

**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 π R<sup>2</sup> = 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:**

**For LTE mode:**

Mode	Frequency Range (MHz)	Max Antenna Gain		Target Output Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
		(dBi)	(numeric)	(dBm)	(mW)			
Band 5	824-849	2.70	1.86	22	158.49	20	0.0587	0.55
Band 41	2516-2670	3.70	2.34	23	199.53	20	0.0930	1.00

**For Wi-Fi mode:**

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)			
802.11b	2412-2462	2.20	1.66	17.00	50.12	20	0.0165	1.00
802.11g		2.20	1.66	16.00	39.81	20	0.0131	1.00
802.11n-HT20		2.20	1.66	15.00	31.62	20	0.0104	1.00
802.11n-HT40	2422-2452	2.20	1.66	15.00	31.62	20	0.0104	1.00

Mode	Frequency (MHz)	Antenna Gain		Conducted output power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
		(dBi)	(numeric)	(dBm)	(mW)			
802.11a	5150-5250	2.20	1.66	14.00	25.12	20	0.0083	1.00
802.11n-HT20		2.20	1.66	15.00	31.62	20	0.0104	1.00
802.11n-HT40		2.20	1.66	15.00	31.62	20	0.0104	1.00
802.11a	5725-5850	2.20	1.66	14.00	25.12	20	0.0083	1.00
802.11n-HT20		2.20	1.66	15.00	31.62	20	0.0104	1.00
802.11n-HT40		2.20	1.66	16.00	39.81	20	0.0131	1.00

Note:

- (1) The target output power was declared by the Manufacturer.
- (2) 2.4GWi-Fi and 5GWi-Fi cannot transmit simultaneously.
- (3) Wi-Fi and LTE can transmit simultaneously, The worst condition is 802.11b of 2.4G Wi-Fi and LTE Band 5, as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0165/1.00 + 0.0587/0.55 = 0.0165 + 0.1067 = 0.1232 < 1.0$$

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