides the identifier's frequency in Hz.

AM4

This command queries the AM modulation of 3000 Hz signal.

Return values:
<%> Provides the AM4 modulation in %.

Manual operation: See "AM 3000 Hz" on page 80

AM5

This command queries the AM modulation of 1300 Hz signal.

Return values:
<%> Provides the AM5 modulation in %.

Manual operation: See "AM 1300 Hz" on page 79

AM6

This command queries the AM modulation of 400 Hz signal.

Return values:
<%> Provides the AM6 modulation in %.

Manual operation: See "AM 400 Hz" on page 79

AM7

This command queries the AM modulation of the identifier.

Return values:
<%> Provides the AM7 modulation in %.

9.3.3 Retrieving ILS MB identifier results

The following commands are required to retrieve identifier results from ILS MB measurements.

ID_F400_DASHLEN

Queries the dash time of 400 Hz signal in "ILS" MB mode.

Return values:
<Time> Length of time a dash for the outer marker.
Default unit: ms

Manual operation: See "400 Hz Dash" on page 81

ID_F1300_DASHLEN

Queries the dash time of 1300 Hz signal in "ILS" MB mode.

Return values:

<Time> Length of time a dash is transmitted for the middle marker.

Default unit: ms

Manual operation: See "1300 Hz Dash" on page 81

ID_F1300_DOTLEN

Queries the dot time of 1300 Hz signal in "ILS" MB mode.

Return values:

<Time> Length of time a dot is transmitted for the middle marker.

Default unit: ms

Manual operation: See "1300 Hz Dot" on page 81

ID_F3000_DOTLEN

Queries the dot time of 3000 Hz signal in "ILS" MB mode.

Return values:

<Time> Length of time a dot is transmitted for the inner marker.

Default unit: ms

Manual operation: See "3000 Hz Dot" on page 81

ID_F400_GAP

Queries the dash-dash gap time of 400 Hz signal in "ILS MB" mode.

Return values:

<Time> Length of time that passes between two transmitted dashes for the outer marker.

Default unit: ms

Manual operation: See "400 Hz Gap" on page 81

ID_F1300_GAP

Queries the dash-dot gap time of 1300 Hz signal in "ILS MB" mode.

Return values:

<Time> Length of time that passes between a transmitted dot and a dash for the middle marker.

Default unit: ms

Manual operation: See "1300 Hz Gap" on page 81

ID_F3000_GAP

Queries the dot-dot gap time of 3000 Hz signal in "ILS MB" mode.

Return values:

<Time> Length of time that passes between two transmitted dots for the inner marker.

Default unit: ms

Manual operation: See "3000 Hz Gap" on page 81

9.3.4 Deprecated commands

The following commands are maintained for compatibility with former Rohde & Schwarz analyzers only. For new remote control programs, use the commands described in Chapter 9.3.1, "Configuring ILS MB measurements", on page 292 and Chapter 9.12, "Data management", on page 360.

FA0

This command stops the continuous output that was started with FA2.

Return values:

<State> **READY.**
The command was executed successfully.

FA2

This command activates the continuous repetition of a set of values. The output rate is defined by the current measurement time.

All values are transmitted as integer values, multiplied with a constant factor.

The following multipliers are applied:

- 10 for RF level [dBm]
- 100 for AM-Mod400 [%]
- 100 for AM-Mod1300 [%]
- 100 for AM-Mod3000 [%]
- 100 for AM-Mod ID [%]

The command FA0 stops the output.

Return values:

<State> **READY.**
The command was executed successfully.

9.4 VOR mode

The following commands are required to configure and perform measurements in the VOR mode. They are only available if the R&S EVSG-K2 VOR analysis option is installed.

9.4.1 Configuring VOR measurements

The following commands are required to configure VOR measurements.

Useful commands for VOR measurements described elsewhere:

- RFCH on page 231

Remote commands exclusive to VOR measurements:

MODE_VOR

The `MODE_VOR` command is identical to the `MV` command.

For description, see `MV` on page 259.

VIEW_VOR?
VIEW_VOR <View type>

This command selects a view type for the VOR mode.

Parameters:

<View type> **MAIN | DIST | ID | LOG**
Available views for VOR mode.

Return values:

<State> **READY.**
The command was executed successfully.

VOR_BB_BW_KHZ? <Bandwidth>
VOR_BB_BW_KHZ <Bandwidth>

This command gets or sets the bandwidth for LF input in "VOR" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ | 18KHZ | 25KHZ | 36KHZ | 50KHZ

Bandwidth

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Bandwidth (IF BW/AF In BW)" on page 73

VOR_BB_LFIN_DCOFFSETV? <DCOffset>
VOR_BB_LFIN_DCOFFSETV <DCOffset>

This command gets or sets the DC offset for LF input in "VOR" mode.

Parameters:

<DCOffset> Power offset of the LF input at 0 Hz.

Default unit: V

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "DC Reference" on page 72

VOR_DEFAULT_FREQSTEP? <StepSize>
VOR_DEFAULT_FREQSTEP <StepSize>

Gets or sets the default RF frequency step size in "VOR" mode.

Parameters:

<StepSize> 8.33_KHZ | 12.5_KHZ | 25_KHZ | 50_KHZ

*RST: 50_KHZ

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Step Size" on page 68

VOR_DEM_AM_BW?
VOR_DEM_AM_BW <Bandwidth>

Gets or sets the demodulator bandwidth for the AM 30 Hz modulation in "VOR" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "AM30 BW" on page 104

VOR_DEM_BEARFILTER? <Type>
VOR_DEM_BEARFILTER <Type>

Defines the filter type used to determine the bearing angle.

Parameters:

<Type> **NARROW**
For small input levels

WIDE
Faster; used in previous software releases

*RST: WIDE

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Bear.Filt." on page 104

VOR_DEM_BW?
VOR_DEM_BW <Bandwidth>

Gets or sets the demodulator Bandwidth in "VOR" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ | 18KHZ | 25KHZ | 36KHZ | 50KHZ

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "IF BW" on page 104

VOR_DEM_FM_BW?
VOR_DEM_FM_BW <Bandwidth>

Gets or sets the demodulator bandwidth for the FM 9960 Hz modulation in "VOR" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "FM BW" on page 104

VOR_DEMFREQS_OFFSET? <Freq. Offset>
VOR_DEMFREQS_OFFSET <Freq. Offset>

Gets or sets a frequency offset of the carrier frequency in "VOR" mode.

Parameters:

<Freq. Offset> Frequency offset

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Freq Offset" on page 102

VOR_ID_STAT?
VOR_ID_STAT <State>

Enables or disables the ID statistics calculation in VOR measurements.

Parameters:

<State> **ON**
The ID code is determined as the most probable code based on the previous decoding results.

OFF
The most recently decoded ID is used.

VOR_RFLF_INPUT? <Input>
VOR_RFLF_INPUT <Input>

Configures the input source for the receiver in "VOR" mode.

Parameters:

<Input>

RX_IN
RF input from RX 1 In/RX 2 In connectors on the front of the R&S EVSF1000

LF_IN
An AF or low frequency signal is provided at the LF In input connector on the rear side of the R&S EVSF1000.

Return values:

<State>

READY.
The command was executed successfully.

Manual operation: See "Input RF/LF" on page 63

VOR_TRIG_EDGE? <TrigEdge>
VOR_TRIG_EDGE <TrigEdge>

Gets or sets whether triggering occurs when the signal rises to the trigger level or falls down to it in "VOR" mode.

Parameters:

<TrigEdge> POSITIVE | NEGATIVE

POSITIVE
Triggers when the signal rises to the trigger level

NEGATIVE
Triggers when the signal falls down to the trigger level

Return values:

<State>

READY.
The command was executed successfully.

VOR_TRIG_SOURCE? <TrigSource>
VOR_TRIG_SOURCE <TrigSource>

Gets or sets the trigger source in "VOR" mode.

Parameters:

<TrigSource> OFF | TIME | EXT

OFF
Free run mode, no trigger used

TIME
time trigger

EXT
external trigger

Return values:

<State> **READY.**
The command was executed successfully.

9.4.2 Retrieving VOR results

The following commands are required to retrieve results from VOR measurements.

Useful commands for retrieving results described elsewhere:

- GETDATADEF on page 366
- GETDATASET on page 366

Remote commands exclusive to VOR results:

AC8

This command queries the CODE of an identifier.

Return values:

<CODE> Code of an identifier

Manual operation: See "ID Code" on page 56

AF0

This command queries the AF frequency of the 30 Hz signal.

Return values:

<[Hz]> AF frequency of 30 Hz signal

Manual operation: See "Freq 30 Hz" on page 95

AF1

This command queries the AF frequency of the 9960 Hz signal.

Return values:

<[Hz]> AF frequency 9960 Hz signal

Manual operation: See "Freq 9960 Hz" on page 95

AF2

This command queries the AF frequency of the FM 30 Hz signal.

Return values:

<[Hz]> AF frequency of FM 30 Hz signal

Manual operation: See "Freq FM30" on page 95

AF8

This command queries the AF frequency of identifier.

Return values:

<[Hz]> Identifier AF frequency

Manual operation: See "ID Freq" on page 61

AM0

This command queries the modulation of the 30 Hz signal.

Return values:

<[%]> 30 Hz signal modulation

Manual operation: See "AM 30 Hz" on page 94

AM1

This command queries the modulation of the 9960 Hz signal.

Return values:

<[%]> 9960 Hz signal modulation

Manual operation: See "AM 9960 Hz" on page 94

AM8

This command queries the modulation of identifier.

Return values:
<[%]> Identifier modulation

Manual operation: See "ID AM" on page 61

AM9

This command queries the modulation of voice.

Return values:
<[%]> Voice modulation

Manual operation: See "Voice AM" on page 95

BE?
BE_TO?
BE

This command queries the bearing angle.

Return values:
<[°]> Bearing angle in [°].

Manual operation: See "Bearing (from)" on page 94

DIST_9960

This command queries the AM distortion of the 9960 Hz signal.

Return values:
<[%]> AM distortion of 9960 Hz signal

FM0

This command queries the FM deviation.

Return values:
<[Hz]> FM deviation

Manual operation: See "FM-Deviation" on page 95

FM1

This command queries the FM index.

Return values:
<[1]> FM index (dimensionless)

Manual operation: See "FM Index" on page 95

FMEAS

This command queries the measured value of the RF frequency.

Return values:

<Hz> Measured RF frequency

SUBCARR_AM1K44

Queries the AM distortion at 1440 Hz (48 segments * 30 Hz) in "VOR" mode.

Return values:

<Distortion> Distortion

Default unit: %

Manual operation: See "Subcarrier AM Distortion" on page 96

SUBCARR_AM1K50

Queries the AM distortion at 1500 Hz (50 segments * 30 Hz) in "VOR" mode.

Return values:

<Distortion> Distortion

Default unit: %

Manual operation: See "Subcarrier AM Distortion" on page 96

SUBCARR_AM60HZ

Queries the AM distortion at a modulation frequency of 60 Hz in "VOR" mode.

Return values:

<Distortion> Distortion

Default unit: %

Manual operation: See "Subcarrier AM Distortion" on page 96

SUBCARR_K2

Queries K2 subcarrier harmonic of VOR signal in "VOR" mode.

Return values:

<Distortion> Distortion 2nd order

Default unit: dB

Manual operation: See "Subcarrier Harmonics" on page 96

SUBCARR_K3

Queries K3subcarrier harmonic of VOR signal in "VOR" mode.

Return values:

<Distortion> Distortion 3rd order

Default unit: dB

Manual operation: See "Subcarrier Harmonics" on page 96

SUBCARR_K4

Queries K4 subcarrier harmonic of VOR signal in "VOR" mode.

Return values:

<Distortion> Distortion 4th order

Default unit: dB

Manual operation: See "Subcarrier Harmonics" on page 96

SUBCARR_K5

Queries K5 subcarrier harmonic of VOR signal in "VOR" mode.

Return values:

<Distortion> Distortion 5th order

Default unit: dB

Manual operation: See "Subcarrier Harmonics" on page 96

9.4.3 Deprecated commands

The following commands are maintained for compatibility with former Rohde & Schwarz analyzers only. For new remote control programs, use the commands described in Chapter 9.4.1, "Configuring VOR measurements", on page 299 and Chapter 9.12, "Data management", on page 360.

FA2

This command activates the continuous repetition of a set of values. The output rate is defined by the current measurement time.

All values are transmitted as integer values, multiplied with a constant factor.

The following multipliers are applied:

- 10 for RF level [dBm]
- 100 for Bearing [DEG]
- 100 for AM-Mod30 [%]
- 100 for AM-Mod9960 [%]
- 10 for FM-Deviation [Hz]
- 10 for FM-Index [1]

The command FA0 stops the output.

Return values:

<State> **READY.**
The command was executed successfully.

FA0

This command stops the continuous output that was started with FA2.

Return values:

<State> **READY.**
The command was executed successfully.

9.5 COM mode

The following commands are required to configure and perform measurements in the COM mode. They are only available if the R&S EVSG-K6 COM analysis option is installed.

9.5.1 Configuring COM measurements

The following commands are required to configure COM measurements.

MODE_COM

This command switches the instrument to the "COM" mode.

Return values:

<State> **READY.**
The command was executed successfully.

VIEW_COM?
VIEW_COM

Gets or sets the view in "COM" mode.

Parameters:

<View type> **MAIN_1_0kHz | MAIN_1_2kHz | REC**
Available views for COM mode.

Return values:

<State> **READY.**
The command was executed successfully.

AMFREQ_OFFSET_TX1?
AMFREQ_OFFSET_TX1 <Freq>

Gets or sets the demodulator upper frequency offset in "COM" mode.

