R&S®EB510
HF MONITORING RECEIVER

High-performance radiomonitoring from 8 kHz to 32 MHz

Product Brochure
Version 04.00

ROHDE&SCHWARZ
Make ideas real

AT A GLANCE

The R&S®EB510 HF monitoring receiver is designed to meet the demanding requirements of ITU-compliant radiomonitoring tasks in stationary and mobile environments The receiver performs high-speed signal searching in the spectrum and provides very wideband demodulation as well as a spectrum overview. It can be operated via the front panel or via remote control software. It is the ideal choice for a large variety of applications – from single-station measurements to nationwide monitoring systems.

The R&S®EB510 HF monitoring receiver has an outstanding feature set for monitoring transmissions, detecting interference, finding unlicensed transmitters or even functioning as a search receiver in the HF spectrum. In addition, it is exceptionally compact and has a low-power design. The R&S®EB510 is the optimum solution for systems that need a high-end receiver but only have limited available space. When combined with analysis software (such as R&S®CA100), it becomes a complete, compact receiving and analysis system covering the frequency range from 8 kHz to 32 MHz.

The receiver can be operated with diverse antennas such as broadband omnidirectional antennas and directional antennas. To limit overloading when using wideband antennas, the R&S®EB510 is equipped with a preselection stage (as recommended by ITU). As a result, intermodulation characteristics are significantly improved.

Due to its compact size and excellent balance between performance and power consumption, the R&S®EB510 is designed not just for stationary operation but also for installation in vehicles, in vessels or in aircraft (as payload).

Key facts

- Digital direct conversion receiver from 8 kHz to 32 MHz
- IF spectrum of up to 32 MHz and parallel demodulation with bandwidths from 100 Hz to 5 MHz
- Fast panorama scan with up to 60 GHz/s across the entire frequency range
- High-speed frequency and memory scan with up to 1600 channels/s
- Polychrome IF spectrum for reliable detection of pulsed signals
- Spectrum and spectrogram (waterfall) display on receiver (model .03) or on PC via the R&S®EB510-Control software (both model .02 and model .03)
- AM, FM, I/Q, AM^2, FM^2, I/Q^2 video panorama
- 1 Gbit LAN interface for remote control and data output
- Comparatively low power consumption for efficient DC operation, e.g. on a vehicle battery
- Space-saving system integration due to ½ 19" width and three height units
- Classification and analysis of signals up to 5 MHz bandwidth (analog and digital modulation) through evaluation of the I/Q data stream using the R&S®CA100IS software (in offline mode)
- Multichannel digital downconversion (DDC) within realtime bandwidth

R&S®EB510 with front panel.

R&S®EB510 without front panel.

BENEFITS

High receiver sensitivity, high signal resolution

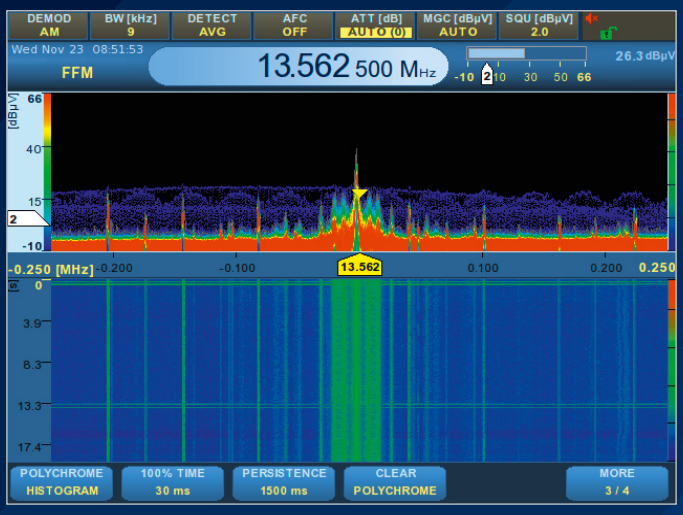
- State-of-the-art FFT based digital signal processing for high receiver sensitivity and detection of extremely weak signals without any loss in processing speed
- Significantly superior signal resolution (compared to conventional analog broadband receivers)

