

1 FCC §2.1091 - RF Exposure

1.1 Applicable Standards

According to §2.1091 (Mobile Devices) RF exposure is calculated.

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 (minute)
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

Note: f = frequency in MHz

* = Plane-wave equivalent power density

1.2 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

1.3 Test Results

Cellular Band

Downlink (Directional Antenna)

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>15.98</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>39.627</u>
<u>Prediction distance (cm):</u>	<u>30</u>
<u>Prediction frequency (MHz):</u>	<u>881.5</u>
<u>Antenna Gain, typical (dBi):</u>	<u>8.5</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>7.0795</u>
<u>Power density at predication frequency and distance (mW/cm²):</u>	<u>0.025</u>
<u>MPE limit for uncontrolled exposure at predication frequency (mW/cm²):</u>	<u>0.588</u>

Downlink (Omni Directional Antenna)

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>15.98</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>39.627</u>
<u>Prediction distance (cm):</u>	<u>30</u>
<u>Prediction frequency (MHz):</u>	<u>881.5</u>
<u>Antenna Gain, typical (dBi):</u>	<u>3.5</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>2.239</u>
<u>Power density at predication frequency and distance (mW/cm²):</u>	<u>0.0079</u>
<u>MPE limit for uncontrolled exposure at predication frequency (mW/cm²):</u>	<u>0.588</u>

Uplink

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>15.88</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>38.726</u>
<u>Prediction distance (cm):</u>	<u>30</u>
<u>Prediction frequency (MHz):</u>	<u>836.5</u>
<u>Antenna Gain, typical (dBi):</u>	<u>8.5</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>7.0795</u>
<u>Power density at predication frequency and distance (mW/cm²):</u>	<u>0.0243</u>
<u>MPE limit for uncontrolled exposure at predication frequency (mW/cm²):</u>	<u>0.558</u>

PCS Band**Downlink (Directional Antenna)**

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>16.04</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>40.180</u>
<u>Prediction distance (cm):</u>	<u>30</u>
<u>Prediction frequency (MHz):</u>	<u>1960</u>
<u>Antenna Gain, typical (dBi):</u>	<u>10</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>10</u>
<u>Power density at predication frequency and distance (mW/cm²):</u>	<u>0.036</u>
<u>MPE limit for uncontrolled exposure at predication frequency (mW/cm²):</u>	<u>1.0</u>

Downlink (Omni Directional Antenna)

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>16.04</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>40.180</u>
<u>Prediction distance (cm):</u>	<u>30</u>
<u>Prediction frequency (MHz):</u>	<u>1960</u>
<u>Antenna Gain, typical (dBi):</u>	<u>5</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>3.1622</u>
<u>Power density at predication frequency and distance (mW/cm²):</u>	<u>0.0113</u>
<u>MPE limit for uncontrolled exposure at predication frequency (mW/cm²):</u>	<u>1.0</u>

Uplink

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>15.86</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>38.548</u>
<u>Prediction distance (cm):</u>	<u>30</u>
<u>Prediction frequency (MHz):</u>	<u>1852.5</u>
<u>Antenna Gain, typical (dBi):</u>	<u>10</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>10</u>
<u>Power density at predication frequency and distance (mW/cm²):</u>	<u>0.0341</u>
<u>MPE limit for uncontrolled exposure at predication frequency (mW/cm²):</u>	<u>1.0</u>

Band 4**Downlink (Bidirectional)**

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>15.80</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>38.460</u>
<u>Prediction distance (cm):</u>	<u>30</u>
<u>Prediction frequency (MHz):</u>	<u>2150</u>
<u>Antenna Gain, typical (dBi):</u>	<u>10</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>10</u>
<u>Power density at predication frequency and distance (mW/cm²):</u>	<u>0.014</u>
<u>MPE limit for uncontrolled exposure at predication frequency (mW/cm²):</u>	<u>1.0</u>

Downlink (Omnidirectional)

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>15.80</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>38.460</u>
<u>Prediction distance (cm):</u>	<u>30</u>
<u>Prediction frequency (MHz):</u>	<u>2150</u>
<u>Antenna Gain, typical (dBi):</u>	<u>5</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>3.163</u>
<u>Power density at predication frequency and distance (mW/cm²):</u>	<u>0.0044</u>
<u>MPE limit for uncontrolled exposure at predication frequency (mW/cm²):</u>	<u>1.0</u>

Uplink

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>16</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>39.811</u>
<u>Prediction distance (cm):</u>	<u>30</u>
<u>Prediction frequency (MHz):</u>	<u>1710.8</u>
<u>Antenna Gain, typical (dBi):</u>	<u>10</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>10</u>
<u>Power density at predication frequency and distance (mW/cm²):</u>	<u>0.036</u>
<u>MPE limit for uncontrolled exposure at predication frequency (mW/cm²):</u>	<u>1.0</u>

Band 13 & Band 17**Downlink (Bidirectional)**

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>15.78</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>37.845</u>
<u>Prediction distance (cm):</u>	<u>30</u>
<u>Prediction frequency (MHz):</u>	<u>751</u>
<u>Antenna Gain, typical (dBi):</u>	<u>8.5</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>7.080</u>
<u>Power density at predication frequency and distance (mW/cm²):</u>	<u>0.0238</u>
<u>MPE limit for uncontrolled exposure at predication frequency (mW/cm²):</u>	<u>0.500</u>

Downlink (Omnidirectional)

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>15.78</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>37.845</u>
<u>Prediction distance (cm):</u>	<u>30</u>
<u>Prediction frequency (MHz):</u>	<u>751</u>
<u>Antenna Gain, typical (dBi):</u>	<u>3.5</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>2.239</u>
<u>Power density at predication frequency and distance (mW/cm²):</u>	<u>0.0075</u>
<u>MPE limit for uncontrolled exposure at predication frequency (mW/cm²):</u>	<u>0.500</u>

Uplink

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>15.98</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>39.628</u>
<u>Prediction distance (cm):</u>	<u>30</u>
<u>Prediction frequency (MHz):</u>	<u>706.5</u>
<u>Antenna Gain, typical (dBi):</u>	<u>8.5</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>7.080</u>
<u>Power density at predication frequency and distance (mW/cm²):</u>	<u>0.0249</u>
<u>MPE limit for uncontrolled exposure at predication frequency (mW/cm²):</u>	<u>0.471</u>

Results

For uplink and downlink, the highest power density levels at **30 cm** are below the MPE uncontrolled exposure limit.

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