



DPC: 22 / 30450603 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

Date: 17 January 2022

Origin: International

Latest date for receipt of comments: 16 February 2022

Project No. 2014/01450

Responsible committee: GEL/210 EMC Policy and Standards Committee

Interested committees:

Title: BS EN 55012 Vehicles, boats and internal combustion engines - 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

- i) has any issues related to 3rd party IPR, patent or copyright
- ii) affects other national standard(s)
- iii) requires additional national guidance or information

**WARNING: THIS IS A DRAFT AND MUST NOT BE REGARDED OR USED AS A BRITISH STANDARD.
THIS DRAFT IS NOT CURRENT BEYOND 16 February 2022**

This draft is issued to allow comments from interested parties; all comments will be given consideration prior to publication. No acknowledgement will normally be sent. **See overleaf for information on the submission of comments.**

No copying is allowed, in any form, without prior written permission from BSI except as permitted under the Copyright, Designs and Patent Act 1988 or for circulation within a nominating organization for briefing purposes. Electronic circulation is limited to dissemination by e-mail within such an organization by committee members.

Further copies of this draft may be purchased from BSI Shop <http://shop.bsigroup.com> or from BSI Customer Services, Tel: +44(0) 20 8996 9001 or email cservices@bsigroup.com. British, International and foreign standards are also available from BSI Customer Services.

Information on the co-operating organizations represented on the committees referenced above may be obtained from <http://standardsdevelopment.bsigroup.com>

Responsible Committee Secretary: **Mrs Geraldine D Salt (BSI)**
Direct tel: **020 8996 7273**
E-mail: geraldine.salt@bsigroup.com

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.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

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/482/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER:

CISPR 12 ED7

DATE OF CIRCULATION:

2021-12-24

CLOSING DATE FOR COMMENTS:

2022-03-18

SUPERSEDES DOCUMENTS:

CIS/D/474/CD, CIS/D/479A/CC

IEC CIS/D : ELECTROMAGNETIC DISTURBANCES RELATED TO ELECTRIC/ELECTRONIC EQUIPMENT ON VEHICLES AND INTERNAL COMBUSTION ENGINE POWERED DEVICES

SECRETARIAT:

Germany

SECRETARY:

Mr Holger Hirsch

OF INTEREST TO THE FOLLOWING COMMITTEES:

SC 61J, TC 69, TC 125, CIS/B, CIS/F

PROPOSED HORIZONTAL STANDARD:



Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.

FUNCTIONS CONCERNED:

☒ EMC

☐ ENVIRONMENT

☐ QUALITY ASSURANCE

☐ 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:

To take into account the comments and suggestions of the national committees and after long discussions in online WG1 meetings, the draft now includes a grouping of vehicles/boats/devices for which different sets of limit values are provided.

CONTENTS

1		
2	FOREWORD	6
3	INTRODUCTION	8
4	1 Scope	9
5	2 Normative references	10
6	3 Terms, definitions and abbreviations	11
7	3.1 Terms and definitions	11
8	3.2 Abbreviations	17
9	4 Limits of radiated disturbance	17
10	4.1 Separation into groups	17
11	4.2 Determination of conformance of vehicle/boat/device with limits	18
12	4.3 Peak and quasi-peak detector limits	20
13	4.4 Average detector limit	21
14	5 Methods of measurement	22
15	5.1 Measuring instruments	22
16	5.1.1 Measuring receiver	22
17	5.1.2 Antenna types	23
18	5.2 Measurement instrumentation uncertainty	24
19	5.3 Measuring site requirements	24
20	5.3.1 General	24
21	5.3.2 Outdoor test site (OTS) requirements	24
22	5.3.3 Alternative test site requirements	26
23	5.4 Test setup for measurement	27
24	5.4.1 Antenna requirements	27
25	5.4.2 Test setup for vehicle in charging mode	31
26	5.5 Test object conditions	40
27	5.5.1 General	40
28	5.5.2 Vehicles and boats	40
29	5.5.3 Devices	43
30	5.6 Data collection	43
31	6 Methods of checking for compliance with CISPR requirements	43
32	6.1 General	43
33	6.2 Application of limit curves	43
34	6.2.1 Measurements under dry conditions	43
35	6.2.2 Measurements under wet conditions	43
36	6.3 Evaluation (general)	44
37	Annex A (normative) Procedure to determine an alternative emission limit for	
38	measurements	45
39	Annex B (informative) Measurement of the insertion loss of ignition noise suppressors	46
40	B.1 Overview	46
41	B.1.1 General	46
42	B.1.2 CISPR box method (50/75 Ω laboratory method)	46
43	B.1.3 Field comparison method	46
44	B.2 Comparison of test methods	46
45	B.2.1 CISPR box method	46
46	B.2.2 Field comparison method	46

