



Military Test System

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Brief Overview of Phenomena

The most frequent cause of damage to telecommunication and data network equipment is overvoltages or overcurrents, caused by atmospheric discharges such as lightning, direct contact with adjacent power cables or coupling of interference signals from co-located cables. Overvoltages generated by lightning surge currents can disrupt or even destroy computer related products, process control equipment and data communications equipment connected to the telephone line. Apart from interference on data lines, telecom equipment is also subjected to interference through the power interface. These can be surges generated by lightning or switching in the power network. If the interference source is in the same circuit as the electronic equipment, the transfer impedance is low and the impulse takes a current form. If the interference is from some external source, the transfer impedance will be higher and a voltage impulse results.

Telecommunications operators aim to maintain a network availability of 99.9%. In order to meet this goal, tests are performed to assess survivability and catastrophic failure of individual equipment. The objective being respectively to check for continued network operation and to ensure that failure does not lead to other equipment in the telephone exchange being damaged or destroyed.

Lightning transients are defined by the cable properties. Telecommunication lines are highly exposed and very long leading to a relatively long voltage impulse being transmitted to electronic interfaces. International telecommunication standards use the 10/700us impulse for telecommunication interfaces, a standard that is being adopted for ethernet and other fast data communication media.

EMC Partner telecom test systems are used to simulate transient (impulses) and also power contact or power induction in the public telephone network.



- Telecom interface voltage impulse (10/700us)

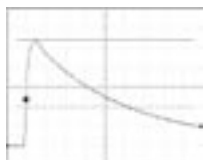
Used to simulate lightning impulses in long telecommunication lines. The 10/700us impulse is used to test telecom interfaces at the exchange and user premises.

Application is through specialized Coupling De-coupling Networks (CDNs) that enable continuous traffic while the impulses are applied.



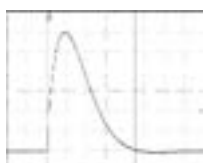
- Power interface impulse (Combination wave)

A selection of damped sinusoidal transients are used to simulate oscillations arising from excitation of the platform wiring due to incidence of lightning, EMP or platform switching. Typical frequencies are in the range from 10's of kHz to 100's of MHz.



- ESD

ESD can result from charging of personnel or equipment. Resultant waveforms and test levels are dependant on location. ESD impulses are used to ensure equipment is not damaged during maintenance procedures.

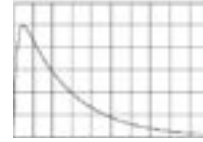


- Voltage Spike

Voltage spikes on the AC or DC power supply interfaces are due to platform power supply switching transients. These are transmitted by interconnecting cables and appear at equipment interfaces throughout a platform on the power supply pins. Disturbances on AC power lines may appear synchronised to particular switching angles of a 400Hz supply.

- EMP

These events result from nuclear detonations. They are characterised by very steep risetime pulses of several hundred kilovolts. Military systems should be hardened to withstand these pulses.



Applicable Standards

Department of Defence

MIL-STD-461F (2007): Requirements for the control of Electromagnetic Interference characteristics of subsystems and equipment.

MIL-STD-883E (1999): Test method standard Microcircuits.

MIL-STD-331B (1989): Fuse and Fuse components.

MIL-STD-750D (1995): Test Method Standard Semiconductor devices.

MIL-STD-464 (1997): Electromagnetic Environmental Effects requirements for systems.

MIL-STD-1541 (1987): Electromagnetic Compatibility Requirements for space systems.

MIL-STD-1275B (2004): Characteristics of 28V DC electrical systems in military vehicles.

MIL-DTL-23659D: Exploding Foil Initiator (EFI) Qualification.



Airbus

ABD0100.1.2 and AMD-24C: Variable frequency and dc power supply tests.



North Atlantic Treaty Organisation

Test Requirement CS-EFA-4 (Imported Transients) of Eurofighter SPE-J-00-E-1000 (1991).



