INTERNATIONAL ELECTROTECHNICAL COMMISSION

CISPR 25

Second edition
2002-08

INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

Radio disturbance characteristics for the protection of receivers used on board vehicles, boats, and on devices – Limits and methods of measurement

*This **English-language** version is derived from the original **bilingual** publication by leaving out all French-language pages. Missing page numbers correspond to the French-language pages.*

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Radio disturbance characteristics for the protection of receivers used on board vehicles, boats, and on devices – Limits and methods of measurement

INTERPRETATION SHEET

This interpretation sheet has been prepared by CISPR subcommittee D: Electro-magnetic disturbances related to electric/electronic equipment on vehicles and internal combustion engine powered devices.

The text of this interpretation sheet is based on the following documents:

ISH	Report on voting
CISPR/D/335/ISH	CISPR/D/338/RVD

Full information on the voting for the approval of this interpretation sheet can be found in the report on voting indicated in the above table.

There is a specific need for standards to define acceptable radio frequency performance of all electrical/electronic products. CISPR 12 and CISPR 25 have been developed to serve the road vehicle and related industries with test methods and limits that provide satisfactory protection for radio reception.

CISPR 12 has been used for many years as a regulatory requirement in numerous countries, to provide protection for radio receivers in the residential environment. It has been extremely effective in protecting the radio environment outside the vehicle.

CISPR 25 controls the radio environment within the vehicle and was developed in response to the variety of radio receivers that can be installed and/or used in modern motor vehicles. The Subcommittee holds the view that interference to on-board radio reception caused by equipment on the same vehicle is a quality, or customer satisfaction issue, rather than a matter for government regulation.

CISPR 25 defines test methods for use by vehicle manufacturers and suppliers, to assist in the design of vehicles and components and ensure controlled levels of on-board radio frequency emissions.

Vehicle test limits are provided for guidance and are based on a typical radio receiver using the antenna provided as part of the vehicle, or a test antenna if a unique antenna is not specified. The frequency bands that are defined are not applicable to all regions or countries of the world. For economic reasons, the vehicle manufacturer must be free to identify what frequency bands are applicable in the countries in which a vehicle will be marketed and which radio services are likely to be used in that vehicle.

February 2007 ICS 33.100.10; 33.100.20

As an example, many vehicle models will likely not have a television receiver installed; yet the television bands occupy a significant portion of the radio spectrum. Testing and mitigating noise sources in such vehicles is not economically justified.

The vehicle manufacturer should define the country in which the vehicle is to be marketed, then choose the applicable frequency bands and limits. Component test parameters can then be selected from CISPR 25 to support the chosen marketing plan.

Based upon the above information, National Standardization Organizations are encouraged to adopt both documents as national standards, taking into account the intended purpose of each of the documents.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION
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RADIO DISTURBANCE CHARACTERISTICS FOR THE PROTECTION OF RECEIVERS USED ON BOARD VEHICLES, BOATS, AND ON DEVICES – LIMITS AND METHODS OF MEASUREMENT

FOREWORD

1) The formal decisions or agreements of the CISPR on technical matters, prepared by sub-committees on which all the National Committees and other member organizations of the CISPR having a special interest therein are represented, express, as nearly as possible, an international consensus on the subject dealt with.
2) They have the form of recommendations for international use and they are accepted by the National Committees and other member organizations of the CISPR in that sense.
3) In order to promote international unification, the CISPR expresses the wish that all National Committees should adopt the text of the CISPR recommendation for their national rules in so far as national conditions will permit. Any divergence between the CISPR recommendations and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

International Standard CISPR 25 has been prepared by CISPR subcommittee D: Electromagnetic disturbances related to electric/electronic equipment on vehicles and internal combustion engine powered devices.

This second edition cancels and replaces the first edition published in 1995. This edition constitutes a technical revision.

The text of this standard is based on the following documents:

FDIS	Report on voting
CISPR/D/271/FDIS	CISPR/D/277/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

Annexes C and E form integral parts of this standard.

Annexes A, B, D, F, G and H are for information only.

The committee has decided that the contents of this publication will remain unchanged until 2007. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

The contents of the corrigendum of March 2004 have been included in this copy.

INTRODUCTION

This standard is designed to protect receivers from disturbances produced by conducted and radiated emissions arising in a vehicle.

Test procedures and limits given are intended to provide provisional control of vehicle-radiated emissions, as well as component/module conducted/radiated emissions of long and short duration.

