

FCC RF Exposure Requirements

General information:

FCCID: U59SDU-2000

Device category: Mobile per Part 2.1091

Environment: Uncontrolled Exposure

Mobile 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. In this configuration the typical antenna for this device has a gain of 0 dBi. Although 0 dBi gain antenna is typical for the installation any gain up to 5 dBi could be used and still maintain compliance. 5 dBi will be used in the equation on the following page to demonstrate this.

This device has provisions for operation in mobile, or a fixed location.

Configuration	Antenna p/n	Type	Duty cycle	Max. Gain (dBi)
mobile	Any	omni	10%	up to 5

Operating configuration and exposure conditions:

The conducted output power is 4.5 Watts. The maximum duty cycle is set as a function of firmware by the host device. This is coded in the firmware to prevent higher duty cycle rates and qualifies for a maximum duty cycle factor of 10%.

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

Mobile Operation: A typical mobile installation consists of an antenna system with a coaxial cable of the type RG 174 which has a loss of 0.5dB for a length of 1 feet.

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 a uncontrolled / general population exposure environment above 300 MHz is f/1500 mW/cm² .

Channel frequency: 450-470 MHz
 The conducted power output is 4.5 Watts
 The coax loss was taken as 0.5 dB.
 Antenna gain was taken as 5 dBi
 10% talk time in 30 minutes

W := 4.5 power in Watts

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

E := 3 exposure time in minutes

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

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

Wexp = 0.45 Watts

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

PC = 10 % on time

Po := Wexp · 1000

f := 460 Frequency in MHz

Po = 450 mWatts

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

dBd := 2.85 antenna gain in dBd

G1 := dBd + 2.15 gain in dBi

S = 0.307

G1 = 5 dBi

CL := 0.5 dB coax loss

G := G1 - CL

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

Gn = 2.818 dB

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

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

R = 18.141 distance in centimeters
 required for compliance

inches = 7.142

Conclusion:

The device complies with the MPE requirements by providing a safe separation distance of 20 cm between the antenna, including any radiating structure, and any persons when normally operated .

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 antenna or transmitter. This device is approved with emissions having a source-based time-averaging duty factor not exceeding 10%.

Mobile – Antenna Installation:

- Antennas used for this transmitter must not exceed an antenna gain of 5 dBi.