Military Test System

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Testing of service systems and vehicles is aimed at ensuring that equipment used on active service performs as intended no matter how hostile or electromagnetically polluted the environment.

With the introduction of more sophisticated systems and an increasing reliance on computer and microchip technology coupled with a need for interoperability between land, sea and air forces, testing requirements are becoming tougher and more extensive.

There are two main sources of transients. Internally generated switching transients can be generated as a result of bouncing relay contacts. These transients could initiate resonances in platform cabling. Such transients can appear in both power supply and data cables.

External events such as incidence of lightning or EMP can result in damped oscillatory transients being transmitted throughout a platform wiring.

Apart from switching transients, lightning or EMP, the most significant EMC events for military vehicles are electrostatic discharge (ESD). Military vehicles in particular can become charged as a result of precipitation, moving through dust laden atmospheres, fuel flow or launch vehicles. An aircraft, for example, has the potential for a discharge equivalent to several 100 Kilovolts, which is a potential threat to operators and servicing personnel. Under dry and cool conditions, personnel can also become charged, that is a potential danger to electronic components and munitions or explosive devices such as foil initiators in ejector seats etc.

Nuclear electromagnetic pulse is a fast risetime free space phenomena arising from the detonation of nuclear devices. Also called NEMP or HEMP, such transients must be taken into account not only by the military, but also in civil defence buildings and equipment.

EMC PARTNER military generators can replicate the following phenomena:

- **Bulk Cable Injection, Impulse Excitation (CS115)**
  
  Used to simulate bouncing relay contacts that could initiate resonances in platform cabling.

  Applied to all cables both power supplies and data using an injection clamp. This simulates the platform structure being used as the power return path.

  The sharp (2ns) rise and fall times and the pulse duration approximate the energy content of such transients.

  A high repetition rate is used to ensure equipment resistability.

- **Damped Sinusoidal Transients (CS116)**
  
  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-DTL-23659D: Exploding Foil Initiator (EFI) Qualification.

#### Airbus

- ABD0100.1.2 and ABD0100.1.8.1: Variable frequency (115V) and dc power supply tests.

#### North Atlantic Treaty Organisation

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 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.

- 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.
### Generator Specifications

#### MIG2000-6 (MIL-STD-461 Modules)

<table>
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<tr>
<th>Module</th>
<th>Parameters</th>
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<tr>
<td><strong>FX-CS106</strong></td>
<td>Voltage range: 100V up to 500V</td>
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<td>Rise time: 1.5µs</td>
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<td>Fall time: 3.5µs</td>
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<td>Duration: 5µs</td>
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<td>Repetition rate: 10Hz (max)</td>
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<td><strong>CS115REC</strong></td>
<td>Current range into 100ohm: 1A up to 10A</td>
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<td>Rise time: &lt; 2ns</td>
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<td>Fall time: &lt; 2ns</td>
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<td></td>
<td>Duration: 30ns</td>
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<td>Repetition rate: 30Hz (max)</td>
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</table>
### CS116-10K10M - 10kHz
- Current range into 100ohm: 0.02A up to 0.2A
- Frequency: 10kHz
- Damping: 4th peak 40 to 50%
- Repetition rate: 2Hz (max)

### CS116-10K10M - 100kHz
- Current range into 100ohm: 0.2A up to 2A
- Frequency: 100kHz
- Damping: 4th peak 40 to 50%
- Repetition rate: 2Hz (max)

### CS116-10K10M - 1MHz
- Current range into 100ohm: 1A up to 15A
- Frequency: 1MHz
- Damping: 4th peak 40 to 50%
- Repetition rate: 2Hz (max)

### CS116-10K10M - 10MHz
- Current range into 100ohm: 2A up to 12A
- Frequency: 10MHz
- Damping: 4th peak 40 to 50%
- Repetition rate: 2Hz (max)

### CS116-30M100M - 30MHz
- Current range into 100ohm: 2A up to 12A
- Frequency: 30MHz
- Damping: 4th peak 40 to 50%
- Repetition rate: 2Hz

### CS116-30M100M - 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
## Accessories and Options

### MIG2000-6

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## 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 x 6cm.

