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Interference-Causing Equipment Standard

Industrial, Scientific and Medical (ISM) Equipment

Preface

Interference-Causing Equipment Standard ICES-001, issue 5, *Industrial, Scientific and Medical (ISM) Equipment*, replaces ICES-001, issue 4, *Industrial, Scientific and Medical (ISM) Radio Frequency Generators*, published in June 2006 and updated in November 2014.

This issue of the ICES-001 standard will come into force upon its publication on the Innovation, Science, and Economic Development Canada (ISED) website. However, a transition period is provided, according to section 2.1, within which compliance with either issue 4 or issue 5 of ICES-001 is accepted.

Listed below are the changes:

1. changed title from *Industrial, Scientific and Medical (ISM) Radio Frequency Generators* to *Industrial, Scientific and Medical (ISM) Equipment*
2. included specific requirements for induction cooking appliances, which were in the scope of edition 4 of CISPR 11 (referenced in ICES-001, issue 4), but were removed from the scope of the edition 6.1 of CISPR 11 (referenced in this issue) (section 1.1 and 3.3)
3. added requirements for ISM equipment with wireless power transfer functionality (section 1.2)
4. added an exemption for external power supplies or converters that are not incorporated in a piece of equipment, when they are subject to and have been demonstrated to comply with another ISED standard (section 1.4)
5. added an exemption for ISM equipment that is covered under another ICES standard (section 1.4)
6. removed requirements that are specified in ICES-Gen and referred to ICES-Gen for all general requirements (section 2.2)

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3. By email to ic.consultationradiostandards-consultationnormesradio.ic@canada.ca

Comments and suggestions for improving this standard may be submitted online using the [Standard Change Request](#) form or by mail or email to the above addresses.

All spectrum and telecommunications related documents are available on ISED's [Spectrum Management and Telecommunications](#) website.

Issued under the authority of
the Minister of Innovation, Science and Industry

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Director General
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1. Scope

This section defines the scope of this standard, including both the general scope as well as special considerations for specific equipment types.

1.1 General

This Interference-Causing Equipment Standard (ICES) sets the minimum requirements applicable to industrial, scientific and medical (ISM) equipment. These requirements include limits for and methods of measurement of radiated and conducted radio frequency emissions produced by ISM equipment, as well as administrative requirements applicable to such equipment.

ISM equipment is defined as interference-causing equipment that generates and/or uses radio frequency energy locally for industrial, scientific, medical, domestic or similar purposes, excluding applications in the field of telecommunications, information technology and other applications covered by other Innovation, Science and Economic Development Canada (ISED) standards.

The scope of ICES-001 covers the following:

- a. All types of equipment that are in the scope of the CSA CISPR 11:19 standard (for a non-exhaustive list of examples of such equipment see Annex A of CSA CISPR 11:19), except if otherwise stated within this standard.
- b. ISM equipment that is not covered by the scope of the CSA CISPR 11:19 standard due to the application of another CISPR product standard and which is not under the scope of another ISED standard, such as induction cooking and ultrasonic humidifiers. For example, induction cooking appliances and ultrasonic humidifiers are excluded from the scope of CSA CISPR 11:19 because they are now subject to CISPR 14-1. However, CISPR 14-1 has not been adopted by ISED as a regulatory requirement in Canada. As such, these types of ISM equipment remain within the scope of ICES-001.

1.2 ISM equipment with wireless power transfer functionality

Wireless power transfer (WPT) is an ISM function. However, equipment having WPT functionality is subject to Radio Standard Specifications RSS-216, [Wireless Power Transfer Devices](#), rather than ICES-001. RSS-216 refers to ICES-001 for some of the applicable limits and measurement methods. Nonetheless, the regulatory standard applicable to wireless power transfer devices is RSS-216.

Equipment that includes functionality for both WPT and some other ISM function shall meet the provisions and requirements of both this standard and RSS-216, while in the corresponding mode of operation, i.e. ISM mode (other than WPT) and wireless power transfer mode, respectively.

