EMC Measurement Software R&S®EMC32-W+

EMC measurements on mobile radio terminals

The new module R&S®EMC32-W+ extends tried-and-tested EMC Measurement Software R&S®EMC32 by EMC measurement methods, which are typically used for mobile phones and other wireless communications terminals in accordance with the ETSI families of standards EN 300 607 and EN 301 489. One of the instruments controllable with the software is the Universal Radio Communication Tester R&S®CMU200, for which a driver is available. This new module thus implements the essential functions of the R&S®ES-K1 and R&S®EMS-K1 predecessor software packages for performing measurements on mobile phones.

Electromagnetic immunity: audio breakthrough

The ETSI family of standards EN 301 489 describes the procedures for assessing the electromagnetic immunity of mobile radio terminals. The interference fields to be created correspond to those defined in the generic standards EN 61000-4-3 and -6. The measured variables (EUT monitoring, FIGs 1 and 2) to be observed, however, are specific for this EUT family and can now also be evaluated with EMC Measurement Software R&S®EMC32-W+:

- The 1 kHz AF level demodulated on the loudspeaker of the headset (audio breakthrough downlink)
- The 1 kHz AF level coupled into the microphone (audio breakthrough uplink)
- The bit error ratio of the digital radio link (for GSM phones replaced by the RXQUAL parameter)

If a measured value exceeds the permissible limit, the standard describes a method used to assess whether this EUT behavior only occurs in a narrowband frequency range or if it is broadband. For this purpose, the interfering frequency

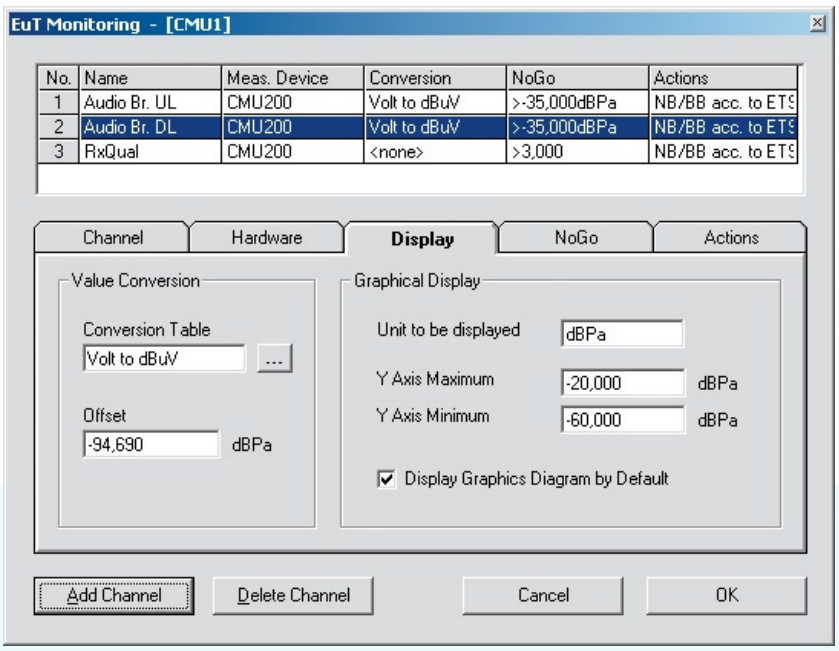

FIG 1 Definition of EUT monitoring for performing an EMS measurement on mobile phones. All three parameters are measured with the R&S®CMU200. Both audio analyzers of the radiocommunication tester are used to perform a parallel measurement of the two AF levels. A driver for the Audio Analyzer R&S®UPL is available as an alternative.

is reduced and increased by defined offsets and the measurement is repeated again. The software automatically shifts the frequency and indicates in the result table whether the effect is narrowband or broadband.

The measured AF levels are referenced to the reference levels measured before the actual measurement at defined useful levels. R&S®EMC32-W+ supports the recording of these reference levels with the new test function "Audio Breakthrough Calibration" (FIG 3).

Spurious emissions

The ETSI family of standards EN 301 489 also describes EMI measurements on mobile phones. The test methods are in line with the basic EMC publications EN 55022 and can be implemented with Software R&S®EMC32-E+ [1, 2], which is already on the market. An innovation is the integration of the Universal Radio Communication Tester R&S®CMU200, which ensures that the radio link to the EUT is maintained throughout the test.

With R&S®EMC32-W+, you can also measure the spurious emissions of GSM telephones in compliance with the ETSI standard EN 300 607-1 governing conformance tests. For other mobile radio systems, similar methods are described in the relevant ETSI standards. You then determine the maximum of the effective radiated power (ERP) that is unintentionally emitted by the EUT outside its useful channel. The software supports the common positioning devices (azimuth Φ) for radiated spurious emissions but also allows you to define an additional positioning device (elevation Θ) to tilt the mobile phone (FIG 4). The elevation parameter is then included in the test sequence definition in order to find the maximum emission (FIG 5).

