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Interested committees:

Title: Draft BS EN 55012 Vehicles, boats and devices with internal combustion engines or traction batteries — Radio disturbance characteristics — Limits and methods of measurement for the protection of off-board receivers

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

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- ii) affects other national standard(s)
- iii) requires additional national guidance or information

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## Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

## UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

## Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
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## Template for comments and secretariat observations

|                  |                        |
|------------------|------------------------|
| Date: xx/xx/20xx | Document: ISO/DIS xxxx |
|------------------|------------------------|

| 1  | 2                                          | (3)                          | 4               | 5                                                                                                                                  | (6)                                                                      | 7                                                  |
|----|--------------------------------------------|------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------|
| MB | Clause No./ Subclause No./Annex (e.g. 3.1) | Paragraph/Figure/ Table/Note | Type of comment | Commend (justification for change) by the MB                                                                                       | Proposed change by the MB                                                | Secretariat observations on each comment submitted |
|    | 3.1                                        | Definition 1                 | ed              | Definition is ambiguous and needs clarifying.                                                                                      | Amend to read '...so that the mains connector to which no connection...' |                                                    |
|    | 6.4                                        | Paragraph 2                  | te              | The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK. | Delete reference to UV photometer.                                       |                                                    |



# CIS/D/467/CD

COMMITTEE DRAFT (CD)

|                                                                |                                                 |
|----------------------------------------------------------------|-------------------------------------------------|
| PROJECT NUMBER:<br><b>CISPR 12 ED7</b>                         |                                                 |
| DATE OF CIRCULATION:<br><b>2020-06-26</b>                      | CLOSING DATE FOR COMMENTS:<br><b>2020-09-18</b> |
| SUPERSEDES DOCUMENTS:<br><b>CIS/D/449/FDIS, CIS/D/454B/RVD</b> |                                                 |

|                                                                                                                                                                                 |                                                                                                                                                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| IEC CIS/D : ELECTROMAGNETIC DISTURBANCES RELATED TO ELECTRIC/ELECTRONIC EQUIPMENT ON VEHICLES AND INTERNAL COMBUSTION ENGINE POWERED DEVICES                                    |                                                                                                                                                          |
| SECRETARIAT:<br>Germany                                                                                                                                                         | SECRETARY:<br>Mr Holger Hirsch                                                                                                                           |
| OF INTEREST TO THE FOLLOWING COMMITTEES:<br>TC 69,CIS/B                                                                                                                         | PROPOSED HORIZONTAL STANDARD:<br><input type="checkbox"/><br>Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary. |
| FUNCTIONS CONCERNED:<br><input checked="" type="checkbox"/> EMC <input type="checkbox"/> ENVIRONMENT <input type="checkbox"/> QUALITY ASSURANCE <input type="checkbox"/> SAFETY |                                                                                                                                                          |

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:  
**Vehicles, boats and devices with internal combustion engines or traction batteries – Radio disturbance characteristics – Limits and methods of measurement for the protection of off-board receivers**

NOTE FROM TC/SC OFFICERS:

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

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**VEHICLES, BOATS AND DEVICES WITH INTERNAL COMBUSTION  
ENGINES OR TRACTION BATTERIES – RADIO DISTURBANCE  
CHARACTERISTICS – LIMITS AND METHODS OF MEASUREMENT  
FOR THE PROTECTION OF OFF-BOARD RECEIVERS****FOREWORD**

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard CISPR 12 has been prepared by CISPR subcommittee D: Electromagnetic disturbances related to electric/electronic equipment on vehicles, boats and internal combustion powered devices.

This seventh edition cancels and replaces the sixth edition published in 2007 and its Amendment 1 (2009). This edition constitutes a technical revision.

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

- a) test setups for electric vehicles and plug-in hybrid electric vehicles in charging mode were added,
- b) antenna positions relative to the vehicle were defined,

- c) some statements dealing with series surveillance and type approval were deleted,  
d) annexes for measurement instrumentation uncertainty were added,  
e) an annex describing networks to be used for the charging mode was added and  
f) general improvements were made.

The text of this International Standard is based on the following documents:

|               |                  |
|---------------|------------------|
| FDIS          | Report on voting |
| CISPR/XX/FDIS | CISPR/XX/RVD     |

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

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

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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

231

## INTRODUCTION

232 There is a specific need for standards to define acceptable radio frequency performance of all  
233 electrical/electronic products. CISPR 12 has been developed to serve the road vehicles,  
234 boats, internal combustion engines and related industries with test methods and limits that  
235 provide satisfactory protection for radio reception.

