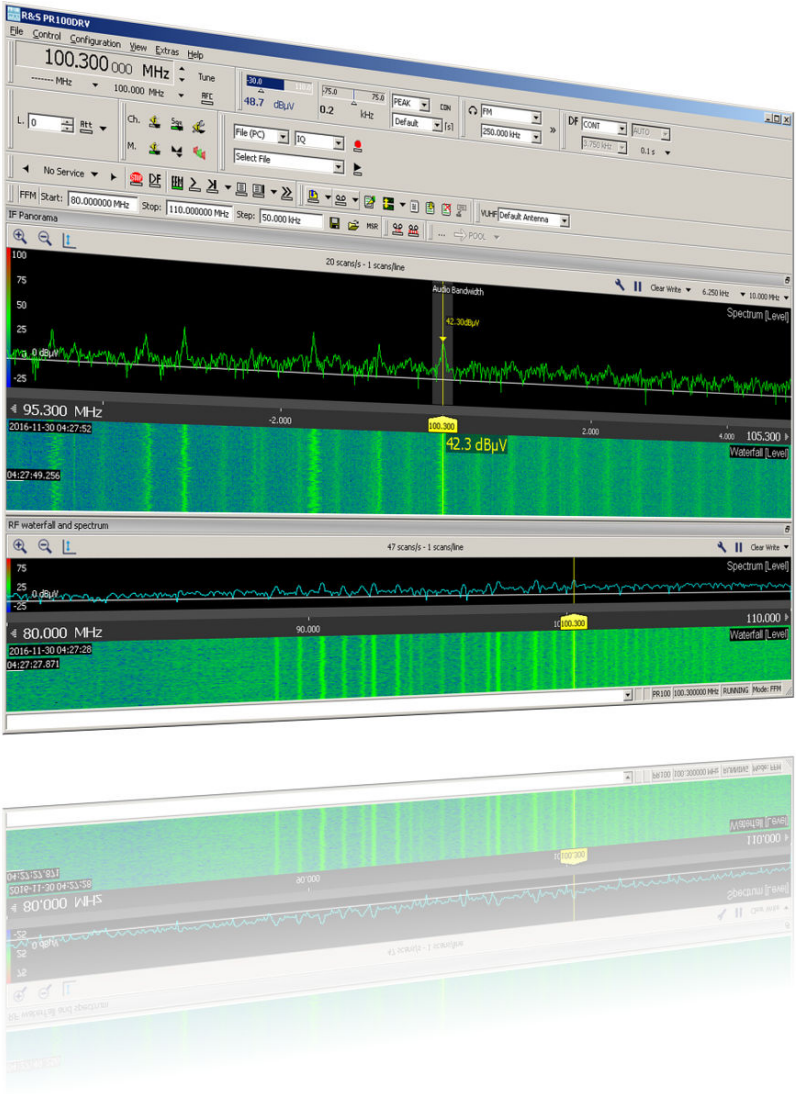
# R&S®PR1-CTL
# PR100 Control Software
# User Manual




3020.8158.02 ─ 07

Monitoring and Network Testing

User Manual

ROHDE&SCHWARZ

This manual describes the following R&S® products:

- R&S®PR1-CTL (3020.8164.02)

The software contained in this product makes use of several valuable open source software packages. For information, see the "Open Source Acknowledgment" link in the "Help" menu.
Rohde & Schwarz would like to thank the open source community for their valuable contribution.

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Throughout this manual, R&S® is abbreviated as R&S. For example, R&S®PR100 is abbreviated as R&S PR100.

# Contents


**1 Introduction ... 7**

**1.1 Overview ... 7**

1.1.1 Naming Conventions ... 7

**1.2 Copyright ... 7**

**1.3 System Requirements ... 7**

**1.4 Documentation ... 8**

1.4.1 Disclaimer ... 8

1.4.2 Conventions ... 8

1.4.3 Typographical Conventions ... 9

1.4.4 Related Documents ... 9

**2 Preparation for Use ... 11**

**2.1 Installation ... 11**

2.1.1 Variants ... 11

2.1.2 Installation Process ... 11

**3 Operating Instructions ... 21**

**3.1 Introduction ... 21**

**3.2 Start-Up ... 21**

3.2.1 Environment requirements for the R&S PR1-CTL client and server installation ... 21

3.2.2 Changing the Device Ethernet LAN settings ... 21

3.2.3 Changing the IP address in the software ... 22

**3.3 Closing the R&S PR1-CTL GUI ... 22**

**3.4 Application Window ... 22**

**3.5 Menu Bar ... 24**

3.5.1 File Menu ... 24

3.5.2 Control Menu ... 25

3.5.3 Configuration Menu ... 28

3.5.4 View Menu ... 42

3.5.5 Extras Menu ... 42

3.5.6 Help Menu ... 43

**3.6 Toolbars ... 43**

3.6.1 Frequency Control ... 44

3.6.2 Level Offset Toolbar....51
3.6.3 Demodulation Settings....52
3.6.4 Audio....53
3.6.5 Standard Toolbar....55
3.6.6 Tools Toolbar....63
3.6.7 Antenna Toolbar....66
3.6.8 Antenna Settings....67
3.6.9 Modus Editor Toolbar....67
3.6.10 Emission Detection....68
3.6.11 Recording and Replay....73
3.6.12 DDF Settings....78
3.6.13 Handover Toolbar....79
3.6.14 Amrec Toolbar....80
3.6.15 Measurement Results Toolbar....82
**3.7 Spectrum Display....83**
3.7.1 Toolbar....84
3.7.2 Spectrum....84
3.7.3 Frequency Axis....86
3.7.4 Waterfall....88
3.7.5 Background Context Menu....88
3.7.6 Configuration Dialog....91
3.7.7 Spectrum Display - Additional Features....97
**3.8 Direction Finding View....100**
3.8.1 Device frequency mode setting....101
3.8.2 Polar Display....102
**3.9 Status Bar....103**
**3.10 Reporting....104**
**3.11 Recordings....104**
3.11.1 Scan-Recording....104
3.11.2 IF-Recording....104
3.11.3 Audio-Recording....104
3.11.4 CSV Recording....105
**3.12 Omni Phase Calibration....105**

3.12.1 Omni Phase Calibration Wizard.....106
3.12.2 Upload Correction Data.....108
3.12.3 Applying correction data.....109
**3.13 Hotkeys.....110**

**4 Typical Operation.....113**
**4.1 General.....113**
**4.2 Monitor Single Frequencies.....114**
**4.3 Frequency Scan.....114**
**4.4 PSCAN.....115**
**4.5 Search.....115**
**4.6 MScan/MSearch.....116**
**4.7 Client Server Remote Control as Option (RA-RC).....116**

# 1 Introduction

## 1.1 Overview

This manual describes the R&S PR1-CTL. The R&S PR1-CTL is used to search and monitor different frequency ranges in the HF, VHF, UHF and SHF area. It allows the operator to scan for multiple signals manually or automatically and to tune to signals for detailed examination. Many types of radio signals can be handled by the configuration of a wide range of signal parameters as well.

The R&S PR1-CTL is a PC-based measurement and monitoring system (stationary or mobile) software that allows to remotely control the operation of the receiver.

The R&S PR1-CTL supports several operational modes which can be used for different tasks:

- FFM: Fixed Frequency Mode - This mode is used to monitor radio communications on fixed frequencies
- SCAN/SEARCH - These modes are used to scan/search for communication channels in a frequency range or to observe channels with known frequencies
- DF: Direction Finding - These modes are used to determine the direction a signal is received from

### 1.1.1 Naming Conventions

The R&S PR1-CTL is in general part of the RAMON software suite. In this framework it can be used to control the receiver.

The R&S PR1-CTL is integrated in the system environment of RAMON. This R&S PR1-CTL, as it will be called is part of the RAMON software suite and has the standard design of Ramon receiver GUIs.

## 1.2 Copyright

This document contains proprietary information to Rohde & Schwarz and shall not be used, disclosed and/or duplicated, printed or copied except in accordance with express written authorization from Rohde & Schwarz.

## 1.3 System Requirements

The computer on which this software is to be installed should meet the minimum system requirements defined in Table 1-1.

*Table 1-1: Minimal system requirements*

| | **required** |
|---|---|
| CPU | Intel® Core™ i5 CPU |
| OS | Windows 10 |
| RAM | 4 GB without database, 16 GB with database |
| Required Hard Disk space | 2 GB without database, 20 GB with database |
| Graphics card | at least OpenGL® 2.1 or later compatible |
| LAN adapter | 1 Gbit/s, RJ-45 connector |
| NOTES:<br>Intel® is a trademark of Intel Corporation or its subsidiaries in the U.S. and/or other countries.<br>OpenGL® and the oval logo are trademarks or registered trademarks of Silicon Graphics, Inc. in the United States and/or other countries worldwide. | |

**R&S RAMON Workstation/Server**

A typical R&S RAMON workstation or server consists of several separate software products. The system requirements for such combinations typically exceed those stated here.

## 1.4 Documentation

This document is designed to describe how to use the R&S PR1-CTL. It does not describe the hardware nor describe how to operate in different search and monitoring scenarios. For further descriptions see the related documents below.

### 1.4.1 Disclaimer

Every effort has been made by Rohde & Schwarz to make sure that the information contained within this document is accurate and correct. However, slight differences may exist between the documentation and particular installations.

The screenshots within this document may show features that are only available with a certain option.

The contents of screenshots are intended as examples only.

### 1.4.2 Conventions

The following elements are used in this document.

**Tip**

Tips give hints such as how to produce more accurate results or optimize calculation speed.

**Hint**

Points out important points to be considered.

**NOTICE**

**Notice**

Hints to possibly unexpected program behavior.

**CAUTION**

**Caution**

Indicates situations where data loss may occur.

### 1.4.3 Typographical Conventions

The following text markers are used in this document:

***Table 1-2: Typographical conventions***

| Convention | Description |
|---|---|
| "Graphical user interface elements" | All names of graphical user interface elements on the screen, such as dialog boxes, menus, options, buttons and softkeys are enclosed by quotation marks. |
| KEYS | Key names are written in capital letters. |
| `Filenames and commands` | Filenames, commands and screen output are distinguished by their font. |
| *input* | Input to be entered by the user is displayed in italics. |
| Links | Links that you can click are displayed in blue font. |
| "References" | References to other parts of the document are enclosed by quotation marks. |

### 1.4.4 Related Documents

The following documents are related to this manual:

# 2 Preparation for Use

## 2.1 Installation

### 2.1.1 Variants

The R&S PR1-CTL is delivered in two variants, a standalone version and a system version. In the standalone version, a CD containing the R&S PR1-CTL is included with the shipment. This CD can be used to install the R&S PR1-CTL on one PC. The system version of the software is used to operate the R&S PR1-CTL as part of the RAMON software family, using all the interfaces to other RAMON software.

### 2.1.2 Installation Process

This chapter uses ESMD screenshots. During installation, dialogs will show R&S PR1-CTL captions and pathnames instead.

To install the R&S PR1-CTL, insert the CD containing the software into the CD-drive. The setup starts automatically. During installation, you will be asked several questions to configure the software correctly.

In the Customize Setup screen, select default or extended installation (Figure 2-1).

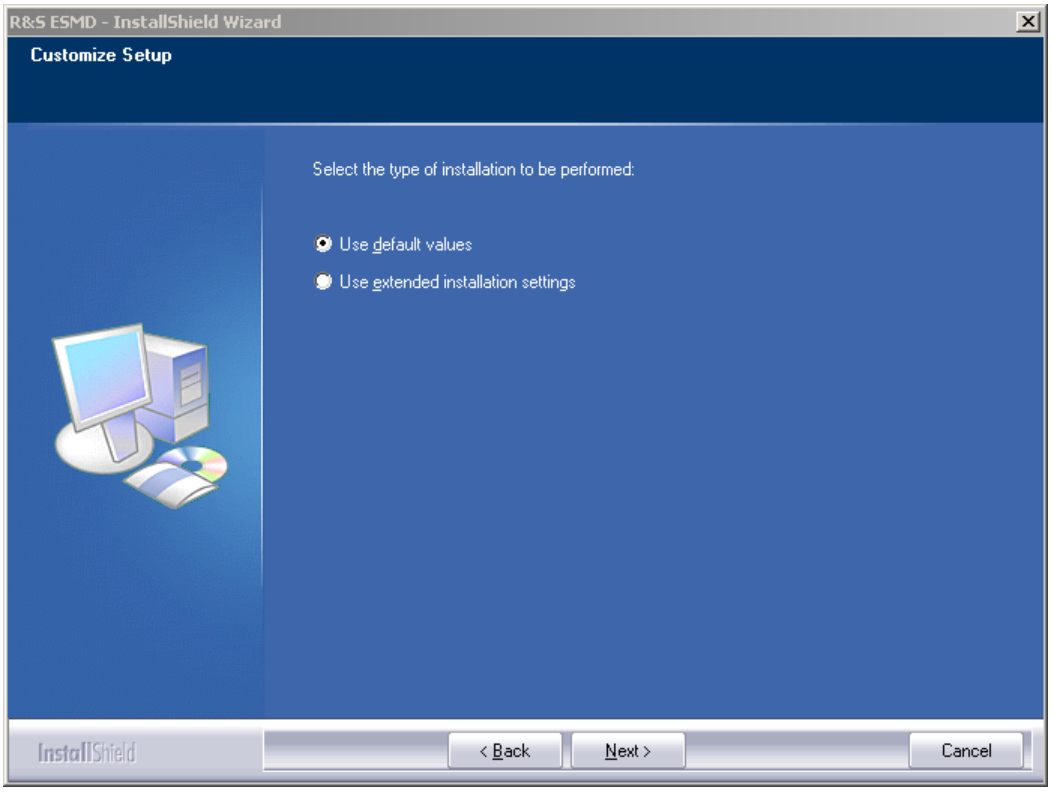



*Figure 2-1: Default or extended installation*

### 2.1.2.1 Installation with Default Values

If you select the default values, the only thing that needs to be configured is the IP address (Figure 2-2) so that the R&S PR1-CTL knows where to locate the receiver.

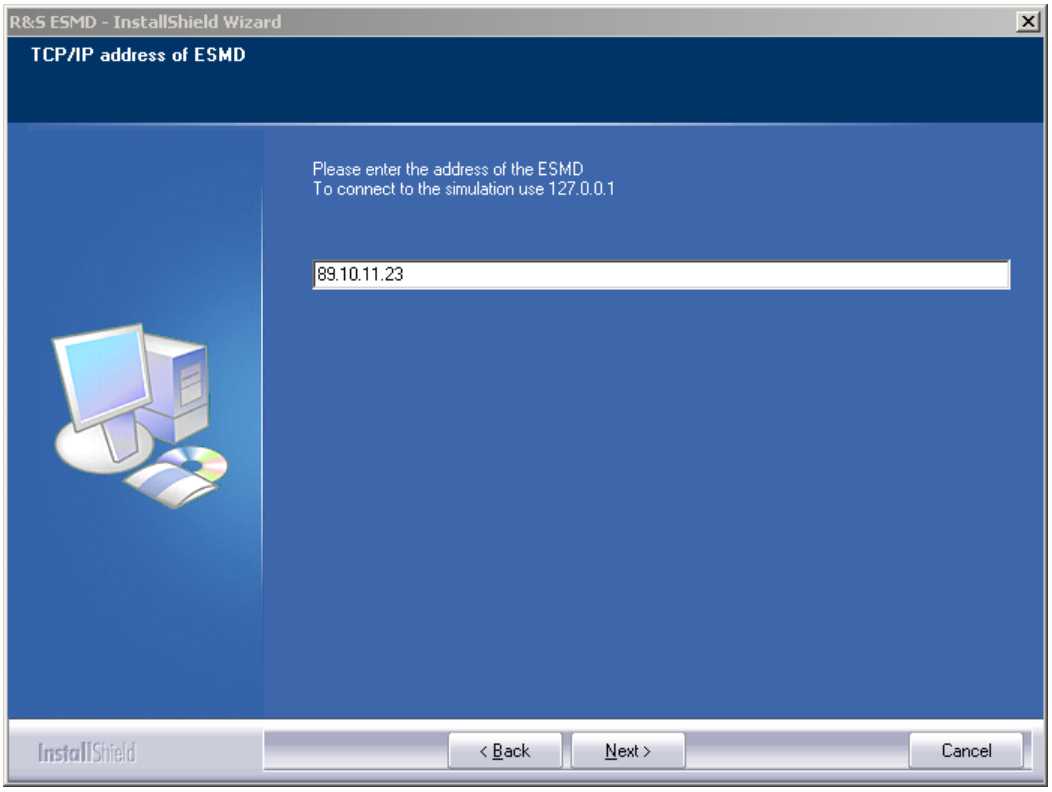



***Figure 2-2: Setting the IP during installation***

After completing the settings for the R&S PR1-CTL, a summary will be shown (Figure 2-3).

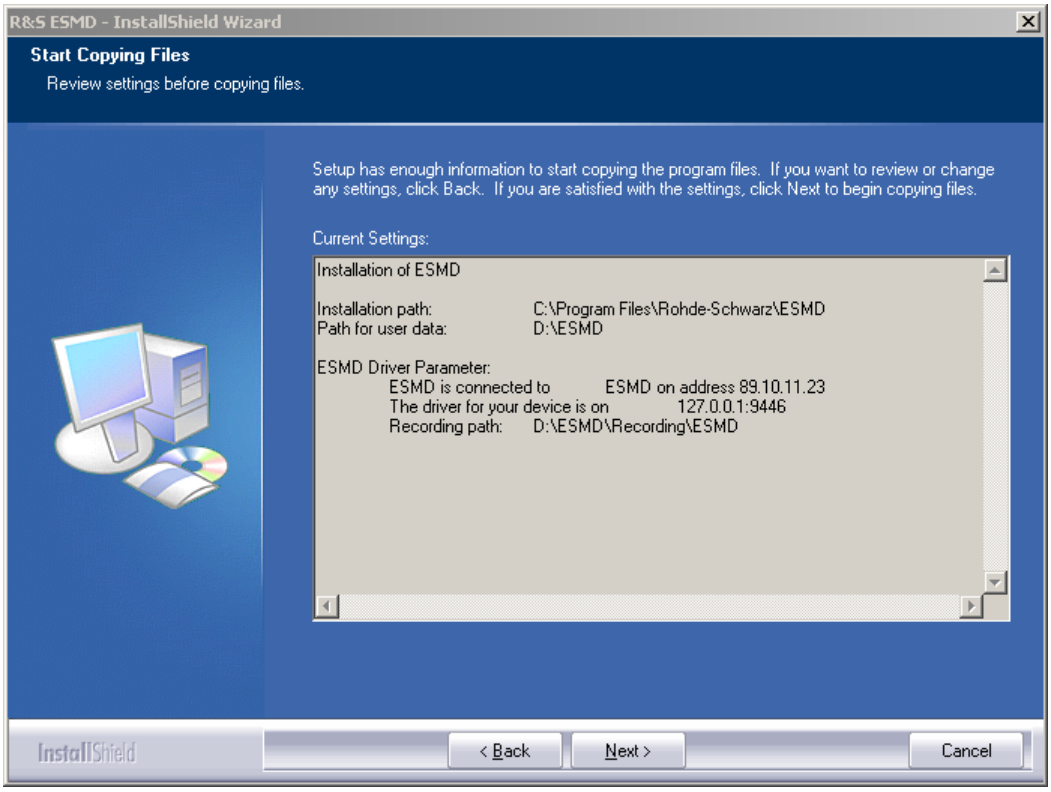



*Figure 2-3: Summary of the installation settings*

### 2.1.2.2 Installation with Extended Settings

If you select this option, more settings can be changed. In the Choose Destination Location screen, you can change the installation directory (Figure 2-4).

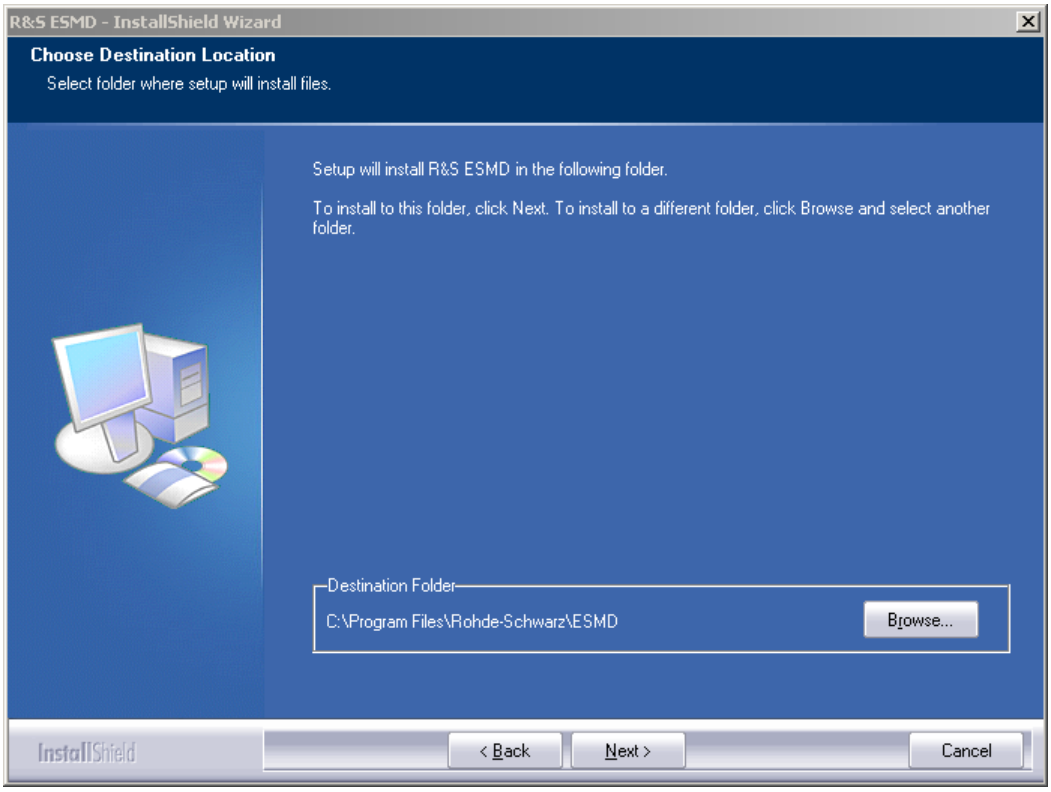



*Figure 2-4: Choosing the installation folder*

Next, enter the folder where all data created during operation will be stored (Figure 2-5).

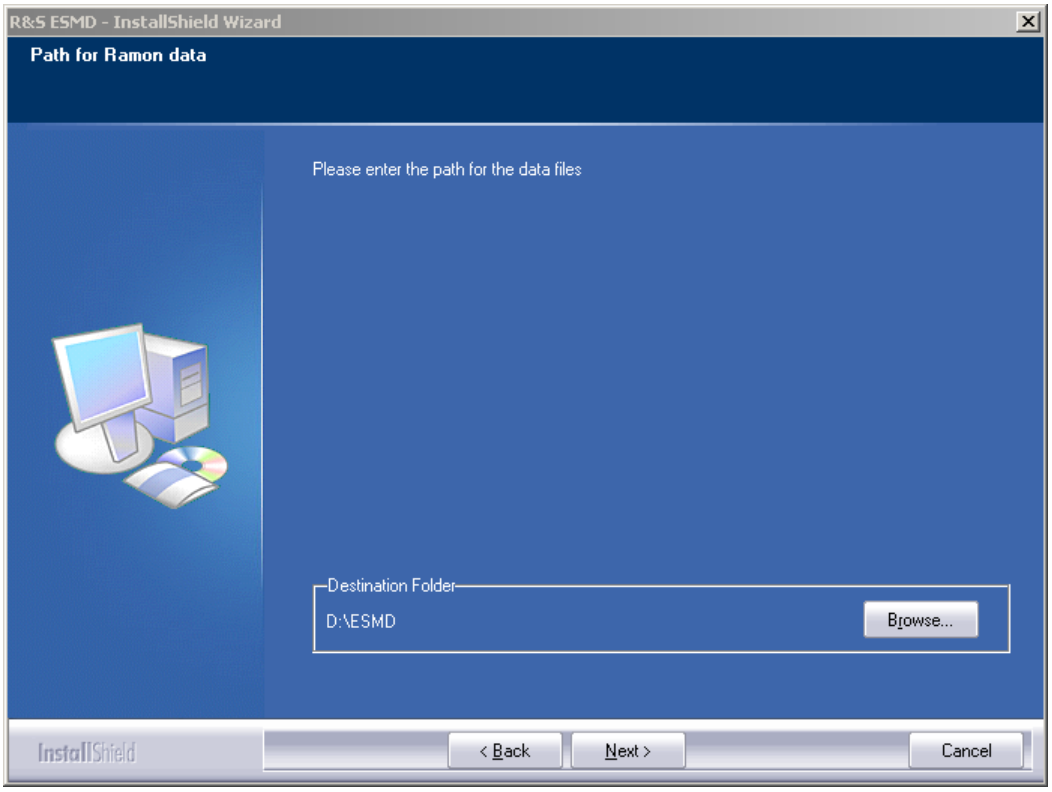



*Figure 2-5: Choosing the data folder*

In the Icon screen, you can select to install the software for the current windows user only, or for all users on this pc (Figure 2-6).

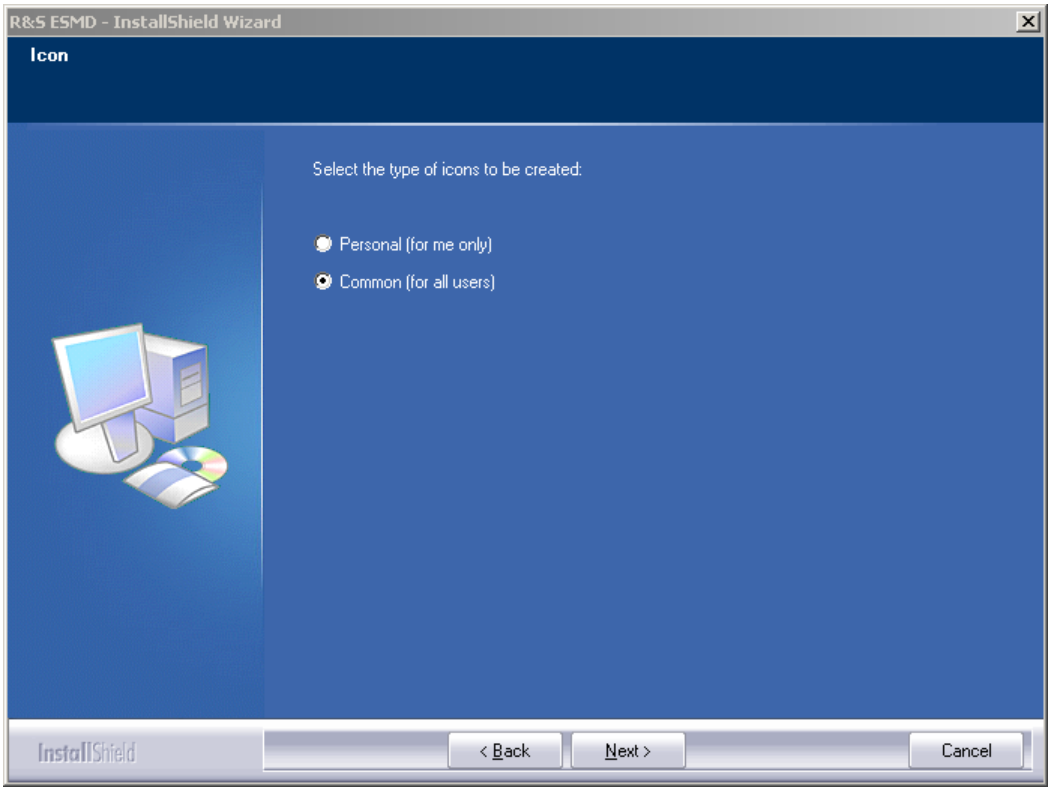



*Figure 2-6: Choosing personal or common installation*

It is possible to install up to four instances (Figure 2-7) of the R&S PR1-CTL. This means that it is possible to control up to four receivers from one control PC.

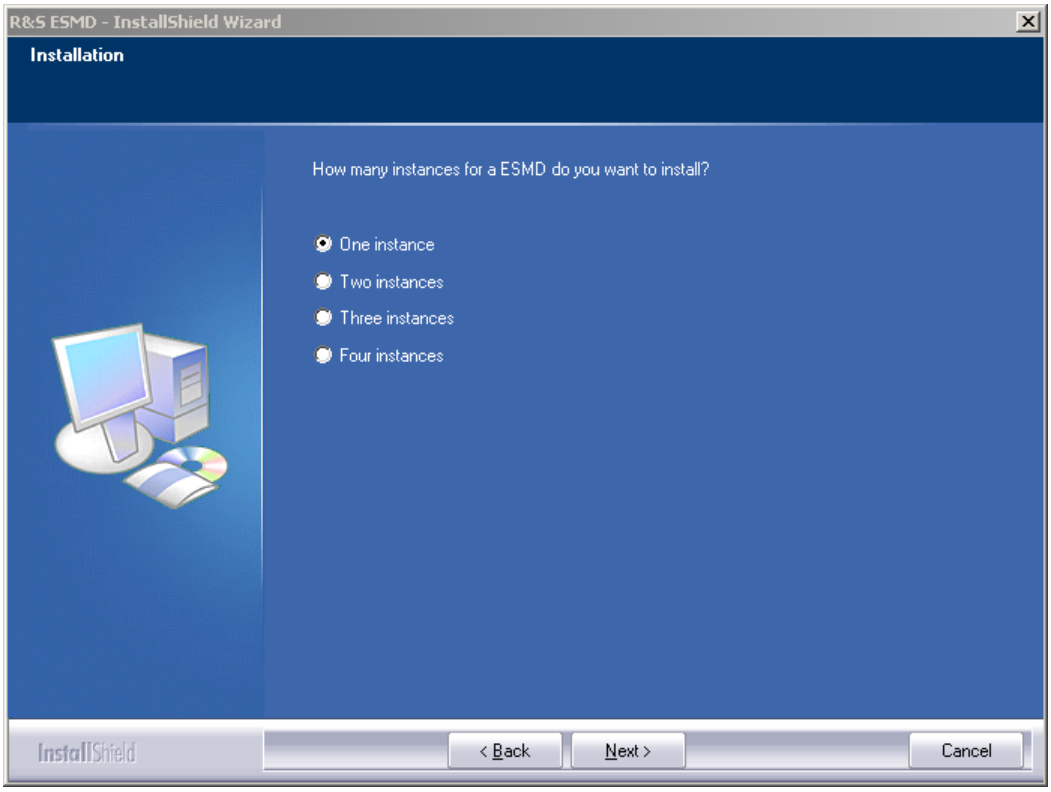



*Figure 2-7: Choosing how many instances to install*

For each instance, it is necessary to set the correct IP address of the receiver that the instance connects to (see Figure 2-8).

