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INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

COMITÉ INTERNATIONAL SPÉCIAL DES PERTURBATIONS RADIOÉLECTRIQUES

Vehicles, boats and internal combustion engines – Radio disturbance characteristics – Limits and methods of measurement for the protection of on-board receivers

Véhicules, bateaux et moteurs à combustion interne – Caractéristiques des perturbations radioélectriques – Limites et méthodes de mesure pour la protection des récepteurs embarqués



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INTERNATIONAL ELECTROTECHNICAL COMMISSION
INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

**VEHICLES, BOATS AND INTERNAL COMBUSTION ENGINES –
RADIO DISTURBANCE CHARACTERISTICS –
LIMITS AND METHODS OF MEASUREMENT FOR
THE PROTECTION OF ON-BOARD RECEIVERS**

FOREWORD

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

This fifth edition cancels and replaces the fourth edition published in 2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) inclusion of new frequency bands,
- b) deletion of the annex on TEM cells,
- c) inclusion of annexes on measurement uncertainty,
- d) overall improvement.

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INTRODUCTION

This document is designed to protect on-board 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.

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 is 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.

As an example, many vehicle models will probably 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 countries in which the vehicle is to be marketed, then choose the applicable frequency bands and limits. Component test parameters can then be selected from this document to support the chosen marketing plan.

The World Administrative Radio communications 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 document, 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.

Radio technology developed for use by government agencies, emergency services (police forces, fire departments, ambulance/health services, etc) are not detailed and the protection limits provided are not necessarily applicable. For these technologies, limits and/or measurement parameters are generally agreed upon by the manufacturer and the service providers.

Mobile services up to 4G technologies have been considered in this edition. 5G technology and/or all mobile services under development have not been considered due to lack of established information in regards to frequency bands and limits.

To accomplish this end, this document:

- 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 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. Components can be evaluated with component testing prior to actual vehicle availability.

VEHICLES, BOATS AND INTERNAL COMBUSTION ENGINES – RADIO DISTURBANCE CHARACTERISTICS – LIMITS AND METHODS OF MEASUREMENT FOR THE PROTECTION OF ON-BOARD RECEIVERS

1 Scope

This document contains limits and procedures for the measurement of radio disturbances in the frequency range of 150 kHz to 5 925 MHz. This document applies to vehicles, boats, internal combustion engines, trailers, devices and any electronic/electrical component intended for use in vehicles, boats, trailers and devices. Refer to International Telecommunications Union (ITU) publications for details of frequency allocations. The limits are intended to provide protection for on-board receivers installed (per the manufacturer's guidelines) in a vehicle from disturbances produced by components/modules in the same vehicle.

The receiver types to be protected are, for example, broadcast receivers (sound and television), land mobile radio, radio telephone, amateur, citizens' radio, Satellite Navigation (GPS etc.), Wi-Fi, V2X, and Bluetooth.

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

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

This document 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.

The emission requirements in this document are not intended to be applicable to the intentional transmissions from a radio transmitter as defined by the ITU including their spurious emissions.

NOTE 1 This exclusion is limited to those intended transmitter emissions, which leave the EUT as radiated emissions and are coupled onto the wire line in the measurement setup. For conducted transmissions on frequencies intentionally produced by the radio part of an EUT, this exclusion does not apply.

NOTE 2 It is usual for customers and suppliers to use radio regulation standards to manage the effect of spurious emissions from a radio transmitter unless limits of spurious emission are agreed in the test plan.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 61851-1:2017, *Electric vehicle conductive charging system – Part 1: General requirements*

CISPR 16-1-1:2019, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus*

CISPR 16-1-2:2014, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-2: Radio disturbance and immunity measuring apparatus – Coupling devices for conducted disturbance measurements*
CISPR 16-1-2:2014/AMD1:2017

CISPR 16-1-6:2014, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-6: Radio disturbance and immunity measuring apparatus – EMC antenna calibration*
CISPR 16-1-6:2014/AMD1:2017

ISO 7637-3:2016, *Road vehicles – Electrical disturbances from conduction and coupling – Part 3: Electrical transient transmission by capacitive and inductive coupling via lines other than supply lines*

ISO 11452-4:2020, *Road vehicles – Component test methods for electrical disturbances from narrowband radiated electromagnetic energy – Part 4: Harness excitation methods*

SAE ARP 958.1 Rev D:2003-02, *Electromagnetic Interference Measurement Antennas; Standard Calibration Method*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

absorber lined shielded enclosure

ALSE

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

3.2

antenna 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

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

artificial mains network

AMN

network that provides a defined impedance to the EUT at radio frequencies, couples the disturbance voltage to the measuring receiver and decouples the test circuit from the supply mains

Note 1 to entry: There are two basic types of AMN, the V-network (V-AMN) which couples the unsymmetrical voltages, and the delta-network which couples the symmetric and the asymmetric voltages separately. The terms line impedance stabilization network (LISN) and V-AMN are used interchangeably.