

5 FCC §2.1091, §15.247(i) & ISED RSS-102 - RF Exposure

5.1 Applicable Standards

According to FCC §15.247(i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* (100)	30
1.34-30	824/f	2.19/f	* (180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

According to ISED RSS-102 Issue 5:

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 MHz⁶ 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.

5.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

5.3 MPE Results

<u>Maximum average output power at antenna input terminal (dBm):</u>	<u>23.89</u>
<u>Maximum average output power at antenna input terminal (mW):</u>	<u>244.91</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>906</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>1.2</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>1.318</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm²):</u>	<u>0.0642</u>
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm ²):	<u>0.604</u>

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0642 mW/cm². Limit is 0.604 mW/cm².

Radio Co-location

Worst Case Colocation 900MHz radio with LTE and Wi-Fi/BT/BLE radios

Frequency Band	Max Conducted Power (dBm)	Antenna Gain (dBi)	Evaluated Distance (cm)	Worst-Case MPE (mW/cm ²)	MPE Limit (mW/cm ²)	Worst-Case MPE Ratios	Sum of MPE Ratios	Limit
Worst Case								
900 MHz Radio	23.89	1.2	20	0.064	0.604	10.6%		
LTE Radio	24.00	3.5	20	0.112	1.0	11.2%		
Wi-Fi/BT/BLE Radio	22.4	1.4	20	0.048	1.0	4.8%		
							26.6%	100%

Note: LTE and Wi-Fi/BT/BLE conducted out power from pre-certified reports FCC ID: RI7ME910C1NA and 2AK4V-DT-450.

Note: antenna used for the LTE radio module is model: SR4L034-R by Antenova; antenna information for the Wi-Fi/BT/BLE radio from the original filing FCC ID: 2AK4V-DT-450.

5.4 RF exposure evaluation exemption for IC

Maximum EIRP power = $23.89\text{dBm} + 1.2\text{ dBi} = 25.09\text{ dBm}$ which is lesser than $1.31 \times 10^{-2}f^{0.6834} = 1.3746\text{ W} = 31.38\text{ dBm}$.

Therefore the RF exposure Evaluation is exempt.