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Spectrum Management and Telecommunications

Interference-Causing Equipment Standard

# Radio Frequency Lighting Devices (RFLDs)

## Preface

This Interference-Causing Equipment Standard ICES-005, Issue 3, for *Radio Frequency Lighting Devices (RFLD)* replaces ICES-005, Issue 2, published February 2007. ICES-005 sets out limits and methods of measurement of radiated and line-conducted radio frequency noise emissions produced by RFLD.

### Changes:

**Section 4.3.2:** The frequency ranges of measurement of radiated emissions were extended to cover different operating frequency bands.

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## 1. General

- 1.1 This Interference-Causing Equipment Standard sets out the technical requirements relative to the radiated and conducted radio noise emissions from radio frequency lighting devices (RFLDs).
- 1.2 Subject to subsections 1.3 and 1.4, sections 3 to 7 apply to every RFLD that is manufactured or imported into Canada, except RFLDs manufactured or imported solely for export purposes.
- 1.2.1 A grace period ending October 1, 2009, is provided, during which compliance with either ICES-005, Issue 2, or ICES-005, Issue 3, will be accepted. After October 1, 2009, only compliance with ICES-005, Issue 3, will be accepted.
- 1.3 Sections 3 to 7 do not apply to RFLDs used:
- (a) solely for demonstration and exhibition purposes; or
  - (b) as prototype units.
- 1.4 Sections 3 to 7 do not apply to units or models of RFLDs for which the manufacturer, importer or owner has been granted a special permission by the Minister.

The Minister may grant a special permission where:

- (a) the manufacturer, importer or owner has presented a written application giving:
- the reasons for the request;
  - an analysis based on sound engineering principles showing that the unit or model of an RFLD will not pose a significant risk to radiocommunications;
  - a guarantee of compliance with all the conditions the Minister may set in the special permission; and
- (b) the Minister is satisfied that the unit or model will not pose a significant risk to radiocommunications.

The special permission is valid only if:

- (a) the unit bears a label stating that it is operating under special permission and setting out the conditions of that special permission; and
- (b) the unit complies with all conditions set out in the special permission.

The Minister may revoke or amend the special permission granted under Subsection 1.4 at any time without prior notice.

## **2. Definitions**

The following definitions apply in this Standard.

An *RFLD* includes any lighting device that uses radio frequency energy to excite a gas inside a bulb in order to produce light, including an electronic ballast and a bulb.

A *Class A RFLD* means a model of RFLD where, by virtue of its characteristics, it is highly unlikely that any units of the model will be used in a residential environment, including a home business. Characteristics considered to be applicable in this assessment include price, marketing and advertising methodology, the degree to which the functional design inhibits applications suitable to residential environments, or any combination of features which would effectively preclude its use in a residential environment.

A *Class B RFLD* means any RFLD that cannot qualify as a Class A RFLD.

## **3. Instrumentation**

### **3.1 Radio Frequency Receivers**

Receivers shall be in accordance with the publication referred to in Section 7(1).

### **3.2 Line Impedance Stabilization Network**

The line impedance stabilization network (LISN) shall be in accordance with the publication referred to in Section 7(2).

### **3.3 Antennas**

A calibrated tuned half-wave dipole antenna or any other linearly polarized antenna, provided the results obtained with such antennas can be correlated with results obtained with a tuned half-wave dipole, shall be used for the measurement of radiated emissions.

## **4. Method of Measurement**

### **4.1 General Requirements**

4.1.1 During the testing period, the RFLD shall be:

- (a) operated in accordance with the manufacturer's specifications;
- (b) configured in a manner which tends to maximize its emissions characteristics in a typical application; and
- (c) operated for a sufficient period of time to ensure that normal operating conditions exist during the testing period.

4.1.2 Any measured levels of radio noise exceeding the limits specified in Section 5 shall be deemed to be emissions from the RFLD, unless it is demonstrated that the emissions originate from ambient sources which cannot be suppressed and that the emissions from the RFLD do not exceed the limits specified in Section 5.

### **4.2 Line-conducted Noise Emissions Measurements**

4.2.1 Testing shall be performed using the test system prescribed in the remainder of this subsection and illustrated in Annex C. Where the use of an LISN is not possible at a user installation site, a line probe must be used. The testing at the user installation shall be modified in accordance with Section 4.4.3.

