



RF Exposure Info / MPE Sample Calculation

Model: ION-M17P/19HP
FCC-ID: XS5-M17P/19HP

The ION-M17P/19HP 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 (PCS 1900 MHz, AWS 1700/2100 MHz and 700 MHz EU), providing a cost-effective solution for distributing capacity from one or more base stations.

The ION-M17P/19HP 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-M17P/19HP is available in a multi-band configuration supporting 1900 MHz and 1700/2100 MHz in parallel and with extension option 700 MHz additionally. It has been specifically tested and optimized for GSM, EDGE, CDMA2000, EV-DO, WCDMA, HSPA+ and OFDM. Furthermore it is provisioned for future improvements to the modulation 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 auto-levelling function compensates for the optical link loss making installation easy and quick. The entire system may be monitored remotely via an Andrew OMC. This is a comprehensive management platform with SNMP protocol and X.733 standard implemented. 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]

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

If we have more bands, than we have to calculated as a percentage:

The additional of the terms have to be lower than 1.

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

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

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

$$R_1 = R_2 = R_3 = \dots = R_n$$

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

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

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

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

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

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.

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

Limits for General Population / Uncontrolled Exposures

Frequency Range (MHz)

Power Density (mW/cm²)

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.

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

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

For example:

The EUT operates at two frequency bands:

Calculation with maximum possible antenna gain and without cable loss (worst case):

Frequency [MHz]	Max Power out [dBm]	Max. possible Antenna gain, without cable loss [dBi]	Max. Distance [m]
1930	43.14	19.1	3.6509
2110	46	16.1	3.5925

R_{all} = 5.122m

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.