### CN-MIG-BT2

Coupling transformer for cable bundles up to 2.5 diameter. Includes 0.1ohm calibration shunt.

### CN-MIG-BT4

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

### VERI5

Coaxial high voltage termination and integrated divider with 5ohm.

### VERI50

Coaxial high voltage termination and integrated divider with 50ohm.

### SYNC-ADAPTER

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

### VERI-MIL2

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

### DC-S17CL

Set of 4 boxes for Voltage Spikes Testing according to DO-160-S17 and MIL-STD-461E CS106, consisting of:
- two decoupling boxes “PARALLEL INJECTION”. Can be used separately for 230V, 50/60Hz, 10A or connected in parallel for max. 115V, 400Hz, max. 10A
- two decoupling boxes “SERIAL INJECTION” with 2x 10µF for use max. 230V, 50Hz or 115V, 60Hz, 400Hz.

### Further Accessories

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

### 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.

### NW-EUT-V

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

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**Software**

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**Predefined test routines for MIL**

**MIL-STD-461F, CS116 10kHz to 100MHz**

12/23/2006 EMC PARTNER AG, 4242.Linqin, Switzerland

- **Load Setup:** CS116-01A
- **Generator:** MK2000-3, 5kW
- **Test Induration:**

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**Operator Action before Continuing with Test**

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**MIG2000-6**

**Load Setup:** CS116-01B

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**Operator Action before Continuing with Test**

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EEMC PARTNER’s Product Range

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

**Immunity Tests**

Transmit Test System can be used to performs all EMC tests on electronic equipment. ESD, EFT, surge, AC dips, AC magnetic field, surge magnetic field, common mode, damped oscillatory and DC dips tests are available as stand-alone or combined test instruments. A large range of accessories for different applications is available: three phase couplers up to 690V/100A, telecom and data line couplers, verification sets, magnetic field coils. Immunity test systems fulfills IEC and EN 61000-4-2, -4, -5, -8, -9, -11, -12, -16, -18, -29.

**Lightning Tests**

A range of test equipment and accessories for aircraft, military and telecom applications. Complete solutions including all hardware and software to meet the requirements of RTCA / EUROCAE DO160 / ED14 for indirect lighting on aircraft systems, MIL-STD-461 tests CS106, CS115, CS116, for military vehicles, ITU-T K44 basic and enhanced tests for impulse, power contact and power induction, FCC part 68 for telecom equipment testing.

**Component Tests**

Modular impulse generators (MIG) for transient component testing on: varistors, gas discharge tubes (GDT), surge protective devices (SPD), X Y capacitors, circuit breakers, watt-hour meters, protection relays, insulation material, suppressor diodes, connectors, chokes, fuses, resistors, emc-gaskets, cables, etc. Manual or fully automated solutions are available up to 100kA (8/20us) and 144kV (1.2/50us).

**Emission Measurements**

One unit performs all measurements on the power supplies of electronic equipment and products for the CE-Mark. HAR1000 uses a novel techniques to deliver clean power source for the EUT in a compact and lightweight form. The system includes all hardware and software including line impedance networks, control and evaluation software. A basic 1-phase system can be easily extended to 3-phase by adding 2 further phases. HARCS Immunity software further expands the system by adding interharmonic tests, voltage variation and ripple on DC tests. Complies with IEC / EN 61000-4-2, -4, -5, -8, -9, -11, -12, -16, -18, -29.

**System Automation**

As addition to the basic generators, a range of accessories are available to enhance capability. Test cabinets, test pistols, adapters and software, simplify interfacing with the EUT.

PS3 programmable source is an EMC hardened supply for frequencies form 16.7Hz to 400Hz. Frequency variation tests can be made using the PS3-SOFT-EXT. Complies with IEC / EN 61000-4-28.
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:

www.emc-partner.com

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