Test System Overview

Test System Features

- Modular construction allows for future expansion
- Clean reproducible waveforms
- Simple operation
- Parameter change during operation (+/-)
- Internal program memory
- Electronic polarity change
- Compact designs
- Fulfills ALL transient requirements
- Remote control and software upgrade through standard interface
- Full range of accessories
- 2 year warranty

User Benefits

The technical excellence and many unique features of EMC PARTNER military generators translate directly into benefits for the user:

- Cost effective solutions to meet many test requirements
- Simple extension to meet future test needs
- Increase quality of test object
- Real time parameter change, ideal development tool
- Save operator time with the automated test routines and test report facility
- Unparalleled reliability and system up-time

Generators

The EMC PARTNER family of military test generators simulate transient and EMC events that have been observed in military vehicles and systems due to external lightning and EMP events or internal platform generated transients. EMC PARTNER military generators are available in a number of versions which can be upgraded to give enhanced test capability at a later date.



MIG2000-6

- MIG2000-6

MIG2000-6 is a modular system using plug-in technology to simulate a wide range of specialist impulses. These include the MIL-STD-461F CS115, CS116 and CS106 waveforms. Modules for the Euro fighter CS-EFA-4 (NATO Fast & Slow) requirement are available as well as for voltage spikes on power supplies.

The unique modular architecture of MIG2000-6 enables integration of additional waveforms to meet specialist requirements.

- MIG1212EMP

This generator simulates the incidence of electromagnetic pulse induced into power supply cables in military or civil defence installations. This system delivers impulses of 0.5/50 μ s and 0.5/250 μ s. Together with the DN-MIG12-16 decoupling unit, it can be moved between locations to test installations in-situ.



MIG1212EMP with DN-MIG12-16

- ESD3000

ESD3000 is a light weight, hand-held battery operated tester. A range of changeable Discharge Modules (DMs) and Discharge Networks (DNs) have been developed specially for military applications. A broad range of accessories enable testing to many applications for contact discharge, air discharge and indirect discharge up to 30kV. ESD3000 architecture allows customer specific requirements to be realised.

Remote control of EMC PARTNER military test systems is possible using either the EMC PARTNER TEMA or GENECS-MIG software packages.

A wide range of accessories are available to facilitate testing. Coupling transformers for cable serial injection and test probes for parallel injection complete the system.

System Flowcharts

The following flowcharts illustrate EMC PARTNER equipment configurations necessary to perform transient tests in accordance with military and avionic standards.

MIG2000-6

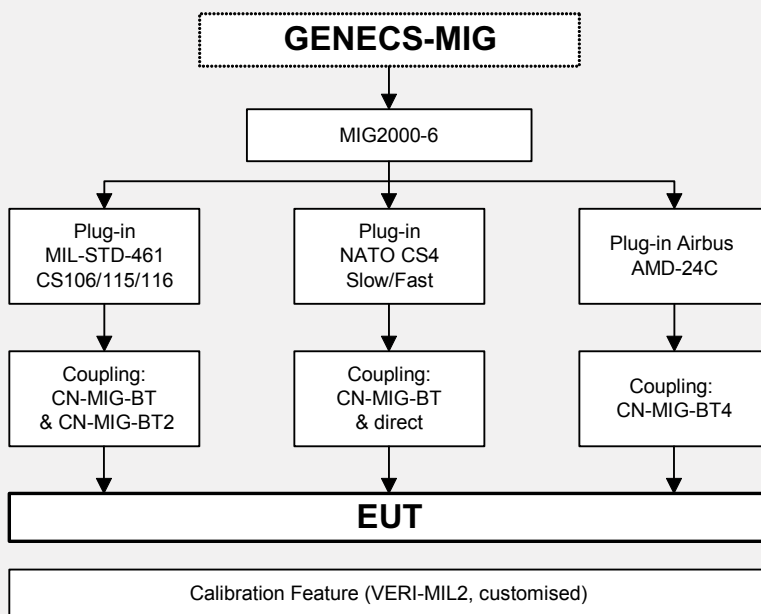
- Serial Coupling

The CN-MIG-BT and CN-MIG-BT2 couplers are used to inject the CS115 transient, the CS116 damped sinusoidal wave and CS106 voltage spikes by the cable induction method.

