

**TÖÖSTUS-, TEADUS- JA MEDITSIINISEADMED.  
RAADIOSAGEDUSLIKE HÄIRINGUTE  
TUNNUSSUURUSED. PIIRVÄÄRTUSED JA  
MÕÕTEMEETODID**

**Industrial, scientific and medical equipment - Radio-  
frequency disturbance characteristics - Limits and  
methods of measurement (CISPR 11:2015, modified +  
CISPR 11:2015/A1:2016)**

**EESTI STANDARDI EESSÕNA****NATIONAL FOREWORD**

See Eesti standard EVS-EN 55011:2016+A1:2017 sisaldab Euroopa standardi EN 55011:2016 ingliskeelset teksti ja selle muudatuse A1:2017 ingliskeelset teksti.	This Estonian standard EVS-EN 55011:2016+A1:2017 consists of the English text of the European standard EN 55011:2016 and its amendment A1:2017.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.  Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 01.04.2016, muudatus A1 21.04.2017.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.  Date of Availability of the European standard is 01.04.2016, for A1 21.04.2017.
Sellesse standardisse on muudatus A1 sisse viidud ja tehtud muudatused tähistatud topeltpüstkriipsuga lehe välisveerisel.  Selles standardis on rahvusvahelise standardi ühismuudatused tähistatud püstkriipsuga teksti välimisel veerisel.  Standard on kättesaadav Eesti Standardikeskusest.	The amendment A1 has been incorporated into this standard and changes have been marked by a double vertical line on the outer row of the page.  Common modifications have been incorporated into this international standard and changes have been marked by a vertical line on the outer row of the page.  The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile [standardiosakond@evs.ee](mailto:standardiosakond@evs.ee).

ICS 33.100.10

**Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele**

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega: Koduleht [www.evs.ee](http://www.evs.ee); telefon 605 5050; e-post [info@evs.ee](mailto:info@evs.ee)

**The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation**

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Homepage [www.evs.ee](http://www.evs.ee); phone +372 605 5050; e-mail [info@evs.ee](mailto:info@evs.ee)

English Version

Industrial, scientific and medical equipment -  
Radio-frequency disturbance characteristics -  
Limits and methods of measurement  
(CISPR 11:2015, modified + CISPR 11:2015/A1:2016)

Appareils industriels, scientifiques et médicaux -  
Caractéristiques de perturbations radioélectriques -  
Limites et méthodes de mesure  
(CISPR 11:2015, modifiée + CISPR 11:2015/A1:2016)

Industrielle, wissenschaftliche und medizinische Geräte -  
Funkstörungen - Grenzwerte und Messverfahren  
(CISPR 11:2015, modifiziert + CISPR 11:2015/A1:2016)

This European Standard was approved by CENELEC on 2016-02-15. Amendment A1 was approved by CENELEC on 2016-07-28. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard and its amendment the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard and its Amendment A1 exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

## European foreword

The text of document CISPR/B/628/FDIS, future edition 6 of CISPR 11, prepared by CISPR SC B "Interference relating to industrial, scientific and medical radio-frequency apparatus, to other (heavy) industrial equipment, to overhead power lines, to high voltage equipment and to electric traction" of CISPR "International special committee on radio interference" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 55011:2016.

A draft amendment, which covers common modifications to CISPR 11:2015 (CISPR/B/628/FDIS), was prepared by CLC/TC 210, "Electromagnetic Compatibility (EMC)" and approved by CENELEC.

The following dates are fixed:

- latest date by which the document has to be implemented (dop) 2017-02-15  
at national level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with (dow) 2019-02-15  
the document have to be withdrawn

This document supersedes EN 55011:2009.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in CISPR 11:2015 are prefixed "Z".

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive(s), see informative Annex ZZ, which is an integral part of this document.

## Endorsement notice

The text of the International Standard CISPR 11:2015 was approved by CENELEC as a European Standard with agreed common modifications.

## Amendment 1 European foreword

The text of document CISPR/B/627/CDV, future CISPR 11:2015/A1, prepared by CISPR SC B "Interference relating to industrial, scientific and medical radio-frequency apparatus, to other (heavy) industrial equipment, to overhead power lines, to high voltage equipment and to electric traction" of CISPR "International special committee on radio interference" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 55011:2016/A1:2017.