1.3 ISM equipment that incorporates wireless modules

ISM equipment that includes functionality for radio communication shall meet the provisions and requirements of both this standard and relevant [RSSs](#), as applicable to the specific radiocommunication technology. A reference to the corresponding RSS report within the ICES-001 report will fulfil this requirement for the purpose of this standard.

However, where the radio functionality is achieved by integrating an already certified radio module, there is no need for a reference to the corresponding RSS report. Instead, the ICES-001 report shall demonstrate the product's compliance with the requirements applicable to the host of an already certified radio module, in accordance with Radio Standards Procedure RSP-100, [Certification of Radio Apparatus and Broadcasting Equipment](#), and RSS-Gen, [General Requirements for Compliance of Radio Apparatus](#). These include compliance with RSS-102, [Radio Frequency \(RF\) Exposure Compliance of Radiocommunication Apparatus \(All Frequency Bands\)](#), for RF exposure, and specific labelling requirements for the host product.

1.4 Exemption from the scope of ICES-001

Switched mode power supplies and semiconductor power converters, when not incorporated in a piece of equipment, are under the scope of CSA CISPR 11:19 (these are classified as group 1 ISM equipment, in accordance with Annex A of CSA CISPR 11:19). However, if such power supplies or converters have already been tested and are in compliance with another ISED standard, they are exempt from ICES-001. For example, external power supply/converter for information technology equipment (subject to [ICES-003](#)) or for lighting equipment (subject to [ICES-005](#)), if they have been tested and are in compliance with ICES-003 and ICES-005, respectively, then they are exempt from ICES-001.

This exemption also applies to power supplies/converters intended for charging electrical vehicles, boats or devices subject to [ICES-002](#) provided they were tested and are in compliance with ICES-002; otherwise, such power supplies/converters shall comply with ICES-001.

ISM equipment covered under another ICES standard is also excluded from ICES-001. For example, thermostats are “control equipment,” which is listed under the examples of group 1 equipment in Annex A of CSA CISPR 11:19. However, thermostats fall under ICES-003 (when external to the heating/cooling appliance), and are therefore excluded from the scope of ICES-001.

2. General requirements and references

This section defines the general requirements related to this standard, including the transition period, compliance with ICES-Gen, and the list of normative references.

2.1 Transition period

A transition period is provided, ending one year after the publication of this standard (i.e. on July, 23 2021), within which compliance with either issue 4 or issue 5 of ICES-001 is accepted. A copy of issue 4 of ICES-001 may be requested by [email](#).

After the expiry of this transition period, all products subject to this standard that continue to be manufactured, imported, distributed, leased, offered for sale, or sold in Canada shall comply with issue 5 of ICES-001.

2.2 ICES-Gen compliance

In addition to this standard, the requirements of ICES-Gen, [*General Requirements for Compliance of Interference-Causing Equipment*](#), shall apply, except where a requirement in ICES-Gen contradicts a requirement in this standard, in which case this standard shall take precedence.

However, where a requirement in one of the normative references specified in section 2.3 contradicts a requirement in ICES-Gen, then ICES-Gen shall take precedence (unless otherwise stated in this standard). For example, ICES-Gen includes specific definitions for Class A and Class B equipment, which as per the above, will take precedence over the corresponding definitions in CSA CISPR 11:19.

2.3 Normative reference

This standard refers to the following publication and, where such reference is made, it shall be in reference to the edition listed below:

- CSA CISPR 11:19, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement* (IEC CISPR 11:2015+A1:2016, MOD)

The CSA CISPR 11:19 can be [purchased](#) online.

3. Technical requirements

This section defines the general technical requirements associated with this standard, as well as specific considerations for certain equipment.

3.1 General

Equipment subject to this standard shall comply with all applicable requirements set forth in CSA CISPR 11:19, except if otherwise stated in this standard, and with the additional requirements specified herein.

No limits apply within the ISM frequency bands listed in [annex A](#). These bands reflect those listed in Table 1 of CSA CISPR 11:19, except for the 433.92 MHz band (433.05 – 434.79 MHz). The 433.92 MHz band is not an ISM band in Canada. As such, the radiated emission limits specified in CSA CISPR 11:19 and in this standard also apply within 433.05 – 434.79 MHz.

