RF Exposure Requirements

General information:

Device category: Fixed per Part 2.1091
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. However, compliance with the power density limits of 1.1310 is not required.

Antenna:

The manufacturer does not specify an antenna. A typical mobile installation antenna has a gain of 5 dBi.

This device has provisions for operation only as a mobile mounted device.

Configuration	Antenna p/n	Type	Max. Gain (dBi)
mobile	Any	omni	5

Operating configuration and exposure conditions:

The conducted output power is 25 Watts. In normal PTT operation the duty cycle is approximately 50%. The manufacturer also markets this device only for occupation use. But, typical installations may not control exposure.

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

- A typical mobile installation consists of an antenna system with a coaxial cable of the type RG 213U which has a loss of 1.0 dB 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: 450-512 MHz
The conducted power output is 25 Watt.
The coax loss was taken as 1.0 dB.
Antenna gain was taken as 5 dBi
50% Duty Factor
Power Density = S= f/1500 mW/cm^2

$W := 25.0$ power in Watts

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

1 for FM
0.6 for SSB

$E := 15$ exposure time in minutes

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

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

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

$Wexp = 12.5$ Watts

$PC = 50$ % on time

$Po := 12500$ mWatts

$dBd := 3$ antenna gain in dBd

$G1 := dBd + 2.15$ gain in dBi

$G1 = 5.15$ dBi

$CL := 1.0$ dB coax loss

$G := G1 - CL$

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

$Gn = 2.6$

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

$R = 92.852$ distance in centimeters required for compliance

$f := 450$ Frequency in MHz

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

$S = 0.3$ $\frac{mW}{cm^2}$

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

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
(See 47 CFR 1.1310)

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

$inches = 36.556$

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

$ft = 3.046$

Conclusion:

The device complies with the MPE requirements by providing a safe separation distance of 93cm 37 inches) between the antenna, including any radiating structure, and any persons when normally operated .

The minimum safe operating distance between the public and the antenna should be at least 93 cm (37 inches) when used with a 3 dBi antenna.