

Appendix A: RF Exposure Compliance

Please refer to the following pages.

1.2 REGULATORY

1.2.1 Maximum Permissible Exposure Limits

DO NOT TRANSMIT with this base station and antenna when persons are within the MAXIMUM PERMISSIBLE EXPOSURE (MPE) Radius of the antenna. The MPE Radius is the minimum distance from the antenna axis that ALL persons should maintain in order to avoid RF exposure higher than the allowable MPE level set by the FCC.



FAILURE TO OBSERVE THESE LIMITS MAY ALLOW ALL PERSONS WITHIN THE MPE RADIUS TO EXPERIENCE RF RADIATION ABSORPTION, WHICH EXCEEDS THE FCC MAXIMUM PERMISSIBLE EXPOSURE (MPE) LIMIT. IT IS THE RESPONSIBILITY OF THE BASE STATION LICENSEE TO ENSURE THAT THE MAXIMUM PERMISSIBLE EXPOSURE LIMITS ARE OBSERVED AT ALL TIMES DURING BASE STATION TRANSMISSION. THE BASE STATION LICENSEE IS TO ENSURE THAT NO BYSTANDERS ARE WITHIN THE RADIUS LIMITS.

1.2.2 Determining MPE Radius

THE MAXIMUM PERMISSIBLE EXPOSURE RADIUS is unique for each site and is determined based on the complete installation environment (i.e. co-location, antenna type, transmit power level, etc.). Determination of the MPE distance is the responsibility of the VIDA^{MAX} user. Calculation of the MPE radius is required as part of the installation. The Limit for **Uncontrolled Exposure Power Density (P_d)** is 10 W/m² for fixed mounted device.

The M/A-COM 4.9 GHz VIDA^{MAX} Base Station is a fixed mounted radio. After installation and commissioning, the safe distance from the 9 dBi omni-directional antenna is greater than 20 cm (8-inches).

1.2.2.1 MPE Calculation for omni-directional Antenna

This MPE Minimum Distance Calculation is based on using a 9 dBi gain omni-directional antenna mounted directly to the base station RF port.

Basic M/A-COM 4.9 GHz VIDA^{MAX} Base Station specifications:

P: Maximum Peak Conducted Power = 27 dBm

G: Maximum Omni Antenna Gain = 9 dBi

Frequency Range = 4.94 to 4.99 GHz

R: Minimum Distance between User and Antenna = 0.2 m

Equation from FCC:

$$P_d = P * G / (4 * \pi * R^2)$$

$$P_d = 0.5 \text{ W} * 7.94 / (4 * 3.1415926 * 0.2^2) = 7.89 \text{ W} / \text{m}^2 < 10 \text{ W} / \text{m}^2$$

The calculation indicates that the minimum 0.2 meter distance between user and the omni-directional antenna (directly mounted to the base station RF port) is required when operating the M/A-COM 4.9 GHz VIDA^{MAX} Base Station.

1.2.2.2 MPE Calculation for Directional Antenna

This MPE Minimum Distance Calculation is based on using a directional antenna with more than 9 dBi antenna gain.

Basic M/A-COM 4.9 GHz VIDA^{MAX} Base Station specifications:

P: Maximum Peak Conducted Power = 27 dBm;

G: Maximum Omni Antenna Gain – Cable Loss = 27 dBi – 1 dB = 26 dBi; (Use numerical G_N value for the calculation): $G_N = 10^{(G/10)}$; For $G = 26$ dBi, $G_N = 10^{(26/10)} = 398$

Frequency Range = 4.94 to 4.99 GHz;

R_{min}: Minimum Distance between user and antenna to comply with FCC MPE Level ($10 \text{ W} / \text{m}^2$);

Equation from FCC:

$$P_d = P * G / (4 * \pi * R_{min}^2)$$

$$R_{min} = \text{SQRT}(0.5 \text{ W} * G_N / (4 * 3.1415926 * 10)) = \text{SQRT}(3.9789\text{E-}3 * G_N)$$

$$R_{min} = 1.26 \text{ m, for } G = 26 \text{ (i.e., } G_N = 398 \text{)}$$

The calculation provides guidelines for users to estimate the minimum safe distance when a high gain antenna is connected to the M/A-COM 4.9 GHz VIDA^{MAX} Base Station. The user should always keep a safe distance from antenna greater than 20 cm or $\text{SQRT}(3.9789\text{E-}3 * G_N)$.

The following table lists the minimum distance for Different Effective Antenna Gain Levels (Antenna Gain – Feeder Cable Loss)

Minimum Safe Distance Calculation Based for Directional Antennas

Effective Antenna Gain (dBi)	Minimum Safe Distance (Meters)	Minimum Safe Distance (Feet)
< 9	0.20	0.65
10	0.20	0.65
11	0.22	0.73
12	0.25	0.82
13	0.28	0.92
14	0.32	1.04
15	0.35	1.16
16	0.40	1.31
17	0.45	1.47
18	0.50	1.64
19	0.56	1.84
20	0.63	2.07
21	0.71	2.32
22	0.79	2.61
23	0.89	2.92

Effective Antenna Gain (dBi)	Minimum Safe Distance (Meters)	Minimum Safe Distance (Feet)
24	1.00	3.28
25	1.12	3.68
26	1.26	4.13
>26	Reduce Transmit Power is required by FCC	

1.2.3 Safety Training Information



YOUR M/A-COM VIDAMAX BASE STATION GENERATES RF ELECTROMAGNETIC ENERGY DURING TRANSMIT MODE. THIS BASE STATION IS DESIGNED FOR AND CLASSIFIED AS “OCCUPATIONAL USE ONLY” MEANING IT MUST BE USED ONLY IN THE COURSE OF EMPLOYMENT BY INDIVIDUALS AWARE OF THE HAZARDOUS RF ENERGY AND THE WAYS TO MINIMIZE EXPOSURE. THIS BASE STATION IS NOT INTENDED FOR USE BY THE “GENERAL POPULATION” IN AN UNCONTROLLED ENVIRONMENT. IT IS THE RESPONSIBILITY OF THE LICENSEE TO ENSURE THAT THE MAXIMUM PERMISSIBLE EXPOSURE LIMITS ARE OBSERVED AT ALL TIMES DURING TRANSMISSION. THE BASE STATION LICENSEE IS TO ENSURE THAT NO BYSTANDERS COME WITHIN THE RADIUS OF THE LIMITS

When licensed by the FCC, this base station complies with the FCC RF exposure limits when persons are beyond the MPE radius of the antenna. In addition, your M/A-COM base stations installation complies with the following Standards and Guidelines with regard to RF energy and electromagnetic energy levels and evaluation of such levels for exposure to humans:

FCC OET Bulletin 65 Edition 97-01 Supplement C, Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

American National Standards Institute (C95.1 – 1992), IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

American National Standards Institute (C95.3 – 1992), IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave.



To ensure that your exposure to RF electromagnetic energy is within the FCC allowable limits for occupational use, do not operate the base station in a manner that would create an MPE distance in excess of that allowable by the FCC.



Changes or modifications not expressly approved by M/A-COM Inc. could void the user’s authority to operate the equipment.