R&S®EM200
DIGITAL COMPACT RECEIVER

Spectrum monitoring and direction finding in a compact format

Product Brochure
Version 05.00

ROHDE&SCHWARZ
Make ideas real

AT A GLANCE

The R&S®EM200 is a cost-efficient and optimized receiver and direction finder in a compact format. It detects, analyzes and demodulates from 8 kHz to 8 GHz and optionally supports direction finding with Rohde & Schwarz compact DF antennas from 20 MHz to 6 GHz. Its small form factor allows easy integration and use in just a few steps. It comes with an easy-to-operate and ready-to-use graphical user interface.

A monitoring receiver and direction finder is vital for just about any spectrum monitoring application. Understanding the complexity of today's spectrum environment and demanding application requirements, the R&S®EM200 offers a suite of tools and benefits that help users ensure high-quality, reliable operations.

The R&S®EM200 is versatile and good in RF performance yet cost-efficient in design. Thanks to its compact size and low power consumption, it can be operated as a single standalone station or integrated into various manned or unmanned platform solutions. Its favorable price/performance ratio makes it an essential and suitable tool for most spectrum monitoring applications as well as communications intelligence (COMINT) and communications electronic support measures (CESM) applications.

The sophisticated preselection stage of the R&S®EM200 reliably protects it against overload due to strong input signals. It also features an internal high-gain preamplifier stage and offers good receiver sensitivity. The resulting dynamic range makes it ideal for various signal scenarios.

The receiver comes with the R&S®EM200GUI virtual front panel control and offers out-of-the-box functions. It can be operated on a Windows laptop or tablet via LAN.

The R&S®EM200 also offers many optional functions. For license verification of analog signal transmission against technical standards, the R&S®EM200 is equipped with ITU-compliant measurement tools. Apart from level measurement and demodulation, it also offers zero span and gated spectrum functions that help users analyze burst or pulsed signals such as TETRA, GSM and DECT, enabling them to examine individual channels of a transmission mode. For resolving separate superimposed, pulsed signals that are not easy to differentiate using spectrum analysis, the polychrome function can be used. For analysis and content production online, the R&S®EM200 offers solutions ranging from simple spectral data and demodulated audio to continuous I/Q streaming of the full 40 MHz bandwidth. The digital data streams are tagged with highly accurate timestamps.

Equipped with the R&S®CS-DF direction finding option and our compact R&S®ADDx07 DF antennas, the R&S®EM200 can easily be upgraded to an angle of arrival (AoA) based direction finder, which provides highly accurate AoA results from 20 MHz to 6 GHz.

In a network of multiple R&S®EM200 receivers, the built-in GNSS module in combination with the R&S®CS-TSA timestamp accuracy option additionally supports very precise time difference of arrival (TDOA) radiolocation over the entire frequency range.

Apart from working with standard system and analysis software from Rohde&Schwarz, the receiver comes with well-documented data and control interfaces and two antenna inputs that cover the complete frequency range. This enables external system integrators to easily include the receiver in third-party software solutions.

KEY FACTS

- High-speed scan up to 64 GHz/s over the entire frequency range from 8 kHz to 8 GHz
- Parallel time and frequency domain analysis up to 40 MHz bandwidth
- Extensive preselection and automatic overload protection as standard
- AoA based direction finding with Rohde&Schwarz compact DF antennas from 20 MHz to 6 GHz as option
- Up to 40 MHz wide I/Q streaming with 10 Gbit interface
- Easy-to-operate, virtual front panel control as standard
- Compact and ideal for use as a standalone solution or integrated into system solutions; a ½ 19" 1 HU instrument that weighs only 3.5 kg

APPLICATIONS

The frequency spectrum may be limited, but the diversity of applications in mobile, wireless and satellite communications continues to increase dramatically. It poses ever-increasing challenges for civil regulation authorities, intelligence services, security agencies, commercial communities, the military, as well as public and even private services. Undeniably, signal monitoring and interception across wide frequency ranges with different signal scenarios is very challenging.

For effective radio reconnaissance and situational awareness, every emission within a large frequency band must be captured to ensure that the targeted signals and detected signals of interest can be identified. The R&S®EM200 is an ideal I/Q source for continuous wideband data collection. The I/Q data can be recorded for postprocessing or offline analysis to exploit the communications pattern and obtain the content of signals.

To preserve communications network integrity, all signals in the frequency ranges of interest must be surveyed simultaneously, especially in time-critical situations to achieve monitoring efficiency and produce clear and precise intelligence on the network to help with later decision-making. It is useful to first have a complete overview of the signal scenario and then focus on specific frequency bands or emissions. The R&S®EM200 is designed for remote monitoring with capabilities for remote power cycling, making it the ideal handoff receiver. The ultimate benefits are that it enables automation and scalability, which makes it future-proof, modular and enables economical large-scale deployments.

