R&S®EVSG1000
VHF/UHF Airnav/Com Analyzer
User Manual

ROHDE&SCHWARZ

Make ideas real

This document describes the following R&S EVSG1000 models with firmware version 1.50 or later:

- R&S EVSG1000 VHF/UHF nav/drone analyzer (1330.0350K02)

- R&S®EVSG1000 (1329.8009.02)

Furthermore, it covers the following options:

- R&S EVSG-B1 Second Signal Processing Unit (1329.8809.02)

- R&S EVSG-B2 Battery Management (1329.8815.02)

- R&S EVSG-B3 Battery Pack (1329.8821.02)

- 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 EVSG-K12 Time domain analysis (1329.9086.02)

- R&S EVSG1-K20 GPS Support(1329.9092.02)

- R&S EVSG1-K21 Data Recording (1329.9105.02)

- R&S EVSG1-K22 High Measurement Rate (1329.9111.02)

- R&S EVSG1-K23 Preselector (1329.9128.02)

- R&S EVSG1-K24 Power Sensor Support (1329.9134.02)

- R&S EVSG1-K25 I/Q data streaming (1329.9157.02)

1178.6227.02 | Version 07 | R&S®EVSG1000

The following abbreviations are used throughout this manual: R&S®EVSG1000 is abbreviated as R&S EVSG1000.

Contents

1　Getting started

Note: the following chapters are identical to those in the printed R&S EVSG1000 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 EVSG1000 is a signal level and modulation analyzer to be used on the ground. 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 portable, robust design and the integrated battery allow for network-independent measurements also outdoors.

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 EVSG1000 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 13. 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.

● 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.

Handling batteries safely

The product contains exchangeable or built-in lithium polymer or lithium ion cells or batteries. The use of the word battery in the following always means all types. Only the battery contents are potentially hazardous. As long as a battery is undamaged and the seals remain intact, there is no danger.

Impact, shock or heat can cause damage such as dents, punctures and other deformations. A damaged battery poses a risk of personal injury. Handle a damaged or leaking battery with extreme care. Immediately ventilate the area since the battery releases harmful gases. If you come into contact with the battery fluid, immediately remove all contaminated clothing. Irritation can occur if the battery fluid comes in contact with your skin or eyes. Immediately and thoroughly rinse your skin or eyes with water and seek medical aid.

For safe handling, follow these rules:

- Do not short-circuit the battery.
- Do not mechanically damage the battery. Do not open or disassemble the battery.
- Do not expose the battery to high temperatures such as open flames, hot surfaces and sunlight.
- Only use the battery with the designated Rohde & Schwarz product.
- Only use the appropriate Rohde & Schwarz charger to charge the batteries. If the batteries are improperly charged, there is a risk of explosion. For charging and discharging temperature ranges, see the product documentation.
- Replace exchangeable batteries only with the same battery type.
- Store the battery in the product or use the product packaging.
- Dispose of exchangeable batteries separately from normal household waste as specified by the local waste disposal agency.

If you disregard these rules, you risk serious personal injury or even death due to explosion, fire or hazardous chemical substances. The product documentation provides further details.

If exchangeable batteries or products with built-in batteries are defective, contact the Rohde & Schwarz customer service. Rohde & Schwarz classifies the severity of the defect. When returning batteries or Rohde & Schwarz products containing batteries, use a carrier qualified to transport dangerous goods and notify the carrier of this classification. Follow the carrier's transport stipulations in line with IATA-DGR, IMDG-Code, ADR or RID.

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 15
- 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 399. For more information, see the R&S EVSG1000 user manual, chapter "Disposal".
🚮	Labeling in line with directive 2006/66/EC for disposal of batteries after they have come to the end of their service life. For more information, see "Disposing batteries" on page 399. For more information, see the R&S EVSG1000 user manual, chapter "Disposal".

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 EVSG1000 user documentation. Unless specified otherwise, you find the documents at:

www.rohde-schwarz.com/manual/EVSG

Further documents are available at:

www.rohde-schwarz.com/product/EVSG

1.2.1 Getting started manual

Introduces the R&S EVSG1000 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 EVSG1000.

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 EVSG1000. 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/EVSG/

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/EVSG.

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 EVSG1000 offers the following key features:

- Detailed analysis of ILS, VOR and Marker Beacon ground measurements (based on ICAO Doc. 8071 and ICAO Annex 10)
- Spectrum preview and detailed signal analysis in frequency and time range
- Dynamic measurements up to 100 measurements per second in high measurement rate modus
- Parallel course and clearance signal analysis in two-frequency systems (ILS)
- 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 EVSG1000 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:
    - AC/DC power supply connector with cable
    - 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 carrying handle on the top of the instrument is designed to lift or carry the instrument. Do not apply excessive external force to the handle.

1.4.3   Setting up the R&S EVSG1000

The R&S EVSG1000 is designed for use either on a bench top or in a rack, or as a portable instrument (with optional battery operation) in a transport bag in the field.

See also:
- "Intended use" on page 13

1.4.3.1   Placing the R&S EVSG1000 on a bench top

To place the R&S EVSG1000 on a bench top

1. Place the R&S EVSG1000 on a stable, flat and level surface. Ensure that the surface can support the weight of the R&S EVSG1000. For information on the weight, see the data sheet.

2. The top surface is not designed for stacking. If you want to stack the R&S EVSG1000 together with other products:

    a) Follow the instructions given for the other products.
    b) Place the R&S EVSG1000 on top.

1.4.3.2   Mounting the R&S EVSG1000 in a rack

A 19"-adapter is available as an accessory (R&S EVSG-Z7 rack adapter kit) to mount the R&S EVSG1000 in a 19" rack (e.g. in a measurement vehicle).

To mount the R&S EVSG1000 in a rack

1. **NOTICE!** Insufficient airflow can cause overheating and damage the product.

    Design and implement an efficient ventilation concept for the rack.

2. Use the adapter kit R&S EVSG-Z7 rack adapter kit to prepare the R&S EVSG1000 for rack mounting. For the order number, see the data sheet.
    Mount the adapter kit. Follow the assembly instructions provided with the adapter kit.

3. Lift the R&S EVSG1000 to shelf height.

4. Grab the handles and push the product onto the shelf until the rack brackets fit closely to the rack.

5. Tighten all screws in the rack brackets with a tightening torque of 1.2 Nm to secure the R&S EVSG1000 in the rack.

To unmount the R&S EVSG1000 from a rack

1. Loosen the screws at the rack brackets.

2. Remove the R&S EVSG1000 from the rack.

3. If placing the R&S EVSG1000 on a bench top again, unmount the adapter kit from the R&S EVSG1000. Follow the instructions provided with the adapter kit.

1.4.3.3 Portable operation

The R&S EVSG1000 was designed as a portable, robust instrument that can also be operated outdoors.

An optional weather protection carrying bag (R&S EVSG-Z1 carrying bag, see Chapter 1.5.3, "Accessories", on page 35) designed specifically for the R&S EVSG1000 allows you to protect the instrument while working in the field. The bag includes ventilation areas at the position of the ventilation outlets in the casing to ensure air circulation. The transparent cover allows you to operate the instrument without removing it from the bag. Together with the optional battery pack (see Chapter 1.4.4.3, "Using an optional battery pack", on page 22), and packed in the dedicated carrying bag, the R&S EVSG1000 is ideally suited for operation directly in the field, even in rough environments.

See also Chapter 1.4.2, "Lifting and carrying", on page 19.

1.4.4 Connecting to power

To ensure high mobility and flexibility while using the R&S EVSG1000, it is equipped with a DC power supply connector on the rear panel of the instrument.

There are various options to supply DC power to the R&S EVSG1000:
*   Using the AC/DC power supply provided with the R&S EVSG1000.
*   Using the internal battery, if options R&S EVSG-B2 Battery Management and R&S EVSG-B3 Battery Pack are installed.
*   Using an external DC power source with a voltage of 10 V DC to 28 V DC and a current of 3.0 A.

For safety information, see "Connecting to power" on page 14.

1.4.4.1 Connecting the provided AC/DC power supply connector

To operate the R&S EVSG1000 on a 230 V AC power supply, use only the provided AC/DC power supply connector.

1. Connect the DC connector on the provided AC/DC power supply connector to the Power Supply connector on the back of the R&S EVSG1000 (see Chapter 1.5.2.1, "Power supply", on page 33).

2. Plug the AC power cable into the AC/DC power supply connector. Only use the AC power cable delivered with the R&S EVSG1000.
   The required ratings are listed next to the AC power connector and in the 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 green Power LED on the front panel of the R&S EVSG1000 lights up.

1.4.4.2 Connecting an external DC power source

The R&S EVSG1000 can be operated directly from an external DC power source with a voltage of 10 V DC to 28 V DC and a current of 3.0 A.

If you use an external power supply unit to supply 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 EVSG1000 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 33).

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 the cable must be extended, ensure the entire cable has a cross-section of at least 1.5 mm^2.

   As soon as the DC power supply is switched on, the green Power LED on the front panel of the R&S EVSG1000 lights up.

1.4.4.3   Using an optional battery pack

As an alternative to the fixed AC or DC power supply, the R&S EVSG1000 can be operated by a battery pack, if the R&S EVSG-B2 Battery Management and R&S EVSG-B3 Battery Pack options are installed. Use only the original battery pack R&S EVSG-B3 Battery Pack. For the order numbers, see the data sheet.

If the battery option was ordered together with the instrument, the R&S EVSG1000 comes with the battery management and battery pack already installed. Otherwise these options must be installed by Rohde & Schwarz service personnel.

For safety information, see "Handling batteries safely" on page 15.

For information on how to exchange a battery pack, see the R&S EVSG1000 user manual, chapter "Maintenance".

For information on how to exchange a battery pack, see Chapter 11.2, "Handling batteries", on page 396.

If the battery pack is installed and no DC power is supplied, the R&S EVSG1000 automatically switches to battery operation.

Charging batteries

Charge the battery before using it for the first time. Following a long storage period, it can be necessary to charge and discharge the battery several times to reach full capacity.

When charging the battery, observe the following:

- For charging, use only the R&S EVSG1000 or the R&S®FSV-B34 battery charger (1321.3950.02).
- If the instrument is connected to the provided AC/DC power supply connector or to an external DC power supply with more than 12 V DC, the internal battery is automatically charged, regardless whether the instrument is switched on or off.
- If the battery temperature rises above +53 °C, charging is interrupted until the temperature drops below +45 °C. Large temperature variations can also cause the charger to be switched off too early.
- Try not to overcharge the battery too often because overcharging reduces the service life of the battery.

Look up the following details in the data sheet:

- Charging conditions
- Recharging interval to avoid deep discharge

When the battery is being charged, the Power LED blinks. During operation, the status bar also indicates that the battery is being charged. See "Status bar" on page 39.

For charging times, see the R&S EVSG1000 user manual, chapter "Maintenance".

For charging times, see Chapter 11.2, "Handling batteries", on page 396.

1.4.5 Switching on or off

The Power LEDs on the front panel indicate the power and operation state of the R&S EVSG1000.

The left LED indicates the operating state:

Table 1-2: Overview of operating states

Status	LED
Off	⬤ gray
Booting	⬤ green, blinking
Ready for operation	⬤ green

The right LED indicates the power state:

Table 1-3: Overview of power states

Status	LED
Not connected to power	⬤ gray
Connected to power	⬤ green
Battery charging	⬤ green, blinking

To switch on the R&S EVSG1000

The instrument is off but connected to power.

► Press the power key.
See Chapter 1.5.1.1, "Power key", on page 28.

The left power LED starts blinking. The instrument boots.

The boot process of the R&S EVSG1000 takes about 30 seconds. Then the instrument automatically starts the measurement mode used before the instrument was switched off. The power LED stops blinking.

If valid data for automatic calibration is not available, the message "UNCAL" is displayed in the status line. It is recommended that you perfom an autocalibration every 2 months or if the difference of the environment temperature changes by more than 10 °C.

See Chapter 1.4.9, "Performing an autocalibration", on page 26.

To shut down the R&S EVSG1000

The instrument is switched on.

► Press the power key.

The operating system shuts down. The LED is no longer lit.

To disconnect from power

The instrument is switched off.

NOTICE

Risk of data loss

If you disconnect the R&S EVSG1000 from power when it is switched on and no (charged) battery is installed, you can lose settings and data. Switch off the instrument before disconnecting it from power.

► Disconnect the R&S EVSG1000 from the power source.

1.4.6 Connecting devices for signal input and output

Information on signal levels is provided in the data sheet. Keep the signal levels within the specified ranges to avoid damage to the product and connected devices.

1. Connect the RF input connector ("RX 1 IN"/"RX 2 IN") with the receiving antenna (see Chapter 1.5.1.3, "RX1 IN / RX2 IN", on page 28).

2. Optionally, connect the power supply for an active receiving antenna (see Chapter 1.5.1.6, "12 v DC out", on page 29).

3. Optionally, connect the GPS receiver (see Chapter 1.5.2.4, "RS232 GPS", on page 33).

4. Optionally, connect a headset (see Chapter 1.5.1.5, "AF out", on page 29).

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 33.

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 EVSG1000 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 EVSG1000 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 EVSG1000. 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 EVSG1000 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 EVSG1000. The default instrument name is `EVSG<serial_number>`, for example, `EVSG1000-123456`. For information on determining the serial number, see Chapter 1.5.2.10, "Device ID", on page 34.

For more information on LAN configuration, see the R&S EVSG1000 user manual.

For more information on LAN configuration, see Chapter 9.4, "LAN (remote) settings", on page 231.

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

The R&S EVSG1000 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 EVSG1000 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 EVSG1000.

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 EVSG1000, connect the data-link-module (Wi-Fi) to the R&S EVSG1000. Otherwise, the R&S EVSG1000 does not determine the IP information automatically.

1. Switch on the R&S EVSG1000.

   The R&S EVSG1000 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 EVSG1000 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 1.5.2.10, "Device ID", on page 34.
   If necessary, configure the data link information for your network.
   For details, see the R&S EVSG1000 user manual.
   For details, see Chapter 9.5, "Data link (Wi-Fi) settings", on page 233.

1.4.9 Performing an autocalibration

After setting up the R&S EVSG1000, perform an autocalibration to ensure the accuracy of the measurements. After initial setup, 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.

If valid data for automatic calibration is not available, the message "UNCAL" is displayed in the status line of the R&S EVSG1000 display.

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 EVSG1000.

1. Select [Setup] > "Cal".

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 the R&S EVSG1000 user manual.

For more information on autocalibration, see "Auto-Calibration (Cal)" on page 239.

1.5 Instrument tour

1.5.1 Front panel

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

Figure 1-1: R&S EVSG1000 - Front panel view

```
 1  = Power key
 2  = System keys
 3  = Display
 4  = Softkeys
 5  = Keypad
 6  = Function keys
 7  = Rotary Knob
 8  = Navigation keys
 9  = RX 1 IN
10  = 12 V DC Out
11  = AF Out
12  = USB connectors
13  = RX2 IN
```

1.5.1.1 Power key

The [Power] key is located on the lower left corner of the front panel. It starts up and shuts down the instrument.

See also "Connecting to power" on page 14 and Chapter 1.4.4, "Connecting to power", on page 20.

1.5.1.2 Display

The TFT color display shows all measurement and configuration details.

1.5.1.3 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 EVSG1000 for RF signal input.

(i) "RX2 In" is supplied as an option (R&S EVSG-B1 Second Signal Processing Unit).

This option allows you to perform two independent measurements simultaneously, for example on different frequencies. This capability is vital in flight inspection systems because localizer and glidepath signals must be measured at the same time. An additional application required in flight inspection systems is the parallel measurement of two different VOR stations.

1.5.1.4 USB

The front panel provides two female USB connectors (USB-A, 2.0 standard) to connect a memory device.

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

1.5.1.5 AF out

Connector for a headset with a 3.5 mm jack plug

1.5.1.6 12 v DC out

DC output for an active receiving antenna.

1.5.1.7 System keys

System keys set the instrument to a predefined state, change basic settings, and provide print and display functions.

Table 1-4: System keys

System key	Assigned functions
[Preset]	Opens the "Preset" menu.
\n\n[Screenshot]	Creates screenshot and stores it internally.
[Audio]	Opens the "Audio" menu.
[Display]	Opens the "Display" menu.
[Help]	Opens the online help.
[Setup]	Opens the "Setup" menu containing general instrument settings.
[Mode]	Opens the measurement mode selection (for example ILS LOC, VOR, COM)

1.5.1.8 Softkeys

Softkeys are virtual keys provided by the software. Thus, more functions can be provided than those that can be accessed directly via the function keys on the instrument. Softkeys are dynamic, i.e. depending on the selected function key, a different list of softkeys is displayed on the right side of the screen. A list of softkeys for a certain function key is also called a menu. Softkeys can either perform a specific function or open a dialog box.

1.5.1.9 Function keys

Function keys provide access to the most common measurement settings and functions.
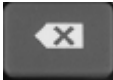
Table 1-5: Function keys

Function key	Assigned functions
[CH Freq]	Sets the center frequency and the start and stop frequencies
[Ampt]	Sets the reference level, the displayed dynamic range, and the RF attenuation for the level display
[BW]	Sets the resolution bandwidth
[Meas]	Provides the measurement settings for the active measurement mode
[Config]	Configures measurements and data input and output
[MTime]	Configures the measurement time
[Marker]	Sets and positions the absolute and relative measurement markers (markers and delta markers)
[Mkr]->	Provides search functions for the measurement markers (maximum/minimum of the trace)
	Sets the center frequency to the current marker frequency
[Mkr Fct]	Provides further marker functions, such as removing all markers
[Record]	Starts and stops the continuous data recording.
[Trigger]	Opens the Trigger Menu.
[Single]	Saves a single dataset.

1.5.1.10 Keypad

The keypad is used to enter numeric parameters, including the corresponding units. It contains the following keys.

Type of key	Description
Decimal point	Inserts a decimal point "." at the cursor position.
Sign key	Changes the sign of a numeric parameter. In the case of an alphanumeric parameter, inserts a "-" at the cursor position.

Type of key	Description
Unit keys (GHz/-dBm MHz/dBm, kHz/dB, Hz/dB etc.)	Adds the selected unit to the entered numeric value and complete the entry. In the case of level entries (e.g. in dB) or dimension-less values, all units have the value "1" as multiplying factor. Thus, they have the same function as an ENTER key.
ESC	Closes all kinds of dialog boxes, if the edit mode is not active. Quits the edit mode, if the edit mode is active. In dialog boxes that contain a "Cancel" button it activates that button. For "Edit" dialog boxes the following mechanism is used: • If data entry has been started, it retains the original value and closes the dialog box. • If data entry has not been started or has been completed, it closes the dialog box.
	If an alphanumeric entry has already been started, this key deletes the character to the left of the cursor.
ENTER	• Concludes the entry of dimensionless entries. The new value is accepted. • With other entries, this key can be used instead of the "Hz/dB" unit key. • In a dialog box, selects the default or focused element.

1.5.1.11 Rotary knob

The rotary knob has several functions:

- For numeric entries: increments (clockwise direction) or decrements (counterclockwise direction) the instrument parameter at a defined step width
- In lists: toggles between entries
- For markers, limit lines, and other graphical elements on the screen: moves their position
- For active scroll bars: moves the scroll bar vertically
- For dialog boxes: Acts like the ENTER key when pressed

While you turn the rotary knob, the settings are applied immediately, and the results are updated accordingly.

1.5.1.12 Navigation keys

The navigation keys can be used alternatively to the rotary knob to navigate through dialog boxes, diagrams or tables.

- **Arrow Up/Arrow Down Keys**
  The <arrow up> or <arrow down> keys do the following:

– For numeric entries: increments (Arrow Up) or decrements (Arrow Down) the instrument parameter at a defined step width

– In a list: scrolls forward and backward through the list entries

– In a table: moves the selection bar vertically

– In windows or dialog boxes with a vertical scroll bar: moves the scroll bar

- **Arrow Left/Arrow Right Keys**
  The <arrow left> or <arrow right> keys do the following:

  – In an alphanumeric edit dialog box, move the cursor.

  – In a list, scroll forward and backward through the list entries.

  – In a table, move the selection bar horizontally.

  – In windows or dialog boxes with horizontal scroll bar, move the scroll bar.

1.5.2 Rear panel

Figure 1-2: R&S EVSG1000 - Rear panel view

1 = Loudspeaker
2 = Li-Ion battery pack
3 = USB
4 = LAN
5 = RS232-GPS
6 = PPS In
7 = Trigger In
8 = LF In
9 = Demod Out
10 = Power Supply

The meanings of the labels on the product are described in Chapter 1.1.2, "Labels on the product", on page 16 and Chapter 1.5.2.10, "Device ID", on page 34.

1.5.2.1 Power supply

XLR connector for an external DC power source (10 V DC to 28 V DC)

For details, refer to "Connecting to power" on page 14 and Chapter 1.4.4, "Connecting to power", on page 20.

1.5.2.2 Li-Ion battery pack

With the Li-Ion battery pack (options (R&S EVSG-B2 Battery Management and R&S EVSG-B3 Battery Pack), the R&S EVSG1000 can be operated independently of an AC or DC power supply.

The charging circuit is protected by an overload protection and an overheating protection.

Generally, the internal battery pack can be charged during operation with the AC/DC power supply or with an external DC voltage supply providing more than 12 V DC. Note, however, that charging can take longer when the instrument is in use.

For details, see "Handling batteries safely" on page 15 and Chapter 1.4.4.3, "Using an optional battery pack", on page 22.

1.5.2.3 LAN (ethernet)

Through the LAN connection (Fast Ethernet), all functions of the R&S EVSG1000 can be remotely operated. The LAN connection can also be used to stream measurement data (TCP port 8000; for I/Q data: 8001 (RX1) or 8002 (RX2)). IP Addresses and subnet mask are defined in the setup menu. The data transfer rate is 100 Mbit/s.

1.5.2.4 RS232 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 (requires option R&S EVSG1-K20 GPS Support).

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 (requires option R&S EVSG1-K20 GPS Support).

1.5.2.6 Trigger in

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

1.5.2.7 LF in (Baseband/Low frequency input)

BNC socket, 50 Ω/20 kΩ to input an AF signal or signals with a very low IF (<25 kHz) to the R&S EVSG1000 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.

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

1.5.2.8 Demod out

BNC connector to output a demodulated signal for connected devices, for example an oscilloscope

1.5.2.9 Loudspeaker

Provides the AF output also available via the Chapter 1.5.1.5, "AF out", on page 29 headphone connector.

1.5.2.10 Device ID

The unique device identifier is provided as a barcode sticker on the rear panel of the R&S EVSG1000.

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, `EVSG1000-123456`.

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

1.5.3 Accessories

Following accessories are available for the operation of the R&S EVSG1000.

- Weather protection bag (R&S EVSG-Z1 carrying bag)
  The weather protection bag has a transparent cover that allows you to use the R&S EVSG1000 in the field even under adverse weather conditions. The front pocket can be used to transport accessories, such as the external power supply.

Figure 1-3: Weather protection bag

- Rugged Transport case (R&S EVSG-Z2 Rugged transport case)
  A hard-top case with trolley functionality.

Figure 1-4: Transport Case

- ILS / VOR Dipole Antenna (R&S EVS-Z3)
  The lightweight design of the ILS/VOR dipole antenna and its compact size makes this antenna ideal for mobile measurements in the field. The antenna comes with two sets of rods of different lengths to support the two frequency ranges. The telescopic mast can be extended to 3.1 m.
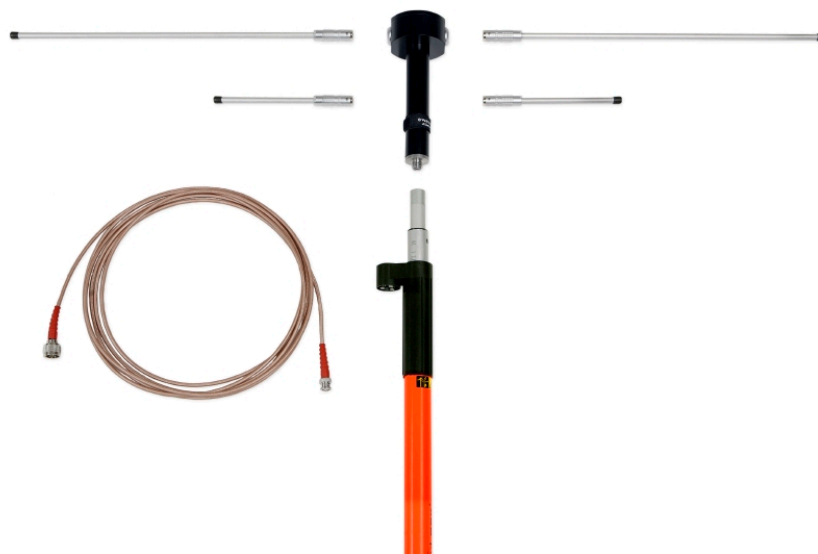
Figure 1-5: ILS / VOR Dipole Antenna

- Antenna bag (R&S EVS-Z4)
  The carrying bag allows you to transport all the antenna elements and the telescopic mast safely.

Figure 1-6: Antenna bag

- Display protection cover (R&S EVS-Z6)
  The protective hard cover protects the front panel during transport.

Figure 1-7: Display protection cover

- 19"-adapter (R&S EVSG-Z7 rack adapter kit)
  This option is required to mount the R&S EVSG1000 in a 19" rack (e.g. in a measurement vehicle).

1.6 Operating basics

The R&S EVSG1000 is designed for ground inspection and is thus optimized for manual operation, via the graphical user interface.

Nevertheless, the instrument can also be controlled remotely, either by executing predefined commands, or by simulating the user interface on a remotely connected device.

This chapter provides an overview on how to work with the R&S EVSG1000. It describes what kind of information is displayed on the screen and how to operate the R&S EVSG1000 manually and remotely.

1.6.1 Understanding the display information

The following figure shows a typical screen display for the R&S EVSG1000. All different screen elements are labeled. They are explained in more detail in the following sections.
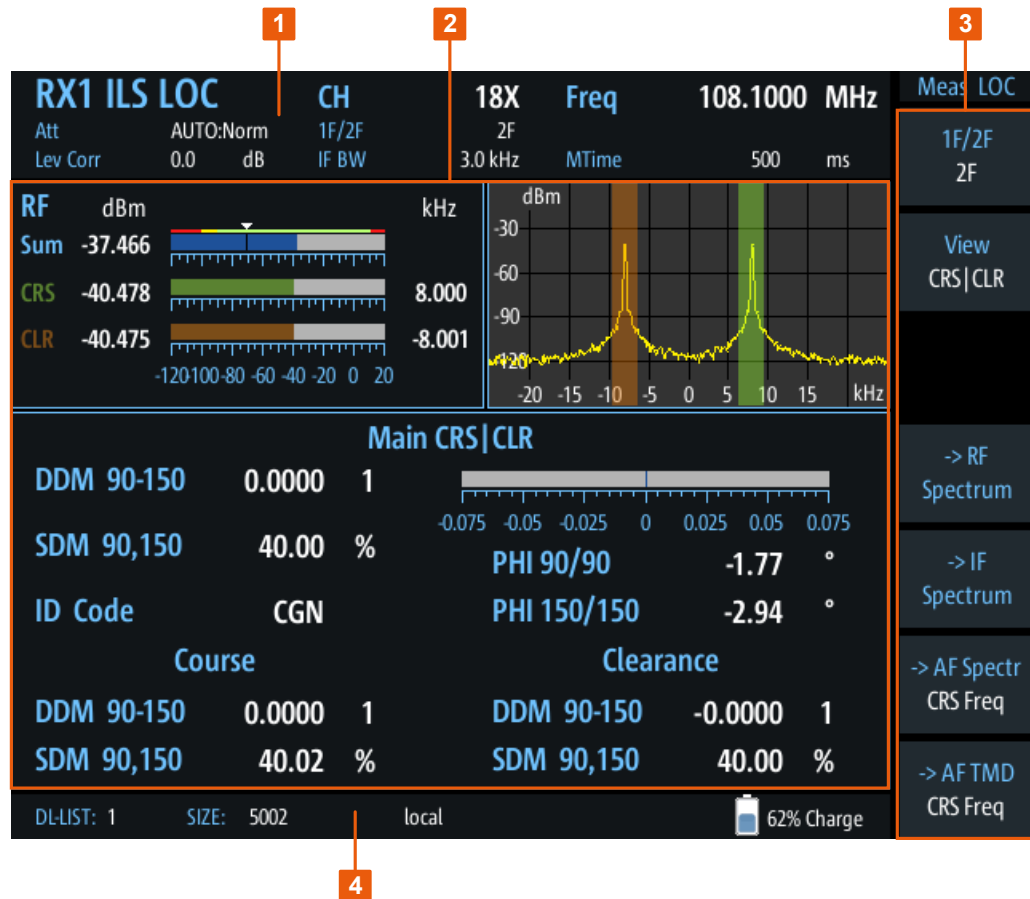
Figure 1-8: R&S EVSG1000 - GUI overview

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 48
- Chapter 8, "Data management", on page 215

● Chapter 7, "R&S EVSG1-K24 Power Sensor Support", on page 213
● Chapter 9, "Common instrument settings", on page 227

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.

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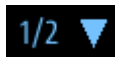
Sometimes, more functions are available than softkeys can be displayed at the same time. In this case, a second menu of functions is available, indicated by "1/2" and "2/2" beneath the softkeys in the display.

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 EVSG1000.

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 1-9: 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 8.2, "Recording measurement data", on page 217)
● Local or remote operation (see Chapter 1.6.4, "Remote control", on page 47)
● Battery status and charge status (in %)
  (See Chapter 9.7, "Instrument configuration and operating status settings", on page 238)

1.6.2 Manual operation

This chapter describes how to operate the R&S EVSG1000 directly on the instrument, using graphical interaction methods. During manual operation, the R&S EVSG1000 display indicates "Local" in the status bar.

1.6.2.1 Changing settings and activating functions

All functions available on the R&S EVSG1000 can be accessed using the keys on the front panel of the instrument. Some keys provide a softkey menu on the display with further functions and settings.

1. Select a key on the front panel of the instrument to activate a function directly, or to display a softkey menu.
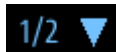
2. Select the softkey for the setting or function as required.
   If necessary, select the "More softkeys" key to switch to the second softkey menu.

   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 turning the rotary knob or pressing the Up and Down arrow keys on the front panel (see Chapter 1.6.2.2, "Entering data", on page 40).

4. Scroll through the available setting values by turning the rotary knob or pressing the Up and Down arrow keys on the front panel, or enter a numeric or alphanumeric value as described in Chapter 1.6.2.2, "Entering data", on page 40.

   Note: While you turn the rotary knob, the settings are applied immediately. If you enter a value using the keypad, you must confirm the setting before the settings are applied.

5. Confirm the new setting and remove the focus by pressing the rotary knob or the [ENTER] key on the front panel.

1.6.2.2 Entering data

You enter data in input fields using elements provided by the front panel, e.g. the keypad, rotary knob, or navigation keys.

Entering numeric parameters

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

1. Enter the parameter value using the keypad, or change the currently used parameter value by turning the rotary knob or pressing the Up or Down arrow keys.

2. After entering the numeric value via keypad, 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 the [ENTER] key 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 1-6.

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 1-6.

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 the [ENTER] key or the rotary knob.