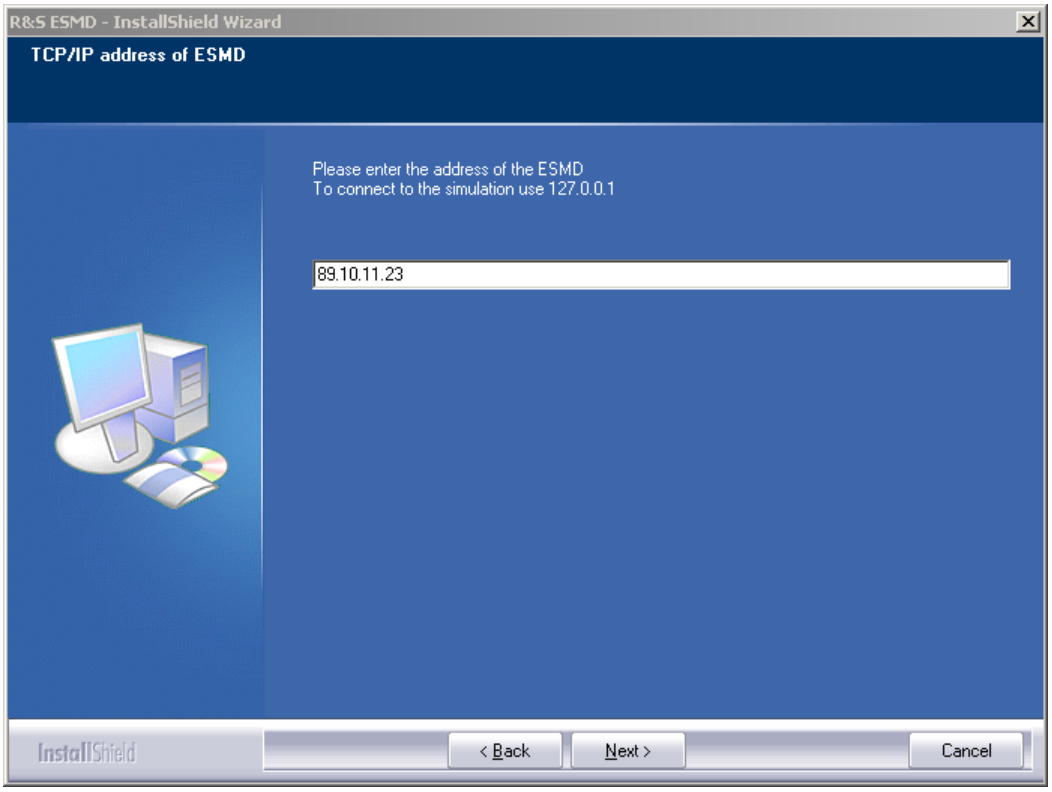



*Figure 2-8: Setting the ip during installation*

Before starting the installation, a summary of all relevant information is displayed (Figure 2-9). You can verify the settings and return to the configuration screens if necessary.

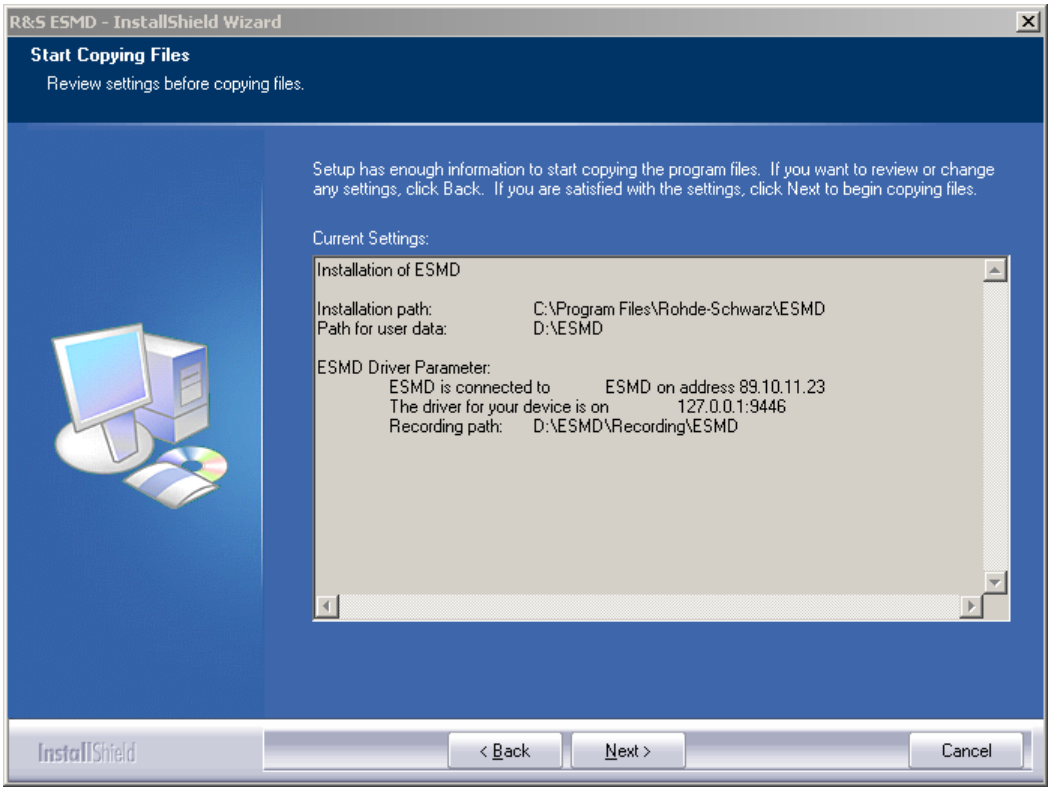



*Figure 2-9: Summary of the installation settings*

# 3 Operating Instructions

## 3.1 Introduction

The R&S HF-VHF-UHF-SHF Receivers can be controlled by means of the Windows application described in this Manual. The following sections describe how to operate the R&S PR1-CTL software. For a quick start please refer to the chapter "Typical Operation".

The R&S Direction Finders can be controlled by means of the Windows application described in this Manual. The following sections describe how to operate the R&S PR1-CTL software. For a quick start please refer to the chapter "Typical Operation".

## 3.2 Start-Up

### 3.2.1 Environment requirements for the R&S PR1-CTL client and server installation

Please verify the following issues before starting the R&S PR1-CTL on the Server PC:

- An Ethernet LAN connection is established to the device.
- The Ethernet LAN address and the Subnet Mask have to be set correctly.

There are two ways to start the R&S PR1-CTL.

- Double-click the icon on the desktop of the PC.
- Click on the Start button, goto Programs – R&S Ramon – R&S PR1-CTL and click on the application link.

The name is equivalent to the selection during the installation procedure (Change GUI name).

The R&S PR1-CTL GUI might be running on several workstations at the same time for the same device.

### 3.2.2 Changing the Device Ethernet LAN settings

Please refer to the device manual for further information.

### 3.2.3 Changing the IP address in the software

The LAN settings can be set during the installation. After the installation is complete the settings can also be changed by starting the application, opening the "Extras" Menu, clicking on Options and then activating the second flag "Configuration". Here the entry DLL3_ConfigDRV/Config/Address can be set to the new IP address.

The new ip address setting will be activated after restarting the software.

## 3.3 Closing the R&S PR1-CTL GUI

There are three ways to quit the R&S PR1-CTL application:

- Select the **Exit** option from the file menu in the menu bar.
- Click the Alt+F4 key combination.
- Click the control menu box and close the application as known from standard Windows usage.

## 3.4 Application Window

Throughout this manual, you may notice screenshots with other device names being used for illustrations purposes. Your application screen will show the actual R&S PR1-CTL captions and pathnames instead.

On startup of the R&S PR1-CTL application, the main application window (Figure 3-1) is displayed.

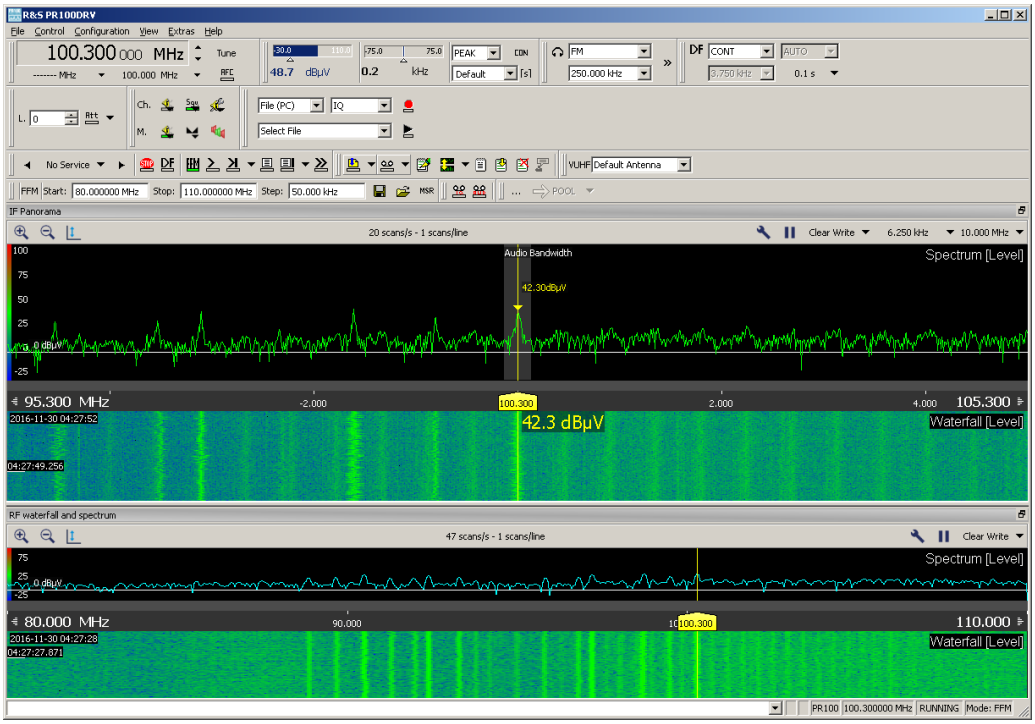



*Figure 3-1: Main Window*

- **Title Bar:**
  In the Title bar the name of the R&S PR1-CTL application is displayed. It also offers a button for closing and resizing the R&S PR1-CTL.
- **Menu Bar:**
  With the Main Menu bar the operator is able to control the receiver and to adjust view of the R&S PR1-CTL. For further information please refer to the chapter Menu Bar (Chapter 3.5, "Menu Bar", on page 24).
- **Toolbars:**
  With the Toolbar the operator is able to control the most important functions of the receiver. For further information please refer to the chapter Toolbar (Chapter 3.6, "Toolbars", on page 43).
- **Spectrum Displays:**
  The size of the spectrum displays can be changed by clicking with the left mouse button on the line separating the spectrum windows and dragging the line. For further information please refer to Chapter 3.7, "Spectrum Display", on page 83.
  - 2D IF spectrum and waterfall display: the visibility of different spectrum displays can be configure in View Selection window, which can be activated by clicking the View Selection button. Toggling of views can be done by pressing F9 key or by clicking the more button then selecting it from dropdown menu.
  - RF spectrum and waterfall display: this display is available in all operating modes.
- **Status Bar:**
  The status bar displays information about the mode of operation. For further information please refer to the Chapter 3.9, "Status Bar", on page 103.

## 3.5 Menu Bar

*Figure 3-2: Menu Bar*

The Menu Bar consists of the following menus:

- File
- Control
- Configuration
- View
- Extras
- Help

The menu items may be selected via the mouse button or by pressing the Alt key and entering the underlined character of the menu name.

### 3.5.1 File Menu

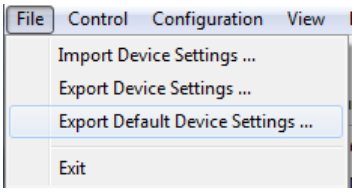



*Figure 3-3: File-Menu*

#### Import Device Settings

Load the device settings from a file in XML format. Report files generated by ToReport can be used for importing the device settings. The settings will reflect on the Ramon GUI.

#### Export Device Settings

Saves the current settings to a file in XML format. All settings such as FFM, Scan, DF and Audio are exported into one file. The user can select where the file will be saved.

#### Export Default Device Settings

Saves the current settings as the default settings in XML format to be loaded at driver startup.

All settings such as FFM, Scan, DF and Audio are exported into one file. File is created on the working directory of the driver's machine with the following filename "<Device-Type>_Startup_Settings.xml.

**Exit**

Closes the R&S PR1-CTL.

### 3.5.2 Control Menu

Menu Control allows you to control the operation modes of the R&S PR1-CTL.

**Stop**

R&S PR1-CTL stops any search, scan and Fixed Frequency Mode (FFM) activity and switches to silent mode. The datastreams are stopped. There will be no traffic from the device to the control software.

**Fixed Frequency Mode**

R&S PR1-CTL stops any search or scan operation in order to monitor a single frequency given in the frequency edit field.

**Panorama Scan**

R&S PR1-CTL starts a scan of the frequency range defined in the Scan / Search section of the toolbar. The frequency step can be set to predefined discrete values of 3.125 kHz, 6.25 kHz, 12.5 kHz, 25 kHz, 50 kHz and 100 kHz.

**Note:** This mode is only available if the device is equipped with the option “PS” .

**Scan**

R&S PR1-CTL starts a scan of the frequency range defined in the Scan / Search section of the modus editor toolbar. No hold and dwell time are considered. The RF spectrum and waterfall views will be displayed.

**Search**

Searches the frequency range that is defined in the Scan / Search section of the toolbar for active signals (signal level above threshold).

**MScan**

Switches to Memory Scan.

**MSearch**

Searches the frequency list that is defined in the frequency store for active signals (signal level above threshold). The frequency store can be filled e.g. with the menu / toolbar <add frequency> item.

**Reset R&S PR1-CTL**

Resets the device.

### Compass Calibration

Opens a dialog where you can calibrate the compass.

- This menu item will be available if an antenna connected to the device has a GH150 compass mounted on it.
- An 8-point calibration process is used. The antenna must be rotated in 45° steps with a tolerance of ±15°.

### Download File from Receiver

Opens a dialog where you can select a file for download (Figure 3-4). The file will be saved in the standard recording directory.

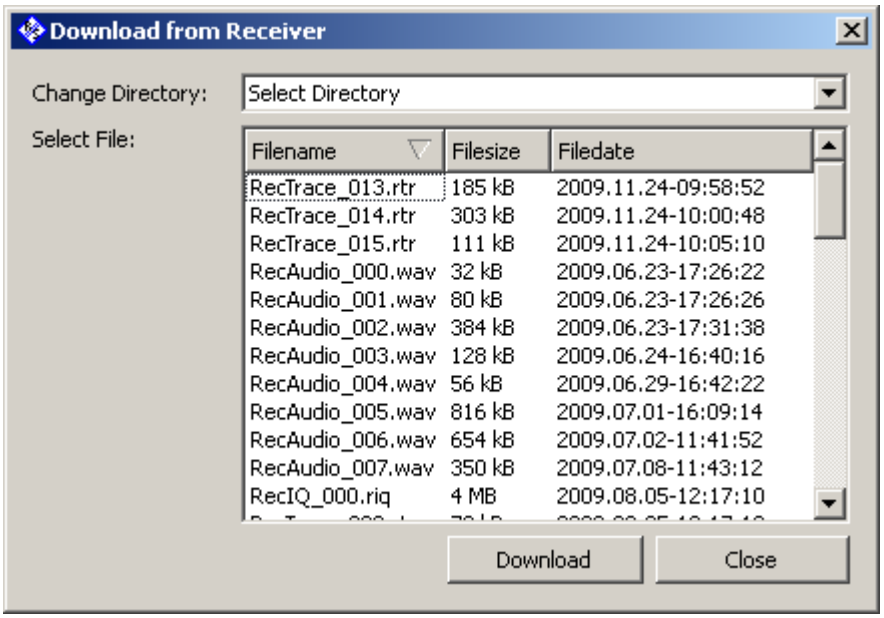



*Figure 3-4: Download File From Receiver*

### LogPer Antenna Rotator

When the rotor device, Antenna.xml, and antenna settings are properly configured, the LogPer Antenna Rotator window is displayed. Otherwise, an appropriate warning screen appears.

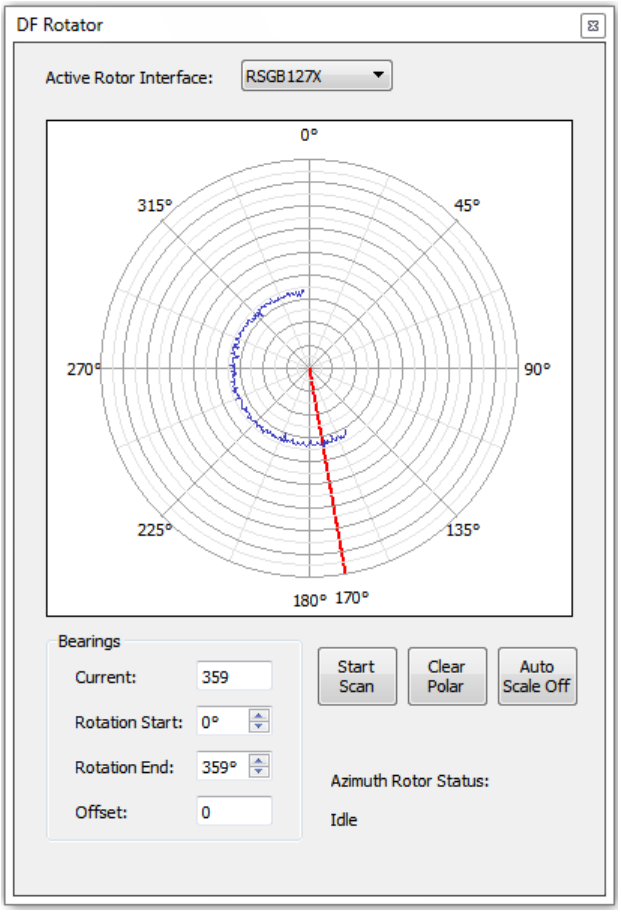



*Figure 3-5: LogPer Antenna Rotator Window*

To control the azimuth rotor from the receiver, the following conditions must be met:

- Radionet's rotor driver is running and an antenna is connected to the rotator
- Antenna connected to the rotator must be defined in Antenna.xml. RotorInterface-Name is the rotor driver type defined in Radionet rs.ini (ie. RotorDriver-Type=RSGB127x).

```
<!-- RotorInterfaceName is the rotor driver type defined in Radionet rs.ini
<Antennas>
        <MatrixOut>4</MatrixOut>
        <Antenna>
                <Name>Antenna1</Name>
                <InternalNumber>0</InternalNumber>
                <ExternalNumber>1</ExternalNumber>
                <FrequencyRange>
                        <StartFrequency>9000</StartFrequency>
                        <StopFrequency>20000000</StopFrequency>
                </FrequencyRange>
                <RotorInterfaceName>RSGB127x</RotorInterfaceName>
        </Antenna>
</Antennas>
```

**Operation:**

Define the start and end bearings of the rotation.

Click the "Start Scan" button, the directional antenna mounted on a mast is rotated step-by-step through the angle range. The measurements are displayed in a level-azimuth diagram in windrose.

The results are evaluated after all azimuth steps have been performed or the operator has stopped the measurement. The angle with the maximum level is preselected and a corresponding bearing value is displayed in windrose as a red beam.

The bearing result is then transferred to MapView where the bearing result is displayed on a digital map. A location can be determined, if the bearing results from different locations are stored and used in Locate control. The operator can also modify the bearing result by selecting the final bearing value in windrose.

Rotators with Radionet rotor driver (ie. GS232B, GB127X family) will work with this feature. This functionality works in FFM and WFFM modes only where the level signals are valid.

## 3.5.3 Configuration Menu

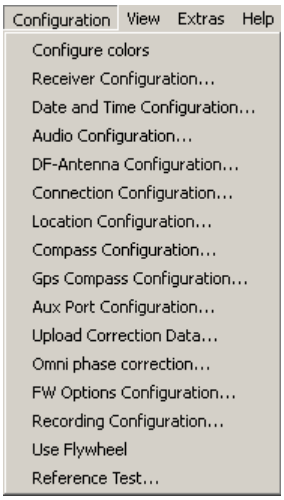



***Figure 3-6: Configuration Menu***

### 3.5.3.1 Configure Colors

A dialog for the color configuration of the application is displayed.

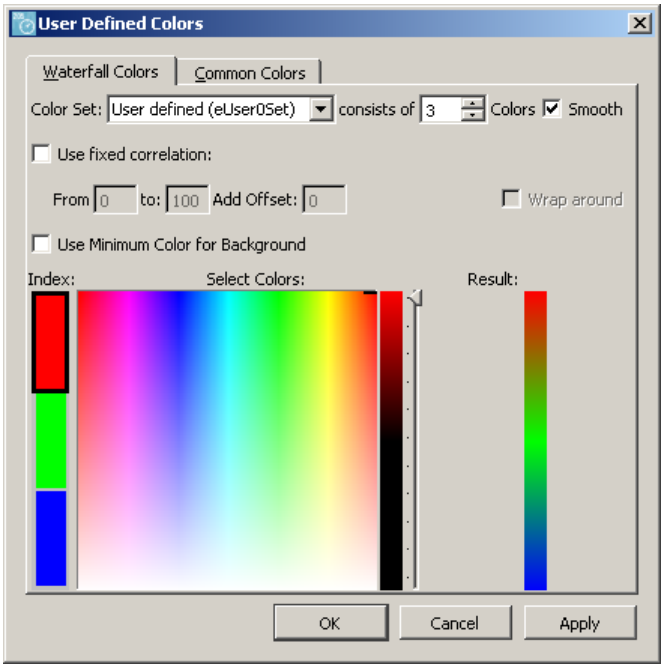



*Figure 3-7: Configure Colors*

### 3.5.3.2 Receiver Configuration

A dialog for the receiver configuration is displayed. Refer to the device manual for further information.

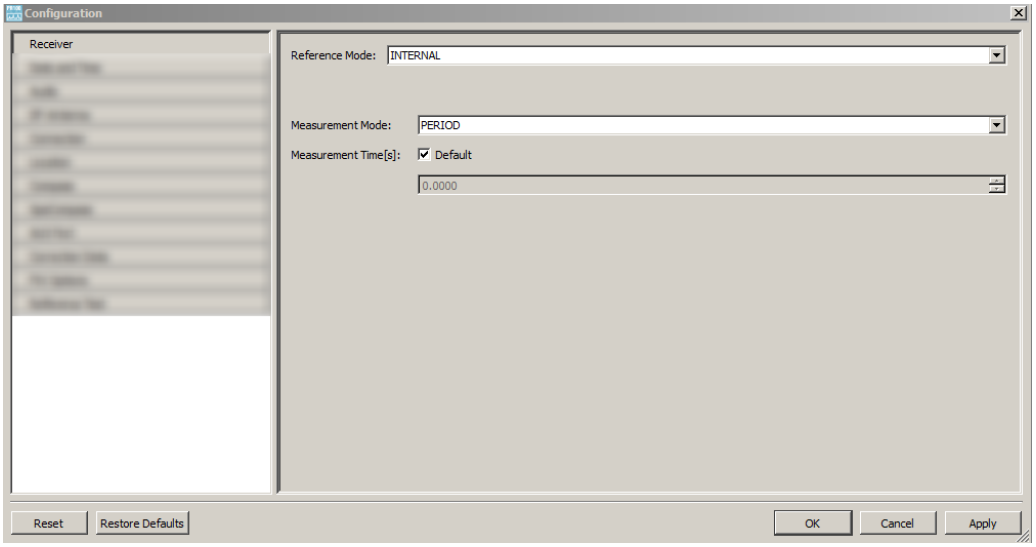



*Figure 3-8: Receiver Configuration*

### 3.5.3.3 Date and Time Configuration

A dialog for the date and time configuration is displayed. You can choose whether to synchronize the time between the PC and the device or not. If you choose no synchronization, the device and PC time will not change. Hence, the times may have mismatched values. Pressing the Apply button only changes the value but does not actually synchronize the time.

You can set the "Start Of Receiver Clock" to "AUTOMATIC" or "EXTERNAL" to determine when to start the clock. Choosing option "EXTERNAL" requires a properly connected GPS PPS device otherwise the clock will stand still.

" Date and Time Source" has 3 options: MANUAL, NTS and GPS. Each sections unlock further corresponding configuration options in the dialog.

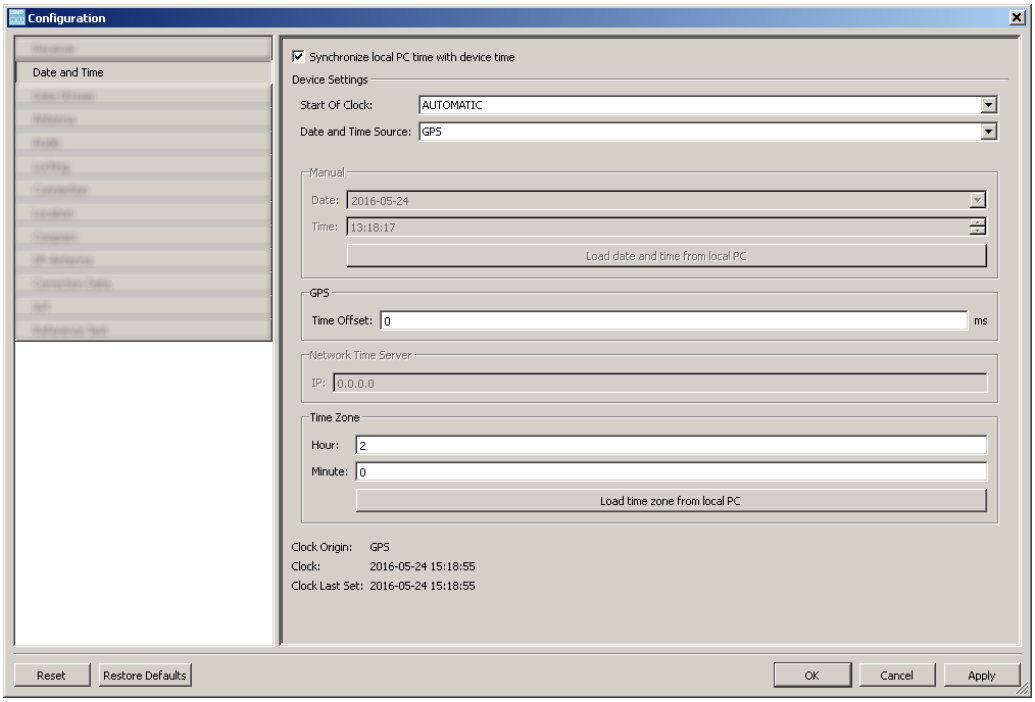



*Figure 3-9: Date and Time Configuration*

Select Manual to input the date and time manually or get the date and time of the PC and set it on the device.

Select NTS to set the clock from a Network Time Server. The device will ask the configured network time server exactly once for the actual date / time. There is no NTP protocol involved.

Select GPS to set the clock from the GPS device connected to the device. Location and time source can be GPS or Manual

**Note:** By changing the date and time source, location source may also be affected due to device limitations. Hence, changing the date and time source to GPS automatically changes the location source to GPS and vice versa. Changing the date and time source to MANUAL automatically changes the location source to MANUAL and vice versa. A notification message stating the issue is depicted in the event of a conflict.

Set the timezone manually or from local PC. This timezone is applicable for NTS and GPS settings.

Click the Apply button to show the clock origin which can be NTS, GPS, Manual or RTC. This parameter informs you whether the settings are valid enough as source for the receiver clock.

Receiver clock shows the updated time. Clock Last Set shows the date and time of the last update on the clock settings.

*Apart from Manual input of date and time, the Clock Origin still depends on the validity of NTS server or on the GPS streaming.*

### 3.5.3.4 Reference Test

Reference Test Configuration is used for creating reference data file for frequencies to monitor, performing current measurements which are then compared against the reference data and saving the comparison results.

The measured data consists of:

- Level
- Azimuth
- DF Level
- DF Quality

**Note:** DF data would only be shown for devices with DF option installed.

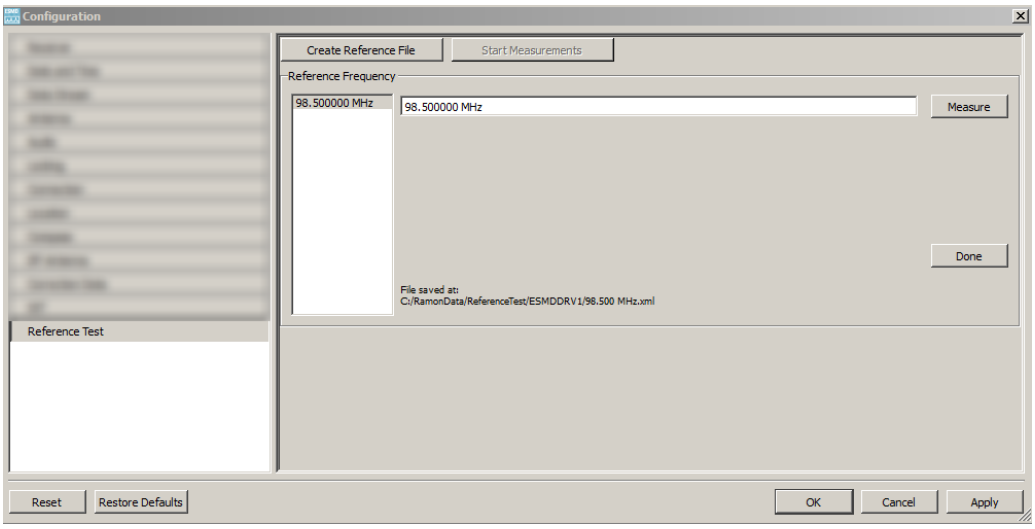



***Figure 3-10: Reference Test Configuration***

Launch the Reference Test dialog by selecting "Reference Test" from Configuration menu. Upon selection of the menu item, a dialog with two options, i.e. Create Reference File and Start Measurements are displayed.

**Create Reference**

Select “Create Reference File”. The dialog opens with center frequency displayed in the edit box. This can be changed to the frequency that needs to be created as reference.

Once the correct frequency is entered in the edit box, click “Measure”. The frequency is added in the list on the left and reference measurement is saved in the driver’s working directory under:

/ReferenceTest/<DeviceDriverName>/98.700 MHz.xml

**Start Measurements**

Select “Start Measurements”. The same controls as Create Reference File are shown with a list of predefined frequencies but you cannot enter any frequency other than what is on the list.

Click on the list to select the desired frequency to be measured.

Click on “Measure” to get the current measurements.

Save the result containing the difference between the reference data and current data with the same settings. The result in xml format is saved in the driver’s working directory under:

/ReferenceTest/<DeviceDriverName>/98.700 MHz_Result.xml

### 3.5.3.5 Connection Configuration

Connection configuration can be used to set the IP address and port number of the device which the control software connects to.

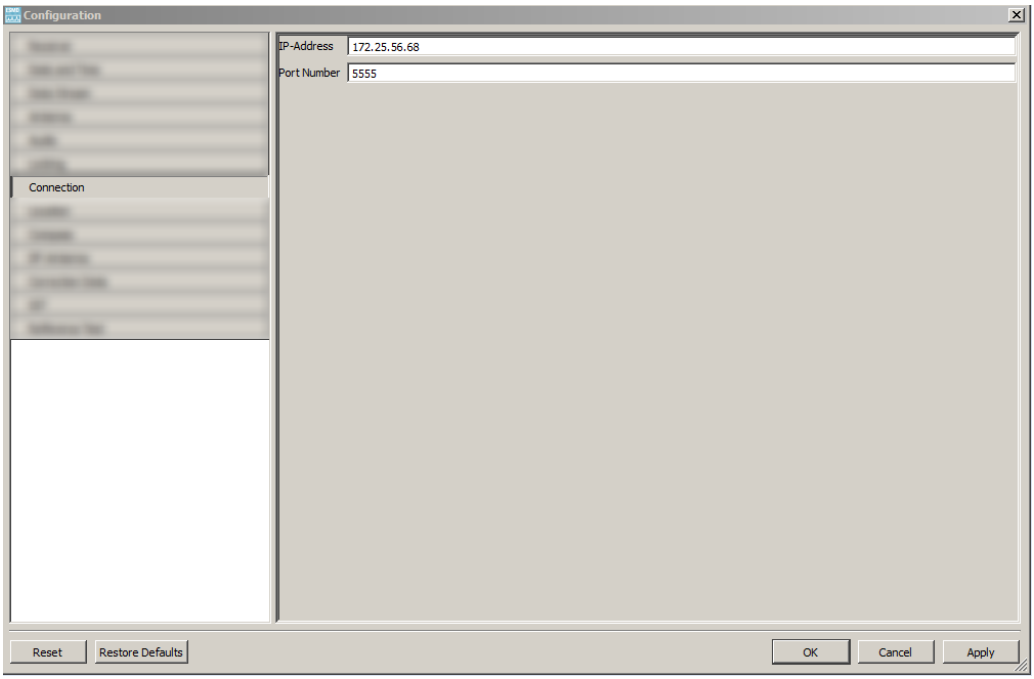



*Figure 3-11: Connection Configuration*

### 3.5.3.6 Audio Configuration

A dialog for the speaker configuration is displayed. You can select the sample rate/Bit per Sample/Channels value for the audio output. It is also possible to change between direct Soundcard Output and Output via the AllAudio Audio-System (if available). Additionally, it is possible to switch the integrated Speaker in the device on and off. You can select AllAudio remote speed if available.

