R&S®ESRP
EMI TEST RECEIVER

Precompliance measurements: fast and straightforward

Product Brochure
Version 02.00

ROHDE&SCHWARZ
Make ideas real

AT A GLANCE

The R&S®ESRP EMI test receiver has been designed for diagnostic measurements during development and for precompliance measurements in order to prepare products for final certification testing. It measures electromagnetic disturbances in the frequency range from 10 Hz to 7 GHz, using either a conventional stepped frequency scan or an FFT-based time domain scan, a method that significantly speeds up measurements. The R&S®ESRP is also a powerful, full-featured signal and spectrum analyzer for lab applications. The straightforward menu structure and intuitive touchscreen of the R&S®ESRP make it very easy to operate in any mode.

EMI measurements that took hours in the past can now be carried out in just a fraction of this time by the R&S®ESRP EMI test receiver using an FFT-based time domain scan. This results in substantial time and cost savings in product development and in preparing the product for final certification. An optional preselection module prevents overloading of the frontend and ensures reproducible results. The R&S®ESRP comes with tried and tested functions such as IF analysis for displaying the spectrum around disturbance signals and spectrograms in the analyzer mode to help users analyze disturbance signals. The neatly organized menu structure makes it easy to navigate to the desired function or setting.

The instrument can simultaneously display up to six different traces on its 21 cm (8.4") touchscreen for fast, effective result analysis. The compact design, low weight, optional ruggedized housing and optional DC power supply make the R&S®ESRP also perfectly suited to mobile applications.

BENEFITS

KEY FACTS

- ▶ EMI test receiver and signal/spectrum analyzer combined in one instrument
- ▶ Optional preselection and preamplifier (R&S®ESRP-B2)
- ▶ Resolution bandwidths in line with CISPR, optionally in decade steps from 10 Hz to 1 MHz (R&S®ESRP-B29)
- ▶ Weighting detectors: max. peak, min. peak, average, RMS, quasi-peak, CISPR-average with meter time constant, and RMS in line with CISPR 16-1-1
- ▶ Standard-compliant disturbance measurements for pulsed disturbances with repetition frequencies ≥ 10 Hz (with R&S®ESRP-B2 preselection/preamplifier option)
- ▶ Fast FFT-based time domain scan as an option (R&S®ESRP-K53)
- ▶ Automatic test routines
- ▶ IF analysis as an option (R&S®ESRP-K56)

DISTURBANCE MEASUREMENTS IN LINE WITH COMMERCIAL STANDARDS

Precompliance measurements

The main focus of the R&S®ESRP is on diagnostic measurements in line with commercial EMC standards and on all measurements in the runup to final product certification. Equipped with the optional preselection (R&S®ESRP-B2), including a 20 dB preamplifier, the R&S®ESRP performs quasi-peak measurements of intermittent disturbance signals with pulse repetition rates of 10 Hz or higher, in line with the CISPR 16-1-1 basic standard.

The R&S®ESRP has a standard frequency range from 9 kHz to 3.6 GHz or 7 GHz. The R&S®ESRP-B29 option extends the frequency range down to 10 Hz.

6 dB resolution bandwidths in decade steps from 10 Hz to 1 MHz are optionally available (R&S®ESRP-B29), for example to enable measurements in line with MIL-STD-461, DO-160 and ICNIRP guidelines on exposure limits.

EMI measurements in spectrum analyzer mode

Like all Rohde&Schwarz EMI test receivers, the R&S®ESRP is based on a powerful signal/spectrum analyzer platform. EMI analysis can be performed during development in the spectrum analyzer mode with or without preselection (option) activated.

Up to 16 configurable markers are placed on the frequencies of disturbance 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 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, enabling fast comparison of disturbance signals with limit lines.

FFT-BASED TIME DOMAIN SCAN SPEEDS UP MEASUREMENTS

Measurement speed significantly faster compared to conventional method

Speed is a crucial factor when testing devices that can only be operated or measured during a short period of time – either because they change their behavior (fluctuating or drifting disturbances), because extended operation might be destructive or because their operating cycle calls for high speed (as in the case of electric window regulators in vehicles). The R&S®ESRP-K53 option enhances the R&S®ESRP with the FFT-based time domain scan. Using this method, the R&S®ESRP performs measurements many times faster than with the conventional stepped frequency scan and thus makes it possible to handle such measurement scenarios. Users can also increase the measurement time (up to max. 100 s) in order to reliably detect intermittent interferers with low repetition rate or isolated pulses.