Parameters:

<Freq> Demodulator upper frequency offset.
Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "TX1 Offset/TX2 Offset" on page 112

AMFREQ_OFFSET_TX2?
AMFREQ_OFFSET_TX2 <Freq>

Gets or Sets the demodulator lower frequency offset in"COM" mode.

Parameters:

<Freq> Demodulator lower frequency offset.
Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "TX1 Offset/TX2 Offset" on page 112

COM_1F2F_MEASMODE? <Mode>
COM_1F2F_MEASMODE <Mode>

Selects the number of frequencies or channels to be measured.

Parameters:

<Mode>
1F
One frequency only is measured, namely the nominal frequency, which is also the center frequency.

2F
Two frequencies are measured at the same time. Which frequencies are measured is configured by the `AMFREQ_OFFSET_TX1` and `AMFREQ_OFFSET_TX2` commands.

Manual operation: See "1F/2F" on page 111

COM_DEFAULT_FREQSTEP? <StepSize>
COM_DEFAULT_FREQSTEP <StepSize>

Gets or sets the default RF frequency step size in "COM" mode.

Parameters:

<StepSize> 8.33_KHZ | 12.5_KHZ | 25_KHZ | 50_KHZ
*RST: 50_KHZ

Return values:

<State>
READY.
The command was executed successfully.

COM_DEMOD_BW_1F?
COM_DEMOD_BW_1F <Bandwidth>

Gets or sets the 1F demodulator bandwidth in "COM" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ

Return values:

<State>
READY.
The command was executed successfully.

Manual operation: See "BW 1F BW 2F" on page 114

COM_DEMOD_BW_2F?
COM_DEMOD_BW_2F <Bandwidth>

Gets or sets the 2F demodulator bandwidth in "COM" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "BW 1F BW 2F" on page 114

COM_TONEFREQ_1K01K2? <Frequency>
COM_TONEFREQ_1K01K2 <Frequency>

Gets or sets the tone frequency to measure AM and distortion values in "COM" mode.

Parameters:

<Frequency> Tone frequency

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Tone Freq." on page 112

COM_TRIG_EDGE? <TrigEdge>
COM_TRIG_EDGE <TrigEdge>

Gets or sets whether triggering occurs when the signal rises to the trigger level or falls down to it in "COM" mode.

Parameters:

<TrigEdge> POSITIVE | NEGATIVE

POSITIVE
Triggers when the signal rises to the trigger level

NEGATIVE
Triggers when the signal falls down to the trigger level

Return values:

<State> **READY.**
The command was executed successfully.

COM_TRIG_SOURCE? <TrigSource>
COM_TRIG_SOURCE <TrigSource>

Gets or sets the trigger source in "COM" mode.

Parameters:

<TrigSource> OFF | TIME | EXT

OFF
Free run mode, no trigger used

TIME
Time trigger

EXT
External trigger

Return values:
<State> **READY.**
The command was executed successfully.

RF_MHZ_5DECIMALS?
RF_MHZ_5DECIMALS <Frequency>

Gets or sets RF frequency in "COM" mode.

Parameters:
<Frequency> RF frequency
Default unit: MHz

Return values:
<State> **READY.**
The command was executed successfully.

9.5.2 Retrieving COM results

The following commands are required to retrieve results from COM measurements.

GET_K2_1K0

This command queries the K2 distortion parameter of 1.0 kHz signal.

Return values:
<[%]> K2 distortion value of 1.0 kHz signal

Manual operation: See "K2 1.0 kHz/ 1.2 kHz" on page 109

GET_K2_1K2

This command queries the K2 distortion parameter of 1.2 kHz signal.

Return values:
<[%]> K2 distortion value of 1.2 kHz signal

Manual operation: See "K2 1.0 kHz/ 1.2 kHz" on page 109

GET_K3_1K0

This command queries the K3 distortion parameter of 1.0 kHz signal.

Return values:
<[%]> K3 distortion value of 1.0 kHz signal

Manual operation: See "K3 1.0 kHz/ 1.2 kHz" on page 109

GET_K3_1K2

This command queries the K3 distortion parameter of 1.2 kHz signal.

Return values:
<[%]> K3 distortion value of 1.2 kHz signal

Manual operation: See "K3 1.0 kHz/ 1.2 kHz" on page 109

GET_K4_1K0

This command queries the K4 distortion parameter of 1.0 kHz signal.

Return values:
<[%]> K4 distortion value of 1.0 kHz signal

Manual operation: See "K4 1.0 kHz/ 1.2 kHz" on page 109

GET_K4_1K2

This command queries the K4 distortion parameter of 1.2 kHz signal.

Return values:

<[%]> K4 distortion value of 1.2 kHz signal

Manual operation: See "K4 1.0 kHz/ 1.2 kHz" on page 109

GET_MEASFREQ

Query the measured value of delta RF carrier frequency to set RF frequency in "COM" mode.

Return values:

<freq> Delta between measured and set RF frequency.

Default unit: kHz

GET_ONE_AMFREQ _1_0

Query the AF frequency of 1F 1.0 kHz signal in "COM" mode.

Return values:

<Freq> AF frequency of 1F 1.0 kHz signal.

Default unit: Hz

Manual operation: See "Freq 1.0 kHz/ 1.2 kHz" on page 109

GET_ONE_AMFREQ_1_2

Query the AF frequency of 1F 1.2 kHz signal in "COM" mode.

Return values:

<Freq> AF frequency of 1F 1.2 kHz signal.

Default unit: Hz

Manual operation: See "Freq 1.0 kHz/ 1.2 kHz" on page 109

GET_ONE_AMMOD_1_0

Query the AM modulation depth of the 1.0 kHz signal in "COM" mode.

Return values:

<ModDepth> AM modulation depth

Default unit: %

Manual operation: See "AM 1.0 kHz/ 1.2 kHz" on page 109

GET_ONE_AMMOD_1_2

Query the AM modulation depth of 1.2 kHz signal in "COM" mode.

Return values:

<ModDepth> AM modulation depth

Default unit: %

Manual operation: See "AM 1.0 kHz/ 1.2 kHz" on page 109

GET_ONE_SINAD _1_0

Query the SINAD frequency of 1F 1.0 kHz signal in "COM" mode.

Return values:

<Freq> SINAD frequency of 1F 1.0 kHz signal.

Default unit: Hz

GET_ONE_SINAD_1_2

Query the SINAD frequency of 1F 1.2 kHz signal in "COM" mode.

Return values:

<Freq> SINAD frequency of 1F 1.2 kHz signal.

Default unit: Hz

GET_ONE_THD _1_0

Query the THD value of 1F 1.0 kHz signal in "COM" mode.

Return values:

<Freq> THD value of 1F 1.0 kHz signal.

Default unit: Hz

GET_ONE_THD_1_2

Query the THD value of 1F 1.2 kHz signal in "COM" mode.

Return values:

<Freq> THD value of 1F 1.2 kHz signal.

Default unit: Hz

GET_THD_1K0

This command queries the THD distortion parameter of 1.0 kHz signal.

Return values:

<[%]> THD distortion value of 1.0 kHz signal

Manual operation: See "THD 1.0 kHz/ 1.2 kHz" on page 110

GET_THD_1K2

This command queries the THD distortion parameter of 1.2 kHz signal.

Return values:

<[%]> THD distortion value of 1.2 kHz signal

Manual operation: See "THD 1.0 kHz/ 1.2 kHz" on page 110

GET_TX1_AMFREQ_1_0

Query the AF upper frequency of 2F 1.0 kHz signal in "COM" mode.

Parameters:

<Freq> AF upper frequency of 2F 1.0 kHz signal.

Default unit: Hz

Manual operation: See "Freq 1.0 kHz/ 1.2 kHz" on page 109

GET_TX1_AMFREQ_1_2

Query the AF upper frequency of 2F 1.2 kHz signal in "COM" mode.

Parameters:

<Freq> AF upper frequency of 2F 1.2 kHz signal.

Default unit: Hz

Manual operation: See "Freq 1.0 kHz/ 1.2 kHz" on page 109

GET_TX1_AMMOD_1_0

Query the TX1 AM modulation depth of 2F 1.0 kHz signal in "COM" mode.

Parameters:

<ModDepth> TX1 AM modulation depth of 2F 1.0 kHz signal.

Default unit: %

Manual operation: See "AM 1.0 kHz/ 1.2 kHz" on page 109

GET_TX1_AMMOD_1_2

Query the TX1 AM modulation depth of 2F 1.2 kHz signal in "COM" mode.

Parameters:

<ModDepth> TX1 AM modulation depth of 2F 1.2 kHz signal.

Default unit: %

Manual operation: See "AM 1.0 kHz/ 1.2 kHz" on page 109

GET_TX1_LEVEL

Query TX1 RF signal level in "COM" mode.

Return values:

<level>	RF signal level of TX1 Default unit: dBm

GET_TX1_MEASFREQ

Query the measured value of delta TX1 RF carrier frequency to set RF frequency in "COM" mode.

Return values:

<freq>	Delta between measured TX1 frequency and set RF frequency. Default unit: kHz

GET_TX1_SINAD_1_0

Query the SINAD of upper frequency of 2F 1.0 kHz signal in "COM" mode.

Parameters:

<Freq>	SINAD of upper frequency of 2F 1.0 kHz signal. Default unit: Hz

GET_TX1_SINAD_1_2

Query the SINAD of upper frequency of 2F 1.2 kHz signal in "COM" mode.

Parameters:

<Freq>	SINAD of upper frequency of 2F 1.2 kHz signal. Default unit: Hz

GET_TX1_THD_1_0

Query the THD of upper frequency of 2F 1.0 kHz signal in "COM" mode.

Parameters:

<Freq>	THD of upper frequency of 2F 1.0 kHz signal. Default unit: Hz

GET_TX1_THD_1_2

Query the THD of upper frequency of 2F 1.2 kHz signal in "COM" mode.

Parameters:

<Freq>	THD of upper frequency of 2F 1.2 kHz signal. Default unit: Hz

GET_TX2_AMFREQ_1_0

Query the AF lower frequency of 2F 1.0 kHz signal in "COM" mode.

Parameters:

<Freq> AF lower frequency of 2F 1.0 kHz signal.
Default unit: Hz

Manual operation: See "Freq 1.0 kHz/ 1.2 kHz" on page 109

GET_TX2_AMFREQ_1_2

Query the AF lower frequency of 2F 1.2 kHz signal in "COM" mode.

Parameters:

<Freq> AF lower frequency of 2F 1.2 kHz signal.
Default unit: Hz

Manual operation: See "Freq 1.0 kHz/ 1.2 kHz" on page 109

GET_TX2_AMMOD_1_0

Query the TX2 AM modulation depth of 2F 1.0 kHz signal in "COM" mode.

Parameters:

<ModDepth> TX2 AM modulation depth of 2F 1.0 kHz signal.
Default unit: %

Manual operation: See "AM 1.0 kHz/ 1.2 kHz" on page 109

GET_TX2_AMMOD_1_2

Query the TX2 AM modulation depth of 2F 1.2 kHz signal in "COM" mode.

Parameters:

<ModDepth> TX2 AM modulation depth of 2F 1.2 kHz signal.
Default unit: %

Manual operation: See "AM 1.0 kHz/ 1.2 kHz" on page 109

GET_TX2_LEVEL

Query TX2 RF signal level in "COM" mode.

Return values:

<level> RF signal level of TX2
Default unit: dBm

GET_TX2_MEASFREQ

Query the measured value of delta TX2 RF carrier frequency to set RF frequency in "COM" mode.

Return values:

<freq> Delta between measured TX2 frequency and set RF frequency.

Default unit: kHz

GET_TX2_SINAD_1_0

Query the SINAD of lower frequency of 2F 1.0 kHz signal in "COM" mode.

Parameters:

<Freq> SINAD of lower frequency of 2F 1.0 kHz signal.

Default unit: Hz

GET_TX2_SINAD_1_2

Query the SINAD of lower frequency of 2F 1.2 kHz signal in "COM" mode.

Parameters:

<Freq> SINAD of lower frequency of 2F 1.2 kHz signal.

Default unit: Hz

GET_TX2_THD_1_0

Query the THD of lower frequency of 2F 1.0 kHz signal in "COM" mode.

Parameters:

<Freq> THD of lower frequency of 2F 1.0 kHz signal.

Default unit: Hz

GET_TX2_THD_1_2

Query the THD of lower frequency of 2F 1.2 kHz signal in "COM" mode.

Parameters:

<Freq> THD of lower frequency of 2F 1.2 kHz signal.

Default unit: Hz

9.6 GBAS/ SCAT-I mode

The following commands are required to configure and perform measurements in the GBAS/ SCAT-I mode. They are only available if the R&S EVSG-K4 GBAS analysis or R&S EVSG-K5 SCAT-I Analysis option is installed.

9.6.1 Configuring GBAS/ SCAT-I measurements

The following commands are required to configure GBAS/ SCAT-I measurements.

Useful commands for configuring GBAS measurements described elsewhere:

- `MODE_GBAS` on page 324
- `GBAS:GETMEAS` on page 327

Remote commands exclusive to GBAS/ SCAT-I measurements

GBAS:ATTMODE?
GBAS:ATTMODE <Mode>

Selects the attenuation of the "GBAS" mode.

Parameters:

<Mode>

AUTO
Automatic attenuation

LN
Low noise attenuation

NORM
Normal attenuation

LD
Low distortion attenuation

<State> **READY.**
The command was executed successfully.

Manual operation: See "RF Mode" on page 69
See "RF Att" on page 176
See "RF Mode" on page 176

GBAS:BUFFER_RUNPAUSE? <State>
GBAS:BUFFER_RUNPAUSE <State>

This command determines whether the display is currently being updated.

