

FINAL VERSION

VERSION FINALE



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

Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement

Appareils industriels, scientifiques et médicaux – Caractéristiques de perturbations radioélectriques – Limites et méthodes de mesure

CONTENTS

FOREWORD.....	8
INTRODUCTION.....	11
Introduction to Amendment 1	12
Introduction to the Amendment 2	12
1 Scope.....	15
2 Normative references	15
3 Terms and definitions	16
4 Frequencies designated for ISM use.....	19
5 Classification of equipment.....	20
5.1 Separation into groups.....	20
5.2 Division into classes	20
5.3 Documentation for the user	21
6 Limits of electromagnetic disturbances	21
6.1 General.....	21
6.2 Group 1 equipment measured on a test site	22
6.2.1 Limits for conducted disturbances.....	22
6.2.2 Limits of electromagnetic radiation disturbance.....	25
6.3 Group 2 equipment measured on a test site	28
6.3.1 Limits for conducted disturbances.....	28
6.3.2 Limits of electromagnetic radiation disturbance.....	29
6.4 Group 1 and group 2 class A equipment measured in situ	35
6.4.1 Limits for conducted disturbances.....	35
6.4.2 Limits of electromagnetic radiation disturbance.....	35
7 Measurement requirements	38
7.1 General.....	38
7.2 Ambient noise	38
7.3 Measuring equipment.....	39
7.3.1 Measuring instruments.....	39
7.3.2 Artificial network (AN)	39
7.3.3 Voltage probe	40
7.3.4 Antennas	40
7.3.5 Artificial hand	41
7.4 Frequency measurement.....	41
7.5 Configuration of equipment under test.....	42
7.5.1 General	42
7.5.2 Interconnecting cables.....	44
7.5.3 Connection to the electricity supply network on a test site	45
7.6 Load conditions of equipment under test.....	47
7.6.1 General	47
7.6.2 Medical equipment.....	48
7.6.3 Industrial equipment	49
7.6.4 Scientific, laboratory and measuring equipment.....	49
7.6.5 Microwave cooking appliances.....	50
7.6.6 Other equipment in the frequency range 1 GHz to 18 GHz.....	50
7.6.7 Electric welding equipment	50

7.6.8	ISM RF lighting equipment.....	50
7.6.9	Medium voltage (MV) and high voltage (HV) switchgear	50
7.6.10	Grid connected power converters	50
7.7	Recording of test-site measurement results	51
7.7.1	General	51
7.7.2	Conducted emissions.....	51
7.7.3	Radiated emissions	51
8	Special provisions for test site measurements (9 kHz to 1 GHz)	52
8.1	Ground planes	52
8.2	Measurement of conducted disturbances	52
8.2.1	General	52
8.2.2	Measurements on grid connected power converters.....	53
8.2.3	Handheld equipment which are normally operated without an earth connection	57
8.3	OATS and SAC for measurements in the range 9 kHz to 1 GHz	57
8.3.1	General	57
8.3.2	Validation of the radiation test site (9 kHz to 1 GHz)	58
8.3.3	Disposition of equipment under test (9 kHz to 1 GHz)	58
8.3.4	Radiation measurements (9 kHz to 1 GHz)	59
8.4	Alternative radiation test sites for the frequency range 30 MHz to 1 GHz	59
8.5	FAR for measurements in the range 30 MHz to 1 GHz	59
9	Radiation measurements: 1 GHz to 18 GHz.....	60
9.1	Test arrangement.....	60
9.2	Receiving antenna	60
9.3	Validation and calibration of test site.....	60
9.4	Measuring procedure	60
9.4.1	General	60
9.4.2	Operating conditions of the EUT	61
9.4.3	Peak measurements	61
9.4.4	Weighted measurements	62
10	Measurement <i>in situ</i>	63
11	Safety precautions for emission measurements on ISM RF equipment	64
12	Measurement uncertainty	64
	Annex A (informative) Examples of equipment classification	65
	Annex B (informative) Precautions to be taken in the use of a spectrum analyzer (see 7.3.1).....	67
	Annex C (normative) Measurement of electromagnetic radiation disturbance in the presence of signals from radio transmitters.....	68
	Annex D (informative) Propagation of interference from industrial radio-frequency equipment at frequencies between 30 MHz and 300 MHz	69
	Annex E (informative) Recommendations of CISPR for protection of certain radio services in particular areas	70
	E.1 General.....	70
	E.2 Recommendations for protection of safety-related radio services	70
	E.3 Recommendations for protection of specific sensitive radio services	70
	Annex F (informative) Frequency bands allocated for safety-related radio services.....	71
	Annex G (informative) Frequency bands allocated for sensitive radio services	72
	Annex H (informative) Statistical assessment of series produced equipment against the requirements of CISPR standards	74

