

EMC Measurement Software R&S EMC32-A

Versatile EMS and EMI measurements for the automobile sector

EMC Measurement Software R&S EMC32-A (automotive) from Rohde & Schwarz is a powerful tool that is specially tailored to measurements in the automobile sector in line with ISO 11451/2 and CISPR25 standards as well as to manufacturer-specific measurement procedures.

The merging of communications and mobility

With regard to technology, the 1990s featured a significant expansion of useful frequency ranges and the introduction of new modulation modes in wireless communications. At the same time, the percentage of electronic components used in the automobile sector rose steadily. In addition to fixtures such as airbags, ABS systems and traction control, which increase passive safety, it is hard to imagine automobiles without the auxiliary devices that make driving more convenient and enhance communication behind the wheel. In terms of electromagnetic compatibility, the merging of mobility and communications creates new challenges.

Mutual influence of electronic components in the vehicle must be excluded, and radiated disturbances from outside must not impair vehicle safety. For this reason, EMC measurements are performed when the vehicles and their electronic subassemblies (ESAs) are still in the development stage.

For this special field of applications in the automobile sector, Rohde & Schwarz has developed EMC Measurement Software R&S EMC32-A. The new software, which is based on EMC Measurement Software R&S EMC32 [*] launched in 2000, reflects Rohde & Schwarz's 20-plus years of experience in EMC measurements and the company's close cooperation with automobile manufacturers and suppliers.

All-in-one package for the automobile EMC world

R&S EMC32-A supports measurements for determining the immunity to conducted and radiated signals as well as emissions of motor vehicles and ESAs. The intuitive, easy-to-operate user interface allows users to get a quick start (FIG 1).

The software's measurement philosophy is ideal for compliance and batch testing with a high EUT throughput as well as for measurements accompanying development. Hence it can be used for a wide range of applications, from development and QM acceptance tests to production and quality assurance.

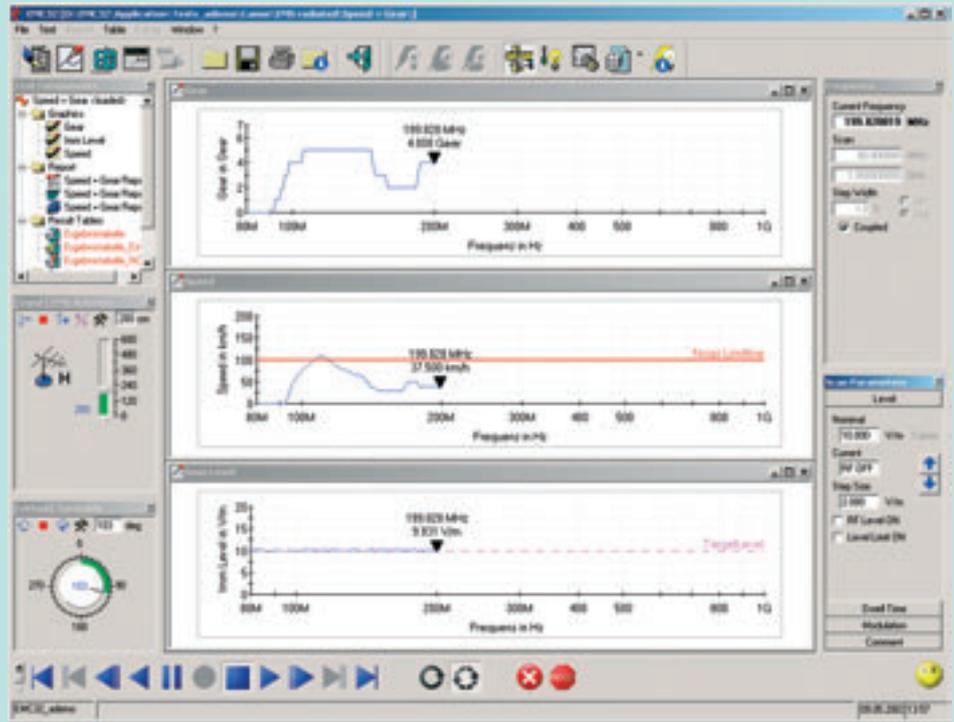


FIG 1 EMC Measurement Software R&S EMC32-A during an EMS test.

