Rhein Tech Laboratories, Inc.
360 Herndon Parkway
Suite 1400
Herndon, VA 20170
http://www.rheintech.com

Client: M/A-Com, Inc.
Model: MultiLink Station
Standards: FCC Part 90/IC RSS-111
ID's: BV8MLINK/3670A-MLINK
Report Number: 2008219

Appendix K: Manual

Please refer to the following pages.

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VIDA Broadband Equipment

Tyco Electronics

Our commitment. Your advantage.

MANUAL REVISION HISTORY

REV	DATE	REASON FOR CHANGE
-	Jul/08	Initial release.
A	Mar/09	Added the MultiLink, B510 BS information, approved antenna options, and instructions for using the base station Web page.

CREDITS

Andrew is a registered trademark of CommScope, Inc.

IndigoVision is a trademark of IndigoVision Group plc.

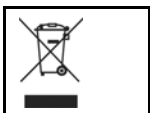Windows is a registered trademark of Microsoft Corporation.

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All other brand and product names are trademarks, registered trademarks, or service marks of their respective holders.

NOTICE!

⌧	This product conforms to the European Union WEEE Directive 2002/96/EC. Do not dispose of this product in a public landfill. Take it to a recycling center at the end of its life.

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Tyco Electronics Technical Publications would particularly appreciate feedback on any errors found in this document and suggestions on how the document could be improved. Submit your comments and suggestions to:

1. REGULATORY AND SAFETY INFORMATION

1.1 REGULATORY APPROVALS

1.1.1 Transmitter

The transmitting devices listed below have been tested and meet the following regulatory requirements:

MODEL	DESCRIPTION	Ch. BW (MHz)	FCC ID (PART 90)	INDUSTRY CANADA (RSS-119)
MAVM-VMCLL (BS-010700-001)	Low Power Copper Client	5 only	BV8VMXCL	3670A-VMXCL
MAVM-VMXCH (BS-010700-002)	High Power Copper Client	5 or 10	BV8VIDA-BB-CL	3670A-VIDABBCL
MAVM-VMCHH (BS-010700-003)	High Power Fiber Client	5 or 10	BV8-VIDA-BB-CL	3670A-VIDABBCL
MAVM-VMCHN (BS-010700-002)	High Power Copper Nomadic Client	5 or 10	BV8VIDA-BB-CL	3670A-VIDABBCL
MAVM-VMCLH (BS-010700-004)	Low Power Fiber Client	5 only	BV8VMXCL	3670A-VMXCL
MAVM-VMXBA (BS-009214-001)	AC Base Station with Copper Ethernet	5 only	BV8VIDA-BB	3670A-VIDABB
MAVM-VMXBD (BS-009214-002)	DC Base Station with Fiber	5 only	BV8VIDA-BB	3670A-VIDABB
MAVM-VMXBC (BS-009214-003)	DC Base Station with Copper Ethernet	5 only	BV8VIDA-BB	3670A-VIDABB
MAVM-MBASE (BS-014648-004)	B510 Base Station	5 or 10	BV8MBASE	3670A-MBASE
MAVM-MLINK (BS-014648-003)	MultiLink Base Station	5 or 10	BV8MLINK	3670A-MLINK

1.1.2 Receiver

This receiver associated with this transmitting device has been tested and declared to meet the regulatory requirements defined in the following sub-sections. Associated FCC labelling is shown below.

M/A-COM, Inc.
VIDA BROADBAND
BS-014648-004 MAVM-MBASE

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERNECE THAT MAY CAUSE UNDESIRED OPERATION.

This Class B digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

B510 Base Station

M/A-COM, Inc.
VIDA BROADBAND
BS-014648-003 MAVM-MLINK

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERNECE THAT MAY CAUSE UNDESIRED OPERATION.

This Class B digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

MultiLink Station

M/A-COM, Inc.
VIDA BROADBAND
BS-010700-XXX MAVM-VMXXX

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERNECE THAT MAY CAUSE UNDESIRED OPERATION.

This Class B digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

Subscriber Station (Client)

M/A-COM, Inc.
VIDA BROADBAND
BS-009214-XXX MAVM-VMXBX

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERNECE THAT MAY CAUSE UNDESIRED OPERATION.

This Class B digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

Base Station (5 MHz channel only)

1.1.3   FCC Compliance

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

1.1.4   Industry Canada

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

> **WARNING**
>
> **The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from Heath Canada's website www.hc-sc.gc.ca/rpb.**

1.2   RF ENERGY EXPOSURE INFORMATION FOR FIXED OPERATION

1.2.1   Maximum Permissible Exposure Limits

DO NOT TRANSMIT with a 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 STATION LICENSEE TO ENSURE THAT THE MAXIMUM PERMISSIBLE EXPOSURE LIMITS ARE OBSERVED AT ALL TIMES DURING STATION TRANSMISSION.   THE 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 Broadband 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/m^2 for fixed mounted device.

The Tyco Electronics 4.9 GHz VIDA Broadband stations may be installed as a fixed mounted radio. After installation and commissioning, the safe distance from the 9 dBi omnidirectional antenna is greater than 20 cm (8-inches).

Table 1-1: MPE Minimum Distance Calculation for Fixed Installations Using High Gain Antennas

Effective Antenna Gain (dBi)	Low Power Fixed Clients (0.1 Watts)		High Power Fixed Stations (0.5 Watts)	
	Minimum Safe Distance (Meters)	Minimum Safe Distance (Feet)	Minimum Safe Distance (Meters)	Minimum Safe Distance (Feet)
<10	0.20	0.65	0.20	0.65
11	0.20	0.65	0.22	0.73
12	0.20	0.65	0.25	0.82
13	0.20	0.65	0.28	0.92
14	0.20	0.65	0.32	1.04
15	0.20	0.65	0.35	1.16
16	0.20	0.65	0.40	1.31
17	0.20	0.65	0.45	1.47
18	0.22	0.73	0.50	1.64
19	0.25	0.82	0.56	1.84
20	0.28	0.92	0.63	2.07
21	0.32	1.04	0.71	2.32
22	0.35	1.16	0.79	2.61
23	0.40	1.31	0.89	2.92
24	0.45	1.47	1.00	3.28
25	0.50	1.64	1.12	3.68
26	0.56	1.84	1.26	4.13
>26	Reduce Transmitter Power as required by FCC			

1.2.2.1   MPE Calculation for omnidirectional Antenna

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

Basic Tyco Electronics 4.9 GHz VIDA Broadband station specifications:

P: Maximum Peak Conducted Power = 27 dBm

G: Maximum Omni Antenna Gain = 9 dBi

Frequency Range = 4.90 to 4.99 GHz

R: Minimum Distance between User and Antenna = 0.2 m

Equation from FCC:

$P_d = P * G_N / (4 * \pi * Rmin^2)$

$P_d = 0.5 \text{ W} * 7.94 / (4 * 3.1415926 * 0.2^2) = 7.9 \text{ W} / m^2 < 10 \text{ W} / m^2$

The calculation indicates that the minimum 0.2 meter distance between user and the omnidirectional antenna (directly mounted to the station RF port) is required when operating the Tyco Electronics 4.9 GHz VIDA Broadband Client.

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 Tyco Electronics 4.9 GHz VIDA Broadband 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): $G_N = 10 ^\wedge (G /10))$; For G = 26 dBi, $G_N = 10 ^\wedge (26 /10) = 398$

Frequency Range = 4.90 to 4.99 GHz;

R_min: Minimum Distance between user and antenna to comply with FCC MPE Level (10 W / m^2);

Equation from FCC:

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

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

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

The calculation provides guidelines for users to estimate the minimum safe distance when a high gain antenna is connected to the Tyco Electronics 4.9 GHz VIDA Broadband station. The user should always keep a safe distance from antenna greater than 20 cm or SQRT (3.9789E-3 * G_N).

The following table lists fixed installation's minimum distance for different Effective Antenna System Gain Levels (Antenna Gain – Feeder Cable Loss). In all cases, the minimum safe distance defined in Table 1-1 or 0.2 meters (8 inches), whichever is greater, is the recommended minimum safe distance for fixed installations.

1.2.3   <u>Safety Training Information</u>

YOUR TYCO ELECTRONICS VIDA BROADBAND CLIENT GENERATES RF ELECTRO-MAGNETIC ENERGY DURING TRANSMIT MODE. THIS CLIENT 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 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 STATION LICENSEE IS TO ENSURE THAT NO BYSTANDERS COME WITHIN THE RADIUS OF THE LIMITS

When licensed by the FCC, this station complies with the FCC RF exposure limits when persons are beyond the MPE radius of the antenna. In addition, your Tyco Electronics VIDA Broadband station 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.

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

⚠️ **CAUTION**	**Changes or modifications not expressly approved by Tyco Electronics Inc. could void the user's authority to operate the equipment.**

1.2.4 Contact Information

For additional information on exposure requirements or other information, contact Tyco Electronics, Inc. at 1-800-528-7711 or at http://www.tewireless.com.

1.3 RF ENERGY EXPOSURE INFORMATION FOR MOBILE OPERATION

The FCC requires licensees and manufacturers to meet radio frequency radiation exposure compliance as defined by FCC rule 47 CFR §2.1091 and as discussed in FCC document OET Bulletin 65: *Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields*.

Page 5 of OET Bulletin 65, Supplement C, subtitled: *Mobile Devices* states the following:

"The FCC rules for evaluating mobile devices for RF compliance are found in 47 CFR §2.1091. For purposes of RF exposure evaluation, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to be generally used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structures and the body of the user or nearby persons."

Page 7 of OET Bulletin 65, Section 2, subtitled: *Guidelines for evaluating Mobile and Portable Devices* states the following:

"Mobile devices identified in 47 CFR §2.1091 that operate at 1.5 GHz or below with an effective radiated power (ERP) of 1.5 watts or more, or those that operate at frequencies above 1.5 GHz with an ERP of 3.0 watts or more are required to perform routine environmental evaluation for RF exposure prior to equipment authorization or use; otherwise, they are categorically excluded."

The Tyco Electronics 4.9 GHz Broadband Client radio with 0.5 Watt RF output, installed as a mobile device using the 5.5 dBi mobile antenna and cable mounts referenced in Table 1-2 has a calculated worst case ERP of 1.78 Watts relative to an isotropic radiator (EIRP). Therefore, it can be concluded that a Tyco Electronics 4.9 GHz Client radio installed as a ***mobile device*** using the Tyco Electronics

recommended mobile antenna system is ***categorically excluded*** from any requirement to perform routine environmental evaluation for RF exposure. This is true with other mobile antenna systems having gains up to 7.7 dBi.

⚠️ CAUTION	**Changes or modifications not expressly approved by Tyco Electronics could void the user's authority to operate the equipment and may require the user to perform routine environmental evaluation of the mobile installation.**

This two-way radio uses electromagnetic energy in the radio frequency (RF) spectrum to provide communications between two or more users over a distance. It uses RF energy or radio waves to send and receive calls. RF energy is one form of electromagnetic energy. Other forms include, but are not limited to, electric power, sunlight, and x-rays. RF energy, however, should not be confused with these other forms of electromagnetic energy, which, when used improperly, can cause biological damage. Very high levels of x-rays, for example, can damage tissues and genetic material.

Experts in science, engineering, medicine, health, and industry work with organizations to develop standards for exposure to RF energy. These standards provide recommended levels of RF exposure for both workers and the general public. These recommended RF exposure levels include substantial margins of protection. All two-way radios marketed in North America are designed, manufactured, and tested to ensure they meet government established RF exposure levels. In addition, manufacturers also recommend specific operating instructions to users of two-way radios. These instructions are important because they inform users about RF energy exposure and provide simple procedures on how to control it. Please refer to the following websites for more information on what RF energy exposure is and how to control your exposure to assure compliance with established RF exposure limits.

http://www.fcc.gov/oet/rfsafety/rf-faqs.html

http://www.osha.gov./SLTC/radiofrequencyradiation/index.html

⚠️ CAUTION	Table 1-2 lists the recommended minimum lateral distance for a controlled environment and for unaware bystanders in an uncontrolled environment, from transmitting types of antennas the at rated radio power for nomadic Client radios installed in a vehicle. Transmit only when unaware bystanders are at least the uncontrolled recommended minimum lateral distance away from the transmitting antenna.

