Tele : 07324- 256130

Army Centre for Electromagnetics
Mhow (MP)
PIN - 900444
c/o 56 APO

2710/M/EMP Sml/

23 Jul 2010

To

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RFI : PROCUREMENT OF FAST TRANSIENT RESPONSE ELECTROMAGNETIC PULSE (EMP) SIMULATOR

1. Govt of India, Ministry of Defence is interested in procuring Quantity One Fast Transient Response EMP Simulator for EMI/EMC testing of equipment to be inducted in the Army as per MIL STD 461E/F at Army Centre for Electromagnetics (ACE), Mhow.

2. The project will involve the following procurement, installation & training for EMP Simulator as per RS 105 test setup according to Mil Std 461 D/E/F for testing of equipment at Army Centre for Electromagnetics.

3. The qualitative requirements and technical specifications for the above are enclosed alongwith.

4. You are requested to provide compliance to the technical parameters and budgetary estimates alongwith approximate time plan for completion of the project.

5. Clarifications if any may be sought from the following, either on telephone or via email:-

Staff Officer (Tech)
Army Centre for Electromagnetics (ACE)
Mhow
MP – 453441
Tele: - 07324 – 256130
Fax: - 07324 – 273080
Email id:- acemhowmp@yahoo.co.in
acemhow-army@nic.in

6. You are kindly requested to furnish above details by 25 Aug 10.

Sd/xxxxxxx
(N Pawar)
Lt Col
SO (Tech)
for Cdr

Encls : **(**As above)

PART I-GENERAL INFORMATION

Related Information

1. The following standards as applicable may be referred:-

   (a) JSG-0261, JSG-0262 and JSG-0269.

   (b) United States Department of Defense Mil Std 461 Revision D/E/F.

Compliance of Metric System

2. The proposed system along with its components, manuals and software should be based on the International System of Unit (SI Units).

Date of Availability

3. The complete system should available for user trial within 180 days of allotment of project.

PART II-OPERATIONAL CHARACTERISTICS

4. **Transient Pulse Waveform**. The test signal generated should be as per the waveform and amplitude shown in the figure at **Appendix A**.

5. **System Specification**. Radiated Susceptibility transient electromagnetic field (RS-105) test as per Mil Std 461 D with following specifications ***or better***:-

   (a) Transient Electric Field Intensity - 50kV/m.
   (b) Magnetic Field Intensity - 130 A/m.
   (c) DC Charging Generator - 60kV, Continuously variable (approximately)
   (d) Transient Pulse Charge and Discharge Time – Maximum 100 nano seconds (Less than or equal to 10 Ns charging time and greater than equal to 75Ns discharge time).

6. **Equipment Under Test (EUT) Size and Test Equipment**. The proposed block diagram of the system and test equipment that are required for the Fast Transient Response Generator (EMP Simulator) are given at Appendix B and C respectively. It should cater for test volume to accommodate equipment of size of ***minimum*** 1m x 1m x1m.

7. **Setup of the Transient Generator**. The proposed simulator is required to be set up in two routines, calibration and test routine as explained below :-

   (a) **Calibration Routine**. The test equipment should conform to the set up given at **Appendix D**.

   (b) **Test routine**. The test equipment should conform to the set up given at **Appendix E**.

8. **Conforming Test Procedure**. The proposed simulator should conform to the test procedure given at **Appendix F**.

9. **Data Presentation**. The data presentation should be as follows :-

(a) Provide photographs of equipment Under Test (EUT) orientation including cables.

(b) Provide a detailed written description of the EUT configuration.

(c) Provide Oscilloscope recordings that show peak value, rise time and pulse width of one applied pulse for each EUT orientation.

(d) Provide the pulse number, with the first pulse being number 1, for each recorded wave shape.

(e) Record the time-to-recovery for each EUT failure, if applicable.

(f) Monitor the applied pulse using at least one of the calibration probe and storage oscilloscopes.

PART III-PHYSICAL CHARACTERISTICS

10. The Simulator shall adhere to the following physical characteristics :-

(a) All cabling should be treated with overall shielding.

