



## RSS-247 – Digital Transmission Systems (DTs), Frequency Hopping Systems (FHSs) and Licence- Exempt Local Area Network (LE-LAN) Devices

### 5.4 Transmitter output power and equivalent isotropically radiated power (e.i.r.p.) requirements Devices shall comply with the following requirements, where applicable:

- a. For FHSs operating in the band 902-928 MHz, the maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p. shall not exceed 4 W if the hopset uses 50 or more hopping channels; the maximum peak conducted output power shall not exceed 0.25 W and the e.i.r.p. shall not exceed 1 W if the hopset uses less than 50 hopping channels.
- b. For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).
- c. For FHSs operating in the band 5725-5850 MHz, the maximum peak conducted output power shall not exceed 1 W, and the e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).
- d. For DTs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted **output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W**, except as provided in section 5.4(e).

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

- e. Fixed point-to-point systems in the bands 2400-2483.5 MHz and 5725-5850 MHz are permitted to have an e.i.r.p. higher than 4 W provided that the higher e.i.r.p. is achieved by employing higher gain directional antennas and not higher transmitter output powers. Point-to-multipoint systems, omnidirectional applications and multiple co-located transmitters transmitting the same information are prohibited from exceeding an e.i.r.p. of 4 W.
- f. Transmitters operating in the band 2400-2483.5 MHz, may employ antenna systems that emit multiple directional beams simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers, provided that the emissions comply with the following:
  - i. Different information must be transmitted to each receiver.
  - ii. If the transmitter employs an antenna system that emits multiple directional beams, but does not emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device (i.e. the sum of the power supplied to all antennas, antenna elements, staves, etc., and summed across all carriers or frequency channels) shall not exceed the applicable output power limit specified in sections 5.4(b) and 5.4(d). However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as the sum of 10 log (number of array elements or staves) plus the directional gain of the element or stave having the highest gain.
  - iii. If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channels, the power supplied to each emission beam is subject to the applicable power limit specified in sections 5.4(b) and 5.4(d). If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed the applicable limit specified in sections 5.4(b) and 5.4(d). In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the applicable limit specified in sections 5.4(b) and 5.4(d) by more than 8 dB.
  - iv. Transmitters that transmit a single directional beam shall operate under the provisions of sections 5.4(b), 5.4(d) and 5.4(e).



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

### 2.5.2 Exemption Limits for Routine Evaluation — RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz<sup>Footnote6</sup> and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than  $4.49/f^{0.5}$  W (adjusted for tune-up tolerance), where  $f$  is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than  $1.31 \times 10^{-2} f^{0.6834}$  W (adjusted for tune-up tolerance), where  $f$  is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).
- In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

## 4. Exposure Limits

For the purpose of this standard, Industry Canada has adopted the SAR and RF field strength limits established in Health Canada's RF exposure guideline, Safety Code 6.<sup>Footnote8</sup>

**Table 2: Internal Electric Field Strength Basic Restrictions (3 kHz-10 MHz)**

Condition <sup>19</sup>	Internal Electric Field Strength* (V/m) (any part of the body)
Controlled Environment	$2.7 \times 10^{-4} f$
Uncontrolled Environment	$1.35 \times 10^{-4} f$

**Note:**  $f$  is frequency in Hz.  
\* Instantaneous, RMS values apply.

**Table 3: SAR Limits for Devices Used by the General Public (Uncontrolled Environment)**

Body Region	Average SAR (W/kg)	Averaging Time (minutes) <sup>20</sup>	Mass Average (g)
Whole Body	0.08	6	Whole Body
Localized Head, Neck and Trunk	1.6	6	1
Localized Limbs	4	6	10

**Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)**

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m <sup>2</sup> )	Reference Period (minutes)
0.003-10 <sup>21</sup>	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142 f^{0.3417}$	$0.008335 f^{0.3417}$	$0.02619 f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000/f^{1.2}$

**Note:**  $f$  is frequency in MHz.

\* Based on nerve stimulation (NS).

\*\* Based on specific absorption rate (SAR).



Table 5: SAR Limits for Controlled Use Devices (Controlled Environment)

Body Region	Average SAR (W/kg)	Averaging Time (minutes) <sup>22</sup>	Mass Average (g)
Whole Body	0.4	6	Whole Body
Localized Head, Neck and Trunk	8	6	1
Localized Limbs	20	6	10

Table 6: RF Field Strength Limits for Controlled Use Devices (Controlled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m <sup>2</sup> )	Reference Period (minutes)
0.003-10 <sup>23</sup>	170	180	-	Instantaneous*
0.1-10	-	1.6/ f	-	6**
1.29-10	193/ f <sup>0.5</sup>	-	-	6**
10-20	61.4	0.163	10	6
20-48	129.8/ f <sup>0.25</sup>	0.3444/ f <sup>0.25</sup>	44.72/ f <sup>0.5</sup>	6
48-100	49.33	0.1309	6.455	6
100-6000	15.60 f <sup>0.25</sup>	0.04138 f <sup>0.25</sup>	0.6455 f <sup>0.5</sup>	6
6000-15000	137	0.364	50	6
15000-150000	137	0.364	50	616000/f <sup>1.2</sup>
150000-300000	0.354 f <sup>0.5</sup>	9.40 x 10 <sup>-4</sup> f <sup>0.5</sup>	3.33 x 10 <sup>-4</sup> f	616000/f <sup>1.2</sup>

**Note:** f is frequency in MHz.

\* Based on nerve stimulation (NS).

