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**Road vehicles — Component test  
methods for electrical disturbances from  
narrowband radiated electromagnetic  
energy —**

Part 1:

**General principles and terminology**

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*Véhicules routiers — Méthodes d'essai d'un équipement soumis à des  
perturbations électriques par rayonnement d'énergie électromagnétique  
en bande étroite* 2005

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Partie 1: Principes généraux et terminologie



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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 11452-1 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

This third edition cancels and replaces the second edition (ISO 11452-1:2001), which has been technically revised.

ISO 11452 consists of the following parts, under the general title *Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy*:

- *Part 1: General principles and terminology*
- *Part 2: Absorber-lined shielded enclosure*
- *Part 3: Transverse electromagnetic mode (TEM) cell*
- *Part 4: Bulk current injection (BCI)*
- *Part 5: Stripline*
- *Part 7: Direct radio frequency (RF) power injection*

Radiating loop method is to form the subject of a future part 8.

## Introduction

In recent years, an increasing number of electronic devices for controlling, monitoring and displaying a variety of functions have been introduced into vehicle designs. It is necessary to consider the electrical and electromagnetic environment in which these devices operate.

Electrical and radio-frequency disturbances occur during normal operation of many items of motor vehicle equipment. They are generated over a wide frequency range with various electrical characteristics and can be distributed to on-board electronic devices and systems by conduction, radiation or both. Narrowband signals generated from sources on or off the vehicle can also be coupled into the electrical or electronic system, affecting the normal performance of electronic devices. Such sources of narrowband electromagnetic disturbances include mobile radios and broadcast transmitters.

The characteristics of the immunity of components to radiated disturbances have to be established. ISO 11452 provides various test methods for the evaluation of component immunity characteristics. Not all test methods need be used for a given device under test (DUT). For example, stripline, transverse electromagnetic (TEM) cell and parallel plate test methods provide very similar exposure to the DUT. Only those tests necessary for replicating the use and mounting location of the DUT need to be included in the test plan. This will help to ensure a technically and economically optimized design for potentially susceptible components and systems.

ISO 11452 is not intended as a product specification and cannot function as one (see A.1). Therefore, no specific values for the test severity level are given.

Annex A of this part of ISO 11452 specifies a general method for functional performance status classification (FPSC), while Annex B explains the principle of constant peak test level. Typical severity levels are included in an annex of each of the other parts of ISO 11452.

Protection from potential disturbances has to be considered a part of total vehicle validation as described in ISO 11451, which covers vehicle test methods. It is important to know the correlation between component and vehicle tests.

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# Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy —

## Part 1: General principles and terminology

### 1 Scope

This part of ISO 11452 specifies general conditions, defines terms, gives practical guidelines and establishes the basic principles of the component tests used in the other parts of ISO 11452 for determining the immunity of electronic components of passenger cars and commercial vehicles to electrical disturbances from narrowband radiated electromagnetic energy, regardless of the vehicle propulsion system (e.g. spark-ignition engine, diesel engine, electric motor).

The electromagnetic disturbances considered are limited to continuous narrowband electromagnetic fields. A wide frequency range (0,01 MHz to 18 000 MHz) is allowed for the immunity testing of the components in this and the other parts of ISO 11452.

### 2 Terms and definitions

[ISO 11452-1:2005](http://www.iso.org/iso/11452-1-2005)

<http://www.iso.org/iso/catalog/standards/sist/8069a149-d3c7-49ae-89af-690eb1867a1f/iso-11452-1-2005>

For the purposes of this document, the following terms and definitions apply.

#### 2.1

##### **absorber-lined shielded enclosure**

shielded enclosure/screened room with radio frequency-absorbing material on its internal ceiling and walls

NOTE The common practice is for the room to have a metallic floor, but absorbing material may also be used on the floor.

#### 2.2

##### **amplitude modulation**

##### **AM**

process by which the amplitude of a carrier wave is varied following a specified law, resulting in an AM signal

#### 2.3

##### **artificial network**

##### **AN**

network inserted in the supply leads of the DUT which provides, in a given frequency range, a specified load impedance for the measurement of disturbance voltages, and which isolates the DUT from the power supply in that frequency range

#### 2.4

##### **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

**2.5**

**bulk current**

total amount of common mode current in a harness

**2.6**

**compression point**

input signal level at which the measurement system becomes non-linear, when the output value will deviate from the value given by an ideal linear system

**2.7**

**coupling**

means or device for transferring power between systems

NOTE Adapted from IEC 60050-726.

**2.8**

**current injection probe**

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

**2.9**

**current (measuring) probe**

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

[IEC 60050-161]

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**2.10**

**degradation (of performance)**

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

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NOTE The term “degradation” can apply to temporary or permanent failure.

[IEC 60050-161]

**2.11**

**dual directional coupler**

four-port device consisting of two transmission lines coupled together in such a manner that a single travelling wave in any one transmission line will induce a single travelling wave in the other, the direction of propagation of the latter wave being dependent upon that of the former

NOTE Adapted from IEC 60050-726.

