Широкополосный мониторинговый приемник ESME

Архангельск (8182)63-90-72
Астана (7172)727-132
Астрахань (8512)99-46-04
Барнаул (3852)73-04-60
Белгород (4722)40-23-64
Брянск (4832)59-03-52
Владивосток (423)249-28-31
Волгоград (844)278-03-48
Вологда (8172)26-41-59
Воронеж (473)204-51-73
Екатеринбург (343)384-55-89
Иваново (4932)77-34-06
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Иркутск (395)279-98-46
Казань (843)206-01-48
Калининград (4012)72-03-81
Калуга (4842)92-23-67
Кемерово (3842)65-04-62
Киров (8332)68-02-04
Краснодар (861)203-40-90
Красноярск (391)204-63-61
Курск (4712)77-13-04
Липецк (4742)52-20-81
Магнитогорск (3519)55-03-13
Москва (495)268-04-70
Мурманск (8152)59-64-93
Набережные Челны (8552)20-53-41
Нижний Новгород (831)429-08-12
Новокузнецк (3843)20-46-81
Новосибирск (383)227-86-73
Омск (3812)21-46-40
Орел (4862)44-53-42
Оренбург (3532)37-68-04
Пенза (8412)22-31-16
Пермь (342)205-81-47
Ростов-на-Дону (863)308-18-15
Рязань (4912)46-61-64
Самара (846)206-03-16
Санкт-Петербург (812)309-46-40
Саратов (845)249-38-78
Севастополь (8692)22-31-93
Симферополь (3652)67-13-56
Смоленск (4812)29-41-54
Сочи (862)225-72-31
Ставрополь (8652)20-65-13
Сургут (3462)77-98-35
Тверь (4822)63-31-35
Томск (3822)98-41-53
Тула (4872)74-02-29
Тюмень (3452)66-21-18
Ульяновск (8422)24-23-59
Уфа (347)229-48-12
Хабаровск (4212)92-98-04
Челябинск (351)202-03-61
Череповец (8202)49-02-64
Ярославль (4852)69-52-93

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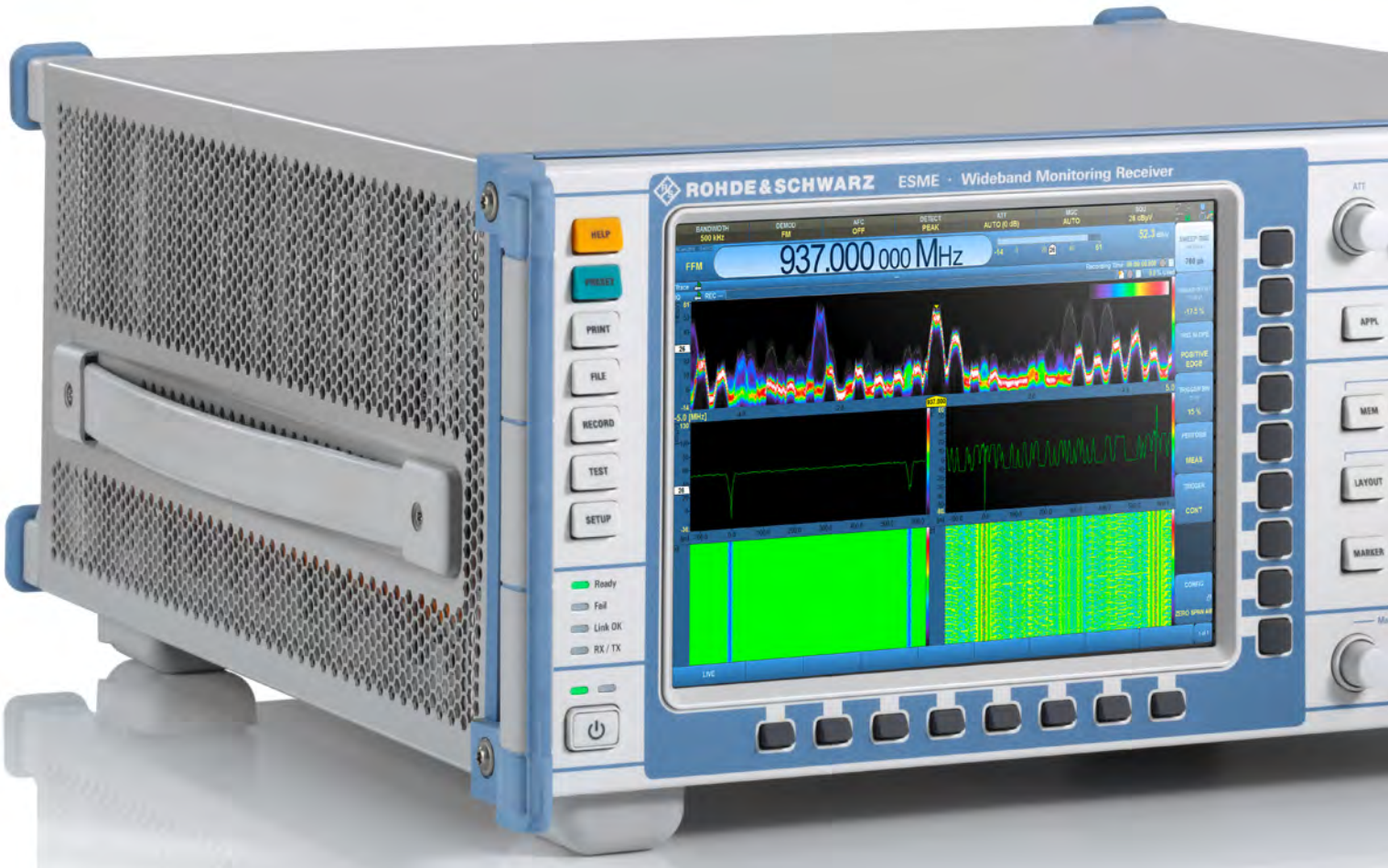
AT A GLANCE

The R&S®ESME wideband monitoring receiver is ideal for high-performance ITU-compliant spectrum monitoring, signal analysis and multichannel digital data streaming from 8 kHz to 40 GHz. In combination with single-channel direction finding (DF) antennas, it optionally supports angle of arrival (AOA) direction finding from 300 kHz to 8.2 GHz. Thanks to its exceptional RF performance, the R&S®ESME provides cutting-edge signal detection and measurement capabilities even in high-density spectrum environments.

