

6.11. RF EXPOSURE REQUIRMENTS [§§ 15.247(e)(i), 1.1310 & 2.1091]

The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation.

FCC 47 CFR § 1.1310:

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 Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f ²)	6
30–300	61.4	0.163	1.0	6
300–1500 .....	.....	.....	f/300	6
1500–100,000 .....	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	30
30–300	27.5	0.073	0.2	30
300–1500 .....	.....	.....	f/1500	30
1500–100,000 .....	.....	.....	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

6.11.1. Method of Measurements

Refer to Sections 1.1310, 2.1091

In order to demonstrate compliance with MPE requirements (see Section 2.1091), the following information is typically needed:

- (1) Calculation that estimates the minimum separation distance (20 cm or more) between an antenna and persons required to satisfy power density limits defined for free space.
- (2) Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement
- (3) Any caution statements and/or warning labels that are necessary in order to comply with the exposure limits
- (4) Any other RF exposure related issues that may affect MPE compliance

Calculation Method of RF Safety Distance:

$$S = \frac{P \cdot G}{4 \cdot \pi \cdot r^2} = \frac{EIRP}{4 \cdot \pi \cdot r^2}$$

Where: P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power
S: power density mW/cm²
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

6.11.2. RF Evaluation

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	Compliance with FCC Rules
Minimum calculated separation distance between antenna and persons required: For mobile applications: *15.15 cm For fixed applications: See user manual for details	Manufacturer' instruction for separation distance between antenna and persons required: For mobile applications: 20 cm For fixed applications: See user manual for details
Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement	Antenna installation and device operating instructions shall be provided to installers to maintain and ensure compliance with RF exposure requirements.
Caution statements and/or warning labels that are necessary in order to comply with the exposure limits	Refer to User's Manual for RF Exposure Information.
Any other RF exposure related issues that may affect MPE compliance	None.

*The minimum separation distance between the antenna and bodies of users are calculated using the following formula:

RF EXPOSURE DISTANCE LIMITS

$$r = \sqrt{\frac{P \cdot G}{4 \cdot \pi \cdot S}} = \sqrt{\frac{EIRP}{4 \cdot \pi \cdot S}}$$

S = 1.0 mW/cm²
EIRP = 34.60 dBm = 10^{34.60/10} mW = 2884 mW (Worst Case)

(Minimum Safe Distance, r) = $\sqrt{\frac{EIRP}{4 \cdot \pi \cdot S}} = \sqrt{\frac{2884}{4 \cdot \pi \cdot (1.0)}} \approx 15.15cm$



Fixed and “mobile” applications

1. See Tables for models specific to the FIXED and MOBILE applications, ALL SYSTEMS ARE POINT TO POINT ONLY.

This device has been designed to operate with the antennas listed below, and having a maximum gain of 32 dB. Antennas not included in this list or having a gain greater than 32 dB are strictly prohibited for use with this device. The required antenna impedance is 50 ohms

OUTDOOR ALL WEATHER SYSTEMS ALL INSTALLED AS FIXED POINT TO POINT ONLY

Rubber Duck Family 5.8 GHz

SYSTEM MODEL	AMPLIFIER	PEAK POWER	ANTENNA GAIN	SEPARATION DISTANCE
RT-L1R5803	NO	26.59 dBm	3dBi Ducky	20cm (7.9 Inches)
RT-X1R5803	YES	29.04 dBm	3dBi Ducky	20cm (7.9 Inches)

Antennas Tested By TCB

Panel Antenna Family 5.8 GHz

SYSTEM MODEL	AMPLIFIER	PEAK POWER	ANTENNA GAIN	SEPARATION DISTANCE
RT-L1R5807	NO	26.59 dBm	7dBi Embedded	20cm (7.9 Inches)
RT-X1R5807	YES	29.04 dBm	7dBi Embedded	20cm (7.9 Inches)
RT-L1R5814	NO	26.59 dBm	14dBi Embedded	30.19 cm (11.9 Inches)
RT-X1R5814	YES	29.04 dBm	14 dBi Embedded	40.03 cm (15.8 Inches)
RT-L1R5821	NO	26.59 dBm	21 dBi External	67.59 cm (26.6 Inches)
RT-X1R5821	YES	29.04 dBm	21dBi Embedded	89.62 cm (35.3 Inches)

Antennas Tested By TCB

Parabolic Antenna Family 5.8 GHz

SYSTEM MODEL	AMPLIFIER	PEAK POWER	ANTENNA GAIN	SEPARATION DISTANCE
RT-L1R5829	NO	26.59 dBm	29 dBi	169.79 cm (66.8 Inches)
RT-X1R5829	YES	29.04 dBm	29 dBi	225.11 cm (88.6 Inches)
RT-L1R5832	NO	26.59 dBm	32 dBi	239.83 cm (94.4 Inches)
RT-X1R5832	YES	29.04 dBm	32 dBi	317.98 cm (125.2 Inches)

Antennas Tested By TCB

Rubber Duck ANTENNA FAMILY 2.4 GHZ

SYSTEM MODEL	AMPLIFIER	PEAK POWER	ANTENNA GAIN	SEPARATION DISTANCE
RT-L2R2403	NO	26.80 dBm	3dBi Ducky	20cm (7.9 Inches)

PANEL ANTENNA FAMILY 2.4 GHZ

SYSTEM MODEL	AMPLIFIER	PEAK POWER	ANTENNA GAIN	SEPARATION DISTANCE
RT-WR2L245	NO	26.80 dBm	15 dBi	34.71 cm (13.7 Inches)

Antennas Tested By TCB

INDOOR DESKTOP SYSTEMS POINT TO POINT ONLY

INDOOR DESKTOP SYSTEMS 5.8 GHz MOBILE APPLICATIONS POINT TO POINT ONLY

SYSTEM MODEL	RPS	AMPLIFIER	PEAK POWER	ANTENNA GAIN	SEPARATION DISTANCE
XRT-L1R583	YES	NO	26.59 dBm	3dBi Ducky	20cm (7.9 Inches)
XRT-L1R588	YES	NO	26.59 dBm	8 dBi Magnetic panel	20cm (7.9 Inches)
XRT-X1R583	YES	YES	29.04 dBm	3dBi Ducky	20cm (7.9 Inches)

INDOOR DESKTOP FAMILY 2.4 GHZ MOBILE APPLICATIONS POINT TO POINT ONLY

SYSTEM MODEL	RPS	AMPLIFIER	PEAK POWER	ANTENNA GAIN	SEPARATION DISTANCE
XRT-L2R243	YES	NO	26.80 dBm	3 dBi Ducky	20cm (7.9 Inches)
XRT-L2R248	YES	NO	26.80 dBm	8 dBi Magnetic panel	20cm (7.9 Inches)

(RPS= Reverse polarity SMA Connector)