Note that data recording and streaming continue regardless of the display update status.

Parameters:
<State> **RUN**
Display is updated continuously.

PAUSE
Display is temporarily not updated.

Example:

Manual operation: See "Display Update Status (Mode)" on page 161

GBAS:EVM_ANGLE_NORM? <Mode>
GBAS:EVM_ANGLE_NORM <Mode>

Determines the mode of EVM calculation for baseband input in "GBAS" mode.

Parameters:
<State> **READY.**
The command was executed successfully.

Query parameters:
<Mode> ANGLE | NORM

ANGLE
Only angle deviations are considered in EVM calculation.

NORM
Both angle and amplitude deviation are considered in EVM calculation.

Manual operation: See "EVM RMS" on page 166
See "EVM Mode" on page 177

GBAS:FMEAS? <Slot>

This command queries the offset of the measured carrier frequency from the nominal frequency in "GBAS" mode.

Parameters:

<Slot> 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7

Selects the slot for which results are queried.

Return values:

<Offset> Measured offset

Default unit: kHz

Usage: Query only

Manual operation: See "Carrier frequency offset (Offs. [kHz])" on page 166

GBAS:FREQRF?
GBAS:FREQRF <Freq>

Gets or sets the channel frequency that determines the carrier frequency at which the GBAS measurement is performed.

Parameters:

<Freq> RF frequency

The VHF data broadcast is defined for carrier frequencies within the range of 108.025 MHz to 117.950 MHz with a channel spacing of 25 kHz.

Default unit: kHz

Return values:

<State> **READY.**

The command was executed successfully.

Manual operation: See "Frequency (Freq)" on page 160

GBAS:LEV? <Slot>
LA? <Slot>

Queries the arithmetic average of the burst power level measured over the period of the synchronization and ambiguity resolution field of the burst.

If no burst was detected, the arithmetic average of the noise power is returned.

Parameters:

<Slot> 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7

Selects the slot for which results are queried.

Return values:

<Freq> Signal level

Default unit: dBm

Example: `GBAS:LEV? 2`

Usage: Query only

Manual operation: See "Burst Level Average (Av [dBm])" on page 163

MODE_GBAS

This command starts GBAS mode.

Return values:

<State> **READY.**
Command was executed successfully.

GBAS:SCREENVIEW ? <View>
GBAS:SCREENVIEW <View>

This command sets or queries the displayed measurement view in "GBAS" mode.

Parameters:

<View> SEQUENCE | FRAME | BURST | CONSTELLATION | MESSAGE | REC

*RST: SEQUENCE

<State> **READY.**
The command was executed successfully.

GBAS:SEQN_SLOT? <Slot>
GBAS:SEQN_SLOT <Slot>

Gets or sets the slot to be displayed in the power vs. time diagram and at the top of the results table in "GBAS" mode.

Parameters:

<Slot> 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7

The slot for which results are determined.

Manual operation: See "Slot" on page 175

SETUP:GBAS_PPS_SOURCE?
SETUP:GBAS_PPS_SOURCE <Source>

Gets or sets the source of the PPS signal required as a time reference.

Parameters:

<Source> **PPS SMA**
Signal provided at the PPS In connector

PPS GPS
Signal provided at the RS232-GPS connector

9.6.2 Retrieving GBAS/ SCAT-I results

The following commands are required to retrieve results from GBAS/ SCAT-I measurements.

GBAS:EVM? <Slot>

Queries the error vector magnitude measured over the period of the burst.

If no burst was detected, the arithmetic average of the noise power is returned.

Query parameters:

<Slot> 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7
Selects the slot for which results are queried.

Return values:

<Result> EVM
Default unit: %

Usage: Query only

Manual operation: See "EVM RMS" on page 166

GBAS:FAILEDMSGS? <Slot>

Queries the number of failed GBAS messages within the period of the burst.

Query parameters:

<Slot> 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7
Selects the slot for which results are queried.

Return values:

<Result> integer

Number of failed messages

Default unit: None.

Usage: Query only

GBAS:GBASBER? <Slot>

Queries the bit error rate (BER) before forward error correction (FEC).

Query parameters:

<Slot> 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7

Selects the slot for which results are queried.

Return values:

<Result> <bits_ok> / <bits_error>

Default unit: None.

Usage: Query only

Manual operation: See "Bit error rate (BER) before FEC" on page 167

GBAS:GBASID? <Slot>

Queries the GBAS ID. If there is more than one message inside the burst, the first GBAS ID is displayed.

Query parameters:

<Slot> 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7

Selects the slot for which results are queried.

Return values:

<ID> 4-character identifier of the ground station broadcasting the message

Default unit: None.

Usage: Query only

Manual operation: See "GBAS ID" on page 163

GBAS:GETMDEF <ParamSel>,<RX-board>

This command outputs the header columns for data delivered by `GBAS:GETMEAS`.

Parameters:

<ParamSel> Determines which parameter selection is output.

FULL
EVS300 compatibility mode

ALL
All values of the current measurement mode are sent as comma-separated text, using actual units.

MEDIUM
A fixed selection of parameters is exported.

SHORT
A short, fixed selection of parameters is exported.

RAW
Only the non-interpreted measurement values from the bit-stream in binary format are exported.

<RX-Board> Selects the RX board for which results are exported.

1
RX board 1 selected

2
RX board 2 selected

1+2
Both RX boards selected

<Slot> 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7
Selects the slot for which results are exported.

Return values:
<Results> Comma-separated list of header data for the selected results.

<State> **READY.**
The command was executed successfully.

GBAS:GETMEAS <ParamSel>, <RX-board>, <Slot>

This command outputs the current measurement result for one or both RX-boards.

For details on the parameters see Chapter 6.4.3.2, "Slot results table", on page 169.

Parameters:
<ParamSel> Determines which parameter selection is output.

FULL
EVS300 compatibility mode
`Channel, STIOCP, Index, Date, Slot, Time, FREQ[MHz], Lev.Av[dBm], SSID, GBAS ID, Train.FEC, App.Dat., App.FEC, GPS_lat., GPS_long., GPS_alt[m], GPS_speed[km/h], GPS_date, GPS_time, GPS_Sat, GPS_Status, GPS_Fix, GPS_HDOP, GPS_VDOP, Temp[°C], ATT.MODE, TrigCounter`

ALL
All values of the current measurement mode are sent as comma-separated text, using actual units.
`RX, STIOCP, Index, Date, Time, Slot, FREQ[MHz], C.Offset[kHz], Lev.Av[dBm], Lev.Pk[dBm], SSID, EVM[%], GBAS ID, Train.FEC, App.Dat., App.FEC, BER, Transm.Len, StartDelay[us], GuardInterv[us], RampUp[us], BurstDur[ms], RampDown[us], GPS_lat., GPS_long., GPS_alt[m], GPS_speed[km/h], GPS_date, GPS_time, GPS_Sat, GPS_Status, GPS_Fix, GPS_HDOP, GPS_VDOP, Temp[°C], ATT.MODE, TrigCounter, RawData`

MEDIUM
A fixed selection of parameters is exported.
`RX, STIOCP, Index , Time, Slot, C.Offset[kHz], Lev.Av[dBm], GBAS ID, Train.FEC, App.Dat., App.FEC, GPS_lat., GPS_long., TrigCounter`

SHORT
A short, fixed selection of parameters is exported.
`RX, Index, Time, Slot, Lev.Av[dBm], GBAS ID, App.Dat., GPS_lat., GPS_long.`

RAW
Only the non-interpreted measurement values from the bit-stream in binary format are exported.

<RX-Board> Selects the RX board for which results are exported.

1
RX board 1 selected

2
RX board 2 selected

1+2
Both RX boards selected

<Slot> 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7

Selects the slot for which results are exported.

Return values:
<Results> Comma-separated list of selected results.

<State> **READY.**
The command was executed successfully.

Example: `GETMEAS FULL, 1+2, 2`
Returns all measurement results for slot 2 in all measurements on both receiver boards.

Manual operation: See "Parameter" on page 203

GBAS:GRAPH_TOLOGG? <Type>
GBAS:GRAPH_TOLOGG <State>

Defines whether graphical information is stored.

Parameters:

<State>

ON
Graphical information such as the time domain and constellation values are stored.

OFF
Graphical information is not stored.

Manual operation: See "Graph Log" on page 204

GBAS:MSG_TOLOGG? <Type>
GBAS:MSG_TOLOGG <Type>

This command defines which message information is stored for each slot.

Parameters:

<Type>

ALL
All message data (human-readable + bitstream) is stored (default).

TXT
Only the human-readable, interpreted message values are stored.

RAW
Only the decoded, non-interpreted message data from the bit-stream in binary format is stored.

NONE
Message data is not included in the slot data record.

*RST: ALL

Manual operation: See "Msg Log" on page 203

GBAS:LOGSLOTS <RX-board>,<Slot>

Selects the GBAS slot to be recorded with the data recorder.

Parameters:

<RX-board>
Selects the RX board for which results are exported.

1
RX board 1 selected

2
RX board 2 selected

1+2
Both RX boards selected

<Slot>
0 | 1 | 2 | 3 | 4 | 5 | 6 | 7
Selects the slot for which results are exported.

Return values:

<State> **READY**
Command was executed successfully.

GBAS:PEAKLEV? <Slot>

Queries the peak burst power level measured over the period of the burst.

If no burst was detected, the arithmetic average of the noise power is returned.

Query parameters:

<Slot> 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7
Selects the slot for which results are queried.

Return values:

<Power> Signal level
Default unit: dBm

Example: `GBAS:PEAKLEV? 2`

Usage: Query only

Manual operation: See "Slot Level Peak (Pk [dBm])" on page 166

GBAS:PPSLOCKED? <Slot>

Queries the state of the PPS synchronization.

Return values:

<Result> **Unlocked**
No valid PPS signal detected.

Burst Locked
Valid burst detected.

PPS Locked
Valid PPS signal detected

Usage: Query only

Manual operation: See "Time reference status (Time Ref.)" on page 161

GBAS:RESETBER

Resets the values for the following measurement results:

- "Bit error rate (BER) before FEC" on page 167
- "Valid Bursts (Valid B.)" on page 167
- "Failed Bursts (Failed B.)" on page 167

Parameters:

<State> **READY.**
The command was executed successfully.

Usage: Event

Manual operation: See "Reset BER" on page 177

GBAS:STOPSTREAM

This command terminates the data stream for both RX Boards in GBAS mode.

Return values:

<State> **READY.**
The command was executed successfully.

GBAS:STREAM <ParamSel>, [+MSG,] <RX Board>, <Slots>

Starts data streaming. In streaming mode, a measured data set is automatically sent to the remote interface. One data set is provided per slot, that is: every 62.5 ms. Streaming can produce large quantities of output. It is mandatory to have a fast data connection and an application that is able to handle the data.

For details on the output see Chapter 9.12.3.6, "GBAS mode", on page 372

Parameters:

<ParamSel> Determines which parameter selection is output.

FULL
EVS300 compatibility mode

ALL
All values of the current measurement mode are sent as comma-separated text, using actual units.

MEDIUM
A fixed selection of parameters is exported.

SHORT
A short, fixed selection of parameters is exported.

RAW
Only the non-interpreted measurement values from the bitstream in binary format are exported.

+MSG Optional: If specified, the message data is included in the data stream, surrounded by curly brackets { }.

<RX-Board> Selects the RX board for which results are exported.

1
RX board 1 selected

2
RX board 2 selected

1+2
Both RX boards selected

<Slots> 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7

Selects one or more slots for which results are exported. Multiple slots can be selected.

Return values:

<State>	**READY.** The command was executed successfully.
Example:	`GBAS:STREAM RAW,1+2,3` Sends the data for slot 3 on both receiver boards as binary data to the USB output.
Example:	`GBAS:STREAM ALL,1,01234567` Outputs the evaluated data (without the message data) for all slots on receiver board 1.
Example:	`GBAS:STREAM ALL+MSG,1,0` Outputs all evaluated data, including message data, for slot 0 on receiver board 1.

GBAS:VALIDMSGS? <Slot>

Queries the number of valid GBAS messages within the period of the burst.

Query parameters:

<Slot>	0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 Selects the slot for which results are queried.

Return values:

<Result>	integer Number of valid messages Default unit: None.
Usage:	Query only

9.7 NDB mode

The following commands are required to configure and perform measurements in the NDB mode. They are only available if the R&S EVSG1-K7 LF-Analysis option is installed.

9.7.1 Configuring an NDB measurement

The following commands are required to configure NDB measurements.

Useful commands for NDB measurements described elsewhere:

- `RFCH` on page 231
- `LA?` on page 231
- `MEASTIME` on page 231

- SQUELCH on page 239
- SETATTMODE on page 232
- Chapter 9.2.5, "Retrieving ID results", on page 288

Remote commands exclusive to NDB measurements:

MODE_NDB

This command switches the instrument to the "NDB" mode.

Return values:

<State>	**READY.** The command was executed successfully.

NDB_DEFAULT_FREQSTEP? <StepSize>
NDB_DEFAULT_FREQSTEP <StepSize>

Gets or sets the default frequency step size in "NDB"mode.

Parameters:

<StepSize>	0.1_KHZ | 1.0_KHZ | 10_KHZ *RST: 1.0_KHZ

Return values:

<State>	**READY.** The command was executed successfully.

