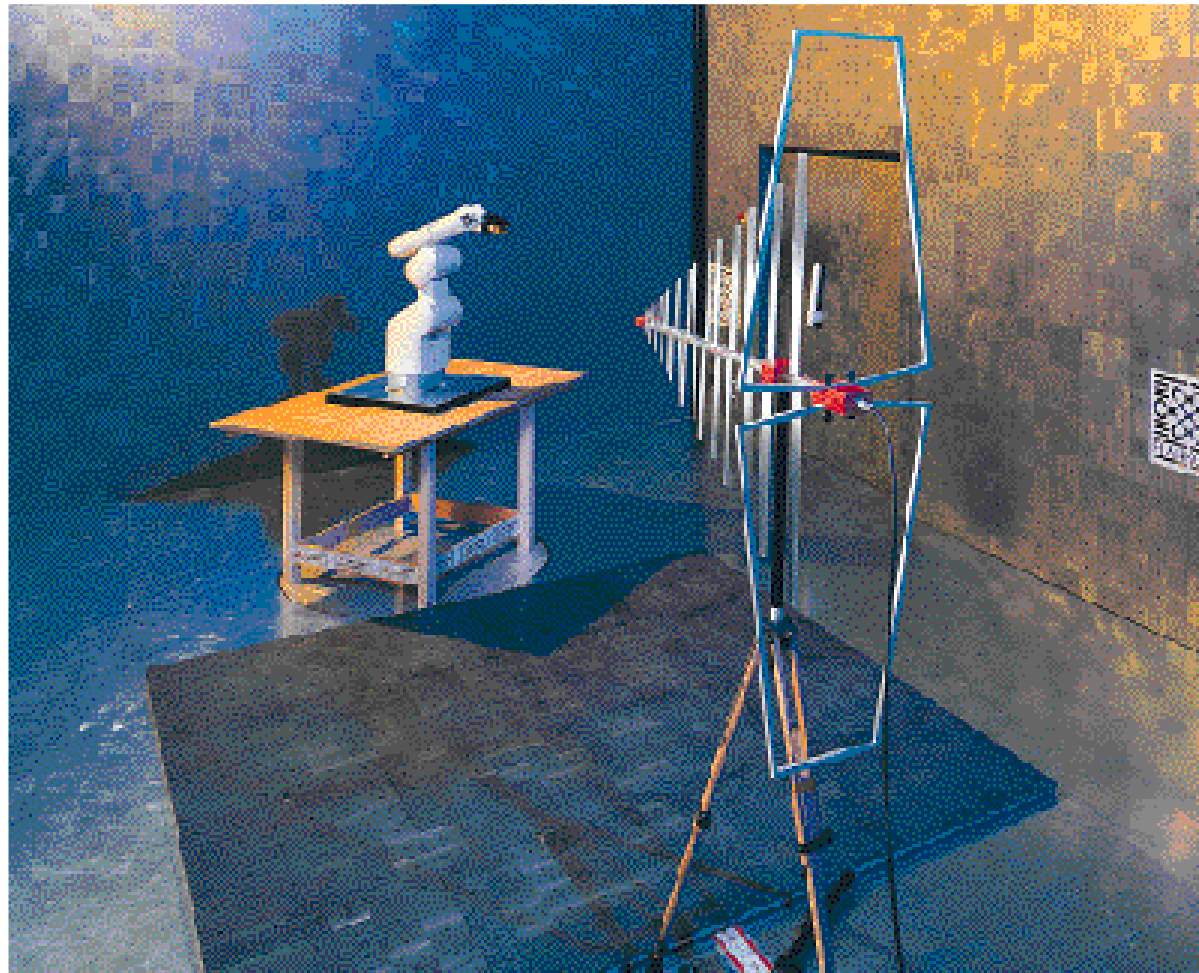


Immunity Test System According to IEC 61000-4-3



We design and supply turnkey
EMC-Laboratories, including the test
environment (anechoic chamber).
This guarantees 100% compatibility between the
test instrumentation and the anechoic chamber.

For testing a test specimen with respect to immunity to RF interference in the frequency range from (26MHz) 80 MHz to 2000 MHz according to IEC 61000-4-3, (EN 61000-4-3) the EUT is exposed to a defined radiated electromagnetic field. To avoid influences on the equipment located in the environment and on the radio services, as well as for reasons of personal safety, this test should be performed in RF shielded rooms.

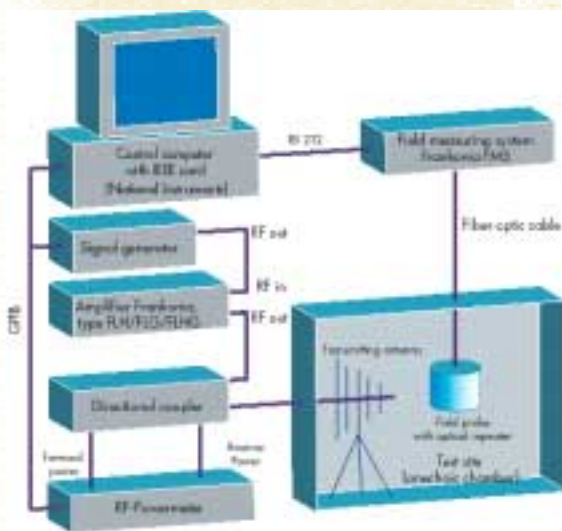
Contrary to this, when performing immunity tests according to IEC 61000-4-6, in the frequency range 150 kHz to 80 MHz (230 MHz), the EUT is exposed to conducted interference voltage. This applies to all EUT with at least one circuit connection (power line, signal line, ground line). During the test process the interference is coupled directly onto the lines to be tested. More detailed information is given in our information sheet „Immunity Test Systems According to IEC 61000-4-6“.

