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Edition 1.1 2023-05
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INTERNATIONAL STANDARD

NORME INTERNATIONALE

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INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE
COMITÉ INTERNATIONAL SPÉCIAL DES PERTURBATIONS RADIOÉLECTRIQUES

Electric and hybrid electric road vehicles – Radio disturbance characteristics – Limits and methods of measurement for the protection of off-board receivers below 30 MHz

Véhicules routiers électriques et hybrides électriques – Caractéristiques de perturbations radioélectriques – Limites et méthodes de mesure pour la protection des récepteurs extérieurs en dessous de 30 MHz

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

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ELECTRIC AND HYBRID ELECTRIC ROAD VEHICLES – RADIO DISTURBANCE CHARACTERISTICS – LIMITS AND METHODS OF MEASUREMENT FOR THE PROTECTION OF OFF-BOARD RECEIVERS BELOW 30 MHz

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CISPR 36 edition 1.1 contains the first edition (2020-07) [documents CISPR/D/462/CDV and CISPR/D/464A/RVC] and its amendment 1 (2023-05) [documents CIS/D/483/CDV and CIS/D/490A/RVC].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard CISPR 36 has been prepared by CISPR subcommittee D: Electromagnetic disturbances related to electric/electronic equipment on vehicles and internal combustion engine powered devices.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under webstore.iec.ch in the data related to the specific publication. At this date, the publication will be

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- withdrawn,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

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INTRODUCTION

There is a specific need for documents to define acceptable low frequency performance of all electrical/electronic products. CISPR 36 has been developed to serve the electric and hybrid electric road vehicle and related industries with test methods and limits that provide satisfactory protection for radio reception.

~~Compliance with this document is sometimes insufficient for the protection of receivers used in the residential environment nearer than 10 m to the vehicle. It also sometimes does not provide sufficient protection for new types of radio transmissions.~~

ELECTRIC AND HYBRID ELECTRIC ROAD VEHICLES – RADIO DISTURBANCE CHARACTERISTICS – LIMITS AND METHODS OF MEASUREMENT FOR THE PROTECTION OF OFF-BOARD RECEIVERS BELOW 30 MHz

1 Scope

This document defines limits for 3 m measurement distance and methods of measurement that are designed to provide protection for off-board receivers (at 10 m distance) in the frequency range of 150 kHz to 30 MHz when used in the residential environment.

NOTE Protection of receivers used on board the same vehicle as the disturbance source(s) is covered by CISPR 25.

This document applies to the emission of electromagnetic energy which might cause interference to radio reception and which is emitted from electric and hybrid electric vehicles (see 3.2 and 3.3) propelled by an ~~internal traction battery (see 3.2 and 3.3)~~ electric motor supplied with electric energy by internal rechargeable energy storage system (with voltages above 60 V) when operated on the road.

~~This document applies to vehicles that have a traction battery voltage between 100 V and 1 000 V.~~

Electric vehicles to which CISPR 14-1 applies are not in the scope of this document.

This document applies only to road vehicles where an electric propulsion is used for sustained speed of more than 6 km/h.

Vehicles where the electric motor is only used to start up the internal combustion engine (e.g. "micro hybrid") and vehicles where the electric motor is used for additional propulsion only during acceleration (e.g. "48 V mild hybrid vehicles") are not in the scope of this document.

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

Annex C lists work being considered for future revisions.

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.

CISPR 16-1-1:2015, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus*

CISPR 16-1-4:2019, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-4: Radio disturbance and immunity measuring apparatus – Antennas and test sites for radiated disturbance measurements*

CISPR 16-2-3:2016, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-3: Methods of measurement of disturbances and immunity – Radiated disturbance measurements*
CISPR 16-2-3:2016/AMD1:2019

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 in which the ceiling and walls are covered with material that absorbs electromagnetic energy (i.e. RF absorber)

3.2
electric vehicle
vehicle propelled exclusively by electric motor(s) powered by on-board ~~traction battery or batteries~~ REESS

Note 1 to entry: Vehicles equipped with an additional power source (e.g. auxiliary combustion engine, fuel cell) used to provide electric power to the electric motor/~~traction battery~~REESS only, without contributing to the mechanical propulsion of the vehicle, are considered ~~as~~ electric vehicles for the purposes of this document.

3.3
hybrid electric vehicle
vehicle propelled by electric motor(s) and internal combustion engine

Note 1 to entry: The two propulsion systems can operate individually or in a combined mode depending on the hybrid system.

