RF Exposure Requirements

General information:

Device category: Fixed per description in 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.

Antenna:

The transceiver is designed to be installed only in sites where the antenna installation sites are outdoor fixed mounted locations. The manufacturer does not specify an antenna, but in fix mounted antenna sites they typically have gains to 3 dBi.

This device has provisions for operation only as a fixed mounted device, or a fixed location.

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

Operating configuration and exposure conditions:

The base stations conducted output power is 10 Watts. In base station operation the duty cycle can reach near 100 %. The manufacturer also markets this device only for occupation use. But, some installations may not control exposure other than separation distance.

- A typical fixed installation consists of an antenna system with a coaxial cable of the type RG-213U which has a loss of 1 dB for a length of 50 feet at VHF 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 below 300 MHz is f in 0.2 = mW/cm^2.

Frequency: 150- 174 MHz
The conducted power output is 10 Watts.
The coax loss was taken as 1.0 dB.
Antenna gain was taken as 3 dBi
100% Duty Factor
Power Density = S= 0.2 mW/cm^2

$W := 10$ power in Watts

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

1 for FM
0.6 for SSB

$E := 30$ exposure time in minutes

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

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

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

$Wexp = 10$ Watts

$PC = 100$ % on time

$Po := 10000$ mWatts

$dBd := 0.85$ antenna gain in dBd

$G1 := dBd + 2.15$ gain in dBi

$G1 = 3$ dBi

$CL := 1.0$ dB coax loss

$G := G1 - CL$

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

$Gn = 1.585$

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

$R = 79.411$ distance in centimeters required for compliance

$f := 300$ Frequency in MHz

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

$S = 0.2 \quad \frac{mW}{cm^2}$

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)

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

$inches = 31.264$

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

$ft = 2.605$

Conclusion:

For a transmitter operating with the above criteria the separation distance should be no less than 80 cm or 2.6 ft between the antenna, including any radiating structure, and any persons when normally operated. Other operating conditions should follow a procedure like that shown above and following the guidelines such as those in FCC document OET-65.