EMC Measurement Software R&S®EMC32-E

Automatic RFI field strength measurements

Numerous and often time-consuming measurements are required to ensure electromagnetic compatibility of a product. An automatic test sequence control saves time and ensures result reproducibility, thus increasing both efficiency and economy of the measurement. The capacity for performing automatic RFI field strength measurements in anechoic chambers and on open-area test sites is another important feature that has been added to EMC Measurement Software R&S®EMC32-E.

Advantages gained from automatic measurements

Compared to RFI voltage and RFI power measurements, RFI field strength measurements involve considerably more technical effort, plus they are among the most time-consuming tasks in RFI measurements. Version 3.0 of EMC Measurement Software R&S®EMC32-E (the module for EMI measurements from R&S®EMC32 [*]) is now available and, by using automatic test sequences, reduces the required time while maintaining high reproducibility and reliability of the results. The main advantages of this method are:

- Time-saving due to automated sequence control
- High measurement certainty by avoiding entry and reading errors
- Ease of operation (measurements at a keystroke)
- Complete and reliably reproducible measurement results

These benefits are particularly useful for routinely recurring series measurements that should run as fast and reproducibly as possible and should be feasible also for less experienced users. The interactive, either partially automatic or purely manual measurement mode of R&S®EMC32-E is usually the better way to handle analyses during development and precompliance measurements, or to solve highly complex and difficult EMI measurement problems.

Automatic measurement principle

The measurement mode for automatic EMI measurements – in R&S®EMC32-E referred to as "EMI Auto Test" – makes it possible to fully automatically perform a test as a sequence of several individual steps; it is available for both conducted and radiated EMI. In the case of radiated EMI emission testing, the new software version 3.0 also supports the highly time-consuming measurement of the RFI field strength in shielded anechoic chambers, and if possible, on open-area test sites; it can therefore be reliably, quickly and reproducibly automated.

This test measures radiated emission via antennas, optionally with automatic control of a mast for setting the antenna height and polarization, and of a turntable for selecting the azimuth position of the EUT (FIG 1).

Manual operation is only required if the turntable and the antenna mast cannot be controlled automatically. In this case, the R&S®EMC32-E interrupts the test sequence at the appropriate positions and continues after the mast and turntable position have been manually set. The associated setting data plus the measurement results are then automatically stored in a result table for further use and analysis (documentation). Initializing an EMI Auto Test also requires a few manual settings (e.g. definition and selection of the test templates used).

More information and data sheets at www.emc32.rohde-schwarz.com

REFERENCES
[*] EMC Measurement Software R&S®EMC32: Comprehensive EMI and EMS measurements at a keystroke. News from Rohde & Schwarz (2001) No. 172, pp 27–29

Automatic test sequence

Since direction of radiation (azimuth) as well as antenna height and polarization of the maximum radiated emission cannot be predicted, these auxiliary parameters are varied by means of preprogrammed settings for each of the three measurement categories, preview measurement, maximization and final measurement. A log file documents each step in the test sequence and continuously provides information about the current measurement status. If required, the automatic sequence can be interrupted or discontinued at any time.

The test itself always consists of preview measurement, data compression, maximization of the preview measurement results, final measurement and report generation (FIG 2).

The preview measurement records the entire frequency spectrum via scan or sweep, provided the test receiver used supports the sweep. In this case, a worst-case result is determined by the number of test sequences; from this result, a frequency list is derived that contains the critical frequencies relevant to the final measurement. To minimize the number of time-consuming final measurements, a series of analysis and data compression techniques can be very flexibly used in R&S®EMC32-E (FIG 3): either peak reduction with subsequent maximization, or subrange maximization, i.e. the determination of the maximum level within each frequency subrange; both result series can then be combined. The subsequent acceptance analysis excludes irrelevant test results, and by means of further maximization the total amount of final test points can be limited.

Information about the final test points thus obtained can be made more precise by means of three optional maximization sequences: one for the frequencies of the preview measurement with

