

Immunity Test System RIS 3000 / RIS 6000

acc. to IEC/EN 61000-4-3

Description

The setup of a radiated immunity test system can be done in the conventional way with many separate instruments or in a more comfortable and less risky way with our new EMC control unit, type ECU-3I-6 (please find a detailed description on pages 9 - 13).

In both ways the components which are needed for such a system are in principle the same:

- Signal Generator
- RF-Power Amplifier(s)
- Directional Coupler(s)
- RF-Power Meter
- Antenna(s)
- RF-Field Strength Meter
- Set of RF-Cables
- Control PC and Control Software

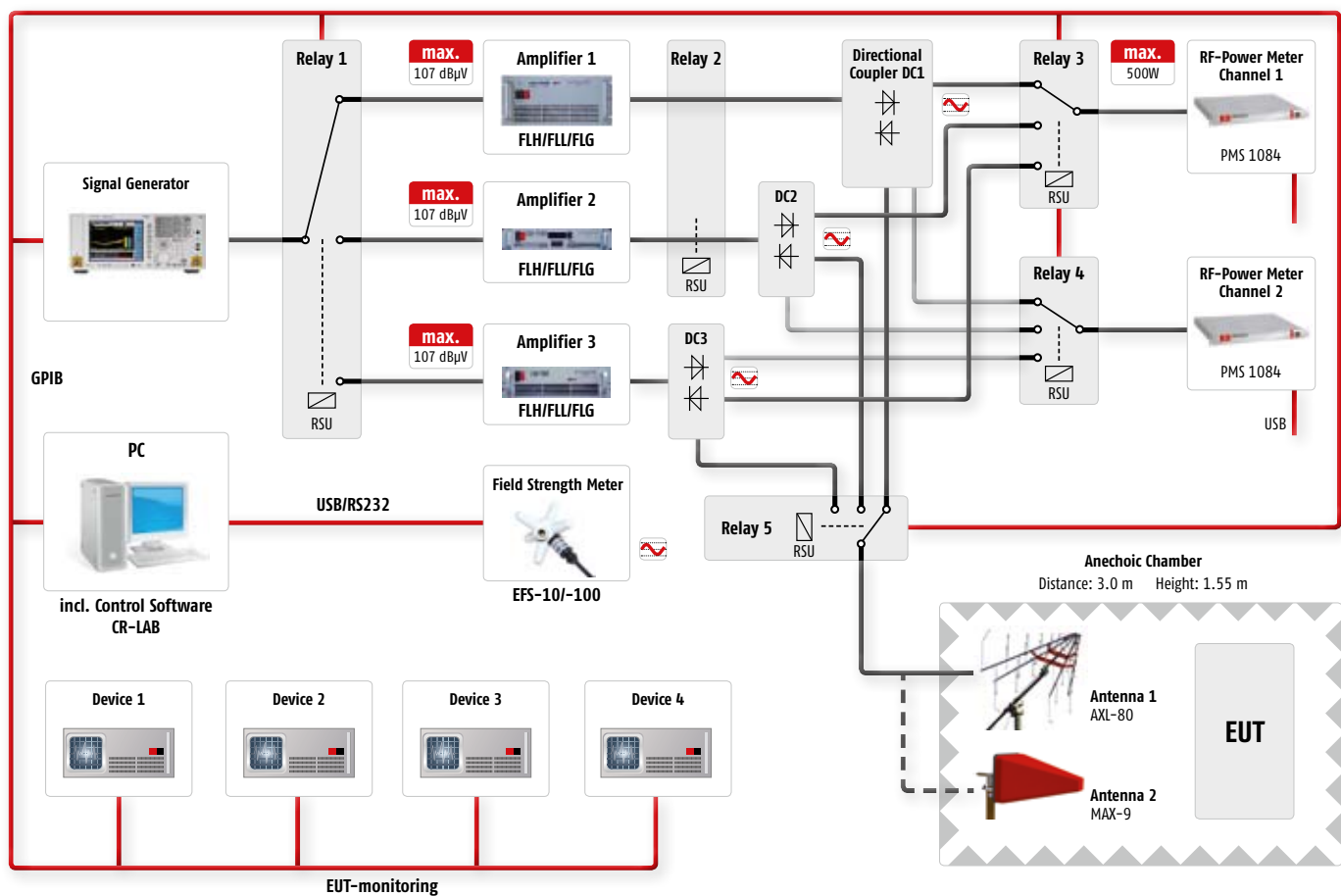


Diagram no. 1

Conventional setup of a radiated immunity test system acc. to IEC/EN 61000-4-3 by means of separate instruments.

Control Computer

The controller is a standard PC with operating system Microsoft® Windows. Depending on the system layout GPIB (IEEE488) with National Instruments interface card, serial bus RS232, USB and other bus systems are supported.

Control Software

CR-LAB is fully compliant to IEC/EN 61000-4-3, IEC/EN 61000-4-20, automotive and MIL standards. The software CR-LAB controls the complete test system and creates the test report. It performs measurement of the uniform area and generates reference calibration data from it. Alternatively reference data can be measured directly. Tests may be performed manually and fully automatic. A full automatic monitoring of the EUT's (Equipment Under Test) function is possible whenever its compliance can be controlled with preset tolerance limits. Up to four values can be monitored and recorded for example by means of multimeters.

