

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

### **Applicable Standard**

According to subpart 15.247 (i) and subpart 1.1310, 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication 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)
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

### **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);

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

**Calculated Data (worst case):****2.4G Wi-Fi&BLE&BT: ( Based on General Population/Uncontrolled Exposure)**

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)			
802.11b	2412~2462	1.0	1.26	20.00	100.00	25	0.0160	1.0
802.11g		1.0	1.26	21.50	141.25	25	<b>0.0226</b>	<b>1.0</b>
802.11n-HT20		1.0	1.26	18.50	70.79	25	0.0113	1.0
802.11n-HT40	2422~2452	1.0	1.26	15.50	35.48	25	0.0057	1.0
BLE	2402-2480	1.0	1.26	10.00	10.00	25	0.0016	1.0
BT	2402-2480	1.0	1.26	12.50	17.78	25	0.0029	1.0

**WCDMA/LTE: ( Based on General Population/Uncontrolled Exposure)**

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
		(dBi)	(numeric)	(dBm)	(mW)			
WCDMA Band II	1850-1910	1.0	1.26	24.50	281.84	25	0.0452	1.00
WCDMA Band V	824-849	1.0	1.26	24.50	281.84	25	0.0452	0.55
LTE Band 2	1850-1910	1.0	1.26	24.00	251.19	25	0.0403	1.00
LTE Band 4	1710-1755	1.0	1.26	24.00	251.19	25	0.0403	1.00
LTE Band 5	824-849	1.0	1.26	24.00	251.19	25	0.0403	0.55
LTE Band 12	699-716	1.0	1.26	24.00	251.19	25	0.0403	0.47
LTE Band 13	777-787	1.0	1.26	24.00	251.19	25	0.0403	0.52
LTE Band 17	704-716	1.0	1.26	24.00	251.19	25	<b>0.0403</b>	<b>0.47</b>

**UHF: ( Based on Occupational/controlled Exposure)**

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
		(dBi)	(numeric)	(dBm)	(mW)			
UHF	410-470	5.5	3.55	33.50	2238.72	25	<b>1.0112</b>	<b>1.37</b>

**Note:**

- 1.The Tune-up output power was declared by the Manufacturer.
- 2.The LTE module FCC ID: R17LE910NAV2(Grant on: 08/19/2015)
3. 2.4G Wi-Fi/BT/BLE, LTE and UHF can transmit simultaneously; the worst condition as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0226/1.0 + 0.0403/0.47 + 1.0112/1.37 = 0.846 < 1.0$$

**Conclusion:** The device meets MPE at distance 25cm.