The following dates are fixed:

- latest date by which the document has to be implemented (dop) 2017-10-21  
at national level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with (dow) 2020-04-21  
the document have to be withdrawn

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

## Endorsement notice

The text of the International Standard CISPR 11:2015/A1:2016 was approved by CENELEC as a European Standard without any modification.

## CONTENTS

FOREWORD .....	8
AMENDMENT 1 FOREWORD .....	10
INTRODUCTION .....	11
INTRODUCTION TO AMENDMENT 1 .....	12
1 Scope .....	13
2 Normative references .....	13
3 Terms and definitions .....	14
4 National measures and frequencies designated for ISM use .....	17
5 Classification of equipment .....	18
5.1 Separation into groups .....	18
5.2 Division into classes .....	19
5.3 Documentation for the user .....	19
6 Limits of electromagnetic disturbances .....	19
6.1 General .....	19
6.2 Group 1 equipment measured on a test site .....	20
6.2.1 Limits for conducted disturbances .....	20
6.2.2 Limits of electromagnetic radiation disturbance .....	23
6.3 Group 2 equipment measured on a test site .....	25
6.3.1 Limits for conducted disturbances .....	25
6.3.2 Limits of electromagnetic radiation disturbance .....	26
6.4 Group 1 and group 2 class A equipment measured in situ .....	32
6.4.1 Limits for conducted disturbances .....	32
6.4.2 Limits of electromagnetic radiation disturbance .....	32
7 Measurement requirements .....	34
7.1 General .....	34
7.2 Ambient noise .....	34
7.3 Measuring equipment .....	35
7.3.1 Measuring instruments .....	35
7.3.2 Artificial network (AN) .....	36
7.3.3 Voltage probe .....	36
7.3.4 Antennas .....	37
7.3.4.2.1 General .....	37
7.3.4.2.2 Open-area test site (OATS) and semi-anechoic chamber (SAC) .....	37
7.3.4.2.3 Fully-anechoic room (FAR) .....	37
7.3.4.2.4 Other sites .....	37
7.3.5 Artificial hand .....	37
7.4 Frequency measurement .....	38
7.5 Configuration of equipment under test .....	38
7.5.1 General .....	38
7.5.2 Interconnecting cables .....	40
7.5.3 Connection to the electricity supply network on a test site .....	41
7.6 Load conditions of equipment under test .....	43
7.6.1 General .....	43
7.6.2 Medical equipment .....	44
7.6.3 Industrial equipment .....	45

7.6.4	Scientific, laboratory and measuring equipment .....	45
7.6.5	Microwave cooking appliances.....	46
7.6.6	Other equipment in the frequency range 1 GHz to 18 GHz.....	46
7.6.7	Electric welding equipment .....	46
7.6.8	ISM RF lighting equipment.....	46
7.6.9	Medium voltage (MV) and high voltage (HV) switchgear .....	46
7.6.10	Grid connected power converters .....	46
7.7	Recording of test-site measurement results .....	47
7.7.1	General .....	47
7.7.2	Conducted emissions.....	47
7.7.3	Radiated emissions .....	47
8	Special provisions for test site measurements (9 kHz to 1 GHz) .....	48
8.1	Ground planes .....	48
8.2	Measurement of conducted disturbances .....	48
8.2.1	General .....	48
8.2.2	Measurements on grid connected power converters.....	49
8.2.3	Handheld equipment which are normally operated without an earth connection .....	53
8.3	OATS and SAC for measurements in the range 9 kHz to 1 GHz .....	53
8.3.1	General .....	53
8.3.2	Validation of the radiation test site (9 kHz to 1 GHz) .....	54
8.3.3	Disposition of equipment under test (9 kHz to 1 GHz) .....	54
8.3.4	Radiation measurements (9 kHz to 1 GHz) .....	55
8.4	Alternative radiation test sites for the frequency range 30 MHz to 1 GHz .....	55
8.5	FAR for measurements in the range 30 MHz to 1 GHz .....	55
9	Radiation measurements: 1 GHz to 18 GHz.....	56
9.1	Test arrangement.....	56
9.2	Receiving antenna .....	56
9.3	Validation and calibration of test site.....	56
9.4	Measuring procedure .....	56
9.4.1	General .....	56
9.4.2	Operating conditions of the EUT .....	57
9.4.3	Preliminary measurement .....	57
9.4.4	Final measurement .....	58
10	Measurement <i>in situ</i> .....	59
11	Safety precautions for emission measurements on ISM RF equipment .....	60
12	Measurement uncertainty .....	60
	Annex A (informative) Examples of equipment classification .....	61
	Annex B (informative) Precautions to be taken in the use of a spectrum analyzer (see 7.3.1).....	63
	Annex C (normative) Measurement of electromagnetic radiation disturbance in the presence of signals from radio transmitters .....	64
	Annex D (informative) Propagation of interference from industrial radio-frequency equipment at frequencies between 30 MHz and 300 MHz .....	65
	Annex E (informative) Recommendations of CISPR for protection of certain radio services in particular areas .....	66
E.1	General.....	66
E.2	Recommendations for protection of safety-related radio services .....	66