4.2.2 Conducted emissions shall be measured by scanning the frequency range of 0.45 MHz to 30 MHz. All emissions that exceed a value of 20 dB below the limits prescribed in Section 5.1 shall be recorded.

4.2.3 The floor of the test site is required to be an earth-grounded conducting surface, which may be the metal floor of a shielded test chamber. A conducting vertical plate or screen of at least 2 m by 2 m in size shall be electrically connected to the conducting ground plane along its entire length. The conducting ground surface is to be at least 2 m by 2 m in size, and shall extend 40 cm beyond the projection (footprint) of the RFLD when facing the vertical plate, and at least 50 cm beyond the projection on the remaining three sides.

4.2.4 The RFLD under test shall be placed:

- (a) on a non-conductive platform 1 m by 1.5 m in size;
- (b) at least 80 cm away from the LISN;

- (c) 40 cm away from the vertical grounded conducting surface or, where a shielded enclosure is used, 40 cm from any one vertical grounded surface of the enclosure; and
- (d) at least 80 cm away from any other grounded conducting surface.

4.2.5 Where the RFLD under test:

- (a) is supplied with a flexible power lead, any portion that is in excess of 80 cm shall be folded back and forth at the approximate centre of the lead so as to form a non-inductive bundle not exceeding 40 cm in length;
- (b) is supplied without a flexible power lead, the power lead used shall be of a length not greater than 1 m; and
- (c) is normally operated with a shielded or armoured power lead, the same type of lead shall be used during the test.

4.2.6 During the testing of the RFLD:

- (a) each current-carrying conductor of the RFLD power lead, except ground (safety) leads, shall be connected individually through the LISN to the input power source;
- (b) each unused 50  $\Omega$  connector of the LISN shall be terminated with a 50  $\Omega$  resistor;
- (c) the LISN shall be placed on top of, or immediately beneath, the conducting ground plane and bonded to the ground plane;
- (d) the LISN shall be placed in series between the RFLD and the power supply mains;
- (e) all voltage measurements shall be made at the plug end of the RFLD power cord, e.g. by the use of mating plugs and receptacles on the RFLD and LISN; and
- (f) each current-carrying conductor of the RFLD shall be individually tested.

4.2.7 All equipment normally grounded, such as the LISN housing, the measuring instrument case, the conducting ground plane, the vertical conducting plane, etc. shall be electrically bonded in accordance with accepted practice.

### 4.3 Radiated Noise Emissions Measurements

4.3.1 Testing shall be performed using the test system prescribed in the remainder of this subsection and illustrated in Annex D. Where testing must be performed at the user installation, the testing shall be modified in accordance with Section 4.4.4.

- 4.3.2 Radiated emissions shall be measured by scanning the frequency range determined in accordance with the following schedule:

<b>Frequency Band in Which RFLD Operates</b>	<b>Frequency Range of Measurement of Radiated Emissions</b>
Below 1.705 MHz	No radiated emissions measurement required
1.705 MHz to 30 MHz	30 MHz to 400 MHz
30 MHz to 500 MHz	30 MHz to 1000 MHz
500 MHz to 1000 MHz	From lowest frequency generated in device or 100 MHz, whichever is lower, to 1000 MHz
Above 1000 MHz	From lowest frequency generated in device or 100 MHz, whichever is lower, to 1000 MHz

All emissions that exceed a value of 20 dB below the limits prescribed in Section 5.2 shall be recorded.

