RF Exposure Info / MPE Sample Calculation

Model: **ION-M85P R EP**
FCC-ID: **XS5-M85PR**

The ION-M85P/9P EP is a robust, intelligent optical Remote Unit to meeting requirements for high reliability with various redundancy options and dual-band capability. The ION-M85P/9P EP is a multi-operator Remote Unit used in conjunction with a Master Unit in the ION optical distribution system. It enables multiple operators to use multiple technologies and move their signals simultaneously to a number of remote locations over the same fiber.
The ION-M85P/9P EP is made up of two individual units that are located in separate Q cabinets and are connected via a cable bridge.

The ION-M85P R EP comprises the DL power amplifiers (PAs) for band 85, the UL antenna ports for bands 85 & 9, as well as the extension port (EP) for the ION-M9P R EU. To be able to upgrade the system for future applications on site by additional bands (e.g. 1800 MHz and 2100 MHz) the ION-M85P R EP provides an additional extension port to connect further extension units (e.g. ION-M18 HP R EU or ION-M21HP R EU).

The ION-M9P R EU comprises the DL power amplifiers for band 9 and DL antenna ports for bands 85 & 9.

Both cabinets are equipped with a PSU, each supplying one PA in the cabinet it is located in, and one PA in the other unit, thus providing PA as well as PSU redundancy preventing a system failure if either a PSU or a PA is defect. Since output power will be decreased in any case of redundancy, having the defect part replaced as quickly as possible is strongly recommended, nevertheless.
The ION system transports signals on the RF layer in a very inexpensive manner, enabling coverage driven roll-out. The ION optical distribution system is a cost-efficient coverage solution for dense urban areas, tunnels, subways, railways, roadways, airports, convention centers and other locations where physical structures increase path loss.
The ION has been specifically designed to reduce zoning problems. The compact mechanical design is architected to be mounted alongside structures in such a way that it has a minimal visual impact.
The ION can be easily set-up and supervised by a graphical user interface (GUI). An auto-levelling function compensates for the optical link loss making installation easy.
The entire system can be monitored remotely by the Andrew OMC. The Andrew OMC uses SNMP protocol and is compliant to X.733 standard. Should a sophisticated management interface not be required, the Master Unit can be directly connected to the alarm interface of a base station via alarm relay contacts.

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 one frequency band:

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]
870	42.5	13.65	2.3778

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.