Manual operation: See "Step Size" on page 122

NDB_DEM_ID_BW? <Bandwidth>
NDB_DEM_ID_BW <Bandwidth>

Gets or sets the ID demodulator Bandwidth in "NDB" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ | 18KHZ | 25KHZ | 36KHZ | 50KHZ

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "IF BW" on page 124

NDB_DEM_DIST_BW? <Bandwidth>
NDB_DEM_DIST_BW <Bandwidth>

Gets or sets the distortion demodulator bandwidth in "NDB" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ | 18KHZ | 25KHZ | 36KHZ | 50KHZ

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "IF BW Dist" on page 124

NDB_EXTERNALATT_LFIN? <Attenuation>
NDB_EXTERNALATT_LFIN <Attenuation>

Gets or sets the external attenuation of the active receiver board for LF input in "NDB" mode.

Parameters:

<Attenuation> External attenuation

Default unit: dB

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Transducer Correction" on page 123

NDB_LFIN_IMPEDENCE? <Impedance>
NDB_LFIN_IMPEDANCE <Impedance>

Gets or sets the impedance for the LF In input in "NDB" mode.

Parameters:

<Impedance> **50_OHM | 20_KOHM**
Sets the impedance.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "LF Imp." on page 123

NDB_UNIT_LEVEL? <Unit>
NDB_UNIT_LEVEL <Unit>

This command sets the level unit in "NDB" mode.

Parameters:

<Unit> dBm | dBuV

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Level Unit" on page 121

VIEW_NDB? <View type>
VIEW_NDB <View type>

Gets or sets the view in "NDB" mode. See Chapter 4.5.2, "NDB measurement and results", on page 115 for details.

Parameters:

<View type> **ID**
ID view
DIST
Distortion view
REC
Recording view

Return values:

<State> **READY.**
The command was executed successfully.

9.7.2 Retrieving NDB measurement results

The following commands are required to retrieve results from NDB measurements.

Useful commands for retrieving results described elsewhere:

- `GETDATADEF` on page 366
- `GETDATASET` on page 366
- `FMEAS` on page 295

Remote commands exclusive to NDB results:

NDB_AMFREQ

This command queries the AM modulation frequency of the ID in "NDB" mode.

Return values:

<[Hz]> AM modulation frequency of the ID

Manual operation: See "ID Freq" on page 118

NDB_AMMOD

This command queries the AM modulation of the identifier in "NDB" mode.

Return values:

<[%]> Modulation depth of the identifier

Manual operation: See "ID AM" on page 118
See "AM 400/1020 Hz" on page 119

NDB_CARLEV_CHANGE

Queries the variance in power level during ID transmission in "NDB" mode.

Return values:

<PowerVariance> Peak-to-peak power level difference during ID transmission.

Default unit: dB

Manual operation: See "Carr Lev Change" on page 117

ID_CODE <ID>

This command queries the ID of the signal in "NDB" mode.

Parameters:

<ID> three or four characters

Manual operation: See "ID Code" on page 118

NDB_IDFREQ_400_1020 <Freq>

This command gets or sets the frequency of the ID in "NDB" mode.

Parameters:

<Freq> 400HZ | 1020HZ

Manual operation: See "ID Freq" on page 122

NDB_K2_PCT

This command queries the K2 distortion parameter of an NDB signal.

Return values:

<[%]> K2 distortion value of an NDB signal

Manual operation: See "K2 400/1020 Hz" on page 119

NDB_K3_PCT

This command queries the K3 distortion parameter of an NDB signal.

Return values:

<[%]> K3 distortion value of an NDB signal

Manual operation: See "K3 400/1020 Hz" on page 119

NDB_K4_PCT

This command queries the K4 distortion parameter of an NDB signal.

Return values:

<[%]> K4 distortion value of an NDB signal

Manual operation: See "K4 400/1020 Hz" on page 120

NDB_POWSUPPL_FC

Queries the distortion of the power supply frequency component in "NDB" mode.

Parameters:

<Power> Distortion caused by the power supply frequency component

Default unit: percent

Manual operation: See "Unwanted AM 30 to 120 Hz" on page 120

NDB_THD_PCT

This command queries the THD distortion parameter of an NDB signal.

Return values:

<[%]> THD distortion value of an NDB signal

Manual operation: See "THD 400/1020 Hz" on page 120

9.8 RF spectrum mode

The following commands are required to configure and perform measurements in the RF Spectrum mode. They are only available if the R&S EVSG-K10 RF spectrum analysis option is installed.

9.8.1 Configuring RF spectrum measurements

The following commands are required to configure RF Spectrum measurements.

MODE_FSCAN

This command switches the instrument to the "RF Spectrum" mode.

Return values:

<State> **READY.**
The command was executed successfully.

FSCAN_ATTMODE?
FSCAN_ATTMODE <Attenuation mode>

This command gets or selects the attenuation mode in the "RF Spectrum" mode.

Parameters:

<Attenuation mode>
: **COUPLED**
  Coupled attenuation
: **LN**
  Low noise attenuation
: **NORM**
  Normal attenuation (0 dB attenuation)
: **LD**
  Low distance attenuation

Return values:

<State>
: **READY.**
  The command was executed successfully.

Manual operation: See "RF Mode" on page 69

FSCAN_FREQCENTER?
FSCAN_FREQCENTER <Frequency>

This command gets or sets the center frequency in "RF Spectrum" mode.

Parameters:

<Frequency>
: FSCAN CENTER frequency
  Default unit: kHz

Return values:

<State>
: **READY.**
  The command was executed successfully.

Manual operation: See "Center" on page 127

FSCAN_FREQSPAN?
FSCAN_FREQSPAN <Frequency>

This command gets or sets the span frequency in "RF Spectrum" mode.

Parameters:

<Frequency>
: FSCAN SPAN frequency
  Default unit: kHz

Return values:

<State>
: **READY.**
  The command was executed successfully.

Manual operation: See "Span" on page 127

FSCAN_FREQSTART?
FSCAN_FREQSTART <Frequency>

This command gets or sets the start frequency in "RF Spectrum" mode.

Parameters:

<Frequency> FSCAN START frequency

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Start" on page 127

FSCAN_FREQSTOP?
FSCAN_FREQSTOP <Frequency>

This command gets or sets the stop frequency in "RF Spectrum" mode.

Parameters:

<Frequency> FSCAN STOP frequency

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Stop" on page 127

FSCAN_GRID_YRANGE_DB? <Range>
FSCAN_GRID_YRANGE_DB <Range>

Gets or selects the range of the y-axis in "RF Spectrum" mode.

Parameters:

<Range> 10_DB | 20_DB | 30_DB | 40_DB | 50_DB | 60_DB | 80_DB | 100_DB | 120_DB

Return values:

<State> **READY.**
The command was executed successfully.

FSCAN_REFLEVEL?
FSCAN_REFLEVEL <Level>

This command gets or sets the reference level in "RF Spectrum" mode.

Parameters:

<Level> FSCAN Reference Level

Default unit: dBm

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Ref Level" on page 128

FSCAN_RESBW_AUTO?
FSCAN_RESBW_AUTO <Mode>

This command gets or sets the mode of specifying the resolution bandwidth in "RF Spectrum" mode.

Parameters:

<Mode> **AUTO**
Set resolution bandwidth automatically.

MANUAL
Set resolution bandwidth manually.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Resolution Bandwidth (RBW Mode/Res BW)" on page 127

FSCAN_RES_BW?
FSCAN_RES_BW <Bandwidth>

This command gets or sets the resolution bandwidth in "RF Spectrum" mode.

Parameters:

<Bandwidth> 15K | 7K5 | 3K75 | 1K87 | 937 | 468 | 234 | 117 | 12K | 6K | 3K | 1K5 | 750 | 375 | 187 | 94 | 47 | 23.4 | 11.7 | 1K2 | 600 | 300 | 150 | 75 | 37.4 | 18.7 | 9.4 | 4.7 | 2.3

FSCAN resolution bandwidth

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Resolution Bandwidth (RBW Mode/Res BW)" on page 127

FSCAN_TRACE_MODE?
FSCAN_TRACE_MODE <Trace mode>

Gets or selects the trace mode of the "RF Spectrum" mode.

Parameters:

<Trace Mode> **CLWR**
Overwrite mode (default): the trace is overwritten by each sweep

AVRG
The average is determined over several sweeps
The number of averaging procedures is defined by
`FFT_TRACE_AVRGCOUNT` on page 354.

MAXHOLD
The maximum value is determined over several sweeps and displayed. The R&S EVSF1000 saves each trace point in the trace memory only if the new value is greater than the previous one.
The number of evaluated sweeps is defined by
`FFT_TRACE_AVRGCOUNT` on page 354.

RMS
The RMS value for each trace point over several sweeps is determined and displayed.
The number of evaluated sweeps is defined by
`FFT_TRACE_AVRGCOUNT` on page 354.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Trace mode" on page 129

FSCAN_TRACE_AVRGCOUNT?
FSCAN_TRACE_AVRGCOUNT <trace average count>

Gets or sets the trace average count of the "RF Spectrum" mode.

Parameters:

<Trace average count> Range: 0 to 100

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Average Count" on page 129

9.8.2 Retrieving RF spectrum results

The following commands are required to retrieve results from RF Spectrum measurements.

FSCAN_GETSPECT

All measurement values are returned as one comma-separated string in "RF Spectrum" mode.

Parameters:

<Trace Data>	Measurement values Default unit: dBm
<State>	**READY.** The command was executed successfully.

9.9 IF spectrum mode

The following commands are required to configure and perform measurements in the IF Spectrum mode. They are only available if the R&S EVSG-K10 RF spectrum analysis option is installed.

9.9.1 Configuring IF spectrum measurements

The following commands are required to configure IF Spectrum measurements.

MODE_IFSPECT

This command switches the instrument to the "IF Spectrum" mode.

Return values:

<State>	**READY.** The command was executed successfully.

IFSPECT_ATTMODE <Mode>

Selects the attenuation of the "IF Spectrum" mode.

Parameters:

<Mode>	**AUTO** Automatic attenuation **LN** Low noise attenuation **NORM** Normal attenuation **LD** Low distortion attenuation
<State>	**READY.** The command was executed successfully.
Manual operation:	See "RF Att" on page 68 See "RF Mode" on page 69

IFSPECT_FREQRF?
IFSPECT_FREQRF <Freq>

Gets or sets the RF frequency in "IF Spectrum" mode.

Parameters:

<Freq>	RF frequency Default unit: kHz
<State>	**READY.** The command was executed successfully.
Manual operation:	See "RF Freq" on page 131

IFSPECT_FREQ_SPAN?
IFSPECT_FREQ_SPAN <Freq>

Gets or sets the span frequency in "IF Spectrum" mode.

Parameters:

<Freq>	Span frequency Default unit: kHz
<State>	**READY.** The command was executed successfully.
Manual operation:	See "Span" on page 131

IFSPECT_GRID_YRANGE_DB? <Range>
IFSPECT_GRID_YRANGE_DB <Range>

Gets or selects the range of the y-axis in "IF Spectrum" mode.

Parameters:

<Range> 10_DB | 20_DB | 30_DB | 40_DB | 50_DB | 60_DB | 80_DB | 100_DB | 120_DB

Return values:

<State> **READY.**
The command was executed successfully.

IFSPECT_REFLEVEL?
IFSPECT_REFLEVEL <Frequency>

Gets or sets the reference level of the "IF Spectrum" mode.

Parameters:

<Freq> Ref Level

Default unit: dBm

<State> **READY.**
The command was executed successfully.

Manual operation: See "Ref Level" on page 132

IFSPECT_RES_BW?
IFSPECT_RES_BW <Bandwidth>

Gets or sets the resolution bandwidth for "IF Spectrum" mode.

Parameters:

<Bandwidth> 200K | 100K | 50K | 25K | 12K5 | 6K2 | 3K1 | 1K6 | 800 | 240K | 120K | 60K | 30K | 15K | 7K5 | 3K75 | 1K87 | 937 | 468 | 234 | 117 | 12K | 6K | 3K | 1K5 | 750 | 375 | 187 | 94 | 47 | 23.4 | 11.7 | 1K2 | 600 | 300 | 150 | 75 | 37.4 | 18.7 | 9.4 | 4.7 | 2.3 | 120.0 | 60.0 | 30.0 | 15.0 | 7.5 | 3.7 | 1.9 | 0.9 | 0.5

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "RBW" on page 132

IFSPECT_RESBW_AUTO?
IFSPECT_RESBW_AUTO <Mode>

This command gets or sets the mode of specifying the resolution bandwidth in "IF Spectrum" mode.

Parameters:

<Mode> **AUTO**
Set resolution bandwidth automatically.

MANUAL
Set resolution bandwidth manually.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "RBW" on page 132

IFSPECT_TRACE_MODE?
IFSPECT_TRACE_MODE <Trace mode>

Gets or selects the trace mode of the "IF Spectrum" mode.

Parameters:

<Trace Mode>

CLWR
Overwrite mode (default): the trace is overwritten by each sweep

AVRG
The average is determined over several sweeps
The number of averaging procedures is defined by `FFT_TRACE_AVRGCOUNT` on page 354.

MAXHOLD
The maximum value is determined over several sweeps and displayed. The R&S EVSF1000 saves each trace point in the trace memory only if the new value is greater than the previous one.
The number of evaluated sweeps is defined by `FFT_TRACE_AVRGCOUNT` on page 354.

RMS
The RMS value for each trace point over several sweeps is determined and displayed.
The number of evaluated sweeps is defined by `FFT_TRACE_AVRGCOUNT` on page 354.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Trace mode" on page 129

IFSPECT_TRACE_AVRGCOUNT?
IFSPECT_TRACE_AVRGCOUNT <trace average count>

Gets or sets the trace average count of the "IF Spectrum" mode.

Parameters:

<Trace average count> Range: 0 to 100

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Average Count" on page 129

9.9.2 Retrieving IF spectrum results

The following commands are required to retrieve results from IF Spectrum measurements.

IFSPECT_GETSPECT

All measurement values are returned as one comma-separated string in "IF Spectrum" mode.

