

# 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=0.29m, as well as the gain of the used antenna, the RF power density can be obtained.



#### 1.3. Calculated Result and Limit

#### Exposure Environment: General Population / Uncontrolled Exposure

For 5GHz Band 1:

Antenna Type : Dipole Antenna

#### Conducted Power for IEEE 802.11ac MCS0/Nss1 VHT20: 25.19dBm

Distance (m)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S)	Limit of Power	Test Result	
			(dBm)	(mW)	(mW/cm <sup>2</sup> )	Density (S) (mW/cm²)		
	0.29	8.67	7.3641	25.1884	330.2510	0.230239	1	Complies

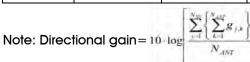
Note: Directional gain =  $10 \cdot \log \left| \frac{\sum_{j=1}^{N_{w}} \left\{ \sum_{k=1}^{N_{w}} g_{j,k} \right\}}{N_{MT}} \right|$ 

For	5GHz	Band	4:
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#### Antenna Type : Dipole Antenna

#### Conducted Power for IEEE 802.11ac MCS0/Nss1 VHT40: 25.93dBm

Distance (m)	Directional	Antenna		m combined utput Power	Power Density (S)	Limit of Power	Test Result
	Gain (dBi)	(numeric)	(dBm)	(mW)	(mW/cm <sup>2</sup> )	Density (S) (mW/cm²)	
0.29	8.67	7.3641	25.9285	391.6058	0.273014	1	Complies



#### For 2.4GHz Band:

#### Antenna Type : Dipole Antenna

#### Conducted Power for IEEE 802.11n MCS0 HT20 : 29.01dBm

Distance (m)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S)	Limit of Power Density (S)	Test Result
(III)			(dBm)	(mW)	(mW/cm²)	(mW/cm <sup>2</sup> )	
0.29	6.97	4.9788	29.0054	795.3077	0.374861	1	Complies

# Note: Directional gain = $10 \cdot \log \left| \frac{\sum_{j=1}^{N_{ext}} \left\{ \sum_{k=1}^{N_{ext}} g_{j,k} \right\}^2}{N_{ext}} \right|$

#### Conclusion:

Both of the 2.4GHz WLAN function, 5GHz Band 1 WLAN function and 5GHz Band 4 WLAN 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 0.374861/1 + 0.230239/1 + 0.273014/1 = 0.878114, which is less than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.