R&S®EPL1000
EMI TEST RECEIVER

Speed. Flexibility. Compliance.

ROHDE & SCHWARZ

Make ideas real

AT A GLANCE

The R&S®EPL1000 is the perfect instrument for quick, precise and compliant EMI measurements up to 30 MHz. The R&S®EPL1000 fully complies with CISPR 16-1-1. With the added features of a spectrum analyzer and a signal and tracking generator, the R&S®EPL1000 is ideal for various lab applications.

With its very fast time domain scan, the R&S®EPL1000 can check all frequencies of a CISPR band A and B in a single shot, so measurements can be made quickly and large frequency segments can be checked gaplessly over extended periods of time, if necessary. Built-in preselection ensures a high dynamic range and enables the acquisition of short pulses. For detailed signal analysis, the R&S®EPL1000 offers a real-time spectrogram function, IF analysis and four-channel click rate analysis.

Automation simplifies measurements and ensures exact reproducibility of test sequences. For example, all lines connected to a Rohde&Schwarz LISN can be checked for CISPR band A and B at the push of a button. Comparing results to configured limit values is also automatic, and the R&S®EPL1000 displays the result of the entire measurement as PASS/FAIL. Using the integrated report generator, the result and the measurement details can easily be saved and printed.

With the optional integrated signal generator including a tracking generator function, the transfer functions of components used for measurements can be quickly and easily determined, without an additional device.

Battery operation, 12 V to 24 V DC input, a carrying bag and other accessories enable very flexible deployment of the R&S®EPL1000.

These and many more functions, as well as compliance with CISPR 16-1-1, make the R&S®EPL1000 the ideal instrument for conducted voltage and current measurements in the frequency range from 5 kHz to 30 MHz. Measuring radiated emissions is equally possible. Typical application areas are precompliance measurements, precertification and certification in line with IEC, EN, CISPR and FCC.

KEY FEATURES

▶ Preselection filters

▶ Time domain scan

▶ Tracking generator

▶ Battery operation

▶ Pulse protected input

BENEFITS

Precise and standard-compliant EMI identification
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# PRECISE AND STANDARD-COMPLIANT EMI IDENTIFICATION

The R&S®EPL1000 meets the requirements of CISPR 16-1-1 and additionally supports the decadic 6 dB bandwidths required by MIL-STD-461 and DO-160. This allows the R&S®EPL1000 to be used during development and for certification of a wide range of electrical products.

The relevant features include:
▶ EMI detectors: peak, quasi-peak, CISPR-average, RMS-average (CISPR 16-1-1)
▶ EMI bandwidth (6 dB)
  – 200 Hz, 9 kHz, 120 kHz and 1 MHz (CISPR 16-1-1)
  – 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz and 1 MHz (MIL-STD-461 and DO-160)
▶ Preselection to increase dynamic range (filters for CISPR band A and B)
  – Identify short pulses
  – Identify small signals in the presence of strong signals
▶ Transducer factors to include used accessory characteristics (for example cable attenuation or LISN characteristics)
  – Simple definition/quick import
  – Library covering most of the Rohde & Schwarz accessories
  – Record of new transducer factors with integrated tracking generator function (part of R&S®EPL1-B91 internal generator option)
  – Selection of one or more
▶ Signal level adaptation to correctly measure strong or weak signals
  – Pulse protected input
  – Attenuation up to 55 dB in 1 dB steps
  – Preamplifier with 20 dB gain