The R&S®ESME wideband monitoring receiver with up to 80 MHz real-time bandwidth is designed for detection, analysis and digital data streaming of signals over a wide frequency range from 8 kHz to 40 GHz. Thanks to its high dynamic range and its spectrum scan speed of up to 110 GHz/s, even weak and low probability of intercept (LPI) signals close to strong transmitters can be reliably detected and measured.

In addition to its wide selection of signal measurement functions, the R&S®ESME provides a powerful feature set for detection and analysis of unwanted emissions as well as for multichannel processing, classification, demodulation and continuous I/Q streaming of unknown signals of interest. All measurements can be recorded for later documentation and further offline analysis. Recorded information ranges from simple spectral data and demodulated audio content to wideband I/Q snapshots with full 80 MHz real-time bandwidth.

In combination with single-channel direction finding (DF) antennas, the R&S®ESME can be up-graded to an angle of arrival (AOA) based direction finder that provides highly accurate bearing results from 300 kHz to 8.2 GHz.



In a network of multiple R&S®ESME receivers, the high timestamp accuracy provided by the optional internal GNSS module additionally supports precise time difference of arrival (TDOA) radiolocation over the entire frequency range.

What sets the R&S®ESME apart from other devices is its excellent RF performance across all relevant frequency bands, the real-time event capture trigger functionality to automatically detect sporadic, pulsed and burst signals, and simultaneous signal representation in the frequency and time domains.

The R&S®ESME can be operated via front panel or LAN remote control and supports a wide range of other products ranging from I/Q recorders and signal generators to dedicated analysis and system soft-ware. Its versatile and well-documented data and control interfaces make third-party system integration an easy task.

KEY FACTS

- High-performance ITU-compliant spectrum monitoring from 8 kHz to 40 GHz (base unit: 20 MHz to 6 GHz)
- Accurate ITU-compliant AOA direction finding from 300 kHz to 8.2 GHz (base unit: 20 MHz to 6 GHz) and support of TDOA and hybrid radiolocation over the entire frequency range
- One of the most linear receivers on the market, optimized for measuring weak signals in dense spectrum environments with up to 80 MHz real-time bandwidth (base unit: 20 MHz)
- Fast panorama scanning with scan speeds up to 110 GHz/s
- Cutting-edge signal measurement capabilities, including polychrome spectrum display
- Simultaneous frequency domain and time domain analysis up to 20 MHz
- Dedicated 80 MHz wideband I/Q streaming and recording concept with real-time replay and processing
- Integrated hardware-accelerated multichannel digital signal processing supports massive narrowband channelization, automatic detection and classification in combination with external R&S®CA120 signal analysis software

TYPICAL APPLICATIONS

ITU-compliant spectrum monitoring and radiolocation

Spectrum monitoring helps verify compliance with licenses, regulations and communications standards and facilitates network management and planning. The R&S®ESME forms the basis for fixed and mobile spectrum monitor-ing stations, and in combination with DF antennas provides precise direction finding. Thanks to its wideband operation with gapless 80 MHz real-time processing, high scan speed and powerful measurement toolset, the R&S®ESME integrated into an R&S®ARGUS spectrum monitoring system [1] is the key component for all ITU-compliant monitoring tasks, including automated de-tection, identification and localization of interfering signals and unlicensed emissions.

Communications intelligence and communications electronic support measures

Intercepting radiocommunications signals to gather relevant information about their characteristics, origin and content is extremely important for many security-providing authorities. The R&S®ESME provides the sensitivity, accuracy and time resolution for any in-depth analysis necessary to identify and locate spectral activities of interest.

In an R&S®RAMON radio monitoring system [2], the R&S®ESME can be used for fast scanning as well as audio content analysis, and with the R&S®MobileLocator software extension [3], transmitters of interest can be automatically detected and located from a single mobile monitoring station.

Besides standard measurement features and inherent analog demodulation, the R&S®ESME supports both wideband and multichannel narrowband I/Q data streaming and recording. Optional external R&S®CA100 and R&S®CA120 signal analysis software and hardware allow online analysis of digital signals, including automatic detection and classification, digital demodulation and dehopping of agile signals. This feature set can be further extended to advanced offline I/Q recording analysis with the R&S®CA210 signal analysis software for tactical communications signals or R&S®TPA pulse analysis software for pulsed, burst and continuous wave (CW) radar signals, including interpulse and intrapulse analysis.

[1] See "R&S®ARGUS Spectrum Monitoring Software" product brochure (PD 3607.1013.12).

[2] See "R&S®RAMON Radiomonitoring Software" product brochure (PD 5214.3152.12).

[3] See "R&S®MobileLocator" product brochure (PD 3607.1271.12).

R&S®ESME installed in a mobile monitoring station

R&S®ESME installed in a COMINT station

HIGH-PERFORMANCE MONITORING IN DENSE SPECTRUM ENVIRONMENTS

Covers the frequency range from HF to SHF in a single 19" device

The R&S®ESME base unit covers the monitoring frequency range from 20 MHz to 6 GHz, which can be extended down to 8 kHz with the R&S®ESME-HF option and up to 18 GHz with the R&S®ESME-MW18 option. The external R&S®MC40 microwave downconverter provides a further extension up to 40 GHz. Equipped with the R&S®ESME-DF option, the R&S®ESME provides AOA direction finding from 20 MHz to 6 GHz. The DF range can be extended down to 300 kHz with the R&S®ESME-HF option and up to 8.2 GHz with the R&S®ESME-MW18 option.

Superior RF performance in dense signal scenarios

The R&S®ESME provides an optimal trade-off between linearity and sensitivity for any given signal scenario. This is achieved by extensive preselection filtering including filterbanks and tunable bandpass filters over the entire frequency range to protect against intermodulation from strong out-of-band signals. Consequently, the R&S®ESME can reliably detect weak signals among strong unwanted signals in a crowded spectrum.

Two digital receive paths for individual tasks

The R&S®ESME features two digital receive paths, a wideband spectrum path with 80 MHz real-time bandwidth for maximum scan speed and fast detection, and a narrowband 20 MHz wide demodulation and measurement path with superior sensitivity, linearity and spectral purity for accurate and intuitive measurement of signal parameters.

