**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:

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

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

**Notice in Installation Manual:**

While installing and operating this transmitter and antenna combination the radio frequency exposure limit of 1mW/cm$^2$ may be exceeded at distances close to the antennas installed. Therefore, the user must maintain a minimum distance of 5 cm from the antenna at all time.
The table below identifies the distances where the 1mW/cm$^2$ exposure limits may be exceeded during continuous transmission using the external antenna

**TABLE 7-1: RF EXPOSURE SEPARATION DISTANCE**

| ANTENNA TYPE | EIRP antenna (dBm) | ANTENNA GAIN | CALCULATED RF EXPOSURE SEPARATION DISTANCE (cm) | MINIMUM RF EXPOSURE SEPARATION DISTANCE (cm) |
|---|---|---|---|---|
| AIR-ANT1949 | 30.1 | 13.5 | 42.7 | |
| AIR-ANT4121 | 24.2 | 12.0 | 18.2 | |
| AIR-ANT3549 | 23.1 | 8.5 | 10.7 | |
| AIR-ANT2012 | 23.9 | 6.5 | 9.3 | |
| AIR-ANT1729 | 23.2 | 6.0 | 8.1 | |
| AIR-ANT2506 | 20.4 | 5.1 | 5.3 | |
| AIR-ANT3213 | 20.7 | 5.0 | 5.4 | |
| AIR-ANT1728 | 20.7 | 5.0 | 5.4 | |
| AIR-ANT5959 | 17.4 | 2.0 | 2.6 | |