Electromagnetic susceptibility – EMS

For EMS measurements, the measurement procedures specified by the international standards ISO 11451 (for motor vehicles) and ISO 11452 (for components) are implemented in the software. The test setups for ISO 11451/2 pre-installed in R&S EMC32-A can be easily adapted to the instruments available in the laboratory interactively or by means of the integrated wizard and appropriate configuration files (FIGs 2 and 3). The online help provides step-by-step instructions from configuring the setup to performing the measurement.

Integrated control algorithms limit the susceptibility level during susceptibility tests, thus protecting the EUT and the test system against overloading.

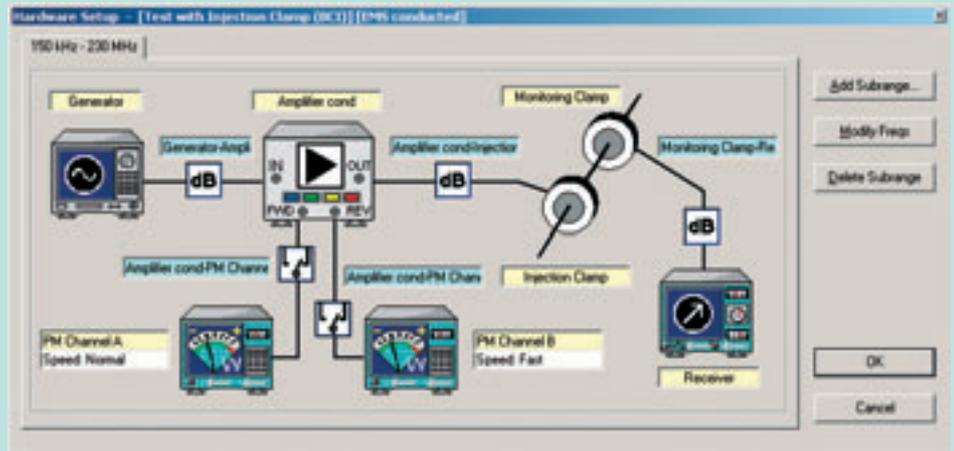


FIG 2 Device configuration for BCI measurements with a spectrum analyzer.

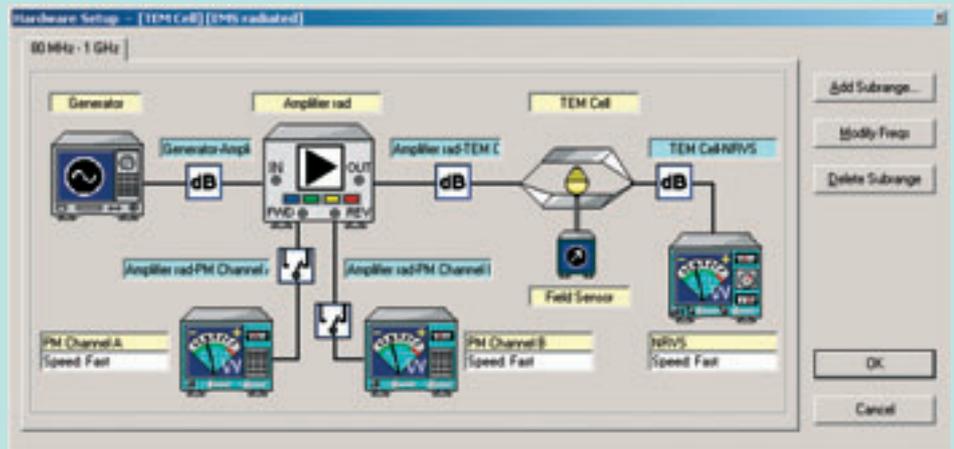


FIG 3 Device configuration for measurements in a TEM cell according to ISO 11452-3.