Comprehensive spectrum analysis with polychrome display

- Polychrome display for detection and analysis of short-duration signals
- Multiple-color spectrum display (polychrome IF spectrum) and color coding of signal duration in the spectrum
- Distinction of overlapping short-duration signals (displayed in blue) and long-duration signals (displayed in red), e.g. wideband interference resulting from switching power supply leakage

Wide spectrum view without scanning

- Full 32 MHz IF spectrum display without scanning
- Monitoring of entire HF range in a single spectral view with simultaneous demodulation
- Panorama scan function for spectral overview with narrower preselection



Wideband pulsed interference caused by a switching power supply.

Retrieval of information through demodulation and signal analysis in a compact system

- Online LAN transfer from an R&S®EB510 to a PC with R&S®CA100 analysis software, for example, for operating an efficient small system for signal reception and analysis
- Online analysis or recording of captured data using R&S®CA100, provision of data for documentation, replay or subsequent additional evaluation
- ITU-compliant signal analysis in line with ITU-R SM.1600 using R&S®CA100 and R&S®CA100IS, optimum tool for single-channel analysis and measurement of analog and digitally modulated signals in accordance with ITU requirements

Efficient operation via remote control

- Remote control of all receiver functions via LAN interface (SCPI command set)
- LAN interface for providing the maximum measured data rate during receiver operation; efficient remote operation in unattended monitoring stations (interface description available, especially essential for system integrators who need to incorporate the receiver into existing software environments)

Convenient remote control with R&S®EB510-Control software

- Short learning curve due to straightforward menu structure and simple operation
- Alignment of displayed signals (depending on task), optimum display on screen
- Remote control of receiver via PC, recording of measured data on hard disk and replay of data on PC for analysis purposes
- Expansion of remote control software functionality through options and add-ons from the R&S®RAMON software suite

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Future-ready investment

- Wide realtime bandwidth and very high scan speed for fast and reliable detection of all signal types in the HF range
- Reception, demodulation and processing of signals of current and future radio services in the HF spectrum

APPLICATIONS

INTERFERENCE DETECTION IN PROFESSIONAL RADIO NETWORKS

Reliable detection of radio interference caused, for example, by defective electronic equipment

To master these tasks, the receiver includes special functions such as selectable measurement time and continuous or periodic level output. Since these functions are also effective in the panorama scan spectrum, even non-periodic interferers can be easily detected. Such interferers are otherwise very difficult to detect due to their irregular appearance in a quickly changing spectrum.

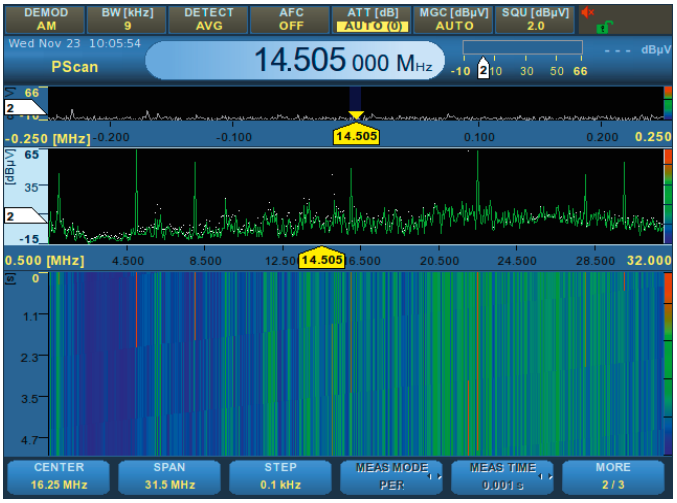
Fast and effective identification of interference sources, e.g. in ground communications

The simultaneous use of the R&S®CA100 analysis software allows efficient differentiation between wanted signals and possible interference signals. Fast differentiation is especially important in security-critical radio scenarios (e.g. vessel traffic service, VTS) as it prevents high failure costs for the service provider. The combination of a fast panorama scan to acquire an overview of the situation with subsequent scanning and analysis in fixed-frequency mode based on I/Q data is particularly well suited to such applications.

