INTERNATIONAL STANDARD

ISO 11452-6

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Road vehicles — Electrical disturbances by narrowband radiated electromagnetic energy — Component test methods —

Part 6: Parallel plate antenna

Véhicules routiers — Perturbations électriques par rayonnement d'énergie électromagnétique à bande étroite — Méthodes d'essai des composants —

Partie 6: Antenne à plaques parallèles

Reference number
ISO 11452-6:1997(E)

Content

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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.

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.

International Standard ISO 11452-6 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

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

— *Part 1: General and definitions*

— *Part 2: Absorber-lined chamber*

— *Part 3: Transverse electromagnetic mode (TEM) cell*

— *Part 4: Bulk current injection (BCI)*

— *Part 5: Stripline*

— *Part 6: Parallel plate antenna*

— *Part 7: Direct radio frequency (RF) power injection*

Annexes A and B of this part of ISO 11452 are for information only.

Road vehicles — Electrical disturbances by narrowband radiated electromagnetic energy — Component test methods —

Part 6:
Parallel plate antenna

1 Scope

This part of ISO 11452 specifies test methods and procedures for testing electromagnetic immunity (off-vehicle radiation sources) of electronic components for passenger cars and commercial vehicles regardless of the propulsion system (e.g. spark-ignition engine, diesel engine, electric motor).

To perform this test method, the electronic module along with the wiring harness (prototype or standard test harness) and peripheral devices will be subjected to the electromagnetic disturbances generated by a parallel plate antenna inside a shielded chamber. The electromagnetic disturbances considered in this part of ISO 11452 are limited to continuous narrowband electromagnetic fields.

Immunity measurements of complete vehicles are generally only possible by the vehicle manufacturer, because, for example, of the high costs of an absorber-lined chamber, preserving the secrecy of prototypes or the large number of different vehicle models. Therefore, for research, development and quality control, laboratory measuring methods are used by the manufacturer.

ISO 11452-1 specifies general test methods, definitions, practical use and basic principles of the test procedure.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 11452. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 11452 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 11452-1:1995, *Road vehicles — Electrical disturbances by narrowband radiated electromagnetic energy — Component test methods — Part 1: General and definitions.*

3 Test conditions

3.1 Test temperature and supply voltage

The ambient temperature during the test shall be (23 ± 5) °C.

The supply voltage during the test shall be (13,5 ± 0,5) V for 12 V electrical systems and (27 ± 1) V for 24 V electrical systems.

If other values are agreed to by the users of this part of ISO 11452, the values shall be documented in the test report.

3.2 Frequency range

The frequency range of the test method is 10 kHz to 200 MHz.

3.3 Modulation

The device under test determines the type and frequency of modulation. If no values are agreed between the users of this part of ISO 11452, the following shall be used:

— no modulation (CW);

— 1 kHz sine-wave amplitude modulation (AM) of 80 %.

3.4 Dwell time

At each frequency, the device under test shall be exposed to the test level for the minimum response time needed to control it. In all cases, this minimum time of exposure shall not be less than 2 s.

3.5 Frequency step sizes

All tests in this part of ISO 11452 shall be conducted with linear frequency step sizes not greater than those specified in table 1.

Table 1 — Frequency step sizes

Frequency band MHz	Maximum frequency step size MHz
> 0,01 to ≤ 0,1	0,01
> 0,1 to ≤ 1	0,1
> 1 to ≤ 10	1
> 10 to ≤ 200	2

Alternatively, logarithmic frequency steps, with the same minimum number of frequency steps in each frequency band, may be used. The values, as agreed by the users of this part of ISO 11452, shall be documented in the test report.

If it appears that the susceptibility thresholds of the device under test are very near the chosen test level, these frequency step sizes should be reduced in the frequency range concerned in order to find the minimum susceptibility thresholds.

3.6 Test severity levels

The user should specify the severity level(s) over the frequency range. Suggested test severity levels are given in annex A.

These suggested test severity levels are expressed in terms of the equivalent root-mean-square value of an unmodulated wave.

4 Test instrument description and specifications

4.1 General

The test consists of generating radiated electric fields by using a parallel plate antenna with radio frequency (RF) sources capable of producing the desired field strengths over the range of test frequencies. The fields shall be monitored with small probes to ensure proper test levels. To reduce testing error, the device under test shall be monitored by optical couplers.

4.2 Shielded enclosure

The shielded enclosure shall be capable of attenuating the generated electromagnetic energy during the test such that it will not introduce an unacceptable level of emissions to the outside environment.

4.3 Instrumentation

4.3.1 Field generating device

The field generating device shall be a parallel plate antenna or equivalent. Any commercially available parallel plate (or element) antenna which is capable of generating the specified test levels at the device under test with available power may be used.

NOTES

1 The parallel plate antenna is basically a parallel balanced transmission line (antenna) that is capable of generating a uniform electric field over a useful physical area. The antenna is designed to interface with a 50 Ω power source and a 50 Ω dummy load in order to achieve good matching characteristics. The test configuration may be designed to test equipment with their associated wiring harnesses. The maximum size of the device under test should not be larger than the width of the antenna.

2 The users are cautioned that since the test apparatus will generate undesirable electromagnetic radiation into the environment, the test may need to be performed inside a shielded enclosure.

4.3.2 Monitoring of the device under test

Test equipment, appropriate to the test power levels, required to monitor the operation of the device under test shall be coupled to the control centre by fibre-optic links or high resistance leads.

4.3.3 Field probes

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

4.4 Test set-up

4.4.1 Installation of the device under test

Examples of the test configuration are shown in figures 1a) and 1b). The device under test with standard test wiring harness and actual or simulated loads shall be used in the test. The device under test, test harness, and other

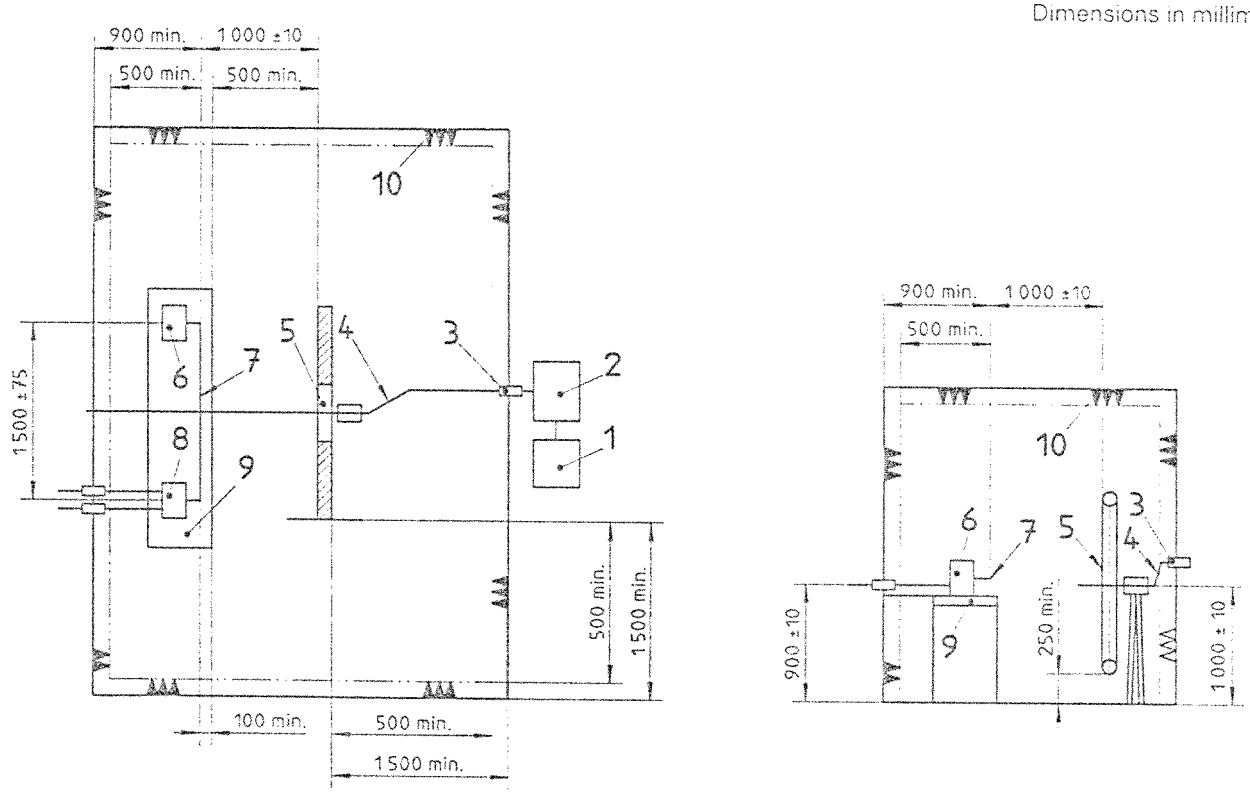
peripherals which are part of the test are placed on a test bench. The length of the test harness shall be (1 500 ± 75) mm. The wiring type is defined by the actual system application and requirement. It is recommended that, if possible, the test be performed using the test harness for the device under test connected to the actual loads at each end. The equipment and wiring harness should be placed in a plane parallel to and half-way between the two plates.