E.3	Recommendations for protection of specific sensitive radio services .....	66
Annex F (informative)	Frequency bands allocated for safety-related radio services .....	67
Annex G (informative)	Frequency bands allocated for sensitive radio services .....	68
Annex H (informative)	Statistical assessment of series produced equipment against the requirements of CISPR standards .....	70
H.1	Significance of a CISPR limit .....	70
H.2	Type tests .....	70
H.3	Statistical assessment of series produced equipment .....	70
H.3.1	Assessment based on a general margin to the limit .....	70
H.3.2	Assessment based on the non-central <i>t</i> -distribution .....	71
H.3.3	Assessment based on the binomial distribution .....	73
H.3.4	Equipment produced on an individual basis .....	73
Annex I (normative)	Artificial Network (AN) for the assessment of disturbance voltages at d.c. power ports of semiconductor power converters .....	74
I.1	General information and purpose .....	74
I.2	Structures for a DC-AN .....	74
I.2.1	AN suitable for measurement of unsymmetrical mode (UM) disturbances .....	74
I.2.2	AN suitable for measurement of common mode (CM) and differential mode (DM) disturbances .....	74
I.2.3	AN suitable for measurement of UM, CM and DM disturbances .....	75
I.3	Employment of DC-ANs for compliance measurements .....	75
I.3.1	General .....	75
I.3.2	Pseudo V-AN .....	75
I.3.3	Delta-AN .....	75
I.4	Normative technical requirements for the DC-AN .....	76
I.4.1	Parameters and associated tolerances in the range 150 kHz to 30 MHz .....	76
I.4.2	Parameters and associated tolerances in the range 9 kHz to 150 kHz .....	77
I.5	Examples of practical implementations of DC-ANs .....	77
Annex J (informative)	Measurements on Grid Connected Power Converters (GCPC) – Setups for an effective test site configuration .....	80
J.1	General information and purpose .....	80
J.2	Setup of the test site .....	80
J.2.1	Block diagram of test site .....	80
J.2.2	DC power supply .....	81
J.2.3	AC power source .....	81
J.2.4	Other components .....	82
J.3	Other test setups .....	82
J.3.1	Configuration comprising laboratory AC power source and resistive load .....	82
J.3.2	Configuration in case of reverse power flow to the AC mains .....	83
Annex K (informative)	Test site configuration and instrumentation – Guidance on prevention of saturation effects in mitigation filters of transformer-less power converters during type tests according to this standard .....	85
K.1	General information and purpose .....	85
K.2	Recommendations for avoidance of saturation effects in the range 9 kHz to 150 kHz .....	86
K.3	Detailed advice .....	86
K.3.1	General .....	86
K.3.2	Insert of series inductors (or common mode chokes) in the laboratory's d.c. power supply chain .....	87