\*\* Based on specific absorption rate (SAR).

SOURCE: <https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf01904.html>

## FOOTNOTE

(8) Health Canada's Safety Code 6: Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz ([http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio\\_guide-lignes\\_direct/index-eng.php](http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct/index-eng.php)).

## GLOSSARY

**SAR** (Specific Absorption Rate).

See more here: <https://www.fcc.gov/consumers/guides/specific-absorption-rate-sar-cell-phones-what-it-means-you>



# TOOLS TO ASSESS EXPOSURE TO RF RADIATION

## Canadian Cell Tower Map

(<https://www.scadacore.com/tools/rf-path/cell-tower-map-canada/>)

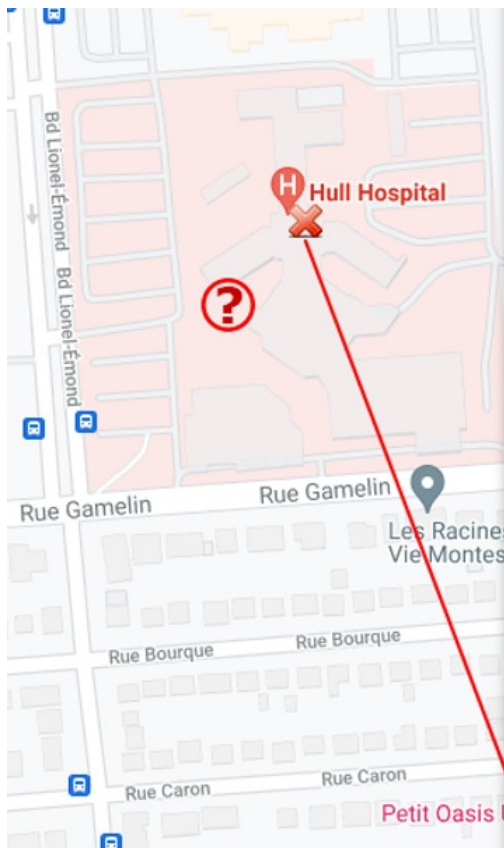


Chart		Location Details			Tower Details					
Company	Station Number	TX Frequency	RX Frequency	Antenna Height	Azimuth	Elevation Angle	Antenna Gain	Total Loss	Output Power	Bandwidth
Rogers Communic...	999999	872.5	872.5	41.8	110	-3	17.8	0.42	8570.42	5
Rogers Communic...	999999	872.5	872.5	39.8	230	-3	17.8	0.42	8570.42	5
Rogers Communic...	999999	1977.5	1977.5	41.8	110	-3	13.5	0.7	3019.96	15
Rogers Communic...	999999	1977.5	1977.5	39.8	230	-3	13.5	0.7	3019.96	15
Rogers Communic...	999999	1977.5	1977.5	41.8	350	-3	13.5	0.7	3019.96	15
Rogers Communic...	999999	2650	2650	41.8	50	-12	15.4	1.11	2142.81	20
Rogers Communic...	999999	2650	2650	39.8	170	-12	15.4	1.73	1857.74	20
Rogers Communic...	999999	2650	2650	41.8	290	-12	15.4	1.73	1857.74	20
FIDO SOLUTIONS ...	999999	1937.5	1937.5	41.8	290	-14	13.3	1.47	926.89	5
FIDO SOLUTIONS ...	999999	1937.5	1937.5	39.8	170	-14	13.3	1.58	903.71	5
FIDO SOLUTIONS ...	999999	1937.5	1937.5	41.8	50	-14	13.3	1.02	1028.09	5
Rogers Communic...	999999	2117.5	2117.5	41.8	290	-10	16.1	1.43	3491.51	15
Rogers Communic...	999999	2117.5	2117.5	39.8	170	-12	16.1	1.54	3396.35	15
Rogers Communic...	999999	2117.5	2117.5	41.8	50	-10	16.1	0.99	3863.78	15
Rogers Communic...	999999	877.5	877.5	41.8	290	-14	13.8	0.94	1161.53	5
Rogers Communic...	999999	877.5	877.5	39.8	170	-14	13.8	1.01	1142.95	5
Rogers Communic...	999999	877.5	877.5	41.8	50	-14	13.8	0.65	1241.74	5
Rogers Communic...	999999	872.5	872.5	41.8	350	-3	17.8	0.42	8570.42	5

Note how the above Cellphone Tower is located on top of a hospital (Hull Hospital, Gatineau, Quebec, Canada), and how transmission output power standards are not respected, as while most of antennas are within the 4W maximum, the cumulative Output Power of this antenna tower exceeds the 57 Watts (4.75 times the maximum recommended).

## RECOMMENDED CHEAP ELECTROMAGNETIC RADIATION METERS



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