► Stimulation and monitoring of EUT

The most important tasks of EMC measurement software for testing ESAs and vehicles (complete systems) are to generate susceptibility and provide functions for stimulating and monitoring the EUT.

Special features for generating susceptibility parameters

A number of interesting measurement functions for generating susceptibility parameters are implemented in R&S EMC32-A:

- ◆ The test specifications for conducted susceptibility BCI (bulk current injection) provide for the measurement of amplifier harmonics and the limiting of the current susceptibility level. For this purpose, the test software allows monitoring of the harmonics by means of a spectrum analyzer or test receiver; this function can also be used for amplifier testing.
- ◆ Parallel measurement of the forward and reflected power and the susceptibility level contribute to increasing the measurement speed and EUT throughput.
- ◆ The software supports the measurement of TEM cell attenuation specified by ISO 11452-3, which ensures reproducibility of measurement results.
- ◆ Additional physical parameters, such as the system impedance of a test setup for BCI tests during operation, can be calculated from the current measurement results by means of user-definable mathematical formulas.

The following **integrated stimulation functions** in R&S EMC32-A allow the EUT to be controlled at defined times in the test sequence:

- ◆ Putting the EUT into a defined state (e.g. switching it on or off) when a measurement is started or stopped
- ◆ Triggering an action of the EUT at certain frequencies or at each test frequency and using the monitoring functions to check the EUT's response to the influence of the susceptibility parameter
- ◆ Resetting the EUT to a defined state after a malfunction has been detected

The software allows **fully automatic monitoring** of the EUT. For this purpose monitoring channels that use defined threshold values or decision windows to provide a Go/NoGo statement as a function of test frequency and the test level. The software displays the test results in a table and/or graph. It also generates a table that only contains frequencies at which an error was detected.

FIG 4 shows the software's extensive interfaces and communication possibilities with the EUT. Communication can be on the basis of physical parameters

(voltage, current, frequency, temperature) and by way of acoustic (sound level) or visual (camera) signals. A truly pioneering feature is the monitoring of the EUT via the vehicle's communication bus systems such as CAN, LIN, MOST or FlexRay.

Monitoring with measuring instruments

If communication is via physical parameters, measuring instruments (oscilloscope, TTL converter or voltmeter) are used to monitor the EUT's output signals or apply a defined signal to its inputs.

Monitoring via the CAN bus

In modern vehicles, the ESAs are linked via the CAN (controller area network) communication bus. Monitoring the data traffic on this bus makes it possible to test the functions of the individual components and of the overall system. The Stuttgart-based company Vector Informatik (www.vector-informatik.de) provides a comprehensive software/hardware solution for this purpose. In this case, R&S EMC32-A uses the open interface (COM, DCOM) of the CANoe™ analysis software to send data to a specific device on the CAN bus and to query parameters such as wheel/engine speed or indicator light frequency. The CANoe™ software

