

## **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.

<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

### **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 (worst case):**

Mode	Frequency Range (MHz)	Tune-up Maximum Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )	MPE ratio
		(dBi)	(numeric)	(dBm)	(mW)				
Wi-Fi 802.11b	2412-2462	0.5	1.12	18.50	70.79	20	0.0158	1.0	<b>0.0158</b>
Wi-Fi 802.11g		0.5	1.12	17.50	56.23	20	0.0125	1.0	0.0125
Wi-Fi 802.11n-HT20		0.5	1.12	17.50	56.23	20	0.0125	1.0	0.0125
Wi-Fi 802.11n-HT40	2422-2452	0.5	1.12	17.50	56.23	20	0.0125	1.0	0.0125
BLE	2402-2480	2.1	1.62	4.00	2.51	20	0.0008	1.00	<b>0.0008</b>
LTE Band 4	1710-1755	2.5	1.78	24.00	251.19	20	0.0889	1.00	0.0889
LTE Band 13	777-787	2.5	1.78	24.00	251.19	20	0.0889	0.52	<b>0.1710</b>
SRD	433.92	/	/	-34.89	0.0003	20	0.0000001	0.29	<b>0.0000003</b>

**Note:**

- (1) The LTE module FCC ID: RI7LE910SVL.  
 (2) The SRD EIRP = 60.31dBμV/m-95.2 = -34.89dBm.  
 (3) Wi-Fi & BLE & SRD & LTE can transmit simultaneously; the worst condition is as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0158 + 0.0008 + 0.1710 + 0.0000003 = 0.1876003 < 1.0$$

**Conclusion:** The device meets MPE at distance 20cm.