

**MAXIMUM PERMISSIBLE EXPOSURE****Standard Applicable****FCC RULES**

Section 15.247 (b)(5) : 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 levels in excess of the Commission's guidelines. *See* § 1.1307(b)(1) of this Chapter.

Section 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency radiation as specified in 1.1307(b) LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (nW/cm <sup>2</sup> )	Average Time (Minutes)
(A) Limits for Occupational/control Exposures				
300-1500	--	--	F/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/Uncontrolled Exposures				
300-1500	--	--	F/300	6
1500-100,000	--	--	1	30

F = Frequency in MHz

**IC RULES**

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

**Table 5**  
**Exposure Limits for Persons Not Classified As RF and Microwave Exposed Workers (Including the General Public)**

1 Frequency (MHz)	2 Electric Field Strength, rms (V/m)	3 Magnetic Field Strength, rms (A/m)	4 Power Density (W/m <sup>2</sup> )	5 Averaging Time (min)
0.003-1	280	2.19		6
1-10	280/f	2.19/f		6
10-30	28	2.19/f		6
30-300	28	0.373	2*	6
300-500	1.585f <sup>0.5</sup>	0.0042f <sup>0.5</sup>	f/150	6
1500-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	818 000 / f <sup>2</sup>
150000-300000	0.158f <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> f <sup>0.5</sup>	3.67 x 10 <sup>-6</sup> f	818 000 / f <sup>2</sup>

\* Power density limit is applicable at frequencies greater than 100 MHz.

Notes: 1. Frequency, *f*, is in MHz.  
2. A power density of 10 W/m<sup>2</sup> is equivalent to 1 mW/cm<sup>2</sup>.  
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

**Calculations**

$$\text{Friis transmission formula: } \mathbf{P_d} = (\mathbf{P_{out}} * \mathbf{G}) / (4 * \mathbf{pi} * \mathbf{r}^2)$$

Where

**P<sub>d</sub>** = power density in mW/cm<sup>2</sup>

**P<sub>out</sub>** = output power to antenna in mW

**G** = gain of antenna in linear scale

**pi** = 3.1416

**r** = distance between observation point and center of the radiator in cm

The limit of **P<sub>d</sub>** is 1 mW/cm<sup>2</sup>. If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance where the **P<sub>d</sub>** at 20 cm is meet the limit of MPE.

**Result : Worse case**

Operation Frequency (GHz)	Distance (cm)	Maximum Peak Output Power (dBm)	Maximum Peak Output Power (mW)	Antenna Gain (dBi)	Power Density (mW/cm <sup>2</sup> )	Power Density (W/m <sup>2</sup> )
2.402	20	-4.03	0.395	0.8	0.00009	0.0009

The **P<sub>d</sub>** at 20 cm distance calculated from the Friis transmission formula is much smaller than the limit requirement 1 mW/cm<sup>2</sup> or 10W/m<sup>2</sup>.

The **Installation Manual** instructs the user to install the device such that it has a separation of at least 20 cm from persons to comply with the FCC's requirements. This separation of 20 cm more than meets the FCC's and Industry Canada RF exposure requirements.