

INTERNATIONAL STANDARD

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AMENDMENT 2
AMENDEMENT 2

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

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





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

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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 amendment is based on the following documents:

FDIS	Report on voting
CIS/B/715A/FDIS	CIS/B/719/RVD

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,
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Introduction to the amendment

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.

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[CISPR 11:2015/AMD2:2019](https://standards.iteh.ai/catalog/standards/sist/95d0edf8-80f2-43df-84e0-600832eca57b/cispr-11-2015-amd2-2019)

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3 Terms and definitions

Add, after the existing definition 3.22 in CISPR 11:2015/AMD1:2016, the following new term and definition:

3.23

power conversion equipment

electrical device converting one form of electrical power to another form of electrical power with respect to voltage, current, frequency, phase and the number of phases

[SOURCE: IEC 62920:2017 3.3]

6.2.1.1 General

Replace the last paragraph by the following new paragraph:

The limits for the LV d.c. power ports specified hereafter apply only to the following types of equipment:

- a) power conversion equipment intended for assembly into photovoltaic power generating systems;
- b) grid connected power converters (GCPCs) intended for assembly into energy storage systems.

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6.2.1.3 Frequency range 150 kHz to 30 MHz

Add the following new paragraph and the new Table 19 after Table 5:

For measurements at LV d.c. power ports, the applicability criteria in accordance with Table 19 apply.

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

Cable length L	Class B group 1 equipment	Class A group 1 equipment
$L < 3$ m	No measurements are required	No measurement are required
$3 \text{ m} \leq L < 30$ m	For measurements, the limits in Table 5 apply The frequency range for measurement starts at a frequency equal to: $f(\text{MHz}) = 60/L$	For measurements, the limits in Table 3 apply ^{a)} The frequency range for measurement starts at a frequency equal to: $f(\text{MHz}) = 60/L$
$L \geq 30$ m	For measurements, the limits in Table 5 apply	For measurements, the limits in Table 3 apply ^{a)}

L : maximum length of a cable (in metres) connected to an LV d.c. power port, and provided with the product or as specified by manufacturer. Where no maximum cable length is specified, L shall be considered as longer than 30 m.

This table applies unless specific conditions are given in the applicable product standard leading at least to the same level of protection of radio reception. Product standards may define specific conditions according to their particular application with the purpose of avoiding radiation.

^{a)} No limits apply if the equipment is installed using good engineering practice regarding EMC.
Examples of good engineering practice are:

- symmetrical d.c. port line configuration,
- installation internal to the building,
- grounded metallic cable trays,
- use of shielded cables,
- manage a separation distance that acts as a barrier from residential environment (eg. greater than 30 m).

If exception ^{a)} is used, the installer may refer to CISPR 11 for in-situ measurement.

<https://standards.iteh.ai/catalog/standards/sist/95d0edf8-80f2-43df-84e0-600832eca57b/cispr-11-2015-amd2-2019>

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

Replace the existing table by the following new table:

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

Frequency range GHz	Limits for a measurement distance of 3 m Peak dB(µV/m)	
	Class A	Class B
1 – 18	82 ^{a)}	70
Within harmonic frequency bands	82 ^{a)}	70
Outside harmonic frequency bands	70	70

Peak measurements with a resolution bandwidth of 1 MHz and a video signal bandwidth (VBW) higher than or equal to 1 MHz. The recommended VBW is 3 MHz.

NOTE In this table, “harmonic frequency bands” means the frequency bands which are multiples of the ISM bands allocated above 1 GHz.

^{a)} At the upper and lower edge frequency of harmonic frequency bands, the more stringent limit of 70 dB(µV/m) applies.

