

## **FCC §1.1310 & §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

### **Applicable Standard**

According to subpart §2.1091 and subpart §1.1310, 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 Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
<b>Frequency Range (MHz)</b>	<b>Electric Field Strength (V/m)</b>	<b>Magnetic Field Strength (A/m)</b>	<b>Power Density (mW/cm<sup>2</sup>)</b>	<b>Averaging Time (minutes)</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;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$  = power density (in appropriate units, e.g. mW/cm<sup>2</sup>);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

**Calculated Data:**

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Output Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
		(dBi)	(numeric)	(dBm)	(mW)			
BT	2402-2480	1.5	1.41	7.50	5.62	20	0.0016	1.0
BLE	2402-2480	1.5	1.41	2.00	1.58	20	0.0004	1.0
802.11b	2412-2462	1.5	1.41	20.50	112.20	20	0.0315	1.0
802.11g		1.5	1.41	17.50	56.23	20	0.0158	1.0
802.11n-HT20		1.5	1.41	17.50	56.23	20	0.0158	1.0
802.11n-HT40	2422-2452	1.5	1.41	17.00	50.12	20	0.0141	1.0
WCDMA Band 2	1850~1910	4.8	3.02	23.00	199.53	20	0.1199	1.0
WCDMA Band 5	824-849	3.5	2.24	23.50	223.87	20	0.0997	0.55
LTE Band 2	1850~1910	4.8	3.02	22.50	177.83	20	0.1068	1.0
LTE Band 4	1710~1755	4.8	3.02	22.00	158.49	20	0.0952	1.0
LTE Band 5	824-849	3.5	2.24	23.50	223.87	20	0.0997	0.55
LTE Band 12	699~716	3.5	2.24	23.50	223.87	20	0.0997	0.47
LTE Band 17	704-716	3.5	2.24	23.00	199.53	20	0.0889	0.47

**Note:**

- (1) The all tune-up output powers are declared by the Manufacturer.
- (2) The LTE module FCC ID: SRQ-ME3630, Date of Grant: 08/28/2017.
- (3) Wi-Fi /BLE /BT and LTE can transmit simultaneously; the worst condition is 802.11b of Wi-Fi and LTE Band 12 as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0315/1.0 + 0.0997/0.47 = 0.0315 + 0.2121 = 0.2436 < 1.0$$

**Result:** The device meet FCC MPE at 20 cm distance.