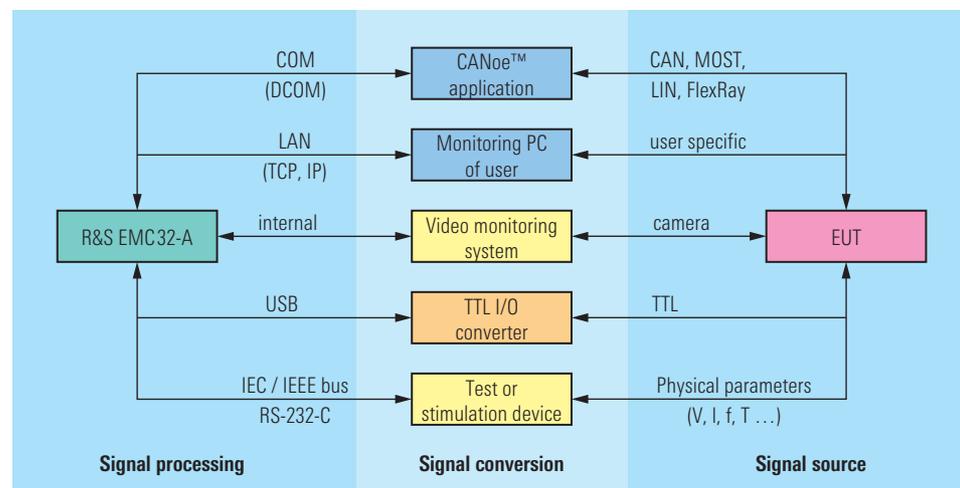


FIG 4 Monitoring possibilities with EMC Measurement Software R&S EMC32-A.

can be installed either on the same computer on which R&S EMC 32-A is operated or on another computer connected via a local network. FIG 5 shows the configuration for monitoring two parameters of a vehicle with a threshold value for the velocity; FIG 6 shows a list of the available parameters of an ABS control unit. An example of the configuration of a measurement channel is shown in FIG 7.

Automatic determination of immunity threshold

Even in the development phase, it is important to determine the characteristic of the maximum susceptibility as a function of frequency. This measurement can be automated using the extensive monitoring capabilities of R&S EMC 32-A. This fully automatic susceptibility measurement outputs two susceptibility level characteristics (hysteresis), which indicate the level at which the EUT's faulty response disappears and the level at which it reoccurs (FIG 8).

EMI measurement according to CISPR 25

R&S EMC 32-A already includes the limit lines required for EMI measurements according to CISPR 25. The EMI measurement as specified by the standard produces up to 300 000 values per measurement, which are displayed by the software in easy-to-read graphs or tables. Both the zoom functionality and the display of additional graphs allow thorough analysis of details in critical frequency ranges (e.g. LF or VHF range).

R&S EMC 32-A also supports monitoring of the EUT for correct functioning in EMI measurements. Particularly supplier companies that use classic temporary-service motors (servomotors, sliding roof, antenna motors) are faced with the

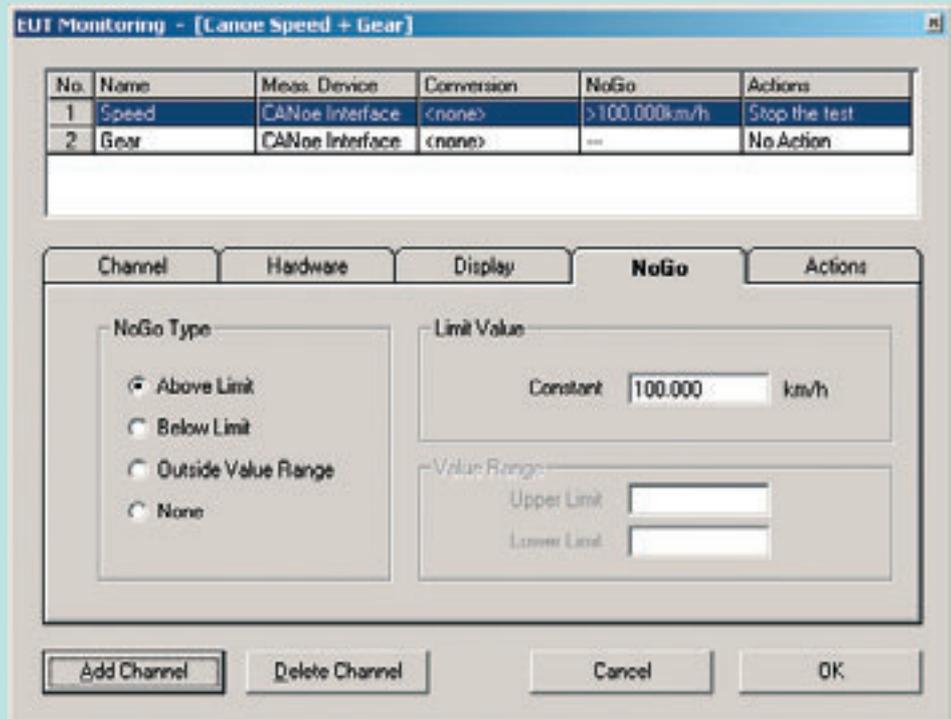


FIG 5 Configuration for monitoring the velocity and gear of a vehicle.