The described immunity test systems are to some extent composed of the same testing and measuring equipment. Therefore, these components have to be acquired only once.

Set-up of test systems for testing in anechoic chambers

Block diagram 1 shows the set-up required for the determination of the reference data.

In the following, the measuring and testing equipment is described in detail.



Block diagram 2: Set-up of a test system according to IEC 61000-4-3 for the determination of the reference data.

Control computer

A commercial IBM compatible PC and Microsoft Windows 95 or higher can be used with Pentium processor, with at least 16 Mbyte RAM memory and a screen resolution of 800 x 600. For controlling the test system it is necessary to have a GPIB interface (IEEE-488) card of „National Instruments“ installed.

Control software

The control software „RF-LAB“ controls the complete test system and prepares the test record. It performs calibration runs and stores the data thereof (see also reference run and test run). Tests may be performed manually and fully automatically. A fully automatic monitoring of the EUT's function is reasonable in all cases where the EUT's compliance with preset tolerance limits can be monitored for up to four values to be measured. Besides, the software supports the measurement of the field homogeneity of anechoic chambers.

- Further essential data of the software:
- ◆ Microsoft Windows platform (WIN 95, WIN 98, WIN NT)
 - ◆ Simple operator's guide
 - ◆ On-line help function
 - ◆ Presentation of the results in on-line graphics
 - ◆ Export function of the files for further processing under Microsoft Word or Microsoft Excel
 - ◆ Step width, test voltage and frequency range can be selected at discretion
 - ◆ Control of the test system by IEEE-488 bus and RS232 bus
 - ◆ Customized modifications possible

Signal generator

A commercial signal generator is used as signal source. It should cover at least the required frequency range from 26 MHz to 2000 MHz and allow an amplitude modulation of the test signal 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 depths and procedures, as well as frequency steps, this is an advantage because it is then perfectly equipped for the future, in case the Standards should be modified in this respect. The main data of a typical signal generator are as follows:

- ◆ Frequency range: 9 kHz - 2,0 GHz
- ◆ RF output: -140 dBm to +13 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)

RF Power amplifier

The software controls the level of the signal generator output with respect to the frequency. This level is increased by the power amplifier to such an extent that the required test field strength is available at the EUT. It depends on the testing set-up, the distance between EUT and antenna (1m,...,3m), and the test level/test field strength (1V/m, 3V/m, 10V/m or special requirements) whether an amplifier output of 10W, 30W, 100W,... is required. Normally, a field strength of 10V/m, with 1kHz / 80% AM, can be obtained with a 100W amplifier in a testing distance of 3 m.

Main data:

- ◆ Type: Frankonia FLH, FLG or FLHG
- ◆ Frequency range: 26 MHz - 2000 MHz
- ◆ Nominal output: 10W ... 100W
- ◆ Feeding for nominal output: 1.0 mW (0dBm)
- ◆ Impedance: 50 Ohm

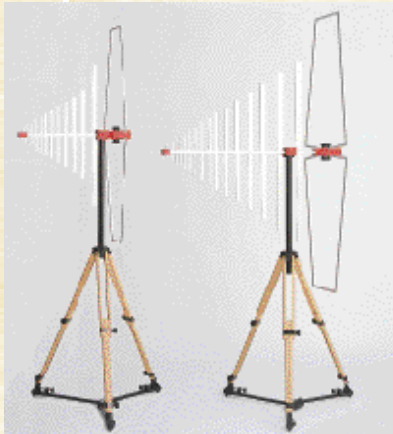


Transmitting antenna

The broadband antennas Frankonia BTA-H/L cover the whole frequency range from 80 MHz to 2000MHz. A time-consuming changing of antennas is no longer necessary. The antennas are equally suitable for emission measurements and may be loaded by up to 1000 W.

Main data:

- ◆ Type: Frankonia BTA-H/L
- ◆ Frequency range: 30 MHz/26 MHz - 2000 MHz
- ◆ Impedance: 50 Ohm
- ◆ Weight: 3 kg / 5 kg



Power measurement

During testing the field strength probe must not be located in the anechoic chamber because it may influence the test result unacceptably. A power measurement during the reference run/test runs assures that the EUT is actually exposed to the requested test conditions. For this purpose, a directional coupler, which is suitable as regards frequency range and power, is inserted in the test circuit behind the amplifier output. A connected 2 channel power measuring equipment determines the forward power as well as the reverse power which are stored and recorded by the control software.

