R&S®ESW
EMI TEST RECEIVER

Excellent RF characteristics and high measurement speed

Product Brochure
Version 10.00

ROHDE&SCHWARZ
Make ideas real

AT A GLANCE

The R&S®ESW is a high-performance EMI test receiver for compliance testing. With its outstanding RF characteristics, high dynamic range and measurement accuracy, the R&S®ESW is ideal for fast and reliable certification measurements. It meets the most stringent requirements in line with CISPR, EN, MIL-STD-461, DO-160 and FCC. The FFT based time domain scan in the R&S®ESW captures and weights disturbance spectra with the shortest testing times and maximum insight. Real-time spectrum analysis enables detailed investigations of even the shortest disturbance signals.

The R&S®ESW EMI test receiver meets the highest EMI compliance testing requirements with its wide dynamic range and high sensitivity resulting from its low noise and built-in preselection with 21 filters.

The R&S®ESW also features highpass filters at 2 MHz and 8 MHz for better conducted sensitivity in power electronic testing. Notch filters for the 2.4 GHz and 5.8 GHz ISM bands round out the input filter design. The notch filters prevent high carrier signals in the ISM bands, such as Bluetooth® or WLAN, from affecting the dynamic range of the R&S®ESW.

Every R&S®ESW comes with an FFT based time domain scan for fast measurements. When equipped with the wideband extension option with an FFT bandwidth of up to 970 MHz, it can measure the CISPR band C and D all at once. The high bandwidth is captured in real-time even with CISPR detectors enabled.

The wideband extension creates faster and more reliable measurements. Tests to military standards have shorter test times and a higher probability of intercept.

KEY FACTS

- Frequency ranges from 1 Hz to 8 GHz, 26.5 GHz or 44 GHz
- In line with all relevant standards: CISPR 16-1-1, ANSI C63.2, MIL-STD-461 and FCC
- High dynamic range and high accuracy for demanding certification measurements
- Measurements with FFT based time domain scan (TDS)
- Preselection with selectable highpass filters and notch filters for the ISM bands
- EMI test receiver and spectrum analyzer in a single instrument
- Optional real-time spectrum analysis with up to 970 MHz bandwidth
- MultiView function for multiple operating modes on a single screen

BENEFITS

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STANDARD-COMPLIANT EMI MEASUREMENTS

Certification measurements

The R&S®ESW is primarily intended for certification measurements in line with EMC standards. These place the highest demands on test equipment since it must correctly detect, measure and weight all disturbance signals, including pulsed, sinusoidal, modulated and intermittent signals.

With its integrated preselection, 20 dB preamplifier and highly linear frontend, the R&S®ESW meets the requirements of commercial and military standards, including CISPR, EN, ETS, ANSI, FCC, VCCI, MIL-STD-461 and DO-160.

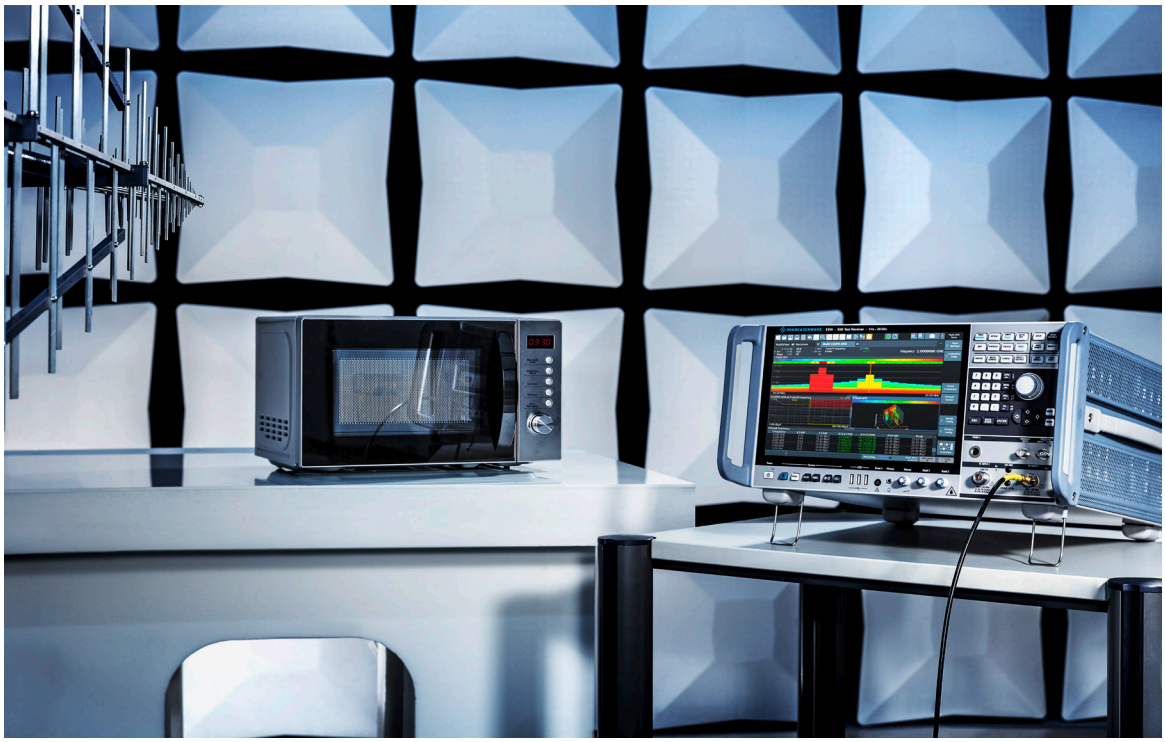
Weighting detectors, such as quasi-peak, CISPR-average and RMS-average, and the amplitude probability distribution (APD) measurement function comply with the CISPR 16-1-1 basic standard, including edition 5. The same holds for the required 6 dB resolution bandwidths of 20 Hz, 9 kHz, 120 kHz and the 1 MHz pulse bandwidth. For MIL-STD-461, DO-160 and ICNIRP standards, the R&S®ESW comes with resolution bandwidths in decade steps from 1 Hz to 10 MHz.

Standard-compliant EMI measurements in spectrum analyzer mode

The R&S®ESW is not just an EMI test receiver. It is also a full-featured spectrum analyzer. When preselection is activated, the R&S®ESW can perform standard-compliant EMI measurements in spectrum analyzer mode – in addition to EMI analysis during development.

Configurable markers can be placed on the frequencies of EMI signals to carry out targeted analysis. Markers can be coupled with CISPR weighting detectors to enable direct comparison with limit lines. The spectrum can also be displayed along 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 comparison of EMI signals with limits.

EMI testing of a microwave oven in an anechoic chamber in line with CISPR 11.



FFT BASED TIME DOMAIN SCAN

The R&S®ESW offers an FFT based time domain scan (TDS) along with a conventional stepped scan mode. The receiver time domain scan measures large frequency segments at once rather than the individual resolution bandwidths for each observation period in conventional stepped scan mode, significantly reducing testing times. The R&S®ESW performs gap-free measurements of conducted disturbances of up to 30 MHz in one segment. Speed is crucial, especially when testing devices with a short operating time. A virtual step size of a quarter of the resolution bandwidth and FFT windows overlapping by > 90 % give the R&S®ESW significantly better frequency resolution and level measurement accuracy than required by CISPR 16-1-1.

The R&S®ESW allows seamless measurements for a period of up to 100 s for each frequency segment. This ensures the reliable detection of narrowband, intermittent disturbance signals and isolated pulses. Pulsed signals play a key role in EMI testing with their extensive dynamic range requirements.

Gap-free conducted disturbance measurements with CISPR detectors

The R&S®ESW captures the entire band for conducted disturbance measurements from 150 kHz to 30 MHz in one segment. The instrument performs the required quasi-peak (QP) and CISPR-average (CAV) weighting in parallel. This eliminates the need for a preview scan (with subsequent data reduction) and cuts measurement time in half.