Perfect for use in signal interception systems and in combination with Rohde&Schwarz signal analysis software, recorders and most receivers and direction finders

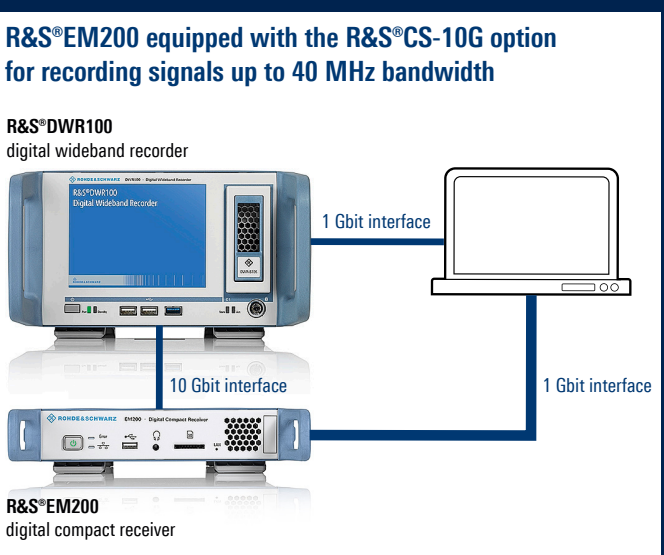
Up to 40 MHz recording with the R&S®DWR100 digital wideband recorder with easy-to-exchange memory packs. Compatible with the Rohde&Schwarz PC based signal analysis and signal processing software for detection, classification, demodulation and decoding of communications signals.

The R&S®EM200 can be extended to support online and offline content recovery and external signal analysis with the Rohde&Schwarz PC based signal analysis and signal processing software. This software includes an extensive library of digital and analog modulation methods, including methods used in digital public mobile radios (PMR).

Multiple R&S®EM200 units can be operated together with one or more Rohde&Schwarz receivers and direction finders

Multiple R&S®EM200 units can be combined with one or more fast and powerful search receivers (e.g. the R&S®ESME or the R&S®DDF260) and operated as an independent receive channel. When used in combination, the search operation remains effective and unaffected, while the R&S®EM200 allows operators to focus on and observe the highest probability of intercept (POI) in the network. The handover of a narrowband signal from the wideband scanning receiver to an R&S®EM200 is carried out from the user workstation using the R&S®RAMON COMINT/CESM radiomonitoring software.

R&S®EM200 equipped with the R&S®CS-10G option for recording signals up to 40 MHz bandwidth

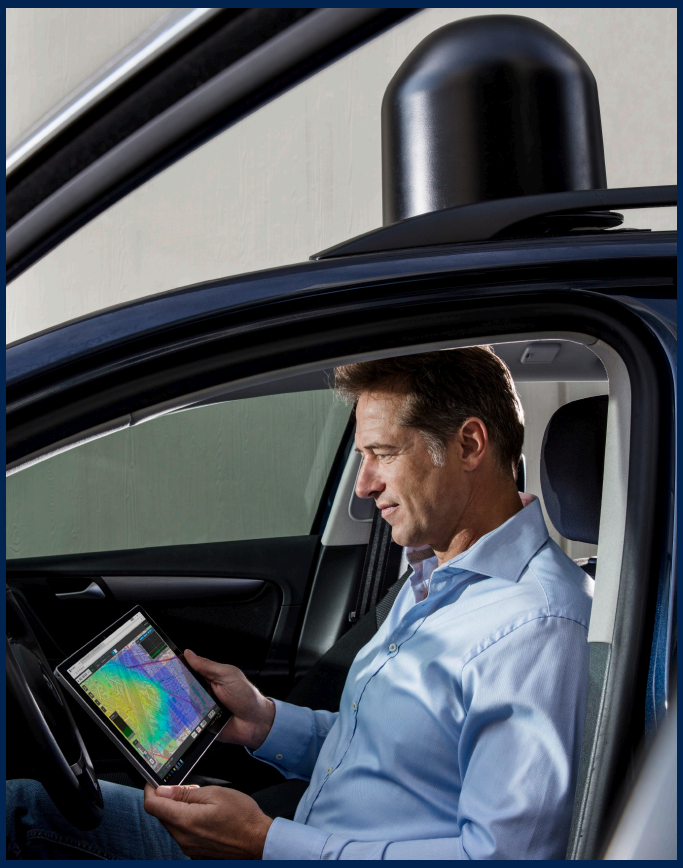


Multiple R&S®EM200 receivers can be operated together with the R&S®ESME wideband monitoring receiver.