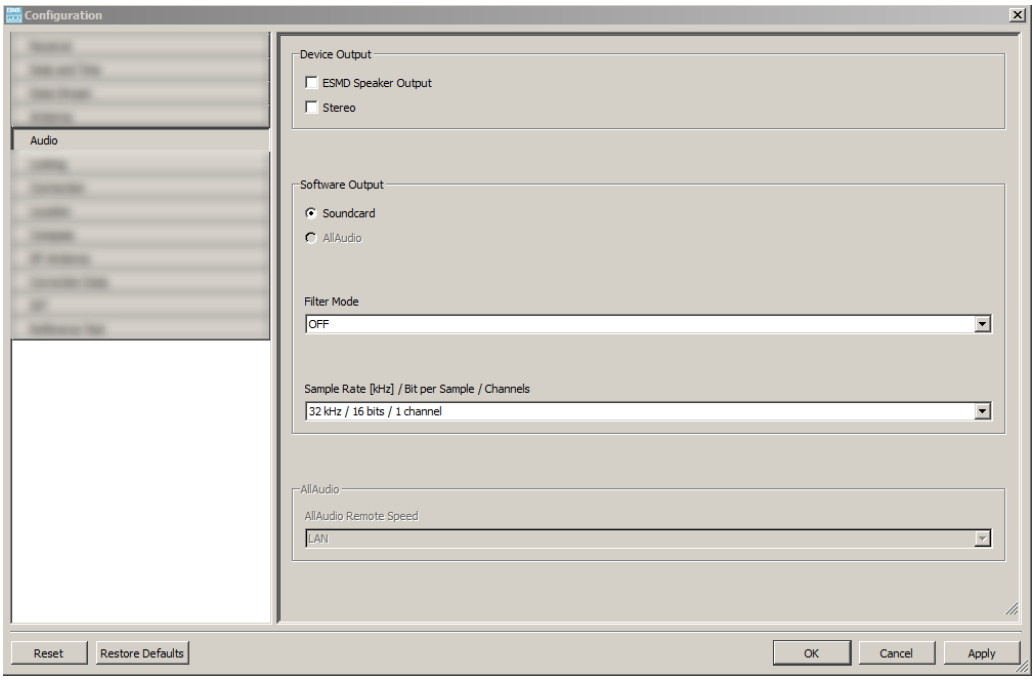



*Figure 3-12: Audio Configuration*

### 3.5.3.7 Location Configuration

Location Configuration item will be available with the installed firmware options “DF” and/or "GPS". A dialog to configure the data source for the location will be displayed. When "GPS" is installed, the operator can choose between receiving the location data from a connected GPS-device or providing the location data manually. In the latter case the “Location”-field will become editable and the location can be entered. DOP and number of received satellites can also be viewed in this window.

In system version of the control software, position source can also be configured as Navigation Server if connection with Navigation Server is available.

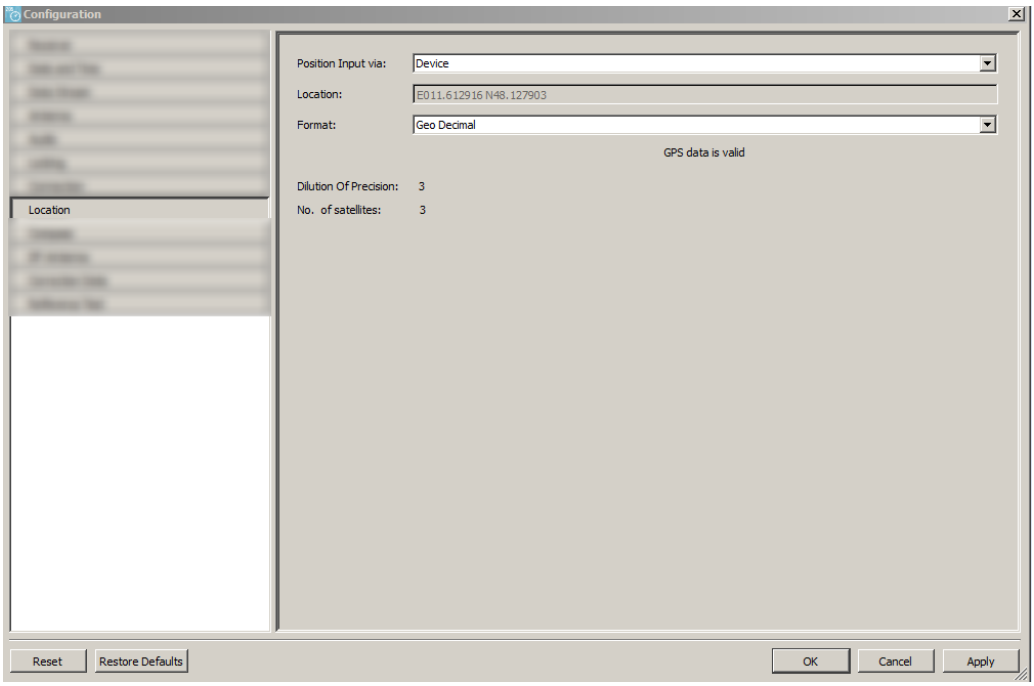



*Figure 3-13: Location configuration*

### 3.5.3.8 Compass Configuration

**Compass Configuration**

In this window, it is possible to view the current compass and declination values and define a heading offset for each connected compass.

In system version of the control software, source of heading information can also be configured as Navigation Server if connection with Navigation Server is available.

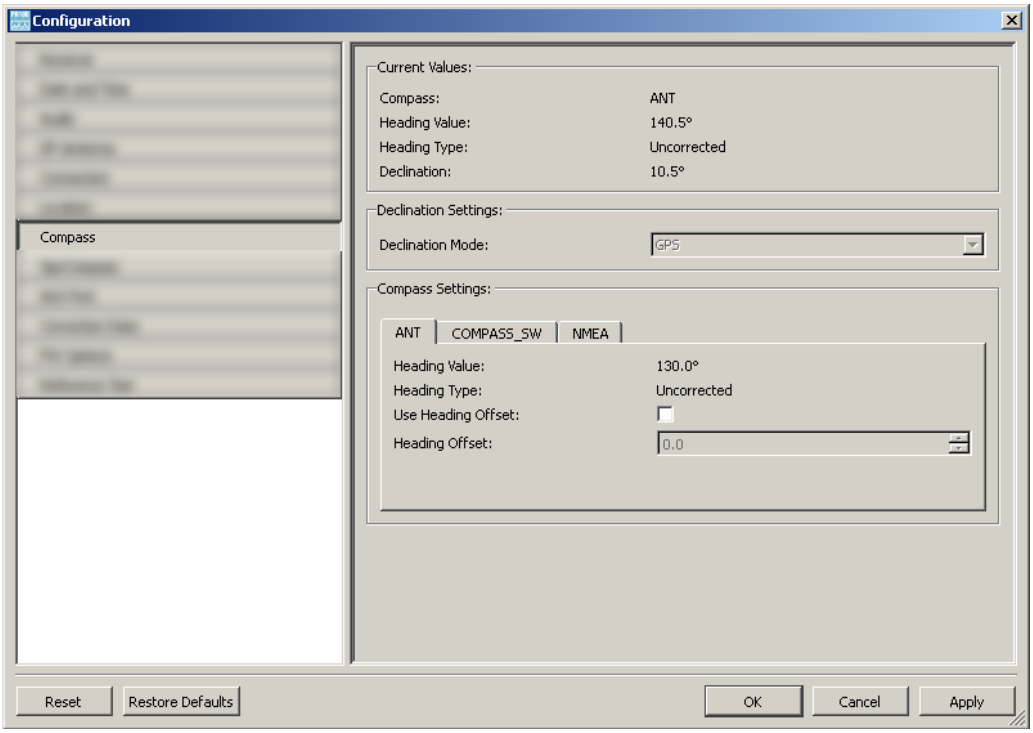



*Figure 3-14: Compass Configuration*

### 3.5.3.9 DF-Antenna Configuration

The DF Antenna configuration menu shows:

- DF Reference of the currently used antenna. If "---" is selected, it means DF reference is North Offset Only
- Upside down roll correction setting of the connected DF antenna. When it is ticked, means the roll correction is 180 degree. Otherwise, it is 0 degree. If there is no DF antenna connected, the checkbox is disabled.
- DF Azimuth Correction data set on currently selected antenna. If no correction is applied, the entry in combobox is blank.

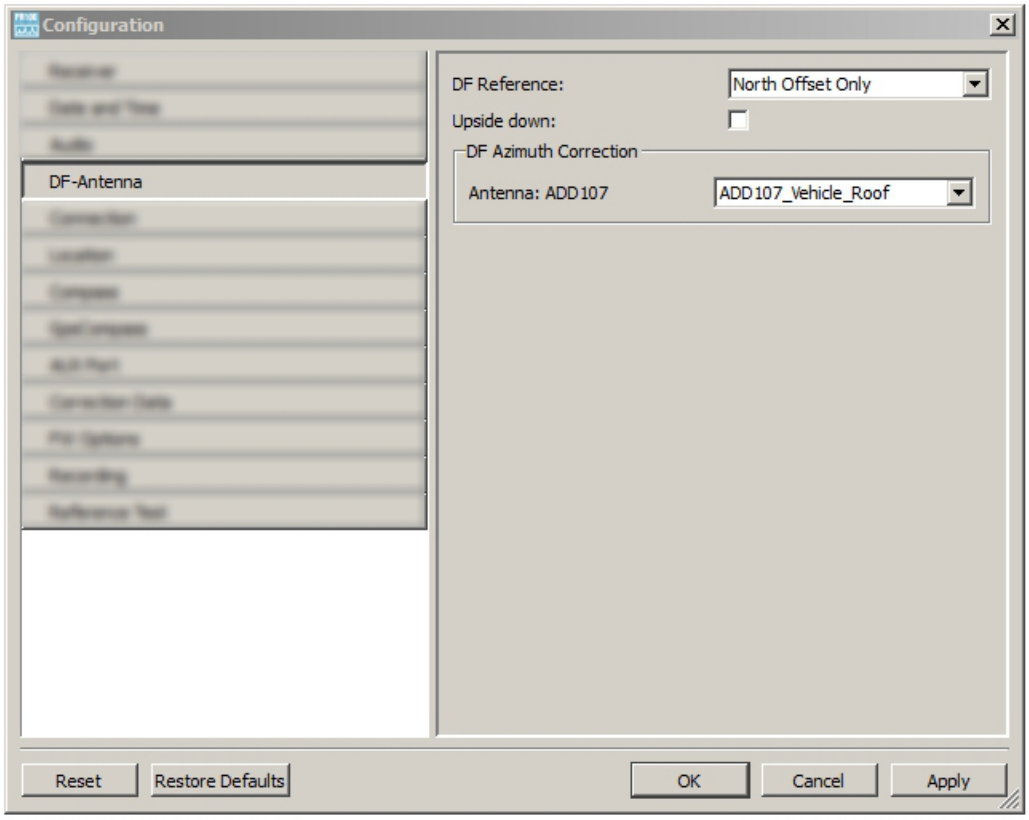



*Figure 3-15: DF-Antenna Configuration*

### 3.5.3.10 GPS Compass Configuration

GPS Compass configuration will be available when the "GPS" option is installed. In this window it is possible to enable GPS/compass functionalities, define the GPS and compass data source, and set the auxiliary port parameters.

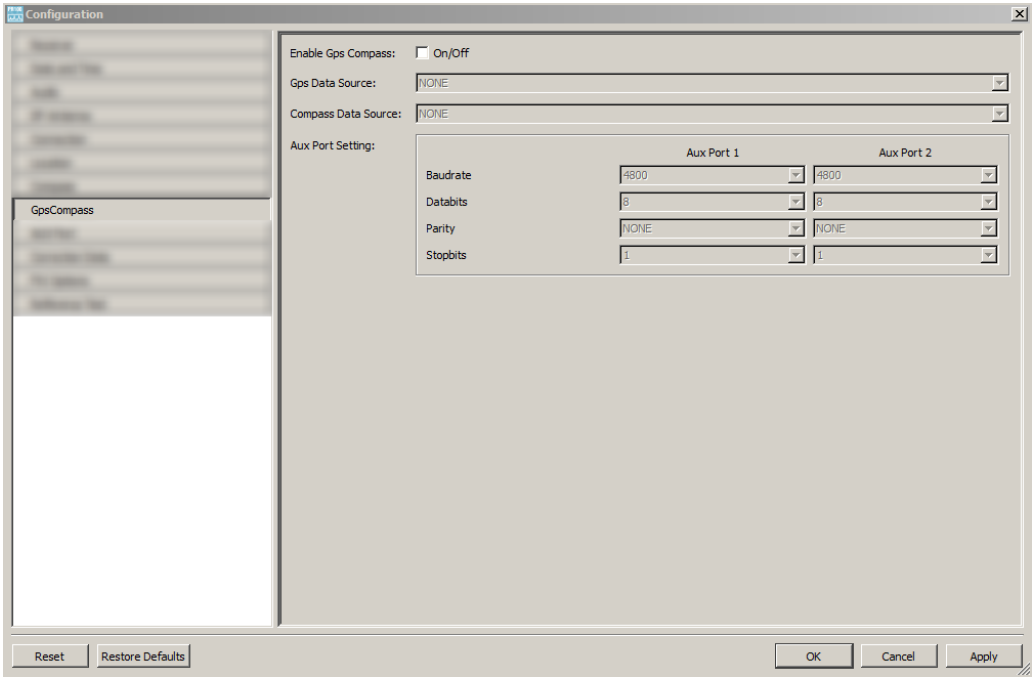



*Figure 3-16: GPS Compass Configuration*

The possible data source settings are the following:

- "GPS data source" - None, Aux1, Aux2, SCPI
- "Compass data source"" - None, Aux1, Aux2, SCPI

If the configuration parameter "Enable GPS Compass" is set to "OFF", neither GPS nor compass data will be displayed on the device nor in polar display view. On the other hand, if it is set to "ON", then both GPS and compass data source must be configured. When you want the GPS source come from connected antenna, both of these parameters should be set to a value of "Aux1". Moreover, the auxiliary ports "Aux1" and "Aux2" must be configured.

### 3.5.3.11 Aux Port Configuration

**Aux Port Configuration**

Accessory auxiliary port configuration is available if either the "GPS" or "DF" option is installed.

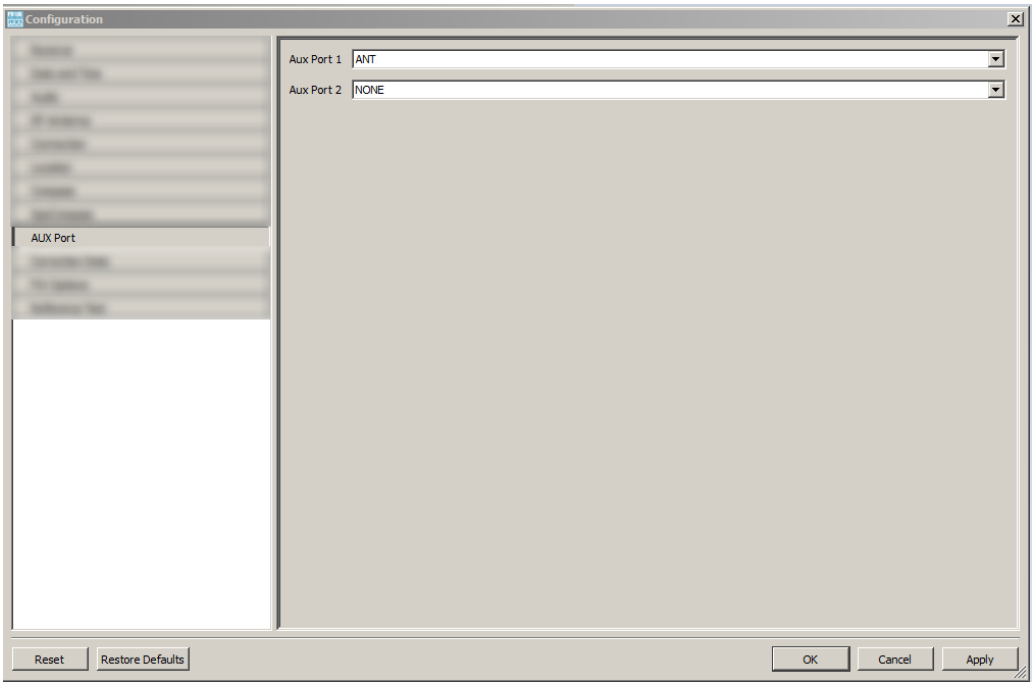



*Figure 3-17: Aux Port Configuration*

Aux port 1 should be set to ANT when using DF antenna. For HE300, HL300 and HE400, this should be set to ANT for detection and GPS Compass data, setting Aux port 1 to TRIG enables external triggering for HE300 and HE400.

#### 3.5.3.12 Upload Correction Data

Please see chapter Omni Phase Calibration for further details.

#### 3.5.3.13 Omni phase correction

Please see chapter Omni Phase Calibration for further details.

#### 3.5.3.14 IGT Configuration

IGT Configuration is available on the control software if the IGT hardware option is installed.

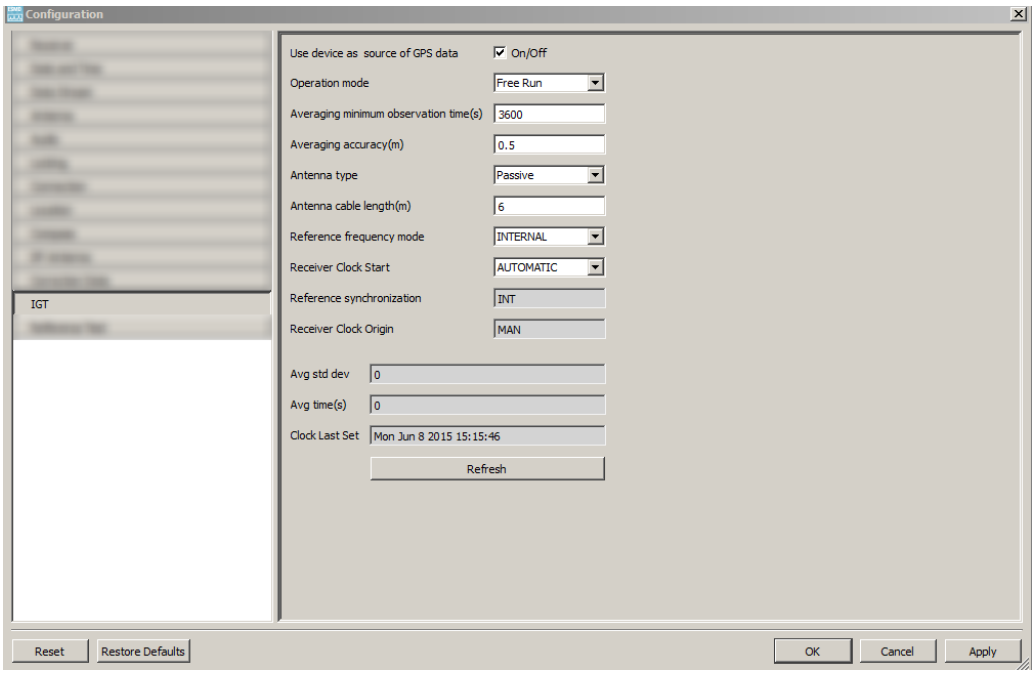



***Figure 3-18: IGT Configuration***

IGT configuration dialog can be used to set IGT parameters to the device. It also shows some of the informative parameters related to IGT. To make the changes take effect, press the Apply or OK button. The various controls are described below:

- "Use device as the source of GPS data" check box is used to set / reset the GPS data source as Manual or Auto. When the check box is selected, the source is set to Auto and the position information from the GPS device is used. When the check box is cleared, position information is taken from the user provided location information
- "Operation mode" can be set to Free Run (FRUN), Averaging (AVER) or Fixed (FIX)
- "Average minimum observation time" edit box is used to provide averaging minimum observation time in seconds
- "Averaging accuracy" edit box is used to provide the averaging accuracy in meters
- "Antenna type" can be either passive (PASS) or active (ACT)
  **Important note:** Incorrect selection can destroy the hardware. For example, selecting ACT for a passive antenna results in permanent destruction of the GPS hardware
- "Antenna cable length" specifies the length of the cable to the GPS antenna in meters
- "Reference frequency mode" sets the source for reference frequency. It can be either internal or external
- "Receiver Clock Start" specifies when to start the clock. The available options are AUTOMATIC and EXTERNAL

- "Reference synchronization" displays the status of the reference synchronization. The possible options are internal (INT), external (EXT), PPS pulse unlocked (PPSU) or PPS pulse locked (PPSL)
- "Receiver Clock Origin" displays the origin of the latest clock setting. The possible options are manual (MAN), booting according to realtime clock (BAC), clock from GPS (GPS) or clock from NTS (NTS)

The parameters below can have momentary values and the most recent values can be retrieved by clicking the Refresh button.

- "Averaging time standard deviation" shows the momentary standard deviation of the averaging in progress
- "Averaging time" shows the averaging observation time in seconds
- "Clock Last Set" shows the time and date when the clock was last set

### 3.5.3.15 Firmware Options Configuration

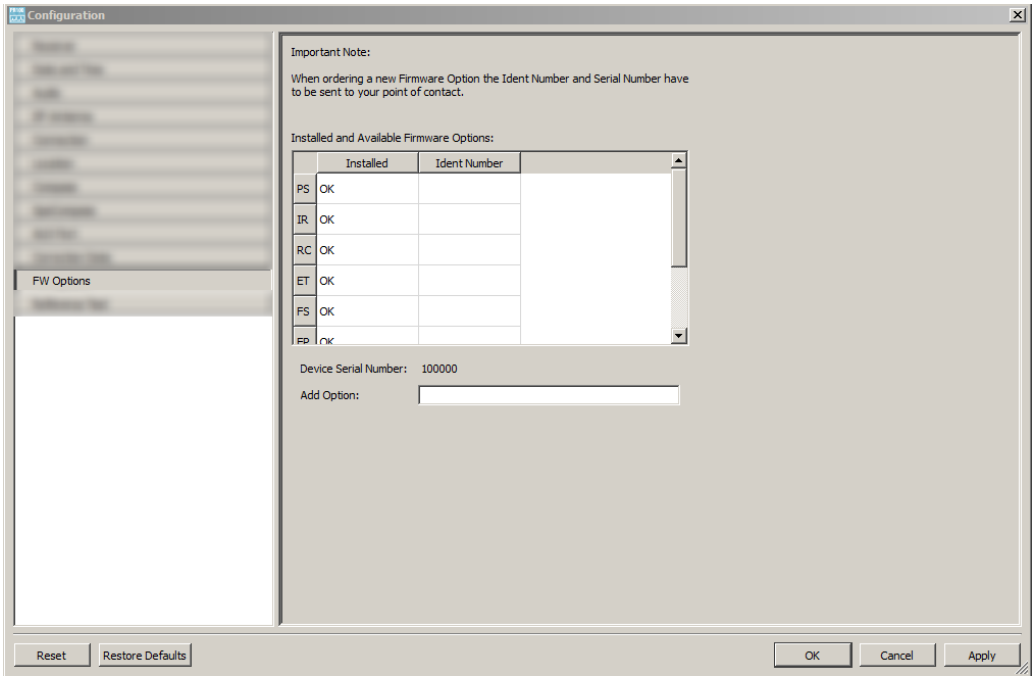



*Figure 3-19: Firmware Options Configuration*

Firmware Options configuration shows the currently installed options on a device marked with 'OK'. Identification number is displayed if available. Below the list of options is the device's serial number and "Add option". You can add option if the option key is available. Press the Apply or Ok button to perform a device reset to add the purchased option on the device.

### 3.5.3.16 Recording Configuration

A dialog for the recording configuration of the application is displayed.

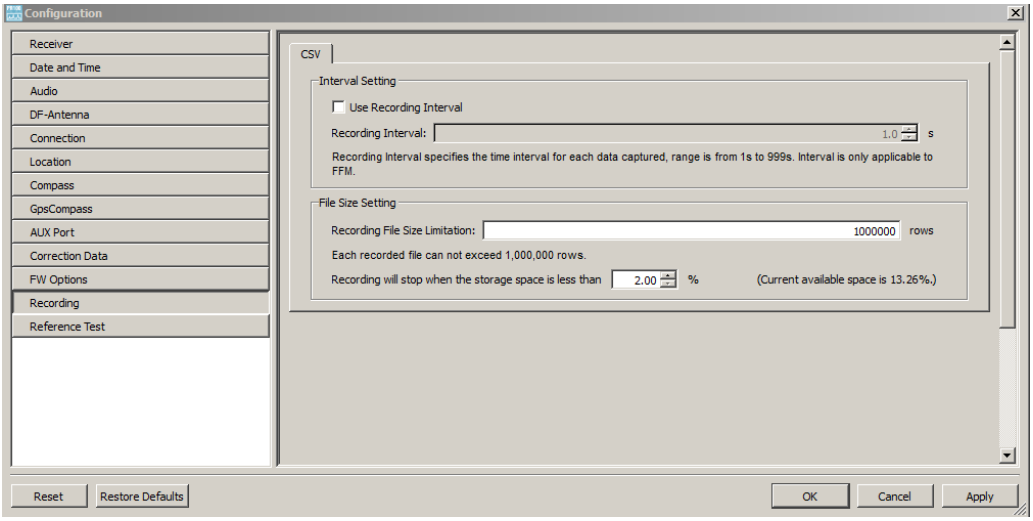



*Figure 3-20: CSV Recording Configuration*

CSV Recording configuration can be used to set CSV recording parameters. The various controls are described below:

- "Use Recording Interval" is used for if the current "Recording Target Location" is "File (PC)" and when the user uses the recording interval, data will be recorded with an interval. If the current "Recording Target Location" is "File (SD-Card)", this checkbox is only used to enable the Recording Interval spinbox. It has no effect on the device' CSV recording.
- "Recording Interval" sets the interval value. The range is from 1 second to 999 second and supports decimal value, e.g., 1.2 second.
- "Recording File Size Limitation" sets the number of rows the CSV recording file can have. Every CSV recording file cannot exceed 1,000,000 rows. The range is from 1 to 1,000,000 rows. This is only for recording on File (PC).
- "Recording will stop when the storage space is less than xx%" sets the CSV recording's stop condition. When the current available disk space is less than the setting, the CSV recording stops. This is only for recording on File (PC). The range is from 2.00% to the current available value.

### 3.5.3.17 Use Flywheel

When checked, the driver for the R&S Flywheel will be loaded. Frequency tuning can be done using the Flywheel.

### 3.5.4 View Menu

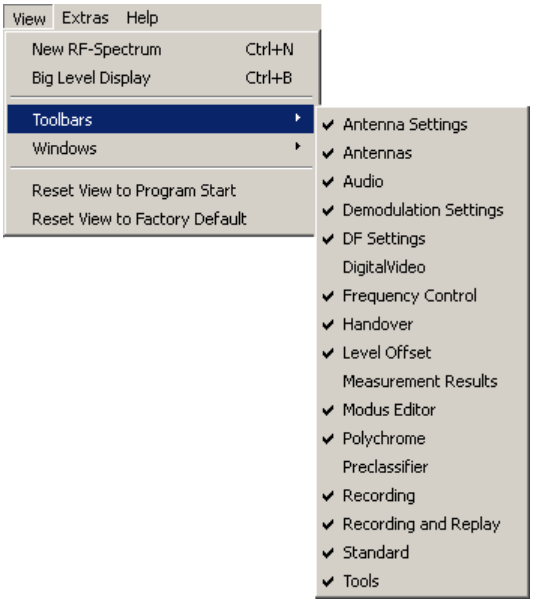



*Figure 3-21: View Menu*

- **New RF-Spectrum**
  Opens a new RF spectrum window.
- **Big Level Display**
  Hides the normal level measurement widget and shows the current Level in big digits.
- **Windows**
  Opens a new window showing the selected display.
- **Reset View to Factory Default**
  Resets the application layout to the factory default.
- **Reset View to Program Start**
  Resets the application layout to the program start.
- **Toolbars**
  Shows or hides the selected toolbar.

### 3.5.5 Extras Menu

- **Reset user colors**
  Reset all user defined colors to the default values.
- **Options**
  The option menu opens a window with information about the GUI and the configuration options of the GUI Software. The following window is opened after choosing “Options”. By selecting the “Configuration” tab an overview of possible configura-

tion attributes is displayed. With this dialog e.g. the TCP/IP Host address of the R&S PR1-CTL can be changed.

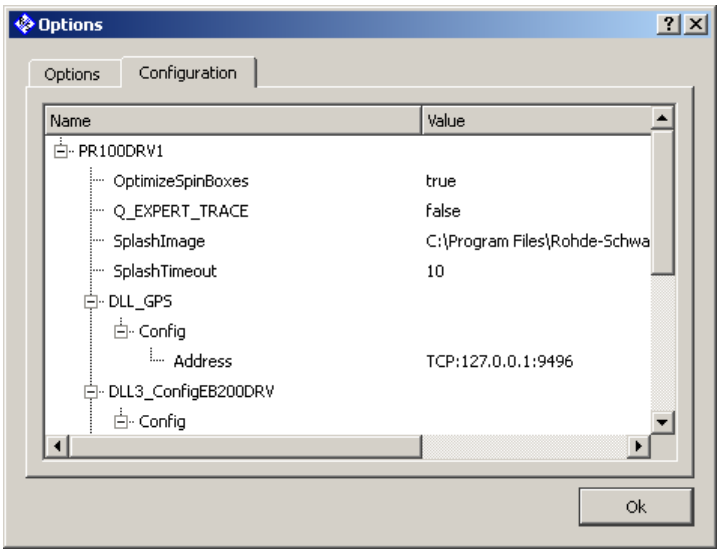



*Figure 3-22: Options Dialog*

### 3.5.6 Help Menu

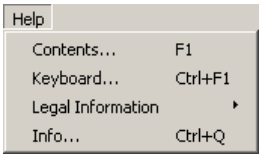



*Figure 3-23: Help Menu*

- **Contents**
  This menu opens the online help, by starting a PDF viewer with this user manual file.
- **Keyboard**
  Displays the available Hotkeys.
- **Legal Information**
  Displays legal information such as the open source acknowledgment.
- **Info**
  Opens a window with information about the software version, modules, configuration options and the firmware of the connected device.

## 3.6 Toolbars

The toolbars of this application contains buttons for the most commonly used items. When a button in one of the toolbars is clicked, the action of the corresponding menu item is performed immediately.

All toolbars can be hidden or shown via the View-menu. These settings are also remembered over a restart of the software.