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

239

240

# VEHICLES, BOATS AND DEVICES WITH INTERNAL COMBUSTION ENGINES OR TRACTION BATTERIES – RADIO DISTURBANCE CHARACTERISTICS – LIMITS AND METHODS OF MEASUREMENT FOR THE PROTECTION OF OFF-BOARD RECEIVERS

## 1 Scope

The limits in this International Standard are designed to provide protection for off-board receivers in the frequency range of 30 MHz to 1 000 MHz when used in the residential environment. Compliance with this document may not provide adequate protection for receivers used in the residential environment nearer than 10 m to the vehicle, boat or device. It also may not provide adequate protection for new types of radio transmissions.

NOTE 1 Experience has shown that compliance with this document may provide satisfactory protection for receivers of other types of transmissions when used in the residential environment, including radio transmissions in frequency ranges other than that specified.

This document applies to the emission of electromagnetic energy that can cause interference to radio reception and which is emitted from:

- a) vehicles propelled by an internal combustion engine, electrical means or both (see 3.31);
- b) boats propelled by an internal combustion engine (inboard or outboard), electrical means or both (see 3.4). Boats are to be tested in the same manner as vehicles except where they have unique characteristics as explicitly stated in this document;
- c) devices equipped with internal combustion engines (see 3.8). In the case of hybrid devices (e.g. equipped with both internal combustion engine and traction batteries), only the internal combustion mode is included in this standard.

See Annex D for a flow chart to help determine the applicability of CISPR 12.

This document does not apply to aircraft, household appliances, traction systems (railway, tramway and electric trolley bus), vehicle / boat / device off-board chargers or to incomplete vehicles. In the case of a dual-mode trolley bus (e.g. propelled by power from either AC/DC mains or an internal combustion engine), the internal combustion propulsion system is included, but the AC/DC mains portion of the vehicle propulsion system is excluded from this document.

NOTE 2 Protection of receivers used on board the same vehicle as the disturbance source(s) are covered by CISPR 25.

The measurement of conducted electromagnetic disturbances while the vehicle is connected to power mains for charging is not covered in this document. The user is referred to appropriate IEC and CISPR standards, which define measurement techniques and limits for this condition.

NOTE 3 See IEC 61851-21-1

The radiated emission requirements in this standard are not intended to be applicable to the intentional transmissions from a radio transmitter as defined by the ITU, nor to any spurious emissions related to these intentional transmissions.

Annex B and Annex C contain methods to evaluate the disturbance characteristics of high voltage ignition systems.

Annex H 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.

IEC 61851-1:2017, *Electric vehicle conductive charging system – Part 1: General requirements*

IEC 61980-1:2015, *Electric vehicle wireless power transfer (WPT) systems - Part 1: General requirements*

IEC 61980-1:2015/COR1:2017

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

CISPR 16-1-2:2014/AMD1:2017

CISPR 16-1-3:2004, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-3 Radio disturbance and immunity measuring apparatus – Ancillary equipment – Disturbance power*

CISPR 16-1-3:2004/AMD1:2016

CISPR 16-1-4:2010, *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 16-1-4:2010/AMD1:2012

CISPR 16-1-4:2010/AMD2:2017

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

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 16-4-2:2011 *Specification for radio disturbance and immunity measuring apparatus and networks – Part 4-2: Uncertainties, statistics and limit modelling – Measurement instrumentation uncertainty*

CISPR 16-4-2:2011/AMD1:2014

CISPR 32:2015, *Electromagnetic compatibility of multimedia equipment – Emission requirements*

ANSI C63.5:2017, *American National Standard for Electromagnetic Compatibility – Radiated Emission Measurements in Electromagnetic Interference (EMI) Control - Calibration and Qualification of Antennas (9 kHz to 40 GHz)*

### 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 artificial mains network AMN

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) that couples the unsymmetrical voltages, and the delta-network that couples the symmetric and the asymmetric voltages separately. The terms "line impedance stabilization network" (LISN) and "V-AMN" are used interchangeably.

Note 2 to entry: Network inserted in the power mains of the vehicle in charging mode which provides, in a given frequency range, a specified load impedance and which isolates the vehicle from the power mains in that frequency range.

Note 3 to entry: This note applies to the French language only.

#### 3.3 asymmetric artificial network AAN

network used to measure (or inject) asymmetric (common mode) voltages on unshielded symmetric signal (e.g. telecommunication) lines while rejecting the symmetric (differential mode) signal

Note 1 to entry: This network is inserted in the communication/signal lines of the vehicle in charging mode to provide a specific load impedance and/or a decoupling (e.g. between communication/signal lines and power mains). AAN is also used in this document for symmetric lines.

Note 2 to entry: This note applies to the French language only.

#### 3.4 boat

vessel intended to be used on the surface of water, its length being no greater than 15 m intended to carry persons or goods and equipped with either an inboard or outboard engine

#### 3.5 bonded, verb

grounding connection with a DC resistance not exceeding 2,5 mΩ and that provides the lowest possible impedance (resistance and inductance) between two metallic parts (see 5.3 of CISPR 16-2-1: 2014).

