

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

### **Applicable Standard**

According to subpart 15.247(i) 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	Antenna Gain		Target Output Power		Evaluation Distance	Power Density	MPE Limit	MPE Ratio
	(MHz)	(dBi)	(numeric)	(dBm)	(mW)	(cm)	(mW/cm <sup>2</sup> )	(mW/cm <sup>2</sup> )	
802.11b	2412~2462	3.00	2.00	17.00	50.12	20	0.0199	1.00	0.0199
802.11g		3.00	2.00	16.00	39.81	20	0.0158	1.00	0.0158
802.11n-HT20		3.00	2.00	15.50	35.48	20	0.0141	1.00	0.0141
802.11n-HT40	2422~2452	3.00	2.00	15.00	31.62	20	0.0126	1.00	0.0126
Zigbee	2405~2480	2.50	1.78	7.00	5.01	20	0.0018	1.00	0.0018

**Note:**

- (1) The target output powers are all declared by the manufacturer.
- (2) Wi-Fi and Zigbee can transmit simultaneously, The worst condition is as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0199/1.00 + 0.0018/1.00 = 0.0199 + 0.0018 = 0.0217 < 1.0$$

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