MPE Calculations

Alien Technology has evaluated the Maximum Permissible Exposure (MPE) calculations and recommends the minimum separation distance from the NanoScanner reader's antenna to be 23 cm in an uncontrolled exposure and 10.3cm in a controlled exposure.

Uncontrolled exposure

From the guidelines in OTE bulletin 65, for the general population, in a *uncontrolled exposure*, we have determined an upper MPE limit

The power density guideline is

$\frac{f}{1500} = 0.601\,{}^{mW}\!/_{cm^2}$ or $\mathbf{6.01}\,{}^{W}\!/_{m^2}$ f = *frequency = 902 Mhz (worst case)*

The field strength for this power density is

$$E = {}^{V}\!/_{m} = \left[\left(\frac{W}{m^2}\right)\bullet 377\right]^{1/2}$$

$$E = \left[(6.01)\bullet(377)\right]^{1/2} = \mathbf{47.6}\,{}^{V}\!/_{m}$$

If one takes this field strength along with the maximum radiated power of 4 watts EIRP into the equation (Antenna Gain (dBi) + power output (dBW))

$P_{Trans} = \frac{4\bullet\pi\bullet d^2}{377}\bullet(E)^2$ d = minimum distance from antenna

The minimum distance at which persons must keep away in a uncontrolled exposure is,

$$d = \left[\frac{\left(P_{Trans}\bullet 377\right)}{4\bullet\pi\bullet E^2}\right]^{1/2} = \left[\frac{(4\bullet 377)}{4\bullet\pi\bullet(47.6)^2}\right]^{1/2} = \mathbf{0.23}m = \mathbf{23}cm$$

Controlled exposure

From the guidelines in OTE bulletin 65, for the general population, in a *controlled exposure*, we have determined an upper MPE limit

The power density guideline is

$\frac{f}{300}$ = $3\,{}^{mW}\!/_{cm^2}$ or $\mathbf{30}\,{}^{W}\!/_{m^2}$ f = *frequency = 902 Mhz (worst case)*

The field strength for this power density is

$$E = {}^{V}\!/_{m} = \left[\left(\frac{W}{m^2}\right)\bullet 377\right]^{1/2}$$

$$E = \left[(30.0)\bullet(377)\right]^{1/2} = \mathbf{106}\,{}^{V}\!/_{m}$$

If one takes this field strength along with the maximum radiated power of 4 watts EIRP into the equation (Antenna Gain (dBi) + power output (dBW))

$$P_{Trans} = \frac{4\bullet\pi\bullet d^2}{377}\bullet(E)^2$$ d = minimum distance from antenna

The minimum distance at which persons must keep away in a controlled exposure is,

$$d = \left[\frac{\left(P_{Trans}\bullet 377\right)}{4\bullet\pi\bullet E^2}\right]^{1/2} = \left[\frac{(4\bullet 377)}{4\bullet\pi\bullet(106)^2}\right]^{1/2} = \mathbf{0.103}m = \mathbf{10.3}cm$$

Definitions

Power Density

$$\frac{W}{cm^2} = \frac{\left(\frac{V}{cm}\right)^2}{377}$$ 1 $cm^2 = 10^{-4}\ m^2$