Note 1 to entry: A low current ( $\leq 100$  mA) 4-wire milliohm meter is recommended for these measurements.

#### 3.6 charging mode

mode that is intended to charge the traction battery with one of the following four categories:

**3.6.1****charging mode 1**

charging mode as defined in IEC 61851-1:2017, 6.2.1.

Note 1 to entry: In some countries, mode 1 charging may be prohibited or requires special precautions.

**3.6.2****charging mode 2**

charging mode as defined in IEC 61851-1:2017, 6.2.2 where the vehicle is connected to AC mains using a charging cable including an Electric Vehicle Supply Equipment (EVSE) box providing control pilot signalling between the vehicle and the EVSE box and personal protection against electric shock

Note 1 to entry: In some countries, special restrictions have to be applied for mode 2 charging.

Note 2 to entry: There is no communication between the vehicle and the AC supply network (mains).

**3.6.3****charging mode 3**

charging mode as defined in IEC 61851-1:2017, 6.2.3 where the vehicle is connected to an EVSE (e.g charging station, wallbox) providing AC power to the vehicle with communication between the vehicle and the charging station (through signal/control lines and/or through wired network lines)

**3.6.4****charging mode 4**

charging mode as defined in IEC 61851-1:2017, 6.2.4 where the vehicle is connected to an EVSE providing DC power to the vehicle (with an off-board charger) with communication between the vehicle and the charging station (through signal/control lines and/or through wired network lines)

**3.7****controller area network****CAN**

network documented in ISO 11898-1 that connects devices, sensors and actuators in systems

Note 1 to entry: This note applies to the French language only.

**3.8****device**

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

Note 1 to entry: Devices include, but are not limited to, chainsaws, irrigation pumps, snow blowers, air compressors, landscaping equipment and inboard or outboard boat engines (when tested separately from boats).

**3.9****direct current charging artificial network****DC-charging-AN**

network inserted in the high-voltage DC lead of vehicle in charging mode, which provides, in a given frequency range, a specified load impedance and which can isolate the vehicle from the HV DC charging station in that frequency range

Note 1 to entry: This note applies to the French language only.

**3.10****electric vehicle**

vehicle propelled exclusively by electric motor(s) powered by onboard traction battery or batteries

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

### 425 **3.11**

#### 426 **EV supply equipment**

#### 427 **EVSE**

428 The conductors, including the phase, neutral and protective earth conductors, the EV  
429 couplers, attachment plugs, and all other accessories, devices, power outlets or apparatuses  
430 installed specifically for the purpose of delivering energy from the premises wiring to the EV  
431 and allowing communication between them if required.

### 432 **3.12**

#### 433 **frequency sub-band**

434 segment of the frequency spectrum (30 MHz to 1 000 MHz) defined to enable statistical  
435 evaluation of the test data acquired by swept frequency testing

### 436 **3.13**

#### 437 **hybrid electric vehicle**

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

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

441 Note 2 to entry: Vehicles where the electric motor is used to start the internal combustion engine are not  
442 considered as a hybrid vehicle.

### 443 **3.14**

#### 444 **ignition noise suppressor**

445 that portion of a high-voltage ignition circuit intended to limit the emission of impulsive ignition  
446 noise

### 447 **3.15**

#### 448 **impulsive ignition noise**

449 unwanted emission of electromagnetic energy, predominantly impulsive in content, arising  
450 from the ignition system within a vehicle, boat or device

### 451 **3.16**

#### 452 **Inboard engine (motor) or inboard installation**

453 a boat propulsion system that is installed (usually factory-installed) inside the hull of the boat  
454 and connected to the propeller by means of a drive shaft that runs through the bottom of the  
455 hull (or to an impeller, in case of jet drives)

### 456 **3.17**

#### 457 **Open-area test site**

#### 458 **OATS**

459 facility used for measurements of electromagnetic fields the intention for which is to simulate  
460 a semi-free-space environment over a specified frequency range that is used for radiated  
461 emission testing of products

462 Note 1 to entry: An OATS typically is located outdoors in an open area and has an electrically-conducting ground  
463 plane. This is defined in CISPR 16-2-3

### 464 **3.18**

#### 465 **Outboard engine (motor) or outboard installation**

466 a self-contained boat propulsion/steering system, including the engine, gearbox, and propeller  
467 or jet drive, all in one unit, which is installed to the outside of the transom (the rear part of the  
468 boat hull) serving for both propulsion and steering of the boat

**3.19****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.

Note 2 to entry: This note applies to the French language only.

**3.20****parallel hybrid propulsion**

propulsion of a parallel hybrid vehicle where both the electric motor and the internal combustion engine work together to power the vehicle

Note 1 to entry: The internal combustion engine (ICE) and the electric motor are both connected to the transmission. A controller in the transmission determines when to operate the electric motor and when to switch to the ICE.