- 4.3.3 Measurements shall be made in an open area test site (OATS), which must be characteristic of cleared, level terrain, free of any reflecting objects, at least within the boundary of an ellipse having a major axis equal to  $2D$  and a minor axis of  $\sqrt{3}D$ , where  $D$  is the distance between the two foci of the ellipse and is equivalent to the measurement distance of 30 m.
- 4.3.4 A conducting ground plane is required and shall extend at least 1 m beyond the periphery of the RFLD and the largest measuring antenna, and cover the entire area between the RFLD and the antenna. It shall be of metal with no holes or gaps larger than one tenth of the wavelength at the highest frequency of measurement.
- 4.3.5 Measurements made in an enclosure or an anechoic chamber will be accepted if it is shown that the results obtained at such a location can be correlated with those made at the open area test site referred to in sections 4.3.3 and 4.3.4.
- 4.3.6 The RFLD under test shall be placed at the centre of a rotatable non-conducting platform that is 1 m above the test site ground level. The platform shall be placed at one focus of the ellipse and the measuring antenna at the other.
- 4.3.7 For each measurement frequency, and employing both horizontal and vertical orientations of the measuring antenna, the orientation of the RFLD together with the height of the electrical centre of the measuring antenna shall be varied so as to obtain a maximum reading on the measuring instrument. At any measurement distance, the antenna height shall be varied from 1 to 4 m. The lowest point of the bottom of the measuring antenna must never come closer than 25 cm to the test site ground level.

4.3.8 The measuring antenna shall be at a horizontal distance of 30 m from the RFLD under test. Where the testing is carried out at distances shorter than prescribed,  $1/d$  shall be used as an attenuation law factor, where  $d$  is the distance.

#### 4.4 User Installation Testing

4.4.1 In some cases, measurements at the user installation might be necessary. The RFLD shall be installed as normally used. Neither a conducting ground plane nor an LISN shall be installed unless one or both are to be a permanent part of the installation. This form of testing is unique to the installation site since the site containment properties affect the measurements.

4.4.2 Where testing of a given system has been accomplished at three or more representative locations, the results may be considered representative of all sites with similar RFLDs for purposes of determining compliance with emissions requirements.

4.4.3 Conducted emissions measurements at a user installation site shall, subject to sections 4.4.1 and 4.4.2, be made in accordance with sections 4.2 and 4.4.3.1.

4.4.3.1 Where the use of an LISN is not possible, a voltage probe may be used for radio noise voltage measurements at a user installation site. Special precautions shall be taken to establish a reference ground for the measurements. The measurements are dependent on the impedance presented by the supply mains and may vary with time and location due to variations in the supply mains. It may be necessary to perform repeated measurements over a suitable period of time to determine the variation in measured values. The time period shall be sufficient to cover all significant variations due to operating conditions at the installation. Such measurement results shall be regarded as unique to that RFLD and its installation environment. The measurements shall be made between each current-carrying conductor in the supply mains and the ground conductor. Since the voltage probe attenuates the radio noise voltage, appropriate calibration factors shall be added to the measured values.

4.4.4 Radiated emissions measurements at a user installation site shall, subject to sections 4.4.1 and 4.4.2, be made in accordance with sections 4.3 and 4.4.4.1.

4.4.4.1 Radiated emissions measurements shall be made at the boundary of the user premises or, if the boundary is less than 30 m from the installation site, at a distance of 30 m from the RFLD installation. For each measurement frequency, and employing both horizontal and vertical orientations of the measuring antenna, the radial of maximum emissions from the installation shall be located and the electrical centre of the antenna height shall be varied so as to obtain a maximum reading on the measuring instrument. The variation in the antenna height shall be from 1 to 4 m. Where measurements are made at distances other than 30 m, the readings shall be extrapolated to a 30 m measurement distance using a  $1/d$  extrapolation factor, where  $d$  is the measurement distance.

## 5. Limits

### 5.1 Conducted Emissions

The limits for line-conducted noise emissions produced by an RFLD on any frequency from 0.45 MHz to 30 MHz, when measured in accordance with Section 4, are as follows:

#### Conducted Emissions Limits – Class A RFLD

Frequency Range (MHz)	Maximum RF Line Voltage (Quasi-Peak)	
	$\mu\text{V}$	$\text{dB}\mu\text{V}$
0.45-1.6	1000	60
1.6-30	3000	70

#### Conducted Emissions Limits – Class B RFLD

Frequency Range (MHz)	Maximum RF Line Voltage (Quasi-Peak)	
	$\mu\text{V}$	$\text{dB}\mu\text{V}$
0.45-2.51	250	48
2.51-3.0	3000	70
3.0-30	250	48

The more stringent limits shall apply at the boundary between frequency ranges.