Parameters:

<Trace Data>	Measurement values Default unit: dBm
<State>	**READY.** The command was executed successfully.

9.10 AF spectrum mode

The following commands are required to configure and perform measurements in the AF Spectrum mode. They are only available if the R&S EVSG-K11 AF spectrum analysis option is installed.

9.10.1 Configuring AF spectrum measurements

The following commands are required to configure AF Spectrum measurements.

MODE_FFT

This command switches the instrument to the "AF Spectrum" mode.

Return values:

<State> **READY.**
The command was executed successfully.

FFT_ATTMODE?
FFT_ATTMODE <Mode>

This command selects the attenuation mode of the "AF Spectrum" mode.

Parameters:

<Mode>

COUPLED
Coupled attenuation

LN
Low noise attenuation

NORM
Normal attenuation (0 dB attenuation)

LD
Low distance attenuation

Return values:

<State> **READY.**
The command was executed successfully.

Example: `FFT_ATTMODE LD`

Manual operation: See "RF Att" on page 68
See "RF Mode" on page 69

FFT_BB_AF_BW_KHZ? <Bandwidth>
FFT_BB_AF_BW_KHZ <Bandwidth>

This command gets or sets the bandwidth for LF input (AF mode) in "AF Spectrum" mode.

Parameters:

<Bandwidth> 0.5KHZ | 1.5KHZ | 3KHZ | 5KHZ | 9KHZ | 12.5KHZ | 18KHZ | 25KHZ

IF bandwidth

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "AF In BW" on page 139

FFT_BB_IF_BW_KHZ? <Bandwidth>
FFT_BB_IF_BW_KHZ <Bandwidth>

This command gets or sets the IF demodulation bandwidth for AM input in "AF Spectrum" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ | 18KHZ | 25KHZ | 36KHZ | 50KHZ

If bandwidth

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "IF BW AM" on page 140

FFT_BB_LFIN_DCOFFSETV? <Power>
FFT_BB_LFIN_DCOFFSETV <Power>

This command gets or sets the reference power for LF input in "AF Spectrum" mode. This value is used to determine the modulation depth and corresponds to the DC power of the AF signal.

Parameters:

<Power> Reference DC power of the AF signal

Default unit: V

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "DC Reference" on page 72

FFT_FREQ_CENTER?
FFT_FREQ_CENTER <Frequency>

Gets or sets the FFT center frequency in "AF Spectrum" mode.

Parameters:

<Frequency> Value of the FFT center frequency.
Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "AF Center" on page 138

FFT_FREQ_SPAN?
FFT_FREQ_SPAN <Frequency>

Gets or sets the FFT span frequency in "AF Spectrum" mode.

Parameters:

<Frequency> Value of the FFT span frequency.
Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "AF Span" on page 138

FFT_FREQ_START?
FFT_FREQ_START <Frequency>

Gets or sets the FFT start frequency in "AF Spectrum" mode.

Parameters:

<Frequency> Value of the FFT start frequency.
Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "AF Start" on page 139

FFT_FREQSTOP?
FFT_FREQSTOP <Frequency>

Gets or sets the FFT stop frequency in "AF Spectrum" mode.

Parameters:

<Frequency> Value of the FFT Stop frequency.
Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "AF Stop" on page 139

FFT_FREQRF?
FFT_FREQRF <Freq>

Gets or Sets RF frequency in "AF Spectrum" mode.

Parameters:

<Freq> FFT RF frequency
Default unit: <kHz>

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "RF Freq" on page 138

FFT_GRID_YRANGE_DB? <Range>
FFT_GRID_YRANGE_DB <Range>

Gets or selects the range of the y-axis in "AF Spectrum" mode.

Parameters:

<Range> 10_DB | 20_DB | 50_DB | 100_DB

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Y-Range" on page 140

FFT_GRID_YRANGE_V? <Range>
FFT_GRID_YRANGE_V <Range>

Gets or selects the range of the y-axis in V for LF input in "AF Spectrum" mode.

Parameters:

<Range> 100_mV | 200_mV | 500_mV | 1_V | 2_V | 5_V

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Y Range" on page 142

FFT_IF_BW_KHZ? <Bandwidth>
FFT_IF_BW_KHZ <Bandwidth>

This command gets or sets the IF demodulation bandwidth for RX input in "AF Spectrum" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ | 18KHZ | 25KHZ | 36KHZ | 50KHZ

RX bandwidth

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "IF BW" on page 139

FFT_RESBW_AUTO? <Mode>
FFT_RESBW_AUTO <Mode>

This command gets or sets the mode of specifying the resolution bandwidth in "aF Spectrum" mode.

Parameters:

<Mode> **AUTO**
Set resolution bandwidth automatically.

MANUAL
Set resolution bandwidth manually.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "RBW" on page 139

FFT_RESBW_FIX_KHZ? <Bandwidth>
FFT_RESBW_FIX_KHZ <Bandwidth>

This command gets or sets the resolution bandwidth for RX input in "AF Spectrum" mode.

Parameters:

<Bandwidth> 100K | 50K | 25K | 12K5 | 6K2 | 3K1 | 1K6 | 800 | 240K | 120K | 60K | 30K | 15K | 7K5 | 3K75 | 1K87 | 937 | 468 | 234 | 117 | 12K | 6K | 3K | 1K5 | 750 | 375 | 187 | 94 | 47 | 23.4 | 11.7 | 1K2 | 600 | 300 | 150 | 75 | 37.4 | 18.7 | 9.4 | 4.7 | 2.3 | 120.0 | 60.0 | 30.0 | 15.0 | 7.5 | 3.7 | 1.9 | 0.9 | 0.5

RX input resolution bandwidth

Default unit: kHz

Return values:
<State> **READY.**
The command was executed successfully.

Manual operation: See "RBW" on page 139

FFT_RFLF_INPUT? <Type>
FFT_RFLF_INPUT <Type>

Gets or sets the type of input for the "AF Spectrum" mode.

Parameters:
<Type> **RX_IN**
RX input
LF_IN
Baseband input

Return values:
<State> **READY.**
The command was executed successfully.

Manual operation: See "Input RF/LF" on page 63

FFT_TRACE_MODE?
FFT_TRACEMODE <Trace Mode>

Gets or sets the trace mode of the "AF Spectrum" mode.

Parameters:
<Trace Mode> **CLWR**
Overwrite mode (default): the trace is overwritten by each sweep
AVRG
The average is determined over several sweeps
The number of averaging procedures is defined by `FFT_TRACE_AVRGCOUNT` on page 354.
MAXHOLD
The maximum value is determined over several sweeps and displayed. The R&S EVSF1000 saves each trace point in the trace memory only if the new value is greater than the previous one.
The number of evaluated sweeps is defined by `FFT_TRACE_AVRGCOUNT` on page 354.
RMS
The RMS value for each trace point over several sweeps is determined and displayed.
The number of evaluated sweeps is defined by `FFT_TRACE_AVRGCOUNT` on page 354.

Return values:
<State> **READY.**
The command was executed successfully.

Manual operation: See "Trace mode" on page 129

FFT_TRACE_AVRGCOUNT?
FFT_TRACE_AVRGCOUNT <trace average count>

Gets or sets the trace average count of the "AF Spectrum" mode.

Parameters:

<Trace average count>	Range:	0 to 100

Return values:

<State>	**READY.** The command was executed successfully.

Manual operation: See "Average Count" on page 129

9.10.2 Retrieving AF spectrum results

The following commands are required to retrieve results from AF Spectrum measurements.

FFT_GETSPECT

All measurement values in dBm are returned as one comma-separated string.

Return values:

All values	Shows all spectrum values.

Manual operation: See "IF spectrum preview" on page 52

9.11 AF time domain mode

The following commands are required to configure and perform measurements in the AF Time domain mode. They are only available if the R&S EVSG-K11 AF spectrum analysis option is installed.

9.11.1 Configuring AF time domain measurements

The following commands are required to configure AF Time Domain measurements.

MODE_SCOPE

This command switches the instrument to the "AF Time Domain" mode.

Return values:

<State> **READY.**
The command was executed successfully.

SCOPE_ATTMODE <Mode>

This command selects the attenuation mode of the "AF Time Domain" mode.

Parameters:

<Mode> **COUPLED**
Coupled attenuation

LN
Low noise attenuation

NORM
Normal attenuation (0 dB attenuation)

LD
Low distance attenuation

Return values:

<State> **READY.**
The command was executed successfully.

Example: `SCOPE_ATTMODE LD`

Manual operation: See "RF Att" on page 68
See "RF Mode" on page 69

SCOPE_BB_AF_BW_KHZ? <Bandwidth>
SCOPE_BB_AF_BW_KHZ <Bandwidth>

This command gets or sets the bandwidth for LF input in "AF Time Domain" mode.

Parameters:

<Bandwidth> 0.5KHZ | 1.5KHZ | 3KHZ | 5KHZ | 9KHZ | 12.5KHZ | 18KHZ | 25KHZ

IF bandwidth

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "AF In BW" on page 139

SCOPE_BB_IF_BW_KHZ? <Bandwidth>
SCOPE_BB_IF_BW_KHZ <Bandwidth>

This command gets or sets the IF demodulation bandwidth for LF input in "AF Time Domain" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ | 18KHZ | 25KHZ | 36KHZ | 50KHZ

RX bandwidth

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "IF BW" on page 147

SCOPE_BB_LFIN_DCOFFSETV? <Power>
SCOPE_BB_LFIN_DCOFFSETV <Power>

This command gets or sets the reference power for LF input in "AF Time Domain" mode. This value is used to determine the modulation depth and corresponds to the DC power of the AF signal.

Parameters:

<Power> Reference DC power of the AF signal

Default unit: V

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "DC Reference" on page 72

SCOPE_FREQRF?
SCOPE_FREQRF <Freq>

This command gets or sets the RF frequency in "AF Time Domain ".

Parameters:

<Freq> RF frequency

Default unit: <kHz>

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "RF Freq" on page 147

SCOPE_IF_BW_KHZ? <Bandwidth>
SCOPE_IF_BW_KHZ <Bandwidth>

This command gets or sets the bandwidth for RX input in "AF Time Domain" mode.

Parameters:

<Bandwidth> 1KHZ | 3KHZ | 6KHZ | 10KHZ | 18KHZ | 25KHZ | 36KHZ | 50KHZ

RX bandwidth

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "IF BW" on page 147

SCOPE_REFLEVEL?
SCOPE_REFLEVEL <RefLev>

This command gets or sets the reference level of the "AF Time Domain" mode.

Parameters:

<RefLev> Set the reference level.

Default unit: <dBm>

Return values:

<State> **READY.**
The command was executed successfully.

SCOPE_RESBW_FIX_KHZ? <Bandwidth>
SCOPE_RESBW_FIX_KHZ <Bandwidth>

This command gets or sets the resolution bandwidth for RX input in "AF Time Domain" mode.

Parameters:

<Bandwidth> 200K | 100K | 50K | 25K | 12K5 | 6K2 | 3K1 | 1K6 | 800 | 240K | 120K | 60K | 30K | 15K | 7K5 | 3K75 | 1K87 | 937 | 468 | 234 | 117 | 12K | 6K | 3K | 1K5 | 750 | 375 | 187 | 94 | 47 | 23.4 | 11.7 | 1K2 | 600 | 300 | 150 | 75 | 37.4 | 18.7 | 9.4 | 4.7 | 2.3 | 120.0 | 60.0 | 30.0 | 15.0 | 7.5 | 3.7 | 1.9 | 0.9 | 0.5

RX input resolution bandwidth

Default unit: kHz

Return values:

<State> **READY.**
The command was executed successfully.

SCOPE_RFLF_INPUT? <Input>
SCOPE_RFLF_INPUT <Input>

Configures the input source for the receiver in "Scope" mode.

Parameters:

<Input> **RX_IN**
RF input from RX 1 In/RX 2 In connectors on the front of the R&S EVSF1000

LF_IN
An AF or low frequency signal is provided at the LF In input connector on the rear side of the R&S EVSF1000.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Input RF/LF" on page 63

SCOPE_TIMEDIV_RF?
SCOPE_TIMEDIV_RF <time/div>

This command gets or sets the Time/Div for RF input in "AF Time Domain" mode.

Parameters:

<time/div> Set value for the Time/Div for RF input.

100_MS
Sets the value to 100 ms.

50_MS
Sets the value to 50 ms.

20_MS
Sets the value to 20 ms.

10_MS
Sets the value to 10 ms.

5_MS
Sets the value to 5 ms.

2_MS
Sets the value to 2 ms.

1_MS
Sets the value to 1 ms.

500_US
Sets the value to 0.5 ms.

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Time/Div" on page 150

SCOPE_TRIGLEVEL_RFPCT?
SCOPE_TRIGLEVEL_RFPCT <Trig level>

This command gets or sets the trigger level for RF Input of the "AF Time Domain" mode.

Parameters:

<Trig level> Set trigger level.

Range: -100 to 100
Default unit: <%>

Return values:

<State> **READY.**
The command was executed successfully.

Manual operation: See "Trigger Level" on page 151

SCOPE_TRIGSLOPE?
SCOPE_TRIGSLOPE <Trigger edge>

This command gets or selects the trigger edge for RF Input of the "AF Time Domain" mode.

Parameters:

<Trigger edge> **POSITIVE**
Sets positive SCOPE trigger slope.

NEGATIVE
Sets negative SCOPE trigger slope.

BOTH
Sets positive and negative SCOPE trigger slope.

<State> **READY.**
The command was executed successfully.

Manual operation: See "Trigger Edge" on page 151

9.11.2 Retrieving RF spectrum results

The following commands are required to retrieve results from AF Time Domain measurements.

