

### 7.3. MAXIMUM PERMISSIBLE EXPOSURE

#### LIMITS

§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.

#### CALCULATIONS

Given

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

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts / meter

P = Power in Watts

G = Numeric antenna gain

d = distance in meters

S = Power Density in milliwatts / square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

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

Changing to units of mW and cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = 100 * d \text{ (m)}$$

yields

$$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$$

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

where

d = distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power Density in mW / cm<sup>2</sup>

Substituting the logarithmic form of power and gain using:

$$P \text{ (mW)} = 10 ^ { (P \text{ (dBm)} / 10) } \text{ and}$$

$$G \text{ (numeric)} = 10 ^ { (G \text{ (dBi)} / 10) }$$

yields

$$d = 0.282 * 10 ^ { ((P + G) / 20) / \sqrt{S} } \quad \text{Equation (1)}$$

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW / cm<sup>2</sup>

Equation (1) and the measured peak power is used to calculate the MPE distance.

## **LIMITS**

S = 1.0 mW / cm<sup>2</sup> from 1.1310 Table 1

## **RESULTS**

No non-compliance noted:

| Power Density Limit<br>(mW/cm <sup>2</sup> ) | Output Power<br>(dBm) | Antenna Gain<br>(dBi) | MPE Distance<br>(cm) |
|----------------------------------------------|-----------------------|-----------------------|----------------------|
| 1.0                                          | 7.70                  | 14.00                 | 3.43                 |

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.