



# SURFACE VEHICLE STANDARD

J1113™-1

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Superseding J1113-1 OCT2018

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

## RATIONALE

Document revised to reflect changes to other SAE Standards within the SAE J1113 series.

## FOREWORD

This SAE Standard brings together methodology for testing the electromagnetic emissions and immunity characteristics of vehicular modules and components. The writers of this series of documents have participated extensively in the drafting of ISO TC 22 Subcommittee 3 and CISPR Subcommittee D documents.

By intent, the methods and limits of this document closely resemble the counterpart international standards.

|                          |                                                                                                                                                                                                                                                            |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SAE J1113-1              | General and Definitions                                                                                                                                                                                                                                    |
| SAE J1113-2              | [Withdrawn as a complete standard. Reserved for use as an exception document for SAE differences from ISO 11452-10.]                                                                                                                                       |
| SAE J1113-3              | [Withdrawn as a complete standard. Reserved for use as an exception document for SAE differences from ISO 11452-7.]                                                                                                                                        |
| SAE J1113-4              | Conducted Immunity-Bulk Current Injection (BCI) Method                                                                                                                                                                                                     |
| SAE J1113-5 through -10  | reserved for future use                                                                                                                                                                                                                                    |
| SAE J1113-11             | Immunity to Conducted Transients on Power Leads                                                                                                                                                                                                            |
| SAE J1113-12             | Electrical Interference by Conduction and Coupling - Coupling Clamp                                                                                                                                                                                        |
| SAE J1113-13             | Immunity to Electrostatic Discharge                                                                                                                                                                                                                        |
| SAE J1113-14 through -20 | reserved for future use                                                                                                                                                                                                                                    |
| SAE J1113-21             | Road Vehicles - Electrical Disturbances by Narrowband Radiated Electromagnetic Energy - Component Test Method - Absorber Lined Chamber [Withdrawn as a complete standard. Reserved for use as an exception document for SAE differences from ISO 11452-2.] |

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|                                                  |                                                                                                                                             |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| SAE J1113-22                                     | [Withdrawn as a complete standard. Reserved for use as an exception document for SAE differences from ISO 11452-8.]                         |
| SAE J1113-23                                     | Withdrawn                                                                                                                                   |
| SAE J1113-24                                     | [Withdrawn as a complete standard. Reserved for use as an exception document for SAE differences from ISO 11452-3.]                         |
| SAE J1113-25                                     | Withdrawn                                                                                                                                   |
| SAE J1113-26                                     | Immunity to AC Power Line Electric Fields                                                                                                   |
| SAE J1113-27                                     | Immunity to Radiated Electromagnetic Fields - Mode Stir Reverberation Method                                                                |
| SAE J1113-28                                     | [Withdrawn as a complete standard. Reserved for use as an exception document for SAE differences from ISO 11452-11.]                        |
| SAE J1113-29 through -40 reserved for future use |                                                                                                                                             |
| SAE J1113-41                                     | [Withdrawn as a complete standard. Reserved for use as an exception document for SAE differences from IEC CISPR 25.]                        |
| SAE J1113-42                                     | [Withdrawn as a complete standard. Reserved for use as an exception document for SAE differences from the emissions portion of ISO 7637-2.] |

## 1. SCOPE

This SAE Standard covers the measurement of voltage transient immunity and within the applicable frequency ranges, audio (AF) and radio frequency (RF) immunity, and conducted and radiated emissions.

By reference, ISO 11452-3, ISO 11452-7, ISO 11452-8, ISO 11452-10, ISO 11452-11, ISO 11452-2, and the emissions portion of ISO 7637-2 are adopted in place of SAE J1113-24, SAE J1113-3, SAE J1113-22, SAE J1113-2, SAE J1113-28, SAE J1113-21, and SAE J1113-42, respectively. In the event that an amendment is made, or a new edition is published, the new ISO document shall become part of this standard 6 months after the publication of the ISO document. SAE reserves the right to identify exceptions to the published ISO document with the exceptions to be documented in SAE J1113-24, SAE J1113-3, SAE J1113-22, SAE J1113-2, SAE J1113-28, SAE J1113-21, and SAE J1113-42, respectively.