(b) All cabling must be kept as short as possible with the test cell.

(c) All cabling must be oriented to minimize coupling to the transient fields.

(d) Since the polarization of the incident transient field in the installation is not know and the EUT needs to be tested in all the orthogonal axes, the axis of the simulator needs to be sufficiently large (to be able to take in 1x1x1 meter size of equipment) to accommodate the EUT without any adverse effect on the test results.

(e) The simulator must be capable of building up of power in steps of 10% in the first stage, and then in three balanced steps as the EUT may exhibit susceptibility at lower levels that does not occur at higher levels due to the presence of Terminal Protection Devices (TPDs).

(f) Capable of measuring the E-field with the B-dot or D-dot probe.

(g) Capable of inverting the probe by rotating by180 degrees.

(h) Capable of measuring the E-field again and invert the signal.

(j) Capable of overlaying and subtracting the two signals.

(k) The system should have both automated and manual operations.

(l) Adequate protection measure should be provided for the personnel handling and operating the system.

(m) Adequate protection measures should be provided for the electronic equipment to the near vicinity and neighboring rooms.

PART IV – OPERATION AND MAINTENANCE

11. Repair and maintenance support should be assured for the entire anticipated life of the system. Functioning of the system should be easy, simple and user friendly. It should be easy to train newly inducted personnel on the functioning and routine maintenance of the system.

12. The vendor should agree to provide calibration services for the life of the simulator.

13. Documents and manuals provided should be exhaustive and in simple and easy to understand English language.

14. The vendor should provide three years warranty and undertake annual maintenance contract for 10 years after expiry to warranty.

PART V- ATTRIBUTES COEFFICIENTS AND MEASURES OF EFFECTIVENESS

15. (a) Vital Characteristics to be allotted : 10 points

(b) Essential characteristics to be allotted : 08 points

(c) Desirable characteristics to be allotted : 05 points

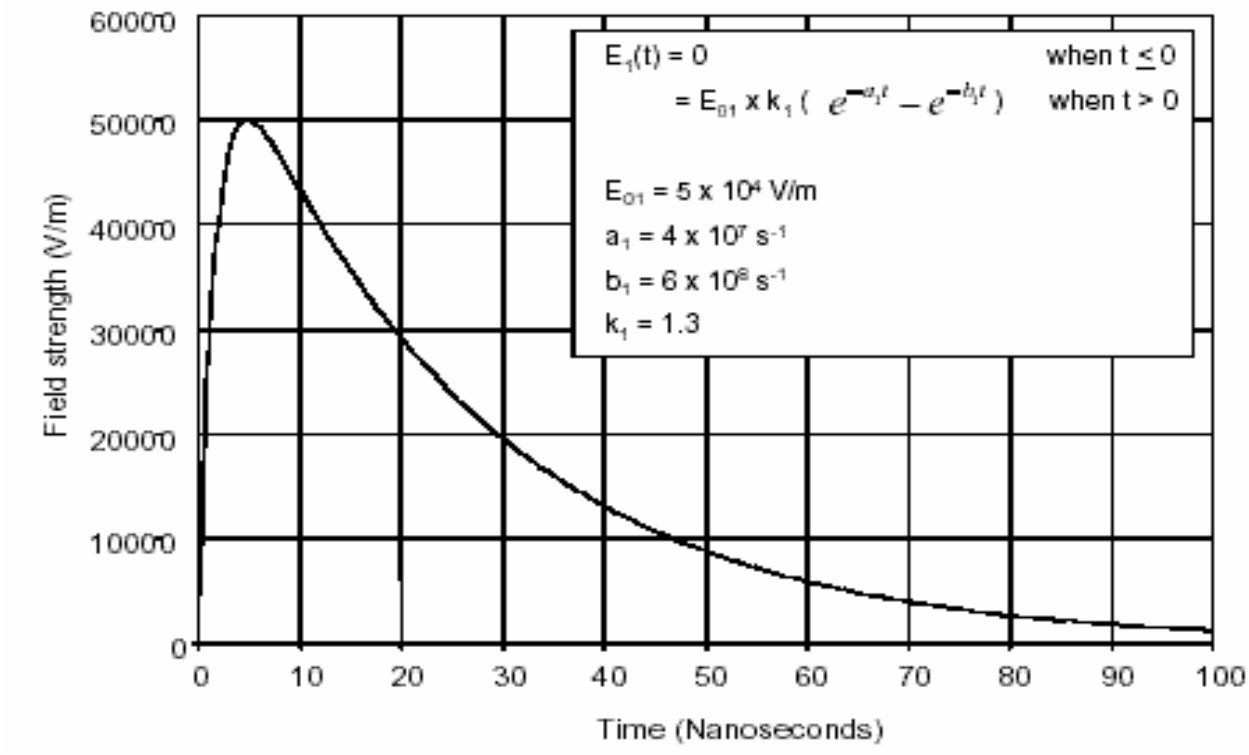
(d) Equipment selected should have 80 % of total points.

