SURFACE VEHICLE RECOMMENDED PRACTICE

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Electromagnetic Compatibility Measurement Procedure for Vehicle Components - Immunity to AC Power Line Electric Fields

RATIONALE

Appendix A - Function Performance Status Classifications (FPSC) of this document has been revised to be consistent with the referenced Appendix in SAE J1113-1.

FOREWORD

This is a test which is being documented in this SAE Recommended Practice. There is no known comparable SAE or ISO test method. It is expected that this method will be used for field experimentation to verify the techniques and the field intensity levels proposed. The committee would appreciate comments relevant to this document.

Vehicles often negotiate areas crossed by high voltage (up to 1 000 000 V) power transmission lines. During operation the vehicle electronics will be exposed to intense AC electric fields. The field intensity from power lines is expected to be higher for 'off road' vehicles than 'on road' vehicles. This test method is most applicable to off road vehicle use, however road vehicles have also seen disruptive fields in service.

Field levels measured during testing have reached as high as 15 000 V/m. Laboratory testing for these conditions should always be performed for vehicle electronics for vehicles which routinely encounter off road driving. Such vehicles would include agricultural and timber harvesting equipment as well as earth moving and construction vehicles.

1. SCOPE

This SAE Recommended Practice covers the recommended testing techniques for the determination of electric field immunity of an automotive electronic device when the device and its wiring harness is exposed to a power line electric field. This technique uses a parallel plate field generator and a high voltage, low current voltage source to produce the field.

2. REFERENCES

For general references, see SAE J1113-1. For AC Power Line magnetic field testing, see SAE J1113-22.

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2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J1113-1 Electromagnetic Compatibility Measurement Procedures and Limits for Vehicle Components of Vehicles, Boats (up to 15 m), and Machines (Except Aircraft) (16.6 Hz to 18 GHz)

SAE J1113-22 Electromagnetic Compatibility Measurement Procedure for Vehicle Components - Part 22 - Immunity to Radiated Magnetic Fields

3. DEFINITIONS

For general definitions, see SAE J1113-1.

4. TEST APPARATUS

The test apparatus shall consist of the following:

4.1 VOLTAGE SOURCE

Any voltage source capable of supplying approximately 15 000 V of AC (50 or 60 Hz as appropriate) at a current of at least 1 mA can be utilized.

4.2 HIGH VOLTAGE VOLTMETER

A high impedance voltmeter capable of measuring at least 15 000 V_{rms}.

NOTE: An example of the construction of a parallel plate field generator is shown in Appendix B.

5. TEST SETUP

NOTE: Hazardous voltage and fields exist on and near the parallel plate field generator when the equipment is energized. Test personnel should ensure that no one is in contact with the field generator during a test.

5.1 Test setup should be as shown in Figure 1. The device under test is installed central to and midway between the field plates of the parallel plate field generator. The resistors used in this fixture are glass, high voltage resistors.

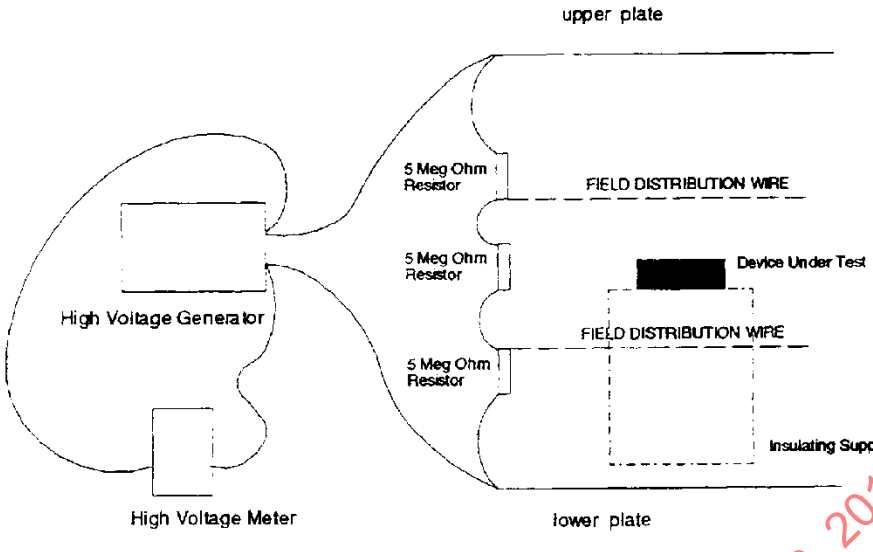

FIGURE 1 - EQUIPMENT SETUP EXAMPLE

5.2 The DUT and wire harness shall be placed in a non-conductive support midway between the plates. The harness shall leave the field area parallel to the field generating plates for at least ½ m beyond the outer edge of the plates. Note that the primary function of the fixture is to fix the positions of the harness and DUT to ensure the most repeatable results and should be constructed with this in mind. This non-conductive fixture shall be constructed of material with a low dielectric constant (e.g., polystyrene or equivalent).

When peripheral devices are used for operating or monitoring the device under test, they should be the original vehicle devices, where possible.

5.3 The AC Field shall be generated as required. The plate voltage, E_v, may be measured by using a high voltage voltmeter at the voltage generator. Since the plates are spaced 1 m apart, the field between the plates will equal the excitation voltage per meter.

NOTE: If field intensities higher than 15 000 V/m are desired, the height of the parallel plate antenna could be reduced in order to generate higher field intensities. The antenna height shall not be reduced to less than 0.5 meters and care should be taken that the DUT height does not exceed 1/3 the antenna height (unless otherwise approved in the test plan). When an antenna with a reduced height is used, the resultant field intensity in V/m is calculated by:

Field Levels (V/m) = Voltage Applied (V_{rms}) x 1/antenna height (in meters).

6. TEST PROCEDURE

Three test configurations are feasible, and are represented by the three orthogonal axes through the DUT. Each of the three axes should be oriented to the primary field of the parallel plate field generator and the module exposed to the AC field in that position for the required dwell time.

6.1 The test fixture may be used in the following manner:

Slowly increase the voltage gradient between the plates to the upper immunity limit noting any malfunctions, their nature and the field strength levels. The dwell time shall be long enough to detect any malfunction of the DUT. When completed, set the excitation voltage to 0 V and allow the system to bleed off the charge before allowing personnel to come in contact with the fixture or with the DUT.

CAUTION: After removing power from the text fixture, monitor the voltage to ensure that the voltage has fallen to a safe level before personnel are allowed to approach.

7. TEST SEVERITY LEVELS

7.1 A full description and discussion of the Function Performance Status Classification including Test Severity Levels are given in SAE J1113-1 Appendix A. Please review it prior to using the suggested Test Severity Levels presented in Appendix A of this part.

8. NOTES AND SPECIAL CONSIDERATIONS

8.1 For most designs of a parallel plate field generator, the field strength is uniform to within approximately 150 mm of the edge of either plate. Closer to the edge, the field rolls off. For this reason, it is recommended that the DUT be placed as close to the center of the space between the plates as can be arranged.

8.2 If a conductive DUT exceeds more than 1/3 of the spacing between the plates, the test field will be perturbed resulting in a stronger field than indicated by the measured voltage.

8.3 Marginal Indicia

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