INTERNATIONAL STANDARD

ISO 11452-2

Second edition
2004-11-01

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

Part 2:
Absorber-lined shielded enclosure

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

Partie 2: Chambre anéchoïque

Reference number
ISO 11452-2:2004(E)

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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 11452-2 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

This second edition cancels and replaces the first edition (ISO 11452-2:1995), 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*

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

Introduction

Immunity measurements of complete vehicles are generally able to be carried out only by the vehicle manufacturer, owing to, for example, high costs of an absorber-lined shielded enclosures, the desire to preserve the secrecy of prototypes or a large number of different vehicles models.

For research, development and quality control, a laboratory measuring method can be used by both vehicle manufacturers and equipment suppliers to test electronic components.

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

Part 2: Absorber-lined shielded enclosure

1 Scope

This part of ISO 11452 specifies an absorber-lined shielded enclosure method for testing the immunity (off-vehicle radiation source) of electronic components for passenger cars and commercial vehicles regardless of the propulsion system (e.g spark-ignition engine, diesel engine, electric motor). The device under test (DUT), together with the wiring harness (prototype or standard test harness), is subjected to an electromagnetic disturbance generated inside an absorber-lined shielded enclosure, with peripheral devices either inside or outside the enclosure. It is applicable only to disturbances from continuous narrowband electromagnetic fields. See ISO 11452-1 for general test conditions.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 11452-1, *Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 1: General principles and terminology*[1)]

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11452-1 apply.

4 Test conditions

The applicable frequency range of the absorber-lined shielded enclosure test method is 80 MHz to 18 GHz.

The user shall specify the test severity level(s) over the frequency range. Suggested test levels are included in Annex C.

Standard test conditions shall be according to ISO 11452-1 for the following:

— test temperature;

1) To be published. (Revision of ISO 11452-1:2001)

- supply voltage;
- modulation;
- dwell time;
- frequency step sizes;
- definition of test severity levels;
- test signal quality.

5 Test location

The tests shall be performed in an absorber-lined shielded enclosure.

The purpose of such an enclosure is to create an isolated electromagnetic compatibility test facility which simulates open field testing. Basically, an absorber-lined shielded enclosure consists of a shielded room with absorbing material on its internal reflective surfaces, optionally excluding the floor. The design objective is to attenuate the reflected energy in the test area by at least 10 dB compared to the direct energy.

6 Test apparatus and instrumentation

6.1 General

Radiated electromagnetic fields are generated using antenna with a radio frequency (RF) energy source capable of producing the desired field strengths. A set of antennae and multiple RF amplifiers could be required to cover the range of test frequencies. The field is monitored electrically with small probes to ensure proper test levels. To reduce test error, the operation of the DUT is usually monitored by fibre-optic couplers.

6.2 Measuring equipment

6.2.1 Field-generating device: any available antenna (including high-power baluns, if appropriate) capable of radiating the specified field strength at the DUT with the available power may be used. The construction and orientation of any field-generating device shall be such that the generated field can be polarized in the mode specified in the test plan.

6.2.2 Field probes, which should be electrically small and isotropic. The transmission lines from the probes should be either fibre-optic links or very high resistance.

6.2.3 Artificial network(s) (AN): see 7.2 and Annex A.

6.2.4 HF generator, with internal (or external) modulation capabilities

6.2.5 High-power amplifier

6.2.6 Powermeter (or equivalent measuring instrument), for measuring forward power and reflected power.

6.3 Stimulation and monitoring of DUT

The device under test (DUT) shall be operated as required in the test plan by actuators that have a minimum effect on the electromagnetic characteristics, e.g. plastic blocks on the push-buttons, pneumatic actuators with plastic tubes.

Connections to equipment monitoring electromagnetic interference reactions of the DUT may be accomplished by using fibre-optics, or high-resistance leads. Other types of lead may be used but require extreme care to minimize interactions. The orientation, length and location of such leads shall be carefully documented to ensure repeatability of test results.

Any electrical connection of monitoring equipment to the DUT may cause malfunctions of the DUT. Extreme care shall be taken to avoid such an effect.

7 Test set-up

7.1 Ground plane

The ground plane shall be made of 0,5 mm thick (minimum) copper, brass or galvanized steel.