PART VI- MISCELLANEOUS

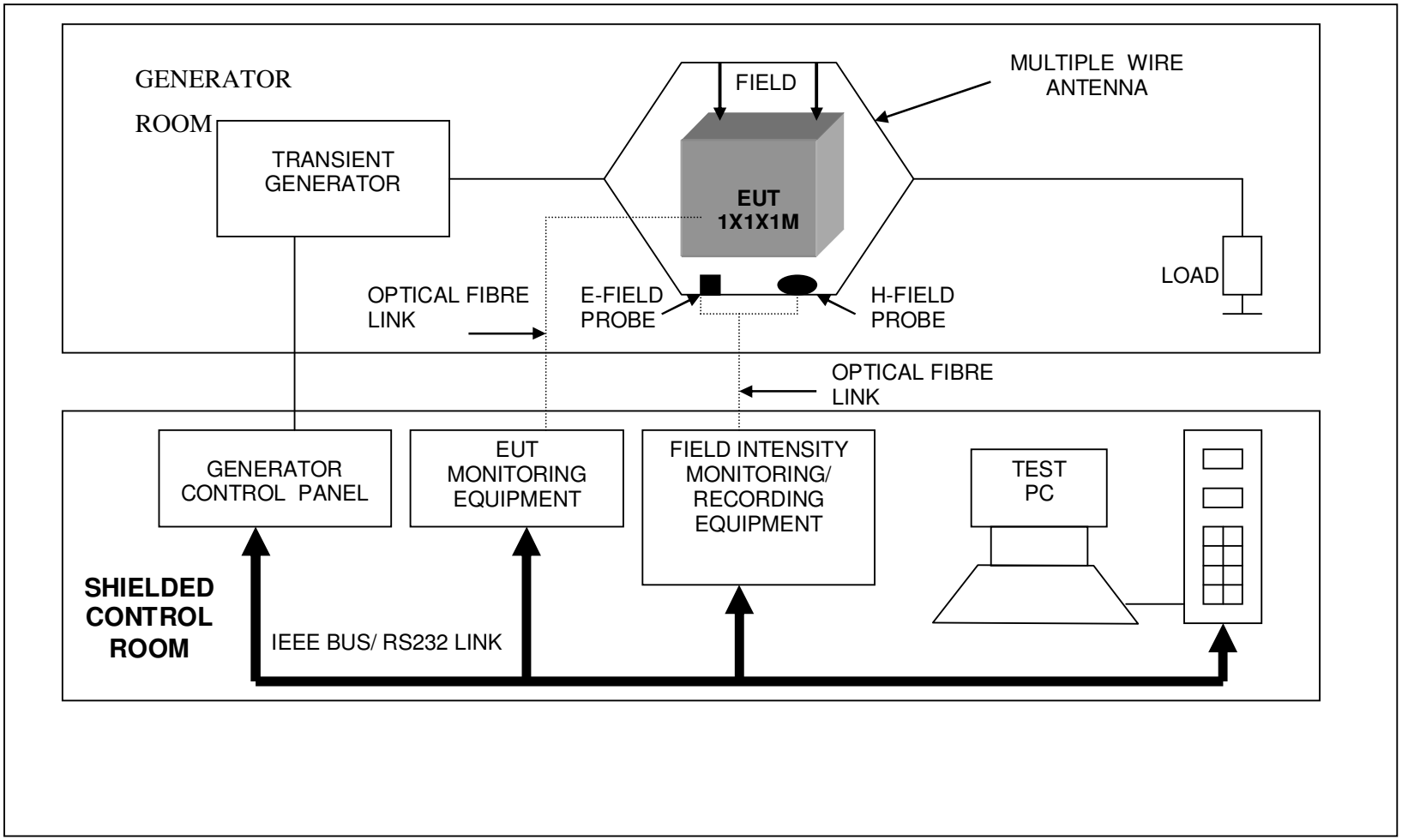
21. Documents and manuals provided should be exhaustive and in simple and easy to understand English language.