## 3.6.1 Frequency Control

### 3.6.1.1 Frequency Display

The Frequency display allows you to control the frequency.

*Figure 3-24: Frequency display*

**Frequency Unit**

You can set the frequency unit for the whole application. Follow these steps:

1. Double click the frequency display.
2. Press the “m”-key for MHz, “k”-key for kHz or “g”-key for GHz.
3. Press ENTER to confirm.
   The new unit is set. The Frequency axis will use this unit.

**Frequency Value**

You can change the frequency in different ways.

Firstly, open the "Frequency" display (F6 shortcut key). Then choose one of the following:

- Double click the frequency display and enter the frequency value directly.
  If you do not specify any unit, the frequency is set with the same unit as before. In order to change the unit, enter the first letter of the unit after the number (for example: 98.5m for 98.5 MHz, or 98500k for 98500 kHz).
  Press the ENTER key or click another element of the window to confirm.
- Set the cursor on the digit of the frequency display that has to be changed. Use the Up or Down arrow keys of the keyboard or click the Up/Down spin buttons to change the frequency.
- Set the last used frequency by clicking the "Previous Frequency" button.
- Select a frequency from the Frequency Store:
  – Click on the Down arrow to the right of the current frequency field to open the "Frequency Store" dialog.

– Select a frequency from the "Frequency Store" to set this frequency and its stored parameters (bandwidth etc.).
**NOTE:** The "Frequency Store" is saved between sessions. For further information refer to Chapter 3.6.1.4, "Frequency Store Dialog Box", on page 45.

- Select a frequency from the Frequency History:
  – Click on the Down arrow to the right of the "Previous Frequency" field to open the "Frequency History" dialog.
  – Select a frequency.
  NOTE: The "Frequency History" is not stored between sessions.

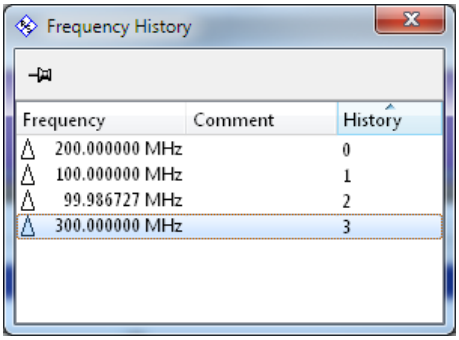



*Figure 3-25: Frequency History dialog*

### 3.6.1.2 Tune

The Tune button Tune helps in locating the best frequency of the signal. In FFM mode, clicking the Tune button adjusts the frequency towards the strongest signal within the bandwidth. This is done by adding the level offset (shown by the "Level Offset" toolbar) to the current frequency.

### 3.6.1.3 Automatic Frequency Control

Automatic Frequency Control (AFC) keeps the current center frequency always at the peak of the current signal. This control is enabled in FFM, WFFM, PSCAN, Search (during dwell time) and MSearch (during dwell time) modes.

The AFC button can be toggled ON/OFF automatic frequency control in the device. Depending on the state, the AFC button changes its color as follows:

- gray: AFC is inactivated (OFF).
- green: AFC is activated (ON).

### 3.6.1.4 Frequency Store Dialog Box

You can open the "Frequency Store" dialog box from the "Frequency" control or from the "Frequency" bar.

The "Frequency Store" offers two views:

- **Small view** - to select a frequency, or

- **Extended view** - to edit frequencies.

When you select a frequency from the list, the window closes ("Auto Hide" mode).

### Small view

The small view enables you to select the frequency to use.

Only the frequency and its name are displayed. The colored icon indicates the classification of the frequency.

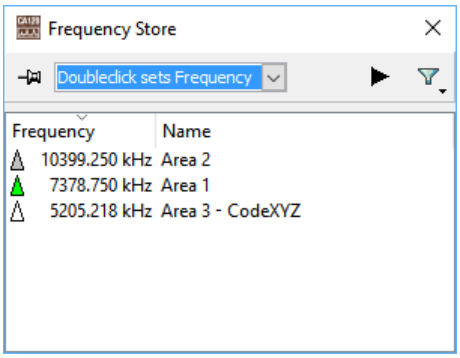



*Figure 3-26: Ssmall view*

The toolbar provides the following commands:

- - "Auto Hide Mode active/inactive"
  Toggles on/off the "Auto hide" mode. If it is on, the dialog box closes automatically after you chose a frequency.
- The drop-down list enables you to choose how to set a frequency:
  – "Double-click sets frequency" - double-click a frequency to use it. If "Auto hide" mode is active, the dialog box closes automatically.
  – "Selection sets frequency" - select a frequency to use it. The "Auto hide" mode is automatically inactive.
- - "More"/"Less" arrow
  Toggles on/off the extended view.
- - "Filter"
  Filters the list according to the frequency type.

### Extended view

The extended view provides different tabs.

- - "Notepad"
  User-defined frequencies (frequency, bandwidth, demodulation, comment) displayed in the frequency bar in the spectrum display. See "Notepad Tab" on page 47.
- - "Recycle bin"
  You can restore deleted entries from here. See "Recycle Bin Tab" on page 47.
- - "Global suppress frequencies and ranges"

You can set the ranges from other applications, e.g. R&S AMMOS IT. See "Local and Global Suppress Ranges Tab" on page 48.

- - "Local suppress frequencies and ranges"
  You can set the ranges from other applications, e.g.R&S JobEditorRA, or in the "Spectrum" display. See "Local and Global Suppress Ranges Tab" on page 48.
- - "Emission detection found frequencies"
  Frequencies of signals found through ED.
  See Chapter 3.6.10, "Emission Detection", on page 68 for a detailed description.

### Notepad Tab

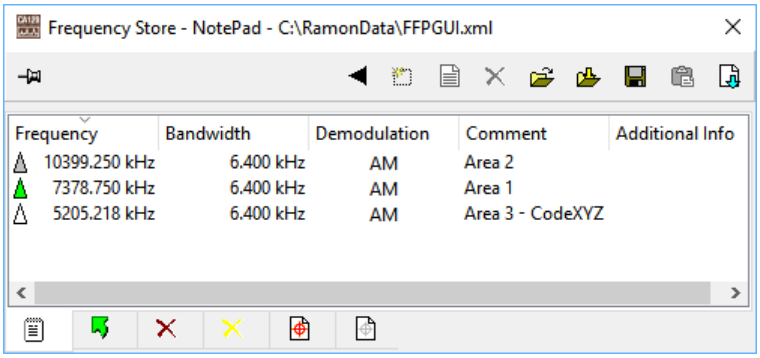



*Figure 3-27: Notepad tab*

"Notepad" is a multipurpose frequency list, that provides the following commands:

- - adds a new entry to the list.
- - edits the selected entry.
- - deletes the selected entries.
- - opens a file.
- - merges file: loads another file into the list, keeping the currently loaded entries.
- - saves items to a list. If a list is opened and a filename is defined in the "Frequency store" (the filename is in the caption), the file is automatically saved during shutdown.
- - pastes an entry.
- - exports the entries to a CSV file.
- - imports the entries from a CSV file.

### Recycle Bin Tab

Whenever an entry is deleted from a frequency list, it is displayed in the "Recycle bin" tab.

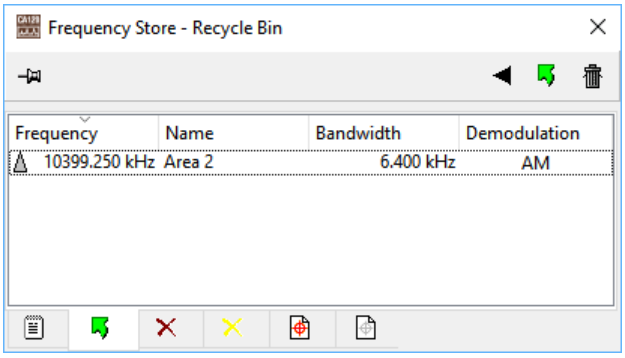



*Figure 3-28: Recycle bin tab*

The following commands are available:

- - restores an entry to its origin.
- - deletes an entry permanently.

"Recycle bin" entries are only available during the current session. Once the application is closed, all entries are lost.

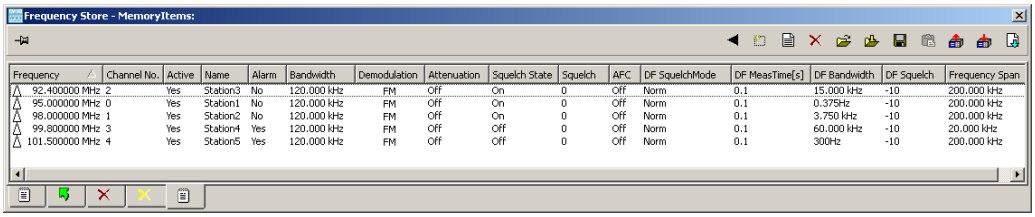
### Local and Global Suppress Ranges Tab

These tabs list the stored frequency ranges that are not scanned or searched by the application. If a blanking signal is input on the device, there is no preclassification data for the suppressed range.

There are two types of suppress ranges:

- **"Local"** suppress ranges - displayed in yellow.
  They are only related to the local device and can be defined by the operator itself.
  They are shown as a yellow bar in the frequency bar.
  The commands of the toolbar are the same as the "Notepad" tab, therefore see "Notepad Tab" on page 47.
- **"Global"** suppress ranges - displayed in red.
  They are defined by a supervisor, who can distribute them over the whole system.
  They are shown as a red bar in the frequency bar and a dark gray block in the spectrum.
  The commands of the toolbar are the same as the "Notepad" tab, therefore see "Notepad Tab" on page 47.
  The following extra command is available:
  - publishes the selected ranges, so that they are visible for all users working on the system. The ranges are saved inside a folder that is automatically read from every user's application.

### 3.6.1.5 Frequency Store Memory Items




| Frequency | Channel No. | Active | Name | Alarm | Bandwidth | Demodulation | Attenuation | Squelch State | Squelch | AFC | DF SquelchMode | DF MeasTime[s] | DF Bandwidth | DF Squelch | Frequency Span |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 92.400000 MHz | 2 | Yes | Station3 | No | 120.000 kHz | FM | Off | On | 0 | Off | Norm | 0.1 | 15.000 kHz | -10 | 200.000 kHz |
| 95.000000 MHz | 0 | Yes | Station1 | No | 120.000 kHz | FM | Off | On | 0 | Off | Norm | 0.1 | 0.375Hz | -10 | 200.000 kHz |
| 98.000000 MHz | 1 | Yes | Station2 | No | 120.000 kHz | FM | Off | On | 0 | Off | Norm | 0.1 | 3.750 kHz | -10 | 200.000 kHz |
| 99.800000 MHz | 3 | Yes | Station4 | Yes | 120.000 kHz | FM | Off | Off | 0 | Off | Norm | 0.1 | 60.000 kHz | -10 | 20.000 kHz |
| 101.500000 MHz | 4 | Yes | Station5 | Yes | 120.000 kHz | FM | Off | Off | 0 | Off | Norm | 0.1 | 300Hz | -10 | 200.000 kHz |

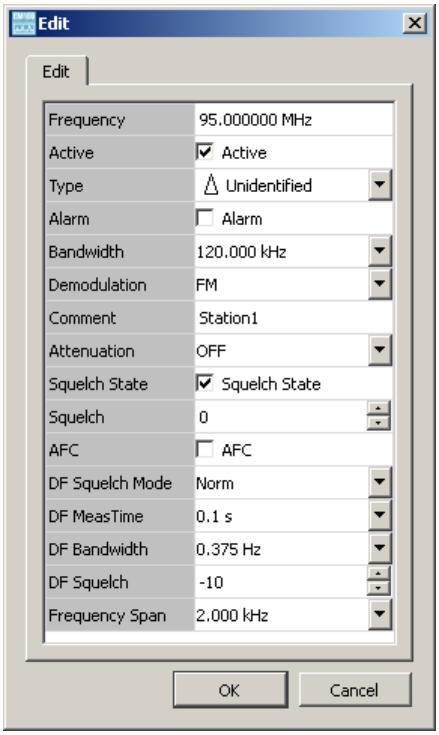
The added frequencies of the Memory Items list will be of interest when applying MScan or MSearch.

The following DF parameters are available in this dialog: DF Squelch mode, DF squelch threshold, DF measurement time, frequency span, and DF Bandwidth.

When editing or adding new memory items, the correct parameters should be set. For example,

- In demodulation mode, USB, LSB and CW supports only bandwidth below 9 KHz.
- In demodulation mode, ISB supports bandwidth between 1.5 KHz and 15 KHz.
- DF measurement time should be lower than the dwell time.
- DF Bandwidth and Span setting should be consistent since not all spans are available in the given DF Bandwidth. Refer to the MEMory:CONTents:DFINder|DF description in the device User Manual.

Clicking on the New symbol creates a new item. A short edit dialog will appear, where parameters of the item can be edited. The dialog's options Frequency, Demodulation, Bandwidth etc. will be initialized with the current settings from the Main Application window.



The comment can be used to identify the frequency with an alias name, which will be automatically displayed in the spectrum. Other static values (e.g. attenuation, squelch, afc, antenna) for this single frequency item can be edited. Frequency items can be activated by checking the Active box. Only the active items will be scanned/searched during MScan or MSearch.

**Alarm Functionality**

When alarm is activated and the frequency signal crosses above the threshold, an alarm sound will be played. "RxAlarm.wav" file is a free beep sound which is included in the installation. This will be used as an alarm sound. If user doesn't like this, he can provide the alarm audio file by following these steps:

1. Logout control software. It will not be effective when alarm sound is added while software is running.
2. If no audio wav file is available, search any wav files in you local machine. (e.g *.wav)
3. Get the location of the control software installation directory.
   Find the target location of the control software application.
4. Copy the wav file you want to use as alarm sound which you found from Step 1.
5. Paste the copied wav file to the installation directory mentioned in Step 3.
6. Rename the <Filename>.wav to**"RxAlarm"** in case-sensitive. You will then have the RxAlarm.wav (wav is the file extension).

Clicking on the Edit symbol opens the edit dialog, where previously defined frequencies can be edited the same way mentioned above.

Clicking the Delete symbol deletes the selected item(s).

Clicking on the File Open symbol will open a file open dialog to select a valid sfl file to load all items in the file in the current frequency store. Previously defined frequencies are discarded.

Clicking on the File Merge symbol will open a file open dialog to select a valid sfl file to merge all items in the file with the current frequency store.

Clicking on the File Save As symbol will open a file save as dialog to save all items in the current list into a sfl file.

*Alarm parameter is a software option only. Logout of control software will not save the settings. It is recommended to always save it in the file and reopen later.*

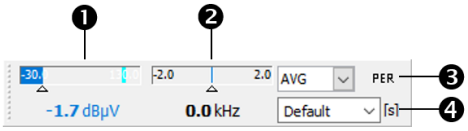
Clicking on the Import symbol will import frequencies from the Frequency Store of the connected device.

Clicking on the Export symbol will export frequencies from the GUI's Frequency Store to the connected device.

Clicking on the File Export will open a file saving dialog allowing the user to export all MemoryItems present in FrequencyStore to a csv file.

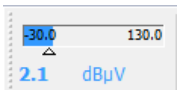
### 3.6.2 Level Offset Toolbar

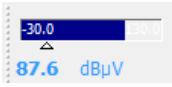
The "Level Offset" toolbar is divided into different sections.

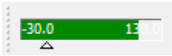



1. Level value - contains the following information:
   - Range of level.
   - Current value of the RF signal level as level indicator (blue background).
   - Maximum value of the RF level of the selected frequency as level indicator (cyan marker).
   - Threshold value (white triangle marker).
   - Current value of the RF signal level as numerical value, at the bottom.

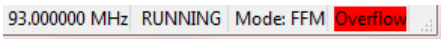
   If you right-click the control, a context menu opens, where you can choose the level unit.
   The following are the RF signal level range and its corresponding level indicator:
   - Level signal is less than 70 dBµV:

     
     
   - Level signal is greater or equal to 70 dBµV:

     
     
   - Level signal is more than 110 dBµV:

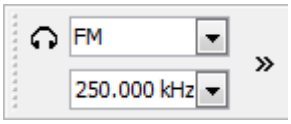
   If there is an overload indicator in the status bar (see below), the measurement is no more reliable. Use "attenuation" or "reduce gain" until the overflow indicator disappears.

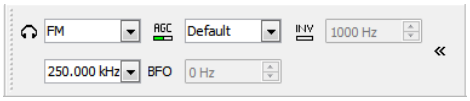
   
   

2. Level offset - contains the following information:
   - Range of audio bandwidth of the main demodulator of your receiver.
   - Level offset to the energy peak (blue marker).
   - Center of the demodulator (white triangle marker).
   - Value of the level offset as numerical value, at the bottom.
3. Peak detector
   Enables you to set the level indication to "AVG", "PEAK", "FAST" or "RMS".
4. Measurement settings

Enables you to switch between "periodic" (PER) or "continuous" (CON) mode. In periodic measurement mode, you can enter the measurement time (in seconds).

## 3.6.3 Demodulation Settings




- In this toolbar the settings concerning the demodulation can be done.
- The bar can be expanded to reveal more monitoring settings by clicking the double right arrow and collapsed by clicking the double left arrow.

### 3.6.3.1 Demodulation

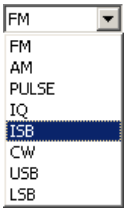



*Figure 3-29: Demodulation Types*

This selection allows to change the current demodulation setting of the device. The entries of this selection depend on the connected device.

### 3.6.3.2 Demodulation Bandwidth

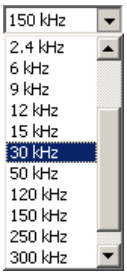



*Figure 3-30: Demodulation Bandwidths*

With this selection the current demodulation bandwidth can be changed. The entries in this selection depend on the connected device.

#### 3.6.3.3 Gain Control

By clicking on the AGC button the gain control can be set to automatic or manual mode.

When set to manual mode it is possible to set the gain control level by the following ways:

- Enter a value in the field right to the AGC/MGC switch.
- Click the up and down buttons to the right of this field.

The range for the manual gain level is from -30 to +130.

#### 3.6.3.4 BFO

In CW demodulation mode it is possible to set the BFO .

This control will only be active when the device is switched to CW demodulation, otherwise it will be disabled.

#### 3.6.3.5 Voice Inversion Descrambling Frequency

By clicking the Voice Inversion Descrambling button, formerly known as Inverse Demodulation, user can switch off/on the feature and search for the appropriate oscillator frequency.

- Green LED on the button indicates that Voice Inversion Descrambling is switched on and set the frequency to its default value.
- Gray LED on the button indicates that it is switched off, thus frequency control is disabled.
- Gray button label indicates that the feature is disabled/unavailable.

Voice Inversion Descrambling controls will only be activated when demodulation is switched to FM, otherwise they will be disabled.

#### 3.6.3.6 Tone Control

Level tone function can be switch on/off by clicking the Tone Mode button.

The LED on the Tone Mode button changes the color:

- gray: tone mode is switched off
- green: tone mode is switched on. User can select the tone control whether only the level tone or audio + tone is output via the audio channel.

### 3.6.4 Audio

There are two display modes for the "Audio" toolbar: standard or compact.

The "Squelch value" spin box and "toggle on/off" buttons are always available.

### Standard Audio toolbar

Use the toggle button to enable or disable the respective feature (sound output, squelch) and use the spin box to select the corresponding parameter value (volume level, squelch level, panorama value).

### Compact Audio toolbar

*Figure 3-31: Compact Controls*

In order to change a value, click the corresponding button and use the sliding bar to set the desired value.

The volume controls provide a checkbox for muting audio output. When muted, the green bar below the speaker symbol will change to grey.

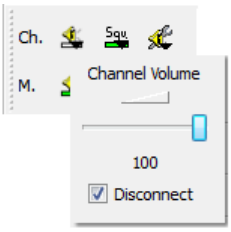



*Figure 3-32: Compact Channel Volume*

The panorama control features a "Center" button which will reset the panorama setting to zero.

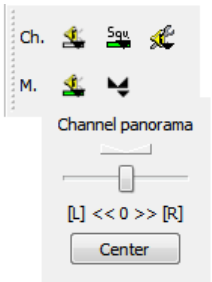



*Figure 3-33: Compact Channel Panorama*

**Audio Settings Button**

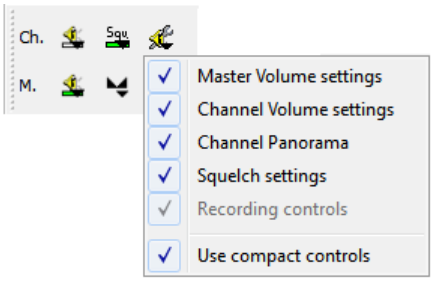



*Figure 3-34: Options Button*

A click on the Audio Settings Button opens a drop-down menu that allows you to toggle on/off the audio controls. Deselecting an entry hides the respective controls.

The last entry allows you to toggle on/off the compact controls mode described above.

## 3.6.5 Standard Toolbar

This toolbar contains the buttons that control the mode of this device.

*Figure 3-35: Standard Toolbar*

### 3.6.5.1 Frequency Services

Located below the Frequency Control you will find the Services Control. Here you may select a service and a channel of this service.

Use the arrow buttons to navigate the channels or enter the channel number directly.

Frequency services or bands consist of a stepwidth, optional frequency range and channel numbers.

A Sample for a frequency service is GSM900 Up: This Service is defined as follows:

- Start Frequency: 890.000 MHz
- Channel Range: 0 to 1023
- Channel Spacing: 200 kHz

The following services are preinstalled:

- GSM900 Up
- GSM900 Down
- GSM1800 Up
- GSM1800 Down
- GSM1900 Up

- GSM1900 Down
- GSM450 Up
- GSM450 Down
- GSM480 Up
- GSM480 Down
- GSM850 Up
- GSM450 Down

While a service is selected, you may navigate through the channels using the arrow keys or you may enter the channel number directly

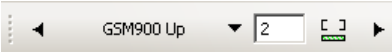



***Figure 3-36: Sample for a detuned channel***

The button next to the channel number indicates wether a channel is selected or not. If the selected frequency is inside the range of the service but does not fit a channel value, it is displayed like in the picture. Click the button to set the frequency to the nearest channel.

***Figure 3-37: Sample: selected frequency outside allowed area.***

If the selected frequency is outside the range of the service, the button is displayed like above. Click the button to set the frequency to the displayed channel.

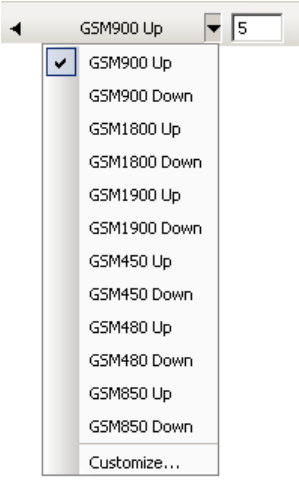



***Figure 3-38: Select a service or define own services.***

Open the combobox and select a service. You may also customize existing services or add new ones. To do so, select Customize..:

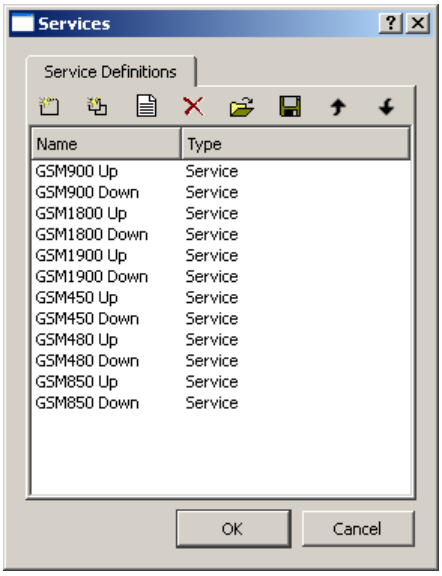



*Figure 3-39: Service Definition Dialog*

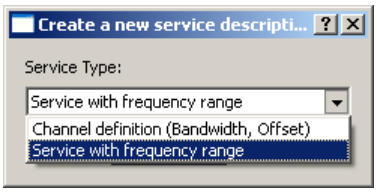
Here in this dialog you may: in the order of toolbar buttons:

- **Create a new Service**
- **Clone an existing service:** GSM services are read only and can't be changed or deleted. If you need a service similar to on of these services, clone one and edit the copy.
- **Edit a Service**
- **Delete a Service**
- **Load a Service Definition File**
- **Save to a Service Definition File**
- **Up/Down:** Change the order of the Services

**Create a new Service**

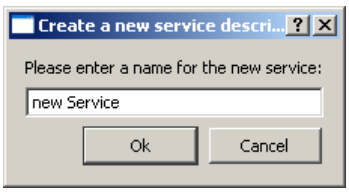
Click Create Button

Select your type of service:

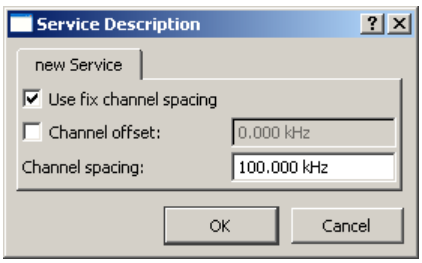



A Channel Definition has no frequency area and no channel numbers. It consists mainly of a channel spacing (stepwidth)

Select the Name of your new service:



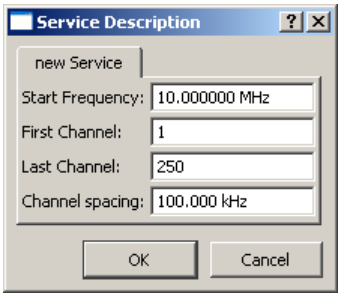

Now, edit your channel definition:




Select "Use fix channel spacing", if you want your channels limited to 100, 200, 300... etc. kHz. You may enter as well a fix offset to your spacing (e.g. offset = 1 kHz would result in 101, 201, 301... etc.

If you deselect "Use fix...", every possible frequency is valid, only the channel spacing is added to / subtracted from the current frequency.

If you have selected "Service with Frequency Range", you may enter your new definitions here:




### 3.6.5.2 Mode Of Operation

You can switch between the different modes of the device by left-clicking on the corresponding button.

*Figure 3-40: Modes Of Operation*

- **Stop**
  Click on the Stop button to stop scanning, searching or FFM polling in order to switch to silent mode. The displays in the GUI is frozen and communication between the driver application and device is suspended until another mode is selected.
- **DF**

Click on the DF button to enable / disabled DF on each modes. This button is disabled during scan modes.

- **Fixed Frequency**
  Click on the FFM button to stop scanning or searching in order to switch to Fixed Frequency mode and monitor a single frequency. The FFM button corresponds to the function key F2. If DF button is ON, the view will be polar display and direction finding mode.
  - Switch to DF On in FFM mode.
  - If the device has DF, GPSC options and DF antenna connected then it shows Polar display with DFIF spectrum
  - If the device has DF, GPSC options and an HE300/HL300/HE400 or no antenna is connected then it shows Polar display with IF spectrum
  - If the device has DF and no GPSC option and DF antenna connected then it shows Polar display with DFIF spectrum
  - If the device has DF and no GPSC option and an HE300/HL300/HE400 or no antenna is connected then it does not switch to DF on mode
  - If the device has no DF but GPSC option then irrespective of the antenna which is connected to the device, it shifts to DF on and the display is with Polar and IF Panorama
- **Frequency Scan**
  (not in firmware versions lower or equal to 1.21)
  Click on the Scan button to start a scan according to the settings defined in the Modus Editor toolbar. The threshold for the scan is set in the level section of the toolbar or by moving the ruler of the RF-spectrum display. The device scans the selected frequency range and the associated RF-spectrum is displayed where you can examine the signal activities. Pressing the function key Shift+F4 also starts a scan.
- **Frequency Search**
  (not in firmware versions lower or equal to 1.21).
  - If the device has DF and GPSC options but no DF antenna connected then DF button is disabled.
  - If the device has DF but no GPSC option and no df antenna connected then a warning message is displayed when you switch to FSearch.

  Turn the DF button Off and start the search. The Search button is used to start searching the selected frequency range for active signals. Frequency range and stepwidth are defined in the Modus Editor toolbar.
  The threshold for searching is set in the level control of the toolbar or by moving the threshold ruler in the RF-spectrum display. The device scans the frequency range of interest; the associated RF-spectrum is displayed. If there is a frequency with signal level over threshold, the device remains at this frequency for the dwell time. The frequency marker jumps to the detected frequency and the frequency is displayed in the frequency edit field.
  The Search button corresponds to the function key F3. Switching between Search and Hold State (in dwell time) is indicated by the LED sign in the Search button. A red color indicates Hold state, while a green color indicates Search state.

Turn the DF button ON and start the search to see the DF Azimuth and Spectrum. It shows DF azimuth data for the given search range when dwell time is more than 2 s.

- **Frequency Search Menu**
  (not in firmware versions lower or equal to 1.21)

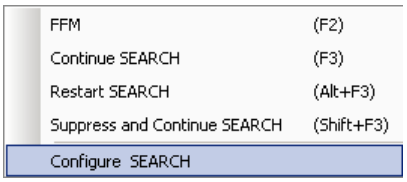



*Figure 3-41: Search Menu*

The Search popup menu button is used to control and edit searching:

– **FFM:** Switches back to FFM mode at current frequency
– **Continue Search:** Continues search in dwell time, start at next frequency
– **Restart Search:** Starts search from the beginning
– **Suppress and Continue Search:** Suppresses current frequency and continue search
– **Configure Search:** Opens the configure search dialog

- **Search Configuration Dialog**
  (not in firmware versions lower or equal to 1.21)

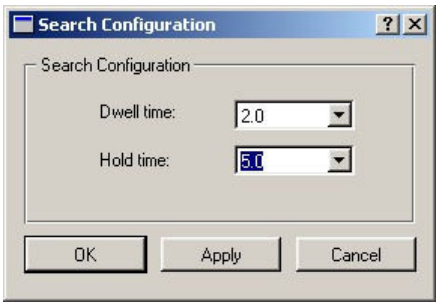



*Figure 3-42: Search Configuration Dialog*

In the search configuration dialog, you can specify attributes for search criteria like dwell time and hold time. The device stops for the defined dwell time if a frequency above the threshold is detected.

- **Memory Scan**
  (not in firmware versions lower or equal to 1.21)
  Click on the MScan button to start a memory scan according to the settings defined in the frequency store list. The frequency store can be filled with the menu / toolbar <add frequency to memory item list> item. Before starting an MSCAN, the frequencies are stored into the device automatically.
  The threshold for the scan is set in the level section of the toolbar or by moving the ruler of the RF-spectrum display. The device scans the current frequency list and the associated RF-spectrum is displayed where you can examine the signal activities.

- **Memory Search**

(not in firmware versions lower or equal to 1.21)

– If the device has DF and GPSC options but no DF antenna connected then DF button is disabled.
– If the device has DF but no GPSC option and no df antenna connected then a warning message is displayed when you switch to MSearch.

Switch the DF button to OFF. The MSearch button is used to start searching the frequency list for active signals. The frequency store can be filled with the menu / toolbar <add frequency to memory item list> item. Before starting an MSEARCH, the frequencies are stored into the device automatically.
The threshold for searching is set in the level control of the toolbar or by moving the threshold ruler in the RF-spectrum display. The device searches the frequency list of interest; the associated RF-spectrum is displayed. If there is a frequency with signal level over threshold, the device remains at this frequency for the dwell time. The frequency marker jumps to the detected frequency and the frequency is displayed in the frequency edit field.
When any of the frequencies in the memory items activates the alarm, the frequency signal is always monitored to check if it goes above the threshold. If that happens, an alarm pop-up message is shown as in Figure 3-43. Message contains the frequency, level value or azimuth value when in DF on, and time when alarm is triggered. Depending on the availability of the alarm sound, upon pop-up the sound is played until you acknowledge it. See"Alarm Functionality" on page 50 for more details.

