

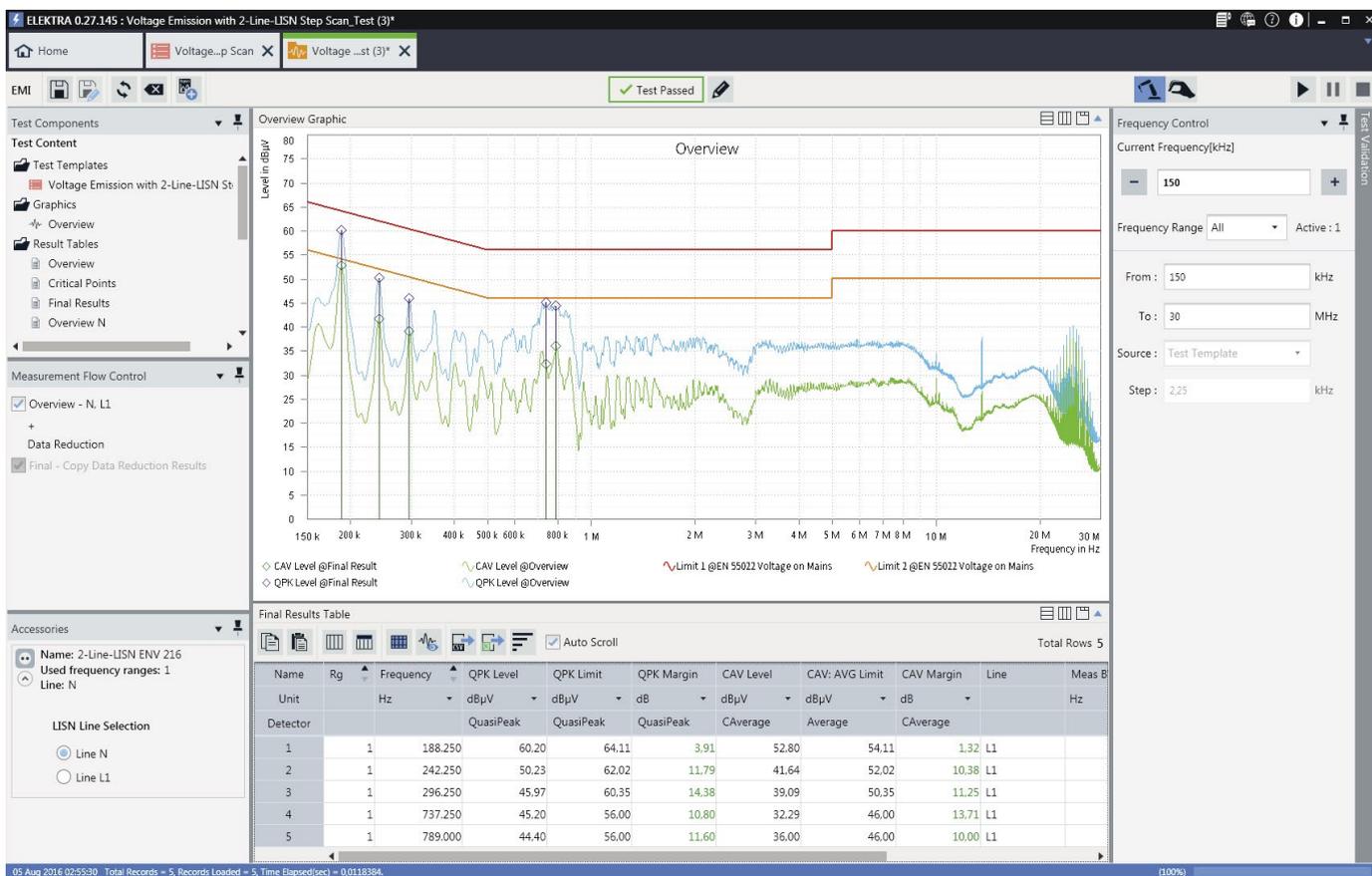
R&S®ELEKTRA: easy-to-use software for measuring electromagnetic interference (EMI)

Every electrical device must pass electromagnetic compatibility (EMC) tests before market approval can be granted. This obstacle is easier to overcome if the device's EMC behavior can be assessed and influenced during the development stage. New EMC test software for Rohde & Schwarz measuring receivers and spectrum analyzers offers valuable support.

Passing EMC tests proving that the device complies with the limits required by law is a prerequisite for market approval of every electrical device. That is why EMI testing is an important aspect of the development process. EMC plays a major role in launching products on time. The ability to assess and influence a product's EMC behavior before final certification is therefore indispensable during product development. The goal is to avoid multiple development cycles and the associated costs, and to lay the groundwork for a smooth certification process.

