15.247 (i) RF Exposure

Spread Spectrum Transmitters operating under 15.247 are categorically excluded from routine environmental evaluation for demonstrating RF exposure compliance with respect to MPE or SAR limits however per 15.247(i) must be operated in a manner that ensures the public is not exposed to RF energy levels in access of the commission's guidelines. The user/installation manual contains the proper cautionary statements and specifies that the transmitting antennas be installed so that a minimum separation distance of 20m will be maintained. Based on the transmitter power and maximum antenna gain (see calculation below) the MPE at a 20cm separation distance is below the limit for acceptable MPE power density levels to meet both the Occupational/Controlled Exposure and the General Population/Uncontrolled Exposure requirements of FCC Part 1.1310. The calculation below uses the more stringent General Population MPE Limits.

$$S = \frac{PG}{4\prod Dsq}$$

P = Maximum Power at the Antenna Port in mW

Gain = Max Power Gain of Antenna

D = Separation Distance to the Antenna in cm

S = Power Density in mW/cm^2

Per 1.1310 For the Frequency of 2.4 GHz the power density limit = $1mW/cm^2$

Freq. Band GHz	Power - Port #1 mW	Power – Port #2 mW	Antenna Gain dBi	MPE mW/cm^2	Limit mW/cm^2
2.4 - 2.483	52.72	51.17	2 (1.58 numeric)	.03265	1

At a 20cm distance the maximum MPE is .03265 mW/cm^2 which is below the 1 mW/cm^2 Limit and was calculated as follows.

Antenna Port #1:

$$S = \frac{52.72x1.58}{4x(3.14)x20sq} = \frac{83.298}{5026.56}$$

$S = .01657\ mW/cm^2$

Antenna Port #2:

$$S = \frac{51.17x1.58}{4x(3.14)x20sq} = \frac{80.849}{5026.56}$$

$S = .01608\ mW/cm^2$

Total Power Density = .03265 mW/cm^2

The 20cm separation distance exceeds the calculated distance for acceptable MPE power density levels to meet both the Occupational/Controlled Exposure and the General Population/Uncontrolled Exposure requirements of FCC Part 1.1310. The calculation below solves for the minimum safe distance and uses the more stringent General Population MPE Limits.

$$S = \frac{PG}{4\prod Dsq}$$

D = Minimum Separation Distance in cm

S = Max allowed Power Density in mW/cmsq

Per 1.1310 For the Frequency of 2400MHz S = 1mW/cmsq

Antenna Port #1:

Power = Max Power Input to Antenna = 52.72 mW

Gain = Max Power Gain of Antenna = 2dBi = 1.58 numeric

$$1\text{mW/cmsq} = \frac{52.72x1.58}{4x(3.14)xDsq} = \frac{83.29}{12.56xDsq}$$

$$Dsq = \frac{83.29}{12.56x1}$$

$$D = \sqrt{6.63} = 2.57\text{cm}$$

Antenna Port #2:

Power = Max Power Input to Antenna = 52.72 mW

Gain = Max Power Gain of Antenna = 2dBi = 1.58 numeric

$$1\text{mW/cmsq} = \frac{51.17x1.58}{4x(3.14)xDsq} = \frac{80.84}{12.56xDsq}$$

$$Dsq = \frac{80.84}{12.56x1}$$

$$D = \sqrt{6.43} = 2.53\text{cm}$$

RSS 102 RF Exposure

Per RSS-102, Section 2.5.1, SAR evaluation is not required if the separation distance between the user and antenna is greater than 20cm. Per RSS 102, Section 2.5.2, RF Exposure Evaluation is required if the separation distance between the user and antenna is greater than 20cm except when the device operates at or above 1.5 GHz with a maximum EIRP of less than 5W.

The device will be installed with a separation distance between the user and antenna which will greater than 20cm thus eliminating the need for a SAR evaluation. The device operates above 1.5 GHz with a maximum EIRP of .8611W thus eliminating the need for an RF Exposure Evaluation.

The Maximum EIRP was derived as follows:

EIRP = Power (watts) x numeric antenna gain relative to dBi

EIRP Port #1 = .083 W x 1.58 = .131 W

EIRP Port #2 = .081 W x 1.58 = .128 W

Total EIRP = .259 W