Parallel measurement of conducted disturbance signal levels throughout CISPR band B

Disturbances emanating from switching power supplies fluctuate depending on the load state – often in the level. In this case, it is difficult to reproducibly find the highest level. Unlike a conventional test receiver, which scans the frequency in small frequency steps, the time domain scan of the R&S®ESRP measures the complete CISPR band B (150 kHz to 30 MHz) on 13 267 frequencies simultaneously. After only around 50 s, the receiver displays the entire disturbance spectrum with quasi-peak and CISPR-average weighting (measurement time: 1 s), and the user can compare the highest levels directly with the applicable limit values.

The R&S®ESRP performs disturbance voltage measurements with quasi-peak and average weighting in a matter of seconds.

POWERFUL MEASUREMENT AND ANALYSIS FUNCTIONS

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

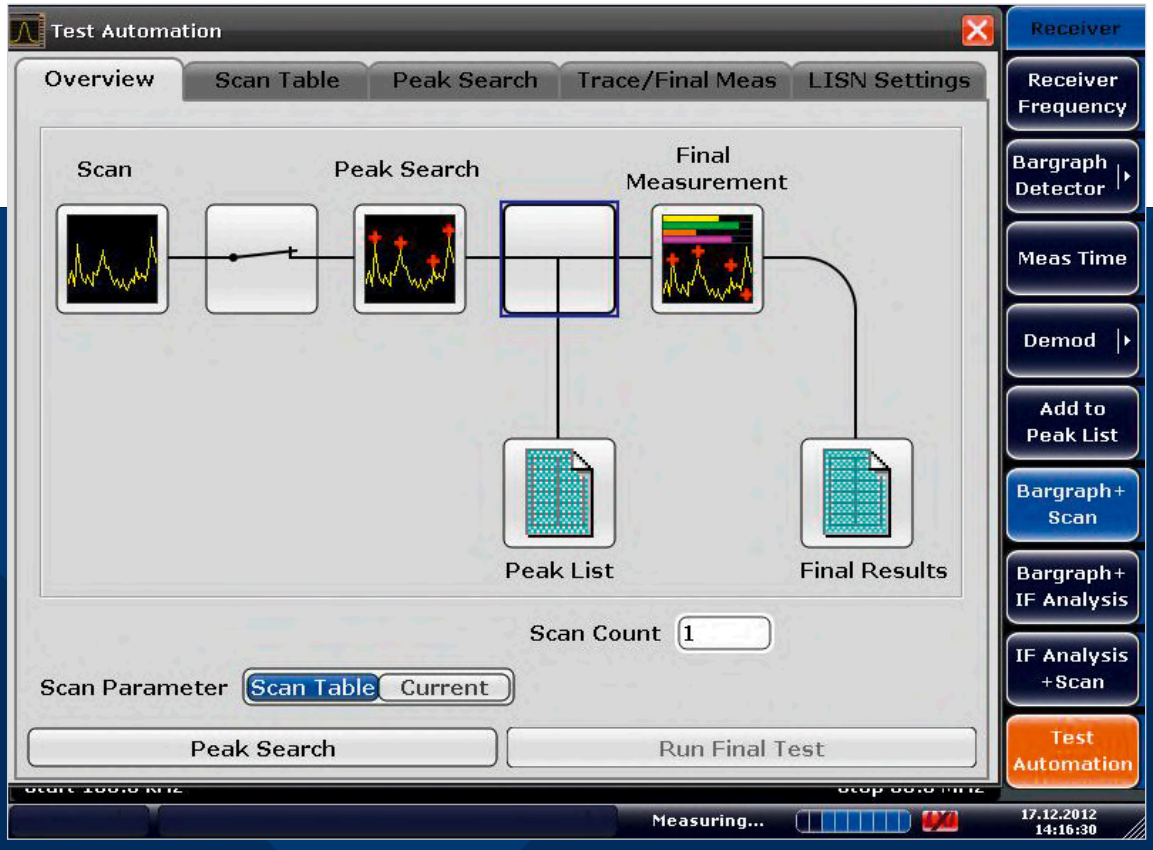
The standard approach for disturbance measurements is a fast preview measurement with peak (and average) weighting combined with a final measurement on the critical frequencies with the specified CISPR weighting.

