FRANKONIA

EMC TEST SYTEMS / INSTRUMENTS AND CONTROL SOFTWARE

Power Signal Generator - PSG-300
acc. to EN 61000-4-16

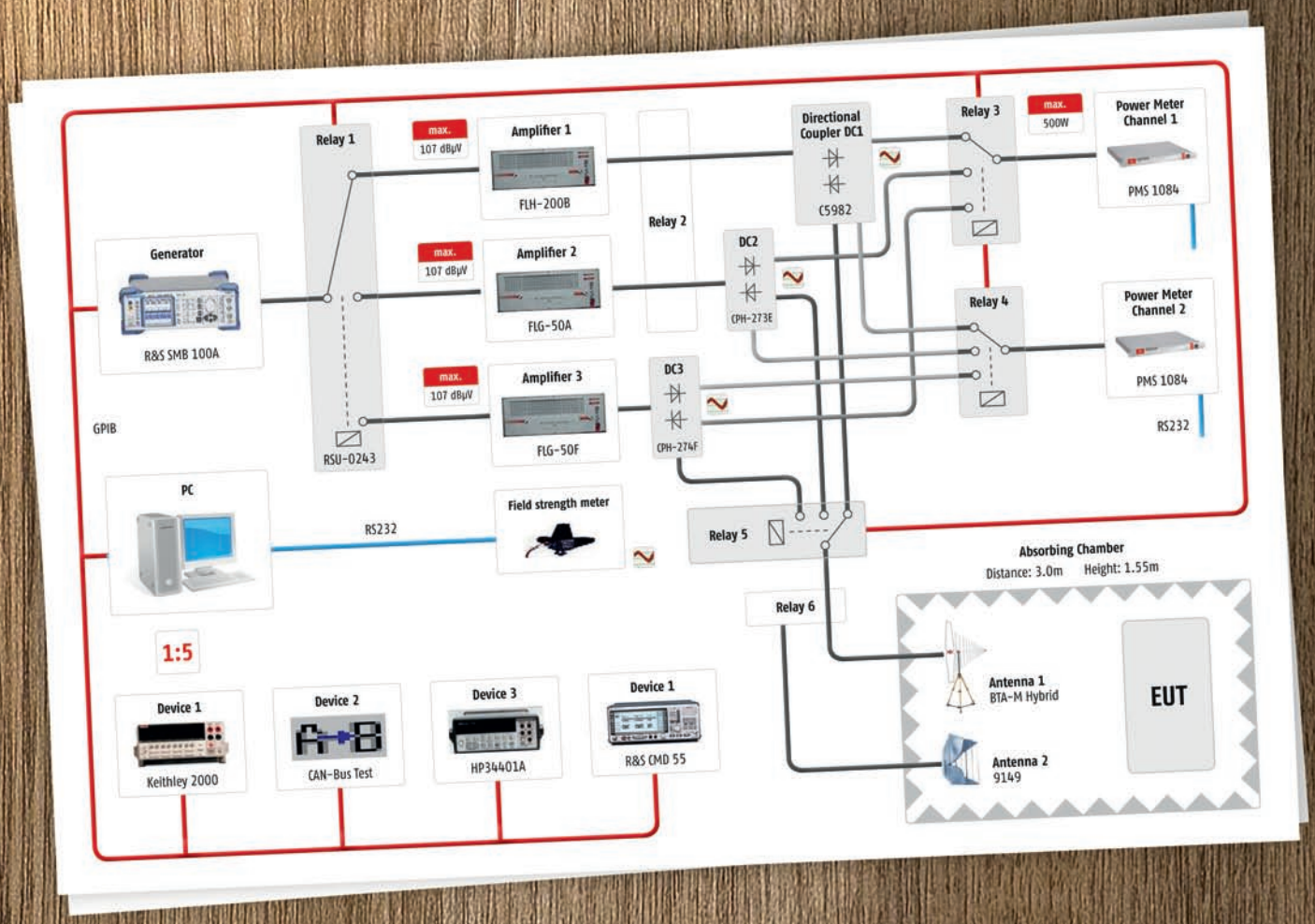
Compact Immunity Test System / BCI Test System - CIT-10
acc. to IEC/EN 61000-4-6 / ISO 11452-4 / MIL-STD 461E

Compact Magnetic Field Test System / Low Frequency Test System - MTS-800
acc. to automotive standards and MIL-STD 461E

Control Software
RF-Lab, CD-Lab, BCI-Lab

Immunity Test Systems - RIS 3000
acc. to IEC/EN 61000-4-3

Content / Index



EMC TEST SYSTEMS:

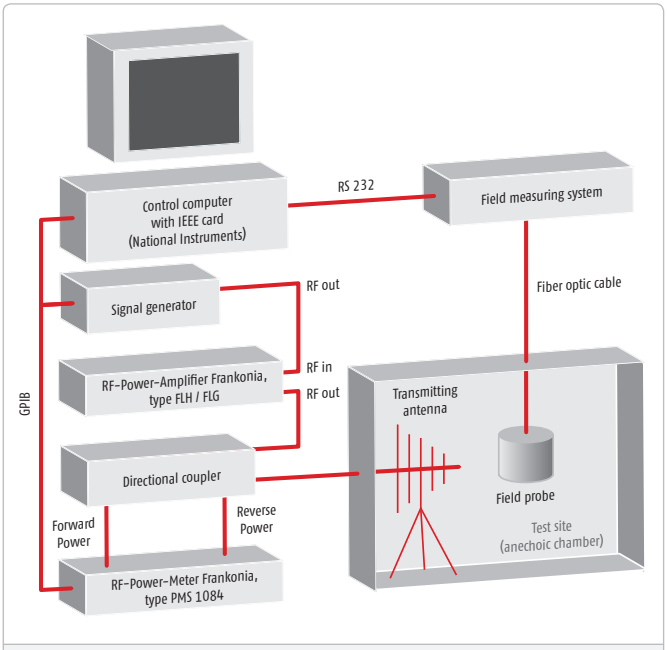
Immunity Test Systems according to IEC/EN 61000-4-3
RIS 3000

General

For testing an EUT with respect to immunity to RF interference in the frequency range from 80MHz to 6 GHz according to IEC/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 (anechoic chambers).

Set-up of Test Systems for testing in anechoic chambers.

Block diagram 1 shows the set-up required for the measurement of the uniform area.



Block diagram 1: Set-up of a test system according to IEC/EN 61000-4-3; Measurement of the uniform area.

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

Control computer

The controller is a standard PC with operating system Microsoft WINDOWS XP/VISTA. Depending on the system layout GPIB (IEEE 488) with National Instruments interface card, serial bus RS 232, USB and other bus systems are supported.

Control software

RF-LAB is fully compliant to IEC/EN 61000-4-3, IEC/EN 61000-4-20, automotive- and MIL standards. The software "RF-LAB" controls the complete test system and prepares the test report. It performs measurement of the uniform area and generates reference calibration data from it. In alternative reference data can be measured directly. Tests may be performed manually and fully automatically. A full automatic monitoring of the EUT´s function is possible whenever its compliance can be monitored 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 WIN VISTA, WIN XP
- 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

A commercial signal generator is used as signal source. It should cover at least the required frequency range such as 80MHz to 6 GHz and allow amplitude modulation with a sine wave of 1kHz 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 modes, as well as a higher frequency range and smaller steps, this may be advantageous for future applications. Minimum requirements are as follows:

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

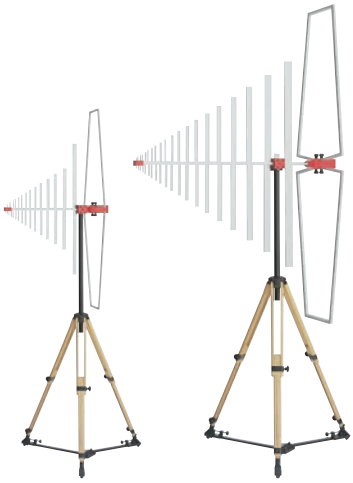
Immunity Test Systems according to IEC/EN 61000-4-3
RIS 3000

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 field strength around 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, 3Vm, 10V/m or special requirements) whether an amplifier output of 10W, 30W, 200W,...2kW, is required. Normally, a field strength of 10V/m, with 1kHz / 80% AM, can be obtained with a 200W amplifier in a testing distance of 3m.

Main data:

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



Transmitting antenna

The broadband antenna Frankonia BTA-M covers the whole frequency range from 80MHz to 3000MHz. It may be loaded by up to 1000W. Above 1GHz horn antennas or small log-periodical antennas like our BTA-S save amplifier power and costs. The antennas are also suitable for emission measurements.

Main data:

• Type:	Frankonia BTA-M	Frankonia BTA-S
• Frequency range:	30MHz to 3GHz	0.7GHz to 9 GHz
• Impedance:	50 Ohm	50 Ohm
• Weight:	5kg	3.7kg

Power measurement

During 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 conditions. For this purpose, a directional coupler is connected at the amplifier output. A power measuring equipment type PMS 1084 determines the forward- and reverse power up to 6GHz. Both are stored and recorded by the control software.

Field strength measurement

A field strength measuring system consists of an isotropic probe, measuring unit and a fibre-optic converter which is connected to the PC. The system is used for the measurement of the field homogeneity of the test set-up.

System Installation into 19" Rack: RIS 3000

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

Typical Dimensions (H x D x W):
1,270 x 710 x 540mm
Weight without instruments: 50kg

Features:

- Moveable rack (on big rubber wheels)
- Instruments are installed into rack and cabled
- Main switch
- Emergency switch
- Easy mountable cover for front and rear side of the rack included

Immunity Test Systems according to IEC/EN 61000-4-3
RIS 3000

Reference data

Reference data can be determined with two different methods: <Calculate Reference File> (from data of homogeneous field) and <Individual Reference Measurement>.