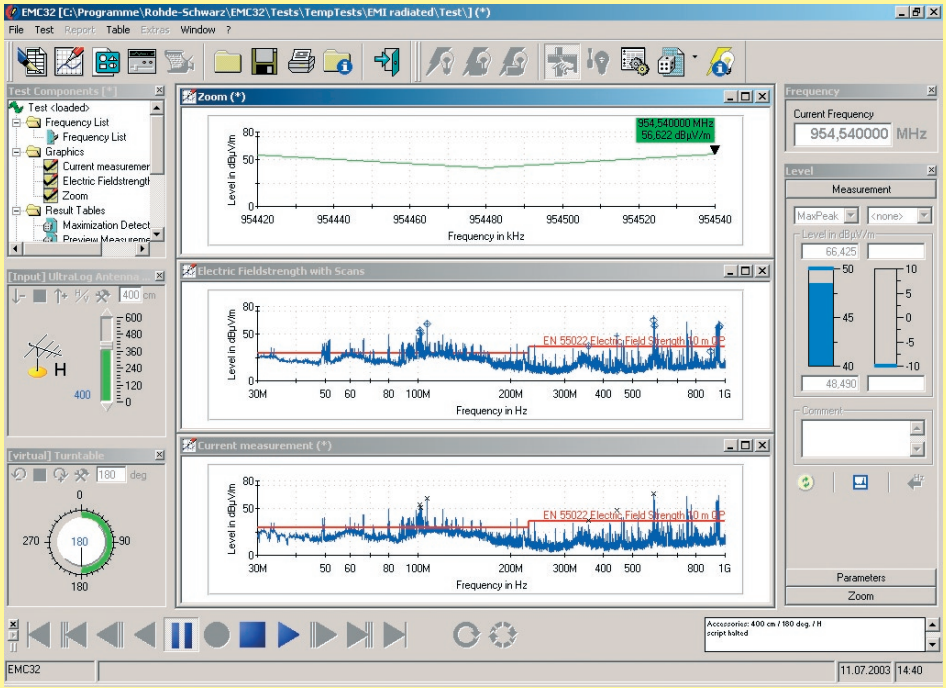

FIG 1 EMC Measurement Software R&S®EMC32-E as a virtual measurement instrument: measurement mode view during the automatic RFI field strength measurement. The test components explorer on the top left gives an overview of all loaded files of the current measurement. Below are the (automatic or manual) settings for mast and turntable. In the center are the measurement zoom graphics for frequency optimization, the overall result with a trace of its own for each result table as well as the active measurement (scan/sweep). The windows on the right provide information about the frequency setting of the test receiver and display the current measurement result numerically and as a bar graph (Clr.Write and Max.Hold). The symbols below control the test sequence (interval, end, start) and the log window next to them indicates its current status.

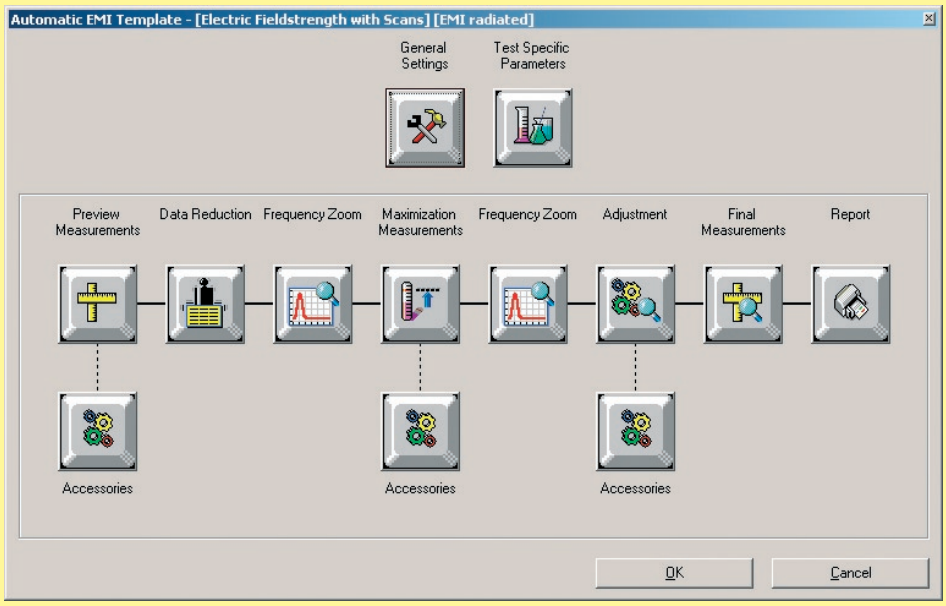

FIG 2 The test template of an automatic RFI field strength measurement with the setting elements for preview measurement, data compression, optional maximization of the critical frequencies with accessories positioning, final measurement and report generation. Test templates that were prepared in advance can be selected for each of these test sequences separately. The sequence (according to priority) for the mast and turntable movements is defined under "test-specific parameters".

