

4 FCC §2.1091 & §15.407(f) IC RSS-102 - 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.

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

Before equipment certification is granted, the procedure of IC RSS-102 must be followed concerning the exposure of humans to RF field

According to IC RSS-102 Issue 5 section 4, RF limits used for general public will be applied to the EUT.

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ f	-	6**
1.1-10	87/ f ^{0.5}	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ f ^{0.25}	0.1540/ f ^{0.25}	8.944/ f ^{0.5}	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 f ^{0.3417}	0.008335 f ^{0.3417}	0.02619 f ^{0.6834}	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ f ^{1.2}
150000-300000	0.158 f ^{0.5}	4.21 x 10 ⁻⁴ f ^{0.5}	6.67 x 10 ⁻⁵ f	616000/ f ^{1.2}
<p>Note: f is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).</p>				

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

Case 1

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>17.95</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>62.3735</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>5785</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>18</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>63.09573</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm²):</u>	<u>0.783</u>
<u>FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u>	<u>1.0</u>
<u>Power density of prediction frequency at 20.0 cm (W/m²):</u>	<u>7.83</u>
<u>IC MPE limit for uncontrolled exposure at prediction frequency (W/m²):</u>	<u>9.76</u>

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.783 mW/cm² and 7.83 W/m². Limit is 1.0 mW/cm² for FCC and 9.76 W/m² for IC.

Case 2

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>20.85</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>121.6186</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>5755</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>15</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>31.623</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm²):</u>	<u>0.765</u>
<u>FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u>	<u>1.0</u>
<u>Power density of prediction frequency at 20.0 cm (W/m²):</u>	<u>7.65</u>
<u>IC MPE limit for uncontrolled exposure at prediction frequency (W/m²):</u>	<u>9.72</u>

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.765 mW/cm² and 7.65 W/m². Limit is 1.0 mW/cm² for FCC and 9.72 W/m² for IC.

Case 3

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>20.36</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>108.64</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>5785</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>15</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>31.623</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm²):</u>	<u>0.684</u>
<u>FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u>	<u>1.0</u>
<u>Power density of prediction frequency at 20.0 cm (W/m²):</u>	<u>6.84</u>
<u>IC MPE limit for uncontrolled exposure at prediction frequency (W/m²):</u>	<u>9.8</u>

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.684 mW/cm² and 6.84 W/m². Limit is 1.0 mW/cm² for FCC and 9.8 W/m² for IC.