FAST AND RELIABLE DETECTION OF SPECTRAL ACTIVITIES

Fast scans with dedicated scan modes

Whether the operational focus is on detecting unknown signals in a given frequency range or monitoring known communications channels, the R&S®ESME offers different dedicated scan modes for every task. The R&S®ESME-PS panorama scan option provides a fast spectral overview up to 110 GHz/s and selectable frequency resolution. Scanning through various known communications channels (e.g. ATC and PTT transmissions) can be performed in frequency scan (FSCAN) or memory scan (MSCAN) mode with speeds of up to 1700 channels/s. Configurable squelch levels and dwell times allow demodulation and listening in on active channels while scanning.

Wideband spectrum display in parallel with demodulation and measurements

During measurement, demodulation or content extraction of detected signals, spectral situational awareness is typically reduced. The two parallel digital receive paths of the R&S®ESME allow users to select a sensitive narrowband demodulation channel within the real-time bandwidth while maintaining the wideband overview of the real-time spectrum. This tremendously reduces reaction times on emerging spectral events with higher priority. The R&S®ESME-DDC digital downconverter option provides four additional internal and independent narrowband channels that all feature measurement, demodulation and streaming.

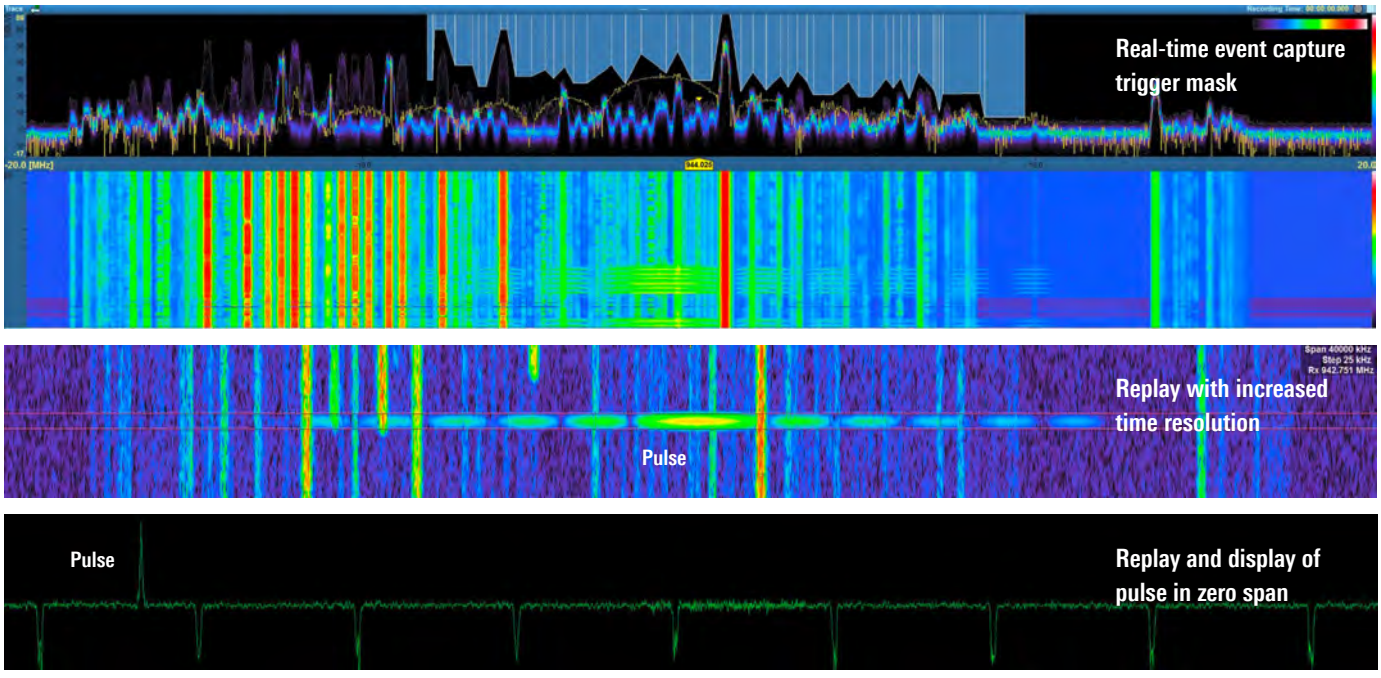
Automatically capture pulsed or short-time emissions

Sporadic, short-time signals are difficult to record and identify, especially when their appearance is not predictable. To avoid resource intensive analysis of mass data, the R&S®ESME-RR option includes a configurable real-time event capture (REC) that can be used to automatically activate I/Q data recording whenever user definable trigger conditions are met (mask based triggering). As a result, the R&S®ESME reliably detects spectral events with durations down to the nanosecond range, for instance radar pulses and electrical spark discharges. The integrated ring buffer ensures that no data is lost, not even prior to the trigger event.

Detection of superimposed pulsed signals

The R&S®ESME offers a polychrome display to separate superimposed, pulsed signals that cannot be differentiated in conventional spectrum displays. To detect such pulsed interferers in a complex signal scenario, the frequency of occurrence is displayed in a color-coded spectrum. Malfunctioning GSM repeaters and DECT phones with a non-standard center frequency are good examples of disturbances that can easily be spotted with the polychrome display.