Table 1-2: MPE Minimum Distance Calculation for Nomadic Client Installations

4.9 GHz CLIENT WITH 0.5 WATT OUTPUT IN NOMADIC OPERATION (MOUNTED IN A VEHICLE) USING THE SPECIFIED ANTENNA AND MOUNTS		RECOMMENDED MINIMUM LATERAL DISTANCE FROM TRANSMITTING ANTENNA	
ANTENNA & MOUNT	ERP (Watts)	CONTROLLED	UNCONTROLLED
Antenna: MAXRAD (B)MEFC49005HF (5.5 dBi gain) Mount: MAXRAD MHFML195C (Permanent)	< 3.0	20 cm	20 cm
Antenna: MAXRAD (B)MEFC49005HF (5.5 dBi gain) Mount: MAXRAD GMHFML195C (Magnetic)	< 3.0	20 cm	20 cm

1.3.1 <u>Nomadic Antennas</u>

> **NOTE**
>
> This device must not be co-located or operated in conjunction with any other antenna or transmitter.

Install the radio's antenna (refer to Table 1-2 for applicable antenna part numbers) in the center of the vehicle's roof. These nomadic antenna installation guidelines are limited to metal body motor vehicles or vehicles with appropriate ground planes. The antenna installation should additionally be in accordance with the following:

- The requirements of the antenna manufacturer/supplier included with the antenna.

- Installation instructions in this manual, including any minimum antenna cable lengths.

- The installation manual providing specific information of how to install the antennas to facilitate recommended operating distances to all potentially exposed persons.

- Use only the Tyco Electronics approved/supplied antenna(s) or approved replacement antenna. Unauthorized antennas, modifications, or attachments could damage the radio and may violate FCC regulations.

1.3.2 <u>Approved Accessories</u>

This radio has been tested and meets the FCC RF guidelines when used with the Tyco Electronics accessories supplied or designated for use with this product. Use of other accessories may not ensure compliance with the FCC's RF exposure guidelines, and may violate FCC regulations.

For a list of Tyco Electronics approved accessories refer to the product manuals, Tyco Electronics' Products and Services Catalog, or contact Tyco Electronics at 1-800-528-7711.

1.3.3 <u>Occupational Safety Guidelines and Safety Training Information</u>

To ensure bodily exposure to RF electromagnetic energy is within the FCC allowable limits for occupational use. Always adhere to the following basic guidelines:

1. The push-to-talk button should only be depressed when intending to send a voice message.

2. The radio should only be used for necessary work-related communications.

3. The radio should only be used by authorized and trained personnel. It should never be operated by children.

4. Do not attempt any unauthorized modification to the radio. Changes or modifications to the radio may cause harmful interference and/or cause it to exceed FCC RF exposure limits. Only qualified personnel should service the radio.

5. Always use Tyco Electronics authorized accessories (antennas, control heads, speakers/mics, etc.). Use of unauthorized accessories can cause the FCC RF exposure compliance requirements to be exceeded.

The information listed above provides the user with information needed to make him or her aware of a RF exposure, and what to do to assure that this radio operates within the FCC exposure limits of this radio.

1.3.4   Common Hazards

The operator of any mobile radio should be aware of certain hazards common to the operation of vehicular radio transmissions. Possible hazards include but are not limited to:

- **Explosive Atmospheres —** Just as it is dangerous to fuel a vehicle while its motor running, be sure to turn the radio OFF while fueling the vehicle. If the radio is mounted in the trunk of the vehicle, DO NOT transport containers of fuel in the trunk.

  Areas with potentially explosive atmosphere are often, but not always, clearly marked. Turn the radio OFF when in any area with a potentially explosive atmosphere. It is rare, but not impossible that the radio or its accessories could generate sparks.

- **Interference To Vehicular Electronic Systems —** Electronic fuel injection systems, electronic anti-skid braking systems, electronic cruise control systems, etc., are typical of the types of electronic devices that can malfunction due to the lack of protection from radio frequency (RF) energy present when transmitting. If the vehicle contains such equipment, consult the dealer for the make of vehicle and enlist his aid in determining if such electronic circuits perform normally when the radio is transmitting.

- **Electric Blasting Caps —** To prevent accidental detonation of electric blasting caps, DO NOT use two-way radios within 1000 feet (305 meters) of blasting operations. Always obey the "Turn Off Two-Way Radios" (or equivalent) signs posted where electric blasting caps are being used. (OSHA Standard: 1926.900).

- **Radio Frequency Energy —** To prevent burns or related physical injury from radio frequency energy, do not operate the transmitter when anyone outside of the vehicle is within the minimum safe distance from the antenna as specified in Table 1-1. Refer to Section 1.2 for additional information.

- **Vehicles Powered By Liquefied Petroleum (LP) Gas —** Radio installation in vehicles powered by liquefied petroleum gas, where the LP gas container is located in the trunk or other sealed-off space within the interior of the vehicle, must conform to the National Fire Protection Association standard **NFPA 58**. This requires:

  o The space containing the radio equipment must be isolated by a seal from the space containing the LP gas container and its fittings.

  o Outside filling connections must be used for the LP gas container.

  o The LP gas container space shall be vented to the outside of the vehicle.

- **Vehicles Equipped with Airbags —** For driver and passenger safety, avoid mounting the radio or any other component above or near airbag deployment areas. In addition to driver-side and passenger-side front-impact airbags, some vehicles may also be equipped with side-impact airbags. For occupant safety, verify the location of all airbags within the vehicle before installing the radio equipment.

1.3.5   Operating Rules and Regulations

Two-way FM radio systems must be operated in accordance with the rules and regulations of the local, regional, or national government.

In the United States, the mobile radio must be operated in accordance with the rules and regulations of the Federal Communications Commission (FCC). Operators of two-way radio equipment must be thoroughly familiar with the rules that apply to the particular type of radio operation. Following these rules helps eliminate confusion, assures the most efficient use of the existing radio channels, and results in a smoothly functioning radio network.

⚠️ **CAUTION**	**Under U.S. law, operation of an unlicensed radio transmitter within the jurisdiction of the United States may be punishable by a fine of up to $10,000, imprisonment for up to two (2) years, or both.**

When using a two-way radio, remember these rules:

- It is a violation of FCC rules to interrupt any distress or emergency message. The radio operates in much the same way as a telephone "party line." Therefore, always listen to make sure the channel is clear before transmitting. Emergency calls have priority over all other messages. If someone is sending an emergency message – such as reporting a fire or asking for help in an accident, do not transmit unless assistance can be offered.

- The use of profane or obscene language is prohibited by Federal law.

- It is against the law to send false call letters or false distress or emergency messages. The FCC requires keeping conversations brief and confines them to business. To save time, use coded messages whenever possible.

- Using the radio to send personal messages (except in an emergency) is a violation of FCC rules. Send only essential messages.

- It is against Federal law to repeat or otherwise make known anything overheard on the radio. Conversations between others sharing the channel must be regarded as confidential.

- The FCC requires self-identification at certain specific times by means of call letters. Refer to the rules that apply to the particular type of operation for the proper procedure.

- No changes or adjustments shall be made to the equipment except by an authorized or certified electronics technician.

1.3.6   Mobile Operating Tips

The following conditions tend to reduce the effective range of two-way radios and should be avoided whenever possible:

- Operating the radio in areas of low terrain, or while under power lines or bridges.

- Obstructions such as mountains and buildings.

ℹ️ **NOTE**	In areas where transmission or reception is poor, communication improvement may sometimes be obtained by moving a few yards in another direction, or moving to a higher elevation.

1.4 SAFETY SYMBOL CONVENTIONS

The following conventions may be used in this manual to alert the user to general safety precautions that must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. Tyco Electronics assumes no liability for the customer's failure to comply with these standards.

WARNING	**The WARNING symbol calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING symbol until the conditions identified are fully understood or met.**
CAUTION	The **CAUTION** symbol calls attention to an operating procedure, practice, or the like, which, if not performed correctly or adhered to, could result in a risk of danger, damage to the equipment, or severely degrade the equipment performance.
NOTE	The **NOTE** symbol calls attention to supplemental information, which may improve system performance or clarify a process or procedure.
	The **ESD** symbol calls attention to procedures, practices, or the like, which could expose equipment to the effects of **E**lectro-**S**tatic **D**ischarge. Proper precautions must be taken to prevent ESD when handling circuit modules.
	The electrical hazard symbol is a WARNING indicating there may be an electrical shock hazard present.
	This symbol indicates the presence of a potential RF hazard.

2. INTRODUCTION

2.1 ABOUT THIS MANUAL

The manual provides information for installing and configuring VIDA Broadband equipment as a system.

This manual is written for the communications professional responsible for planning, installing, and implementing the VIDA Broadband Network.

2.2 REFERENCE MANUALS

It may be necessary to consult one or more of the following manuals when installing, operating, or maintaining a VIDA Broadband Network.

Table 2-1: Related Documentation

Documentation	Manual Number
📖 VIDA Broadband BAS/UAS User's Manual	MM-011540-001
📖 RNM/CNM User's Manual	MM1000018633
📖 VIDA Broadband System Manual	MM-011541-001
📖 VIDA Broadband Base Station Product Manual	MM-009804 -001
📖 VIDA Broadband Client Product Manual	MM-010539-001
📖 VIDA Broadband B510 Base Station Product Manual	MM-016895 -001
📖 VIDA Broadband MultiLink Station Product Manual	MM-013752-001
📖 VIDA Broadband Network Services Installation and Configuration Manual	MM-014640-001
📖 VIDA Broadband Basic Network Applications Programming Guide	MM-014641-001
📖 VIDA Broadband Systems Troubleshooting Guide	MM-014642-001
📖 VIDA Broadband Systems RF Planning Guide	MM-015601-001

2.3   CUSTOMER SERVICE

2.3.1   Technical Assistance

The Technical Assistance Center's (TAC) resources are available to help with overall system operation, maintenance, upgrades, and product support. TAC is the point of contact when answers are needed to technical questions.

Product specialists, with detailed knowledge of product operation, maintenance, and repair provide technical support via a toll-free (in North America) telephone number. Support is also available through mail, fax, and e-mail.

For more information about technical assistance services, contact your sales representative, or contact the Technical Assistance Center directly at:

North America:	1-800-528-7711
International:	1-434-385-2400
Fax Number:	1-434-455-6712
E-mail:	tac@tycoelectronics.com

2.3.2   Customer Resource Center

If any part of the system equipment is damaged on arrival, contact the shipper to conduct an inspection and prepare a damage report. Save the shipping container and all packing materials until the inspection and the damage report are completed. In addition, contact the Customer Resource Center to make arrangements for replacement equipment. Do not return any part of the shipment until you receive detailed instructions from a Tyco Electronics representative.

Contact the Customer Resource Center at:

North America:

Phone Number:	1-800-368-3277 (toll free)
Fax Number:	1-800-833-7592 (toll free)
E-mail:	CustomerFocus@tycoelectronics.com

International:

Phone Number:	1-434-455-6403
Fax Number:	1-434-455-6676
E-mail:	InternationalCustomerFocus@tycoelectronics.com

2.4   SOFTWARE COMPATIBILITY

Table 2-2: Current Software Releases

Media	Part Number	Version
☻ Base Station Media Kit	SK-014991-001	Version R3B
☻ Subscriber Station Media Kit	SK-016517-001	Version R7F

Table 2-3: VIDA Broadband Software Compatibility Chart

Base Station (BS)	Unified Administrator System (UAS)			
	Ver. 3.0.9	**Ver. 4.3.1**	**Ver. 4.3.2**	
BS ver. 1.1.0	Compatible	**Do Not Use**	**Do Not Use**	
BS ver. 1.1.2	Compatible	**Do Not Use**	**Do Not Use**	
BS ver. R2A	**Do Not Use**	Compatible	Compatible	
BS ver. R2B	**Do Not Use**	Compatible	Compatible	
BS ver. R3A	**Do Not Use**	Compatible	Compatible	
BS ver. R3B	**Do Not Use**	Compatible	Compatible	
Base Station (BS)	**Subscriber Station (SS)**			
	Ver. 0.194.0.0	**Ver. 5.0.23**	**Ver. 6.6.1.0**	**Ver. 7.5.7.0**
BS ver. 1.1.0	Compatible	Compatible	Compatible	**Do Not Use**
BS ver. 1.1.2	Compatible	Compatible	Compatible	**Do Not Use**
BS ver. R2A	Compatible	Compatible	Compatible	**Do Not Use**
BS ver. R2B	Compatible	Compatible	Compatible	Compatible
BS ver. R3A	Compatible	Compatible	Compatible	Compatible
BS ver. R3B	Compatible	Compatible	Compatible	Compatible
Notes:				
1.	Only the versions listed have been authorized for use in the field.			
2.	All UAS versions are compatible with all SS versions.			
3.	SS ver. 7.5.7.0 is incompatible with all BS versions prior to R2B.			
4.	All BS versions starting with R2A and later require UAS version R4x or later.			

