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 $1mW/cm^2$. The Electric field generated for a $1mW/cm^2$ exposure (S) is calculated as follows:

$S = E^2/Z$

where:
S = Power density
E = Electric field
Z = Impedance

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

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

The impedance of free space is 337 ohms, where E and H fields are perpendicular.
Thus:

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

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,

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

Example using the Stub Omni-directional antenna

1. 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