

## 1. RF Exposure Limit

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>.

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

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

$$S = \text{Power density in mW/cm}^2, Z = \text{Impedance of free space, } 377\Omega$$

$$E = \text{Electric field strength in Volts/m, } G = \text{Numeric antenna gain, and } d = \text{distance in meter}$$

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  $P \text{ (mW)} = P \text{ (W)} / 1000$ ,  $d \text{ (cm)} = 100 * d \text{ (m)}$

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

$$d = \text{distance in cm, } P = \text{Power in mW, } G = \text{Numeric antenna gain, and } S = \text{Power density in mW/cm}^2$$

## 2. Calculated MPE Safe Distance

### 2.1 For 802.11b

According to above equation, the following result was obtained.

Peak Output Power		Antenna Gain		Safe Distance	Power Density (mW/cm <sup>2</sup> )	FCC Limit
(dBm)	(mW)	Log	Linear	(cm)	@ 20cm Separation	(mW/cm <sup>2</sup> )
13.90	24.55	3.5	2.24	2.091	0.010 9	1

According to above table, safe separation distance,  $D = 0.282 * \sqrt{24.55 * 2.24} = 2.091 \text{ cm}$ .

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 24.55 * 2.24 / (4 * 3.14 * 20^2) = 0.010 9$$

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

### 2.2 For 802.11g

According to above equation, the following result was obtained.

Peak Output Power		Antenna Gain		Safe Distance	Power Density (mW/cm <sup>2</sup> )	FCC Limit
(dBm)	(mW)	Log	Linear	(cm)	@ 20cm Separation	(mW/cm <sup>2</sup> )
13.40	22.88	3.5	2.24	2.019	0.010 2	1

According to above table, safe separation distance,  $D = 0.282 * \sqrt{22.88 * 2.24} = 2.019 \text{ cm}$ .

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 22.88 * 2.24 / (4 * 3.14 * 20^2) = 0.010 2$$

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna