RF Exposure Info / MPE Sample Calculation

Model: **ION-M7P/17P**
FCC-ID: **XS5-ML717P**

THE ION-M7P/17P IS A SUBPOPULATION OF ION™-M7P/85P/17P/19P

The ION-M7P/85P/17P/19P transports signals on the RF layer in a way 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 provides a 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-M7P/85P/17P/19P is available in single or multi-band configuration supporting 700 MHz, 850 MHz, 1700 MHz/ 2100 MHz and 1900 MHz in parallel. It has been specifically tested and optimized for LTE, iDEN, GSM, EDGE, CDMA2000, EV-DO, WCDMA, HSPA+, and OFDMA. Furthermore, it is provisioned for future improvements to the modulation and frequency bands. In addition it is backwards compatible to legacy standards such as TDMA and Analog.

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-leveling function compensates for the optical link loss making installation easy and quick. The entire system may be monitored remotely via an Andrew OMC. This platform uses SNMP protocol and is compliant to X.733 standard.

Should a sophisticated interface not be required, the Master Unit can be directly connected to the alarm interface of a base station via its contact relay.

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 3 frequency bands: 728-746, 746-757 and 2110-2155 MHz.
The max measured conducted output power is 43.31 / 43.37 /43.14 dBm.

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

Frequency [MHz]	Max Power out [dBm]	Max. possible Antenna gain, **without** cable loss [dBi]	Max. Distance [m]
728	43.31	18.8	5.1627
747	43.37	18.8	5.1319
2110	43.14	19	3.6091

The worst case would be if all bands were active:

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

$R_{all} > 8.125$ m (see previous page for formula)

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.