# MAXIMUM PERMISSIBLE EXPOSURE

## 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/cm².

The electric field generated for a 1mW/cm²exposure is calculated as follows:

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

Where

$S$ = Power density in mW/cm², $Z$ = Impedance of free space, 377Ω

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

Combing 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)

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

Where

$d$ = distance in cm, $P$ = Power in mW, $G$ = Numeric antenna gain, and $S$ = Power density in mW/cm²

## 2. Calculated MPE Safe Distance and Density

According to above equation, the following result was obtained.

| Peak Output Power | | Antenna Gain | | Safe Distance | Power Density (mW/cm²) | FCC Limit |
|---|---|---|---|---|---|---|
| (dBm) | (mW) | Log | Linear | (cm) | @ 20cm Separation | (mW/cm²) |
| 2.50 | 1.78 | 0.0 | 1.0 | 0.29 | 0.0841 | 1 |

According to above table, separation distance, $D = 0.282 * \sqrt{1.78} = 0.29$ cm,

And the power density at 20cm, $S = 0.282 * \sqrt{1.78/20} = 0.0841$