The R&S®ESRP offers a choice of common limit lines defined in commercial product standards. The results of the preview measurement – obtained with a fast time domain scan or a stepped frequency scan – are compared with the limit lines.

Next, the test receiver identifies critical frequencies in accordance with user-defined criteria and presents them in a table (peak list). Users can manually edit the peak list by adding or deleting frequencies. In the last step, the test receiver performs a final measurement using a measurement time and detector(s) as required by the standard.

The R&S®ESRP can remotely control Rohde&Schwarz line impedance stabilization networks via its AUX port. Disturbance voltage measurements on power lines are performed fully automatically on all phases. This ensures reliable detection of the highest disturbance level.

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



IF analysis function for displaying the spectrum around disturbance signals

The optional IF analysis function of the R&S®ESRP 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 bar graph display for the current receive frequency (screenshot on page 9). Alternatively, the IF spectrum can be shown together with the stored results of the preview measurement. The center frequency of the IF spectrum can be controlled by the position of the marker, which is placed on the signal peaks detected during the preview measurement (screenshot on page 8).

The center frequency of the IF spectrum always corresponds to the current receive frequency. The R&S®ESRP can therefore be tuned to the signal of interest quickly and accurately. In addition, the IF spectrum provides a detailed overview of the spectrum occupancy around the signal of interest and – with sufficiently wide IF bandwidth – information about the spectral distribution of a modulated signal in the measurement channel. Any signals received can be quickly classified as disturbance signals or wanted signals. AM and FM audio demodulation can be activated in parallel, making it easier to identify detected signals, for example in order to find and exclude ambient signals in open-area measurements.

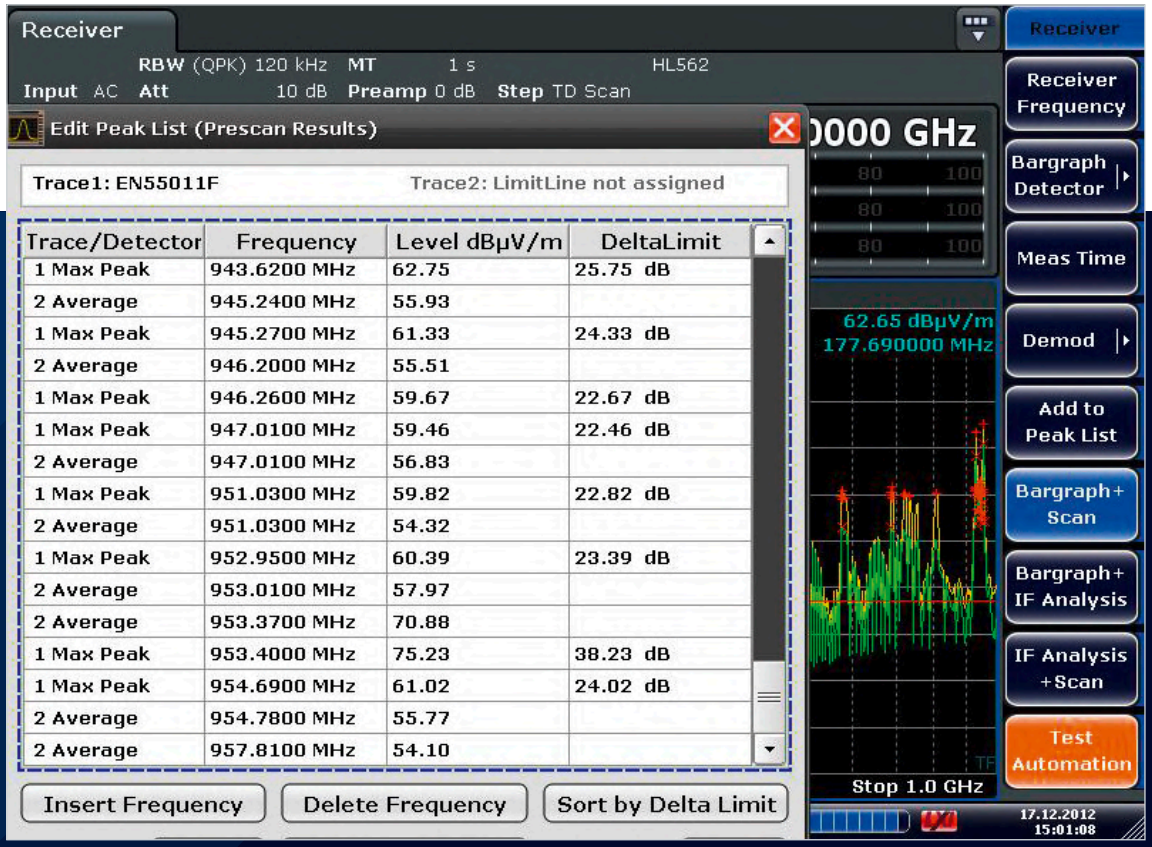
Simultaneous display of up to six traces and four bar graphs