SCOPE_GETMEAS

All measurement values in % (RF Input) or in mV (BB Input) are returned as one comma-separated string.

Return values:
All values Shows all measured values.

9.12 Data management

The following commands are required to configure data streaming and recording.

9.12.1 Data recording

The following commands are required for data recording.

CLEARACTIVELIST

This command clears the currently active list. All entries are deleted.

Return values:

<EventResult> **READY**
Command was executed successfully
ERROR
An error occurred; command was not successful

Example: `SETACTIVELIST 2`
Defines list 2 as the active list.
`CLEARACTIVELIST`
Clears list 2.

Manual operation: See "Clear List" on page 202

DL_START

Starts logging data for the active RX board and the currently selected parameters until the `DL_STOP` command is executed. The data received from the active RX board is stored internally.

To reduce the amount of logged data, restrict it to specific parameters.

Return values:

<EventResult> **READY.**
The command was executed successfully.
ERROR
An error occurred; command was not successful.

DL_STOP

Stops logging data.

Return values:

<EventResult> **READY**
Command was executed successfully
ERROR
An error occurred; command was not successful

Usage: Event

GETACTIVELIST

This command returns the number of the currently active data logger list.

Return values:

<ListNo> integer
List number
Range: 1 to 999

Example:
`SETACTIVELIST 2`
Sets list 2 as the active list.
`GETACTIVELIST`
Queries the number of the active list.
Result:
`2`

Manual operation: See "List" on page 202

GETDATA_FROM_ACTIVELIST <start index>,<stop index>

Exports the selected data lines of the active data logger list.

Parameters:

<Start index> Specifies the data line of the data logger list to start with.

<Stop index> Specifies the data line of the data logger list to stop with. A stop parameter of -1 exports the data logger list to the end.

GETDLTIME?

Gets the data logger time for the current mode: "ILS LOC", "ILS GP", "ILS MB", "VOR", or "COM".

Parameters:

<Time> Data logger time

Default unit: ms

Usage: Query only

GETFREEMEMORY

This command queries the amount of free storage space on the internal flash memory.

Return values:

<FreeMemSize> Default unit: MByte

GETLISTDATA <ListNo>

This command queries the contents of the selected list.

Setting parameters:

<ListNo> List number

Range: 1 to 9999

Return values:

<ListData> Contents of the list.

<EventResult> **READY.**
The command was executed successfully.

ERROR
An error occurred; command was not successful.

GETLISTSIZE

This command queries the size of the active list.

Return values:

<NoEntries>	integer Number of entries in the active list. Range: 0 to 1 000 000

CLEARALLLISTS

This command clears all 999 lists. All entries are deleted in all lists.

Return values:

<EventResult>	**READY** Command was executed successfully **ERROR** An error occurred; command was not successful
Manual operation:	See "Clear All Lists" on page 204

SETUP:GBAS_PPS_SOURCE?
PPSSMA_TRIG_SOURCE <Source>

Determines which input triggers data storage for ILS LOC, ILS GP, ILS MB, VOR and COM modes.

Parameters:

<Source>	**PPS SMA** SMA input of the GNSS connector **PPS GPS** PPS input of the GNSS connector

RECIQ <State>

If enabled, the raw, unprocessed I/Q data is also recorded when you execute `DL_START`. This feature requires the R&S EVSG1-K25 I/Q data streaming option. I/Q data is available in ILS, VOR, MB, COM, and GBAS mode.

I/Q data is stored as a separate file with the same file name as the data list, but the extension `.iq`.

For details see Chapter 7.2.2, "I/Q data recording and streaming", on page 201.

Parameters:

<Sate>	ON | OFF

Return values:

<EventResult>	**READY.** The command was executed successfully.

ERROR
An error occurred; command was not successful.

Manual operation: See "Rec IQ" on page 204

SAVEACTIVELIST2USB <Filename>

This command copies the active list to a connected USB storage device as a `.csv` file. The file name is set automatically (e.g `llz_rx1_list9.csv`).

Note that this command is time-consuming for long lists (max. 1 000 000 entries).

To reduce the amount of logged data, restrict it to specific parameters.

Parameters:

<Filename> string

Path, file name and extension of the file on the USB device to which the data is stored: Note that a specified path must already exist on the USB device, otherwise an error occurs.

Return values:

<EventResult> **READY.**
The command was executed successfully.

ERROR
An error occurred; command was not successful.

Example:

```
SETACTIVELIST 2
//Defines list 2 as the active list.
SAVEACTIVELIST2USB
```

Manual operation: See "Export List to USB" on page 204

SELECTLISTPARAM <Params>

This command selects the parameters to be logged.

Parameters:

<Params> Set of parameters to be included in data log.

ALL
All parameters are selected for logging.

FULL
The selected parameters are compatible to EVS300.

MEDIUM
A reduced set of parameters is selected.

SHORT
A minimum set of parameters is selected.

Example:

```
//Select all parameters for logging
SELECTLISTPARAM ALL
```

Manual operation: See "Data selection (Sel, not GBAS/SCAT-I mode)" on page 203

SETACTIVELIST <ListNo>

This command selects the active data logger list (to save measurement results).

Setting parameters:

<ListNo> integer

List number

Range: 1 to 999

Return values:

<EventResult> **READY**
Command was executed successfully.

ERROR
An error occurred; command was not successful.

Example: `SETACTIVELIST 2`

Usage: Setting only

Manual operation: See "List" on page 202

SETDLTIME <Time>

Sets the data logger time for the current mode: "ILS LOC", "ILS GP", "ILS MB", "VOR", or "COM".

Parameters:

<Time> Data logger time

Default unit: ms

Return values:

<State> **READY.**
The command was executed successfully.

9.12.2 Data streaming

The following commands are required for data streaming.

Useful commands for streaming described elsewhere:

- `GBAS:STREAM` on page 331
`GBAS:STOPSTREAM` on page 331

Remote commands exclusive to data streaming:

GETDATADEF

This command defines the data delivered by GETDATASET on page 366.

GETDATASET

This command creates the output of the current streaming measurement results for the active board.

Return values:

<ActBoard>	CH:1 | CH:2 The currently active receiver board for which the results are returned.
<Data>	Data for the active board as described by GETDATADEF on page 366.
<State>	READY. The command was executed successfully.

STREAM <ParamSelection>, <RX Board>

Starts data streaming. In streaming mode, a measured data set is automatically sent to the remote interface. The Meastime (see MEASTIME on page 231) defines how often the data sets are produced. Every data set is preceded by the channel number. Streaming can produce large quantities of output. It is mandatory to have a fast data connection and an application that is able to handle the data.

For details on the output see Chapter 9.12.3, "Results for data streaming", on page 367

Parameters:

<ParamSelection>	**ALL** All values of the current measurement are send as comma-separated text, using current units. **FULL** Compatible to R&S EVS300. **MEDIUM** A fixed selection of parameters is exported. **SHORT** A short, fixed selection of parameters is exported.
<RX Board>	**1** Data streaming is started for RX board 1. **2** Data streaming is started for RX board 2. **1+2** Data streaming is started for both RX boards.

Return values:

<State> **READY.**
The command was executed successfully.

STOPSTREAM

This command terminates the data stream for both RX Boards.

Return values:

<State> **READY.**
The command was executed successfully.

MARKSTREAM

This command sets the `S` flag in the running stream output.

Return values:

<State> **READY.**
The command was executed successfully.

9.12.3 Results for data streaming

Which parameters and results are returned during streaming depends on the measurement mode and the parameter selection.

The individual measurement results are described in the result views.

Status flags

The "STIOCPMV" value contains status flags, if applicable:

- **S**: Start (started manually)
- **T**: Triggered (externally)
- **I**: Invalid
- **O**: Overload (RF input signal too high)
- **C**: Corrected (includes RF input correction factor)
- **P**: PPS-synced
- **M**: Morse ID available
- **V**: Valid signal (ILS LOC/GP and VOR only)

For compatibility reasons, the streaming results contain placeholders for all R&S EVSx variants and options, regardless of whether the particular instrument supports or provides those results. If not applicable, the result remains empty.

9.12.3.1 ILS LOC mode

All parameters

RX, STIOCPM, Index , Date, Time, FREQ[MHz], SINGLE[kHz], CRS_UF, CLR_LF[kHz], LEVEL[dBm], AM-MOD./90Hz[%], AM-MOD./150Hz[%], FREQ_90[Hz], FREQ_150[Hz], DDM(90-150)[1], SDM[%], PHI-90/150[°], VOICE-MOD.[%], ID-MOD.[%], ID-F.[Hz], ID-CODE, ID-Per.[s], Last_ID[s], DotLen[ms], DashLen[ms], DotDashGap[ms], Lettergap[ms], LEV_CLR_LF[dBm], LEV_CRS_UF[dBm], AM-MOD_CLR_LF/90Hz[%], AM-MOD_CLR_LF/150Hz[%], FREQ_90_CLR_LF[Hz], FREQ_150_CLR_LF[Hz], DDM_CLR_LF(90-150)[1], SDM_CLR_LF[%], PHI-90/150_CLR_LF[°], AM-MOD_CRS_UF/90Hz[%], AM-MOD_CRS_UF/150Hz[%], FREQ_90_CRS_UF[Hz], FREQ_150_CRS_UF[Hz], DDM_CRS_UF(90-150)[1], SDM_CRS_UF[%], PHI-90/150_CRS_UF[°], PHI-90/90[°], PHI-150/150[°], ResFM90[Hz], ResFM150[Hz], K2/90Hz[%], K2/150Hz[%], K3/90Hz[%], K3/150Hz[%], K4/90Hz[%], K4/150Hz[%], THD/90Hz[%], THD/150Hz[%], AM240[%], GPS_lat., GPS_long., GPS_alt[m], GPS_speed[km/h], GPS_date, GPS_time, GPS_Sat, GPS_Status, GPS_Fix, GPS_HDOP, GPS_VDOP, GPS_Und.[m], Temp[°C], MeasTime[ms], MeasMode, LOC_GP, ATT.MODE, DemodOffset_1F, DemodOffset_CRS, DemodOffset_CLR, Autotune_1F, Autotune_CRS, Autotune_CLR, IFBW_Man_WIDE, IFBW_Man_UCLC, TrigCounter, IQPosition, IQSamples

Full parameters

Channel, STIOCPM, Index , Date, Time, FREQ[MHz], CRS_UF/SINGLE[kHz], CLR_LF[kHz], LEVEL[dBm], AM-MOD./90Hz[%], AM-MOD./150Hz[%], FREQ_90[Hz], FREQ_150[Hz], DDM(90-150)[1], SDM[%], PHI-90/150[°], VOICE-MOD.[%], ID-MOD.[%], ID-F.[Hz], ID-CODE, LEV_CLR_LF[dBm], LEV_CRS_UF[dBm], AM-MOD_CLR_LF/90Hz[%], AM-MOD_CLR_LF/150Hz[%], DDM_CLR_LF(90-150)[1], SDM_CLR_LF[%], AM-MOD_CRS_UF/90Hz[%], AM-MOD_CRS_UF/150Hz[%], DDM_CRS_UF(90-150)[1], SDM_CRS_UF[%], PHI-90/90[°], PHI-150/150[°], K2/90Hz[%], K2/150Hz[%], K3/90Hz[%], K3/150Hz[%], THD/90Hz[%], THD/150Hz[%], GPS_lat., GPS_long., GPS_alt[m], GPS_speed[km/h], GPS_date, GPS_time, GPS_Sat, GPS_Status, GPS_Fix, GPS_HDOP, GPS_VDOP, Temp[°C], MeasTime[ms], MeasMode, LOC_GP, ATT.MODE, TrigCounter

Medium parameters

RX, STIOCPM, Index , Date, Time, LEVEL[dBm], DDM(90-150)[1], SDM[%], LEV_CLR_LF[dBm], LEV_CRS_UF[dBm], DDM_CLR_LF(90-150)[1],

SDM_CLR_LF[%], DDM_CRS_UF(90-150)[1], SDM_CRS_UF[%], GPS_lat., GPS_long., MeasMode, LOC_GP, ATT.MODE, TrigCounter

Short parameters

RX, Time, LEVEL[dBm], LEV_CRS_UF[dBm], LEV_CLR_LF[dBm], DDM(90-150)[1], DDM_CRS_UF(90-150)[1], DDM_CLR_LF(90-150)[1], SDM[%], SDM_CRS_UF[%], SDM_CLR_LF[%], GPS_lat., GPS_long.

