

## 4 FCC §2.1091, §1.1307 & ISEDC RSS-102 - RF Exposure

### 4.1 Applicable Standards

According to FCC §2.1091, 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 Footnote6 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.

## 4.2 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

## 4.3 MPE Results for FCC

### NFC Standalone

Maximum Peak E.R.P. (dBm): -15.607

Maximum Peak E.R.P. (mW): 0.027

Prediction distance (cm): 20

Prediction frequency (MHz): 13.56

Power density of prediction frequency at 20 cm (mW/cm<sup>2</sup>): 0.00000547

FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm<sup>2</sup>): 0.979

The device is compliant with the FCC requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.00000547 mW/cm<sup>2</sup>. Limit is 0.979 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							
BLE	7.36	20	0.0011 mW/cm <sup>2</sup>	1.0 mW/cm <sup>2</sup>	0.11%	0.11%	100%
UWB	-41.4883	20	0.000000141 mW/cm <sup>2</sup>	1.0 mW/cm <sup>2</sup>	0.00000141%		
NFC*	-15.607	20	0.00000547 mW/cm <sup>2</sup>	0.979 mW/cm <sup>2</sup>	0.00000559%		

Note\*: NFC is ERP

## 4.4 MPE Results for IC

### NFC

Maximum NFC e.r.p. = -15.607 dBm (0.027 mW), which is less than the exemption threshold, i.e., 1 W.

Therefore, the RF exposure evaluation is exempt for NFC.

**Note: Per ANSI C63.10 Sections 10.3.9 and G.4, Max ERP was determined by the following calculation:**

**81.843dBuV/m @ 3m – 95.3 -2.15 dB = -15.607 dBm [ERP]**