The R&S®ESRP has a 21 cm (8.4") touchscreen with 800 × 600 pixel resolution. It can simultaneously display up to six different traces (including limit lines) in a single diagram. This provides the following benefits:

- Time-saving operation through simultaneous measurements using different weighting detectors
- Direct comparison of traces
- With up to four million values per trace, the R&S®ESRP performs frequency scans with narrow IF bandwidths even across very wide frequency ranges. Even for scans of this type, the R&S®ESRP provides high frequency resolution and therefore measures the disturbance frequency with high 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, for example during subsequent detailed analysis

The R&S®ESRP provides a combined numeric and analog bar graph 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.

Results of standard-compliant final measurements presented in tabular format, stating the offset values (deltas) with respect to the applicable limit values. Results can be exported as an ASCII file for further processing.



Preset antenna factors (transducers) and user-created transducer sets

The R&S®ESRP comes with a set of typical transducers for test antennas used in radiated disturbance measurements. Users can also create and save correction tables of their own for antennas, cable losses, line impedance stabilization networks, external preamplifiers, etc. Multiple correction factors (for different antennas covering various frequency ranges, different cables, external preamplifiers, etc.) can be combined in transducer sets. The R&S®ESRP automatically takes into account all activated transducers and correction factors and selects the appropriate measurement unit.

EMI limit line library for commercial standards, with convenient editor

The R&S®ESRP also includes a selection of important limit lines in line with commercial product emission standards. Users can edit limit lines and add new ones with an easy-to-use table editor.

Upper part of screen: Continuous spectral display of RF input signal around the current receive frequency using the IF analysis function.
Lower part of screen: Stored results of 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 with the combined numeric and bar graph display.

Integration into R&S®ELEKTRA EMC test software

R&S®ELEKTRA EMC test software is a complete solution that controls EMC test systems. As the base option for EMI measurements, the R&S®ELEMI-E essential EMI test software helps users define, perform, evaluate and archive EMI measurements in line with current EMI standards. Users can quickly generate correct and reproducible results. R&S®ELEKTRA also supports the R&S®ESRP.

