

RF Maximum Permissible Exposure (MPE)

Exhibit Requirements for Installations in the United States of America

FCC Part 1, Section 1.1307 table 1- Transmitters, Facilities and Operations Subject to Routine Environmental Evaluation states the following for Part 90 Devices:

- Part 90 devices Non-building-mounted antennas: height above ground level to lowest point of antenna <10 m and power >1000 W ERP (1640 W EIRP). Building-mounted antennas: power >1000 W ERP (1640 W EIRP).

Another way of wording this is that Part 90 devices are not Subject to Routine Environmental Evaluation when the antenna is installed at 10Meters or higher and operating total power level of all channels is less than 1640 Watts EIRP.

As an example, a 100W transmitter with a 10dB gain antenna with a low loss cable would translate into 1,000 Watts EIRP in the envelope lobe. If it is mounted 10 Meters or higher above where people could be walking, you have a safe installation and do not have to perform MPE calculations for safe distance.

No antenna is supplied with this unit. Some suggested antennas are:

- Manufacturer: Sinclair Model: SC225 Gain: 0 dBd (2.15 dBi)
- Manufacturer: Sinclair Model: SC233 Gain: 3 dBd (5.15 dBi)
- Manufacturer: Sinclair Model: SD114 Gain: 7.5 dBd (9.65 dBi)

If the antenna is lower than 10Meters then you need to verify that your installation is at a safe distance for Exposure to the General Population.

For United States installations, you must ensure that your installation complies with the Maximum Permissible Exposure (MPE) requirements for general population that are specified under FCC Part 1 - Section 1.1310 - Table 1.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842f	4.89f	*900f ²	6
30-300	61.4	0.163	f	6
300-1,500			f/30	6
1,500-100,000			f	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	824f	2.19f	*180f ²	30
30-300	27.5	0.073	0.2	30
300-1,500			f/150	30
1,500-100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

For US Installations, the maximum power density resulting from the composite Effective Isotropic Radiated Power (EIRP) from the antenna connected to this equipment must be limited to the maximum permissible exposure as stated below:

- Power density limit for the band 152 to 174MHz = 0.2 mW/cm²**

MPE and Safe Distance Calculations for USA Installations

This Power Density value is determined by the combination of RF output, cable loss, antenna gain, and distance from the antenna when energized.

The MPE calculation for US installations is expressed as follows:

- Power Density Pd (mW/cm²) = $\left(\frac{EIRP}{4\pi r^2}\right)$**

Where

- d** = distance from the antenna expressed in cm.
- EIRP expressed in mW = $10^{\left(\frac{Tx\ power\ (dBm) + Ant\ Gain\ (dBi) - Cable\ Loss\ (dB)}{10}\right)}$**
- Tx Power (dBm) = 10*log[Tx Power (mW)]**

As an example, with the transmitter running at 100 watts output into an antenna with a gain of 10 dBi using a short cable with 0dB loss, to verify if 650cm (6.5meters) is a safe distance from the antenna to ensure exposure compliance of 0.2mW/cm²:

- 100 Watts Tx Power = 50dBm
- $EIRP\ (mW) = 10^{\left(\frac{Tx\ power\ (50dBm) + Ant\ Gain\ (10dBi) - Cable\ Loss\ (0dB)}{10}\right)} = 10^{\left(\frac{60}{10}\right)} = 1,000,000mW$
- $Pd\ (mW/cm^2) = \left(\frac{EIRP}{4\pi r^2}\right) = \left(\frac{1,000,000}{4\pi * 650^2}\right) = \left(\frac{1,000,000}{5,309,291}\right) = 0.19\ mW/cm^2$

- 6.5 meters (21.125 Feet) is a safe distance for US installations when using a 10dBi Antenna.

The minimum safe distance, from a radiating structure using different Gain Antennas"

- For the Band 152 to 174MHz with 2dBi Gain Antenna: d (safe distance) = 2.6 m
- For the Band 152 to 174MHz with 6dBi Gain Antenna: d (safe distance) = 4.0 m
- For the Band 152 to 174MHz with 10dBi Gain Antenna: d (safe distance) = 6.5 m

