# 4 FCC §15.407(f) - RF Exposure

## 4.1 Applicable Standard

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.

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 Gen	eral Population/Uncont	rolled Exposure	
0.3-1.34	614	1.63	* (100)	30
1.34-30	824/f	2.19/f	* (180/f <sup>2</sup> )	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

Limits for General Population/Uncontrolled Expo
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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

# 3 dBi Antenna, 5.2 GHz

Maximum peak output power at antenna input terminal (dBm):	<u>22.39</u>
Maximum peak output power at antenna input terminal (mW):	173.38
Prediction distance (cm):	<u>20</u>
Prediction frequency (MHz):	<u>5230</u>
Maximum Antenna Gain, typical (dBi):	<u>3</u>
Maximum Antenna Gain (numeric):	<u>1.995262</u>
Power density of prediction frequency at 20.0 cm (mW/cm <sup>2</sup> ):	0.068822
MPE limit for uncontrolled exposure at prediction frequency (mW/cm <sup>2</sup> ):	<u>1</u>

The device meets FCC MPE requirement for uncontrolled exposure environment at 20 cm distance.

## 3 dBi Antenna, 5.8 GHz

Maximum peak output power at antenna input terminal (dBm):	<u>21.55</u>
Maximum peak output power at antenna input terminal (mW):	142.89
Prediction distance (cm):	<u>20</u>
Prediction frequency (MHz):	<u>5785</u>
Maximum Antenna Gain, typical (dBi):	<u>3</u>
Maximum Antenna Gain (numeric):	<u>1.99526231</u>
Power density of prediction frequency at 20.0 cm (mW/cm <sup>2</sup> ):	0.0567
<u>MPE limit for uncontrolled exposure at prediction frequency (mW/cm<sup>2</sup>):</u>	<u>1</u>

The device meets FCC MPE requirement for uncontrolled exposure environment at 20 cm distance.

#### 5 dBi Antenna, 5.2GHz

Maximum peak output power at antenna input terminal (dBm):	<u>23.42</u>
Maximum peak output power at antenna input terminal (mW):	<u>219.786</u>
Prediction distance (cm):	<u>20</u>
Prediction frequency (MHz):	<u>5230</u>
Maximum Antenna Gain, typical (dBi):	<u>5</u>
Maximum Antenna Gain (numeric):	<u>3.162278</u>
Power density of prediction frequency at 20.0 cm (mW/cm <sup>2</sup> ):	0.13827
MPE limit for uncontrolled exposure at prediction frequency (mW/cm <sup>2</sup> ):	<u>1</u>

## 5 dBi Antenna, 5.8 GHz

Maximum peak output power at antenna input terminal (dBm):	<u>21.74</u>
Maximum peak output power at antenna input terminal (mW):	<u>149.28</u>
Prediction distance (cm):	<u>20</u>
Prediction frequency (MHz):	<u>5745</u>
Maximum Antenna Gain, typical (dBi):	<u>5</u>
Maximum Antenna Gain (numeric):	<u>3.162278</u>
Power density of prediction frequency at 20.0 cm (mW/cm <sup>2</sup> ):	<u>0.094</u>
MPE limit for uncontrolled exposure at prediction frequency (mW/cm <sup>2</sup> ):	<u>1</u>

The device meets FCC MPE requirement for uncontrolled exposure environment at 20 cm distance.

#### 8 dBi Antenna, 5.2 GHz

Maximum peak output power at antenna input terminal (dBm):	<u>22.66</u>
Maximum peak output power at antenna input terminal (mW):	<u>184.5015</u>
Prediction distance (cm):	<u>20</u>
Prediction frequency (MHz):	<u>5230</u>
Maximum Antenna Gain, typical (dBi):	<u>8</u>
Maximum Antenna Gain (numeric):	<u>6.309573</u>
Power density of prediction frequency at 20.0 cm (mW/cm <sup>2</sup> ):	0.2316
limit for uncontrolled exposure at prediction frequency (mW/cm <sup>2</sup> ):	<u>1</u>

The device meets FCC MPE requirement for uncontrolled exposure environment at 20 cm distance.

#### 8 dBi Antenna, 5.8 GHz

Maximum peak output power at antenna input terminal (dBm):	<u>21.47</u>
Maximum peak output power at antenna input terminal (mW):	<u>140.2814</u>
Prediction distance (cm):	<u>20</u>
Prediction frequency (MHz):	<u>5785</u>
Maximum Antenna Gain, typical (dBi):	<u>8</u>
Maximum Antenna Gain (numeric):	<u>6.309573</u>
Power density of prediction frequency at 20.0 cm (mW/cm <sup>2</sup> ):	<u>0.1761</u>
MPE limit for uncontrolled exposure at prediction frequency (mW/cm <sup>2</sup> ):	<u>1</u>

# 12 dBi Antenna, 5.2 GHz

Maximum peak output power at antenna input terminal (dBm):	18.42
Maximum peak output power at antenna input terminal (mW):	25.35129
Prediction distance (cm):	<u>20</u>
Prediction frequency (MHz):	<u>5230</u>
Maximum Antenna Gain, typical (dBi):	<u>12</u>
Maximum Antenna Gain (numeric):	<u>15.84893</u>
Power density of prediction frequency at 20.0 cm (mW/cm <sup>2</sup> ):	<u>0.219</u>
MPE limit for uncontrolled exposure at prediction frequency (mW/cm <sup>2</sup> ):	<u>1</u>

The device meets FCC MPE requirement for uncontrolled exposure environment at 20 cm distance.

## 12 dBi Antenna, 5.8 GHz

Maximum peak output power at antenna input terminal (dBm):	<u>16.05</u>
Maximum peak output power at antenna input terminal (mW):	40.27
Prediction distance (cm):	<u>20</u>
Prediction frequency (MHz):	<u>5745</u>
Maximum Antenna Gain, typical (dBi):	<u>12</u>
Maximum Antenna Gain (numeric):	<u>15.84893</u>
Power density of prediction frequency at 20.0 cm (mW/cm <sup>2</sup> ):	0.127
<u>MPE limit for uncontrolled exposure at prediction frequency (mW/cm<sup>2</sup>):</u>	<u>1</u>

The device meets FCC MPE requirement for uncontrolled exposure environment at 20 cm distance.

#### 15 dBi Antenna, 5.2 GHz

Maximum peak output power at antenna input terminal (dBm):	15.21
Maximum peak output power at antenna input terminal (mW):	<u>33.19</u>
Prediction distance (cm):	<u>20</u>
Prediction frequency (MHz):	<u>5230</u>
Maximum Antenna Gain, typical (dBi):	<u>15</u>
Maximum Antenna Gain (numeric):	<u>31.62278</u>
Power density of prediction frequency at 20.0 cm (mW/cm <sup>2</sup> ):	0.2088
MPE limit for uncontrolled exposure at prediction frequency (mW/cm <sup>2</sup> ):	<u>1</u>

# 15 dBi Antenna, 5.8 GHz

Maximum peak output power at antenna input terminal (dBm):	<u>15.71</u>
Maximum peak output power at antenna input terminal (mW):	37.24
Prediction distance (cm):	<u>20</u>
Prediction frequency (MHz):	<u>5755</u>
Maximum Antenna Gain, typical (dBi):	<u>15</u>
Maximum Antenna Gain (numeric):	31.62278
Power density of prediction frequency at 20.0 cm (mW/cm <sup>2</sup> ):	0.2343
MPE limit for uncontrolled exposure at prediction frequency (mW/cm <sup>2</sup> ):	<u>1</u>