22. Vendor must provide technical literature training literature, parts list, installation and operating instructions.

Appendix A
(Refers to Para 5 of QR for EMP Simulator)



FUNCTIONAL BLOCK DIAGRAM OF RS 105 AUTOMATED TEST SYSTEM

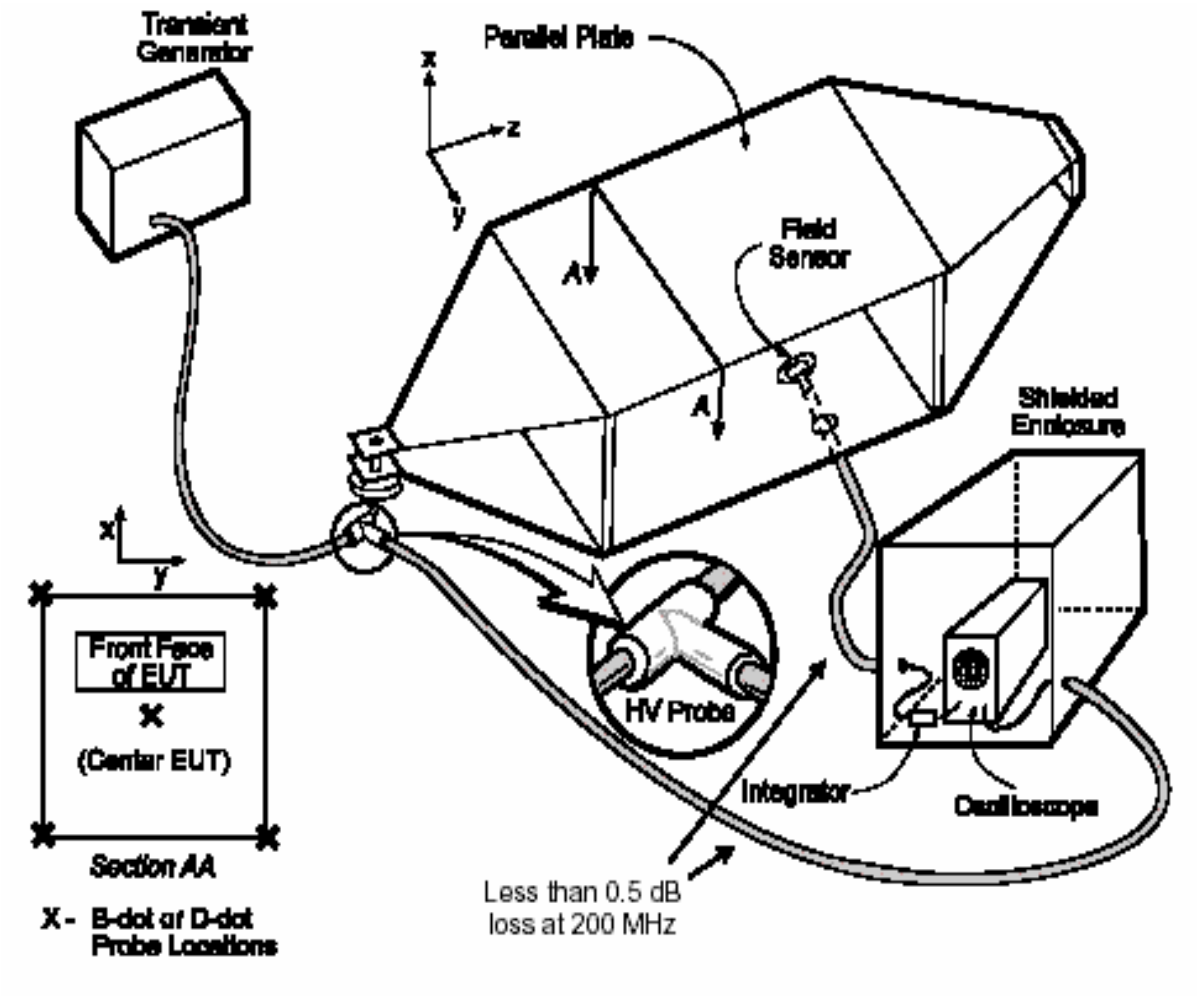


Appendix C
(Refers to Para 7 of QR
for EMP Simulator)

TEST EQUIPMENT REQUIRED FOR FAST TRANSIENT RESPONSE EMP SIMULATOR (RADIATED SUSCEPTIBILITY, TRANSIENT ELECTROMAGNETIC FIELD (RS 105) AUTOMATED TEST SYSTEM)