The right strategy for all EMI testing needs

The three R&S®ESW time domain scan optimization modes – dynamic, speed and automatic – offer the right choice for every EMI testing requirement. The dynamic mode has the highest dynamic range for pulses. Speed mode maximizes speed while remaining fully compliant with CISPR 16-1-1 for frequencies above 300 MHz. Even in the most demanding frequency range from 30 MHz to 300 MHz, it will display the correct quasi-peak value down to a pulse repetition frequency (PRF) of 10 Hz or 5 Hz when equipped with the wideband extension option (see page 6). Automatic mode offers the best of both worlds by maintaining full compliance at highest possible measurement speed.

Wideband measurements with up to 970 MHz bandwidth

The R&S®ESW with installed wideband option (see next page) extends the FFT bandwidth to 970 MHz and can perform spectrogram measurements in real-time without any gaps between consecutive measurements. The R&S®ESW can make measurements of CISPR bands C and D all at once or measurements of up to 450 MHz in real time for the frequency range above 1 GHz for unprecedented testing speeds.

Total measurement times for various standards

Standard	Frequency range	Resolution bandwidth	Measurement time	Detector(s)	Automatic TDS (base unit)	Speed TDS (base unit)	Speed TDS (with R&S®ESW-B1000 wideband option) [1]
CISPR band B	150 kHz to 30 MHz	9 kHz	100 ms	peak	110 ms	110 ms	110 ms
CISPR band B	150 kHz to 30 MHz	9 kHz	1 s	quasi-peak and CAV	2 s	2 s	2 s
CISPR band C/D	30 MHz to 1 GHz	120 kHz	10 ms	peak	380 ms	380 ms	18 ms
CISPR band C/D	30 MHz to 1 GHz	120 kHz	1 s	quasi-peak and CAV	50 s	40 s	1.8 s
CISPR band C/D (automotive)	30 MHz to 1 GHz	9 kHz	1 s	quasi-peak and CAV	64 s	40 s	22.5 s
MIL-STD	1 GHz to 18 GHz	1 MHz	15 ms	peak	13.1 s	13.1 s	11 s
MIL-STD	18 GHz to 40 GHz	1 MHz	15 ms	peak	18 s	18 s	18 s

[1] See page 6 for more details on wideband extension.

WIDEBAND EXTENSION FOR HIGH TESTING SPEEDS AND MORE INSIGHT

Up to 970 MHz FFT bandwidth

The bandwidth extension option reduces overall testing time by speeding up measurements over CISPR bands C and D as one single frequency segment with 970 MHz of bandwidth, for greater insight and more detailed interference analysis of sporadic interference.

Real-time measurements with CISPR detectors in receiver mode

The quasi-peak detector with long time constants and the high dynamic range requirements in the frequency range up to 1 GHz form a bottleneck that limits overall speed for commercial testing. The wideband extension reduces testing times to the technical minimum by capturing the full quasi-peak range between 30 MHz and 1 GHz in one segment. MIL-STD testing with peak detector benefits from extended measurement times that increase the probability of intercept for sporadic interference while still enabling higher testing speeds. Highly complex devices under test are easier to debug and analyze with the real-time spectrogram in the full CISPR bands C and D range.

High dynamic range wideband testing

The wideband extension adds eight parallel paths to the input stage. Each path covers one frequency segment and with all combined, the FFT bandwidth is extended to up to 970 MHz. Each path has its own preselection filter to ensure frequency selectivity and the parallel concept of the R&S®ESW wideband extension ensures a high dynamic range. An FPGA with high computing power combines the data streams from the eight analog-to-digital converters and calculates the spectral components, while delivering traces to the instrument at an unprecedented bandwidth in real-time with no time gaps between consecutive measurements. Parallel CISPR detectors reduce the need for pretesting. Pulse resolution with a repetition rate of < 5 Hz makes the wideband extensions fully CISPR 16-1-1 compliant in the 300 MHz to 1 GHz frequency range (see detailed description of time domain scan modes on previous page).

Improvements in testing time with wideband extensions

Standard	Frequency range	Resolution bandwidth	Measurement time
CISPR band C/D	30 MHz to 1 GHz	120 kHz	10 ms
CISPR band C/D	30 MHz to 1 GHz	120 kHz	1 s
CISPR band C/D (automotive)	30 MHz to 1 GHz	9 kHz	1 s
CISPR band E	1 GHz to 6 GHz	1 MHz	1 s
MIL-STD	30 MHz to 1 GHz	100 kHz	150 ms
MIL-STD	1 GHz to 18 GHz	1 MHz	15 ms

[1] Automatic TDS mode ensures full compliance to CISPR 16-1-1 in all frequency ranges.
[2] Speed TDS mode maximizes testing speed while resolving pulses with repetition frequency < 5 Hz (10 Hz with base unit).

Wideband extension option

The wideband extension option is available for the full FFT bandwidth of up to 970 MHz (R&S®ESW-B1000) and 350 MHz (R&S®ESW-B350). R&S®ESW-B350 can be upgraded to R&S®ESW-B1000 with a software license. Two versions are available for either option, R&S®ESW-B350 and R&S®ESW-B350R or R&S®ESW-B1000 and R&S®ESW-B1000R.

The "non-R" versions are export license free, but restricted to a real-time bandwidth of 170 MHz. The "R" version is export restricted and allows real-time processing for the full available bandwidth.

Receiver measurement with CISPR detectors from 30 MHz to 1 GHz in one single segment with R&S®ESW-B1000 bandwidth extension option with real-time spectrogram.

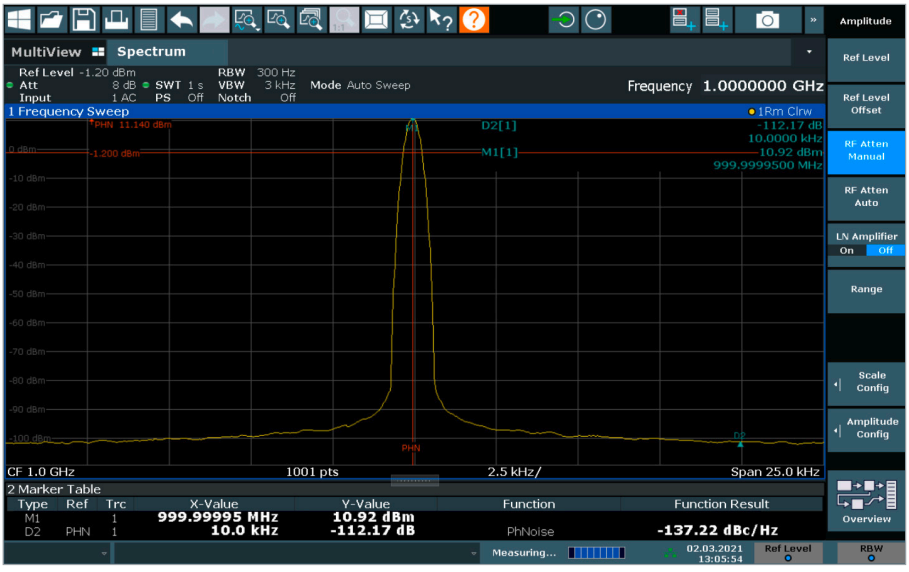
Detector(s)	Automatic TDS [1] (base unit)	Automatic TDS [1] (with R&S®ESW-B1000 or R&S®ESW-B1000R option)	Speed TDS [2] (with R&S®ESW-B1000 or R&S®ESW-B1000R option)
peak	380 ms	18 ms	18 ms
quasi-peak and CAV	50 s	18.5 s	1.8 s
quasi-peak and CAV	64 s	22.5 s	22.5 s
peak and CAV	293 s	26 s	26 s
peak	4.1 s	155 ms	155 ms
peak	13.1 s	11 s	11 s

RF PERFORMANCE THAT MEETS EXACTING DEMANDS

With a displayed average noise level (DANL) of –168 dBm (1 Hz) and a 1 dB compression point of +15 dBm, the R&S®ESW features an exceptionally wide dynamic range that can handle even the most challenging tasks. The R&S®ESW delivers reproducible and reliable results with a measurement uncertainty of ±0.37 dB (for f ≤ 8 GHz).