3.2 Statistical compliance

The provisions of Annex H of CSA CISPR 11:19 shall not be applied for the purpose of demonstrating compliance with ICES-001. As per the [Radiocommunication Act](#) and the [Radiocommunication Regulations](#), each unit of an equipment model shall comply with all applicable requirements, including the conducted and radiated emission limits.

3.3 Induction cooking appliances

This section defines specific requirements for induction cooking appliances.

3.3.1 Labelling requirements

For the purpose of labelling requirements (see section 4.2), all induction cooking appliances are Class B.

3.3.2 Instrumentation, test methods and test facilities

The instrumentation, test methods and test facilities used to demonstrate compliance with the limits defined in sections 3.3.3 and 3.3.4 shall be in accordance with the requirements set out in CSA CISPR 11:19 and in its normative references, as listed therein (specifically CISPR 16-1-1, CISPR 16-1-2, CISPR 16-1-4, CISPR 16-2-1 and CISPR 16-2-3 of editions as listed in CSA CISPR 11:19), except that:

- a. All radiated emission measurements in terms of magnetic field strength shall be performed with a shielded loop antenna. A ferrite-rod antenna shall not be used.
- b. For all radiated emission measurements in terms of magnetic field strength, the loop antenna shall be placed such that:
 - i. its centre shall be at 1.3 m height above the ground plane;
 - ii. the projection of its centre onto the ground plane shall be at the specified measurement distance from the projection on the ground plane of the closest point on the boundary of the equipment under test (EUT); and
 - iii. measurements shall be performed with the loop antenna placed vertically, in turn, in two polarizations (the measurement axis specified below is the line segment connecting the projections on the ground plane of the centre of the loop antenna and the centre of the EUT arrangement):
 - coaxial (loop plane perpendicular to the ground plane and to the measurement axis); and
 - coplanar (loop plane perpendicular to the ground plane and coplanar with the measurement axis).

- c. For all radiated emission measurements in terms of induced current, a large loop antenna system (LLAS) with a diameter of 2 m shall be used. Unless otherwise specified below, the LLAS shall comply with all applicable requirements in CISPR 16-1-4 and the measurement method shall follow the procedures specified in CISPR 16-2-3 (of the editions normatively referenced in CSA CISPR 11:19). Before performing measurements on the EUT, the LLAS shall be validated using the reference folded dipole, as per the requirements in Annex C of CISPR 16-1-4 (the edition normatively referenced in CSA CISPR 11:19) amended in accordance with [annex B](#) herein. The validation does not need to be performed before each EUT measurement, however:
- i. Measurements on the EUT shall be performed with the LLAS at the exact same location and in same position as it was during the last successful LLAS validation measurements. If the LLAS has been moved from the location/position where the last successful validation measurements were performed, the LLAS shall be re-validated before carrying out measurements on the EUT.

Where the LLAS is folded and moved for storage when not in use, but for measurements on EUTs it is brought back and installed in the same location, position and orientation (within a tolerance of ± 20 cm) as it was during the last successful LLAS validation measurements, there is no need to perform a full re-validation of the LLAS, except if [3.3.2 \(c\)\(ii\)](#) applies. In such case, before performing measurements on EUTs, the LLAS shall be re-validated at least with one position of the folded dipole for each one of the three loops of the LLAS.

- ii. The last successful validation of the LLAS shall not be older than three years at the time when measurements are performed on the EUT. The date of the last successful LLAS validation shall be specified in the test report.

In all cases, for measurements, the induction cooking appliance shall be operated in accordance with A.9 of Annex A of CISPR 14-1 Ed.6.0 (2016-08).

3.3.3 Conducted emissions limits

The limits for the mains terminal disturbance voltages applicable to induction cooking appliances are presented in [table 1](#). The induction cooking appliance shall comply with both the quasi-peak and the average limits.