9.12.3.2 ILS GP mode

All parameters

RX, STIOCPM, Index , Date, Time, FREQ[MHz], SINGLE[kHz], CRS_UF, CLR_LF[kHz], LEVEL[dBm], AM-MOD./90Hz[%], AM-MOD./150Hz[%], FREQ_90[Hz], FREQ_150[Hz], DDM(90-150)[1], SDM[%], PHI-90/150[°], VOICE-MOD.[%], ID-MOD.[%], ID-F.[Hz], ID-CODE, ID-Per.[s], Last_ID[s], DotLen[ms], DashLen[ms], DotDashGap[ms], Lettergap[ms], LEV_CLR_LF[dBm], LEV_CRS_UF[dBm], AM-MOD_CLR_LF/90Hz[%], AM-MOD_CLR_LF/150Hz[%], FREQ_90_CLR_LF[Hz], FREQ_150_CLR_LF[Hz], DDM_CLR_LF(90-150)[1], SDM_CLR_LF[%], PHI-90/150_CLR_LF[°], AM-MOD_CRS_UF/90Hz[%], AM-MOD_CRS_UF/150Hz[%], FREQ_90_CRS_UF[Hz], FREQ_150_CRS_UF[Hz], DDM_CRS_UF(90-150)[1], SDM_CRS_UF[%], PHI-90/150_CRS_UF[°], PHI-90/90[°], PHI-150/150[°], ResFM90[Hz], ResFM150[Hz], K2/90Hz[%], K2/150Hz[%], K3/90Hz[%], K3/150Hz[%], K4/90Hz[%], K4/150Hz[%], THD/90Hz[%], THD/150Hz[%], AM240[%], GPS_lat., GPS_long., GPS_alt[m], GPS_speed[km/h], GPS_date, GPS_time, GPS_Sat, GPS_Status, GPS_Fix, GPS_HDOP, GPS_VDOP, GPS_Und.[m], Temp[°C], MeasTime[ms], MeasMode, LOC_GP, ATT.MODE, DemodOffset_1F, DemodOffset_CRS, DemodOffset_CLR, Autotune_1F, Autotune_CRS, Autotune_CLR, IFBW_Man_WIDE, IFBW_Man_UCLC, TrigCounter, IQPosition, IQSamples

Full parameters

Channel, STIOCPM, Index , Date, Time, FREQ[MHz], CRS_UF/SINGLE[kHz], CLR_LF[kHz], LEVEL[dBm], AM-MOD./90Hz[%], AM-MOD./150Hz[%], FREQ_90[Hz], FREQ_150[Hz], DDM(90-150)[1], SDM[%], PHI-90/150[°], VOICE-MOD.[%], ID-MOD.[%], ID-F.[Hz], ID-CODE, LEV_CLR_LF[dBm], LEV_CRS_UF[dBm], AM-MOD_CLR_LF/90Hz[%], AM-MOD_CLR_LF/150Hz[%], DDM_CLR_LF(90-150)[1], SDM_CLR_LF[%], AM-MOD_CRS_UF/90Hz[%], AM-MOD_CRS_UF/150Hz[%], DDM_CRS_UF(90-150)[1], SDM_CRS_UF[%], PHI-90/90[°], PHI-150/150[°], K2/90Hz[%], K2/150Hz[%], K3/90Hz[%], K3/150Hz[%], THD/90Hz[%], THD/150Hz[%], GPS_lat., GPS_long., GPS_alt[m], GPS_speed[km/h], GPS_date, GPS_time, GPS_Sat, GPS_Status, GPS_Fix, GPS_HDOP, GPS_VDOP, Temp[°C], MeasTime[ms], MeasMode, LOC_GP, ATT.MODE, TrigCounter

Medium parameters

RX, STIOCPM, Index , Date, Time, LEVEL[dBm], DDM(90-150)[1], SDM[%], LEV_CLR_LF[dBm], LEV_CRS_UF[dBm], DDM_CLR_LF(90-150)[1], SDM_CLR_LF[%], DDM_CRS_UF(90-150)[1], SDM_CRS_UF[%], GPS_lat., GPS_long., MeasMode, LOC_GP, ATT.MODE, TrigCounter

Short parameters

RX, Time, LEVEL[dBm], LEV_CRS_UF[dBm], LEV_CLR_LF[dBm], DDM(90-150)[1], DDM_CRS_UF(90-150)[1], DDM_CLR_LF(90-150)[1], SDM[%], SDM_CRS_UF[%], SDM_CLR_LF[%], GPS_lat., GPS_long.

9.12.3.3 ILS MB mode

All parameters

RX, STIOCP, Index , Date, Time, FREQ[MHz], MEAS.F[kHz], LEVEL[dBm], AM-MOD./3000Hz[%], AM-MOD./1300Hz[%], AM-MOD./400Hz[%], FREQ_3000[Hz], FREQ_1300[Hz], FREQ_400[Hz], ID-MOD.[%], ID-F.[Hz], GPS_lat., GPS_long., GPS_alt[m], GPS_speed[km/h], GPS_date, GPS_time, GPS_Sat, GPS_Status, GPS_Fix, GPS_HDOP, GPS_VDOP, Temp[°C], IFBW Manual, MeasTime[ms], ATT.MODE, TrigCounter

Full parameters

Channel, STIOCP, Index , Date, Time, FREQ[MHz], MEAS.F[MHz], LEVEL[dBm], AM-MOD./3000Hz[%], AM-MOD./1300Hz[%], AM-MOD./400Hz[%], FREQ_3000[Hz], FREQ_1300[Hz], FREQ_400[Hz], ID-MOD.[%], ID-F.[Hz], GPS_lat., GPS_long., GPS_alt[m], GPS_speed[km/h], GPS_date, GPS_time, GPS_Sat, GPS_Status, GPS_Fix, GPS_HDOP, GPS_VDOP, Temp[°C], MeasTime[ms], ATT.MODE, TrigCounter

Medium parameters

RX, STIOCP, Index , Date, Time, LEVEL[dBm], AM-MOD./3000Hz[%], AM-MOD./1300Hz[%], AM-MOD./400Hz[%], FREQ_3000[Hz], FREQ_1300[Hz], FREQ_400[Hz], GPS_lat., GPS_long., TrigCounter

Short parameters

RX, Time, LEVEL[dBm], AM-MOD./400Hz[%], AM-MOD./1300Hz[%], AM-MOD./3000Hz[%], GPS_lat., GPS_long.

9.12.3.4 VOR mode

All parameters

RX, STIOCPMV, Index , Date, Time, FREQ[MHz], MEAS.F[kHz], LEVEL[dBm], AM-MOD./30Hz[%], AM-MOD./9960Hz[%], FREQ_30[Hz], FREQ_9960[Hz], FREQ_FM30[Hz], BEARING(from)[°], FM-DEV.[Hz], FM-INDEX, VOICE-MOD.[%], ID-MOD.[%], ID-F.[Hz], ID-CODE, ID-Per.[s], Last_ID[s], DotLen[ms], DashLen[ms], DotDashGap[ms], Lettergap[ms], SubCarr_K2[dB], SubCarr_K3[dB], SubCarr_K4[dB], SubCarr_K5[dB], AM60Hz[%], AM1k44[%], AM1k50[%], No.Of Segm, GPS_lat., GPS_long., GPS_alt[m], GPS_speed[km/h], GPS_date, GPS_time, GPS_Sat, GPS_Status, GPS_Fix, GPS_HDOP, GPS_VDOP, GPS_Und.[m], Temp[°C], IFBW Manual, MeasTime[ms], ATT.MODE, TrigCounter, I/Q_Position, I/Q_Samples

Full parameters

Channel, STIOCPM, Index , Date, Time, FREQ[MHz], MEAS.F[MHz], LEVEL[dBm], AM-MOD./30Hz[%], AM-MOD./9960Hz[%], AM-DIST./9960[%], FREQ_30[Hz], FREQ_9960[Hz], FREQ_FM30[Hz], BEARING(from)[°], FM-DEV.[Hz], FM-INDEX, VOICE-MOD.[%], ID-MOD.[%], ID-F.[Hz], ID-CODE, GPS_lat., GPS_long., GPS_alt[m], GPS_speed[km/h], GPS_date, GPS_time, GPS_Sat, GPS_Status, GPS_Fix, GPS_HDOP, GPS_VDOP, Temp[°C], MeasTime[ms], ATT.MODE, TrigCounter

Medium parameters

RX, STIOCPM, Index , Date, Time, LEVEL[dBm], BEARING(from)[°], GPS_lat., GPS_long., GPS_alt[m], TrigCounter

Short parameters

RX, Time, LEVEL[dBm], BEARING(from)[°], AM-MOD./30Hz[%], AM-MOD./9960Hz[%], FM-DEV.[Hz], GPS_lat., GPS_long.

9.12.3.5 COM mode

All parameters

RX, STIOCP, Index , Date, Time, FREQ[MHz], MEAS.F[MHz], MEAS.F_TX1[MHz], MEAS.F_TX2[MHz], LEVEL[dBm], LEVEL_TX1[dBm], LEVEL_TX2[dBm], AM-MOD[%], AM-MOD_TX1[%], AM-MOD_TX2[%], AMFREQ[Hz], AMFREQ_TX1[Hz], AMFREQ_TX2[Hz], GPS_lat., GPS_long., GPS_alt[m], GPS_speed[km/h], GPS_date, GPS_time, GPS_Sat, GPS_Status, GPS_Fix, GPS_HDOP, GPS_VDOP, Temp[°C], IFBW Manual 1F, IFBW Manual 2F, MeasTime[ms], ATT.MODE, TrigCounter

Full parameters

Channel, STIOCP, Index , Date, Time, FREQ[MHz], MEAS.F_TX1[MHz], MEAS.F_TX2[MHz], LEVEL[dBm], LEVEL_TX1[dBm], LEVEL_TX2[dBm], AM-MOD[%], AM-MOD_TX1[%], AM-MOD_TX2[%], AMFREQ[Hz], AMFREQ_TX1[Hz], AMFREQ_TX2[Hz], GPS_lat., GPS_long., GPS_alt[m], GPS_speed[km/h], GPS_date, GPS_time, GPS_Sat, GPS_Status, GPS_Fix, GPS_HDOP, GPS_VDOP, Temp[°C], MeasTime[ms], ATT.MODE, TrigCounter

Medium parameters

RX, STIOCP, Index , Date, Time, MEAS.F[MHz], MEAS.F_TX1[MHz], MEAS.F_TX2[MHz], LEVEL[dBm], LEVEL_TX1[dBm], LEVEL_TX2[dBm], AM-MOD[%], AM-MOD_TX1[%], AM-MOD_TX2[%], GPS_lat., GPS_long., TrigCounter

Short parameters

RX, Time, LEVEL[dBm], AM-MOD[%], AM-MOD_TX1[%], AM-MOD_TX2[%], GPS_lat., GPS_long.

9.12.3.6 GBAS mode

All parameters

RX, STIOCP, Index , Date, Time, Slot, FREQ[MHz], C.Offset[kHz], Lev.Av[dBm], Lev.Pk[dBm], SSID, EVM[%], GBAS ID, Train.FEC, App.Dat., App.FEC, BER, BER Recv. Bursts, BER Missed Bursts, Transm.Len, StartDelay[us], Sync. Seq.[us], GuardInterv[ms], GPS_lat., GPS_long., GPS_alt[m], GPS_speed[km/h], GPS_date, GPS_time, GPS_Sat, GPS_Status, GPS_Fix, GPS_HDOP, GPS_VDOP, Temp[°C], ATT.MODE, TrigCounter, GraphData, IQPosition, IQSamples, RawData

Full parameters

Channel, STIOCP, Index , Date, Slot, Time, FREQ[MHz], Lev.Av[dBm], SSID, GBAS ID, Train.FEC, App.Dat., App.FEC, GPS_lat., GPS_long., GPS_alt[m], GPS_speed[km/h], GPS_date, GPS_time, GPS_Sat, GPS_Status, GPS_Fix, GPS_HDOP, GPS_VDOP, Temp[°C], ATT.MODE, TrigCounter

Medium parameters

RX, STIOCP, Index , Time, Slot, C.Offset[kHz], Lev.Av[dBm], GBAS ID, Train.FEC, App.Dat., App.FEC, GPS_lat., GPS_long., TrigCounter

Short parameters

```
RX, Index , Time, Slot, Lev.Av[dBm], GBAS ID, App.Dat.,
GPS_lat., GPS_long.
```

9.12.3.7 NDB mode

All parameters

```
RX,STIOCP,
Index ,Date,Time,FREQ[kHz],IDFREQ[Hz],MEAS.F[kHz],LEVEL[dB�V],
IMP[Ohm],CarLevChange[dB],AM-MOD/[%],AM-FREQ[Hz],ID-CODE,
ID-Per.[s],Last_ID[s],DotLen[ms],DashLen[ms],DotDashGap[ms],
Lettergap[ms],K2[%],K3[%],K4[%],THD[%],PSFC[%],GPS_lat.,
GPS_long.,GPS_alt[m],GPS_speed[km/h],GPS_date,GPS_time,GPS_Sat,
GPS_Status,GPS_Fix,GPS_HDOP,GPS_VDOP,GPS_Und.[m],IF-BW[kHz],
MeasTime[ms],ATT.MODE,TrigCounter,I/Q_Position,I/Q_Samples
```

Medium parameters

```
RX,STIOCP,
Index ,Date,Time,FREQ[kHz],IDFREQ[Hz],MEAS.F[kHz],LEVEL[dB�V],
IMP[Ohm],AM-MOD/[%],AM-FREQ[Hz],ID-CODE,K2[%],K3[%],K4[%],
THD[%],PSFC[%],GPS_lat.,GPS_long.,MeasTime[ms],ATT.MODE
```

Short parameters

```
RX,STIOCP,
Index ,FREQ[kHz],IDFREQ[Hz],MEAS.F[kHz],LEVEL[dB�V],AM-MOD/[%],
AM-FREQ[Hz],ID-CODE
```

9.13 Information on commands

HELP?

Returns a list of all remote commands available for the R&S EVSF1000, including a short description.

Return values:

<CommandList> List of commands, consisting of the command syntax and a short description.

Usage: Query only

10 Maintenance, storage and disposal

The product does not require regular maintenance. It only requires occasional cleaning. It is however advisable to check the nominal data from time to time.

Cleaning

Do not use any liquids for cleaning. Cleaning agents, solvents, acids and bases can damage the front panel labeling, plastic parts and display.

Storage

Protect the product against dust. Ensure that the environmental conditions, e.g. temperature range and climatic load, meet the values specified in the data sheet.

10.1 Disposal

Rohde & Schwarz is committed to making careful, ecologically sound use of natural resources and minimizing the environmental footprint of our products. Help us by disposing of waste in a way that causes minimum environmental impact.

Disposing electrical and electronic equipment

A product that is labeled as follows cannot be disposed of in normal household waste after it has come to the end of its service life. Even disposal via the municipal collection points for waste electrical and electronic equipment is not permitted.