In the panorama scan mode, the frequency range of interest is scanned in defined steps, and an FFT of suitable width is calculated for each step. The step width for the fast panorama scan can be selected from 100 Hz to 2 MHz to match the channel spacing used by a wide variety of radio services. The panorama scan provides high scan rates at narrow resolution bandwidths, yielding high sensitivity and signal resolution without compromising the wideband overview.

Its high performance and wide range of special functions make the R&S®EB510 an ideal choice for detecting all types of radio interference efficiently.

Interference in radiocommunications, e.g. in ground communications, not only impedes operation – it may even pose a threat to life.



The R&S®EB510's panorama scan makes it possible to examine the entire HF frequency band, including preselection filtering and showing results in the combined spectrum and waterfall display.

MONITORING OF USER-SPECIFIC RADIO SERVICES

Monitoring of a large number of radio services with different scan modes

In the frequency scan mode, a user-defined frequency range is scanned using fixed channel spacing. The receiver steps through the frequency range of interest and checks every channel for occupancy. If a signal is detected with a level exceeding the predefined threshold, the receiver dwells at the corresponding frequency for the set hold time, allowing for the signal to be demodulated and processed. In the case of analog modulation, the demodulated signal can be monitored via the headphones or loudspeaker.

In the memory scan mode, predefined channels stored in memory locations are consecutively scanned and analyzed to see if any signals are present. The R&S®EB510 offers 10 000 user-definable memory locations. Receive parameters can be assigned separately to each memory location.

The memory scan mode is particularly useful for scanning individual frequencies that do not have a fixed channel spacing or that use different demodulation modes and bandwidths. The memory scan mode offers users a greater degree of freedom than the frequency scan mode in similar applications.

The frequency scan mode is mainly intended for monitoring radio services that use fixed channel spacing, whereas the memory scan mode is used for variable channel spacing.

Smooth operation of an organization's own radio network is vital to ensure operational readiness — not only for government operators.

MULTICHANNEL DIGITAL DOWNCONVERSION (DDC)

Parallel monitoring of one plus three signals within realtime bacndwidth

When equipped with the R&S®EB510-DDC digital downconverter option, the receiver has three additional digital downconverters in addition to the wideband demodulation path. These converters function entirely in parallel within the realtime bandwidth and can be parameterized independently of one another.

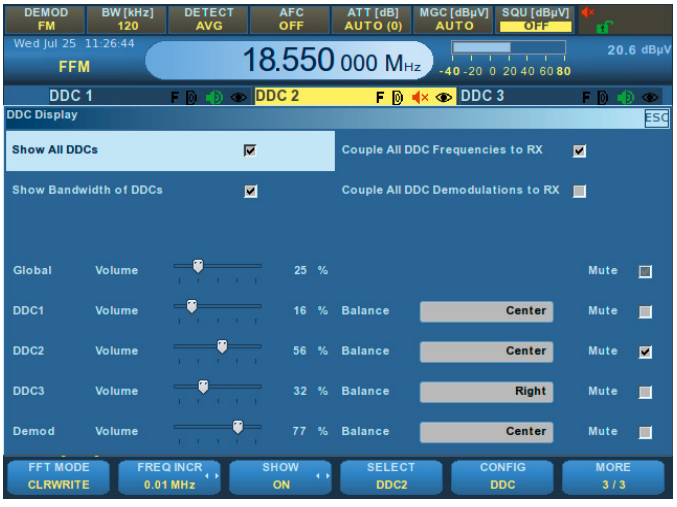
Each of these digital downconverters features:

- AM, FM, PULSE, I/Q, LSB, USB and CW demodulation mode
- Comprehensive set of 20 IF bandwidths from 100 Hz to 150 kHz (100 Hz to 8 kHz for LSB, USB, CW)
- Squelch function

Moreover, each DDC with individual AGC provides the complex baseband (I/Q), the associated signal level and an audio signal.

