

## 16. MAXIMUM PERMISSIBLE EXPOSURE

### 16.1 RF Exposure Calculation

According to the FCC rule 1.1310 table 1B, the limit for the maximum permissible RF exposure for an uncontrolled environment is 1mW/cm<sup>2</sup> for PCS Band and 0.596mW/cm<sup>2</sup> for Cellular Band.

The electric field generated for a 1mW/cm<sup>2</sup> exposure is calculated as follows:

$$E = \sqrt{(30 * P * G) / d}, \text{ and } S = E^2 / Z = E^2 / 377, \text{ because } 1\text{mW} / \text{cm}^2 = 10\text{W} / \text{m}^2$$

Where

S = Power density in mW/cm<sup>2</sup>, Z = Impedance of free space, 377Ω

E = Electric field strength in Volts/m, G = Numeric antenna gain, and d = distance in meter

Combining equations and rearranging the terms to express the distance as a function of the remaining variable

$$d = \sqrt{(30 * P * G) / (3770 * S)}$$

Changing to units of mW and cm, using P (mW) = P (W) / 1000, d (cm) = 100 \* d (m)

$$d = 0.282 * \sqrt{(P * G) / S}$$

$$d = 0.282 * \sqrt{(P * G) / S}, \quad S = 0.282 * \sqrt{(P * G) / d}$$

Where

d = distance in cm, P = Power in mW, G = Numeric antenna gain, and S = Power density in mW/cm<sup>2</sup>

### 16.2 Calculated MPE Safe Distance

According to above equation, the following result was obtained.

Band	Peak Output Power		Antenna Gain		Power Density(mW/cm <sup>2</sup> ) @ 20cm Separation
	(dBm)	(mW)	Log	Linear	
Cellular	12.0	15.85	1.0	1.26	0.28
PCS	17.0	50.0	1.0	1.26	0.50

According to above table,

$$\text{The power density for Cellular Band, } S = 0.282 * \sqrt{15.85 * 1.26 / 20} = 0.282$$

$$\text{The power density for PCS Band, } S = 0.282 * \sqrt{50.0 * 1.26 / 20} = 0.50$$

Following Caution on the manual will be described.

“CAUTION: Exposure to Radio Frequency Radiation.

Antenna shall be mounted in such a manner to minimize the potential for human contact during normal operation. The antenna should not be contacted during operation to avoid the possibility of exceeding the FCC radio frequency exposure limit.”