

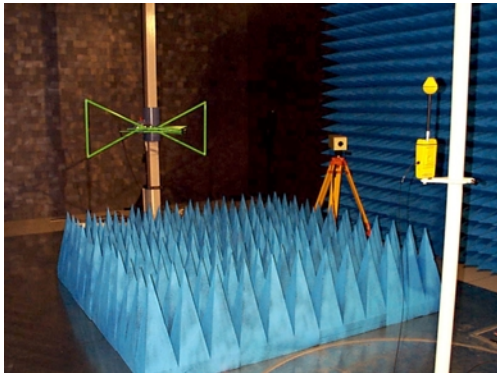
# Systems & Projects

EMC Centre of the University of Liège, Belgium



Since October 1998, the EMC Centre of ULg (University of Liège) is fully operational in order to test and certify a diversity of products which have to comply to the European EMC directive.

The EMC Test Centre has been realised in close cooperation with Rohde & Schwarz Belgium, who was in charge of the turnkey project management.



## Standards

At the moment, ULg is able to test according to the following standards :

### Generic Standards

- EN50081-1, -2
- EN50082-1, -2

### Basic Standards

- EN61000-3-2, -3
- EN61000-4-2, -3, -4, -5, -6, -8, -11, -13, -29

### Product Standards

- EN55011, EN55014, EN55014-2, EN55015, EN55022
- CISPR24
- EN60601-1-2
- ...

### ETSI

- ETS300-279, ETS300-339, ETS300-445, ETS300-680-1, -2, ETS300-683, ETS300-684
- ETS300-329, ETS300-342-1
- ...

## Products which can be tested

- electromedical apparatus (radio-therapy, ultrasound / microwave equipment, electro-surgery, ...)
- ISM (industrial, scientific and medical equipment)
- household equipment (dryers, refrigerators, ovens, ...) and electrical tools
- lighting equipment
- ITE (Information technology equipment) like PCs and peripherals
- Analog & digital radiocommunication equipment (GSM, DECT) and short range devices (SRDs)

## Anechoic Chambre and Control Room

With respect to the existing building, an anechoic chambre with approximate inner dimensions of  $l \times w \times h = 10 \times 6 \times 6$  m is used for radiated emission and immunity tests. The shielding of the chambre is specified up to 18 GHz, by using appropriate shielding materials, filters and honeycombs.

Access to the anechoic chamber is provided by a single leaf door of 2 m x 2.4 m (wxh).

The absorbing material consists of ferrite tiles, which work in the frequency range from 26-1000 MHz. They have been extended by pyramidal foam absorbers covering the frequency range from 1 to 18 GHz.

For emission tests, the floor is reflective. For immunity tests, the reflective floor is covered by movable pyramidal absorbers.

Adjacent to the anechoic chambre, a shielded control room of 6x4x3 m houses the test systems.

## Test Systems

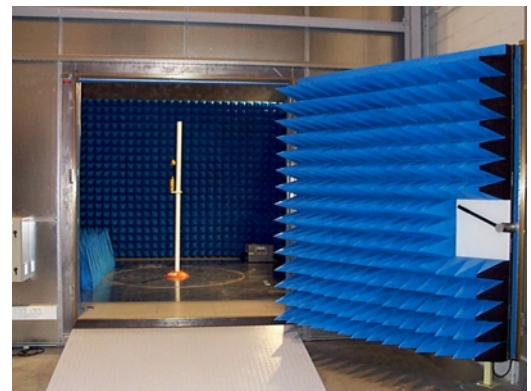
Based on the analysis of applicable standards, the following test systems have been configured, especially adapted to the requirements of ULg, allowing maximum flexibility in the future.

## RFI Emission Tests

The emission measurements are performed via the **powerful EMI Test Receiver ESI26**, which covers the frequency range from 20 Hz to 26.5 GHz, and combines excellent EMI RF characteristics for fully compliant measurements acc. to CISPR16, with high speed spectrum analysis functions.

Three LISNs are used : a **LISN ESH3-Z5** for single phase AC powered equipment, a **LISN ENV4200** for three phase AC powered equipment up to 200 A, and a **LISN ESH3-Z6** for DC powered EUTs. These conducted emission measurements are done on a **wooden table** in the control room, or in the anechoic chamber in case of floor standing equipment.

A single **BILOG antenna** covers the whole frequency range from 30 MHz to 2 GHz.



Two **microwave antennas HL025** are used for fieldstrength measurements from 1 to 26.5 GHz. One antenna is equipped with an integrated low noise preamplifier. The second antenna is used for the application of the substitution method and measurements of ERP (Effective Radiated Power). Therefore a **microwave signal generator SMP03** up to 27 MHz is used.



The **automatic mast HCM** offers the user great flexibility in controlling antennas. It does not influence the accuracy of the measurement results, due to an adequate choice of materials and remote control system (**Controller HCC** via fibre optics).

The **automatic turntable** of 2m diameter is integrated in the floor and assures groundplane continuity. It can handle EUTs up to 1000 kg, and is remote controlled via a controller located in the control area.

For measurements of RFI Power or shielding effectiveness, an **absorbing clamp MDS21** is placed on the **automatic clamp rail HCA**, controlled by a **HCC**.

