

## **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:

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

**Calculation Data:**

Mode	Frequency Range (MHz)	Antenna Gain With cable loss		Tune-up Output Power★		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )	MPE Ratio
		(dBi)	(numeric)	(dBm)	(mW)				
BLE	2402-2480	1.76	1.50	-2.00	0.63	20	0.0002	1.0	0.0002
2.4G Wi-Fi	2412-2462	1.76	1.50	23.00	199.53	20	0.0595	1.0	0.0595
LTE Band 5	824-849	-0.77	0.84	23.50	223.87	20	0.0373	0.5493	0.0679
LTE Band 41	2555-2655	0.98	1.25	25.00	316.23	20	0.0788	1.0	0.0788

**Note:**

1. For the above tune up power were declared by the manufacturer.
2. 2.4G Wi-Fi , LTE Band 41 can transmit simultaneously ( worst case ) .

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0595 + 0.0788 = 0.1383 < 1.0$$

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