2.5   TERMS AND ABBREVIATIONS

Table 2-4: Abbreviations

Term	Definition
AES	Advanced Encryption Standard
BAS	Broadband Administration Server
BE	Best Efforts
BS	Base Station
CID	Connection Identifier
CR	Classifier Rule
DES	Data Encryption Standard
DHCP	Dynamic Host Configuration Protocol
EDACS	Enhanced Digital Access Communications System
GPS	Global Positioning System
IEEE	Institute of Electrical & Electronics Engineers
JDBC	Java Database Connectivity
JSP	Java Server Page
LMR	Land Mobile Radio
MAC	Media Access Control
MIB	Management Information Base
OFDM	Orthogonal Frequency Division Multiplexing
QoS	Quality of Service
RSS	Received Signal Strength
SF	Service Flow
SNMP	Simple Network Management Protocol
SS	Subscriber Station (Client)
TAC	Technical Assistance Center
TFTP	Trivial File Transfer Protocol
UAS	Unified Administration System
UGS	Unsolicited Grant Services
VIDA	Voice, Interoperability, Data, and Access
WAN	Wide Area Network

3. SYSTEM DESCRIPTION

VIDA Broadband provides integrated public safety grade wireless broadband video and data services for mission-critical applications. VIDA Broadband combines the security of the licensed 4.9 GHz public safety frequency band with the robust 802.16 communications industry standard to create a true public safety broadband network. With this state-of-the-art network, public safety customers can implement applications such as streaming video, web applications, economical licensed LMR backhaul, and other bandwidth intensive applications. Since the network provides guaranteed Quality of Service (QoS), it is especially suited for applications such as video surveillance, perimeter control, and mobile command. VIDA Broadband is integrated with the VIDA network allowing seamless sharing of network resources, including hardware network management and administration.
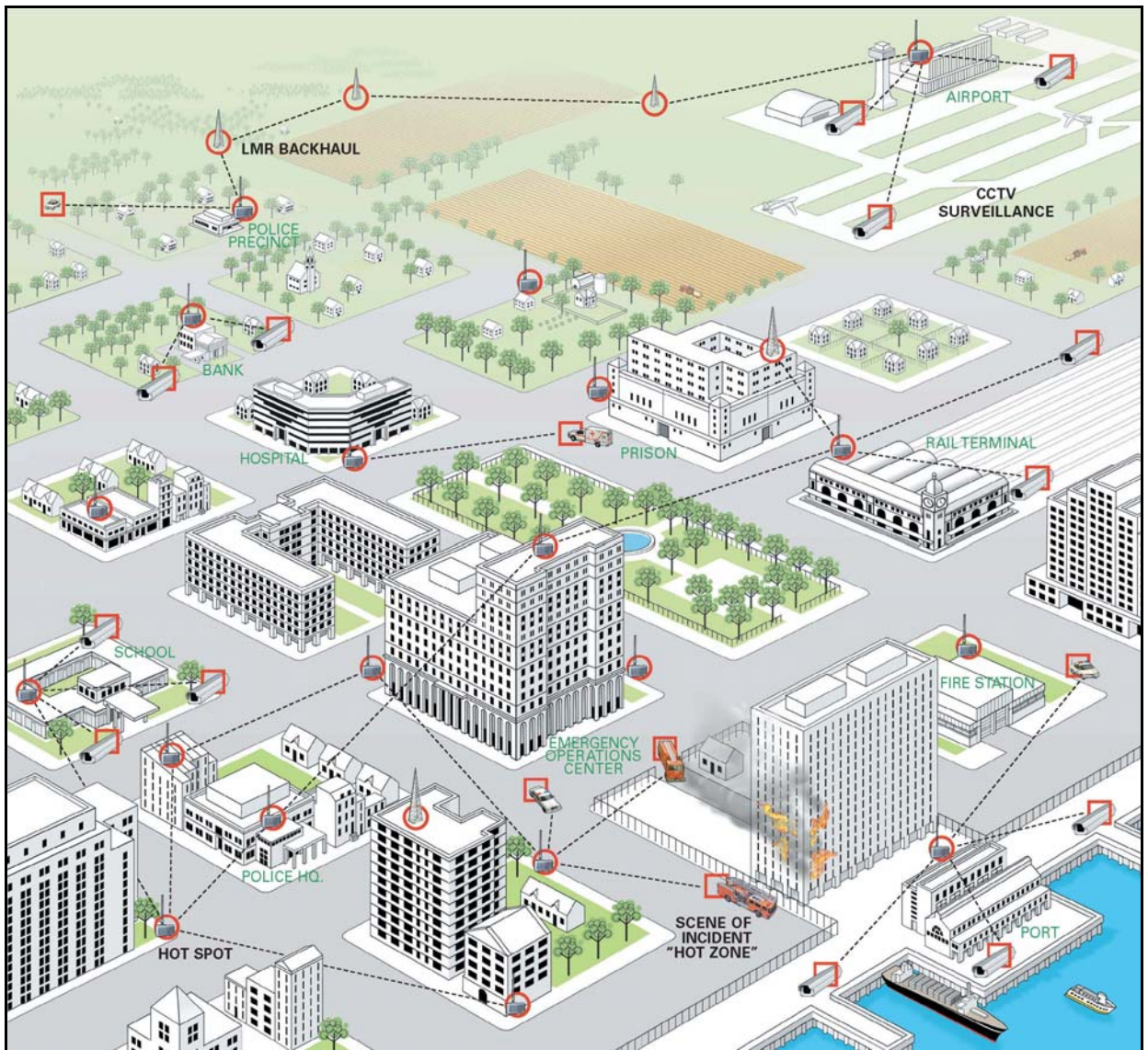
Figure 3-1: VIDA Broadband Network

The basic architecture of the 4.9 GHz VIDA Broadband network is a point-to-multipoint network. A system consists of one or more base station(s) and at least one or more clients per base station as shown in Figure 3-1. There are two configurations of client devices; fixed and nomadic. Fixed client devices are usually mounted outdoors with directional antennas and have a range of up to 10 miles. Nomadic clients are vehicle mounted and use an omnidirectional antenna. The range of a nomadic client to base station is typically a few hundred meters.

The VIDA Broadband Base Station implements the 802.16e-2005 OFDM protocol to deliver an over-the-air throughput from 3 to 19 Mbps (for 5 MHz channel) and 3 to 38 Mbps (for 10 MHz channel). All communication over the wireless channel is scheduled by the base station, with contention slots provided for the VIDA Broadband Client to request bandwidth. This coordinated scheduling feature of the protocol provides significant advantages such as:

- Minimizes contention between clients.

- Maximizes channel utilization.

- Maximizes ability to coordinate frequency usage among users.

- Enables guaranteed bandwidth services for critical applications.

3.1   SYSTEM COMPONENTS

The VIDA Broadband Base and Subscriber Stations are designed for easy mounting on a variety of outdoor structures including light poles and telephone poles. The base stations and clients in the VIDA Broadband Network use IPC IP66-rated enclosures for operation in challenging environmental conditions, and the UAS software is the same as that in use by numerous federal and public safety systems across North America. The VIDA Broadband client can also be vehicle mounted for nomadic applications using an optional vehicle mounting kit.

The VIDA Broadband system comprises the following:

- **Base Station Equipment (BS):** VIDA Broadband Base Stations provide the coordinating point in a point-multipoint network, transferring data between an IP network and remote subscriber stations as well as managing the subscriber stations on the network.

- **Subscriber Station (SS):** VIDA Broadband Client used to transfer data from a fixed or nomadic location to the base station.

- **MultiLink Station:** VIDA Broadband MultiLink Stations provide full capacity network extension, transferring data between an IP network and remote subscriber stations, with no loss of capacity.

- **Networking Equipment:** Standard Switches and Routers supporting connections to the backbone or Intranet.

- **Management Systems:** UAS Management, RNM system monitoring, and other Operation Support Systems.

3.2   BASE STATION

The VIDA Broadband Base Stations provide the public safety grade infrastructure for the 4.9 GHz VIDA Broadband network. The base stations are FCC-certified and implement a 5 or 10 MHz channel version of the IEEE 802.16e-OFDM profile in the 4.90 to 4.99 GHz (4.94 to 4.99 GHz for BS-009214 base stations) communications band. This implementation allows using up to ten 5 MHz channels with the BS-009214 base

stations or up to eighteen possible 5 MHz channels (10 Public Safety and 8 Federal) or nine possible 10 MHz channels (5 Public Safety and 4 Federal) with the BS-014648 base station. The base stations transmit up to 27 dBm power (0.5W) satisfying the high-power FCC mask and deliver from 1 to 19 Mbps (for a 5 MHz channel) and 3 to 38 Mbps (for a 10 MHz channel) over-the-air throughput.

The base station schedules all communication over the wireless channel, with contention slots provided for subscriber stations to request bandwidth. Based on traffic loading, multiple "connections" can be established between the base station and each subscriber station in the network, with different QoS for each connection, allowing for great flexibility when designing a network. Low priority processes (such as e-mail) can be mapped to best effort services while high priority processes (such as streaming video or LMR backhaul) can be mapped to unsolicited grant services (UGS) which offer guaranteed throughput. Network convergence is provided in the form of 802.16 classifier rules that ensure network level QoS over the airlink.

Tyco Electronics offers four base station configurations:

- MAVM-VMXBA (BS-009214-001) - AC powered with copper Ethernet port (5 MHz channel)

- MAVM-VMXBC (BS-009214-003) - DC powered with copper Ethernet port (5 MHz channel)

- MAVM-VMXBD (BS-009214-002) - DC powered with Fiber Optic Ethernet port (5 MHz channel)

- MAVM-MBASE (BS-014648-004) - DC powered with Copper Ethernet and Fiber Optic ports (5 MHz or 10 MHz channel)

The AC model operates on 110 Vac and uses a 100Base-TX Ethernet based data port configuration. The DC models require +24 Vdc, have built-in surge protection, and have either a 100Base-TX Ethernet based data port or a 100Base-FX Fiber Optic data port. The BS-014648 DC powered base station has both 100Base-TX and 100Base-FX ports.

The base station, shown in Figure 3-2, is housed in a steel NEMA 4 enclosure that satisfies IP66 requirements for outdoor deployments.

Figure 3-2: VIDA Broadband B510 (BS-014648-004) Base Station

3.3   SUBSCRIBER STATION (CLIENT)

The 4.9 GHz VIDA Broadband Subscriber Station (SS), also referred to as a Client, is shown in Figure 3-3. The Client is housed in a ruggedized enclosure suitable for nomadic or outdoor installations. The NEMA 4 housing satisfies IP66 requirements for outdoor deployments. The Client is designed for multiple mounting configurations to allow nomadic or fixed structure mounting.

- MAVM-VMCLL (BS-010700-001) - 0.1W, Copper Ethernet (5 MHz channel)

- MAVM-VMXCH (BS-010700-002) - 0.5W, AC/DC, Copper Ethernet (5 or 10 MHz channel)

- MAVM-VMCHN (BS-010700-002)[1] - Nomadic, 0.5W, DC, Copper Ethernet (5 or 10 MHz channel)

- MAVM-VMCHH (BS-010700-003) - 0.5W, DC, Fiber (w/surge protection) (5 or 10 MHz channel)

- MAVM-VMCLH (BS-010700-004) - 0.1W, DC, Fiber (w/surge protection) (5 MHz channel)

Figure 3-3: VIDA Broadband Client

The high power (0.5 Watt) copper model is available for fixed or nomadic applications and is approved for 5 or 10 MHz channel bandwidth. The low power (0.1 Watt) copper model is typically installed in fixed locations only and is only approved for 5 MHz channel operation. Both the high and low power copper models are designed to operate on 11 to 30 Vdc or 16 to 26 Vac and use a 100Base-TX Ethernet data port configuration. However, a DC supply is recommended in all applications for cleaner and lower-noise power.

The fiber models have built-in lightning protection, are powered by DC voltage only, and use a 100Base-FX Fiber Optic data port configuration.

---

[1] High Power Copper Client supplied with nomadic installation kit.