**3.21****powerline communications****PLC**

communication technique based on error-tolerant modulation schemes, which transmits information superimposed to electrical power over lines or cables

**3.22****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..."

**3.23****resistive distributor brush**

resistive pick-up brush in an ignition distributor cap

**3.24****resistive ignition cable**

ignition cable whose conductor has a high resistance (attenuation)

**3.25****RF disturbance power**

RF power measured with a current transformer of an absorbing clamp and an RF measuring receiver

Note 1 to entry: It can be measured – as the RF disturbance voltage – in a peak or quasi-peak mode.

**3.26****series hybrid propulsion**

propulsion of a series hybrid vehicle where the electric motor is solely responsible for turning the vehicles wheels

Note 1 to entry: The electric motor is energized by the battery pack or by the generator, which is powered by the internal combustion engine. The ICE in a series hybrid is not coupled to the wheels and does not directly propel the vehicle. A controller in the transmission determines how much power is needed to propel the vehicle and whether to use power from the battery or the generator.

**3.27****signal/control port**

port intended for the interconnection of components of an EUT, or between an EUT and local AE and used in accordance with relevant functional specifications (for example for the maximum length of cable connected to it)

Note 1 to entry: Examples include RS-232, Universal Serial Bus (USB), High-Definition Multimedia Interface (HDMI), IEEE Std 1394 ("FireWire").

Note 2 to entry: For vehicles in charging mode, this includes Control Pilot signal, PLC technology used on Control Pilot signal line and CAN."

**3.28****spark discharge**

discharge of energy stored in the ignition coil, in an arc across the electrodes of a measuring spark-plug

Note 1 to entry: See E.5

**3.29****tracking generator**

test signal oscillator (continuous wave, cw) that is frequency locked to the receive frequency of a measuring receiver

**3.30****traction batteries**

high voltage (HV) batteries used for the propulsion of electric or hybrid electric vehicles

**3.31****unladen, adj**

not carrying any additional weight in the vehicle or boat (passengers or cargo)

**3.32****vehicle**

machine operating on land which is intended to carry persons or goods or that is operated by a person

Note 1 to entry: Vehicles include, but are not limited to cars, trucks, buses, mopeds, agricultural machinery, earth-moving machinery, trailers, material-handling equipment, mining equipment, floor treatment machines, walk-behind floor treatment machines and snowmobiles,

**3.33****vehicle inlet****electric vehicle inlet**

part of a vehicle coupler incorporated in, or fixed to, the electric vehicle

[SOURCE: IEC 62196-1:2014, 3.3.2]

**3.34****wired network port**

port for the connection of voice, data and signalling transfers intended to interconnect widely dispersed systems by direct connection to a single-user or multi-user communication network

Note 1 to entry: Examples of these include CATV, PSTN, ISDN, xDSL, LAN and similar networks.

Note 2 to entry: Wired network ports may support screened or unshielded cables and may also carry AC or DC power where this is an integral part of the telecommunication specification.

**3.35****Wireless Power Transfer****WPT**

Transfer of electrical energy from a power source to an electrical load via electric and/or magnetic fields or electromagnetic waves

Note 1 to entry: The alternative term “wireless power transmission” is also often used in technical documents