By reference, IEC CISPR 25 is adopted as the standard for the measurement of component emissions. In the event that an amendment is made, or a new edition is published, the new IEC document shall become part of this standard 6 months after the publication of the IEC document. SAE reserves the right to identify exceptions to the published IEC document with the exceptions to be documented in SAE J1113-41.

Emissions from intentional radiators are not controlled by this document. (See applicable appropriate regulatory documents.) The immunity of commercial mains powered equipment to over voltages and line transients is not covered by this document.

## 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 +1 724-776-4970 (outside USA), [www.sae.org](http://www.sae.org)

|              |                                                                                                                                                                                                                                                                                        |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SAE J1113-2  | [Withdrawn as a complete standard. Reserved for use as an exception document for SAE differences from ISO 11452-10.]                                                                                                                                                                   |
| SAE J1113-3  | [Withdrawn as a complete standard. Reserved for use as an exception document for SAE differences from ISO 11452-4.]                                                                                                                                                                    |
| SAE J1113-4  | Immunity to Radiated Electromagnetic Fields - Bulk Current Injection (BCI) Method                                                                                                                                                                                                      |
| SAE J1113-11 | Immunity to Conducted Transients on Power Leads                                                                                                                                                                                                                                        |
| SAE J1113-12 | Electrical Interference by Conduction and Coupling - Capacitive and Inductive Coupling via Lines Other than Supply Lines                                                                                                                                                               |
| SAE J1113-13 | Electromagnetic Compatibility Measurement Procedure for Vehicle Components - Part 13: Immunity to Electrostatic Discharge                                                                                                                                                              |
| SAE J1113-21 | Electromagnetic Compatibility Measurement Procedure for Vehicle Components - Part 21: Immunity to Electromagnetic Fields, 30 MHz to 18 GHz, Absorber-Lined Chamber [Withdrawn as a complete standard. Reserved for use as an exception document for SAE differences from ISO 11452-2.] |
| SAE J1113-22 | [Withdrawn as a complete standard. Reserved for use as an exception document for SAE differences from ISO 11452-8.]                                                                                                                                                                    |
| SAE J1113-24 | [Withdrawn as a complete standard. Reserved for use as an exception document for SAE differences from ISO 11452-3.]                                                                                                                                                                    |
| SAE J1113-26 | Electromagnetic Compatibility Measurement Procedure for Vehicle Components - Immunity to AC Power Line Electric Fields                                                                                                                                                                 |
| SAE J1113-27 | Electromagnetic Compatibility Measurements Procedure for Vehicle Components - Part 27 - Immunity to Radiated Electromagnetic Fields - Reverberation Method                                                                                                                             |
| SAE J1113-28 | [Withdrawn as a complete standard. Reserved for use as an exception document for SAE differences from ISO 11452-11.]                                                                                                                                                                   |
| SAE J1113-41 | [Withdrawn as a complete standard. Reserved for use as an exception document for SAE differences from IEC CISPR 25.]                                                                                                                                                                   |
| SAE J1113-42 | [Withdrawn as a complete standard. Reserved for use as an exception document for SAE differences from the emissions portion of ISO 7637-2.]                                                                                                                                            |
| SAE J1812    | Function Performance Status Classification for EMC Immunity Testing                                                                                                                                                                                                                    |

### 2.1.2 IEEE Publications

Available from IEEE Operations Center, 445 and 501 Hoes Lane, Piscataway, NJ 08854-4141, Tel: 732-981-0060, [www.ieee.org](http://www.ieee.org).