The specified limits do not apply within the industrial, scientific and medical (ISM) frequency bands specified in Annex A.

### 5.2 Radiated Emissions

The limits for radiated noise emissions produced by an RFLD on any frequency from 30 MHz to 1000 MHz, when measured in accordance with Section 4, are as follows:

#### Radiated Emissions Limits

Frequency Range (MHz)	Field Strength Limits at 30 m (Quasi-Peak)			
	Class A RFLD		Class B RFLD	
	$\mu\text{V}/\text{m}$	$\text{dB}\mu\text{V}/\text{m}$	$\mu\text{V}/\text{m}$	$\text{dB}\mu\text{V}/\text{m}$
30-88	30	30	10	20
88-216	50	34	15	23.5
216-1000	70	37	20	26

The more stringent limits shall apply at the boundary between the two frequency ranges.

The specified limits do not apply within the ISM frequency bands specified in Annex A.

## **6. Procedural Requirements**

- 6.1 A record of the measurements and results shall be retained by the manufacturer or importer for a period of at least five years and made available for examination upon request by the Minister.
- 6.2 A label indicating compliance must accompany each RFLD. The label must be affixed to the apparatus. Where it is not feasible to affix a label to the apparatus because of insufficient space or other constraints, a notice of compliance must be included in the user manual. Suggested text in English and in French for the notice indicating compliance with this Standard can be found in Annex B.

## **7. Reference Publications**

This Standard refers to the following publications and, where such reference is made, it shall be to the editions listed below.

- (1) Canadian Standards Association Standard C108.1.1-1977, *Electromagnetic Interference Measuring Instrument - C.I.S.P.R. Type*.
- (2) Canadian Standards Association Standard C108.1.5-M85-CAN3, *Line Impedance Stabilization Network (LISN)*.

**Annex A - Table of ISM Frequency Bands**

<b>Lower Frequency Limit of Band (MHz)</b>	<b>Centre Frequency (MHz)</b>	<b>Upper Frequency Limit of Band (MHz)</b>
6.765	6.780	6.795
13.553	13.560	13.567
26.957	27.120	27.283
40.660	40.680	40.700
902.000	915.000	928.000
2400	2450	2500
5725	5800	5875
24000	24125	24250
61000	61250	61500
122000	122500	123000
244000	245000	246000

**Annex B**

Suggested text for the notice indicating compliance with this Standard:

*This Class [\*] RFLD complies with the Canadian standard ICES-005.*

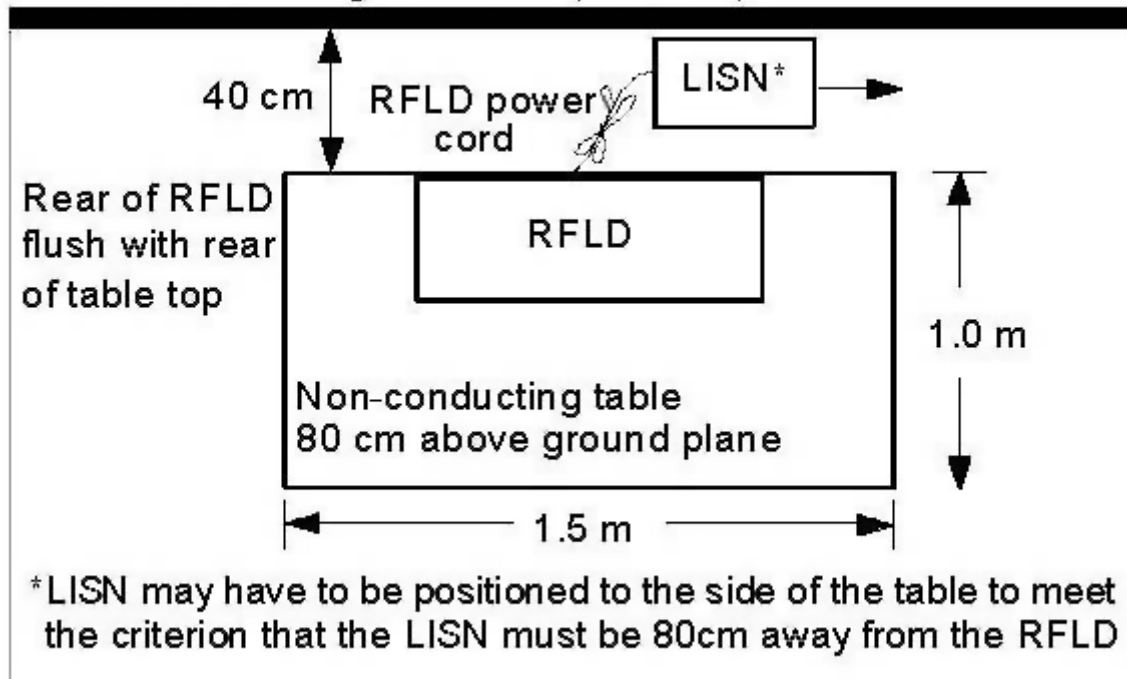
*Ce DEFR de la classe [\*] est conforme à la NMB-005 du Canada.*