K.3.3	Employment of additional common mode decoupling capacitors at the interface between the AE port of the DC-AN and the laboratory d.c. power supply port allocated in the test environment.....	88
K.4	Background information .....	89
Annex ZA (normative)	Normative references to international publications with their corresponding European publications .....	91
Annex ZB (normative)	Frequencies designated on a national basis in CENELEC countries for use as fundamental ISM frequencies .....	93
Annex ZZ (informative)	Coverage of Essential Requirements of EU Directives .....	94
Bibliography	.....	95
Figure 1	– Circuit for disturbance voltage measurements on mains supply .....	36
Figure 2	– Artificial hand, RC element.....	38
Figure 3	– Example for a typical cable arrangement for measurements of radiated disturbances in 3 m separation distance, Table-top EUT .....	39
Figure 4	– Example for a typical test set up for measurement of conducted and/or radiated disturbances from a floor standing EUT, 3D view .....	40
Figure 5	– Disposition of medical (capacitive type) and dummy load .....	44
Figure 6	– Typical arrangement for measurement of conducted disturbances at LV d.c. power ports with the DC-AN used as termination and decoupling unit to the laboratory d.c. power source .....	50
Figure 7	– Typical arrangement for measurement of conducted disturbances at LV d.c. power ports with the DC-AN used as termination and voltage probe .....	51
Figure 8	– Typical arrangement for measurement of conducted disturbances at LV d.c. power ports with the DC-AN used as voltage probe and with a current probe – 2D diagram .....	52
Figure 9	– Typical arrangement for measurement of conducted disturbances at LV d.c. power ports with a DC-AN used as voltage probe and with a current probe – 3D diagram .....	52
Figure 10	– Test site .....	54
Figure 11	– Minimum size of metal ground plane .....	54
Figure 12	– Decision tree for the measurement of emissions from 1 GHz to 18 GHz of group 2 equipment operating at frequencies above 400 MHz .....	57
Figure H.1	– An example of possible difficulties .....	73
Figure I.1	– Practical implementation of a 150 $\Omega$ DC-AN suitable for measurement of UM disturbances (Example) .....	77
Figure I.2	– Practical implementation of a 150 $\Omega$ DC-AN suitable for measurement of CM and DM disturbances (Example, see also Figure A.2 in CISPR 16-1-2:2014).....	78
Figure I.3	– Practical implementation of a 150 $\Omega$ DC-AN suitable for measurement of UM, or CM and DM disturbances (Example 1).....	78
Figure I.4	– Practical implementation of a 150 $\Omega$ DC-AN suitable for measurement of UM, or CM and DM disturbances (Example 2).....	79
Figure I.5	– Practical implementation of a 150 $\Omega$ DC-AN suitable for measurement of UM, or CM and DM disturbances (Example 3).....	79
Figure J.1	– Setup of the test site (Case 1) – 2D diagram .....	80
Figure J.2	– Setup of the test site (Case 1) – 3D diagram .....	81
Figure J.3	– Setup of the test site (Case 2) – 2D diagram .....	82
Figure J.4	– Setup of the test site (Case 2) – 3D diagram .....	83
Figure J.5	– Setup of the test site (Case 3) – 2D diagram .....	84

