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SURFACE VEHICLE RECOMMENDED PRACTICE

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(R) FUNCTION PERFORMANCE STATUS CLASSIFICATION FOR EMC IMMUNITY TESTING

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1. Scope—This SAE Recommended Practice provides a general method for defining the function performance status classification for the functions of automotive electronic devices upon application of the test conditions specified as described in appropriate EMC test standards (for example, the SAE J1113 series and the SAE J551 series). Testing of devices could be performed either on or off vehicles. Appropriate test signal and methods, region of performance, and test signal severity level would have to be specified in the individual cases.

2. References

2.1 Applicable Documents—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 J551/1—Performance Levels and Methods of Measurement of Electromagnetic Compatibility of Vehicles and Devices (60 Hz to GHz)
SAE J551/11—Vehicle Electromagnetic Immunity—Off-Vehicle Source
SAE J551/12—Vehicle Electromagnetic Immunity—On-Board Transmitter Simulation
SAE J551/13—Vehicle Electromagnetic Immunity—Bulk Current Injection
SAE J551/15—Vehicle Electromagnetic Immunity—Electrostatic Discharge (ESD)
SAE J1113/1—Electromagnetic Compatibility Measurement Procedures and Limits for Vehicle Components (Except Aircraft) (60 Hz to 18 GHz)
SAE J1113/4—Immunity to Radiated Electric Fields and Bulk Current Injection (BCI) Method
SAE J1113/11—Immunity to Conducted Transients on Power Leads
SAE J1113/12—Electrical Interference by Conduction and Coupling—Coupling Clamp
SAE J1113/13—Electromagnetic Compatibility Measurement Procedure for Vehicle Components—Part 13—Immunity to Electrostatic Discharge
SAE J1113/21—Road Vehicles—Electrical Disturbances by Narrowband Radiated Electromagnetic Energy—Component Test Methods—Absorber Lined Chamber
SAE J1113/22—Electromagnetic Compatibility Measurement Procedure for Vehicle Components—Part 22—Immunity to Radiated Magnetic Fields from Power Lines
SAE J1113/27—Electromagnetic Compatibility Measurements Procedure for Vehicle Components—Part 27—Immunity to Radiated Electromagnetic Fields

3. Definitions—See SAE J1113/1 or SAE J551/1

4. Measurement Philosophy—Electrical and radio frequency interference occurs during the normal operation of many items of motor vehicle equipment and when the vehicle is subjected to electromagnetic noises from the outside environment. It is generated over a wide frequency range with various electrical characteristics and may be distributed to on-board electronic devices and systems by conduction and/or radiation.

During recent years, an increasing number of electronic devices has been introduced into vehicle designs in order to perform, control, monitor and display various functions including the engine management system. It has been necessary therefore, to consider the electrical and electromagnetic environment in which these devices are required to operate. Interference can be generated in the vehicle electrical system itself by the normal operation of various power devices such as power window, power lock, air conditioning, etc. This interference can cause a temporary malfunction or even permanent damage to the electronic equipment. Significant numbers of performance deviations, resulting from this interference, have been reported.

Narrowband and broadband signals generated from sources inside or outside the vehicle could also be coupled into the electrical/electronic system, affecting the normal performance of electronic devices. These sources of electromagnetic disturbance are, for example, vehicle's ignition system, mobile telephones, broadcast transmitters, etc. Protection from this potential interference has to be considered in a total system validation.

It must be emphasized that components or systems shall only be tested with the conditions, as described in individual test method, that represent the simulated automotive electromagnetic environments to which the devices would actually be subjected. This will help to assure a sound technically and economically optimized design for potentially susceptible components and systems.

It should also be noted that this document is not intended to be a product specification and cannot function as one. It should be used in conjunction with a test procedure such as the SAE J1113 series and the SAE J551 series. Therefore, no specific values for the test pulse severity level were given in the document (only ranges are provided) since they should be determined by the vehicle manufacturer and the supplier. Nevertheless, using the concepts described in this document and by careful application and agreement between manufacturer and supplier, it could, in fact, be a statement of how a particular device could be expected to perform under the influence of the specified interference signals.

Examples for the application of how the concept of function performance status classification could be applied to the conducted and radiated immunity testing are included in this document (See Appendix A).

5. Essential Elements of Function Performance Status Classification—Four elements are required to describe a function performance status classification. They can be generically applied to all immunity testing for electromagnetic disturbances (both conducted and radiated). These elements are listed below and they will be discussed in detail in Sections 5, 6, 7, and 8 of this document.

5.1 Test Signal and Test Method—This element provides the reference to respective test signals applied to the device under test and the method of test. They are usually referred to a specific test procedure (Section 6).

5.2 Functional Status Classification—This element describes the operational status of the function of an electrical/electronic device within the vehicle (Section 7).

5.3 Region of Performance—This element describes the region, bounded by two test signal severity levels, which defines the expected performance objectives for the function of the device under test (Section 8).

5.4 Test Signal Severity Level—This element defines the specification of test signal severity level of essential signal parameters as described in Sections 5 and 9.

6. Test Signal and Test Method—The test procedures used and methods of application are to be described in specific standards. The function performance status classification resulting from these tests would be applicable only to those particular standards.