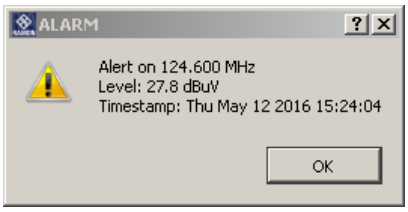



*Figure 3-43: Alarm pop-up message*

**Note:** If a single threshold is set for each frequency in the frequency list, this threshold is used instead of the common threshold.
Turn the DF button On. The DF Azimuth and Spectrum is shown with the list of available active frequencies.
When in DF On, AF squelch is used for signal detection during frequency scanning. If there is a frequency with signal level over threshold, DF is triggered and DF squelch is used from that point. The device remains at this frequency and direction finding is done within the dwell time.
In case DF measurement time is higher than dwell time, it will scan on that frequency but will have incomplete or no DF results.

- **Memory Search Menu**
  (not in firmware versions lower or equal to 1.21)

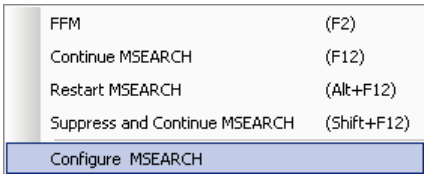



*Figure 3-44: Memory Search Menu*

The Memory Search Popup Menu button is used to control and edit memory searching.

– **FFM:** Switches back to FFM mode at current frequency
– **Continue MSEARCH:** Continues Msearch in dwell time, start after current frequency
– **Restart MSEARCH:** Starts memory search from the beginning of the frequency list
– **Suppress and Continue MSEARCH:** Suppresses current frequency and continue search
– **Configure MSEARCH:** Opens the configure memory search dialog

- **Memory Search Configuration Dialog**
  (not in firmware versions lower or equal to 1.21)

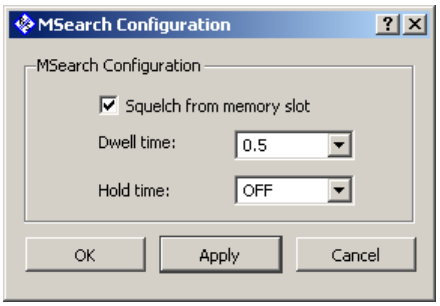



*Figure 3-45: Memory Search Configuration*

In the memory search configuration dialog, you can specify attributes for memory search criteria like dwell time, hold time and squelch from memory slot enable. The device stops for the defined dwell time if a frequency above the threshold is detected.

- **Panorama Scan (PSCAN)**
  **Note:** This mode is available only if the device option “PS” is installed.
  Click on the PSCAN button to start scanning according to the settings defined in the Modus Editor toolbar. The threshold for the scan is set in the level section of the toolbar or by moving the ruler of the RF-spectrum display. You obtain a fast overview of the signal activities in a selected frequency range. The device scans the selected frequency range and the associated RF-spectrum is displayed. The PSCAN button corresponds to the function key F4.

### 3.6.6 Tools Toolbar

*Figure 3-46: Tools Toolbar*

This toolbar contains useful tools for the device control.

- **Logging:**
  Click with the left mouse button on the Logging button to start logging. The Logger application must be started to activate this function. See the Logger manual for further details.
  **Note:** The logger application is delivered with the RAMON Basic Software.
  Click with the left mouse button on the Logging Popup button to show the logging popup menu to enable/disable logging and to set the logging interval.
  The following menu functions are available:
  – Menu Off switches logging off
  – Menu On switches logging on
  – Menu Logger Settings... pops up the logging settings dialog:

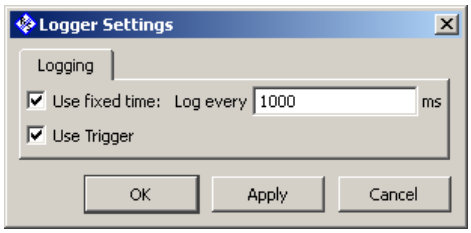



*Figure 3-47: Logger Settings Dialog*

  Enter the desired time in milliseconds and enable / disable a trigger functionality. The logging data are sent to the logger application according to the defined interval.

- **Scan-Recording (Option)**
  SeeChapter 3.11.1, "Scan-Recording", on page 104 for details on Scan-Recording.
- **To Report**
  On left mouse click on the ToReport button, a set of current settings and results of the device is sent to the ReportGenerator application which then generates and saves the report in XML format. Settings, such as FFM, audio and DF, are reported regardless of the current mode. Scan settings are reported only if the current mode is scanning or searching. Recordings are reported only once while location is always reported if there is a DF connection. Output report file is used by ReportEdit application or for importing device settings. Refer to ReportEdit manual for further details. The ToReport button corresponds to the function key Shift+F10.
- **View Selection**
  This button allows you to toggle through the available views for this mode and device. Click this button to open the "View Selection" dialog. In this dialog, you can select the view to switch to. The views can also be selected manually by clicking on the more button and selecting the view.

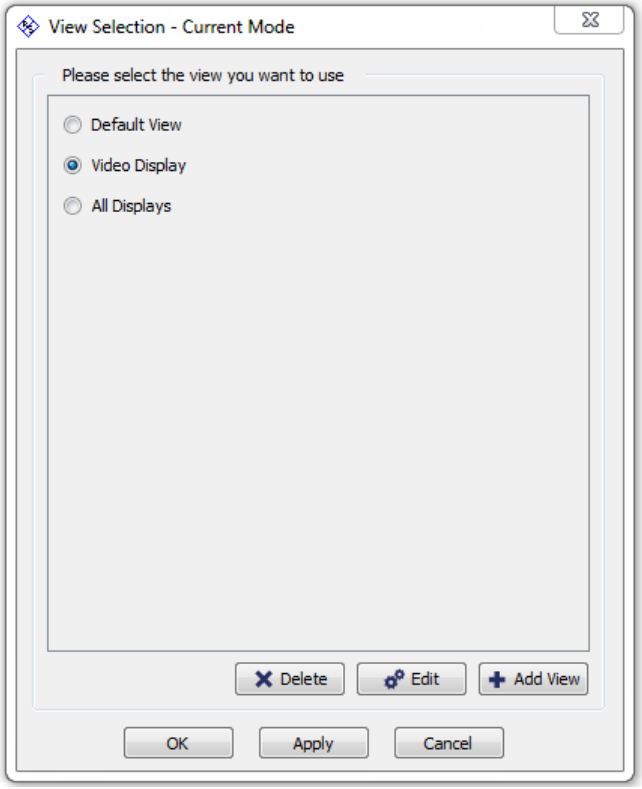



*Figure 3-48: View Selection window*

Each mode has its own view selection list. To make the selected view takes effect, press the Apply or OK button. If you are not satisfied with the preconfigured views, you can modify or delete them or add a new view. The Default View cannot be edited or deleted.

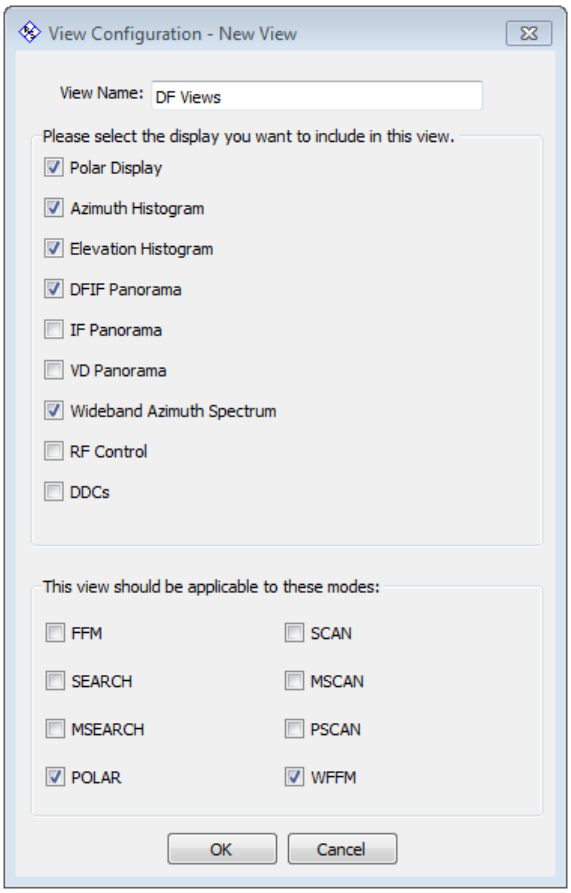



*Figure 3-49: View Configuration window*

Click the Edit or Add View button to open the View Configuration window.

– Add View: Sets the name of the view, including displays and modes where the view is applicable. Click "OK" to save the configuration and add it to the list in the "View Selection" window.
– Edit View: Modifies the configuration of a view item. The initial selected options are preconfigured to the current setup of the view. Click "OK" to update the view configuration on all applicable modes.
– Delete View: Click "Delete" in the View Selection window to remove an item in the list and delete them on all applicable modes.

- **Add Frequency To Notepad**
  Click with the left mouse button on the Add Frequency to Notepad button to add the marked frequency in the RF / IF-display into the Frequency Store Notepad section. The Add Frequency to Notepad button corresponds to the function key Shift +F9.
- **Add Frequency to Memory Item List**
  Click with the left mouse button on the Add Frequency to Memory Item List button to add the marked frequency in the RF/IF-display into the Frequency Store Memory Items section. All frequencies in the store can be exported to the device to set these frequencies for the memory scan.
  See chapter Known Frequency List and MSCAN / MSEARCH for further details.

- **Suppress Frequency**
  Click with the left mouse button on the Suppress Frequency button to add the marked frequency in the RF / IF-display into the Global / Local Suppress Channels section of the Frequency Store. All frequencies in the store can be exported to the device to set these frequencies for the memory scan. These frequencies are not scanned or searched.
  See chapter Known Frequency List and MSCAN / MSEARCH for further details.
- **Chat**
  Several GUI connected to a common driver can transmit messages to each other through a chat window. This functionality can be enabled in the setup menu option during installation.

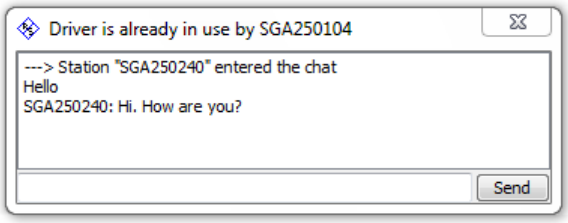



*Figure 3-50: Chat Window*

This chat window automatically pops up when another user GUI is connected to the same driver. Click with the left mouse button on the Chat button to open and close the chat window.

## 3.6.7 Antenna Toolbar

This toolbar contains the details of the antenna connected on the device based on the Antenna xml or internal antenna inputs or the currently used antenna. Antenna toolbar will be displayed only if any of the three requirements mentioned earlier is met.

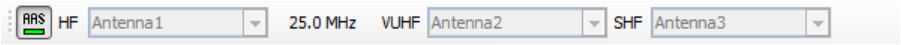



*Figure 3-51: Antenna Toolbar with Antenna Xml*

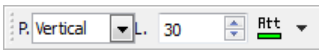
Make sure that the Antenna.xml contains a maximum of four antenna definitions. If there are more than four antenna definitions, only the first four antennae will be used for switching and the rest will be ignored.

- **Automatic Antenna Switch**
  Click Automatic Antenna Switch (AAS) button to turn on/off automatic selection of antenna based on the current frequency. Green led means ON and all antenna combo boxes are disabled. Grey led is OFF and all antenna combo boxes are enabled. Automatic Antenna Switch will be shown only if Antenna xml is defined.
- **HF Antennas**

Click the combo box to show all antennas connected to HF tuners which are defined in the antenna xml. Select from the list to switch between HF antenna. This will be shown only if antenna xml has antennas connected to HF. This can also contain the list of HF internal inputs of the device if antenna xml is not defined.

- **HF Tuner Limit** 25.0 MHz
  HF Tuner Limit is displayed only if the device has HF tuner. Value is in MHz to define the frequency limit for HF antennas. This is not editable. HF Tuner Limit can be configured in Antenna Configuration dialog.
- **VUHF Antennas** VUHF Antenna2
  Click the combo box to show all antennas connected to VUHF tuners which are defined in the antenna xml. Select from the list to switch between VUHF antenna. This will be shown only if antenna xml has antennas connected to VUHF. This can also contain the list of VUHF internal inputs of the device if antenna xml is not defined. In the case wherein antenna xml is not define and device does not support internal input, this combo box will display the currently used antenna.
- **SHF Antennas** SHF Antenna3
  Click the combo box to show all antennas connected to SHF tuners which are defined in the antenna xml. Select from the list to switch between SHF antenna. This will be shown only if antenna xml has antennas connected to SHF.

## 3.6.8 Antenna Settings




The Antenna Settings contains the following information:

### 3.6.8.1 Attenuation

The Attenuation can be set to ON or OFF by clicking the Attenuation button.

The LED on the Attenuation button changes the color:

- gray: attenuation is set to OFF.
- green: attenuation is set to ON (device's input attenuator will be enabled).

## 3.6.9 Modus Editor Toolbar

In the Modus Editor Toolbar the settings for the Search, Scan and Panorama Scan of the device can be defined. Additionally they can be saved and loaded here.

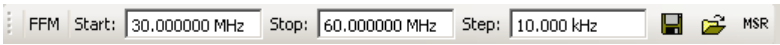



*Figure 3-52: Modus Editor Toolbar*

- **Modus Box**
  The modus box at the left side of the toolbar indicates the actual mode of the receiver.

- **Define the Scan/Search parameters**
  Define the start frequency, stop frequency and stepwidth for a scan or search run. This settings can not be changed during scan or search mode.
  In PSCAN mode of operation only discrete step values of 3.125 kHz, 6.25 kHz, 12.5 kHz, 25 kHz, 50 kHz und 100 kHz can be selected. Other step values will be changed to the next possible value automatically.

**Multiple Scan Ranges**

More than one ranges can be defined for fast scans such as PSCAN and DSCAN. It is possible to define ranges as well as individual frequencies for scanning. The frequency ranges and individual frequencies to be scanned are given through 'Multiple Scan Ranges' configuration dialog (shown below). This can be invoked by clicking on the 'MSR' button on the modus editor toolbar.

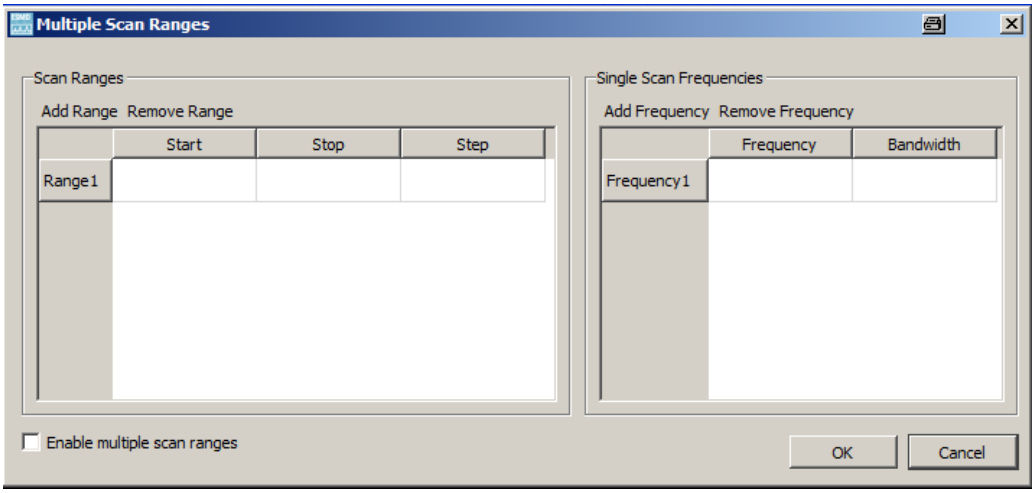



*Figure 3-53: Multiple Scan Ranges dialog box*

Unit of the entries in the table are in MHz by default. 'Add Ranges' and 'Add Frequencies' buttons are used to add new row for entering frequency ranges and single frequencies respectively. Scanning multiple ranges can be enabled by selecting the 'Enable multiple scan ranges' check box present at the bottom of the dialog box. Performing a fast scan (PSCAN or DSCAN) while this check box is selected and with valid ranges or frequencies defined actually performs scan on the entries defined in the dialog box. Normal fast scan is performed when the user selects to perform fast scan with a cleared 'Enable multiple scan ranges' check box; even if there are valid entries in the dialog box. By selecting "Skip Suppress Ranges" menu item from RF Scan Widget, unused ranges between two ranges can be hidden.

## 3.6.10 Emission Detection

Emission Detection is a feature which calculates an adaptive noise floor and detects energy above that noise floor. The resulting emissions are marked in the GUI and are listed in a table in the Frequency Store interface. This feature is only applicable with the proper license and installation settings.

*Figure 3-54: Emission detection toolbar*

With this toolbar it is possible to enable Emission Detection as well as configure its parameters.

- is used for switching the Emission Detection on and off. If switched on, the switching button gets a green line for showing an active status. In the spectrum window, the detected activities are represented by markers in the frequency bar. Active emissions are represented by blue markers while inactive emissions are shown with gray markers.

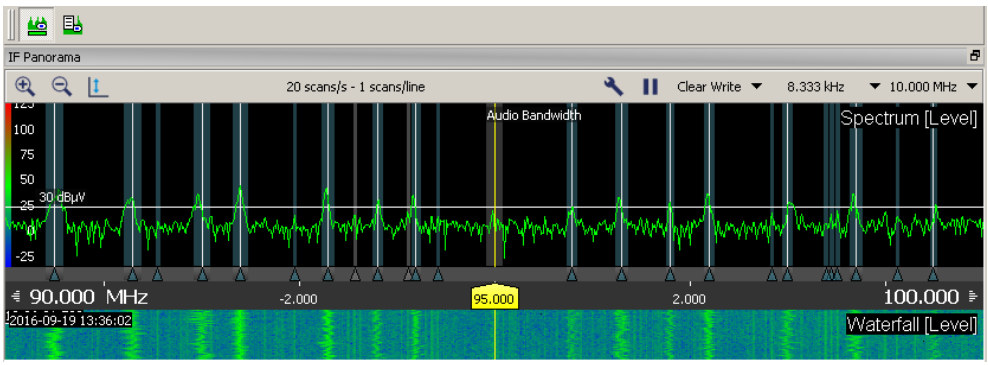
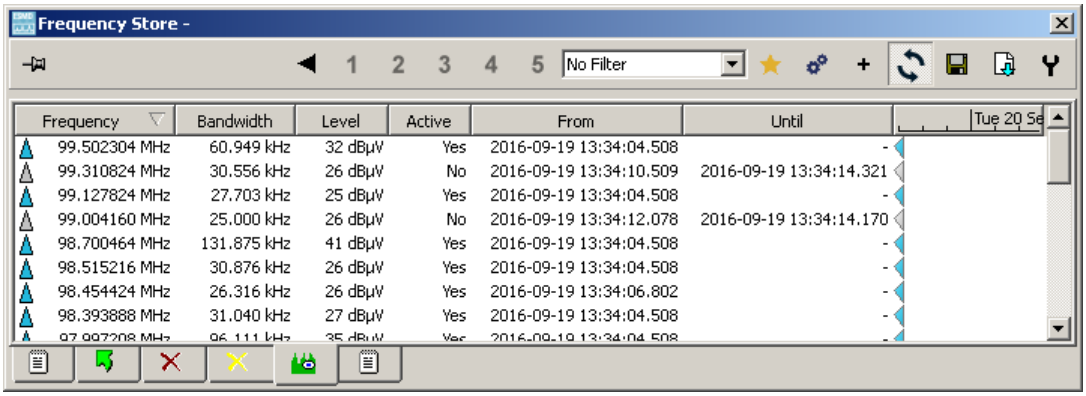



*Figure 3-55: Emission detection markers in the spectrum*

- is used for configuration.

### Emission Detection List

The detection list displays detailed information on all detected emissions. This is located as a tab in the Frequency Store interface.




| Frequency | Bandwidth | Level | Active | From | Until |
|---|---|---|---|---|---|
| 99.502304 MHz | 60.949 kHz | 32 dBµV | Yes | 2016-09-19 13:34:04.508 | - |
| 99.310824 MHz | 30.556 kHz | 26 dBµV | No | 2016-09-19 13:34:10.509 | 2016-09-19 13:34:14.321 |
| 99.127824 MHz | 27.703 kHz | 25 dBµV | Yes | 2016-09-19 13:34:04.508 | - |
| 99.004160 MHz | 25.000 kHz | 26 dBµV | No | 2016-09-19 13:34:12.078 | 2016-09-19 13:34:14.170 |
| 98.700464 MHz | 131.875 kHz | 41 dBµV | Yes | 2016-09-19 13:34:04.508 | - |
| 98.515216 MHz | 30.876 kHz | 26 dBµV | Yes | 2016-09-19 13:34:04.508 | - |
| 98.454424 MHz | 26.316 kHz | 26 dBµV | Yes | 2016-09-19 13:34:06.802 | - |
| 98.393888 MHz | 31.040 kHz | 27 dBµV | Yes | 2016-09-19 13:34:04.508 | - |
| 97.997208 MHz | 96.111 kHz | 35 dBµV | Yes | 2016-09-19 13:34:04.508 | - |

*Figure 3-56: Emission detection results list*

Each emission has the following data:

- Measured frequency
- Bandwidth
- Level

- Active Status
- Start time
- Stop time (for Inactive Emissions)

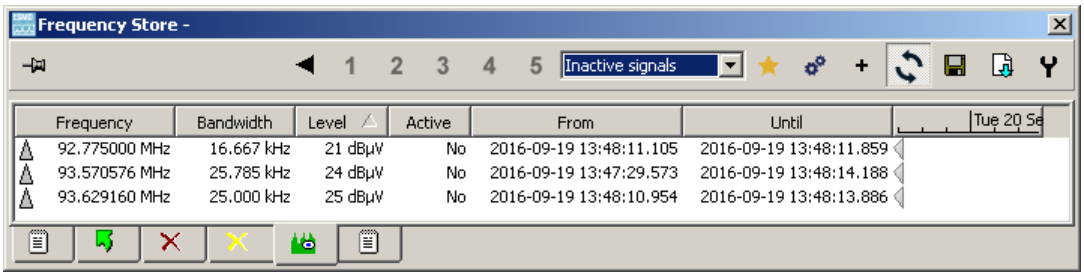
The data can be sorted by clicking the column header. The arrow determines the column used for sorting, as well as the order of sorting.

Detection updates can be disabled and enabled via the button.

The data can be downloaded in XML via or CSV format via .

Via the button, each column can be hidden or shown.

It is also possible to filter the data via the filter widgets:




### Emission Detection Parameters

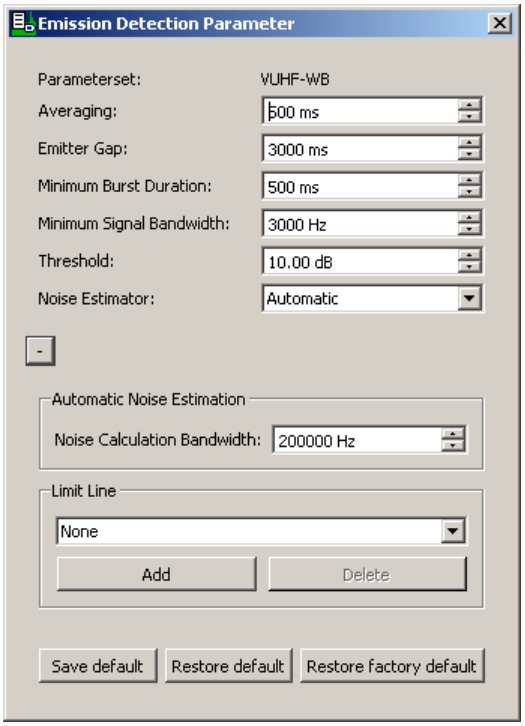
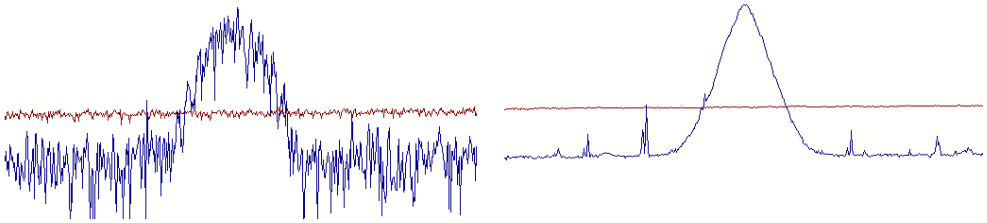



*Figure 3-57: Emission detection parameter settings*

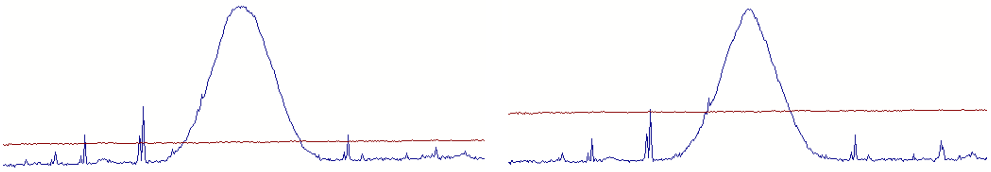
- **Averaging**
  Detector internal averaging time. Not to be mixed up with any kind of device averaging.

The detector internal averaging does only influence the detection algorithm itself, not the display of the spectrum data. It is always additional to any setup device internal averaging. It is a floating average over all spectra received in the selected time range. This means if more spectra per second are send by the device more spectra will be used for averaging if the same averaging time is set.
In general averaging has a major influence on the detector performance. A higher averaging time, no matter if device or detector averaging, leads to a better detector sensitivity for conventional signals (signal duration longer than the selected averaging times) but worse time resolution of the detected emissions. The figure on the left shows a spectrum without averaging. The figure on the right shows the same signal with an averaging of about 1 second. Recommended values are from 500 ms up to 5 seconds. In general it is recommended that the device averaging time is shorten then the detector averaging.

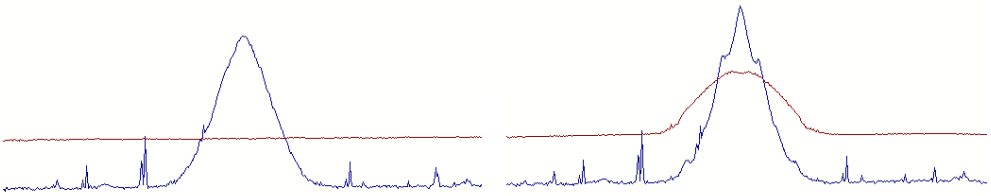


- **Emitter Gap**
  Timeout after which inactive emissions are finally removed from the detector database. After this time the emissions and any measured parameters are removed. If an emission is detected again on the same frequency within the timeout, the last valid emission parameters are reused and further updated. If it is detected after the timeout, all parameters are measured again. The timeout has no influence on the activity generation. An activity is stopped immediately when it is marked inactive by the detector. Recommended values are from 3 seconds up to 30 seconds.
- **Minimum Burst Duration**
  Minimum duration a signal has to be detected to start an activity. Once an activity is started even shorter bursts are taken into account in order to update the activity. This can help reduce false detections due to noise or random interferences. Recommended values are from 500 milliseconds up to 5 seconds. A values down to 0 milliseconds are also possible and may be necessary for pulsed digital signals.
- **Minimum Signal Bandwidth**
  Minimum bandwidth a detected signal has to have to start an activity. Once an activity is started even smaller bandwidth are taken into account in order to update the activity. This can help reduce false detections due to noise or random interferences. No values can be recommended because the value heavily depends on the observed signal scenario.
- **Threshold**
  Relative threshold value, added to the internally calculated adaptive noise floor. The noise floor is calculated by suppressing signals in the averaged spectrum (See also “noise calculation bandwidth Parameter”). In order to get a usable threshold for the detector an offset, the relative threshold has to be added to the noise floor. The left figure shows a relative threshold of 3 dB the right figure a relative threshold of 10 dB. Values from 3dB up to 20 dB are recommended. Lower values can be

chosen if a bigger time frame for device or detector averaging is set. Again the exact value depends heavily on the signal scenario observed.



- **Noise Estimator**: Automatic
  The algorithm used for estimation of the noise floor. With automatic estimator the noise floor is calculated out of the averaged spectra.
- **Noise Calculation Bandwidth**
  The noise calculation bandwidth parameter influences the automatic noise floor estimator. In order to calculate the noise floor out of the averaged spectra the signal in the spectra are suppressed by a special algorithm. The noise calculation bandwidth controls the maximum bandwidth a signal may have in order to be suppressed and not seen as noise floor. This is not a hard decision but a soft crossover from signal to noise floor. Therefore also a signal with a slightly higher bandwidth might still be correctly detected. The default value HF is 2 kHz for VUHF 200 kHz. In most situations there is no need to change these values. If very broad signals should be detected the suppression bandwidth should be adapted to the estimated bandwidth of the signals of interest. If a heavy distorted noise floor is observed a slight reduction of the suppression bandwidth may help to improve the detection performance. The left figure shows the correct value of 200 kHz noise calculation bandwidth for a VUHF broadcast signal. The right figure shows the result of a misaligned noise calculation bandwidth with 20 kHz, the signal is not suppressed correctly. In this case would still be detected but the measured bandwidth would be too small. Both spectra are about 500 kHz broad.



- **Noise Estimator**: Limit Line
  The algorithm used for estimation of the noise floor. With limit line estimator the noise floor is calculated using max hold values during a user configurable period in time. Multiple limit lines can be created and selected later on for comparison with the current radio spectrum. The selected limit lines are used as the threshold line over which signal has to be in order to be detected.
  This means that signal that were present during the creation of the limit line will not be detected but only new signal will be detected.
- **Limit Line**
  Using the “Add” button a new limit line can be recorded. The user is asked for the time period and the name for the limit line. After pressing “OK” the limit line recorder starts immediately. It records the averaged spectra for the given amount

of times and applies a max hold algorithm on them. The resulting limit line is stored and may later be selected.
Within the combo box different limit lines, e.g. for different points in time may be selected.
Using the “Delete” button, a previously limit line can be deleted.

## 3.6.11 Recording and Replay

There are two toolbars available in the Receiver to make several types of recordings, as follows:

- Record and Replay Toolbar
- Recording Toolbar

### 3.6.11.1 Record and Replay Toolbar

With this toolbar (see Figure 3-58) it is possible to control the recording capabilities of the device (if supported) and to make several types of recordings on the computer.

*Figure 3-58: Recording and Replay Toolbar*

#### Recording

The first selection (see Figure 3-59) can be used to define where to record the file to. The options available depend on the device the software is used with.

There can be up to three options:

- Memory (if supported by the device):
  The recording is saved to the internal memory of the device
- File (SD-Card) (if supported by the device):
  The recording is saved to the internal SD-Card of the device.
- File (PC):
  The recording is saved on the local computer in the recordings directory.

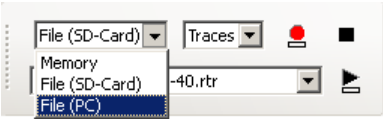



*Figure 3-59: Destination of recording*

The next selection (see Figure 3-60) defines what is recorded:

- IQ:
  This records the IQ datastream to the defined target.
- Audio:

This records the Audio datastream to the defined target.
When recording starts, if squelch is enabled and the signal is below threshold, a warning message appears in the status bar. A recording file without audio data is also created. Otherwise, if the signal is above threshold when recording starts, audio datastream is recorded.