H.1	Significance of a CISPR limit	74
H.2	Type tests	74
H.3	Statistical assessment of series produced equipment.....	74
H.3.1	Assessment based on a general margin to the limit	74
H.3.2	Assessment based on the non-central <i>t</i> -distribution	75
H.3.3	Assessment based on the binomial distribution.....	77
H.3.4	Equipment produced on an individual basis	78
Annex I (normative) Artificial Network (AN) for the assessment of disturbance voltages at d.c. power ports of semiconductor power converters		79
I.1	General information and purpose	79
I.2	Structures for a DC-AN	79
I.2.1	AN suitable for measurement of unsymmetrical mode (UM) disturbances	79
I.2.2	AN suitable for measurement of common mode (CM) and differential mode (DM) disturbances.....	79
I.2.3	AN suitable for measurement of UM, CM and DM disturbances	80
I.3	Employment of DC-ANs for compliance measurements	80
I.3.1	General	80
I.3.2	Pseudo V-AN.....	80
I.3.3	Delta-AN.....	80
I.4	Normative technical requirements for the DC-AN	81
I.4.1	Parameters and associated tolerances in the range 150 kHz to 30 MHz	81
I.4.2	Parameters and associated tolerances in the range 9 kHz to 150 kHz	82
I.5	Examples of practical implementations of DC-ANs	82
Annex J (informative) Measurements on Grid Connected Power Converters (GCPC) – Setups for an effective test site configuration.....		85
J.1	General information and purpose	85
J.2	Setup of the test site	85
J.2.1	Block diagram of test site	85
J.2.2	DC power supply	86
J.2.3	AC power source	86
J.2.4	Other components	87
J.3	Other test setups	87
J.3.1	Configuration comprising laboratory AC power source and resistive load.....	87
J.3.2	Configuration in case of reverse power flow to the AC mains	88
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.....		90
K.1	General information and purpose	90
K.2	Recommendations for avoidance of saturation effects in the range 9 kHz to 150 kHz	91
K.3	Detailed advice	91
K.3.1	General	91
K.3.2	Insert of series inductors (or common mode chokes) in the laboratory's d.c. power supply chain	92
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.....	93

K.4	Background information	94
	Bibliography.....	96
Figure 1	– Circuit for disturbance voltage measurements on mains supply	40
Figure 2	– Artificial hand, RC element.....	41
Figure 3	– Example for a typical cable arrangement for measurements of radiated disturbances in 3 m separation distance, Table-top EUT	43
Figure 4	– Example for a typical test set up for measurement of conducted and/or radiated disturbances from a floor standing EUT, 3D view	44
Figure 5	– Disposition of medical (capacitive type) and dummy load	48
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	54
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	55
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	56
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	56
Figure 10	– Test site	58
Figure 11	– Minimum size of metal ground plane	58
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	61
Figure H.1	– An example of possible difficulties	77
Figure I.1	– Practical implementation of a 150 Ω DC-AN suitable for measurement of UM disturbances (Example)	82
Figure I.2	– Practical implementation of a 150 Ω DC-AN suitable for measurement of CM and DM disturbances (Example, see also Figure A.2 in CISPR 16-1-2:2014)	83
Figure I.3	– Practical implementation of a 150 Ω DC-AN suitable for measurement of UM, or CM and DM disturbances (Example 1).....	83
Figure I.4	– Practical implementation of a 150 Ω DC-AN suitable for measurement of UM, or CM and DM disturbances (Example 2).....	84
Figure I.5	– Practical implementation of a 150 Ω DC-AN suitable for measurement of UM, or CM and DM disturbances (Example 3).....	84
Figure J.1	– Setup of the test site (Case 1) – 2D diagram	85
Figure J.2	– Setup of the test site (Case 1) – 3D diagram	86
Figure J.3	– Setup of the test site (Case 2) – 2D diagram	87
Figure J.4	– Setup of the test site (Case 2) – 3D diagram	88
Figure J.5	– Setup of the test site (Case 3) – 2D diagram	89
Figure J.6	– Setup of the test site (Case 3) – 3D diagram	89
Figure K.1	– Flow of the common mode RF current at test site configuration level	92
Figure K.2	– Blocking of flow of common mode RF current by insert of series inductors.....	93
Figure K.3	– Blocking of flow of common mode RF current by employment of additional CM decoupling capacitors	93
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	94