The data streams output at the DDC channels can be either recorded internally in the receiver, or are available via LAN to be recorded by the remote control PC. Recording of four independent data streams is supported by the R&S®EB510-Control software package.

Smooth one plus three demodulation channels can be user-distributed within the realtime bandwidth.



Control interface for managing of DDC information output.

NATIONWIDE MONITORING SYSTEM FOR REGULATORY AUTHORITIES

ITU-compliant spectrum monitoring using the R&S®ARGUS system software

For more than 20 years, R&S®ARGUS has been a highly successful control software solution for ITU-compliant measurement and analysis tasks. It offers a variety of measuring modes designed to support typical measurement procedures and greatly simplify everyday tasks. It can also perform a large number of analyses that enable detailed evaluation of measurements and the creation of precise, in-depth reports. These capabilities are now also available in combination with the R&S®EB510.

Full access to receiver functions from a PC

The user-friendly standard interface in R&S®ARGUS makes the entire range of R&S®EB510 functionality available on a PC. Measurement results are displayed in realtime in the form of graphics and tables. The results are stored along with the receiver settings in an internal database to allow subsequent evaluation in line with ITU requirements.

The entire system is calibrated, taking into account the frequency-dependent sensitivity of the antenna and attenuation and loss in cables and switches.

Automatic identification of deviations from the desired state

In combination with R&S®ARGUS, the R&S®EB510 can automatically identify whether the current signal scenario is consistent with expectations. Users can define a valid range of values for each measurement parameter depending on the frequency. If a measured value is outside the defined range, R&S®ARGUS immediately issues an alarm. As a result, new and unknown transmitters can be discovered just as easily as transmitters that exceed licensed transmission parameters (e.g. excessive frequency deviation).

Guided measurements

One unique feature in R&S®ARGUS are its guided measurement modes. Users simply choose a frequency range and the type of measurement task (field strength, spectrum occupancy or bandwidth, for example). R&S®ARGUS then configures the right device settings automatically and selects the appropriate antenna based on the frequency and polarization. This allows even relatively inexperienced users to conduct complex measurements with the R&S®EB510.

Easy integration into existing R&S®ARGUS radiomonitoring systems

The R&S®EB510 is quick and easy to integrate into existing infrastructures as a replacement for existing equipment or to expand a station's measurement capabilities. Importantly, the receiver can operate not just in combination and coordination with other equipment such as direction finders and specialized analysis devices but also as a handoff receiver in a networked system. The ability to operate in parallel is not confined to the devices within a single radiomonitoring station: Multiple devices at separate stations can process several measurement tasks synchronously.

Remote operation made easy

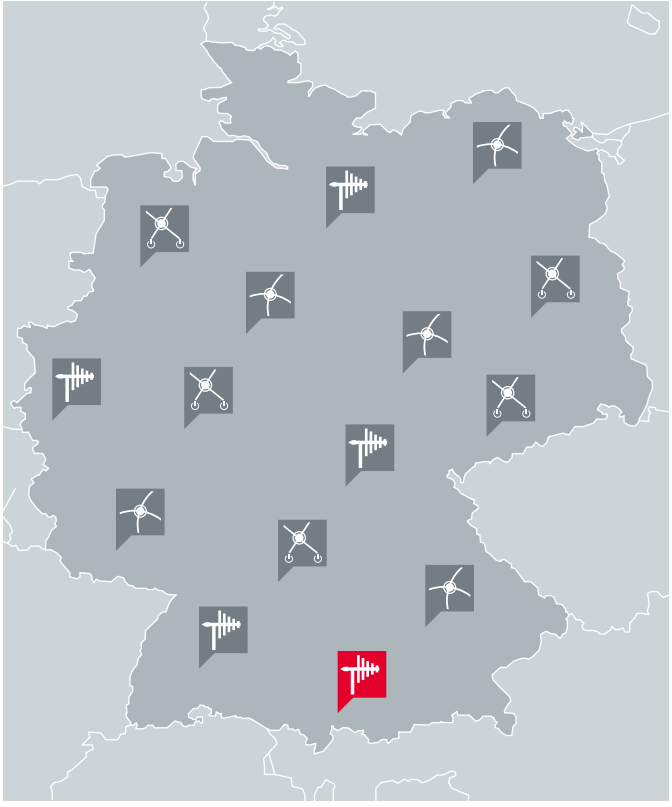
Remote operability is a key requirement for radiomonitoring systems, and here, too, R&S®ARGUS sets standards. It has built-in sophisticated bandwidth management (SBM) that tunes the transmission rate to suit the available network bandwidth. If necessary, the software can reduce and compress data automatically. This ensures, for example, that the receiver's IF spectrum and audio streams reach the central station in sufficiently high quality, even with narrowband connections.