Table 1: Conducted emission limits for induction cooking appliances (AC mains terminals)

Frequency range (MHz)	Appliances rated 120 V, without an earth connection Quasi-peak (dB μ V)	Appliances rated 120 V, without an earth connection Average (dB μ V)	All other appliances Quasi-peak (dB μ V)	All other appliances Average (dB μ V)
0.009 – 0.05	122	—	110	—
0.05 – 0.15	102 to 92 *	—	90 to 80 *	—
0.15 – 0.5	72 to 62 *	62 to 52 *	66 to 56 *	56 to 46 *
0.5 – 5	56	46	56	46
5 – 30	60	50	60	50
Note: The more stringent limit applies at transition frequencies.				
* The limit level in dB μ V decreases linearly with the logarithm of frequency.				

3.3.4 Radiated emissions limits

This section defines the radiated emission limits.

3.3.4.1. Frequency range from 9 kHz to 30 MHz

Induction cooking appliances that fit within a sphere having a diagonal of 1.6 m shall comply with either:

- the limits in table 2, in terms of magnetic field strength measured at a distance of 3 m from the EUT's boundary; or
- the limits in table 3, in terms of induced current measured with a 2 m LLAS.

The limits in table 2 shall not be used for LLAS measurements (i.e. by applying the conversion factor from Annex C of CISPR 16-1-4 for converting from induced current to equivalent magnetic field strength at 3 m distance). When measurements are performed using the LLAS, the limits in table 3 shall be applied.

Larger induction cooking appliances, which do not fit within a sphere having a diagonal of 1.6 m, shall comply with the limits in table 2, in terms of magnetic field strength measured at a distance of 3 m from the EUT's boundary.

Table 2: Magnetic field strength radiated emission limits for induction cooking appliances

Frequency range (MHz)	Quasi-peak, at 3 m distance (dB μ A/m)
0.009 – 0.07	69
0.07 – 0.15	69 to 39 *
0.15 – 30	39 to 7 *
* The limit level in dB μ A/m decreases linearly with the logarithm of frequency.	

Table 3: Induced current radiated emission limits for induction cooking appliances

Frequency range (MHz)	Horizontal * Quasi-peak (dB μ A)	Vertical * Quasi-peak (dB μ A)
0.009 – 0.07	88	106
0.07 – 0.15	88 to 58 **	106 to 76 **
0.15 – 30	58 to 22 **	76 to 40 **
* The horizontal limit applies to the horizontally-polarized magnetic field, as measured with each of the two vertically positioned large loop antennas of the LLAS. The vertical limit applies to induced currents measured with the horizontally positioned large loop of the LLAS.		
** The limit level in dB μ A decreases linearly with the logarithm of frequency.		

3.3.4.2. Frequency range from 30 MHz to 1 GHz

Induction cooking appliances shall comply with the limits in [table 4](#), in terms of electric field strength measured at a distance of 3 m or 10 m from the EUT's boundary.

Table 4: Electric field strength radiated emission limits for induction cooking appliances

Frequency range (MHz)	OATS or SAC * 10 m measurement distance Quasi-peak (dB μ V/m)	OATS or SAC * 3 m measurement distance Quasi-peak (dB μ V/m)	FAR * 3 m measurement distance Quasi-peak (dB μ V/m)
30 – 230	30	40	42 to 35**
230 – 1000	37	47	42
Note: The more stringent limit applies at the transition frequency.			
* OATS = open-area test site, SAC = semi-anechoic chamber, FAR = fully-anechoic room (see CSA CISPR 11:19).			
** The limit level in dB μ V/m decreases linearly with the logarithm of frequency.			

3.4 ISM equipment not in the scope of CSA CISPR 11:19

ISM equipment (other than induction cooking appliances) that is excluded from the scope of CSA CISPR 11:19 due to the application of another CISPR standard and which are not under the scope of another ISED standard [see [1.1 \(b\)](#)] shall comply with the requirements for group 2 equipment, as specified in CSA CISPR 11:19.

4. Administrative requirements

This section defines the administrative requirements related to this standard, such as reporting and labelling requirements.

4.1 Test report

The requirements specified in ICES-Gen shall apply.

