

**(R) Electromagnetic Compatibility—Component Test Procedure—
Part 42—Conducted Transient Emissions**

1. Scope

1.1 This SAE Standard defines a component-level test procedure to evaluate automotive electrical and electronic components for Conducted Emissions of transients, and for other electromagnetic disturbances, along battery feed (B+) or switched ignition inputs of a Device Under Test (DUT). Test apparatus specifications outlined in this procedure were developed for components installed in the 12-V passenger cars, light trucks, 12 V heavy-duty trucks, and vehicles with 24 V systems.

1.2 Measurement Philosophy—Various inductive loads installed in a vehicle could be a source of electromagnetic disturbances during switching and/or operating conditions. These disturbances, propagating in the vehicle's electrical system through the interconnecting wiring harness, could adversely affect the proper performance of the on-board electronics. In order to achieve Electromagnetic Compatibility (EMC) of the system, the characteristics of these disturbances should be analyzed. This procedure provides a uniform means for evaluating transients and other disturbances conducted from the DUT along its power supply lines. These tests are performed in a laboratory (bench test). A DUT which is considered to be a potential source of disturbances should be tested according to the procedure described in this document.

NOTE 1—While this procedure is aimed mainly at measuring transients of simple inductive devices (motors, solenoids, relays, etc.), it also applies to subsystems comprised of inductive devices combined with electronics and/or switches. When such a subsystem is fed with both direct feed power supply line and switched ignition power supply line, the test plan should specify where transients are to be measured, and whether these two power supply lines should be tied together for the test.

NOTE 2—This document is a part of the SAE J1113-XX series, EMC Measurement Procedures and Limits for Vehicle Components.

2. References

2.1 Applicable Publications—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.

SAE J1113 (various parts)—Electromagnetic Compatibility Measurement Procedures and Limits for Vehicle Components (Except Aircraft)

SAE J1113-1—Electromagnetic Compatibility—Component Test Procedure—Part 1: General and Definitions

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3. **Definitions**— See SAE J1113-1.

4. **Apparatus**

4.1 **Test Facility**—Care shall be taken to ensure that the surrounding electromagnetic environment would not interfere with the measurement setup.

4.2 **Test Instrumentation**

4.2.1 **ARTIFICIAL NETWORK (AN)**—A 5 μH AN unit capable of handling 50 A load current shall be used for all measurements. The impedance curve for the AN is shown in Figure 1. If the AN has an EMI port, it should be terminated with a 50 Ω load (this load could be within a measuring instrument.) See Figure 2 for example 5 μH AN schematic.

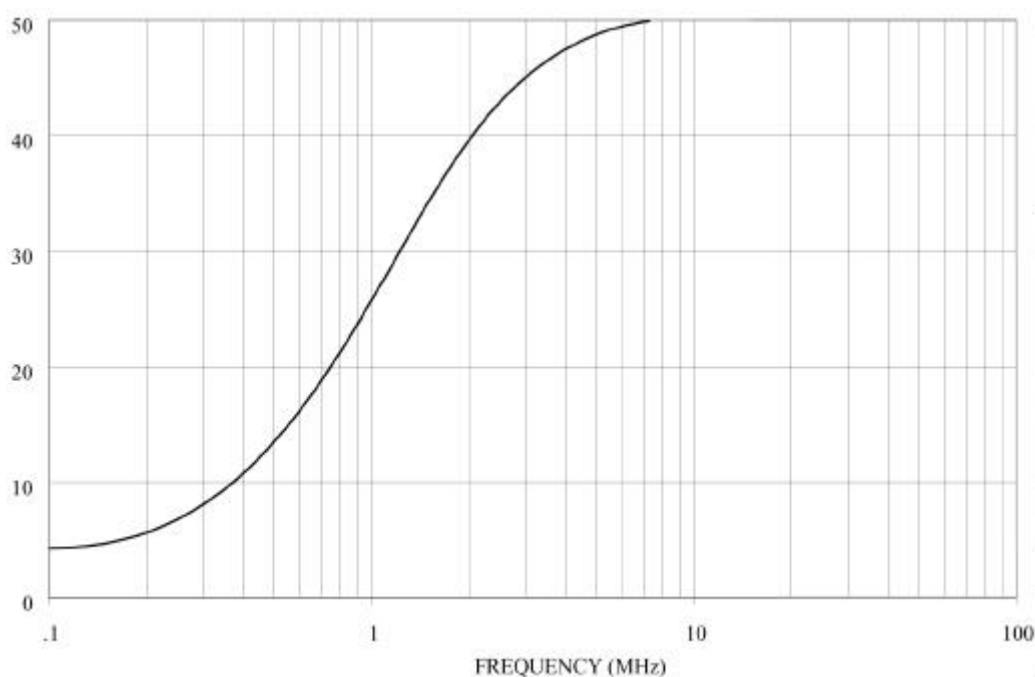


FIGURE 1—IMPEDANCE CURVE FOR ARTIFICIAL NETWORK (AN)

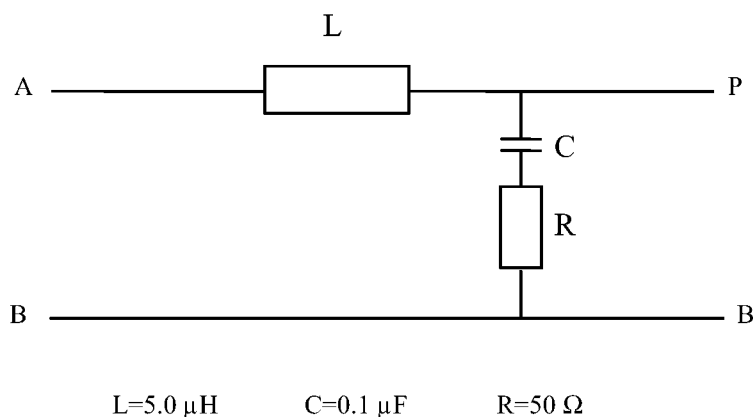


FIGURE 2—EXAMPLE OF 5 μH AN SCHEMATIC

4.2.2 DATA ACQUISITION EQUIPMENT—The equipment utilized should meet the following requirements:

4.2.2.1 *Oscilloscope*—Use of a digitizing oscilloscope is preferred. If a digitizing oscilloscope is not available, a storage oscilloscope may be used. The oscilloscope used must meet the following requirements.

