R&S®ESR
EMI TEST RECEIVER

More speed, more insight, more intelligence

Product Brochure
Version 04.00

ROHDE&SCHWARZ
Make ideas real

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AT A GLANCE

The R&S®ESR is an EMI test receiver for the frequency range from 10 Hz to 26.5 GHz and complies with the CISPR 16-1-1 standard. The receiver measures electromagnetic disturbances with the conventional stepped frequency scan or – at an extremely high speed – with an FFT based time domain scan.

Featuring real-time spectrum analysis with a wide range of diagnostic tools, the test receiver also enables detailed analysis of disturbance signals. The R&S®ESR has clearly structured menus and an intuitive touchscreen, making it easy to operate in any mode.

The R&S®ESR meets all EMI compliance testing requirements with its high dynamic range and sensitivity. It is the ideal core component in any EMI compliance system, delivering fast and reliable measurement results. With the optional FFT based time domain scan, the R&S®ESR saves considerable time and cost during product development and certification. With up to 30 MHz of FFT segments processed in parallel, the instrument captures the CISPR bands A and B in a single shot.

Besides offering functionality for EMC conformance testing, the R&S®ESR features real-time spectrum analysis, providing new diagnostic tools such as a spectrogram, persistence mode and frequency mask trigger. With these tools, users can detect hidden or sporadic emissions and analyze their causes.

The test receiver displays up to six different traces on the large 21 cm (8.4") touchscreen for fast, effective result analysis. Compact dimensions, a lightweight design, optional ruggedized housing and an optional DC power supply make the R&S®ESR an ideal choice for mobile applications, too.

KEY FACTS

- All-in-one EMI test receiver and spectrum analyzer
- Compliant with CISPR 16-1-1
- Preselection with integrated 20 dB preamplifier
- Resolution bandwidths in line with CISPR and optionally in decade steps from 10 Hz to 1 MHz (MIL-STD-461, DO-160)
- FFT based time domain scan (option) or conventional stepped frequency scan
- Real-time spectrum analysis (option)
- Automatic test routines
- IF analysis (option)

BENEFITS

Standard-compliant disturbance measurements
▶ page 4

FFT based time domain scan (option)
▶ page 5

Real-time spectrum analysis for detailed investigation of disturbances (option)
▶ page 6

Powerful measurement and analysis functions in the frequency and time domain
▶ page 8

Four-channel click rate measurement
▶ page 10

Fast and reliable R&S®ELEKTRA EMC test software
▶ page 11

Convenient operation, straightforward display
▶ page 12

Robust and compact – ideal also for mobile use
▶ page 13

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STANDARD-COMPLIANT DISTURBANCE MEASUREMENTS

Certification measurements

The main focus of the R&S®ESR is certification measurements in line with EMC standards. Standard-compliant certification measurements place very high demands on the test equipment since it must correctly detect, measure and weight all of the disturbance signals that occur. These include pulsed and sinusoidal as well as modulated and intermittent signals.

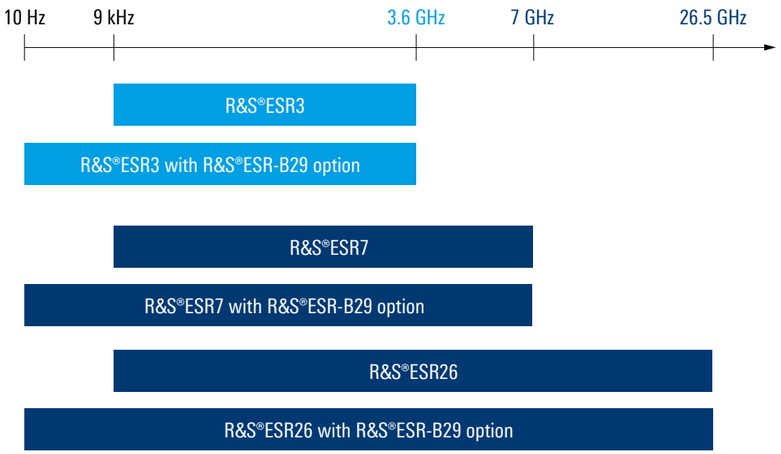
With its integrated preselection with 16 fixed filters up to 7 GHz, a 20 dB preamplifier and a highly linear frontend, the R&S®ESR meets the requirements of commercial and military standards such as CISPR, EN, ETS, ANSI, FCC, VCCI, MIL-STD-461 and DO-160 up to 26.5 GHz. The test receiver has a standard frequency range from 9 kHz to 3.6/7/26.5 GHz, which can optionally be extended down to 10 Hz.