- AOS:
  Audio On Squelch is recorded to the defined target.
  The recorded file contains only signals above threshold.
- Traces:
  The datastreams for the IF & RF spectrums (FFM & PSCAN mode) are recorded to the defined target.

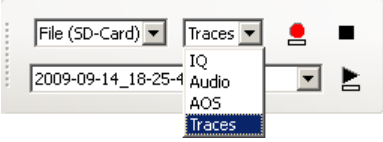



*Figure 3-60: What to record*

Recording can then be started by pressing the red recording button. It is stopped by pressing the recording button again or by pressing the black stop button.

### Replay

The selection in Figure 3-61 defines which file is replayed. This selection consists of all the *.rtr files in the recording directory on the local PC. All the recordings made on the target “File (PC)” are saved in this folder. If a recording was made on the SD-Card of the device, the file can be downloaded and then saved in this folder.

The replay can then be started by pressing the black play button. Pressing this button again or pressing the stop button will end the replay.

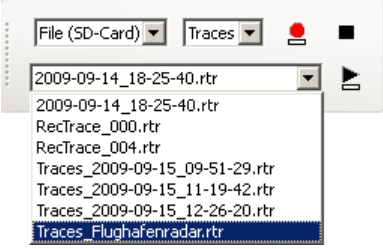



*Figure 3-61: Replay file selection*

### Offline Replay

Files that were recorded earlier can also be replayed without having to connect the R&S PR1-CTL Software to a real receiver. For this, a simulation is installed together with the control software.

**Connecting to the Simulation:** When starting the software without having a real device connected, the software starts up in an inactive state (see Figure 3-62). It is now possible to open the Extras->Options menu. By clicking on the second tab called “Configuration” (see Figure 3-63), it is possible to change the IP address where the

software should look for the device. Now the DLL3_ConfigEB200DRV/Config/Address entry needs to be changed to the IP and port where the simulation is running. Normally this is “TCP:127.0.0.1:15621” as can be seen on the screenshot (Figure 3-63). After changing the address, the software needs to be restarted. Additionally, the simulation needs to be started. This is possible via the menu entries in the Windows “Start”-dialog. Now the control software connects to the simulation.

**Replaying recordings offline:** Once the control software is connected to the simulation, recordings can be replayed like in online mode (see Figure 3-61). The recordings need to be placed in the Recording folder in the RamonData folder.

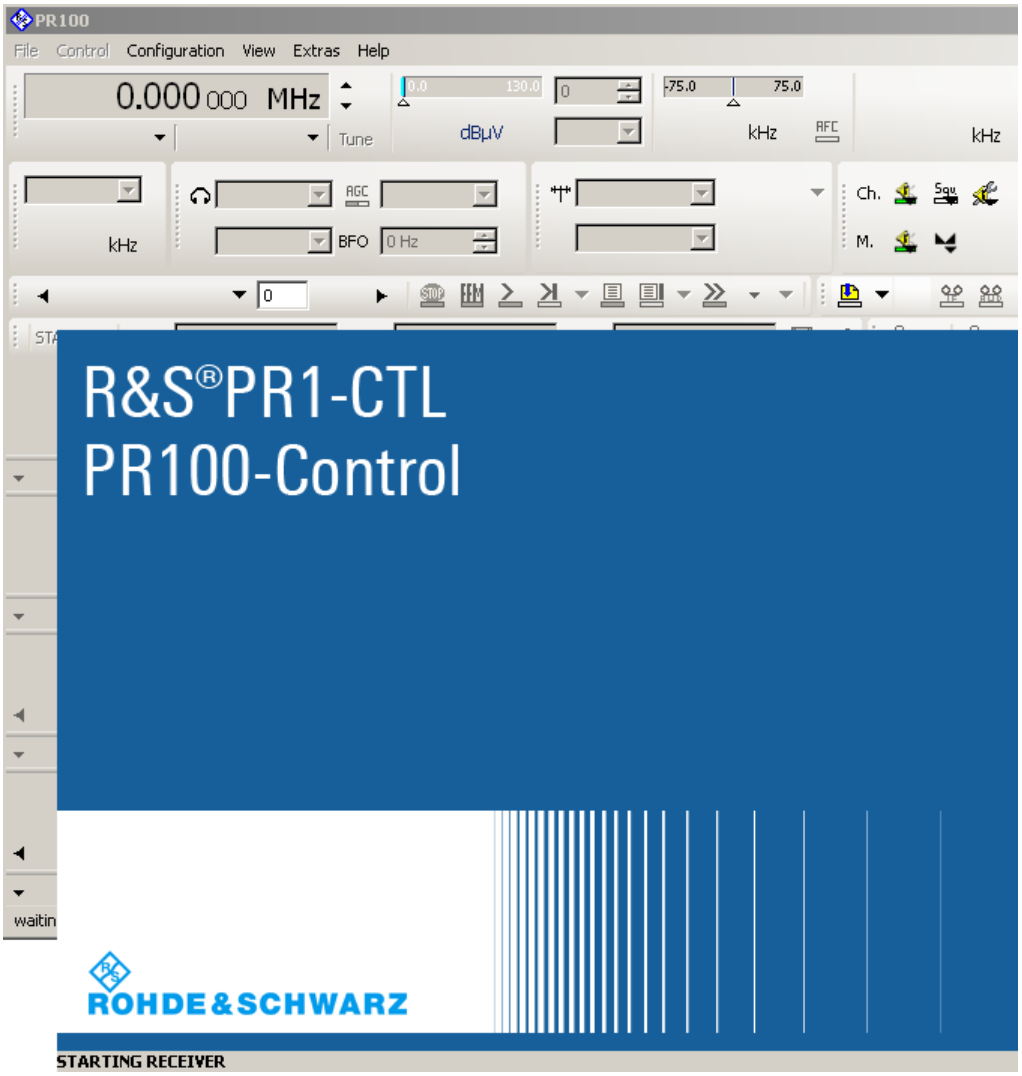



*Figure 3-62: Inactive Control Software*

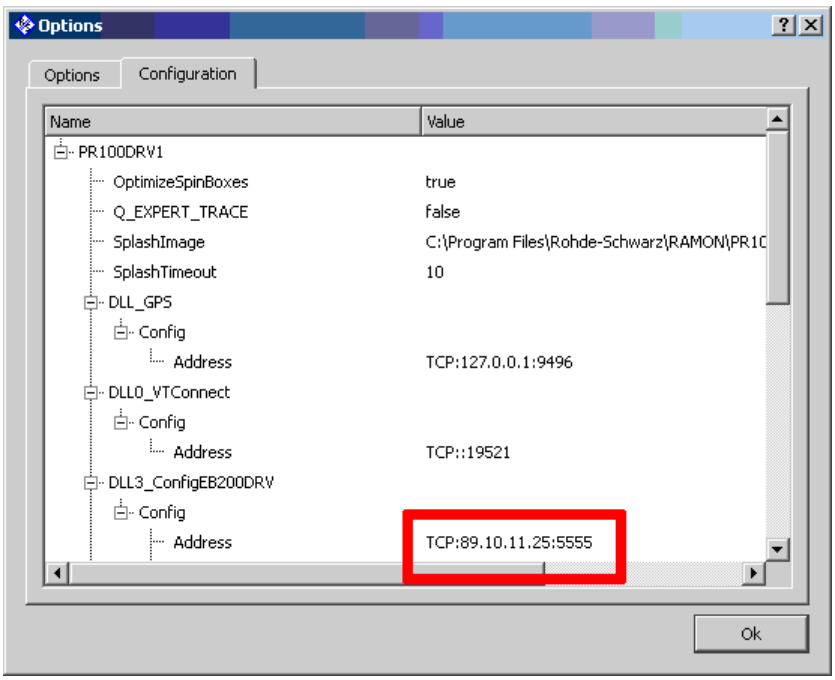



*Figure 3-63: Configuration of the receiver address*

### 3.6.11.2 Recording Toolbar

With the recording toolbar Figure 3-64, depending on the options installed/available on the device IQ, Audio data can be recorded and RDS, SelCall data can be visualized.

IQ recording is not supported in DF mode.

*Figure 3-64: Recording Toolbar*

- Click on the button to start IQ recording. During recording, the button turns green .
  Click on the same button to stop recording.
- Click on the button to start Audio recording. When recording starts, the button turns green

Recorded data is saved in a recording file in the location `RamonData\Recording`.

Maximum recorded file size is configurable by user. Default maximum file size is 15GB. Recorded files are split if the recording exceeds the configured maximum file size.

- Click on the button to activate RDS. Clicking on the down arrow and selecting RDS Output opens the RDS results window Figure 3-65. Whenever RDS is activated, the button turns green . Click on the same button to deactivate RDS.

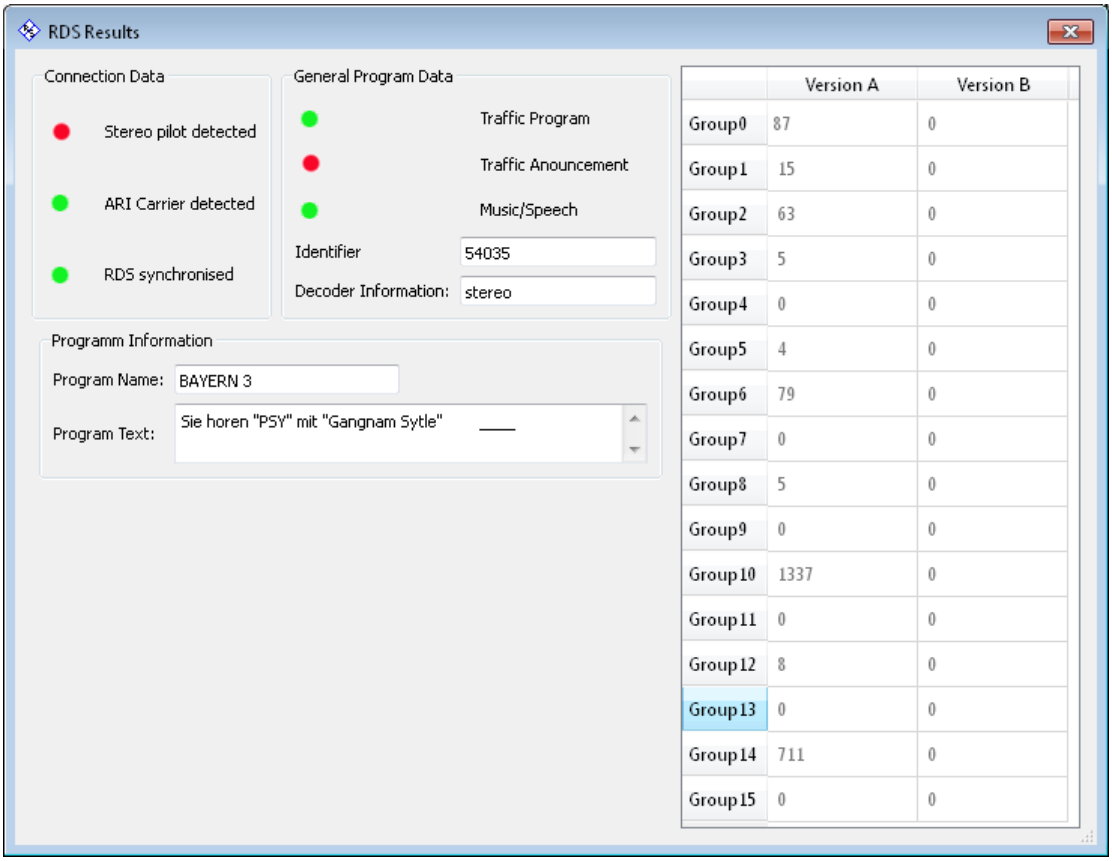



*Figure 3-65: RDS Results*

- Similarly, click on the button to activate SelCall. SelCall results Figure 3-66 can be visualized by clicking on the down arrow and selecting SelCall Output.

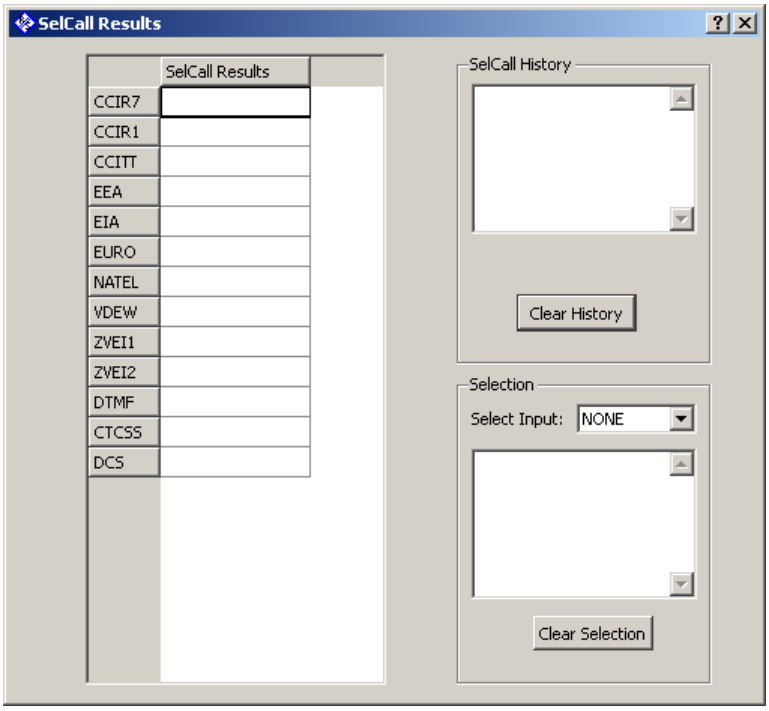
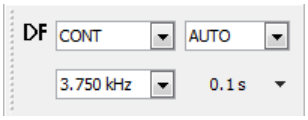



*Figure 3-66: SelCall Results*

## 3.6.12 DDF Settings




The Direction Finding (DF) functionality is only available if the firmware option “DF” has been purchased.

The controls in the DF Setting toolbar are used to set direction finding specific functions in the R&S PR1-CTL.

There are four main controls here:

- **DF-Mode** **:**
  Here it is possible to choose between three modes:
  - **CONT:**
    Continuous direction finding.
    In this mode direction finding is done continuously. This may allow bearings to be taken where signals are specially modulated or very weak and the squelch no longer starts the direction-finding process.
  - **GATE:**
    Signal-triggered direction finding.
    This mode is used where emissions of transmitters may be temporarily interrupted by the modulation (e.g. temporary transmissions) if the transmitter's up time is too short for NORMal mode.

– **NORM:**
Direction finding with squelch.
This mode is preferably used to monitor radio networks. The direction-finding process is started and stopped by the squelch of the DF unit. The DF display reflects the different angles of arrival of the monitored signals without any delay.

- **DF-Bandwidth** 15.000 kHz **:**
Here it is possible to adjust the bandwidth the direction finder uses for its calculations.
  – When in DF mode, the DF bandwidth of the center channel will be decoupled from the IF Panorama step width.
  – When in DF mode, the DF bandwidth has the higher priority over the IF span and IF step setting. Changing the IF span or IF step will only be allowed on a range which does not impact the DF bandwidth setting. On the other hand, when the control software is in non-DF mode, IF span and IF step settings have the higher priority over DF bandwidth.
  – These settings (that are DF bandwidth, span, and step) for DF and AF mode shall be kept separate. This means when switching to DF, the previous settings from DF will be applied. When switching back to AF mode, the previous settings for AF mode will be applied.
- **Averaging Time** 0.1 s **:**
Here it is possible to adjust the time the direction finder uses for averaging before delivering a result
- **Selectivity** AUTO **:**
Here it is possible to set the desired selectivity. The selectivity can be altered in DF mode only. In AF mode, the selectivity is always AUTO.
There are 4 options available:
  – **AUTO:**
  Sets automatic selection. With AUTO the selectivity is set automatically depending on the receiver mode DF or AF.
  – **NORM:**
  Sets normal selection.
  – **NARR:**
  Sets narrow selection.
  – **SHAR:**
  Sets sharp selection.

### 3.6.13 Handover Toolbar

In case a MasterSlave server software was purchased and installed, the Handover Toolbar (Figure 3-67) will be filled with buttons referring to other applications that also connected to the same server.

*Figure 3-67: Handover Toolbar*

The buttons consist of three sections. The first one indicates the current state the button is in, the second one is just a label containing the name of the other application and the third one opens a context menu (Figure 3-71).

Pressing one of these buttons will result in transferring the most important settings (like frequency, demodulation, bandwidth) from the current application to the application which is referred to by the button. This is called a "handover".

*Figure 3-68: Handover Button*

*Figure 3-69: Couple mode active*

*Figure 3-70: Couple mode inactive*

Each of the buttons can be in one of two states:

- **Handover:** when the button is pressed, the current settings will be transferred immediately and only once (Figure 3-68).
- **Couple:** when the button is pressed, the couple mode is activated (Figure 3-69) and settings will be transferred automatically every time one of them is changed. Pressing the button again will deactivate the couple mode (Figure 3-70).

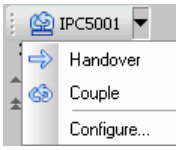



*Figure 3-71: Button Context Menu*

The button state can be changed via a context menu (Figure 3-71). The third menu entry called "Configure" in the context menu will open a dialog and let the user choose which settings are going to be transferred when a handover is executed.

## 3.6.14 Amrec Toolbar

### 3.6.14.1 General Remarks

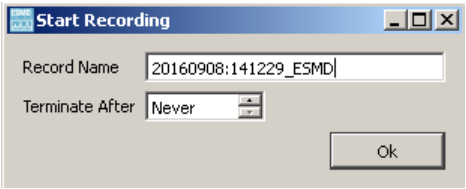
The Amrec toolbar allows access to Amrec devices for recording radio data through a LAN network or (optional feature) using the 10G interface. If the Receiver supports DDC's, the specific channels can be recorded on Amrec as well. There is access to viewing and editing history comments of recent records.

Prerequisite is a running Amrec server with at least one configured Amrec device.

*Figure 3-72: Activated Amrec toolbar*

### 3.6.14.2 Recording

The red button starts a normal recording.




After a recording is started a name for the recording is requested. The suggested default is the record identifier but a descriptive name may help later on.

With ‘Never’ termination of recording starts an infinite recording only limited on the Amrec disk space, otherwise the recoding will be stopped automatically after the time in seconds specified.

Alternatively use continuous recording button and then start recording, which limits the recording in size and always contains the latest data but not necessarily all data.

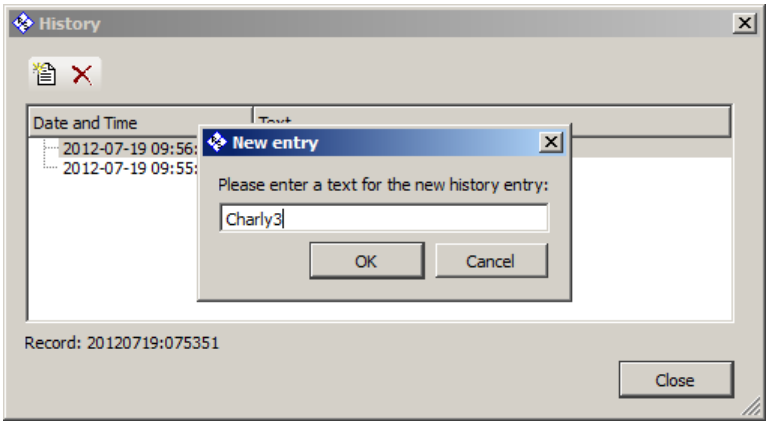
A recording is stopped by pressing the „Record“ button again.

The available disc-space can be seen from the disc space indicator depending on which device is selected in the toolbar.

*Figure 3-73: Activated Amrec recording button in the DDC control*

### 3.6.14.3 History Comments

History comments may be added to a recording while it is being recorded. Press "H" to open the history dialog of the current recording.




The comment is inserted into the recording at the current point of time.

## 3.6.15 Measurement Results Toolbar

The measurement Results toolbar (show in Figure 3-74) can be used to display the supported sensor data during a particular driver mode of operation.

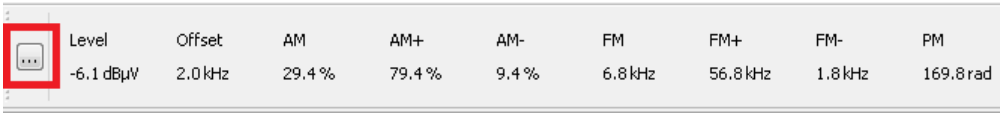



***Figure 3-74: Measurement Results Toolbar***

By clicking the measurement selection button highlighted in Figure 3-74, measurement selection dialog (Figure 3-75) will be opened.

Depending on the driver mode of operation, supported sensor items are displayed. ITU measurements such as Modulation depth, frequency deviation, PM, Bandwidth etc., can be activated and deactivated by selecting the required measurement item. If an item is selected then measurement results corresponding to the selected item is displayed in the measurement results toolbar. If there is no or invalid value associated with the sensor item then the result for that item is displayed with '- - -' value.

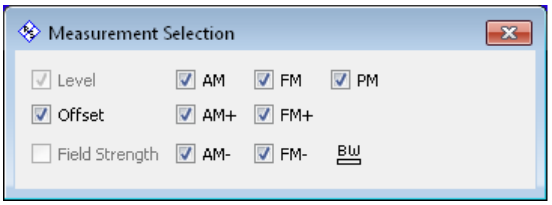



***Figure 3-75: Measurement Selection Dialog***

The button in measurement selection dialog will activate bandwidth measurement. When the button is clicked then the bandwidth measurement mode xdB is activated. The bandwidth button will be replaced with where user can set the XDB measurement mode value. If xdB button is clicked again then BETA% measurement mode will be activated. xdB will be replaced by where user can set the BETA% measurement mode value.

In case of Polar mode of operation, measurement selection button is disabled. The toolbar displays available DF related measurement results as shown in Figure 3-76.

*Figure 3-76: Measurement Results Toolbar in Polar mode*

## 3.7 Spectrum Display

The spectrum display shows the results of a scan or search activity performed on a defined frequency range.

The main actions you can perform on the spectrum display are the following:

- Apply a threshold to the spectrum - refer to Chapter 3.7.2, "Spectrum", on page 84.
- Hold the maximum and the minimum value of a curve - refer to the "Max (Min) Hold" function of the spectrum, see Chapter 3.7.6.4, "Spectrum", on page 92.
- See the results for the current frequency in a result pane - refer to the context menu of the frequency axis, see Chapter 3.7.3, "Frequency Axis", on page 86.
- Make measurements using the frequency markers - refer to Chapter 3.7.2, "Spectrum", on page 84 or to Chapter 3.7.4, "Waterfall", on page 88.
- Display the difference between the current curve and a reference curve - refer to Chapter 3.7.6.7, "Reference Line (Differential Mode)", on page 94.
- Save the current curve - refer to the "Create Snapshot" option of the context menu, see Chapter 3.7.5, "Background Context Menu", on page 88.

Depending on the device and on the software mode you are using, you see one or more spectrum displays. Each one consists of different components and offer different features.

You can switch off some components, or move and reposition them by using drag and drop with the mouse scroll wheel. You can also customize the colors used, using the "Configuration" dialog options, see Chapter 3.7.6, "Configuration Dialog", on page 91.

Therefore, the spectrum display can look different from the standard one that is shown and described here.

The spectrum display can contain the following components:

- **Toolbar** - see Chapter 3.7.1, "Toolbar", on page 84.
- **Spectrum** - see Chapter 3.7.2, "Spectrum", on page 84.
- **Frequency axis** - see Chapter 3.7.3, "Frequency Axis", on page 86.
- **Waterfall** - see Chapter 3.7.4, "Waterfall", on page 88.
- **Context menu** - see Chapter 3.7.5, "Background Context Menu", on page 88.

### 3.7.1 Toolbar

The standard toolbar can contain the following buttons:

- frequency range "zoom in".
- frequency range "zoom out".
- zoom auto Y: adapts the y range of the spectrum to contain the whole curve.
- opens the "Configuration" dialog, see Chapter 3.7.6, "Configuration Dialog", on page 91 for more details.
- holds/restarts the signal.
- 40 MHz enables you to set the frequency range displayed on the frequency axis. Depending on the software mode you are using, you can also toggle "Absolute" on/off, to display the frequencies as absolute values or values relative to the center frequency.
- 5.00 kHz enables you to set the step values of the displayed frequency range.
- Max Hold in IF spectrum or PSCAN mode, if the "Panorama Mode" is activated, enables you to select from the drop-down list the following:
  - "Clear Write" - standard mode.
  - "Max Hold" - keeps the maximum value, so that short-time signals are visible.
  - "Min Hold" - keeps the minimum values, so that weak signals are more visible.
  - "Average" - smooths out the curve (especially the noise).

### 3.7.2 Spectrum

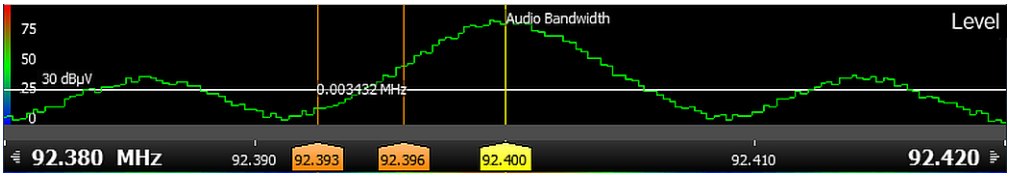



*Figure 3-77: Example: Spectrum*

The spectrum component can consist of the following parts:

- **Spectrum** - the spectrum displays a signal of interest within the frequency range defined in the frequency axis.
  If you right-click on the spectrum component, you open the context menu described in Chapter 3.7.5, "Background Context Menu", on page 88.
- **Y-axis** - offers the following functions:
  - **Scale** - indicates the level of the spectrum.
  - **Zoom function** - enables you to zoom vertically the display. Perform the following steps:
    - Click and hold the left mouse button on the y-axis.
    - Drag the mouse up or down, two horizontal lines appear.
    - Release the left mouse-button. The display makes a zoom to the range defined by the lines.

– **Move function** - enables you to move the level range displayed on the y-axis. Perform the following steps:
  - Press the SHIFT key and click and hold the left mouse-button on the y-axis.
  - Drag the axis up or down as required, an arrow indicates the direction and the current position on the axis.
  - Release the SHIFT key and the left-mouse button: the spectrum changes accordingly.
– **Context menu** - appears when you right-click the y-axis.
  The following functions can be available:
  - "Undo zoom step" - restores the previous zoom level of the y-axis. If you have performed multiple zoom operations, you can perform multiple undoes.
  - "Redo" - reverses the previous "Undo zoom step".
  - "Optimal Height" - adjusts the scale, so that signals are displayed across the full y-axis.
  - "Threshold Marker" - if selected, makes the threshold visible. If not, the threshold is hidden and is displayed only when you hover over it with the mouse cursor.

To restore the zoom or the move range function, double-click in the y-axis.

- **Threshold** - the threshold is a horizontal or curved line used as a reference.
  – You can change its value by using drag and drop or changing its settings, see Chapter 3.7.6.6, "Threshold", on page 94.
  – In case you have zoomed or moved the y-axis to a new range and the threshold is no longer visible, the link "Make threshold visible" appears near the y-axis. By clicking it, the y-axis range moves to include the threshold.
  – You can choose the type of threshold you want to display using the "Threshold" option of the background context menu, see Chapter 3.7.5, "Background Context Menu", on page 88.
  – You can hide the threshold or make it always visible using the "Threshold Marker" option of the spectrum y-axis context menu, as explained above in this chapter.

  For more threshold settings, see Chapter 3.7.6.6, "Threshold", on page 94.
- **Frequency markers** - the following markers can be available:
  – Current frequency marker - displays the frequency of interest and the respective values. You can toggle the marker on/off from the frequency axis context menu, see Chapter 3.7.3, "Frequency Axis", on page 86.
  – Additional frequency markers - display additional frequencies of interest and the respective values. You can toggle the additional markers on/off from the frequency axis context menu, see Chapter 3.7.3, "Frequency Axis", on page 86.
  – Measurement markers - select and display a frequency range:
    - Position the mouse in the spectrum and click the left mouse-button.
    - Drag it until the desired point and then release the mouse-button.

Two vertical measurement markers mark the range selected and indicate the frequency. The frequency difference is also calculated and displayed.
To remove the measurement markers, press the ESC key, or click any other point in the spectrum, or select the option "Hide Measurement Ranges" of the background context menu.

– Memory items markers - display the memory items.

- **Spectrum label** - shows which dimension is displayed in the y-axis of the spectrum.
  To change the dimension displayed, use the "Spectrum" option of the background context menu or use the "Configuration" dialog; see Chapter 3.7.5, "Background Context Menu", on page 88 and Chapter 3.7.6.4, "Spectrum", on page 92 for more details.
- **Center frequency marker** - in "IF" mode and "RF signal spectrum" mode a special yellow marker indicates the center of the frequency range. The frequency scale is relative to the center. If you move the marker to a different position using drag and drop, the frequency range is automatically moved, relative to the new center.

### 3.7.3 Frequency Axis

The frequency axis offers the following functions:

- **Scale** - indicates the displayed frequency range and enables you to determine the frequency of any signals present in the spectrum.
  You can change the frequency range via the "Configuration" dialog, as described in Chapter 3.7.6.5, "Axis", on page 93 or using the commands of the toolbar, as described in Chapter 3.7.1, "Toolbar", on page 84.
- **Zoom function** - enables you to zoom the frequency axis.
  To zoom in/out, position the mouse cursor on the axis and use the mouse scroll, or perform the following steps:
  – Click and hold the left mouse button on the frequency axis.
  – Drag the mouse left or right, two vertical lines appear.
  – Release the left mouse-button. The axis makes a zoom to the range defined by the lines.
- **Move function** - enables you to move the frequency range displayed. Use the buttons ◀ and ▶ at its beginning/end, or perform the following steps:
  – Press the SHIFT key and click and hold the left mouse-button on the axis.
  – Drag the axis left or right as required, an arrow indicates the direction and current position on the axis.
  – Release the SHIFT key and left-mouse button: the frequency range changes accordingly.
- **Definition of frequency ranges** - enables you to define individual frequency ranges and skip, zoom or magnify them:
  – Position the mouse in the spectrum and click the left mouse-button.
  – Drag it until the desired point and then release the mouse-button.

  Right-click on the range created and choose one of the commands listed, as described in Chapter 3.7.5, "Background Context Menu", on page 88.

- **Context menu** - appears when you right-click on the frequency axis.