Automatically captured pulse with duration in ns range replayed with increased time resolution



ITU-COMPLIANT SPECTRUM MONITORING

Hardware performance verification

The hardware performance of the R&S®ESME fulfills the requirements of Table 3.3-1 of the ITU Handbook on Spectrum Monitoring, Edition 2011. All R&S®ESME specifications are verified in line with the following ITU recommendations:

- ITU-R SM.1836 (IF filter edge steepness measurements)
- ITU-R SM.1837 (IP3 measurements)
- ITU-R SM.2125 (IP2 measurements)
- ITU-R SM.1838 (noise figure measurements)
- ITU-R SM.1839 (scan speed measurements)
- ITU-R SM.1840 (sensitivity measurements)

Equipped with the R&S®ESME-DF direction finder upgrade, the DF performance of the R&S®ESME is compliant with Table 3.4-1 and Table 3.4-2 of the ITU Handbook on Spectrum Monitoring, Edition 2011 and the following ITU recommendations are fulfilled:

- ITU-R SM.2060 (system DF accuracy measurements)
- ITU-R SM.2125 (DF sensitivity and DF scan speed measurements)

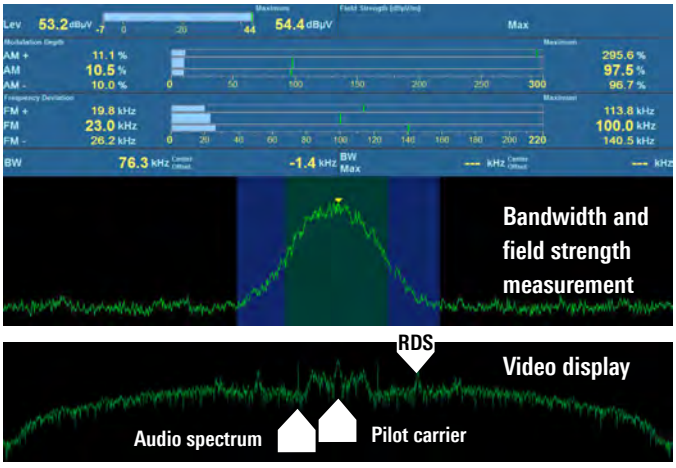
Measurement verification

Upgraded with the R&S®ESME-IM option, the R&S®ESME performs all relevant parameter measurements for AM, FM and PM modulated signals. The following ITU recommendations are covered:

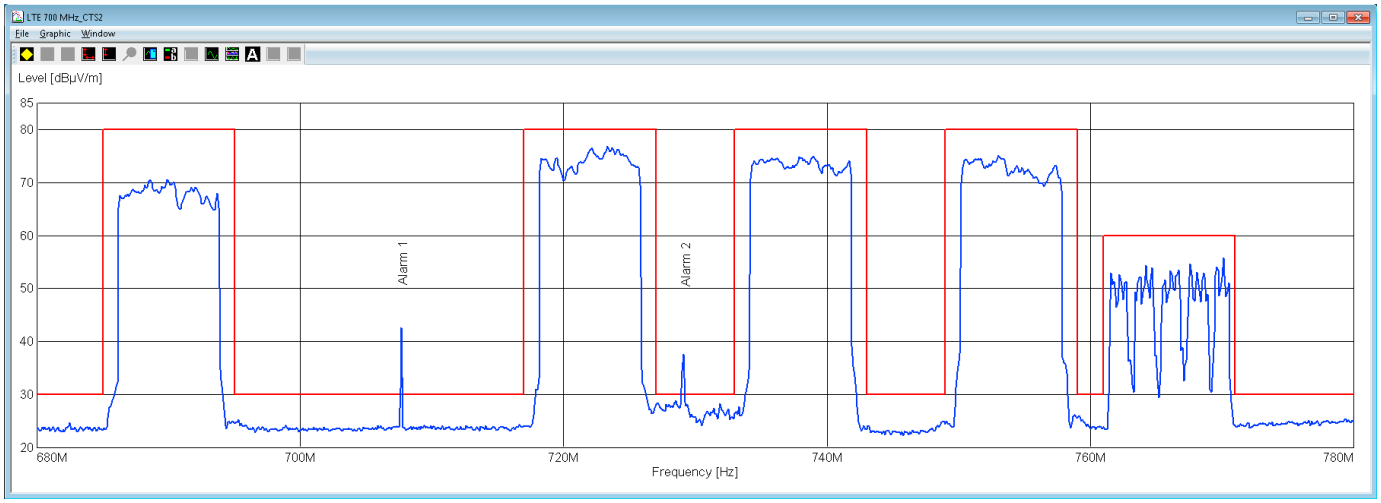
- ITU-R SM.377 (frequency and frequency offset measurements)
- ITU-R SM.378 (field strength measurements)
- ITU-R SM.328 (determination of modulation modes)
- ITU-R SM.443 (bandwidth measurements)
- ITU-R SM.1880 (determination of spectral occupancy, with PC based R&S®ARGUS software package)
- ITU-R SM.1600 (parameters of digitally modulated signals, with PC based R&S®CA100 signal analysis software [1])

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

ITU compliant measurement tools, for example an FM broadcast signal



Real-time comparison of the live result (blue trace) with a reference spectrum mask (red trace) reveals the presence of two unexpected signals at 707.7 MHz and 729.1 MHz. Automatic subsequent in-depth analysis of these frequencies reveals technical parameters, the identity and location of the interferers.