– Autoranging function for automated optimization of the signal adaptation to make maximum use of the dynamic range and to avoid overload within the signal processing chain
▶ Limit line display and checking to easily evaluate measurement results
  – Easy definition of limit lines
  – Library with more than 170 EMI limit lines based on the latest versions of common EMI standards (CISPR/EN, FCC, MIL-STD-461 and DO-160) for fast and accurate configuration of measurements
▶ Report generation to easily record, document and exchange results
  – User-defined layout and content definition through templates
  – On-screen display and save of reports (pdf and Word file format)
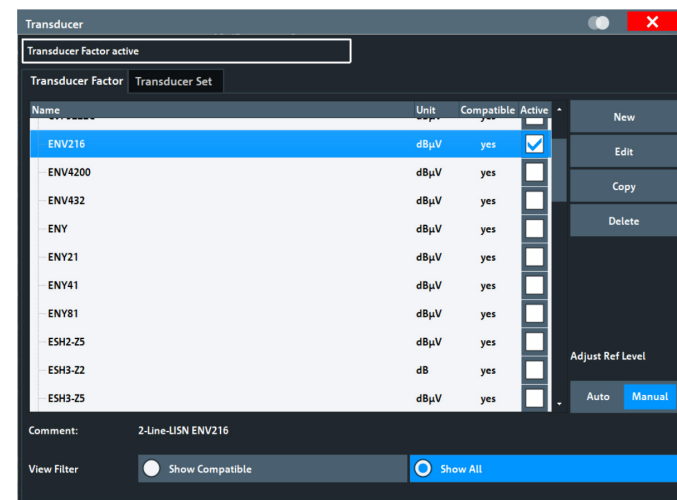
Layout definition and preview of test reports.
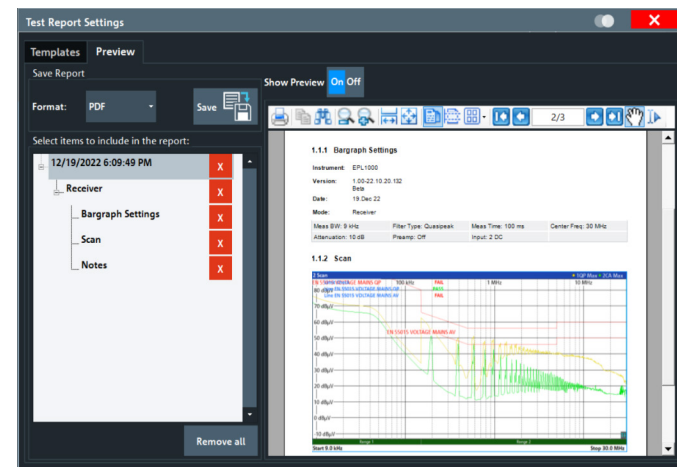
Selection of limit lines and assignment to individual traces.
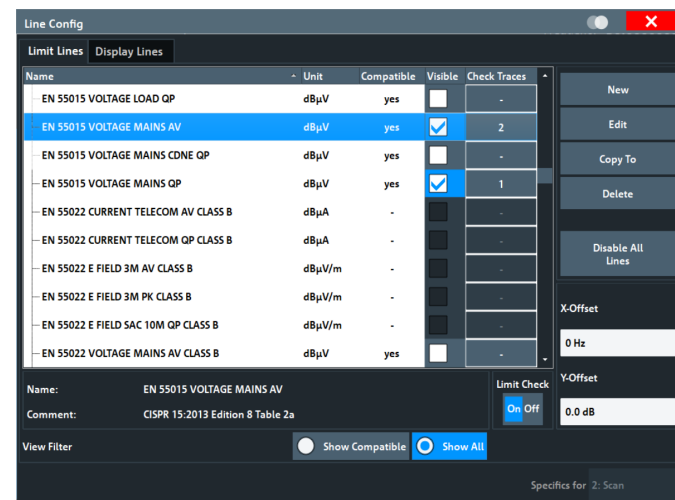
Selection of one or more transducers.

# FAST MEASUREMENTS THANKS TO TIME DOMAIN SCAN

Superfast measurement
The R&S®EPL1000 can measure an entire CISPR band (A or B) in a single measurement. This is done using FFT in full compliance with the requirements of CISPR 16-1-1. Larger frequency segments can be measured automatically in multiple steps using time domain scan (TDS). Up to three traces can be activated with different detectors, including CISPR detectors. This enables very fast standard-compliant EMI measurements directly with the detector required by the standard. Dividing the measurement into preview and final measurements is not necessary, but this is supported by the R&S®EPL1000 as an alternative method (automatic sequence of preview measurement, peak search and final measurement).

Fast and reliable detection of sporadic emissions
Highly parallelized measurements enable long and gapless checking of relatively large frequency segments. Every emission in the measured frequency segment (e.g. CISPR band B) is detected, no matter how short. For measuring intermittent disturbances, the measurement time can be as long as 100 s. As all detected emissions of a measurement belong to the same time segment, any dependencies in the emissions can be easily recognized.

