

RF Exposure Report

General information:

Device category: Mobile 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:

This device is typically used in fixed location service only.

The although the manufacturer does not specify an antenna. A typical antenna in this type of service has a gain of 3 dBi.

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

Operating configuration and exposure conditions:

The conducted output power is 50 Watts. But under 90.205 the power could be as high as 60 Watts. In typical use the duty cycle can approach 100%.

The manufacturer also markets this device only for occupation use. But in fixed use the exposure is generally uncontrollable.

A typical installation consists of an antenna system with a coaxial cable of the type RG 213/U which has a loss of 1dB for a length of 20 feet at these frequencies.

MPE Calculation:

The minimum separation distance is calculated as follows:

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

The limit for uncontrolled exposure environment above 300 MHz is $f/1500$ mW/cm² .

Channel frequency: 406.1 - 470 MHz

The conducted power output is 50 watt.

The coax loss was taken as 1.5 dB (30 ft).

Antenna gain was taken as 3 dBi

W := 60.0 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)

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

W_{exp} = 60 Watts

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

PC = 100 % on time

P_o := 60000 mWatts

f := 406.1 Frequency in MHz

dBd := 0.85 antenna gain in dBd

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

G₁ := dBd + 2.15 gain in dBi

G₁ = 3 dBi

CL := 1.5 dB coax loss

$$S = 0.271 \frac{\text{mW}}{\text{cm}^2}$$

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

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

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

(See 47 CFR 1.1310)

$$R := \sqrt{\frac{(P_o \cdot G_n)}{(4 \cdot \pi \cdot S)}}$$

R = 157.834 distance in centimeters required for compliance

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

inches = 62.139

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

ft = 5.178

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

"FCC RF Exposure Requirements:

CAUTION:

The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other transmitter/antenna system. The antenna should be mounted so as to maintain a distance of at least 5 ft (1.6m) between the antenna and bystanders, when operated in a typical installation and a 3 dBi antenna.

Failure to observe these restrictions will result in exceeding the FCC RF exposure limits.