Calculate Reference File

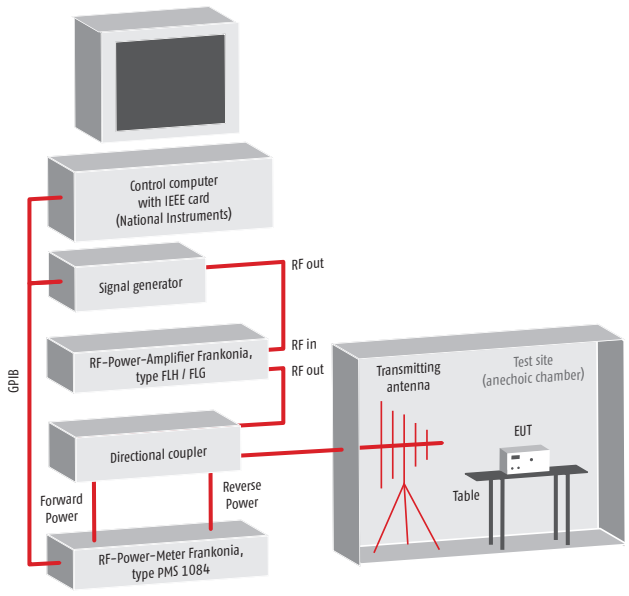
Acc. to standard the reference data of a desired test field strength shall be calculated from data measured in the field homogeneity measurement. This can simply be done by use of this function.

Individual Reference measurement (for individual test set-up)

The software supports individual measurement of reference files. This may be necessary if an exactly defined test level at a defined EUT- position or a profile of test level versus frequency is requested.

Testing

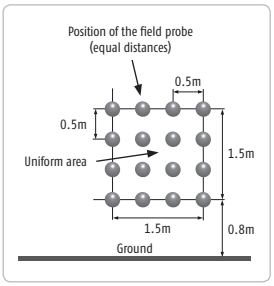
The testing set-up is described in block diagram2. On the basis of the reference data (reference calculation or reference measurement) determined for the respective testing set-up, the required test level and/or test field strength is adjusted reproducibly in the test run by means of the control software for each frequency step. For this purpose, the signal is amplitude-modulated with a sine wave 1kHz / 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/EN 61000-4-3 in the test run.

Homogeneous / Uniform Field

To assure the reproducibility of the immunity test, the standard prescribes the homogeneity of the field generated. The anechoic chamber must guarantee a homogeneous field within the size 1.5m x 1.5m in a distance of 1 to 3m 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 0.5m x 0.5m. The lowest part of the homogeneous field surface is situated at 0.8m 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 80MHz up to 6GHz. The requested field homogeneity for the respective frequency is met, as soon as in 12 measuring points out of 16 (1.5m x 1.5m), or in 4 measuring points out of 4 (0.5m x 0.5m) the difference between the highest and lowest field strength value amounts to 0dB to +6dB. 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 2dB saturation of the system as required by the standard.



Compact Immunity Test System CIT-10, 10kHz - 400MHz

acc. to IEC/EN 61000-4-6 / ISO 11452-4 / MIL-STD 461E

General:

The CIT-10 is a complete test system for conducted RF- immunity tests according to IEC/EN 61000-4-6, ISO 11452-4, MIL STD 461E/F CS114, SAE-J1113-2, DC 10614 and similar standards. Its internal RF generator and RF-power-amplifier produce output signals with max. up to 150W within a frequency range from 100 (10)kHz up to 400MHz. Generated signals are measured via one of the max. 3 internal RF-Voltmeters. Furthermore via an optional, internal directional coupler forward and reflected power can be measured. The whole test system allows full automatic tests for the specified frequency range. As a "stand-alone" test system the CIT-10 is convincing by its easy and comfortable handling and the excellent cost-performance ratio. Add-ons like coupling/decoupling devices are available as well.

Special Features:

- Conducted RF immunity tests acc. to IEC/EN 61000-4-6 and BCI tests acc. to ISO 11452-4 and MIL –STD 461E
- Signalgenerator, RF-power-amplifier, RF-power-meter and directional coupler (optional) in one 19" case
- Stand-alone operation possible with optional available netbook
- Control-software included
- Most important parameters are shown on a integrated display
- Automatic EUT-monitoring
- Operation via USB port of a PC or Notebook
- Complete range of CDN´s available

Applications:

Immunity Testing:

Testing according to IEC/EN 61000-4-6, ISO 11452-4, MIL STD 461E/F CS114, DC10614 can be performed automatically.

Generation, amplification and verification of RF-Signals:

The internal amplifier amplifies any signal from 100 (10)kHz up to 400MHz. Using the internal generator can also generate a desired narrowband signal. Signals up to 30dBm can be measured at the same time. If a directional coupler is installed, forward and reflected power are measured as well.

Compact Immunity Test System CIT-10, 10kHz - 400MHz

acc. to IEC/EN 61000-4-6 / ISO 11452-4 / MIL-STD 461E

Features:

Internal RF-Power-Amplifier

Several amplifier modules are available. Highest output power can be 150 W over the specified frequency range. The amplifier input can be accessed via the back panel of the CIT-10, so that the amplifier can also be used with any external generator. 20W, 75W and 150W amplifiers are available as standard.

Internal RF-Voltmeter

Accurate measurements of RF signals from -40 dBm up to +30 dBm are done by the internal RF-voltmeter which can be accessed (for separate use) via a BNC connector. Two internal voltmeters measure the forward and reverse power on an optional available directional coupler or if no directional coupler is installed, the output voltage of the amplifier is measured.

Amplitude Modulation

Frequencies generated by the generator can also be modulated with a LF signal. Modulation frequencies may vary from 1 Hz up to 100kHz, modulation levels are available from 0% to 100%.

Internal RF-Signal Generator

As the internal generator generates its output signal without any internal mixing components, low harmonics and spurious frequencies are assured.

BCI-Tests with additional Power-Meter

For BCI-Tests the CIT-10 can be equipped with up to 3 pieces internal power meters.

User defined signals

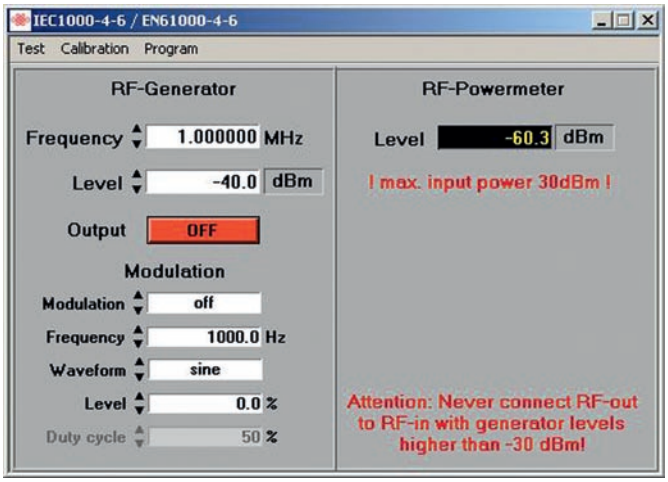
External signals (e.g. EUT Fail or external instruments) can be connected and monitored using the application software.

Set-up:

The CIT-10 is a PC-controlled test equipment. It can be operated by any commercial IBM compatible PC (WIN/NT/2000/XP/VISTA) via USB port. All settings of the equipment, e.g. start frequency, stop frequency, step width, test voltage etc. are made by means of the control software which is also included in the delivery. The three functional units Signal generator, RF power amplifier and RF voltmeter are set automatically by the software, depending on the pre-set test parameters. Each component, however, may also be called and operated as separate measuring and testing equipment. This means: using the CIT-10 as testing system, you have three full, additional "single units" at your disposal, for which separate inputs and outputs are available as BNC connections. Due to the computer-aided control of the CIT-10, any modifications which may become necessary, for example, due to the revision of standards, may be performed without problems and without having to manipulate the hardware of the equipment.

Functioning:

The equipment is ready for operation immediately after connection of the USB port, installation of the drivers and the control software. After starting of the control software, the main menu offers the manual control of <RF-Generator> and <RF-Power Meter>. Further options in the menu are <Calibration> (<CDN-Calibration>, <Self-Calibration>) and <Test> (<Complete Test>, <Selective Test>).

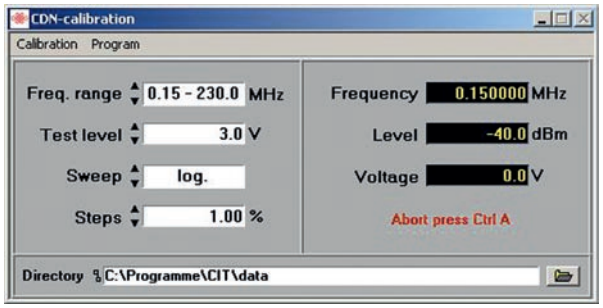


Compact Immunity Test System CIT-10, 10kHz - 400MHz

acc. to IEC/EN 61000-4-6 / ISO 11452-4 / MIL-STD 461E

CDN-Calibration:

The CDNs (Coupling/Decoupling Networks) serve to inject the test voltage into the lines to be tested and/or to decouple any connected peripheral equipment from the EUT. The characteristics of the CDNs as well as of the power amplifier are not absolutely linear over the whole frequency range, i.e. the amount of power required to generate a constant test voltage over the whole frequency range varies slightly, depending on the frequency. In the calibration run, the frequency-dependent output level of the signal generator, which is necessary for a constant test voltage, will be determined and stored in the software, together with the defined frequency range and the desired test voltage. The data records thus created may then be stored and recalled for tests.