Field strength measurement

The field strength measuring system type FMS consists of the evaluation unit, an isotropic probe and a fibre-optic converter. The system is used for the measurement of the field homogeneity of the anechoic chamber as well as for the performance of the reference runs.



Main data:

- ◆ Frequency range: 10 Hz to 18 GHz (different probes)
- ◆ Max. field strength: 30 V/m; 120 V/m; 350 V/m (depending on the probe)
- ◆ Max. operating time with rechargeable battery: 12 h

Set-up of test system for testing in the „TEM-pact“ GHz TEM Cell

According to IEC 61000-4-3, TEM Cells are admissible as alternative test site to anechoic chambers, provided that the volume of the homogeneous field, in proportion to the EUT, is big enough. The testing set-up is similar to that in the anechoic chamber. However, there is no transmitting antenna since the cell itself fulfills this function. The performance of a power measurement is not necessary. Instead, the field strength is documented during measurement. The inner conductor divides the cell into two symmetric parts. The probe, located in the upper part of the cell, allows the measurement of the field strength without influencing the field conditions in the lower part. For equivalent test levels, a lower amplifier power is required than in the anechoic chamber. For the generation of a field of 10 V/m, with amplitude modulation of 1 kHz sine wave / 80 %, a 10 W amplifier (FLH 10) is sufficient.

Reference run and test run

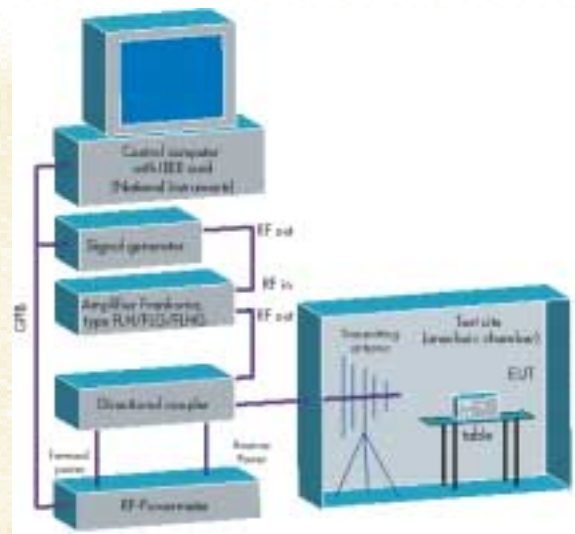
The procedures for reference measurement and testing in the anechoic chamber and in the „TEMPact“ GHz TEM cell are similar.

Reference measurement

The components of the testing set-up (amplifier, antennas, cables, measuring environment) are not linear over the frequency range 80 (26) MHz to 2000 MHz. For this reason, a reference run has to be performed for each selection of equipment, antenna, antenna polarisation and test field strength. The set-up of the test assembly for determining the reference data is set forth in block diagram 1. The measurement is performed in the empty anechoic chamber, i.e. without EUT. Proceeding from the start frequency, and for each subsequent frequency step, the control software determines the respective output level of the signal generator, at which the requested field strength (without modulation) is reported by the field strength measuring system. The frequencies, the respective levels and the power are stored in a reference file. This reference data is required for performing the subsequent test runs. A new reference run must be performed only if new components are used in the measuring system or within defined intervals. This assures the reproducibility of the tests.

Testing

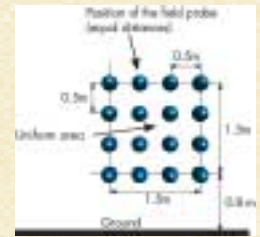
The testing set-up is described in block diagram 2. On the basis of the reference data determined for the respective testing set-up, the required test level and/or test field strength is adjusted reproducibly in the test run by means of the control software for each frequency step. For this purpose, the signal is amplitude-modulated with a sine wave 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. 4 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 output is realized by a printer connected to the PC. The data can be exported for further processing in other data processing programs, e.g. Microsoft Word and Microsoft Excel.



Block diagram 2: Set-up of a test system according to IEC 61000-4-3 in the test run.

Homogeneous field

To assure the reproducibility of the immunity tests, the Standard prescribes the homogeneity of the field generated. The anechoic chamber must guarantee a homogeneous field within the size 1.5 m x 1.5 m in a distance of 1 to 3 m from the transmitting antenna, e.g. Frankonia type BTA. 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. 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 (26 MHz) up to 2000 MHz. The requested field homogeneity for the respective frequency is met, as soon as in 12 measuring points out of 16 (1.5 m x 1.5 m), or in 4 measuring points out of 4 (0.5 m x 0.5 m) the difference between the highest and the lowest field strength value amounts to 0dB to +6dB. The high requirements regarding field homogeneity cannot be met by normal RF-shielded cabins because of reflexions. It is necessary to line the shielding walls with absorbing material (pyramid or ferrite absorbers) in order to attenuate the reflexions. The Standards allow to use (GHz)TEM Cells like the Frankonia „TEMPact“ as an alternative test room. Due to the limited space in the TEMPact only EUT with dimensions not exceeding 75 cm x 45 cm x 25 cm (L x W x H) can be used. Please request our information material regarding anechoic chambers and GHz TEM Cells.



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