Basis for a radiolocation system

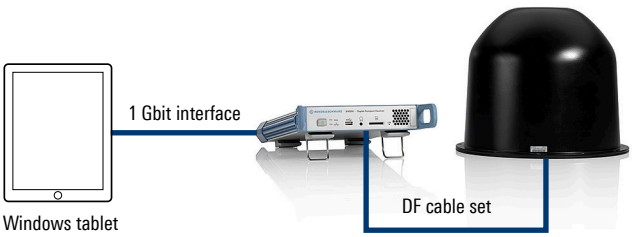
Multiple R&S®EM200 receivers operated in a network can form the basis for a high-performance radiolocation system. If the R&S®EM200 sensors are equipped with the R&S®CS-DF option and connected to one of our compact R&S®ADDx07 DF antennas, the system can perform highly AoA based radiolocation from 20 MHz up to 6 GHz. Alternatively, if the R&S®EM200 sensors feature the R&S®CS-TSA timestamp accuracy option, the network can turn into a precise TDOA system with emitter radiolocation over the entire frequency range. The radiolocation accuracy of TDOA systems mainly depends on the timestamp accuracy of the measured I/Q data. The built-in GNSS module combined with the R&S®CS-TSA option provides extremely precise timestamps with an error of less than 50 ns (RMS). Furthermore, if the R&S®EM200 sensors in network operation are upgraded with both the R&S®CS-DF option and the R&S®CS-TSA option, even hybrid AoA and TDOA emitter radiolocation up to 6 GHz can be performed.

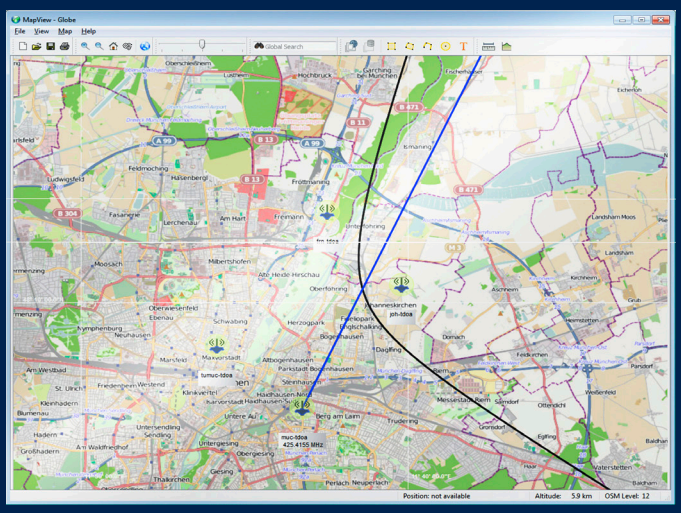
Whether the R&S®EM200 is operated as a single compact DF system, in a network of multiple DF systems or in a mobile monitoring system, Rohde&Schwarz system software such as R&S®RAMON, R&S®ARGUS and R&S®MobileLocator provide easy control and operation.



R&S®MobileLocator PC based automatic radiolocation software with a Rohde&Schwarz compact DF antenna.

Schematic diagram of a DF system setup with R&S®EM200





The R&S®EM200 together with the R&S®ARGUS monitoring software in an AoA/TDOA hybrid application.

EASY TO INTEGRATE INTO SYSTEMS

R&S®EM200 with 19" adapters for single or double unit installation

Single unit

Double unit

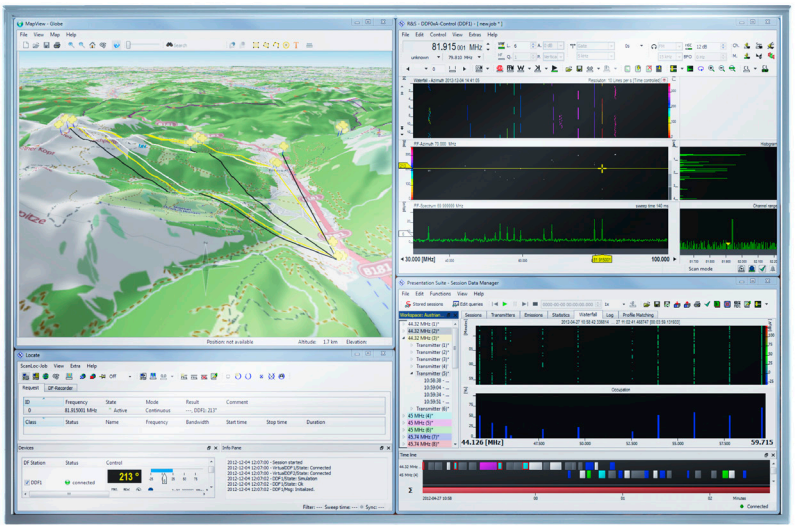
Well-balanced in design and RF performance

Though compact, the R&S®EM200 receiver is well equipped with a wide range of features and functions just like those in high-end receivers. Its favorable price/performance ratio makes it an indispensable instrument for all types of radiomonitoring tasks where space-saving integration and cost efficiency are crucial.