Featuring a low displayed average noise level (–168 dBm typ. at 1 Hz bandwidth, with preamplifier switched on), the R&S®ESR also measures very weak signals precisely and with a good signal-to-noise ratio. The weighting detectors, including CISPR-average (average detector with meter time constant) and RMS-average, meet the requirements of the CISPR 16-1-1 standard, as do the EMI resolution bandwidths (200 Hz, 9 kHz, 120 kHz as 6 dB bandwidths, 1 MHz as impulse bandwidth). 6 dB resolution bandwidths in decade steps from 10 Hz to 1 MHz are optionally available to enable measurements in line with MIL-STD-461, DO-160 or ICNIRP.

Standard-compliant EMI measurements in spectrum analyzer mode

With preselection activated, the R&S®ESR can perform standard-compliant EMI measurements in addition to EMI analysis during development. Up to 16 configurable markers can be placed on the frequencies of EMI signals to carry out targeted analysis. Markers can be coupled with a CISPR weighting detector to enable direct comparison with limit values. The spectrum can also be displayed on a logarithmic frequency axis, which simplifies result analysis across a wide frequency range and displays limit lines in compliance with relevant standards. Critical frequencies are presented in a peak list and are used for fast standard-compliant comparisons of EMI signals with limit lines.

R&S®ESR models



FFT BASED TIME DOMAIN SCAN (OPTION)

Fast measurements due to hardware based FFT calculation

The R&S®ESR-B50 and R&S®ESR-K53 options enhance the R&S®ESR by adding an FFT based time domain scan. This scan mode delivers measurement speeds up to 6000 times higher than the conventional stepped frequency scan mode.

The R&S®ESR performs frequency scans in the CISPR bands in just a few milliseconds and measures conducted disturbances in real time. Spectral signal components with a bandwidth of up to 30 MHz are covered without any time gaps. With a virtual step size of ¼ of the resolution bandwidth and FFT windows overlapping by > 90 %, the test receiver achieves level measurement accuracy in line with CISPR 16-1-1.

Speed is a crucial factor when testing devices that can only be operated or measured for a short period of time – either because they change their behavior (fluctuating and drifting disturbances), because extended operation might be destructive or because they require high speed operating cycles, such as electric window regulators in motor vehicles. The extremely fast time domain scan delivers results very quickly, making it easy to handle such scenarios.

Users can also increase the measurement time to reliably detect intermittent narrowband interferers and isolated pulses. The R&S®ESR allows seamless measurement of a disturbance signal for a period of up to 100 s for each frequency segment.

Measurement of CISPR band A and B (conducted testing) in a single shot with enabled CISPR detectors

The time domain scan function is particularly useful when carrying out weighted measurements of conducted disturbances, for example when measuring disturbance voltage in the frequency range from 150 kHz to 30 MHz in line with CISPR product emission standards. The R&S®ESR measures this range in real time and immediately performs the required quasi-peak and average weighting. No preview scan is required.

The R&S®ESR performs disturbance voltage measurements up to 30 MHz with quasi-peak and average weighting in a single shot.

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REAL-TIME SPECTRUM ANALYSIS FOR DETAILED INVESTIGATION OF DISTURBANCES (OPTION)

Real-time measurement mode

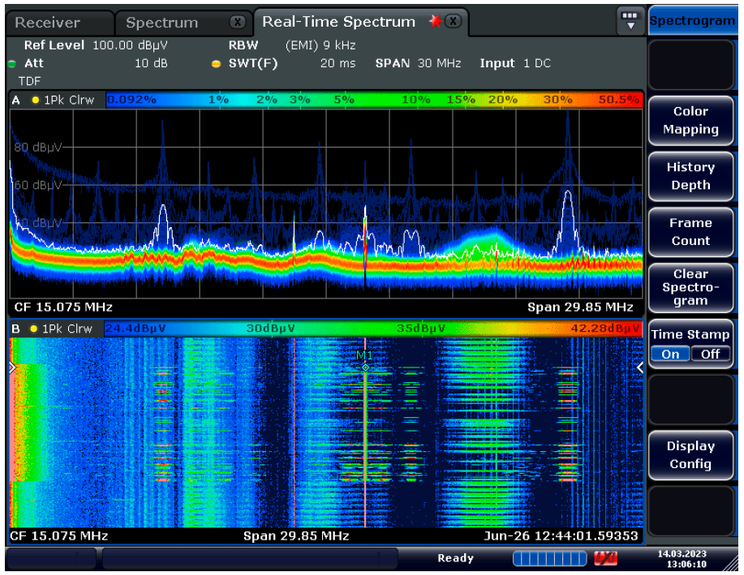
In real-time measurement mode, receiver measurements are performed consecutively within the real-time bandwidth and with no time gaps between measurements. This enables the measurement of sporadic or rapidly changing disturbances for detailed analysis. The standard receiver scan captures all signals within the given measurement period before moving to the next frequency segment. By contrast, the real-time mode remains at a fixed frequency segment to capture all signals for a practically infinite amount of time and without any time gaps. The R&S®ESR enables such real-time measurements by simultaneously capturing and processing signals with 40 MHz of bandwidth.