   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 1-6: 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 Æ À Ç
9	D E F 9 É

Key name (upper inscription)	Series of (special) characters and number provided
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>

1.6.2.3 Getting help

If any questions or problems concerning the R&S EVSG1000 arise, an online help system is provided on the instrument and can be consulted at any time.

Displaying the online help system on the instrument

1. Press the [Help] key on the front panel.

EVSG Online help

User Manual

Open Source Acknowledgement (OSA)

use cursor keys to move

HELP key to toggle between links

ENTER to follow links

BACK to go back

ESC to leave help

Field left: navigate left panel

Field right: navigate right panel
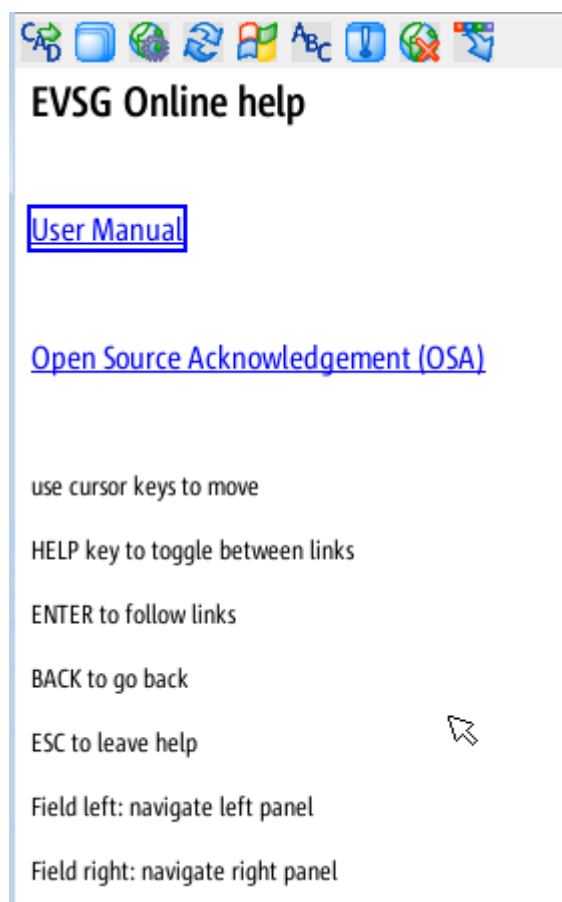
2. Press [Enter] to display the user manual contents.
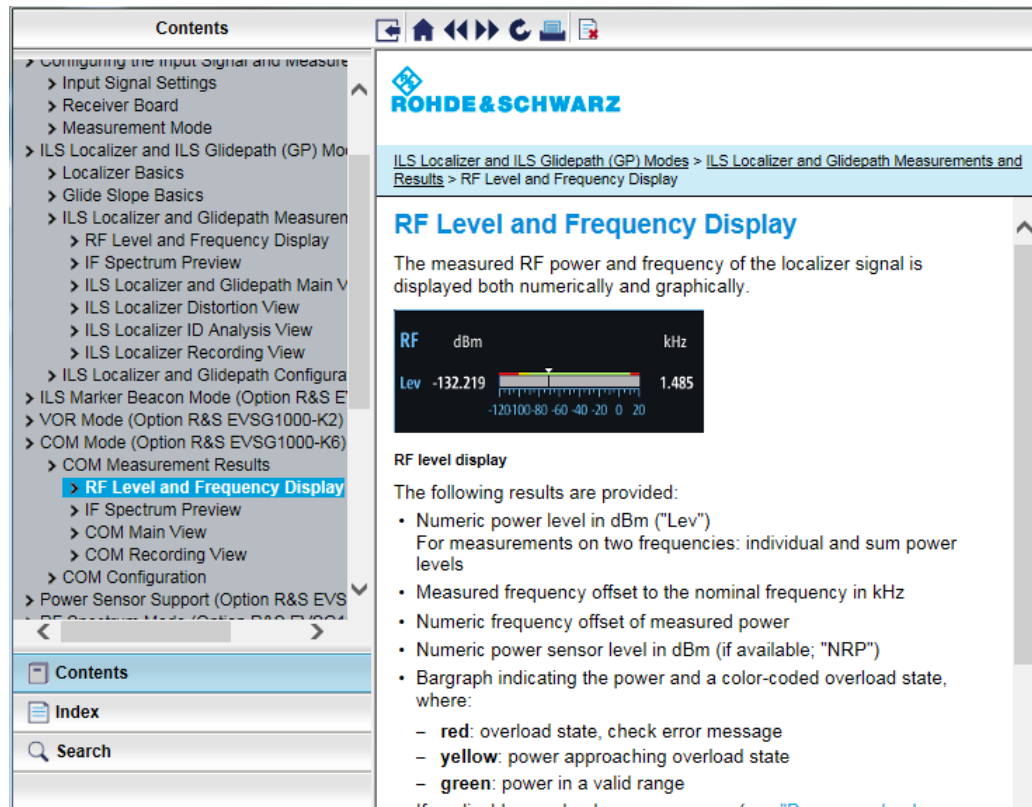
Navigating in the help system

To move up and down

► Use the arrow keys.

To switch between areas

► Press the Field left and Field right keys.
VNC:
Press the [PAGE UP] and [PAGE DOWN] keys.

To follow a link

► Press [Enter].

To exit the online help and return to the firmware view

► Press [ESC].

1.6.3   Manual operation from a VNC viewer

As an alternative to operating the R&S EVSG1000 directly on the instrument, you can perform the same tasks 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 EVSG1000 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 EVSG1000 via VNC can be protected by a password. In this case, enter *instrument* as the password in the login window.

(See also Chapter 9.4, "LAN (remote) settings", on page 231.)

Keyboard commands for operation via a VNC viewer

Keyboard commands (VNC viewer) shows the mapping between the keyboard shortcut and the interface element on the R&S EVSG1000.

Table 1-7: 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

Keyboard	Usage
F8	**1/2 ▼** Show additional softkeys
k	Trigger
l	Single
ESC	ESC
0	0
1	1
4	4
7	7
q	CH/FREQ
d	MTime
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

1.6.4 Remote control

You can control the R&S EVSG1000, including data transfer, remotely from another device using the LAN connection (Fast Ethernet).

You define the IP address and subnet mask in the "Setup" menu.

Remote control is performed using predefined remote commands which are sent from the control device to the R&S EVSG1000. The R&S EVSG1000 can also return queried data to the control device.

For details on the available remote commands, see Chapter 10, "Remote commands", on page 246.

While in remote control, the R&S EVSG1000 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 EVSG1000 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 228).
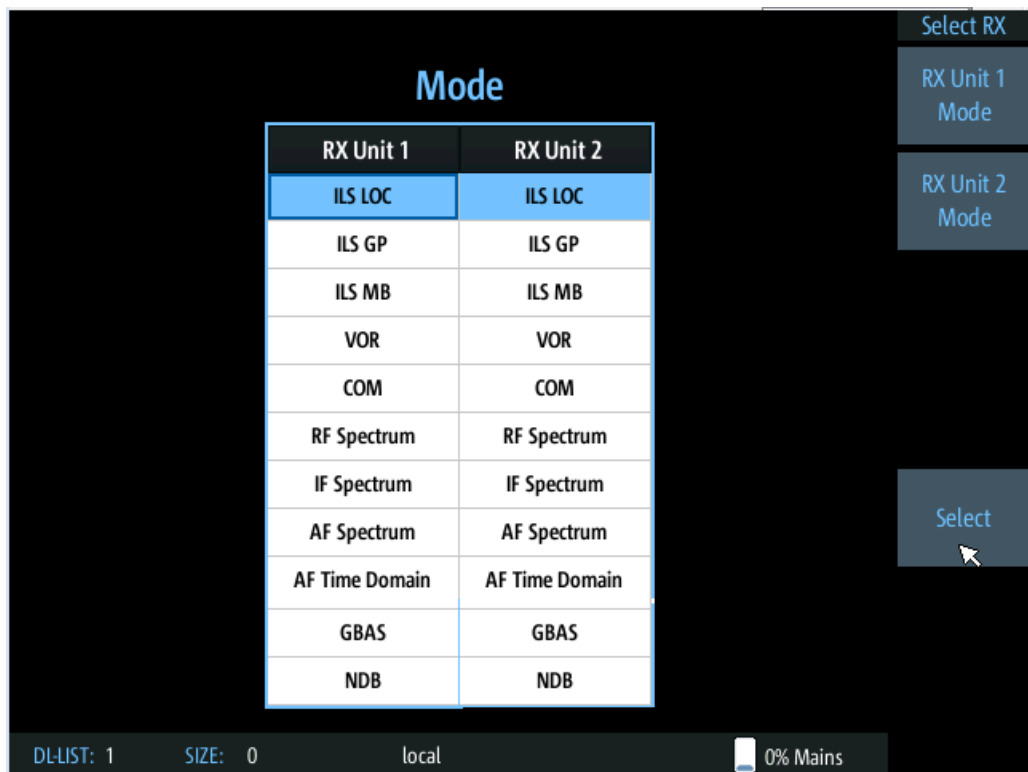
Figure 2-1: Measurement mode selection

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 248

GETMEAS on page 247

GBAS:GETMDEF on page 348

GBAS:GETMEAS on page 348

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 52.

Measurement mode
The currently active measurement mode on the active receiver board, e.g. "ILS LOC". See Chapter 3.3, "Measurement mode", on page 52.

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 79.

Frequency (FREQ)
The measured frequency on the active receiver board. See "Channel frequency configuration (CH FREQ)" on page 79.

RF attenuation (Att)
The used attenuation mode; see also "RF Mode" on page 81.

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 76.

Level correction (Lev Corr)
The applied level correction by a transducer. See "Transducer Correction" on page 81.

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 82.

Measurement time (MTime)
The duration of a single measurement. See Chapter 4.1.4.6, "Setting the measurement time (MTime)", on page 86.

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: [Setup] > "Signal In"

Access VNC: [n] > [F1]

The following settings configure the receiver signal to be measured by the R&S EVSG1000.

For some measurement modes, you can switch the type of signal input. See the description of the individual modes.
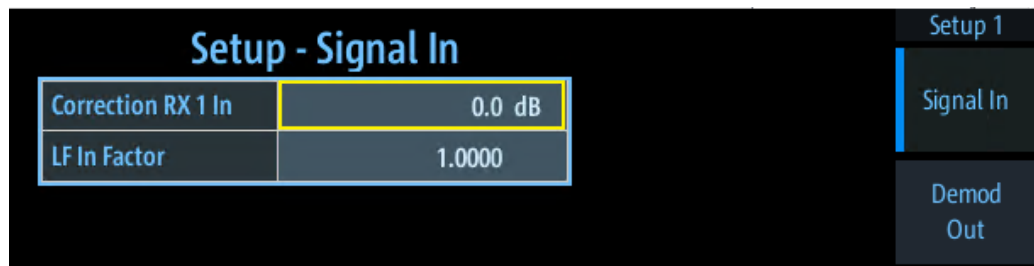
ⓘ RX2 is only available with the option R&S EVSG-B1 Second Signal Processing Unit.

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

("Correction RX 2 In" is only available with option R&S EVSG-B1 Second Signal Processing Unit.)

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 to configure

1. Press the [Mode] key on the front panel.

2. Select the "RX Unit 1" or "RX Unit 2" softkey.

3. Press [Enter] or the rotary knob to confirm the selection.

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 252

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 48).

To select a measurement mode

1. Press the [Mode] key on the front panel.

2. Select the required measurement mode using the rotary knob or arrow keys.

3. Press [Enter] or the rotary knob to confirm the selection.

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 281

MODE_GP on page 281

4 Numeric measurement modes

4.1 ILS localizer and ILS glidepath (GP) modes

Access: [Mode] > "ILS LOC"/ "ILS GP"

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 281

MODE_GP on page 281

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.
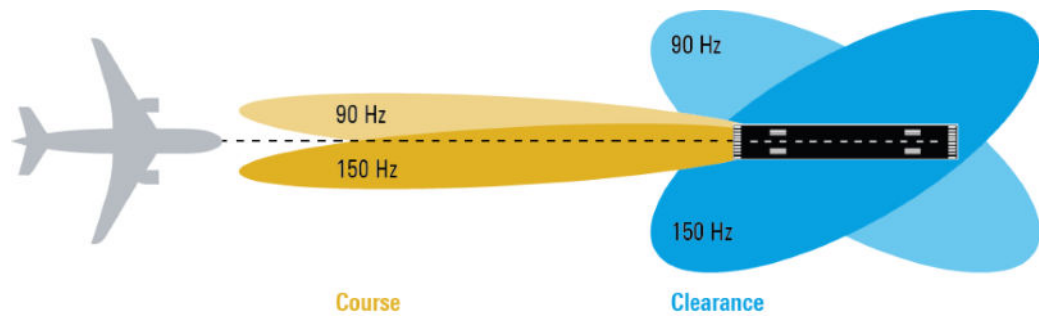
Course and clearance signals

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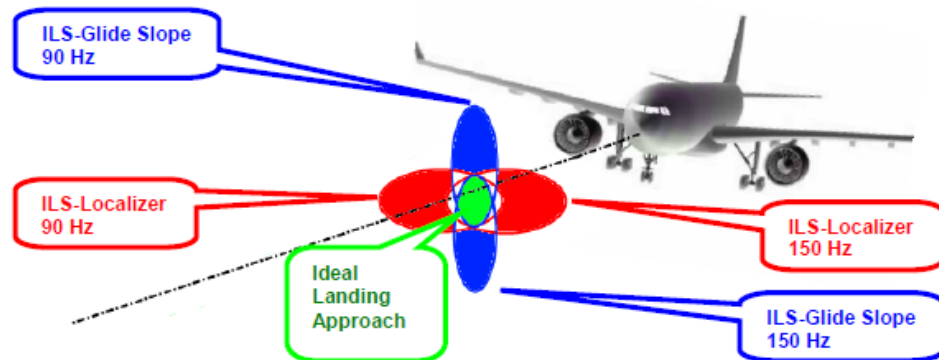
Figure 4-1: Approach navigation using instrument landing system (ILS)

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.
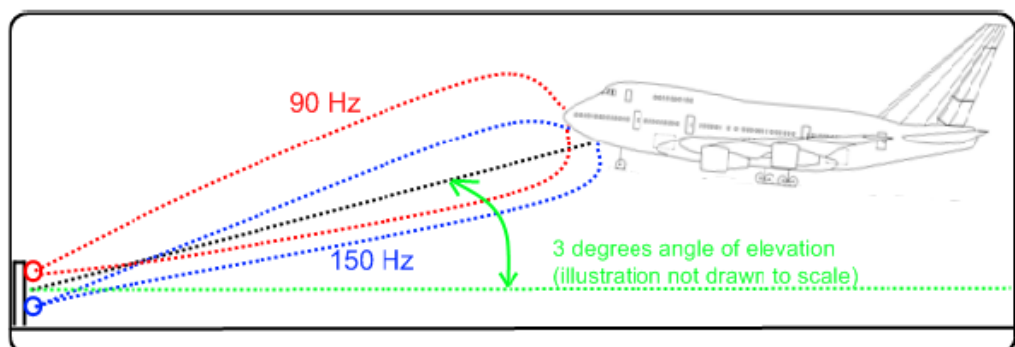
4.1.3 ILS localizer and glidepath measurements and results

A single receiver board in the R&S EVSG1000 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 per-

formed 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 EVSG1000 searches the input signal for peaks. You can define a power threshold that the carrier must exceed to be detected ("Carrier Thresh" on page 79).

2. "Check": the R&S EVSG1000 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 67. In the recorded dataset, the STIOCPM status indicates a "V" for valid (see "Status flags" on page 75).

3. ● "Auto Lock" option (default): "Lock": the R&S EVSG1000 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 EVSG1000 determines a valid ILS signal, it remains tuned to that frequency. If the signal becomes invalid at that frequency, the R&S EVSG1000 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.

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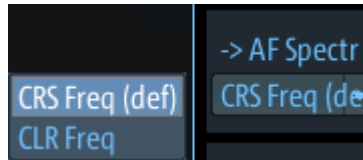
To return from the graphical results to the ILS Localizer or Glidepath mode, select "Return" ([F7]).

For details on the graphical results, see:
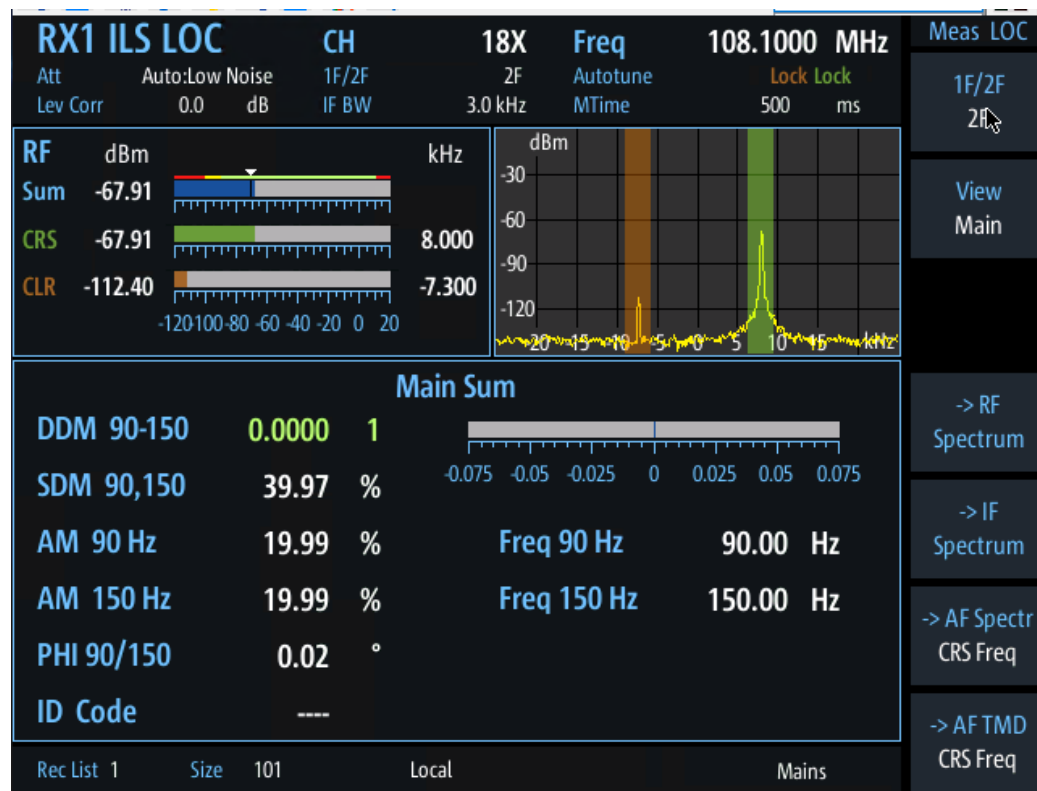
Figure 4-2: ILS Localizer mode main results view

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 52.

- Measurement mode
  The currently active measurement mode on the active receiver board, e.g. "ILS GP". See Chapter 3.3, "Measurement mode", on page 52.

- "CH"
  Receiver frequency channel, see "Channel setup" on page 76

- "Freq"
  Nominal measurement frequency of the RF signal, see "Freq" on page 80.

- RF attenuation ("Att")
  The used attenuation mode; see also "RF Mode" on page 81.

- Frequency selection "1F/2F"
  See "Carrier configuration (1F/2F Config)" on page 77

- "Autotune"
  Status of the automatic carrier selection, see "Autotune function" on page 57

- "Lev Corr"
  Applied level correction, see "Transducer Correction" on page 81

- "IF BW"
  Measurement bandwidth, see Chapter 4.1.4.4, "Bandwidth (BW)", on page 82

- Measurement time ("MTime")
  See Chapter 4.1.4.6, "Setting the measurement time (MTime)", on page 86.

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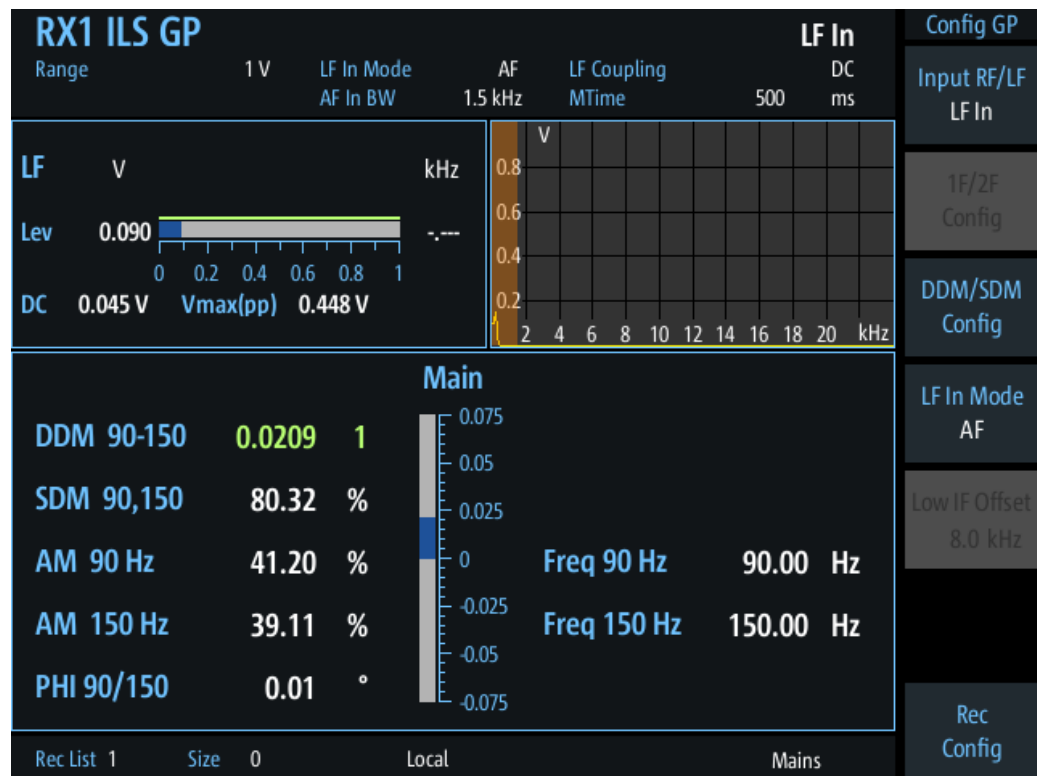
Figure 4-3: AF signal analysis in ILS GP mode

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 52.
- Measurement mode
  The currently active measurement mode on the active receiver board, e.g. "ILS
  GP". See Chapter 3.3, "Measurement mode", on page 52.
- ("Range")
  Sensitivity of the measurement. See "Range" on page 84.
- LF Input type ("LF In Mode")
  See "LF In Mode" on page 83.
- "LF coupling"
  AC or DC coupling for LF input, see "Coupling" on page 84
- Measurement Bandwidth ("AF In BW")
  Measurement bandwidth for LF input. See "AF In BW" on page 154.
- 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 85.
- Measurement time ("MTime")
  See Chapter 4.1.4.6, "Setting the measurement time (MTime)", on page 86.

Remote command:

`VIEW_LLZ` on page 291

4.1.3.1 RF level and frequency display

The measured RF power and frequency of the input signal are displayed both numeri-cally and graphically.
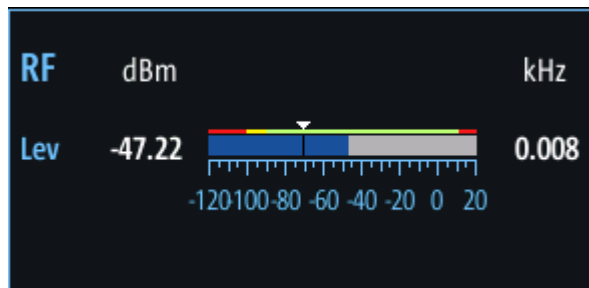
Figure 4-4: RF level display

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
● Numeric power sensor level in dBm (if available; "NRP")
● 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 75.

Remote commands to retrieve results:

LA? on page 249

RF? on page 249

ILS LOC/GS mode:

FSINGLE on page 305

FCRS on page 305

FCLR on page 305

LCRS on page 307

LCLR on page 307

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.
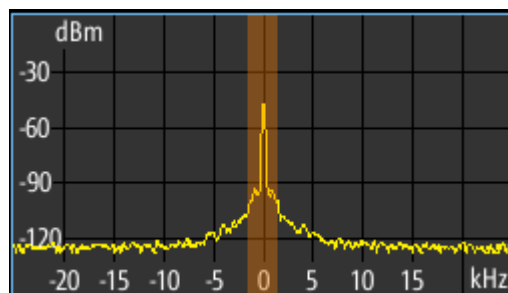
Figure 4-5: IF spectrum preview

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.
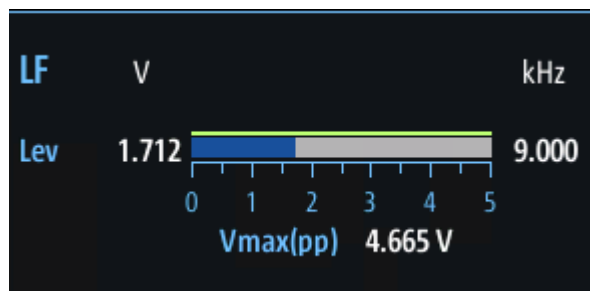
Figure 4-6: LF level display

The following results are provided:

Lev

Numeric power level in Volt

Remote command:

LLZ_BB_LEV_V on page 309

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 309

Vmax(pp)

Maximum peak-to-peak power level in Volt

Remote command:

LLZ_BB_VMAXPP_V on page 309

Low IF frequency

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

Remote command:
FSINGLE on page 305

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.
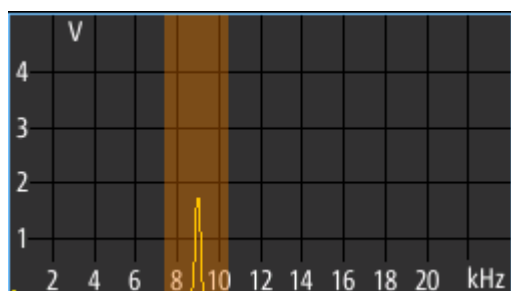
Figure 4-7: IF spectrum preview

Remote command:
FFT_GETSPECT on page 375

4.1.3.4 ILS localizer and glidepath main view

The ILS Localizer and Glidepath main view provides the following results:
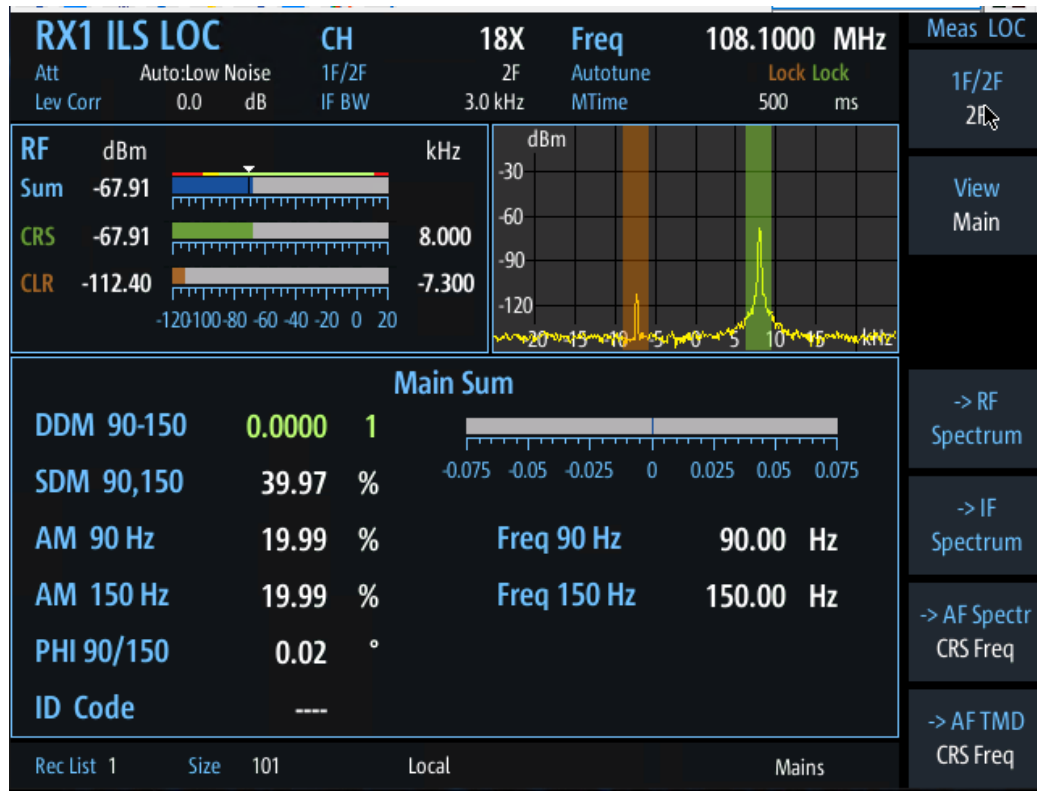
Figure 4-8: ILS Localizer main view
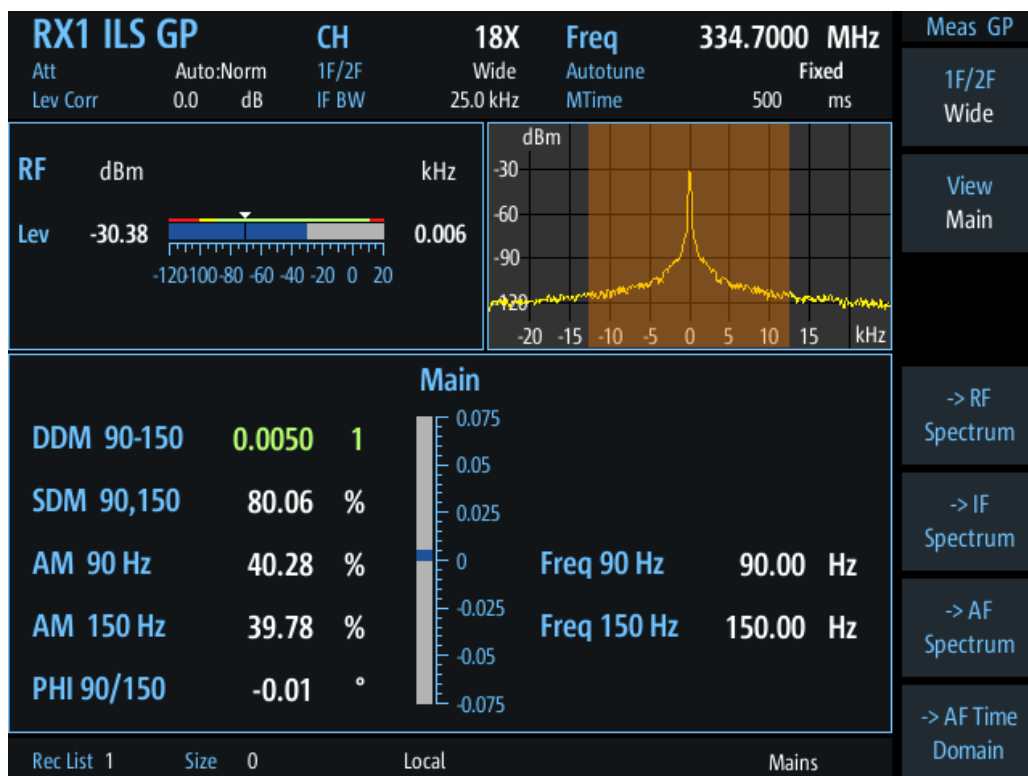
Figure 4-9: ILS Glidepath main view
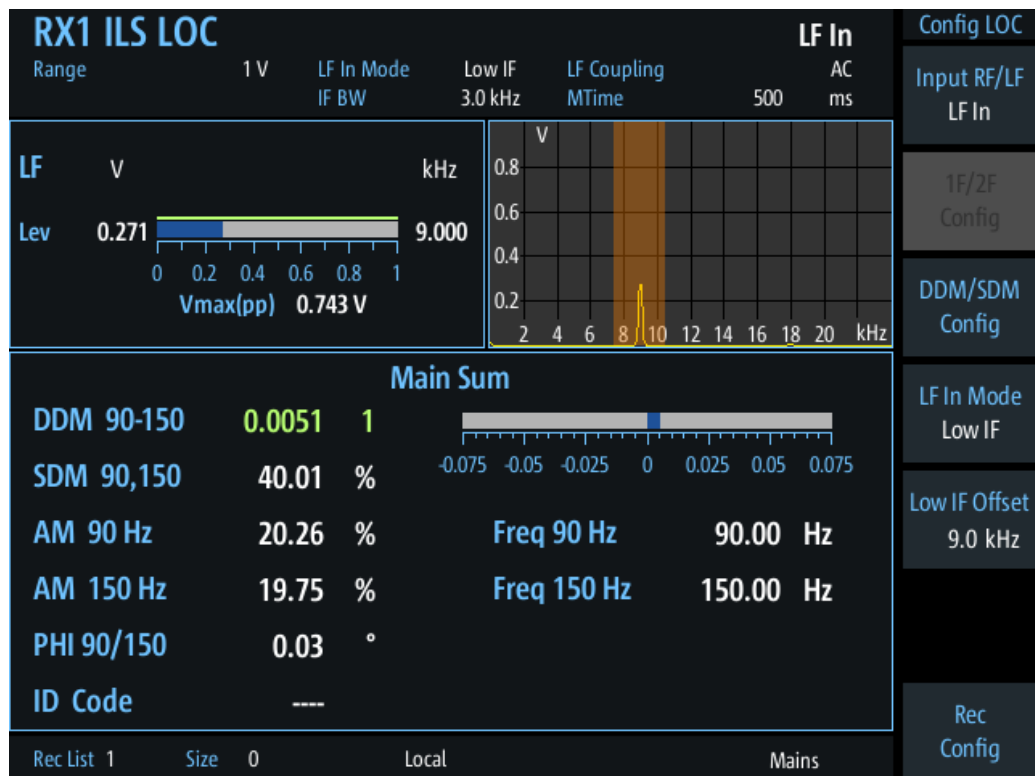
Figure 4-10: ILS LF Input main view

