

4 FCC §2.1091 & §15.407(f) - RF Exposure

4.1 Applicable Standards

According to FCC §15.407(f) and §1.1307(b)(1), 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 level in excess of the Commission's guidelines.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* (100)	30
1.34-30	824/f	2.19/f	* (180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

4.3 MPE Results

5 GHz Wi-Fi

<u>Maximum output power at antenna input terminal (dBm):</u>	<u>19.04</u>
<u>Maximum output power at antenna input terminal (mW):</u>	<u>80.16781</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>5825</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>1.0</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>1.258925</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm²):</u>	<u>0.0200785</u>
<u>FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u>	<u>1.0</u>

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0200785 mW/cm². Limit is 1.0 mW/cm².

2.4 GHz BLE

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>12.77</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>18.92344</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>2440</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>1.0</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>1.258925</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm²):</u>	<u>0.004739</u>
<u>FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u>	<u>1.0</u>

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.004739 mW/cm². Limit is 1.0 mW/cm².

2.4 GHz Classic Bluetooth

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>12.87</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>19.36422</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>2441</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>1.0</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>1.258925</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm²):</u>	<u>0.004850</u>
<u>FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u>	<u>1.0</u>

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.004850 mW/cm². Limit is 1.0 mW/cm².

Worst case colocation 5 GHz Wi-Fi and 2.4 GHz Classic Bluetooth.

Frequency Band	Max Conducted Power(dBm)	Evaluated Distance (cm)	Worst-Case MPE (mW/cm ²)	MPE Limit (mW/cm ²)	Worst-Case MPE Ratios	Sum of MPE Ratios	Limit
Worst Case							
5 GHz WiFi	19.04	20	0.0200785	1.0	2.00785%		
2.4 GHz Classic Bluetooth	12.87	20	0.0048500	1.0	0.485%	2.49285%	100%