Spectrogram for seamless spectrum display in the time domain

The R&S®ESR offers a spectrogram function that allows users to analyze the behavior of disturbance signals in the time domain. Each spectrum is presented as a horizontal line with different levels assigned different colors, and the individual spectral lines are joined continuously.

Recording is seamless at a rate of up to 10 000 lines per second, which corresponds to a time resolution of 100 µs. For an even more detailed representation, the R&S®ESR reprocesses the recorded data to achieve resolutions of up to 60 ns.

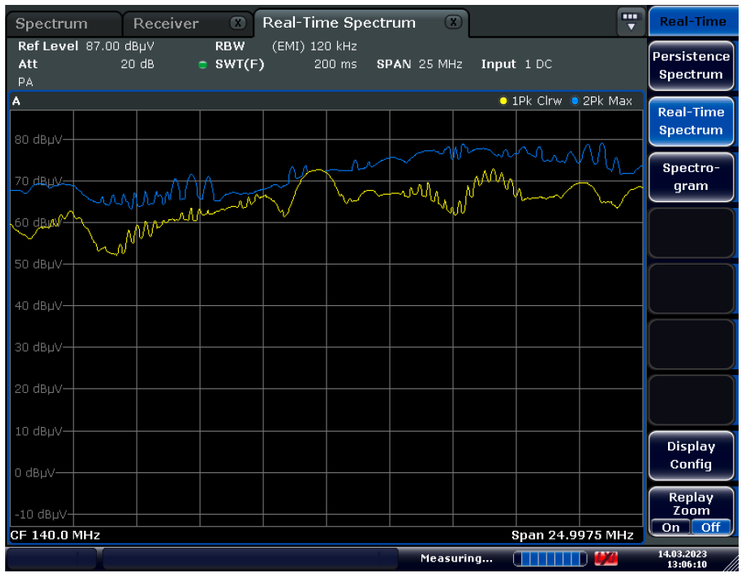
Frequently occurring signals are in red and sporadic signals in blue. If signals no longer occur at a specific frequency with a specific amplitude, the pixels will disappear after a user-defined persistence period. The different pulsed disturbances can also easily be distinguished from one another.



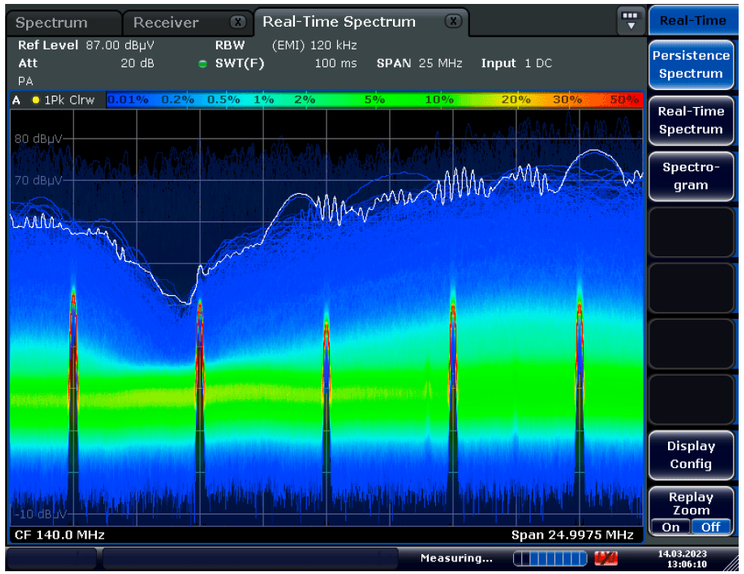
Simultaneous display of disturbance spectrum in persistence mode (top) and as a spectrogram (bottom). The spectrogram provides seamless information about the behavior over time of disturbances emitted by a DUT. In persistence mode, users can clearly distinguish between narrowband and broadband disturbances. The position in time of an individual user-selected spectrum (shown as a white trace in persistence mode) is indicated in the spectrogram by the marker M1, which can be positioned as required.