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 305
DD1 on page 305
DCLR on page 304
DCRS on page 304

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 308
SD1 on page 308
SCLR on page 308
SCRS on page 308

AM 90 Hz
AM modulation depth of 90 Hz ILS component

Remote command:
AM2 on page 302
AM2CLR on page 302
AM2CRS on page 303

Freq 90 Hz
AF frequency of 90 Hz ILS component

Remote command:
AF2 on page 302

AM 150 Hz
AM modulation depth of 150 Hz ILS component

Remote command:
AM3 on page 303
AM3CLR on page 303
AM3CRS on page 303

Freq 150 Hz
AF frequency of 150 Hz ILS component

Remote command:
AF3 on page 302

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 307

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

Remote command:
AC8 on page 302
AC8 on page 326

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.
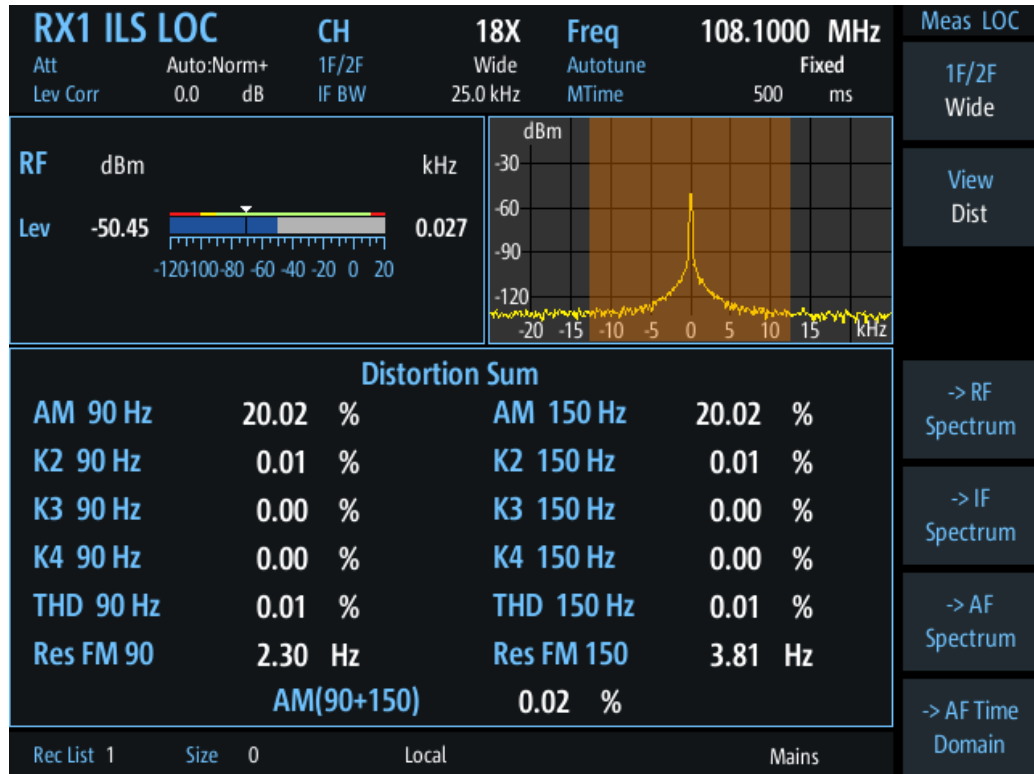
Figure 4-11: ILS Localizer Distortion view

AM 90 Hz
AM modulation depth of 90 Hz ILS component

Remote command:
AM2 on page 302
AM2CLR on page 302
AM2CRS on page 303

K2 90 Hz

Distortion 2nd order, 90 Hz signal

Remote command:
K2_90 on page 306

K3 90 Hz

Distortion 3rd order, 90 Hz signal

Remote command:
K3_90 on page 306

K4 90 Hz

Distortion 4th order, 90 Hz signal

Remote command:
K4_90 on page 306

THD 90 Hz

Total Harmonic Distortion (THD), 90 Hz signal

Remote command:
THD_90 on page 308

Res. FM 90

Residual frequency modulation for 90 Hz signal

Configure the filter using "Res. FM Filt. (ILS only)" on page 82.

Remote command:
RESIDFM_90 on page 307

AM 150 Hz

AM modulation depth of 150 Hz ILS component

Remote command:
AM3 on page 303
AM3CLR on page 303
AM3CRS on page 303

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 306

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 306

K4 150 Hz

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

Remote command:
K4_150 on page 306

THD 150 Hz

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

Remote command:
THD_150 on page 308

Res. FM 150

Residual frequency modulation for 150 Hz signal

Remote command:
RESIDFM_150 on page 307

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 304

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.
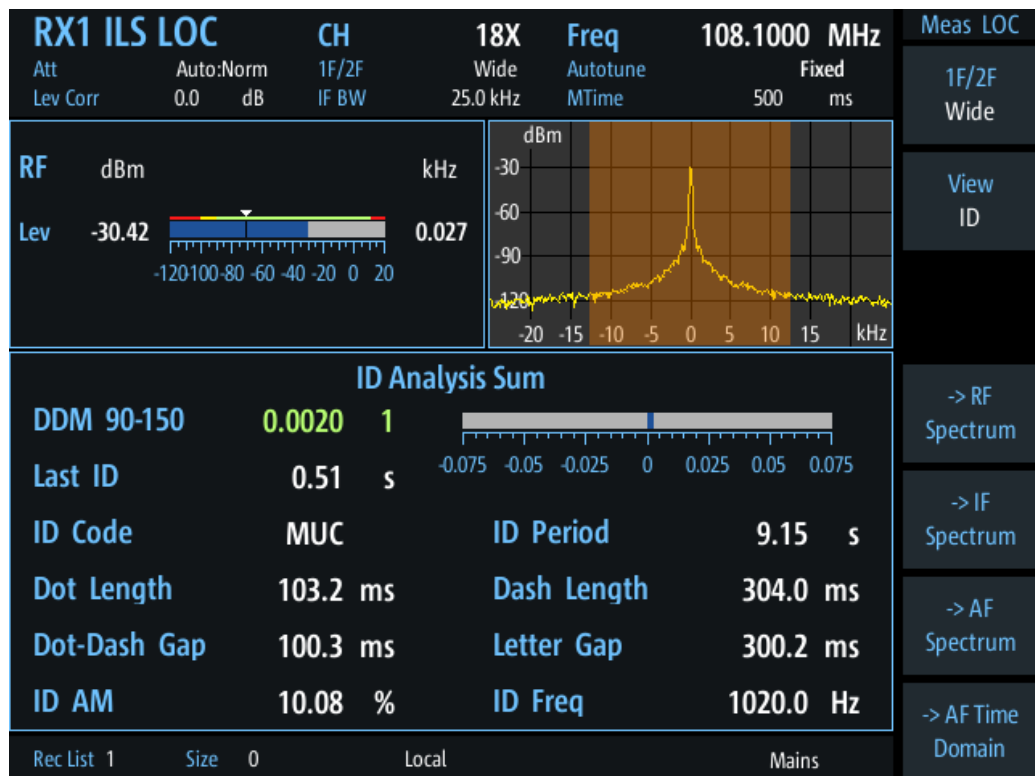
Figure 4-12: ID Analysis view

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 305
DD1 on page 305
DCLR on page 304
DCRS on page 304

Last ID

Time since last ID pulse was measured

Remote command:

LASTID_TIME on page 311

ID Code

Morse-decoded ID with three or four letters.

Remote command:

AC8 on page 302

AC8 on page 326

ID Period

Time between two measured ID pulses

Remote command:

ID_PERIOD on page 310

Dot Length

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

Remote command:

ID_DOT_LENGTH on page 310

Dash Length

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

Remote command:

ID_DASH_LENGTH on page 309

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 310

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 310

ID AM

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

Remote command:

AM8 on page 303

AM8 on page 327

ID Freq

Frequency of the morse signal.

Remote command:
AF8 on page 302
AF8 on page 327

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 219). 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 387.

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 8.2, "Recording measurement data", on page 217.

Remote commands to retrieve data:

GETDATADEF on page 387

GETDATASET on page 387

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 8.2, "Recording measurement data", on page 217.

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 83.

Input RF/LF
Access: [Config]

Access VNC: [s]

Configures the input source for the currently selected receiver (see "To select the receiver board to configure" on page 52).

For details on the connectors see Chapter 1.5.1.3, "RX1 IN / RX2 IN", on page 28.

"RF In"   An RF signal is provided from the RX 1 In/RX 2 In connectors on the front of the R&S EVSG1000. 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 EVSG1000.
                 If both receivers are used, only one of them can be set to analyze input from "LF In".
                 Analyzing LF input requires option R&S EVSG1-K7 LF-Analysis.

Remote command:
GS_RFLF_INPUT on page 299
LLZ_RFLF_INPUT on page 289
VOR_RFLF_INPUT on page 324
FFT_RFLF_INPUT on page 374
SCOPE_RFLF_INPUT on page 379
SETUP:INPUT on page 253

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: > [Meas] > "1F/2F"

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 77).

"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 simultane-
                    ously. 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 79).

"2F CLR"   Both the course and clearance frequencies are measured simultane-
                    ously. 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 79).

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

Remote command:
`DEMODE_LLZ` on page 283
`DEMODE_GS` on page 293

Carrier configuration (1F/2F Config)

Access: [Config] > "1F/2F Config"

Access VNC: [s] > "F1"

Configures the carriers and frequencies for measurements on a single or two frequen-
cies (not wideband). Which settings are available depends on the "1F/2F" on page 76.

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 78 and "Clearance" on page 78.

"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 57.
For all carrier measurements (not the wideband measurement), the "Auto Lock" function is enabled by default (see "1F/2F" on page 76).

"Auto Retune"   Both carriers are determined automatically at the beginning of the measurement. If the carrier frequency changes, the R&S EVSG1000 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 57.

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 288
GS_DEMFREQS_OFFSET_AUTOMAN on page 297

Course

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

Remote command:
LLZ_DEMFREQS_OFFSET_UPPERFREQ on page 288
GS_DEMFREQS_OFFSET_UPPERFREQ on page 298

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 288
GS_DEMFREQS_OFFSET_LOWERFREQ on page 298

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 287
GS_DEMFREQS_OFFSET_1F on page 298

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 77.

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 290
GS_START_FINDCARRIER on page 299

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 296
LLZ_CARRIER_THRESHOLD_DB on page 286

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 275

Channel frequency configuration (CH FREQ)

Access: [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 402 and Chapter B, "VOR channel frequency list", on page 404.)

CH

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

Remote command:
RFCH on page 250

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 249

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 286
GS_DEFAULT_FREQSTEP on page 296
VOR mode:
VOR_DEFAULT_FREQSTEP on page 322

4.1.4.3 Ampt

Access: [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 81).

"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 250

SCOPE_ATTMODE on page 377

FFT_ATTMODE on page 369

IFSPECT_ATTMODE on page 365

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 250

FSCAN_ATTMODE on page 360

SCOPE_ATTMODE on page 377

FFT_ATTMODE on page 369

IFSPECT_ATTMODE on page 365

GBAS:ATTMODE on page 343

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 251

SETUP:EXTERNALATT_RX2 on page 252

4.1.4.4 Bandwidth (BW)

Access: [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 287
GS_DEM_1F2F_BW on page 296
Wideband measurements:
LLZ_DEM_WIDE_BW on page 287
GS_DEM_WIDE_BW on page 297

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 286
GS_DEM_ID_BW on page 296
Wideband measurements:
LLZ_DEM_ID_WIDE_BW on page 286
GS_DEM_ID_WIDE_BW on page 297

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 69).

"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 289

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: [Config]

Access VNC: [s]

Configures the input source for the currently selected receiver (see "To select the receiver board to configure" on page 52).

For details on the connectors see Chapter 1.5.1.3, "RX1 IN / RX2 IN", on page 28.

"RF In"	An RF signal is provided from the RX 1 In/RX 2 In connectors on the front of the R&S EVSG1000. 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 EVSG1000. If both receivers are used, only one of them can be set to analyze input from "LF In". Analyzing LF input requires option R&S EVSG1-K7 LF-Analysis.

Remote command:
GS_RFLF_INPUT on page 299
LLZ_RFLF_INPUT on page 289
VOR_RFLF_INPUT on page 324
FFT_RFLF_INPUT on page 374
SCOPE_RFLF_INPUT on page 379
SETUP:INPUT on page 253

LF In Mode
Access: [Config]

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 285
GS_BB_WIDE1F on page 295

Low IF Offset
Access: [Config]

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 83).

Remote command:
LLZ_BB_1F_OFFSETKHZ on page 283
GS_BB_1F_OFFSETKHZ on page 293

Range
Access: [AMPT]

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 254

Coupling
Access: [AMPT]

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 254

DC Reference
Access: [AMPT]

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 284
GS_BB_LFIN_DCOFFSETV on page 294
VOR_BB_LFIN_DCOFFSETV on page 322
FFT_BB_LFIN_DCOFFSETV on page 371
SCOPE_BB_LFIN_DCOFFSETV on page 378

LF In Factor
Access: [AMPT]

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 254

Bandwidth (IF BW/AF In BW)
Access: [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 284
GS_BB_BW_KHZ on page 294
VOR_BB_BW_KHZ on page 322
Low IF mode:
LLZ_BB_LOWIF_BW_KHZ on page 285
GS_BB_LOWIF_BW_KHZ on page 295

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

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 284
GS_BB_AF_BW_IDDIST_KHZ on page 294
Low IF mode:
GS_BB_LOWIF_BW_IDDIST_KHZ on page 295
LLZ_BB_LOWIF_BW_IDDIST_KHZ on page 285

Res. FM Filt.
Access: [BW]

Access VNC: [e]

Defines the filter type used to determine residual FM (see Chapter 4.1.3.5, "ILS localizer distortion view", on page 69).

"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 289

4.1.4.6 Setting the measurement time (MTime)

Access: [MTime]

Access VNC: [d]

The measurement time determines the interval at which new measurement results are displayed. Internally, values are captured every 100 ms, that is: 10 per second. (With the option R&S EVSG1-K22 High Measurement Rate installed, the internal capture rate is 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 220).

Enter the time in milliseconds.

Remote command:

MEASTIME on page 249

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 273

SDM Unit
Specifies the unit of the SDM display.

1 (dimensionless value) | % | µA

Remote command:

SETUP:UNIT:SDM on page 274

ILS Phase

Specifies the value range in the ILS phase.

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

Remote command:

SETUP:UNIT:ILSPHASE on page 274

DDM Polarity

Specifies the DDM polarity.

90−150 | 150−90

Remote command:

SETUP:UNIT:POLARITYDDM on page 274

DDM Bargr

Configures the scaling of the DDM bargraph.

0.075 | 0.150 | 0.400 (dimensionless)

Remote command:

SETUP:UNIT:BARGRAPH on page 273

4.2 R&S EVSG-K3 Marker beacon analysis

Access: [Mode] > "ILS MB"

Access VNC: [m] > Down arrow key

Remote command:

MODE_MB on page 314

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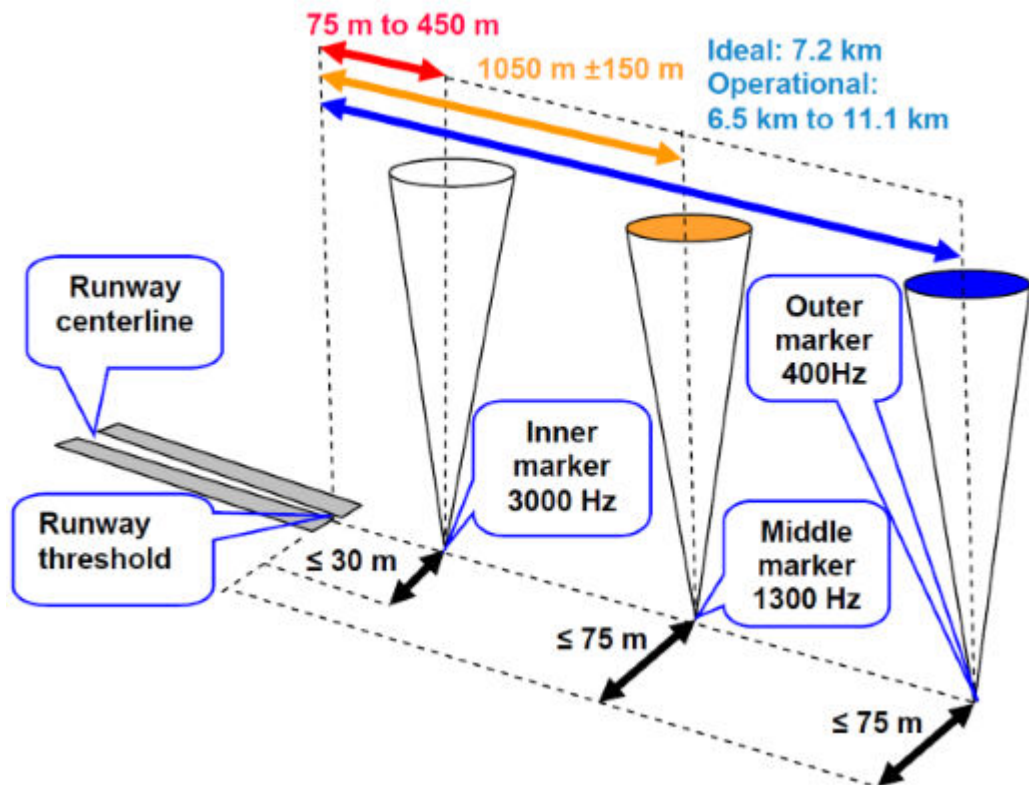
Figure 4-13: Marker beacon placement with respect to runway

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 139
- Chapter 5.2, "IF spectrum analysis", on page 144
- Chapter 5.3, "R&S EVSG-K11 AF spectrum analysis", on page 149
- Chapter 5.4, "R&S EVSG-K12 Time domain analysis", on page 158

Remote command:

VIEW_MB on page 316

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.
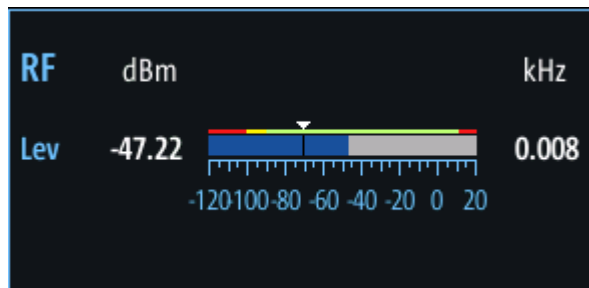
Figure 4-14: RF level display

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
- Numeric power sensor level in dBm (if available; "NRP")
- 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 75.

Remote commands to retrieve results:

LA? on page 249

RF? on page 249

FMEAS on page 316

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.
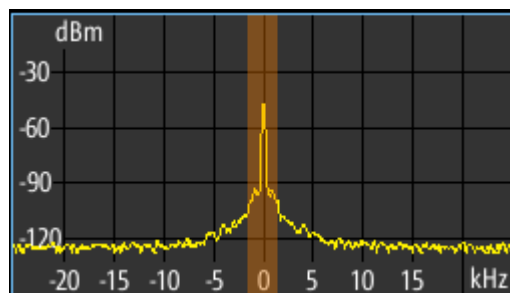
Figure 4-15: IF spectrum preview

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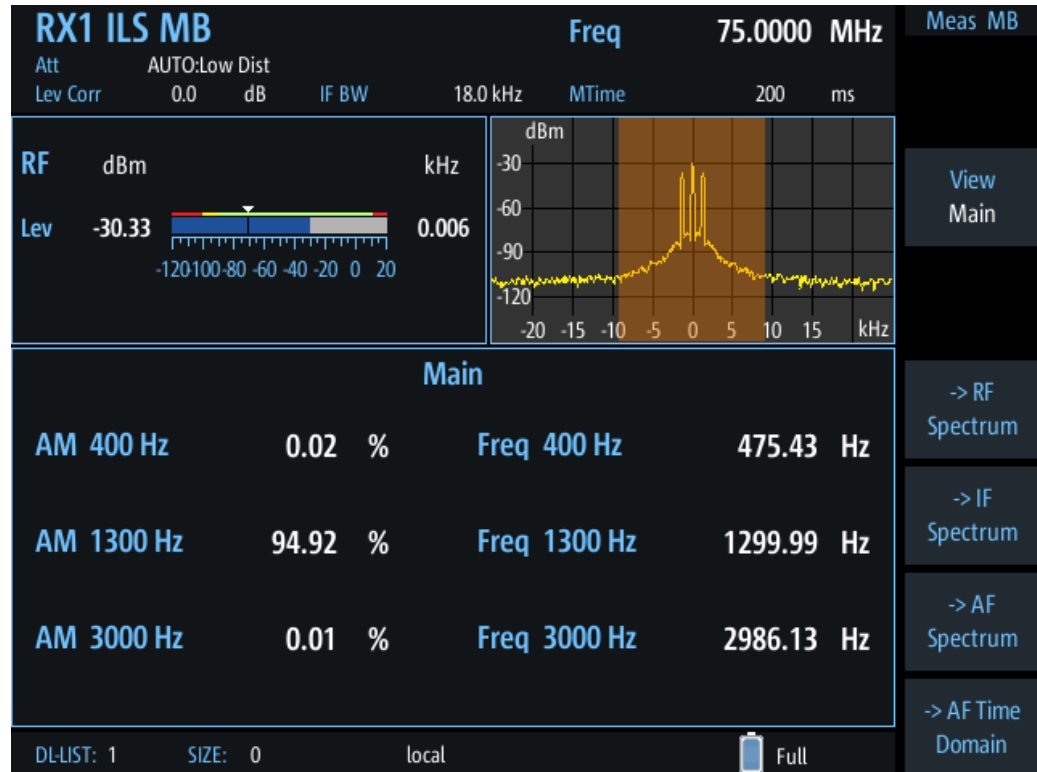
AM 400 Hz
AM modulation depth of the 400-Hz component

Remote command:
AM6 on page 317

Freq 400 Hz
Measured frequency of the 400-Hz component

Remote command:
AF6 on page 317

AM 1300 Hz

AM modulation depth of the 1300-Hz component

Remote command:
AM5 on page 317

Freq 1300 Hz

Measured frequency of the 1300-Hz component

Remote command:
AF5 on page 317

AM 3000 Hz

AM modulation depth of the 3000-Hz component

Remote command:
AM4 on page 317

Freq 3000 Hz

Measured frequency of the 3000-Hz component

Remote command:
AF4 on page 316

4.2.2.4 ILS marker beacon ID analysis

Displays the results of the marker beacon signal id analysis.
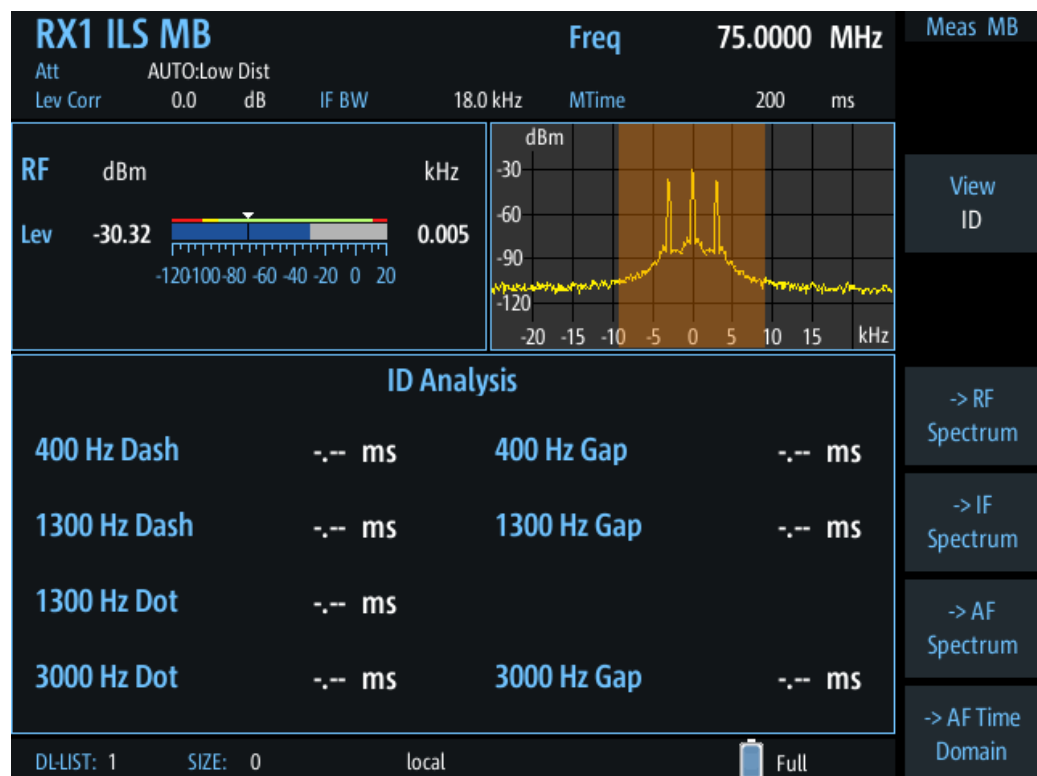
400 Hz Dash

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

Remote command:

ID_F400_DASHLEN on page 318

400 Hz Gap

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

Remote command:

ID_F400_GAP on page 319

1300 Hz Dash

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

Remote command:

ID_F1300_DASHLEN on page 318

1300 Hz Dot

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

Remote command:

ID_F1300_DOTLEN on page 318

1300 Hz Gap

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

Remote command:

ID_F1300_GAP on page 319

3000 Hz Dot

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

Remote command:

ID_F3000_DOTLEN on page 319

3000 Hz Gap

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

Remote command:

ID_F3000_GAP on page 319

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 219). If available, the stored GNSS data from the GNSS receiver is also displayed.
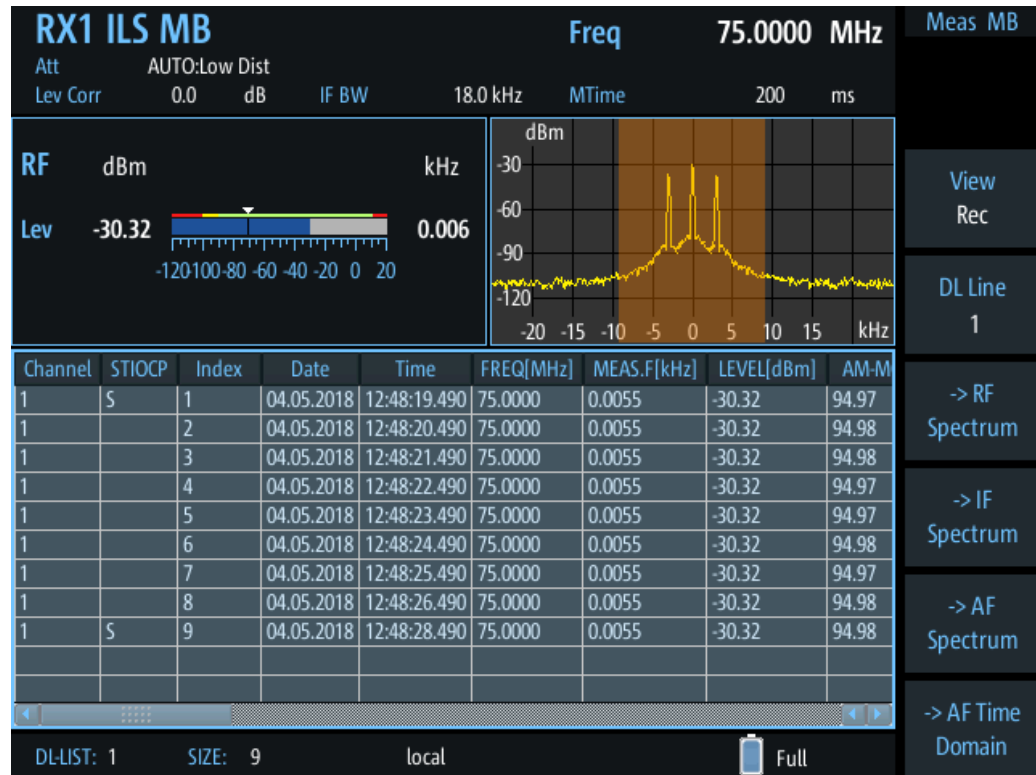
Which measurement results are stored is described in the remote commands, see `GETDATADEF` on page 387.

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

For details on data logging, see Chapter 8.2, "Recording measurement data", on page 217.

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 8.2, "Recording measurement data", on page 217.