Essential data of the software are:

- Microsoft® Windows platform
- Simple operator's guide
- Online help function
- Presentation of the results in online graphics and reports
- Export function of the files for further processing under Microsoft® Word, Microsoft® Excel,...
- Measurement of homogeneous field incl. evaluation
- Calculation of reference data
- 2dB saturation test on base of homogeneous field measurement compliant to standard
- Measurement of reference data with fixed test level or profile of level vs. frequency
- Permanent VSWR control during test and operator defined limitation as well as restriction of max. input level of amplifier and max. allowed output power
- Automatic multiple repetition of test
- Manual test mode
- Manual increase/decrease of test level
- Automatic test mode incl. monitoring of the EUT
- Handshake function to EUT via serial interface
- Easy and fast graphical device set-up, system layout can be printed
- Fully compliant to IEC/EN 61000-4-3, IEC/EN 61000-4-20, automotive- and MIL standards
- Control of the test system by GPIB, USB interfaces,...
- Customized modifications possible

Signal Generator

As signal source a commercial signal generator or the built-in signal generator of our EMC test & control unit ECU-3/-6 is used. It should cover at least the required frequency range such as 80 MHz to 6 GHz and allow amplitude modulation with a sine wave of 1 kHz and 80 %, as requested by the standards. Besides, it should meet the requirements regarding frequency step width (1 % of the preceding value). If the equipment offers further modulation depth and modes, as well as a higher frequency range and smaller steps, this might be advantageous for future applications. Minimum requirements are as following:

- Frequency range: 9 kHz – 3.0 GHz (6.0 GHz)
- RF output: -40 dBm to 0 dBm
- Frequency resolution: 1 Hz
- Level resolution: 0.1 dB
- Amplitude modulation: 0 to 99.9 %
- Further modulation types: frequency modulation, phase modulation, pulse modulation
- Interface: GPIB (IEEE-488), RS232, USB



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RF-Power Amplifier

The software controls the level of the signal generator output for each test frequency. This signal level is amplified by the power amplifier output in order to generate the required test field strength around the EUT. It depends on the testing setup, the distance between EUT and antenna (1 m - 3 m) and the test level / test field strength (1 V/m, 3 V/m, 10 V/m or special requirements) whether an amplifier output of 10 W, 30 W, 200 W - 2 kW is required. Normally, field strength of 10 V/m, with 1 kHz / 80% AM, can be obtained with a 200 W amplifier in a testing distance of 3 m.

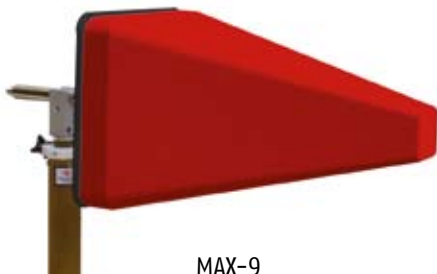
Main characteristics

- Type: Frankonia FLH, FLG,
- Frequency range: 1 MHz- 6 GHz
- Nominal output: 4 W ... 2000 W
- Input for nominal output: 107 dB μ V (0 dBm)
- Impedance: 50 Ω



RF-Power Meter / Directional Couplers

While testing the field strength probe is replaced by the EUT. A power measurement during the test runs assures that the EUT is actually exposed to the requested test condition. Thus a directional coupler is connected with the amplifier output. A power measuring device type PMS 1084 determines the forward and reverse power up to 6 GHz. Both are stored and recorded by the control software. For this purpose directional couplers are connected with the amplifier output or the built-in directional couplers of our EMC test & control unit ECU-3/-6 is used. The forward and reverse power is measured by our RF-Power Meter PMS 1084 or by the built-in power measuring channels of the ECU-3/-6. Both metering values are recorded and stored by the control software CR-LAB.



MAX-9

Transmitting Antenna(s)

Broadband antennas, like our model AXL-4000, which cover the whole frequency range from 80 MHz up to 4 GHz may be used as a single-antenna-solution. The advantage of these antennas is that they can be used for immunity tests as well as for emission measurements. In order to save amplifier power and costs it is recommended to use so called double stacked log.-periodical antennas for immunity tests, like our model AXL-80. This antenna type offers a much higher gain compared to the above described broadband antennas. For our systems we recommend the following antenna types:

- 30 MHz - 4 GHz, type ALX-400
- 80 MHz - 4 GHz, type AXL-80
- 1 GHz - 6 GHz, type MAX-9

As an alternative horn antennas can be used in the GHz range if a max. uniform area of 1.0 m is sufficient.