- Extensive preselection consisting of tracking, bandpass, high pass, low pass and combination of filters
- Multiple scan modes (memory scan and frequency scan) with fast scan speed
- Two independent digital paths for real-time spectrum and demodulation
- High measurement bandwidths of up to 40 MHz that are ideal for measuring the signal level of modern digital signals
- Includes a built-in GNSS module as standard
- Switchable automatic or manual attenuation

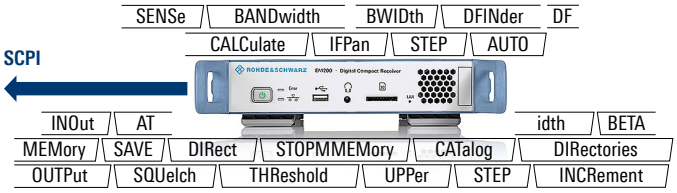
Compatible with a wide range of powerful Rohde&Schwarz system software modules to support users in automation in various fields

Continuous network monitoring is important to ensure smooth operations in dense radiocommunications traffic. R&S®EM200 is ideal for deployment in a network and can be remotely controlled. It offers easy networking and integration of systems, with R&S®RAMON or R&S®ARGUS software providing flexibility and adaptation to a variety of communications systems and data transmission bandwidths.



R&S®RAMON radiomonitoring software.

Remote control commands in line with the SCPI standard



SCPI refers to standard commands for programmable instruments

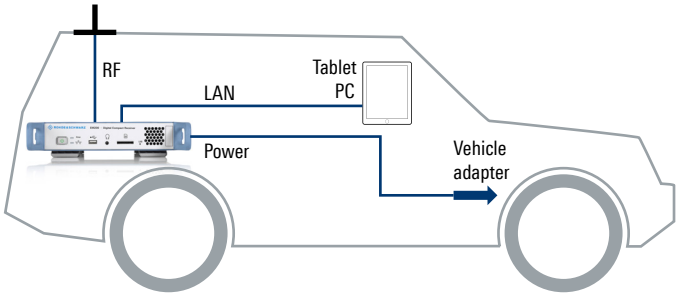
Open remote control interfaces and data formats

Thanks to the open or standard output data formats and interfaces, third-party system integration of the R&S®EM200 is a simple process:

- Standard commands for programmable instruments (SCPI standard) for device control
- Baseband I/Q stream from the wideband spectrum path including additional meta information (delivered to the client in documented formats)
- Several I/Q data formats available (e.g. AMMOS, VITA49.0 [1])
- Easily structured trace data format for spectral and measurement data

[1] Depends on firmware version.

DC operation (e.g. from a vehicle battery)



Compact and ideal for use as a standalone solution or integrated in systems with space constraints; ½ 19" 1 HU instrument that weighs only 3.5 kg

The R&S®EM200 is able to receive its power directly from a DC source, such as a vehicle battery. Thanks to its wide input voltage range from 10 V to 32 V DC, the receiver can be operated from both car and truck batteries.

Its low power consumption of approximately 18 W typically enables this compact receiver to be operated long-term from an autonomous source.

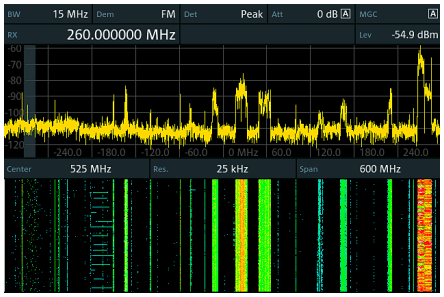
Convenient and ready-to-use virtual front panel control

The included Windows based, ready-to-use R&S®EM200GUI virtual front panel control offers fast and easy-to-use analysis via Ethernet. It comes with all receiver functions and an intuitive graphical user interface.

- Ready-to-use for standalone operation with all receiver functions
- Comprehensive visualization modes for measurement and evaluation of signals
- Reference and troubleshooting tool for integration into third-party applications
- Can be operated on a desktop computer, laptop or tablet running on a Windows operating system via LAN

Windows based R&S®EM200GUI virtual front panel control in desktop view.

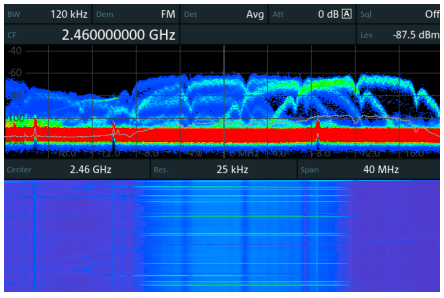
WIDE RANGE OF APPS



Fast spectral scan (panorama scan) across the entire frequency range, including waterfall display.