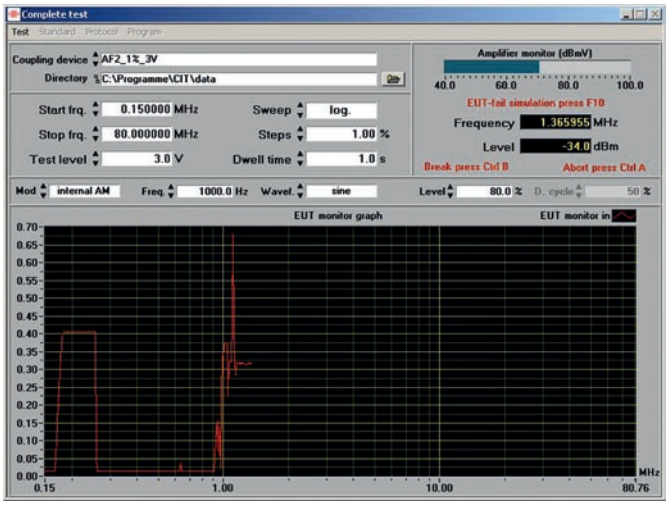
Self-Calibration:

When selecting this menu option, the test equipment will perform a self-calibration. In this case, the output of the signal generator must be connected to the input of the voltmeter.

Test:

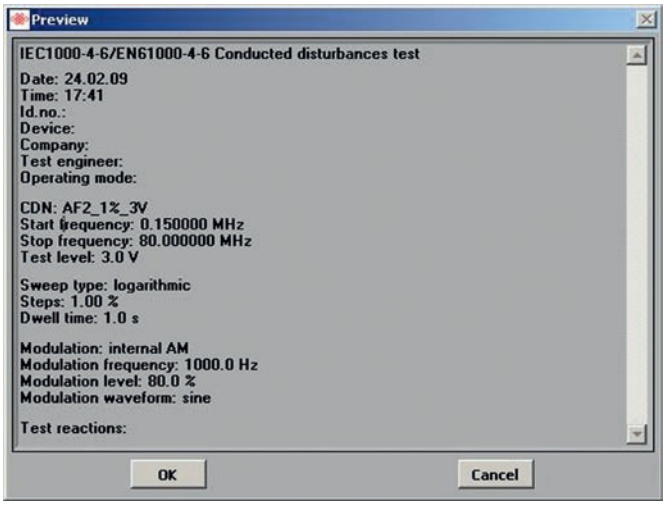
The menu option <Test> offers the selection possibilities <Complete Test>, <Selective Test> and <Protocol>. The settings for a test, e.g. start and stop frequency, step width and test voltage are made automatically via the calibration file of the selected coupling unit. It is now possible to decide whether the test is to be performed exactly according to these pre-settings, i.e. exactly as in the calibration, or whether modifications of the pre-settings shall be admissible. If the calibration run was performed, for example, for a test voltage of 10V, and the test is to be performed now with 3V without having to perform a new calibration run for this purpose, this can be done by selecting menu item <Extrapolation>.

Is a suitable measuring instrument connected to the specified serial port of the CIT-10, EUT can be monitored automatically. Data are shown graphically. During all test routines the amplifier output is monitored in a bar display. This guarantees correct tests.
In the case of <Complete Test>, a test is performed over the complete selected frequency range; in this case the test frequency is increased by the control software according to the selected step width and the entered dwell time. If there is a malfunction of the EUT, the test may be stopped at any time. It is then possible to either increase or reduce the frequency by any number of steps, as well as to switch on and off the modulation and test voltage. Besides, a description of the malfunction occurred may be entered in a comment line which is included in the test record.



<Selective Test> offers the possibility of testing the EUT at discrete frequencies. This can be done either with a fixed test voltage or, optionally, with a ramp function. In case of the ramp function, the start and stop voltage, the step width by which the test voltage is to be increased, as well as the dwell time between the individual steps may be preset by the tester.

The standard <Protocol> consists of the head of the protocol and a diagram which shows the test results. In the head of the protocol the date and time are taken over from the computer; in addition, details like temperature, air humidity, tester, as well as testing set-up and EUT, may be registered. The protocol may be printed directly. It is also possible to edit the protocol individually.



Compact Immunity Test System CIT-10, 10kHz - 400MHz

acc. to IEC/EN 61000-4-6 / ISO 11452-4 / MIL-STD 461E

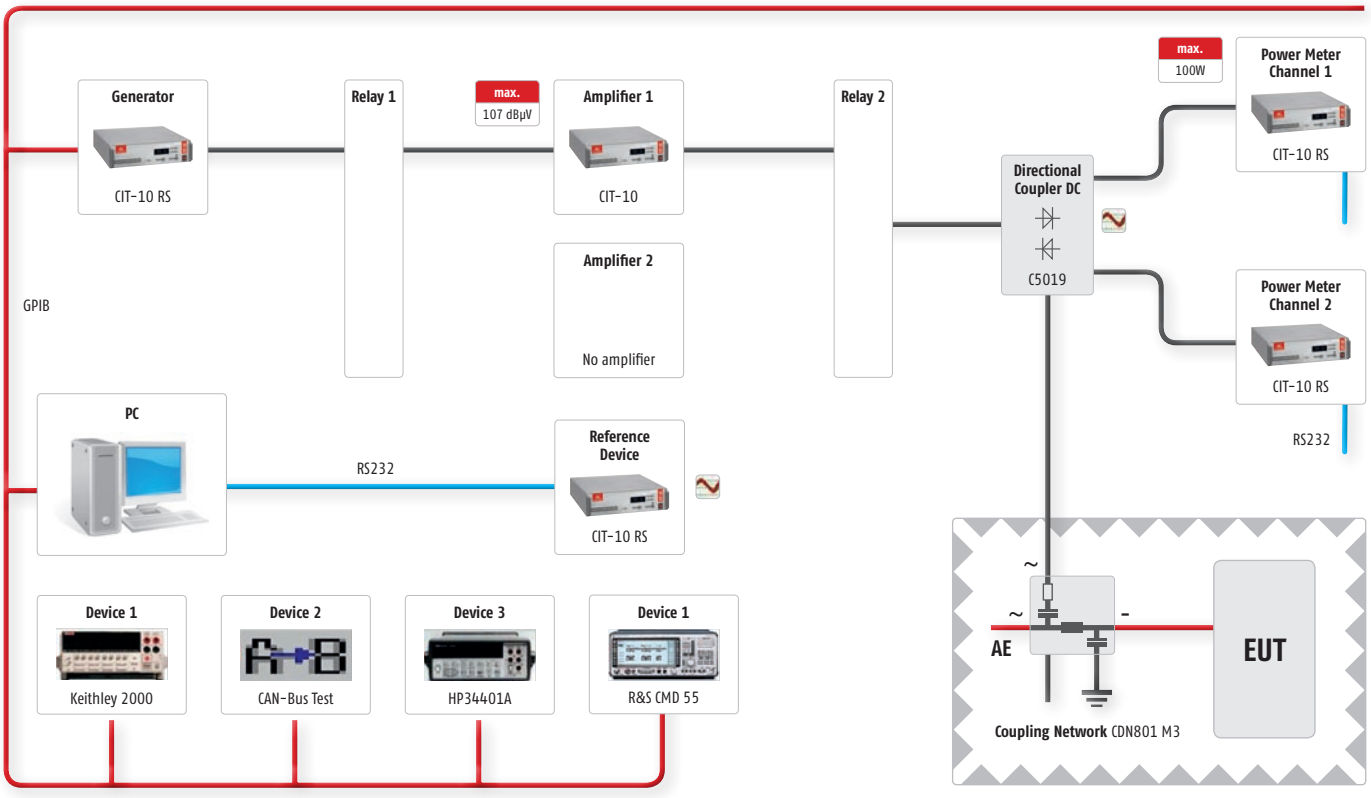
Technical data:	
RF Voltmeter (external in-/output)	
Frequency range	10 kHz to 400MHz
Measuring range	+30 dBm to - 40 dBm
Accuracy	±0.5 dB
VSWR	< 1.1 : 1
Input	BNC, 50 Ohm
RF Generator	
Output	BNC, 50 Ohm
Frequency range	10 kHz to 400 MHz
Frequency resolution	1 Hz
Output level range	0 to - 60 dBm
Output level resolution	0.1 dB
Output level accuracy	±0.5 dB (± 1 dB max)
Accuracy (frequency)	±5 ppm (TCXO)
Harmonics	< -30 dBc
Non harmonics	< -45 dBc
Amplitude modulation (internal)	0 to 100%; resolution 0.5% (internal AF Generator)
Amplitude modulation (external)	BNC jack 1 Hz to 100 kHz, 0 to 100% Input impedance > 100 kOhm
Pulse modulation	variable duty cycle 10 - 90%; resolution 1 % (internal AF Generator)
VSWR	< 1.5:1
AF Generator	
Output jack	BNC
Frequency range	1 Hz to 100 kHz
Frequency resolution	0.1 Hz
Output voltage	0 to 1 V amplitude; resolution 5mV
Accuracy (frequency)	±50 ppm
Signal	Sine wave / square wave / triangular
RF Voltmeter (internal, 2 pcs.)	
Frequency range	10 kHz to 400 MHz
Measuring range	+53 dBm to - 0 dBm
Accuracy	±0.5 dB
Directional coupler (optional)	
Frequency range	10 kHz to 400 MHz
Power	200 W CW
Insertion loss	0.5 dB max
VSWR	1.25 : 1 max
Directivity	20 dB min