The instrument's wide dynamic range and very low phase noise make it possible to detect small signals in the vicinity of large carrier signals. The R&S®ESW phase noise is –137 dBc (1 Hz) at 10 kHz offset from a 1 GHz carrier signal, and –128 dBc (1 Hz) at 10 kHz offset from a 10 GHz carrier signal. Close to the carrier, at 10 Hz offset, the phase noise is –110 dBc (1 Hz).

Displayed average noise level (DANL) up to 1 GHz. The noise figure with the preamplifier switched on is approx. 8.5 dB.

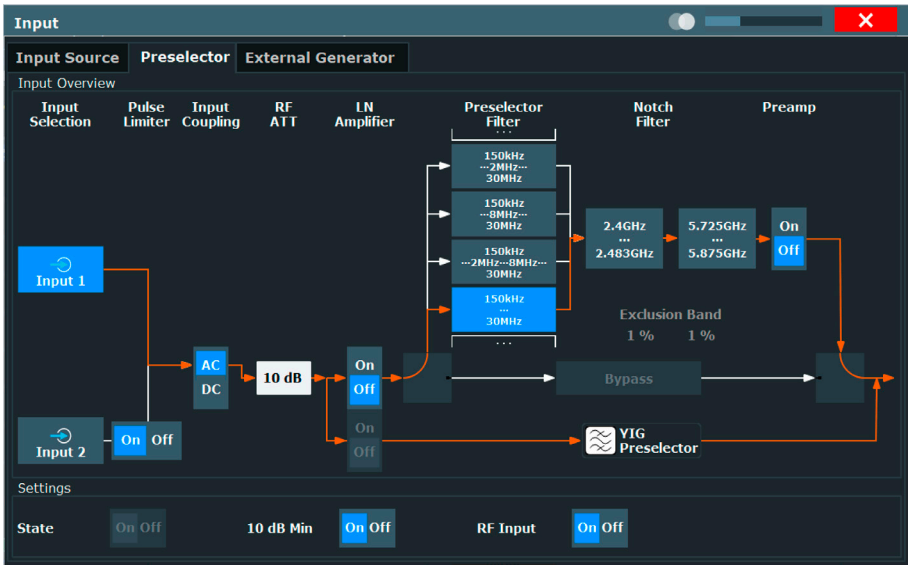


Phase noise at 10 kHz from the carrier: –137 dBc (1 Hz).

PRESELECTION FILTERS AND PREAMPLIFIER

During EMI measurements, preselection filters are essential for test equipment such as test receivers and spectrum analyzers, since wideband disturbance spectra can overload test equipment frontends. Preselection filters suppress strong out-of-band signals so that high-sensitivity measurements can be performed within the passband. The built-in preamplifier can be activated to further enhance sensitivity.

The R&S®ESW offers 21 preselection filters for the range up to 8 GHz, plus selectable highpass filters for 2 MHz and 8 MHz, to suppress data carriers on AC supply lines in compliance with CISPR 16-1-1. In addition, the R&S®ESW offers notch filters specifically for the license-free ISM bands at 2.4 GHz and 5.8 GHz that are used by wireless transmission technologies such as Bluetooth® and WLAN. A switchable pulse limiter additionally protects the second, pulse-resistant, RF input against high-energy signals.



Configurable preselection filters.

Display of trace and active preselection filter.

MULTICHANNEL APD MEASUREMENTS

Amplitude probability distribution

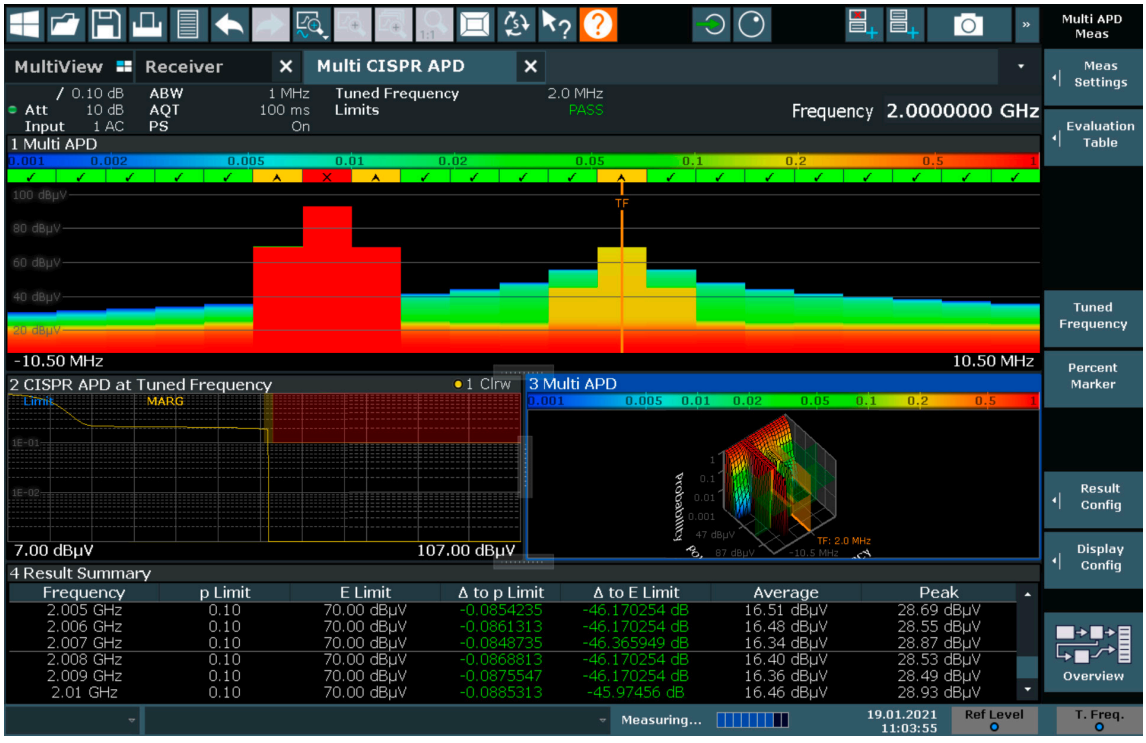
The amplitude probability distribution (APD) provides insight into amplitudes and their probability of occurrence within a defined bandwidth and time window. For each amplitude on the x-axis, the APD shows the probability of smaller or equal amplitudes occurring. The APD is ideal for evaluating the impact of interferers on digital communications systems.

The R&S®ESW-K58 APD multichannel measurement function performs APD measurements on microwave ovens or IT equipment above 1 GHz on multiple channels in parallel. The application fulfills all requirements of CISPR 16-1-1. With parallel measurements, the multi CISPR APD always captures drifting interferers with at least one channel.

The application allows testing of up to 67 channels at 120 kHz analysis bandwidth (ABW) or up to 21 channels at 1 MHz ABW. When equipped with the wideband extension option (see page 6), the application allows up to 255 channels at ≤ 200 kHz ABW or up to 51 channels at 1 MHz ABW. It shows all channels simultaneously with individual limit checking. In the same display, 2D and 3D plots intuitively combine the visualization of disturbances and corresponding limits. In the 3D display, pan functions are available to select analysis regions of interest using touch gestures. The result table presents margins or exceeded limits for every evaluated channel.

Use the single-channel APD display at a variable tuned frequency to investigate an individual channel in detail. Thanks to the APD multichannel measurement function, the R&S®ESW is ready and able to handle upcoming standards.

APD multichannel measurement display.