To accomplish this end, this standard:

– establishes a test method for measuring the electromagnetic emissions from the electrical system of a vehicle;
– sets limits for the electromagnetic emissions from the electrical system of a vehicle;
– establishes test methods for testing on-board components and modules independent from the vehicle;
– sets limits for electromagnetic emissions from components to prevent objectionable disturbance to on-board receivers;
– classifies automotive components by disturbance duration to establish a range of limits.

NOTE 1 Component tests are not intended to replace vehicle tests. Exact correlation between component and vehicle test performance is dependent on component mounting location, harness length, routing and grounding, as well as antenna location. Component testing, however, permits components to be evaluated prior to actual vehicle availability.

NOTE 2 Annex B provides helpful methodology for resolution of disturbance problems.

RADIO DISTURBANCE CHARACTERISTICS FOR THE PROTECTION OF RECEIVERS USED ON BOARD VEHICLES, BOATS, AND ON DEVICES – LIMITS AND METHODS OF MEASUREMENT

1 Scope

This International Standard contains limits[1] and procedures for the measurement of radio disturbances in the frequency range of 150 kHz to 1 000 MHz. The standard applies to any electronic/electrical component intended for use in vehicles and devices. Refer to International Telecommunications Union (ITU) publications for details of frequency allocations. The limits are intended to provide protection for receivers installed in a vehicle from disturbances produced by components/modules in the same vehicle[2]. The methods and limits for a complete vehicle are in Clause 5 and the methods and limits for components/modules are in Clause 6.

NOTE Achieving satisfactory compatibility with on-board radio reception will also in most cases provide satisfactory compatibility with adjacent radio receiver reception.

The receiver types to be protected are: sound and television receivers[3], land mobile radio, radio telephone, amateur and citizens' radio. For the purpose of this standard, a vehicle is a machine, which is self-propelled. Vehicles include (but are not limited to) passenger cars, trucks, agricultural tractors and snowmobiles. Annex A provides guidance in determining whether this standard is applicable to a particular equipment.

The limits in this standard are recommended and subject to modification as agreed between the vehicle manufacturer and the component supplier. This standard is also intended to be applied by manufacturers and suppliers of components and equipment which are to be added and connected to the vehicle harness or to an on-board power connector after delivery of the vehicle.

This International Standard does not include protection of electronic control systems from radio frequency (RF) emissions, or from transient or pulse-type voltage fluctuations. These subjects are expected to be included in ISO publications.

The methods described in Clauses 5 and 6 apply to the suppression of on-board radio disturbances for motor vehicles, devices and working machinery, to achieve acceptable radio reception with on-board radio receivers. The requirements contained herein specify the maximum permissible disturbance voltage at the receiver end of the vehicle antenna transmission line in the frequency range of 150 kHz to 1 000 MHz.

On-board radio disturbance suppression reduces the radio disturbance energy which is applied by electrical equipment within the vehicle to the on-board power supply of a vehicle. Disturbances can also be coupled from vehicle wiring to the receiving antenna on the vehicle. Both articles describe methods of safeguarding radio reception in the same vehicle in which the disturbance arises. Annex B provides a helpful methodology for resolution of disturbance problems.

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1 Only a complete vehicle test can be used to determine the component compatibility with respect to a vehicle's limit.

2 Adjacent vehicles can be expected to be protected in most situations.

3 Adequate television protection will result from compliance with the levels at the mobile service frequencies.

Since the mounting location, vehicle body construction and harness design can affect the coupling of radio disturbances to the on-board radio, Clause 6 of this standard defines multiple limit levels. The level class to be used (as a function of frequency band) will be agreed upon between the vehicle manufacturer and the component supplier.

The World Administrative Radiocommunications Conference (WARC) lower frequency limit in region 1 was reduced to 148,5 kHz in 1979. For vehicular purposes, tests at 150 kHz are considered adequate. For the purposes of this standard, test frequency ranges have been generalized to cover radio services in various parts of the world. Protection of radio reception at adjacent frequencies can be expected in most cases.

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.

IEC 60050-161:1990, *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility*

CISPR 12, *Vehicles, boats and internal combustion engine driven devices – Radio disturbance characteristics – Limits and methods of measurement for the protection of receivers except those installed in the vehicle/boat/device itself or in adjacent vehicles/boats/devices*

CISPR 16-1:1999, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1: Radio disturbance and immunity measuring apparatus*

3 Definitions

For the purpose of this International Standard, the following definitions apply.

3.1
receiver terminal voltage (antenna voltage)
voltage generated by a source of radio disturbance and measured in dB(μV) by a radio disturbance measuring instrument conforming to the requirements of CISPR 16-1

3.2
component continuous conducted emissions
noise voltages/currents of a steady-state nature existing on the supply or other leads of a component/module which may cause disturbance to reception in an on-board receiver

3.3
antenna matching unit
unit for matching the impedance of an antenna to that of the 50 Ω measuring instrument over the antenna measuring frequency range

3.4
antenna correction factor
factor which is applied to the voltage measured at the input connector of the measuring instrument to give the field strength at the antenna

NOTE The antenna correction factor is comprised of an antenna factor and a cable factor.