Parallelization of the measurements within the CISPR bands by time domain scan
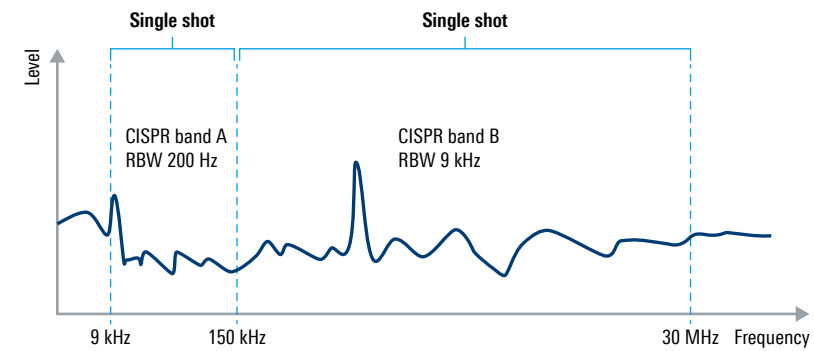
Times for common detectors and measurement times for CISPR bands A and B with associated RBW

Detectors	Measurement time	Total time [1]
Peak	0.1 s	0.5 s
	1 s	1.4 s
	15 s	15.4 s
Quasi-peak and CISPR-average	1 s	3 s
	15 s	17 s

[1] Necessary settling times for a valid measurement are included and automatically considered by the R&S®EPL1000.

Checking a laptop power supply in CISPR band B. The measurement takes just 3 s for one line with a measurement time of 1 s. All signal components are captured seamlessly in the same time frame.

AUTOMATION OF MEASUREMENTS

Automatic measurement of multiple frequency segments with individual settings

The scan table enables the definition of multiple frequency ranges with individual measurement settings. This way, for example, the RBW can be defined individually for CISPR band A and B. Using the configured settings, the R&S®EPL1000 automatically measures all defined frequency ranges sequentially.

## Automatic measurement of multiple lines connected to a LISN

Line impedance stabilization networks (LISNs) from Rohde & Schwarz connected to the R&S®EPL1000 with an R&S®EZ-21 control cable can be remotely controlled by the R&S®EPL1000, including selection of the line to be measured by the R&S®EPL1000. This function allows all lines connected to a LISN to be measured automatically. On the R&S®EPL1000 GUI, the user simply selects the lines to be measured automatically.

Preview and final measurement

The R&S®EPL1000 also supports conventional level determination with only one frequency measured at a time (stepped scan). To reduce the total time, the measurement can be divided into preview and final measurement with peak search. With this method, final measurement is usually performed only for critical frequency points (peaks) using a detector required by the standard with a longer measurement time, allowing the total time to be considerably reduced. Preview measurement, peak search and final measurement with evaluation can be completely automated in the R&S®EPL1000.
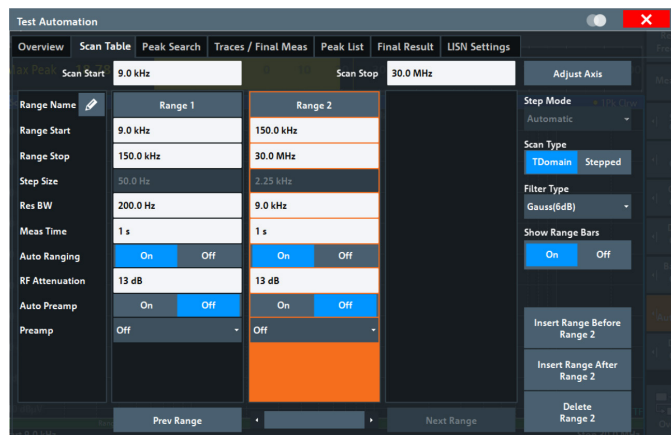
Scan table with two segments for CISPR bands A and B.
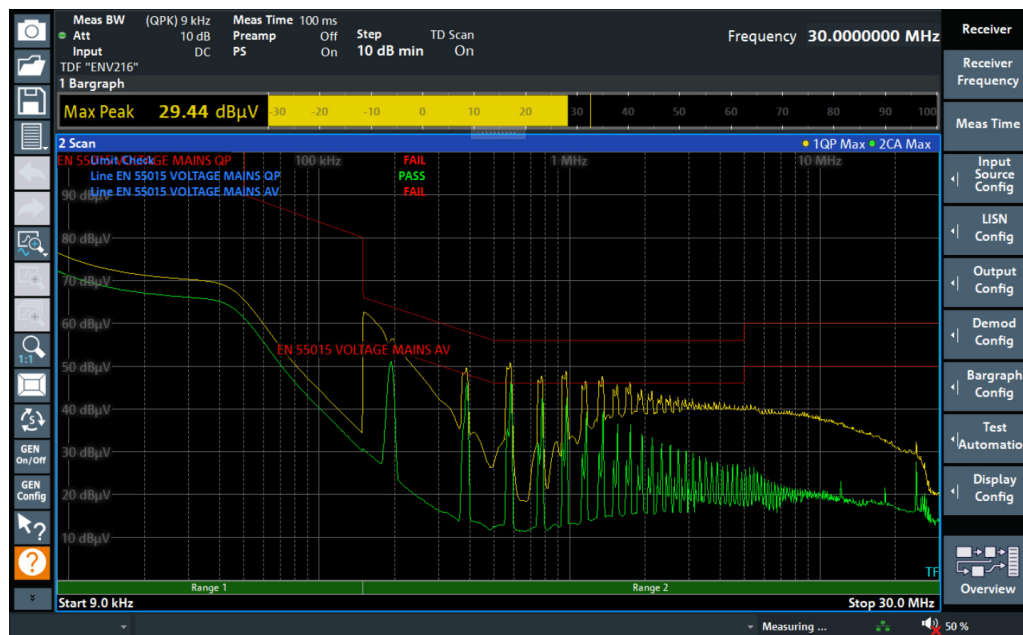
The result of automatic measurement of an LED lamp in line with EN 55015. CISPR bands A and B are fully measured with quasi-peak and CISPR-average detectors on the neutral and live lines. The results are evaluated using the associated limit lines. The result is indicated as PASS/FAIL. The entire measurement is made at the push of a button in just about 13 s (1 s measurement time plus required settling time per segment and line).