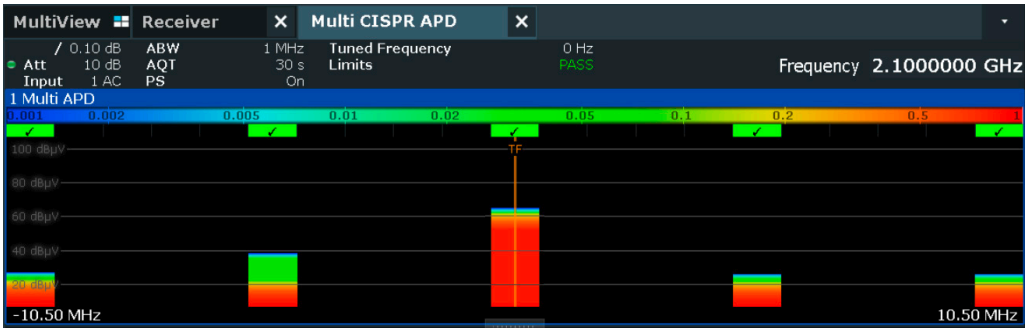
Microwave oven testing in line with CISPR 11

The CISPR 11 product standard defines the procedures and limits for emission testing of microwave ovens. Such products cause fluctuating interference above 1 GHz, which can be captured with peak detection.

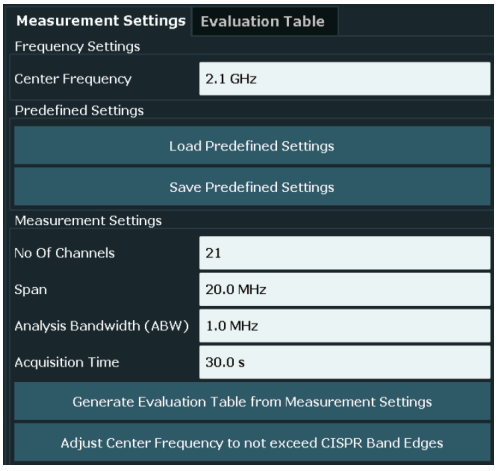
The repeatability of peak measurements on microwave ovens is poor. Moreover, the sheer amplitude of the highest peak emission, without information on its duration and repetition rate, provides very limited information on the real disturbance potential. Therefore, CISPR 11 requires weighted measurements on peaks that exceed the peak limit. The most advanced measurement function for this is APD, which delivers insights into both the duration and level of an interference signal.

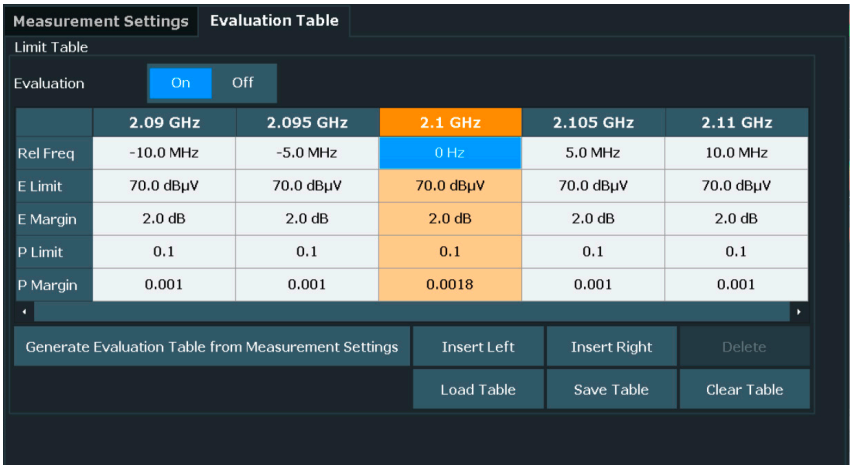
CISPR 11 is the first standard to introduce multichannel APD testing. The 2019 version defines five measurement points, the critical interference frequency itself and ±5 MHz and ±10 MHz offsets. APD measurements are performed in the frequency range from 1 GHz to 18 GHz with an analysis bandwidth of 1 MHz. An amplitude probability limit of 10^{-1} is defined. This means that the amplitude of the interference exceeds the specified field strength level during the defined acquisition time (AQT) of 30 s with a probability of 10 %. If the equipment passes the measurement with the APD weighting function, the final test result is PASS.

2D probability plot for easy PASS/FAIL visualization for all measurement channels.



Measurement and evaluation settings for testing microwave ovens against CISPR 11.





	2.09 GHz	2.095 GHz	2.1 GHz	2.105 GHz	2.11 GHz
Rel Freq	-10.0 MHz	-5.0 MHz	0 Hz	5.0 MHz	10.0 MHz
E Limit	70.0 dBµV	70.0 dBµV	70.0 dBµV	70.0 dBµV	70.0 dBµV
E Margin	2.0 dB	2.0 dB	2.0 dB	2.0 dB	2.0 dB
P Limit	0.1	0.1	0.1	0.1	0.1
P Margin	0.001	0.001	0.0018	0.001	0.001

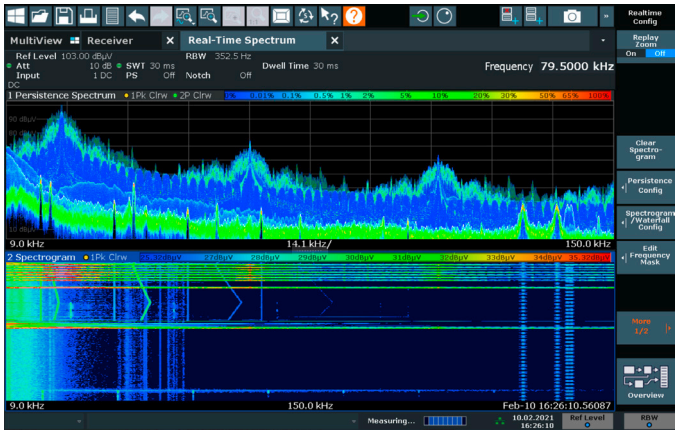
REAL-TIME SPECTRUM ANALYSIS AND IF ANALYSIS

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 measuring of sporadic or fast changing disturbances for detailed analysis. The normal receiver scan captures all signals within the given measurement time before moving to the next frequency segment. By contrast, the real-time mode remains at a fixed frequency segment to capture all signals practically for an infinite amount of time and without any time gaps. The R&S®ESW enables such real-time measurements by simultaneously capturing and processing signals with high computational power.

Wideband real-time measurements

Instruments with the R&S®ESW-B1000 bandwidth extension option have up to 970 MHz real-time bandwidth in all operating modes when the span is within the applicable real-time bandwidth. The R&S®ESW-K55E or R&S®ESW-K55R wideband real-time spectrogram option ensures safe operations and correct settings at all times. The R&S®ESW-K55 option adds the real-time mode to all R&S®ESW instruments that are not equipped with the R&S®ESW-B1000 or the R&S®ESW-B350 option at a maximum bandwidth of 80 MHz. The real-time R&S®ESW-K55E and R&S®ESW-K55R bandwidth extension options also use CISPR detectors. R&S®ESW-K55R is only available for instruments with the R&S®ESW-B1000R or R&S®ESW-B350R options.



Real-time spectrum in persistence mode (top) and spectrogram of fast changing emissions (bottom).

Spectrogram for seamless spectrum display

The R&S®ESW has a spectrogram function to analyze disturbance signal behavior in the time domain in all operating modes. The spectrum for each time interval (i.e. measurement time) is displayed as a horizontal line, with levels assigned different colors. The seamless recording has an acquisition memory depth of up to 100 000 frames.

Real-time options

Option	Real-time bandwidth	CISPR detector(s)	Persistence mode	Spectrogram mode	Frequency mask trigger	Log-axis, limit lines and transducers
R&S®ESW-K55 [1]	80 MHz		•	•	•	
R&S®ESW-K55R [2]	▶ up to 970 MHz with R&S®ESW-B1000R ▶ up to 350 MHz with R&S®ESW-B350R	•		•		•
R&S®ESW-K55E	▶ 60 MHz ▶ up to 170 MHz with R&S®ESW-B350 or R&S®ESW-B1000	•		•		•

[1] Not available if instrument is equipped with wideband extension option.
[2] Requires R&S®ESW-B1000R or R&S®ESW-B350R wideband option (export restrictions apply).