Figure K.5 – Prevention of saturation of mitigation filters by use of additional decoupling capacitors 95

Figure K.6 – Change in the resonant frequency caused by the increase and decrease in the decoupling capacitor's capacitance 95

Figure K.7 – DC-AN circuit example where capacitance of blocking capacitors of the LC decoupling circuit can be increased or decreased..... 95

Table 1 – Frequencies in the radio-frequency (RF) range designated by ITU for use as fundamental ISM frequencies..... 20

Table 2 – Disturbance voltage limits for class A group 1 equipment measured on a test site (a.c. mains power port)..... 23

Table 3 – Limits for conducted disturbances of class A group 1 equipment measured on a test site (d.c. power port) 24

Table 4 – Disturbance voltage limits for class B group 1 equipment measured on a test site (a.c. mains power port)..... 24

Table 5 – Disturbance voltage limits for class B group 1 equipment measured on a test site (d.c. power port) 25

Table 6 – Electromagnetic radiation disturbance limits for class A group 1 equipment measured on a test site..... 27

Table 7 – Electromagnetic radiation disturbance limits for class B group 1 equipment measured on a test site..... 27

Table 8 – Disturbance voltage limits for class A group 2 equipment measured on a test site (a.c. mains power port)..... 29

Table 9 – Disturbance voltage limits for class B group 2 equipment measured on a test site (a.c. mains power port)..... 29

Table 10 – Electromagnetic radiation disturbance limits for class A group 2 equipment measured on a test site..... 31

Table 11 – Electromagnetic radiation disturbance limits for class A EDM and arc welding equipment measured on a test site..... 32

Table 12 – Electromagnetic radiation disturbance limits for class B group 2 equipment measured on a test site..... 33

Table 13 – Electromagnetic radiation disturbance peak limits for group 2 equipment operating at frequencies above 400 MHz 34

Table 14 – Electromagnetic radiation disturbance weighted limits for group 2 equipment operating at frequencies above 400 MHz 34

Table 15 – Electromagnetic radiation disturbance APD level corresponding to 10^{-1} limits for class B group 2 equipment operating at frequencies above 400 MHz 35

Table 16 – Electromagnetic radiation disturbance limits for class A group 1 equipment measured *in situ* 36

Table 17 – Electromagnetic radiation disturbance limits for class A group 2 equipment measured *in situ* 37

Table 19 – Applicability of measurements at d.c. power ports 25

Table 20 – Frequency sub-ranges to be used for weighted measurements..... 62

Table E.1 – Limits for electromagnetic radiation disturbances for *in situ* measurements to protect specific safety-related radio services in particular areas..... 70

Table H.1 – General margin to the limit for statistical evaluation 75

Table H.2 – The non-central *t*-distribution factor *k* as a function of the sample size *n* 76

Table H.3 – Application of the binomial distribution 78

Table I.1 – Parameters and associated tolerances in the range 150 kHz to 30 MHz 81

Table I.2 – Parameters and associated tolerances in the range 9 kHz to 150 kHz 82

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.

DISCLAIMER

This Consolidated version is not an official IEC Standard and has been prepared for user convenience. Only the current versions of the standard and its amendment(s) are to be considered the official documents.

This Consolidated version of CISPR 11 bears the edition number 6.2. It consists of the sixth edition (2015-06) [documents CISPR/B/628/FDIS and CISPR/B/631/RVD], its amendment 1 (2016-06) [documents CISPR/B/627/CDV and CISPR/B/639A/RVC] and its amendment 2 (2019-01) [documents CIS/B/715A/FDIS and CIS/B/719/RVD]. The technical content is identical to the base edition and its amendments.

This Final version does not show where the technical content is modified by amendments 1 and 2. A separate Redline version with all changes highlighted is available in this publication.

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 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 Ω 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)*.

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

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the stability date indicated on the IEC web site 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

- a) that ISM RF equipment is an important source of disturbance;
- b) that methods of measuring such disturbances have been prescribed by the CISPR;
- c) 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.

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

Introduction to the Amendment 2

This AMD 2 combines the contents of two fragments which have been circulated as CIS/B/688/CDV (f2) and CIS/B/697/CDV (f3).