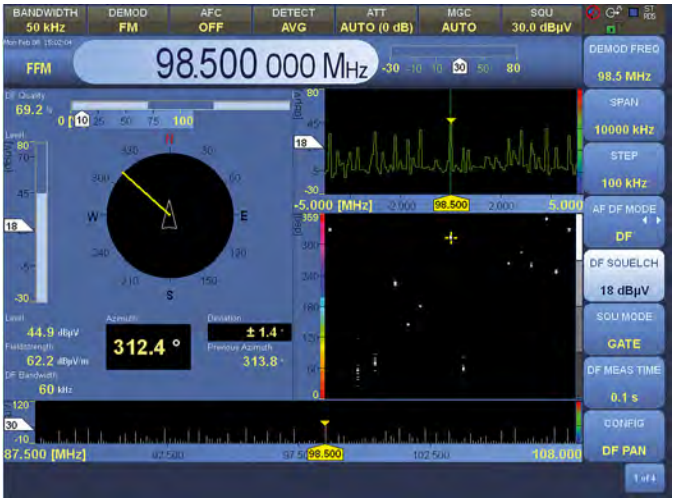


ACCURATE DIRECTION FINDING AND RADIOLOCATION

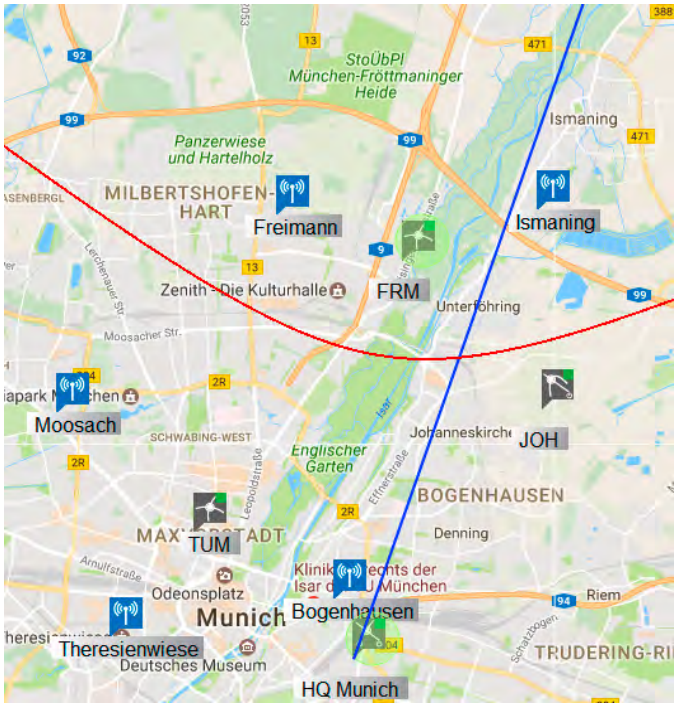
ITU-compliant direction finding with superior accuracy

Equipped with the R&S®ESME-DF direction finding option, the R&S®ESME turns into a high-performance AOA direction finder. Thanks to the precise correlative interferometer DF method in combination with innovative R&S®ADDx single-channel DF antennas [1] (covered frequency range: 300 kHz to 8.2 GHz), the R&S®ESME produces highly accurate bearing results.

[1] See "R&S®ADDx Single-Channel DF Antennas" product brochure (PD 3606.8295.12).



Once a signal in the selected DF bandwidth in the real-time spectrum exceeds the predefined DF squelch level, its bearing line is shown in the DF polar diagram along with an indication of the measurement quality.



Hybrid TDOA/AOA location result in R&S®ARGUS. Combined with data from spectrum management, it shows that the measured location of the interferer does not coincide with a licensed transmitter.

Below 1.3 GHz, the active antenna elements can be switched to passive operation with a mouse click for quick adaption to the signal environment. In the most relevant frequency range from 80 MHz to 1.3 GHz, DF antennas feature a market-leading system DF accuracy of typ. 0.5° RMS. This performance is not compromised by side-arm lightning protection thanks to the integrated lightning rod. The R&S®ESME-MAP op-tion displays information about the current location, DF measurements and triangulation results directly on a map based on the OpenStreetMap (OSM) format.

Basis for a precise radiolocation system

Multiple R&S®ESME receivers in a network can form the basis for a high-performance radiolocation system. Upgraded with the R&S®ESME-DF option, the R&S®ESME network can perform highly accurate AOA based radiolocation up to 8.2 GHz. Alternatively, if the R&S®ESME features the R&S®ESME-IGT2 internal GNSS option that provides exceptionally accurate timestamps, the network can turn into a precise TDOA[2] system with emitter radiolocation over the entire frequency range. If the R&S®ESME features both the R&S®ESME-DF and the R&S®ESME-IGT2 options, even hybrid AOA and TDOA emitter radiolocation up to 8.2 GHz can be performed.

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

AOA DF error correction

The metal structure of a vehicle platform as well as additional monitoring antennas installed near the DF antenna typically affect the operational DF accuracy of mobile monitoring stations. This can be improved significantly by measuring the vehicle on a turntable in combination with DF error correction. The R&S®ESME-COR option together with the R&S®SV-V-8 vehicle measurement service enables DF error correction to significantly improve the DF accuracy.

[2] See "Increasing timestamp accuracy in TDOA applications" application card (PD 3606.7530.92).

CUTTING-EDGE SIGNAL MEASUREMENT CAPABILITIES

Measurements in frequency and time domains

Besides standard marker functions, the R&S®ESME offers a versatile toolset for signal measurements in the frequency domain, including waterfall (spectrogram), video spectrum and polychrome spectrum. Additionally, the R&S®ESME-ZS zero span option provides simultaneous signal representation in the frequency and time domains with up to 20 MHz real-time bandwidth and enables a wide array of time domain measurements. This functionality is particularly useful when analyzing time division duplex (TDD) signals such as TDD-5G and TDD-LTE or time division multiple access (TDMA) signals such as TETRA, GSM or DECT.

Selective call analysis

Using the R&S®ESME-SL option, selective call information can be demodulated and decoded for signal identification. The following selective call methods are supported: CCIR1, CCIR7, CCITT, EEA, EIA, EURO, DCS, DTMF, CTCSS, NATEL, VDEW, ZVEI1 and ZVEI2.

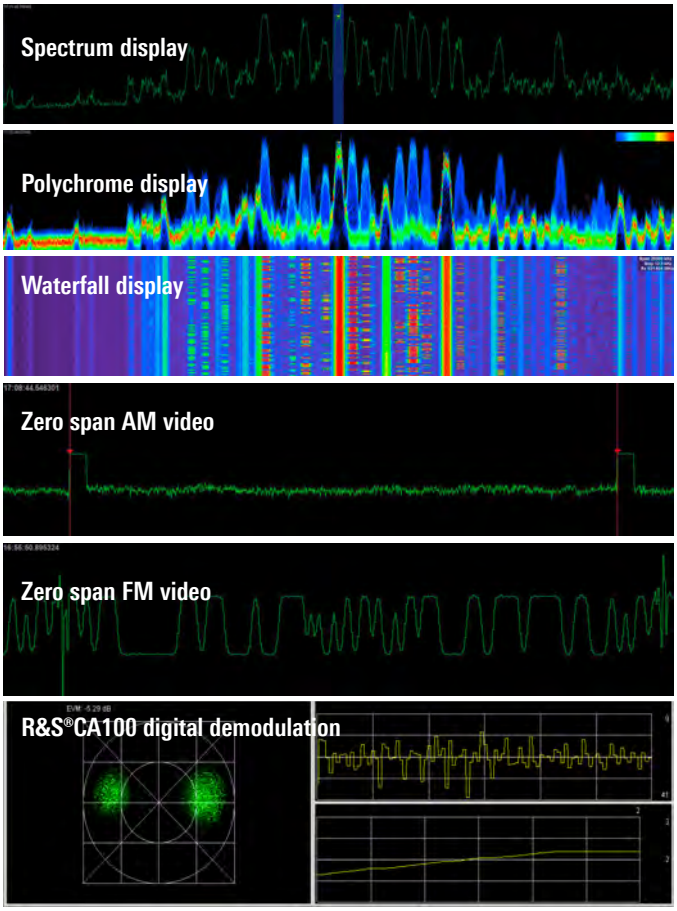
Multichannel signal detection and analysis