Waveforms are induced through the coupling transformer(s) into interconnecting cables and power leads.

- Parallel Coupling

The waveforms are applied directly from the generator output, using special test probes, to designated connector pins or connections on an EUT.



As part of the test process, each transient must be verified. A calibration feature is substituted for the EUT to verify the test set-up including couplers and cables.



ESD3000

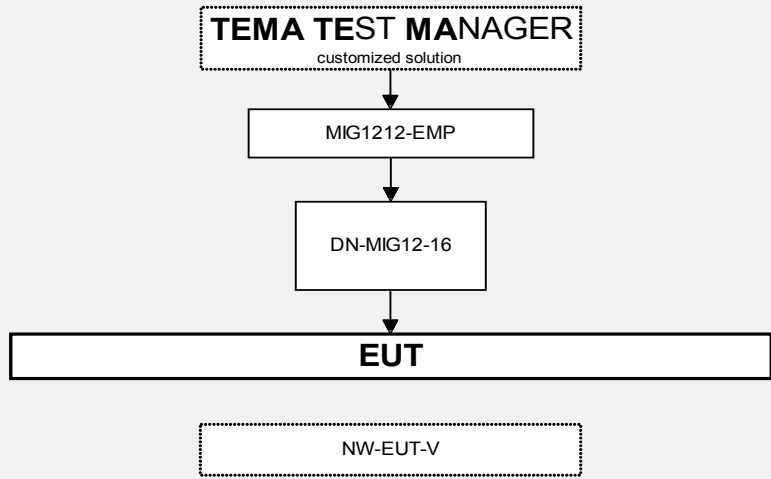


Serial Coupling with CN-MIG-BT

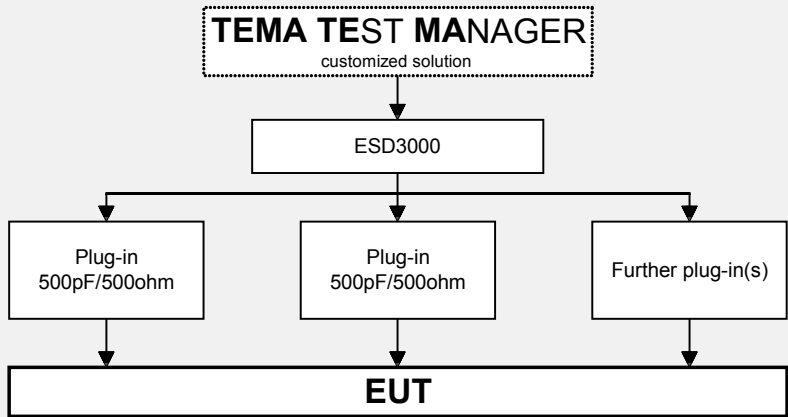


Parallel coupling "direct"

MIG1212EMP



ESD3000



Generator Specifications

MIG2000-6 (MIL-STD-461 Modules)

CS106

Voltage range	100V up to 500V
Rise time	1.5µs
Fall time	3.5µs
Duration	5µs
Repetition rate	10Hz (max)

CS115

Current range into 100ohm	1A up to 10A
Rise time	< 2ns
Fall time	< 2ns
Duration	30ns
Repetition rate	30Hz (max)

CS116 (10kHz)

Current range into 100ohm	0.02A up to 0.2A
Frequency	10kHz
Damping	4th peak 40 to 50%
Repetition rate	2Hz (max)

CS116 (100kHz)