The faces of the device under test shall be located at a minimum distance of 100 mm from the edge of the ground plane. All leads and cables shall be a minimum of 100 mm from the edge of the ground plane and the distance to the ground plane (from the lowest point of the harness) shall be ($50\ ^{+10}_{0}$) mm above the ground plane.

The device under test shall be placed at (100 ± 5) mm from the longitudinal line of the wiring harness [see figure 1a)].

Power shall be applied to the device under test via a 5 µH/50 Ω artificial network.

Dimensions in millimetres



a) Top view

b) Side view

Key

1 Signal generator
2 Amplifier
3 Bulkhead connector
4 Double shielded coaxial cable
5 Parallel plate antenna (shaded areas represent extended arms)
6 Device under test
7 Wiring harness (power and signal lines)
8 Artificial network (power lines)
9 Test bench
10 Typical RF absorber (optional)

Figure 1 — Example of test configuration with parallel plate antenna

4.4.2 Location of field generating device

4.4.2.1 Height and distance of measurement

The centre of the parallel plate antenna shall be (1 000 ± 10) mm above the floor. No part of any antenna radiating elements shall be closer than 250 mm to the floor.

4.4.2.2 Antenna location

The radiating elements of the field generating devices shall not be closer than 500 mm to any absorbing material and shall not be closer than 1 500 mm to the wall of the enclosed facility.

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

The centre between the parallel plate antenna shall be in line with the wiring harness.

4.4.3 Test bench description

The test shall be performed inside a shielded enclosure (with or without absorbers) on a bench top with a non-metallic surface. The bench top shall be (900 ± 10) mm above the floor (either metallic or absorber lined). The system under test shall not be connected to the chamber ground.

The test harness shall not be closer than 900 mm from the wall and shall not be closer than 500 mm from absorbers (if present).

4.4.4 Test actuators and monitors

The device under test shall be operated as required in the test plan by actuators which have a minimum effect on it, e.g. plastics blocks on the push-buttons, pneumatic actuators with plastics tubes. Connections to equipment monitoring electromagnetic interference reactions of the device under test may be accomplished by using fibre-optics, or by high resistance leads. Other types of leads 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 the test results.