**2.12**

**electromagnetic compatibility**

**EMC**

ability of equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbance to anything in that environment

[IEC 60050-161]

**2.13**

**electromagnetic disturbance**

any electromagnetic phenomenon which may degrade the performance of a device, equipment or system, or adversely affect living or inert matter



**EXAMPLE** An electromagnetic disturbance may be an electromagnetic noise, an unwanted signal or a change in the propagation medium itself.

[IEC 60050-161]

**2.14  
electromagnetic interference**

**EMI**

degradation of the performance of equipment, transmission channel or system caused by electromagnetic disturbance

**NOTE** The English words “interference” and “disturbance” are often used indiscriminately.

[IEC 60050-161]

**2.15  
forward power**

power supplied by the output of an amplifier or generator

**2.16  
functional status**

performance level agreed between the customer and the supplier which is specified in the test plan

**2.17  
ground (reference) plane**

flat conductive surface whose potential is used as a common reference

[IEC 60050-161]

**2.18  
immunity (to a disturbance)**

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

[IEC 60050-161]

**2.19  
immunity level**

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

[IEC 60050-161]

**2.20  
narrowband emission**

emission which has a bandwidth less than that of a particular measuring apparatus or receiver

[IEC 60050-161]

**2.21  
net power**

forward power minus reflected power

**2.22  
polarization**

property of 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

NOTE 1 When this direction varies with time, the property may be characterized by the locus described by the extremity of the considered field vector.

NOTE 2 Adapted from IEC 60050-726.

**2.23**  
**pulse modulation**  
**PM**

process by which the amplitude of a carrier wave is varied following a specified law, resulting in a PM signal

**2.24**  
**electromagnetic radiation**

phenomenon by which energy in the form of electromagnetic waves emanates from a source into space

NOTE By extension, the term "electromagnetic radiation" sometimes also covers induction phenomena.

[IEC 60050-161]

**2.25**  
**electromagnetic radiation**

energy transferred through space in the form of electromagnetic waves

[IEC 60050-161]

**2.26**  
**reflected power**

power reflected by the load due to impedance mismatch between RF source and the load

**2.27**  
**shielded enclosure**  
**screened room**

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

[IEC 60050-161]

**2.28**  
**standing wave ratio**  
**SWR**  
**voltage standing wave ratio**  
**VSWR**

ratio, along a transmission line, of a maximum to an adjacent minimum magnitude of a particular field component of a standing wave

NOTE 1 SWR is expressed by the equation:

$$\text{SWR} = \frac{(1+r)}{(1-r)}$$

where  $r$  is the absolute value of the coefficient of reflection.

NOTE 2 Adapted from IEC 60050-726.

**2.29**  
**stripline**

terminated transmission line consisting of two parallel plates between which a wave is propagated in the transverse electromagnetic mode to produce a specified field for testing purposes

[IEC 60050-161]

**2.30****(electromagnetic) susceptibility**

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.

[IEC 60050-161]

**2.31****transmission line system****TLS**

field-generating device that works in a similar way to a TEM (transverse electromagnetic mode) wave generator

EXAMPLE Stripline, TEM cell, parallel plate.

**2.32****transverse electromagnetic cell****TEM cell**

enclosed system, often a rectangular coaxial line, in which a wave is propagated in the transverse electromagnetic mode to produce a specified field for testing purposes

[IEC 60050-161]

**2.33****transverse electromagnetic mode****TEM mode**

mode in which the longitudinal components of both the electric and magnetic field strength vectors are everywhere zero

ISO 11452-1:2005

NOTE Adapted from IEC 60050-726. <http://standards.iteh.ai/catalog/standards/sist/8069a149-d3c7-49ae-89af-690eb1867a1f/iso-11452-1-2005>

**3 General aim and practical use**

The test methods, procedures, test instrumentation and levels specified in ISO 11452 are intended to facilitate component specification for electrical disturbances by narrowband radiated electromagnetic energy. A basis is provided for mutual agreement between vehicle manufacturers and component suppliers intended to assist rather than restrict.

Certain devices are particularly susceptible to some characteristics of electromagnetic disturbance, such as frequency, severity level, type of coupling or modulation.

Electronic devices are sometimes more susceptible to modulated, as opposed to unmodulated, radio-frequency (RF) signals. The reason is that high-frequency disturbances can be demodulated by semiconductors. In the case of unmodulated signals, this leads to a continuous shift of, for example, a voltage; in the case of amplitude-modulated signals, the resulting low-frequency fluctuations can be interpreted as intentional signals (e.g. speed information) and therefore disturb the function of the DUT more severely.

A single standard test might not reveal all the needed information about the DUT. It is thus necessary for users of ISO 11452 to anticipate the appropriate test conditions, select applicable parts of ISO 11452 and define function performance objectives. The main characteristics of each test method in ISO 11452-2 to ISO 11452-7 are presented in Table 1.