COMPREHENSIVE EMI ANALYSIS FUNCTIONS

Click rate analyzer (R&S®EPL1-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®EPL1-K59 click rate analyzer 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 a PASS/FAIL information is given. 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 R&S®ACAEPL1000 accredited calibration option provide result documentation.

The R&S®EPL1-K59 click rate analyzer option also features the extensive analysis of measured values to help understand and improve emission characteristics. It is ideal for certification and precertification as well as EMI debugging and analysis.

▶ 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 within 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 of the emissions of an oven with the R&S®EPL1-K59 click rate analyzer option. Clicks are identified on CH1. The complete timeline at the top shows a nearly regular distribution of the pulses. The detail window shows that the quasi-peak detector exceeds the limit. Although several clicks are detected, the oven has passed the test.

Level at a frequency: bargraph display

The bargraph display visualizes the level at a selected frequency. Instantaneous and maximum values are also displayed. Up to four graphs, each with its own detector, can be displayed at the same time. This function enables quick and easy analysis of the level at a frequency.

Level versus frequency and time: spectrogram function

The spectrogram function is ideal for capturing and analyzing signal properties over both time and frequency. Users can select either a 2D or 3D presentation and quickly measure results with markers. The function is especially helpful when measuring time varying signals. Sporadic signal components are easily identified and analyzed.

