

## 4 FCC §2.1091, FCC §15.247(i) – RF Exposure

### 4.1 Applicable Standards

According to FCC §15.247(i), Radio frequency devices operating under the provisions of this part are subject to the radio frequency radiation exposure requirements specified in §§ 1.1307(b), 1.1310, 2.1091, and 2.1093 of this chapter, as appropriate. Applications for equipment authorization of mobile or portable devices operating under this section must contain a statement confirming compliance with these requirements. Technical information showing the basis for this statement must be submitted to the Commission upon request.

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)
<b>Limits for General Population/Uncontrolled Exposure</b>				
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

## 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 FCC MPE Results

Radio	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (mW)	Power Density at 20cm (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )
LoRa	927.5	4.2	18.50	22.7	186.21	0.037	0.618
BT	2402	3.3	12.8	16.1	40.74	0.008	1.000
5 GHz Wi-Fi	5745	6.31	24.9	31.21	1321.3	0.26	1.000
2.4 GHz Wi-Fi	2437	5.01	24.2	29.21	833.7	0.17	1.000
LTE	1710	4	25	29	794.33	0.158	1.000

NOTE: LoRa determined from original test report (SZ24090158S01 by MORLAB)

NOTE: 2.4 GHz and 5 GHz Wi-Fi cannot transmit simultaneously.

NOTE: Wi-Fi antenna gain is considering worst-case MIMO antenna gain. i.e. single antenna gain + 10\*log(2)

### Worst Case Sum of Ratios:

**LoRa + BT + 2.4 Wi-Fi + LTE:  $0.037/0.618 + 0.008/1.0 + 0.17/1.0 + 0.158/1.0 = 0.396 < 1$**

**LoRa + BT + 5 Wi-Fi + LTE:  $0.037/0.618 + 0.008/1.0 + 0.26/1.0 + 0.158/1.0 = 0.486 < 1$**

For the different combination of transmitters, a separation distance of 20 cm complies with the MPE simultaneous transmission limit of  $\leq 1.0$ .