

Technical Information

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R&S TMSR

Lightweight Interception and Direction Finding System

- ◆ Compact multipurpose interception and DF system for security organizations, border/coast guards, special task forces, etc
- ◆ Detection, identification, direction finding and recording of radio signals between 10 kHz and 3000 MHz
- ◆ Listening in to demodulated AM, FM, SSB and CW signals
- ◆ Recording, replay and evaluation of audio signals
- ◆ Easy means of obtaining results
- ◆ Immediate detection of electronic emissions beyond line of sight
- ◆ Identification and pre-evaluation of detected emitters
- ◆ Display of results plus situation display on digital maps
- ◆ High mobility and quick deployment

Introduction

An increasing number of low-intensity conflicts throughout the world have led to a growing demand for portable, highly mobile communications intelligence and direction finding equipment. Special task forces from security organizations require modular and easily scalable reconnaissance equipment, while national defence organizations need electronic support measures (ESM) equipment that enables situational awareness in out-of-area deployments.

Lightweight equipment of this type is now available in the form of the R&S TMSR system, which has been primarily designed for:

- ◆ Generation of an (initial) image of the radio scenario in the frequency range from 0.5 MHz to 3 GHz
- ◆ Situational awareness beyond line of sight
- ◆ Detection concentration in shadowed areas
- ◆ Detection of deployable transmitters
- ◆ Overt or covert reconnaissance before and during missions
- ◆ Protection of your own forces

Depending on the mission, the R&S TMSR can be used under a wide variety of operating conditions:

- ◆ When deployment on short notice is required
- ◆ With very low outlay in personnel and material
- ◆ For uncertain or unknown positions
- ◆ As a manpack version that can be carried by one person
- ◆ Adaptable to various means of transportation

Basic components

Each R&S TMSR system consists of the following basic components:

- Transit case with integrated power distribution
- Miniport Receiver R&S EB200
- Handheld Directional Antenna HE200
- Digital Direction Finder R&S DDF195
- Laptop or rack-integrated computer
- GPS Receiver
- R&S RAMON software for convenient device control, result display and evaluation

The Miniport Receiver R&S EB200 is a very small and compact manpack unit with a very wide frequency coverage. Owing to its high scanning speed of up to 1.2 GHz/s (in DIGI-Scan mode), it is ideal for use as a search or scan receiver. To support monitoring operations, the receiver includes an IF panorama display with a realtime bandwidth of up to 1 MHz.

The Digital Direction Finder R&S DDF195, consisting of the DF Processor R&S EBD195 and the DF Antenna R&S ADD195, is connected to the IF of the Miniport Receiver R&S EB200. The R&S DDF195 with its advanced correlative interferometer method delivers reliable DF results even in mobile operation. It processes conventional as well as short-time signals with dwell times down to 10 ms.

The transit case with an integrated shock-mount frame protects the instruments even under tough environmental conditions. It allows quick-and-easy changing of carriers and setups.

Modes of operation

The modular system design supports the following modes of operation:

Manpack operation

For operation as a manpack system, the Miniport Receiver R&S EB200 is removed from the transit case and stowed in a carrying bag as shown in FIG 1. The receiver is thus easy to carry and convenient to operate, as well as being weather-protected.



FIG 1: Manpack operation

The handheld Active Directional Antenna R&S HE200 is used in this implementation. It consists of four antenna modules, covering the entire frequency range from 10 kHz to 3 GHz.

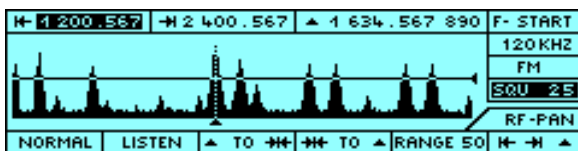


FIG 2: DIGI-Scan spectrum display of R&S EB200.

The receiver is powered from a battery that can be quickly exchanged. Operation time can thus be adapted to the mission by means of additional batteries, which can also be stored in the carrying bag.

Working with the manpack system, the operator can use the fast DIGI-Scan of the receiver to obtain an overview of the spectrum occupancy (FIG 2). Even volatile and short signal bursts are clearly indicated and are accessible in this mode. The receiver can be changed to listen mode with a single keystroke.

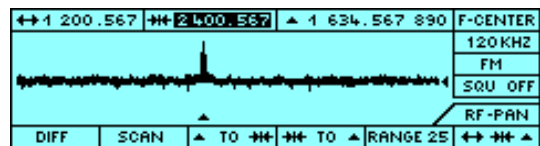


FIG 3: R&S EB200 with DIGI-Scan differential mode.