3.4   MULTILINK STATION

The VIDA Broadband MultiLink Station's base and subscriber functionality operate on separate single channels selected from the eighteen possible 5 MHz channels (10 Public Safety and 8 Federal) or nine possible 10 MHz channels (5 Public Safety and 4 Federal) of the IEEE 802.16e-OFDM profile in the 4.90 to 4.99 GHz communications band.   The MultiLink Station transmits up to 27 dBm power out each antenna port and both satisfy the high power FCC mask.   The MultiLink Station is DC powered and has the option of operating with either Copper Ethernet 100Base-TX and/or Fiber 100Base-FX.   The MultiLink Station merges the features of a base station with a fully functional subscriber with the same outline and similar weight as a base station-only device.   The base station and subscriber functions share the 100- Base-TX Ethernet and 100-Base-FX fiber optic data ports through the internal Ethernet switch. The MultiLink Station is ideal for full capacity network extension

The MultiLink Station, shown in Figure 3-4, is identified as follows:

- MAVM-MLINK (BS-014648-003) – MultiLink Station with Built-in Subscriber Station

Figure 3-4: VIDA Broadband MultiLink Station

The VIDA Broadband MultiLink Station is housed in a steel NEMA 4 enclosure that satisfies IP66 requirements for outdoor deployments.   To provide for flexible RF deployment configurations, the base station and built-in subscriber station can use a combination of antenna mounting options, including:

- Direct or remote mounting of an omnidirectional antenna on the base station or subscriber station

- Direct or remote mounting of a directional antenna on the front face of the MultiLink station for either the base station or subscriber station, or

- Direct or remote mounting of an antenna through the connection of an RF cable to the base station or subscriber station.

3.5 NETWORKING EQUIPMENT

The base station equipment is connected to the IP backbone through standard data communication and telecommunication equipment. The 100Base-TX or 100Base-FX Fiber ports of the base station can be connected directly to a multi-port router or an Ethernet switch.

The point-to-point link from the base station to the backbone can be either wired or wireless. Data to the Internet is routed to the backbone through standard routers.

The subscriber stations may also use their 100Base-TX or 100Base-FX Fiber ports to connect directly to a multi-port router or an Ethernet switch. Use of routers and switches depends on the site configuration (point-to-point, multi-hop, backhaul, etc.) and associated equipment (cameras, cell site, etc.).

3.6 MANAGEMENT EQUIPMENT

Provisioning of the VIDA Broadband system is accomplished using the Unified Administration System (UAS) installed on the Broadband Administration Server (BAS) or as part of the Regional VIDA Manager (RVM) installed on a Sun Server.

For provisioning of a VIDA Broadband standalone system, the BAS is available in one of three configurations. The BAS Laptop Server (CM-014992-003) configuration is useful when initial system configuration is all that is required. For installations that may require frequent system changes or adjustments, it is recommended to use the BAS Rack-mount Server (CM-014992-001) or the BAS Tower Server (CM-014992-002).

For VIDA Broadband systems which are integrated with a radio communication system (P25, OpenSky, etc.), the RVM UAS is required to configure/manage the broadband equipment from a centralized server.

3.6.1 <u>Unified Administration System</u>

The Unified Administration System (UAS) is the centralized access point from which the VIDA Broadband network is provisioned. The network administrator uses the UAS to configure and provision base stations, clients, service flows, and classifier rules to enable enforced QoS across the network. Because VIDA Broadband uses the WiMAX scheduled protocol, the base stations are able to enforce these rules over all traffic to provide guaranteed QoS. In addition, the network administrator can set up and change mission-critical parameters (priorities, etc.) in real time to maximize performance during specific incidents.

Figure 3-5: Example of UAS Subscriber Stations Screen

3.6.2   Regional Network Manager

The Regional Network Manager (RNM), part of the Regional VIDA Manager (RVM) on a Sun Unix Server, provides system status, fault, and performance data. In addition, the RNM monitors system activity in real time and logs all significant events.

The RNM is a collection of applications and administrative programs that permit the user to view and monitor the VIDA Broadband network components from a centralized access point. The RNM uses a graphically oriented interface that creates a visual representation of the network.

A major feature of the RNM is the graphical visualizations of the VIDA Broadband network. For example, the **Network Viewer** and **Object List** applications offer different representations of the managed objects within the network (such as base stations, clients, routers, etc.). The Network Viewer illustrates the hierarchical relationships, while the Object List allows you to specify powerful filtering clauses. In both applications, the current status of each object is conveyed using descriptive color-coding.

The RNM also displays fault and performance information, allowing you to locate trouble spots in the system and fix them quickly. It can also be set up to emit an audible alert when problems occur, thus making it possible to quickly and effectively recover from problem situations.

4. PLANNING A FIXED STATION INSTALLATION

Careful planning and preparation of any installation will always benefit the end result. Follow these simple recommendations when planning your installation:

1. Always read and follow all installation instructions, local and national building and electrical codes, and general safety rules.

2. Before beginning the installation, collect information from the Site Deployment Order (SDO) specific to the site access such as:

    - Permission to access the site.

    - Important contact names and telephone numbers.

    - Location of and directions to the site.

    - Keys and/or lock combinations to access the site and equipment shelter (if any), or points of contact to obtain them.

    - Site entry alarm system pass-codes and/or disable keys.

    - Information about work practices needed to work safely at the site.

3. Other important information that may or may not be included on the SDO includes:

    - Type of mounting—metal pole, wooden pole, tower base, exterior wall, etc.

    - Drawing or description of each site showing how the equipment is to be installed.

    - Applicable inspections completed (pole installation, electrical, local build code, etc.).

    - Installer must be aware of other transmitters and receivers on site that could cause interference to, or be interfered with by, the broadband equipment. Strong signals from, or to, co-located equipment may inflict permanent damage to either device.

 WARNING
VIDA Broadband equipment has a maximum allowed input power of 0 dBm in the 4.9 to 4.99 GHz band. Although other frequencies may have a higher threshold, any signal, at any frequency, above 0 dBm presented to the Broadband equipment should be cleared by the factory prior to installation.

4. We recommend pre-staging the equipment to become familiar with the specific hardware and cabling, tooling, and supplies that are needed to complete the installation.

4.1 SITE EVALUATION

Before installing the VIDA Broadband Client, the System Engineer and Installer should plan the site installation. Since higher RF frequencies do not readily pass through trees or buildings, consideration should be given to the following:

- Ensure there are no obstructions (such as buildings or trees) in the radio path between base station and client units.

- Ensure that any future building construction or tree growth will not obstruct the radio path.

- Ensure there is sufficient clearance around the Fresnel Zone so there is minimal interference from obstacles along the radio propagation path.

- Ensure the installation adheres to any local and national building codes and permits.

- Ensure sufficient electrical power is available at the installation site.

- When using directional antennas, align the antenna to maximize the Received Signal Strength Indication (RSSI) from the base station.

- Ensure the area around an omnidirectional antenna is clear (at least 30 inches) so as not to distort the RF pattern.

- Locate the client away from any sources of interference that could degrade the performance of the equipment. Consult the RF Planning Guide, MM-015601-001 for additional information.

- Ensure the base station and clients are within each other's maximum RF coverage range.

- Ensure maximum standard CAT-5 cable length connecting the client to the Ethernet LAN is 100 meters (328 ft.) and maximum antenna cable length is five (5) feet.

4.2   ELECTRICAL POWER

The input voltage source required depends on the model being installed. For example, clients use either 11 to 30 Vdc or 16 to 26 Vac. An AC powered base station requires 120 Vac, 50-60 Hz, and DC powered base stations and the MultiLink station require 21 to 27 Vdc.

Careful consideration should be given regarding the voltage drop across the selected power cabling to maintain the input power requirements. If a backup power source is desired, it must be provided by an external backup power source.

! CAUTION	Stations using Fiber optic cables use a DC input power source only. **DO NOT** apply an AC power source to these stations.

DC Power Source Options

We recommend using power supplies that are FCC Part 15 Class A or B compliant. Using power supplies that are not compliant could be in violation of FCC Regulations. It is the installer's responsibility to ensure the installation meets FCC Regulations.

4.3   SITE GROUNDING

Installers should review the recommended grounding procedures in the Tyco Electronics *Site Grounding and Lightning Protection Guidelines Manual, AE/LZT 123 4618/1* and ensure a suitable ground is installed between the station ground lug and earth ground. Grounding must also be in compliance with any local and national electrical codes.

4.4   SURGE PROTECTION

When installing a VIDA Broadband Base Station, MultiLink Station, or Subscriber Station you should always install external surge protectors to protect the system components from lightning or transient damage. Table 4-1 lists surge protectors that have been tested in VIDA Broadband systems and are available from Tyco Electronics. Detailed specifications for these devices can be found in Appendix C.1.

Table 4-1: Surge Protection Options

Part Number	Description
PT-016508-001	RF Port Surge Protector, Coax, Type N, 4.9 GHz.
PT-016508-002	GPS Port Surge Protector, Coax, TNC.
PT-016508-003	Cat5e, RJ-45, Data Port Surge Protector.
PT-016508-004	Surge Protector, DC, Wire, 27 Vdc
PT-016508-005	Surge Protector, DC, Wire, 54 Vdc
PT-016508-006	Surge Protector, AC/DC, Wire, 24 Vac/ 30 Vdc
PT-016508-007	Surge Protector, Coax, BNC, CCTV, and PTZ Data
PT-016508-008	Surge Protector, Coax, BNC, CCTV
PT-016508-009	Surge Protector, AC, wire, 120 Vac

4.5   ANTENNA SELECTION

The VIDA Broadband Base Station, MultiLink Stations, and Subscriber Stations allow users to choose from variety of antenna types and installation configurations.

4.5.1   Antenna Requirements

There are several basic "types" of antennas. Each type has certain advantages and disadvantages for particular applications in microwave and broadband wireless networks. Antennas and any associated cabling which connects the antenna to the Broadband equipment comprise an "Antenna System." In this Antenna System all cable loss is subtracted from the antenna gain, the result being the Effective Antenna System gain. Generally, the antenna system used with a VIDA Broadband device must meet the following requirements:

Omnidirectional Antenna: Vertical or Horizontal Polarization
9 dBi Effective Maximum System Gain

Directional Antenna: Linear Vertical or Horizontal
26 dBi Effective Maximum System Gain

(Reduction of Transmitter Power is required if the Effective Maximum Antenna System Gain is greater than 26 dBi for 5 MHz operation or 29 dBi for 10 MHz operation)

System antenna gain is defined as the antenna gain minus any cable or other losses between the base station antenna port and the antenna.

> VIDA Broadband equipment is designed to use directional antennas with an antenna system gain up to 26 dBi in a point-to-point or point-to-multipoint configuration.
>
> In 5 MHz applications, the Transmitter Output Power must be reduced if the Effective Antenna System Gain is greater than 26 dBi. The power reduction needs to be at least equal to or greater than the amount the antenna system gain exceeds 26 dBi.
>
> In 10 MHz applications, customers may use an Effective Maximum Antenna System Gain up to 29 dBi before a power reduction is required. This is because of the Broadband equipment's self imposed 27 dBm maximum power; verses a permitted power of 30 dBm.

NOTE

4.5.2 Antenna Types

The following paragraphs describe the different types of antennas that can be used with VIDA Broadband devices. Table 4-2 contains a list of approved antennas. More detailed descriptions of the antennas can be found in Appendix C.2.

Omnidirectional Antennas

An omnidirectional antenna is a vertical antenna. A vertical antenna's radiation pattern or signal radiates in all directions, losing power as the distance increases. Their radiation patterns are weaker directly above or below the vertical plane. An omnidirectional antenna also picks up signals from all directions.

Grid Parabolic Antennas

The Grid parabolic antenna is a directional antenna that greatly reduces wind loading on a tower or other mounting structures. Grid antennas have a lower front-to-back ratio than solid parabolic antennas. They are also limited to a single polarization. They are ideal in applications where the best performance is not required and tower and wind loading are the main concern.

Standard Parabolic Antennas

Standard parabolic antennas consist of a parabolic shaped reflector spun from a sheet of aluminum. The parabolic shape focuses energy at the feed point of the antenna. The parabolic antennas have a narrow focused beam of energy and relatively high gain compared to many other types of antennas. These antennas will have a mounting system to attach the antenna to a pipe or tower leg.

High Performance Antennas

High Performance antennas are formed of aluminum, which is spun to precise tolerances. Then a shroud is also fabricated of aluminum and fitted with a planar radome to protect the feed and provide for a significant reduction in side lobes. Often manufacturers will use absorber material to improve the pattern performance of the side lobes and front-to-back ratio.

Sector Antennas

Sector antennas are designed to provide segmented RF coverage over a selected (sector) area; sector antennas deliver a wider beamwidth than point-to-point parabolic antennas. Antenna configurations can consist of flat panel micro strip and slot radiating designs, as well as traditional parabolic configurations. Some common horizontal beamwidths used include 60, 90, 120, and 180 degrees.