3.5
compression point
input signal level at which the gain of the measuring system becomes non-linear such that the indicated output deviates from an ideal linear receiving system's output by the specified increment in dB

3.6
class
performance level agreed upon by the purchaser and the supplier and documented in the test plan

3.7
device
machine driven by an internal combustion engine which is not primarily intended to carry persons or goods

NOTE Devices include, but are not limited to, chainsaws, irrigation pumps, snow blowers, air compressors, and landscaping equipment.

3.8
RF boundary
element of an EMC test set-up that determines what part of the harness and/or peripherals are included in the RF environment and what is excluded

NOTE It may consist of, for example, ANs, BANs, filter feed-through pins, RF absorber coated wire, and/or RF shielding.

3.9
artificial network (AN)
line impedance stabilization network (LISN[4])
network inserted in the supply lead or signal/load lead of apparatus to be tested which provides, in a given frequency range, a specified load impedance for the measurement of *disturbance voltages* and which may isolate the apparatus from the supply or signal sources/loads in that frequency range

[IEV 161-04-05, modified]

3.10
bandwidth (of an equipment)
width of a frequency band over which a given characteristic of an equipment or transmission channel does not differ from its reference value by more than a specified amount or ratio

NOTE The given characteristic may be, for example, the amplitude/frequency characteristic, the phase/frequency characteristic or the delay/frequency characteristic.

[IEV 161-06-09, modified]

3.11
bandwidth (of an emission or signal)
width of the frequency band outside which the level of any spectral component does not exceed a specified percentage of a reference level

[IEV 161-06-10]

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4 In the USA.

3.12
broadband emission
an *emission* which has a *bandwidth* greater than that of a particular measuring apparatus or receiver

NOTE An emission which has a pulse repetition rate (in Hz) less than the bandwidth of a particular measuring instrument can also be considered as a broadband emission.

3.13
disturbance suppression
action which reduces or eliminates electromagnetic disturbance

[IEV 161-03-22]

3.14
disturbance voltage
interference voltage (deprecated)
voltage produced between two points on two separate conductors by an electromagnetic disturbance, measured under specified conditions

[IEV 161-04-01]

3.15
narrowband emission
an emission which has a bandwidth less than that of a particular measuring apparatus or receiver

NOTE An emission which has a pulse repetition rate (in Hz) greater than the bandwidth of a particular measuring instrument can also be considered as a narrowband emission.

3.16
peak detector
a detector, the output voltage of which is the peak value of an applied signal

[IEV 161-04-24]

3.17
quasi-peak detector
a detector having specified electrical time constants which, when regularly repeated identical pulses are applied to it, delivers an output voltage which is a fraction of the peak value of the pulses, the fraction increasing towards unity as the pulse repetition rate is increased

[IEV 161-04-21]

3.18
average detector
a detector the output voltage of which is the average value of the envelope of an applied signal

NOTE The average value must be taken over a specified time interval.

[IEV 161-04-26]

3.19
electromagnetic environment
the totality of electromagnetic phenomena existing at a given location

[IEV 161-01-01]

3.20
shielded enclosure
screened room
a mesh or sheet metallic housing designed expressly for the purpose of separating electromagnetically the internal and the external environment

[IEV 161-04-37]

3.21
ground (reference) plane
a flat conductive surface whose potential is used as a common reference

[IEV 161-04-36]

4 Requirements common to vehicle and component/module emissions measurement

4.1 General test requirements and test plan

4.1.1 Test plan

A test plan shall be established for each item to be tested. The test plan shall specify the frequency range to be tested, the emissions limits, the disturbance classification (broadband long or short duration – or narrowband), antenna types and locations, test report requirements, supply voltage and other relevant parameters.

4.1.2 Determination of conformance of EUT with limits

If the type of disturbance is unknown, tests shall be made to determine whether measured emissions are narrowband and/or broadband to apply limits properly as specified in the test plan.

Figure 1 outlines the procedure to be followed in determining conformance with limits.

4.1.3 Categories of disturbance sources (as applied in the test plan)

Electromagnetic disturbance sources can be divided into three types:

a) continuous/long duration broadband and automatically actuated short-duration equipment;

b) manually actuated short-duration broadband;

c) narrowband.

NOTE For examples, see 4.1.4 and 4.1.5 and table 1.