Frequency mask trigger for detection of sporadic spectral events

Sporadic events are often difficult to detect and measure. The frequency mask trigger, which operates in the frequency domain, provides a solution to this problem. The R&S®ESR measures every single spectrum – up to 250 000 per second – and compares them with a frequency-dependent mask. If a spectrum violates the mask, the R&S®ESR activates a trigger and either displays that spectrum and then freezes the display or, in continuous mode, updates the display whenever a spectrum violates the mask.



Display of a broadband disturbance in conventional analyzer mode – in this example caused by an electric motor with poor EMI suppression. The yellow trace represents the current spectrum, the blue trace Max Hold.



Disturbance spectrum for the same motor in persistence mode, where a second pulsed disturbance is clearly visible. It cannot be identified in the conventional analyzer mode (upper diagram) since it is hidden by the broadband disturbance.

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POWERFUL MEASUREMENT AND ANALYSIS FUNCTIONS IN THE FREQUENCY AND TIME DOMAIN

Automatic test sequences with preview measurement, data reduction and final measurement

The standard approach when performing disturbance measurements is a fast preview measurement with peak and average weighting combined with a final measurement on the critical frequencies with the required CISPR weighting. The R&S®ESR supports this approach, offering a choice of common limit lines defined in commercial product emission standards. The results of the preview measurement are compared with the limit lines. Next, the test receiver identifies critical frequencies in line with user-defined criteria and presents them in a table (peak list). This table can be manually edited prior to the final measurement with standard-compliant measurement time and CISPR detector(s). Users can add or delete frequencies interactively. The results of the final measurement can be exported as an ASCII file for further processing.

The R&S®ESR can remotely control Rohde&Schwarz line impedance stabilization networks (LISN) via its AUX port. The instrument's test automation performs reliable disturbance voltage measurements on power lines fully automatically on all phases.

IF analysis function for displaying the spectrum around disturbance signals (option)

The optional IF analysis function of the R&S®ESR provides a spectral display of the RF input signal in a selectable range around the EMI receive frequency. The IF spectrum display can be coupled to the bargraph display for the current receive frequency. Alternatively, the IF spectrum can be displayed together with the stored results of the preview measurement. The marker in the preview diagram can be used to control the center frequency of the IF spectrum (marker track function).

The center frequency of the IF spectrum always corresponds to the current receive frequency. The IF spectrum provides a detailed overview of the spectrum occupancy around the measurement channel and information about the spectral distribution of a modulated signal. Any signals received can be quickly classified as disturbance signals or wanted signals. Parallel AM and FM audio demodulation enable detected signals to be easily identified.

Time domain display (zero span)

The time domain display function of the R&S®ESR allows users to assess the behavior over time of a disturbance signal at a fixed frequency. The receiver measures the level over time at the set receive frequency for an interval of 50 µs to 100 s, for example to determine the pulse repetition frequency (PRF) of a broadband disturbance. To reliably measure a pulsed disturbance, the observation time per frequency must be as long as the signal's pulse interval. The user can also determine whether and to what extent a narrowband disturbance is fluctuating, and whether it is amplitude-modulated or pulsed.

Simultaneous display of up to six traces and four bargraphs

The R&S®ESR has a 21 cm (8.4") touchscreen with 800 × 600 pixel resolution. It displays up to six traces (including limit lines) simultaneously in a single diagram.

- Time-saving operation through simultaneous measurements of different weighting detectors.
- With up to four million values per trace, the R&S®ESR can perform seamless frequency scans with narrow IF bandwidths even across very wide frequency ranges. The R&S®ESR provides high frequency resolution and accuracy. This is a major advantage over spectrum analyzers and test receivers that use a lower number of test points.
- The displayed frequency range can be traced back to real measured values even when zooming in closely.

The R&S®ESR provides a combined numeric and analog bargraph display of results for up to four detectors, including the Max Hold function. This allows users to rapidly recognize the effect of changes made to the device under test.