Nationwide radiomonitoring network at a glance – R&S®ARGUS station information system

Another advanced feature of R&S®ARGUS is its station information system (SIS). The SIS shows the current status of every radiomonitoring system location on an electronic map. The information provided includes the current connection status, the availability and utilization of measuring equipment, ambient parameters such as temperature and humidity, as well as the power supply status in unattended radiomonitoring stations.

The map display also supports remote control features. When users click a symbol on the map, R&S®ARGUS automatically connects to the receiver in question. The R&S®EB510 in the remote station is then ready to accept measurement tasks.

Overview of status, location and capability of all monitoring sites



HANDOFF RECEIVER IN NETWORKED SYSTEMS

Parallel demodulation of multiple narrowband signals and simultaneous broadband spectrum scanning

Multiple R&S®EB510 receivers can be combined and operated as a bundled solution. One R&S®EB510 is used as a search receiver, the others are used for demodulating signals and producing audio or I/Q data streams.

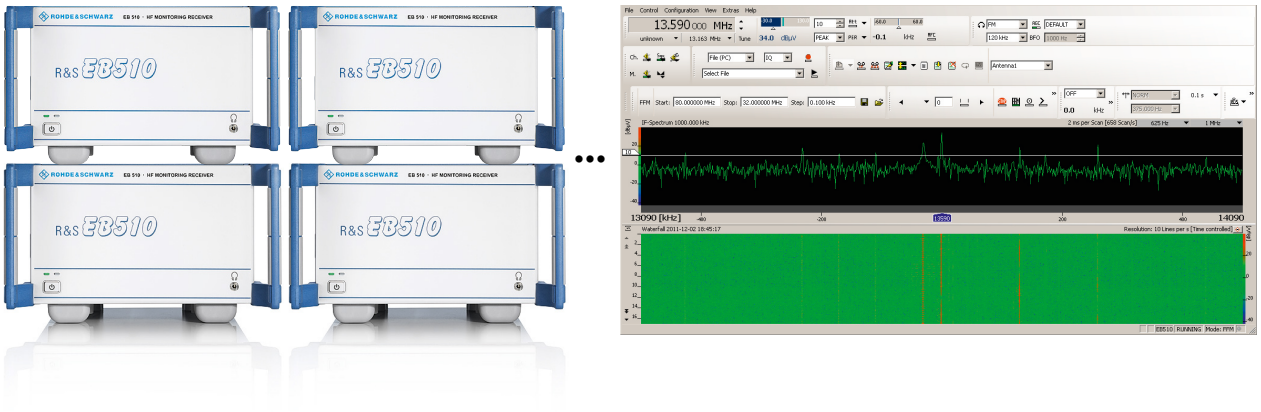
The handover of a signal from the search receiver to a data production receiver is carried out from the user workstation running with R&S®RAMON system software. The major advantage of this system configuration is that the fast signal search across a wide frequency scenario and the narrowband production of multiple audio or I/Q data streams occur simultaneously. This allows the user to achieve optimum results in a minimum of time.