ANSI/IEEE STD 100 Standard Dictionary of Electrical and Electronic Terms

|            |                                                                                                                                                                     |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IEEE C63.2 | Electromagnetic Noise and Field Strength Instrumentation, 10 kHz to 40 GHz Specifications                                                                           |
| IEEE C63.4 | American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz |
| IEEE C95.1 | IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz - Description                            |

### 2.1.3 IEC Publications

Available from IEC Central Office, 3, rue de Varembe, P.O. Box 131, CH-1211 Geneva 20, Switzerland, Tel: +41 22 919 02 11, [www.iec.ch](http://www.iec.ch).

|               |                                                                                                                                                                                         |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CISPR 25      | Fourth Edition 2016-10 Vehicles, boats and internal combustion engines - Radio disturbance characteristics - Limits and methods of measurement for the protection of on-board receivers |
| IEC 60050-161 | International Electrotechnical Vocabulary - Electromagnetic Compatibility                                                                                                               |
| IEC 60050-726 | International Electrotechnical Vocabulary - Transmission Lines and Waveguides                                                                                                           |

### 2.1.4 ISO Publications

Copies of these documents are available online at <https://webstore.ansi.org/>.

|             |                                                                                                                                                                                                                                          |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ISO 7637-1  | Road Vehicles - Electrical Interference by Conduction and Coupling: Part 1 - Definitions and General                                                                                                                                     |
| ISO 7637-2  | Road Vehicles - Electrical Interference by Conduction and Coupling: Part 2 - Vehicles with Nominal 12 V or 24 V Supply Voltage - Electrical Transient Conduction Along Supply Lines Only                                                 |
| ISO 7637-3  | Road Vehicles - Electrical Disturbance by Conduction and Coupling: Part 3 - Vehicles with Nominal 12 V or 24 V Supply Voltage - Electrical Transient Transmission by Capacitive and Inductive Coupling Via Lines Other Than Supply Lines |
| ISO 10605   | Road Vehicles - Electrical Disturbances from Electrostatic Discharges                                                                                                                                                                    |
| ISO 11452-1 | Road Vehicles - Component Test Methods for Electrical Disturbances from Narrowband Radiated Electromagnetic Energy - Part 1: General and Definitions                                                                                     |
| ISO 11452-2 | Road Vehicles - Component Test Methods for Electrical Disturbances from Narrowband Radiated Electromagnetic Energy - Part 2: Absorber-Lined Chamber                                                                                      |
| ISO 11452-3 | Road Vehicles - Component Test Methods for Electrical Disturbances from Narrowband Radiated Electromagnetic Energy - Part 3: Transverse Electromagnetic Mode (TEM) Cell                                                                  |
| ISO 11452-4 | Road Vehicles - Component Test Methods for Electrical Disturbances from Narrowband Radiated Electromagnetic Energy - Part 4: Bulk Current Injection (BCI)                                                                                |
| ISO 11452-5 | Road Vehicles - Component Test Methods for Electrical Disturbances from Narrowband Radiated Electromagnetic Energy - Part 5: Stripline                                                                                                   |
| ISO 11452-7 | Road Vehicles - Component Test Methods for Electrical Disturbances from Narrowband Radiated Electromagnetic Energy - Part 7: Direct Radio Frequency (RF) Power Injection                                                                 |

|              |                                                                                                                                                                                                        |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ISO 11452-8  | Road Vehicles - Component Test Methods for Electrical Disturbances from Narrowband Radiated Electromagnetic Energy - Part 8: Immunity to Magnetic Fields                                               |
| ISO 11452-9  | Road Vehicles - Component Test Methods for Electrical Disturbances from Narrowband Radiated Electromagnetic Energy - Part 9: Portable Transmitters                                                     |
| ISO 11452-10 | Road Vehicles - Component Test Methods for Electrical Disturbances from Narrowband Radiated Electromagnetic Energy - Part 10: Immunity to Conducted Disturbances in the Extended Audio Frequency Range |
| ISO 11452-11 | Road Vehicles - Component Test Methods for Electrical Disturbances from Narrowband Radiated Electromagnetic Energy - Part 11: Reverberation Chamber                                                    |

## 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 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), [www.sae.org](http://www.sae.org).

