

Electromagnetic Compatibility Measurement Procedure for Vehicle Components—Immunity to Radiated Electromagnetic Fields, 10 KHz to 1000 MHz—Tri-Plate Line Method

1. **Scope**—This procedure covers the recommended testing techniques for the determination of radiated immunity of an automotive electronic device. This technique uses a Tri-Plate Line (TPL) operating over a frequency range from 10 KHz to 1000 MHz. This technique is limited to components which have a maximum height of equal to or less than 1/3 the height between the driven element and the outer, ground plates.

A TPL, a variation of a TEM cell design, is constructed without sides to the cell. The primary advantage to the use of the TPL as opposed to a TEM cell is that its construction permits large devices to be placed within the cell with their associated cables attached without special feed through ports or adapters as required for a TEM cell. The lack of sides which would be found in a TEM cell permits easy routing of the cables to and from the Equipment Under Test (DUT).

The TPL does not have a serious problem with fields reflected from the side walls as does with the TEM cell. This permits its use to frequencies above that of a TEM cell of the same physical size. Note that although the construction of the TPL limits generation of uniform electric and magnetic fields to frequencies below 500 MHz, experience has shown that the TPL may be used at frequencies up to 1 GHz and still provide reasonable and repeatable test results. This may only occur if the test setup requirements (i.e., DUT plus 1 meter of cable) and characterization procedures, delineated in this SAE Standard are followed.

The lack of side walls also means that the TPL must be used within an RF shielded enclosure to prevent RF energy, radiated from the TPL from interfering with near-by electronic devices. To prevent potential resonances and reflected waves within the shielded enclosure from distorting the fields produced within the TPL, the test chamber walls and ceiling must be lined with RF absorbing material. These issues are discussed in greater detail in the body of this document. It is the intent of the EMI committee to withdraw this document in five years unless there is a demand to retain the document.

CAUTION—Hazardous voltages and fields exist on and near the TPL when the equipment is energized. Test personnel should ensure that no one is in the test chamber during a test.

- 1.1 **Rationale**—This specific standard was used exclusively by Ford Motor Company. There were no other known users of this standard. In October of 2003, the Ford requirements were significantly changed which included deletion of the Tri Plate Line as an acceptable method. The method/standard was replaced with other SAE/ISO standards. No plans to use the TriPlate line method in the future. Given these facts, the proposal for deletion of the J1113-25 was made.

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2. References—For general references, see SAE J1113-1.

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

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1113-1—Electromagnetic Compatibility Measurement Procedures and Limits for Vehicle Components (Except Aircraft) (60 Hz to 18 GHz)

SAE J1113-21—Road Vehicle—Electrical Disturbances by Narrowband Radiated Electromagnetic Energy—Component Test Methods—Part 21: Absorber-Lined Chamber

SAE J1812—Performance Status Classification for EMC Immunity Testing

3. Definitions—For general definitions, see SAE J1113-1.

4. Test Equipment—The test apparatus shall consist of the following:

4.1 Signal Source—Any signal source and power amplifier capable of supplying adequate RF power, both modulated and unmodulated, to develop the immunity levels specified in the test plan shall be used, provided the following requirements are met:

- a. Residual FM shall be less than 10 Hz
- b. Frequency resolution shall be less than 100 Hz
- c. Harmonics and spurious outputs shall not be more than -20 dBc referred to the fundamental power

4.2 Power Measurement—In-line directional couplers and RF wattmeters capable of measuring forward, reflected, and TPL output power up to the maximum power and frequency in use.

4.3 Field Strength Meter—An RF field strength meter and a small, 3 axis isotropic field probe capable of measuring field strengths from 50 to 200 V/m up to 1000 MHz. This instrumentation shall be used during characterization. Please refer to Appendix A.

4.4 TPL Construction—Construction of the TPL is contained in Appendix B.

4.5 TPL 50 Ω Load—A 50 Ω load capable of handling the expected maximum power and frequency in use.

4.6 RF Shielded, Absorber-Lined Test Chamber—Since the TPL has no side walls, RF energy can radiate from the TPL into the open environment. For this reason, the TPL testing shall be performed in a shielded enclosure. To avoid standing wave patterns within the shielded enclosure, which may affect testing of the DUT, the room shall include RF absorber on the walls and ceiling. The absorber shall be selected to reduce the reflected E-field by 10 dB or greater in the vicinity of the TPL.