Antenna factors (transducers) and user-created transducer sets

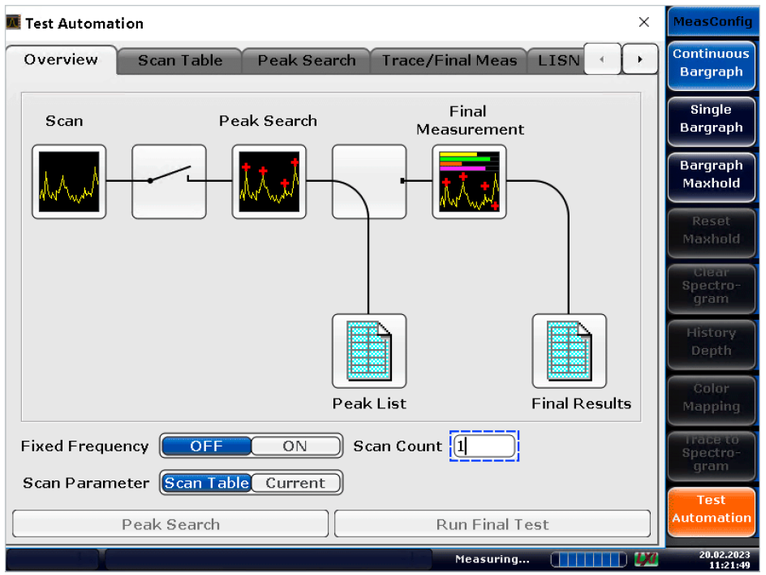
The R&S®ESR comes with a set of typical transducers for test antennas employed in radiated disturbance measurements. Users can also create and save their own correction tables for antennas, cables, LISNs, external preamplifiers, etc. Multiple correction factors can be combined in transducer sets. The R&S®ESR automatically takes into account activated transducers and correction factors and displays them in the correct measurement unit.

EMI limit line library for commercial standards, with convenient editor

The R&S®ESR also includes a selection of important limit lines in accordance with commercial product emission standards. Users can edit, add and save limit lines in the table editor.

Tracking generator for scalar network analysis (option)

The optional internal R&S®FSV-B9 tracking generator enhances the R&S®ESR to operate as a scalar network analyzer in the frequency range from 9 kHz to 7 GHz. With this option, users can quickly and easily determine the frequency-dependent insertion loss of test cables or filters, for example, and store the results as correction tables (transducers) in the R&S®ESR.



The R&S®ESR allows users to quickly and easily configure automatic test sequences (preview measurement, data reduction, final measurement) and execute them at the press of a button. The final measurement can also be carried out interactively.

Upper part of screen: continuous spectral display of RF input signal around the current EMI receive frequency using the IF analysis function.
Lower part of screen: display of saved preview measurement. The center frequency in the upper diagram is controlled by the marker position in the lower diagram (marker track function).
Alternatively, the IF spectrum display can be coupled to the combined numeric and bargraph display.

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FOUR-CHANNEL CLICK RATE MEASUREMENT

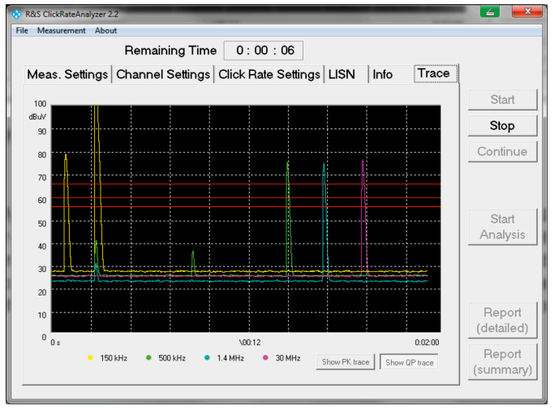
Click rate analysis in line with CISPR 14-1

The R&S®ESR supports measurements in line with CISPR 14-1 and EN 55014-1. Thermostatic or program-controlled electrical appliances such as washing machines and air conditioners generate discontinuous disturbances. Due to the aperiodic nature of click disturbances, the limit values they need to comply with are not as low as those for continuous disturbances. To apply these less stringent limit values, users need to measure the duration, repetition rate (click rate) and amplitudes of clicks.

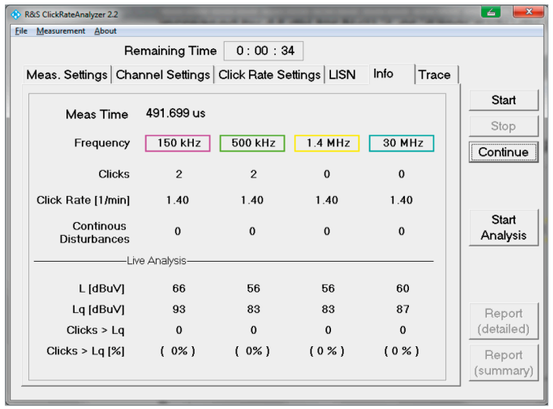
The R&S®ESR measures the pulse amplitude and duration automatically and in parallel on the frequencies specified by the CISPR/EN standard (150 kHz, 500 kHz, 1.4 MHz, 30 MHz), effectively providing the functionality of a click rate analyzer.