The R&S®EPL1-K55E option lets the instrument offer an additional real-time spectrogram mode. The mode makes sure that the entire measured frequency range is recorded over time without any gaps. The measured level versus frequency at a selected time is displayed as a pixel line on the screen. The color represents the measured level. The measurement can run for a quasi-unlimited time and the last 100 000 lines will be stored in a ring buffer. For example, when the measurement time is set to 50 ms the buffer can contain the measured values of the last 5000 s.
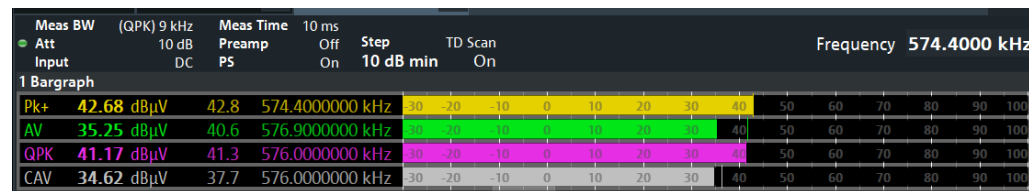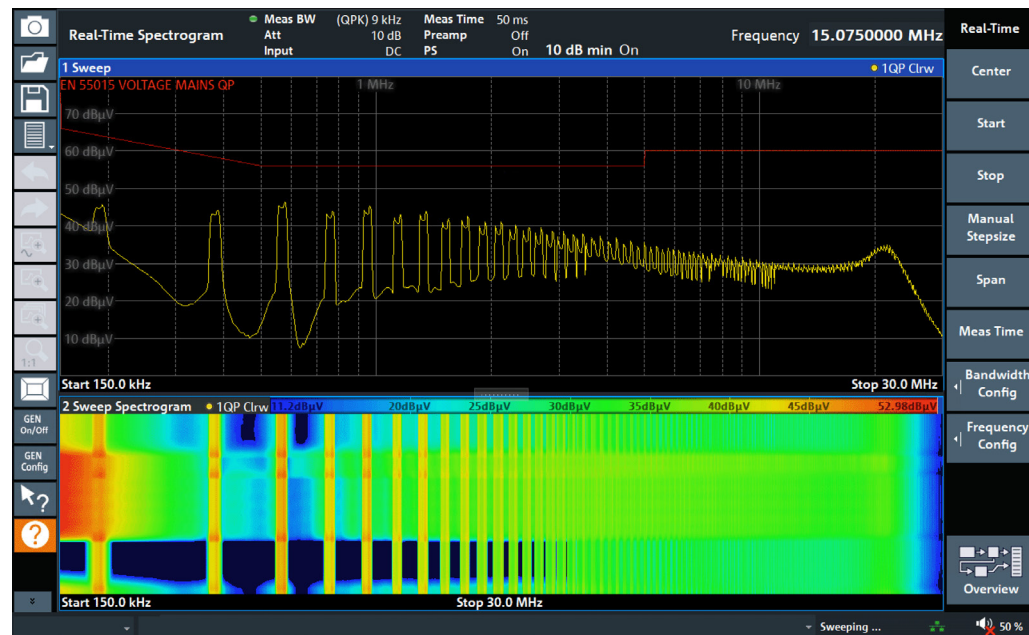
In the standard spectrogram function, the level values within one line can come from consecutive periods. Time gaps may exist between these periods within one line as well as between the individual lines.
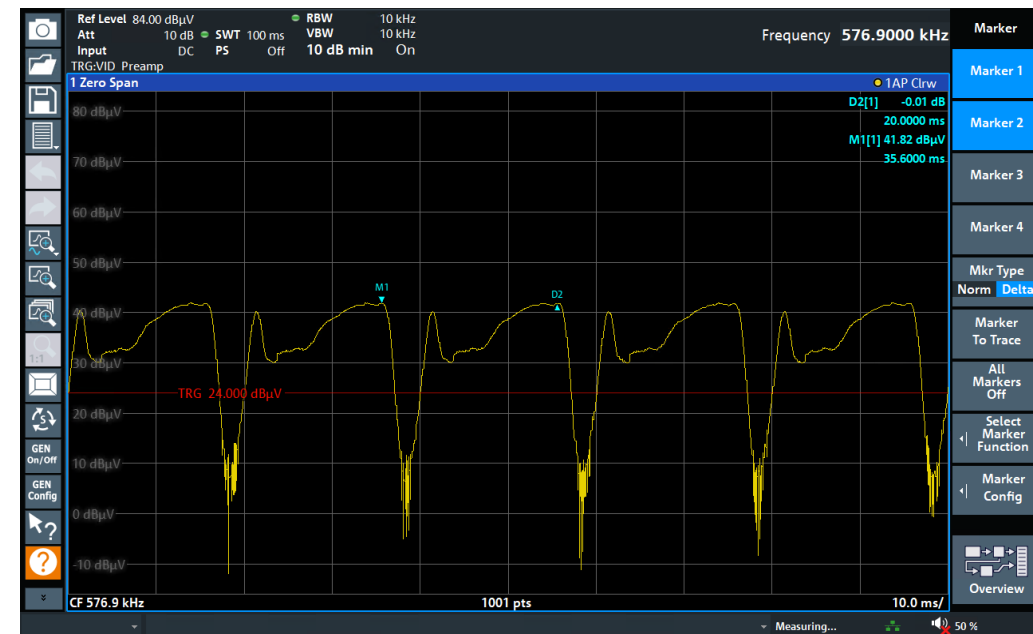
The real-time spectrogram mode makes sure that users can only use settings that create gapless measurements. Both the standard and real-time spectrogram functions enable the use of transducers, EMI bandwidths, CISPR detectors and limit lines. For example, in real-time spectrogram mode the entire CISPR band B can be gaplessly measured over time and frequency using a quasi-peak detector. The results for the entire ring buffer time period can be visualized and measured with markers.

## Level at a frequency versus time: zero span

The level over time at a selected frequency is displayed as a trace. Level and time values can be determined quickly and exactly using markers. This can for example be helpful to determine the period of periodic interferers to specify an appropriate measurement time.

IF analysis (R&S®EPL1-K56 option)

The R&S®EPL1000 offers IF analysis as an option. This can be combined with the bargraph display and a spectrogram function. Marker functions enable precise measurement.

