



360 Herndon Parkway
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Herndon, VA 20170
<http://www.rheintech.com>

Carlson Wireless Technologies, Inc.
I-WLL-T
FCC ID: OPA-I-WLL-T
Work Order: 2000422

10 ANTENNA SPECIFICATIONS

Patch antenna

Electrical Specifications:

Model No.	Yagi Patch
Frequency Range	2.400 –2.4835 GHz
Gain	13.8 dBi



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11 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.

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

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

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

Thus:

$$E = \sqrt{10 \times 337} = 61.4 \text{ V/m} \text{ which is equivalent to } 1\text{mW/cm}^2$$

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,

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

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

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

$$G = \text{Log}^{-1} 2.15 = 1.64$$

Notice in Installation Manual:

WARNING: It is the responsibility of the professional installer to ensure that when using the outdoor antenna kits in the United States (or where FCC rules apply), only the antenna configurations shown in the table below is used. The use of any antenna other than those listed is expressly forbidden in accordance to FCC rules CFR47 part 15.204.

Notice in Installation Manual: FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an Uncontrolled Environment when installed as directed. This equipment should be installed and operated with fix-mounted antennas that are installed with a minimum of 2 meters of separation distance between the antenna and all persons body during normal operation and the antennas as shown below:

The table below identifies the distances where the 1mW/cm^2 exposure limits may be exceeded during continuous transmission using the antennas listed.

Antenna Type	Gain (dBi)	Gain Numeric	Peak output Power (mW)	Calculated RF Exposure Separation Distance (cm)	Minimum RF Exposure Separation Distance (m)
Patch	13.8	24	55.7	10.3	2
Grid	24	251.2	55.7	33.4	2