Persistence mode (spectral histogram) to clearly identify pulsed and continuous disturbances

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.

IF analysis function for displaying the spectrum around disturbance signals

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

The IF spectrum center frequency always corresponds to the current receive frequency. The test receiver can be quickly and accurately tuned to the signal of interest. The IF spectrum also provides a detailed overview of spectrum occupancy around the measurement channel. Any received signals can be quickly classified as disturbance or useful signals. AM and FM audio can be demodulated in parallel, making detected signals easier to identify and ambient interferers easier to exclude in open-area measurements.

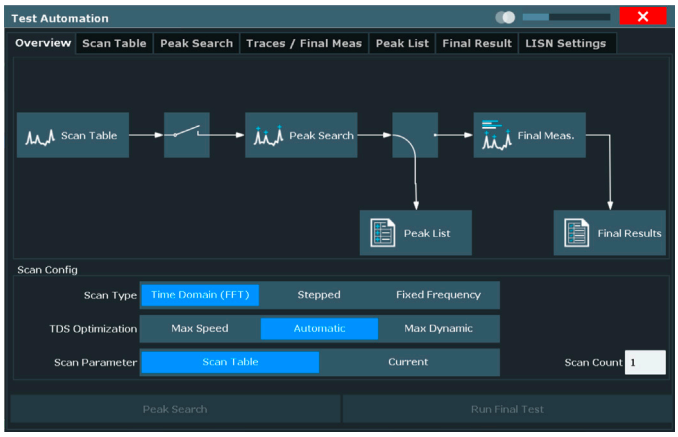
IF analysis (middle) and scanned RF spectrum (bottom).

AUTOMATED TESTING AND REPORT GENERATION

Preview measurement – data reduction – final measurement

A fast pretest with peak and average detectors followed by a final test on the critical frequencies with the required CISPR weighting detectors is the common and well accepted approach for disturbance measurements. The R&S®ESW EMI test receiver performs this procedure fully automatically.

The instrument offers preconfigured limit lines defined in commercial product emission standards. From the preview measurements, the test receiver identifies critical frequencies based on user-defined criteria and presents them in a peak list. Users can edit the peak list by adding or deleting frequencies. In the last step, the receiver performs the final test with CISPR-compliant measurement time and detectors.



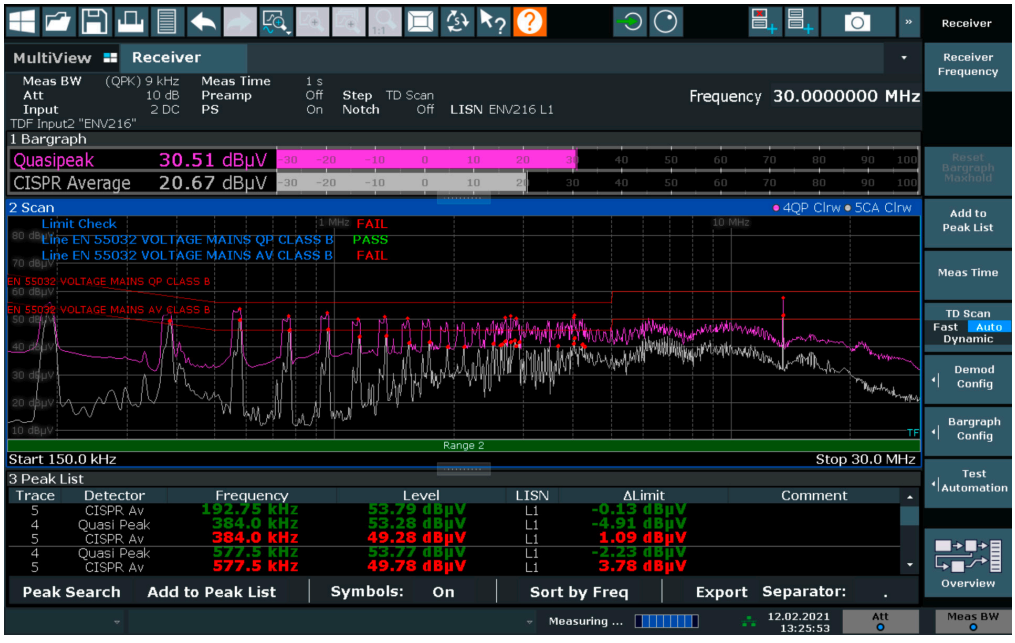
Test automation configuration menu.

Immediate final testing for conducted disturbances

The R&S®ESW eliminates the need for pretesting in the CISPR bands A and B. The instrument simultaneously and seamlessly measures spans up to 30 MHz using the time domain scan with quasi-peak and CISPR-average detector. It achieves the compliance test results very quickly.

Conducted tests require switching over multiple phases. The R&S®ESW remotely controls Rohde & Schwarz line impedance stabilization networks (LISN) via its AUX port and automatically measures on all phases.

Fully automated testing of conducted disturbances with CISPR detectors without prescan.



R&S®ELEKTRA remote control and automation software.

R&S®ELEKTRA EMC measurement software for remote control and automation

The R&S®ELEKTRA EMC measurement software ideally supplements every Rohde & Schwarz EMI test receiver. It not only features remote control of manual measurements, but also performs fully automated tests, including control of accessories.

The modular test software package supports manual, partially and fully automated interference (EMI) and immunity (EMS) measurements in line with commercial and military standards. It provides reliable acquisition, analysis and documentation of measurement results and offers remote control of accessories such as mast and turntable systems.

Report generator

The report generator integrated in the R&S®ESW provides all the necessary capabilities for documenting EMI measurements. Reports contain a task description, the applicable standards, the test procedures used, specific user-defined procedures, any applied transducers and limit lines, plus result graphs from the preview measurement (with varying DUT load states if applicable), final measurement results in tabular form, and a graph of the final measurement. Sufficient space is provided for individual interpretations and comments.

Reports can be saved as templates for easy reuse. Different templates can be defined with individual layouts and parameter lists. Reports are created, saved and exported in PDF or DOC format.

Comprehensive reports in PDF or DOC format.

CONVENIENT OPERATION, STRAIGHT-FORWARD RESULT DISPLAY

The R&S®ESW features a touchscreen GUI for convenient, intuitive operation. The straightforward, menu-driven design lets users quickly find their way around the instrument. All functions and measurement parameters can be configured using either keys and knobs on the instrument, or a mouse and keyboard. The large WXGA color display (30.7 cm/12.1") with high resolution (1280 × 800 pixel) provides good readability. The large rotary knob controls the receive frequency as long as no data input field is open. Another, smaller knob controls the volume of the integrated speaker or connected earphones.

Two additional small knobs can be customized by the user by assigning functions such as resolution bandwidth, RF attenuation and measurement time. A signal of interest can immediately be analyzed by varying the selected parameters and comparing the effects. Each knob can be assigned up to five parameters.

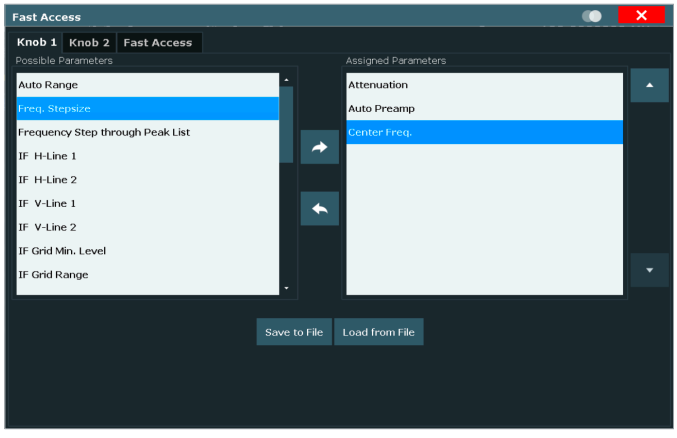
Scan table

In receiver mode, disturbance measurements in the frequency domain are controlled by the settings in the scan table. The scan parameters are presented in an easy-to-read manner and can be individually configured for each task and DUT with up to 10 independently defined subranges.