47	B.3	CISPR box method (50/75 Ω laboratory method of measurement of insertion	
48		loss of ignition noise suppressors)	47
49	B.3.1	General conditions and limitations of measurement	47
50	B.3.2	Test procedure	47
51	B.3.3	Test box construction	47
52	B.3.4	Results	47
53	Annex C (informative)	Methods of measurement to determine the attenuation	
54		characteristics of ignition noise suppressors for high voltage ignition systems	51
55	C.1	General.....	51
56	C.2	Recommended requirements for ignition noise suppressors	51
57	C.3	Test set-up	51
58	C.4	Test procedure.....	52
59	C.5	Measuring spark-plugs without suppression elements	56
60	C.6	Test setup examples	56
61	C.6.1	General	56
62	C.6.2	Connection of a right-angle spark-plug ignition noise suppressor	56
63	C.6.3	Connection of a distributor rotor	57
64	C.6.4	Connection of distributor caps with integrated ignition noise	
65		suppressors	58
66	C.6.5	Connection of resistive ignition cables	58
67	Annex D (informative)	Applicability of CISPR 12	60
68	D.1	Flow chart.....	60
69	D.2	Example products that are in the scope of CISPR 12	61
70	D.2.1	General	61
71	D.2.2	Vehicles	61
72	D.2.3	Boats and boat engines/motors	62
73	D.2.4	Devices	62
74	D.3	Grouping.....	62
75	Annex E (normative)	Direct current charging artificial networks (DC-charging-AN),	
76		artificial mains networks (AMN) and asymmetric artificial networks (AAN).....	65
77	E.1	General.....	65
78	E.2	Direct current charging artificial networks (DC-charging-AN).....	65
79	E.3	Artificial mains networks (AMN)	67
80	E.4	Asymmetric artificial network (AAN)	67
81	E.4.1	General	67
82	E.4.2	Signal/control port with symmetric lines	68
83	E.4.3	Signal/control port with PLC (technology) on control pilot line	68
84	E.4.4	Signal/control port with control pilot line	69
85	Annex F (informative)	Measurement instrumentation uncertainty	71
86	F.1	General.....	71
87	F.2	Uncertainty sources	71
88	F.3	Measurand.....	73
89	F.4	Input quantities to be considered	73
90	Annex G (informative)	Uncertainty budgets for radiated disturbance measurements of	
91		electric field strength	76
92	G.1	General.....	76
93	G.2	Typical CISPR 12 uncertainty budgets	76
94	G.3	Receiver's frequency step	80
95	Annex H (informative)	Items under consideration	81

96	H.1	General.....	81
97	H.2	Frequency range.....	81
98	H.3	Correlation between OTS, ALSE and OATS Measurements	81
99	H.4	Calibration of antennas	81
100	H.5	Charging mode for boats.....	81
101	H.6	Necessity for the use of artificial networks in the test setups.....	81
102		Bibliography	82
103			
104		Figure 1 – Method of determination of conformance.....	19
105		Figure 2 –Quasi-peak limits at 10 m antenna distance	20
106		Figure 3 –Peak limits at 10 m antenna distance	21
107		Figure 4 – Limits of disturbance (average detector) at 10 m antenna distance	22
108		Figure 5 – Measuring site (OTS) for vehicles, boats and devices	25
109		Figure 6 – Measuring site (OTS) for boats	26
110		Figure 7 – Antenna height to measure emissions – Elevation view (vertical polarization	
111		shown).....	28
112		Figure 8 – Antenna distance to measure emissions – Plan view (horizontal polarization	
113		shown).....	28
114		Figure 9 – Antenna position for $N = 1$ (one antenna position to be used) – Horizontal	
115		polarization shown	30
116		Figure 10 – Example antenna positions for $N = 2$ (multiple antenna positions to be	
117		used) – Horizontal polarization shown.....	31
118		Figure 11 – Example of test setup for vehicle with socket located on vehicle side	
119		(charging mode 1 or 2, AC powered, without communication)	33
120		Figure 12 – Example of test setup for vehicle with socket located front/rear of	
121		vehicle (charging mode 1 or 2, AC powered, without communication)	34
122		Figure 13 – Example of test setup for vehicle with socket located on vehicle side	
123		(charging mode 3 or mode 4, AC/DC powered, with communication).....	37
124		Figure 14 – Example of test setup for vehicle with socket located front/rear of vehicle	
125		(charging mode 3 or mode 4, AC/DC powered, with communication).....	38
126		Figure 15 – Example of test setup for vehicle in charging mode through wireless power	
127		transfer	40
128		Figure A.1 – Calculation of the resulting gain reduction X_{dB}	45
129		Figure B.1 – Test Circuit	48
130		Figure B.2 – General arrangement of the test box	48
131		Figure B.3 – Details of the test box lid	49
132		Figure B.4 – Details of the test box	49
133		Figure B.5 – Straight spark-plug ignition noise suppressor (screened or unscreened)	49
134		Figure B.6 – Right-angle spark-plug ignition noise suppressor (screened or	
135		unscreened).....	49
136		Figure B.7 – Noise suppression spark-plug	50
137		Figure B.8 – Resistive distributor brush	50
138		Figure B.9 – Noise suppressor in distributor cap	50
139		Figure B.10 – Noise suppression distributor rotor.....	50
140		Figure B.11 – Noise suppression ignition cable (resistive or reactive)	50
141		Figure C.1 – Test set-up, side view	53
142		Figure C.2 – Test set-up, top view	54