5. Test Setup—Test setup should be as shown in Figures 1, 2, and 3.

5.1 TPL Location and Grounding in Test Chamber—Figure 1 illustrates the location of the TPL within the shielded, absorber-lined test chamber. The minimum distance between the open sides of the TPL and the absorber material shall be greater than 1 m. The minimum distance between the ends of the TPL and absorber material shall be greater than 0.5 m. The TPL ground plane shall be bonded to the shield room walls or floor via bonding straps, or via the braid of the coaxial feed and load cables if either cable is less than 2 m in length.

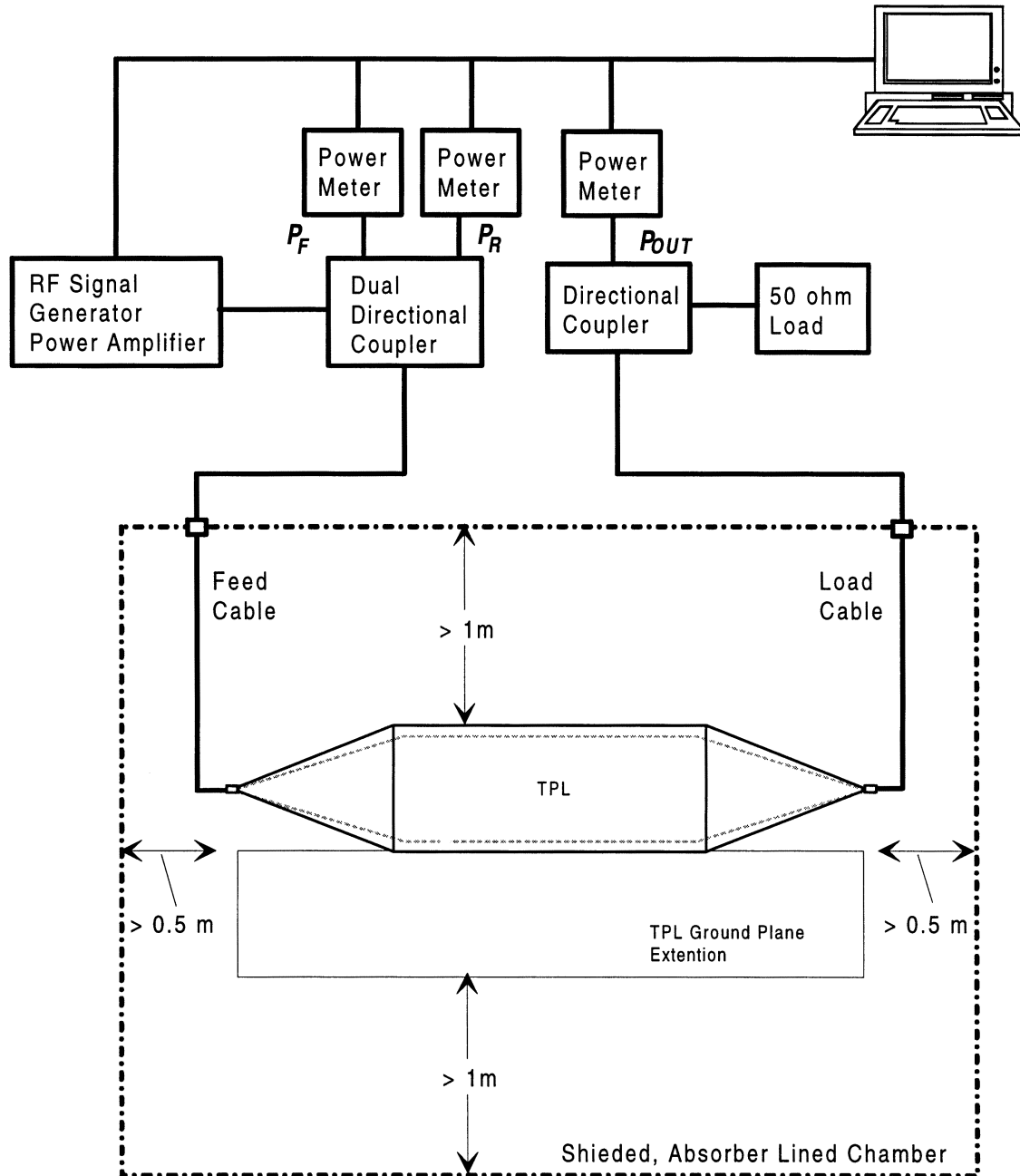


FIGURE 1—TPL TEST CONFIGURATION