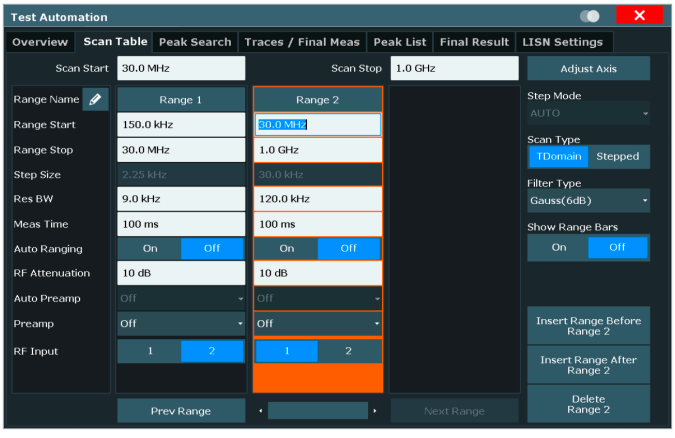
The same scan table is used for the time domain scan function, where the step size is set to a quarter of the resolution bandwidth by internal coupling.

Two rotary knobs with user-assignable functions.

Parameter selection for rotary knobs.



Scan table.



MultiView: simultaneous display of multiple results

With the MultiView function, results from different operating modes are clearly displayed on the 12.1" multi-touch screen. For example, the R&S®ESW can display the frequency spectrum in sweep or scan mode in one window, while using the IF analysis function to present a single-frequency measurement – including spectrogram – in another window. Up to four different single-frequency measurements can be displayed at a time.

The individual measurements using different modes and/or coupled parameters are performed completely independently of each other. The MultiView display shows all active measurement modes, facilitating result comparisons.

Touchscreen user interface

Block diagrams of the signal flow can be edited right on the screen. The user touches a desired element and modifies the corresponding parameter(s). This provides direct and easy access to all functions. The logical, consistently flat menu structure makes it very easy to define setups and configurations. For example, the preselector/preamplifier stage can be completely configured in a single dialog window.

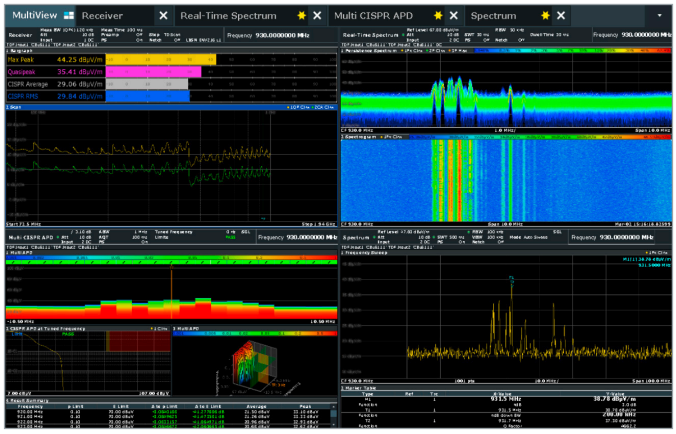
The dialog windows are transparent so that the signal remains visible in the background. All regularly used functions are assigned hard keys.

The toolbar provides quick access to general instrument functions such as zooming or saving screen content.

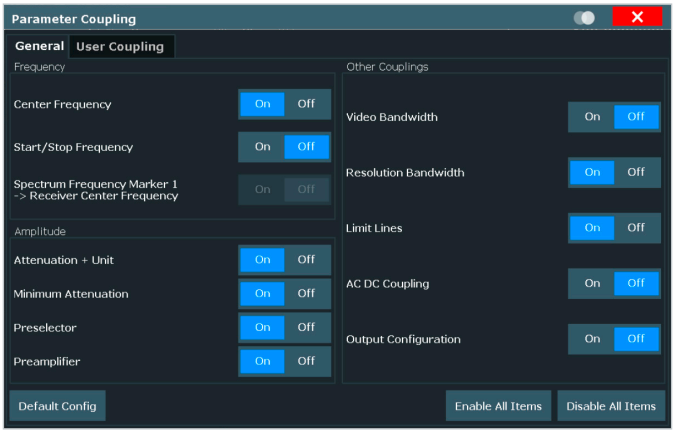
Save results and instrument setups

Measurement data and instrument setups can be saved to the instrument's internal hard disk or an external storage medium. The R&S®ESW accesses external media via USB or LAN. Users can store results as ASCII files for further processing. These files contain the trace data together with the most important instrument setups.

MultiView display with four operation modes shown simultaneously.



Parameter coupling between receiver and spectrum analyzer mode.



CLICK RATE ANALYZER (R&S®ESW-K59 OPTION)

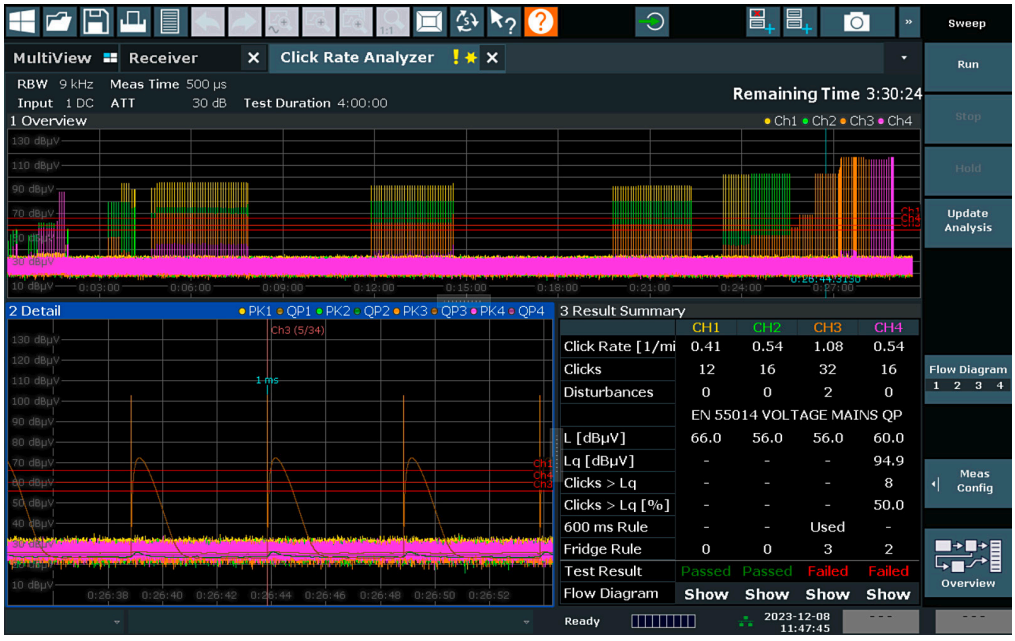
Thermostat or software-controlled devices such as ovens, rice cookers, irons, refrigerators, air conditioners and washing machines can generate discontinuous disturbances (clicks). Higher limits than those for continuous disturbances can be used to evaluate discontinuous disturbances as long as the clicks are not too long or too frequent.

The R&S®ESW-K59 click rate analyzer option has everything you need for CISPR 14-1 compliant discontinuous disturbance measurements (click measurements). These measurements can be easily configured and run for a defined period of time or until a specific number of clicks are detected. The measured values are automatically evaluated in line with CISPR 14-1 edition 6 or 7 and classified as PASS/FAIL. Details about the evaluation are also provided. When ordered with the instrument, the function is verified with CISPR 16-1-1 defined pulses. The R&S®DCV-2 option or the accredited calibration option with the click rate analyzer (CRA) also provide result documentation.