SAE HS-3600      Surface Vehicle Electromagnetic Compatibility (EMC) Standards Manual

### 2.2.2 ANSI Accredited Publications

Copies of these documents are available online at <https://webstore.ansi.org/>.

ANSI C63.5      American National Standard for Electromagnetic Compatibility - Radiated Emissions Measurements in Electromagnetic Interference (EMI) Control - Calibration of Antennas (9 kHz to 40 GHz)

ANSI C63.14      American National Standard Dictionary for Technologies of Electromagnetic Compatibility (EMC), Electromagnetic Pulse (EMP), and Electrostatic Discharge (ESD) (Dictionary of EMC/EMP/ESD Terms and Definitions)

ANSI C63.16      Methodologies and Criteria for Electronic Equipment

### 2.2.3 CISPR Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, [www.ansi.org](http://www.ansi.org).

CISPR 22      Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment

### 2.2.4 ISO Publications

Copies of these documents are available online at <https://webstore.ansi.org/>.

ISO TR 10305      Generation of Standard EM Fields for Calibration of Power Density Meters - 20 kHz to 1000 MHz

### 2.2.5 IEEE Publications

Available from IEEE Operations Center, 445 and 501 Hoes Lane, Piscataway, NJ 08854-41411331, Tel: 732-981-0060, [www.ieee.org](http://www.ieee.org).

|              |                                                                                                                                                                                                                 |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IEEE C63.5   | American National Standard for Electromagnetic Compatibility - Radiated Emissions Measurements in Electromagnetic Interference (EMI) Control - Calibration of Antennas (9 kHz to 40 GHz)                        |
| IEEE C63.14  | American National Standard Dictionary for Technologies of Electromagnetic Compatibility (EMC), Electromagnetic Pulse (EMP), and Electrostatic Discharge (ESD) (Dictionary of EMC/EMP/ESD Terms and Definitions) |
| IEEE C63.16  | Methodologies and Criteria for Electronic Equipment                                                                                                                                                             |
| IEEE STD 211 | IEEE Standard Definition of Terms for Radio Wave Propagation                                                                                                                                                    |
| IEEE STD 291 | IEEE Standard Methods for Measuring Electromagnetic Field Strength of Sinusoidal Continuous Waves, 30 Hz to 30 GHz                                                                                              |

### 2.2.6 Other Publications

Kinderman, J., Blink, R., Eisenlord, D., Laskowski, M. et al., "Implementation of EMC Testing of Automotive Vehicles," SAE Technical Paper 810333, 1981, <https://doi.org/10.4271/810333>.

Vrooman, G., "An Indoor 60 Hz to 40 GHz Facility for Total Vehicle EMC Testing," SAE Technical Paper 831011, 1983, <https://doi.org/10.4271/831011>.

Adams, J. W., Taggart, H. E., Kanda, M., and Shafer, J., "Electromagnetic Interference (EMI) Radiative Measurements for Automotive Applications," NBS Tech. Note 1014, June 1979.

Tippet, J. C., Chang, D. C., and Crawford, M. L., "An Analytical and Experimental Determination of the Cutoff Frequencies of Higher-Order TE Modes in a TEM cell," NBSIR 76-841, June 1976.

Tippet, J. C., Modal Characteristics of Rectangular Coaxial Transmission Line, Thesis submitted June 1978 for degree of Doctor of Philosophy to University of Colorado, Electrical Engineering Dept., Boulder, CO.

Nichols, F. J., and Hemming, L. H., "Recommendations and Design Guides for the Selection and Use of RF Shielded Anechoic Chamber in the 30-1000 MHz Frequency Range," IEEE Inter. Symposium on EMC, Boulder, CO, August 18-20, 1981, pp 457-464.