143	Figure C.3 – Pressure chamber with ventilation	55
144	Figure C.4 – Top view of the set-up of a right-angle ignition noise suppressor for	
145	distributors	56
146	Figure C.5 – Location of high voltage ignition components	57
147	Figure C.6 – Top view of the test set-up for distributor rotors	58
148	Figure C.7 – Side view of the test set-up for ready-to-use resistive ignition cables	59
149	Figure E.1 – Example of 5 μ H / 50 Ω DC-charging-AN schematic	66
150	Figure E.2 – Characteristics of the DC-charging-AN impedance	66
151	Figure E.3 – Example of AAN circuit for signal/control port with PLC (technology) on	
152	control pilot	69
153	Figure E.4 – Example of AAN circuit for pilot line	70
154	Figure F.1 – Sources of measurement instrumentation uncertainty	72
155	Figure G.1 – Example of measurement for frequency step uncertainty evaluation for	
156	120 kHz bandwidth	80
157		
158	Table 1 – Quasi-peak limits at 10 m antenna distance	20
159	Table 2 – Peak limits at 10 m antenna distance	21
160	Table 3 – Spectrum analyser parameters	23
161	Table 4 – Scanning receiver parameters	23
162	Table 5 – Internal combustion engine operating speeds	42
163	Table C.1 – Limits	51
164	Table D.1 – Examples of products in the scope of CISPR 12 with their assignment to	
165	the groups	63
166	Table E.1 – Magnitude of the DC-charging-AN impedance Z_{PB}	67
167	Table F.1 – Input quantities to be considered for radiated disturbance measurements	73
168	Table G.1 – Typical uncertainty budget – 3 m/10 m distance – Biconical antenna	76
169	Table G.2 – Typical uncertainty budget – 3 m/10 m distance – Log-periodic antenna	78
170		
171		

INTERNATIONAL ELECTROTECHNICAL COMMISSION

INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

**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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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.

242

INTRODUCTION

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

247 CISPR 12 has been used for many years as a regulatory requirement in numerous countries,
248 to provide protection for radio receivers at a 10 m distance. It has been effective in protecting
249 the radio environment outside the vehicle.

250

251

**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 in the frequency range of 30 MHz to 1 000 MHz for off-board receivers. Compliance with this document might not provide adequate protection for receivers nearer than 10 m to the vehicle, boat or device.

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

- 1) vehicles propelled by an internal combustion engine (ICE), electrical means or both (see 3.1.31);
- 2) boats propelled by an internal combustion engine (inboard or outboard), electrical means or both (see 3.1.4). Boats are to be tested in the same manner as vehicles except where they have unique characteristics as explicitly stated in this document;
- 3) devices equipped with internal combustion engines (see 3.1.8). 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 document;
- 4) inboard and outboard boat engines or motors (i.e. equipped with internal combustion engine, electrical motor, or both), when marketed independently.

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

This document does not apply to aircraft, household appliances, medical devices, traction systems (railway engine or locomotive, streetcar or tram 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 electric propulsion portion of the vehicle is excluded from this document. In addition, domestic helper robots, such as household cleaning robots, hotel service robots and personal safety robots are also excluded from the scope of this document.

NOTE 1 Appliances without combustion engine for typical housekeeping and service functions in the household and similar environment are covered by the requirements of CISPR 14-1.

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

This document does not prescribe measurement methods or limits for conducted disturbances, for the charging mode of operation, where the (electric or hybrid) vehicle/boat is connected to power mains, either directly (i.e. plug-in vehicle or boat) or indirectly (i.e. wireless power charging). 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 for road vehicles and IEC 61000-6-3, IEC 61000-6-4 and IEC 61000-6-8 for other types of vehicles or boats.

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

Equipment that is covered by other CISPR product and product family emission standards are excluded from the scope of this standard, except where they include internal combustion engine(s). In the latter case, the equipment shall comply with this standard in all modes of operation where the internal combustion engine(s) is(are) active.

NOTE 4 The other CISPR product or product family emission standard might also apply to the equipment for those modes of operation where the internal combustion engine(s) is (are) not active. In case the internal combustion engine(s) is (are) always in operation, the other CISPR product or product family emission standard might still apply, for verifying the emissions from the other components and circuitry of the equipment.

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 each reference, only the edition cited applies.

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

IEC 61980-1:2020, *Electric vehicle wireless power transfer (WPT) systems - 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 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 16-1-3:2004/AMD2:2020

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 16-1-4:2019/AMD1:2020

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 16-2-1:2014, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-1: Methods of measurement of disturbances and immunity – Conducted disturbance measurements*
CISPR 16-2-1:2014/COR1:2020

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

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 16-4-2:2011/AMD2:2018

CISPR 32:2015, *Electromagnetic compatibility of multimedia equipment – Emission requirements*
CISPR 32:2015/AMD1:2019

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)*
Corrigendum 1:2018.