Flat Panel Antennas

Flat panel antennas are designed for point-to-point and point-to-multi point applications. Typically, flat panel antennas are designed to be lightweight, easy to install, aligned and durable for years of reliable service. These antennas are ideal for concealment in many architectural environments. In addition to pole mounting, the approved panel antenna can be mounted directly to the VIDA Broadband base station, MultiLink station, or client.

Table 4-2: Antenna Options

Part Number	Description
AN-013386-001	Antenna, Dish, 2 ft, 26.6 dBi, Type N Connector
AN-013386-002	Antenna, 90 degree Sector Panel, 16 dBi, Vertical polarization, Type N Connector
AN-013386-003	Antenna, Sector, 90 degree, 16 dBi, Horizontal, Type N Connector
AN-013386-004	Antenna, 60 degree Sector Panel, 17 dBi, Vertical polarization, Type N Connector
AN-013386-005	Antenna, Sector, 60 degree, 17 dBi, Horizontal, Type N Connector
AN-013386-006	Antenna, Grid, 2 ft, 26.4 dBi, Type N Connector
AN-013386-007	Antenna, Dish, 1 ft, 21.2 dBi, Type N Connector
AN-013386-008	Antenna, 10.5 degree Sector Panel, 1 ft, 21 dBi, Type N Connector
AN-013386-009	Antenna, Omnidirectional, 8 dBi, 16 degree, Type N Connector
AN-013386-010	Antenna, Dish, 2 ft, 6 degree, 27.7 dBi, Type N Connector
AN-013386-011	Antenna, Omnidirectional, Vertical polarization, 18 degree, 5.5 dBi, Type N Connector
AN-013386-012	Antenna, Omnidirectional, 8 degree, 9 dBi, Type N Connector
AN-013386-013	Antenna, Panel, 9 degree, 15 x 13 in., 20 dBi, Type N Connector
AN-013386-014	Antenna, 4.9 -5.85 GHz, 12 dBi, 180 Degree Sector Panel with type N Connector.
AN-013386-015	Antenna, 4.94-4.99 GHz, 15 dBi, 120 Degree Sector Panel with type N Connector.

4.6   INSTALLATION EXAMPLES

The following sections contain examples of various installations. These include:

4.6.1   Sample Base Station Installation
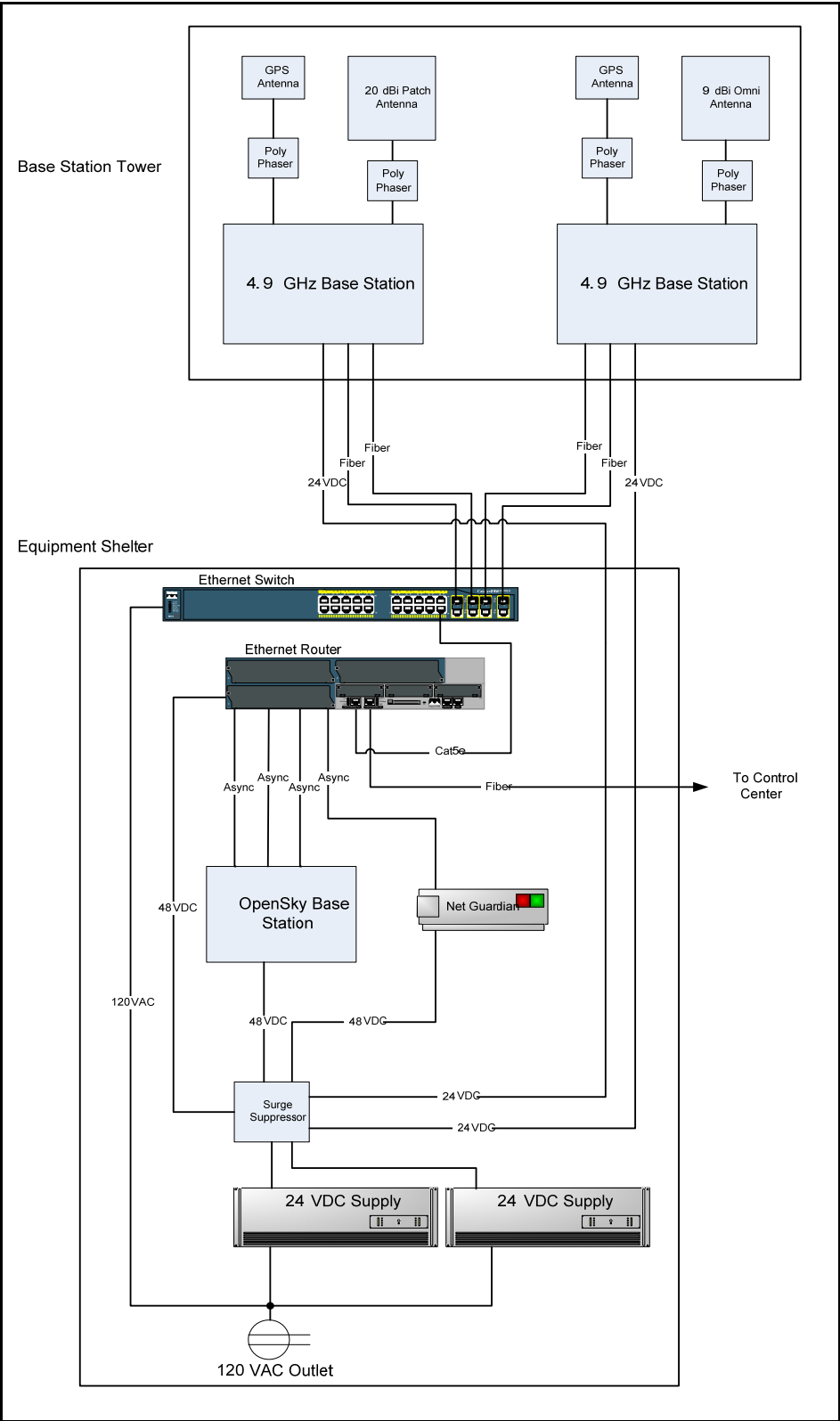
Figure 4-1: Sample Fiber Base Station Installation

4.6.2   Sample Subscriber Station Installation
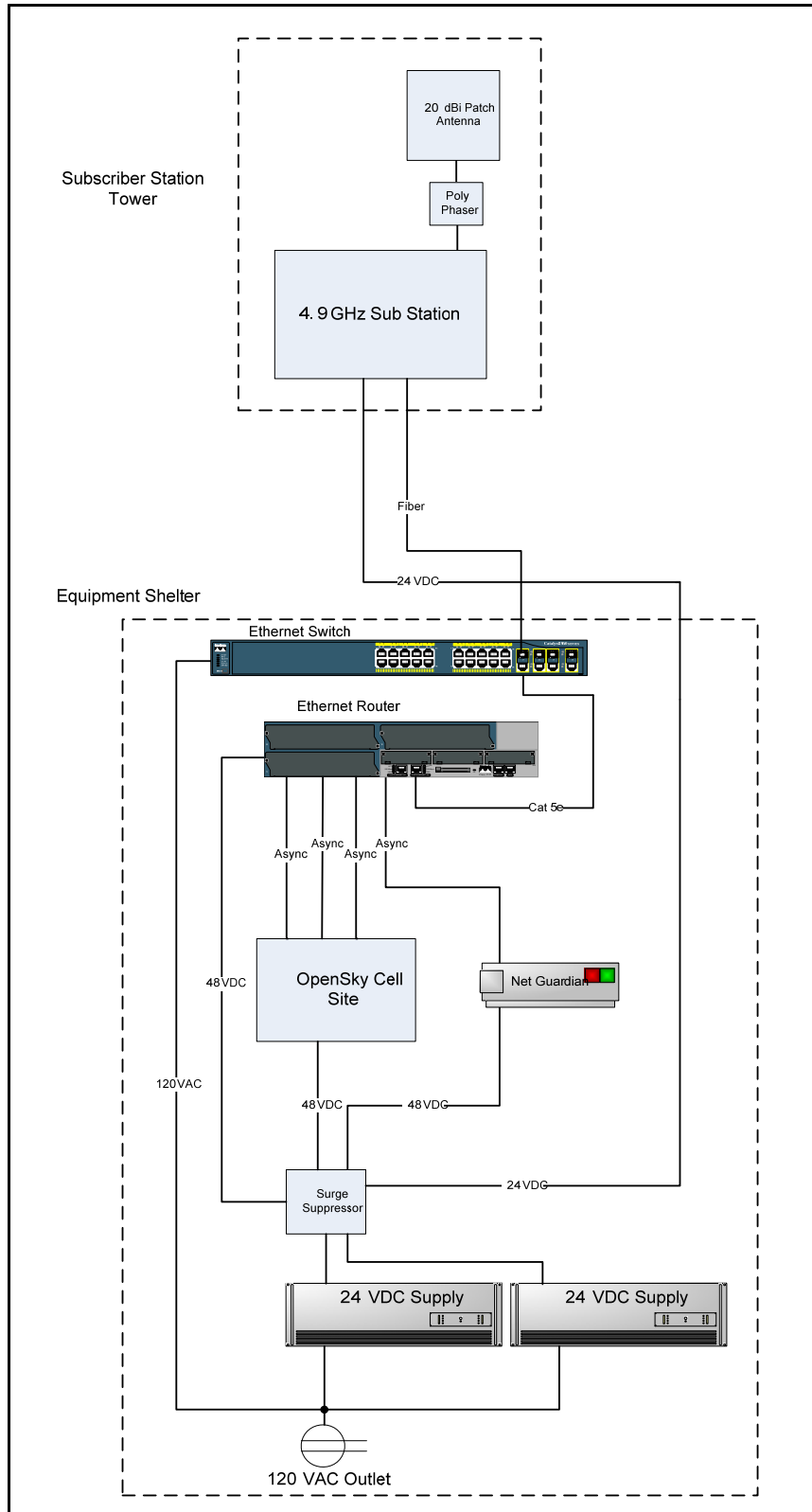
Figure 4-2: Sample Fiber Subscriber Station Installation

5.   PRE-STAGING EQUIPMENT

5.1   BASE STATION CONFIGURATION

The base station is designed to acquire an IP address in one of the following ways:

- **Default**

The base station has a default IP address of 10.0.49.1. This address can be used to access the base station as long as it has not been assigned an IP address via DHCP.

> **NOTE**
>
> Once the base station has been given an IP address via DHCP, the default address is no longer valid.

- **Static**

The base station can be configured to use a static IP address. The base station has a default static IP address of 192.168.11.3. When the base station is running in static IP mode, both the default IP address of 10.0.49.1 and the user assigned static IP address can be used to access the base station.

- **DHCP**

If the base station is configured for DHCP, it will always request an IP address via DHCP on boot up. If a DHCP server responds to the request, the base station will continue to use the assigned IP address until it is rebooted. If the base station does not receive an IP address via DHCP, due to no DHCP server or a connectivity problem, it will use its last known IP address until it is rebooted. This address is stored on the base station and will not change unless the base station is assigned a new IP address via DHCP on a subsequent boot up or the base station is configured to use a static address. If DHCP fails, both the last know IP address and the default IP address, which may be different, can be used to access the base station.

When setting up a new BS, and before deploying it into the field, we recommend pre-configuring the BS with the IP address that it will use in the field.

- If the BS will be using a static IP address, manually assign the IP address before installing the BS in the field.

- If the BS will be using DHCP in the field, connect the BS to a DHCP server that contains the actual IP address information that the BS will use in the field.

When the BS boots up for the first time, it will be connected to the DHCP server directly and will have the ability to acquire an IP address from the DHCP server. The BS will then store the address as the last know IP address. This way, if no DHCP server exists in the field's network, or if there is a connectivity problem with the BS in the field before a DHCP server is found, access to the BS will still be possible through the last know IP address given to the BS.

5.1.1 BS Configuration

To configure the BS with transmission parameters such as RF Attenuation and RF Channel/Frequency, a configuration script is used. This script is called **bs_config** and can be found in the **/ixa/wimax** directory in the base station.

> The script takes time between configuration steps. After typing Enter, wait for the prompt to come back before typing Enter again. If you do not wait for the prompt to return you may cause the script to fail.

