

## 5 FCC §2.1091 & ISEDC RSS-102 - RF Exposure

### 5.1 Applicable Standards

According to FCC §2.1091 and §1.1310(e)(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

### HF RFID Standalone

<u>Maximum ERP (dBm):</u>	<u>-21</u>
<u>Maximum ERP (mW):</u>	<u>0.0079</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>13.56</u>
<u>Power density of prediction frequency at 20 cm (mW/cm<sup>2</sup>):</u>	<u>0.000002</u>
<u>FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm<sup>2</sup>):</u>	<u>0.979</u>

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.000002 mW/cm<sup>2</sup>. Limit is 0.979 mW/cm<sup>2</sup>.

### BLE Standalone

<u>Maximum EIRP (dBm):</u>	<u>4.579</u>
<u>Maximum EIRP (mW):</u>	<u>2.87</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>2402</u>
<u>Power density of prediction frequency at 20 cm (mW/cm<sup>2</sup>):</u>	<u>0.0006</u>
<u>FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm<sup>2</sup>):</u>	<u>1</u>

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0006 mW/cm<sup>2</sup>. Limit is 1 mW/cm<sup>2</sup>.

**LF RFID**

Maximum ERP (dBm): -2.14  
Maximum ERP (mW): 0.61  
Prediction distance (cm): 20  
Prediction frequency (MHz): 0.125  
Power density of prediction frequency at 20 cm (mW/cm<sup>2</sup>): 0.00012  
FCC MPE limit for uncontrolled exposure at prediction frequency 100  
(mW/cm<sup>2</sup>):

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20cm is 0.00012 mW/cm<sup>2</sup>. Limit is 100 mW/cm<sup>2</sup>.

**Worst Case Co-location MPE Calculation:**

Radio	Max EIRP (dBm)	Evaluated Distance (cm)	Worst-Case Exposure Level	Limit	Worst-Case Ratios	Sum of Ratios	Limit
Worst Case							
HF RFID <sup>1</sup>	-21	20	0.000002mW/cm <sup>2</sup>	0.979 mW/cm <sup>2</sup>	0.0002%	0.06%	100%
BLE <sup>2</sup>	4.579	20	0.0006 mW/cm <sup>2</sup>	1.0 mW/cm <sup>2</sup>	0.06%		
LF RFID <sup>1</sup>	-2.14	20	0.00012 mW/cm <sup>2</sup>	100 mW/cm <sup>2</sup>	0.00012%		

<sup>1</sup> NFC is e.r.p

<sup>2</sup> BLE Max EIRP is based on test report "BMD-340 FCC OQPSK" by AGC issued on 2018-05-30.

**5.4 IC Exemption****HF RFID**

Maximum e.r.p = -21 dBm (0.0079 mW) which is less than the exemption threshold, i.e., 1W

Therefore, the SAR evaluation is exempt

**BLE**

Maximum e.i.r.p = 4.579 dBm (2.87 mW) which is less than the exemption threshold, i.e.,  $1.31 \times 10^{-2} \times f^{0.6834} \text{ W} = 2.68 \text{ W}$ .

Therefore, the SAR evaluation is exempt

**LF RFID**

Maximum LF RFID e.r.p = -2.14 dBm (0.61 mW) which is less than the exemption threshold, i.e., 1W

Therefore, the SAR evaluation is exempt

*Note: Per ANSI C63.10 Sections 10.3.9 and G.4, Max ERP for HF RFID was determined by the following calculation:  $76.45 \text{ dBuV/m @ } 3\text{m} - 95.3 - 2.15 \text{ dB} = -21 \text{ dBm [e.r.p]}$*