  The following functions are available:

  – "Linearize" - restores the linear frequency axis scale after you have magnified a range.
  – "Undo" - undoes the last action on the frequency axis.
  – "ReDo" - restores the undone action on the frequency axis.
  – "Absolute" - when the "Center Frequency Marker" is shown, the scale of the frequency range is relative to the center frequency. Choose "Absolute" to display the absolute frequency values in the frequency axis.
  – "Marker Frequency" - contains the frequency marker options:
  "Show Line" - displays the marker as a permanent yellow vertical line.
  "Riding Y" - displays a down arrow in the spectrum and some crosshairs in the other components, indicating the y-axis current value along the marker.
  "Result Panel" - displays all currently available measurements in a panel next to the marker.
  For a description of the different markers, see Chapter 3.7.2, "Spectrum", on page 84

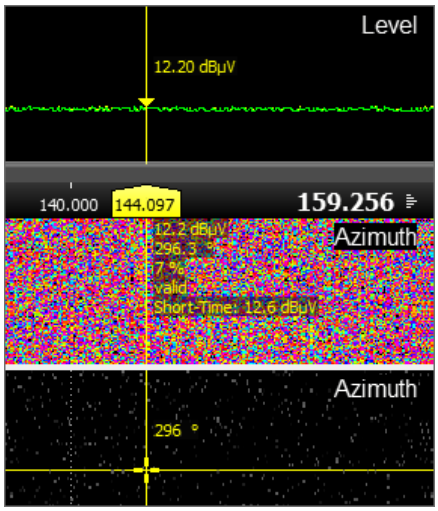



*Figure 3-78: Example: Frequency marker with riding Y and result panel activated*

  – "Add Marker 1-4" - contains the additional frequency marker options. For each of them you can select the following:
  "Show Line" - displays an extra marker as a blue vertical line.
  "Result Panel" - displays all the values related to the marker's frequency in a panel next to the marker.
  For a description of the different markers, see Chapter 3.7.2, "Spectrum", on page 84

### 3.7.4 Waterfall

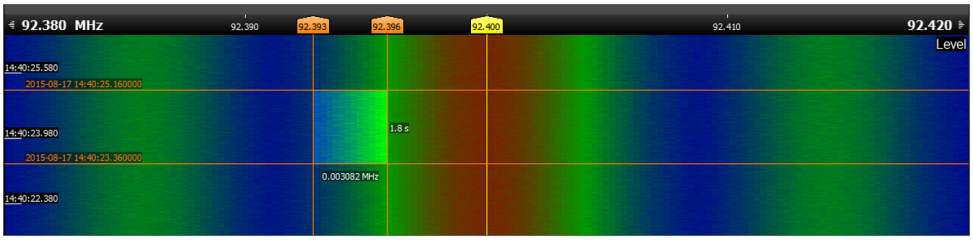



*Figure 3-79: Example: Frequency axis and waterfall with measurement markers*

The waterfall displays all active frequencies of the spectrum over a period of time in the form of a waterfall.

The waterfall component consists of the following parts:

- **The waterfall** - uses colors to visualize the changes in level over time. Each horizontal line represents a scan. These moves towards the bottom of the display over time, giving a waterfall effect. The colors correspond with the colors in the y-axis of the spectrum.
- **Y-axis** - a floating time scale.
- **Measurement markers** - markers to select a section of the waterfall:
  - Position the mouse in the waterfall and click the left mouse-button.
  - Drag it diagonally over the desired section and then release the mouse-button.

  Two vertical and two horizontal measurement markers mark the section selected. The vertical markers indicate the level. The horizontal markers indicate the time. The level and time differences are also calculated and displayed respectively.
  The waterfall is frozen as long as the measurement markers are displayed. The measurement markers can be removed by pressing the ESC key, by clicking anywhere in the waterfall, or via the context menu by selecting "Hide Measurement Ranges".
- **Waterfall label** - shows which dimension is displayed in the y-axis of the waterfall component.
  To change the dimension displayed, use the "Waterfall" option of the background context menu or use the "Configuration" dialog; see Chapter 3.7.5, "Background Context Menu", on page 88 and Chapter 3.7.6.3, "Waterfall", on page 92 for more details.

If you right-click on the waterfall component, you open the context menu described in Chapter 3.7.5, "Background Context Menu", on page 88.

You can change the settings of the waterfall component in the "Configuration" dialog, as described in Chapter 3.7.6.3, "Waterfall", on page 92.

### 3.7.5 Background Context Menu

When you right-click in the spectrum/waterfall/azimuth/elevation component, you access the background context menu.

The menu offers the following options:

- **"Configuration"**
  Opens the "Configuration" dialog. See Chapter 3.7.6, "Configuration Dialog", on page 91 for a complete description.
- **"Max Hold"**
  Toggles the "Max Hold" on/off. See Chapter 3.7.6.4, "Spectrum", on page 92 for more details.
- **"Differential Mode"**
  Toggles the differential mode on/off. This option is available only when a reference curve has been loaded; see Chapter 3.7.6.7, "Reference Line (Differential Mode)", on page 94 for more details.
- **"Create Snapshot"**
  Enables you to use the current curve as a threshold or to save it.

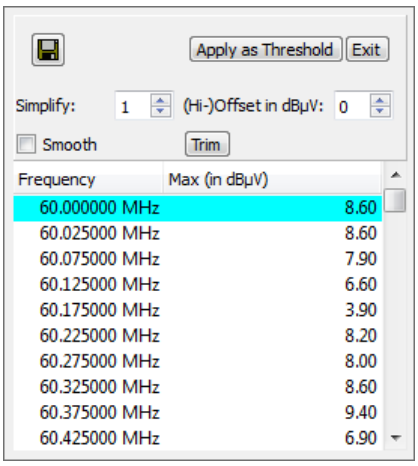



*Figure 3-80: Create snapshot dialog*

In the "Create Snapshot" dialog, the list of points defining the curve is shown. You can use the following buttons:

– saves the curve as a CSV file.
– "Apply as Threshold" - displays the curve in a white color in the spectrum. You can then save the curve using the commands described in Chapter 3.7.6.6, "Threshold", on page 94.
– "Exit" - closes this dialog.

To simplify the curve, you can use the following:

– "Simplify" - enables you to simplify the curve by displaying only one value for every group of frequencies. For example, if you select "5", the maximum value of five frequencies is taken, thus the curve is higher. To lower it, use the "Hi-Offset in dBµV" command.
– "Hi-Offset in dBµV" - enables you to lower the simplified curve by entering or choosing an appropriate y value.
– "Smooth" - smooths the curve.
– "Trim" - applies the current simplifying settings.
  **NOTE:** the undo operation is not available in this case, therefore it is not possible to restore the original curve.

**NOTE:** if the option "Max(Min) Hold" is activated at the time of the snapshot, the curve is stored with the max/min hold.

- **"Hide Measurement Ranges"** -
  Removes the measurement markers from the display. The definition of measurement markers is described in Chapter 3.7.2, "Spectrum", on page 84.
- **"Zoom to X Range"**
  Enlarges the selected range to be the current frequency range. You can obtain the same by pressing F10. If you want to undo the zooming action, choose "Undo" form the context menu or press F11. The definition of a range is described in Chapter 3.7.3, "Frequency Axis", on page 86.
- **"Magnify X Range"**
  Performs a zoom-in of the selected range, while the rest of the axis keeps the old zoom. To restore a uniform frequency axis, choose "Linearize" from the context menu. The definition of a range is described in Chapter 3.7.3, "Frequency Axis", on page 86.
- **"Add Local Suppress Range"**
  Displays the selected range in black, without any spectrum or waterfall data. To undo this action, choose "Clear Local Suppress Range". The definition of a range is described in Chapter 3.7.3, "Frequency Axis", on page 86.

Overlapping suppress ranges are merged.

- **"Clear Local Suppress Range"**
  Undoes the "Add Local Suppress Range" action for the selected range.
- **"Clear All Local Suppress Ranges"**
  Undoes the "Add Local Suppress Range" action for all the defined ranges.
- **"Skip Suppress Ranges"**
  Hides all the ranges that have been suppressed. The frequency axis is no longer linear. To restore it, choose "Linearize" from the frequency axis context menu.
- **"Threshold"**
  Enables you to select the following:
  – "single value" - displays the threshold as a white horizontal line. You can edit its value in the "Configuration" dialog, see Chapter 3.7.6.6, "Threshold", on page 94, or by dragging and dropping the threshold line with your mouse.
  – "curve" - displays the threshold as a white curve. This option is available only:
  - if you have loaded a CSV file representing a curve through the "Configuration" dialog, see Chapter 3.7.6.7, "Reference Line (Differential Mode)", on page 94, or
  - if you have created a snapshot of a curve, using the "Create Snapshot" option of the context menu.

## 3.7.6 Configuration Dialog

The "Configuration" dialog can be opened via:

- The button of the toolbar.
- The "Configuration" option of the background context menu.

The "Configuration" dialog consists of two areas:

- Left area - lists the items that can be configured. The currently selected item is highlighted.
  Some items, indicated with a left arrow, have subitems. Click the item to open the list of its subitems.
- Right area - lists the options valid for the item or subitem currently selected in the left area.

The following buttons are available:

- "OK" - confirms your changes and closes the dialog.
- "Cancel" - aborts the dialog.
- "Apply" - implements the changes made.

The left area of the "Configuration" dialog can contain the following items:

- **"Level Display Unit"** - see Chapter 3.7.6.1, "Level Display Unit", on page 91.
- **"Resolution"** - see Chapter 3.7.6.2, "Resolution", on page 91.
- **"Waterfall"** - see Chapter 3.7.6.3, "Waterfall", on page 92.
- **"Spectrum"** - see Chapter 3.7.6.4, "Spectrum", on page 92.
- **"Axis"** - see Chapter 3.7.6.5, "Axis", on page 93.
- **"Threshold"** - see Chapter 3.7.6.6, "Threshold", on page 94.
- **"Reference Line" ("Differential" mode)** - see Chapter 3.7.6.7, "Reference Line (Differential Mode)", on page 94.
- **"Colors"** - see Chapter 3.7.6.8, "Colors", on page 95.

### 3.7.6.1 Level Display Unit

The **"Level Display Unit"** item enables you to choose the unit of the level:

- "Level [dBµV]".
- "Level [dBm]".

### 3.7.6.2 Resolution

You can configure the resolution of the transmitted data to limit the data traffic.

The **"Resolution"** item has the following options:

- "Frequency" - sets the horizontal resolution of the spectrum. You can choose between "High", "Med" and "Low".

- "Data" - sets the vertical resolution of the azimuth and elevation components. You can choose between "High", "Med" and "Low".
- "Waterfall" - determines the velocity of the waterfall. In the drop-box, you can select a speed based on the number of scans per line or on the number of lines per second.
- "Sample rate" - sets the refresh time of all the components and the result panel. You can choose between "Auto", "High", "Med" and "Low"; if you choose "Auto", the refresh time is adapted to the scan speed of the device in use.

### 3.7.6.3 Waterfall

The **"Waterfall"** item has the following options:

- "Show" - toggles the waterfall component on/off.
- "Show Grid" - toggles the grid-lines (floating time axis and frequency axis) on/off.
- "Show Y Labels" - toggles the floating time axis on/off.
- "Speed" - enables you to select the velocity of the waterfall. The speed depends on the interval chosen: the number of scans per line or the number of lines per second. This option appears also in the "Resolution" item, as explained in Chapter 3.7.6.2, "Resolution", on page 91.
- "Dimension" - enables you to select the dimension displayed. The options depend on the device you are using: for a standard receiver, only level is available. If you use a direction finder, level, azimuth, elevation and quality can be available.

### 3.7.6.4 Spectrum

The **"Spectrum"** item has the following options:

- "Show" - toggles the spectrum component on/off.
- "Show Grid" - toggles the grid-lines on/off.
- "Show Y Labels" - toggles the numbered scale of the y-axis on/off.
- "Show Color Legend" - toggles the color scale of the y-axis on/off. These colors reflect the colors used in the waterfall.
- "Y-axis Dimension" - enables you to set which dimension is displayed in the spectrum component.
- "Show 2 Curve" - toggles a second curve on/off.
- "Fill below Curve" - toggles the filling below the second curve on/off.
- "2nd Dimension" - enables you to set which dimension is displayed as a second curve in the spectrum component.

The **"Max (Min) Hold"** function enables you to keep the maximum and minimum values of the level spectrum for a desired time. You can use the following options:

- "Calculate maximum" - calculates and displays the maximum value as a second curve on the spectrum. The second curve is blue.

- "Calculate minimum" - calculates and displays the maximum and the minimum value as a second curve on the spectrum. This parameter must be selected together with "Calculate maximum", otherwise no second curve is displayed.
- "Hold Time" - enables you to select the time of persistence of the maximum/minimum values (in seconds). This action generates a horizontal stretch in the second curve.
- "Show Curve" - toggles the green curve indicating the current level on/off.

*Figure 3-81: Example: Spectrum with Max hold function turned on*

**NOTE:** the "Max(min) Hold" function is persistent: if set before shutdown, it will be automatically applied after restart.

### 3.7.6.5 Axis

Sets the settings of the frequency axis and the different components of the Y axis.

The **"Frequency"** subitem has the following options:

- "Display values from/to" - enables you to set the minimum and maximum frequencies that define the frequency range displayed.
- "Skip Suppress Ranges" - toggles the suppress ranges off/on.
- "Edit Suppress Ranges" - opens a dialog to allow you to create, edit, open, delete and save suppress ranges. You can also merge suppress ranges.
- "Special Ranges" - enables you to define special frequency ranges that you want to magnify or hide:
  - Insert the minimum and maximum frequencies of the special range.
  - Choose the option "Hide", or enter a magnification value.
  - Click "Insert" to insert the special range into the list above.
  - To replace or delete a special range of the list, select it and use the "Replace" and "Delete" buttons.

The **"Level"** subitem enables you to enter the minimum and maximum values of the level y-axis range.

The **"Short Time Level"** subitem enables you to enter the minimum and maximum values of the short time y-axis level range.

### 3.7.6.6 Threshold

The configuration dialog **"Threshold"** item offers you the following options:

- "Threshold Value in dbµV" - enables you to type or select the desired value.
- "Use Threshold Line" - enables you to load a CSV file curve by clicking the "Load/ Edit" button.
- "Apply Threshold Status" - depending on the device you are using, enables you to set the following options server-side:
  - "Use Threshold" - visualizes only the values above the threshold, but keeps the whole level curve.
  - "Apply to Level Curve" - visualizes only the values of the level curve that are above the threshold.
    **NOTE:** when you select this option, the following option "Hide curve below threshold" is automatically selected.
- "Curve Graphics" - enables you to set the following graphical options:
  - "Hide curve below threshold" - hides any part of the curve which is below the threshold line.
  - "Gray curve below threshold" - applies a gray background to the spectrum below the threshold line.

### 3.7.6.7 Reference Line (Differential Mode)

The differential mode enables you to display the difference between the current curve and a reference curve in the spectrum component.

The **"Reference Line (Differential Mode)"** item enables you to load the reference curve and activate the differential mode.

The following buttons are available:

- opens a CSV file representing a curve.
- adds a CSV file representing a curve.
- subtracts a CSV file representing a curve.
- saves the resultant curve as a CSV file.
- To simplify the curve, you can use the following:
  - "Simplify" - enables you to simplify the curve by displaying only one value for every group of frequencies. For example, if you select "5", the maximum value of five frequencies is taken, thus the curve is higher. To lower it, use the "Hi-Offset in dBµV" command.
  - "Hi-Offset in dBµV" - enables you to lower the simplified curve by entering or choosing a y value.
  - "Smooth" - smooths the curve.
  - "Trim" - applies the current "Simplify" settings.
    **NOTE:** the undo operation is not available in this case, therefore it is not possible to restore the original curve.

After you have loaded your reference line, select the checkbox "Apply" at the top of the dialog and then confirm with the "Apply" or "Ok" button. The differential mode is activated.

You can also toggle the differential mode on/off using the "Differential Mode" option of the background context menu, see Chapter 3.7.5, "Background Context Menu", on page 88.

When the "Differential mode" is active, the color set is different from the standard one and the threshold is changed to an absolute value. For example, if you set a threshold of 20 dBµV, when you toggle the "Differential mode" on, the threshold is the interval -20/+20 dBµV.

### 3.7.6.8 Colors

You can customize many of the colors used in the spectrum display.

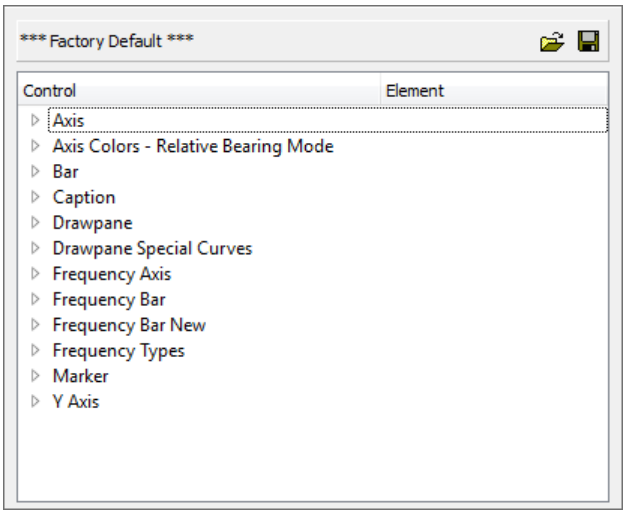



*Figure 3-82: Colors assignments*

**"Assignments"** - this menu item enables you to change the color settings for the spectrum. The top bar displays the name and location of the current CST file in use, or "Factory Default" if the default set is used.

You can use the button to load an existing CST file and the button to save the changes you make through this dialog.

The individual parts of the spectrum are listed below and can be configured from here. For example, to change the color of the scale of the y-axis:

- Select "Y axis".
- Double click the field "Text" to access the corresponding drop-down list.
- Select a color from the drop-down list.
- Click "Apply" to implement the changes.
- Save your changes in a CST file.

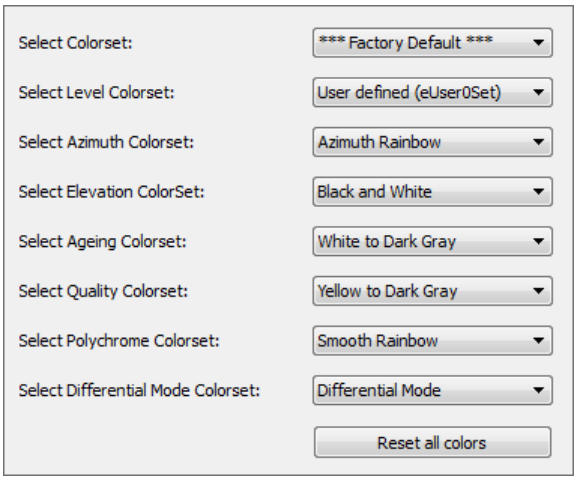



*Figure 3-83: Colors waterfall*

**"ColorSets (Waterfall)"** - this menu item enables you to assign a color set to a specific function. Color settings can be changed for the user interface, the waterfall and the "Polychrome IF Panorama". For example, to assign a color set for the waterfall:

- Select "Select Level ColorSet".
- Choose a color set from the drop-down list (e.g."User Defined (1) or Rainbow ").
- Select "Apply" to activate the change.

To restore the default color settings, click the "Reset all colors" button.

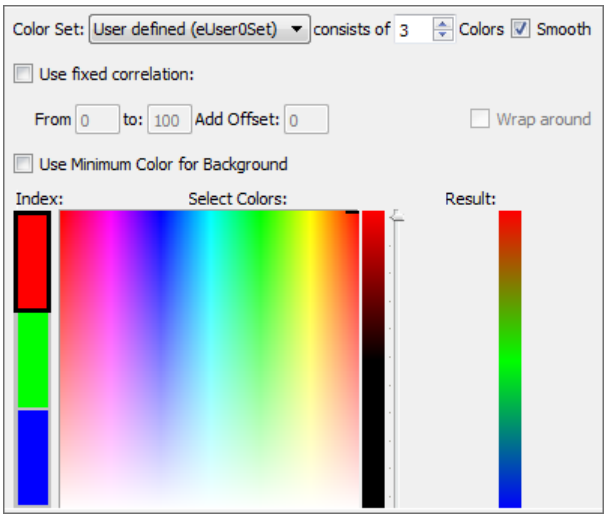



*Figure 3-84: User-defined color sets*

**"User defined ColorSets"** - this menu item enables you to redefine one of the three pre-defined color sets. The default color set is "User defined (0)".

To redefine a color set:

- Select a color set from the "Color Set" drop-down list.
- Select the total number of colors desired from the "Color Set" field (up to 36). The vertical "Index" bar displays a corresponding number of fields.
- Select a field and choose the desired color from the color box "Select Colors". You can change its intensity using the adjacent scale. The result is shown in the "Result" bar. Repeat the color assignment for every field.

You can also use the following options:

- Select "Smooth" to get a continuous transition between the colors of the different fields.
- Select "Use Minimum Color for Background" to use the lowest color on the scale for the background.
- Select "Use fixed correlation" to assign a specific color to a defined range of values.
  For example, in case you interested only in azimuth values between 0 and 90, perform these steps:
  - Type 0 and 90 in the "From" and "to" entries. The "Result" bar displays a numbered scale from 0 to 90.
  - If you have set a total number of three colors in the "Color Set" field, the "Index" bar has three fields. The lowest one corresponds to the 0 to 30 range, the middle one to the 30 to 60 range and the top one to the 60 to 90 range.
  - Assign a different color to each field or, if one field is more significative than the others, assign a color only to that field and leave the others empty. You can therefore easily detect an azimuth signal occurring in that field.
  - Assign the color set edited to the azimuth, by choosing the "ColorSets(Waterfall)" subitem and select the edited color set from the drop-down list near the "Select Azimuth ColorSet" option.

## 3.7.7 Spectrum Display - Additional Features

If the device you are using has the DF option, the spectrum display offers you some extra features, which are described in this chapter.

### 3.7.7.1 Toolbar

The toolbar contains the following extra button:

- toggles the azimuth and elevation histogram on/off, see "Histogram" on page 100 for more details.

### 3.7.7.2 Azimuth

The azimuth component offers the same features as the spectrum, you can therefore refer to Chapter 3.7.2, "Spectrum", on page 84.

You can activate the azimuth component via the "Configuration" dialog, see "Azimuth" on page 99 for more details.

### 3.7.7.3 Elevation

The elevation component offers the same features as the spectrum, you can therefore refer to Chapter 3.7.2, "Spectrum", on page 84.

You can activate the elevation component via the "Configuration" dialog, see "Elevation" on page 100 for more details.

### 3.7.7.4 Histogram

The histogram component shows the azimuth and elevation histograms. It is displayed as a separate component only when the related option "Separate Widget" in the "Configuration" dialog is selected. If not, the histogram is shown directly inside the azimuth and elevation components. Other settings in the "Configuration" dialog allow you to toggle the histogram on/off, see "Histogram" on page 100 for more details.

You can also toggle the histogram on/off using the button of the Toolbar or the "Histogram" option of the background context menu; see Chapter 3.7.7.1, "Toolbar", on page 97 and Chapter 3.7.7.5, "Background Context Menu", on page 98.

### 3.7.7.5 Background Context Menu

The background context menu contains the following extra options:

- **"Histogram"** - toggles the azimuth and elevation histogram on/off, see "Histogram" on page 100 for more details.
- **"Waterfall"** - enables you to configure the waterfall component to display one of the following:
  - "Level" - displays the level values.
  - "Azimuth" - displays the azimuth values.
  - "Elevation" - displays the elevation values.
  - "Quality" - displays the quality values.
  - "Validity" - displays the validity values.
  - "Short Time Level" - displays the short-time level values.
- **"Azimuth"** - enables you to set the position of the yellow horizontal ruler in the azimuth component:
  - "Current" - the ruler is in the current value position.
  - "Histogram" - the ruler is in the highest histogram value position.
  - "Manual" - enables you to move the ruler as desired by using drag and drop.
- **"Elevation"** - enables you to set the position of the yellow horizontal ruler in the elevation component:
  - "Current" - the ruler is in the current value position.
  - "Histogram" - the ruler is in the highest histogram value position.

  - "Manual" - enables you to move the ruler as desired by using drag and drop.
- **"Spectrum"** - enables you to choose which dimension is displayed in the spectrum component:
  - "Level" - displays the level values.
  - "Quality" - displays the quality values.
  - "Short Time Level" - displays the short-time level values.

### 3.7.7.6 Configuration Dialog

The following items of the "Configuration" dialog contain further subitems:

- **Axis** - see "Axis" on page 99.

The "Configuration" dialog contains the following extra items:

- **Azimuth** - see "Azimuth" on page 99.
- **Elevation** - see "Elevation" on page 100.
- **Histogram** - see "Histogram" on page 100.

**Axis**

The **"Axis"** item also contains the following subitems:

- The **"Azimuth"** subitem enables you to enter the minimum and maximum values for the azimuth y-axis range.
- The **"Elevation"** subitem enables you to enter the minimum and maximum values for the elevation y-axis range.
- The **"Quality"** subitem enables you to enter the minimum and maximum values for the quality y-axis range.

**Azimuth**

The "Azimuth" item offers the following options:

- "Show" - toggles the azimuth component on/off.
- "Show Grid" - toggles the grid-lines on/off.
- "Show Y Labels" - toggles the numbered scale on/off.
- "Show Color Legend" - toggles the color scale (behind the y-axis) on/off. These colors reflect the colors used in the waterfall.
- "Hold Time" - defines the hold time in which the histogram is calculated (in seconds).
- "Quality Color Coding" - if selected, the quality value is indicated by different colors.
- "Resolution" - enables you to set the resolution of the azimuth component. You can find the same setting in the "Resolution" item of the "Configuration" dialog, see Chapter 3.7.6.2, "Resolution", on page 91 for more information.
- "Calculation Mode" - enables you to set the position of the yellow horizontal ruler in the azimuth component:
  - "Current" - the ruler is in the current value position.

– "Histogram" - the ruler is in the highest histogram value position.
– "Manual" - enables you to move the ruler as desired by using drag and drop.

**Elevation**

The "Elevation" item has the following options:

- "Show" - toggles the elevation component on/off.
- "Show Grid" - toggles the grid-lines on/off.
- "Show Y Labels" - toggles the numbered scale on/off.
- "Show Color Legend" - toggles the color scale (behind the y-axis) on/off. These colors reflect the colors used in the waterfall.
- "Hold Time" - defines the hold time in which the histogram is calculated (in seconds).
- "Quality Color Coding" - if selected, the quality value is indicated by different colors.
- "Resolution" - enables you to set the resolution of the elevation component. You can find the same setting in the "Resolution" item of the "Configuration" dialog, see Chapter 3.7.6.2, "Resolution", on page 91 for more information.
- "Calculation Mode" - enables you to set the position of the yellow horizontal ruler in the azimuth component:
  – "Current" - the ruler is in the current value position.
  – "Histogram" - the ruler is in the highest histogram value position.
  – "Manual" - enables you to move the ruler as desired by using drag and drop.

**Histogram**

The **"Histogram"** item has the following options:

- "Show Histogram" - toggles the histogram on/off. It is shown inside the relative component.
- "Separate Widget" - displays the histogram in a separated component.
- "Right aligned" - shows the histogram right aligned.

You can also change the hold time, that is the time during which the histogram is calculated, in the azimuth or elevation items. See "Azimuth" on page 99 and "Elevation" on page 100.

## 3.8 Direction Finding View

Direction finding view will be available with the installed firmware options "GPS" and/or “DF”.

This window is activated via the button.

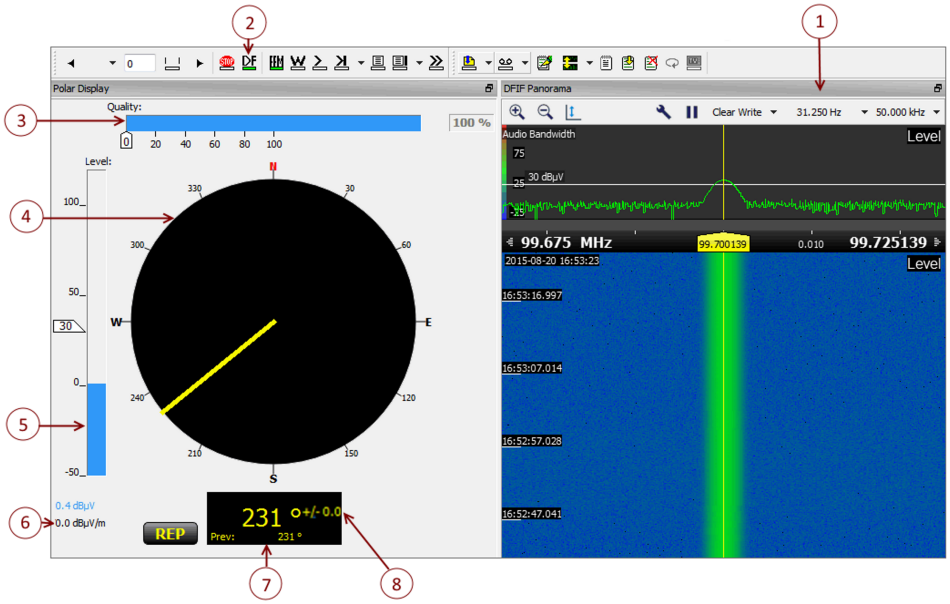



*Figure 3-85: Direction Finding window*

1 = Step mode and step value. Available when "DF" option is installed.
2 = Df On/Off button. Available when "GPS" and/or "DF" options are installed.
3 = Bearing quality bar and Value with DF Quality squelch marker. Available when "DF" option is installed.
4 = Azimuth direction for DF or compass value for GPSC in north related view.
5 = Signal level as bar and value with level threshold marker.
6 = Signal field strength value.
7 = Current and previous DF azimuth or compass value.
8 = Azimuth deviation.

## 3.8.1 Device frequency mode setting

Depending on the options installed and antenna connected, the activation of the "DF" button will set the device to either DF or CW frequency mode.

These are the behaviors on FFM mode:

- DF and GPSC options installed:
  - DF antenna is connected: the activation of the "DF" button will set the device to DF frequency mode. "Polar" and "DFIF panorama" will be the active dock widgets.
  - HE300/HL300/HE400 or no antenna is connected: the activation of the "DF" button will set the device to CW frequency mode. "Polar" and "IF panorama" will be the active dock widgets. When in Search and MSearch modes, the "DF" button should be disabled.
- DF option installed, GPSC option not installed:
  - DF antenna is connected: the activation of the "DF" button will set the device to DF frequency mode.
  - HE300/HL300/HE400 or no antenna is connected: Control SW cannot shift to DF on. A warning message will be displayed when you try to shift to DF Search and to DF MSearch.

- GPSC option installed, DF option not installed:
  - DF Antenna or HE300/HL300/HE400 or no antenna connected: the activation of the "DF" button will set the device to CW frequency mode.

## 3.8.2 Polar Display

**Note**

The availability of the quality display, elevation display and roll bar depends on the device's frequency mode.

- The elevation and roll bar will be displayed during AF mode. These will have values when the antenna connected supports the measurement of elevation angles and roll data.
- In DF frequency mode, the quality bar will be shown, while the elevation and roll bar will be hidden.

**Setting of the polar display:**

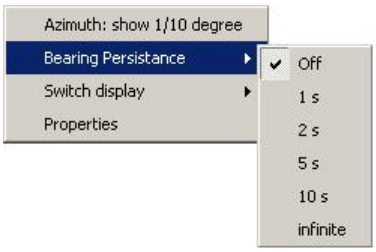



*Figure 3-86: Context menu*

- **Azimuth: show 1/10 degree** - enables display of 1/10 degree for the azimuth. (Please note that the accuracy of a DF system depends on location, antenna, surroundings etc.)
- **Bearing Persistence** - when DF mode is supported, it sets how long a bearing is displayed after the signal gets inactive when the DF Mode is ‘Normal’ or ‘Gate’ (in continuous mode azimuth is always displayed).
- **Large fonts** - switches the display to a larger font (e.g. for high resolution notebook displays).
- **Properties** - opens the Properties Dialog.

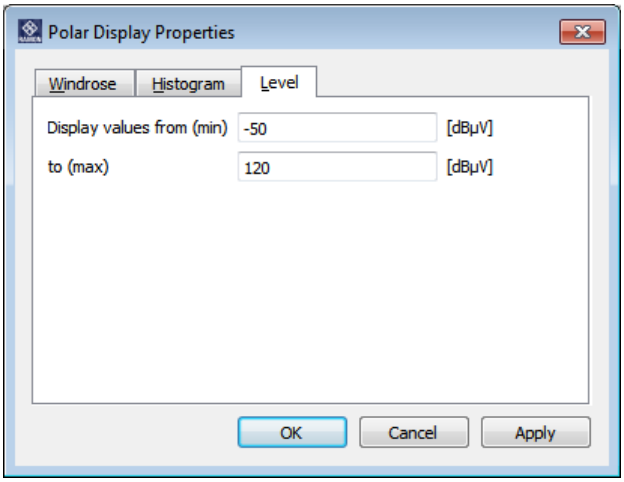



*Figure 3-87: Properties dialog - Level tab*

The "Level" tab of the "Properties" dialog enables you to set the minimum and maximum values of the displayed Level.