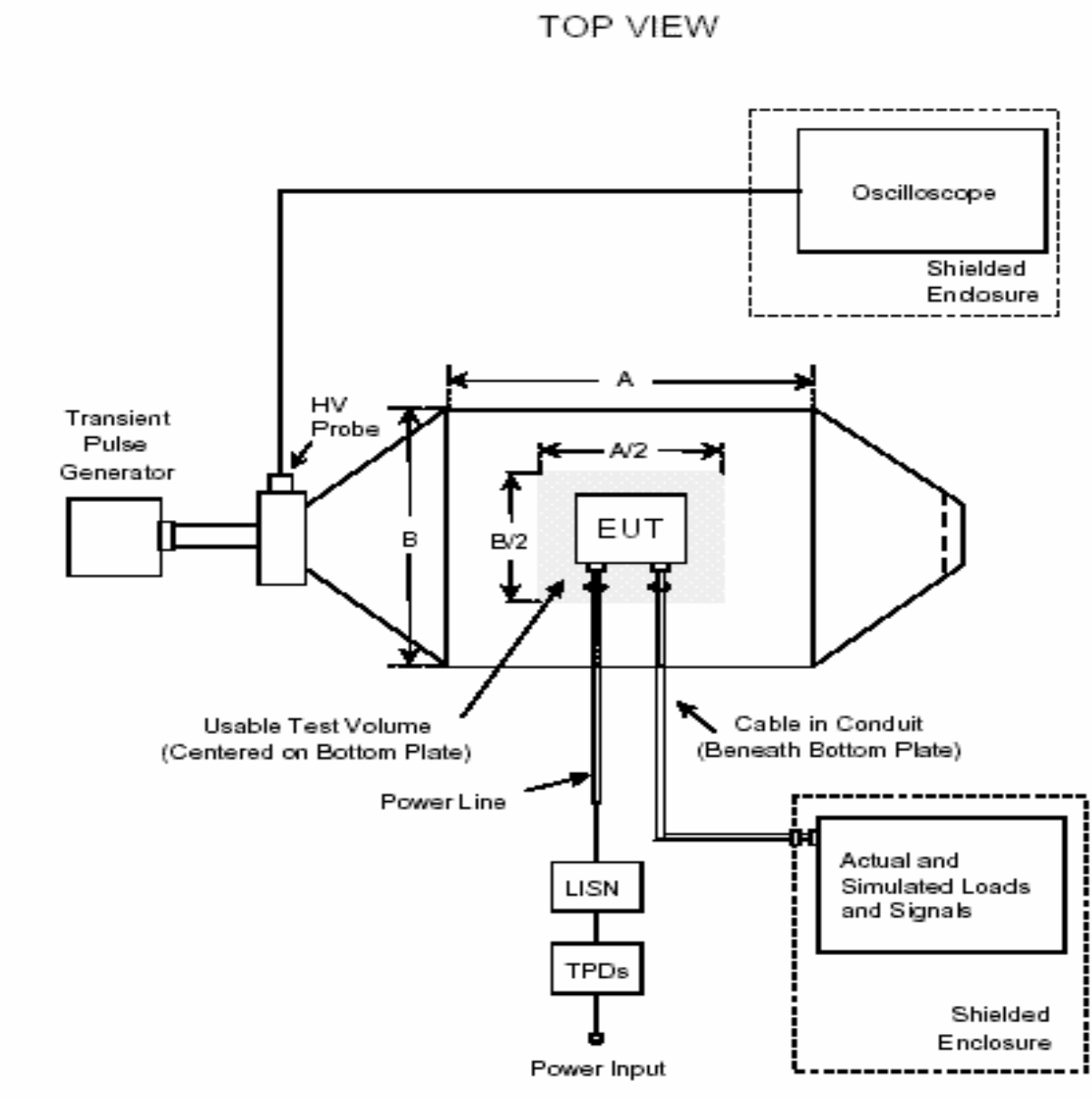
Ser	Equipment Nomenclature and Specifications	Qty
1.	Transverse Electromagnetic (TEM) Cell, parallel plate transmission line or equivalent antenna.	01
2.	Transient Pulse Generator, mono-pulse output, plus and minus polarity. (a) Transient Electric Field Intensity – 50 KV/m. (b) Magnetic Field Intensity – 130 A/m. (c) Transient waveform pulse – As per Appendix A.	01
3.	DC Charging Generator – 60 KV, continuous wave (approx) with matching transformer	01
4.	Matching termination load resistors	01
5.	Storage Oscilloscope, 500 MHz, single-shot bandwidth (minimum), variable sampling rate up to one giga-sample per second (Gsa/s).	01
6.	Terminal Protection Devices (TPDs).	01 set
7.	High voltage probe, 1 GHz bandwidth (minimum) with fiber optic link.	01
8.	B-dot sensor Probe with fiber optic link.	01
9.	D-dot Sensor Probe with fiber optic link.	01
10.	Line Impedance Stabilization Networks (LISNs).	01
11.	Integrator, time constant ten times the overall pulse width.	03
12.	Shielded room for control and measurement equipment.	01
13.	Optical Fibre link for EUT and its monitoring equipment.	01
14.	System computer (controller) with software and accessories.	01
15.	Three-Phase stabilizer with Isolation Transformers	01 set