a. Digitizing Oscilloscope

1. Minimum Sampling Time—0.5 ns/sample or less
2. Memory Size—2000 samples minimum
3. Bandwidth—DC to 400 MHz minimum (at -3 dB)
4. Input Sensitivity—5 mV/division minimum

b. Storage Oscilloscope

1. Bandwidth—DC to 400 MHz minimum (at -3 dB)
2. Input Sensitivity—5 mV/division minimum
3. Writing Speed—100 cm/μs minimum

NOTE—The recording may be made with an oscilloscope camera or any other appropriate recording device. Oscilloscopes with other specifications may be substituted as required. Substituted oscilloscope specifications shall be documented in the test report.

4.2.2.2 *Voltage Probes*—Different voltage probes should be used depending on the magnitudes:

a. Voltage Transients with amplitude exceeding 200 V

1. Attenuation—100:1 (100x probe)
2. Input Breakdown Voltage—1.5 kV minimum
3. Bandwidth—DC to 400 MHz minimum
4. Input Impedance—1 MΩ minimum
5. Probe Cable Length—3 m maximum
6. Probe Ground Lead Length—130 mm maximum

b. Voltage Transients with amplitude equal and below 200 V

1. Attenuation—10:1 (10x probe)
2. Input Breakdown Voltage—250 V minimum
3. Bandwidth—DC to 400 MHz minimum
4. Input Impedance—1 MΩ minimum
5. Probe Cable Length—3 m maximum
6. Probe Ground Lead Length—130 mm maximum

NOTE—Input resistance R and capacitance C are specified in Table 1. The probe cable and probe ground lengths will influence the measurement results and shall be stated in the test report.

TABLE 1—VOLTAGE PROBE PARAMETERS

F (MHz)	R (kΩ)	C (pF)
1	>40	<4
10	>4	<4
100	>0.4	<4

NOTE—Voltage probes with other specifications may be substituted as required. Substituted probe specifications shall be documented in the test report.

4.3 Power for the DUT—The DUT shall be powered by a fully charged 12 V standard automotive battery maintained at $13.0\text{ V} \pm 0.5\text{ V}$ with the DUT connected and operating. Should a charger be required to maintain the required voltage, it should be disconnected during the actual data acquisition. If a power supply is used either to supplement or used in place of the battery, the power supply must simulate the battery's low output impedance and it must be capable of supplying at least twice the rated current of the DUT, refer to SAE J1113-1, 6.6.

4.4 Shunt Resistor R_s (Optional)—The shunt resistor R_s (see Figure 3) simulates the DC resistance of other vehicle devices which are connected in parallel to the device under test and are not disconnected from it by the ignition switch. R_s is selected to correspond to the resistance measured on the wiring harness between the disconnected ignition switch terminal and ground, with the switch off, and shall be specified by the vehicle manufacturer. In the absence of any specification, a value of $R_s = 40\ \Omega$ shall be used. If a wire-wound resistor is used, the winding shall be bifilar (i.e., with a minimum reactive component.)

NOTE—In order to simulate the worst-case condition, R_s may be deleted.

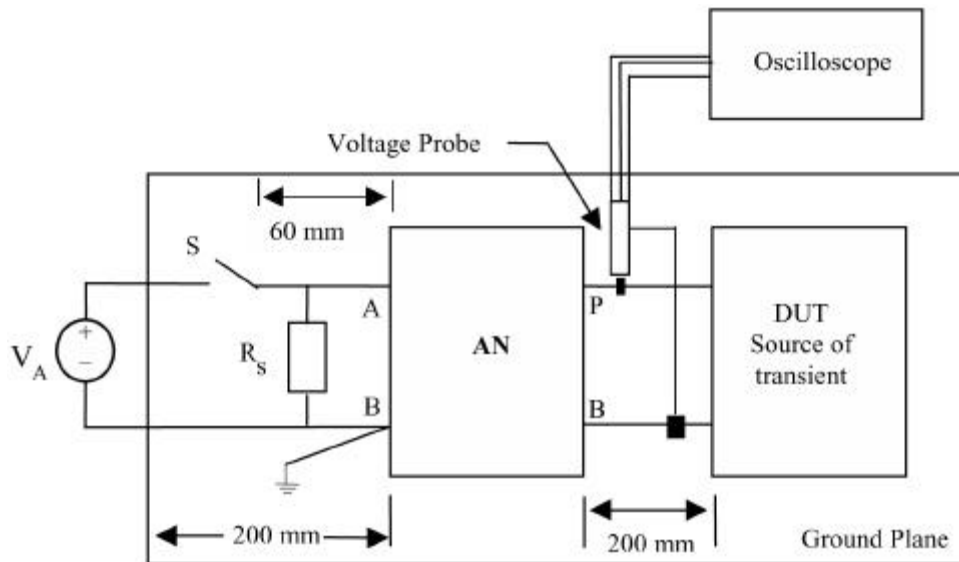


FIGURE 3A—TEST SETUP FOR SLOWER TRANSIENTS (RISE AND FALL TIME IN ms RANGE)