

# Appendix B. Maximum Permissible Exposure

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# 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 that distance of at least 0.2 m is normally 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/ 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

### (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/m²) =  $\frac{E^2}{377}$ 

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=0.25m, as well as the gain of the used antenna, the RF power density can be obtained.

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#### 1.3. Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

For 5GHz Band (NII):

Antenna Type: Dipole Antenna

Conducted Power for IEEE 802.11 ac VHT20 MCS0NSS1: 26.53dBm

Distance (m)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	Output Power		Power Density (S) (mW/cm²)	Limit of Power Density (S)	Test Result
			(Hullielic)	(dBm)	(mW)	(IIIW/CIII-)	(mW/cm²)	
0.25	5180	9.39	8.6908	26.5268	449.4467	0.497586	1	Complies

Note:  $DirectionalGain = 10 \cdot log \left[ \frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$ 

For 5GHz Band (DTS):

Antenna Type: Dipole Antenna

Conducted Power for IEEE 802.11ac VHT40 MCS0NSS1: 26.53dBm

Distance (m)	Test Freq. (MHz)	Directional Gain Gain (dBi)	Antenna Gain (numeric)	Oulpul Power		Power Density (S) (mW/cm²)	Limit of Power Density (S)	Test Result
		(GBI)	(Hullielic)	(dBm)	(mW)	(IIIW/CIII')	(mW/cm²)	
0.25	5755	9.39	8.6908	26.5307	449.8550	0.498038	1	Complies

Note:  $Directional Gain = 10 \cdot \log \left[ \frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$ 

For 2.4GHz Band:

Antenna Type: Dipole Antenna

Conducted Power for IEEE 802.11ac VHT20 MCS0NSS1: 27.49 dBm

Distance (m)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)		aximum d Average r Power	Power Density (S) (mW/cm²)	Limit of Power Density (S)	Test Result
0.25	2437	8.27	6.7152	27.4935	561.4941	0.480325	1	Complies

Note:  $Directional Gain = 10 \cdot log \left[ \frac{\displaystyle \sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$ 

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### Conclusion:

Both of the WLAN 2.4GHz Band and WLAN 5GHz Band 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 0.480325 / 1 + 0.498038 / 1 = 0.978363, which is less than "1". This confirmed that the device complies.

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