

## 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 <sup>2</sup> )	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 <sup>2</sup> )	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 MHz<sup>6</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.

## 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

### 2.4 GHz Wi-Fi

<u>Maximum output power at antenna input terminal (dBm):</u>	<u>19.91</u>
<u>Maximum output power at antenna input terminal (mW):</u>	<u>97.95</u>
<u>Tuned up output power at antenna input terminal (dBm):</u>	<u>20.91</u>
<u>Tuned up output power at antenna input terminal (mW):</u>	<u>123.31</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>2462</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>-0.87</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>0.82</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm<sup>2</sup>):</u>	<u>0.02</u>
<u>FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm<sup>2</sup>):</u>	<u>1.0</u>

The device is compliant with the requirement MPE limit for uncontrolled exposure. The tuned up power density at the distance of 20 cm is 0.02 mW/cm<sup>2</sup>. Limit is 1.0 mW/cm<sup>2</sup>.

### BLE

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>6.24</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>4.21</u>
<u>Tuned up output power at antenna input terminal (dBm):</u>	<u>7.24</u>
<u>Tuned up output power at antenna input terminal (mW):</u>	<u>5.30</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>2480</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>-0.87</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>0.82</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm<sup>2</sup>):</u>	<u>0.00086</u>
<u>FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm<sup>2</sup>):</u>	<u>1.0</u>

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.00086 mW/cm<sup>2</sup>. Limit is 1.0 mW/cm<sup>2</sup>.

Note: Client declares that no combination of Bluetooth, 2.4 GHz Wi-Fi and 5GHz Wi-Fi cannot transmit simultaneously.

**5.4 RF exposure evaluation exemption for IC****2.4 GHz Wi-Fi**

$$20.91 - 0.87 \text{ dBi} = 20.04 \text{ dBm} < 1.31 \times 10^{-2} f^{0.6834} = 2.684 \text{ W} = 34.29 \text{ dBm}$$

**2.4 GHz BLE**

$$7.24 - 0.87 \text{ dBi} = 6.37 \text{ dBm} < 1.31 \times 10^{-2} f^{0.6834} = 2.676 \text{ W} = 34.28 \text{ dBm}$$

Therefore the RF exposure is not required.

Note: Client declares that no combination of Bluetooth, 2.4 GHz Wi-Fi and 5GHz Wi-Fi cannot transmit simultaneously.