Figure 10-1: Labeling in line with EU directive WEEE

Rohde & Schwarz has developed a disposal concept for the eco-friendly disposal or recycling of waste material. As a manufacturer, Rohde & Schwarz completely fulfills its obligation to take back and dispose of electrical and electronic waste. Contact your local service representative to dispose of the product.

11 Transporting

Lifting and carrying

See:

- Chapter 1.4.2, "Lifting and carrying", on page 10.

Packing

Use the original packaging material. It consists of antistatic wrap for electrostatic protection and packing material designed for the product.

If you do not have the original packaging, use similar materials that provide the same level of protection. You can also contact your local Rohde & Schwarz service center for advice.

Securing

When moving the product in a vehicle or using transporting equipment, make sure that the product is properly secured. Only use items intended for securing objects.

To secure the R&S EVSF1000 in a flight inspection aircraft, use the optional installation tray (R&S EVSF1-Z1) for rackmounting or another rackmounting adapter. See Chapter 1.4.3.1, "Mounting the R&S EVSF1000 in a rack", on page 10.

Transport altitude

The maximum transport altitude without pressure compensation is specified in the data sheet.

12 Contacting customer support

Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz product, contact our customer support center. A team of highly qualified engineers provides support and works with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz products.

Contact information

Contact our customer support center at www.rohde-schwarz.com/support, or follow this QR code:

Figure 12-1: QR code to the Rohde & Schwarz support page

Annex

A ILS channel frequency list

The following table indicates the frequencies for the signals for specific ILS channels as defined by the International Civil Aviation Organization (ICAO).

Table A-1: ILS LOC and ILS GP - channel and frequency

ICAO Channel	Localizer mode Frequency (MHz)	Glidepath mode Frequency (MHz)
18X	108.10	334.70
18Y	108.15	334.55
20X	108.30	334.10
20Y	108.35	333.95
22X	108.50	329.90
22Y	108.55	329.75
24X	108.70	330.50
24Y	108.75	330.35
26X	108.90	329.30
26Y	108.95	329.15
28X	109.10	331.40
28Y	109.15	331.25
30X	109.30	332.00
30Y	109.35	331.85
32X	109.50	332.60
32Y	109.55	332.45
34X	109.70	333.20
34Y	109.75	333.05
36X	109.90	333.80
36Y	109.95	333.65
38X	110.10	334.40
38Y	110.15	334.25
40X	110.30	335.00
40Y	110.35	334.85
42X	110.50	329.60
42Y	110.55	329.45

ICAO Channel	**Localizer mode** **Frequency (MHz)**	**Glidepath mode** **Frequency (MHz)**
44X	110.70	330.20
44Y	110.75	330.05
46X	110.90	330.80
46Y	110.95	330.65
48X	111.10	331.70
48Y	111.15	331.55
50X	111.30	332.30
50Y	111.35	332.15
52X	111.50	332.90
52Y	111.55	332.75
54X	111.70	333.50
54Y	111.75	333.35
56X	111.90	331.10
56Y	111.95	330.95

B VOR channel frequency list

The following table indicates the frequencies for the signals for specific VOR channels as defined by the International Civil Aviation Organization (ICAO).

Table B-1: VOR - channel and frequency list

ICAO Channel	VOR Frequency (MHz)		ICAO Channel	VOR Frequency (MHz)		ICAO Channel	VOR Frequency (MHz)
17X	108.00		75X	112.80		103X	115.60
17Y	108.05		75Y	112.85		103Y	115.65
19X	108.20		76X	112.90		104X	115.70
19Y	108.25		76Y	112.95		104Y	115.75
21X	108.40		77X	113.00		105X	115.80
21Y	108.45		77Y	113.05		105Y	115.85
23X	108.60		78X	113.10		106X	115.90
23Y	108.65		78Y	113.15		106Y	115.95
25X	108.80		79X	113.20		107X	116.00
25Y	108.85		79Y	113.25		107Y	116.05
27X	109.00		80X	113.30		108X	116.10
27Y	109.05		80Y	113.35		108Y	116.15
29X	109.20		81X	113.40		109X	116.20
29Y	109.25		81Y	113.45		109Y	116.25
31X	109.40		82X	113.50		110X	116.30
31Y	109.45		82Y	113.55		110Y	116.35
33X	109.60		83X	113.60		111X	116.40
33Y	109.65		83Y	113.65		111Y	116.45
35X	109.80		84X	113.70		112X	116.50
35Y	109.85		84Y	113.75		112Y	116.55
37X	110.00		85X	113.80		113X	116.60
37Y	110.05		85Y	113.85		113Y	116.65
39X	110.20		86X	113.90		114X	116.70
39Y	110.25		86Y	113.95		114Y	116.75
41X	110.40		87X	114.00		115X	116.80
41Y	110.45		87Y	114.05		115Y	116.85
43X	110.60		88X	114.10		116X	116.90

ICAO Channel	VOR Frequency (MHz)		ICAO Channel	VOR Frequency (MHz)		ICAO Channel	VOR Frequency (MHz)
43Y	110.65		88Y	114.15		116Y	116.95
45X	110.80		89X	114.20		117X	117.00
45Y	110.85		89Y	114.25		117Y	117.05
47X	111.00		90X	114.30		118X	117.10
47Y	111.05		90Y	114.35		118Y	117.15
49X	111.20		91X	114.40		119X	117.20
49Y	111.25		91Y	114.45		119Y	117.25
51X	111.40		92X	114.50		120X	117.30
51Y	111.45		92Y	114.55		120Y	117.35
53Y	111.65		93Y	114.65		121X	117.40
55X	111.80		94X	114.70		121Y	117.45
55Y	111.85		94Y	114.75		122X	117.50
57X	112.00		95X	114.80		122Y	117.55
57Y	112.05		95Y	114.85		123X	117.60
53X	111.60		93X	114.60		123Y	117.65
58X	112.10		96X	114.90		124X	117.70
58Y	112.15		96Y	114.95		124Y	117.75
59X	112.20		97X	115.00		125X	117.80
59Y	112.25		97Y	115.05		125Y	117.85
70X	112.30		98X	115.10		126X	117.90
70Y	112.35		98Y	115.15		126Y	117.95
71X	112.40		99X	115.20			
71Y	112.45		99Y	115.25			
72X	112.50		100X	115.30			
72Y	112.55		100Y	115.35			
73X	112.60		101X	115.40			
73Y	112.65		101Y	115.45			
74X	112.70		102X	115.50			
74Y	112.75		102Y	115.55			

C References

- [1] RTCA DO-246, GNSS-Based Precision Approach Local Area Augmentation System (LAAS) Signal-in-Space Interface Control Document (ICD), July 2017
- [2] RTCA DO-217, Minimum aviation system performance standards DGNSS instrument approach system: Special Category I (SCAT-I), August 1996
- [3] ICAO AN10 Vol1, ICAO Annex 10, Aeronautical Telecommunications, Volume 1, July 2018

D Format description of GBAS and SCAT-I data

The Data Recorder records and manages the data captured during one or a series of measurements. Up to 999 lists with a maximum of 1 000 000 data lines each can be recorded. One line corresponds to the captured data at the receive frequency for the GBAS/SCAT-I signal in one time slot.

Similarly, a data stream consists of lines of measurement results, where one line corresponds to the captured data at the receive frequency for the GBAS/SCAT-I signal in one time slot.

You can also query a single measurement result, which corresponds to one row in the Data Recorder list.

In all three cases, the available parameters and their format are identical.

Which parameters are recorded is user-definable and can be defined individually for each list. The following overview describes all available parameters (full list) in their default order.

The format of the data for each slot is identical, regardless whether a parameter contains data or not. Thus, you can create a table from the exported comma-separated list. If a slot is empty, only the general data is stored in the list entry; the message-specific parameters are cropped.

When a list is stored to a file, a header line is automatically included that describes the provided parameters.

General Information

The following general information is always included, regardless whether the slot contains data or not, and whether the signal is GBAS or SCAT type.

Table D-1: General information for the individual slot

No.	Column	Description
	Channel	RF board 1 or 2
1	STIOCP	Status Flags: • **S**: Start (started manually) • **T**: Triggered (externally) • **I**: Invalid (power level not permitted or too low) • **O**: Overload (RF input signal too high) • **C**: Corrected (includes RF input correction factor) • **P**: PPS-synced (triggered by external PPS)
2	Index	Counts each measurement
3	Date	Date of measurement
4	Time	Time of measurement
5	Temp[°C]	Temperature on R&S EVSF1000 mainboard
6	SLOT	Time slot (A | B | C | D | E | F | G | H)

No.	Column	Description
7	FREQ[MHz]	Receiving frequency
8	F_DEV[kHz]	Frequency deviation
9	LEVEL[dBm]	Level measured over the "Synchronization and Ambiguity Resolution" period of the GBAS/SCAT signal
10	SSID	Received Station ID, equivalent to GBAS ID or SCAT ID
11	Len[bit]	Length of the entire message block
12	Train.FEC	FEC of the training sequence
13	Applic.FEC	FEC of the data content
14	MBI	Message block identifier
15	MT 1	Message type 1 available (YES | NO)
16	MT 4	Message type 4 available (YES | NO)
17	GPS_lat.	Received GPS data
18	GPS_long.	
19	GPS_alt[m]	
20	GPS_speed[km/h]	
21	GPS_date	
22	GPS_time	
23	GPS_Sat	
24	GPS_Status	
25	GPS_Fix	
26	GPS_HDOP	
27	GPS_VDOP	
28	GPS_Dist[m]	Distance between GPS reference point and current GPS position
29	GPS_Angle[°]	Angle between GPS reference point and current GPS position
30	ATT.MODE	Attenuator mode during slot measurement (LN | NORM | LD) In AUTO mode: the used hardware setting

GBAS Signal - MT1

After the general information, if the slot contains a message type 1, the following burst data is provided for each of the up to 32 satellites (in "full" list only):

Table D-2: Decoded message type 1 data for the individual slot and each satellite (GBAS)

Column	Description
MT1 GBAS	Section label (separator in list)
MB CRC	

Column	Description
MB ID	Message block ID: • `1010 1010`: normal LAAS message (GBAS) • `1111 1111`: test LAAS message (GBAS)
Stat ID	Received Station ID, equivalent to GBAS ID or SCAT ID
MsgLen[byte]	
Z-Cnt[m:s]	
Add.Msg.Flag	
NrOfMeasn	
MeasnType	
EphDecorPar[m/m]	
EphemCrcMSB	
EphemCrcLSB	
SrcAvailDur[sec]	
SatID	
IOD	
PRC[m]	
RRCor[m/s]	
S_pr_gnd[m]	
DiffnprcB1[m]	
DiffnprcB2[m]	
DiffnprcB3[m]	
DiffnprcB4[m]	

For details on the correction data parameters, refer to the GBAS specification [1].

MT4

If the slot contains a message type 4, the following decoded message data is provided for each of the up to 15 FASDBs (in "full" list only):

Table D-3: Decoded message type 4 data for the individual slot and each FASDB (GBAS)

Column	Description
MT4 GBAS	Section label (separator in list)
MB CRC	
MB ID	Message block ID: • `1010 1010`: normal LAAS message (GBAS) • `1111 1111`: test LAAS message (GBAS)
Stat ID	Received Station ID, equivalent to GBAS ID or SCAT ID
MsgLen[byte]	

Column	Description
DataSetLen	
OpType	
SbasServProv	
AirportID	
RunwayNo	
RunwayLtr	
ApproachPerfDesig	
RouteInd	
RPDS	
RefPathID	
LTP_FTP_Lat[°]	
LTP_FTP_Long[°]	
LTP_FTP_Height[m]	
DeltaFPAP_Lat[°]	
DeltaFPAP_Long[°]	
TCH	
UnitTCH	
GPA[°]	
CourseWidth[m]	
DeltaLenOffset[m]	
VertAlertLim[m]	
LatrAlertLim[m]	
FASCRC	

SCAT-I Signal - MT1

After the general information, if the slot contains a message type 1, the following burst data is provided for each of the up to 32 satellites (in "full" list only):

Table D-4: Decoded message type 1 data for the individual slot and each satellite (SCAT-I)

Column	Description
MT1 SCAT	Section label (separator in list)
MB CRC	
MB ID	Message block ID: • `1001 1001`: SCAT-I
Stat ID	Received Station ID, equivalent to GBAS ID or SCAT ID
MsgLen[byte]	

Column	Description
Z-Cnt[m:s]	
Acc.Err.Bnd.[m/s*s]	
K_md_gnd	
SatID	
PRC[m]	
IOD	
RRCor[m/s]	
S_pr_gnd[m]	
B_pr_gnd[m]	
S_fail_gnd[m]	
B_fail_gnd[m]	
PRC[m]	

For details on the correction data parameters, refer to the SCAT-I specification [2].

MT4

If the slot contains a message type 4, the following decoded message data is provided for each of the up to 15 FASDBs (in "full" list only):

Table D-5: Decoded message type 4 data for the individual slot and each FASDB (SCAT-I)

Column	Description
MT4 DATA	Section label (separator in list)
MB CRC	
MB ID	Message block ID: • `1001 1001`: SCAT-I
Stat ID	Received Station ID, equivalent to GBAS ID or SCAT ID
MsgLen[byte]	
OpType	
AirportID	
RunwayNo	
RunwayLtr	
RouteInd	
ValInd	
RPDS	
RefPathID	
ThDP_Lat[°]	

Column	Description
ThDP_Long[°]	
ThDP_Height[m]	
DERP_LAT[°]	
DERP_Long[°]	
TCH[ft]	
GPA[°]	
FASCRC	

List of commands

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