Spectrum monitoring and interference hunting

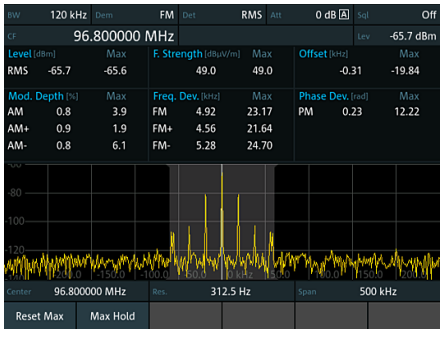
The wide R&S®CS-PS panorama scan option helps users easily identify wideband emissions. The high scan speed of up to 64 GHz/s allows detection of even nonperiodic emissions. Such emissions are usually difficult to detect due to their irregular occurrence in a quickly changing spectrum. The R&S®EM200GUI virtual front panel control provides a signal overview for the frequency range of interest in a fast spectral or waterfall display.



Polychrome display uses color to indicate the relative occupancy of each frequency versus time.

Polychrome spectrum to distinguish superimposed, pulsed signals

The R&S®CS-PC polychrome spectrum display option makes it possible to separate superimposed, pulsed signals that cannot be differentiated using conventional methods (e.g. spectrum, waterfall, max. hold). It is very useful for signal separation, for example to identify pulsed interfering signals superimposed on pulsed wanted signals. Additionally, the R&S®EM200GUI can optionally include a waterfall display to track changes in the signal versus time.

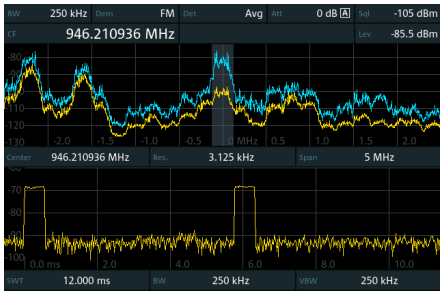


ITU-compliant measurements of AM depth, FM deviation and PM deviation in a single view.

Analog modulation measurements

The R&S®CS-MM modulation measurement option enables simultaneous measurements of the modulation parameters for AM, FM and PM modulated signals in line with the ITU Handbook on Spectrum Monitoring. The modulation depth, frequency deviation and phase deviation can be determined concurrently. Digitally modulated signals can be analyzed, classified and demodulated with the PC based R&S®CA100 signal analysis software [1], which also enables manual parameter measurements in line with ITU-R SM.1600 once upgraded with the R&S®CA100IS option.

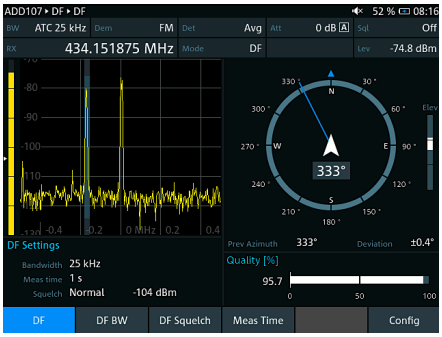
[1] See "R&S®CA100 Signal Analysis and Signal Processing Software" (PD 3606.9340.12).



Simultaneous display of frequency spectrum (top) and magnitude of signal (bottom).

Measurement in frequency and time domain

When used in combination with the R&S®CS-ZS zero span option, the R&S®EM200 enables visualization of the behavior of a signal versus time. This is especially useful when displaying the timeslots of a TDMA based transmission system. It reveals the time-dependent behavior of any signal and enables the observation of the individual pulses of a digital signal. Since the R&S®EM200 is configured to simultaneously display the amplitude and the instantaneous frequency, it allows users to characterize the signal of interest without losing sight of the signals in the spectrum of interest.

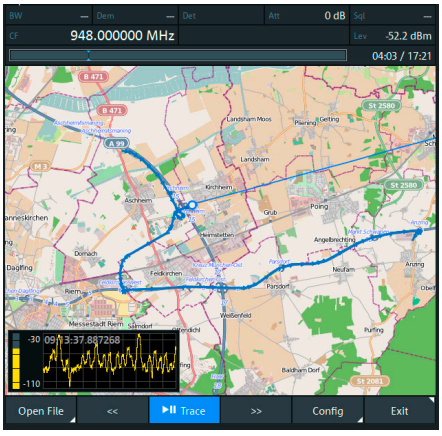


DF polar display and application with R&S®CS-DF option.

Accurate AoA direction finding

For faster and more precise direction finding, the R&S®EM200 can be easily upgraded and transformed into a high-performance, direction finding system.

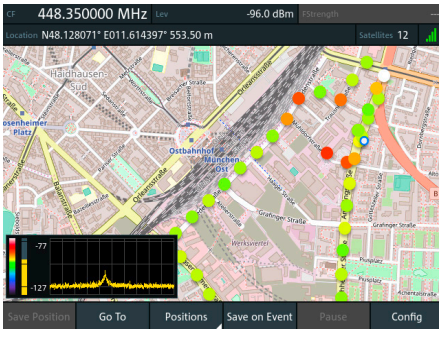
Using the R&S®CS-DF option and an R&S®ADDx07 compact VHF/UHF/SHF DF antenna, the DF system offers a typical system DF accuracy of 1° to 3° (RMS) depending on the choice of DF antenna and frequency band. In particular, high-precision DF performance and robustness is achieved in those frequency bands where the DF method correlative interferometer is employed. The R&S®EM200 based DF system manages virtually all types of interferers, irrespective of bandwidth and modulation type.



