

## **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);

### **Calculated Data:**

#### **2.4G WI-FI**

<b>Mode</b>	<b>Frequency Range (MHz)</b>	<b>Antenna Gain</b>		<b>Tune-up Output Power</b>		<b>Evaluation Distance (cm)</b>	<b>Power Density (mW/cm<sup>2</sup>)</b>	<b>MPE Limit (mW/cm<sup>2</sup>)</b>
		<b>(dBi)</b>	<b>(numeric)</b>	<b>(dBm)</b>	<b>(mW)</b>			
802.11b	2412~2462	2.47	1.77	23.00	199.53	20	0.0701	1.0
802.11g		2.47	1.77	22.50	177.83	20	0.0625	1.0
802.11 n-HT20		2.47	1.77	23.00	199.53	20	0.0701	1.0
802.11 n-HT40	2422~2452	2.47	1.77	22.00	158.49	20	0.0557	1.0

**WCDMA&LTE**

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	2.71	1.87	22.5	177.83	20	0.0661	1.0
WCDMA Band IV	1710-1755	1.85	1.53	22.5	177.83	20	0.0541	1.0
WCDMA Band V	824-849	-1.61	0.69	22.5	177.83	20	0.0244	0.55
LTE Band 2	1850-1910	2.71	1.87	22.5	177.83	20	0.0661	1.0
LTE Band 4	1710-1755	1.85	1.53	22.5	177.83	20	0.0541	1.0
LTE Band 12	699-716	0.50	1.12	22.5	177.83	20	0.0396	0.47

**Note:**

1. For the above tune up power were declared by the manufacturer.
2. 2.4G Wi-Fi, WCDMA / LTE can transmit simultaneously, The worst condition is as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0701/1.00 + 0.0396/0.47 = 0.1544 < 1.0$$

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