MPE Calculations

FCC part 1.1310, Table 1 limits the power density for uncontrolled exposure to 1mW/ cm^2 for systems operating in the UNII bands. The distance, d(cm) from the antenna at which the power density, P_d (mW/cm^2) is below this limit is calculated from the maximum EIRP, P_t (mW) using the equation:

$$P_d = P_t/(4 \pi d^2)$$

Re-arranging for the distance at which the power density is 1mW/cm2 gives:

$$d = \sqrt{(P_t/(4 \pi))}$$

The BitRage model CR45-A-53 is designed to use a 2' dish antenna with a gain of 28dBi. The maximum output power is 1.3dBm, giving an EIRP of 29.3 dBm (851 mW):

$$d = \sqrt{(851/(4 \pi))} = \mathbf{\underline{8.2\ cm\ (3.2")}}$$

For the 5.8 GHz system the maximum output power is +6.5dBm when using 2' or 3' dish antennas of gains 28dBi and 31 dBi respectively. The EIRP with the 2' antenna is 34.5 dBm (2818mW) and with the 3' antenna the EIRP is 37.5dBm (5623 mW). The 5.8 GHz radio can also use a 6' dish antenna with a gain of 37 dBi when the output power is reduced +1.8dBm. This combination has an EIRP of 38.8dBm (7585mW).

The distance from the antenna that the power density is 1mW/ cm^2 for all of the systems is given in the table below. The last column shows the calculated power density 1.5m form the antenna.

Frequency	Maximum output power (dBm)	Antenna	Antenna gain	EIRP (mW)	1mW/ cm^2 distance	Power density at 1.5m
5.3 GHz	+1.3	Radio Waves Inc. SP2-5.2 2' dish	28 dBi	851	8.2 cm	0.003 mW/cm^2
5.8 GHz	+6.4	Radio Waves Inc. SP2-5.2 2' dish	28 dBi	2754	14.8 cm	0.010 mW/cm^2
5.8 GHz	+6.4	Radio Waves Inc. SP3-5.2 3' dish	31 dBi	5623	20.9 cm	0.020 mW/cm^2
5.8 GHz	+1.7	Radio Waves Inc. SP6-5.2 6' dish	37 dBi	7585	24.3 cm	0.027 mW/cm^2

The installation manual requires that the antenna be mounted such that it is a distance of 1.5m from areas of uncontrolled Additional Warnings are also placed in the User Guide. The relevant text from the two manuals has been extracted and is shown on the following pages.

Relevant text from the "Installation and Set-Up Guide"

RF Exposure Limits

The CR45-A-53, CR45-A-58, and CR45-A-58L transceivers, used in conjunction with 28, 31 and 37 dBi gain antennas, are to be used in point-to-point applications only. The transceivers can be provided with or without an integral antenna. If the transceiver is provided without an integral antenna, then antennas used for these transmitters shall be professionally installed on permanent structures for outdoor operations. The installer is responsible for ensuring that the systems using high-gain, directional antennas are used exclusively for fixed, point-to-point operations.

The installer shall mount all transmit antennas so as to comply with the limits for human exposure to radio frequency (RF) fields per paragraph 1.1307 of the Federal Communications Commission (FCC) Regulations. The FCC requirements incorporate limits for Maximum Permissible Exposure (MPE) in terms of electric field strength, magnetic field strength, and power density.

The CR45A transceivers are to be installed on customers' rooftops and towers designated for fixed wireless applications. Table 1 specifies the *minimum* distance that must be maintained between the antenna and any areas where persons may have access, such as rooftop walkways and sidewalks, as well as through windows and other RF-transparent areas behind which persons may be located.

Table 2-1 Antenna Radiation Hazard

Radio	Frequency	Power Output, dBm	Antenna Gain, DBi	MPE Distance
CR45-A-53	5.3 GHz	+2.5 dBm	28 dBi	1.5m (5 ft)
CR45-A-58	5.8 GHz 5.8GHz	+6.5 dBm +6.5 dBm	31 dBi 28 dBi	1.5m (5 ft)
CR45-A-58L	5.8 GHz	+1.8dBm	37 dBi	1.5m (5 ft)

Antenna Warning Label

The following label wording must be placed on the antenna and visible from at least 1.5 meters (5 feet) away:

CAUTION: To comply with FCC RF exposure requirements, antennas used for this device must be installed to provide a separation distance of at least 15m(5 feet) from all persons to satisfy RF exposure compliance.

Additional Responsibilities

In addition to meeting these requirements, the antenna system installer is responsible for installing antennas so that they comply with FCC RF exposure requirements. The FCC RF exposure requirements at a given location are based on the sum total of contributions from all radio sources.

For BitRage antennas placed in close proximity to other transmitters, installers must ensure that MPE guidelines in 1.1307 of the FCC Rules can still be met, after including the contribution from the new antenna. Further information and guidance is available in FCC Bulletin OET 65, www.fcc.gov/oet/rfsafety.

Persons operating the equipment must ensure that it does not cause interference. Specifications must be followed for any special cables (for example, shielded cables) that are required for the unit to meet the EMC standards to which compliance is declared.

The user must not make any modifications to the unit, unless expressly approved by the party responsible for compliance. Failure to comply with this rule could void the user's authority to operate the equipment.

Relevant text from the User Guide

Hazard Warnings

Warning:	***The CR45-A products should only be installed by professional installers***.

RF Exposure Compliance

Installation of the CR45A and its antenna must be performed by qualified personnel who are following the procedures and guidelines given in the *CR45A Installation and Setup Guide*.

To comply with FCC radio frequency exposure requirements, the antennas used for this device must be installed to provide a separation distance at least 1.5 meters (5 feet) from all persons. Under no circumstances should you or anyone get closer than 1.5 m to the antenna without first ensuring that the system is powered off.

User Requirements

Persons operating the equipment must ensure that it does not cause interference. Specifications must be followed for any special cables (for example, shielded cables) that are required for the unit to meet the EMC standards to which compliance is declared.

The user must not make any modifications to the unit, unless expressly approved by the party responsible for compliance. Failure to comply with this rule could void the user's authority to operate the equipment.