Trace record and replay with R&S®CS-IR option.

Trace and audio recording and replay

The R&S®CS-IR trace recording and replay option allows users to record monitoring traces with demodulated audio and geolocation, which can be replayed on the device or via the PC based R&S®EM200GUI. Recorded information is saved internally or onto a USB stick or SD card. Recording and replay is particularly useful for continuous measurements in unattended or mobile monitoring missions or simply for documentation. Recordings made during mobile operations can be replayed on a map with the R&S®CS-MAP mapping option.



Coverage measurement with R&S®CS-MAP option.

Interference analysis with digital maps

The R&S®CS-MAP option provides map display, triangulation and level mapping functions. For all map applications, a convenient integrated spectral view is additionally displayed, allowing users to keep track of the signal during signal hunting. OpenStreetMap (OSM) maps can be easily downloaded using the OSM wizard and transferred to the receiver via an SD card, USB stick or the drive in the remote control PC.

Automatic occupied bandwidth measurement of a DVB-T signal (ß % method).

Bandwidth and channel power measurements

The R&S®CS-SPM spectral measurement option provides occupied bandwidth, bandwidth center offset and channel power measurements. Two methods are available for bandwidth measurements: x dB and ß %. Bandwidth measurements are in line with ITU-R Recommendations SM.328-11 and SM.443-4 and the ITU Handbook on Spectrum Monitoring, chapter 4.5.

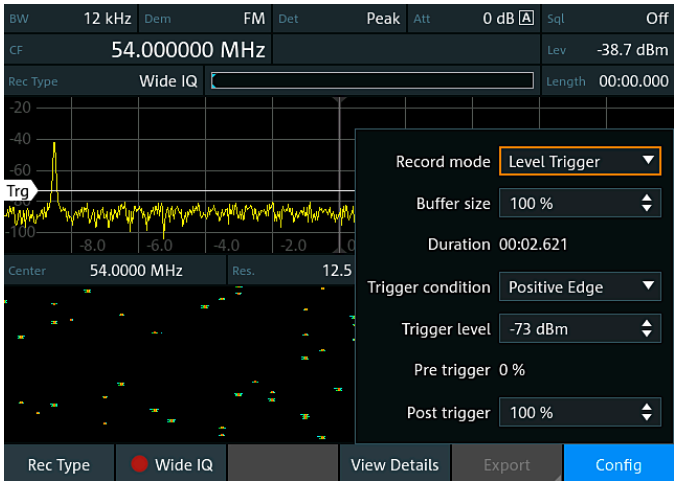
R&S®EM200 together with the R&S®ADD207 compact UHF/SHF DF antenna.

RECORDING AND REPLAY OF WIDEBAND DIGITAL I/Q DATA

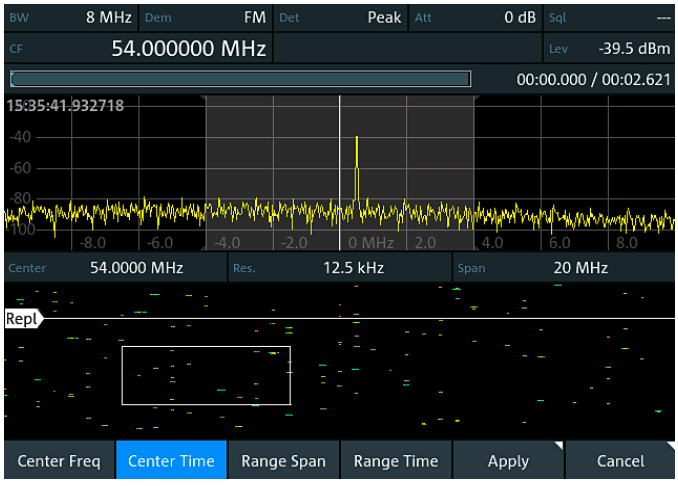
I/Q snapshot recording and replay

The R&S®CS-IQ I/Q snapshot recording and replay option supports the recording and replay of digital I/Q data up to 40 MHz real-time bandwidth. I/Q data replay is limited only by the recorded bandwidth and the internal memory size (512 Mbyte) of the R&S®EM200. A wide range of user-definable trigger conditions is available to start a recording. These include manual triggering at the press of a button, external triggering via the AUX 2 port (caused by events such as gate, positive/negative edge), and a level trigger that can be defined directly on the R&S®EM200GUI.