All emission measurements are automated by **the EMI Software ES-K1**, which runs under Microsoft Windows. It simplifies the reporting facilities, and enables further dataprocessing via commercial software (like EXCEL)

## RFI Immunity Tests

The EMS test system performs conducted immunity tests from 150 kHz to 230 MHz, as well as radiated immunity tests from 80 MHz to 2 GHz.

The test system consists of a signal generator SMY02, followed by three power amplifiers.

A 100 W amplifier from 80-1000 MHz drives a log.-periodic antenna generating (pulse or modulated) fields over 10 V/m at 3 m distance. A 150 W amplifier from 10 kHz-220 MHz is used for conducted immunity tests with different CDNs and an injection clamp. The conducted tests are done on a wooden table with metal surface.

The third amplifier delivers 50 W from 1 to 2 GHz.

All three power amplifiers are followed by directional couplers for the measurement and control of the output power. The RF power (normal and Peak-Envelope-Power) is measured by the dual channel power meter URV5.

The amplifiers, signal paths and power control units are automatically switched by the System Control Interface Unit SCIU.

All system components are controlled via the EMS System Software EMS-K1, allowing full automatic test runs.

For observation of the EUT, a shielded colour camera system and a microphone system are available.

For the measurements of EUTs according to ETSI standards, the EMS Test System has been extended with an EUT monitoring system. It allows to measure any parameter of an analog or digital transmitter/receiver, thanks to the use of the Radiocommunication Service Monitor CMS52 and the Digital Radiocommunication tester CMD65. Audio signals are applied to the EUT by means of acoustic tubes, artificial mouth / ear and test heads. The audio analyzer UPL takes care of all audio measurements.

The EMS Test System allows full automatic EUT monitoring during the immunity test, thanks to the powerful EMS Immunity Software.



## Transient Immunity Tests

An **ESD simulator ESD30** allows electrostatic air discharges up to 18 kV, and contact (relay) discharges up to 8 kV.

Electric Fast Transients and Surges are generated by a **Combined Transient Immunity Generator UCS500**. The high voltage transient pulses are coupled in the EUT via the external 3 phase coupling matrix or via a **capacitive coupling clamp**.

The **Telecom Surge Simulator TSS500** is generating the so-called CCITT pulses (10/700  $\mu$ s), for testing equipment with telecommunication I/O lines (modems, ...).

## LF EMI and EMS Tests

For measurements on the 50 Hz power supply line, the standards EN61000-3-2&3 are applicable.

**Harmonics** are measured by using a **Real-Time Harmonic Analyzer**, which measures the harmonics across a shunt resistance. The AC source consists of a **4 channel Programmable Oscillator** followed by **three 5000 VA Power Amplifiers**.

**Flicker** is measured by means of a **Flickermetre** which analyses the AC voltage supply to the EUT via a **3 phase LISN** (complex impedance).

Since the test system is built up around a variable source with power amplifier, these components can also be used for tests according to EN61000-4-8 (magnetic immunity), by adding a **triaxial Helmholtz coil of 1.5x1.5x1.5 m** in which the EUT is placed. Fieldstrengths of up to 1000 A/m can be generated.

The **voltage dips, variations and interruptions** acc. to EN61000-4-11/29 are also generated by this test system.

Furthermore, the freely programmable generator allows interharmonic immunity testing according EN61000-4-13, and makes the system suitable for power supply network simulation, mains signalling and for future standards.

All different tests are done fully automatical using special system software, running under Windows.

## System configurations

The fixed measurement equipment is placed in **19" racks**, with ventilation, power supply control, slides, etc...

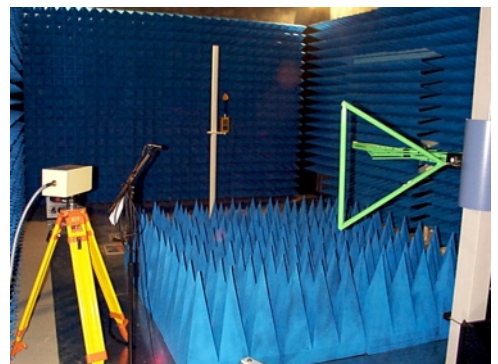
The RF and control cabling goes directly from the racks into the false bottom of the floor, in which the cable ducts are integrated.

Several connection points in the anechoic chambre provide easy access to the cables and connectors. Besides coaxial lines for RF signals, control lines and fibre optics, connections for compressed air and water inlet/outlet are also available.

For future extensions, access panels are equipped with universal feedthrough connections.

Only the best quality of **RF cables** and connections is a guarantee for accurate and reproducible EMC measurements. Therefore the cable sets are very low loss (to obtain maximum sensitivity) and have a high shielding (to avoid interference between the measurement signals and test set-up). They are calibrated by the test systems and their correction values are taken into account by the software.

For the control of the measurement systems, two **process controllers** are equipped with the required I/O-Interfaces (like GPIB, RS232, TTL I/O, Relays, etc...). One is placed on a conventional integrated **workbench**, and controls the EMI and EMS Test Systems, and the second controller is placed on a mobile trolley. It controls the Transient as well as the LF Test System.



## Our partners:

- Anechoic Chamber  
**SIEPEL & HYFRAL**
- Amplifiers  
**AMPLIFIER RESEARCH & BONN**
- Transient Immunity Test System  
**EMTEST**
- LF Test System  
**SPITZENBERGER+SPIES**



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