3 Terms, definitions and abbreviations

3.1 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>
-

3.1.1

absorber lined shielded enclosure

ALSE

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

3.1.2

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 this network, the V-network (V-AMN), which couples the unsymmetric voltages, and the delta-network (Δ -AMN), which couples symmetric (DM) and asymmetric (CM) voltages separately.

Note 2 to entry: The coupling feature of the AMN is not used for CISPR 12 testing. The coaxial port (“receiver port”) of the AMN is equipped with a 50 Ω termination for all measurements according to this standard.

[SOURCE: CISPR 16-1-2:2014/AMD1:2017, 3.1.6 modified – added Note 2 to entry]

3.1.3**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: The term “Y-network” is a synonym for AAN.

Note 2 to entry: The coupling feature of the AAN is not used for CISPR 12 testing. The coaxial port of the AAN is equipped with a 50 Ω termination for all measurements according to this standard.

[SOURCE: CISPR 16-1-2:2014/AMD1:2017, 3.1.7 modified – added Note 2 to entry]

3.1.4**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 inboard or outboard engine(s)/motor(s)

3.1.5**bonding, verb**

connect to ground using a ground connection complying with 5.3 of CISPR 16-2-1:2014, with a DC resistance not exceeding 2,5 m Ω

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

3.1.6**charging mode**

mode of operation intended for charging the Rechargeable Energy Storage System (REESS)

3.1.6.1**charging mode 1**

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

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

3.1.6.2**charging mode 2**

charging mode as defined in 6.2.2 of IEC 61851-1:2017, where the vehicle is connected to AC mains using a charging cable, which has an Electric Vehicle Supply Equipment (EVSE) box in-line (e.g. In-Cable Control Box / In-Cable Control and Protection Device), 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 with the vehicle.

3.1.6.3**charging mode 3**

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

3.1.6.4**charging mode 4**

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

3.1.7**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.

3.1.8**device**

machine, equipped with 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 power generators.

3.1.8.1**small device**

device that is handheld or has a footprint that fits within a circle not larger than 1,5 m in diameter, regardless of orientation, without considering passive elements

Note 1 to entry: Examples include chainsaws, irrigation pumps, push-type snow blowers, air compressors, grass trimmer (regardless of the length of its handle).

3.1.8.2**large device**

device that is not a small device

Note 1 to entry: Examples include power generators and large landscaping equipment.

3.1.9**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.

3.1.10**electric vehicle****EV**

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

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 only, without contributing to the mechanical propulsion of the vehicle, are considered as an electric vehicle

3.1.11**EV supply equipment****EVSE**

equipment or a combination of equipment, providing dedicated functions to supply electric energy from a fixed electrical installation or supply network to an EV for the purpose of charging

3.1.12**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.

3.1.13**hybrid electric vehicle**

vehicle equipped with both internal combustion engine and electric propulsion motor(s)

Note 1 to entry: The internal combustion engine and the electric propulsion motor(s) can operate individually or in a combined mode depending on the hybrid system.

Note 2 to entry: The internal combustion engine can be used for propulsion (parallel hybrid) or as electric power generator (series hybrid).

3.1.14**ignition noise suppressor**

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

3.1.15**impulsive ignition noise**

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

3.1.16**inboard engine (motor)**

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

Note 1 to entry: All types of inboard boat engines (motors) that are marketed independently are under the scope of CISPR 12: equipped with internal combustion engine, with electrical motor, or hybrid.

3.1.17**open-area test site****OATS**

facility for radiated disturbance measurements in which the ground reflection is made reproducible by a large flat electrically conducting ground plane

Note 1 to entry: An OATS is an uncovered outdoor site, which is far enough away from buildings, electric lines, fences, trees 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.

3.1.18**outboard engine (motor)**

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

Note 1 to entry: All types of outboard boat engines (motors) that are marketed independently are under the scope of CISPR 12: equipped with internal combustion engine, with electrical motor, or hybrid.

3.1.19**outdoor test site****OTS**

radiated disturbance measurement site without metallic ground plane and with specific requirements that are set out in this document

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

3.1.20**parallel hybrid propulsion**

propulsion of a hybrid electric vehicle where both the electric motor and the internal combustion engine work together for the propulsion of 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.

3.1.21**plug-in hybrid vehicle**

vehicle propelled by electric motor(s) and internal combustion engine with traction battery which has vehicle inlet for charging

3.1.22**powerline communications technology****PLC technology**

communication technology based on error-tolerant modulation schemes, which is able to transmit high frequency signals superimposed to low-frequency signals on lines or in cables

3.1.23**resistive distributor brush**

pick-up brush in an ignition distributor cap where the brush is made of a conductor with high electrical resistance

3.1.24**resistive ignition cable**

ignition cable whose conductor has a high electrical resistance (attenuation)

3.1.25**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.

3.1.26**series hybrid propulsion**

propulsion of a hybrid electric vehicle where the electric motor is solely responsible for the propulsion of the vehicle

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.

