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# Level Probing Radar Equipment

## Preface

Radio Standards Specification RSS-211, Issue 1, *Level Probing Radar Equipment*, sets out the minimum requirements for the certification of Level Probing Radar (LPR) and Tank Level Probing Radar (TLPR) devices operating within the bands 5.65-8.50 GHz, 8.50-10.55 GHz, 24.05-29.00 GHz and 75-85 GHz. These devices are defined as Category I equipment as per RSS-Gen, Issue 4, [General Requirements for Compliance of Radio Apparatus](#).

The change is the following:

- (1) This is a new standard derived from Annex 11 of RSS-210, Issue 8, [Licence-exempt Radio Apparatus \(All Frequency Bands\): Category I Equipment](#).

Inquiries may be directed to the following address:

Industry Canada  
Engineering, Planning and Standards Branch  
235 Queen Street  
Ottawa, Ontario K1A 0H5

Attention: Regulatory Standards  
Email: [res.nmr@ic.gc.ca](mailto:res.nmr@ic.gc.ca)

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Daniel Duguay  
Director General  
Engineering, Planning and Standards Branch

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## 1. Scope

This Radio Standards Specification (RSS) sets out the minimum requirements for the certification of Level Probing Radar (LPR) equipment, which includes Tank Level Probing Radar (TLPR) devices, operating within the bands 5.65-8.50 GHz, 8.50-10.55 GHz, 24.05-29.00 GHz and 75-85 GHz.

## 2. General Information

Devices covered under RSS-211 are considered Category I equipment, for which a technical acceptance certificate (TAC) issued by the Certification and Engineering Bureau of Industry Canada or a certificate issued by a recognized certification body (CB) is required, pursuant to subsections 4(2) of the [Radiocommunication Act](#) and 21(1) of the [Radiocommunication Regulations](#).

LPR equipment may operate in open-air environments or inside an enclosure (storage tank) containing the substance being measured. LPR and TLPR equipment shall utilize a dedicated or integrated transmit antenna.

The equipment shall be professionally installed and maintained to ensure a vertically downward orientation of the transmit antenna and the installation shall be only at fixed locations; installation is not required at the time of certification. Hand-held and residential consumer applications are not permitted.

Devices covered by this standard are licence-exempt. The devices subject to this standard operate on a “no-interference, no-protection” basis.

### 2.1 RSS-Gen Compliance

In addition to the requirements in RSS-211, the requirements in RSS-Gen, [General Requirements for Compliance of Radio Apparatus](#), shall be met.

### 2.2 Radio Frequency (RF) Exposure Compliance

All devices that fall under this document shall comply with the applicable requirements of RSS-102, [Radio Frequency \(RF\) Exposure Compliance of Radiocommunication Apparatus \(All Frequency Bands\)](#).

### 2.3 Receivers

The requirements for receivers for use with transmitters subject to RSS-211 are set out in RSS-Gen.

### 2.4 Definitions

The following terms and definitions apply to this standard:

**Enclosed container** refers to a closed metallic tank, a reinforced concrete tank or a similar enclosed structure made of comparable attenuating material, containing liquids or solids.

**Level Probing Radar (LPR) and Tank Level Probing Radar (TLPR) devices** are short range radar transmitters used in a wide variety of applications to measure the amount of various substances, mostly liquids or granulate.

**LPR fundamental emission bandwidth** refers to the width of the signal between two points, one below and one above the centre frequency, outside of which all emissions are attenuated by at least 10 dB relative to the maximum power level when measured in an equivalent resolution bandwidth. The fundamental emission bandwidth measurement shall be made using a peak detector with a resolution bandwidth of 1 MHz and a video bandwidth of at least 3 MHz.

**Peak power**, in the case of unswept frequency devices, refers to the peak level of transmission contained within a 50 MHz bandwidth centred on the frequency at which the highest average radiated power occurs ( $f_M$ ). If a resolution bandwidth (RBW) other than 50 MHz is employed, the peak equivalent isotropically radiated power (EIRP) shall be corrected using  $20 \log(\text{RBW}/50)$  dB, where the RBW is in units of megahertz. In the case of swept frequency devices, the peak level of transmission shall be measured with an RBW of 1 MHz, and no RBW correction is needed.

