

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 ², H ² or \$ (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 ², H ² 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 802.11ac MCS0/Nss1 VHT20: 22.38dBm

Distance (m)	Test Freq.	Directional Gain (dBi)	Antenna Gain	The maximum combined Average Output Power		Power Density (S)	Limit of Power Density (S)	Test Result
			(numeric)	(dBm)	(mW)	(mW/cm²)	(mW/cm²)	
0.25	5180	5.67	3.6908	22.3825	173.0816	0.081377	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 MCS0/Nss1 VHT20: 29.90dBm

Distance (m)	Test Freq.	Directional Gain (dBi)	Antenna Gain	The maximum combined Average Output Power		Power Density (S)	Limit of Power Density (S)	Test Result
			(numeric)	(dBm)	(mW)	(mW/cm²)	(mW/cm²)	
0.25	5745	5.67	3.6908	29.8989	976.9888	0.459347	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 MCS0/Nss1 VHT20: 29.13 dBm

Distance (m)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain	The maximum combined Average Output Power		Power Density (S)	Limit of Power Density (S)	Test Result
			(numeric)	(dBm)	(mW)	(mW/cm²)	(mW/cm²)	
0.25	2437	5.37	3.4445	29.1283	818.1352	0.358985	1	Complies

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

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CONCULSION:

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 0.459347 / 1 + 0.358985 / 1 = 0.8183, which isless than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.

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