Technical data:	
Power amplifier	
Frequency range	100kHz (10kHz) to 400MHz (75W, 150W) 100kHz to 230MHz (20W)
Gain	51 dB ± 1.5 dB
Output power	75W/150W (optional) 20W (100kHz to 230MHz)
Distortion	<20 dBc at 75W
Input impedance	50 Ohm, VSWR < 1.5:1
Output impedance	50 Ohm nom.
EUT-fail input	
Input resistance	2.2 kOhm
Level	TTL/CMOS compatible, optical decoupled
EUT-Monitor input	
Input voltage	0-10 V
Input impedance	100 kOhm
Amplifier monitor	
Output	BNC, 50 Ohm
Level	- 40 dB (amplifier output), ±3 dB
Interfaces	
USB-A	Multimeter (for EUT control)
USB-A	Relays switching unit
USB-B	Connection to computer
General data	
Temperature range	0 to 40°C
Warm-up time	15 min.
Housing	19" Subrack or desktop case
Width / height / depth	449 mm x 133 mm x 435.5 mm
AC input	100 - 240 VAC; 50/60 Hz
Volume of delivery	CIT-10 (basic equipment), cabling, system software
Part Number	CIT-10/20 with integrated 20W power-amplifier;
	CIT-10/75 with integrated 75W power-amplifier;
	CIT-10/150 with integrated 150W power-amplifier;
	CIT-10/W without internal power-amplifier;

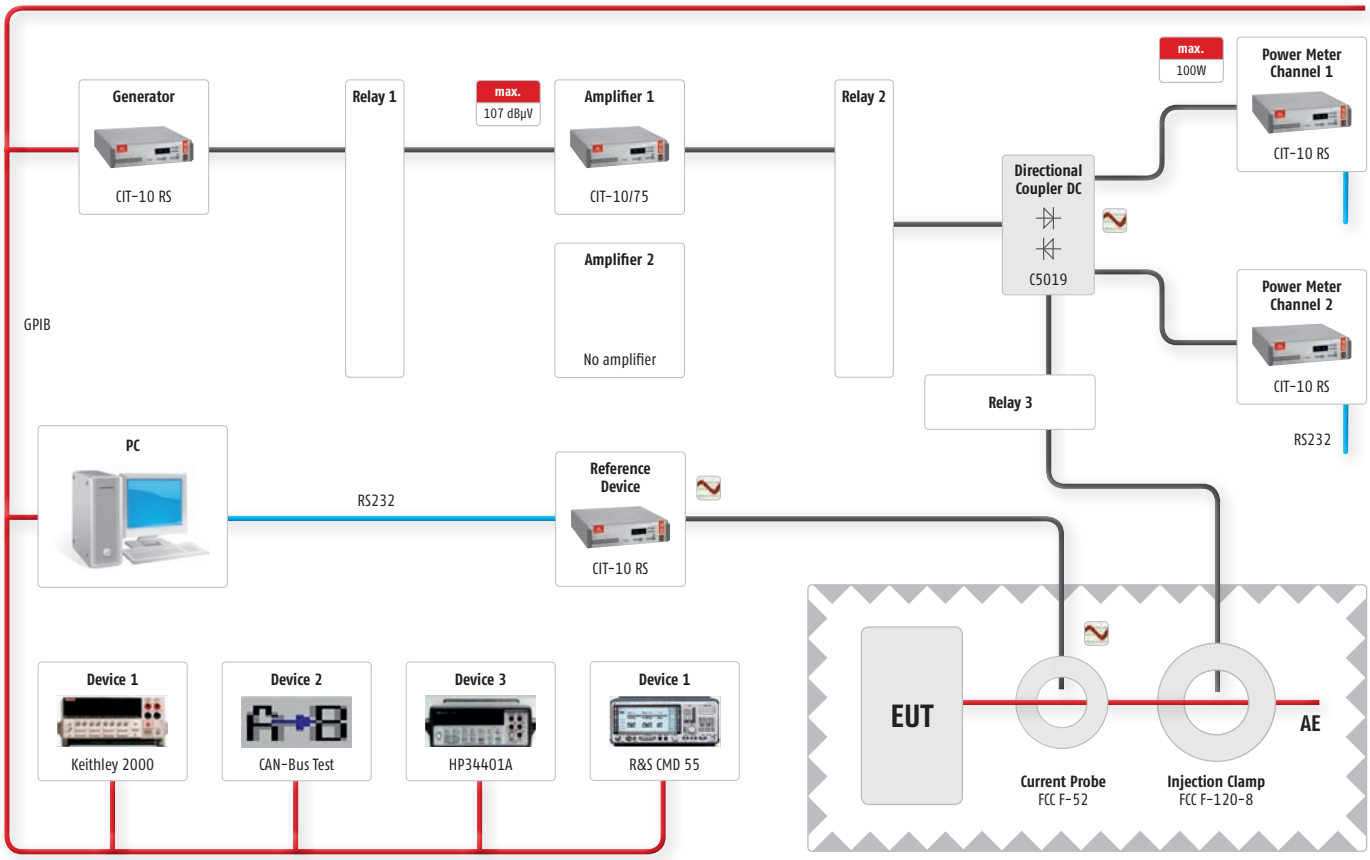
Compact Immunity Test System CIT-10, 10kHz - 400MHz

acc. to IEC/EN 61000-4-6 / ISO 11452-4 / MIL-STD 461E

Circuit diagram of a test system according to IEC/EN 61000-4-6:



Circuit diagram of a BCI test system:



Compact Immunity Test System CIT-10
Coupling / Decoupling Networks (CDNs)

Description

Immunity tests according to IEC/EN require coupling of RF disturbance voltages into any conducting cable of an EUT. Furthermore these disturbances should not be coupled into any further equipment so that a decoupling path to any auxiliary equipment is provided. We offer a wide range of CDN´s for different types of interconnected lines which are fully calibrated for the frequency range from 150kHz to 230MHz. The following CDNs are available: M-, AF-, S-, T-, RJ, USB-types. Almost any network can be assembled on customer´s requests. Guidance for selecting the appropriate CDN is given in the following table:

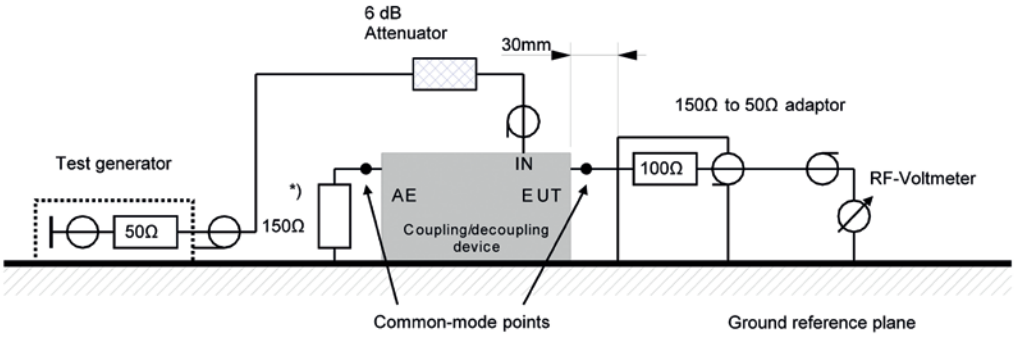
Type	Interconnected lines
M1, M2, M3, M4, M5, M2+M3	Unscreened supply (mains)
AF2, AF4, AF5, AF6, AF8	Unscreened nonbalanced lines
S1, S2,S4, S8, S9, S15, S25, S36	Screened lines
T2, T4, T8	Unscreened balanced lines
RJ11, RJ45	Unscreened data lines
RJ11/S, RJ45/S, USB	Screened data lines

Test procedure with Coupling/Decoupling (CDNs) Networks acc. to IEC/EN 61000-4-6:

- The EUT shall be placed on an isolating support, 0.1 m above the ground reference plane.
  For table-top equipment, the ground reference plane may be placed on a table.
- On all cables to be tested, coupling and decoupling devices shall be inserted.
- The coupling and decoupling devices shall be placed on the ground reference plane, making direct contact with it at about 0.1 – 0.3 m from the EUT.
- The cables between the coupling and decoupling devices and the EUT shall be as short as possible and shall never be bundled or wrapped.
- The height above the ground reference plane shall be between 30 and 50mm (where possible).
- The 6dB attenuator shall be placed to the coupling and decoupling device as near as possible.
- The test shall be performed with the test generator connected to each of the CDN´s in turn while the other non-exited RF-input ports of the CDN´s are terminated by a 50Ω load resistor.

Calibration of Coupling Devices:

The coupling and decoupling devices shall be placed on a ground reference plane:



*) The 150Ω loading (e.g. a 150Ω to 50Ω adaptor terminated with a 50Ω load) at the AE-port shall only be applied to unscreened cables (screened cables will have their screen connected to the ground reference plane at the AE-side).

Compact Immunity Test System CIT-10
Coupling / Decoupling Networks (CDNs)

Set-up for level setting at the EUT-port of coupling and decoupling devices:

1. The test generator (RF-out) shall be connected to the RF-input port of the coupling device via the 6dB-attenuator.
2. The EUT port of the coupling device shall be connected in common-mode through the 150Ω to 50Ω adaptor to the RF-Voltmeters (calibration).
3. The AE-port shall be loaded in common-mode with a 150Ω to 50Ω adaptor, terminated with 50Ω.

