



SURFACE VEHICLE STANDARD

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Electromagnetic Compatibility Measurement Procedures for
Integrated Circuits - Integrated Circuit EMC Measurement Procedures -
General and Definitions

RATIONALE

This technical report is being stabilized because it covers technology, products, or processes which are mature and not likely to change in the foreseeable future.

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Documents

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1. SCOPE

This SAE Recommended Practice provides supporting information for the emission and immunity measurement procedures defined in the SAE J1752 series of documents.

1.1 Measurement Philosophy

The near field magnetic or electromagnetic radiation from an integrated circuit can be measured in a controlled manner that yields repeatable results. These emissions are related to the far field electromagnetic radiation potential of the IC and of the electronic module of which it is a part. The intent is to provide a quantitative measure of the RF emissions from ICs for comparison or other purposes. Similar quantitative measures of the immunity of an IC to RF fields and transients are being investigated.

2. REFERENCES

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

SAE J1752-2 Integrated Circuit Radiated Emissions Measurement Procedure, Surface Scan Method (Loop Probe Method) 10 MHz to 3 GHz)

SAE J1752-3 Integrated Circuit Radiated Emissions Measurement Standard, TEM/Wideband TEM (GTEM) Cell Method TEM Cell (150 kHz to 1 GHz), Wideband TEM Cell (150 kHz to 8 GHz)

2.1.2 IEEE Publication

Available from the IEEE, 445 Hoes Lane, Piscataway, NJ 08854-1331, Tel: 732-981-0060, www.ieee.org.

IEEE Standard Dictionary, STD100

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 The following publications are referenced for ANSI EMC Definitions.

Goulette, R. R., Crawhall, R. J., and Xavier, S. K., of Bell Northern Research, Ottawa, Ontario, Canada, "The Determination of Radiated Emissions Limits for Integrated Circuits within Telecommunications Equipment," IEICE Transactions on Communications, Vol. E75-B, No. 3, March 1992

Goulette, R. R. of Bell Northern Research, Ottawa, Ontario, Canada, "The Measurement of Radiated Emissions from Integrated Circuits," 1992 IEEE International EMC Symposium Record, August 1992

Koepke, G. H. and Ma, M. T., "A New Method for Determining the Emission Characteristics of an Unknown Interference Source," Proc. 5th Intl. Zurich Symposium and Technical Exhibition on EMC, (Zurich, Switzerland), March 1983, pp. 35-40

3. DEFINITIONS

Refer to the IEEE Standard Dictionary of Electrical and Electronic Terms (IEEE Std 100-1992) for additional definitions.

3.1 ASSOCIATED EQUIPMENT

Transducers (e.g., probes, networks and antennas) connected to a measuring receiver or test generator; also transducers (e.g., probes, networks, and antennas) which are used in the signal or disturbance transmission path between an EUT and measuring equipment or a (test-) signal generator.

3.2 AUTO SWEEP

The fastest calibrated sweep which a spectrum analyzer will automatically select based on start frequency, stop frequency, resolution bandwidth, and video bandwidth.

3.3 CONDUCTED EMISSIONS

Conducted emissions are transients and/or other disturbances observed on the external terminals of a device during its normal operation.

3.4 DEVICE UNDER TEST (DUT)

The device, equipment or system being evaluated; as used in this standard, it refers to a semiconductor device being tested.

3.5 DIE SHRINK

The amount of shrink of the mask used to produce the IC expressed as a percentage of the original artwork layout (drawn size).

3.6 ELECTROMAGNETIC EMISSION

The phenomenon by which electromagnetic energy emanates from a source.

3.7 ELECTROMAGNETIC RADIATION

- a. The phenomena by which energy in the form of electromagnetic waves emanates from a source into space.
- b. Energy transferred through space in the form of electromagnetic waves.

3.8 GROUND (REFERENCE) PLANE

Flat conductive surface used as a common potential reference.

3.9 LEAD FRAME

The supporting structure for the silicon die that interfaces the external pins to the die.

3.10 LOOP PROBE

A single turn (E-field shielded) magnetic field probe as described in SAE J1752-2.

3.11 MCM

Multichip module, an integrated circuit whose elements are formed on or within two or more semiconductor chips that are mounted in a single package.

3.12 MCU

Microcontroller unit.

3.13 MULTI IC SETS

A set of ICs that function as a unit, in a higher level of integration the set could be a single IC.

3.14 1 GHZ TEM CELL

A transverse electromagnetic mode (TEM) cell with a VSWR of 1.5:1 or less and an absence of multi-moding up to an operating frequency of 1 GHz.

3.15 PREAMPLIFIER NOISE FLOOR

The inherent thermal noise generated by the first stage amplifier that limits the signal resolution of the measurement system.

3.16 REFERENCE POINT

The specific port or point on the test set-up where the measurement of the sampled parameter is made.

3.17 REPETITION RATE

The number of surges, spikes, or pulses per unit time.

3.18 RF AMBIENT (ELECTROMAGNETIC ENVIRONMENT)

The totality of electromagnetic phenomena existing at a given location.

3.19 SHIELDED ENCLOSURE

Mesh or sheet metallic housing designed expressly for the purpose of separating electromagnetically the internal and external environment.

3.20 SIGNIFICANT IC CHANGES

All changes that may influence the electromagnetic emissions of an IC. Examples are: new device, new manufacturer or process line, die shrink, new package type, significant process change, internal/external clock changes, I/O drive capability changes, etc.

3.21 SYSTEM GAIN

The gain (or attenuation) of the measurement path between the reference point and the input of the RF measuring instrument.

3.22 TEST PLAN

The test plan is a document provided by the test requester to define the tests to be done, the object of the testing, the DUT operating status, the conditions for the test and performance objectives. It completely guides the implementation of the test, by reference to the standard test procedure, or by detailing revisions or additions for the specific DUT.

3.23 WIDEBAND TEM CELL (SOMETIMES REFERRED TO AS A GTEM CELL)

A cell developed as a continuously expanding section of 50 Ω transmission line where the center conductor is transformed into an off center septum. Because of its construction, the wideband TEM (transverse electromagnetic mode) cell does not suffer from the size versus frequency constraints of a conventional TEM cell and provides more test volume at high frequencies.