AM/FM audio output

AM and FM audio output can help understand the characteristic of an interferer or to easily identify ambient interferers, for example during open area testing. Audio output is possible via the integrated loudspeaker or the headphone output. Comprehensive analysis functions for the modulation parameters of AM, FM and PM signals can be activated with the R&S®FPL1-K7 keycode option.

Spectrum analysis

In addition to the various EMI-specific measurement functions, the R&S®EPL1000 includes spectrum analysis functions, equivalent to those offered by a modern spectrum analyzer.

Bargraph display with four detectors.

Real-time analysis of the emissions of an LED lamp while changing the brightness levels. The measurement was made with a quasi-peak detector.

Analysis of the emissions of an LED lamp at 576 kHz versus time. The trigger function ensures a stable display. A period of 20 ms was measured using the marker functions.
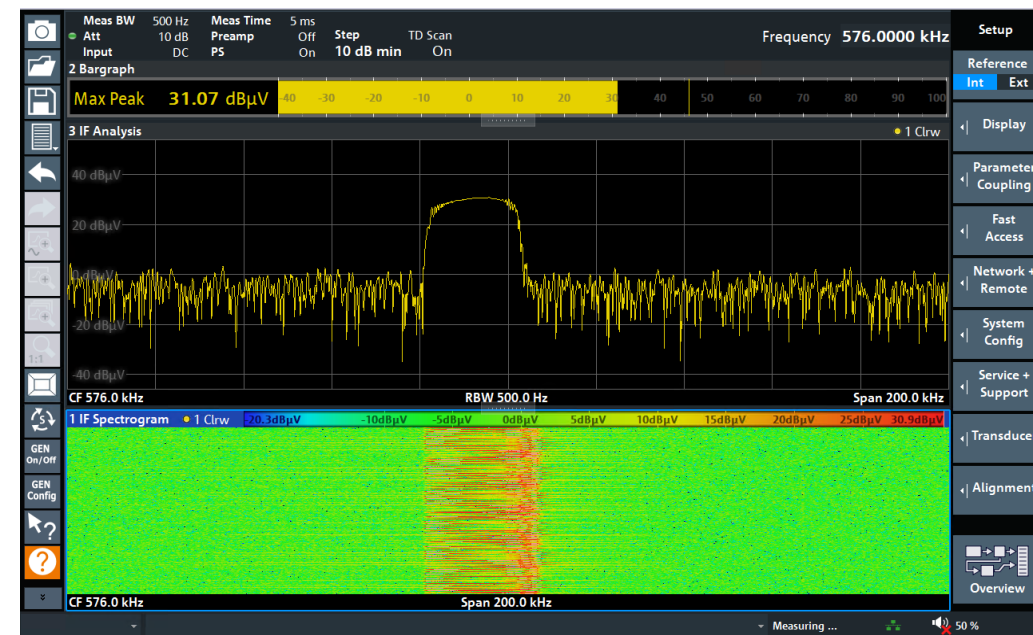
Analysis of the emissions of an LED lamp at 576 kHz using bargraph display in combination with IF spectrum and spectrogram function. The dynamic behavior of the signal, especially in the range of 560 kHz to 585 kHz, is clearly visible.

SIMPLE INTEGRATION INTO EMI TEST SYSTEMS

Integration into networks
The R&S®EPL1000 can be integrated into TCP/IP networks via its Ethernet interface. A GPIB interface (R&S®FPL1-B10) can additionally be integrated as an option.

Integration into any desired software applications via SCPI command set
Using SCPI commands, the functions of the R&S®EPL1000 can be controlled and measurement results can be retrieved. This enables integration into EMC measurement system software as well as any other software applications.

Integration into ELEKTRA EMC test software
R&S®ELEKTRA EMC test software is a complete solution that controls EMC test systems. The R&S®ELEMI-E essential EMI test software as base option for EMI measurements 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®EPL1000.

For more information, see the R&S®ELEMI-E essential EMI test software product brochure (PD 3607.6021.12) and the R&S®ELEKTRA EMC test software product brochure (PD 5216.3695.12).

Use of R&S®EPL1000 with R&S®ELEKTRA

VERSATILE REMOTE CONTROL FUNCTIONS

Remote control of R&S®LISNs
R&S®LISNs, such as the R&S®ENV216, can be remotely controlled via a proprietary interface integrated in the R&S®EPL1000. This way, the line to be measured can be selected on the R&S®EPL1000. This is especially helpful when the LISN and the R&S®EPL1000 are not in the same location. Suitable cables are available with lengths of 3 m or 10 m (R&S®EZ-21).