In contrast to common EMC standards, which stipulate the use of the quasi-peak detector and EMI filters with 6 dB bandwidths, ETSI EN 300 607-1 calls for maxima (peak detector) to be measured with 3 dB analyzer bandwidth. To meet this requirement, the software is equipped with a special driver that controls the EMI Test Receiver R&S®ESIB in such a way that the scans and individual measurements usually running in the receiver mode are emulated by zero span measurements in the analyzer mode.

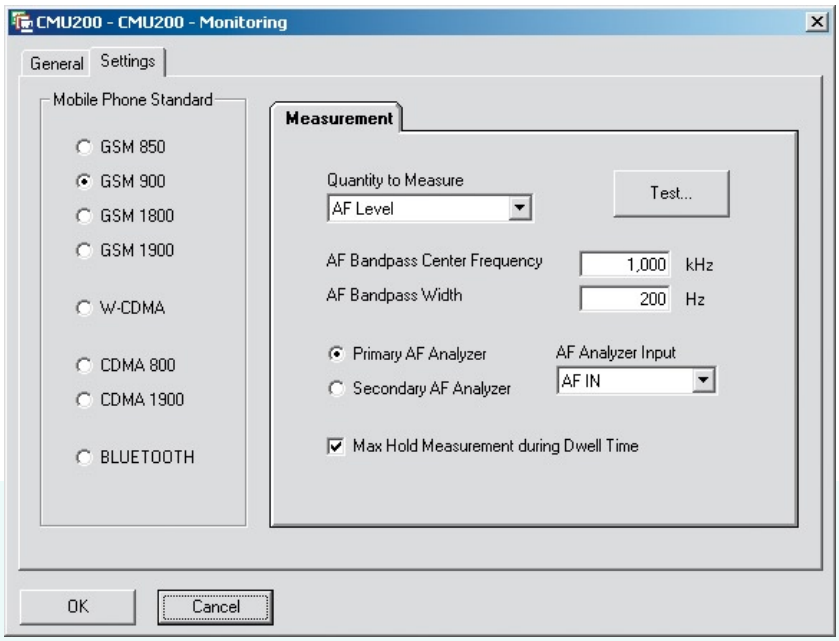

FIG 2 Entry window for programming the R&S®CMU200 for measuring an AF level. Marking the check box "Max Hold Measurement during Dwell Time" results in a fast cyclical measurement of the level in order to determine the highest demodulated level before the noise cancellation algorithms of the mobile phone become active.

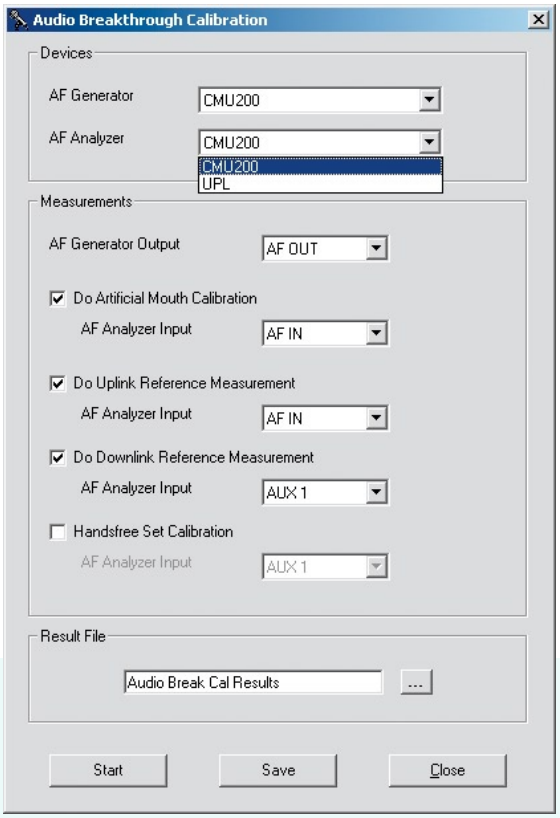

FIG 3 Dialog field for recording the AF reference levels. The method requires manual intervention of the user. The software provides the user with essential information.

The standard specifies the measurement of spurious emissions as substitution measurement: You first have to find the direction in which the EUT sends its maximum emission and then replace the EUT by a generator and a standard dipole. Subsequently, you have to set the generator so that the same value is measured. Since the user often has to intervene, it is difficult to automate this method. A precalibration of the test path is therefore permissible. The attenuation of the path is recorded in the anechoic chamber using a calibrated transmitting antenna. When the measurement is made, the measured power will then be corrected by this attenuation, allowing the power actually radiated by the EUT to be calculated.