3.1.27**signal/control port**

port intended for the interconnection of components of an equipment under test (EUT), or between an EUT and local associated equipment (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, for the purpose of this document, signal/control ports include control / pilot signal lines, PLC signals used on control / pilot signal lines and CAN-signal lines.

3.1.28**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 C.5

3.1.29**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 may be high voltage (HV) batteries.

3.1.30**unladen**, adj

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

3.1.31**vehicle**

self-propelled machine, operating on land, which is either intended to carry persons or goods or that is operated by a person, or is a mobile machine

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 (only if self-propelled), eTransporters and snowmobiles.

Note 2 to entry: Goods, in this definition, include shipping boxes and containers (such as carried by a lorry, truck, van, or forklift), construction or mining materials (such as carried by a paver, dump truck, cement truck), liquid substances (such as carried by a street sweeper, milk tanker truck, or gas tanker truck / lorry), etc.

Note 3 to entry: In case the vehicle is operated by a person (i.e., non-autonomous vehicles), that person can be inside the vehicle (e.g., car, truck, excavator), near the vehicle (e.g., walk-behind floor treatment machine), or operating the vehicle through remote control.

3.1.31.1**self-propelled**

equipped with a propulsion engine or motor

Note 1 to entry: This term is not meant to imply that the machine is necessarily autonomous (robotic).

3.1.31.2 mobile machine

self-propelled machine, operating on land, which is designed and constructed specifically to perform work and that, due to its construction characteristics, is not suitable for carrying passengers or for transporting goods

EXAMPLES: Agricultural machinery, earth-moving machinery, material-handling equipment, mining equipment, floor treatment machines, ice resurfacing machines.

Note 1 to entry: Machinery mounted on a motor vehicle chassis is not considered as mobile machinery.

[SOURCE: European Union Directive 2007/46/EC of 5-09-2007, Article 3, definition 16, modified – second sentence moved to Note 1; added examples]

3.1.31.3**road vehicle**

vehicle designated to operate on a road

[SOURCE: ISO 12353-1:2020]

3.1.32**vehicle inlet****electric vehicle inlet**

part of a vehicle coupler incorporated in, or fixed to, the electric vehicle or hybrid vehicle (if equipped)

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

3.1.33**wired network port**

port for the connection of voice, data and signaling 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.



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

616 3.1.34

617 wireless power transfer

618 WPT

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

621 3.2 Abbreviations

622 The following are abbreviations used in this standard that are not already given in 3.1.

623 AE associated equipment

624 EUT equipment under test

625 ICE internal combustion engine

626 MIU measurement instrumentation uncertainty

627 PE protective earth

628 RBW resolution bandwidth

629 SAM standard antenna method

630 SSM standard site method

631

632 4 Limits of radiated disturbance

633 4.1 Separation into groups

634 The vehicles, boats and devices subject to this standard are separated into groups, as follows:

635 Group 1: vehicles, boats and devices with ICE, including hybrid when the ICE is operating
636 (either used for propulsion or power generation); hybrid vehicles, boats and devices with small
637 energy storage capacity, where the ICE starts and stops frequently without user control, are
638 considered group 1.

639 Group 2: vehicles and boats with electric propulsion motor(s), including hybrid when the ICE is
640 not operating, excluding those in Group 3;

641 Group 3: vehicles with electric propulsion motor(s) (including hybrid when the ICE is not
642 operating) that are in one of the following categories:

- 643 • E-transporters (see IEC 63281-0, currently 125/47/CD);
- 644 • pedal cycles with pedal assistance, which are equipped with an auxiliary electric motor
645 having a maximum continuous rated power of less than or equal to 750 W, where the output
646 of the motor is cut off when the cyclist stops pedalling and is otherwise progressively
647 reduced and finally cut off before the vehicle speed reaches 32 km/h;
- 648 • any other vehicles designed to be used in pedestrian areas.

4.2 Determination of conformance of vehicle/boat/device with limits

Group 1, group 2 and group 3 vehicles/boats devices shall comply with the average detector limits when in “Key-On, Engine-Off” mode (see 5.5.2.2 and 5.5.3).

Group 1 and group 2 vehicles/boats/devices shall comply with the applicable peak or quasi-peak detector limits when in “Engine-Running” mode (see 5.5.2.3 and 5.5.3).