**Operating frequency range** refers to the frequency band of operation defined as  $f_H - f_L$ , where the frequency points are designated as  $f_L$  where the power falls 10 dB below the  $f_M$  level, and as  $f_H$  where the power falls 10 dB above the  $f_M$  level.

**Still pipe** refers to a vertical, perforated pipe used to reduce measurement errors arising from liquid turbulence, surface flow or agitation of the liquid. A still pipe shall always be inserted inside an enclosed container. The pipe cannot be used alone or outside the tank in the same way a bypass pipe is used in a process tank.

### 3. Related Documents

This standard refers to the following publications. Where there may be discrepancies between the requirements stated in the RSS-211 text and the relevant text of the publications referenced in this section, the RSS-211 text shall take precedence.

**ETSI EN 302 729** — [Electromagnetic compatibility and Radio spectrum Matters \(ERM\); Short Range Devices \(SDR\); Level Probing Radar \(LPR\) equipment operating in the frequency ranges 6 GHz to 8,5 GHz, 24,05 GHz to 26,5 GHz, 57 GHz to 64 GHz, 7 GHz to 85 GHz; Part 1: Technical characteristics and test methods](#)

**ETSI EN 302 372** — [Electromagnetic compatibility and Radio spectrum Matters \(ERM\); Short Range Devices \(SDR\); Equipment for Detection and Movement; Tanks Level Probing Radar \(TLPR\) operating in the frequency bands 5,8 GHz, 10 GHz, 25 GHz, 61 GHz and 77 GHz; Part 1: Technical characteristics and test methods](#)

**RSS-Gen** — [General Requirements for Compliance of Radio Apparatus](#)

**RSS-102** — [Radio Frequency \(RF\) Exposure Compliance of Radiocommunication Apparatus \(All Frequency Bands\)](#)

## 4. Measurement Method

In addition to the requirements in RSS-Gen, the method for measuring LPR and TLPR devices provided in the documents referenced in Section 3 of this standard shall apply. Compliance with the limits set out in this section shall be demonstrated using the method of measurement described in this standard and in the publications referenced in Section 3.

Radiated measurements of the fundamental emission bandwidth and power shall be made with maximum main beam coupling between the LPR and test antennas (boresight).

Measurements of the unwanted emissions radiating from an LPR shall be made using elevation and azimuth scans to determine the location at which the emissions are maximized.

All emissions at and below 960 MHz are based on measurements employing an International Special Committee on Radio Interference (CISPR) quasi-peak detector.

The fundamental emission bandwidth measurement shall be made using a peak detector with a resolution bandwidth of 1 MHz and a video bandwidth of at least 3 MHz.

The provisions in RSS-Gen that require emissions to be averaged over a 100 ms period and that limit the peak power to 20 dB above the average limit do not apply to devices operating under this standard.

The compliance measurement shall be performed using the normal operation of the equipment (*e.g.*, for frequency-modulated continuous-wave devices, the sweep is not suspended and for pulsed devices, the pulse gating is not suspended).

The test report shall be prepared in accordance with RSS-Gen and the requirements in RSS-211.

## 5. Limits

Compliance with the limits set out in this section shall be demonstrated using only the method of measurement described in the publications referenced in Section 3 and this standard.

### 5.1 Requirements Applicable to All Bands

- (a) The minimum fundamental emission bandwidth shall be 50 MHz.
- (b) The fundamental emission bandwidth shall be confined within the designated device operating bands under all conditions.
- (c) The sweep, step or hop function is never stopped with the fundamental emission within any restricted band specified in RSS-Gen.
- (d) Unwanted emissions shall not exceed the general field strength limits set out in RSS-Gen.