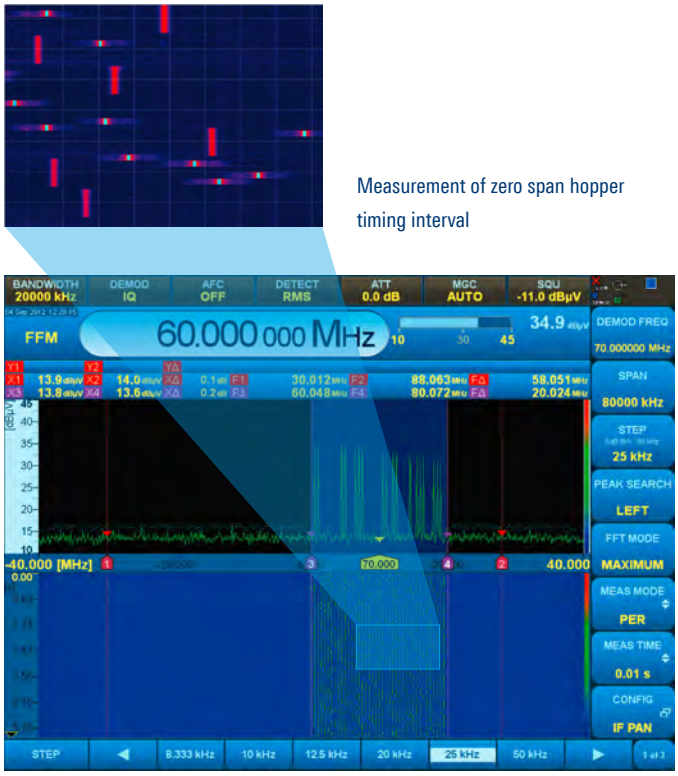
The R&S®ESME-SP signal processing board option in conjunction with the R&S®CA120 multichannel signal analysis software [1] supports parallel multichannel signal detection and analysis.

The R&S®ESME-DDCE DDC signal extraction option provides up to 128 parallel channels for continuous narrowband I/Q data streaming to the R&S®CA120 signal analysis software, which automatically performs classification, demodulation, decoding and voice recording. The R&S®ESME-HRP high-resolution panorama option offers a spectrum at higher frequency resolution for detecting, finding and classifying fixed frequency signals. The R&S®ESME-ST short-time signal detection option allows automatic detection of frequency hopping signals within the receiver's real-time bandwidth. The detected short-time signals that match user-defined selection criteria are output to R&S®CA120 as a continuous I/Q data stream for further processing.

[1] See "R&S®CA120 Multichannel Signal Analysis Software" product brochure (PD 3606.9327.12).

Example of GSM signal shown using different displays





Measurement of zero span hopper timing interval

EASY SYSTEM INTEGRATION

The R&S®ESME is more than a powerful standalone instrument. If a more advanced system solution is re-quired, the R&S®ESME can be connected to many products or be used to upgrade an ex-isting system with minimum installation and setup times. The wide array of well-documented data formats as well as hardware and software interfaces en-able easy integration into a multitude of third-party system solutions.

Built-in antenna switch and control interfaces

With several antenna connectors (three to five depending on the configuration) and an integrated fast antenna switch, the R&S®ESME can easily be connected to an antenna network. All necessary control interfaces for DF antennas and external devices such as preamplifiers are included.