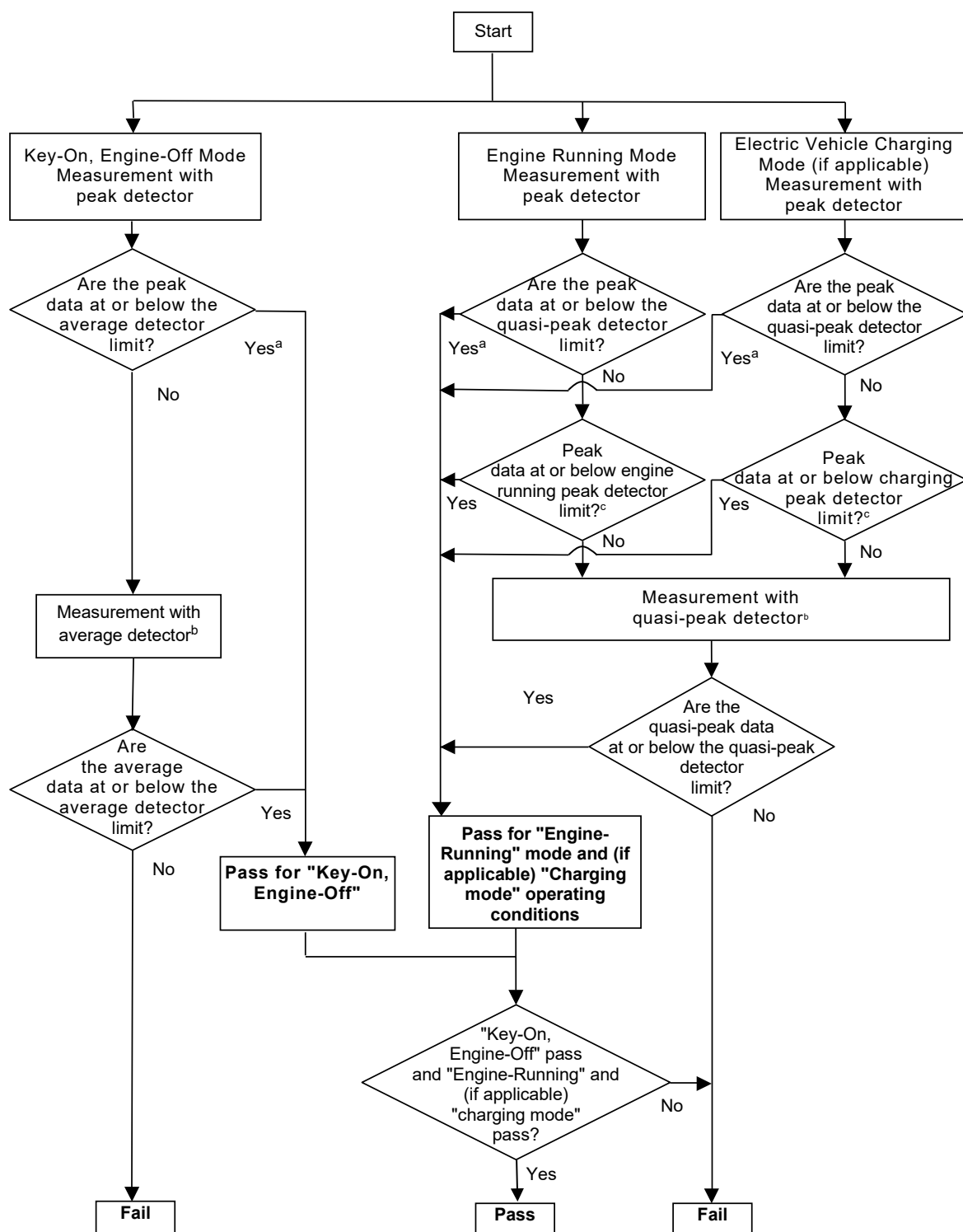
Group 3 vehicles shall comply with the quasi-peak detector limits when in “Engine-Running” mode (see 5.5.2.3).

Group 2 vehicles/boats shall comply with the applicable peak or quasi-peak detector limits when in “Charging” mode (see 5.5.2.4).

Group 3 vehicles shall comply with the quasi-peak detector limits when in “Charging” mode (see 5.5.2.4).

The limits given in this document take into account uncertainties.

Figure 1 defines the method for determination of conformance.



662

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

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

669 c This decision block does not apply for group 3 vehicles, because there is no peak limit specified for them. As
 670 such, for group 3 vehicles, a No obtained in the previous decision block will directly trigger a measurement with
 671 quasi-peak detector.

672

Figure 1 – Method of determination of conformance

4.3 Peak and quasi-peak detector limits

The limits applicable to group 1 and group 2 vehicles, boats, and devices in the “Engine-Running” mode and to group 2 vehicles in the “Charging” mode are specified in Figure 2 and Table 1 (for quasi-peak detector) and in Figure 3 and Table 2 (for peak detector) at 10 m antenna distance.

The limits applicable to group 3 vehicles in the “Engine-Running” and “Charging” modes are specified in Figure 2 and Table 1 at 10 m antenna distance.

For accurate determination of the limit value within 75 MHz to 400 MHz frequency range, the equations given in Table 1 and Table 2 shall be used. For measurements at 3 m antenna distance, 10 dB shall be added to the limit.

When evaluating compliance with the quasi-peak limit while using a peak detector (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.