Figure J.6 – Setup of the test site (Case 3) – 3D diagram .....	84
Figure K.1 – Flow of the common mode RF current at test site configuration level .....	87
Figure K.2 – Blocking of flow of common mode RF current by insert of series inductors.....	88
Figure K.3 – Blocking of flow of common mode RF current by employment of additional CM decoupling capacitors .....	88
Figure K.4 – CM termination impedance at the EUT port of a DC-AN – Magnitude-versus-frequency characteristic in the range 3 kHz to 30 MHz, Example .....	89
Figure K.5 – Prevention of saturation of mitigation filters by use of additional decoupling capacitors .....	90
Figure K.6 – Change in the resonant frequency caused by the increase and decrease in the decoupling capacitor's capacitance .....	90
Figure K.7 – DC-AN circuit example where capacitance of blocking capacitors of the LC decoupling circuit can be increased or decreased .....	90
Table 1 – Frequencies in the radio-frequency (RF) range designated by ITU for use as fundamental ISM frequencies.....	18
Table 2 – Disturbance voltage limits for class A group 1 equipment measured on a test site (a.c. mains power port).....	21
Table 3 – Limits for conducted disturbances of class A group 1 equipment measured on a test site (d.c. power port) .....	22
Table 4 – Disturbance voltage limits for class B group 1 equipment measured on a test site (a.c. mains power port).....	22
Table 5 – Disturbance voltage limits for class B group 1 equipment measured on a test site (d.c. power port) .....	23
Table 6 – Electromagnetic radiation disturbance limits for class A group 1 equipment measured on a test site.....	24
Table 7 – Electromagnetic radiation disturbance limits for class B group 1 equipment measured on a test site.....	25
Table 8 – Disturbance voltage limits for class A group 2 equipment measured on a test site (a.c. mains power port).....	26
Table 9 – Disturbance voltage limits for class B group 2 equipment measured on a test site (a.c. mains power port).....	26
Table 10 – Electromagnetic radiation disturbance limits for class A group 2 equipment measured on a test site.....	28
Table 11 – Electromagnetic radiation disturbance limits for class A EDM and arc welding equipment measured on a test site.....	29
Table 12 – Electromagnetic radiation disturbance limits for class B group 2 equipment measured on a test site.....	30
Table 13 – Electromagnetic radiation disturbance peak limits for group 2 equipment operating at frequencies above 400 MHz .....	31
Table 14 – Electromagnetic radiation disturbance weighted limits for group 2 equipment operating at frequencies above 400 MHz .....	31
Table 15 – Electromagnetic radiation disturbance APD level corresponding to $10^{-1}$ limits for class B group 2 equipment operating at frequencies above 400 MHz.....	32
Table 16 – Electromagnetic radiation disturbance limits for class A group 1 equipment measured <i>in situ</i> .....	32
Table 17 – Electromagnetic radiation disturbance limits for class A group 2 equipment measured <i>in situ</i> .....	33
Table 18 – Frequency sub-ranges to be used for weighted measurements .....	59

Table E.1 – Limits for electromagnetic radiation disturbances for <i>in situ</i> measurements to protect specific safety-related radio services in particular areas .....	66
Table H.1 – General margin to the limit for statistical evaluation .....	70
Table H.2 – The non-central <i>t</i> -distribution factor <i>k</i> as a function of the sample size <i>n</i> .....	72
Table H.3 – Application of the binomial distribution .....	73
Table I.1 – Parameters and associated tolerances in the range 150 kHz to 30 MHz .....	76
Table I.2 – Parameters and associated tolerances in the range 9 kHz to 150 kHz .....	77
Table ZB.1 — Frequencies designated on a national basis in CENELEC countries for use as fundamental ISM frequencies .....	93
Table ZZ.1 — Correspondence between this European Standard and Directive 2004/108/EC .....	94

This document is a preview generated by EVS

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

**INDUSTRIAL, SCIENTIFIC AND MEDICAL EQUIPMENT –  
RADIO-FREQUENCY DISTURBANCE CHARACTERISTICS –  
LIMITS AND METHODS OF MEASUREMENT**

## 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 11 has been prepared by CISPR Subcommittee B: Interference relating to industrial, scientific and medical radio-frequency apparatus, to other (heavy) industrial equipment, to overhead power lines, to high voltage equipment and to electric traction.

This sixth edition cancels and replaces the fifth edition published in 2009 and its Amendment 1 published in 2010. It constitutes a technical revision.

It introduces and permits type testing on components of power electronic equipment, systems and installations. Its emission limits apply now to low voltage (LV) a.c. and d.c. power ports, irrespective of the direction of power transmission. Several limits were adapted to the practical test conditions found at test sites. They are also applicable now to power electronic ISM RF equipment used for wireless power transfer (WPT), for instant power supply and charging purposes. The limits in the range 1 GHz to 18 GHz apply now to CW-type disturbances and to fluctuating disturbances in a similar, uniform and technology-neutral way. For these measurements, two alternative methods of measurement are available, the traditional log-AV method and the new APD method.

For measurements at LV d.c. power ports of power electronic equipment, a modern implementation of the 150  $\Omega$  Delta-network specified in CISPR 16-1-2 has been made available.