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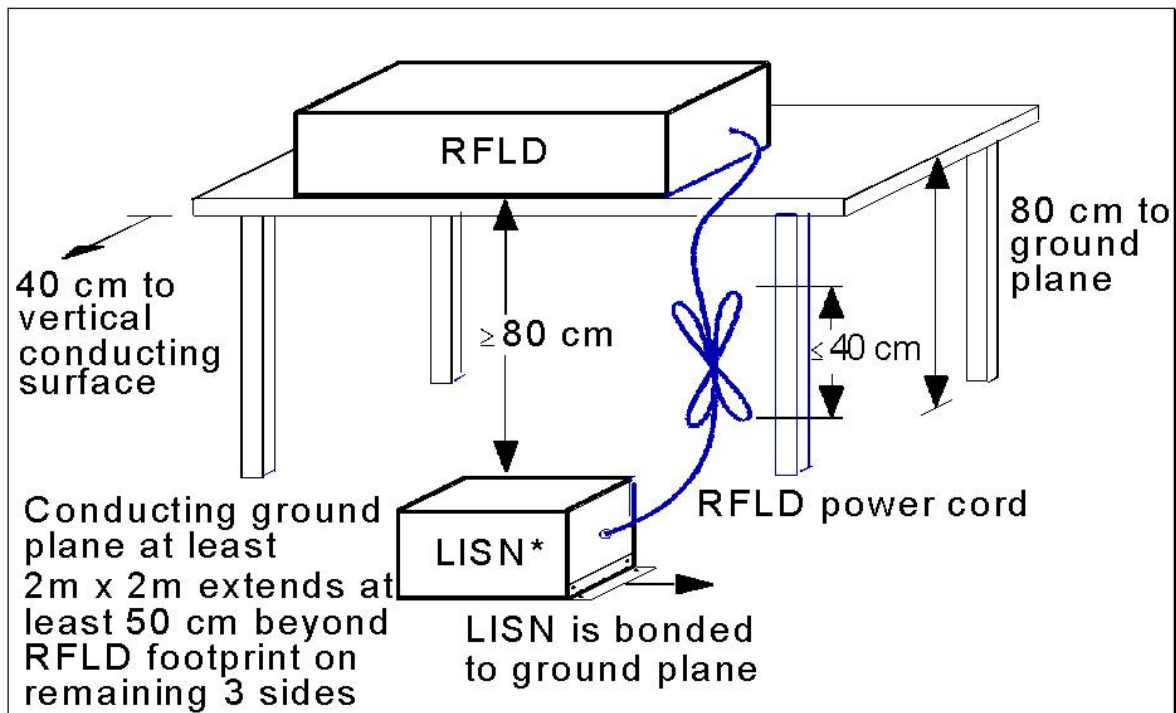
\* Insert “A” or “B”, but not both, as appropriate for the equipment requirements.