Step 1.   Telnet into the BS

telnet –l root <BS IP Address>

password: tyco

Step 2.   Execute Script

The telnet session will start you in the **/ixa/wimax/** directory. From this directory execute the script:

```
./bs_config
```

The following output will appear:

```
--- Base station file configuration program ---

Mounting flash file systems
Please be patient, this may take several minutes...

Options:
1 - Keep current configuration. Copy the old files
2 - Manually re-configure the base station.
3 - Manually re-configure the base station with advanced options.
```

Choose Option 3.

Each step in the script will first show the current value of the setting. The script will then wait for you to either type in a new value followed by the **Enter** key, or just press the **Enter** key to accept the current value.

Step 3.   Assign a Channel/Frequency

When prompted, enter the RF frequency that will be used by the BS. Refer to Table 5-1 for channel/frequency options (5 MHz offset 2500 kHz, 10 MHz offset 5000 kHz):

Enter channel in kHz, (range 4900000 – 500000):

Table 5-1: Available Frequencies

5 MHz Frequencies	10 MHz Frequencies
4902500	4905000
4907500	
4912500	4915000
4917500	
4922500	4925000
4927500	
4932500	4935000
4937500	
4942500	4945000
4947500	
4952500	4955000
4957500	
4962500	4965000
4967500	
4972500	4975000
4977500	
4982500	4985000
4987500	

NOTE

Frequencies highlighted in gray are only available on 10 MHz products.

Step 4.   Set the RF Attenuation

When prompted, enter the RF attenuation to be used by the BS.

For instance, a setting of RF_ATTENUATION = 5 will result in max power, or a BS TX power of 26 dBm. Increasing the RF_ ATTENUATION value will result in decreasing the actual BS TX output power. Table 5-2 lists the approximate BS TX output power for the assigned values.

Enter RF ATTENUATION in dB (decimal, range 0 - 31):

Table 5-2: RF Attenuation vs. TX Power

RF_ATTENUATION (Decimal Value)	BS TX Power (dBm)
5	26
6	25
7	24
8	23
9	22
10	21
…	…
31	0

Step 5.   Set the GPS Synchronization Value

The GPS synchronization value is a configuration parameter used to synchronize collocated base stations and subscriber stations in order to avoid self interference. This parameter synchronizes the downlink (DL) and uplink (UL) frames from the two base stations. Specifically, the network is configured so the frames between BS1 and BS2 are out of phase. That is, when BS1 is in the downlink mode, BS2 is in uplink mode and the reverse when modes are switched. Thus, when SS2 is receiving the downlink signal from BS1, the collocated BS2 is in uplink mode and is listening to data sent by its subscribers. In the other half of the frame, SS2 is in uplink mode and is transmitting at the same time as BS2. With this coordination, no special isolation is required between the antenna for SS2 and BS2. Two omnidirectional antennas can be used without having any interference issues. When a link is repeated through more than two hops, the phase of the frame at each subsequent hop is flipped (that is, the phase of the third hop BS is the same as the first).

When prompted, enter the synchronization values.

GPS synchronization value:

No Sync: GPS_SYNC = 20040000

TX frame sync: GPS_SYNC = 20040001

RX frame sync: GPS_SYNC = 20040002

Step 6.   Set the Channel Bandwidth

Enter the channel bandwidth for the parameter. If using a 5MHz channel, enter 0, if using a 10MHz channel, enter 1.

```
Bandwidth value, 0 - 5 MHz, 1 - 10MHz:
```

Step 7.   Set the Debug Flag

Press <**Enter**> and accept the default value for this parameter. This value does not need to be changed unless instructed by the TE support team.

```
Debug flag, 0 will reboot, 1 will not:
```

Step 8.   Enable Remote Logging

When prompted, enable the syslog option. If syslog is turned on, the BS syslog will be sent to the syslog server.

```
Enable remote syslog server(1-on,0-off):
```

Step 9.   Identify the Remote Logging Server

If Remote Logging is enabled, you need to enter the IP address of the syslog server. The BS syslog will be sent here.

```
IP address of a remote host syslog deamon will log to (if enabled):
```

Step 10.   Enable BSCP Trace

This is for BS debugging and should not be modified from the default value unless instructed by the TE support team.

Step 11.   BSCP Trace Output

This is for BS debugging and should not be modified from the default value unless instructed by the TE support team.

Step 12.   BSCP Trace File Name

This is for BS debugging and should not be modified from the default value unless instructed by the TE support team.

Step 13.   BSCP Trace IP Address

This is for BS debugging and should not be modified from the default value unless instructed by the TE support team.

Step 14.   BSCP Trace Port

This is for BS debugging and should not be modified from the default value unless instructed by the TE support team.

Step 15.   Enable All BSCP Traces

This is for BS debugging and should not be modified from the default value unless instructed by the TE support team.

Step 16.   Mcapp Trace Level

This is for BS debugging and should not be modified from the default value unless instructed by the TE support team.

Step 17.   Enter the SNMP Community Name

This is the SNMP community name used to talk to the UAS. This name must match the name defined in the UAS configuration. Unless you have specific SNMP requirements, leave the community name as "public."

    Enter community name:

Step 18.   Enter SNMP Network Address

This is the SNMP network used to talk to the UAS. This network must match the network that the UAS resides in. If the IP address of the UAS changes, this network address needs to be modified to match the change.

    Enter SNMP network addr/size:

Step 19.   Enter the SNMP Network Name

This is the SNMP name used to talk to the UAS. This name must match the name defined in the UAS. Unless you have specific SNMP requirements, leave the community name as the default.

    Enter network name:

Step 20.   Enter the SNMP Trap Community Name

This is the SNMP trap community name. This is used by SNMP trap monitoring applications such as the RNM. Unless you have specific SNMP requirements, leave the community name as "public."

    Enter trap community name:

Step 21.   Select the IP Address Mode

When prompted, select the BS IP Address mode. Accept the default value zero (0) if the BS will be using a DHCP assigned IP address. Enter one (1) for the user defined static IP address.

    Interface configuration 1 - static IP, 0 - DHCP IP:

Step 22.   Set the Static IP Address

When prompted, enter the BS static IP address. If the BS is configured for DHCP, this value will be ignored.

    Static IP address (if enabled):

Step 23. Set the Static IP Subnet Mask

When prompted, enter the BS static IP subnet mask. If the BS is configured for DHCP, this value will be ignored.

```
Static IP subnet mask (if enabled):
```

Step 24. Set the Default Gateway

When prompted, enter the BS's default gateway. If the BS is configured for DHCP, this value will be ignored.

```
Default Gateway 1 – enabled, 0 – No Default Gateway:
```

Step 25. Default Gateway Address

When prompted, enter the BS's default gateway address. If the BS is configured for DHCP, this value will be ignored.

```
Default Gateway Address:
```

Step 26. Verify Operation

Any time you run the **bs_config** script, you must restart the base station before the settings will take effect. After the BS reboots, run the **bs_config** script again and make sure your settings are what you expect them to be. When each setting appears, just press the **Enter** key to accept the current value.

5.1.2   <u>Booting the Base Station</u>

The base station will boot from flash memory and acquire an IP address in one of the following ways:

1. Default Address

    A BS which has never had an IP Address will default to 10.0.49.1.

2. If the Base station is configured to use DHCP, it submits a DHCP Request:

    a. If the BS receives a response:

        •   The BS will use the DHCP address from this point forward.

        •   The default address of 10.0.49.1 is no longer valid.

    b. If the BS does not receive a response:

        •   The BS will use the last known assigned address from this point forward.

        •   The default address of 10.0.49.1 is still valid. Both the last known assigned address and the default address can be used to access the BS.

3. If the Base station is configured to use a static address, it will boot up using the user defined static address.

    The default address of 10.0.49.1 is still valid. Both the user defined static address and the default address can be used to access the BS.

Approximate durations from time of Power-up / Reboot:

- Ping works continuously 55 seconds.

- BS access via telnet possible 90 seconds.

- SS registers and traffic flowing 3 ½ - 4 ½ minutes.

5.1.3 IP Address Testing

Before putting the BS in the field, make sure the BS can be accessed with the IP address that is expected. BS connectivity can be tested by connecting both BS network ports to a switch connected to another network device, such as a laptop computer, that can send a ping command to the BS.

```
ping <BS IP address>
```

If the BS responds, then this IP address will be stored as the last known address and will be the IP address of the BS until a new IP address is assigned via DHCP or the BS is changed to static IP mode.

If the BS does not respond, refer to Section 5.1.1 and assign an IP address to the BS.

5.2   SUBSCRIBER STATION CONFIGURATION

5.2.1   IP Address Assignment

The subscriber is capable of acquiring an IP address in one of two ways.

- **DHCP**

By default, when the subscriber station boots up it requests an IP address via DHCP. If the request is answered by a DHCP server, the subscriber uses the assigned IP address until it reboots. Whenever a subscriber station reboots, it will request an new IP address via DHCP. If the subscriber does not receive an IP address it will automatically reboot approximately every 30 seconds.

Once the DHCP server has successfully granted an IP address to the subscriber station, the new IP address can be used for communication. However, the subscriber station also has a built-in default IP address of 10.0.0.1. This address can be used to communicate with the SS at any time.

- **Static**

The subscriber can be configured to use a static IP address. When the subscriber is configured to use a static IP address, it no longer requests an IP address via DHCP on boot up. For more information on how to assign the subscriber a static IP address, refer to Section B.16, IP Mode Settings.

> **NOTE**
>
> Any machine that is trying to communicate with the SS via the SS Ethernet port using the 10.0.0.1 address must have an IP address between 10.0.0.2 and 10.0.0.15. Any IP address outside of this range will be ignored.
>
> Any machine trying to communicate across the RF link to the SS, should not use an IP address between 10.0.0.1 and 10.0.0.15. Using an address in this range will allow traffic to flow through the SS, but will not allow direct communication to the SS. For example, video will flow from a camera, through the SS to the BS, but a user on the BS switch will not be able to open the SS webpage.

5.2.2   IP Address Testing

Subscriber connectivity can be tested by connecting the SS network port to a switch connected to another network device, such as a laptop, that can send a ping command to the SS.

```
ping <SS IP address>
```

If the SS responds, then the assigned IP address is valid. If the IP address was assigned via DHCP and the address is the same address that will be used in the field, or the address is static, then it can be used to configure the SS in the future.

If the SS does not respond, refer to Section 5.2.1 to properly assign an IP address to the SS.

5.2.3   Default IP Address

The subscriber is designed to have a default IP address that is always accessible. This address is 10.0.0.1. This address is accessible even if an address has been assigned to the subscriber via DHCP. If accessing the subscriber directly through its Ethernet port, make sure to assign an address between 10.0.0.2 and 10.0.0.15 to the machine being used. Any address outside of this range will be ignored.

5.2.4 Subscriber Station RF Frequency Assignment

We recommend configuring the subscriber station to only look for the RF frequency that it will be communicating with in the field. By only looking for the assigned BS RF frequency, the network registration process will speed up, and multiple BS signal conflicts will be eliminated. It is possible that a subscriber can try to register with a BS if it receives a suitable signal from that BS, even though it does not have permission to register with that particular BS. Assigning only one frequency for the subscriber to look for minimizes this situation. For more information on how to change the subscriber RF frequency, refer to Section B.8, Defining Frequency Channels.

To make sure the subscriber is communicating with the proper BS, open the subscriber Web page and verify the frequency the subscriber is using. This process is explained in more detail in Section B.2.

5.3 NETWORK SERVICES CONFIGURATION

5.3.1 DHCP Configuration

It may be necessary to configure a DHCP server that will grant DHCP addresses to all base stations and subscriber stations in the network. This server can be a stand alone machine or can reside on the BAS and if DHCP is being used by any of the network devices, the server needs to be running at all times. Both the base stations and subscriber stations can be configured to request an IP address on boot up. It is important to note that the DHCP server needs connectivity to both Ethernet ports of the BS. If both ports are not connected to the DHCP server, the SS and the BS may not receive proper IP addresses.

5.3.2 NTP Configuration

Network Time Protocol is available for use by the base station as an option. It is not necessary, and therefore an NTP Server is not necessary unless BS NTP is desired. As with the DHCP server, it is not necessary for the NTP server to be on the same machine as the UAS or the DHCP server.

Instructions for installing and configuring the Network Services can be found in the *VIDA Broadband Network Services Installation and Configuration Manual, MM-014640-001*.

6. INSTALLING A FIXED STATION

> **NOTE**
> Become familiar with the hardware and electrical components of the system before attempting installation. Read and follow the installation instructions found in this manual and all other user and installation instructions for associated hardware. If any questions arise that are not answered in this or any other supplied instructions, contact the Tyco Electronics Technical Assistance Center for assistance.