4.2.3.1 Setting the receiver frequency

Access: [CH FREQ]

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 249

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: [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 81).
"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 250
SCOPE_ATTMODE on page 377
FFT_ATTMODE on page 369
IFSPECT_ATTMODE on page 365

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 250
FSCAN_ATTMODE on page 360
SCOPE_ATTMODE on page 377
FFT_ATTMODE on page 369

IFSPECT_ATTMODE on page 365

GBAS:ATTMODE on page 343

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 251

SETUP:EXTERNALATT_RX2 on page 252

4.2.3.3 Setting the measurement time (MTime)

Access: [MTime]

Access VNC: [d]

The measurement time determines the interval at which new measurement results are displayed. Internally, values are captured every 100 ms, that is: 10 per second. (With the option R&S EVSG1-K22 High Measurement Rate installed, the internal capture rate is 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 220).

Enter the time in milliseconds.

Remote command:

MEASTIME on page 249

4.3 R&S EVSG-K2 VOR analysis

Access: [Mode] > "VOR"

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 EVSG1000.

Remote command:

MODE_VOR on page 321

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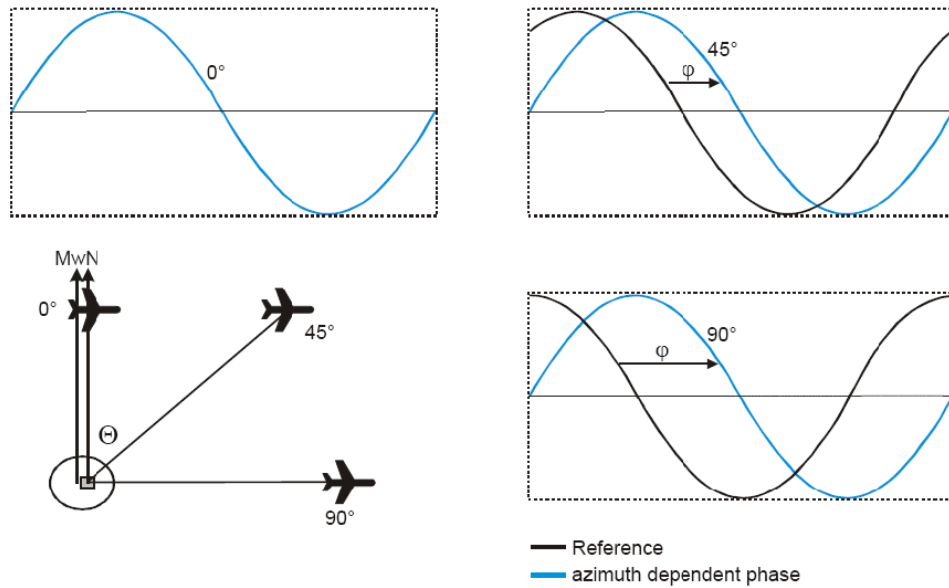
Figure 4-16: Basics of the VOR phase angles (Φ) depending on the azimuth angle (Θ)

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 55 in the ILS signal.

The spectrum of a VOR signal is therefore composed of the carrier and three modulated components.
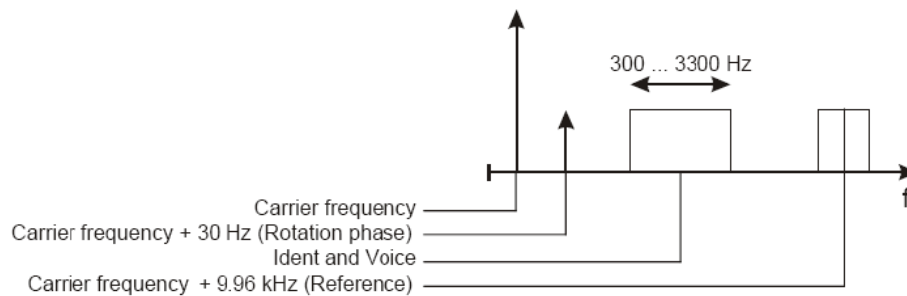
Figure 4-17: Example of the VOR Spectrum

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.
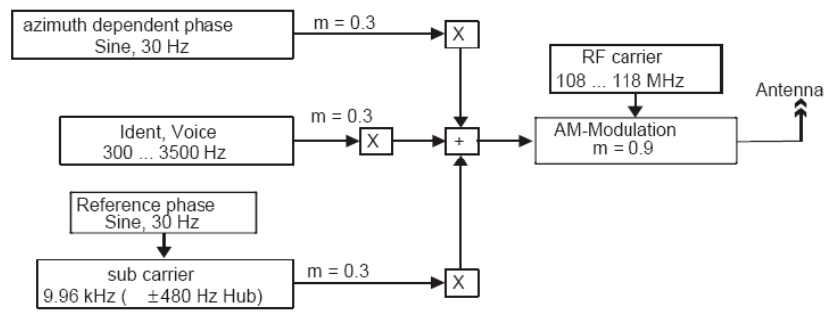
Figure 4-18: Basics of the VOR signal generation

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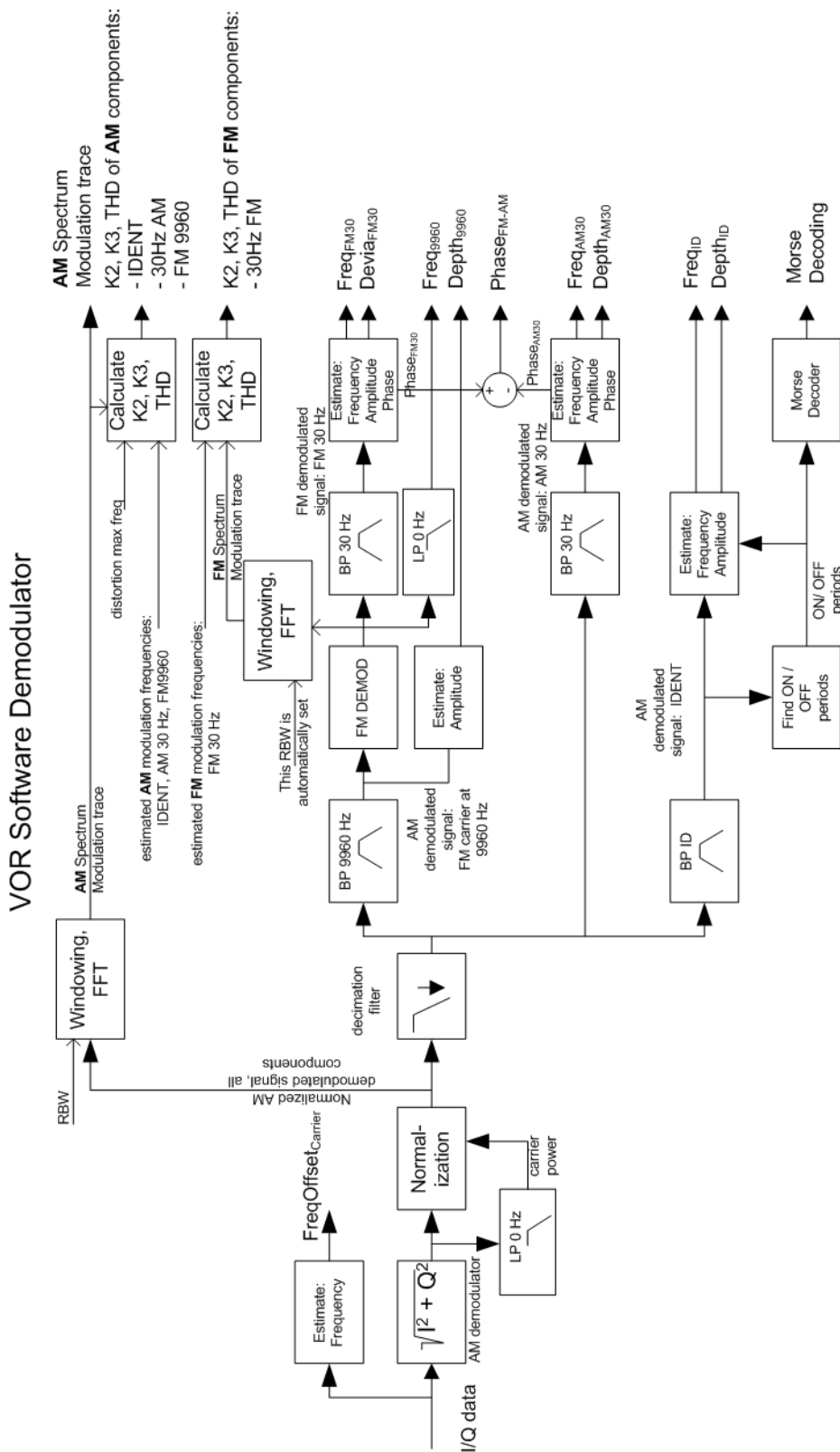
Figure 4-19: Block diagram of the VOR software demodulator

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:
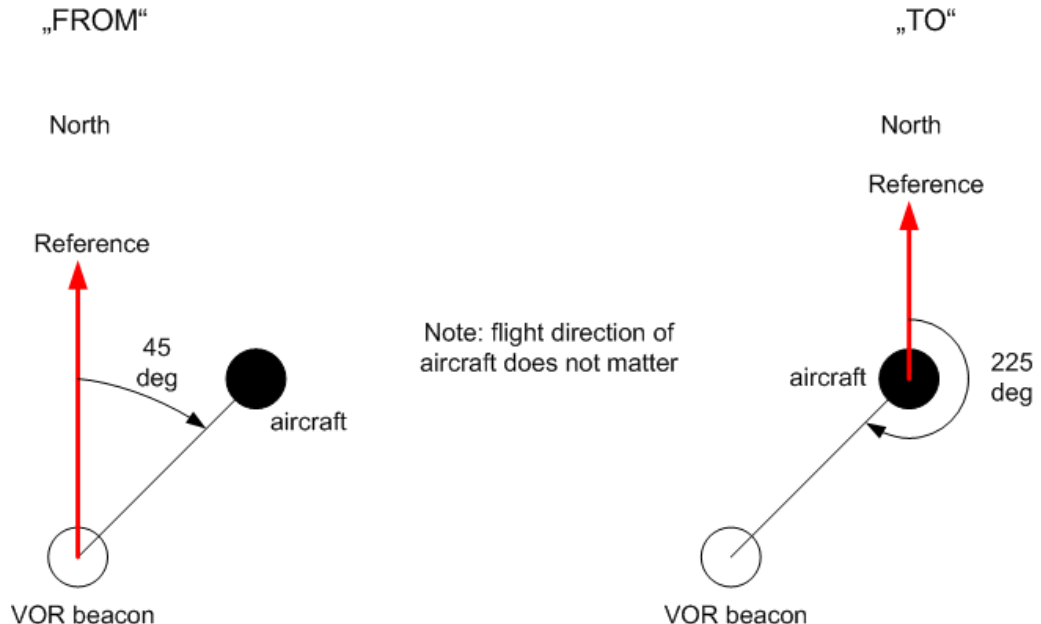
Figure 4-20: Phase notation in VOR measurements

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.
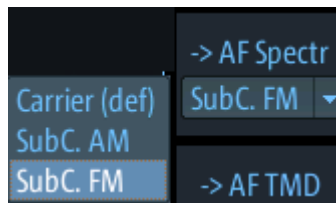
You can select one of the following carriers:

- 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 139
- Chapter 5.2, "IF spectrum analysis", on page 144
- Chapter 5.3, "R&S EVSG-K11 AF spectrum analysis", on page 149
- Chapter 5.4, "R&S EVSG-K12 Time domain analysis", on page 158

Remote command:

VIEW_VOR on page 321

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.
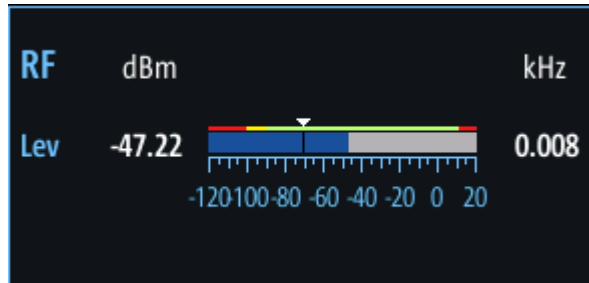
Figure 4-21: RF level display

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
- Numeric power sensor level in dBm (if available; "NRP")
- 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 75.

Remote commands to retrieve results:

LA? on page 249

RF? on page 249

FMEAS on page 328

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.
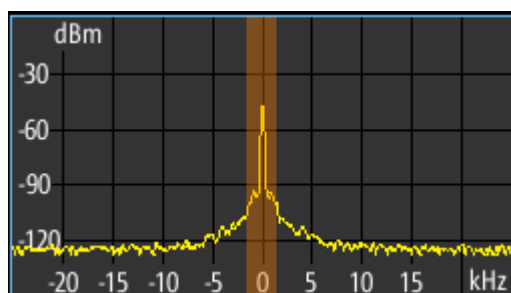
Figure 4-22: IF spectrum preview

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.
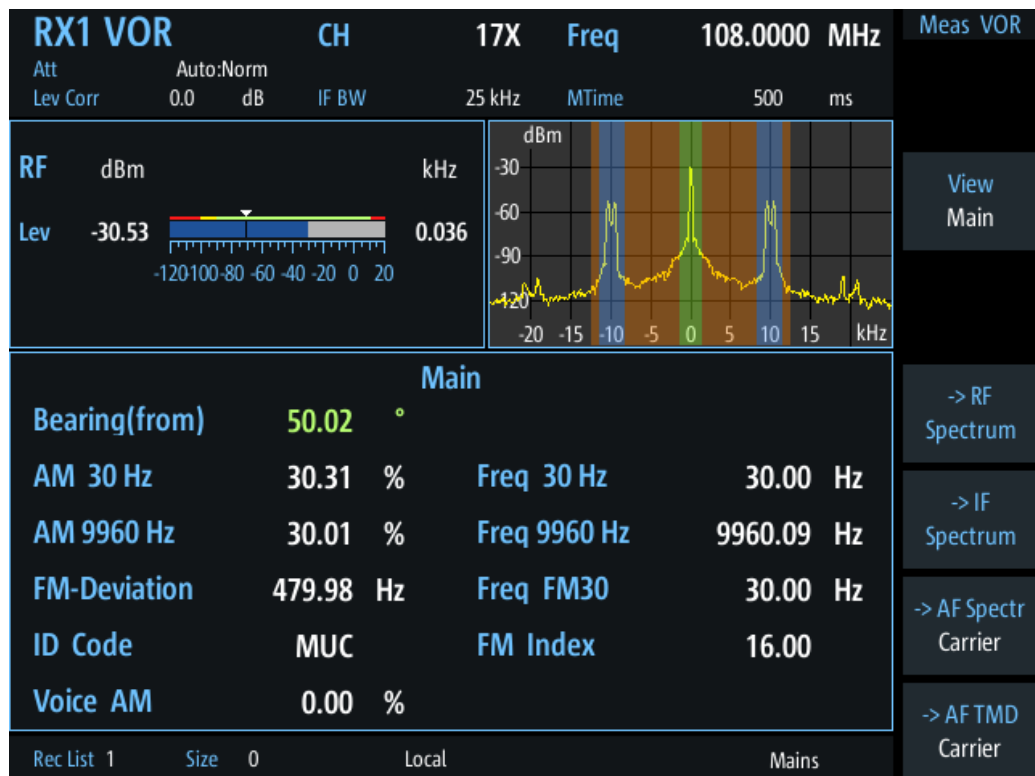
Bearing (from)

Phase between both 30-Hz signals (direction of the R&S EVSG1000 in relation to the ground station).

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

Remote command:
BE on page 327

AM 30 Hz

AM modulation depth of 30 Hz AM rotational signal

Remote command:
AM0 on page 327

AM 9960 Hz

AM modulation depth of 9.96 kHz subcarrier

Remote command:
AM1 on page 327

FM-Deviation

FM frequency deviation of 30 Hz subcarrier

Remote command:
FM0 on page 328

ID Code

Morse-decoded ID with three or four letters.

Remote command:
AC8 on page 302
AC8 on page 326

Voice AM

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

Remote command:
AM9 on page 327

Freq 30 Hz

AF frequency of 30 Hz AM rotational signal

Remote command:
AF0 on page 326

Freq 9960 Hz

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

Remote command:
AF1 on page 326

Freq FM30

AF frequency of the 30 Hz reference signal

Remote command:
AF2 on page 326

FM Index

FM frequency deviation of 30 Hz subcarrier

Remote command:
FM1 on page 328

4.3.2.4 VOR distortion view

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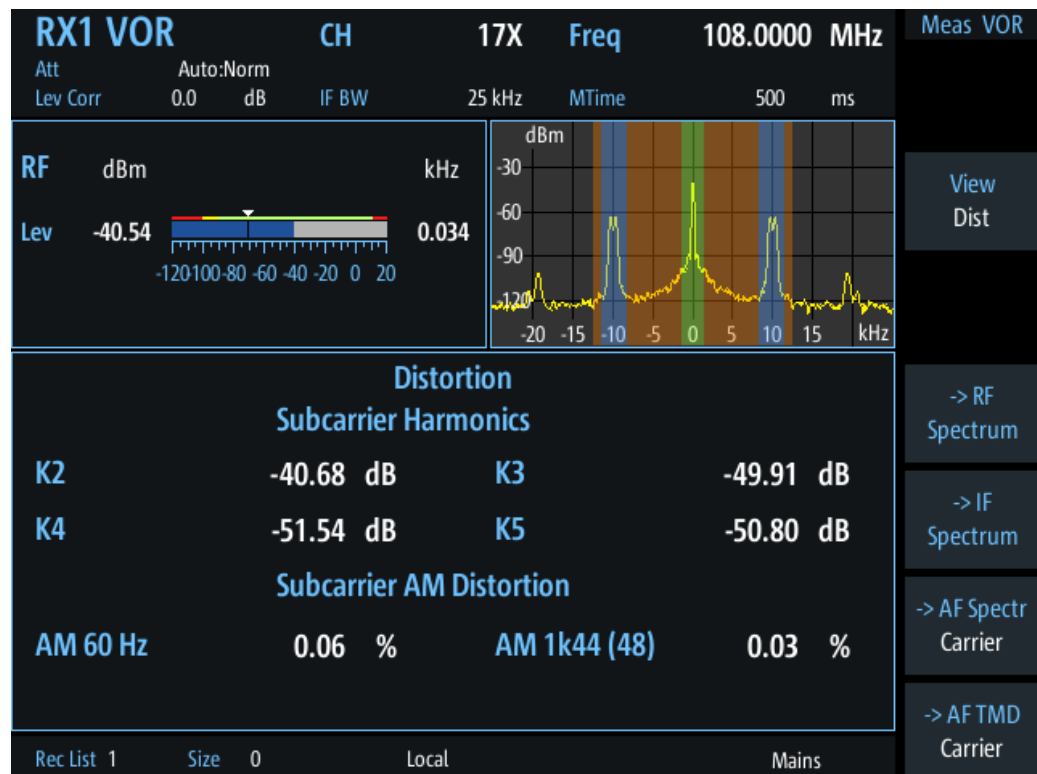
Subcarrier Harmonics

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 329
SUBCARR_K3 on page 329
SUBCARR_K4 on page 329
SUBCARR_K5 on page 329

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 114). 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 328
SUBCARR_AM1K50 on page 328
SUBCARR_AM60HZ on page 329

4.3.2.5 VOR ID analysis view

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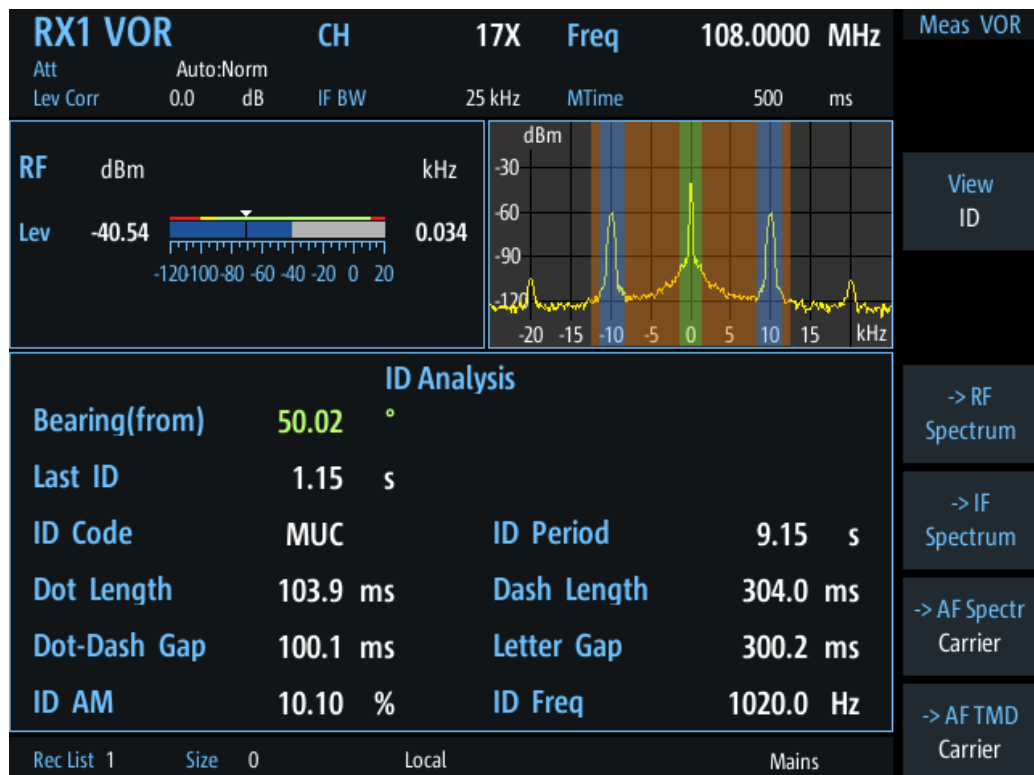
Bearing (from)

Phase between both 30-Hz signals (direction of the R&S EVSG1000 in relation to the ground station).

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

Remote command:
BE on page 327

Last ID
Time since last ID pulse was measured

Remote command:
LASTID_TIME on page 311

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

Remote command:
AC8 on page 302
AC8 on page 326

ID Period
Time between two measured ID pulses

Remote command:
ID_PERIOD on page 310

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

Remote command:
ID_DOT_LENGTH on page 310

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

Remote command:
ID_DASH_LENGTH on page 309

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 310

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 310

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

Remote command:
AM8 on page 303
AM8 on page 327

ID Freq

Frequency of the morse signal.

Remote command:
AF8 on page 302
AF8 on page 327

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 219). If available, the stored GNSS data from the GNSS receiver is also displayed.
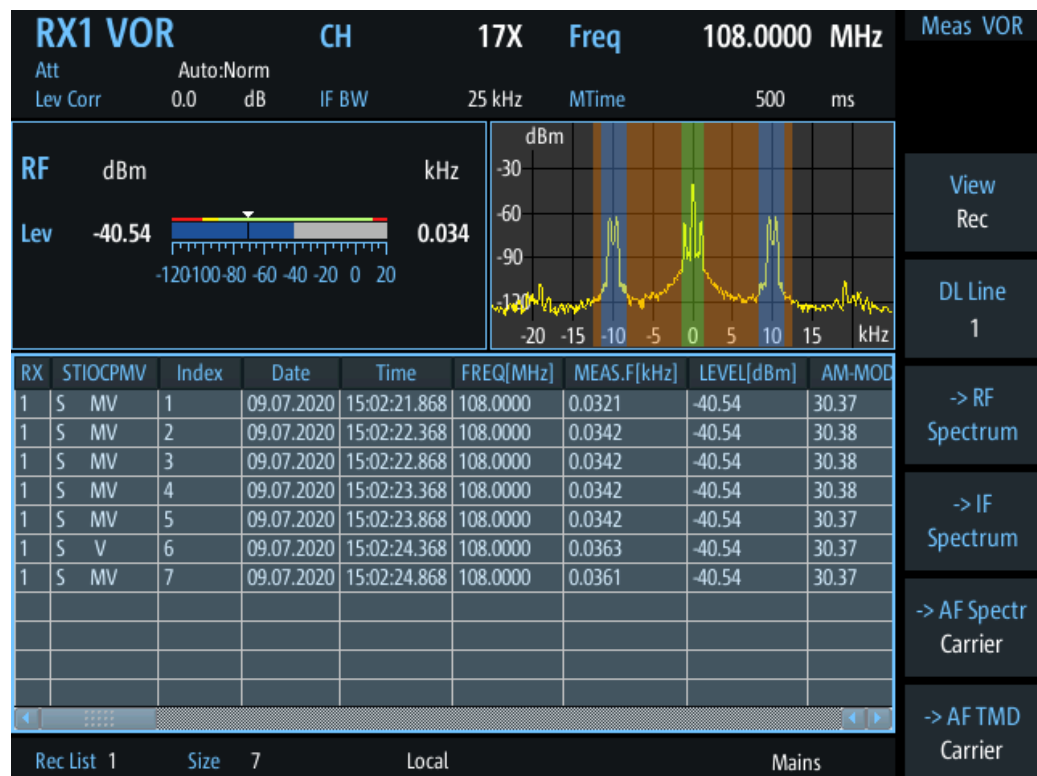
Which measurement results are stored is described in the remote commands, see GETDATADEF on page 387.

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

For details on data logging, see Chapter 8.2, "Recording measurement data", on page 217.

ⓘ **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 387

GETDATASET on page 387

4.3.3 Configuring VOR measurements

The following settings are available for VOR measurements.

ⓘ Settings for recording, including trigger settings, are described in Chapter 8.2, "Recording measurement data", on page 217.

ⓘ **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 83.

4.3.3.1 General measurement configuration

Access: [Config]

Access VNC: [s]

Input RF/LF
Access: [Config]

Access VNC: [s]

Configures the input source for the currently selected receiver (see "To select the receiver board to configure" on page 52).

For details on the connectors see Chapter 1.5.1.3, "RX1 IN / RX2 IN", on page 28.

"RF In"	An RF signal is provided from the RX 1 In/RX 2 In connectors on the front of the R&S EVSG1000. 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 EVSG1000. If both receivers are used, only one of them can be set to analyze input from "LF In". Analyzing LF input requires option R&S EVSG1-K7 LF-Analysis.

Remote command:
GS_RFLF_INPUT on page 299
LLZ_RFLF_INPUT on page 289
VOR_RFLF_INPUT on page 324
FFT_RFLF_INPUT on page 374
SCOPE_RFLF_INPUT on page 379
SETUP:INPUT on page 253

Signal Direction
Defines the reference for phase notation (see Chapter 4.3.1.3, "Phase notation in VOR measurements", on page 103).

"From"	North direction at the VOR beacon
"To"	North direction at the receiver/ aircraft

Remote command:
SETUP:UNIT:VORDIRECTION on page 275

No. of Segm
Selects the number of used antenna segments for which the AM distortion results are displayed. See also "VOR receiver" on page 98. 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 324

4.3.3.2 Channel frequency configuration (CH FREQ)

Access: [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 402 and Chapter B, "VOR channel frequency list", on page 404.)

CH

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

Remote command:
RFCH on page 250

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 249

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 286
GS_DEFAULT_FREQSTEP on page 296
VOR mode:
VOR_DEFAULT_FREQSTEP on page 322

4.3.3.3 Ampt

Access: [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 81).

"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 250
SCOPE_ATTMODE on page 377
FFT_ATTMODE on page 369
IFSPECT_ATTMODE on page 365

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 250
FSCAN_ATTMODE on page 360
SCOPE_ATTMODE on page 377
FFT_ATTMODE on page 369

IFSPECT_ATTMODE on page 365

GBAS:ATTMODE on page 343

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 251

SETUP:EXTERNALATT_RX2 on page 252

4.3.3.4 Bandwidth (BW)

Access: [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 323

AM30 BW

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

Remote command:

VOR_DEM_AM_BW on page 322

FM BW

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

Remote command:

VOR_DEM_FM_BW on page 323

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 323

4.3.3.5 Setting the measurement time (MTime)

Access: [MTime]

Access VNC: [d]

The measurement time determines the interval at which new measurement results are displayed. Internally, values are captured every 100 ms, that is: 10 per second. (With the option R&S EVSG1-K22 High Measurement Rate installed, the internal capture rate is 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 220).

Enter the time in milliseconds.

Remote command:

MEASTIME on page 249

4.4 R&S EVSG-K6 COM analysis

Access: [Mode] > "COM"

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 EVSG1000. 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 EVSG1000 can perform COM measurements on signals containing one or two carriers (see Chapter 4.1.4.2, "Channel and frequency configuration", on page 76). It assumes a 1000 Hz test tone is being sent.

Remote command:

MODE_COM on page 331

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:

Remote command:

MODE_COM on page 331

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
- Numeric power sensor level in dBm (if available; "NRP")
- 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

(i) **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 75.