The minimum width of the ground plane shall be 1 000 mm. The minimum length of the ground plane shall be 2 000 mm, or the length of the entire underneath of the equipment plus 200 mm, whichever is the larger.

The height of the ground plane (test bench) shall be (900 ± 100) mm above the floor.

The ground plane shall be bonded to the shielded enclosure such that the d.c. resistance shall not exceed 2,5 mΩ. In addition, the bond straps shall be placed at a distance no greater than 0,3 m apart edge to edge.

7.2 Power supply and AN

Each DUT power supply lead shall be connected to the power supply through an AN.

Power supply is assumed to be negative ground. If the DUT utilizes a positive ground, then the test set-ups shown in the figures need to be adapted accordingly. Power shall be applied to the DUT via a 5 µH/50 Ω AN (see Annex A for the schematic). The number of ANs required depends on the intended DUT installation in the vehicle.

— For a remotely grounded DUT (vehicle power return line longer than 200 mm), two ANs are required: one for the positive supply line and another for the power return line (see Annex B).

— For a locally grounded DUT (vehicle power return line 200 mm or shorter), only one AN is required, for the positive supply (see Annex B).

The AN(s) shall be mounted directly on the ground plane. The case or cases of the AN(s) shall be bonded to the ground plane.

The power supply return shall be connected to the ground plane — between the power supply and the AN(s).

The measuring port of each AN shall be terminated with a 50 Ω load.

7.3 Location of DUT

The DUT shall be placed on a non-conductive, low relative permittivity (dielectric-constant) material ($\varepsilon_r \leqslant 1,4$), at (50 ± 5) mm above the ground plane.

The case of the DUT shall not be grounded to the ground plane unless it is intended to simulate the actual vehicle configuration.

The face of the DUT shall be located at a distance of (200 ± 10) mm from the edge of the ground plane.

7.4 Location of test harness

The part of the test harness parallel to the front edge of the ground plane shall be (1500 ± 75) mm.

The total length of the test harness between the DUT and the load simulator (or the RF boundary) shall not exceed 2 000 mm. The wiring type is defined by the actual system application and requirement.

The test harness shall be placed on a non-conductive, low relative permittivity (dielectric-constant) material ($\varepsilon_r \leqslant 1{,}4$), at (50 ± 5) mm above the ground plane.

That part of the test harness parallel to the front edge of the ground plane shall be at a distance of (100 ± 10) mm from the edge of the ground plane.

7.5 Location of load simulator

Preferably, the load simulator shall be placed directly on the ground plane. If the load simulator has a metallic case, this case shall be bonded to the ground plane.

Alternatively, the load simulator may be located adjacent to the ground plane (with the case of the load simulator bonded to the ground plane) or outside of the test chamber, provided the test harness from the DUT passes through an RF boundary bonded to the ground plane.

When the load simulator is located on the ground plane, the d.c. power supply lines of the load simulator shall be connected through the AN(s).

7.6 Location of field generating device (antenna)

The height of the phase centre of the antenna shall be (100 ± 10) mm above the ground plane.

No part of any antenna radiating element shall be closer than 250 mm to the floor. The radiating elements of the antenna shall not be closer than 500 mm to any absorber material, and shall not be closer than 1 500 mm to the walls or ceiling of the shielded enclosure.

The distance between the wiring harness and the antenna shall be (1 000 ± 10) mm. This distance is measured from