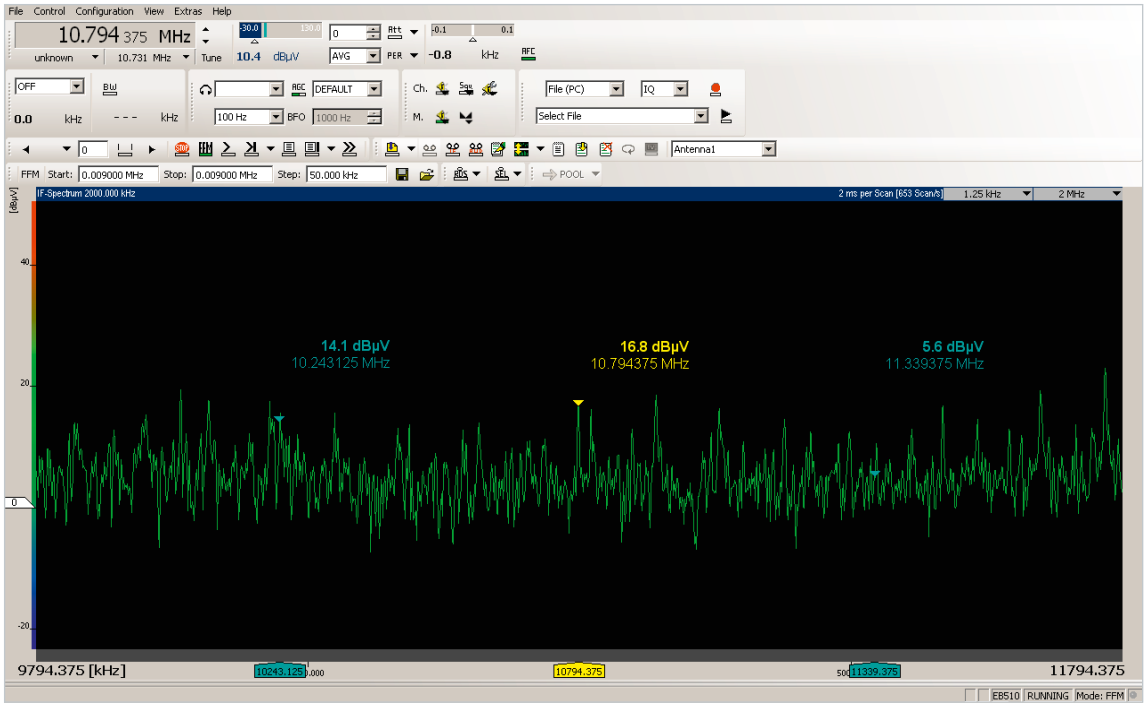
Multiple R&S®EB510 receivers can be operated together via R&S®RAMON system software

Search receivers

Data production receivers

R&S®RAMON system software





Display of IF spectrum and use of marker function.

CONVENIENT REMOTE CONTROL WITH R&S®EB510-CONTROL SOFTWARE

Major functional features of R&S®EB510-Control

Fast and simple operation

The main functions can be accessed using shortcuts.

The graphical display of results includes:

- IF spectrum with waterfall diagram
- Panorama scan spectrum with waterfall diagram
- Level indication based on demodulation path

Users can adapt the colors of the display and the size and arrangement of the windows as required for a specific task or area of application. Easy-to-use measurement functions are available within the diagrams.

Display, storage and playback of spectra and waterfall data

R&S®EB510-Control enables the recording and playback of panorama scan and IF signal spectra. In addition, digital audio data and I/Q baseband data (digital IF) of up to 5 MHz bandwidth can be stored, e.g. for the subsequent analysis of digitally modulated signals.