The differential mode of the DIGI-Scan supports immediate recognition of changes in the radio scenario, e.g. occurrence or disappearance of radio signals. Upon activation of this mode, the displayed spectrum (i.e. a snapshot of the current radio scenario) is stored as a reference. Only new signals and variations in signal strength are then clearly discernible as peaks (FIG 3).

Measuring the angle of incidence of a detected signal is possible with the directional antenna by means of the signal level. This is supported by activation of a tone (audible in the loudspeaker or earphone) whose pitch reflects the signal level.

Important frequencies can be stored within one of the 1000 memory locations of the Miniport Receiver R&S EB200. These parameters can later be used for further processing by the R&S RAMON software.

Mobile operation

The R&S TMSR system can also be operated in vehicles, ships or helicopters.

The entire system can quickly be set up in a vehicle with the DF antenna fixed to the rooftop by means of an R&S car adapter. This setup is shown in FIG 4. In this case, the Miniport Receiver

R&S EB200 is stowed in the transit case and operated in conjunction with the Digital Direction Finder R&S DDF195.



FIG 4: Vehicle setup – DF Antenna R&S ADD195 fixed to rooftop.

Stationary operation

When used in a stationary environment (e.g. within a building), the system can be operated from the AC mains supply (110 V or 240 V).

Changing from one setup to another can be accomplished in just a matter of minutes.

Added value

The R&S RAMON software adds substantially more functionality to the system. The following commercial-off-the-shelf (COTS) software modules are included:

- R&S EB200-Control
- R&S DDF195-Control
- R&S RAMON Basic (incl. the Logger)
- R&S RA-REC, RA-RPLY and RA-ACT
- R&S MapView

- R&S AllAudio (AFBASIC and AF-REC)

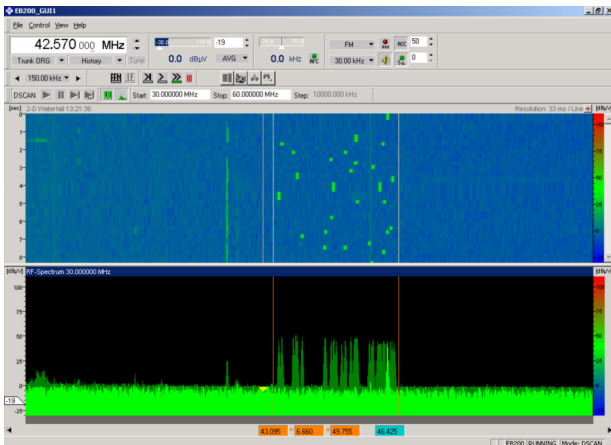
These software modules provide the following functionality:

- ◆ Display of high-resolution and high-speed RF and IF spectrum and 2D waterfall for recognition of signals
- ◆ Direction finding with standard polar view and azimuth histogram/waterfall view for observation of radio networks
- ◆ Instant replay of RF spectrum display for evaluation of short duration signals via an integrated RF spectrum data buffer
- ◆ Recording, replay and statistical evaluation of frequency spectrum data
- ◆ Display of COMINT results plus additional (e.g. tactical) information on digital maps
- ◆ Recording of digital audio signals
- ◆ Import and export of RF frequency parameter sets from the Miniport Receiver R&S EB200 to and from the R&S RAMON control software

The software supports the following modes of operation:

- ◆ Fixed frequency mode (FFM): Display, analysis and direction finding of a fixed frequency signal
- ◆ Search: Searching a single frequency list or a frequency range including display of bearings
- ◆ Scan: Display of current spectrum occupancy

The screenshots in FIG 5 provide an example of the graphical user interface of the device control software.



stance measurement and selection of map objects and single results can be accessed quickly via a special toolbar. The current situation can be displayed with the aid of graphic symbols, text elements and lines that can be freely positioned on the map. Thus, detected radio networks as well as a tactical situation can be displayed.

R&S AllAudio enables listening-in, recording and replay of the receiver's audio signal. The recordings are stored on the computer hard disk in an audio database. The operator can set bookmarks during recording in order to later quickly find the bookmarked section or recording. Comments can also be added.

For more information about the R&S RAMON software modules, please refer to the corresponding Technical Information publications from Rohde & Schwarz.

System configurations

Two preconfigured systems are available:

R&S TMSR 100

This system consists of the Miniport Receiver R&S EB200, the DF Processor R&S EBD195, the System Process Controller R&S SPCC and the R&S RAMON software described above. All the units are integrated into the transit case (see FIG 6).