Current range into 100ohm	0.2A up to 2A
Frequency	100kHz
Damping	4th peak 40 to 50%
Repetition rate	2Hz (max)

CS116 (1MHz)

Current range into 100ohm	1A up to 15A
Frequency	1MHz
Damping	4th peak 40 to 50%
Repetition rate	2Hz (max)

CS116 (10MHz)

Current range into 100ohm	2A up to 12A
Frequency	10MHz
Damping	4th peak 40 to 50%
Repetition rate	2Hz (max)

CS116 (30MHz)

Current range into 100ohm	2A up to 12A
Frequency	30MHz
Damping	4th peak 40 to 50%
Repetition rate	2Hz

CS116 (100MHz)

Current range into 100ohm	1A up to 6A
Frequency	100MHz
Damping	4th peak 40 to 50%
Repetition rate	2Hz

For avionics applications (DO160, AMD-24C) please refer to the Avionics Test System brochure for more information.

MIG1212EMP

0.5/250µs

Voltage Range Common mode	1 up to 12kV
Risetime	500ns
Duration	ca. 250µs
Current Range Common mode	100 up to 1.2kA
Risetime	500ns
Duration	ca. 155µs

0.5/50µs

Voltage Range Differential mode	1 up to 12kV
Risetime	500ns
Duration	ca. 50µs
Current Range Differential mode	100 up to 1.2kA
Risetime	500ns
Duration	ca. 155µs

ESD3000

Please refer to ESD Test System brochure for further information.

Accessories and Options

MIG2000-6

	MIL-STD-461 CS106	MIL-STD-461 CS115	MIL-STD-461 CS116 10kHz	MIL-S TD-461 CS116 100kHz	MIL-STD-461 CS116 1MHz	MIL-STD-461 CS116 10MHz	MIL-STD-461 CS116 30MHz	MIL-STD-461 CS116 100MHz	MIL-STD-1275D	Euro Fighter CS-EFA-4	Airbus AMD24-C	DO160 section 17	DO160 section 19
Plug-ins													
CS106	X												
CS115 REC		X											
CS116-10K10M			X	X	X	X							
CS11630M100M							X	X					
NATO-SLOW 10u										X			
NATO-FAST-150n										X			
Fx-DO-160-S17												X	
Fx-DO-160-S19													X
Fx-MIL1275B									X				
Fx-AMD24C											X		
Accessories													
CN-MIG-BT	X	X	X	X	X	X				X		X	
CN-MIG-BT2							X	X					
CN-MIG-BT4											X		
SYNC-ADAPTER										X	X	X	
VERI-MIL2		X	X	X	X	X	X	X					
VERI-50		X	X	X	X	X	X	X		X		X	
VERI5	X									X	X		

Example of a plug-in



Plug-ins

Enhance MIG2000-6's capability by including additional waveforms. New plug-ins are automatically recognised and controlled by the MIG2000-6 firmware.

CN-MIG-BT

Coupling transformer for cable bundles up to 3.5 x 6cm.



CN-MIG-BT

CN-MIG-BT2

Coupling transformer for cable bundles up to 3.5 x 6cm. Includes 0.1ohm calibration shunt.



CN-MIG-BT2

CN-MIG-BT4

Coupling transformer for cable bundles up to 3.5 x 6cm.



CN-MIG-BT4

VERI5

Coaxial high voltage termination and integrated divider with 5ohm.



VERI5

VERI50

Coaxial high voltage termination and integrated divider with 50ohm.



VERI50

Sync-Adapter

Power line synchronisation box for superimposing transients on 50Hz, 60Hz and 400Hz supplies.



Sync-Adapter

VERI-MIL2

Coaxial calibration jig. Needs two 50ohm terminations with dividers.



VERI-MIL2

Further Accessories

For further accessories, please refer to the Avionics Test System brochure.

MIG1212EMP

DN-MIG12-16

De-coupling network. Single phase up to 230V/3kVA and three phase 440V/10kVA.

