

## Appendix C. 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.

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm <sup>2</sup> )	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

(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/ cm <sup>2</sup> )	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

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

**E** = Electric field (V/m)

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

### 1.3. Calculated Result and Limit

#### 1.3.1. For 5GHz Band:

For UNII Band:

Antenna Type : PCB Antenna

Max Conducted Power for IEEE 802.11an MCS0 20MHz Ant. 3 + Ant. 4 + Ant. 5: 16.98 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power ( mW )	Power Density (S) (mW/cm <sup>2</sup> )	Limit of Power Density (S) (mW/cm <sup>2</sup> )	Test Result
4.42	2.7669	16.9807	49.8970	0.027480	1	Complies

For ISM Band:

Antenna Type : PCB Antenna

Max Conducted Power for IEEE 802.11an MCS0 20MHz Ant. 3 + Ant. 4 + Ant. 5: 29.45 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power ( mW )	Power Density (S) (mW/cm <sup>2</sup> )	Limit of Power Density (S) (mW/cm <sup>2</sup> )	Test Result
4.42	2.7669	29.4546	881.9751	0.485743	1	Complies

#### 1.3.2. For 2.4GHz Band:

Antenna Type : PCB Antenna

Max Conducted Power for IEEE 802.11n MCS0 20MHz Ant. 1 + Ant. 2: 29.66 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power ( mW )	Power Density (S) (mW/cm <sup>2</sup> )	Limit of Power Density (S) (mW/cm <sup>2</sup> )	Test Result
3.48	2.2284	29.6574	924.1443	0.409912	1	Complies

### 1.3.3. For 5GHz & 2.4GHz Band (Co-Location):

<For 5GHz Band>:

Antenna Type : PCB Antenna

Max Conducted Power for IEEE 802.11an MCS0 20MHz Ant. 3 + Ant. 4 + Ant. 5: 28.36 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power ( mW )	Power Density (S) (mW/cm <sup>2</sup> )	Limit of Power Density (S) (mW/cm <sup>2</sup> )	Test Result
4.42	2.7669	28.3617	685.7558	0.377676	1	Complies

<For 2.4GHz Band>:

Antenna Type : PCB Antenna

Max Conducted Power for IEEE 802.11n MCS0 20MHz Ant. 1 + Ant. 2: 29.66 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power ( mW )	Power Density (S) (mW/cm <sup>2</sup> )	Limit of Power Density (S) (mW/cm <sup>2</sup> )	Test Result
3.48	2.2284	29.6574	924.1443	0.409912	1	Complies

#### CONCLUSION:

Both of the 5GHz and 2.4GHz can transmit simultaneously, the formula of calculated the MPE is:

$$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$$

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is  $0.485743 / 1 + 0.409912 / 1 = 0.895655$ , which is less than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.