Table 1 – Quasi-peak limits at 10 m antenna distance

Frequency MHz	Limit dB(μV/m)
30 to 75	34
75 to 400	$34 + 15,13 \lg(f/75)$
400 to 1 000	45
Where f is the frequency, in MHz	

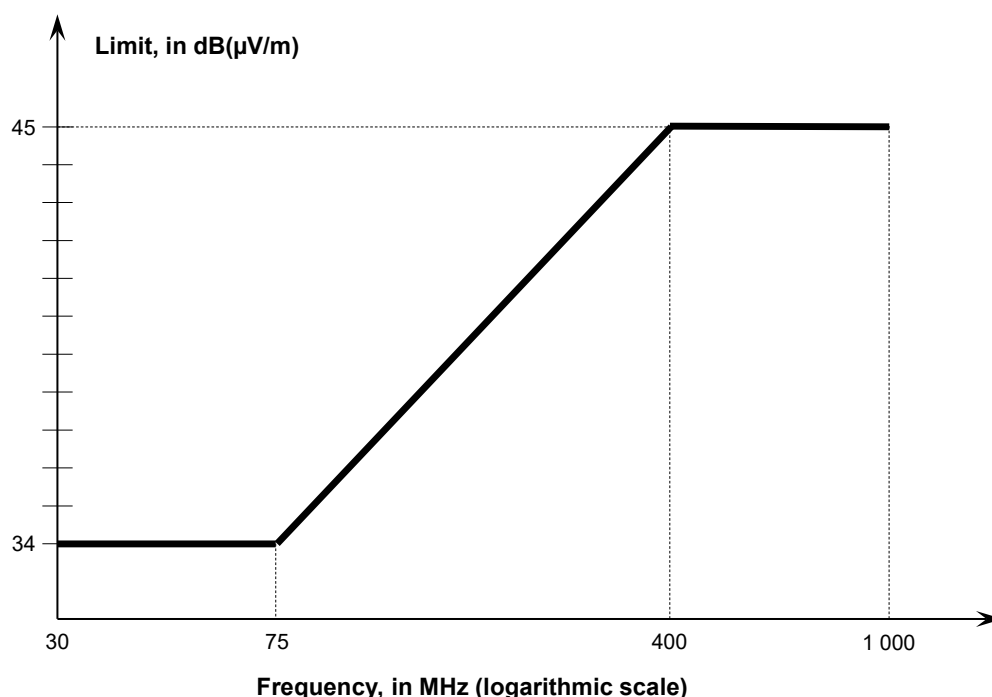


Figure 2 – Quasi-peak limits at 10 m antenna distance

Table 2 – Peak limits at 10 m antenna distance

Frequency MHz	Limit dB(μV/m)		
	Group 1 ("Engine Running")	Group 2 ("Engine Running")	Group 2 ("Charging")
30 to 75	54	47	40
75 to 400	$54 + 15,13 \lg(f/75)$	$47 + 15,13 \lg(f/75)$	$40 + 15,13 \lg(f/75)$
400 to 1 000	65	58	51

Where f is the frequency, in MHz

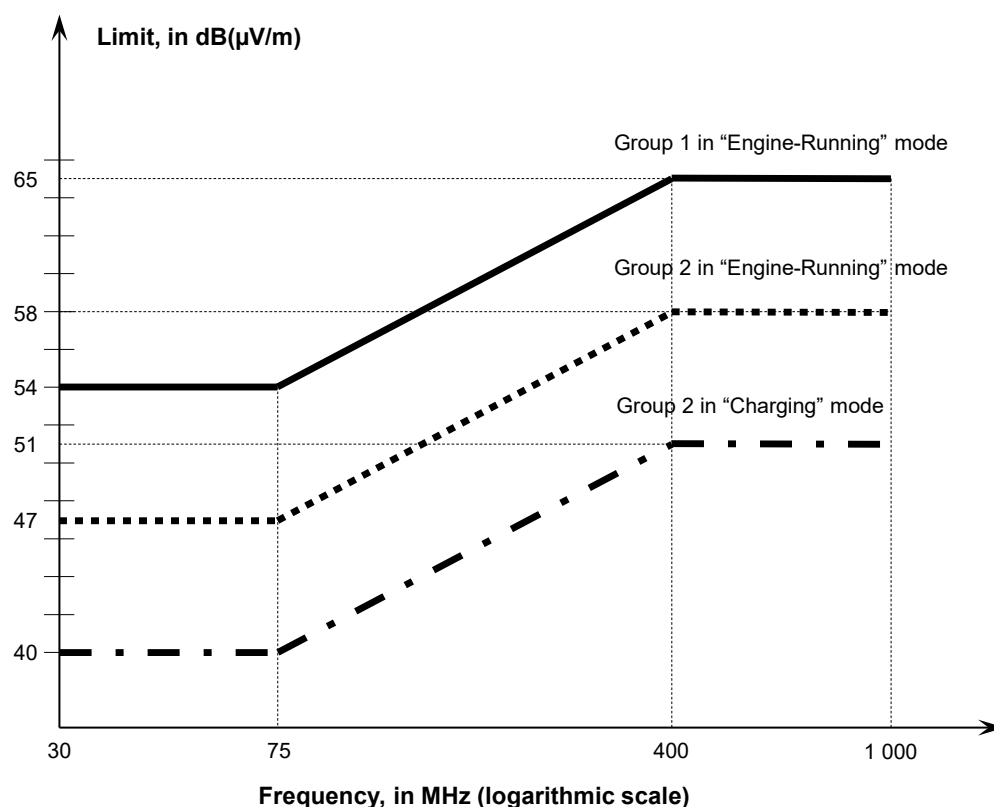


Figure 3 –Peak limits at 10 m antenna distance

4.4 Average detector limit

The limit for emissions measured with the average detector at 10 m antenna distance is specified in Figure 4. 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.