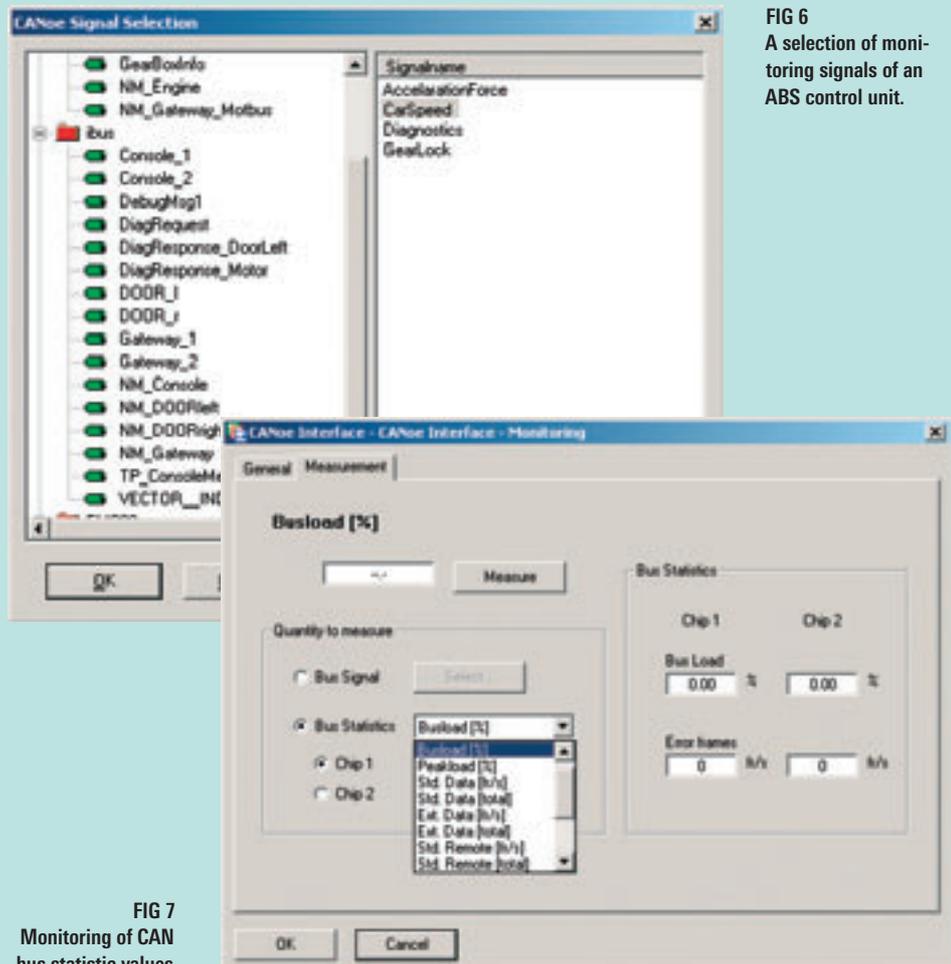


FIG 6 A selection of monitoring signals of an ABS control unit.

FIG 7 Monitoring of CAN bus statistic values.

- ▶ challenge during an emission measurement of keeping the EUT running continuously for a length of time that exceeds its duration of operation under real conditions. For this reason, Rohde & Schwarz has taken customer requirements for a flexible monitoring solution during emission measurements into account by introducing R&S EMC32-A.