## 3. DEFINITIONS

The definitions listed below apply to certain terms used in the various parts of SAE J1113 and are not intended to be an exhaustive list. For more information, check other resources such as IEC publications 60050(161) and 60050(726) and the latest editions of ANSI/IEEE Dictionaries of Technological terms. Definitions without a source reference were defined within the SAE committee activities.

### 3.1 ABSORBER-LINED SHIELDED ENCLOSURE (ALSE)

A shielded room with absorbing material on its internal ceiling and walls.

NOTE: The common practice is to have the metallic floor of the ALSE exposed (semi-anechoic condition), or absorbing material may be placed over the entire floor area (fully anechoic condition). (Adapted from ISO 11452-1.)

### 3.2 AMPLITUDE MODULATION (AM)

The process by which the amplitude of a carrier wave is varied following a specified law. The result of the process is an AM signal. (Adapted from ISO 11452-1.)

### 3.3 ARTIFICIAL NETWORK (AN); LINE IMPEDANCE STABILIZATION NETWORK (LISN)

A network inserted in the supply leads of apparatus to be tested which provides, in a given frequency range, a specified load impedance for the measurement of disturbance voltages and which isolates the apparatus from the power supply in that frequency range. (Adapted from IEC 60050-161-04-05.)

### 3.4 BENCH TESTING

Bench testing is component testing performed in a laboratory or test facility.

### 3.5 BOND

A connection between conductive parts or surfaces that assures that the required electrical conductivity will be achieved.

### 3.6 BROADBAND ARTIFICIAL NETWORK (BAN)

Device used in power, signal and control lines that presents a controlled impedance to the DUT over a specified frequency range while allowing the DUT to be interfaced to its support system. (Adapted from ISO 11452-1.)

### 3.7 BULK CURRENT

Total amount of common mode current in a harness. (Refer to ISO 11452-1.)

### 3.8 BULK CURRENT INJECTION PROBE

A device for injecting current in a conductor without interrupting the conductor and without introducing significant impedance into the associated circuits.

### 3.9 BURST

Transient comprised of a complex series of transient voltage variations. (Refer to ISO 7637-1.)

### 3.10 BURST CYCLE TIME

Time between the start of the first pulse of two consecutive bursts. (Refer to ISO 7637-1.)

### 3.11 BURST DURATION

Time during which a complex series of transient variations occurs during a single burst. (Refer to ISO 7637-1.)

### 3.12 CAN

Controller Area Network.

### 3.13 CLASS

A performance level agreed upon by the purchaser and the supplier and documented in the test plan. (Refer to CISPR 25, 1st Edition.)

### 3.14 CONDUCTED SUSCEPTIBILITY THRESHOLD

Conducted susceptibility threshold is defined as the level of conducted interference at which the device under test (DUT) responds undesirably or experiences performance degradation. For conducted susceptibility bench testing, a representative number of conducted interference waveforms are artificially generated and injected into the DUT to determine the threshold level of susceptibility.

### 3.15 COUPLING

A means or a device for transferring power between systems. (Adapted from IEC 60050-726-14-01.)



### 3.16 CURRENT PROBE (MEASURING OR MONITORING)

A device for measuring the current in a conductor without interrupting the conductor and without introducing significant impedance into the associated circuits. (Adapted from IEC 60050-161-04-35.)

### 3.17 DAMPED SINUSOID

A waveform composed of a sine wave having a decaying amplitude envelope. The waveform occurs when a pulse excites a circuit having a condition of resonance.

### 3.18 DEGRADATION (OF PERFORMANCE)

An undesired departure in the operational performance of any device, equipment, or system from its intended performance.

NOTE: The term “degradation” can apply to temporary or permanent failure. (IEC 60050-161-01-19.)

### 3.19 DEVICE

1. An electrical or electronic component, module, subassembly, or system. Each could include a wiring harness(es).
2. Machine driven by an internal combustion engine which is not primarily intended to carry persons or goods. Devices include, but are not limited to, chainsaws, irrigation pumps, snow blowers, air compressors, and landscaping equipment (see Machine). (Refer to CISPR 25.)