Extensive analysis capabilities for general laboratory applications

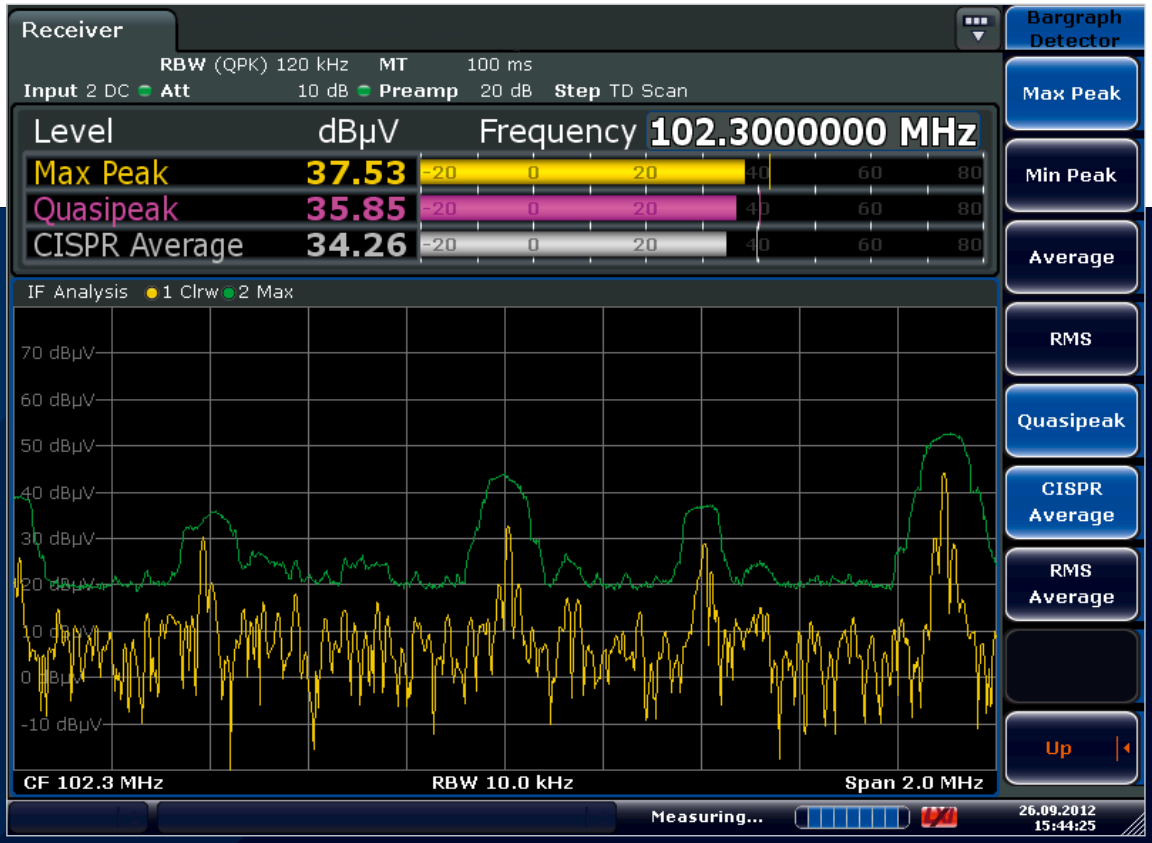
The R&S®ESRP is based on a powerful signal and spectrum analyzer platform. The test receiver provides test routines for many typical measurements such as:

- AM modulation depth
- Third order intercept (TOI)
- Phase noise
- Power measurement functions

For more information, see these product brochures:

- R&S®ELEMI-E essential EMI test software (PD 3607.6021.12)
- R&S®ELEKTRA EMC test software (PD 5216.3695.12)

Upper part of screen: Combined numeric and bar graph level display for the current receive frequency with up to four different weighting detectors. Lower part of screen: Continuous spectral display of RF input signal around the receive frequency using the IF analysis function (max. 10 MHz span).



CONVENIENT OPERATION, STRAIGHTFORWARD DISPLAY

Touchscreen-based user interface with undo/redo functions

The R&S®ESRP features a touchscreen GUI for convenient operation. The straightforward menu navigation allows users to familiarize themselves quickly with the instrument. All functions and measurement parameters can also be configured using a mouse and keyboard. The large display is easy to read.

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.

Straightforward scan settings in tabular format

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

In receiver mode, the R&S®ESRP is tuned across a user-defined frequency range in line with the settings made in the scan table. Users can define up to 10 frequency subranges and configure the parameters independently for each subrange, for example range start/stop, step size, measurement time, resolution bandwidth, input attenuation.

Integrated online help

Context-sensitive help provides detailed information about the current function and lists the associated remote control commands. The online help supports less experienced users, and programming becomes an easier task.

Storage of results and instrument settings on internal and external media

Measurement data and instrument settings can be saved to and recalled from the instrument's internal hard disk or an external storage medium. Results can be stored as ASCII files for further processing. These files contain the trace data and the most important instrument settings. Data can be saved externally on a USB flash drive via the USB port, for example, or on a network drive via the LAN interface.