5 Test procedures

5.1 Test plan

Prior to performing the tests, a test plan shall be prepared; it shall include interface tests points, mode of operation for the device under test, acceptance criteria for the device under test, and any special instructions and modifications of the standard test. Each device under test shall be verified under the most significant conditions, i.e. at least in stand-by mode and in a mode where all the actuators can be excited.

5.2 Test methods

The test set-up is shown in figure 1. The device under test and associated wiring harness and loads should be placed on non conductive fixture either next to the antenna (depending on the physical size of the device under test), or between the extended arms [shaded areas of item 5 in figure 1 a)].

The test may be conducted according to one of the two methods in 5.2.1 and 5.2.2.

5.2.1 Substitution method

The substitution method is based upon the use of net power as the reference parameter used for calibration and test.

Measurements using the substitution method can be affected by coupling between the antenna and the device under test as well as by reflected energy. During the test, the net power shall be maintained relative to the calibration point up to a limit of 2 dB increase in forward power.

If the forward power has to be increased by 2 dB or more, this shall be indicated in the test report.

The electric field shall be generated, as required, with the specified antenna. Care shall be taken that the test equipment is not affected by the test signals.

The specific field strength and polarization shall be calibrated prior to the actual testing by substituting a field measuring device with its sensing element (100 ± 10) mm above the mid-point of the test harness and at (1 000 ± 10) mm from the radiating antenna. This calibration may be used for all subsequent testing provided that exactly the same location is used for the device under test.

After calibration, substitute the field measuring device by the device under test and its associated peripherals. The test is conducted by subjecting the device under test to the test signal based on the calibrated value as predetermined in the test plan. The device under test shall be oriented in each orthogonal plane to determine maximum susceptibility.

5.2.2 Closed-loop levelling method

This method is different from the substitution method in that during the actual test, the electric field strength measured by the field measurement device is fed back to the signal generator either to increase or to decrease the field strength until the predetermined test severity level is achieved.

Fields shall be generated with the specified antenna according to the configuration specified in 4.3 and 4.4.

Placement of the probe is critical to reduce measurement errors. If the probe is placed near a discontinuity, such as a sharp bend or corner of the test bench, or near a resonant cable or component, the resulting measurement could be in error by a substantial amount. Unless otherwise specified by the probe's manufacturer the probe shall be placed above a flat surface.

Place the device under test and the associated wiring harness and loads in the same configuration as described in 4.4. Place the field measurement device with its sensing element (100 ± 10) mm above the mid-point of the test harness and at (1 000 ± 10) mm from the antenna.

Users are cautioned that the presence of the device under test may affect the reading of the field probes.

NOTE — Since the electric field is symmetrical on either side of the antenna, the field measurement device may be located on the side of the antenna opposite to the device under test (the mirror image of the device under test).

5.3 Test report

When required in the test plan, a test report shall be submitted detailing information regarding the test equipment, test site, systems tested, frequencies, power levels, system interactions, type of table and any other relevant information regarding the test.

Annex A
(informative)

Function performance status classification (FPSC)

NOTE — A detailed explanation of the application of function performance status classification (FPSC) is given in ISO 11452-1:1995, annex A.

Table A.1 gives test severity levels and values of the related electric field strength.

Table A.1 — Test severity levels

Test severity level	Electric field strength V/m
I	25
II	50
III	75
IV	100
V	Specific value agreed between the users of this part of ISO 11452

Table A.2 — Frequency bands

Frequency band	Frequency range MHz
F1	> 0,01 to ≤ 0,1
F2	> 0,1 to ≤ 1
F3	> 1 to ≤ 10
F4	> 10 to ≤ 200

Annex B
(informative)

Typical power versus field strength generated by a commercially available parallel plate antenna

ve the desired electric field level, amplifiers with proper power capability should be used. Table B.1 ximate field strength versus power required for a commercially available parallel plate antenna.

Tableau B.1 — Power versus electric field strength

Power W	Electric field strength V/m	
	between extension arms	1 m from antenna
10	33	2
100	110	6
400	220	13
1 000	330	20