

APPENDIX A: RF EXPOSURE CALCULATIONS FOR HIGH GAIN ANTENNAS

From FCC 1.1310 table 1A, the maximum permissible RF exposure for an uncontrolled environment is $1\text{mW}/\text{cm}^2$. The Electric field generated for a $1\text{mW}/\text{cm}^2$ exposure (S) is calculated as follows:

$$S = E^2/Z$$

where:

S = Power density

E = Electric field

Z = Impedance

$$E = \sqrt{S \times Z}$$

$$1\text{mW}/\text{cm}^2 = 10\text{ W}/\text{m}^2$$

The impedance of free space is 377 ohms, where E and H fields are perpendicular.
Thus:

$$E = \sqrt{10 \times 377} = 61.4\text{ V/m which is equivalent to } 1\text{mW}/\text{cm}^2$$

Using the relationship between Electric field E, Power in watts P, and distance in meters d, the corresponding Antenna numeric gain G and the transmitter output power and solving for d,

$$d = \sqrt{\frac{P_{\text{eak}} \times 30 \times G}{E}}$$

Example using the Stub Omni-directional antenna

- The Numeric gain G of antenna with a gain specified in dB is determined by:

$$G = \text{Log}^{-1} (\text{dB gain}/10)$$

$$G = \text{Log}^{-1} 0.215 = 1.64$$

The following tables represent the RF exposure separation distance. The value shown in Table 11-1 was calculated from the defacto EIRP (= antenna gain + power output). The table represents the typical RF distance and the worst-case configuration based on the antenna specification provided by the manufacturer for the bore sight gain.

TABLE 11-1: RF EXPOSURE SEPARATION DISTANCE FROM DEFACTO EIRP

ANTENNA PART #	EIRP (dBm)	ANTENNA GAIN (dBi)	CALCULATED RF EXPOSURE SEPARATION DISTANCE (cm)	MINIMUM RF EXPOSURE SEPARATION DISTANCE (cm)
WI-FI Switch antenna	41.6	29.2 (Theoretical gain)	34.0	200 cm
WI-FI Switch antenna	40.6	28.2 (Measured gain)	30.2	200 cm