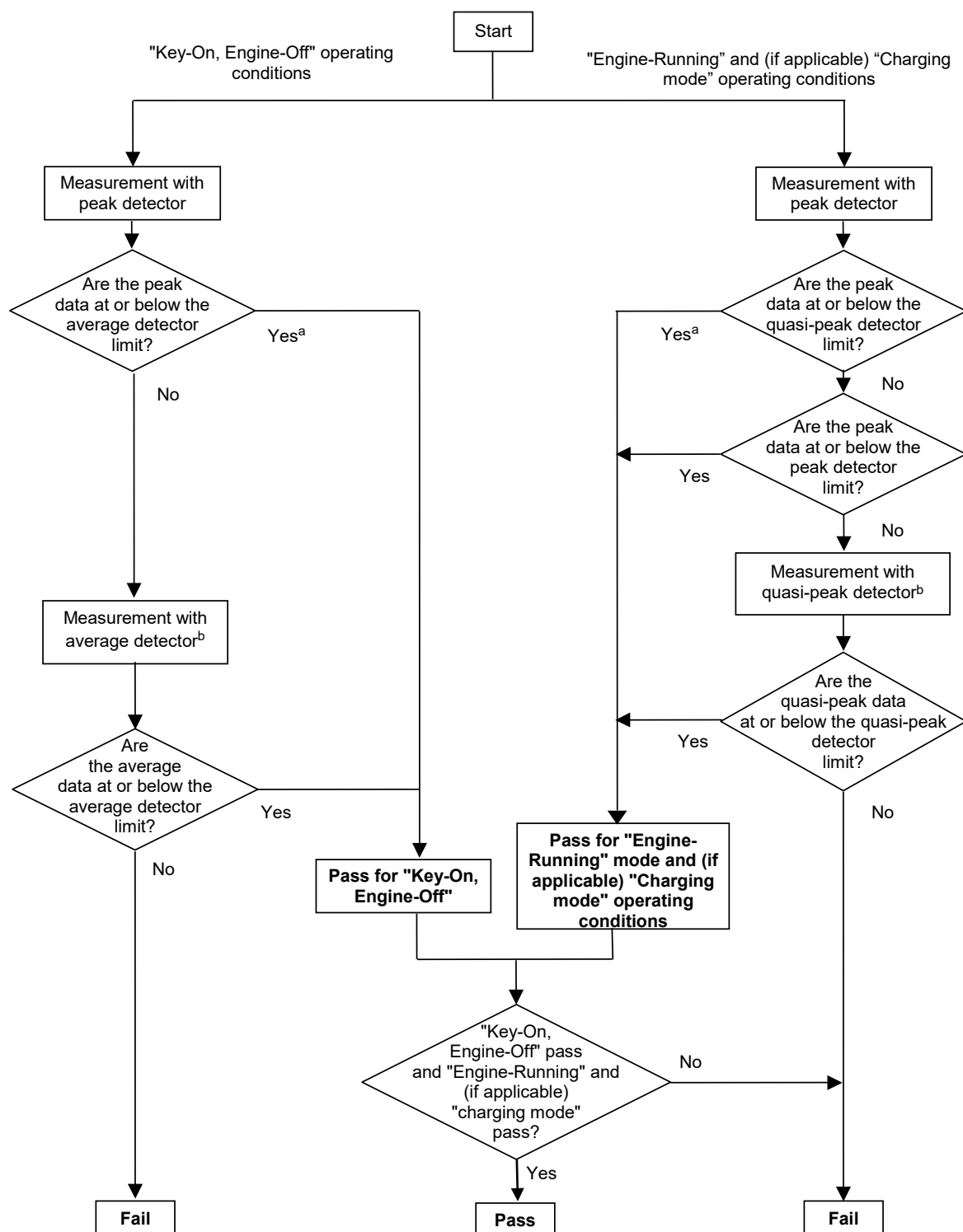
**4 Limits of radiated disturbance****4.1 Determination of conformance of vehicle/boat/device with limits**

In the 30 MHz – 1 GHz frequency range, the vehicle/boat/device shall comply with:

- average detector limits when the vehicle/boat/device is in “Key-On, Engine-Off” mode (see 5.5.2.2 and 5.5.3), and
- peak or quasi-peak detector limits when the vehicle/boat/device is in “Engine-Running” mode (see 5.5.2.3 and 5.5.3), and
- if applicable, peak or quasi-peak detector limits when the vehicle is in “Charging mode connected to the power grid” (see 5.5.2.4).

The limits given in this document take into account uncertainties.

Figure 1 defines the method for determination of conformance.



IEC

a Because the measurement result with peak detector is always higher than or equal to the measurement result with quasi-peak detector (and average detector respectively) and applicable peak detector limit is always higher than or equal to applicable quasi-peak detector limit (and average detector limit respectively), 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 applicable limit (average or peak) when measured with peak detector need to be remeasured with average or quasi-peak detector, as applicable.

**Figure 1 – Method of determination of conformance**

## 4.2 Peak and quasi-peak detector limits

The limits for emissions measured with peak or quasi-peak detectors at 10 m antenna distance are given in the table of Figure 2 and are shown graphically in Figure 2. For more accurate determination, the equations given in Figure 2 shall be used. For measurements at 3 m antenna distance, 10 dB shall be added to the limit.

When quasi-peak limits are being used, and a peak detector is used for time efficiency, any peak field-strength levels above the quasi-peak limit shall be re-measured using the quasi-peak detector.

The peak and quasi-peak detectors are defined in CISPR 16-1-1.