### 3.20 DEVICE UNDER TEST (DUT)

The device, equipment, or system being evaluated.

### 3.21 DIRECTIONAL COUPLER

A three- or four-port device consisting of two transmission lines coupled together in such a manner that a single traveling wave in any one transmission line will induce a single traveling wave in the other; the direction of propagation of the latter wave being dependent upon that of the former. (Refer to IEC 60050-726-14-02.)

### 3.22 ELECTROMAGNETIC COMPATIBILITY (EMC)

The ability of an equipment or system to function satisfactory in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment. (Refer to IEC 60050-161-01-07.)

### 3.23 ELECTROMAGNETIC ENVIRONMENT

The totality of electromagnetic phenomena existing at a given location. (Refer to IEC 60050-161-01-01.)

### 3.24 ELECTROMAGNETIC IMMUNITY (TO A DISTURBANCE)

The ability of a device, equipment, or system to perform without degradation in the presence of an electromagnetic disturbance. (Adapted from IEC 60050-161-01-20.)

### 3.25 ELECTROMAGNETIC INTERFERENCE

Degradation of the performance of an equipment, transmission channel, or system caused by an electromagnetic disturbance.

NOTE: The English words “interference” and “disturbance” are often used indiscriminately. (Refer to IEC 60050-161-01-06.)

### 3.26 ELECTROMAGNETIC SUSCEPTIBILITY

The inability of a device, equipment, or system to perform without degradation in the presence of an electromagnetic disturbance.

NOTE: Susceptibility is the lack of immunity. (Refer to IEC 60050-161-01-21.)

### 3.27 ELECTROSTATIC DISCHARGE (ESD)

A transfer of electric charge between bodies of different electrostatic potential in proximity or through direct contact. (Refer to IEC 60050-161-01-22.)

### 3.28 FORWARD POWER

That power supplied by the output of an amplifier (or generator). (Refer to ISO 11452-1.)

### 3.29 FUNCTION PERFORMANCE STATUS AND FUNCTION PERFORMANCE STATUS CLASSIFICATIONS

#### 3.29.1 FUNCTION PERFORMANCE STATUS

Expected performance objectives for the function of the device under test subjected to test conditions, agreed between the customer and the supplier which is specified in the test plan. (Refer to ISO 11452-1.)

#### 3.29.2 FUNCTIONAL PERFORMANCE STATUS CLASSIFICATIONS

See Appendix A for definitions of functional performance status classifications, the associated regions of performance, and performance objectives.

### 3.30 GLOW DISCHARGE

A portion of the transient waveform characterized by a short fall time preceded by a relatively longer rise time. The waveform occurs at the end of the initial switch arc of the on-to-off switching operation of inductive loads. There may be a single or multiple occurrence of this waveform.

### 3.31 GROUND (REFERENCE) PLANE

A flat conductive surface whose potential is used as a common reference. (Refer to IEC 60050-161-04-36.)

### 3.32 IMMUNITY LEVEL

The maximum level of a given electromagnetic disturbance incident on a particular device, equipment, or system for which it remains capable of operating at a required degree of performance. (Refer to IEC 60050-161-03-14.)

### 3.33 INDUCTIVE KICK

A portion of the transient waveform which occurs during the on-to-off switching operation of inductive loads at the end of the initial switch arc. It is characterized by an exponential wave shape with negative voltage amplitude.

### 3.34 INFORMATIVE APPENDIX

Applies here to classify an appendix that contains information that is advisory or explanatory in nature, as opposed to being mandatory.

### 3.35 LOAD DUMP

An exponentially decaying positive transient produced by the alternator when the load presented by the battery or any other large current load is suddenly removed.