## 5.2 LPR Devices Operating in the Bands 5.65-8.50 GHz, 24.05-29.00 GHz and 75-85 GHz

- (a) For devices operating in open-air environments, the antenna shall have a maximum half-power beamwidth of 12° for the bands 5.65-8.5 GHz and 24.05-29 GHz, and a maximum half-power beamwidth of 8° for the band 75-85 GHz.
- (b) For average emission limits, LPR devices shall not exceed the limits provided in Table 1 measured in a 1 MHz measurement bandwidth with an average detector. For peak emission limits, LPR devices shall not exceed the limits provided in Table 1 measured in a 50 MHz measurement bandwidth with a peak detector.

**Table 1: EIRP Emission Limits for LPR Devices**

Frequency Band (GHz)	Average Emission Limit (EIRP in dBm/MHz) as Measured Boresight	Peak Emission Limit (EIRP in dBm Measured in 50 MHz) as Measured Boresight
5.65-8.50	-33	+7
24.05-29.00	-14	+26
75-85	-3	+34

- Notes:**
1. The minimum bandwidth at the -10 dB point is 50 MHz.
  2. All emission limits defined herein are based on boresight measurements (*i.e.*, measurements performed within the main beam of an LPR antenna).

- (c) LPR devices must limit the antenna side lobe gain relative to the main beam gain for off-axis angles from the main beam of greater than 60° for the levels provided in Table 2.

**Table 2: Antenna Side Lobe Gain Limits**

Frequency Band (GHz)	Antenna Side Lobe Gain Limit Relative to Main Beam Gain (dB)
5.65-8.50	-22
24.05-29.00	-27
75-85	-38

The standard ETSI EN 302 729 contains measurement techniques for the LPR “boresight-axis” method.

### 5.3 TLPR Devices Operating in the Bands 5.65-8.50 GHz, 8.50-10.55 GHz, 24.05-29.00 GHz and 75-85 GHz

- (a) The device shall be installed inside a closed container or in a still pipe by qualified installers.
- (b) The leakage of the RF field outside the container at 3 m from the container or still pipe walls shall not exceed the values outlined in Table 3. The levels shall be assessed using the procedures defined in ETSI EN 302 372.

**Table 3: EIRP Emission Limits for TLPR Devices**

Frequency Band (GHz)	Maximum Average EIRP (in dBm/MHz) Outside Tank Enclosure Structure Inside the Operating Frequency Range
5.65-8.50	-41.3
8.50-10.55	-41.3
24.05-29.00	-41.3
75-85	-41.3

This measurement is required only for the test report for the purpose of equipment certification, and not for every installation. As radio leakage depends on the type of container wall and its thickness, field installations must use a similar construction and the radio device manufacturer shall provide proper installation instructions to the end-user.

## 6. User Manual

The user manual of the device shall comply with the requirements of RSS-Gen and clearly indicate the following notices:

- (i) *The installation of the LPR/TLPR device shall be done by trained installers, in strict compliance with the manufacturer's instructions.*
- (ii) *The use of this device is on a "no-interference, no-protection" basis. That is, the user shall accept operations of high-powered radar in the same frequency band which may interfere with or damage this device. However, devices found to interfere with primary licensing operations will be required to be removed at the user's expense.*
- (iii) For devices under section 5.3 of this document, the device's user manual shall also contain the following notice or its equivalent:

*This device shall be installed and operated in a completely enclosed container to prevent RF emissions, which can otherwise interfere with aeronautical navigation.*

- (iv) For devices operating in the frequency band 77.5-85 GHz, the device's user manual shall also contain the following notice or its equivalent:

***The installer/user of this device shall ensure that it is at least 10 km from the Dominion Astrophysical Radio Observatory (DRAO) near Penticton, British Columbia. The coordinates of the DRAO are latitude 49°19'15" N and longitude 119°37'12" W. For devices not meeting this 10 km separation (e.g., those in the Okanagan Valley, British Columbia,) the installer/user must coordinate with, and obtain the written concurrence of, the Director of the DRAO before the equipment can be installed or operated. The Director of the DRAO may be contacted at 250-497-2300 (tel.) or 250-497-2355 (fax). (Alternatively, the Manager, Regulatory Standards, Industry Canada, may be contacted.)***

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