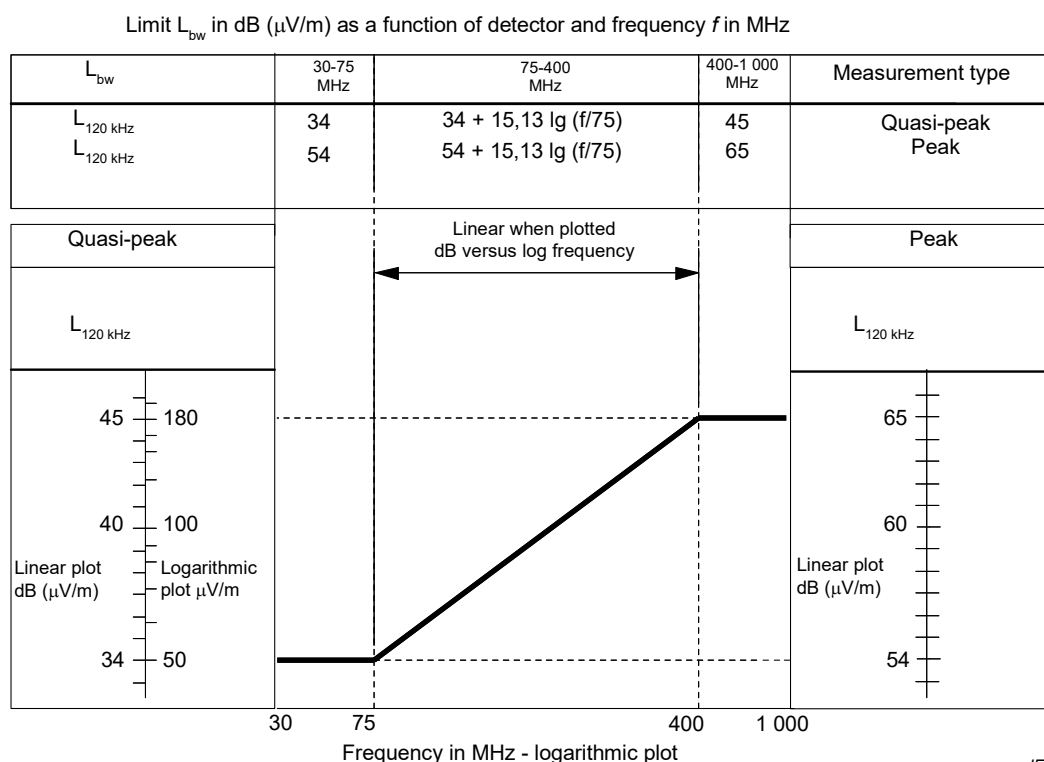


**Figure 2 – Limits of disturbance (peak and quasi-peak detector) at 10 m antenna distance**

## 4.3 Average detector limit

The limit for emissions measured with the average detector at 10 m antenna distance is shown in Figure 3. Vehicles/boats/devices not including electronic oscillators with an operating frequency greater than 9 kHz shall be deemed to be in compliance with the requirements of this clause without performing tests for emissions with average detector. For measurements at 3 m antenna distance, 10 dB shall be added to the limit.

The average detector is defined in CISPR 16-1-1.

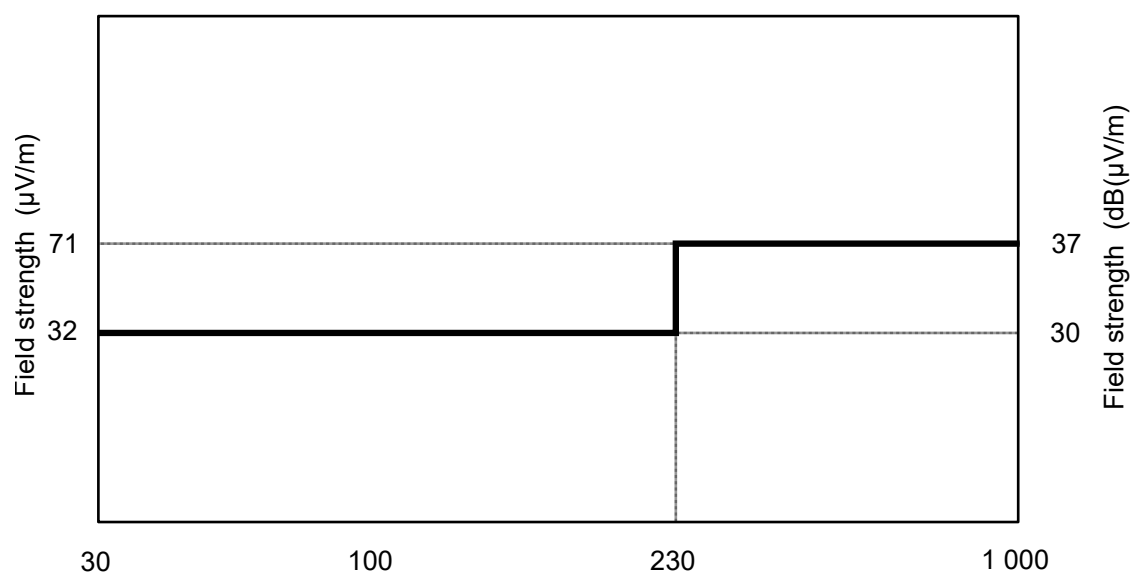


**Figure 3 – Limits of disturbance (average detector) at 10 m antenna distance**

## 5 Methods of measurement

### 5.1 Measuring instruments

#### 5.1.1 Measuring receiver

##### 5.1.1.1 General

The measuring receiver shall comply with the requirements of CISPR 16-1-1. Either manual or automatic frequency scanning can be used.