16.	Earthing/Grounding with less that 2 Ω resistance.	01 set
17.	Spares	As Reqd
18.	Documents and Manuals.	01 set
19.	Site Preparation	As Reqd

Appendix D
(Refers to Para 8(a) of
QR for EMP Simulator)



RS 105 - Typical calibration setup using parallel plate radiation system.

Appendix E
(Refers to Para 8 (b) of
QR for EMP Simulator)



RS 105 - Typical test setup using parallel plate radiation system.

Appendix F
(Refers to Para 9 of
QR for EMP Simulator)

CONFORMING TEST PROCEDURE FOR FAST TRANSIENT RESPONSE EMP SIMULATOR (RADIATED SUSCEPTIBILITY, TRANSIENT ELECTROMAGNETIC FIELD (RS 105) AUTOMATED TEST SYSTEM)

Setup

1. **Calibration**. Configure the test equipment in accordance with figure at Appendix D.

(a) Before installing the EUT in the test volume, place the B-dot or D-dot sensor probe in the center position of the five point grid in the vertical plane where the front face of the EUT will be located (see figure at Appendix D).

(b) Place the high-voltage probe across the input to the radiation system at the output of the transient pulse generator. Connect the probe to a storage oscilloscope.

2. **EUT Testing**. Configure the test equipment as shown in figure at Appendix E for testing of the EUT.