Remote commands to retrieve results:

LA? on page 249

RF? on page 249

COM mode:

GET_MEASFREQ on page 336

GET_TX1_MEASFREQ on page 339

GET_TX2_MEASFREQ on page 341

GET_TX1_LEVEL on page 339

GET_TX2_LEVEL on page 341

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.
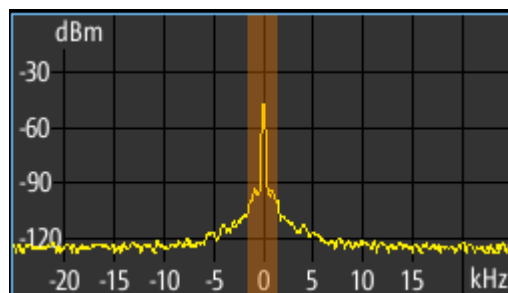
Figure 4-24: IF spectrum preview

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 125):
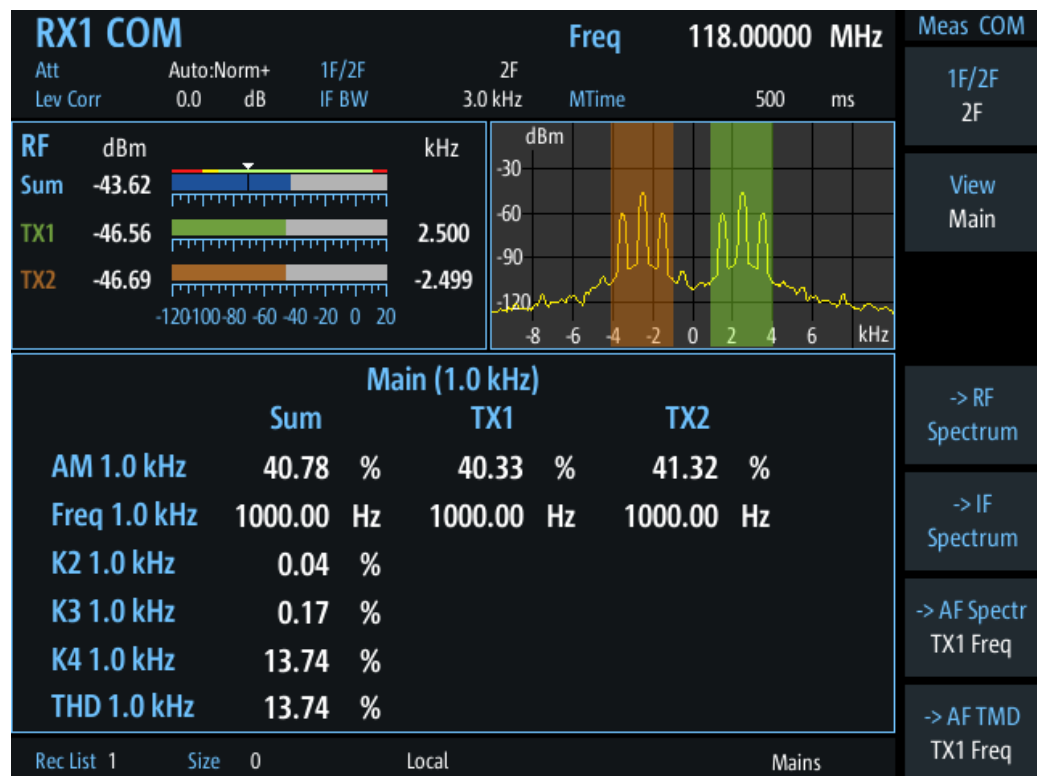
Figure 4-25: COM Main view

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 139
- Chapter 5.2, "IF spectrum analysis", on page 144
- Chapter 5.3, "R&S EVSG-K11 AF spectrum analysis", on page 149
- Chapter 5.4, "R&S EVSG-K12 Time domain analysis", on page 158

Remote command:

VIEW_COM on page 331

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 337
GET_TX1_AMMOD_1_0 on page 339
GET_TX2_AMMOD_1_0 on page 341
GET_ONE_AMMOD_1_2 on page 337
GET_TX1_AMMOD_1_2 on page 339
GET_TX2_AMMOD_1_2 on page 341

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 337
GET_TX1_AMFREQ_1_0 on page 338
GET_TX2_AMFREQ_1_0 on page 340
GET_ONE_AMFREQ_1_2 on page 337
GET_TX1_AMFREQ_1_2 on page 339
GET_TX2_AMFREQ_1_2 on page 340

K2 1.0 kHz/ 1.2 kHz
Distortion 2nd order, 1.0 kHz/ 1.2 kHz signal

Remote command:
GET_K2_1K0 on page 335
GET_K2_1K2 on page 336

K3 1.0 kHz/ 1.2 kHz
Distortion 3rd order, 1.0 kHz/ 1.2 kHz signal

Remote command:
GET_K3_1K0 on page 336
GET_K3_1K2 on page 336

K4 1.0 kHz/ 1.2 kHz
Distortion 4th order, 1.0 kHz/ 1.2 kHz signal

Remote command:

GET_K4_1K0 on page 336

GET_K4_1K2 on page 336

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 338

GET_THD_1K2 on page 338

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 219). If available, the stored GNSS data from the GNSS receiver is also displayed.
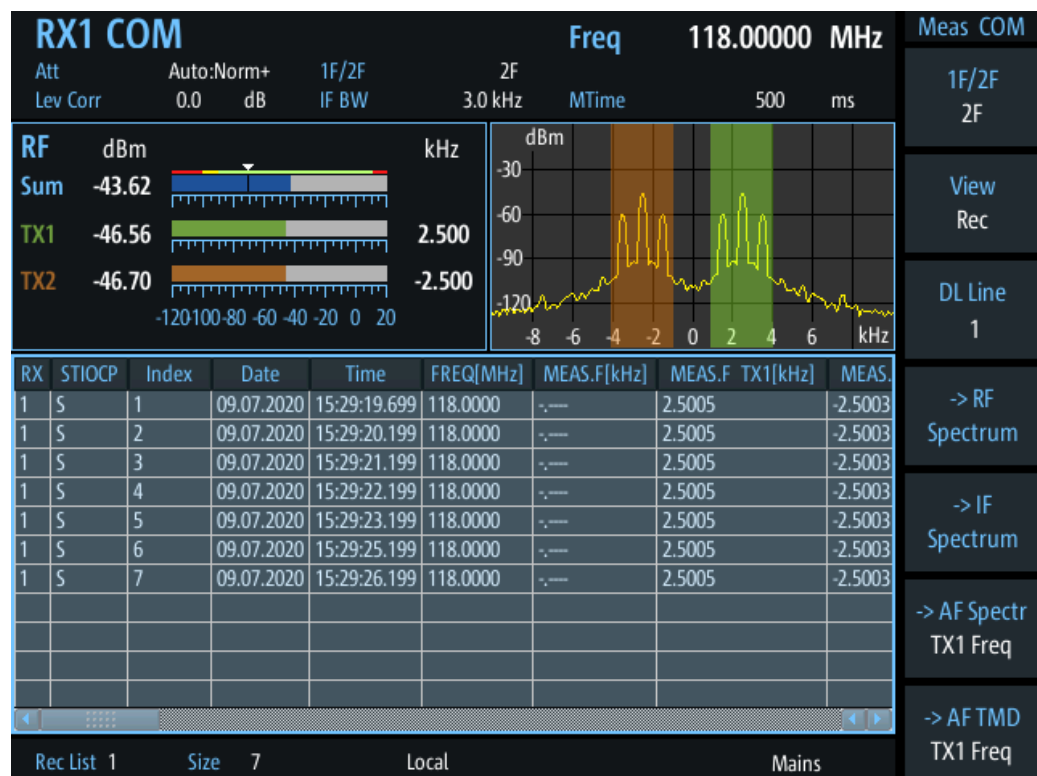
Which measurement results are stored is described in the remote commands, see GETDATADEF on page 387.

The individual measurement results are described in Chapter 4.4.1.3, "COM main view", on page 121.

For details on data logging see Chapter 8.2, "Recording measurement data", on page 217.

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: > [Meas] > "1F/2F"

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 332

Carrier configuration

Access: [Config]

Access VNC: [s] > "F1"

Configures the carriers and frequencies for measurements on a single or two frequen-
cies. Which settings are available depends on the measurements on the "1F/2F"
on page 124.

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 332
AMFREQ_OFFSET_TX2 on page 332

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

Remote command:
COM_TONEFREQ_1K01K2 on page 333

Channel frequency configuration (CH FREQ)

Access: [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.

R&S®EVSG1000   **Numeric measurement modes**

R&S EVSG-K6 COM analysis

Remote command:
RF on page 249

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: [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 81).

"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 250
SCOPE_ATTMODE on page 377
FFT_ATTMODE on page 369
IFSPECT_ATTMODE on page 365

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 250
FSCAN_ATTMODE on page 360
SCOPE_ATTMODE on page 377
FFT_ATTMODE on page 369
IFSPECT_ATTMODE on page 365
GBAS:ATTMODE on page 343

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 251
SETUP:EXTERNALATT_RX2 on page 252

4.4.2.3 Bandwidth (BW)

Access: [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 333
COM_DEMOD_BW_2F on page 333

4.4.2.4 Setting the measurement time (MTime)

Access: [MTime]

Access VNC: [d]

The measurement time determines the interval at which new measurement results are displayed. Internally, values are captured every 100 ms, that is: 10 per second. (With the option R&S EVSG1-K22 High Measurement Rate installed, the internal capture rate is 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 220).

Enter the time in milliseconds.

Remote command:

`MEASTIME` on page 249

4.5 Non-directional beacon mode

Access: [Mode] > "NDB"

Access VNC: [m] > Down arrow key

Using the LF IN connector and the R&S EVSG1-K7 LF-Analysis option, the R&S EVSG1000 can analyze non-directional beacon signals.

Remote command:

`MODE_NDB` on page 354

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 149
- Chapter 5.4, "R&S EVSG-K12 Time domain analysis", on page 158

Remote command:
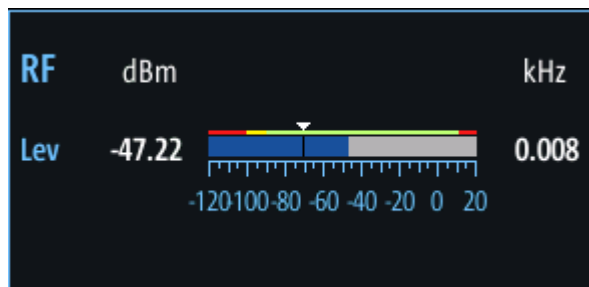
`VIEW_NDB` on page 356

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.
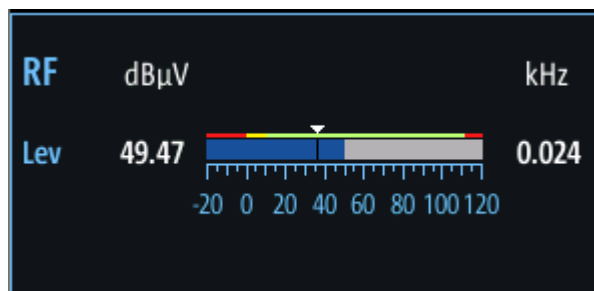
Figure 4-26: RF level display

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.
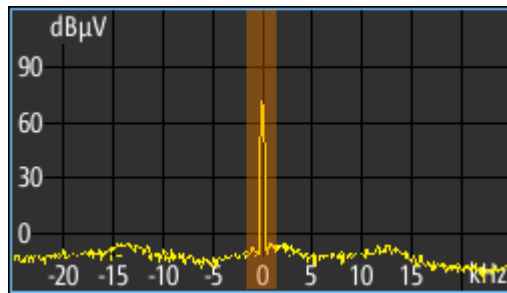
Figure 4-27: IF spectrum preview

Remote commands to retrieve results:

RF? on page 249

LA? on page 249

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 135.

Last ID

Time since last ID pulse was measured

Remote command:

LASTID_TIME on page 311

Carr Lev Change

Variance in power level during ID transmission.

Remote command:

NDB_CARLEV_CHANGE on page 357

ID Code

Morse-decoded ID with three or four letters.

Remote command:

ID_CODE on page 358

ID Period

Time between two measured ID pulses

Remote command:

ID_PERIOD on page 310

Dot Length

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

Remote command:

ID_DOT_LENGTH on page 310

Dash Length

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

Remote command:

ID_DASH_LENGTH on page 309

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 310

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 310

ID AM
AM Modulation depth of identifier signal.

Remote command:
NDB_AMMOD on page 357

ID Freq
Frequency of the morse signal.

Remote command:
NDB_AMFREQ on page 357

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 135.
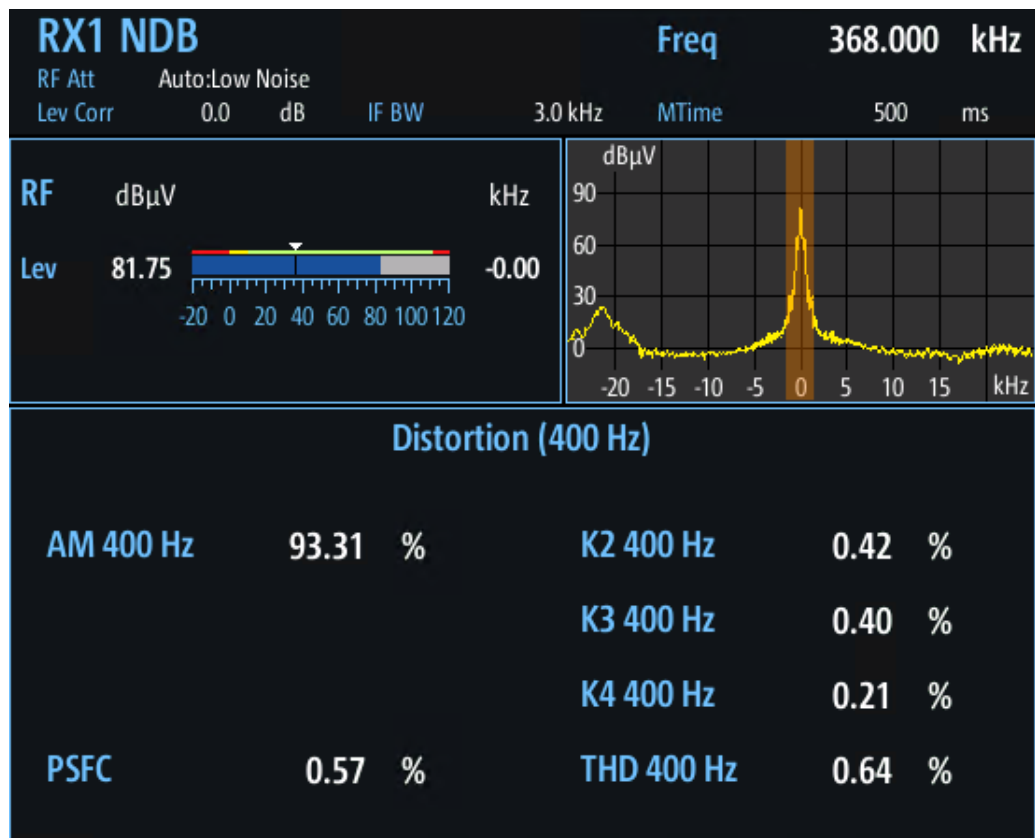
Figure 4-28: NDB Distortion view

AM 400/1020 Hz

AM modulation depth of 400/1020 Hz beacon ID.

Remote command:
NDB_AMMOD on page 357

K2 400/1020 Hz

Distortion 2nd order, 400/1020 Hz beacon ID

Remote command:
NDB_K2_PCT on page 358

K3 400/1020 Hz

Distortion 3rd order, 400/1020 Hz beacon ID

Remote command:
NDB_K3_PCT on page 358

K4 400/1020 Hz

Distortion 4th order, 400/1020 Hz beacon ID

Remote command:
NDB_K4_PCT on page 358

Unwanted AM 30 to 120 Hz

Measures spurs in the antenna switching range.

Remote command:
NDB_POWSUPPL_FC on page 358

THD 400/1020 Hz

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

Remote command:
NDB_THD_PCT on page 359

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 219).
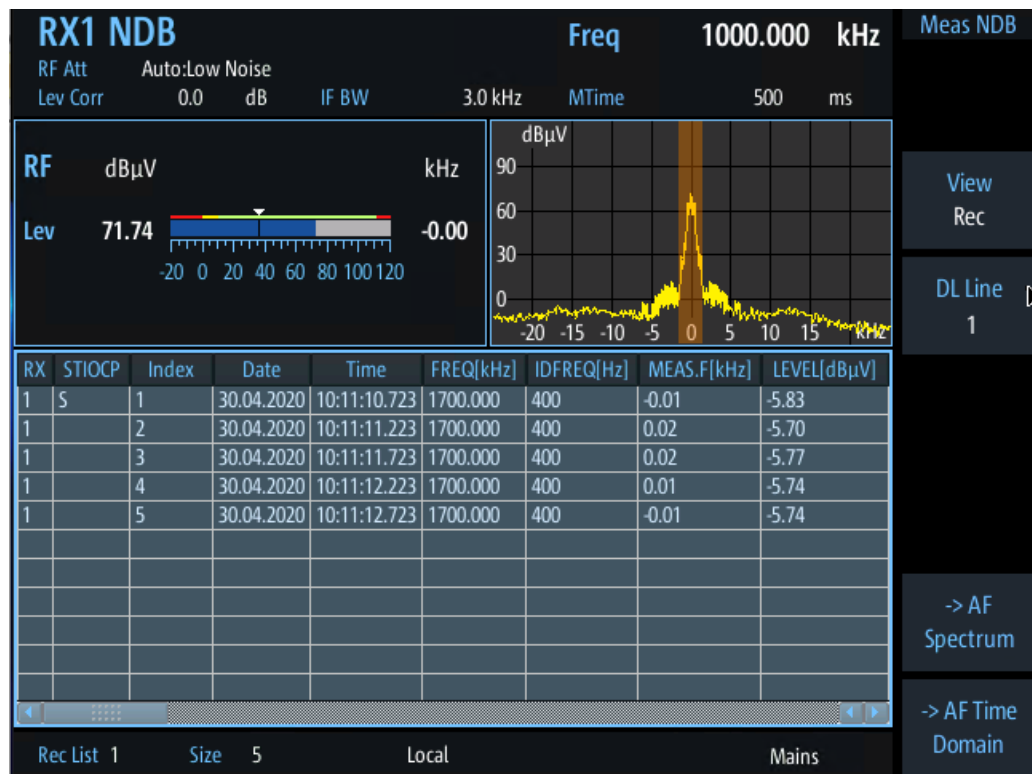
Which measurement results are stored is described in the remote commands, see GETDATADEF on page 387.

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

For details on data logging, see Chapter 8.2, "Recording measurement data", on page 217.

ⓘ **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 8.2, "Recording measurement data", on page 217.

4.5.3.1 General measurement settings

Access: [CONFIG]

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 356

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

Remote command:
NDB_IDFREQ_400_1020 on page 358

4.5.3.2 Receiver frequency

Access: [CH FREQ]

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 249

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 355

4.5.3.3 Amplitude

Access: [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 Chapter 4.5.2.1, "RF level, frequency and IF spectrum display", on page 129). 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 81).
"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 250

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 250

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 356

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 355

4.5.3.4   Setting the bandwidth

Access: [BW]

Access VNC: [e]

The bandwidth determines the frequency range for which the measurement is per-
formed. 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 355

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

Remote command:
NDB_DEM_DIST_BW on page 355

4.5.3.5   Setting the measurement time (MTime)

Access: [MTime]

Access VNC: [d]

The measurement time determines the interval at which new measurement results are displayed. Internally, values are captured every 100 ms, that is: 10 per second. (With the option R&S EVSG1-K22 High Measurement Rate installed, the internal capture rate is 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 220).

Enter the time in milliseconds.

Remote command:

`MEASTIME` on page 249

5 Graphic measurement modes

5.1 R&S EVSG-K10 RF spectrum analysis

Access: [Mode] > "RF Spectrum"

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.
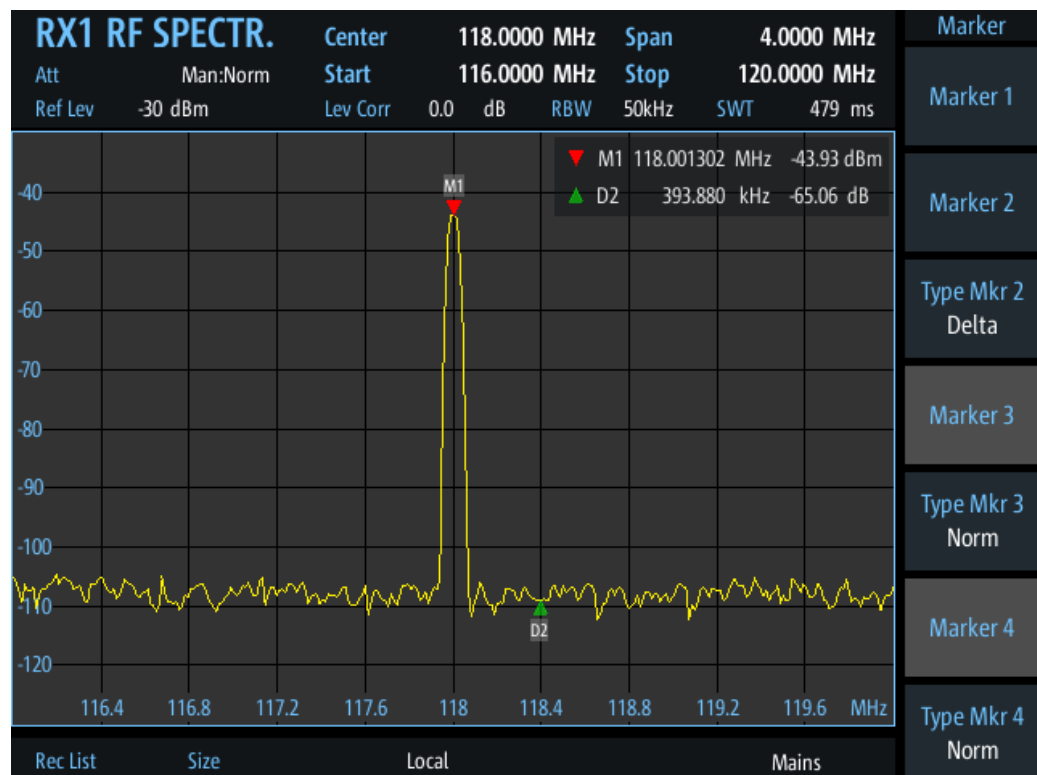
Figure 5-1: RF Spectrum

ⓘ   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 52.
- Measurement mode
  The currently active measurement mode on the active receiver board, e.g. "RF Spectrum". See Chapter 3.3, "Measurement mode", on page 52.
- Frequency range
  "Center", "Span", "Start", "Stop"
  The swept frequency range, see Chapter 5.1.1, "Configuring the frequency range", on page 140.
- RF attenuation ("Att")
  The used attenuation mode; see also "RF Mode" on page 81.
- Reference level ("Ref Lev")
  The maximum expected power level, see "Ref Level" on page 142.
- Level correction ("Lev Corr")
  The applied level correction by a transducer. See "Transducer Correction" on page 81.
- Resolution Bandwidth ("RBW")
  Resolution bandwidth with which the measurement is performed. See "Resolution Bandwidth (RBW Mode/Res BW)" on page 142.

Remote command to select RF Spectrum mode:

MODE_FSCAN on page 360

Remote command to retrieve trace results:

FSCAN_GETSPECT on page 364

5.1.1 Configuring the frequency range

Access: [CH F]

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 360

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 360

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 361

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 361

5.1.2 Configuring the bandwidth

Access: [BW]

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 EVSG1000, 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 362
FSCAN_RES_BW on page 362

5.1.3   Configuring the amplitude (y-axis)

Access: [Ampt]

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 361

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 250
FSCAN_ATTMODE on page 360
SCOPE_ATTMODE on page 377
FFT_ATTMODE on page 369
IFSPECT_ATTMODE on page 365
GBAS:ATTMODE on page 343

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 251
SETUP:EXTERNALATT_RX2 on page 252

5.1.4 Configuring the trace

Access: [Meas]

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 EVSG1000 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 374
IFSPECT_TRACE_MODE on page 367
FSCAN_TRACE_MODE on page 363

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 375
IFSPECT_TRACE_AVRGCOUNT on page 368
FSCAN_TRACE_AVRGCOUNT on page 363

5.2 IF spectrum analysis

Access: [Mode] > "IF Spectrum"

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.
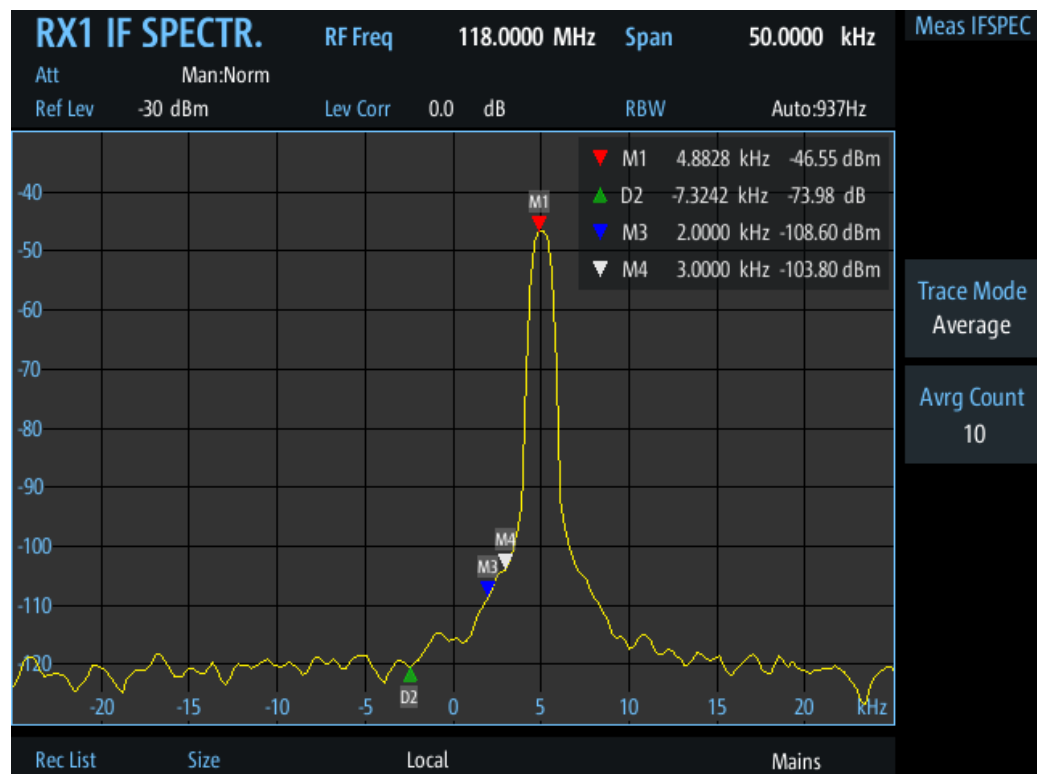
Figure 5-2: IF Spectrum

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 52.
- Measurement mode
  The currently active measurement mode on the active receiver board, e.g. "RF Spectrum". See Chapter 3.3, "Measurement mode", on page 52.
- Frequency range ("RF Freq", "Span")
  The swept frequency range, see "RF Freq" on page 146.
- Reference level ("Ref Lev")
  The maximum expected power level, see "Ref Level" on page 147.
- Level correction ("Lev Corr")
  The applied level correction by a transducer. See "Transducer Correction" on page 81.
- Resolution Bandwidth ("RBW")
  Resolution bandwidth with which the measurement is performed. See "RBW" on page 146.

Remote command to select RF Spectrum mode:

MODE_IFSPECT on page 364

Remote command to retrieve trace results:

IFSPECT_GETSPECT on page 368

5.2.1 Configuring the frequency range

Access: [CH F]

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 365

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 146. The configured value is displayed as "Span" in the measurement settings area.

Remote command:
IFSPECT_FREQ_SPAN on page 365

5.2.2 Configuring the bandwidth

Access: [BW]

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 EVSG1000, 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 366
IFSPECT_RESBW_AUTO on page 367

5.2.3 Configuring the amplitude (Y-Axis)

Access: [Ampt]

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 366

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 81).

"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 250
SCOPE_ATTMODE on page 377
FFT_ATTMODE on page 369
IFSPECT_ATTMODE on page 365

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 250
FSCAN_ATTMODE on page 360
SCOPE_ATTMODE on page 377

FFT_ATTMODE on page 369
IFSPECT_ATTMODE on page 365
GBAS:ATTMODE on page 343

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 251
SETUP:EXTERNALATT_RX2 on page 252

5.2.4   Configuring the trace

Access: [Meas]

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 EVSG1000 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 374
IFSPECT_TRACE_MODE on page 367
FSCAN_TRACE_MODE on page 363

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 375
IFSPECT_TRACE_AVRGCOUNT on page 368
FSCAN_TRACE_AVRGCOUNT on page 363

5.3 R&S EVSG-K11 AF spectrum analysis

Access: [Mode] > "AF Spectrum"

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.
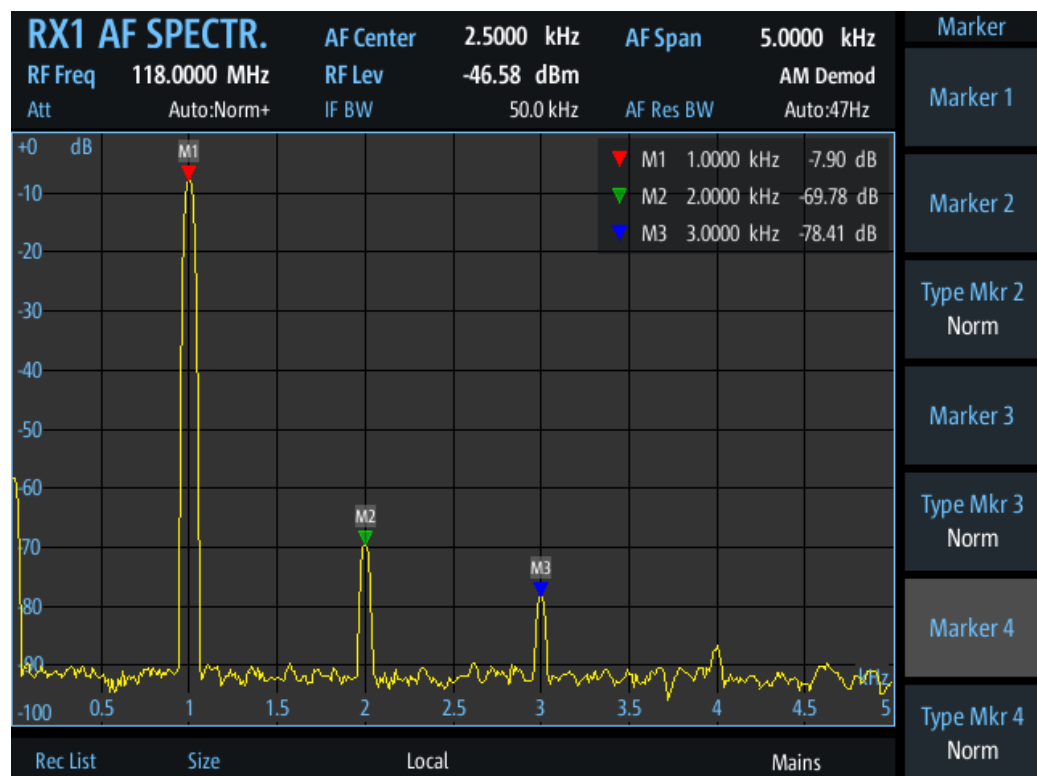
Figure 5-3: AF Spectrum for RF input

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 52.
- Measurement mode
  The currently active measurement mode on the active receiver board, e.g. "AF Spectrum". See Chapter 3.3, "Measurement mode", on page 52.
- "RF Freq"
  Nominal measurement frequency of the RF signal, see "RF Freq" on page 152.
- "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 140.

- RF attenuation ("Att")
The used attenuation mode; see also "RF Mode" on page 81.

- Resolution Bandwidth ("RBW")
Resolution bandwidth with which the measurement is performed. See "Resolution Bandwidth (RBW Mode/Res BW)" on page 142.

- 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 104

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 52.

- Measurement mode
  The currently active measurement mode on the active receiver board, e.g. "AF Spectrum". See Chapter 3.3, "Measurement mode", on page 52.

- 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 152.

- LF Input type ("LF In")
  Only AF signals can be analyzed as LF input in AF Spectrum mode. See "Input RF/LF" on page 75.

- ("Range")
  Sensitivity of the measurement. See "Range" on page 84.

- Measurement Bandwidth ("AF In BW")
  Measurement bandwidth for LF input. See "AF In BW" on page 154.

- 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 153.

- 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 104

ⓘ 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 369

Remote command to retrieve trace results:

FFT_GETSPECT on page 375

5.3.1 Configuring the input signal

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

Input RF/LF
Access: [Config]

Access VNC: [s]

Configures the input source for the currently selected receiver (see "To select the receiver board to configure" on page 52).

For details on the connectors see Chapter 1.5.1.3, "RX1 IN / RX2 IN", on page 28.

"RF In"	An RF signal is provided from the RX 1 In/RX 2 In connectors on the front of the R&S EVSG1000. 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 EVSG1000. If both receivers are used, only one of them can be set to analyze input from "LF In". Analyzing LF input requires option R&S EVSG1-K7 LF-Analysis.

Remote command:
GS_RFLF_INPUT on page 299
LLZ_RFLF_INPUT on page 289
VOR_RFLF_INPUT on page 324
FFT_RFLF_INPUT on page 374
SCOPE_RFLF_INPUT on page 379
SETUP:INPUT on page 253

5.3.2   Configuring the frequency range

Access: [CH F]

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 372

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 371

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 371

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 371

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 372

5.3.3 Configuring the bandwidth

Access: [BW]

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 EVSG1000, 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 373
FFT_RESBW_FIX_KHZ on page 374

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

Remote command:
FFT_IF_BW_KHZ on page 373

AF In BW
Access: [BW]

Access VNC: [e]

Bandwidth with which the LF input is measured.

