

# Appendix B. Maximum Permissible Exposure



## 1. Maximum Permissible Exposure

## **1.1.** Applicable Standard

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 levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm²)	Averaging Time  E  <sup>2</sup> ,  H  <sup>2</sup> or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(A) Limits for Occupational / Controlled Exposure

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm²)	Averaging Time  E  <sup>2</sup> ,  H  <sup>2</sup> or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; \*Plane-wave equivalent power density

## 1.2. MPE Calculation Method

$$E (V/m) = \frac{\sqrt{30 \times P \times G}}{d}$$
 Power Density:  $Pd (W/m^2) = \frac{E^2}{377}$ 

E = Electric field (V/m)

**P** = Average RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained.



### 1.3. Calculated Result and Limit

#### For 5GHz UNII Band:

#### Antenna Type : PIFA Antenna

Max Conducted Power for IEEE 802.11a : 16.48dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm <sup>2</sup> )	Test Result
5.00	3.1623	16.4800	44.4631	0.027987	1	Complies

#### For 5GHz ISM Band:

Antenna Type : PIFA Antenna

#### Max Conducted Power for IEEE 802.11a: 16.44dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm <sup>2</sup> )	Test Result
5.00	3.1623	16.4400	44.0555	0.027730	1	Complies

#### For 2.4GHz Band:

Antenna Type : PIFA Antenna

Max Conducted Power for IEEE 802.11b: 18.45dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm <sup>2</sup> )	Test Result
3.50	2.2387	18.4500	69.9842	0.031185	1	Complies

#### For Bluetooth:

Antenna Type : PIFA Antenna

#### Max Conducted Power for Bluetooth 1.0 : 7.89 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm <sup>2</sup> )	Test Result
3.50	2.2387	7.8900	6.1518	0.002741	1	Complies

For Bluetooth:

Antenna Type : PIFA Antenna

Max Conducted Power for Bluetooth 4.0 : 8.09 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm <sup>2</sup> )	Test Result
3.50	2.2387	8.0900	6.4417	0.002870	1	Complies



#### CONCULSION:

Both of the WLAN function and Bluetooth function can transmit simultaneously, the formula of calculated the MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + .....etc. < 1

CPD = Calculation power density

#### LPD = Limit of power density

Therefore, the worst-case situation is 0.031185 / 1 + 0.002870 / 1 = 0.034055, which isless than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.