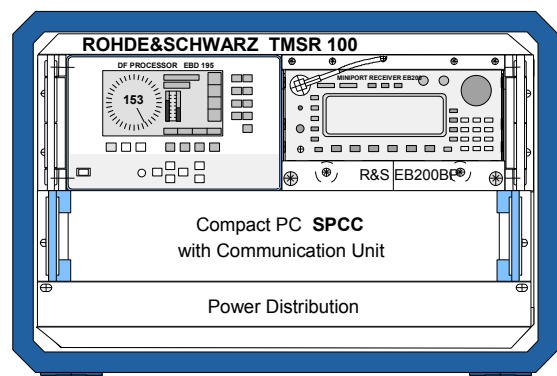


FIG 6: Setup configuration of R&S TMSR 100.

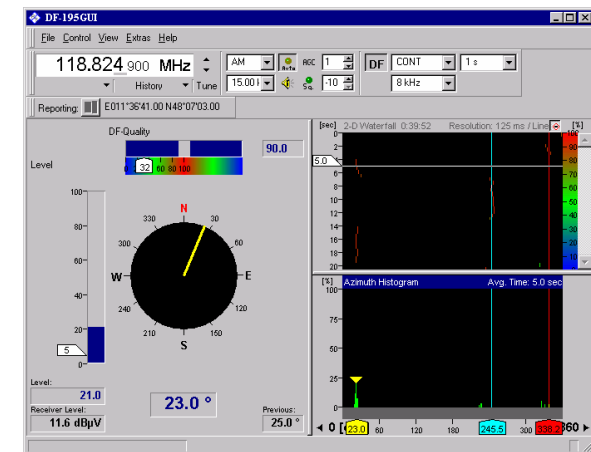


FIG 5: User interface window for R&S EB200 and DF Unit R&S EBD195.

The operator can enter any setting for the receiver or direction finder directly on the PC or via the front panels of the devices. The receiver or direction finder settings and results will correspondingly be displayed in different graphical views on the screen of the control PC. Direct control on the instruments will be mirrored within the respective displays of the graphical user interface. This is very convenient in situations where controlling the instruments via their front panels is easier (e.g. in a vehicle during movement) but the operator still wants to have large scalable displays of the results.

R&S MapView is used to display and evaluate DF and location results, the site of the direction finder and the current DF bearings being displayed on a digital map. Frequently used functions such as zooming map sections, shifting map sections, di-

This system is designed for use with one DF Antenna R&S ADD195 and covers the frequency range from 20 MHz to 1300 MHz.

The System Process Controller R&S SPCC is a highly compact PC with an already integrated router. Thus it is readily prepared for communication within a wide area network (WAN) as it can be directly connected to various types of communication equipment. Three different interface configurations are offered for connection to either analog PSTN lines, digital ISDN lines or with an integrated GSM modem.

R&S TMSR 200

This system contains the Switch Unit R&S ZS129A1 (antenna selector) and the Laptop Computer R&S SPCN instead of the integrated System Process Controller R&S SPCC (see FIG 7). All units except the laptop are integrated into the transit case.

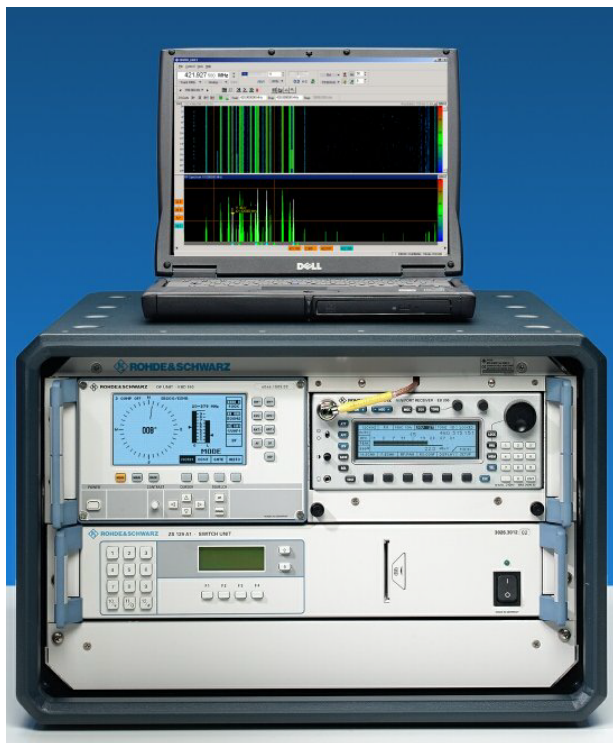


FIG 7: Setup configuration of R&S TMSR 200.