Removable SSD to keep test data confidential

To keep their test data confidential, users can exchange the R&S®ESRP standard SSD for another SSD (R&S®ESRP-B18 option). The test receiver can then be sent in for calibration, repair or any other purpose without any confidential test data leaving the test lab. Device-specific alignment data remains in the test receiver, where it is stored separately and independently of user data.

Remote control via GPIB or LAN

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

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

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

Free-of-charge firmware updates – always in step with new developments

R&S®ESRP firmware can be upgraded using a USB flash drive or via LAN. The firmware upgrades can be downloaded free of charge at www.rohde-schwarz.com.

ROBUST AND COMPACT – IDEAL FOR MOBILE USE

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

The optional R&S®FSV-B30 DC power supply enables the R&S®ESRP to be operated from 12 V to 15 V DC sources. Using the optional rechargeable R&S®FSV-B32 battery pack, the R&S®ESRP can record field measurements for up to two hours on a single charge. In addition, a ruggedized housing with a carrying handle (R&S®FSV-B1 option) is available for mobile applications.

Removable SSD for high vibration and shock loading

The R&S®ESRP is equipped as standard with a removable SSD to handle scenarios with above-average fluctuations in the operating temperature (+5 °C to +40 °C), or when the instrument is exposed to strong shock and vibration loads, for example in vehicles.

Compact design

With a compact and robust design and low weight of approximately 9.5 kg (without hardware options), the R&S®ESRP is also an ideal choice for mobile applications.

SPECIFICATIONS IN BRIEF

Base unit		
Frequency		
Frequency range	R&S®ESRP3	9 kHz to 3.6 GHz
	R&S®ESRP3 with R&S®ESRP-B29 option	10 Hz to 3.6 GHz
	R&S®ESRP7	9 kHz to 7 GHz
	R&S®ESRP7 with R&S®ESRP-B29 option	10 Hz to 7 GHz
Level		
Maximum RF level (CW)	RF attenuation ≥ 10 dB; RF preamplifier off, RF attenuation ≥ 10 dB; RF preamplifier on	30 dBm (= 1 W), 23 dBm (= 0.2 W)
Maximum pulse voltage	RF attenuation ≥ 10 dB	150 V
Maximum pulse energy	RF attenuation ≥ 10 dB; 10 µs	1 mWs
1 dB compression	RF attenuation 0 dB, RF preamplifier and preselection off	+3 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®ESRP-B29 option in analyzer and receiver mode	additionally 10 Hz to 100 kHz (–6 dB) in decade steps
Preselection (R&S®ESRP-B2 option)	can be switched off in analyzer mode	16 fixed filters
Preamplifier (R&S®ESRP-B2 option)	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 16 000 s
	span ≥ 10 Hz (swept)	1 ms to 16 000 s
	span ≥ 10 Hz (FFT)	7 µs to 16 000 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 × IF bandwidth
Detectors	receiver mode	max. peak, min. peak, quasi-peak, RMS, average, average with meter time constant (CISPR-average), RMS-average (CISPR-RMS)
Displayed average noise level (DANL)	receiver mode, nominal, average detector (AV), RF attenuation 0 dB, termination 50 Ω	
	RF preamplifier off	
	500 MHz, bandwidth 120 kHz	< 6 dBµV
	3 GHz, bandwidth 1 MHz	< 17 dBµV
	RF preamplifier on	
	500 MHz, bandwidth 120 kHz	< –7 dBµV
	3 GHz, bandwidth 1 MHz	< 5 dBµV
Number of sweep (trace) points		
	analyzer mode (standard)	101 to 32001
	analyzer mode (EMI)	101 to 200001
	receiver mode	max. 4000000
Total measurement uncertainty	CW signal level 0 dB to –70 dB below reference level, S/N > 20 dB, auto sweep time, RF attenuation 10/20/30/40 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	0.57 dB

For specifications, see PD 3606.7576.22 and www.rohde-schwarz.com.

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Rohde&Schwarz
The Rohde&Schwarz technology group is among the trailblazers when it comes to paving the way for a safer and connected world with its leading solutions in test&measurement, technology systems and networks&cybersecurity. Founded more than 90 years ago, the group is a reliable partner for industry and government customers around the globe. The independent company is headquartered in Munich, Germany and has an extensive sales and service network with locations in more than 70 countries.

www.rohde-schwarz.com

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