Fragment 2: Requirements for semiconductor power converters (SPC)

CISPR 11 Ed. 6.1 needs to be supplemented with further information for full inclusion of type test requirements for SPCs specified hereafter. These requirements apply only to the following types of equipment:

- a) power conversion equipment intended for assembly into photovoltaic power generating systems, such as grid connected power converters (GCPCs) and d.c. to d.c. converters,
- b) GCPCs intended for assembly into energy storage systems.

Fragment 3: Improvement of repeatability for measurements in the frequency range 1-18 GHz

Based on the comments from the National Committees on CIS/B/662/DC, CIS/B/WG1 decided on its meeting in Hangzhou 2016 to amend the test procedure for group 2 equipment in the frequency range 1 to 18 GHz for the following reasons:

- a) CISPR 11 allows final measurements on group 2 equipment operating at frequencies above 400 MHz with two different weighting functions, the traditional "LogAV detector" with a video bandwidth of 10 Hz and the new APD method, where the Amplitude Probability Distribution is evaluated.

With the alignment of emission requirements for sources of fluctuating emissions with those generating CW-type emissions (Fraction 4 of the last general maintenance of CISPR 11) for

most of the frequency range 1 to 18 GHz the peak detector is used mostly for preliminary measurements, while the number of final measurements with the LogAV detector has been increased from 2 frequencies to max. 7 frequencies.

In parallel, with fraction 3, the APD detector has been introduced, but only with the traditional 2 final frequencies (one in the range 1 GHz to 2.4 GHz and one in the range 2,5 GHz to 18 GHz).

The number of final frequencies to be measured should be aligned for both weighting functions.

- b) During practical measurements cases have been observed, where the critical frequency changed between preliminary and final measurement by more than 5 MHz. The range of 10 MHz for weighted measurements (± 5 MHz from highest peak emission) seems therefore not always to be sufficient.

An extension of this frequency range seems advisable and could increase the repeatability.

In the range 11,7 to 12,7 GHz, an EUT fails immediately if one peak exceeds the limit of 73 dB[μ V/m]. Observations on a big number of different microwave ovens have shown that during the final measurement (at least 2 min) such peaks may occur very seldom, and with a very short duration, and an estimated overall duration of less than 1 % of the measuring time.

A state-of-the-art digital communication service should be able to tolerate such peaks. Meanwhile, in countries where broadcasting systems, which are already standardized and widely spread and is difficult to avoid disturbance by such peaks, are under operation, additional limits could be separately introduced as necessary.

- c) The repeatability of the peak measurement on microwave ovens is poor. Moreover, the sheer height of the highest peak emission, without information on its duration and repetition rate, provides very limited information on the real disturbance potential.

Measurements with both of the weighting methods have a significantly better repeatability and should, by their physical nature, give a better judgement for the disturbing potential of the EUT on digital radio services.

- d) The conditions for preliminary and final measurements became ambiguous in Edition 6.0 (CISPR 11:2015), particularly regarding the required test time. Furthermore, it has been found that, in some cases, a duration of 20 s for the preliminary peak measurement may not be enough. To further increase the repeatability, WG1 decided not to divide the peak measurements anymore into preliminary and final measurements, but to require a 2-minute max hold peak measurement at every azimuth.

CISPR SC/B WG1 agreed to present the following proposals to the National Committees:

- 1) Define the same 7 final frequency ranges for the APD method as already defined for the LogAV method (detector).
- 2) Extend the frequency range for the final weighted measurement to 20 MHz.

For the APD method this would mean to measure on 5 final frequencies, the critical frequency itself, ± 5 MHz and ± 10 MHz.

For the LogAV detector, the requirement remains to perform for the final measurements at least 5 consecutive sweeps in max hold mode. The test time increases accordingly, and coverage of the fluctuations is the same as before.

- 3) Change the peak limit in Table 13 to a constant value of 70 dB[μ V/m] throughout the frequency range and replace the requirement of a final peak measurement in the range 11,7 GHz to 12,7 GHz by a requirement of an additional weighted measurement at the frequency of the highest peak emission in this range. This may lead to a maximum of 8 final weighted measurements.

- 4) Discard the distinction between preliminary and final peak measurements and make instead the peak measurements on all azimuths for 2 minutes.

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]¹.

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

¹ Figures in square brackets refer to the Bibliography.