RF Exposure Info / MPE Sample Calculation

Model: ION-M17EP19P
FCC-ID: XS5-M17E19P

The ION-M17EP/19P is a multi-band multi-operator Remote Unit with various Extension Units (EUs). It is used in conjunction with a Master Unit (MU) in the ION optical distribution system. This system transports multiple frequency bands simultaneously (1900 MHz and 1700/2100 MHz), providing a cost-effective solution for distributing capacity from one or more base stations. By supporting the entire AWS-3 spectrum, faster and more reliable wireless service is ensured and network quality can be improved The ION-M17EP/19P transports signals on the RF layer in a very inexpensive manner. This means that multiple operators and multiple technologies are moved simultaneously from a cluster of base stations to a remote location over the same fiber.

The ION optical distribution system is a cost-effective coverage solution for dense urban areas, tunnels, subway, airports, convention centers, high-rise buildings and other locations where physical structures increase path loss. It has been specifically designed to reduce zoning problems and to provide homogeneous coverage. The compact, mechanical design is specifically architected to mount inside of poles or along side structures in such a way that it has a minimal visual impact.

The ION-M17EP/19P is available in a multi-band configuration supporting 1900 MHz and 1700/2100 MHz. It has been specifically tested and optimized for GSM, CDMA2000, WCDMA, and LTE/LTE-A signals. Furthermore, it is provisioned for future modulation schemes and frequency bands.

The ION is easily set-up and supervised via a graphical user interface (GUI). Remote Units can be commissioned through the use of built-in test equipment. An autolevelling function compensates for the optical link loss making installation easy and quick. The entire system as well as complete network of systems can be managed remotely most efficiently by CommScope`s A.I.M.O.S, which includes alarm monitoring, task automation, inventory management and many more features.

Should a sophisticated interface not be required, the master unit can be directly connected to the alarm interface of a base station via relay alarming.

The specific device generally will be professionally installed.
Hereby the gain of the finally installed antenna(s), cable attenuation and antenna height will be defined site specific at the time of licensing with the appropriate FCC Bureau(s).

The maximum permissible exposure limit is defined in **47 CFR 1.1310 (B).**

S = power density limit [W/m]
P = power [W]
R = distance [m]

$S_n = \frac{P_n G_n}{4\pi R_n^{\ 2}}$ => $R_n = \sqrt{\frac{P_n G_n}{4\pi S_n}}$ (to calculate the distance at one frequency)

If we have more bands, than we have to calculated as a percentage:
The additional of the terms have to be lower than 1.

$$\frac{S_{cal1}}{S_1} + \frac{S_{cal2}}{S_2} + \frac{S_{cal3}}{S_3} + ... + \frac{S_{caln}}{S_n} < 1$$

$$\frac{\frac{P_1 G_1}{4\pi R_1^{\ 2}}}{S_1} + \frac{\frac{P_2 G_2}{4\pi R_2^{\ 2}}}{S_2} + \frac{\frac{P_3 G_3}{4\pi R_3^{\ 2}}}{S_3} + ... + \frac{\frac{P_n G_n}{4\pi R_n^{\ 2}}}{S_n} < 1$$

We are looking for a distance of ensures that the formula is satisfied.

$R_1 = R_2 = R_3 = ... = R_n$

$$\frac{P_1 G_1}{4\pi R^{\ 2} S_1} + \frac{P_2 G_2}{4\pi R^{\ 2} S_2} + \frac{P_3 G_3}{4\pi R^{\ 2} S_3} + ... + \frac{P_n G_n}{4\pi R^{\ 2} S_n} < 1$$

$$\frac{P_1 G_1}{4\pi S_1} + \frac{P_2 G_2}{4\pi S_2} + \frac{P_3 G_3}{4\pi S_3} + ... + \frac{P_n G_n}{4\pi S_n} < R^2$$

$$\sqrt{\frac{P_1 G_1}{4\pi S_1} + \frac{P_2 G_2}{4\pi S_2} + \frac{P_3 G_3}{4\pi S_3} + ... + \frac{P_n G_n}{4\pi S_n}} < R$$

With $R_n = \sqrt{\frac{P_n G_n}{4\pi S_n}}$ => $R_n^{\ 2} = \frac{P_n G_n}{4\pi S_n}$

$$\sqrt{R_1^{\ 2} + R_2^{\ 2} + R_3^{\ 2} + ... + R_n^{\ 2}} < R$$

What you have to do for calculate the minimum distance were the power density limit is met:

1) If you have **one path**, you have to put you special values in the following formula.

$$R_n = \sqrt{\frac{P_n G_n}{4\pi S_n}}$$ (Distance for one carrier)

Limits for General Population / Uncontrolled Exposures

Frequency Range (MHz)	Power Density (mW/cm^2)
300 – 1500	S = f/1500
1550 – 100,000	S = 1

2) If you have **more than one path**, you must add the individual terms quadratic.

$$R_n = \sqrt{\frac{P_n G_n}{4\pi S_n}}$$ (Distance for individual carrier)

$$\sqrt{R_1^2 + R_2^2 + R_3^2 + \ldots + R_n^2} < R$$ (See previous page)

For example:

The EUT operates in the 2 frequency bands (see table):
The max measured conducted output power is 43 dBm (20 W).

Calculation for every path with maximum allowed antenna gain and without cable loss:

Frequency [MHz]	Max Power out [dBm]	Max. allowed antenna gain, **without** cable loss [dBi]	Max. Distance [m]
2110 - 2180	43	9	0,3551
1930 – 1995	43	9	0,3551

The worst case would be if all bands were active:

$$\sqrt{R_1^2 + R_2^2 + R_3^2 + \ldots + R_n^2} < R$$

R_{all} > 0.502 m (see previous page for derivation)

For more accurate calculation, the cable loss and actual antenna gain have to be included in the finally system.
The antenna(s) used with device must be fixed-mounted on permanent structures with a distance to any human body to comply with the RF Exposure limit.