Application: Superimposing NEMP impulses onto power supply lines.



MIG1212EMP with
DN-MIG12-16

NW-EUT-V

Reference load used to verify MIG1212EMP voltage impulse. 6nF capacitor from each phase to PE.



NW-EUT-V

ESD3000

Please refer to the ESD Test System brochure for further information.

Software

For remote control of EMC PARTNER military generators, one of the following software packages is needed:

- GENECS-MIG. This is a relatively simple program that reproduces generator front panel functions on a PC. In addition to remote programming and control of the generators, test report information is available to word processing or other evaluation programs such as EXCEL.
- TEMA Software. Comfortable control of EMC PARTNER generators from a PC. Enables several generator types to be included in the same test sequence. Generates an enhanced level of test report.

Predefined test routines for MIL

The screenshot displays the Test-Manager software interface for a test sequence titled "MIL-STD-461F, CS116 10kHz to 100MHz". The main window shows a sequence of six test steps, each with a waveform icon and a "pass/fail" indicator. The test parameters are as follows:

- Step 1: CS116 10kHz test 0.1A, Load Setup: CS11610k, Generator: MCG2000-6 3.5A, Result: Test not run.
- Step 2: CS116 100kHz test 1.0A, Load Setup: CS116100k.
- Step 3: CS116 100kHz test 1.0A, Load Setup: CS116100k.
- Step 4: CS116 100kHz test 1.0A, Load Setup: CS116100k.
- Step 5: Operator Action before Continuing with Test.
- Step 6: CS116 30MHz test 10.0A, Load Setup: CS11630M.

An inset window titled "MCG2000-6" shows the generator control interface. It includes a "RUN" button, a "TRIG" button, and a display showing "Running" status, "Break + 10A", "Timer 225s", and "Rep. 1 3.00s". The interface also shows "Status: o.k." and "F1-F6" function keys.

EMC PARTNER's Product Range

The Largest Range of Impulse Test Equipment up to 100kA and 100kV.

Immunity Tests

Transient Test System performs all of the following tests on electronic equipment as required for the CE-mark up to full levels: ESD, EFT, surge, dips, a.c. magnetic field, surge magnetic field and common mode tests. A large range of accessories for different applications is available: MF antennas, three phase couplers, verification sets, coupling kits, etc. The Transient Test System complies with IEC 61000-4-2, -4, -5, -8, -9, -11, -12p, -16p, -29p.

TRA2000, ESD3000 and CDN2000A-06-32 – a complete automatic three-phase test system



Lightning Tests

EMC PARTNER offers a wide range of testers in accordance with national and international standards. These include FCC 68 part D, ITU K.44, ETS 300 046, Bellcore GR1089 for telecom, RTCA DO160D for aircraft and MIL-STD-461E for military electronic equipment testing.

MIG0600MS and MIG-OS-MB – a multiple stroke and multiple burst aircraft test system



Component Tests

EMC PARTNER offers a wide range of modular impulse generators (MIG) for transient component testing on: varistors, arresters, surge protective devices (SPD), capacitors, circuit breakers, watt-hour meters, protection relays, insulation material, suppressor diodes, connectors, chokes, fuses, resistors, emc-gaskets, cables, etc.

MIG1212CAP – an automatic 8 bank capacitor test system



Emission Measurements

One unit performs all measurements on the power supplies of electronic equipment and products for the CE-Mark.

The HAR1000 includes an amplifier for a clean power source, a line impedance network, the measurement systems Harmonics and Flicker. Accessories: three phase extension and HARCS Immunity software. Complies with IEC/EN 61000-3-2 and -3.

HAR1000-3P and HARCS Software – a complete three-phase harmonics and flicker test system



For further information please do not hesitate to contact EMC PARTNER's representative in your region. You will find a complete list of our representatives and a lot of other useful information on our website:

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