NOTE A preamplifier can be used between the antenna and measuring receiver in order to achieve the 6 dB noise floor requirements. If a preamplifier is used to achieve the 6 dB noise floor requirement (see 5.3.1.3), the laboratory should establish a procedure to avoid overloading 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 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 1.

**Table 1 – Spectrum analyser parameters**

| Frequency range<br>MHz | Peak detector         |              | Quasi-peak detector |            | Average detector      |             |
|------------------------|-----------------------|--------------|---------------------|------------|-----------------------|-------------|
|                        | RBW at<br>–3 dB       | Scan time    | RBW at<br>–6 dB     | Scan time  | RBW at<br>–3 dB       | Scan time   |
| 30 to 1 000            | 100 kHz or<br>120 kHz | 100 ms / MHz | 120 kHz             | 20 s / MHz | 100 kHz or<br>120 kHz | 100 ms /MHz |

When a spectrum analyser is used for measurements, the video bandwidth shall be at least three times the RBW.

### 5.1.1.3 Scanning receiver parameters

The dwell time of the scanning receiver shall be adjusted for the CISPR frequency band and detection mode used. The minimum dwell time, maximum step size and bandwidth (BW) are listed in Table 2.

**Table 2 – Scanning receiver parameters**

| Frequency range MHz | Peak detector |           |            | Quasi-peak detector |           |            | Average detector |           |            |
|---------------------|---------------|-----------|------------|---------------------|-----------|------------|------------------|-----------|------------|
|                     | BW at –6 dB   | Step size | Dwell time | BW at –6 dB         | Step size | Dwell time | BW at –6 dB      | Step size | Dwell time |
| 30 to 1 000         | 120 kHz       | 60 kHz    | 5 ms       | 120 kHz             | 60 kHz    | 1 s        | 120 kHz          | 60 kHz    | 5 ms       |

## 5.1.2 Antenna types

### 5.1.2.1 Preferred antenna

The antenna shall be a balanced dipole (see CISPR 16-1-4). Free-space antenna factors are to be used. For frequencies of 80 MHz or above, the antenna shall be resonant in length, and for frequencies below 80 MHz it shall be the length equal to the 80 MHz resonant length. It shall be matched to the transmission line by a suitable symmetric-asymmetric transformer device.

### 5.1.2.2 Alternative antennas

Any linearly polarized broadband antenna may be used for measurements. The antenna factor shall be determined with one of the following methods for the intended measurement distance, i.e. 10 m or 3 m and for the reference point as defined in 5.4.1.3:

- ANSI C63.5 reference antenna method;
- ANSI C63.5 standard site method;
- CISPR 16-1-6 using the standard antenna method (SAM) with a tuned or calculable dipole as the standard antenna and performed at a metal ground plane site;
- CISPR 16-1-6 using the standard site method (SSM) performed at a metal ground plane site.

When broadband antennas are used, they shall meet the requirements for complex antennas given in CISPR 16-1-4.

## 5.2 Measurement instrumentation uncertainty

The measurement instrumentation uncertainty shall be calculated as described in Annex F. Measurement instrumentation uncertainty shall not be taken into account in the determination of compliance.

Examples of uncertainty budgets are given in Annex G. If the calculated expanded measurement instrumentation uncertainty exceeds that of the corresponding example in Annex G, the value of the expanded uncertainty shall be documented in the test report.

NOTE The provisions for measurement instrumentation uncertainty (MIU) in this document do not follow CISPR 16-4-2 for considering MIU. The deviation from policy is justified due to the missing site validation method which will be covered in a future project for CISPR 12. An estimation of the uncertainty contribution caused by site imperfections cannot be made without site validation criterion.