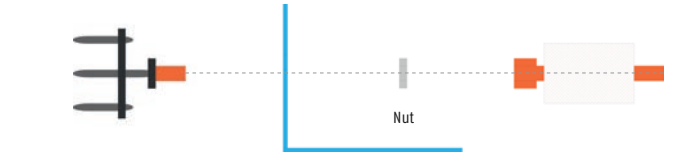
With direct injection to screened cable (CDN S types), the 150Ω load at the AE-port is not required as the screen will be connected to the ground reference plane at the AE-port side.

Although the 150Ω load at the AE-port is mandatory with CDN T, AF and M types calibration data are identical with the AE-port open or short. This is because a capacitor is connected to ground at the AE-port side, which leads to a RF-short-circuit similar to the CDN S types. This means that even with CDN M, AF and T types the 150Ω load at the AE-port is not required.

To calibrate a CDN the following items are required:

• adaptor • fastening angle • 50Ω/150Ω adaptor

Fastening angle and 50Ω/150Ω adaptor should be ordered for the first CDN. For each following CDN only the specific adaptor has to be ordered.



Adapter with BNC jack, specific for each CDN, e.g. with 3 banana plugs for CDN M3 | Fastening angle | 50 / 150 Ohm adpter with BNC connectors

Direct Injection: Any shielded connection to an EUT can also be connected to the RF disturbance voltage via a direct injection adapter.

Electromagnetic Coupling Clamp acc. to IEC/EN 61000-4-6

Description

The EM coupling clamp is used in all cases where CDNs are not advisable or not available. The lines to be tested are in this case inserted in the clamp and the test voltage is injected inductively. RF electromagnetic fields frequently degrade electronic equipment by generating common mode currents on cables. The effect of these E and H fields on the equipment can be simulated by injecting common mode currents into the cables of the equipment being tested for RF immunity. IEC/EN 61000-4-6 defines the methods for testing the immunity of electronic equipment to conducted mode currents between 150kHz and 230MHz. The electromagnetic (EM) clamp is a high efficiency broadband clamp-on injection device developed to test the immunity of electronic equipment when the standard IEC/EN 61000-4-6 CDN using the direct capacitive coupling technique is not possible nor appropriate. The EM Clamp is often used to test unshielded multiple conductor cables.

Type	F-203I-23MM
Frequency range	10KHz to 1000MHz
Max. allowed power:	
10KHz to 100 MHz:	100 watts CW for 15 minutes
100 MHz to 230 MHz:	100 watts CW for 10 minutes
230 MHZ to 1GHz:	50 watts CW for 10 minutes
The test level of the immunity test with the specified values corresponds to a field strength of 100V/m	
Directivity	>10dB above 20 MHz
Dimensions (L x W x H)	23 x 610 x 135 mm
RF-disturbance connector	N type
Max. cable diameter	23mm
Weight	approx. 7.5 kg
Options:	Calibration set consisting of: - 2 pcs. calibration corners incl. 150/50 W adapter - 1 pcs. calibration cable

Magnetic-Field Test System / Low-Frequency Test System for Emission – and Immunity Tests / MTS-800

General:

The MTS-800 is a compact test system for broadband generation and measurement of magnetic fields. Its internal components allow automatic EMC tests according to automotive standards where high field strength need to be generated or measured.

In combination with our triaxial Helmholtz coils full automated susceptibility tests are possible at magnetic field strength up to 1000 A/m for frequencies from DC to 1 kHz. Lower field strength can be generated for frequencies up to 250 kHz. Due to the triaxial set-up of our Helmholtz coil major improvement in device handling is achieved because there is no need to turn an EUT during tests.

The MTS-800 complies to all magnetic field requirements of relevant EMC and military standards.

Tests and measurements are controlled by a program which will set most parameter automatically. For any relevant standard, which are fulfilled by the MTS-800, limit values are already included into the software package, although any different value can be defined by a user. After every test full reports will be created automatically. Report layout is pre-defined, though any user-defined layout is possible. High performance is guaranteed by a self-calibration process which utilizes an internal source as reference.

According to

EN 55103-1/2, EN 61000-4-16, EN 61000-4-8,
SAE J1113-22, ISO 11452-8,
MIL-STD-461E (CE101, RE101, CS101, CS109 and RS101),
Automotive manufacturer standards

Special Features:

- Frequency range for emission and immunity measurements: DC – 250 kHz
- 800W precision power amplifier, signal generator and spectrum analyzer in one compact unit
- All instruments may as well be used as stand-alone devices
- Powerful but easy to operate software, fully expandable for future standards modifications
- Standard software allows easy operation, report generation and integration of external measuring instrument for EUT monitoring
- Prepared for connection of external multimeter for EUT control
- Fully automated tests with triaxial Helmholtz coil. Software controlled generation of magnetic field in x-, y- and z- direction; no need to turn the EUT!
- Large variety of extensive accessories available

Magnetic-Field Test System / Low-Frequency Test System for Emission – and Immunity Tests / MTS-800

Applications:

Magnetic Field Generation

MTS-800 enables a user to generate strong magnetic fields up to 1000 A/m. Even alternating fields up to 250 kHz can be generated by the magnetic test system.

Automotive Testing

Intensive testing is required for new products which should be used in any automotive application. The MTS-800 allows fast and easy testing according to many automotive standards as described before.

Low Frequency emission and immunity tests

acc. to MIL-STD 461E, CE 101, RE 101, CS 101, CS 109 and RS 101. Individual software modules and hardware accessories are available for each of these tests.

Features:

Automatic Testing Capabilities

Full compliance with several immunity test as ISO 11452-8, MIL-STD-461E/F RS101, CS101, CS109, IEC/EN 55103-2, IEC/EN 61000-4-8, SAE J1113-2, SAE J1113-22, Ford ES-XW7T-1A278-AC, GM W3097, PSA B21 7110, Renault 36-00-808, DC-11224, DC 10614 and similar standards.

Furthermore the MTS-800 allows emission measurements according to MIL-STD-461E/F RE101, CE101 and IEC/EN 55103-1.

Software

Any function is controlled via an application software which also guide the user through any test or measurement. Adaptation of signal strength or measurement graphs are possible at any stage. User defined signals complement the usage for fast and reliable tests. The application software is written in LabVIEW which guarantees stable and fast performance on any Microsoft® Windows platform.

Components

MTS-800 consists of three independent module: a signal generator (DC – 250 kHz), a power amplifier (800 W output maximum, DC – 1MHz bandwidth) and spectrum analyzer (16 Bit, 1 MSPS sampling rate). All modules can be used as stand-alone units.

Self-calibration

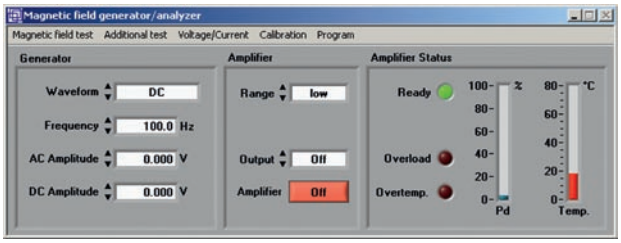
Using an ultra-stable voltage source self-calibration correction values are stored in an internal EEPROM. Any voltage signal or voltage measurement device is calibrated at a self-calibration process automatically in about a minute.

Accessories

Frankonia provides also many different coils and loop sensor which are ideally suited for the described tests. Any additional equipment is ready to use without a need for recalibration. Not only our own equipment can be used with the MTS-800, but also user defined coils. A calibration mode is included in the software to complement the magnetic test system with any further equipment.

Magnetic-Field Test System / Low-Frequency Test System for Emission – and Immunity Tests / MTS-800

The software starts with the generator/amplifier control panel. This window allows basic settings of generator and amplifier.

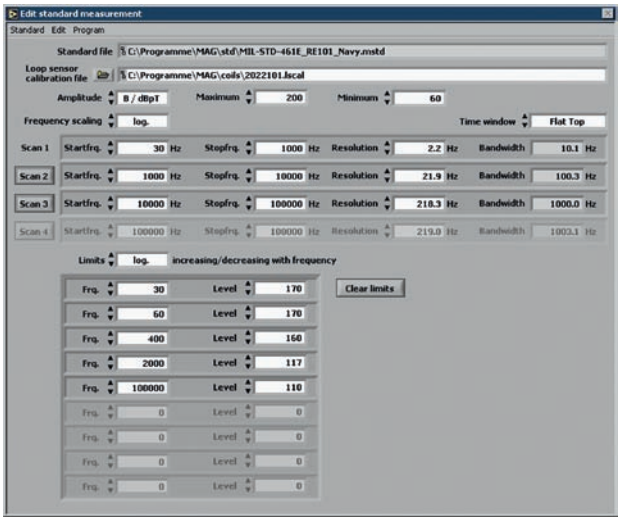


Control Panel

Open the Magnetic field measurement window for spectrum analyzer measurements. Perform a single or continuous measurement. Perform test according to predefined standards.

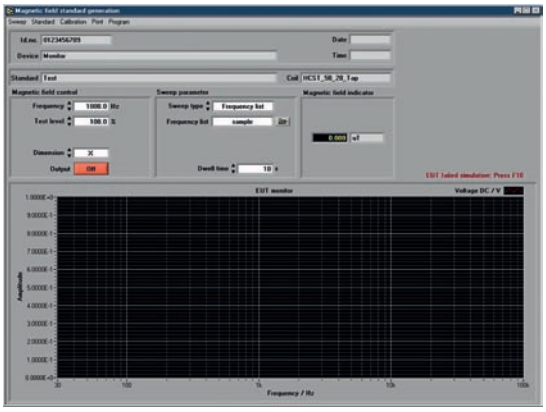
Measurement results

Edit a predefined standard or create a new one.
Load, save and print data.