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

Replace the existing table by the following new table:

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

Frequency range GHz	Limits for a measuring distance of 3 m weighted dB(μ V/m)
1 – 2,4	60
2,5 – 5,725	60
5,875 – 18	60

Weighted measurements shall be performed with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

To check conformance with the limits of this table, weighted measurements shall be performed in all the following frequency ranges, in which the limit of Table 13 was exceeded during the peak measurement:

a) 1,0 GHz – 2,4 GHz ^a;

b) 2,5 GHz – 6,125 GHz (outside the band 5,72 GHz – 5,88 GHz) ^a;

c) 6,125 GHz – 8,575 GHz;

d) 8,575 GHz – 11,025 GHz;

e) 11,025 GHz – 13,475 GHz ^b;

f) 13,475 GHz – 15,925 GHz;

g) 15,925 GHz – 18,0 GHz ^a.

At sub-ranges where the limit of Table 13 was exceeded, a weighted measurement shall be performed with a span of 20 MHz around the centre frequency adjusted to the frequency of the highest disturbance level in the respective sub-range.

^a In cases where the frequency of highest emission during peak measurement is found closer than 10 MHz from the frequency edges 1 GHz, 2,4 GHz, 2,5 GHz, 5,72 GHz, 5,88 GHz or 18 GHz, the span for weighted measurements shall remain 20 MHz, but in such a case, the centre frequency shall be adjusted so that the frequency edges are not exceeded.

^b In any case, a final weighted measurement shall be performed at the frequency of the highest emission, which exceeds the limit of Table 13 in the frequency range 11,7 GHz – 12,7 GHz for satellite downlink. If the highest disturbance level in this sub-range is outside of the range for satellite downlink, in this sub-range two final measurements shall be performed

NOTE See Annex B for further guidance on the use of the spectrum analyzer.

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

Replace the existing table by the following new table:

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

Frequency range GHz	Limits for a measurement distance of 3 m APD level corresponding to 10^{-1} dB(μ V/m)
1 – 2,4	70
2,5 – 5,725	70
5,875 – 18	70

To check conformance with the limits of this table, APD measurements shall be performed in all the following frequency sub-ranges, in which the limit of Table 13 was exceeded during the peak measurement:

- a) 1,0 GHz – 2,4 GHz ^a;
- b) 2,5 GHz – 6,125 GHz (outside the band 5,72 GHz – 5,88 GHz) ^a;
- c) 6,125 GHz – 8,575 GHz;
- d) 8,575 GHz – 11,025 GHz;
- e) 11,025 GHz – 13,475 GHz ^b;
- f) 13,475 GHz – 15,925 GHz;
- g) 15,925 GHz – 18,0 GHz ^a.

Final APD measurements shall be performed at 5 frequencies as explained in 9.4.4.2.3.

^a In cases where the frequency of highest emission during peak measurement is found closer than 10 MHz from the frequency edges 1 GHz, 2,4 GHz, 2,5 GHz, 5,72 GHz, 5,88 GHz or 18 GHz, final APD measurements shall be omitted at frequencies outside the bands, for which limits are defined.

^b In any case, final APD measurements shall be performed around the frequency of the highest emission, which exceeds the limit of Table 13 in the frequency range 11,7 GHz – 12,7 GHz for satellite downlink. If the highest disturbance level in this sub-range is outside of the range for satellite downlink, in this sub-range two final measurements shall be performed

NOTE An APD level corresponding to 10^{-1} means that the amplitude of the disturbance exceeds the specified level during the observation time with a probability of 10 %.

8.2.2.2.1 General

Replace the 1st paragraph by the following new paragraph:

Measurements at d.c. power ports only need to be performed on the following types of equipment:

- a) power conversion equipment intended for assembly into photovoltaic power generating systems;
- b) grid connected power converters (GCPCs) intended for assembly into energy storage systems.