This International Standard CISPR 11 has the status of a Product Family EMC standard in accordance with IEC Guide 107, *Electromagnetic compatibility – Guide to the drafting of electromagnetic compatibility publications (2014)*.

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

FDIS	Report on voting
CISPR/B/628/FDIS	CISPR/B/631/RVD

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

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

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://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.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

The main content of this standard is based on CISPR Recommendation No. 39/2 given below:

RECOMMENDATION No. 39/2

**Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment**

The CISPR

CONSIDERING

- that ISM RF equipment is an important source of disturbance;
- that methods of measuring such disturbances have been prescribed by the CISPR;
- that certain frequencies are designated by the International Telecommunication Union (ITU) for unrestricted radiation from ISM equipment,

RECOMMENDS

that the latest edition of CISPR 11 be used for the application of limits and methods of measurement of ISM equipment.

## AMENDMENT 1 FOREWORD

This amendment has been prepared by CISPR Subcommittee B: Interference relating to industrial, scientific and medical radio-frequency apparatus, to other (heavy) industrial equipment, to overhead power lines, to high voltage equipment and to electric traction.

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

CDV	Report on voting
CISPR/B/627/CDV	CISPR/B/639A/RVC

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

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the stability date indicated on the IEC website under "<http://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.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

## INTRODUCTION

This CISPR publication contains, amongst common requirements for the control of RF disturbances from equipment intended for use in industrial, scientific, and medical electrical applications, specific requirements for the control of RF disturbances caused by ISM RF applications in the meaning of the definition of the International Telecommunication Union (ITU), see also Definition 3.13 in this International Standard. CISPR and ITU share their responsibility for the protection of radio services in respect of the use of ISM RF applications.

The CISPR is concerned with the control of RF disturbances from ISM RF applications by means of an assessment of these disturbances either at a standardised test site or, for an individual ISM RF application which cannot be tested at such a site, at its place of operation. Consequently, this CISPR Publication covers requirements for conformity assessment of both, equipment assessed by means of type tests at standardised test sites or of individual equipment under in situ conditions.

The ITU is concerned with the control of RF disturbances from ISM RF applications during normal operation and use of the respective equipment at its place of operation (see Definition 1.15 in the ITU Radio Regulations). There, use of radio-frequency energy decoupled from the ISM RF application by radiation, induction or capacitive coupling is restricted to the location of that individual application.

This CISPR publication contains, in 6.3, the essential emission requirements for an assessment of RF disturbances from ISM RF applications at standardised test sites. These requirements allow for type testing of ISM RF applications operated at frequencies up to 18 GHz. It further contains, in 6.4, the essential emission requirements for an in situ assessment of RF disturbances from individual ISM RF applications in the frequency range up to 1 GHz. All requirements were established in close collaboration with the ITU and enjoy approval of the ITU.

However, for operation and use of several types of ISM RF applications the manufacturer, installer and/or customer should be aware of additional national provisions regarding possible licensing and particular protection needs of local radio services and applications. Depending on the country concerned, such additional provisions may apply to individual ISM RF applications operated at frequencies outside designated ISM bands (see Table 1). They also may apply to ISM RF applications operated at frequencies above 18 GHz. For the latter type of applications, local protection of radio services and appliances requires an accomplishment of the conformity assessment by application of the relevant national provisions in the frequency range above 18 GHz in accordance with vested interests of the ITU and national administrations. These additional national provisions may apply to spurious emissions, emissions appearing at harmonics of the operation frequency, and to wanted emissions at the operation frequency allocated outside a designated ISM band in the frequency range above 18 GHz.

Recommendations of CISPR for the protection of radio services in particular areas are found in Annex E of this International Standard.

Definition 1.15 of the ITU Radio Regulations reads as follows:

**1.15** *industrial, scientific and medical (ISM) applications (of radio frequency energy):* Operation of equipment or appliances designed to generate and use locally radio frequency energy for industrial, scientific, medical, domestic or similar purposes, excluding applications in the field of telecommunications.

[ITU Radio Regulations Volume 1: 2012 – Chapter I, Definition 1.15]

## INTRODUCTION TO AMENDMENT 1

This Amendment introduces the fully-anechoic room (FAR) for measurements of the disturbance field strength in the range 30 MHz to 1 GHz on equipment in the scope of CISPR 11.