This section provides general information regarding installation of the VIDA Broadband Base Station or Client in fixed station configurations. For best results, the units should be installed by one of the many Tyco Electronics Authorized Service Centers located throughout the United States. Their experienced service personnel can provide a proper radio installation and make any final adjustments that may be needed.

This manual attempts to cover the most common installation requirements for the units. However, variations in sites may require pre-planning to reduce installation time and improve the overall professionalism of the installation. When necessary, pre-stage a site installation to become familiar with specific hardware and cabling requirements, tooling, and supplies that are needed to complete the installation.

The VIDA Broadband Base Stations, MultiLink Stations, and Subscriber Stations (Clients) are enclosed in an outdoor enclosure that satisfies IP66 requirements for outdoor environmental conditions. The user can choose different antenna types (omnidirectional or directional) depending on the application.

The units use weatherproof connectors for the power, RJ-45, and Fiber Optic DATA connections. External protection devices for lightning and power surges should be installed in-line with the antenna ports, power ports, and Ethernet connections on all configurations except models with built in protection.

We recommend using a DC power source for all installations where the VIDA Broadband Base Stations or Clients may experience the effects of frequent thunderstorms. Using a DC power source may provide extra isolation from lightning surges that are usually induced through AC power transformers when connected directly to the AC power mains. Also, the DC models offer greater protection through the use of built-in surge protection devices and Fiber Optic connectivity. Always follow all local and national electrical and building codes when installing surge protection devices.

> **NOTE**
> Both the RJ-45 and AC/DC power connectors achieve weatherproof properties only when properly mated with approved cabling. The dust cap provided for the RJ-45 Service Port should be installed at all times during normal operation.

6.1 TOOLS AND TEST EQUIPMENT REQUIRED

The following tools and test equipment are recommended for installing and testing the stations:

- Common hand tools, including screwdrivers, wire cutters, pliers, open and box end wrenches, etc.
- Tyco Electronics-AMP Modular Plug Hand Assembly 790163-7 and Die Set 790163-8 (or equivalent).
- Cable tester, Ideal VDV MultiMedia Cable Tester #33-856, or equivalent.
- Digital Voltmeter (DVM), capable of measuring AC and DC voltage.
- Received Signal Strength Indication (RSSI), EA-015564.

6.2 CUSTOMER SUPPLIED MATERIALS

The customer or designated installer must provide the following:

- Cat5e Copper Ethernet cable should not to exceed 100 meters (328 ft.). (Refer to Appendix D for cable descriptions and fabrication instructions.)
- Power Cable, length as required. (Refer to Appendix D for cable descriptions and fabrication instructions.)
- RF coaxial cable (for directional or remotely mounted antenna), i.e. LMR-400 low loss 1/2" Superflex coaxial cable.
- Surge Devices, as required. (Refer to Table 4-1 and Appendix C.1 for approved devices.)
- Antenna. (Refer to Table 4-2 and Appendix C.1.7 for approved antennas.)
- Pole mounting straps, i.e. Band-It® bands and buckles.
- Power source.

6.3 MOUNTING THE STATION FOR FIXED OPERATION

The VIDA Broadband Base Stations, MultiLink stations, and subscriber stations (clients) are usually pole mounted. Pole mounting may include mounting the unit onto a horizontally suspended light post or side arm, or a vertical telephone pole, mast pipe, or tower leg. An example of each mounting method is depicted in Figure 6-1 and Figure 6-2.
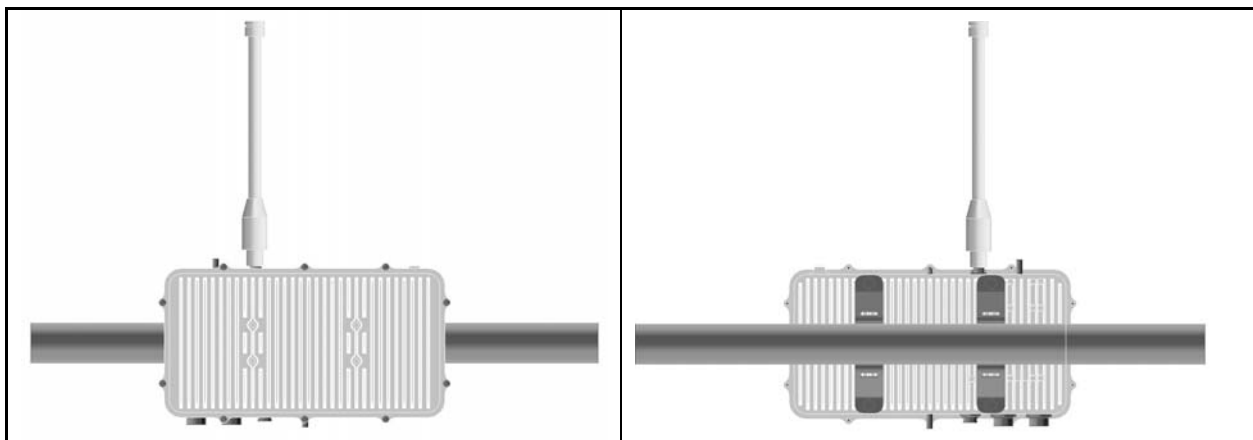

Figure 6-1: Side Bar Mounting Example (VIDA Broadband Base Station shown)
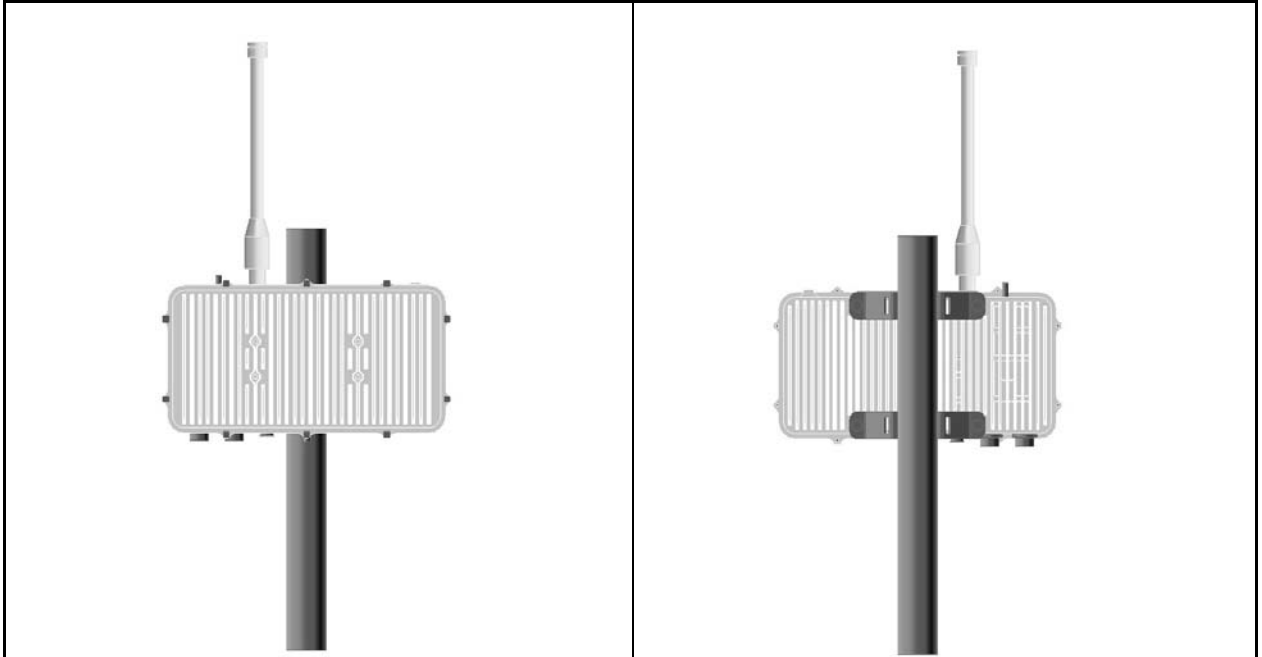
Figure 6-2: Vertical Pole Mounting Example (VIDA Broadband Base Station shown)

Each base station, MultiLink station, or subscriber station package includes two mounting brackets (FM-008586) and necessary hardware for attaching the brackets to the units. The mounting brackets accommodate pole diameters from 2 1/2" to 6" inches. An alternate bracket (FM-015677) is available for mounting units on poles less than 2 1/2" in diameter.

6.3.1   Attaching the Mounting Brackets

1. Install the brackets so when the unit is mounted on a pole, the heat sink fins are vertical. This position provides the best thermal convection (vertical fins) and shields the multiple connectors from rain.

    As shown in Figure 6-3, pole-mounting brackets can be installed onto the mounting surface of the base station, MultiLink station, or client such that the units may be mounted horizontally or vertically.

> **NOTE**
>
> It is important to mount the units so their heat sink fins are positioned vertically, as shown in Figure 6-3. This gives the units the best thermal performance, allowing air to move naturally through the fins.

2. Attach mounting brackets to the unit using the flat washer, lock washer, and hex head bolt included with the brackets. (Ensure that the lock washer is closest to the bolt's head followed by the flat washer positioned next to the mounting bracket.)

Mounting the units so the fins are vertical also allows the RF antenna port to be in the best position for attaching an omnidirectional antenna directly to the unit.
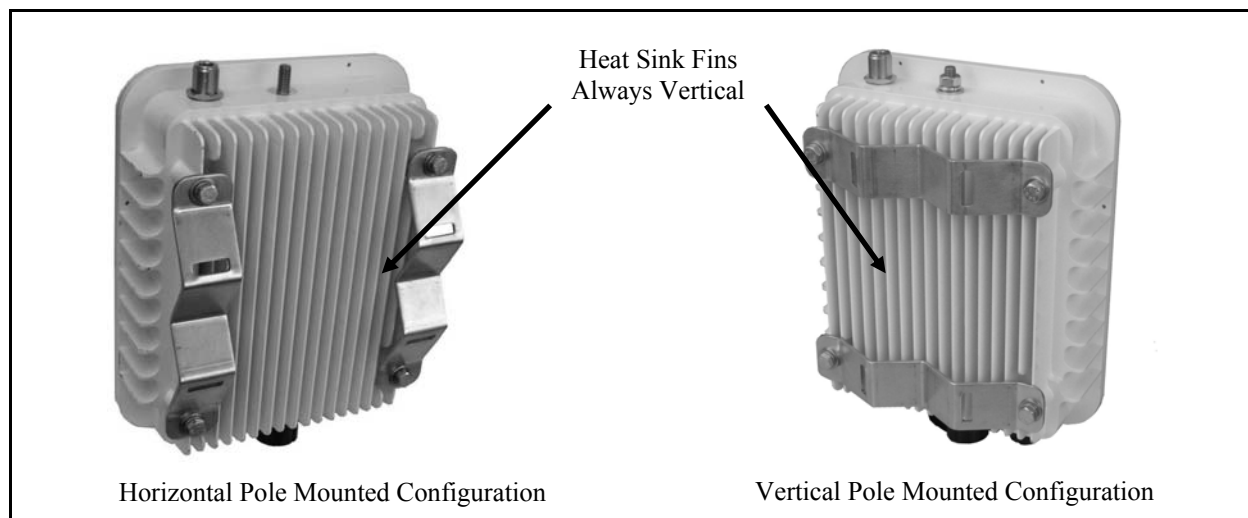
Heat Sink Fins
Always Vertical

Horizontal Pole Mounted Configuration   Vertical Pole Mounted Configuration

Figure 6-3: Installing Mounting Brackets (VIDA Broadband Client shown)

6.3.2   Attaching the Unit to a Pole

1. Orient the unit on the pole so the fins are vertical and the antenna port is pointing straight up.

> ⚠️ **CAUTION**
>
> When mounting the unit on a pole, the installer must ensure the mounting bands are secure and resist movement or rotation.

2. Strap the unit to pole using Band-It bands and buckles (not supplied). Follow the manufacturer's guidelines for proper band installation techniques.

3. After installation, check the overall unit for stability and verify that the unit is not loose fitting.

6.3.3   Optional Mounting

Optionally, the VIDA Broadband Base Stations, MultiLink stations, and subscriber stations (clients) can be mounted to a flat surface, such as a wall, using the optional mounting bracket FM-010668 shown in Figure 7-1.

1. Using the mounting bracket as a template, mark and prepare the wall mounting location.

> ℹ️ **NOTE**
>
> The installer must provide screws or bolts and wall anchors for mounting the broadband units to the wall. The hardware size and anchor type depends on the structure of the building. When selecting screw or bolt and anchor sizes, consideration must be given to the weight of the unit and load that may be induced in windy conditions.