4.2 Labelling and user manual requirements

The requirements specified in ICES-Gen shall apply. An example ISED compliance label, to be placed on each unit of an equipment model (or in the user manual, if allowed), is given below:

CANICES-001 (*) / NMB-001 (*)

* Insert either “A” or “B”, but not both, to identify the applicable Class of the ISM equipment.

The labelling requirements in ICES-001, issue 4, did not require the Class (i.e. “A” or “B”) to be included in ISED’s supplier declaration of conformity label (SDoC: see ICES-Gen for more information). ISM equipment that continues to be placed on the Canadian market after the expiration of the transition period provided in section 2.1 is allowed to continue to use the labelling requirements of ICES-001, issue 4, instead of those specified in this section as long as all of the following conditions are satisfied:

- a. the equipment was already on the Canadian market before the transition period expired and it was already in compliance with ICES-001, issue 4;
- b. the equipment continues to be placed on the Canadian market after the expiration of the transition period and it is unmodified;
- c. if the equipment is modified in any way after the expiration of the transition period, this exemption is no longer valid and its labelling shall comply with this standard (i.e. the Class of the equipment shall be mentioned on the label); and
- d. this exemption only applies to the ISED label and does not extend to the other requirements in ICES-001 (such as technical requirements or test report requirements).

“Placed on the Canadian market” (used in the paragraph above) means any of the activities listed in [subsection 4\(3\) of the Radiocommunication Act](#), i.e. manufacture, importation, distribution, lease, offering for sale, or sale.

Annex A: Industrial, scientific and medical (ISM) frequency bands

No limits apply within the ISM frequency bands specified in [table A1](#).

Table A1: ISM frequency bands

Centre frequency (MHz)	Bandwidth (MHz)	Lower limit (MHz)	Upper limit (MHz)
6.78	± 0.015	6.765	6.795
13.56	± 0.007	13.553	13.567
27.12	± 0.163	26.957	27.283
40.68	± 0.020	40.660	40.700
915	± 13	902	928
2,450	± 50	2,400	2,500
5,800	± 75	5,725	5,875
24,125	± 125	24,000	24,250
61,250	± 250	61,000	61,500
122,500	± 500	122,000	123,000
245,000	± 1,000	244,000	246,000

Annex B: Large loop antenna system validation

For each of the three LLAS loops, for each of the eight positions of the validation dipole, the measured validation factor, MVF , shall be equal to or larger than $(RVF - 3 \text{ dB})$ and equal to or smaller than $(RVF + 3 \text{ dB})$, where:

- MVF shall be calculated as $20 \log_{10} (V_{GO} / I_M) \text{ dB}\Omega$, where V_{GO} is the signal generator's open circuit voltage, in Volts, and I_M is the induced current measured with the LLAS loop, in Amperes;
- RVF is the reference validation factor, in $\text{dB}\Omega$, of values over frequency as listed in [table B1](#).

Table B1: Reference validation factor

Freq. (MHz)	RVF (dB Ω)	Freq. (MHz)	RVF (dB Ω)	Freq. (MHz)	RVF (dB Ω)	Freq. (MHz)	RVF (dB Ω)	Freq. (MHz)	RVF (dB Ω)
0.009	72.52	0.1	72.52	2	73.81	12	83.34	22	87.41
0.01	72.52	0.2	72.54	3	75.01	13	83.90	23	87.68
0.02	72.52	0.3	72.55	4	76.26	14	84.42	24	87.94
0.03	72.52	0.4	72.58	5	77.46	15	84.90	25	88.19
0.04	72.52	0.5	72.61	6	78.56	16	85.34	26	88.43
0.05	72.52	0.6	72.65	7	79.57	17	85.75	27	88.66
0.06	72.52	0.7	72.70	8	80.47	18	86.13	28	88.88
0.07	72.52	0.8	72.75	9	81.30	19	86.48	29	89.09
0.08	72.52	0.9	72.81	10	82.04	20	86.81	30	89.30
0.09	72.52	1	72.88	11	82.72	21	87.12	—	—