3.4
open-area test site
OATS
facility for measurements and calibrations in which the ground reflection is made reproducible by a large flat electrically conducting ground plane

Note 1 to entry: An OATS can be used for radiated disturbance measurements, where it is also designated as a COMTS. An OATS can also be used for antenna calibrations, where it is designated as a CALTS.

Note 2 to entry: An OATS is an uncovered outdoor site, and is far enough away from buildings, electric lines, fences, trees, underground cables, pipelines, and other potentially reflective objects, so that the effects due to such objects are negligible. See CISPR 16-1-4 for guidance on the construction of an OATS.

[SOURCE CISPR 16-2-3:2016, 3.1.20]

3.5
outdoor test site
OTS
measurement site similar to an open-area test site as specified in CISPR 16-1-4, but without any type of metallic ground plane and with different dimensions

Note 1 to entry: Specific requirements are defined in this document.

3.6
residential environment
environment having a 10 m protection distance between the source and the point of radio reception

Note 1 to entry: Examples of a residential environment include rooming houses, private dwellings, entertainment halls, theatres, schools, public streets, shopping centres / malls, etc.

3.7
~~**traction battery**~~
~~battery used for the propulsion of electric vehicle or hybrid electric vehicle~~

rechargeable energy storage system
REESS
storage system that provides electric energy for electric propulsion, which can be recharged

Note 1 to entry: Components of the REESS can be high voltage (HV) batteries.

3.8
vehicle
machine operating on land which is intended to carry persons or goods

Note 1 to entry: Vehicles include, but are not limited to, cars, trucks, buses and mopeds.

3.9
high voltage
HV
operating voltage above 60 V

Note 1 to entry: The term high voltage can be defined with a different voltage range in other standards.

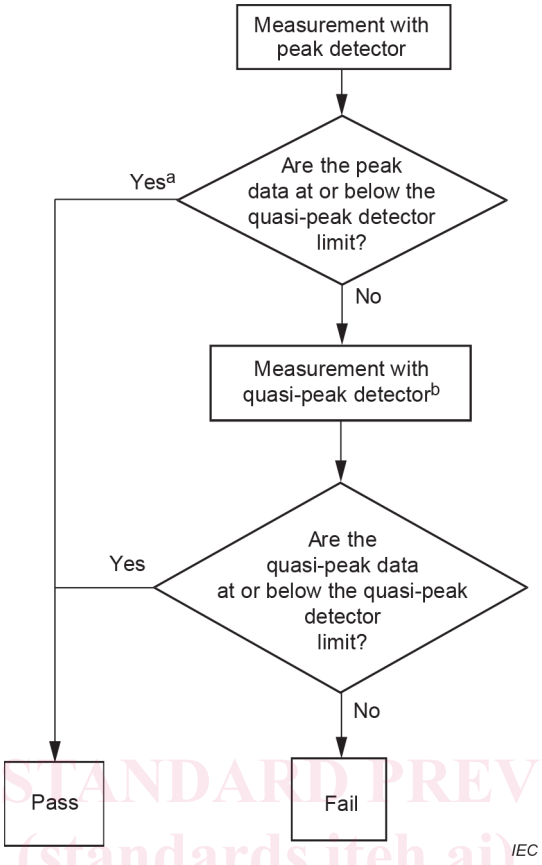
4 Limits of radiated disturbances

4.1 Determination of conformance of vehicle with limits

The vehicle shall comply with the quasi-peak detector magnetic field strength limits specified in 4.2, when ~~it is in "Propulsion" mode of operation,~~ operated as per 5.4.2.2.

The limits given in this document take into account uncertainties.

If an initial peak detector prescan is performed (i.e., before any quasi peak detector measurements), then the compliance shall be determined based on the flowchart in Figure 6.



a Because the measurement result with peak detector is always higher than or equal to the measurement result with quasi-peak detector, this single detector measurement can lead to a simplified and quicker conformance process.

b This flow-chart is applicable for each individual frequency, i.e. only the emissions that are above the limit when measured with peak detector need to be remeasured with quasi-peak detector.

Figure 6 – Determination of conformance when using a peak detector prescan

4.2 Quasi-peak detector limits

The limit for emissions measured with quasi-peak detector at 3 m antenna distance is given in Table 1 and is shown graphically in Figure 1. It is expressed in dB(μA/m). For more accurate determination, the formula given in Table 1 shall be used.