Under normal circumstances, however, design engineers only occasionally and marginally concern themselves with EMC. It therefore makes sense to provide user-friendly, specialist software for measurements during development, i.e. software that controls the test setup and "knows" all the necessary device setups and workflows. Rohde & Schwarz is now replacing its R&S®ES-SCAN software that was previously available for this purpose with the R&S®ELEKTRA software presented here.

Fig. 1: Result of a voltage emission measurement with a two-line LISN.



R&S®ELEKTRA supports both the measurement of conducted emissions via LISNs (Fig. 1) and of radiated emissions via antennas. The software also offers a further alternative of using gigahertz transverse electromagnetic (GTEM) cells to measure emissions. GTEM cells can be thought of as an expanded coaxial transmission line in which the device under test (DUT) is arranged between an inner conductor (septum) and an outer conductor. The IEC 61000-4-20 standard requires measurements along the x-, y-, and z-axis of the DUT, whereby the device is rotated. An R&S®ELEKTRA algorithm converts the measurement results into a spectrum that corresponds to the spectrum measured in an open area test site (OATS). For DUTs such as battery-operated hand tools, this type of measurement even complies with CISPR 14-1 standards. GTEM cells are often used in the development and pre-certification of multimedia equipment (CISPR 32).

The starting point for each measurement is choosing a standard-specific template. Templates for key commercial and military standards are included. They contain the receiver settings and show the transducer test setup (Fig. 2). Tables containing transducer factors for many antennas, LISNs and other accessories are also included and are factored into the measurement result by the software.

To measure the RF spectrum, R&S®ELEKTRA first loads the template settings into the receiver or spectrum analyzer. If a device supports both operating modes – which all Rohde&Schwarz measuring receivers do – the user decides

Highlights

- ▮ Clear, straightforward configuration of the measuring receiver or spectrum analyzer from a PC
- ▮ Reliable recording, analysis and documentation of measurement results
- ▮ Automated phase selection for LISNs
- ▮ Measurements using GTEM cells
- ▮ Determination of the highest levels using selectable acceptance limits and selectable subranges
- ▮ Editable frequency list for automatic or semi-automatic final measurements
- ▮ Saving of measurement results and settings on the control PC, including limit lines and transducer factors
- ▮ Flexible report configuration for different layouts
- ▮ Can be used with the R&S®ESCI, R&S®ESPI, R&S®ESL, R&S®ESR, R&S®ESU, R&S®ESRP and R&S®ESW EMI test receivers, the R&S®FSL spectrum analyzer and the R&S®FSV and R&S®FSW signal and spectrum analyzers
- ▮ Backup wizard for regular data backups

Fig. 2: Configuration of a voltage emission measurement. Measurement settings, frequency range, limit line and accessories are neatly grouped together.

The screenshot displays the R&S ELEKTRA software interface for configuring a voltage emission measurement. The interface is organized into several sections:

- Subrange Maxima:** Includes an 'Acceptance Analysis Offset' set to -12 dB.
- Final Measurement:** Features detector settings (QuasiPeak, CAverage, None, None), options for 'Measure Critical Points on these LISN Lines' (N, L1), and 'Use Data Reduction Results as Final Results'. The 'Final Measurement Time Per Point' is set to 1 s.
- Frequency Range List:** A table with columns for 'Active', 'Frequency Range', 'Meas BW (OV)', 'Use individual Limit Lines', and 'Comment'. The active entry shows a frequency range of 150 kHz - 30 MHz, a measurement bandwidth of 9 kHz, and the limit line 'EN 55022 Voltage on Mains'.
- Schematic Diagram:** Shows the measurement setup including the 'EMI Test Receiver', 'Receiver-2-Line-LISN E', '2-Line-LISN ENV 216', and the 'EUT' (Device Under Test).
- Settings (Overview):** A panel with various configuration options:
 - Meas BW:** 9 kHz
 - Step Size:** 2.25 kHz
 - Points:** 13268
 - Meas Time:** Per Point: 20 ms, Total: 265,36 s
 - Input Selection:** 1 DC
 - RF Attenuation:** 10 dB
 - Min Attenuation:** 10 dB