To carry out standard-compliant analysis, sufficient memory space must be available to seamlessly record peak values and quasi-peak values for a period of at least two hours. With a memory depth of up to four million values per trace, the R&S®ESR is ideal for this task. Its click rate analysis application documents results in a detailed report, providing statistics and documenting any clicks that do not conform to the standard (exceptions). Finally, the R&S®ESR click rate analyzer outputs a pass/fail statement to indicate whether the DUT meets the requirements of the standard.

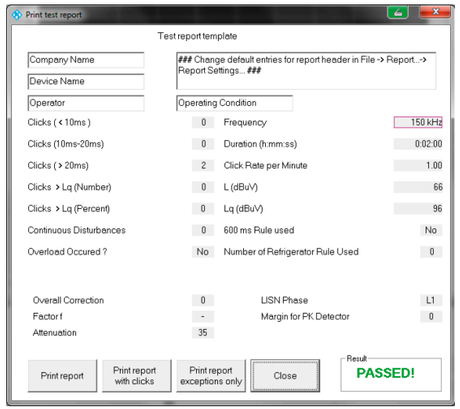
Click rate analysis – graphical display.



Click rate analysis – numerical results.



Click rate analysis – report.



FAST AND RELIABLE R&S®ELEKTRA EMC TEST SOFTWARE

For remote control and automation

The R&S®ELEKTRA EMC measurement software ideally supplements the Rohde&Schwarz EMI test receivers. The software enables remote control of manual measurements and also performs fully automated tests, including control of accessories. The future-ready, revolutionary user interface is intuitive for new and existing users of EMC test software.

Manual, partially and fully automated measurements

The modular test software package supports manual, partially and fully automated interference (EMI) and immunity (EMS) measurements in line with commercial and military standards. R&S®ELEKTRA provides reliable acquisition, analysis and documentation of measurement results and offers remote control of all EMC system components such as mast and turntable systems.

R&S®ELEKTRA remote control and automation software.

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CONVENIENT OPERATION, STRAIGHTFORWARD DISPLAY

Touchscreen user interface with undo/redo functions

The R&S®ESR features a touchscreen GUI for convenient, intuitive operation. The straightforward, menu-driven design makes it easy to learn how to use the test receiver. All functions and measurement parameters can be configured using the instrument's keys and rotary knob, or a mouse and keyboard. The large high-resolution display (800 × 600 pixel) provides good readability.

Up to six prior operating steps can be canceled and restored using the undo/redo softkeys. This enables users to quickly toggle between two different states or to correct erroneous entries.

Scan table

In receiver mode, disturbance measurements in the frequency domain are controlled by the settings in the scan table. The scan parameters are presented in a clear manner and can be configured as required for a given task or device under test.

Integrated context-sensitive help

Context-sensitive help provides detailed information about the current function and lists the associated remote control commands. The R&S®ESR is easy to operate even for less experienced users, which simplifies programming.

Storage of results and instrument settings on internal and external media

Measurement data and instrument setups can be saved to, and recalled from, the instrument's internal hard disk drive (HDD) and external storage media. The R&S®ESR accesses external media via USB or LAN.

Removable hard disk drive to keep test data confidential

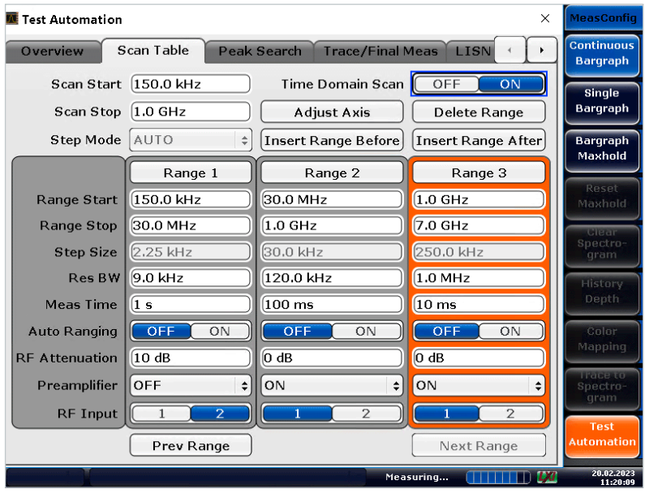
To keep their test data confidential, users can exchange the R&S®ESR standard hard disk drive for another, neutral hard disk drive (R&S®ESR-B19 option). The test receiver can then be sent in for calibration, repair or any other purpose without any confidential test data leaving the lab. Device-specific alignment data remains in the test receiver, where it is stored independently of user data.