7. Functional Status Classification—Functional status classification classifies the operational status of the function for an electrical/electronic device within the vehicle. A given device or system may have several different functions and each individual function may have its own class of functional status. The classification of the function for any given device should be determined between the vehicle manufacturer and supplier. It is important to point out that, in many cases, only one or two classification (s) will apply to a particular product. For example, if the device has only one function, only part of Appendix A will apply (class A, B or C). Three classes have been established and are listed as follows:

7.1 Class A—Any function that provides a convenience.

7.2 Class B—Any function that enhances, but is not essential to the operation or control of the vehicle.

7.3 Class C—Any function that controls or affects the essential operation of the vehicle.

8. Region Of Performance—The region of performance defines performance objectives when the device is subjected to different test signal severity levels.

8.1 Region I—The function shall operate as designed during and after exposure to a disturbance.

8.2 Region II—The function may deviate from design but will return to normal after the disturbance is removed.

8.3 Region III—The function may deviate from designed performance during exposure to a disturbance but simple operator action may be required to return the function to normal, once the disturbance is removed.

8.4 Region IV—The device/function shall not have sustained any damage after the disturbance is removed.

9. Test Signal Severity Level—The test signal severity level is the stress level (voltage, volts per meter, etc.) applied to the device under test for any given test method (Section 6) and region of performance (Section 8) during the test.

The test signal severity level should be determined by the vehicle manufacturer and supplier (examples for how the test signal severity level could be applied are included in the Appendix A).

10. Notes

10.1 Marginal Indicia—The (R) is for the convenience of the user in locating areas where technical changes have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.

PREPARED BY THE SAE EMI STANDARDS COMMITTEE

APPENDIX A

FUNCTIONAL STATUS CLASSIFICATION, REGION OF PERFORMANCE, AND TEST SIGNAL SEVERITY LEVEL FOR IMMUNITY TESTING

A.1 Application of Functional Status Classification, Region of Performance, and Test signal Severity Level—See Figure A1.

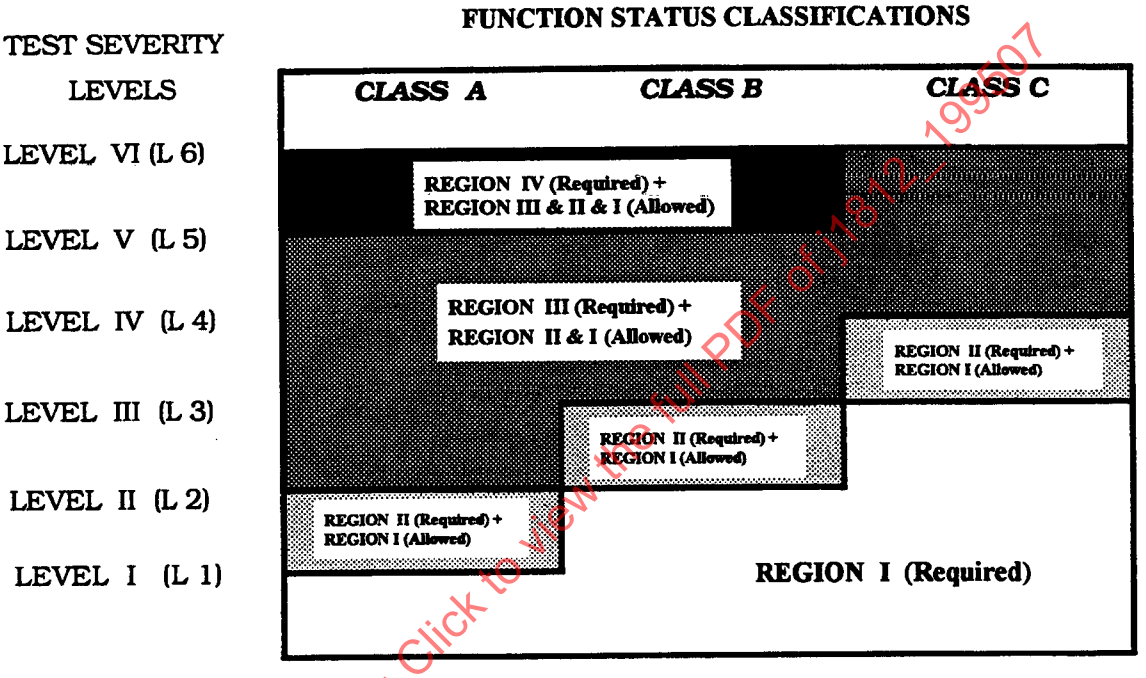

FIGURE A1—FUNCTION PEFORMANCE STATUS CLASSIFICATION

A.2 Example 1—Test Signal Severity Selection Table—SAE J1113-11—Conducted Transient Injection—Severity levels for each test pulse are determined jointly by the vehicle manufacturer and the supplier prior to performing the test. The values are entered in the following table. It should be included in the test plan and test report.

TABLE A1—EXAMPLE 1—TEST SIGNAL SEVERITY SELECTION TABLE—SAE J1113-11

Pulse Severity Levels	Pulse 1	Pulse 2	Pulse 3a	Pulse 3b	Pulse 4	Pulse 5
L 6	V					
L 5	0.8 V					
L 4	0.6 V					
L 3	0.4 V					
L 2	0.2 V					
L 1						