# MIL STD 461G Changes: A Brief Review

The MIL STD Revision G affected several existing tests and testing methodology, as well as adding new tests and test procedures not referenced in the past. Table IV in the standard includes two new tests: Conducted Susceptibility CS 117 - Induced Lightning Transients, Cables and Power Leads, and Conducted Susceptibility CS 118 - Personnel Borne Electrostatic Discharge. A reference of table IV is below:

**TABLE IV. Emission and susceptibility requirements.**

| Requirement | Description |
|---|---|
| CE101 | Conducted Emissions, Power Leads |
| CE102 | Conducted Emissions, Power Leads |
| CE106 | Conducted Emissions, Antenna Terminal |
| CS101 | Conducted Susceptibility, Power Leads |
| CS103 | Conducted Susceptibility, Antenna Port, Intermodulation |
| CS104 | Conducted Susceptibility, Antenna Port, Rejection of Undesired Signals |
| CS105 | Conducted Susceptibility, Antenna Port, Cross-Modulation |
| CS109 | Conducted Susceptibility, Structure Current |
| CS114 | Conducted Susceptibility, Bulk Cable Injection |
| CS115 | Conducted Susceptibility, Bulk Cable Injection, Impulse Excitation |
| CS116 | Conducted Susceptibility, Damped Sinusoidal Transients, Cables and Power Leads |
| CS117 | Conducted Susceptibility, Lightning Induced Transients, Cables and Power Leads |
| CS118 | Conducted Susceptibility, Personnel Borne Electrostatic Discharge |
| RE101 | Radiated Emissions, Magnetic Field |
| RE102 | Radiated Emissions, Electric Field |
| RE103 | Radiated Emissions, Antenna Spurious and Harmonic Outputs |
| RS101 | Radiated Susceptibility, Magnetic Field |
| RS103 | Radiated Susceptibility, Electric Field |
| RS105 | Radiated Susceptibility, Transient Electromagnetic Field |

1. Changes have been made to the general requirements for the set-up for floor standing equipment, which now requires that the equipment cables to be located on a test bench 5cm above ground. Previously they were placed on the floor during testing. A comparison of the two set ups can be found below:

FIGURE 4. Test setup for free standing EUT in shielded enclosur

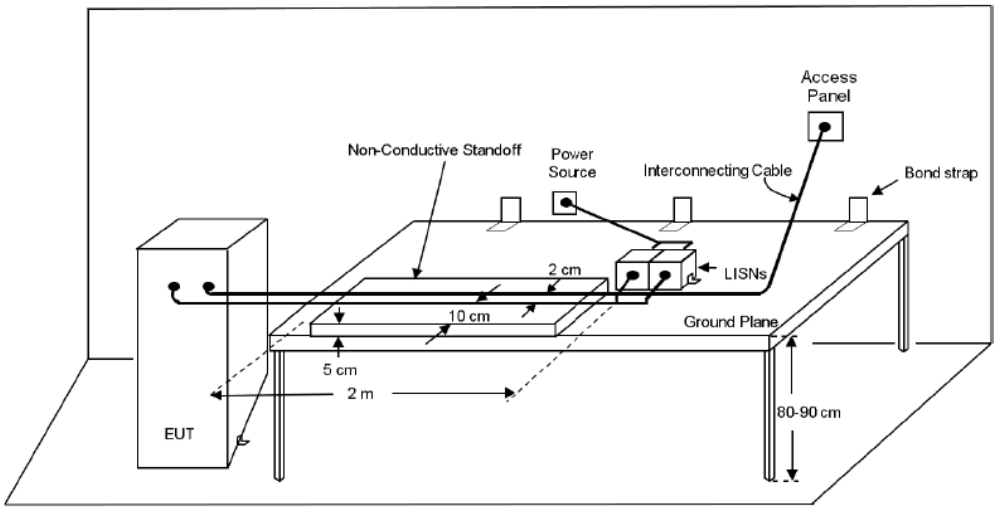


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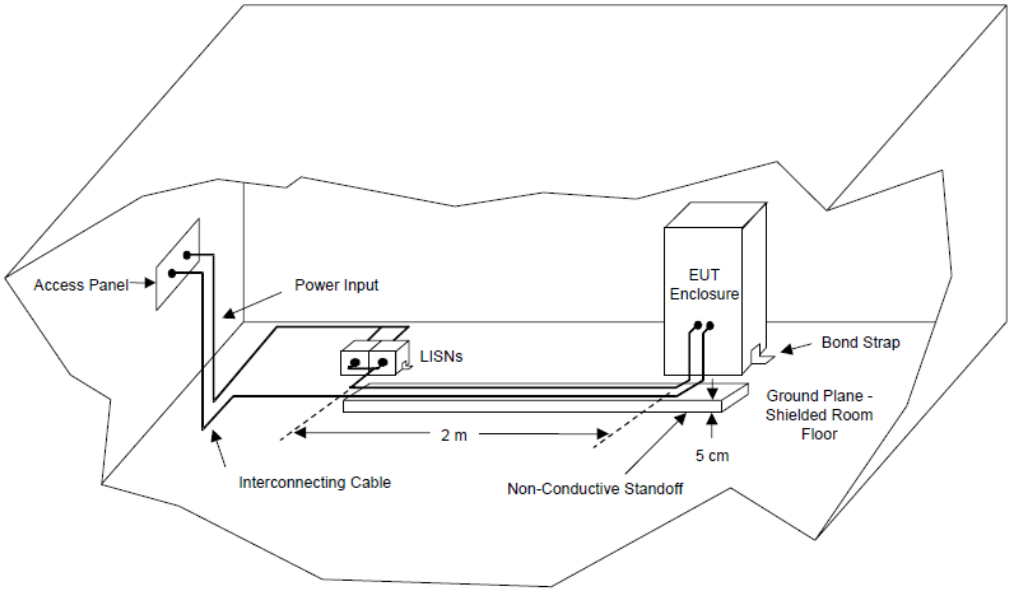
FIGURE 4. Test setup for free standing EUT in shielded enclosure.

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2. Changes to Conducted Emissions CE 101, Power Leads, Verification Procedure Changes. The update requires verification to be performed at 1.1kHz, 3kHz, and 9.9kHz instead of 1 kHz, 3 kHz, and 1 0kHz. This is considered a minor change, but clarifies test parameters.

3. Changes to Conducted Emissions CE 102, Power Leads, Verification Procedure Changes. In addition to requiring different levels at 10 kHz and 100 kHz, additional frequencies above 1MHz have been identified. Sections from the standard are referenced below:

   Section 2

   Apply a signal; level of 90 dBuV at 10 kHz and 100 KHz to the power input terminal of the LISN. At 10 kHz and 100 kHz, use an oscilloscope to verify that there is a proper signal level at the LISN, and that it is sinusoidal. After establishing the proper signal at the list, disconnect the LISN and measure the resulting voltage using a 50 Ohm termination. The ratio of the LISN voltage to the 50 Ohm voltage measurement must be within the following tolerance: at 10 kHz = -14 dB (+1 dB/-2 dB) and at 100 kHz = -3 dB (+ 1 dB/-2 dB) and at 100 kHz = -3 dB (+ 1 dB/-2dB).

   Section 3

   Apply a signal level that is at least 6 dB below the limit at 10.5 kHz, 100 kHz, 1.95 MHz, and 9.8 MHz to the power output terminal of the LISN. At 10 kHz and 100 kHz use an oscilloscope to calibrate the signal level. At 1.95 MHz and 9.8 MHz, use a calibrated output level directly form a 50 ohm signal generator.

4. CE106- Additional NAVY requirements

5. CS101 Limited to current draws equal to or less than 30 Amperes per phase

6. CS114 has a verification procedure now where the forward power is replayed into a dual jig setup using steps double of the normal test. The recorded current should be +/-3dB of the calibrated level. Calibration is also done with the measurement probe in circuit. While testing the forward power is to be used with a secondary limit of maximum current of the curve plus 6dB (ex Curve #5 115dBuA) across the entire range.

7. CS117 is lighting induced transients, cables and power leads. NO Pin injection.

8. CS118 Personal borne Electrostatic discharge aka ESD: uses normal 330Ohm/150pF tips, but there is a verification requirement. The verification has specs for voltage measurement using an ESD volt meter and current parameter using a target. This sounds like a lot of work up front for each test sample. Contact discharge 8kV for conductive surfaces Air discharge as high as 15kV is required where contact discharge cannot be applied.

9. RE102 System Verification has specific frequencies to be checked. The antenna to antenna continuity check is performed at the highest frequency of each band. It must tested to 18GHz no matter the clock frequency.

   Section C

   Using the system check path of the Figure RE 102-5, perform the following evaluation of the overall measurement system from the coaxial cable end used at each antenna to the data output device at 10.5 kHz (only for measurements implemented between 10 kHz and 2 MHZ), 2.1 MHz, 12 MHZ, and 29.5 MHz for active rod antennas, 197 MHZ for the biconical antenna, 990 MHZ for the large double ridge horn antenna, and 17.5 GHz for the small double horn antenna. For rod antennas that use passive matching networks, the evaluation should be performed at the center frequency of each band. A check shall also be performed when the measurement path is changed for a particular antenna such as the coaxial cable, addition or removal of preamplifiers, or different ports used on the measurement receiver. System check path verification shall be performed near the upper end of the affected frequency band.

Additional details and information can be reviewed with the D.L.S. technical staff by contacting Jack Black at jblack@dlsemc.com.