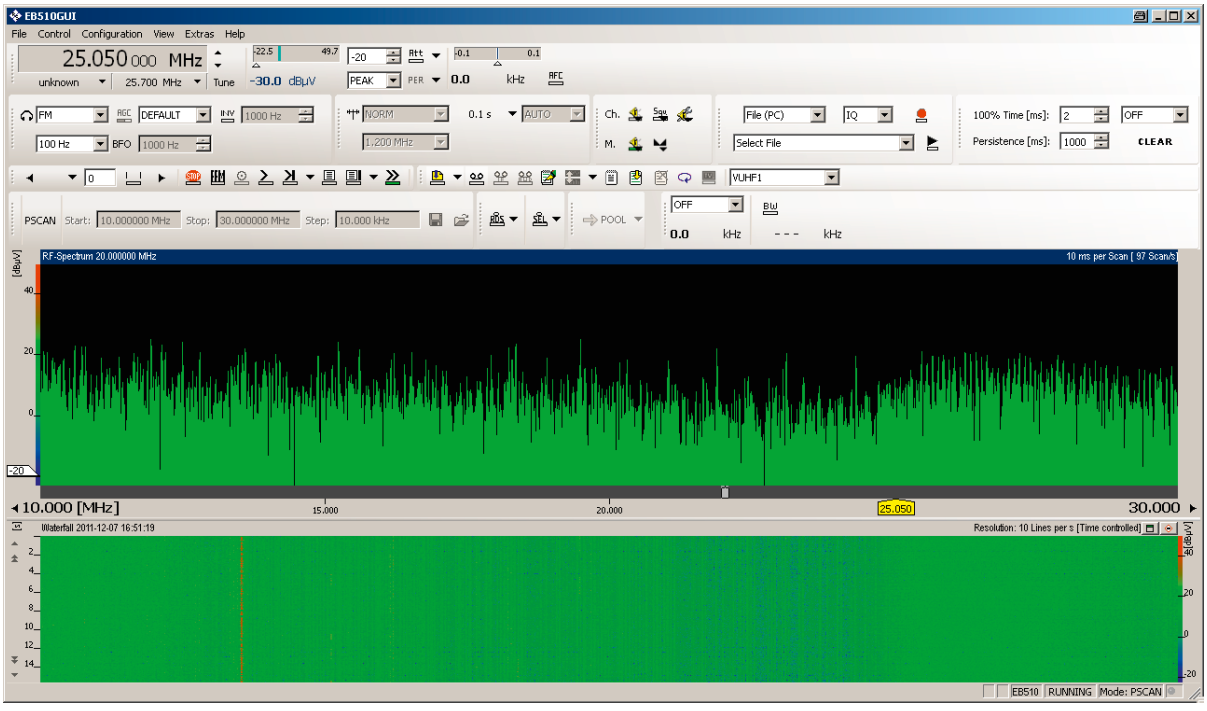
Buffering of frequency scan data in a ring buffer

Recording in the ring buffer can be stopped by a mouse click. The stored signals are then available in playback mode for analysis.

Frequency list for marking signals

With a mouse click, radio channels can be marked, saved in a list and graphically placed over the spectrum. The frequency list is available for storage and subsequent analysis.

The R&S®EB510-Control remote control software is supplied free of charge with the R&S®EB510. It is part of the R&S®RAMON software family and enables convenient and efficient operation of the receiver from a PC workstation. The software offers a straightforward menu structure and intuitive operation so that training requirements for operating personnel are minimal.



Wideband panorama scan with Max Hold function and waterfall diagram.

SPECIFICATIONS IN BRIEF

Specifications in brief		
Frequency		
Frequency range	base unit	8 kHz to 32 MHz
Demodulation		
Demodulation modes	all IF bandwidths	AM, FM, φM, pulse, I/Q
	IF bandwidths ≤ 8 kHz	LSB, USB, CW
	IF bandwidths ≥ 1 kHz	ISB
IF bandwidths		
Bandwidth	demodulation, level and offset measurements (3 dB bandwidth), 29 filters	100/150/300/600 Hz, 1/1.5/2.1/2.4/2.7/3.1/4/4.8/6/9/12/15/30/50/120/150/250/300/500/800 kHz, 1/1.25/1.5/2/5 MHz
IF panorama		
FFT IF panorama	up to 4096-point FFT	dynamic, overlapping FFT
	operating modes	automatic or variable with selectable frequency resolution
		0.625/1.25/2.5/3.125/6.25/12.5/25/31.25/50/62.5/100/125/200/250/312.5/500/625 Hz, 1/1.25/2/2.5/3.125/5/6.25/8.333/10/12.5/20/25/50/100/200/500 kHz, 1 MHz, 2 MHz
IF panorama span		1/2/5/10/20/50/100/200/500 kHz, 1/2/5/10/20/32 MHz
Panorama display		clear/write, average, max. hold, min. hold, histogram
Memory scan		10 000 programmable memory locations
	speed	up to 1600 channels/s
Frequency scan		user-selectable start/stop frequency and step width
	speed	up to 1600 channels/s
Panorama scan	with R&S®EB510-PS option	RF spectrum with user-selectable start/stop frequency and step width: 100/125/200/250/500/625 Hz, 1/1.25/2/2.5/3.125/5/6.25/8.333/10/12.5/20/25/50/100/200/500 kHz, 1 MHz, 2 MHz
	speed	up to 60 GHz/s