Table 1 – Limit of disturbance (quasi-peak detector at 3 m antenna distance)

Frequency MHz	***H* field** dB(μA/m)
0,15 to 4	$26{,}11 - 15{,}64 \times \lg(f_{\mathrm{MHz}})$
4 to 15	$33{,}17 - 27{,}35 \times \lg(f_{\mathrm{MHz}})$
15 to 30	$16{,}63 - 13{,}29 \times \lg(f_{\mathrm{MHz}})$

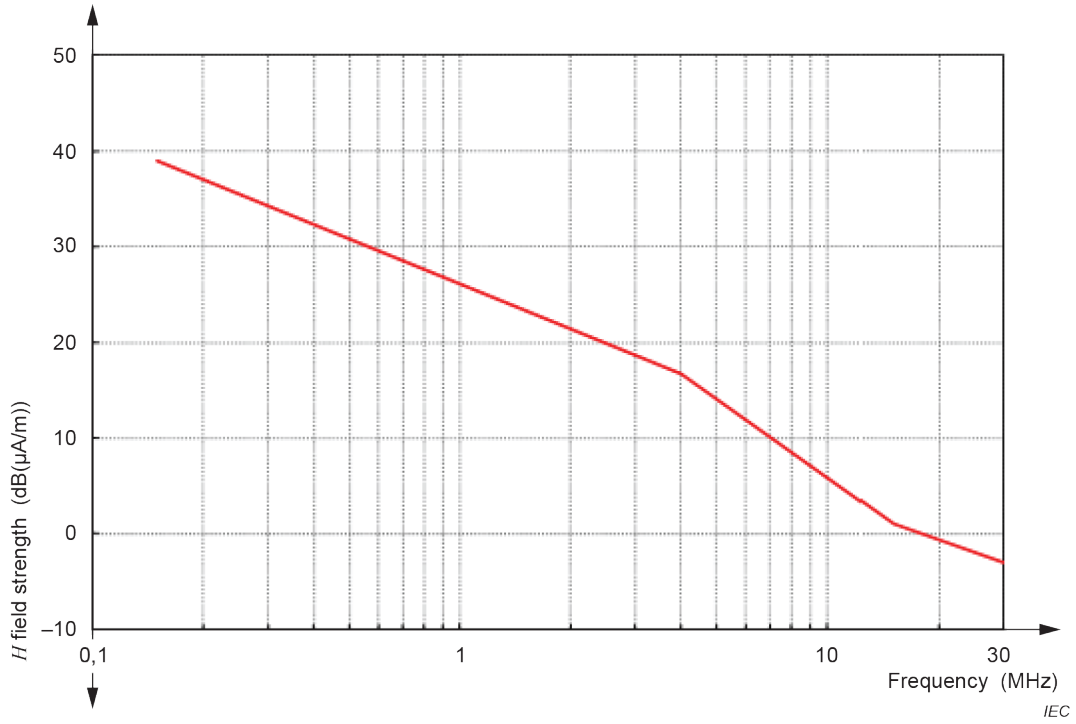


Figure 1 – Limit of magnetic field disturbance (quasi-peak detector) at 3 m antenna distance

5 Methods of measurement

5.1 Measurement instruments

5.1.1 Measuring receiver

5.1.1.1 General

The measuring receiver (including FFT-based measurement instruments) shall comply with the requirements of CISPR 16-1-1:2015. Either manual or automatic frequency scanning may be used.

A preamplifier can be used between the antenna and measuring receiver in order to achieve the 6 dB noise floor requirements (see 5.2.1.2). If a preamplifier is used to achieve the 6 dB noise floor requirement, the laboratory should establish a procedure to avoid overload of the preamplifier, such as using a step attenuator. The laboratory should also ensure the receiver is not overloaded in all measurement scenarios, with or without an external preamplifier.

5.1.1.2 Spectrum analyser parameters

The scan rate of the spectrum analyser shall be adjusted for the CISPR frequency band and detection mode used. The maximum scan rate shall comply with the requirements of CISPR 16-2-3.

Spectrum analysers may be used for performing compliance measurements to this document providing the precautions cited in CISPR 16-1-1:2015 on the use of spectrum analysers are adhered to and that the broadband emissions from the product being tested have a repetition frequency greater than 20 Hz.

The minimum scan time and resolution bandwidth (RBW) are listed in Table 2.