Comprehensive driver package

A comprehensive driver package, which is standard with R&S EMC32-A, is used for controlling the following equipment classes:

- ◆ Signal generators / analyzers
- ◆ Power meters
- ◆ Field-strength sensors

- ◆ Amplifier control units
- ◆ Switch units
- ◆ Mast and turntable control units

To ensure the use of existing systems or of instruments from other manufacturers, configuration files for the generic drivers supplied with R&S EMC32-A can be downloaded for the following equipment classes from the Rohde & Schwarz website:

- ◆ Signal generators
- ◆ Power meters
- ◆ Amplifier control units
- ◆ EUT monitoring equipment

There you will also find an up-to-date overview of all drivers, sorted according to equipment classes, in tabular and graphic form.

Summary

EMC Test Software R&S EMC32-A is an outstanding all-in-one package for EMC measurements in the automobile sector. It features not only comprehensive functionality for stimulating and monitoring automotive components and motor vehicles but also standard-compliant generation of required immunity signals and EMI measurements. With its modular structure, the software can be easily adapted to changes in standards or manufacturer-specific test procedures and allows new measurement instruments to be integrated. It is therefore a future-proof investment.

Robert M. Gratzl; Marcus J. Donhauser

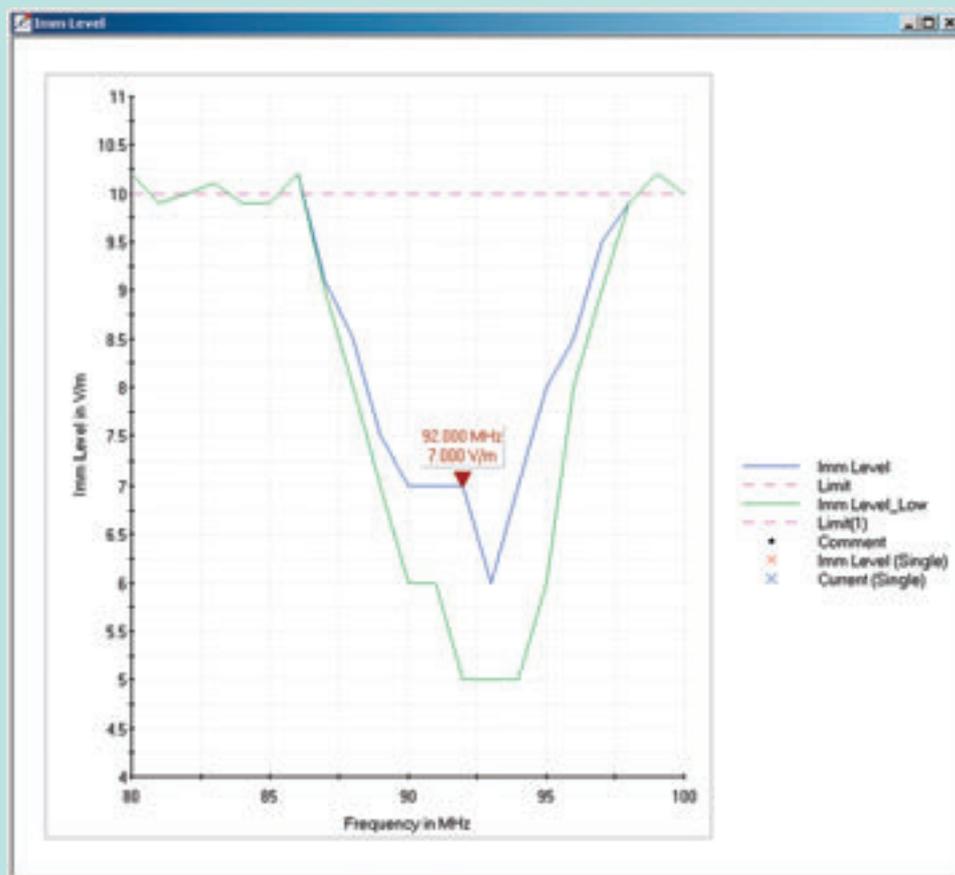


FIG 8

Result of an automatic determination of susceptibility threshold.

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



Data sheet R&S EMC32

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