The laptop can optionally be delivered integrated into a briefcase. Within the briefcase, the laptop is cushioned on shock-mounts and the interface connectors are accessible via a multipoint connector on the left side of the briefcase.

With the RF switch matrix R&S ZS129A1 the system is designed for use with several DF and monitoring antennas. This way the system can be equipped with antennas covering the frequency range from 10 kHz to 3 GHz for monitoring and 0.5 MHz to 3 GHz for direction finding.

Both systems include an AC/DC power distribution that enables direct connection of various DC and AC supplies. Internally, all instruments operate with DC voltage. Moreover, a network hub is integrated to enable the connection of additional external network devices and additional Miniport Receivers R&S EB200.

Extending the system

Because the R&S TMSR uses COTS components, it offers virtually unlimited capabilities for updates, upgrades and extensions to meet future requirements.

Enhanced functionality can be achieved by using the following optional components:

- Second Miniport Receiver R&S EB200
- Second EB200-Control Software R&S EB2-CTL
- Master/Slave Handover Software R&S RA-MSH

- Report Editor and Database Software
R&S RA-REP
R&S RA-RDB
- DF Evaluation Software
R&S DF-EVAL

Working with two receivers

Together with the second receiver, an optional integration kit can be ordered. It contains the necessary cables to connect the second Miniport Receiver R&S EB200 to one of the ports of the integrated network hub, and to the power supply. In case of the TMSR200 system, a special version of the switch matrix ZS129A1 will also serve for connection of the second receiver to the respective antenna(s). With the additional R&S RAMON **EB200-Control** software, the receiver can now be operated with the same full functionality as the one already integrated into the rack. The second receiver now can be used as a search receiver for continuous observation of the RF spectrum, while the integrated receiver is used as a hand-off receiver for monitoring, audio recording and – in conjunction with the R&S DDF195 – for direction finding.

The **Master-Slave Handover** software module is used to couple the two receivers. It permits the operator to hand over settings from one receiver to another. Therefore, one receiver can be used in scan mode (as a master) while tasking one or more additional receivers for monitoring operation in fixed frequency mode (as slaves – in this case the rack-integrated R&S EB200). By using the cursor to select a frequency in the master's RF spectrum display, the operator tunes the slave receiver to this frequency (including the master receiver settings such as bandwidth and type of modulation). The operator can now listen in to the detected signal on the slave receiver and observe the signal with the corresponding IF spectrum data. Also, the bearing will concurrently be processed by the direction finder.

Running a database

The **Report Editor** is used to create preformatted measurement result files referred to as *reports*. Each report contains the measurement results of the receiver; the operator can add the results to the Report Editor by just clicking a button on the graphical user interface (GUI) of R&S EB200-Control or R&S DDF195-Control. In addition, screenshots of the R&S MapView map display, audio recordings from R&S AllAudio and comments from the operator can be stored in the report.

An Oracle 8i database is used to store reports. Optional report extensions can be used to sort the reports and to search and retrieve stored reports. It is also possible to send stored signal parameter sets directly from a report to the receiver, similarly to the Master/Slave Handover function.

With **DF Evaluation**, bearing results can be collected and evaluated. DF Evaluation allows continuous or triggered recordings, replay and post-evaluation of DF missions, i.e. car or DF locations and DF results. A single mobile R&S TMSR system can be used to fix a position by conducting multiple DF measurements from different car or DF locations (running fix).

Lightweight Location System R&S TMSLoc

By means of optional communication modules, individual R&S TMSR systems can be linked to stationary COMINT stations as well as interlinked to form a location system. A lightweight location system consisting of several (2 to 4) R&S TMSR systems is called R&S TMSLoc.

The following range of communication modules is available:

- Line communication using analog and digital modems (PSTN)
- Wireless communication using R&S GC128 GSM modems or the built in GSM modem of the process controller R&S SPCC
- Wireless communication using VHF / UHF radios. These can be either commercial or tactical radios.

One of the stations will act as a master, with the others acting as slaves that are tasked by the master. Especially the R&S TMSR 100 is suitable as a slave system, because the PC, router and communication interface for line- or GSM-based communication are already implemented.

For more detailed information about TMSLoc please refer to the respective Technical Information.