It contains the complete set of requirements for measurement of radiated disturbances from equipment fitting into the validated test volume of a given FAR. It specifies a separation distance of 3 m and restricts use of the FAR to measurements on table-top equipment.

At the moment the FAR can be used:

- for measurements on table-top equipment fitting into the validated test volume of the given FAR,
- for a separation distance of 3 m only, and
- if the FAR was validated according to CISPR 16-1-4.

The limits for class A and class B group 1 equipment in this CDV base on the limits in the generic emission standards IEC 61000-6-3:2006/AMD 1 (2010) and IEC 61000-6-4:2006/AMD 1 (2010). The limits for class A and class B group 2 equipment were derived using the same approximation formula as used when deriving the limits for the generic emission standards in mid of the years 2000 to 2010. CISPR/H/104/INF, published in 2005, gives detailed explanations how these limits for the FAR were derived.

More detailed background information is still found in CISPR/B/627/CDV.

CISPR/B WG1 in October 2015



# INDUSTRIAL, SCIENTIFIC AND MEDICAL EQUIPMENT – RADIO-FREQUENCY DISTURBANCE CHARACTERISTICS – LIMITS AND METHODS OF MEASUREMENT

## 1 Scope

This International Standard applies to industrial, scientific and medical electrical equipment operating in the frequency range 0 Hz to 400 GHz and to domestic and similar appliances designed to generate and/or use locally radio-frequency energy.

This standard covers emission requirements related to radio-frequency (RF) disturbances in the frequency range of 9 kHz to 400 GHz. Measurements need only be performed in frequency ranges where limits are specified in Clause 6.

For ISM RF applications in the meaning of the definition found in the ITU Radio Regulations (see Definition 3.13), this standard covers emission requirements related to radio-frequency disturbances in the frequency range of 9 kHz to 18 GHz.

NOTE Emission requirements for induction cooking appliances are specified in CISPR 14-1 [1]<sup>1</sup>.

Requirements for ISM RF lighting equipment and UV irradiators operating at frequencies within the ISM frequency bands defined by the ITU Radio Regulations are contained in this standard.

Equipment covered by other CISPR product and product family emission standards are excluded from the scope of this standard.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CISPR 16-1-1:2010, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus*

CISPR 16-1-1:2010/AMD 1:2010

CISPR 16-1-1:2010/AMD 2:2014

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

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

---

<sup>1</sup> Figures in square brackets refer to the Bibliography.

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 16-2-3:2010, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-3: Methods of measurement of disturbances and immunity – Radiated disturbance measurements*

CISPR 16-2-3:2010/AMD 1:2010

CISPR 16-2-3:2010/AMD 2:2014

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

CISPR 16-4-2:2011/AMD 1:2014

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

IEC 60601-1-2:2014, *Medical electrical equipment – Part 1-2: General requirements for basic safety and essential performance – Collateral standard: Electromagnetic disturbances – Requirements and tests*

IEC 60601-2-2:2009, *Medical electrical equipment – Part 2-2: Particular requirements for the basic safety and essential performance of high frequency surgical equipment and high frequency surgical accessories*

IEC 60974-10:2014, *Arc welding equipment – Part 10: Electromagnetic compatibility (EMC) requirements*

IEC 61307:2011, *Industrial microwave heating installations – Test methods for the determination of power output*

IEC 62135-2:2007, *Resistance welding equipment – Part 2: Electromagnetic compatibility (EMC) requirements*

ITU Radio Regulations (2012), *Radio regulations, Volume 3 – Resolutions and recommendations, Resolution no. 63* (available at <http://www.itu.int/pub/R-REG-RR-2012>)

### **3 Terms and definitions**

For the purposes of this document, the terms and definitions given in IEC 60050-161, as well as the following, apply.

#### **3.1**

##### **a.c. mains power port**

port used to connect to a public low voltage a.c. mains power distribution network or other low voltage a.c. mains installation

#### **3.2**

##### **arc welding equipment**

equipment for applying current and voltage and having the required characteristics suitable for arc welding and allied processes