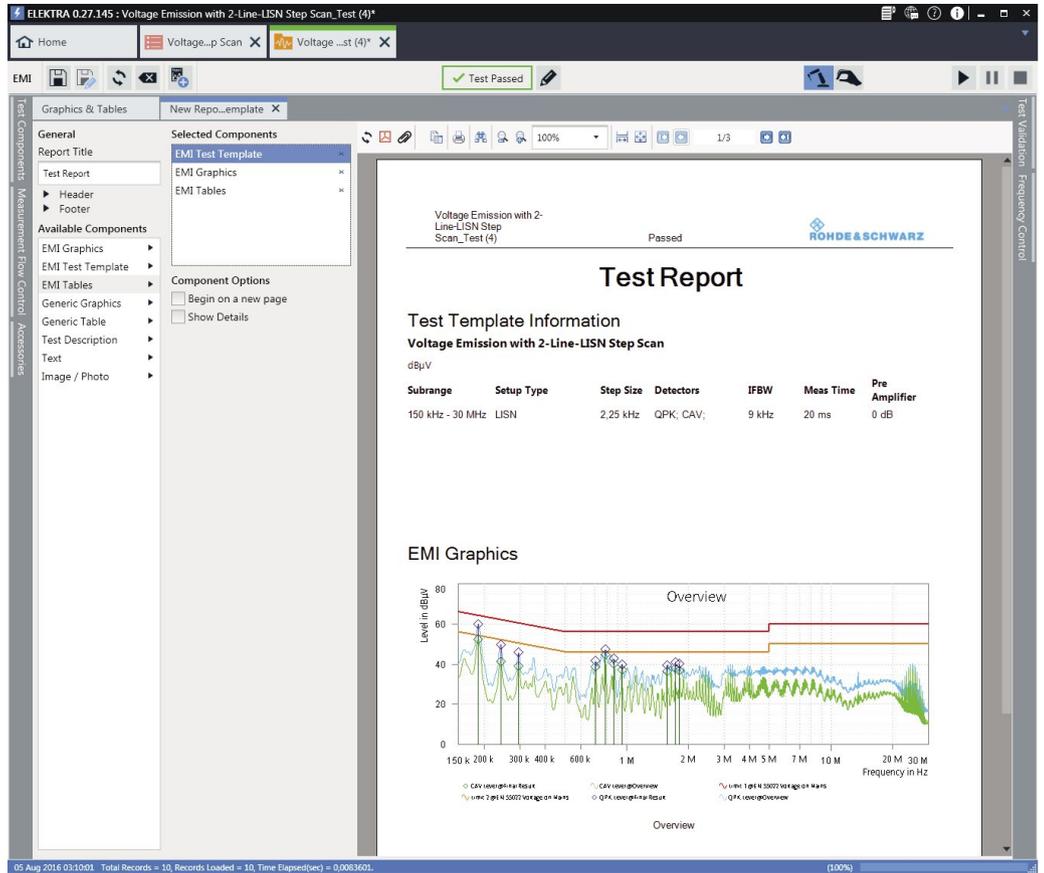


Fig. 3: The test report documents measurement results and settings. Users can add texts and pictures.

which one to use. The software starts, interrupts when required, and ends the test sequence. R&S®ELEKTRA automatically switches phases for conducted emission measurements using multiphase LISNs.

The next step, evaluating the measurement results, takes place either automatically or manually. Marker functions such as marker-to-peak are available for manual analysis. The software also automatically compares the measured spectrum to the limit lines – even in frequency subranges if needed – and finds out-of-limit conditions. A collection of key limit lines for commercial and military standards is included. Customers can of course also define their own limit lines. The frequencies with the highest interference levels in relation to the limit line are saved to the frequency list. This list can be edited to add known interferers or to remove ambient interferers.

When the measurement has been done with a standard-compliant detector, the frequency list will already contain the correct levels. This is the case, for example, when using a receiver with time domain scan that only takes seconds to measure a voltage emission of up to 30 MHz despite the comparatively slow quasi-peak detector. If this turbo method is not available, users typically first use the fast peak detector to perform preliminary measurements. Final measurements

with a standard-compliant detector, i.e. either quasi-peak or CISPR-average, are only carried out for the frequencies that have the highest interference levels. R&S®ELEKTRA offers two methods for these final measurements. If a stable interference scenario can be assumed, then a fully automated final measurement is recommended, where the software sets and measures, one after the other, all frequencies determined to be critical in the preliminary measurements. If, on the other hand, fluctuating interferers are expected, the interactive method is ideal, where the user manually sets the receiver to exactly the frequencies that have critical levels at the preliminary measurement points.

Each measurement is documented. All results and the settings used to obtain these results are stored in a database where they remain available for future comparisons or reports. The user selects the desired report components. Free elements, such as texts and pictures of the test setup, can be added to the measurement results and the setup data. The user checks the report with the preview function and then prints it out or saves it in a portable format such as PDF (Fig. 3). To evaluate the results using external software, the user exports the measurement results in a tabular (CSV) or Excel format (xlsx).

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