Remote control via remote desktop (Microsoft)
The R&S®EPL1000 can easily be operated remotely with a remote desktop connection. The R&S®EPL1000 screen display, along with an interactive visual simulation of the R&S®EPL1000 controls, is displayed on the client computer. This allows remote operation in the usual way as if the user was sitting directly at the device.

Access via web server
A connection with the web server integrated in the R&S®EPL1000 can be established by simply entering the IP address in the browser. This allows the instrument to be used remotely, just like with remote desktop. Multiple users can access the instrument at the same time from different computers and see the same user interface. The web server also supports simple data exchange with the R&S®EPL1000.

FOR STATIONARY, PORTABLE AND OUTDOOR USE

Operation in a rack, in the lab or on the go
Fold-out feet on the bottom and a carrying handle on the top of the R&S®EPL1000 enable flexible deployment in the lab. Professional installation in a 19" rack is easy using the R&S®EPL1-Z6 rackmount kit. The R&S®EPL1-Z1 protective hard cover for the front of the instrument and the R&S®EPL1-Z2 carrying bag – a perfect fit for the R&S®EPL1000 – make transportation easy and safe. A Kensington lock can be used to secure the instrument.

Flexible power supply, including an integrated rechargeable battery
With an input voltage range of 110 V to 240 V, the R&S®EPL1000 can be connected to all customary AC power sources. If an AC power source is not available, the integrable 12 V to 24 V DC input (R&S®FPL1-B30) can be used as an alternative. And if no external power source is available, the R&S®EPL1000 is still usable thanks to the integrated rechargeable battery (R&S®FPL1-B31). For an especially long operating time, the batteries can be exchanged (R&S®FPL1-Z4/R&S®FSV-B34). This makes outdoor measurements far away from power sources easy (such as in-situ measurements).

Data protection when the instrument is used at different locations or by different users
The memory pack (SSD) of the R&S®EPL1000, together with the associated controller unit, can easily be exchanged (R&S®EPL1-B19). This allows easy and very reliable removal of sensitive measurement data from the instrument. If the R&S®EPL1000 is transferred without a memory pack, no data can be handed over with the instrument. After the recipient inserts a replacement SSD including controller unit, the R&S®EPL1000 is again fully ready to use.

SPECIFICATIONS IN BRIEF

Specifications in brief		
RF input		50 Ω, N connector (female); integrated pulse limiter
Frequency range		5 kHz to 30 MHz
Attenuator setting range		0 dB to 55 dB, in 1 dB steps
Preselection bandwidths (–6 dB), nominal	10 Hz to 150 kHz	fixed lowpass filter
	150 kHz to 30 MHz	38 MHz, fixed bandpass filter
Preamplifier	switchable	20 dB (nom.); located between preselection and first mixer
EMI filters (–6 dB)		10/100/200 Hz, 1/9/10/100/120 kHz, 1 MHz
Noise indication (receiver mode)	termination = 50 Ω, average detector (AV), RF attenuation = 0 dB, preamplifier on/off	
	9 kHz ≤ f < 100 kHz, bandwidth = 200 Hz	< –25 dBμV/–15 dBμV
	100 kHz ≤ f < 150 kHz, bandwidth = 200 Hz	< –25 dBμV/–15 dBμV
	150 kHz ≤ f < 1 MHz, bandwidth = 9 kHz	< –9 dBμV/+1 dBμV
	1 MHz ≤ f < 10 MHz, bandwidth = 9 kHz	< –16 dBμV/–4 dBμV
	10 MHz ≤ f < 30 MHz, bandwidth = 9 kHz	< –12 dBμV/–4 dBμV
Detectors	standard	min. peak, RMS and average
	CISPR in line with CISPR 16-1-1:2019	max. peak, quasi-peak, CISPR-average and RMS-average
Maximum number of traces		6
Time domain scan examples for total time		see table on page 5
IF analysis	R&S®EPL1-K56	
Span		max. 10 MHz
Resolution bandwidths		10 Hz to 100 kHz in 1/2/3/5 sequence
Detector		sample
Internal generator	R&S®FPL1-B91	50 Ω, N connector (female)
Operating modes		tracking generator, CW generator, power sweep
AF demodulation types		AM and FM (loudspeaker and phone jack)
Display		21 cm LC TFT color display (10.1"), 1280 × 800 pixel (WXGA resolution)
Remote control interfaces		
LAN interface		10/100/1000BASE-T, RJ-45
GPIB interface (IEC/IEEE bus control)	R&S®FPL1-B10	interface in line with IEC 625-2 (IEEE 488.2); 24 pin Amphenol connector (female)
User port (LISN remote control)		25 pin D-Sub (female)
USB interfaces	front	2 ports, type A plug, version 2.0
	rear	2 ports, type A plug, version 3.1
Power supply		
AC supply		100 V to 240 V ± 10 %, 50 Hz to 60 Hz ± 5 %
DC power input voltage range	R&S®FPL1-B30	12 V to 24 V (nom.), 10.4 V to 28 V
Battery operating time	R&S®FPL1-B31	2 h (nom.)
Dimensions	W × H × D	408 mm × 186 mm × 235 mm (16.06 in × 7.32 in × 9.25 in)
Net weight (nom.)	without options	6.9 kg (15.2 lb)
	with internal battery	8.6 kg (18.95 lb)
Recommended calibration interval		1 year