## Annex C - Configuration for the Measurement of Line-conducted Emissions

## Top View

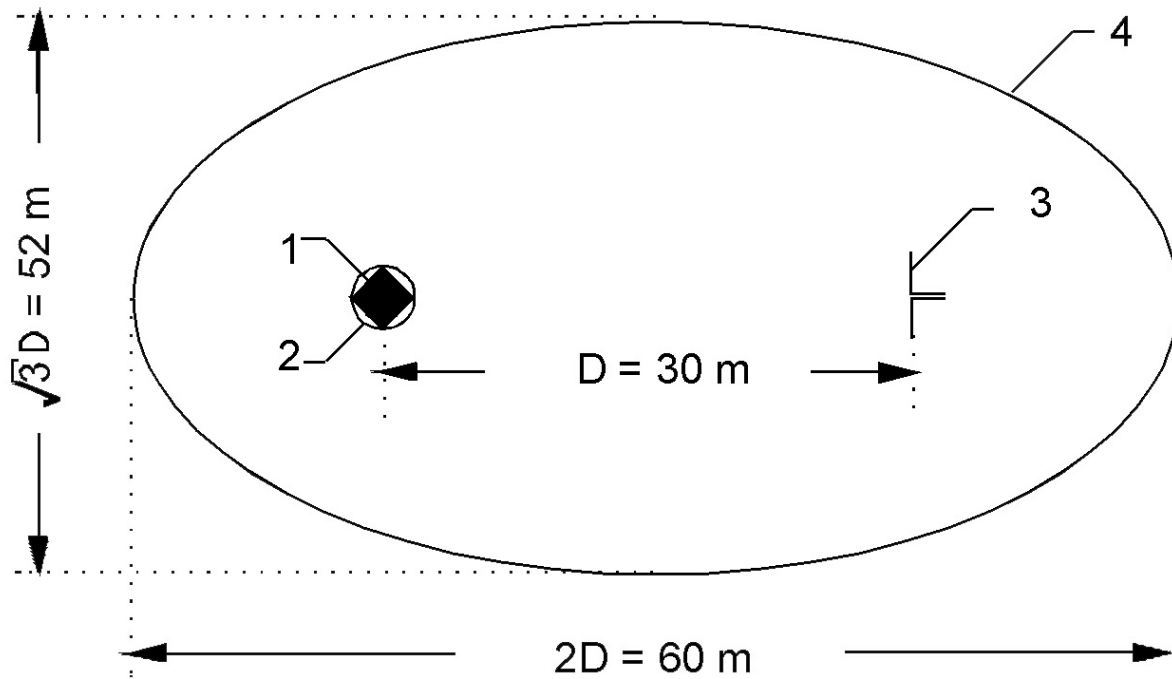
Vertical Conducting Surface  $\geq (2\text{m} \times 2\text{m})$ 

## Side View

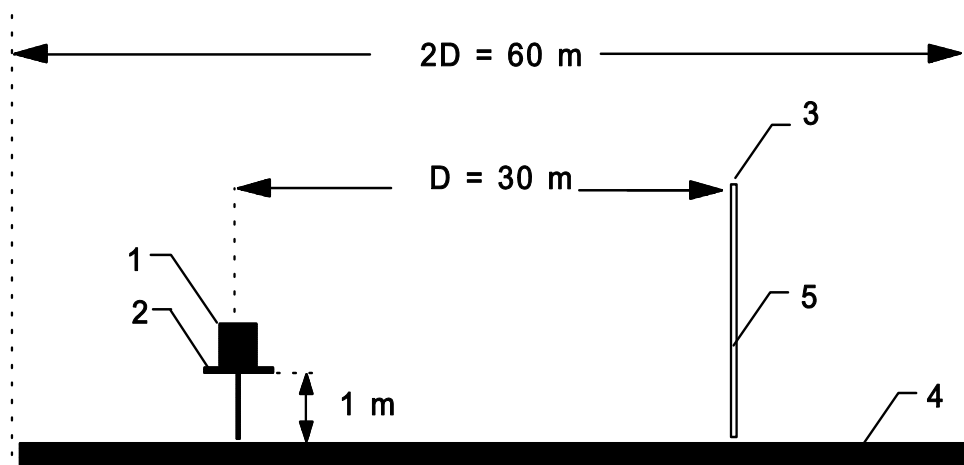


## Annex D - Configuration for the Measurement of Radiated Emissions

Top View



Side View



Not to Scale

- 1: RFLD under test
- 2: rotatable platform
- 3: tuned half-wave dipole

- 4: boundary of the area of free reflecting objects
- 5: adjustable mast