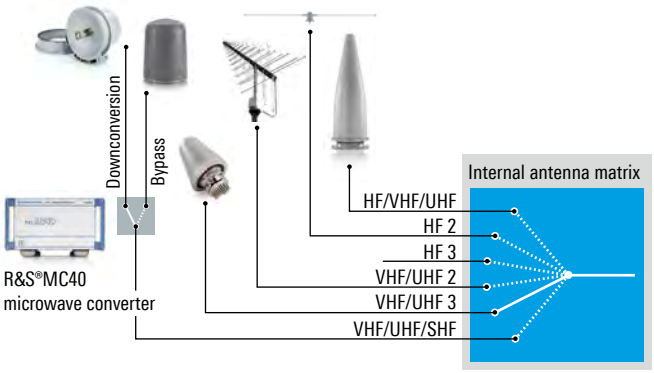
Mobile monitoring solution

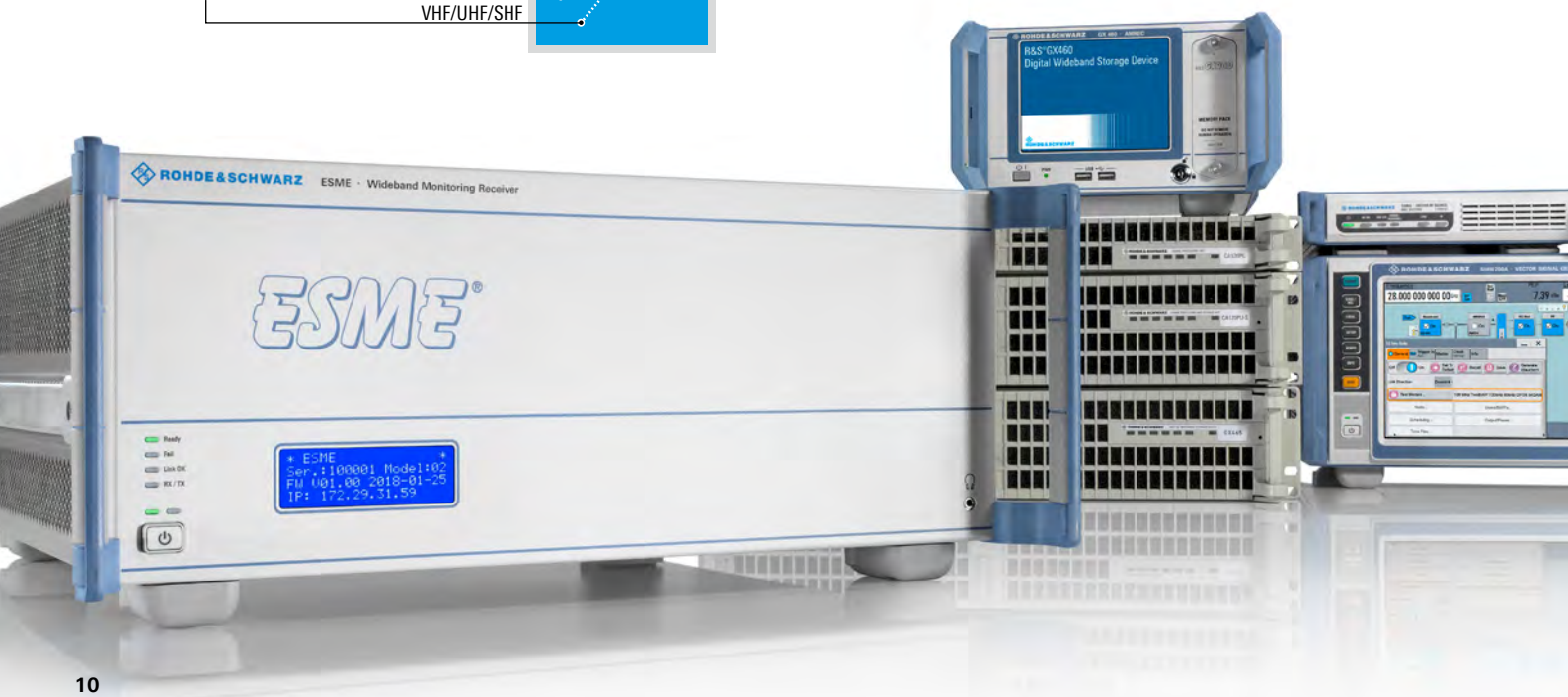
The R&S®ESME is ideal for integration into vehicles for monitoring and searching for interference sources. The R&S®ESME-DC DC power supply option receives its power directly from a DC source such as a vehicle battery. Thanks to its wide input voltage range from 12 V to 32 V DC, the R&S®ESME can be powered from both car and truck batteries.

Easy connection with a wide array of supported products

provides all the components neces-sary to field a full monitoring system with a streamlined workflow and minimal setup times. High-performance spectrum monitoring antennas and R&S®ADDx DF antennas featuring an integrated omnidirectional antenna path for spectrum measurements are automatically recognized. With the R&S®ESME at its core, components such as additional handoff receivers, the R&S®DWR100 and R&S®DWR150 digital wideband recorders, the R&S®CA100 and R&S®CA120 signal analysis software and hardware as well as the R&S®RAMON and R&S®ARGUS monitoring software complement the basic receiver functions in a modular and upgradable fashion.

Antenna network





Dedicated and versatile recording, replay and streaming concept for analysis and documentation

Basic recording and streaming functions are a standard R&S®ESME feature. The R&S®ESME-IR internal recording option allows recording of all receiver measurements for documentation purposes. These recordings can be replayed on the internal GUI; all functions of the R&S®ESME-MAP option are available. It is possible to see at a glance where, when and which measurement or audio recording was made. The internal storage capacity can be extended with the R&S®ESME-SSD internal hard disk.

With the R&S®ESME-RR record and replay option, digital wideband I/Q data can be recorded using internal memory or streamed to dedicated wideband recording devices such as the R&S®DWR100 or R&S®DWR150 via the optional R&S®RX-10G interface. These recordings support the full 80 MHz real-time bandwidth and can either be replayed in real time on the R&S®ESME or used for further offline signal analysis with the R&S®CA210 signal analysis software [1] for communications signals or R&S®TPA technical pulse analysis software [2] for radar signals.

[1] See "R&S®CA210 Signal Analysis Software" product brochure (PD 3607.3600.12).
[2] See "R&S®TPA Technical Pulse Analysis" product brochure (PD 5214.5390.12).

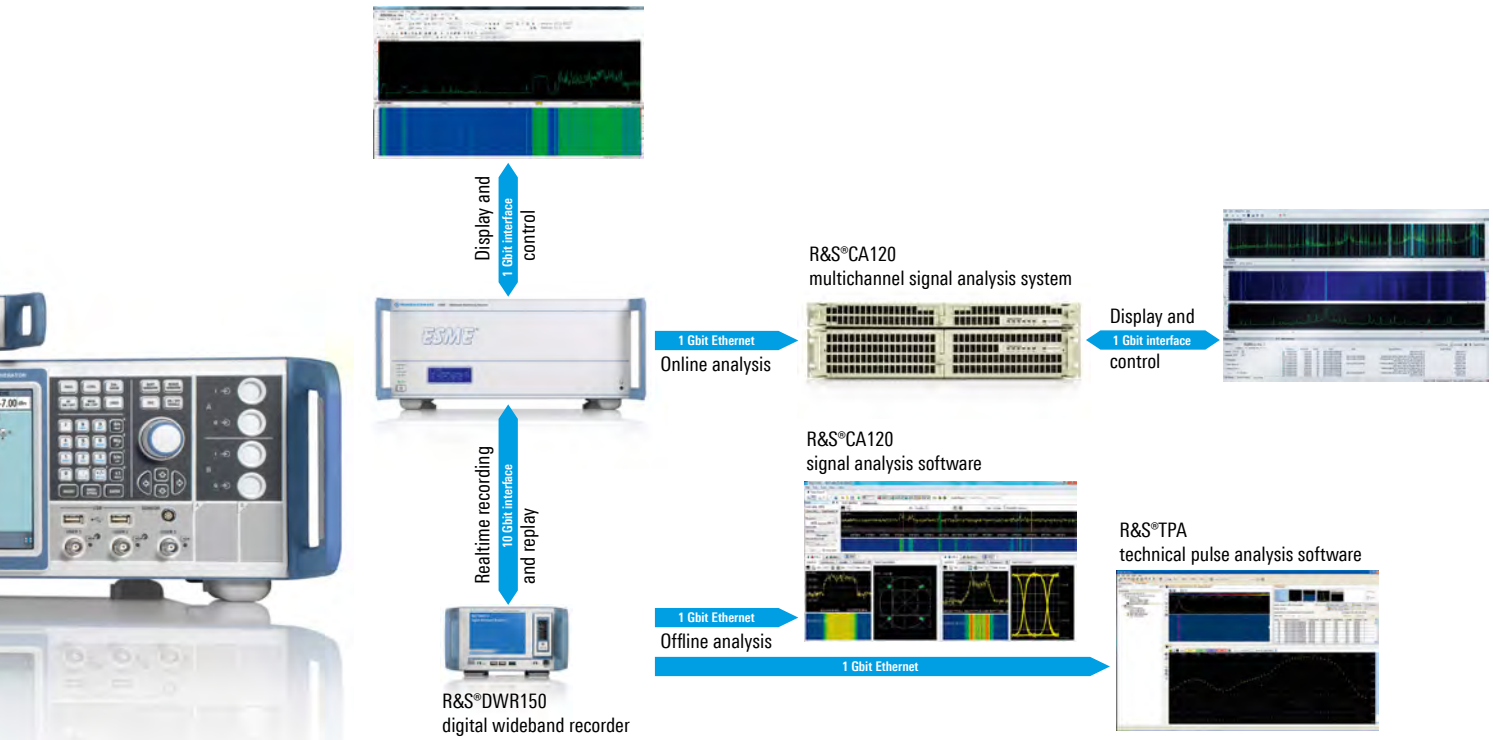
Open remote control interfaces and data formats