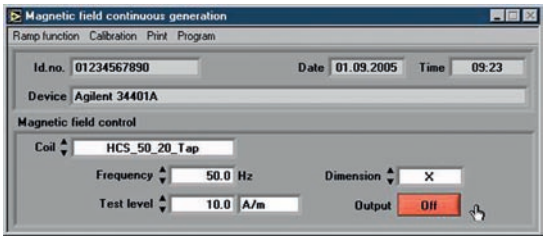
Example standard file for MIL-STD-461E / RS101_Navy

Open the Magnetic field generation window for susceptibility tests according to predefined standards.



Standard generation window

Open the continuous generation window for long term magnetic field test.



Magnetic field continuous generation window

Further features and possibilities:
Susceptibility tests with fixed frequencies and test levels or use the ramp function to sweep from start to stop level. Verify the generated field of any radiating coil with loop sensor.
Short term generation window for short term magnetic field tests (optional).
Scope mode window.
Determine the coil factor of an unknown coil
Self calibration of the MTS-800

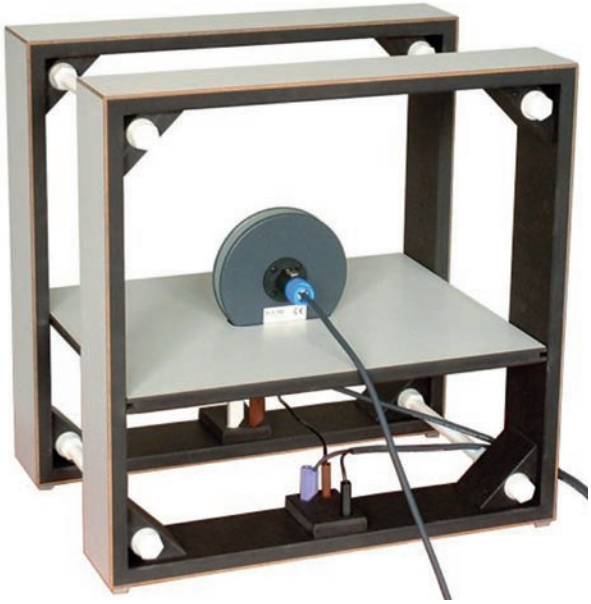
Magnetic-Field Test System / Low-Frequency Test System for Emission – and Immunity Tests / MTS-800

Type	MTS-800
Voltage input (Analyzer)	
Frequency range	DC - 250 kHz
Input impedance	1MOhm / 50 Ohm switchable
Connector	XLR, unbalanced
Max. input voltage	100V continuous (attenuator autoset at overvoltage); 10 V at 50 Ohm
Gain	-20/0/20 dB Preamplifier, 0/20/40 dB ADC Amplifier; Self-calibration with ultra stable on-board reference
Current input	
Frequency range	DC - 250 kHz
Shunts	10mOhm / 1 Ohm / 100 Ohm
Max. input current	20 A continuous (overload protection); 1 Ohm and 100 Ohm shunt are protected by an additional 1.5 A fuse
Connector	4 mm safety jack (+, -) measurement via insulation amplifier or input jacks
Measurement range	20A, 10A, 1A, 100mA, 10mA, 1mA automatic offset and gain; Self-calibration with ultra stable on-board reference
AD converter	
Resolution	16 Bit
Sampling rate	1.25 MSPS
Aliasingfilter	0.01dB Tschebyscheff filter, fg = 260 kHz; filter may be switched off
Generator	
Frequency range	DC - 250 kHz
Output impedance	50 Ohm
Connector	BNC, unbalanced
Signal	Sine wave / triangular /square wave/ DC
Amplitude	0 - 10V AC, - 10V - + 10V DC
Resolution	12 Bit (2.5mV), Switchable - 20dB Attenuator; Self-calibration with ultra stable on-board reference
Amplifier	
Frequency range	DC - 1 MHz
Connector	4mm safety jacks (output); BNC, unbalanced (input)
Current	16Arms
Voltage	50Vrms / 75 VDC
Distortion (DC-100kHz, load ≥ 4Ohm)	< 0.10%
General data	
EUT control / Connector	9-pin Sub-D; RS-232
Connection to Computer	USB
Temperature range	0 to 40°C
Warm-up time	15 min.
Housing	19" Subrack or desktop case
Width / heigth / depth	449 mm / 177 mm / 580 mm
Weight (shipping)	approx. 40 kg (net 34kg)
Gain	10 ± 0.1% (±0.01 % /°C)

Magnetic-Field Test System / Low-Frequency Test System for Emission – and Immunity Tests / MTS-800

Accessories:

- Common mode test adapter for balanced signal and control connections according to EN 55103-3
- Calibration network for common mode test adapter according to EN 55103-2
- Current transducer for balanced video connections according to EN 55103-2
- Enclosed variable transformer for short term field according to EN 61000-4-8; prim. 230V, sec. 0 to 230V, max. current 20A; incl. supply cable



Helmholtz coil HCS_50/28_TAP with Loop Sesor RLS_133

Coil-Type	Specification
HCST_50/28_TAP	Tapped triaxial Helmholtz coil for immunity tests.
HCS_50/28TAP	Tapped single axis Helmholtz coil for immunity tests. Designed for the generation of magnetic fields with field strength > 1000A/m.
HCS_125/75_TAP	Tapped single axis Helmholtz coil for immunity tests according to EN 55103

Triaxial Helmholtz coil HCST_50/28_TAP

Helmholtz Coils:

Several Helmholtz coils are available for susceptibility tests. We also offer tri-axial Helmholtz coils which are suitable for MTS-800. To achieve 1000 A/m at 1 kHz, it is absolutely necessary to use our Helmholtz coils and an optional available compensation board.

Magnetic-Field Test System / Low-Frequency Test System for Emission – and Immunity Tests / MTS-800

Loop sensor LS_040

Radiating Loop / Loop Sensor RLS_133

Radiating loop RL_120

Loop Sensors / Radiating Loops:

For immunity tests radiating loops are necessary to generate magnetic fields. Suitable loops are available. Measuring emissions require loop sensors which can also be ordered from us.

Coil-Type	Specification
RL_120	120mm radiating loop according to MIL-STD-461E
LS_040	Electrostatically shielded loop sensor according to MIL-STD-461E
LS_133	Electrostatically shielded loop sensor according to MIL-STD-461E
RLS_133	Electrostatically shielded loop sensor according to EN 55103-1/2. Useas Radiating loop and loop sensor

Coupling transformer CT2.5/50AC with differential amplifier

Coupling Transformer:

MIL-STD-461E CS 101 requires a coupling transformer for conducted susceptibility tests. We developed a coupling transformer which meets all requirements. Due to direct coupling to voltage mains, the coupling transformer has an additional differential amplifier for common mode rejection of the AC mains. Using the coupling transformer without this amplifier can destroy any measurement instrument due to overvoltage.

Magnetic-Field Test System / Low-Frequency Test System for Emission – and Immunity Tests / MTS-800

Testing equipment acc. to EN 55103-2:

EN 55103-2 requires certain immunity tests for frequencies from 50 Hz to 10 kHz. The following test equipment fulfils all requirements according to EN 55103-2, annex B.

Current transducer incl. correction network

Calibration network

Common mode test adapter

Technical specifications for all accessories are available on request.

Accessories selecting table:

Test equipment MIL-STD 461E	Recommended Model	CE101	CS101	CS109	RE101	RS101
Measurement receiver	MTS-800	•		•	•	•
Current probe	Pearson Model 3525	•		•		•
Signal generator	MTS-800	•	•	•	•	•
Power amplifier	MTS-800		•	•		•
Data recording device	MTS-800	•			•	
Oscilloscope	MTS-800	•	•			
Coupling transformer	CT_2.5/50AC		•	•		
Isolation transformer	Any commercially available model		•	•		
LISNs	Any commercially available model	•	•		•	•
Radiating loop 12cm	RL_120					•
Loop sensor 4cm	LS_040					•
Loop sensor 13.3cm	LS_133				•	
Ohmmeter	Any commercially available model				•	

Standards	
CE101	Conducted Emission, Power Leads, 30Hz to 10kHz
CS101	Conducted Susceptibility, Power Leads, 30Hz to 150kHz
CS109	Conducted Susceptibility, Structure Current, 60Hz to 100kHz
RE101	Radiated Emission, Magnetic Field, 30Hz to 100kHz
RS101	Radiated Susceptibility, Magnetic Field, 30Hz to 100kHz

Power Signal Generator – PSG-300

according to: EN 61000-4-16, DC – 300kHz and IEC/EN 61543, 1kHz – 150kHz

General:

The PSG-300 contains a linear precision power amplifier with a wide bandwidth (DC-300kHz), suitable for all applications concerning fast alternating signals at high output power. The built in generator provides sine, square and triangle waves. Communication between PSG-300 and PC is via USB connection. The application sofware is suited for general power generator applications and for immunity tests according to EN 61000-4-16 as well as to IEC/EN 61543. Short term tests are enabled by phase controlled switching of an external power source. The PSG-300 is equipped with a silent, temperature-controlled fan. Internal safeguards protect the amplifier from overheating and high power dissipation. They also assure protection against short-circuits and overload.

The number one choice for all applications with the need for fast and powerful signals, e.g.:

- Simulation of DC/AC supply lines
- Generation of magnetic fields with Helmholtz or similar coils
- Control of piezo actors
- Immunity testing according to EN 61000-4-16
- Calibration devices etc.