Remote command:
SCOPE_BB_AF_BW_KHZ on page 377
FFT_BB_AF_BW_KHZ on page 370

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 104).

Remote command:
FFT_BB_IF_BW_KHZ on page 370

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

Access: [Ampt]

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 372

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 81).
"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 250

SCOPE_ATTMODE on page 377

FFT_ATTMODE on page 369

IFSPECT_ATTMODE on page 365

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 250

FSCAN_ATTMODE on page 360

SCOPE_ATTMODE on page 377

FFT_ATTMODE on page 369

IFSPECT_ATTMODE on page 365

GBAS:ATTMODE on page 343

5.3.5 Configuring the amplitude (Y-Axis) for LF input

Access: [Ampt]

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 373

Grid Unit
Access: [CONFIG]

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 161).

Range
Access: [AMPT]

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 254

Coupling
Access: [AMPT]

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 254

DC Reference
Access: [AMPT]

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 284
GS_BB_LFIN_DCOFFSETV on page 294
VOR_BB_LFIN_DCOFFSETV on page 322
FFT_BB_LFIN_DCOFFSETV on page 371
SCOPE_BB_LFIN_DCOFFSETV on page 378

LF In Factor
Access: [AMPT]

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 254

5.3.6 Configuring the trace

Access: [Meas]

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 EVSG1000 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 374
IFSPECT_TRACE_MODE on page 367
FSCAN_TRACE_MODE on page 363

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 375
IFSPECT_TRACE_AVRGCOUNT on page 368
FSCAN_TRACE_AVRGCOUNT on page 363

5.4 R&S EVSG-K12 Time domain analysis

Access: [Mode] > "AF Time Domain"

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.
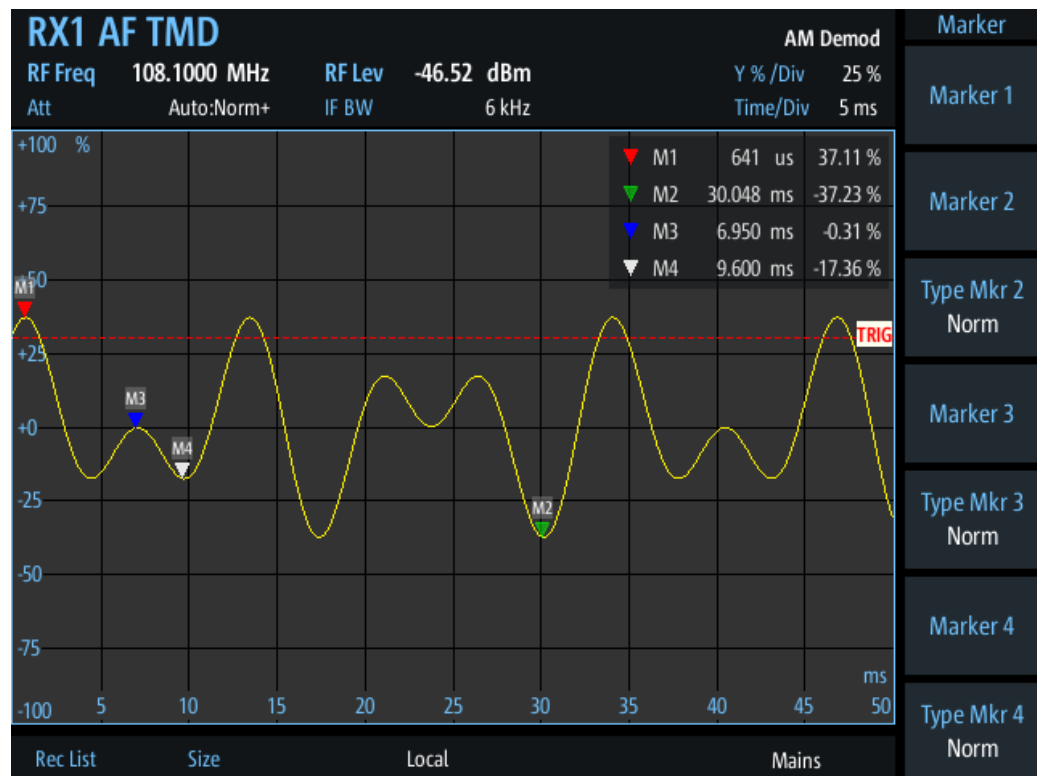
Figure 5-5: AF Time Domain Mode of an ILS signal with DDM = 0,0 %

ⓘ 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 52.

- Measurement mode
  The currently active measurement mode on the active receiver board, e.g. "AF Spectrum". See Chapter 3.3, "Measurement mode", on page 52.

- "RF Freq"
  Nominal measurement frequency of the RF signal, see "RF Freq" on page 152.

- "RF Lev"
  The measured level of the RF signal

- RF attenuation ("Att")
  The used attenuation mode; see also "RF Mode" on page 81.

- Y-axis scaling ("Y % / Div")
  Range per y-axis division. See "Y % /Div" on page 162.
- X-axis scaling ("Time / Div")
  Time per x-axis division. See "Time/Div" on page 165.

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.
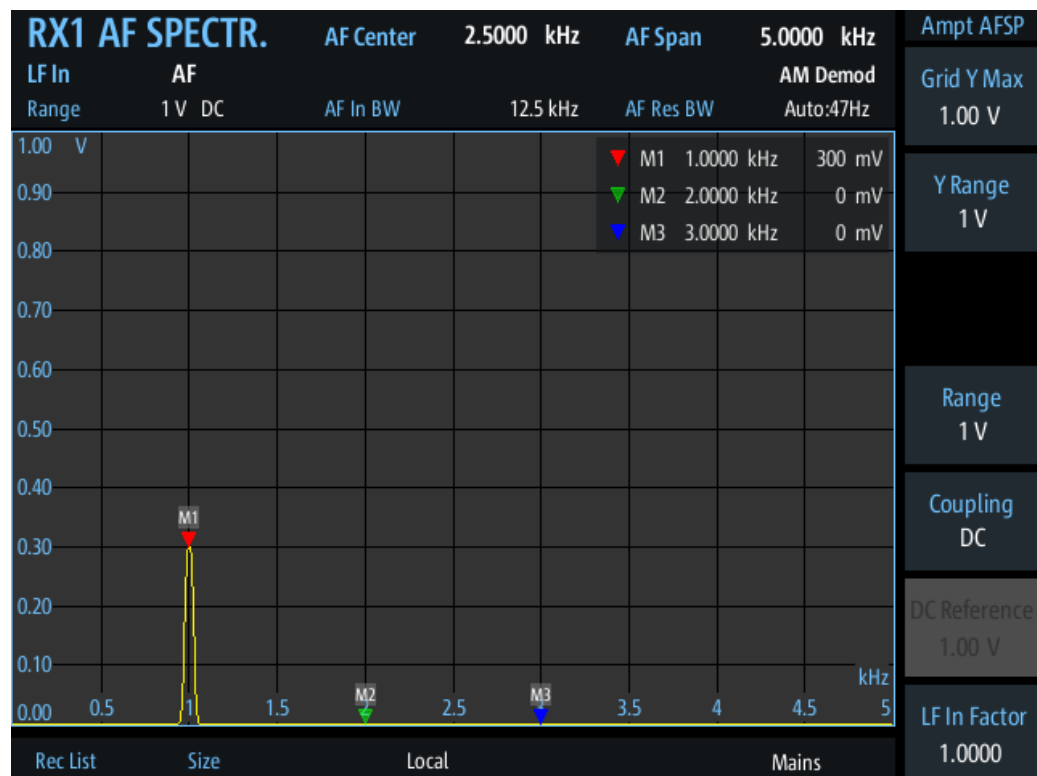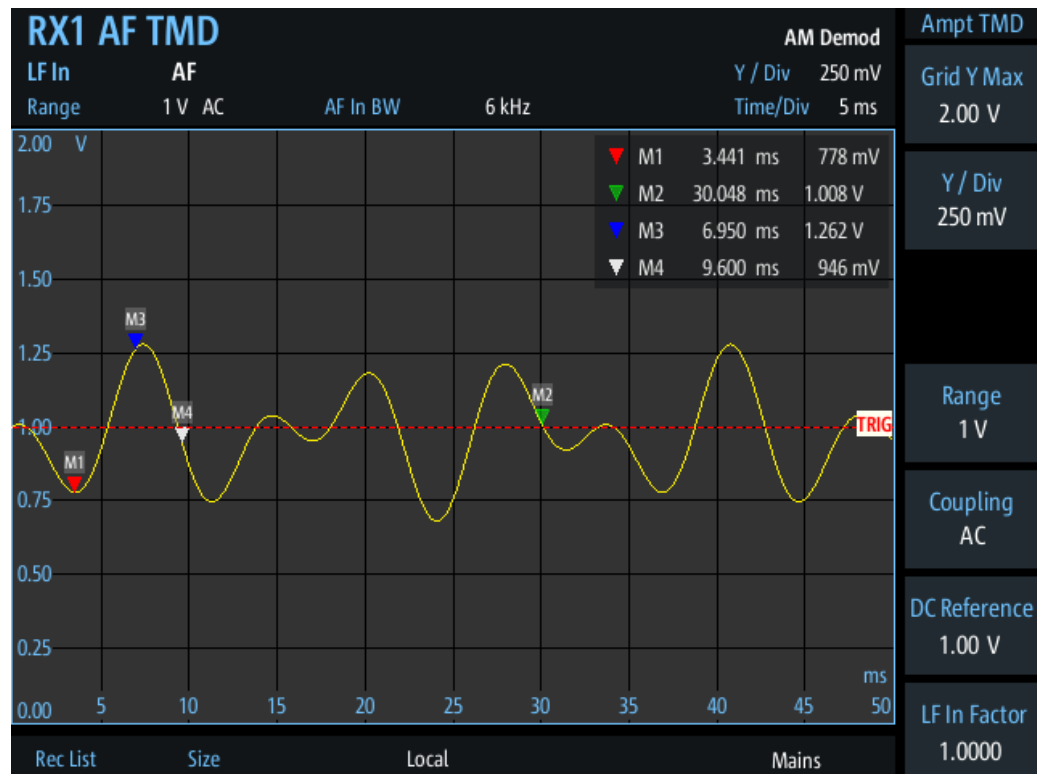

Figure 5-6: AF Time Domain Mode of an ILS signal from LF input

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 52.
- 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 52.
- 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 75.
- ("Range")
  Sensitivity of the measurement. See "Range" on page 84.
- Measurement Bandwidth ("AF In BW")

Measurement bandwidth for LF input. See "AF In BW" on page 154.

- 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 163.
- X-axis scaling ("Time / Div")
  Time per x-axis division. See "Time/Div" on page 165.

Remote command to select AF time domain mode:

MODE_SCOPE on page 376

Remote command to retrieve trace results:

SCOPE_GETMEAS on page 381

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: [Config]

Access VNC: [s]

Configures the input source for the currently selected receiver (see "To select the receiver board to configure" on page 52).

For details on the connectors see Chapter 1.5.1.3, "RX1 IN / RX2 IN", on page 28.

"RF In"	An RF signal is provided from the RX 1 In/RX 2 In connectors on the front of the R&S EVSG1000. 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 EVSG1000. If both receivers are used, only one of them can be set to analyze input from "LF In". Analyzing LF input requires option R&S EVSG1-K7 LF-Analysis.

Remote command:
GS_RFLF_INPUT on page 299
LLZ_RFLF_INPUT on page 289
VOR_RFLF_INPUT on page 324
FFT_RFLF_INPUT on page 374
SCOPE_RFLF_INPUT on page 379
SETUP:INPUT on page 253

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: [CH F]

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 378

IF BW
Defines the bandwidth with which the RX input is measured.

Remote command:
SCOPE_IF_BW_KHZ on page 378
LF input:
SCOPE_BB_IF_BW_KHZ on page 377

AF In BW
Access: [BW]

Access VNC: [e]

Bandwidth with which the LF input is measured.

Remote command:
SCOPE_BB_AF_BW_KHZ on page 377
FFT_BB_AF_BW_KHZ on page 370

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

Access: [Ampt]

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 81).

"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 250
SCOPE_ATTMODE on page 377
FFT_ATTMODE on page 369
IFSPECT_ATTMODE on page 365

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 250
FSCAN_ATTMODE on page 360
SCOPE_ATTMODE on page 377
FFT_ATTMODE on page 369
IFSPECT_ATTMODE on page 365
GBAS:ATTMODE on page 343

5.4.4 Configuring the amplitude (Y-Axis) for LF input

Access: [Ampt]

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: [CONFIG]

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 161).

Range
Access: [AMPT]

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 254

Coupling
Access: [AMPT]

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 254

DC Reference
Access: [AMPT]

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 284
GS_BB_LFIN_DCOFFSETV on page 294
VOR_BB_LFIN_DCOFFSETV on page 322
FFT_BB_LFIN_DCOFFSETV on page 371
SCOPE_BB_LFIN_DCOFFSETV on page 378

LF In Factor
Access: [AMPT]

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 254

5.4.5 Configuring the measurement time

Access: [MTime] > "Time/Div"

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 380

5.4.6 Configuring the trigger

Access: [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 mea-
                surement is performed without a trigger. This setting helps you deter-
                mine 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 con-
                nected external trigger device is received. The trigger device must be
                connected to the "Trigger In" connector on the rear panel of the
                R&S EVSG1000.

"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 381

Trigger Level

For the Trigger Source = "Level", this value specifies the level in percent the input sig-
nal must reach to trigger a measurement.

Remote command:
SCOPE_TRIGLEVEL_RFPCT on page 380

5.4.7 Configuring the trace

Access: [Meas]

Access VNC: [a]

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

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 EVSG1000 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 374

IFSPECT_TRACE_MODE on page 367

FSCAN_TRACE_MODE on page 363

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 375

IFSPECT_TRACE_AVRGCOUNT on page 368

FSCAN_TRACE_AVRGCOUNT on page 363

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.
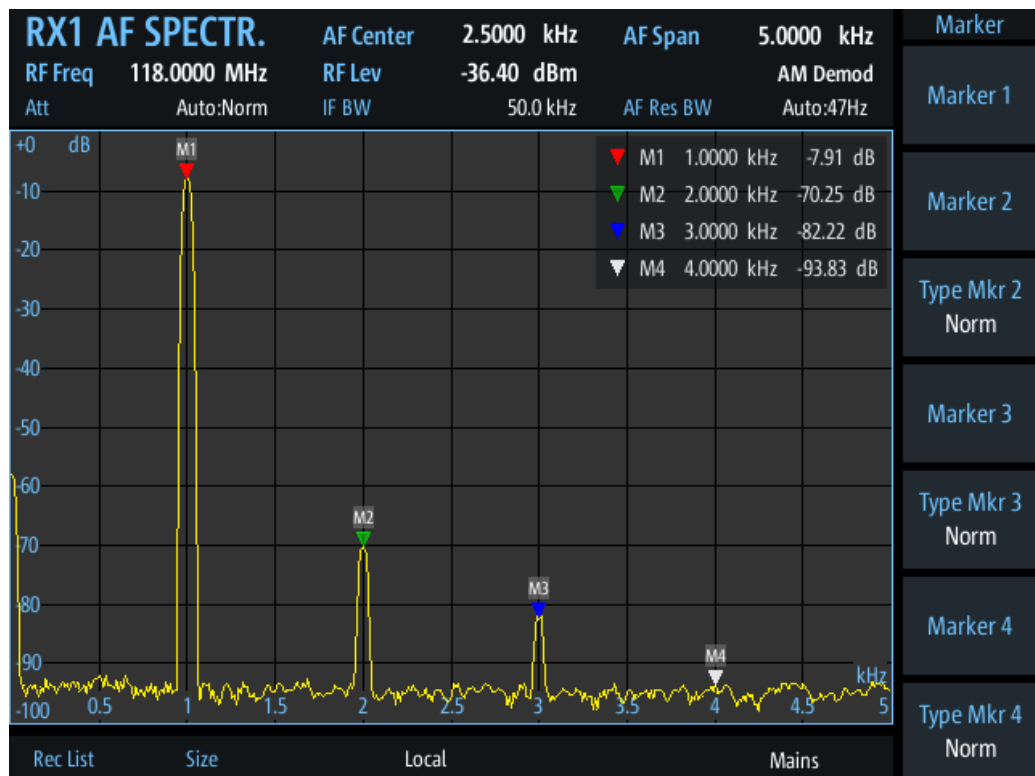
Up to four markers can be active at the same time. Markers 2 to 4 can be either normal markers or delta markers. A normal marker indicates the absolute signal value at the defined position in the diagram. A delta marker indicates the value of the marker relative to marker 1.

Activating/Deactivating a marker
Access: [Marker] > "Marker<x>"

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 169), 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: [Mkr Fct] > "All Markers Off"

Access VNC: [j] > "F1"

Deactivates all markers in the diagram.

Moving a marker to a peak in the diagram
Access: [Marker ->] > "Peak" / "Next Peak"

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 168.

Adapting the center frequency to the current marker position
Access: [Marker ->] > "Center = Marker Freq"

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 168.

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: [Mode] > "GBAS"

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 EVSG1000.

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 406).

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 406).

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 174.

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).
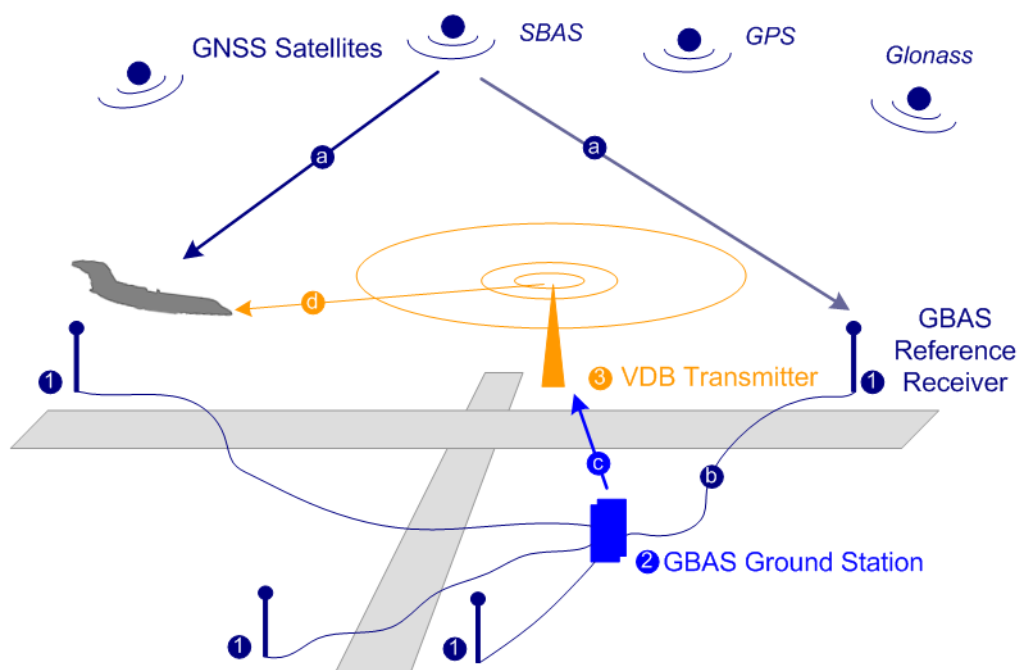
Figure 6-1: GBAS components and signals (simplified representation)

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.
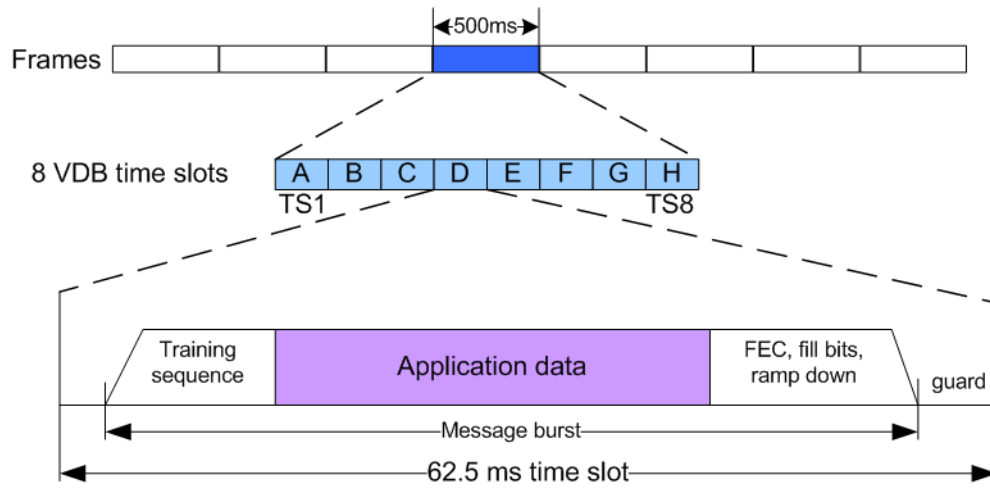
Figure 6-2: TDMA timing structure (simplified representation)

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 EVSG1000 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).
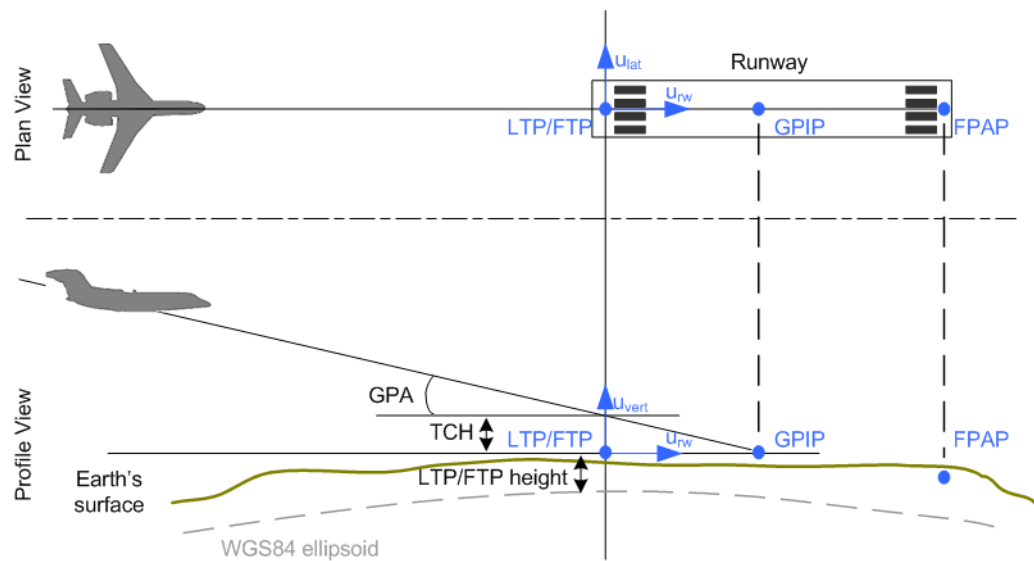
Figure 6-3: Final Approach Segment (FAS) diagram, according to [1]

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 EVSG1000 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 EVSG1000 can analyze the GBAS/SCAT-I signal and detect the individual GBAS time slots.

If no valid PPS signal is detected, the R&S EVSG1000 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 measurement information

The following measurement information is displayed in all GBAS / SCAT-I views.

RX1 GBAS   Frame **T**   Slot **E**   Freq   116.42500 MHz
Att   MAN:Low Noise+
Lev Corr   0.0 dB   IF BW   16.8 kHz   Time Ref. PPS Locked   Mode   Run

RX board (RX1 | RX2)
The currently active receiver board. See Chapter 3.2, "Receiver board", on page 52.

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 52.

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 344

RF attenuation (Att)
The used attenuation mode; see also "RF Mode" on page 191.

Level correction (Lev Corr)
The applied level correction by a transducer. See "Transducer Correction" on page 81.

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 191.

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 351

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 343

6.3 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 345

6.3.1 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 173). 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 190). 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 6.3.2, "Frame view", on page 178
- Chapter 6.3.3, "Burst view", on page 182
- Chapter 6.3.4, "Constellation view", on page 185
- Chapter 6.3.5, "Message view", on page 186

For each slot in each displayed frame, the following information is provided in the corresponding table cell (for a valid GBAS burst, if available).

EDDF
-65.4 dBm
MT: 1

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 347

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 345

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.

6.3.2 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 173). 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 190). Data recording and streaming, however, continue as usual. When updating is resumed, the displayed results in the view are updated.
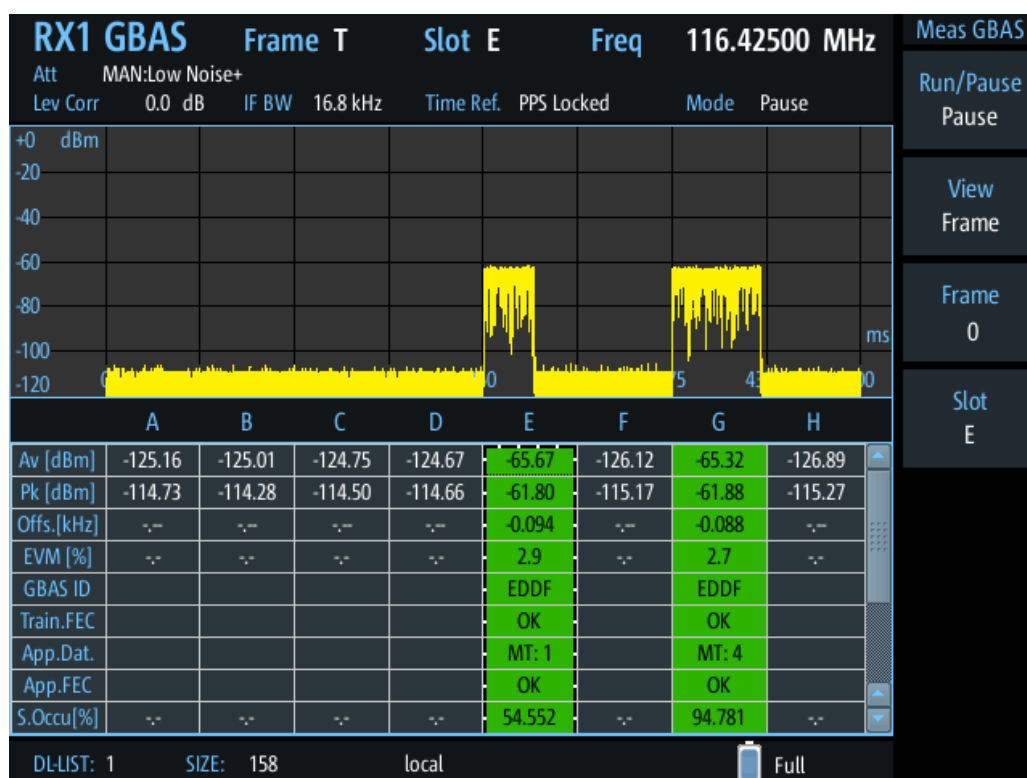
The "Frame" view contains two different displays:

6.3.2.1 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.
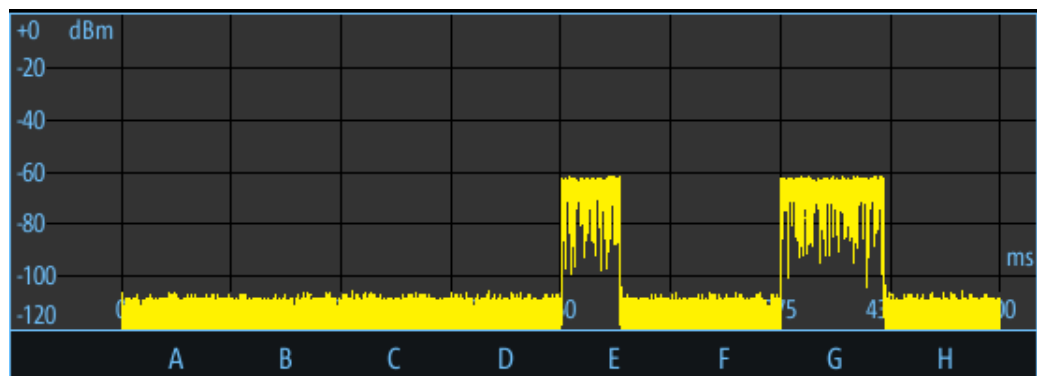
The measured power is indicated for a range of -120 dBm to 0 dBm on the y-axis.

