

RF Exposure Requirements

General information:

Device category: Mobile per Part 2.1091

Environment: Uncontrolled Exposure

Mobile devices that operate under Part 95 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 3 dBi could be used and still maintain compliance. 3 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	50%	3

Operating configuration and exposure conditions:

The conducted output power is 4. Watts. The maximum duty cycle is set as a function of talking versus listening and is taken at 50 %.

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

Mobile Operation: A typical mobile installation consists of an antenna system with a coaxial cable of the type RG 58/U which has a loss of 0.5 dB for a length of 30 feet.

MPE Calculation:

The minimum separation distance is calculated as follows:

$$E(V/m) = \frac{\sqrt{30 \times P \times G}}{d}$$

Power density: $P_d(mW/cm^2) = \frac{E^2}{3770}$

The limit for a uncontrolled/ general population exposure environment below 30 MHz is 180/f² mW/cm².

Channel frequency: 27 MHz

The conducted power output is 4. Watts

The coax loss was taken as 0.5 dB.

Antenna gain was taken as 3 dBi

50% talk time in 30 minutes

$W := 4$	power in Watts	$D := 1$	Duty Factor in decimal % (1=100%)
			1 for FM
	peak - antenna gain	$E := 15$	exposure time in minutes
		$U := 30$	(use 6 for controlled and 30 for uncontrolled)
$W_{exp} := W \cdot D \cdot \left(\frac{E}{U} \right)$		$PC := \left(\frac{E}{U} \right) \cdot 100$	
$W_{exp} = 2$	Watts	$PC = 50$	% on time

$P_o := 2000.0$	mWatts	$f := 27.0$
$dB_d := 0.85$	antenna gain in dBd	
$G1 := dB_d + 2.15$	gain in dBi	$S := \frac{180}{f^2}$
$G1 = 3$	dBi	See 47 CFR 1.1310
$CL := 0.5$	dB coax loss	
$G := G1 - CL$		$S = 0.247 \frac{mW}{cm^2}$
$G_n := 10^{\frac{G}{10}}$	gain numeric	
$G_n = 1.778$		
$R := \sqrt{\frac{(P_o \cdot G_n)}{(4 \cdot \pi \cdot S)}}$		
$R = 33.856$	distance in centimeters required for compliance	$inches := \frac{R}{2.54}$ $inches = 13.329$
		$ft := \frac{inches}{12}$
		$ft = 1.111$

Conclusion:

The device complies with the MPE requirements by providing a safe separation distance of 36 cm between the antenna, including any radiating structure, and any persons when normally operated . This is based on a typical installation and an antenna with 3 dBi of gain. This device is approved with emissions having a source-based time-averaging duty factor not exceeding 50%.