RF Exposure Requirements

General information:

Device category: Fixed per Part 2.1091/1.1307/1.1310
Environment: Uncontrolled Exposure

Fixed devices that operate under Part 90 of this chapter are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use if they operate at frequencies of 1.5 GHz or below and their effective radiated power (ERP) is 1.5 watts or more. Compliance with the power density limits of 1.1310 is required.

Antenna:

The manufacturer does not specify an antenna. A typical fix mounted antenna has a gain of anywhere from 3 dBi.

This device has provisions for operation from a fixed location.

Configuration	Antenna p/n	Type	Max. Gain (dBi)
Fixed mounted	Any	omni or directional	3

Operating configuration and exposure conditions:

The conducted output power is 3 Watts. Although the device is fixed mounted control of exposure is an uncontrolled environment but the duty cycle will be approximately 100% or less and is controlled thru the software of the system.

- Part 2.1091 states that devices are excluded from routine evaluation if the EIRP is less than 2.46Watt (or 1.5WERP).

- Fixed operation: A typical installation consists of an antenna system with a coaxial cable of the type RG 8U which has a loss of 1dB for a length of 30 feet at UHF. frequencies.

MPE Calculation:

The minimum separation distance is calculated as follows:

$$E(V/m) = \frac{\sqrt{30 \times P \times G}}{d} \qquad \text{Power density: } P_d(mW/cm^2) = \frac{E^2}{3770}$$

The limit for uncontrolled exposure environment above 300 MHz is f/1500 mW/cm^2 .

Frequency: 406.1 MHz
The conducted power output is: 3 Watts
The coax loss was taken as: 1 dB (30 ft RG-8 type).
Antenna gain was taken as: 3 dBi

$W := 3$ power in Watts

$D := 1$ Duty Factor in decimal % (1=100%)

           1 for FM

$E := 6$ exposure time in minutes

$U := 6$ (use 6 for controlled and 30 for uncontrolled)

$Wexp := W \cdot D \cdot \left(\dfrac{E}{U} \right)$

$PC := \left(\dfrac{E}{U} \right) \cdot 100$

$Wexp = 3$ Watts

$PC = 100$ % on time

$Po := 3000$ mWatts

$f := 406.1$ Frequency in MHz

$dBd := 0.85$ antenna gain in dBd

$G1 := dBd + 2.15$ gain in dBi

$S := \dfrac{f}{1500}$ power density limit for uncontrolled exposure

$G1 = 3$ dBi

$CL := 1$ dB coax loss

$S = 0.271$

$G := G1 - CL$

General population
S is 1 between 1500 and 100k MHz
S is f/1500 for 300 to 1500 MHz
S is 0.2 between 30 and 300 MHz

$Gn := 10^{\frac{G}{10}}$ gain numeric

Occupational
S is 1 between 30 and 300 MHz
S is f/300 between 300 and 1500 MHz
S is 5 between 1500 and 100k MHz

$Gn = 1.585$ dB

$R := \sqrt{\dfrac{(Po \cdot Gn)}{(4 \cdot \pi \cdot S)}}$

$R = 37.384$ distance in centimeters required for compliance

$inches := \dfrac{R}{2.54}$

$inches = 14.718$

$ft := \dfrac{inches}{12}$

$ft = 1.227$

Conclusion:

The device complies with the MPE requirements when providing a safe separation distance of 37 cm (1.2 ft) between the antenna, including any radiating structure, and any persons when operated as described in the report which is typical of its intended use.

Proposed RF exposure safety information to include in User's Manual:

"FCC RF Exposure Requirements:

See Users Manual