Remote control via GPIB or LAN

The R&S®ESR can be remotely controlled via its standard IEC 625-2 (IEEE 488.2) interface or a LAN interface (10/100/1000BASE-T).

Drivers for LabView, LabWindows/CVI, VXIplug&play

For software integration, drivers for LabView, LabWindows/CVI and VXIplug&play are available free of charge at www.rohde-schwarz.com.



In receiver mode, the R&S®ESR tunes across the frequency range defined in the scan table. Users can choose up to ten frequency subranges and configure the parameters independently for each subrange, e.g. range start/stop, step size, measurement time, resolution bandwidth, input attenuation.

ROBUST AND COMPACT – IDEAL ALSO FOR MOBILE USE

DC power supply for field use, optionally with external battery pack and ruggedized housing

The optional R&S®FSV-B30 DC power supply allows the R&S®ESR to be operated from 12 V to 24 V DC sources. Using the optional rechargeable R&S®FSV-B32 battery pack, the R&S®ESR records measurements for up to two hours on a single charge. For mobile applications, ruggedized housing (R&S®ESR-B1 option) is available.

Solid-state drive (SSD) for vibration and shock resistance

The R&S®ESR comes with a removable hard disk drive. It can be replaced with a solid-state drive (R&S®ESR-B18 option) to handle operating temperature fluctuations (+5 °C to +40 °C) or if the instrument is exposed to strong shocks and vibration, for example in vehicles.

Compact design

With its compact, rugged and lightweight design (the R&S®ESR7 without hardware options weighs 12.8 kg), the R&S®ESR is an ideal choice for mobile applications, too.

R&S®ESR rear view.

Battery-operated in-situ measurements with the R&S®ESR.

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SPECIFICATIONS IN BRIEF

Base unit		
Frequency		
Frequency range	R&S®ESR3	9 kHz to 3.6 GHz
	with R&S®ESR-B29 option	10 Hz to 3.6 GHz
	R&S®ESR7	9 kHz to 7 GHz
	with R&S®ESR-B29 option	10 Hz to 7 GHz
	R&S®ESR26	9 kHz to 26.5 GHz
	with R&S®ESR-B29 option	10 Hz to 26.5 GHz
Level		
Max. RF level (CW)	RF attenuation ≥ 10 dB; RF preamplifier off	30 dBm (= 1 W)
	RF attenuation ≥ 10 dB; RF preamplifier on	23 dBm (= 0.2 W)
Maximum pulse voltage	RF attenuation ≥ 10 dB	
	input 1	150 V
	input 2	450 V
Maximum pulse energy	RF attenuation ≥ 10 dB; 10 µs	
	input 1	1 mWs
	input 2	20 mWs
1 dB compression	RF attenuation 0 dB; RF preamplifier and preselection off	+5 dBm, nominal
IF and resolution bandwidths		
	analyzer mode (span ≥ 10 Hz) and receiver mode	10 Hz to 10 MHz (–3 dB) in 1/2/3/5/10 steps
	analyzer and receiver mode	200 Hz, 9 kHz, 120 kHz (–6 dB), 1 MHz (impulse bandwidth)
	with R&S®ESR-B29 option in analyzer and receiver mode	additionally 10 Hz to 100 kHz (–6 dB) in decade steps
Preselection	can be switched off in analyzer mode	16 fixed filters
Preamplifier	can be switched on/off	1 kHz to 7 GHz, 20 dB gain, nominal
Measurement time	analyzer mode (sweep time)	
	span = 0 Hz	1 µs to 16000 s
	span ≥ 10 Hz (swept)	1 ms to 16000 s
	span ≥ 10 Hz (FFT)	7 µs to 16000 s
	receiver mode (stepped frequency scan)	50 µs to 100 s (per frequency)
	receiver mode (time domain scan)	50 µs to 100 s (per frequency subrange)
Frequency step size	receiver mode (stepped frequency scan)	min. 1 Hz
	receiver mode (time domain scan)	0.25 × resolution bandwidth
Detectors	receiver mode	max. peak, min. peak, quasi-peak, RMS, average, average with meter time constant (CISPR-average), RMS-average (CISPR-RMS)
Noise indication	receiver mode, nominal, average detector (AV), RF attenuation 0 dB, termination 50 Ω	
	preamplifier off	
	30 MHz ≤ f < 1 GHz, bandwidth 120 kHz	< 8 dBµV
	1 GHz ≤ f < 3.6 GHz, bandwidth 1 MHz	< 20 dBµV
	3.6 GHz ≤ f ≤ 26.5 GHz, bandwidth 1 MHz	< 26 dBµV
	preamplifier on	
	30 MHz ≤ f < 1 GHz, bandwidth 120 kHz	< –3 dBµV
	1 GHz ≤ f < 3.6 GHz, bandwidth 1 MHz	< 9 dBµV
	3.6 GHz ≤ f ≤ 26.5 GHz, bandwidth 1 MHz	< 13 dBµV
Number of sweep (trace) points		
	analyzer mode (standard)	101 to 32001
	analyzer mode (EMI)	101 to 200001
	receiver mode	max. 4000000
	real-time analysis (option)	801