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

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

Extensive examples for software integration are included in the documentation.

Recording and interfaces



SPECIFICATIONS IN BRIEF

Specifications in brief		
Frequency range	base unit	20 MHz to 6 GHz
	with R&S®ESME-HF option	8 kHz to 6 GHz
	with R&S®ESME-HF and R&S®ESME-MW18 options	8 kHz to 18 GHz
	external R&S®MC40 microwave downconverter [1]	up to 40 GHz
Real-time bandwidth	in HF	up to 20 MHz
	in VHF/UHF with R&S®ESME-ADC2 and R&S®ESME-WB options	up to 80 MHz
	demodulation and measurement path	up to 20 MHz
Scan speed	with R&S®ESME-PS and R&S®ESME-WB options	up to 110 GHz/s at 2000 kHz resolution bandwidth
40 Gbit I/Q Interface	with R&S®ESME-DIQ and R&S®RX-40G options	I/Q streaming up to 80 MHz bandwidth
Optional AOA direction finding	with R&S®ESME-DF option	
Frequency range DF	base unit	20 MHz to 6 GHz
	with R&S®ESME-HF option	300 kHz to 6 GHz
	with R&S®ESME-MW18 option	20 MHz to 8.2 GHz
	with R&S®ESME-HF and R&S®ESME-MW18 options	300 kHz to 8.2 GHz
Real-time bandwidth DF	for wideband DF	up to 20 MHz
Instrument DF accuracy		0.2° RMS (typ.)
System DF accuracy (with lightning protection installed)	80 MHz to 1.3 GHz	0.5° RMS (typ.)
	20 MHz to 80 MHz and 1.3 GHz to 6 GHz	1° RMS (typ.)

[1] Requires R&S®ESME-MW18.

ORDERING INFORMATION

Designation	Type	Order No.
Base unit (including accessories such as power cable, manual)		
Wideband monitoring receiver, without front panel control	R&S®ESME	4113.0000.02
Wideband monitoring receiver, with front panel control	R&S®ESME	4113.0000.03
Hardware options		
HF frequency range extension, 8 kHz to 32 MHz	R&S®ESME-HF	4113.2232.02
Microwave extension, 18 GHz	R&S®ESME-MW18	4113.2478.02
Multifunction board	R&S®ESME-ADC2	4113.2355.02
DC power supply	R&S®ESME-DC	4113.2203.02
Wideband I/Q data streaming board [1]	R&S®ESME-DIQ	4113.2449.02
10 Gbit Ethernet interface (without transceiver module) [2]	R&S®RX-10G	4074.7604.04
40 Gbit I/Q interface [2]	R&S®RX-40G	4093.2404.02
Internal GNSS module (GPS, GLONASS, BeiDou)	R&S®ESME-IGT2	4113.2384.02
Internal SSD [3]	R&S®ESME-SSD	4113.2410.02
Signal processing board	R&S®ESME-SP	4113.2261.02

[1] Requires R&S®ESME-ADC2.
[2] Requires R&S®ESME-DIQ.
[3] Requires R&S®ESME model .03 with front panel control.

Designation	Type	Order No.
Software options		
Panorama scan	R&S®ESME-PS	4113.2010.02
Internal recording	R&S®ESME-IR	4113.2155.02
Map display	R&S®ESME-MAP	4113.2161.02
ITU measurement software	R&S®ESME-IM	4113.2026.02
Zero span	R&S®ESME-ZS	4113.2178.02
Selective call analysis	R&S®ESME-SL	4113.2032.02
80 MHz IF panorama bandwidth [1)]	R&S®ESME-WB	4113.2061.02
Digital downconverter [1)]	R&S®ESME-DDC	4113.2055.02
Direction finder upgrade kit	R&S®ESME-DF	4113.2290.02
DF error correction	R&S®ESME-COR	4113.2078.02
Record and replay [1)]	R&S®ESME-RR	4113.2149.02
DDC signal extraction [4)]	R&S®ESME-DDCE	4113.2103.02
High-resolution panorama spectrum [4)]	R&S®ESME-HRP	4113.2126.02
Detection of short-time signals [5)]	R&S®ESME-ST	4113.2110.02
Accessories		
Documentation of calibration values	R&S®ESME-DCV	4113.2326.02
Microwave converter 40 GHz [6)]	R&S®MC40	4098.6008.02
Digital wideband storage device (up to 40 MHz IF bandwidth recording)	R&S®DWR100	1525.7551.50
Digital wideband storage device (up to 80 MHz IF bandwidth recording)	R&S®DWR150	1525.7551.60
19" rack adapter	R&S®ZZA-411	1096.3283.00

Service options		
Extended warranty, one year	R&S®WE1	Please contact your local 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	

[4)] Requires R&S®ESME-ADC2 and R&S®ESME-SP.
[5)] Requires R&S®ESME-DDCE.
[6)] Requires R&S®ESME-MW18.