# 5 FCC §2.1091, §15.247(i)– RF Exposure

# 5.1 Applicable Standards

According to FCC §15.247(i) 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 <sup>2</sup> )	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

# 5.2 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

<sup>\* =</sup> Plane-wave equivalent power density

#### 5.3 MPE Results

#### Radio 1

## 5 GHz Wi-Fi

Maximum output power at antenna input terminal (dBm):21.91Maximum output power at antenna input terminal (mW):155.2387Prediction distance (cm):20Prediction frequency (MHz):5745

Maximum Antenna Gain, typical (dBi): 2.6

Maximum Antenna Gain (numeric): 1.82

Power density of prediction frequency at 20.0 cm (mW/cm<sup>2</sup>): 0.05620844

FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm $^2$ ): 1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.05620844mW/cm<sup>2</sup>. Limit is 1.0 mW/cm<sup>2</sup>.

#### 2.4 GHz Wi-Fi

Maximum peak output power at antenna input terminal (dBm): 22.47

Maximum peak output power at antenna input terminal (mW): 176.6038

Prediction distance (cm): 20
Prediction frequency (MHz): 2437

Maximum Antenna Gain, typical (dBi): 1.8

Maximum Antenna Gain (numeric): 1.51

Power density of prediction frequency at 20.0 cm (mW/cm<sup>2</sup>): 0.05305266

FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm $^2$ ): 1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.05305266mW/cm<sup>2</sup>. Limit is 1.0 mW/cm<sup>2</sup>.

# Radio 2

## 5 GHz Wi-Fi

Maximum output power at antenna input terminal (dBm): 19.18

Maximum output power at antenna input terminal (mW): 22.704

Maximum output power at antenna input terminal (mW): 82.7942

Prediction distance (cm): 20
Prediction frequency (MHz): 5745

Maximum Antenna Gain, typical (dBi): 2.6

Maximum Antenna Gain (numeric): 1.82

Power density of prediction frequency at 20.0 cm (mW/cm<sup>2</sup>): 0.029959016

FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm<sup>2</sup>): 1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.029959016mW/cm<sup>2</sup>. Limit is 1.0 mW/cm<sup>2</sup>.

## 2.4 GHz Wi-Fi

Maximum peak output power at antenna input terminal (dBm): 22.02

Maximum peak output power at antenna input terminal (mW): 159.2209

Prediction distance (cm): 20

Prediction frequency (MHz): 2412

Maximum Antenna Gain, typical (dBi): 1.8

Maximum Antenna Gain (numeric): 1.51

Power density of prediction frequency at 20.0 cm (mW/cm<sup>2</sup>): 0.047830747

FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm<sup>2</sup>): 1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.047830747mW/cm<sup>2</sup>. Limit is 1.0 mW/cm<sup>2</sup>.

#### 2.4 GHz Classic Bluetooth

Maximum peak output power at antenna input terminal (dBm): 12.81

Maximum peak output power at antenna input terminal (mW): 19.09853

Prediction distance (cm): 20

Prediction frequency (MHz): 2402

Maximum Antenna Gain, typical (dBi): 1.8

Maximum Antenna Gain (numeric): 1.51

Power density of prediction frequency at 20.0 cm (mW/cm<sup>2</sup>): 0.005737293

FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm<sup>2</sup>): 1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.005737293mW/cm<sup>2</sup>. Limit is 1.0 mW/cm<sup>2</sup>.

# Worst case colocation Radio 1 5 GHz Wi-Fi, Radio 2 2.4 GHz Wi-Fi and 2.4 GHz Classic Bluetooth:

Frequency Band	Max Conducted Power(dBm)	Evaluated Distance (cm)	Worst-Case MPE (mW/cm²)	MPE Limit (mW/cm <sup>2</sup> )	Worst- Case MPE Ratios	Sum of MPE Ratios	Limit		
Worst Case									
Radio 1 5 GHz WiFi	21.91	20	0.05620844	1.0	5.621%				
Radio 2 2.4 GHz WiFi	22.02	20	0.047830747	1.0	4.783%	10.978%	100%		
2.4 GHz Classic BT	12.81	20	0.005737293	1.0	0.574%				