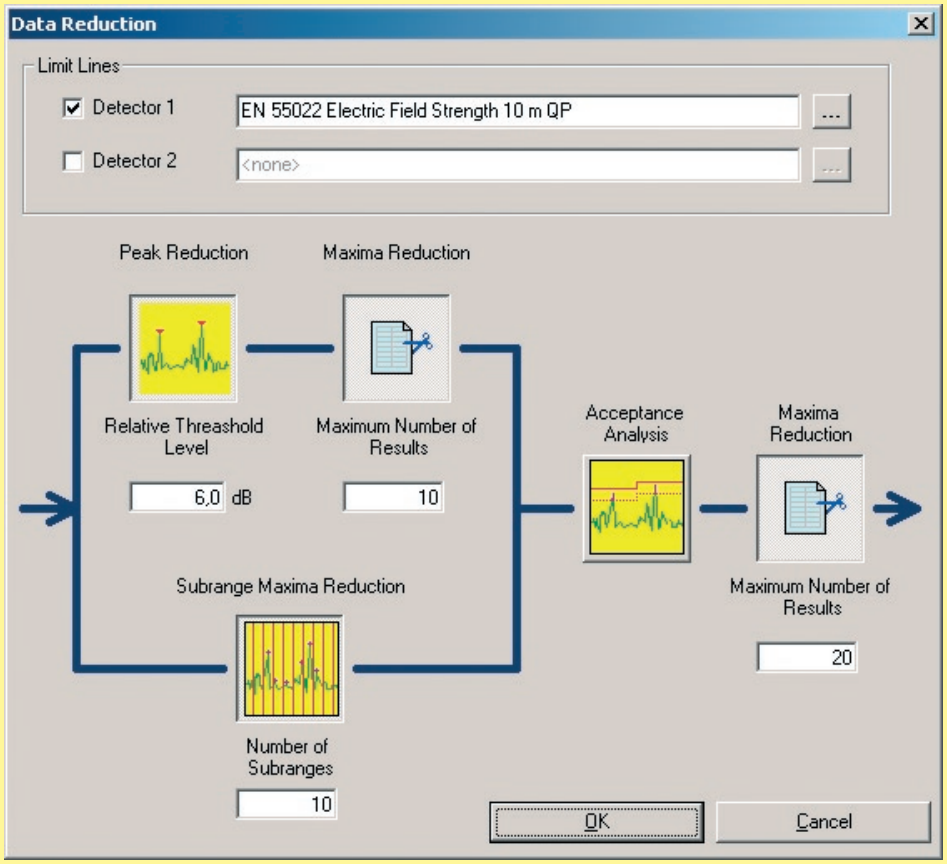

FIG 3 Data compression editor: Subrange maximization (lower path) and peak generation with subsequent limitation to a fixed number of results (upper path) can either be performed in parallel or as alternatives. This is followed by an optional acceptance analysis relative to the selected limit line or any other acceptance line as well as a further optional limitation of the number of maxima.

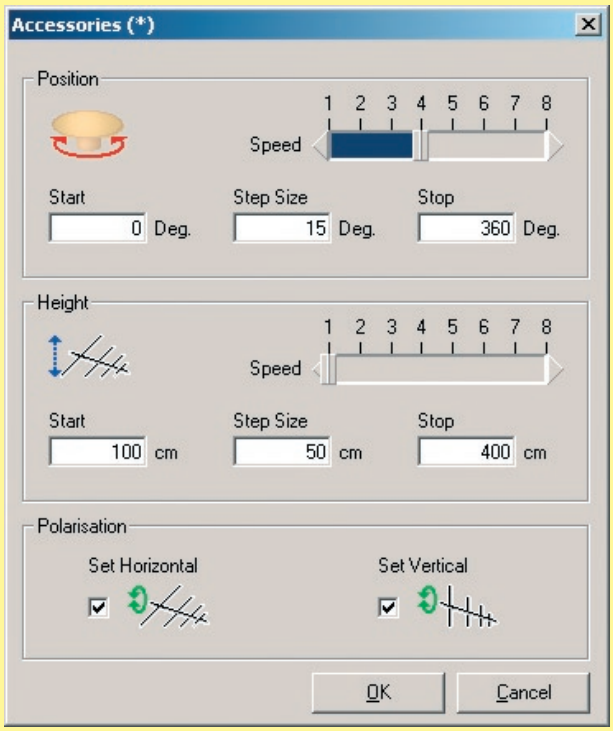

FIG 4
Editor for accessories settings for preview measurement and first maximization; the settings can be performed independently of each other.

partial scan or sweep (frequency zoom), and second for the levels by further varying the accessories settings (FIG 4) with another frequency zoom for fast drifting interferers. Another maximization across a defined local setting range of the accessories is used for definitively determining the location of the maximum interference.

The actual assessment of the critical signals for all determined settings of the three "dimensions", i.e. antenna height, antenna polarization and turntable azimuth, takes place in the final measurement.

The report finally combines the preconfigured test elements (e.g. test information, graphics, result lists, etc) and can be generated without further interaction directly as a printout or file (in HTML, RTF or PDF format), if required.

Summary

Performing automated RFI field strength measurements is an important EMC application and requires a possible flexible selection and adaptation of the setting parameters to the measurement task at hand and to the individual measurement environment. The new version 3.0 of R&S®EMC32-E satisfies this requirement to a great extent, covering "measurements at a keystroke", e.g. for serial tests, just as well as it has been supporting EMC specialists in the interactive analysis and assessment of an EUT. It is available to all users of R&S®EMC32-E as a free-of-charge update.

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