6.3.2.2 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 345

Slot Level Peak (Pk [dBm])

Highest measured power level in the slot in dBm

Remote command:
GBAS:PEAKLEV? on page 351

Carrier frequency offset (Offs. [kHz])

Offset of the measured carrier frequency from the nominal frequency

Remote command:
GBAS:FMEAS? on page 344

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 346
For baseband input also:
GBAS:EVM_ANGLE_NORM on page 344

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 347

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 347

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

6.3.3 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.
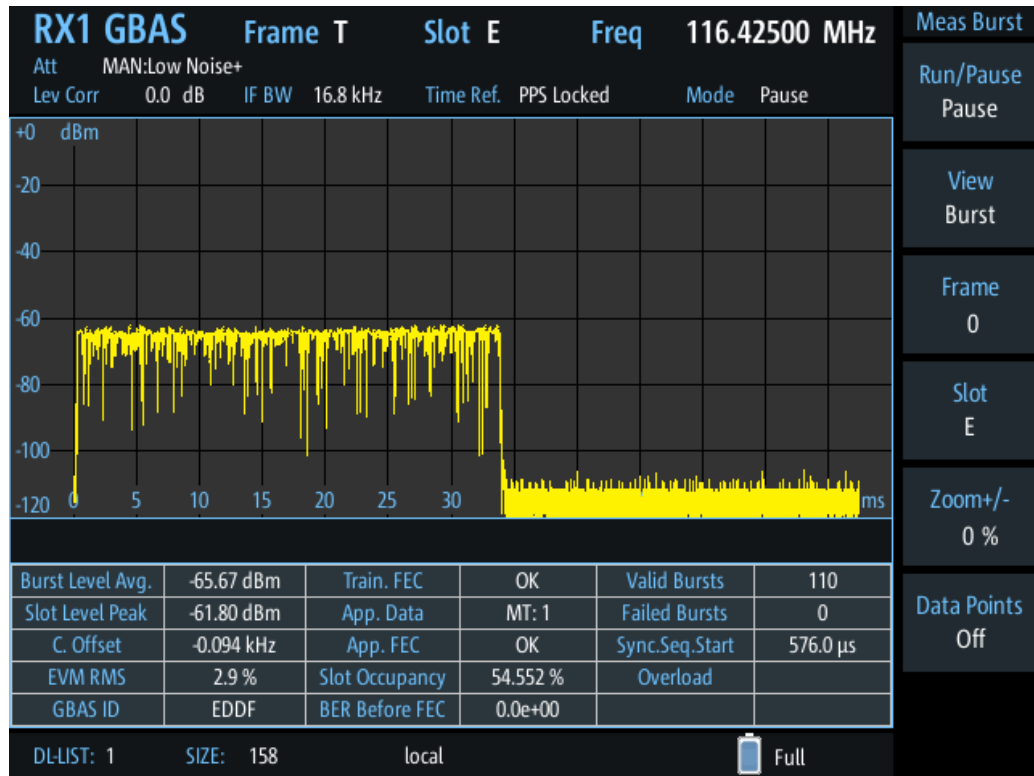
Figure 6-4: Example for a "Burst" view with a diagram and result table

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 190). 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 6.3.3.1, "Slot power vs. time diagram", on page 183
- Chapter 6.3.3.2, "Slot results table", on page 184

6.3.3.1 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.
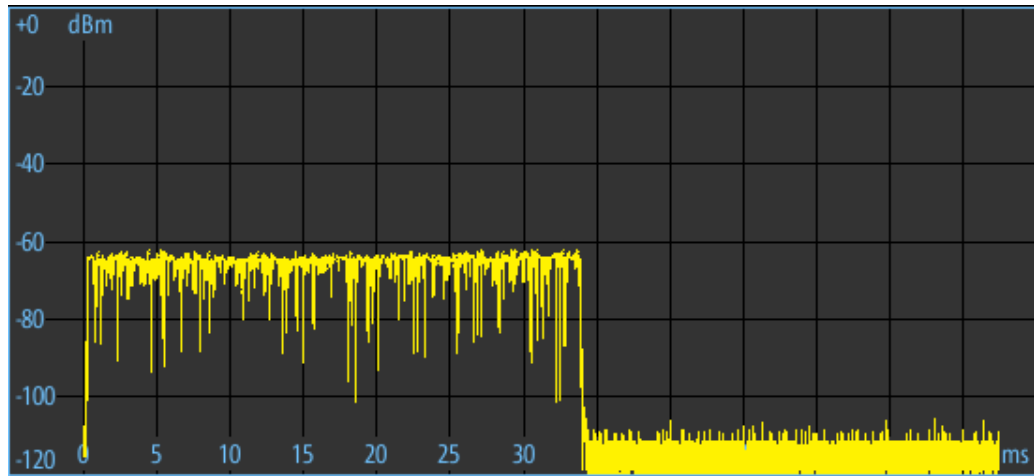
Figure 6-5: Power vs. time diagram for a slot in Burst view

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.
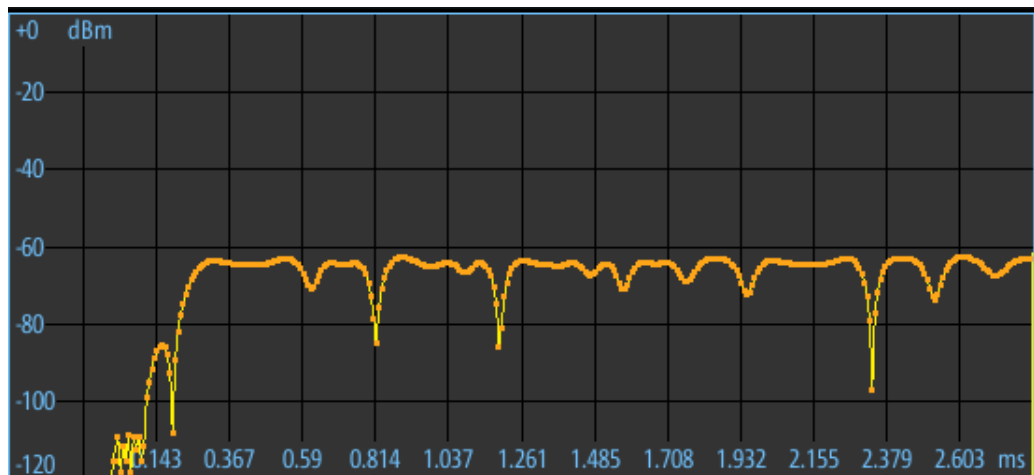
Figure 6-6: Power vs. time diagram with highlighted data points

6.3.3.2 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.

6.3.4 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 6.3.2.2, "Frame results table", on page 180).
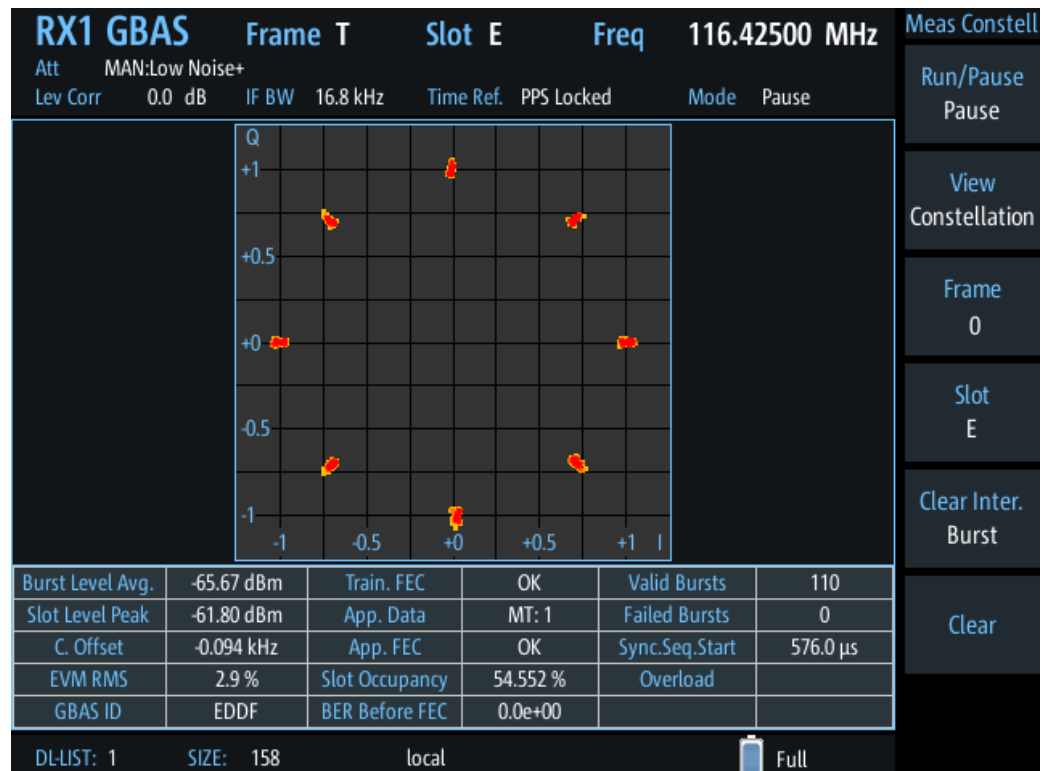
The constellation diagram shows the in-phase and quadrature components of the received D8PSK symbols in the slot. The in-phase components (I) are displayed on the x-axis, the quadrature (Q) components on the y-axis.

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 dia-
                   gram is displayed.

Clear

Clears all points from previous bursts in the constellation diagram and starts a new dia-
gram.

6.3.5 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 6.5, "Message
XML interface", on page 193).

For each type of data content, a separate row is displayed with the following informa-
tion:

- "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.

6.3.6 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 219). If available, the stored GNSS data from the GNSS receiver is also displayed.

RX	STIOCP	Index	Date	Time	Slot	FREQ[MHz]	Lev.Av[dBm]	Lev.Pk[dBm]	C.Offse
1	S	1	04.12.2018	13:35:24.760	C	116.42500	-124.98	-114.89	-.—
1		2	04.12.2018	13:35:24.823	D	116.42500	-124.92	-115.20	-.—
1		3	04.12.2018	13:35:24.885	E	116.42500	-65.67	-61.80	-0.094
1		4	04.12.2018	13:35:24.948	F	116.42500	-125.27	-115.08	-.—
1		5	04.12.2018	13:35:25.010	G	116.42500	-65.32	-61.88	-0.093
1		6	04.12.2018	13:35:25.073	H	116.42500	-125.64	-115.38	-.—
1		7	04.12.2018	13:35:25.135	A	116.42500	-124.59	-114.70	-.—
1		8	04.12.2018	13:35:25.198	B	116.42500	-125.03	-114.58	-.—
1		9	04.12.2018	13:35:25.260	C	116.42500	-124.56	-114.44	-.—
1		10	04.12.2018	13:35:25.323	D	116.42500	-124.78	-115.13	-.—
1		11	04.12.2018	13:35:25.385	E	116.42500	-65.41	-61.87	-0.092
1		12	04.12.2018	13:35:25.448	F	116.42500	-124.02	-114.61	-.—
1		13	04.12.2018	13:35:25.510	G	116.42500	-64.84	-61.73	-0.096
1		14	04.12.2018	13:35:25.573	H	116.42500	-123.81	-115.05	-.—
1		15	04.12.2018	13:35:25.635	A	116.42500	-123.77	-114.57	-.—
1		16	04.12.2018	13:35:25.698	B	116.42500	-124.90	-114.26	-.—
1		17	04.12.2018	13:35:25.760	C	116.42500	-125.19	-115.49	-.—

RX1 GBAS   DL-List 1   Line 11   Freq   116.42500 MHz

Att   MAN:Low Noise+

Lev Corr   0.0 dB   IF BW   16.8 kHz   Time Ref.   PPS Locked   Mode   Pause

Meas REC

DL Line 11

View Rec

-> Rec Burst View

-> Rec Const. View

-> Rec Msg. View

DL-LIST: 1   SIZE: 158   local   Full

The individual measurement results are described in Chapter 6.3.2.2, "Frame results table", on page 180.

ℹ️ **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 190). 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 8.2.3, "Recording settings", on page 219.

For details on data logging, see Chapter 8.2, "Recording measurement data", on page 217.

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".

6.4   GBAS/ SCAT-I measurement configuration

The following settings are available for GBAS/ SCAT-I measurements.

Settings for recording are described in Chapter 8.2, "Recording measurement data", on page 217.

6.4.1   View configuration

The following functions are available to configure the GBAS/ SCAT-I views except for the "Recording" view.

Access: [Meas]

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 345

6.4.2 Frequency configuration

Access: > [CH Freq] > "Freq"

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 344

6.4.3 Amplitude configuration

Access: [AMPT]

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 EVSG1000 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 343

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 343

6.4.4 Bandwidth configuration

Access: [BW]

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.

6.4.5 General configuration

Access: [Config]

Access VNC: [S]

PPS SRC
Source of the PPS signal required as a time reference

"TRIG"   Signal provided at the Trigger In connector

"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 6.5, "Message XML interface", on page 193).

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 EVSG1000 (see Chapter 6.5, "Message XML interface", on page 193).

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 EVSG1000

"Custom"   Uses the imported definition (see "Import xml" on page 192).

Reset BER
Resets the values for the following measurement results:

- "Bit error rate (BER) before FEC" on page 182
- "Valid Bursts (Valid B.)" on page 182
- "Failed Bursts (Failed B.)" on page 182

Remote command:
GBAS:RESETBER on page 352

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 344

6.5 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 6.3.5, "Message view", on page 186).

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 EVSG1000 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 EVSG1000 (see "Import xml" on page 192).

To customize the "Message" view results

1. Connect a USB storage device to the R&S EVSG1000.

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 EVSG1000.

5. Select [Config] > "DEC DEF" > "Custom".

   The R&S EVSG1000 decoder uses the edited, imported message definition and displays the defined results in the "Message" view.

6.5.1 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 196).

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.

Step 1
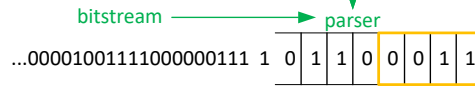
```
<Element>                                    XML file
  <data_content>ABC_XYZ</data_content>
  <data_content_short>ABC</data_content_short>
  <bits_used>4</bits_used>
  <type>value</type>
</Element>
```

bitstream ──────────► parser   Interpretation

...00001001111000000111 1 0 1 1 0 0 0 1 1 ──►

Data Content	Bits used	Value	Binary
ABC_XYZ	4	3	0011

Step 2

```
<Element>                                    XML file
  <data_content>KLMO</data_content>
  <data_content_short>KLM</data_content_short>
  <bits_used>8</bits_used>
  <type>value</type>
</Element>
```

bitstream ──────────► parser   Interpretation

...0000100111100000 0 1 1 1 0 1 1 0 ──►
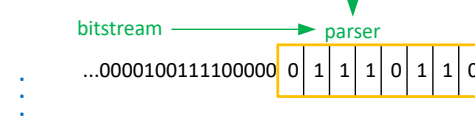
Data Content	Bits used	Value	Binary
KLMO	8	118	01110110

Step n

```
<Element>                                    XML file
  <data_content>Fill Bits</data_content>
  <data_content_short>FILL_BITS</
data_content_short>
  <type>fill</type>
</Element>
</Gbas>
```

bitstream ──────────► parser   Output in Message view table

End ──►
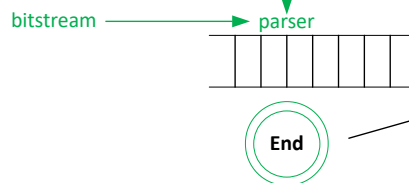
Data Content	Bits used	Value	Binary
ABC_XYZ	4	3	0011
KLMO	8	118	01110110

6.5.2 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 EVSG1000 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 6.5.4, "Format description of elements", on page 200.

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 6.3.5, "Message view", on page 186).

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	01000111110111111000110001110110000 00011110010000

6.5.3   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.
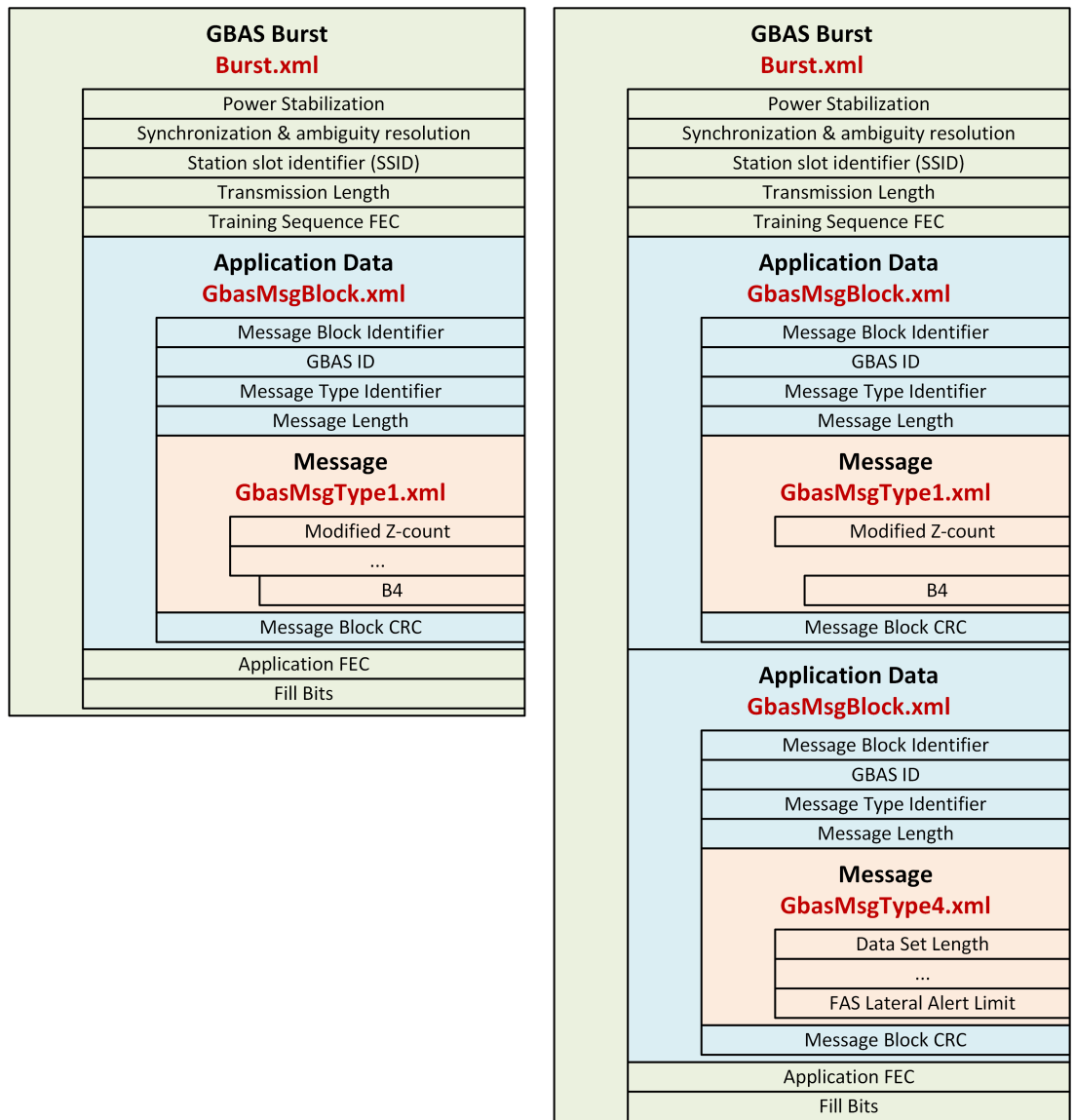
Figure 6-7: Examples for xml message interpretation files; left: message type 1; right: message types 1 and 4

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>000010011110000001101110001100011111101111100010</bits>
    <type>fixed</type>
    </Element>
    ...
</Gbas>
```

The format of the individual elements is described in the following sections.

6.5.4 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.

6.5.5 Output elements

6.5.5.1 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>
```

6.5.5.2 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>
```

6.5.5.3 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

6.5.5.4 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

6.5.5.5 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>
```

6.5.5.6 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>
```

6.5.5.7 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>
```

6.5.5.8 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>
```

6.5.5.9 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

6.5.5.10 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>
```

6.5.5.11 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>
```

6.5.5.12 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>
```

6.5.6 Control elements

6.5.6.1 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>
```

6.5.6.2 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>
```

6.5.6.3 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>
```

6.5.7 Auxiliary elements

6.5.7.1 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 R&S EVSG1-K24 Power Sensor Support

In power-sensor mode you can select terminating sensors (R&S NRPxx) of the Rohde & Schwarz sensor family R&S NRP.

- R&S NRP-Zxx
  (xx = 11, 21, 22, 23, 24, 27, 28, 31, 32, 37, 41, 51, 52, 55, 56, 57, 58, 61, 71, 81, 85, 86, 91, 92, 96, 98, 211, 221)
- R&S NRP-Cxx
  (xx = 18, 33, 40, 50)
- R&S NRP-Cxx B1
  (xx = 18, 33, 40, 50)
- R&S NRP-xxS
  (xx = 8, 18, 33)
- R&S NRP-xxS10
  (xx = 18)
- R&S NRP-xxS20
  (xx = 18)
- R&S NRP-xxS25
  (xx = 18)
- R&S NRP-xxSN
  (xx = 8, 18, 33)
- R&S NRP-xxSN10
  (xx = 18)
- R&S NRP-xxSN20
  (xx = 18)
- R&S NRP-xxSN25
  (xx = 18)
- R&S NRP-xxA
  (xx = 18)
- R&S NRP-xxAN
  (xx = 18)
- R&S NRP-xxT
  (xx = 18, 33, 40, 50, 67, 110)
- R&S NRP-xxTN
  (xx = 18, 33, 40, 50, 67)
- R&S NRP-xxW
  (xx = 18)
- R&S NRP-xxWN
  (xx = 18)

Sensors are connected to the USB port of the R&S EVSG1000 and the used frequency is the frequency of the active RX-board.

The display shows the average level and the sensor type.
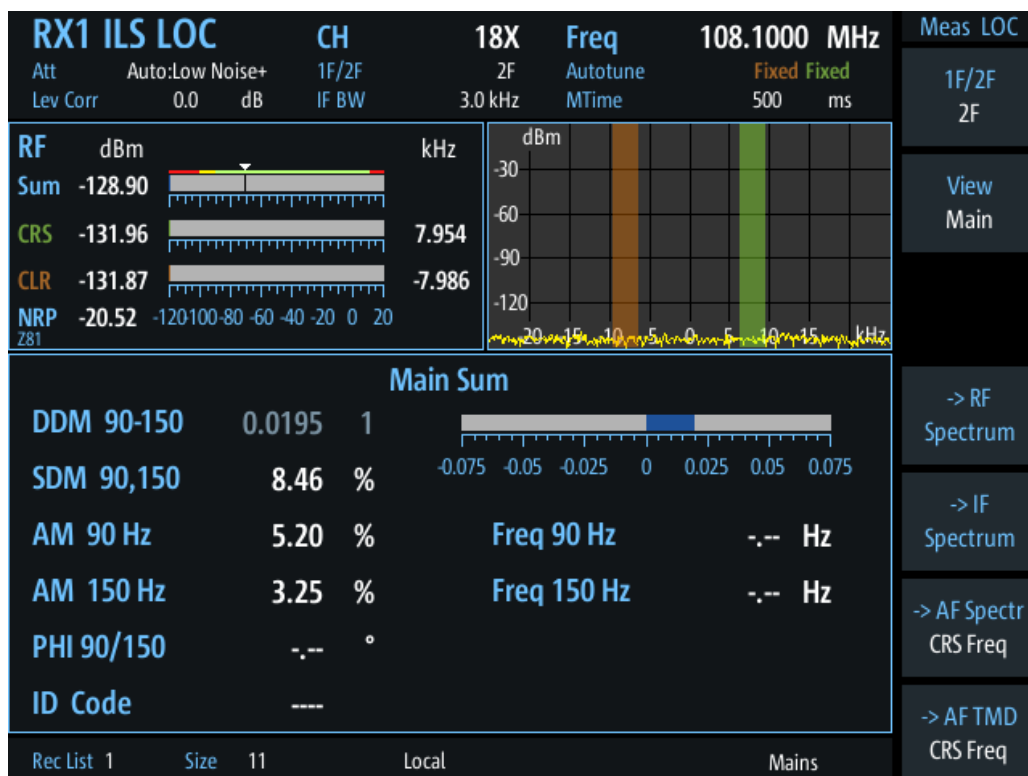
Figure 7-1: R&S NRP - Average Power

Remote commands:

GETNRPTYPE on page 252

GETNRPPOW on page 253

8 Data management

The R&S EVSG1000 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.

8.1 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 EVSG1000. 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 48)
- All general instrument settings except for the network settings (see Chapter 9, "Common instrument settings", on page 227)
- Date and time of storage

The list of UserPresets and the corresponding functions are available in the [Preset] menu.

8.1.1 Storage and recall functions

Access: [Preset]

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

Access: [Preset] > "Preset"

When delivered, the R&S EVSG1000 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**
Access: [Preset] > "Factory 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 271

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.>.evsgpreset, where <no.> is a consecutive number. The file name can be edited. The files are stored to the subdirectory EVSG1000_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.

8.2 Recording measurement data

During a measurement with the R&S EVSG1000, the input signal is captured and various results are calculated and displayed on the screen (see Chapter 2, "Measurements and results", on page 48). These results can also be stored in data lists, which can be exported as .csv files for further investigation.

Recording measurement data requires the R&S EVSG1-K21 Data Recording option.

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

8.2.1 GNSS data synchronization

Together with the measurement results, the GNSS data at the time of signal input is also stored, if available (see Chapter 9.8, "GNSS configuration", on page 244). 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.

8.2.2 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 EVSG1000. 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 EVSG1000 (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.

8.2.3 Recording settings

Access: "Config" >"Rec Config"

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 197.

List

Selects a specific data set list (1 to 999, the list number is shown in the softkey).

Remote command:
SETACTIVELIST on page 386
GETACTIVELIST on page 383

Clear List

Deletes all entries in the current list.

Remote command:
CLEARACTIVELIST on page 382

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 86). 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 386).

"All"	Includes all EVSG1000 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 386

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 348).

Parameter ← Data selection (Select, GBAS/SCAT-I mode only)

Defines which parameters are stored for each slot.

"All"	Includes all EVSG1000 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 348

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 350

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 350

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 385

Clear All Lists
Deletes all entries in all data lists.

Remote command:
CLEARALLLISTS on page 384

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 385

8.2.4　Activating and triggering data recording

By default, data is recorded in a specific time interval (see "Time" on page 220) 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: [Record]

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 222.

If enabled, raw, unprocessed I/Q data is also recorded to a separate file (see "Rec IQ" on page 221).

Trigger Source

Access: [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 220.

"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 EVSG1000.

Offset

Access: [Trigger] > "Offset"

Access VNC: [k] > "F4"

Defines an offset to the specified trigger event before data storage is actually started.

Trigger Edge

Access: [Trigger] > "Trig 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: [Trigger] > "Input"

Access VNC: [k] > "F7"

Determines which input triggers data storage or defines the GNSS PPS synchronization source.

"TRIG"	(Default:) Trigger input connector
"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 253

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).

8.2.5 Viewing recorded data

The "Recording" view displays the recorded data for the current measurement mode from the selected data file (see "List" on page 219).

The following functions are available in the "Recording" view for all modes.

DL Line
Selects a particular line (record) in the data recording file.

8.2.6 Analyzing recorded I/Q data

Optionally, raw, unprocessed I/Q data is recorded to a separate file during recording (see "Rec IQ" on page 221).

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*.

8.2.7 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".

8.3 Creating and storing screenshots

Access: [Setup] > "Screenshots"

You can create a screenshot of the current display on the R&S EVSG1000 at any time during operation. Creating screenshots is useful to document measurement results, for example.

Creating a Screenshot
Access: [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 EVSG1000 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 EVSG1000 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 EVSG1000

All screenshots stored on the R&S EVSG1000 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.

9 Common instrument settings

Common instrument settings are applied regardless of which measurement mode is selected.

ⓘ Configuring screenshots is described in Chapter 8, "Data management", on page 215.

Configuring the signal input is described in Chapter 3.1, "Input signal settings", on page 51.

9.1 Audio output settings

Access: [Audio]

Access VNC: [c]

(Not in "Preset" view.)

Audio output is available at the loudspeaker on the rear panel or the headphones connector on the front panel of the R&S EVSG1000.

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 258

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 259

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 256

Speaker

Enables or disables AF output at the loudspeaker on the rear panel of the
R&S EVSG1000.

Remote command:
SETUP:SPEAKER on page 258

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.

9.2 Display

Access: [Display]

Access VNC: [v]

(Not in "Preset" view.)

Some general settings are available for the display on the R&S EVSG1000. In particu-
lar, you can configure the display brightness depending on the used power source.

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 52).

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 252

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 273

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.

Brightness Mains

Defines the brightness of the display if an external power supply is used (as opposed to "Brightness Battery" on page 230).

Enter a percentage value (0 % to 100 %). The default value is 50 %.

Remote command:
DISPLAY_BRIGHTNESS_MAINS on page 270

Brightness Battery

Defines the brightness of the display if the power is supplied by a battery. This is useful to save energy when the available power is limited.

Enter a percentage value (0 % to 100 %). The default value is 50 %.

Remote command:
DISPLAY_BRIGHTNESS_BATTERY on page 270

9.3 Demodulation output settings

Access: [Setup] > "Demod Out"

Access VNC: [n] > [F2]

After demodulation of the signal, the signal data is available in the baseband (BB). The R&S EVSG1000 provides this baseband signal at the Demod Out connector of the instrument. Thus, you can analyze the data with other connected devices, for example an oscilloscope.
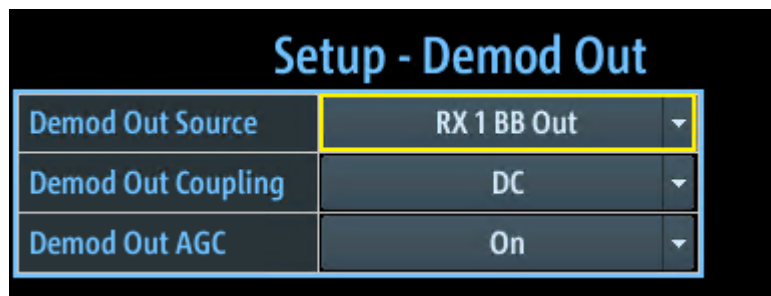
Demod. Out Source
Specifies the source of the output signal.

"RX 1 BB Out | Output provided by the BB Out connector on receiver board "RX1" or
RX 2 BB Out"   "RX 2".

"Off"   No output signal is provided.

Remote command:
SETUP:DEMOD_OUT on page 257

Demod Out Coupling
Determines the coupling mode for demodulation output.

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

"DC"   The DC component of the AF signal is also output.

Remote command:
SETUP:DEMOD_OUT_COUPLING on page 251

Demod Out AGC

Determines whether the level for demodulation output is automatically corrected using the automatic gain control (AGC).

Remote command:
SETUP:DEMOD_OUT_AGC on page 251

9.4 LAN (remote) settings

Access: [Setup] > "Remote"

Access VNC: [n] > [F4]

The following settings are required to operate the R&S EVSG1000 in a LAN, for example from a controller PC.

Setup - Remote

TCP/IP DHCP	On
TCP/IP Address	10.255.255.98
TCP/IP Netmask	255.255.255.0
TCP/IP Gateway	10.255.255.1
Hostname	EVSG-900015
VNC Password	Off
Used IP Address	172.23.226.41
Used IP Netmask	255.255.255.128
Used IP Gateway	172.23.226.1

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.

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 233).

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.

Example:

```
172.17.40.139
```

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 EVSG1000 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:

`EVSG<serial_number>`

For example, `EVSG1000-123456`.

For information on determining the serial number, see Chapter 1.5.2.10, "Device ID", on page 34.

Use the keypad to enter the name, see Table 1-6.

Remote command:
GETHOSTNAME on page 265

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 EVSG1000 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.

9.5 Data link (Wi-Fi) settings

Access VNC: [n] > [F5]

The R&S EVSG1000 can be equipped with an optional R&S EVSD1-Z5 Data-link-module (Wi-Fi). Thus, you can configure the R&S EVSG1000 as a Wi-Fi access point for wireless communication from a remote device.

The following settings configure the R&S EVSG1000 as a Wi-Fi access point.
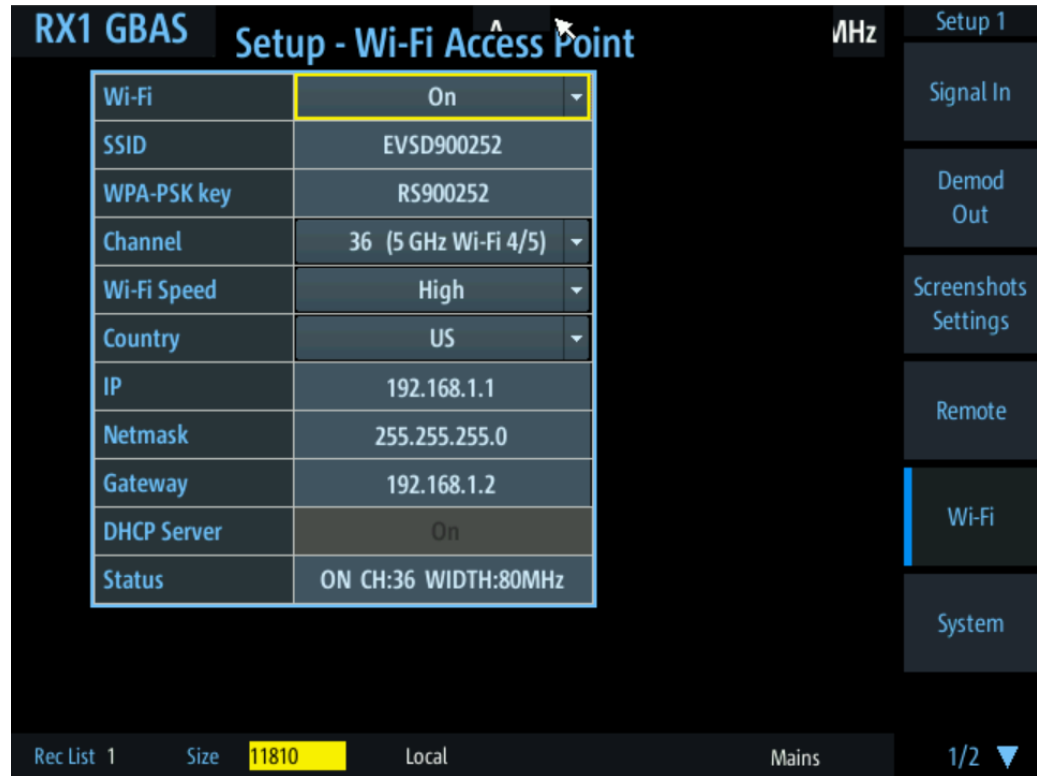
Wi-Fi

Enables or disables a data connection via the optional Wi-Fi interface.

Remote command:
`WIFI:ONOFF` on page 268

SSID

Service set identifier, the name of the Wi-Fi. The default name is `EVSG<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 41.

Remote command:
WIFI:SSID on page 267

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 1.5.2.10, "Device ID", on page 34.

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 41.

Remote command:
WIFI:WPAPSK on page 267

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 268

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 269

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 269

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 267

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 267

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 268

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 270

9.6 System settings

Access: [Setup] > "System"

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 272

Time

Sets the time of the internal clock in the format `hh.mm.ss`.

Example:

12.08.23

Remote command:
SETUP:TIME on page 272

Energy Saver

Switches the energy saver setting ON and OFF. If the energy saver setting is activated, the display is switched off when the specified time elapses. Data is still connected, only the backlight is turned off.

To turn the backlight back on, press [Enter].

The timer can be set from one minute to 60 minutes.

Remote command:
SETUP:ENERGYSAVER on page 271

Boot on Power Up

Automatically switches on the R&S EVSG1000 when it is connected to an external power supply (if not in operation already).

Remote command:
SETUP:BOOTONPOWERUP on page 271

Flash size / Flash used

Indicates the size of the flash memory in the R&S EVSG1000, and the percentage currently in use.

9.7 Instrument configuration and operating status settings

The following settings concern the instrument operating status, and hardware and software configuration.

Auto-Calibration (Cal)
Access: [Setup] > "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 EVSG1000.

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 9-1: 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 278
KALSCREEN on page 279
STARTKAL on page 279
GETKALSTATUS on page 278

Error Log
Access: [Setup] > "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 EVSG1000 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.

Setup - Error Log	
Copy to USB...	Delete all error messages...
10.07.2020 14:03:35	C:1 TEST ERROR MESSAGE NR. 03
10.07.2020 14:03:22	C:1 TEST ERROR MESSAGE NR. 02
10.07.2020 14:02:59	C:1 TEST ERROR MESSAGE NR. 01

Remote command:
GETERRORLOG on page 276

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 276
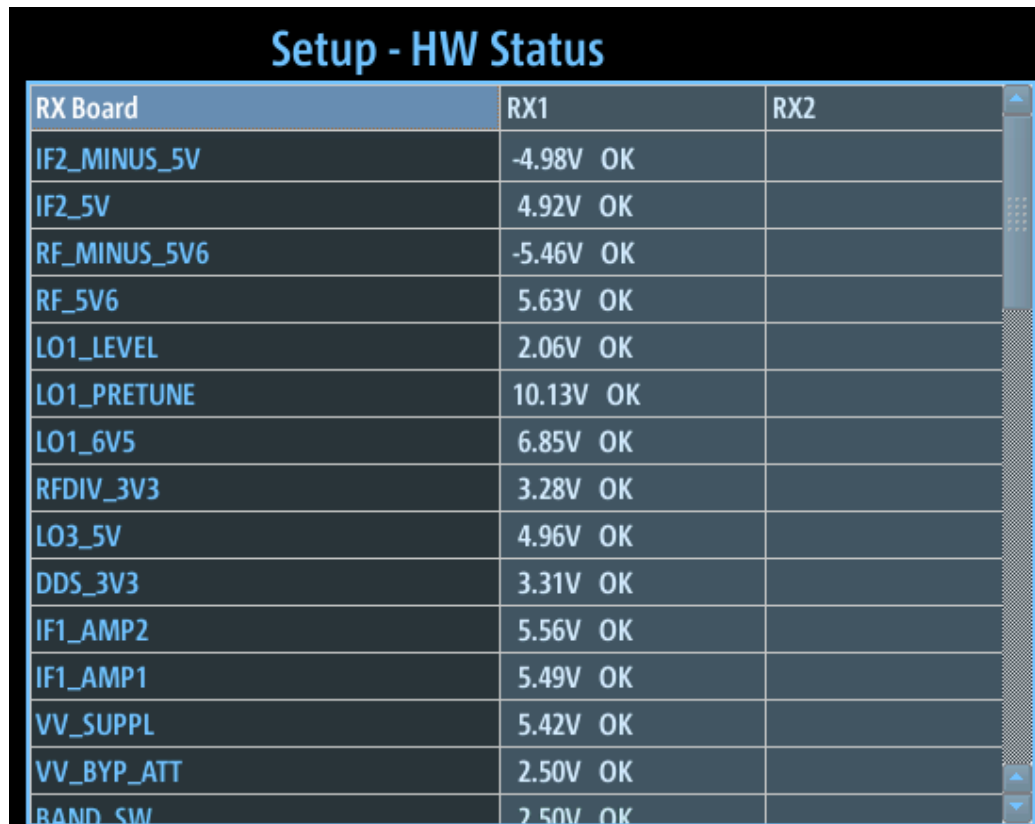
HW Status
Access: [Setup] > "HW Status"

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 EVSG1000, such as test voltages and temperatures.

The values are provided individually for RX1 and RX2 boards.

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 EVSG1000:

● An error message is created in the error log (see "Error Log" on page 240).
● 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 13, "Contacting customer support", on page 401.

Remote command:
GETUNCAL on page 248
BI? on page 276
GETTEMP on page 277

Installed Options
Access: [Setup] > "Signal In"

Access VNC: [n] > [F8] > [F4]

Displays a table with the currently installed option keys.

For all purchased R&S EVSG1000 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 276

Inventory
Access: [Setup] > "Signal In"

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.

Remote command:
INV? on page 277
VER? on page 278

SW Update ← Inventory
Updates the R&S EVSG1000 software using an update file on a connected USB device.

The R&S EVSG1000 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.

Power supply and battery charge state
The currently used power supply and the charge state of the battery is indicated in the status bar of the R&S EVSG1000 display. The following status messages are available:

"Mains"   No battery is installed in the instrument.

"Charge"   Battery is currently being charged.

"Bat"   The instrument is running on the battery power supply.

Full   Battery is fully charged.

Charge susp.   Charge suspended, but not yet fully charged; for example, due to overheating during the charge process.

Remote command:
BATT on page 276

9.8 GNSS configuration

Access: [Setup] > "GPS / GNSS"

Access VNC: [n] > [F8] > [F6]

If a GNSS receiver is connected to the R&S EVSG1000, 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 262

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 263

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 EVSG1000. Although it is possible to store data on the R&S EVSG1000 without the PPS signal connected, the stored data can be assigned to the actual GNSS time incorrectly. For details, see Chapter 8.2.1, "GNSS data synchronization", on page 218.

"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 263

Interface
Determines the interface used to connect a GNSS receiver.

"RS-232"	(See Chapter 1.5.2.4, "RS232 GPS", on page 33)
"USB"	Chapter 1.5.1.4, "USB", on page 29
"USB u-blox"	Chapter 1.5.1.4, "USB", on page 29
"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 261

Exp. Format
Export format for the GNSS data output by the data logger.

"Min"	(Default:) Minutes, seconds, degrees
"Decimal"	Decimal format

10 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 EVSG1000 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 EVSG1000.

Set the IP addresses and subnet mask identifier in the setup menu (see Chapter 9.4, "LAN (remote) settings", on page 231).

ⓘ   Only one remote session can be active. A new attempt to establish a connection disconnects the current active session.

Channel addressing

The R&S EVSG1000 offers two possibilities to address one of two independent RX boards by remote control.

- Active RX board
  Any remote command is valid for the current active RX board as shown in the info line of the display (see Chapter 1.6.1, "Understanding the display information", on page 38).
- 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`

10.1 Common instrument and measurement setup

The following commands are required to configure general instrument and measurement settings that are independent of the measurement mode.

10.1.1 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 13, "Contacting customer support", on page 401.

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 240

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 80
	See "Freq" on page 95
	See "Freq" on page 125
	See "Freq" on page 135

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 402.

Return values:

<State>   **READY.**
The command was executed successfully.

Manual operation: See "CH" on page 80

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 81
See "RF Mode" on page 81
See "RF Att" on page 136
See "RF Mode" on page 136

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.

Manual operation: See "Demod Out AGC" on page 231

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.

Manual operation: See "Demod Out Coupling" on page 230

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 81

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 81

10.1.2 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 228

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

Return values:

<State>	**READY.**
	The command was executed successfully.

Example:	`SETUP:INPUT 1, RF`
Manual operation:	See "Input RF/LF" on page 75

10.1.3 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>	**TRIG**
	Signal provided at the Trigger In connector
	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 222

10.1.4 Baseband input

The following commands are required to configure baseband input.

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 84

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 85

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 84

10.1.5 Audio, demodulation and output configuration

The following commands are required to configure various types of output.

SETUP:AF_SOURCE_OUT <Source>

Selects the source for "AF Out" for active RX-Board.

Parameters:

<Source>   **AM_DEMOD_CC_BB**
                             AM Demodulation at the center carrier

                             AM_DEMOD_UC
                             AM Demodulation at the upper carrier of a 2F ILS signal

                             AM_DEMOD_LC
                             AM Demodulation at the lower carrier of a 2F ILS signal

                             FM_DEMOD_CC
                             FM Demodulation at the center carrier

                             FM_DEMOD_UC
                             FM Demodulation at the upper carrier of a 2F ILS signal

                             FM_DEMOD_LC
                             FM Demodulation at the lower carrier of a 2F ILS signal

Return values:

<State>   **READY.**
                          The command was executed successfully.

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 228

SETUP:BB_SOURCE_OUT <Source>

Selects the source for "BB Out" for active RX-Board.

Parameters:

<Source>   **AM_DEMOD_CC_BB**
                          AM Demodulation at the center carrier

                          AM_DEMOD_UC
                          AM Demodulation at the upper carrier of a 2F ILS signal

                          AM_DEMOD_LC
                          AM Demodulation at the lower carrier of a 2F ILS signal

                          FM_DEMOD_CC
                          FM Demodulation at the center carrier

                          FM_DEMOD_UC
                          FM Demodulation at the upper carrier of a 2F ILS signal

                          FM_DEMOD_LC
                          FM Demodulation at the lower carrier of a 2F ILS signal

Return values:

<State>   **READY.**
                          The command was executed successfully.

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:DEMOD_OUT? <Mode>
SETUP:DEMOD_OUT <Mode>

Gets or sets the Demodulation-Out mode.

Parameters:

<Mode>	**OFF**
	No output signal is provided.
	RX_1_BB_OUT
	Output provided by the BB Out connector on receiver board "RX1" or "RX 2".
	RX_2_BB_OUT
	Output provided by the BB Out connector on receiver board "RX1" or "RX 2".

Return values:

| <State> | **READY.** |
| | The command was executed successfully. |

Manual operation: See "Demod. Out Source" on page 230

SETUP:DEMOD_OUT_AGC? <Value>
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.

Manual operation: See "Demod Out AGC" on page 231

SETUP:DEMOD_OUT_COUPLING? <Mode>
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.

Manual operation: See "Demod Out Coupling" on page 230

SETUP:SPEAKER <State>

This command activates/deactivates the speaker.

Parameters:
<State>   ON | OFF

Return values:
<State>   **READY.**
                         The command was executed successfully.

Manual operation: See "Speaker" on page 228

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 227

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 227

10.1.6 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 245

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 244

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 245

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 245

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 EVSG1000. 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 EVSG1000 clock is synchronized. If the R&S EVSG1000 clock differs from the selected synchronization source time by more than 1000 ms, the R&S EVSG1000 clock is adjusted accordingly.

Parameters:

<Source>	**OFF**
	No synchronization is performed for the internal R&S EVSG1000 clock.

GPS

Synchronization with a connected GNSS (see the main R&S EVSG1000 User Manual).

Example: SETUP:TIMESYNC OFF

10.1.7 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 233

LO

This command sets the R&S EVSG1000 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.
The "ESC" button has no effect.

OFF
The R&S EVSG1000 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 EVSG1000 clock (see `SETUP:TIMESYNC` on page 264).

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

10.1.8 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 234

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 235

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 236

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 236

WIFI:GATEWAY <Address>

Wi-Fi gateway address

Parameters:

<Address>   Four number blocks separated by dots. Each block contains val-
                     ues between 0 and 255.

                     *RST: 192.168.1.2

Return values:

<State>   **READY.**
                     The command was executed successfully.

Manual operation: See "Gateway" on page 236

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 234

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 235

WIFI:SPEED?
WIFI:SPEED <DataRate>

Determines the used Wi-Fi data rate.

Parameters:

<DataRate>   **LOW**
                           (Default:) Uses 20 MHz bandwidth. Data transfer is less suscep-
                           tible to distortion.

                           HIGH
                           Uses 80 MHz bandwidth, if available. Guard interval is reduced
                           to increase the data rate. Data transfer becomes more suscepti-
                           ble to distortion.

                           *RST: LOW

Return values:

<State>   **READY.**
                           The command was executed successfully.

Manual operation: See "Wi-Fi Speed" on page 235

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 235

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 236.

Return values:

<State>   **READY.**
                 The command was executed successfully.

Manual operation: See "Status" on page 236

10.1.9 System settings

The following commands are required to configure basic system settings.

DISPLAY_BRIGHTNESS_BATTERY <Percentage>

This command sets the display brightness in battery mode.

Parameters:

<Percentage>   numeric value

                    Setting of display brightness.

                    Range: 0 to 100

Return values:

<State>   **READY.**
                    The command was executed successfully.

Manual operation: See "Brightness Battery" on page 230

DISPLAY_BRIGHTNESS_MAINS <Percentage>

This command sets the display brightness in mains mode.

Parameters:

<Percentage>   numeric value

                      Setting of display brightness.

                      Range: 0 to 100

Return values:

<State>   **READY.**

                      The command was executed successfully.

Manual operation: See "Brightness Mains" on page 229

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 217

SETUP:ENERGYSAVER <Value>

This command specifies the energy saver properties.

Parameters:

<Value>   **ON**
                      The energy saver is on.

                      OFF
                      The energy saver is off.

                      1 to 60
                      The energy saver is started after the defined time.

                      Default unit: min

Return values:

<State>   **READY.**

                      The command was executed successfully.

Manual operation: See "Energy Saver" on page 238

SETUP:BOOTONPOWERUP <State>

If power is applied to the instrument, it can be started immediately.

Parameters:

<State>   **ON**
                      The R&S EVSG1000 is started immediately after power is applied to the instrument.

OFF

The R&S EVSG1000 must be started manually 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 238

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 237

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 238

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.

10.1.10 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 87
                           See "Level View" on page 229

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 86

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 87

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 87

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 86

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 79

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 114

10.1.11   Retrieving instrument information

The following commands are required to retrieve information on the instrument and operation status.

BATT

Gets the battery status.

Return values:

<Battery level>   Battery charge state

Default unit: %

<State>   **READY.**
The command was executed successfully.

Manual operation: See "Power supply and battery charge state" on page 243

BI?

This command returns built-in-test information.

Return values:
<BI-Info>

Usage: Query only

Manual operation: See "HW Status" on page 240

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 240

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 241

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 240

---

*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 242

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 EVSG1000 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 242

10.1.12 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 239

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 239

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 239

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 239

10.1.13   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 281
- `MODE_LOC` on page 281
- `MODE_GP` on page 281
- `MODE_MB` on page 314
- `MODE_VOR` on page 321
- `MODE_COM` on page 331
- `MODE_FSCAN` on page 360
- `MODE_IFSPECT` on page 364
- `MODE_FFT` on page 369
- `MODE_SCOPE` on page 376

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.

10.2 ILS localizer (LOC) and glidepath (GP) modes

The following commands are required to configure and perform measurements in the ILS Localizer and Glidepath modes.

10.2.1 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 280.

MODE_GP

This command switches the instrument to the "ILS GP" mode.

Return values:

<State>   **READY.**

The command was executed successfully.

10.2.2 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 76

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 84

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 85

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 85

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 84

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 85

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 85

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 83

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 79

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 80

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 82

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 82

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 82

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 82

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 78

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 car-
                            rier frequency changes, the R&S EVSG1000 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 77

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 78

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 78

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 82
                           See "Res. FM Filt." on page 85

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 EVSG1000

                               LF_IN
                               An AF or low frequency signal is provided at the LF In input con-
                               nector on the rear side of the R&S EVSG1000.

Return values:

<State>   **READY.**
                               The command was executed successfully.

Manual operation: See "Input RF/LF" on page 75

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 79

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 56 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 56 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.

10.2.3   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 76

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 84

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 85

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 85

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 84

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 85

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 85

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 83

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 79

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 80

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 82

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 82

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 82

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 82

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 EVSG1000 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 77

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 78

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 78

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 78

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 EVSG1000

                               LF_IN
                               An AF or low frequency signal is provided at the LF In input con-
                               nector on the rear side of the R&S EVSG1000.

Return values:

<State>   **READY.**
                               The command was executed successfully.

Manual operation: See "Input RF/LF" on page 75

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 79

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.

10.2.4 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 387
● GETDATASET on page 387

- `LA?` on page 249
- `RF` on page 249
- `FFT_GETSPECT` on page 375

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 68

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 68

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 68

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 73

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 68

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 68

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 68

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 68

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 68

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 68

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 73

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 71

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 67

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 67

DD0

This command queries the current DDM value.

Return values:

<DDM [1]>   DDM value (dimensionless)

Manual operation: See "DDM 90-150" on page 67

DD1

This command queries the current DDM value.

Return values:

DDM [µA]   DDM value (µA)

Manual operation: See "DDM 90-150" on page 67

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 63

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 70

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 70

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 71

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 70

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 70

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 71

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 68

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 70

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 71

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 68

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 68

SD0

This command queries the current SDM value.

Return values:
SDM [1]   SDM value (dimensionless)

Manual operation: See "SDM 90,150" on page 68

SD1

This command queries the current SDM value.

Return values:
SDM [µA]   SDM value (µA)

Manual operation: See "SDM 90,150" on page 68

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 71

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 70

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 63

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 63

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 63

10.2.5 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 73

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 73

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 73

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 73

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 73

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 73

10.2.6 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 10.2.1, "Configuring the ILS LOC and GP modes", on page 281 and Chapter 10.12, "Data management", on page 381.

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 313, 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 312, but output is preceded by a timestamp.

Return values:

<State>　　　　　　　　**READY.**

　　　　　　　　　　　　The command was executed successfully.

FA5

The same as FA1 on page 312, 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.

GSLLZ

Queries if the R&S EVSG1000 is in GS or LOC mode.

Return values:

<mode>　　　　　　　**GS | LOC**
　　　　　　　　　　　Shows the current mode.

10.3 ILS marker beacon (MB) mode

The following commands are required to configure and perform measurements in the ILS Marker beacon mode.

10.3.1 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 280.

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.

10.3.2 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 387
- GETDATASET on page 387

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 92

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 92

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 91

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 92

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 92

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 91

AM7

This command queries the AM modulation of the identifier.

Return values:

<%>   Provides the AM7 modulation in %.

10.3.3 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 93

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 93

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 93

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 93

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 93

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 93

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 93

10.3.4 Deprecated commands

The following commands are maintained for compatibility with former Rohde & Schwarz analyzers only. For new remote control programs, use the com-

mands described in Chapter 10.3.1, "Configuring ILS MB measurements", on page 314 and Chapter 10.12, "Data management", on page 381.

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.

10.4 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.

10.4.1 Configuring VOR measurements

The following commands are required to configure VOR measurements.

Useful commands for VOR measurements described elsewhere:

● `RFCH` on page 250

Remote commands exclusive to VOR measurements:

MODE_VOR

The `MODE_VOR` command is identical to the `MV` command.

For description, see `MV` on page 281.

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 85

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 84

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 80

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 117

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 117

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 117

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 117

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 115

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 EVSG1000

                        LF_IN
                        An AF or low frequency signal is provided at the LF In input con-
                        nector on the rear side of the R&S EVSG1000.

Return values:
<State>   **READY.**
                        The command was executed successfully.

Manual operation: See "Input RF/LF" on page 75

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.

10.4.2 Retrieving VOR results

The following commands are required to retrieve results from VOR measurements.

Useful commands for retrieving results described elsewhere:

- GETDATADEF on page 387
- GETDATASET on page 387

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 68

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 108

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 108

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 108

AF8

This command queries the AF frequency of identifier.

Return values:
<[Hz]>   Identifier AF frequency

Manual operation: See "ID Freq" on page 73

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 107

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 107

AM8

This command queries the modulation of identifier.

Return values:
<[%]>   Identifier modulation

Manual operation: See "ID AM" on page 73

AM9

This command queries the modulation of voice.

Return values:
<[%]>   Voice modulation

Manual operation: See "Voice AM" on page 108

BE?
BE_TO?
BE

This command queries the bearing angle.

Return values:

<[°]>   Bearing angle in [°].

Manual operation: See "Bearing (from)" on page 107

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 108

FM1

This command queries the FM index.

Return values:

<[1]>   FM index (dimensionless)

Manual operation: See "FM Index" on page 108

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 109

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 109

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 109

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 109

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 109

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 109

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 109

10.4.3 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 10.4.1, "Configuring VOR measurements", on page 320
and Chapter 10.12, "Data management", on page 381.

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.

10.5　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.

10.5.1　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 125

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 125

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 fre-
                     quencies are measured is configured by the
                     AMFREQ_OFFSET_TX1 and AMFREQ_OFFSET_TX2 commands.

Manual operation: See "1F/2F" on page 124

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 127

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 127

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 125

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.

10.5.2 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 122

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 122

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 122

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 122

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 122

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 122

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 122

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 122

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 122

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 122

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 123

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 123

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 122

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 122

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 122

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 122

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 122

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 122

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 122

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 122

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

10.6 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.

10.6.1 Configuring GBAS/ SCAT-I measurements

The following commands are required to configure GBAS/ SCAT-I measurements.

Useful commands for configuring GBAS measurements described elsewhere:

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 81
                            See "RF Att" on page 191
                            See "RF Mode" on page 191

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 176

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 cal-
                       culation.

Manual operation: See "EVM RMS" on page 181
                        See "EVM Mode" on page 192

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 181

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 spac-
                       ing of 25 kHz.
                       Default unit: kHz

Return values:

<State>   **READY.**
                       The command was executed successfully.

Manual operation: See "Frequency (Freq)" on page 175

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 178

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 190

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> **TRIG**

Signal provided at the Trigger In connector

PPS SMA

Signal provided at the PPS In connector

PPS GPS

Signal provided at the RS232-GPS connector

10.6.2 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 181

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 182

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 178

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 6.3.3.2, "Slot results table", on page 184.

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 220

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 221

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 bitstream 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 220

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 181

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 176

GBAS:RESETBER

Resets the values for the following measurement results:

- "Bit error rate (BER) before FEC" on page 182
- "Valid Bursts (Valid B.)" on page 182
- "Failed Bursts (Failed B.)" on page 182

Parameters:

<State>	**READY.**
	The command was executed successfully.

Usage:	Event
Manual operation:	See "Reset BER" on page 192

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 10.12.3.6, "GBAS mode", on page 394

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

10.7 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.

- Configuring an NDB measurement...354
- Retrieving NDB measurement results...357

10.7.1 Configuring an NDB measurement

The following commands are required to configure NDB measurements.

Useful commands for NDB measurements described elsewhere:

- `RFCH` on page 250
- `LA?` on page 249
- `MEASTIME` on page 249
- `SQUELCH` on page 259
- `SETATTMODE` on page 250
- Chapter 10.2.5, "Retrieving ID results", on page 309

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 136

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 137

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 137

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 137

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 137

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 135

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 128 for details.

Parameters:

<View type>   **ID**
                                       ID view
                                       DIST
                                       Distortion view
                                       REC
                                       Recording view

Return values:

<State>   **READY.**
                                       The command was executed successfully.

10.7.2 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 387
- `GETDATASET` on page 387
- `FMEAS` on page 316

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 132

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 132
                           See "AM 400/1020 Hz" on page 133

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 131

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 131

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 135

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 133

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 133

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 133

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 133

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 133

10.8   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 analy-
sis option is installed.

10.8.1   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 81

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 141

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 141

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 141

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 141

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 142

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 142

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 142

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 375.

                     MAXHOLD
                     The maximum value is determined over several sweeps and dis-
                     played. The R&S EVSG1000 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 375.

                     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 375.

Return values:

<State>   **READY.**
                     The command was executed successfully.

Manual operation: See "Trace mode" on page 143

FSCAN_TRACE_AVRGCOUNT?
FSCAN_TRACE_AVRGCOUNT <trace average count>

Gets or sets the trace average count of the "RF Spectrum" mode.

Parameters:

<Trace average   Range: 0 to 100
count>

Return values:

<State>   **READY.**
                     The command was executed successfully.

Manual operation: See "Average Count" on page 143

10.8.2 Retrieving RF spectrum results

The following commands are required to retrieve results from RF Spectrum measure-
ments.

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.

10.9 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.

10.9.1 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 81
                            See "RF Mode" on page 81

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 146

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 146

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 147

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 146

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 146

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 375.

               MAXHOLD
               The maximum value is determined over several sweeps and displayed. The R&S EVSG1000 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 375.

               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 375.

Return values:

<State>   **READY.**
              The command was executed successfully.

Manual operation: See "Trace mode" on page 143

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 143

10.9.2 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.

10.10 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.

10.10.1 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 81

See "RF Mode" on page 81

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 154

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 154

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 84

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 153

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 153

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 153

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 153

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 152

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 154

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 156

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 154

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 153

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 153

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 75

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 375.

MAXHOLD

The maximum value is determined over several sweeps and displayed. The R&S EVSG1000 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 375.

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 375.

Return values:

<State>   **READY.**
The command was executed successfully.

Manual operation: See "Trace mode" on page 143

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 143

10.10.2 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 64

10.11 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.

10.11.1 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 81
                                See "RF Mode" on page 81

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 154

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 162

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 84

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 162

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 162

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 EVSG1000

                          LF_IN
                          An AF or low frequency signal is provided at the LF In input con-
                          nector on the rear side of the R&S EVSG1000.

Return values:

<State>   **READY.**
                          The command was executed successfully.

Manual operation: See "Input RF/LF" on page 75

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 165

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 166

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 166

10.11.2 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.

10.12 Data management

The following commands are required to configure data streaming and recording.

10.12.1 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 219

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 219

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 221

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>   **TRIG**
                Signal provided at the Trigger In connector

                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 8.2.2, "I/Q data recording and streaming", on page 218.

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 221

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 221

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 220

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 219

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.

10.12.2 Data streaming

The following commands are required for data streaming.

Useful commands for streaming described elsewhere:

- GBAS:STREAM on page 352
  GBAS:STOPSTREAM on page 352

Remote commands exclusive to data streaming:

GETDATADEF

This command defines the data delivered by GETDATASET on page 387.

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 387.
<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 249) 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 10.12.3, "Results for data streaming", on page 389

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.

10.12.3 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.

10.12.3.1 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.
```

10.12.3.2 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.
```

10.12.3.3 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.
```

10.12.3.4 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.
```

10.12.3.5 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.
```

10.12.3.6 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.
```

10.12.3.7 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
```

10.13 Information on commands

HELP?

Returns a list of all remote commands available for the R&S EVSG1000, including a short description.

Return values:

<CommandList>	List of commands, consisting of the command syntax and a short description.

Usage:	Query only

11 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.

11.1 Cleaning

Do not use any liquids for cleaning. Cleaning agents, solvents, acids and bases can damage the front panel labeling, plastic parts and display.

11.2 Handling batteries

The R&S EVSG1000 provides an optional internal battery pack (R&S EVSG-B3 Battery Pack)

Safe handling of batteries is described in Maintenance information is provided here.

Keep the batteries clean and dry. If the terminals become soiled, clean them with a dry, clean cloth.

Charging batteries

Charging batteries

Charge the battery before using it for the first time. Following a long storage period, it can be necessary to charge and discharge the battery several times to reach full capacity.

When charging the battery, observe the following:

* For charging, use only the R&S EVSG1000 or the R&S®FSV-B34 battery charger (1321.3950.02).
* If the instrument is connected to the provided AC/DC power supply connector or to an external DC power supply with more than 12 V DC, the internal battery is automatically charged, regardless whether the instrument is switched on or off.
* If the battery temperature rises above +53 °C, charging is interrupted until the temperature drops below +45 °C. Large temperature variations can also cause the charger to be switched off too early.
* Try not to overcharge the battery too often because overcharging reduces the service life of the battery.

Look up the following details in the data sheet:

* Charging conditions
* Recharging interval to avoid deep discharge

When the battery is being charged, the Power LED blinks. During operation, the status bar also indicates that the battery is being charged. See "Status bar" on page 39.

Table 11-1: Charging times

Used charger	Status	Approximate duration/h
Product	Running	12
	Standby	7
	Switched off	7
Rohde & Schwarz charger		4
Product/Rohde & Schwarz charger	After deep discharge	12
	Low temperatures between 0 °C and 5 °C	12

Storing batteries

Ideally, store the battery in the product and follow the instructions in Chapter 11.3, "Storage", on page 399. Otherwise, observe the following rules:

- Prevent short-circuiting of the batteries, which can happen if batteries touch each other or come into contact with metallic objects in the storage container. As storage container, you can use the product packaging.
- Do not expose to direct sunlight.
- Store the battery at room temperature.
- Store the battery at a state of charge between 50 % and 70 %.

To exchange the battery pack

Use only the original battery pack R&S EVSG-B3 Battery Pack (1329.8821.02).

1. Switch off the instrument.

2. Disconnect the instrument from any power supply.

3. Unscrew the fours screws on the panel labeled "R&S EVSG-B3 Battery Pack" on the back of the instrument.

4. Remove the panel.

5. Grasp the battery by the attached plastic strip and pull it to the right and upwards.

6. Lift the battery pack out completely.

7. Carefully place the new battery pack into the slot with the writing facing upwards and not upside-down.

8. Push the battery pack to the left until you feel it snap into place, ensuring a tight connection.

   A space about 2 fingers wide remains to the right of the battery pack. This is where the notch of the metal panel fits in.

9. Replace the panel over the battery pack so the metal notch rests in the empty space.

10. Fasten the four screws to close the battery pack slot.

11. Reconnect the instrument to the power supply to charge the new battery.

11.3 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.

11.4 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 11-1: 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.

Disposing batteries

A product that contains a battery cannot be disposed of in the normal household waste after it has come to the end of its service life. It is labeled as follows:

Figure 11-2: Disposal information in line with EU battery directive

Dispose of batteries as specified by the local waste disposal agency. Alternatively, you can contact the Rohde & Schwarz local service representative.

For information on returning batteries to Rohde & Schwarz subsidiaries, see "Handling batteries safely" on page 15.

12 Transporting

Lifting and carrying

See:

*   Chapter 1.4.2, "Lifting and carrying", on page 19.

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.

Transport altitude

The maximum transport altitude without pressure compensation is specified in the data sheet.

13 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 13-1: 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 EVSG1000 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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