Recorded digital I/Q data is replayed from the internal memory and displayed directly on the R&S®EM200GUI. It can also be replayed and evaluated offline using the I/Q analysis app. During a replay, all receiver functions are available, and parameters can be changed by the user. For a deeper analysis, the time resolution in the waterfall diagram can be increased to one microsecond per line. This provides users with a detailed view of the spectral signal characteristics even for very short events. Recorded I/Q data can be easily transferred from the internal memory to an external storage medium in various file formats (IQ, HDF5, ARB and WAV).

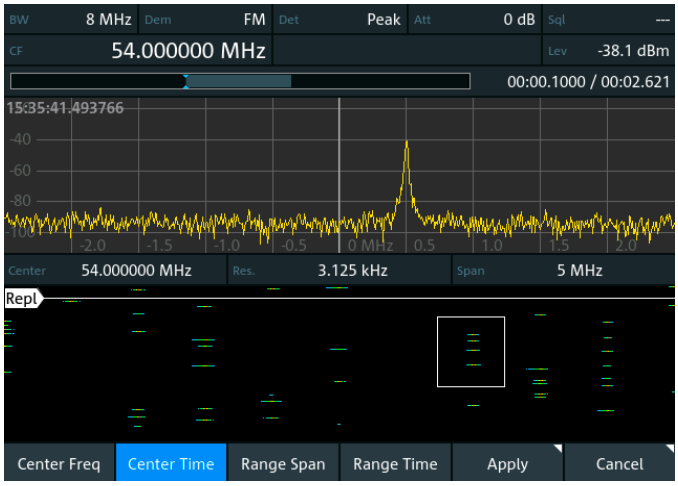


Easy selection of trigger events for I/Q snapshot recording on a live spectrum.



Recorded signals can be evaluated offline using the I/Q analysis app.

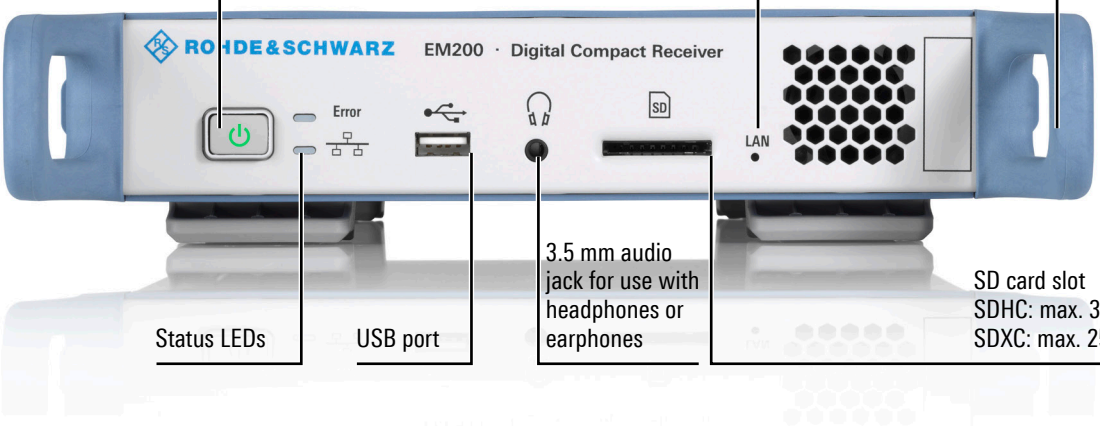
Maximum recording capacity of the internal memory	
Span	**Max. record length (approx.)**
500 kHz	1.2 min
5 MHz	10.48 s
10 MHz	5.24 s
20 MHz	2.62 s
40 MHz	1.31 s



