

	360 Herndon Parkway, Suite 1400	Report number	2002057
	Herndon, VA 20170	FCC	Part 15.247
	http://www.rheintech.com	Industry Canada	RSS-210
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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/cm². The Electric field generated for a 1mW/cm² exposure (S) is calculated as follows:

$$S = E^2/Z$$

where:

S = Power density

E = Electric field

Z = Impedance.

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

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

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

Thus:

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

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

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

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

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

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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 value shown in Table 11-2 was calculated from the radiated EIRP measurement. The tables represent the typical RF distance and the worst-case configuration based on the antenna specification provided from the manufacturer.

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

ANTENNA TYPE	Power Output (dBm)	ANTENNA GAIN (dBi)	CALCULATED RF EXPOSURE SEPARATION DISTANCE (cm)	MINIMUM RF EXPOSURE SEPARATION DISTANCE (cm)
Patch antenna	16.6	5.0	3.4	20.0

TABLE 11-2: RF EXPOSURE SEPARATION DISTANCE FROM MEASURED EIRP

ANTENNA TYPE	EIRP (dBm)	ANTENNA GAIN (dBi)	CALCULATED RF EXPOSURE SEPARATION DISTANCE (cm)	MINIMUM RF EXPOSURE SEPARATION DISTANCE (cm)
Patch antenna	20.6	5.0	3.0	20.0