ORDERING INFORMATION

Designation	Type	Order No.
Base unit		
HF monitoring receiver, with control front panel frequency range from 8 kHz to 32 MHz, IF spectrum (max. 32 MHz), remote control software supplied with receiver	R&S®EB510	4091.7009.03
HF monitoring receiver, without control front panel frequency range from 8 kHz to 32 MHz, IF spectrum (max. 32 MHz), remote control software supplied with receiver	R&S®EB510	4091.7009.02
Software options		
Panorama scan RF scan, high-speed FFT scan across user-selectable range, selectable spectral resolution	R&S®EB510-PS	4072.9200.04
ITU measurement ITU-compliant measurement of AM/FM-modulated signals in the R&S®EB510	R&S®EB510-IM	4072.9100.04
Digital downconverter three digital downconverters for user-defined placement within realtime bandwidth	R&S®EB510-DDC	4072.9500.04
Selective call selective call analysis	R&S®EB510-SL	4072.9800.04
Internal recording	R&S®EB510-IR	4072.9551.04
Map display	R&S®EB510-MAP	4072.9451.04
Documentation		
Documentation of calibration values	R&S®EB510-DCV	4072.8403.04
Accessories		
Rack adapter		
19" Rack adapter (2 × R&S®EB510 side by side)	R&S®ZZA-T04	1109.4187.00
19" Rack Adapter (1 × R&S®EB510 + 1 × blind plate)	R&S®ZZA-T02	1109.4164.00
Power supply		
DC power cable	R&S®EB500-DCC	4072.7036.00
Compass and GNSS		
External GPS module	R&S®EB5-EGT	4073.2009.02

Service options		
Extended warranty, one year	R&S®WE1	Contact your local Rohde&Schwarz sales office.
Extended warranty, two years	R&S®WE2	
Extended warranty, three years	R&S®WE3	
Extended warranty, four years	R&S®WE4	
Extended warranty with calibration coverage, one year	R&S®CW1	
Extended warranty with calibration coverage, two years	R&S®CW2	
Extended warranty with calibration coverage, three years	R&S®CW3	
Extended warranty with calibration coverage, four years	R&S®CW4	
Extended warranty with accredited calibration coverage, one year	R&S®AW1	
Extended warranty with accredited calibration coverage, two years	R&S®AW2	
Extended warranty with accredited calibration coverage, three years	R&S®AW3	
Extended warranty with accredited calibration coverage, four years	R&S®AW4	

Service at Rohde&Schwarz
You're in great hands

- Worldwide
- Local and personalized
- Customized and flexible
- Uncompromising quality
- Long-term dependability

Rohde&Schwarz

The Rohde&Schwarz technology group is among the trailblazers when it comes to paving the way for a safer and connected world with its leading solutions in test&measurement, technology systems and networks&cybersecurity. Founded more than 85 years ago, the group is a reliable partner for industry and government customers around the globe. The independent company is headquartered in Munich, Germany and has an extensive sales and service network with locations in more than 70 countries.

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Sustainable product design

- Environmental compatibility and eco-footprint
- Energy efficiency and low emissions
- Longevity and optimized total cost of ownership

Certified Quality Management
ISO 9001

Certified Environmental Management
ISO 14001

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R&S®EB510 HF Monitoring Receiver
Data without tolerance limits is not binding | Subject to change

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