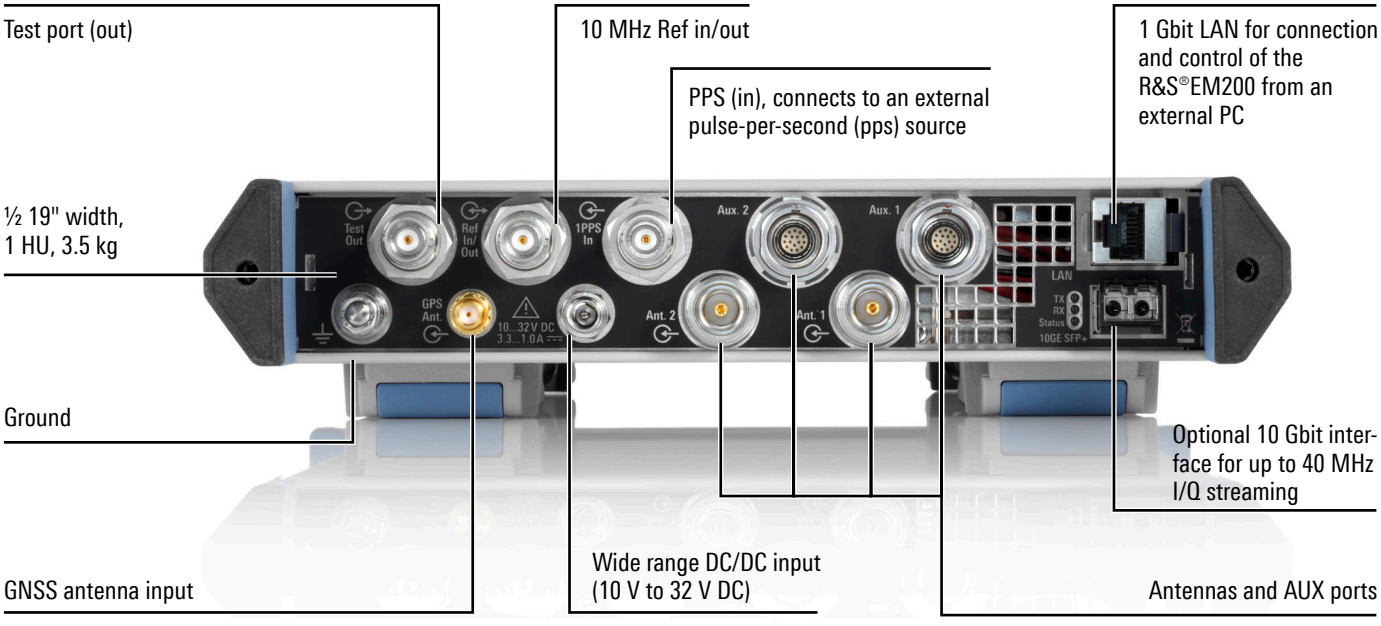
Detailed display of spectral signal characteristics with increased time resolution.

DESIGNED FOR MAXIMUM FLEXIBILITY FOR A WIDE VARIETY OF APPLICATIONS

FRONT PANEL



REAR PANEL



ORDERING INFORMATION

Designation	Type	Order No.
Base unit (including accessories such as power cord and manual)		
Digital compact receiver IF spectrum (max. 40 MHz), spectrogram (waterfall display), plug-in power supply, SD card for storing user settings	R&S®EM200	4108.3005.02
Hardware options		
10G Ethernet interface (without transceiver module)	R&S®CS-10G	4108.5220.02
Software options		
Panorama scan	R&S®CS-PS	4500.7070.02
Polychrome spectrum	R&S®CS-PC	4500.7040.02
Field strength measurement	R&S®CS-FS	4500.7211.02
Modulation measurement	R&S®CS-MM	4500.7340.02
Time domain measurement	R&S®CS-ZS	4500.7111.02
Direction finding	R&S®CS-DF	4500.7370.02
Trace recording and replay	R&S®CS-IR	4500.7240.02
Timestamp accuracy and external GNSS	R&S®CS-TSA	4500.7170.02
Mapping and geotagging Includes support for map display, triangulation and geotagging	R&S®CS-MAP	4500.7140.02
Spectral measurement	R&S®CS-SPM	4500.7311.02
I/Q snapshot recording and replay	R&S®CS-IQ	4500.7270.02
Accessories		
Telescopic antenna	R&S®CS-ZANT	4500.7470.00
Active GNSS antenna	R&S®CS-ZNAV	4500.7440.00
Optical cable, for 10 Gbit, incl. two optical transceivers; length: 20 m	R&S®GX460-OCG	4094.8641.02
Copper cable, for 10 Gbit, incl. two transceivers; length: 5 m	R&S®GX460-OCG	4094.8635.02
Car adapter, connector for cigarette lighter	R&S®HA-Z302	1321.1340.02
Headphones	R&S®FSH-Z36	1145.5838.02
19" adapter, BW2010 cabinet, 1 HU ½ 19", device + dummy	R&S®ZZA-KN21	1175.3204.00
19" adapter, BW2010 cabinet, 1 HU ½ 19", 2 devices side by side	R&S®ZZA-KN20	1175.3191.00
Documentation		
Documentation of calibration values	R&S®CS-DCV	4500.7011.02

Service options		
Extended warranty, one year	R&S®WE1	
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	Please contact your local Rohde&Schwarz sales office.
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	

OpenStreetMap (OSM)

OpenStreetMap (OSM) is a user-editable world map that is available at the following internet address: https://www.openstreetmap.org/
OSM is a wiki project in which users can participate by uploading and editing geographical information such as GPS tracking data or the course of a road or river. This world map is growing daily. OpenStreetMap data can be used freely under the terms of the Creative Commons Attribution-ShareAlike 2.0 license.

Service that adds value

- 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.

www.rohde-schwarz.com

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

Rohde&Schwarz training

www.training.rohde-schwarz.com

Rohde&Schwarz customer support

www.rohde-schwarz.com/support

PD 3609.3136.12 | Version 05.00 | July 2022 (sk/ch)
R&S®EM200 Digital Compact Receiver
Data without tolerance limits is not binding | Subject to change

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