The R&S®ESW-K59 click rate analyzer option can also provide extensive analysis of measured values to help understand and improve emission characteristics. The option is ideal for certification and precertification as well as EMI debugging and analysis.

Key features

- Compliant with CISPR 14-1 editions 6 and 7
- Simultaneous and gapless measurement of all four frequencies defined by CISPR 14-1
- Optional frequency setting in line with DENAN law (Japan)
- Up to four hours of measurement time
- Save and recall settings and measured values for later analysis
- Analyze 4 hours of measurement values in a few seconds
- Reanalyze measured values with modified settings
- Result summary window with details for each channel
- Flow chart diagram to visualize results (PASS/FAIL)
- User defined report generation with graphics and analysis results for each click (configurable)
- Measurement value export for external processing
- Special operating mode to measure repetitive igniters
- Display of all or selected channels and detectors
- Overview of complete timeline with free time selection for detail window
- Detail window with extensive analysis functions
  - Zoom function
  - Duration information with each click
  - Marker and delta marker measurements
  - Fast browsing through click sequence
- Click info window with detailed measurement results for the selected click



Analysis with the R&S®ESW-K59 click rate analyzer option. The detail window in the bottom left shows a limit is exceeded in the quasi-peak detector and is counted as a click. This complements the timeline at the top displaying all clicks over the full test time.

DATA PROTECTION AND REMOTE CONTROL

Keeping test data confidential

To keep their test data confidential and secure, users can exchange the R&S®ESW standard hard disk drive for an optional solid-state drive (SSD) (R&S®ESW-B18) that contains only the operating system and the instrument firmware. The R&S®ESW can then be sent in for calibration or repair without any confidential data leaving the lab. Device-specific setups and parameter settings remain in the test receiver, where they are stored separately and independently from the user data and measurement results. Exchanging the internal hard disk drive is a simple matter of removing two screws on the back of the instrument.

To meet the most stringent security requirements, write protection (R&S®ESW-K33 option) is available for the internal hard disk drive. All data entered is written to SDRAM and deleted when the instrument is switched off.

USB write protection (R&S®FSW-B33 option) blocks the USB 2.0 interface and prevents data from being written to an external mass storage device. Read access is retained.

Remote control via GPIB or LAN

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

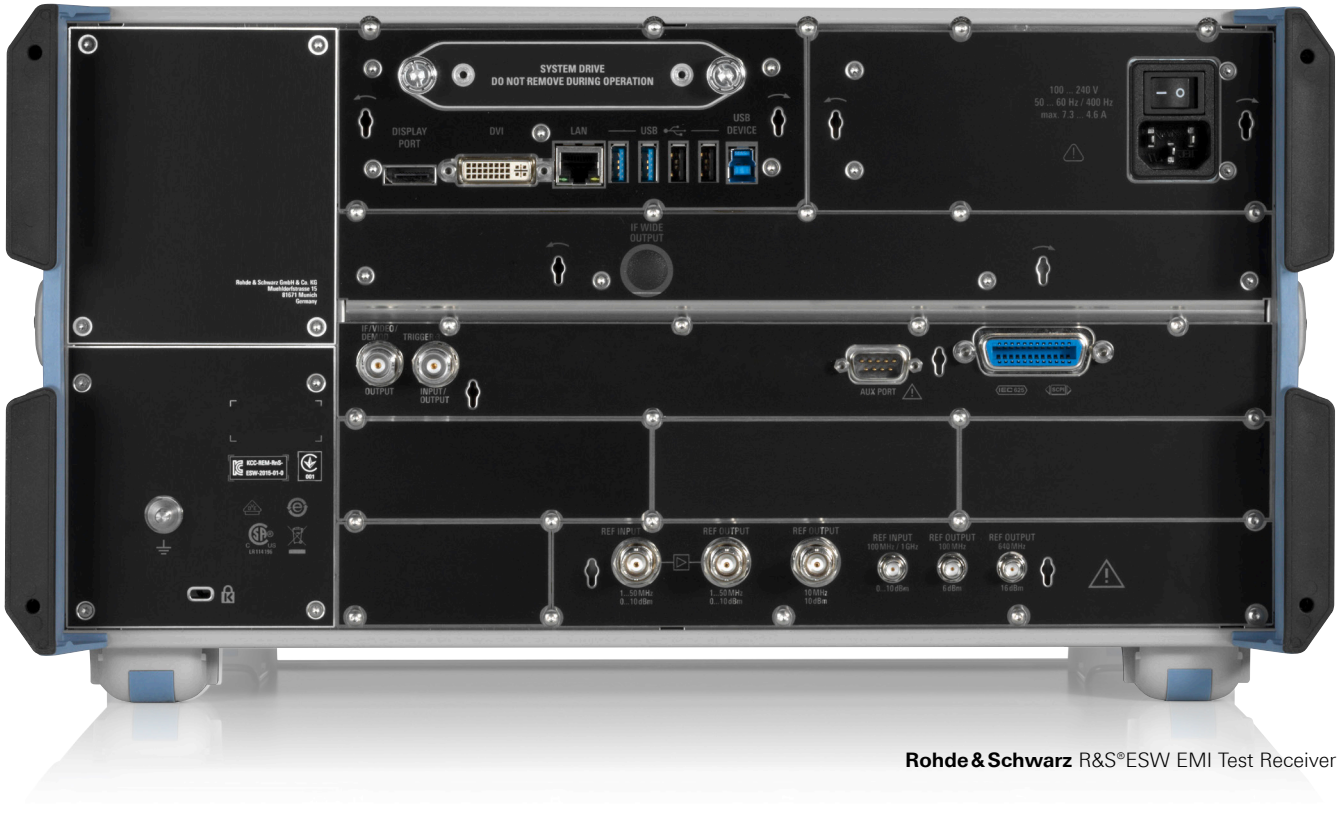
Drivers for LabVIEW, LabWindows/CVI, VXI plug & play

For software integration of the R&S®ESW, drivers for LabVIEW, LabWindows/CVI and VXI plug & play are available free of charge.

Real-time SCPI trace export

The R&S®ESW features SCPI commands for the simultaneous export of up to four traces while the receiver continuously scans. This process allows infinite capturing and transmission of trace data temporarily stored in the instrument's ring buffer. Both automation software such as the R&S®ELEKTRA or custom software or scripts offer user-specific emission analysis. Adequately high measurement times suitable for the infrastructure allow exporting in real time with this trace export function.

Rear view of R&S®ESW with removable hard disk drive.