### 5.3 Measuring site requirements

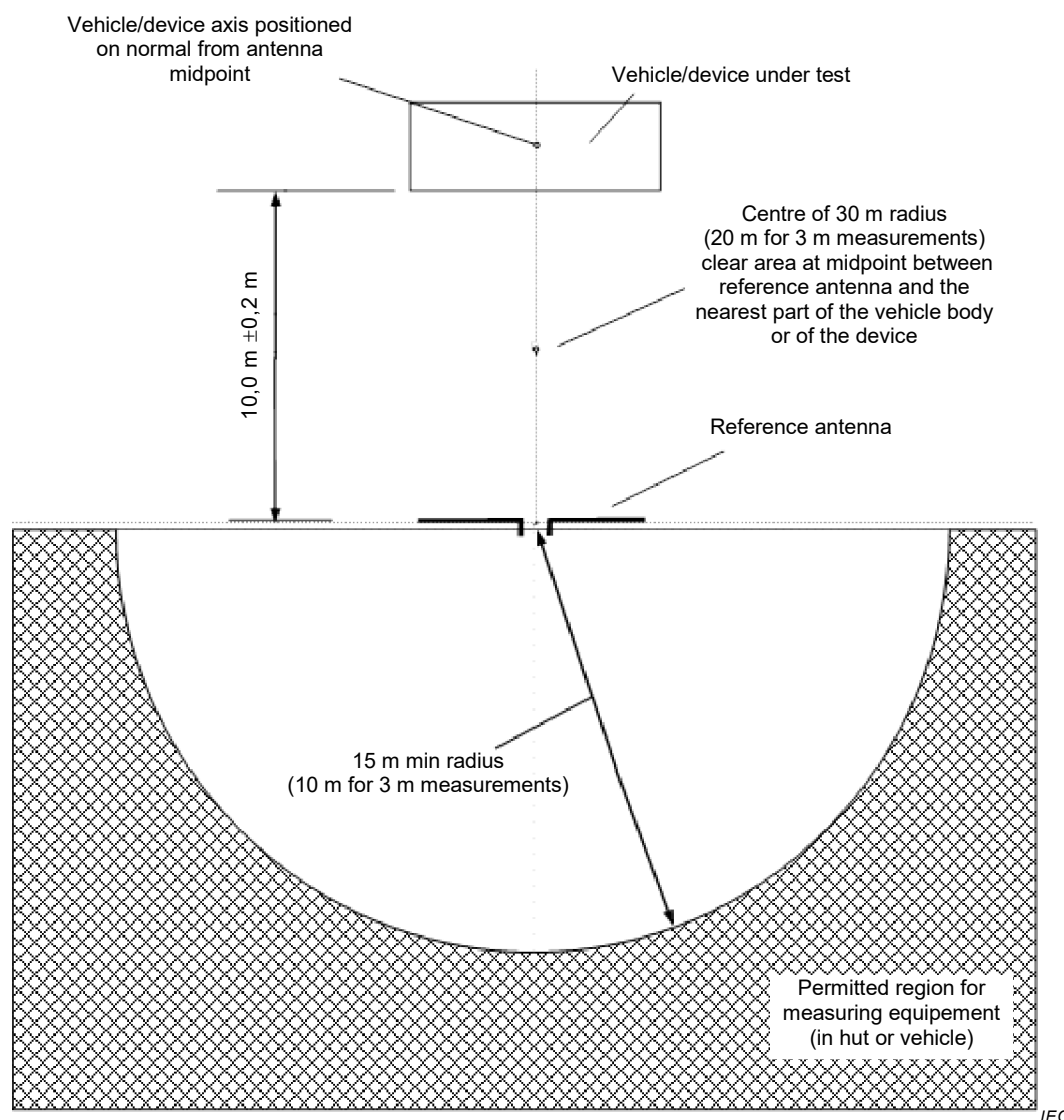
#### 5.3.1 Outdoor test site (OTS) requirements

##### 5.3.1.1 OTS for vehicles and devices

The test site shall be a clear area, free from electromagnetic reflecting surfaces (except the floor) within a circle of minimum radius of 30 m (20 m radius for 3 m measurements) measured from a point midway between the vehicle or device and the antenna. As an exception, the measuring equipment, and test hut or vehicle in which the measuring equipment is located (when used) may be within the test site, but only in the permitted region indicated by the crosshatched area of Figure 4.

NOTE The site requirements defined in 5.3.1.1 and Figure 4 are the application of CISPR 16-1-4 to large automotive objects.

Vehicles and devices smaller than 2 m in length and width may be tested on an OTS with dimensions corresponding to CISPR 16-1-4:2010, Figures 2 and 3. The test equipment / test hut / vehicle containing the test equipment shall be located outside the obstruction-free area depicted in Figures 2 and 3 of CISPR 16-1-4.



678

679 The 10,0 m  $\pm$  0,2 m dimension may be changed to 3,00 m  $\pm$  0,05 m in accordance with 5.4.1.3.

680 Note The horizontal distance is from the reference point of the antenna to the nearest part of the vehicle body or  
 681 to the nearest peripheral part of the device"

682

**Figure 4 – Measuring site (OTS) for vehicles and devices**

### 683 5.3.1.2 OTS for boats

#### 684 5.3.1.2.1 General

685 The test site shall be a clear area free from electromagnetic reflecting surfaces (except the  
 686 water surface) within a circle of minimum radius of 30 m (20 m radius for 3 m measurements)  
 687 measured from a point midway between the boat or the engine under test and the antenna.  
 688 Exceptions for the measuring equipment are specified in 5.3.1.2.2 and also in 5.3.1.2.3. The  
 689 test hut or vehicle, boat or test fixture in/on which the measuring equipment is located may be  
 690 within the test site, but only in the permitted region indicated by the crosshatched area in  
 691 Figure 5. The antenna shall be installed on a non-metallic boat or non-metallic test platform.