When measuring spurious emissions, you have to take into account that the available mobile radio carriers, especially the BCCH, are also received by the measuring equipment. They may overload the receiver input and result in intermodulation. You therefore use tunable bandstop filters, which can suppress a very narrow frequency band (ideally a GSM channel of 200 kHz) with a high attenuation (>40 dB). Although it is quite difficult to tune these filters, which normally have at least six poles, R&S®EMC32-W+ supports you by offering the new mode "Notch Filter Tuning" in the calibration configuration for system paths.

Summary

EMC Measurement Software R&S®EMC32-W+ includes the essential functions offered by the tried-and-tested software packages R&S®ES-K1 and R&S®EMS-K1 for performing measurements on mobile phones. This underlines the flexibility and upward compatibility of the R&S®EMC32 platform, which features a consistently modular structure and an adaptable device driver concept. The software now supports all methods for securing the EMC of mobile phones. These methods are implemented at many locations using Rohde & Schwarz systems.

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More information at www.rohde-schwarz.com (search term: EMC32)

REFERENCES

[1] EMI Measurement Software R&S®EMC32-E+: All-purpose software for complete EMI measurements. News from Rohde & Schwarz No. 184 (2004), pp 42–45

[2] EMC Test Software R&S®EMC32-A: Versatile EMS and EMI measurements for the automobile sector. News from Rohde & Schwarz No. 178 (2003), pp 36–40

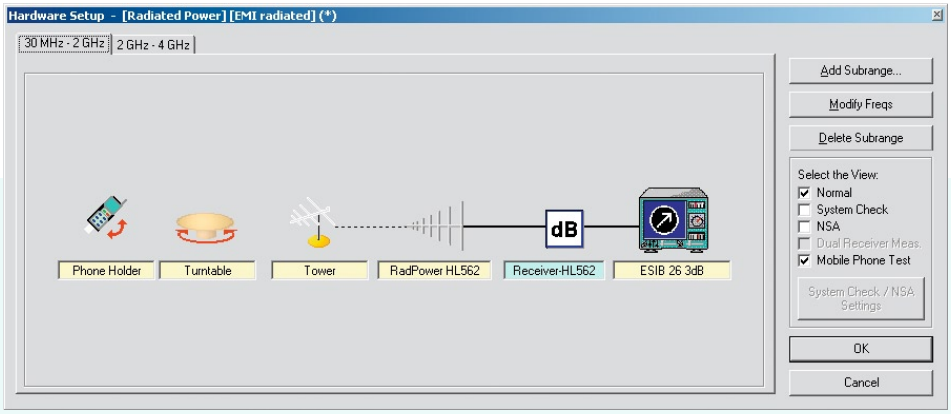

FIG 4 Hardware setup for measuring radiated spurious emission with tilting equipment for mobile phones.

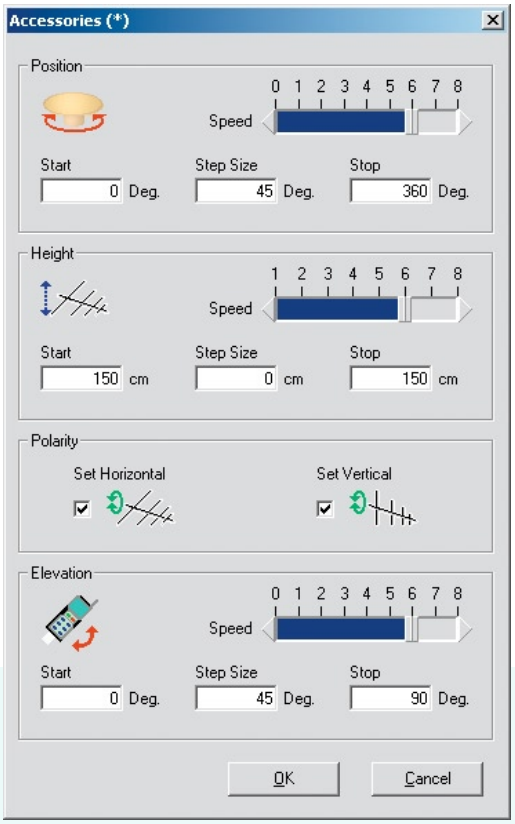

FIG 5 Parameterization of accessories for positioning the EUT and the test antenna. In addition, priority levels can be assigned to each accessory to optimize the positioning order with regard to achieving a short measurement time.