— the phase centre (mid-point) of the biconical antenna, or

— the nearest part of the log-periodic antenna, or

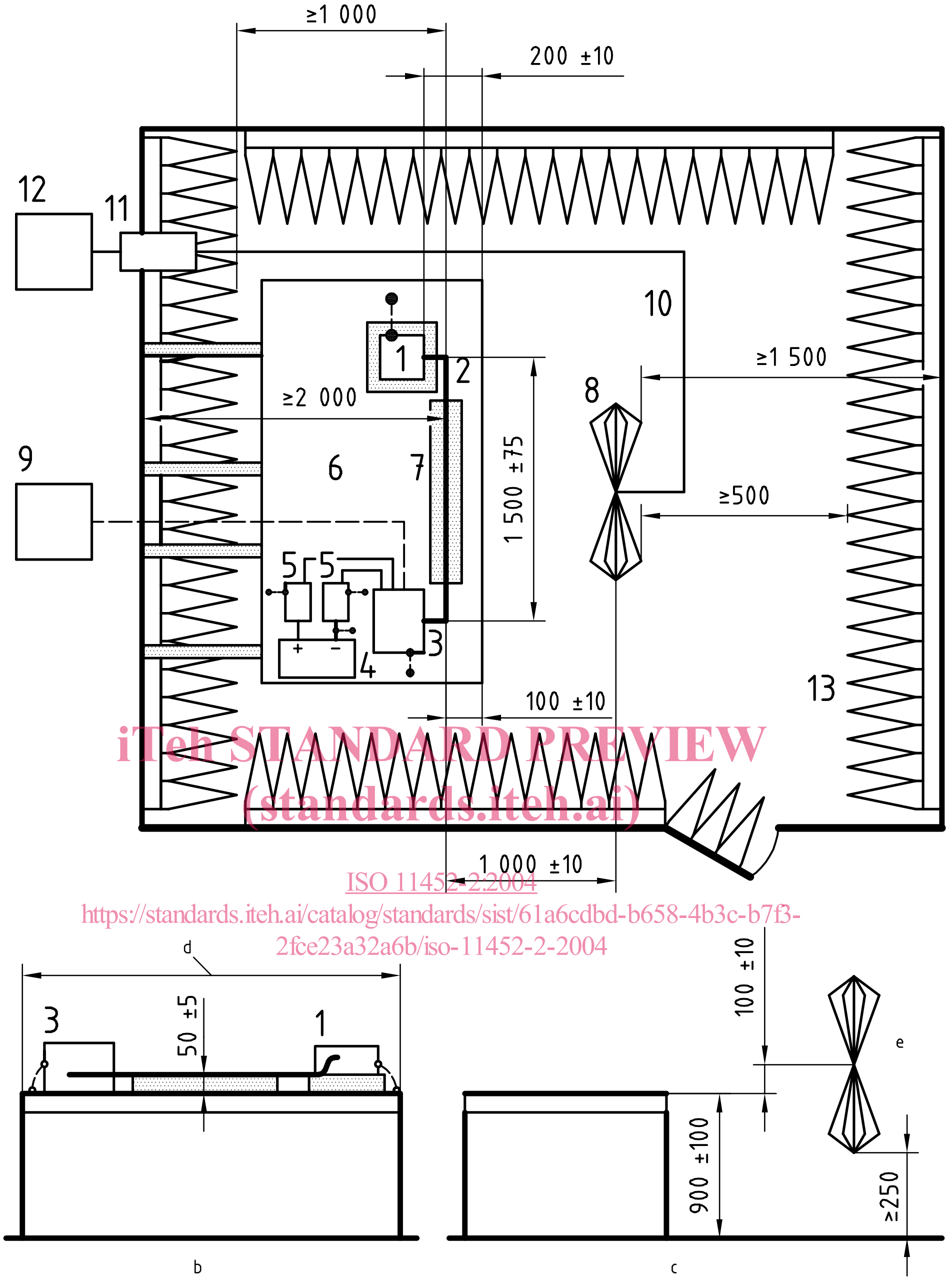
— the nearest part of the horn antenna.

The phase centre of the antenna for frequencies from 80 MHz to 1 000 MHz shall be in line with the centre of the longitudinal part (1 500 mm length) of the wiring harness.

The phase centre of the antenna for frequencies above 1 000 MHz shall be in line with the DUT.

Examples of test set-ups are shown in Figures 1 to 3.

Dimensions in millimetres



Key

1 DUT (grounded locally if required in test plan)
2 test harness
3 load simulator (placement and ground: connection according to 7.5)
4 power supply (location optional)
5 artificial network (AN)
6 ground plane (bonded to shielded enclosure)
7 low relative permittivity support ($\varepsilon_r \leqslant 1,4$)
8 biconical antenna
9 stimulation and monitoring system
10 high quality double-shielded coaxial cable (50 Ω)
11 bulkhead connector
12 RF signal generator and amplifier
13 RF absorber material

a Upper view (horizontal polarisation).
b Front view.
c Side view.
d See 7.1.
e Vertical polarization.

Figure 1 — Example test set-up — Biconical antenna