Base unit		
Total measurement uncertainty	CW signal, level 0 dB to –70 dB below reference level, S/N > 20 dB, auto sweep time, RF attenuation 10 dB, 20 dB, 30 dB, 40 dB, preselection on, span/RBW < 100, 95% confidence level, +20°C to +30°C	
	9 kHz ≤ f < 3.6 GHz	0.47 dB
	3.6 GHz ≤ f < 7 GHz	0.59 dB
	7 GHz ≤ f < 13.6 GHz	1.01 dB
	13.6 GHz ≤ f ≤ 26.5 GHz	1.34 dB

ORDERING INFORMATION

Designation	Type	Order number
EMI test receiver, 9 kHz to 3.6 GHz	R&S®ESR3	1316.3003.03
EMI test receiver, 9 kHz to 7 GHz	R&S®ESR7	1316.3003.07
EMI test receiver, 9 kHz to 26.5 GHz	R&S®ESR26	1316.3003.26
Accessories supplied Power cable, probe power cable and quick start guide; for R&S®ESR26 additionally: test port adapter with 3.5 mm female (1021.0512.00) and N female (1021.0535.00) connectors		
Software options		
Time domain scan (requires R&S®ESR-B50)	R&S®ESR-K53	1316.3590.02
Real-time analysis (requires R&S®ESR-B50)	R&S®ESR-K55	1316.3603.02
IF analysis	R&S®ESR-K56	1316.3610.02
Hardware options		
Impact protection (plastic corners and front panel cover)	R&S®ESR-B1	1316.4100.02
OCXO frequency reference, temperature drift: 0.1 ppm (+5°C to +40°C)	R&S®FSV-B4	1310.9522.02
OCXO extended frequency reference, improved temperature drift: 0.01 ppm (+5°C to +40°C)	R&S®FSV-B4	1310.9522.03
Tracking generator, 9 kHz to 3.6/7 GHz	R&S®FSV-B9	1310.9545.02
External generator control	R&S®ESR-B10	1310.9551.03
Replacement SSD for R&S®ESR with FMR11 and Windows 10 [1]	R&S®ESR-B18	1316.3555.18
Second HDD for R&S®ESR with FMR11 and Windows 10 [1]	R&S®ESR-B19	1316.3561.18
RF preamplifier, 20 dB, 9 kHz to 7 GHz	R&S®FSV-B22	1310.9600.02
10 Hz frequency extension and military bandwidths	R&S®ESR-B29	1316.3578.02
DC power supply for 12 V/24 V supply voltage	R&S®FSV-B30	1329.0243.02
Lithium-ion battery pack	R&S®FSV-B32	1321.3750.03
Lithium-ion battery charger	R&S®FSV-B34	1321.3950.02
Hardware for time domain scan and real-time analysis	R&S®ESR-B50	1316.3584.02
Upgrade kits		
Windows 10 upgrade for R&S®ESR with FMR11 CPU board, with hard drive [2]	R&S®ESR-U2	1338.2300.10
Windows 10 upgrade for R&S®ESR with FMR11 CPU board, with solid-state drive [2]	R&S®ESR-U2	1338.2300.11

Service options		
Extended warranty, one/two year(s)	R&S®WE1/WE2	Contact your local Rohde&Schwarz sales office.
Extended warranty with calibration coverage, one/two year(s)	R&S®CW1/CW2	
Extended warranty with accredited calibration coverage, one/two year(s)	R&S®AW1/AW2	

[1] Only for instruments delivered with Windows 10 ex factory or instruments with the R&S®ESR-U2 upgrade. For other models and spare parts, contact your local Rohde&Schwarz service center.

[2] For R&S®ESR with the following serial numbers: R&S®ESR3: > 101830, R&S®ESR7: > 101393, R&S®ESR26: > 101295. For instruments with lower serial numbers, contact your local Rohde&Schwarz service center.

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