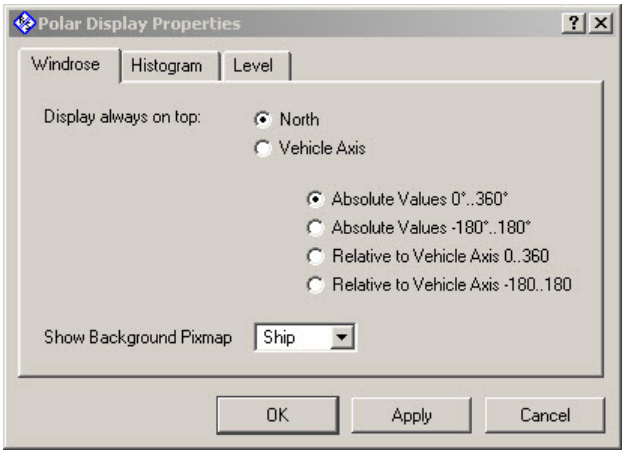



*Figure 3-88: Properties dialog - Windrose tab*

The "Windrose" tab of the "Properties" dialog enables you to set the appearance of the polar display for mobile DF platforms like vehicles or ships.

## 3.9 Status Bar

The status bar displays information about the status and the current mode of operation of the device.

The left side of the bar is used to display some messages.

*Figure 3-89: Receiver status bar*

## 3.10 Reporting

Sends the monitored results to the inbox of the application ReportEdit by clicking with the left mouse button on the menu item.

## 3.11 Recordings

### 3.11.1 Scan-Recording

Click on the button to start recording. Click again to stop recording.

The data is saved in a recording file in `RamonData\Recording`. This file contains information about time, frequency, level, etc. and can be used for later evaluation with tools such as ScanReplay or ActivityAnalyzer.

### 3.11.2 IF-Recording

Click on the button to start an IF-Recording in FFM mode. The recorded data will be saved to a WAV-File in the configured directory. The filename contains information about the recording date and time. Further analysis of the recording can be done using R&S AmLab, R&S GX430 or similar tools.

The status of the recording can either be “running” or “off”. In state running the small bar inside the button will be illuminated in green, otherwise it will be gray.

The recording bandwidth and frequency are taken from the current settings in the user interface. If a bandwidth higher than the maximum allowed for the recording is selected it will automatically be changed. This limitation is due to the maximum throughput of the network. But also at lower bandwidth settings there is a possibility that packet loss will be experienced. This leads to gaps in the time resolution of the recording. It is especially likely to happen at high bandwidths (>300kHz) where the network usage is near its maximum (for 100MBit connections), if the computer is busy doing other tasks or if the hard disk is under heavy usage so that the data cannot be written in time. If packet loss is experienced it is advisable to reduce other network traffic and shutdown other tasks currently running on the computer.

Current maximum possible recording bandwidth is 5MHz. Storage medium should be fast enough to cope with the high data rate (~25Mbps) incurred due to recording signal at this bandwidth. It is suggested to the user to use high performance hard disks such as SSD or SCSI to successfully record the data at maximum possible bandwidth.

### 3.11.3 Audio-Recording

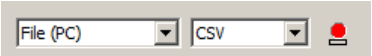
(not with firmware versions equal or lower than 1.21)

By clicking on the Audio-Recording button , located right next to the IF-Recording button, an audio recording of the current audio output with the current quality settings is started. Clicking again will stop the recording. The output is even recorded if the audio output is muted at the time of recording. After stopping the recording activity a *.wav file is written to the standard recording directory (most likely D:\RamonData \Recording\..). These audio files can be played back with any standard media player like the Windows Media Player, Quicktime, VLC or MPlayer. The name of the files will include all the relevant information, such as the recording time, recorded frequency, demodulation bandwidth and demodulation type.

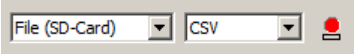
### 3.11.4 CSV Recording

CSV Recording records trace data in CSV format on device and PC. The supported modes are FFM, Scan, Search, MScan, MSearch frequency and DF modes. For DF MSearch, CSV recording is only available on PC, not device.

When "Recording Target Location" is set to "File (PC)", CSV recording is only done in the control software.




When setting "Recording Target Location" to "File (SD-Card)", CSV recording is only done in the device.




## 3.12 Omni Phase Calibration

Omni phase calibration is a process of creating omni phase correction data for antennae employing Watson-Watt direction finding (DF) method e.g. ADD107 and ADD119. Watson-Watt DF method is susceptible to an azimuth error of 180° under certain conditions, depending on the near environment of the DF antenna, e.g. the vehicle it is mounted on or the person who carries a mobile DF system. This error has a systematic nature and can therefore be corrected. A correction data file is generated and is uploaded to the device.

RAMON provides features to:

- generate a file containing the correction data and upload it to the device, and
- upload already created correction data file to the device.

These features can be invoked from the 'Omni phase correction...' and 'Upload Correction Data ...' menu items respectively; present under Configuration menu of the device control software.

### 3.12.1 Omni Phase Calibration Wizard

Start the wizard by selecting 'Omni phase correction...' menu item present under the Configuration menu. Upon selection of the menu item, a wizard page, as shown in the figure below, will be displayed

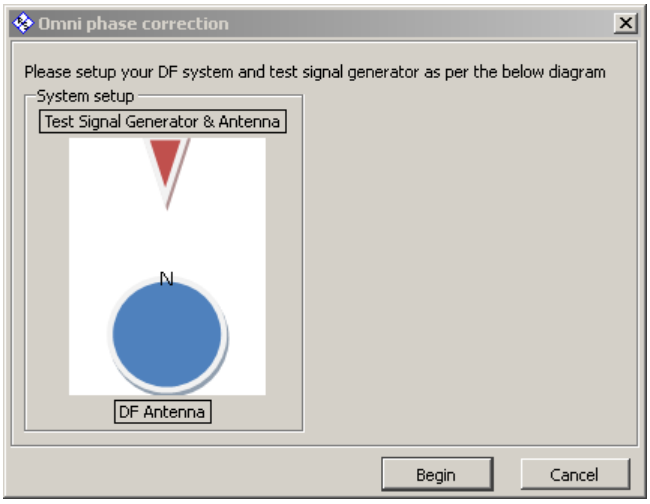



*Figure 3-90: Figure 1: Omni phase calibration wizard - First page*

Connect the Watson-Watt DF antenna to the device; a Watson-Watt antenna is necessary to successfully proceed with the wizard. Position the transmitting antenna, which is connected to the test signal generator, right in front of the north marking of the DF antenna. Once the set up is ready as per the diagram shown on the first wizard page, click the 'Begin' button to start with the measuring steps.

**Note:**If the control software fails to detect a Watson-Watt antenna connected to the device, a warning dialog box will be shown when Begin button is clicked.

A screenshot of the second page of the wizard is shown below:

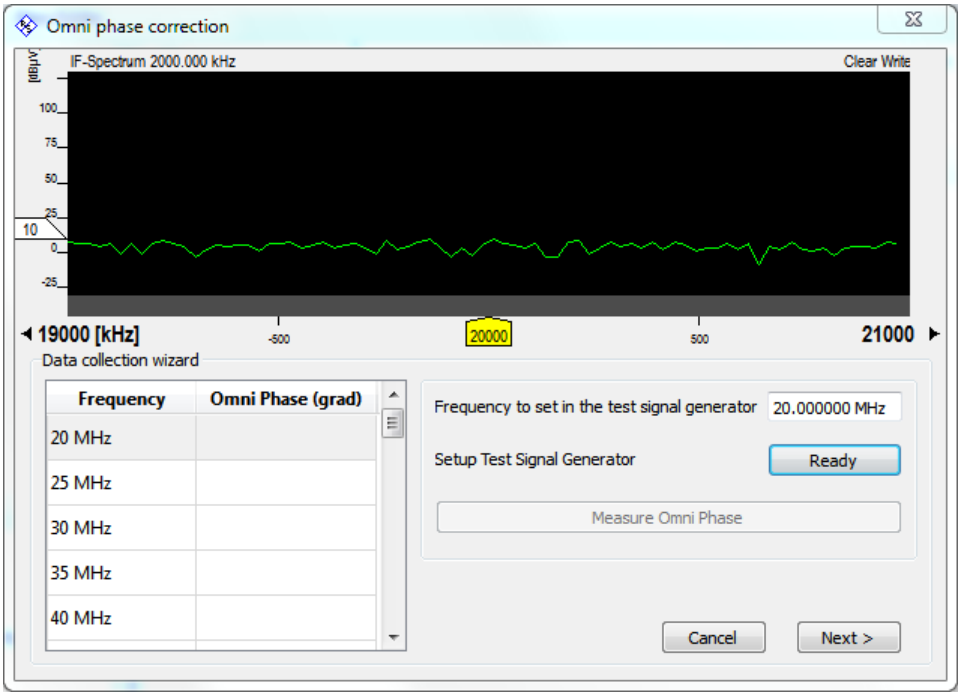



*Figure 3-91: Figure 2: Omni phase calibration wizard - Second page*

When the second page is shown, the device will be switched to the DF mode and the center frequency will be selected as the minimum frequency of the Watson-Watt range of the connected antenna. User has a flexibility to enter a frequency with in ±1Mhz of the center frequency for all frequency except the first and last frequency of the Watson-Watt range. This is to make sure that the selected center frequency is free from transmissions other than that of the signal generator. Current selected center frequency will be high lighted in the table on the left hand side of the wizard page. Steps to be followed to measure omni phase value are given below:

1. Make sure that there is no existing signals at the center frequency by looking at the IF-Spectrum.
   a) If an existing emission is detected at the center frequency, move the center frequency to a one which is free from emissions.
2. Set the signal generator frequency to the value shown on the edit box. Make sure that the transmitted power is good enough to view a peak in the IF-Spectrum.
3. Once the signal generator is configured with the center frequency, press the 'Ready' button to acknowledge that the setting is made at the signal generator.

   Now the 'Measure Omni Phase' button will be enabled.
4. Click the 'Measure Omni Phase' button to measure the omni phase value.

   The measured (and corrected) value will be updated on the 'Omni Phase' column of the table for the corresponding frequency. And the next frequency from the table will be automatically selected.

Continue the above steps for all the frequencies listed in the table. Once omni phase is measured for all the frequency points, click the 'Next' button. "Save Correction data file' dialog box will be displayed as shown below:

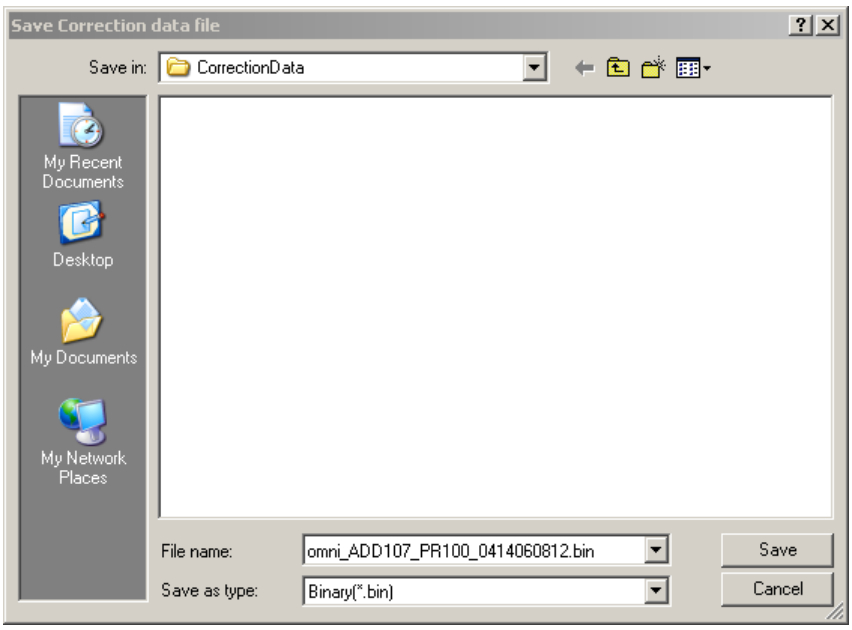



*Figure 3-92: Figure 3: Omni phase calibration wizard - Save page*

The 'File name:' field will be pre-populated with a default file name that contains both the selected antenna name and the device name with the date time stamp. You can either accept the proposed name or given a different name. Make sure that the file name does not exceed 32 characters in length. Click the save button.

Upload correction data dialog box will be shown with the pre-selection of the latest correction data file. Select the 'Apply correction data to antenna' check box if it is not already selected to select the correction data to the antenna after uploading it to the device. Press 'Upload Data' to upload the file and end the wizard. Or the user can choose not to upload the file right away by clicking on the 'Close' button.

### 3.12.2 Upload Correction Data

User can upload the already generated correction data to the device. For this, select the 'Upload Correction Data ...' menu item from the 'Configuration' menu. A file selection dialog box, shown in the figure below, will be displayed:

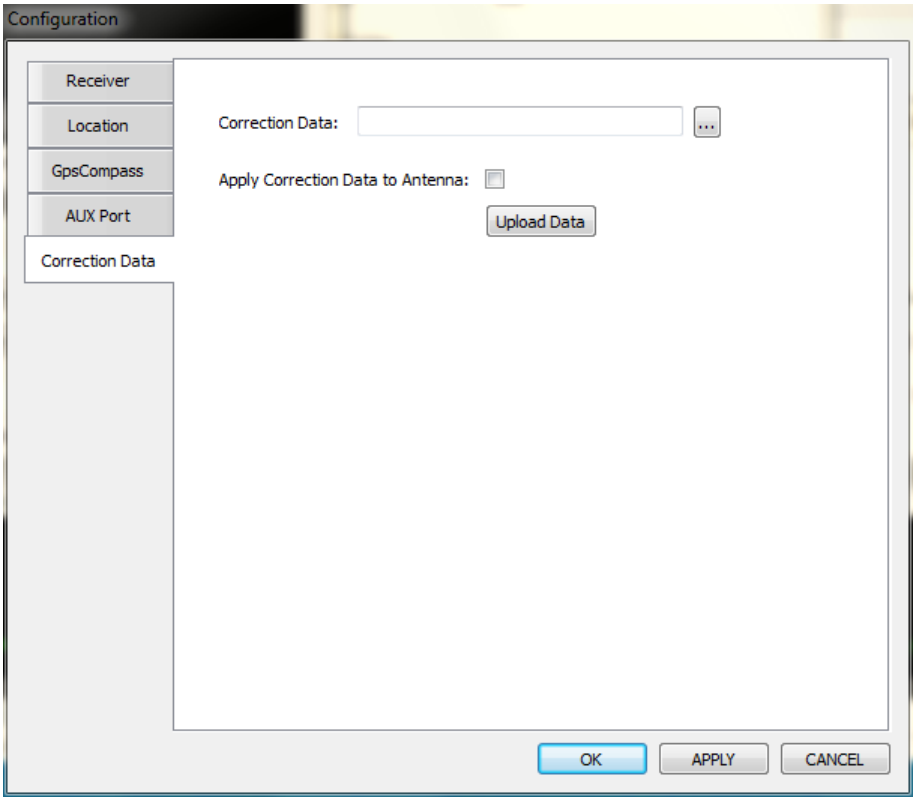



*Figure 3-93: Figure 4: Upload correction data dialog box*

Click on the '...' button to launch a file open dialog box. Select the file to be uploaded to the device. Select the 'Apply correction data to antenna' check box to apply the correction data that is being uploaded to the connected Watson-Watt antenna. Click 'Upload Data' button to upload the selected file to the device. After uploading (and selecting) the correction data to the device, an information dialog box will be show to notify the user the status of uploading.

## 3.12.3 Applying correction data

After uploading the correction data file to PR100/DDF007 device, the uploaded file has to be selected manually for a DF antenna to use. This can be done in either of the two ways - using control software or with manual selection.

### Using control software

Before uploading the file to the device, i.e, before clicking the 'Upload Data' button on the Upload Correction Data dialog box, select the 'Apply correction data to antenna' check box. This selection will apply the correction data to the antenna after uploading it to the device.

### Manual selection of correction data to the antenna

Follow the procedure listed below to manually select any of the correction data files, which are already uploaded to the device, to the antenna.

1. If the device is not already in the Configuration mode, press the 'CONF' button on the device.

   Device will go to configuration mode and the 'General Configuration Menu' will be displayed.

2. Select 'Antenna' soft key.

   'Antenna Configuration Menu' will be displayed.

3. Highlight the Watson-Watt DF antenna using the Rotary knob to select it.

4. Press the 'View' soft key.

   Details of the selected antenna will be displayed in read-only mode.

5. Press the 'Edit' soft key.

   Antenna details page will enter into editable mode.

6. Highlight the 'Correction Set' item from the list using the Rotary knob.

7. While the 'Correction Set' item is highlighted, press the center button of the Rotary knob.

   A drop-down list with all the correction data files present in the device will be displayed.

8. Highlight the correction data to be used for the antenna by rotating the Rotary knob.

9. While the desired correction data file is highlighted, press the center button of the Rotary knob.

   Now the selected file will be shown against the 'Correction Set' field. But it is not yet applied.

10. Press 'OK' soft key to accept the changes.

    Now the selected correction data file is applied for the antenna.

11. Press the 'Exit' soft key to exit the selected antenna configuration mode. Press 'Exit' soft key again to exit antenna configuration mode and press 'CONF' button to exit the configuration mode.

## 3.13 Hotkeys

Selecting the Menu Help – Keyboard displays the available Function and Hot Keys.

EM550CTRL

Hotkeys

| Key | Shift | Alt | Ctrl | Scope | Comment |
|---|---|---|---|---|---|
| Down | | | | Spectrum Window | Cursor left to next maximum |
| Escape | | | | Focussed Spectrum Window (RF and IF) | Clear Display of Ranges |
| F | | | X | Application Wide | Edit Frequency |
| F1 | | | | Application Wide | Help |
| F1 | | X | | Application Wide | Decrease Volume |
| F1 | X | | | Application Wide | Display this window |
| F10 | | | | Focussed Spectrum Window (RF) | Zoom In |
| F10 | | | | Spectrum Window (IF) | Decrease IF Bandwidth - Zoom In |
| F10 | | | X | Application Wide | Toggle Logging On/Off |
| F10 | | X | | Application Wide | Increase Squelch |
| F10 | X | | | Application Wide | To Report |
| F11 | | | | Focussed Spectrum Window (RF) | Zoom Out |
| F11 | | | | Spectrum Window (IF) | Increase IF Bandwidth - Zoom Out |
| F11 | | | X | Application Wide | Toggle Recording On/Off |
| F2 | | | | Application Wide | FFM |
| F2 | | X | | Application Wide | Increase Volume |
| F2 | X | | | Application Wide | Stop |
| F3 | | | | Application Wide | Continue SEARCH |
| F3 | | X | | Application Wide | Restart SEARCH |
| F3 | X | | | Application Wide | Suppress and Continue SEARCH |
| F4 | | | | Application Wide | Panorama Scan |
| F4 | | X | | Application Wide | Exit Application |
| F4 | X | | | Application Wide | Scan |
| F5 | | | X | Application Wide | Open Frequency Store |
| F6 | | | | Application Wide | Edit Frequency |
| F7 | | | | Application Wide | Select Modulation |
| F7 | | | X | Application Wide | Toggle Current / Last Frequency |
| F7 | X | | | Application Wide | Add Suppress Frequency to Frequency Store and Suppress |
| F8 | | | | Application Wide | Select Bandwidth |
| F8 | | | X | Application Wide | Open Frequency History |
| F9 | | | | Application Wide | Toggle View |
| F9 | | | X | Focussed RF Display | Create Instant Replay |
| F9 | | X | | Application Wide | Decrease Squelch |
| F9 | X | | | Application Wide | Add Frequency to Frequency Store |
| F9 | X | | X | Application Wide | Reset user colors |
| Left | | | | Spectrum Window | Cursor left to next channel |
| N | | | X | Application Wide | New RF-Spectrum |
| Right | | | | Spectrum Window | Cursor right to next channel |
| Space | | | | Focussed Spectrum Window (RF and IF) | Toggle Result Panel |
| Up | | | | Spectrum Window | Cursor right to next maximum |

OK

*Figure 3-94: Hotkeys*

Keyboard - Hotkeys Overview

Hotkeys

| Key | Shift | Alt | Ctrl | Scope | Comment |
|---|---|---|---|---|---|
| B | | | X | Application Wide | Big Level Display |
| Delete | | | | Spectrum Window | Delete last Additional Frequency Ruler |
| Down | | | | Spectrum Window | Cursor left to next maximum |
| Escape | | | | Focussed Waterfall, Azimuth, Elevation and Spectrum Window | Clear Ruler |
| Escape | | | | Spectrum Window | Clear Ruler |
| Escape | | | | Scan Widgets | End Measurement Mode |
| F | | | X | Application Wide | Edit Frequency |
| F1 | | | | Application Wide | Help |
| F1 | | | X | Application Wide | Display this window |
| F1 | | | X | Application Wide | Keyboard... |
| F1 | | | | Application Wide | Manual... |
| F1 | | X | | Application Wide | Decrease Volume |
| F10 | X | | | Application Wide | To Report |
| F10 | | | X | Application Wide | Toggle Logging On/Off |
| F10 | | X | | Application Wide | Increase Squelch |
| F10 | | | | Spectrum Window (RF) | Zoom In |
| F10 | | | | Spectrum Window (IF) | Decrease IF Bandwidth - Zoom In |
| F11 | | | X | Application Wide | Recording On/Off |
| F11 | X | | X | Spectrum Window (RF) | Zoom To Job |
| F11 | | | | Spectrum Window (RF) | Zoom Out |
| F11 | | | | Spectrum Window (IF) | Increase IF Bandwidth - Zoom Out |
| F2 | | | X | Application Wide | WFFM |
| F2 | | | | Application Wide | FFM |
| F2 | X | | | Application Wide | Stop |
| F2 | | X | | Application Wide | Increase Volume |
| F4 | | | | Application Wide | Scan |
| F5 | | | | Application Wide | Edit Job |
| F5 | | | X | Application Wide | Open Frequency Store |
| F6 | X | | | Application Wide | Add Frequency to Memory Items |
| F6 | | | | Application Wide | Edit Frequency |
| F7 | X | | | Application Wide | Add Suppress Frequency to Frequency Store and Suppress |
| F7 | | | | Application Wide | Select Modulation |
| F7 | | | X | Application Wide | Toggle Current / Previous Frequency |
| F8 | | | | Application Wide | Select Bandwidth |
| F8 | | | X | Application Wide | Open Frequency History |
| F9 | | | | Application Wide | Toggle View |
| F9 | X | | | Application Wide | Add Frequency to Frequency Store |
| F9 | | X | | Application Wide | Decrease Squelch |
| Left | | | | Spectrum Window | Cursor left to next channel |
| N | | | X | Application Wide | New RF-Spectrum |
| Q | | | X | Application Wide | Info... |
| Right | | | | Spectrum Window | Cursor right to next channel |
| Shift | | | | Waterfall, Azimuth, Elevation and Spectrum Drawpane | Switch to secondary mode |
| Space | | | X | Azimuth and Elevation Window | Toggle automatic mode |
| Space | | | | Focussed Waterfall, Azimuth, Elevation and Spectrum Window | Toggle Result Panel |
| Space | | | | Spectrum Window | Toggle Result Panel |
| T | | X | | Spectrum Window | Toggle Selection or Frequency Ruler |
| Up | | | | Spectrum Window | Cursor right to next maximum |

OK Cancel

*Figure 3-95: Hotkeys*

# 4 Typical Operation

## 4.1 General

The R&S PR1-CTL is a versatile software designed to allow the operator to receive radio signals, search and scan through radio frequencies for signals and measure frequency occupancy and coverage using a R&S receiver.

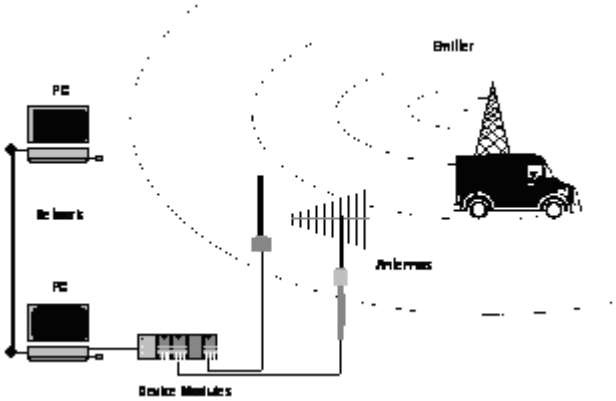



*Figure 4-1: Typical Setup*

The Operator can use the R&S PR1-CTL software to manually tune into radio signals for monitoring and recording on the device. The operator can also define a set of search criteria, which can be used in an overview mode to scan for signals that may be of interest. Any signals found by the R&S PR1-CTL software during the scan can be analysed by the operator. Additionally, their activity may be monitored and recordings of signals can be made. The operator can listen to the signals by switching on the speaker of the receiver.

**Note:** Digital audio signals can be distributed or recorded in LAN/WAN area using the Rohde&Schwarz AllAudio application. This is an additional software package which is not included in the R&S PR1-CTL software. Please contact your local Rohde&Schwarz sales office for more information. In addition to that the R&S PR1-CTL gives the possibility to distribute the Audio output of the device to the local soundcard on your PC.

The R&S PR1-CTL application provides an easy way of controlling the receiver within a monitoring system. Using the application the operator is able to:

- set all important parameters of the device
- monitor single frequencies including aural monitoring
- obtain an overview of the signal activities in a selected frequency range by watching the RF-spectrum display while scanning
- perform a panorama scan (PSCAN) of the selected frequency range and watch the RF-spectrum display
- search for active signals in a selected frequency range
- reset the device

## 4.2 Monitor Single Frequencies

If the frequency to be monitored is known it can be entered quickly in the following way:

- Switch to the Fixed Frequency Mode with function key F2 or by pressing the button in the toolbar
- Use the function key F6 to select the frequency edit field and enter the frequency numerically using the numerical key pad and pressing Enter.

Bandwidth and modulation should be adjusted as appropriate using the controls located in the main toolbar

The operator has to decide if he wants to use AFC for monitoring. Additionally Level Indication and Gain Control can be set.

If the operator detects an interesting signal, he may add the corresponding frequency to a single frequency list (see chapter Frequency Store).

## 4.3 Frequency Scan

The R&S PR1-CTL application provides possibilities for the remote control of the device as a scanning receiver within a monitoring and measurement system.

The operator has possibilities for scanning:

- Frequency Scan is used to obtain an overview of activities in a selected frequency range.
- PSCAN is used to get a very fast overview over a selected frequency range.

In the SCAN / Search toolbar the operator defines the parameters for scanning; then he starts the frequency scan either via the Scan button in the toolbar or via the function key Shift+F4. The spectrum of the selected frequency range is displayed in the RF-spectrum area. The operator obtains an overview of the signal activities in the selected frequency range. In order to detect interesting signals it is possible to zoom into the frequency range in several steps. Besides this, the operator may examine the RF-waterfall. An interesting frequency may be marked with the frequency marker of the RF-spectrum display. After the operator stops scanning, the device remains on the selected frequency and the operator may listen to the audio of this signal.

The operator may start scanning by pressing the appropriate button in the toolbar.

Typical steps for performing a frequency scan with the R&S PR1-CTL application are:

- Define the scan parameters in the Modus Editor toolbar
- Start scanning the selected frequency range by clicking on the Scan button . Start- and stop frequency of the frequency range are displayed below the RF-spectrum display.
- Set the RF-threshold
- Watch the RF-spectrum display of the R&S PR1-CTL application to obtain an overview of the signal activities in the selected frequency range

- Zoom into interesting areas of the spectrum display in several steps. Zoom out again.
- Set the frequency marker to interesting signals in the RF-spectrum display in order to view the corresponding frequency and the level.
- Stop scanning by clicking on the FFM button to monitor the selected frequency. Please refer to the last section for information about monitoring single frequencies and handling the audio function.

## 4.4 PSCAN

PSCAN is used to scan the frequency range of interest with nearly 10 MHz Steps and performing a high resolution FFT at each step.

Note: PSCAN is available if the device option “PS” is installed. For PSCAN the operator defines the parameters for scanning (start, stop and step frequency) in the PSCAN toolbar and starts the PSCAN (either by the button in the toolbar , via the menu entry or the function key F4). The step frequencies can be selected from the discrete values 3.125 kHz, 6.25 kHz, 12.5 kHz, 25 kHz, 50 kHz and 100 kHz. Other values will be set to the next possible value automatically when the PSCAN has been started.

The spectrum of the selected frequency range is displayed in the RF-spectrum area. The operator quickly obtains an overview of the signal activities in the selected frequency range. In order to detect interesting signals it is possible to zoom into the frequency range in several steps.

## 4.5 Search

The R&S PR1-CTL application provides possibilities for the remote control of the device as a searching receiver within a monitoring and measurement system. After having obtained an overview of activities by scanning, searching is used to monitor interesting frequencies and frequency ranges for activities. The operator defines a frequency range in order to search for active signals. Additionally he has to define the stepwidth, the dwell time and set the signal threshold. The device stops at each signal with signal level over threshold. During the dwell time the operator may monitor the signal. If the operator is not interested in a signal he may continue searching before the dwell time has elapsed.

Typical steps for using the device as a searching receiver in the R&S PR1-CTL application are:

- Define the search parameters in the SCAN toolbar
- Searching starts at the currently selected reference frequency. You may change the start frequency by setting another reference frequency
- Set the volume of the audio to a suitable value
- Start searching for active signals by clicking on the Search button , or with function key F3. The search starts at the current position of the reference frequency ruler

- Set the threshold according to the signal activity in the selected frequency range by dragging the white threshold label in the RF-spectrum display
- Frequency and signal level of the detected signals are displayed during the dwell time. Set bandwidth and modulation according to the detected signal
- Press the Continue button (Continue menu item) if you are no longer interested in the signal and want to continue searching before the dwell time has elapsed
- Select the Suppress menu if you are no longer interested in the signal and want to suppress this frequency

## 4.6 MScan/MSearch

In addition to the workflow described in the Scan and Search sections above, the operator can perform Scan and Search activities not only using ranges, but also using frequency lists.

This can be done as follows:

- The frequencies that should be used for a MScan / MSearch must be marked active in the Frequency Store of the GUI
- For a MSearch, setup the dwell and hold times in the MSearch configuration dialog
- Press the MScan or MSearch button to start the measurement
- The further handling of a MScan / MSearch is similar to the handling of a Scan / Search as described above

## 4.7 Client Server Remote Control as Option (RA-RC)

Remote Control is only available for the R&S PR1-CTL as part of a Ramon System. With Remote Control you can install a R&S PR1-CTL Driver on a PC directly connected to the device. The driver is responsible for the communication with the device.

On a Remote PC a R&S PR1-CTL GUI can be installed. This GUI will communicate with the R&S PR1-CTL driver via LAN in the network. With Remote Control it is possible to Control several devices with several GUIs remotely without the devices being near the Remote PC.

If the R&S PR1-CTL GUI is installed and correctly configured, the device can be remote controlled from

- The PC that is connected to the device via Ethernet LAN and where the driver is running
- Other PC’s which have network access to the PC that is directly connected to the device

One device can be remote controlled by more than one GUI application at the same time. If one remote operator changes the settings of the device, the changed settings will be displayed at all connected GUI applications