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

Replace the existing figure by the following new figure:

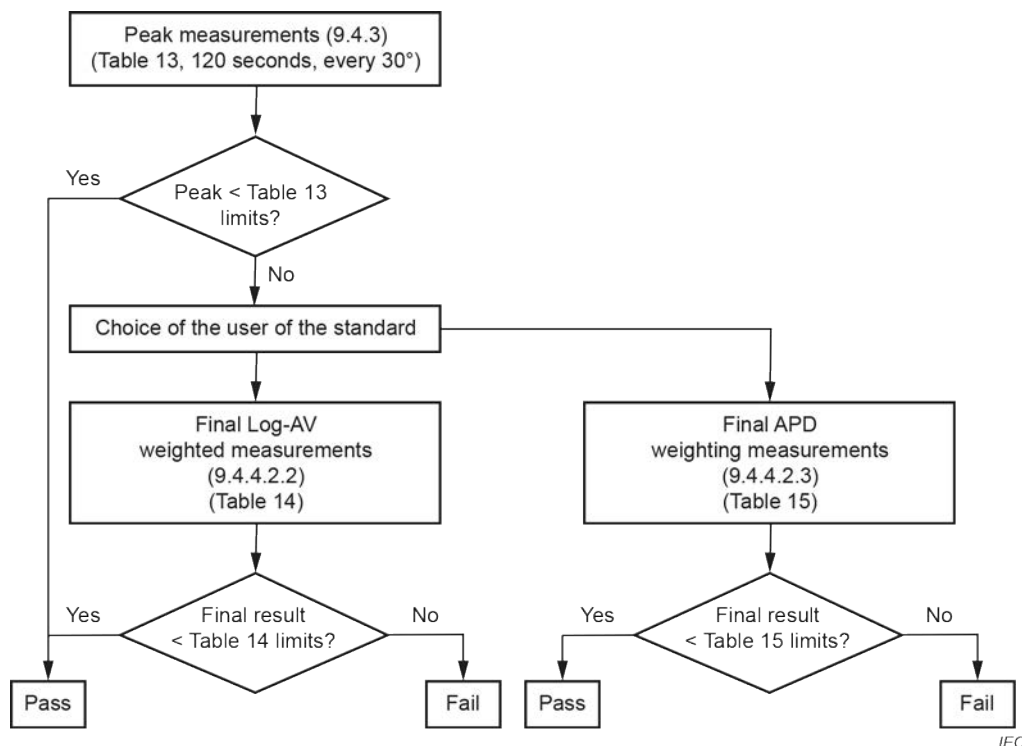


Figure 12 – Decision tree for the measurement of emissions from 1 GHz to 18 GHz of group 2 equipment operating at frequencies above 400 MHz

9.4.3 Preliminary measurements

Replace the existing title and text of 9.4.3 by the following new title and text:
<http://standards.iteh.ai/catalog/standards/cispr/600832eca57b/cispr-11-2015-amd2-2019>

9.4.3 Peak measurements

Peak measurements in the range above 1 GHz shall be made for both polarizations of the antenna with the azimuth of the EUT varying every 30° (starting position perpendicular to the front surface plane of the EUT, i.e. in a position perpendicular to the front door, in case of microwave ovens). At each of these 12 positions, a measurement in maximum-hold mode over the full frequency range 1 GHz to 18 GHz shall be made for a period of 2 min.

During the measurement, the water load should be exchanged to cold water before it starts to boil. The measurement at the particular frequency where this happened needs to be re-started.

NOTE 1 If the measurements are carried out in frequency subranges, the measurement time for each subrange is accordingly shorter. For example, the measuring time for a subrange 1 GHz to 2,4 GHz would be about 10s and the time for a subrange 2,5 GHz to 18 GHz would be about 110 s.

If the emissions from the EUT in this frequency range are very stable, the measurement time at each azimuth/polarization may be reduced, e.g. to 20 s.

The obtained measurement result(s) shall be compared to the peak limit (see Table 13).

If the EUT passes the peak measurement, then the final test result is PASS, see Figure 12.

If the EUT does not pass the peak measurement, final weighted measurements shall be carried out, see Figure 12.