(a) Place the EUT centerline on the centerline of the working volume of the radiation system in such a manner that it does not exceed the usable volume of the radiation system (h/3, B/2, A/2)/(x,y,z) as shown in figure at Appendix E (h is the maximum vertical separation of the plates). If the EUT is mounted on a ground plane in the actual installation, the EUT shall be placed on the radiating system ground plane. The EUT shall be bonded to the ground plane in a manner that duplicates the actual installation. Otherwise, the EUT shall be supported by dielectric material that produces a minimum distortion of the EM fields.

(b) The EUT orientation shall be such that the maximum coupling of electric and or magnetic fields is simulated. This may require more than one test orientation.

(c) Cables for EUT operation and monitoring shall be oriented to minimize induced currents and voltages on the cables. Cabling shall be oriented normal to the electric field vector and in a manner that minimizes the loop area normal to the magnetic field vector. Cables extending out of the parallel plate working volume should remain normal to the electric field vector for a minimum distance equal to 2 times h.

(d) Bond the bottom plate of the radiation system to an earth reference.

(e) Keep the top plate of the radiation system at least 2 times h from the closest metallic ground, including ceiling, building structural beams, metallic air ducts, shielded room walls, and so forth.

(f) Place the EUT actual or simulated loads and signals for electrical interfaces in a shielded enclosure when an open radiator is used.

(g) Place TPDs in the EUT power lines near the power source to protect the power source.

(h) Connect the transient pulse generator to the radiation system.

Procedures

3. Turn on the measurement equipment and allow a sufficient time for stabilization.

4. **Calibration**. Perform the following procedures using the calibration setup: -

(a) Generate a pulse and adjust the pulse generator to produce a pulsed field, as measured with the B-dot or D-dot probes, which meets the peak amplitude, rise time, and pulse width requirements. High voltages are used which are potentially lethal. Record the drive pulse waveform as displayed on the oscilloscope.

(b) Tolerances and characteristics of the RS105 limit shall be as follows: -

(i) Rise time (between 10% and 90% points) between 1.8 ns and 2.8 ns (electric field continuously increasing).

(ii) Full Width Half Maximum (FWHM) pulse width equal to 23 ns + 5ns.

(iii) Peak value of the electric or magnetic field for each grid position:

0 dB < magnitude < 6 dB above limit.

(c) Repeat steps at Para 4(a) and 4(b) above for the other four test points on figure at Appendix D.

(d) Determine the pulse generator settings and associated pulse drive amplitude which simultaneously satisfies the field requirements for all five grid positions.

5. EUT Testing. Perform the following procedures using the test setup: -

(a) Turn on the EUT and allow sufficient time for stabilization.

(b) Test the EUT in its orthogonal orientations whenever possible.

(c) Apply the pulse starting at 10% of the pulse peak amplitude determined in Para 4(d) with the specified waveshape where practical. Increase the pulse amplitude in step sizes of 2 or 3 until the required level is reached.

(d) Ensure that the drive pulse waveform characteristics at the required test level are consistent with those noted in Par 4(b).

(e) At least five pulses at a rate of not more than 1 pulse per minute.

(f) Monitor the EUT during and after each pulse for signs of susceptibility or degradation of performance.

(g) If an EUT malfunction occurs at a level less than the specified peak level, terminate the test and record the level.

(h) If susceptibility is noted, determine the threshold level in accordance with Threshold of Susceptibility as given below and verify that it is above the limit.

(j) **Threshold of Susceptibility**. When susceptibility indications are noted in EUT operation, a threshold level shall be determined where the susceptible condition is no longer present. Thresholds of susceptibility shall be determined as follows: -

(i) When a susceptibility condition is detected, reduce the interference signal until the EUT recovers.

(ii) Reduce the interference signal by an additional 6 dB.

(iii) Gradually increase the interference signal until the susceptibility condition reoccurs. The resulting condition is the threshold of susceptibility.

(iv) Record this level, frequency range of occurrence, frequency and level of greatest susceptibility, and other test parameters, as applicable.