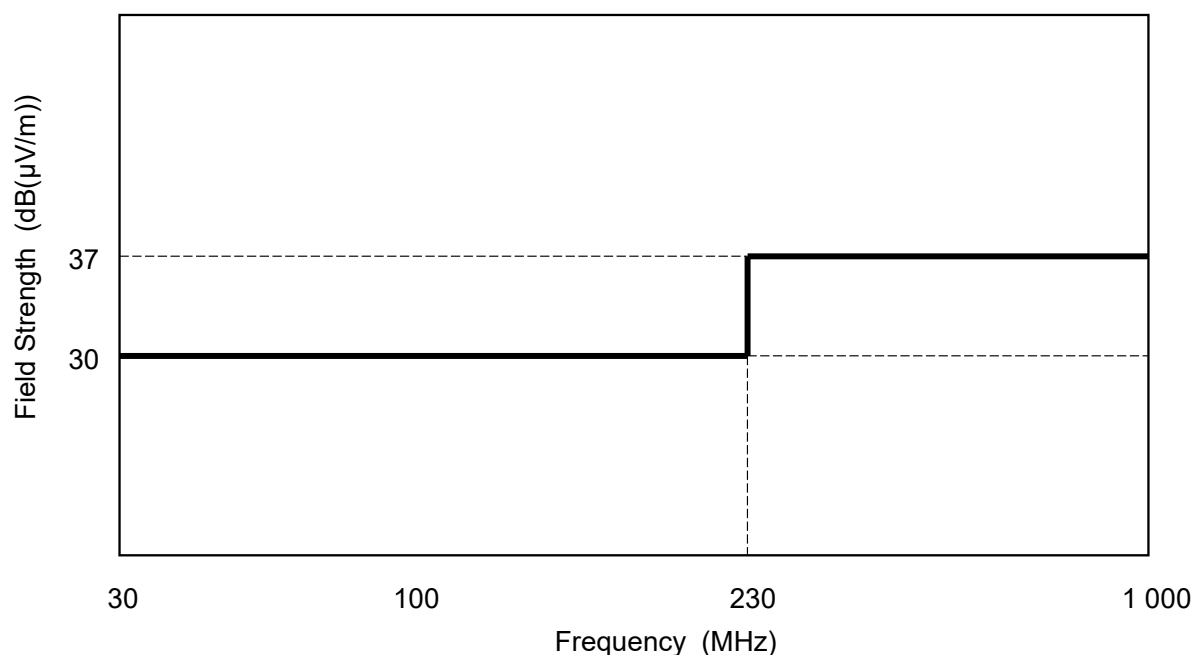


Figure 4 – Limits of disturbance (average detector) at 10 m antenna distance

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 may be used.

A preamplifier may 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 5.3.2.3), 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 3.

Table 3 – Spectrum analyser parameters

Frequency range MHz	Peak detector		Quasi-peak detector		Average detector	
	RBW at –3 dB	Scan time	RBW at –6 dB	Scan time	RBW at –3 dB	Scan time
30 to 1 000	100 kHz or 120 kHz	100 ms / MHz	120 kHz	20 s / MHz	100 kHz or 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 bandwidth (BW), minimum dwell time and maximum step size are listed in Table 4.

Table 4 – 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 of one of the following types:

- tuned dipole antennas;
- biconical antennas;
- log-periodic dipole array (LPDA) antennas;
- hybrid antennas.

Free-space antenna factors are to be used. If a tuned dipole is used the antenna shall be resonant in length for frequencies of 80 MHz or above, and for frequencies below 80 MHz it shall be the length equal to the 80 MHz resonant length. It shall be matched to the characteristic impedance of the antenna cable 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 fully 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 General

Boats, inboard engines, and outboard engines may be tested on either land based or water based sites depending upon site availability.

5.3.2 Outdoor test site (OTS) requirements

5.3.2.1 Land based OTS

This land based OTS may be used for vehicles, boats 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, boat 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 5.

NOTE The site requirements defined in 5.3.2.1 and Figure 5 are the application of CISPR 16-1-4:2019/AMD1:2020 to large automotive objects.

Vehicles, boats and devices smaller than 2 m in length and width may be tested instead on an OTS with dimensions corresponding to Figure 5 or Figure 6 of CISPR 16-1-4:2019/AMD1:2020.. The test equipment / test hut / vehicle containing the test equipment shall be located outside the obstruction-free area depicted in Figure 5 and Figure 6 of CISPR 16-1-4:2019/AMD1:2020.