Specifications

Operating temperature range	-10°C to +45°C
Storage temperature range	-40°C to +70°C
Humidity	80% cyclic, +25°C/+40°C
Sinusoidal vibration	5 Hz to 150 Hz
Random vibration	10 Hz to 500 Hz
Shock	40 g shock spectrum
EMC	meets EMC directive of EU (89/336/EEC) and German EMC law
Safety	meets EN60950 / VDE0805
Quality standard	developed and manufactured in compliance with ISO 9000
Power supply	100 to 240 V _{AC} / 47 to 63 Hz / 235 VA 11 to 32 V _{DC} / 200 W
Dimensions (W x H x D) (box)	555 mm x 358 mm x 720 mm
Weight	approx. 45 kg

Ordering information

Basic versions

Lightweight Interception and Direction Finding System with integrated PC R&S TMSR 100 3028.3510.02

R&S EB200 with DIGI-Scan, IF panorama, LAN interface, two battery packs and carrying bag, R&S HE200, R&S EBD195, DF Antenna R&S ADD195, GPS receiver, **R&S SPCC** with keyboard and mouse, R&S RAMON software, **communication unit for network connection via analog dialled or leased line**, hub, power distribution and transit case

Note: An antenna cable set and a monitor / TFT display for local operation are required.

Lightweight Interception and Direction Finding System with integrated PC R&S TMSR 100 3028.3510.03

R&S EB200 with DIGI-Scan, IF panorama, LAN interface, two battery packs and carrying bag, R&S HE200, R&S EBD195, DF Antenna R&S ADD195, GPS receiver, **R&S SPCC** with keyboard and mouse, R&S RAMON software, **communication unit for network connection via dialled ISDN line**, hub, power distribution and transit case

Note: An antenna cable set and a monitor / TFT display for local operation are required.

Lightweight Interception and Direction Finding System with integrated PC R&S TMSR 100 3028.3510.04

R&S EB200 with DIGI-Scan, IF panorama, LAN interface, two battery packs and carrying bag, R&S HE200, R&S EBD195, DF Antenna R&S ADD195, GPS receiver, **R&S SPCC** with keyboard and mouse, R&S RAMON software, **communication unit for network connection via GSM900, or GSM1800**, hub, power distribution and transit case

Note: An antenna cable set and a monitor / TFT display for local operation are required.

Lightweight Interception and Direction Finding System with integrated antenna switch unit and external notebook R&S TMSR 200 3028.3561.02

R&S EB200 with DIGI-Scan, IF panorama, LAN interface, two battery packs and carrying bag, R&S HE200, R&S EBD195, DF Antenna R&S ADD195, GPS receiver, **Switch Unit R&S ZS129A1 (1 out of 6)**, laptop **R&S SPCN** with mouse, PCMCIA 2x serial port extension card and soft carrying bag, R&S RAMON software, hub, power distribution and transit case

Note: An antenna cable set is required.

Options

External inverter (DC/AC) e.g. for TFT display	R&S TMS-B3	3026.7618.02
Front and rear cover for transit case with opening for cables and fan	R&S TMS-B4	3026.4919.02
Adapter for antenna R&S HE309 / HF902 to be mounted on tripod R&S AC008-Z	R&S TMS-H1	3026.7260.02
5 m RF cable for monitoring antennas	R&S TMS-H2	3026.7360.05
10 m RF cable for monitoring antennas	R&S TMS-H2	3026.7360.10
20 m RF cable for monitoring antennas	R&S TMS-H2	3026.7360.20
Grounding set for antennas	R&S TMS-H3	3026.7418.02
Adapter for DF antenna R&S ADD071 to be mounted on tripod R&S AP502Z2	R&S TMS-H4	3026.7460.02
Roof rack adapter for DF antenna R&S ADD195	R&S TMS-H5	3026.8766.02
Battery pack with 24 V / 26 Ah	R&S TMS-H6	3026.8014.02
Case for antenna cables	R&S TMS-H8	3026.8114.02
Photo tripod e.g. for use with antenna R&S HE200	R&S TMS-H10	3026.8189.02
Adapter for antenna R&S HE010 for mounting on photo tripod R&S TMS-H10	R&S TMS-H11	3026.8214.02
Adapter for antenna R&S HE500 for mounting on photo tripod R&S TMS-H10	R&S TMS-H12	3026.8266.02

Transportable communication system for R&S TMSR100 / 200 consisting of router, power distribution, inverter and transit case	R&S TMS-C	3026.4919.02
PSTN network interface for router and modem for analog dial / leased line for R&S TMS-C	R&S TMS-C1	3026.7760.02
ISDN network interface for router for ISDN dial line	R&S TMS-C2	3026.7818.02
GSM network interface for router and R&S GC128 for GSM / GPRS 900 / 1800	R&S TMS-C3	3026.7860.02