ORDERING INFORMATION

Designation	Type	Order No.	Retrofitted by
Base unit			
EMI test receiver, 5 kHz to 30 MHz	R&S®EPL1000	1350.4444.10	
Hardware options			
Internal generator, 5 kHz to 30 MHz	R&S®EPL1-B91	1350.4073.02	factory only
Replacement SSD, including controller unit	R&S®EPL1-B19	1350.4450.02	user
OCXO, precision frequency reference	R&S®FPL1-B4	1323.1902.02	service only
GPIB interface	R&S®FPL1-B10	1323.1890.02	user
DC power supply for 12 V/24 V supply voltage	R&S®FPL1-B30	1323.1877.02	user
Lithium-ion battery pack, with controller unit for internal battery slot	R&S®FPL1-B31	1323.1725.02	service only
Keycode options			
Real-time spectrogram	R&S®EPL1-K55E	1350.4473.02	user (keycode)
Click rate analyzer	R&S®EPL1-K59	1350.4509.02	user (keycode)
IF analysis	R&S®EPL1-K56	1350.4067.02	user (keycode)
AM/FM/PM measurement demodulator	R&S®FPL1-K7	1323.1731.02	user (keycode)

Designation	Type	Order No.
EMC test software		
Essential EMI test software	R&S®ELEMI-E	5601.0030.02
License dongle	R&S®EMCPC	5601.0018.02
Recommended extras		
Protective hard cover	R&S®EPL1-Z1	1350.4296.02
Soft carrying bag, for transport and outdoor operation	R&S®EPL1-Z2	1350.4309.02
H-style shoulder harness (requires R&S®FPL1-Z2 option)	R&S®EPL1-Z3	1350.4315.02
Spare lithium-ion battery pack	R&S®FPL1-Z4	1323.1677.02
19" rackmount kit	R&S®EPL1-Z6	1350.4321.02
Lithium-ion battery charger, for charging spare batteries	R&S®FSV-B34	1321.3950.02
Control cable, for R&S®ENV216/R&S®ENV432/R&S®ENV420		
Length: 3 m	R&S®EZ-21	1107.2087.03
Length: 10 m	R&S®EZ-21	1107.2087.10
Calibration		
Accredited calibration	R&S®ACAEPL1000	3599.0699.03
Accredited calibration with click rate analyzer (R&S®EPL1-K59) verification	R&S®ACAEPL1000	3599.4771.03
Documentation of calibration values	R&S®DCV-2	0240.2193.09
Printout of DCV	R&S®DCV-ZP	1173.6506.02

Service options		
Extended warranty, one/two/three/four year(s)	R&S®WE1/R&S®WE2/ R&S®WE3/R&S®WE4	
Extended warranty with calibration coverage, one/two/three/four year(s)	R&S®CW1/R&S®CW2/ R&S®CW3/R&S®CW4	Contact your local Rohde & Schwarz sales office.
Extended warranty with accredited calibration coverage, one/two/three/four year(s)	R&S®AW1/R&S®AW2/ R&S®AW3/R&S®AW4	

Your local Rohde & Schwarz expert will help find the best solution for you.
Contact your local Rohde & Schwarz sales office for more information, www.sales.rohde-schwarz.com

Service at Rohde & Schwarz
You're in great hands

- ► Worldwide
- ► Local and personalized
- ► Customized and flexible
- ► Uncompromising quality
- ► Long-term dependability

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 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

Sustainable product design

- ▶ Environmental compatibility and eco-footprint
- ▶ Energy efficiency and low emissions
- ▶ Longevity and optimized total cost of ownership

Certified Quality Management
ISO 9001

取扱代理店

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兵庫営業所	TEL：078-452-3332
姫路営業所	TEL：079-271-4488
姫路中央営業所	TEL：079-284-1005
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