

## 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

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

## 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 <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | 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%                 | 26.6%             | 100%  |
| 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%                  |                   |       |

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 = 23.89dBm + 1.2 dBi = 25.09 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.