SPECIFICATIONS IN BRIEF

Specifications in brief		
Frequency		
Frequency range	R&S®ESW8	1 Hz to 8 GHz
	R&S®ESW26	1 Hz to 26.5 GHz
	R&S®ESW44	1 Hz to 44 GHz
Aging per year	with R&S®ESW-B4 OCXO precision frequency reference option	$\pm 3 \times 10^{-8}$ (standard value: $\pm 1 \times 10^{-7}$)
Bandwidths		
Resolution bandwidth	standard filters (–3 dB)	1 Hz to 10 MHz in 1/2/3/5 sequence
	EMI filters (–6 dB)	1 Hz, 10 Hz, 20 Hz, 1 kHz, 9 kHz, 10 kHz, 100 kHz, 120 kHz, 1 MHz, 10 MHz
Detectors	receiver mode	max. peak, min. peak, quasi-peak, RMS, average, average with meter time constant (CISPR-average), RMS-average (CISPR RMS)
APD measurement function		
Minimum amplitude probability		10^{-7}
Maximum acquisition time		120 s
APD multichannel measurement function (R&S®ESW-K58 option)		
Analysis bandwidth (–6 dB)		1 Hz ≤ ABW ≤ 1 MHz
Maximum number of channels	ABW ≤ 300 kHz	67
	ABW = 1 MHz	
	base unit	21
	with R&S®ESW-B350/-B350R/-B1000/-B1000R option	51
Third order intercept (TOI)	10 MHz ≤ f_{in} < 3 GHz, Δf > 5 × RBW, RF attenuation = 0 dB, level 2 × –15 dBm, preselection off, preamplifier off	> +20 dBm, typ. +25 dBm
1 dB compression	f_{in} ≤ 3 GHz, RF attenuation = 0 dB, preselection off, preamplifier off	+15 dBm (nom.)
Preselection filters		
Status	receiver mode	always on
	analyzer mode	on/off (selectable)
Number of preselection filters		21
Notch filters	selectable, 20 dB nom. reject attenuation	2400 MHz to 2483 MHz, 5725 MHz to 5875 MHz
Highpass filters	selectable, additional to preselection filters	2 MHz, 8 MHz [1]
Preamplifier (switchable)	1 kHz to 8 GHz	20 dB (nom.)
Noise indication of instruments with R&S®ESW-B24 low-noise amplifier option (receiver mode)		
Preamplifier = off, LNA = on, RF attenuation = 0 dB, termination = 50 Ω, average (AV) detector, +5 °C to +40 °C, nominal, calculated from DANL data		
R&S®ESW44	150 kHz ≤ f ≤ 1 MHz, BW = 9 kHz	< –14 dBµV
	1 MHz < f < 30 MHz, BW = 9 kHz	< –19 dBµV
	30 MHz ≤ f < 1 GHz, BW = 120 kHz	< –7 dBµV
	1 GHz ≤ f ≤ 3 GHz, BW = 1 MHz	< 2 dBµV
	3 GHz < f ≤ 8 GHz, BW = 1 MHz	< 5 dBµV
	8 GHz < f ≤ 18 GHz, BW = 1 MHz	< 5 dBµV
	18 GHz < f ≤ 26.5 GHz, BW = 1 MHz	< 6 dBµV
	26.5 GHz < f ≤ 40 GHz, BW = 1 MHz	< 7 dBµV
	40 GHz < f ≤ 43 GHz, BW = 1 MHz	< 10 dBµV
	43 GHz < f ≤ 44 GHz, BW = 1 MHz	< 21 dBµV
Preamplifier = off, LNA = on, TD scan with R&S®ESW-B350/-B350R/-B1000/-B1000R option, TDS optimization: max speed, RF attenuation = 0 dB, termination = 50 Ω, average (AV) detector, +5 °C to +40 °C, nominal, calculated from DANL data		
All models	30 MHz ≤ f < 1 GHz, BW = 120 kHz	< –10 dBµV
R&S®ESW8, R&S®ESW26	1 GHz ≤ f ≤ 8 GHz, BW = 1 MHz	< 1 dBµV
R&S®ESW44	1 GHz ≤ f ≤ 3 GHz, BW = 1 MHz	< 2 dBµV
	3 GHz < f ≤ 8 GHz, BW = 1 MHz	< 5 dBµV

[1] Filter is only available for instruments starting from the following serial numbers: R&S®ESW8: 103055, R&S®ESW26: 103028, R&S®ESW44: 103048.

Specifications in brief		
Time domain scan (TDS) maximum frequency segment processed in parallel		
TDS optimization: max speed, any detector	f < 8 GHz	up to 60 MHz
	f ≥ 8 GHz	up to 30 MHz
TDS optimization: max speed, any detector, with R&S®ESW-B350/-B350R option	30 MHz ≤ f < 8 GHz	
	RBW = 9 kHz	90 MHz
	RBW = 120 kHz, 1 MHz	350 MHz
TDS optimization: max speed, any detector, with R&S®ESW-B1000/-B1000R option	30 MHz ≤ f < 1000 MHz	
	RBW = 9 kHz	90 MHz
	RBW = 120 kHz	970 MHz
	RBW = 1 MHz	880 MHz
	1 GHz ≤ f < 8 GHz	
	RBW = 9 kHz	90 MHz
	RBW = 120 kHz, 1 MHz	450 MHz
TDS optimization: dynamic, any detector		up to 30 MHz
TDS optimization: automatic	CISPR detector off	see "TDS optimization: max speed"
	CISPR detector on	
	RBW = 200 Hz, 9 kHz, 1 MHz	see "TDS optimization: dynamic"
	RBW = 120 kHz, CISPR band B, C	see "TDS optimization: dynamic"
	RBW = 120 kHz, CISPR band D, E	see "TDS optimization: max speed"
Receiver mode total measurement times		see time comparisons in sections about FFT based time domain scan and the R&S®ESW wideband extension, pages 5 to 7
Total measurement uncertainty		
Preselection off	10 MHz < f ≤ 3.6 GHz	< 0.3 dB
Dimensions (nominal)	W × H × D, including front handles and rear feet	462 mm × 240 mm × 504 mm (18.19 in × 9.45 in × 19.84 in)
Net weight, without options (nominal)	R&S®ESW8	20.6 kg (45.42 lb)
	R&S®ESW26	22.1 kg (48.72 lb)
	R&S®ESW44	25.2 kg (55.56 lb)

ORDERING INFORMATION

Designation	Type	Order No.
Base units		
EMI test receiver, 1 Hz to 8 GHz	R&S®ESW8	1328.4100.09
EMI test receiver, 1 Hz to 26.5 GHz	R&S®ESW26	1328.4100.27
EMI test receiver, 1 Hz to 44 GHz	R&S®ESW44	1328.4100.45
Hardware options		
OCXO precision frequency reference	R&S®ESW-B4	1328.5012.02
Resolution bandwidths up to 40 MHz	R&S®ESW-B8E	1345.0167.02
Resolution bandwidths up to 80 MHz (for R&S®ESW8/R&S®ESW26)	R&S®ESW-B8	1345.1474.26
Resolution bandwidths up to 80 MHz (for R&S®ESW44)	R&S®ESW-B8	1325.1474.02
External generator control	R&S®ESW-B10	1328.5006.02
Spare solid-state drive (removable hard drive)	R&S®ESW-B18	1328.4997.02
LO/IF connections for external mixers (for R&S®ESW26)	R&S®ESW-B21	1331.6945.26
LO/IF connections for external mixers (for R&S®ESW44)	R&S®ESW-B21	1331.6945.44
Low-noise amplifier, 150 kHz to 8 GHz	R&S®ESW-B24	1328.4980.08
Low-noise amplifier, 150 kHz to 26.5 GHz	R&S®ESW-B24	1328.4980.26
Low-noise amplifier, 150 kHz to 44 GHz	R&S®ESW-B24	1328.4980.44
USB mass memory write protection	R&S®FSW-B33	1313.3602.02
350 MHz FFT bandwidth, real-time bandwidth: 170 MHz	R&S®ESW-B350	1345.0438.02
350 MHz FFT and real-time bandwidth	R&S®ESW-B350R	1351.1184.02
970 MHz FFT bandwidth, real-time bandwidth: 170 MHz	R&S®ESW-B1000	1345.0421.02
970 MHz FFT and real-time bandwidth	R&S®ESW-B1000R	1351.1178.02
Firmware options		
AM/FM/PM modulation analysis	R&S®ESW-K7	1331.6216.02
Security write protection of solid-state drive	R&S®ESW-K33	1328.4916.02
80 MHz real-time measurement application	R&S®ESW-K55	1328.4968.02
Real-time spectrogram for EMI tests, bandwidth up to 170 MHz	R&S®ESW-K55E	1351.1026.02
Real-time spectrogram for EMI tests, bandwidth up to 970 MHz	R&S®ESW-K55R	1351.1226.02
APD multichannel measurement function	R&S®ESW-K58	1345.0150.02
Click rate analyzer, 4 channels, CISPR 14-1 compliant	R&S®ESW-K59	1351.1361.02
Health and utilization monitoring service (HUMS)	R&S®ESW-K980	1345.0221.02
PC software		
R&S®ELEKTRA EMI test software, for emissions	R&S®ELEMI-E	5601.0030.02
R&S®ELEKTRA EMI advanced test software, for emissions	R&S®ELEMI-EA	5601.0424.02
R&S®ELEKTRA EMI system test software, for emissions	R&S®ELEMI-EAS	5601.0382.02

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