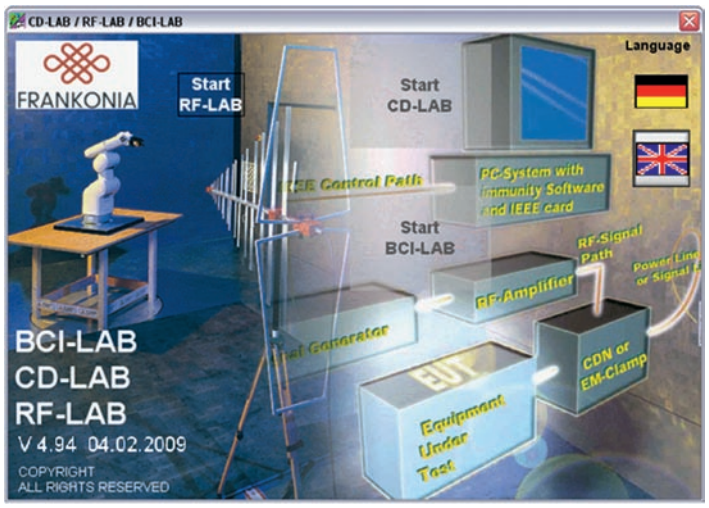
Features:

- Short circuit and overload protection
- Completely linear and low noise design
- Outstanding DC stability
- Over temperature switch off
- Protection / Ready LED

Type	PSG-300 / 260W	PSG-300 / 600W
Amplifier:		
Frequency range	DC – 1 MHz (small signal -3 dB)	
Power bandwidth	DC – 200 kHz	
Slew rate	100 V/µs	
Offset	±1 mV (±0.1 mV/°C)	
Gain	10 ±0.1 % (±0.01 %/°C)	
Output voltage	50 Veff / ±75 Vpeak	
Output current	5 Aeff / ±7.5 Apeak	16 Aeff / ±23 Apeak
Distortion (DC – 100 kHz, load ≥ 4 Ω)	< 0.10%	
Input impedance	100 kΩ	
Max. input voltage	80 V (cont.), 100 V (< 1 min)	
Noise (10 Hz – 1 MHz, input: 50 Ω)	0.5 mVeff	
Power dissipation (each side)	260 W (100 ms)	600 W (100 ms)
Output connector	4mm MC	
Output connector 50 Ohm	BNC	
Generator:		
Frequency range	DC, 0.05Hz - 300 kHz	
Frequency resolution	0.05 Hz	
Frequency accuracy	+/-20ppm	
Waveform	Sine, square, triangle	
External generator input	BNC	
Input connector for phase controlled	switching of external	
switching of external power source	power source	
General data:		
Remote control	USB connector	
Dimension (B x H x T)	84 TE x 3 HE x 410 mm	84 TE x 4 HE x 580 mm
Weight	approx. 14 kg	approx. 40 kg

RF-LAB / Control Software for Radiated Immunity Tests

acc. to common immunity test standard IEC / EN 61000-4-3, IEC/ EN 61000-4-20, automotive- and military standards



Short Description:

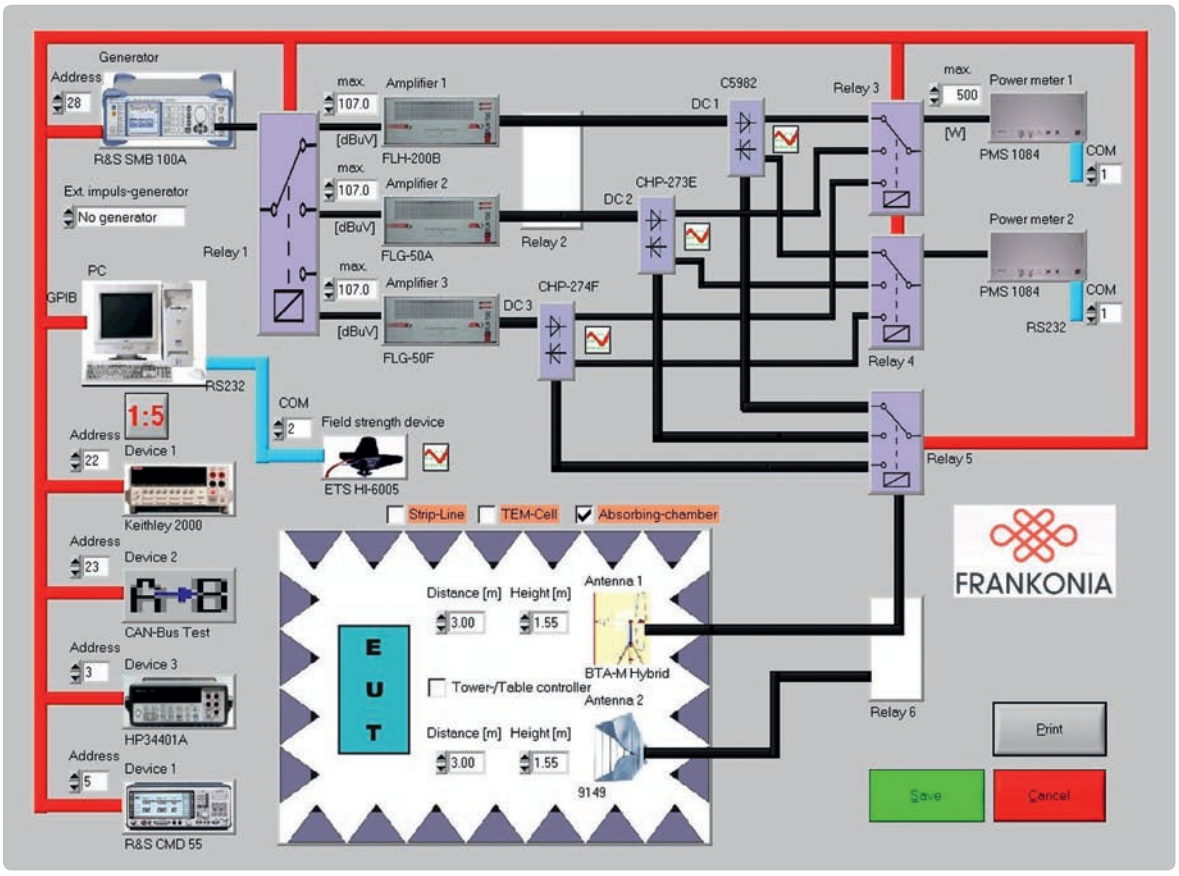
The software 'RF-LAB' controls radiated immunity test systems. The system configuration is done in a graphical set-up. The calibration files for the testing can be calculated from the uniformity measurement or measured in calibration runs. These data are stored. Tests can be performed manually with optical monitoring of the EUT or fully-automatically by up to 4 measuring instruments. Besides the software supports the measurement and evaluation of field uniformity as described in IEC / EN 61000-4-3. Calibration data, test results, and field uniformity are presented in professional reports, which contain all necessary data.

Special Features:

- Online-help function
- Graphical device specification
- Input of calibration data for all devices
- Test function for system check
- Generation of calibration file for testing by calculation from homogeneous field data or measurement
- Saturation test of test system as requested by standard
- Testing by manual optical monitoring
- Allows detailled examination by manual increase / decrease of the applied test level during test
- Testing by automatical monitoring/ evaluation of EUT with up to 4 measuring instruments
- Measurement and evaluation of field uniformity
- Presentation of results in on-line graphics
- Professional reporting system
- Export function for files for further processing in Microsoft Word, Microsoft Excel, ...
- German/ English language switchable
- Customized modifications possible

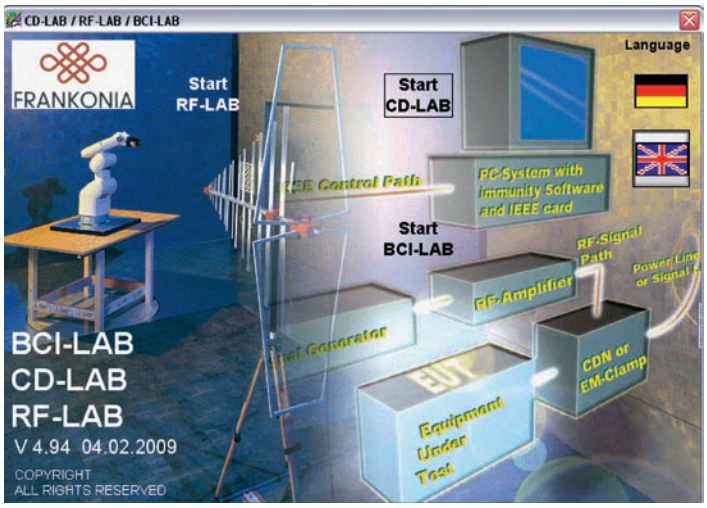
Technical Data:

Microsoft Windows-platform: WIN XP
Requires standard PC
Control of test system by
IEEE-488 (GPIB)-BUS, RS232-bus and USB
Recommended GPIB-interface card: National Instruments



CD-LAB / Control Software for Conducted Immunity Tests

acc. to common immunity test standard IEC / EN 61000-4-6



Special Features:

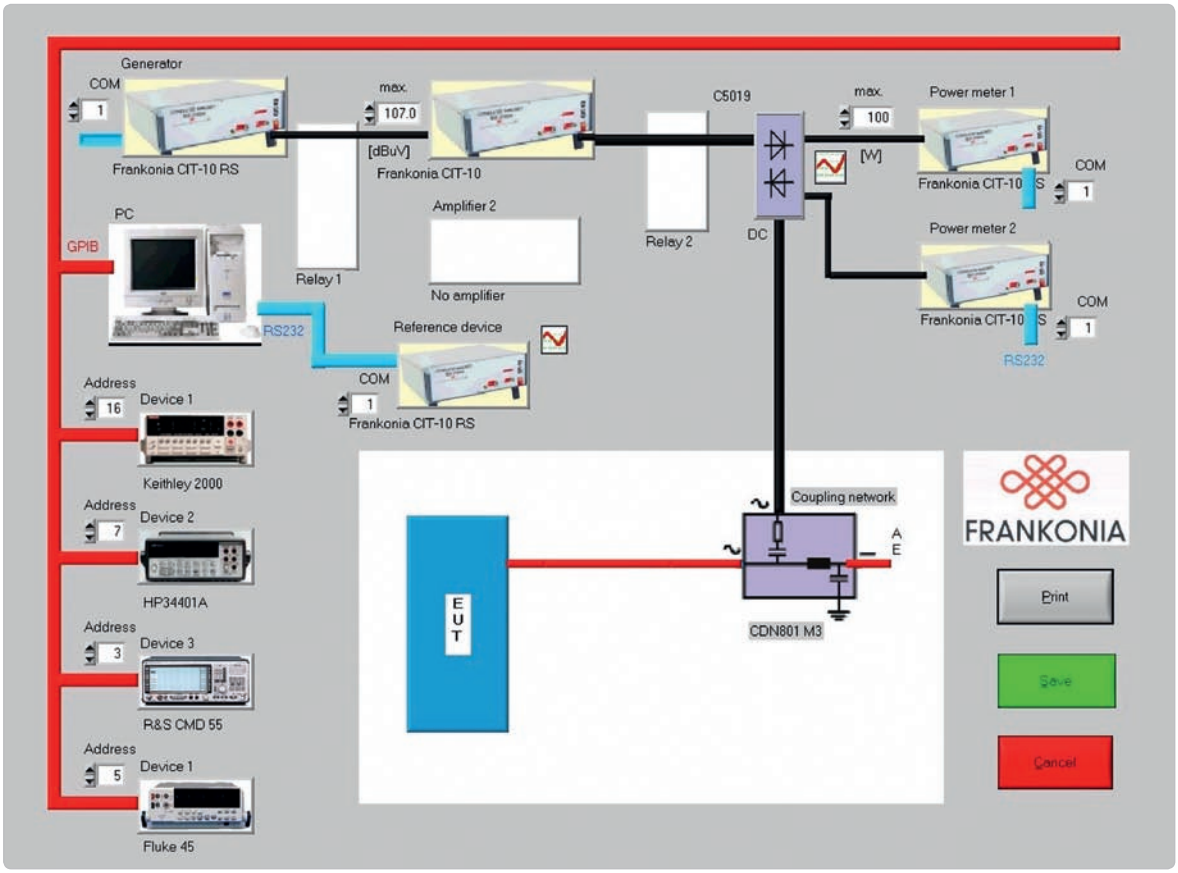
- Online-help function
- Graphical device specification
- Input of calibration data for all devices
- Test function for system check
- Testing by manual optical monitoring
  Allows detailled examination by manual increase / decrease of the applied test level during test
- Saturation test of test system as requested by standard
- Testing by automatical monitoring/ evaluation of EUT by up to 4 measuring instruments
- Supports measurement of filter attenuation
- Presentation of results in on-line graphics
- Professional reporting system
- Export function for files for further processing in Microsoft Word, Microsoft Excel, ...
- German/ English language switchable
- Customized modifications possible

Short Description:

The software 'CD-LAB' controls conducted immunity test systems. The system configuration is done in a graphical set-up. The software performs calibration runs and stores the data thereof. Tests can be performed manually with optical monitoring of the EUT or fully-automatical by up to 4 measuring instruments. Calibration data and test results are presented in professional reports, which contain all necessary data.

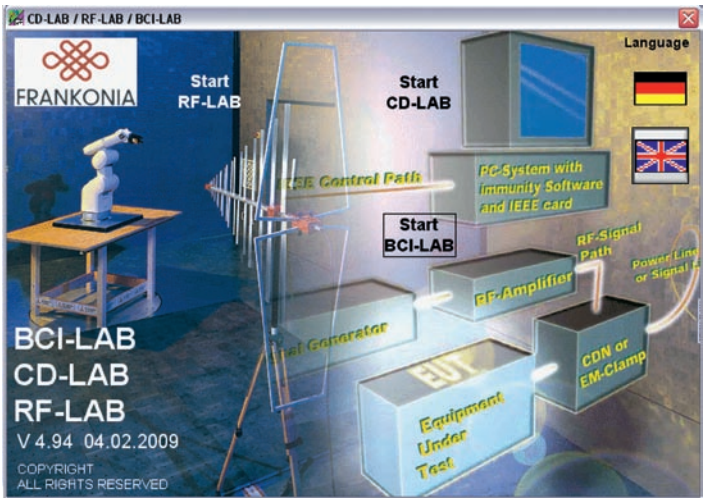
Technical Data:

Microsoft Windows-platform: WIN XP
Requires standard PC
Control of test system by
IEEE-488 (GPIB)-BUS, RS232-bus and USB
Recommended GPIB-interface card: National Instruments



BCI-LAB / Control Software for Immunity Tests with Bulk Current Injection

acc. to common immunity test standard ISO 11452-4



Specail Features:

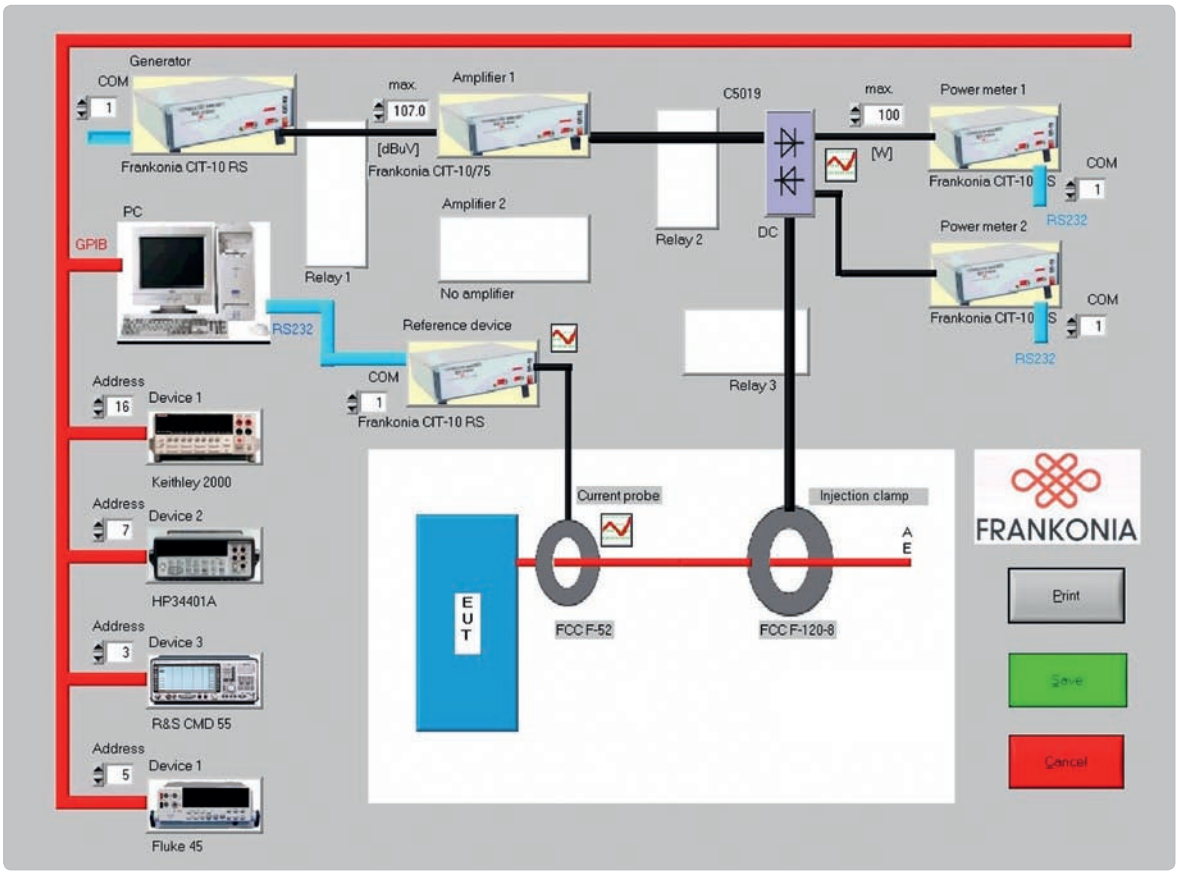
- Online-help function
- Graphical device specification
- Input of calibration data for the devices
- Testing by manual optical monitoring
- Testing by automatical monitoring/ evaluation of EUT by up to 4 measuring instruments
- Saturation test of test system as requested by standard
- Presentation of results in on-line graphics
- Professional reporting system
- Export function for files for further processing in Microsoft Word, Microsoft Excel, ...
- Test function for system check
- German/ English language switchable
- Customized modifications possible

Short Description:

The software 'BCI-LAB' controls BCI-immunity test systems. The system configuration is done in a graphical set-up. The software supports both, online control method and calibrated clamp method. Tests can be performed manually with optical monitoring of the EUT or automatically by up to 4 measuring instruments. Test results are presented in professional reports, which contain all necessary data.

Technical Data:

Microsoft Windows-platform: WIN XP
Requires standard PC
Control of test system by
IEEE-488 (GPIB)-BUS, RS232-bus and USB
Recommended GPIB-interface card: National Instruments



FRANKONIA

Frankonia EMC Test-Systems GmbH

Daimlerstraße 17
91301 Forchheim

Tel.: +49 (0) 91 91 / 73 666 - 0
Fax. +49 (0) 91 91 / 73 666 - 20

Web. http://www.frankonia-emv.com
Mail. sales@frankonia-emv.com