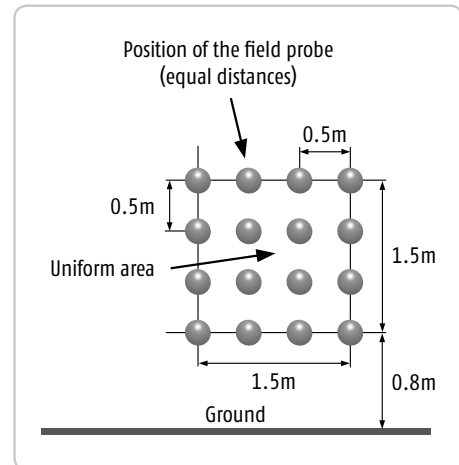


AXL-80

Function and operation of the test system

Homogeneous Field / Uniform Field

To assure the reproducibility of the immunity test, the standard prescribes the homogeneity of the field generated. The immunity test system incl. anechoic chamber must guarantee a homogeneous field within a size of 1.5 m x 1.5 m in a distance of 1 m to 3 m from the transmitting antenna, (e.g. Frankonia type AXL-80). If a smaller surface is sufficient for exposing the EUT and its connection cables to radiation, the homogeneous field can be reduced to 0.5 m x 0.5 m. The lowest part of the homogeneous field surface is situated at 0.8 m above the floor. The level to be set is the max. intended test level incl. modulation. That means for 10 V/m incl. 80 % AM a level of 18 V/m must be provided. To assure the correct display of the field probe the measurements are performed without modulation in the empty anechoic chamber. The homogeneous field has to be established in 1 % steps, starting from 80 MHz up to 6 GHz. The field homogeneity for the respective frequency is met, if the difference between the highest and lowest field strength value lies in between 0 dB and +6 dB (12 of 16 measuring points within a field size of 1.5 m x 1.5 m or 4 of 4 measuring points within a field size of 0.5 m x 0.5 m). The high requirements regarding field homogeneity cannot be met by normal RF-shielded cabins (without absorber lining). The software uses these data to check the 2 dB saturation of the system as required by the standard.



Calculate Reference File

According to the standard the reference data of desired test field strength shall be calculated from data measured in the field homogeneity measurement. This can simply be done by use of this function with our control software CR-LAB.

Individual Reference Measurement

Reference data can be determined with two different methods: <Calculate Reference File> (from data of homogeneous field) and <Individual Reference Measurement>. The software supports individual measurement of reference files. This might be necessary if a defined test level at a defined EUT-position or a profile of test level versus frequency is requested.

Testing

The test setup is described in diagram no. 1 and no. 2. On basis of the reference data (reference calculation or reference measurement) determined for the respective test setup, the required test level and/or test field strength is adjusted reproducibly in the test run by means of the control software for each frequency step. For this purpose, the signal is amplitude-modulated with a sine wave of 1 kHz / 80%. The verification of the EUT's function is performed manually (optically) or, if possible, automatically. In the latter case the EUT's function is tested by means of max. four measuring values with respect to its compliance with preset tolerance values. The determined data, the results, a description of the test system as well as a comment regarding the measurement are summarized by the software in a measuring record. The data can be printed as well as exported into other data processing programs, e. g. Microsoft® Word or Microsoft® Excel.

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RF-Field Strength Meter

A field strength meter is necessary for the measurement of the uniform area. It should be of small size in order to avoid disturbances of the field by the physical size of the field strength meter itself. The data transfer from the anechoic chamber to the control room should be via fibre optic link. It makes sense to integrate the fibre optic converter directly into the sensor because long conductive cables could influence the accuracy, too. The test frequency range from 80 MHz to 3 or 6 GHz should at least be covered by the field strength meter. We suggest the use of our field strength meter type EFS-10/100 which works in the frequency range from 10 or 100 kHz up to 9.25 GHz and with a max. field strength from 0.14 V/m to 500 V/m



RF-Relay Switching Unit RSU

In most cases two or three RF-power amplifiers and two different antennas are needed to cover the whole test frequency range. It would be very time-consuming to change the cabling between the different amplifiers, antennas and power meters manually. For this purpose software controlled switching relays are used, as they work much faster and without any damage to the RF-cables, which might be caused by changing the connections manually. Furthermore, cabling mistakes cannot occur.

Control Software CR-LAB and RF-Cabling

It is rather impossible to set all frequency steps and output levels of the signal generator manually. Also the necessary recording of forward and reverse power as well as the EUT-monitoring would be very time consuming. Not to mention the measurement of the uniform field and the calculation of the forward power, which is needed for each frequency step at each test level. All that is done in a very comfortable way by our control software CR-LAB. With CR-LAB you just select your start/step frequency and your test level. Anything else is carried out by the software automatically.

The RF-cabling work is a very important part of a radiated immunity test system, as the cable-attenuation could finally decide whether you reach your test level or not. All essential RF-cables are included in our systems and in the calculation according to the required amplifier output power.



System installation in a 19"-Rack RIS 3000 / RIS 6000

On request the test systems supplied are installed into a 19"-rack. The picture on the left shows an example of a radiated immunity test system acc. to IEC/EN 61000-4-3, type RIS 3000.

Features:

- Moveable rack (on big rubber wheels)
- Instruments are installed into rack and cabled
- Main switch
- Easy mountable cover for front and rear side of the rack included
- Typical dimensions (HxDxW): 1,270 x 710 x 540 mm
- Weight without instruments: 50 kg