### 3.36 MODULATION FACTOR (m)

The ratio of the peak variation of the envelope to the reference value. The reference value is usually taken to be the amplitude of the un-modulated wave. The value of m varies between 0 and 1.

### 3.37 NET POWER

Forward power in Watts minus reflected power in Watts at the same location on the transmission line. (Refer to ISO 11452-1.)

### 3.38 NORMATIVE APPENDIX

An appendix containing information whose use is mandatory when applying this document.

### 3.39 POLARIZATION (OF A WAVE OR FIELD VECTOR)

The property of a sinusoidal electromagnetic wave or field vector defined at a fixed point in space by the direction of the electric field strength vector or of any specified field vector; when this direction varies with time, the property may be characterized by the locus described by the extremity of the considered field vector. (Refer to IEC 60050-726-04-01.)

### 3.40 PULSE DURATION

From ISO 7637-1.

Time from the instant the absolute value of the pulse rises above 10% of the absolute value of the peak amplitude to the instant it falls below 10% of this.

### 3.41 QUALITY FACTOR “Q”

If a DUT has a frequency response with a center frequency  $f_{DUT}$  and a -3 dB bandwidth (BW), Q is defined as the ratio of  $f_{DUT}/BW$ .

### 3.42 REFLECTED POWER

Power reflected by the load due to impedance mismatch between RF source and the load. (Adapted from ISO 11452-1.)

### 3.43 RF BOUNDARY

An element of an EMC test set-up that separates that part of the harness and/or peripherals that is included in the RF environment and that part that is excluded. It may consist of, for example, ANs, BANs, filter feed-through pins, RF absorber coated wire, and/or shielding.

### 3.44 RF DISTURBANCE POWER

RF power measured with a current transformer of an absorbing clamp and an RF measuring instrument. It may be measured (as the RF disturbance voltage) in a peak or quasi-peak mode.

### 3.45 RIPPLE

Regular or irregular variations in voltage around the nominal DC voltage level during steady state operation of the system.

### 3.46 RIPPLE PEAK

The greatest variations due to ripple above and below the nominal DC level are called the upper peak and lower peak, respectively. Peak-to-peak ripple is the difference between the upper peak and lower peak voltages.

### 3.47 SHALL

Used to express a command; i.e., conformance with the specific recommendation is mandatory and deviation is not permitted. The use of the word “shall” is not qualified by the fact that compliance with the document is considered voluntary.

### 3.48 SHIELDED ENCLOSURE/SCREENED ROOM

A mesh or sheet metallic housing designed expressly for the purpose of separating electromagnetically the internal and external environment. (Refer to IEC 60050-161-04-37.)

### 3.49 SOURCE RESISTANCE

The output resistance of the source.

### 3.50 SPIKE

A transient that exceeds peak ripple for a period less than 150  $\mu$ s. Spikes are sometimes high-frequency oscillations resulting from sudden load variations.

### 3.51 STANDING WAVE RATIO (in a transmission line) (SWR); VOLTAGE STANDING WAVE RATIO (VSWR)

The ratio, along a transmission line, of a maximum to an adjacent minimum magnitude of a particular field component of a standing wave. (Adapted from IEC 60050-726-07-09.)

NOTE: SWR or VSWR is usually measured in terms of line voltage or line current.

### 3.52 SURGE

A non-oscillatory transient that exceeds peak ripple, is infrequent, and has a duration equal to or greater than 150  $\mu$ s.

### 3.53 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 device under test (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.

### 3.54 TIME BETWEEN BURSTS

The time between the end of one burst and the start of the next one. (Refer to ISO 7637-1.)

### 3.55 TRANSIENT

A temporary increase or decrease of voltage or current. Transients may take the form of spikes or surges. Specific transient parameters include:

#### 3.55.1 AMPLITUDE

The maximum voltage excursion beyond ripple peak.

#### 3.55.2 WIDTH (T)

The time from the instant the transient reaches 10% of its maximum amplitude to the instant it falls below that value. (Refer to ISO 7637-1.)