2. Attach the bracket to the unit using the hardware provided. The bracket should be oriented so when the unit is mounted on the wall the heat sink fins are vertical.

3. Attach the assembly to the wall using screws or bolts (neither is provided). After installation, check the overall unit for stability and verify the unit assembly is secure.

6.4 CONNECTING SUBSCRIBER STATION POWER

Power is supplied to the Subscriber Station (Client) through a 2-pin connector. A 2-pin #12-16 Socket Multi-Con-X mating connector kit, CN-014934 is supplied with the unit. A pre-made 2/12 AWG Power Cable assembly, CA-014984-XXXXX or CA-014988-XXXXX is available in various lengths. Refer to Appendix D.1 for details.

The High and Low Power Standard models require 11 to 30 Vdc or 16 to 26 Vac. A DC supply is recommended in all applications for cleaner and lower-noise power; however, an AC supply may be used. Connect the supply voltage per the pin out shown in Table 6-1 (DC) or Table 6-2 (AC).

6.4.1 Subscriber Station DC Connections

⚠ WARNING	**When making cables for DC connections, pay close attention to polarity and the connector keyway. Reversing polarity will cause serious damage to the unit.**

Table 6-1: Client DC Power Connector

Connection	Pin	Power Connector
PWR+ (+11 to +30 Vdc)	1	PWR+ (11-30 Vdc) ── PWR- (Return)
PWR- (Return)	2	

6.4.2 Subscriber Station AC Connections

⚠ WARNING	**The client models MAVM-VMCHH (BS-010700-003) and MAVM-VMCLH (BS-010700-004) use DC input power only. DO NOT apply AC power to these units. Failure to observe this warning will result in damage to the equipment.**

⚡	**The AC supply must be isolated from AC mains; the use of an isolating step-down transformer is necessary. The Vac supply must not have a ground path; ground should be supplied through a separate wire to the grounding stud. Failure to observe this warning may result in electrical shock or damage to equipment.**

Table 6-2: Client AC Power Connector

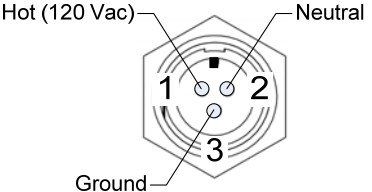| Connection	Pin	Client AC Power Connector
HOT (16 to 26 Vac)	1	Hot (16-26 Vac) ── Neutral
Neutral	2	

6.5   CONNECTING BASE STATION AND MULTILINK STATION POWER

The MAVM-VMXBA base station uses AC power. All other base stations and the MultiLink stations require DC input power. Power is supplied to the AC powered base station through a three-pin connector. The DC powered units use a two-pin connector.

6.5.1   Base Station AC Connections

The AC powered VIDA Broadband Base Station (MAVM-VMXBA) requires 120-230 Vac, 50-60 Hz power applied to the following contacts. A 3-pin #12-16 Socket Multi-Con-X mating connector kit, CN-014935 is supplied with the unit. A pre-made 3/12 AWG Power Cable assembly, CA-014985-XXXXX is available in various lengths. Refer to Appendix D.1 for details.

Table 6-3: Base Station AC Power Connector

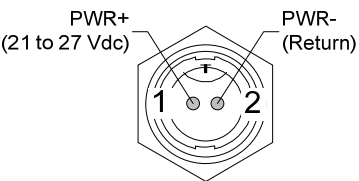| Connection	Pin	Power Connector
Hot (120 ±15% Vac 50-60 Hz)	1	Hot (120 Vac) Neutral
Neutral	2	1 2
Ground	3	3 Ground

6.5.2   Base Station and MultiLink Station DC Connections

A DC powered VIDA Broadband Base Station requires 24 ±3 Vdc applied to the following contacts. A 2-pin #12-16 Socket Multi-Con-X mating connector kit, CN-014934 is supplied with the unit. A pre-made 2/12 AWG Power Cable assembly, CA-014984-XXXXX or CA-014988-XXXXX is available in various lengths. Refer to Appendix D.1 for details.

⚠ **WARNING**

When making cables for DC connections, pay close attention to polarity and the connector keyway. Reversing polarity will cause serious damage to the unit.

Table 6-4: Base Station and MultiLink Station DC Power Connector

Connection	Pin	Power Connector
PWR+ (+24 ±3 Vdc)	1	PWR+ (21 to 27 Vdc) PWR- (Return)
Return (PWR-)	2	1 2

6.5.3   Attaching Power Cables

CAUTION

When installing cables, ensure they are not under any stress, a service loop is maintained, and the cables are restrained according to industry best practices.

To connect power:

1. Connect the proper power cable (refer to Appendix D.1 for cable details) to the appropriate power source.

2. Mate the other end of the power cable's connector to the unit's power connector by visually aligning the connector key and firmly push and turn the outer locking ring clockwise until it stops. A click will be sensed to confirm proper mating.

3. For added protection against long-term exposure to weather, seal the connectors using approved industry techniques for sealing the connectors.

4. Install a power cable grounding kits as required. Refer to the *Site Grounding and Lightning Protection Guidelines Manual, AE/LZT 123 4618/1* for additional details on proper grounding techniques.

NOTE

The cable conveying power to the base station, MultiLink station, or subscriber station(s) should be grounded at the radio and then every 75 feet until terminated at the surge suppressor or power source. The recommended kit for grounding the power cable is Andrew® Part Number 223158-2 (Tessco # 493736), as described in Appendix C.3.1. Follow the instructions provided in the kit for proper installation.

6.6   NETWORK/DATA CONNECTIONS

Network connections are made using either a standard Ethernet RJ-45 protocol or Fiber Optic connection. All DATA connectors are industrial grade, rugged, UV rated, weatherproof, dustproof and made for use in extreme electrical and climatic conditions. Each connector meets the IP67 industrial standard for weatherproof and dustproof electrical connections.

CAUTION

When installing cables, ensure they are not under any stress, a service loop is maintained, and the cables are restrained according industry best practices.

To connect the Data cable:

1. Select proper length Ethernet or Fiber Optic cables. Ethernet cables are described in Appendix D.2, and Fiber Optic cables are described in Appendix D.2.5.

2. Connect one end of the cable to the LAN or Fiber Optic network connection.

3. Mate the other end of the Data cable to the station data connector by visually aligning the connector key and firmly push and turn the outer locking ring clockwise until it clicks.

4. Be sure to install a dust cap on any ports not being used.

5. For added protection against long-term exposure to weather, use appropriate industry approved methods to seal the connector.

6. For Cat5e copper Ethernet cables, install a grounding kit within six inches of the unit and then every 75 feet. Refer to the *Site Grounding and Lightning Protection Guidelines Manual, AE/LZT 123 4618/1* for additional details on proper grounding techniques.

> **NOTE**
>
> The base station, MultiLink station, or subscriber station(s) Ethernet cable should be grounded at the radio and then every 75 feet until terminated at the surge suppressor. The recommended kit for grounding the power cable is Andrew® Part Number 223158-2 (Tessco # 493736), as described in Appendix C.3.1. Follow the instructions provided in the kit for proper installation.

6.7 GROUNDING STUDS

Grounding studs are provided on the base stations, MultiLink Stations, and clients. For safety purposes, earth ground and lightning protection connections should be made as required by local ordinances and the *Site Grounding and Lightning Protection Guidelines Manual, AE/LZT 123 4618/1*.

> **CAUTION**
>
> On units with two grounding studs, only use one ground stud. This will prevent unwanted ground paths through the unit housing.

6.8 ANTENNA INSTALLATION

There are three basic methods for mounting a fixed station antenna. These methods include the following:

- Connecting the antenna directly to the Antenna Port, typically used with an omnidirectional antenna.

- Mounting the antenna to the base station, MultiLink station, or subscriber station case using built-in mounting holes, typically used for a directional antenna. A short RF cable connects the antenna to the RF Port.

- Remotely mounting the antenna using mounting brackets recommended by the antenna manufacturer and an RF cable connects the antenna to the base station or subscriber.

> **NOTE**
>
> The RF cables connecting the base station, MultiLink station, or subscriber station to the antenna should be kept as short as possible. The cable should be constructed from a high quality heliax cable such as Andrew LDF4-50A or equivalent.
>
> If the distance between the radio equipment and the antenna exceeds 30 feet, use a larger low loss cable such as Andrew LDF5-50A or equivalent.
>
> The 1/2" LDF 4-50A cable offers approximately 5.5 dB of loss per 100 feet and LDF 5-50A cable offers approximately 3.2 dB of loss per 100 feet.
>
> The losses are in addition to any connector losses that may occur.

6.8.1   Mounting an Antenna Directly to the Antenna Port

Certain smaller sized lower gain omnidirectional antennas may be mounted directly to the base station, MultiLink station, or subscriber station RF antenna port. This eliminates the need for an RF transmission line. Attention must be given to the antenna gain, physical size, and wind loading characteristics when choosing the right antenna for direct mounting to the antenna port.

Mounting an Omnidirectional Antenna Directly to the Unit:

An omnidirectional antenna may be mounted vertically directly to the unit using the following procedure:

1. Connect an N-type male to male RF adapter (not included) to the omnidirectional antenna. Hand-tighten the connector.

2. For units without built-in lightning protection, external lightning protection is required to provide maximum protection to the site. Connect the optional lightning suppressor to the antenna assembly as shown in Figure 6-4.
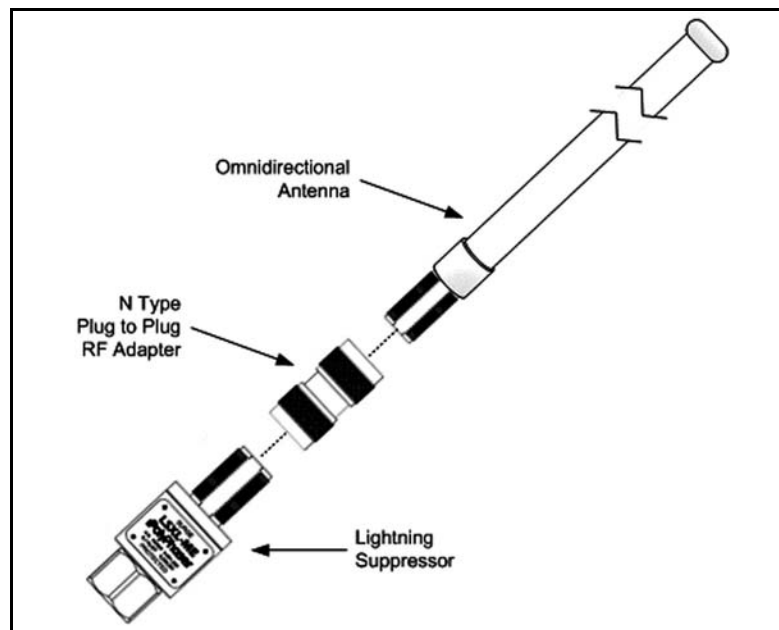
Figure 6-4: VIDA Broadband Client Antenna with External Lightning Protection

3. Connect the completed antenna assembly to the RF antenna connector.

6.8.2   Mounting a Directional Antenna to the Case

A directional antenna can be mounted directly on the unit using the optional universal mounting bracket MNT-2 kit. After the universal mounting bracket is attached, it can be adjusted to point the forward beam pattern of the antenna in the direction needed for network connectivity. (Refer to Section 8.3 for antenna alignment instructions.)

Four mounting holes are provided for mounting an antenna to the front cover housing of the base station, MultiLink station, and subscriber stations. These mounting holes are spaced at a 1.772" x 5.118" (45 mm × 130 mm) rectangular pattern tapped to accept 1/4-20 UNC-2B hardware with a minimum hole depth of 0.31".

A low loss RF cable (not included) is needed to connect between the unit's antenna connector and the directional antenna. The RF cable and connectors must be capable of passing frequencies up to 5.2 GHz with minimal loss.

To install Universal Mounting Bracket:

1. Using the four bolts, lock washers, and flat washers included in the kit, attach the universal antenna mounting bracket, shown in Figure 6-5-A, to the unit as shown in Figure 6-5-B.

2. Attach the antenna panel bracket assembly to the antenna panel, as shown in Figure 6-5-C.

3. Attach the two bracket assemblies together with the universal knuckle, as shown in Figure 6-5-D.

4. Attach a short RF cable between the antenna and the unit's antenna port.

   Recommend using LMR-400 Low loss coaxial cable with N Type Male connectors.
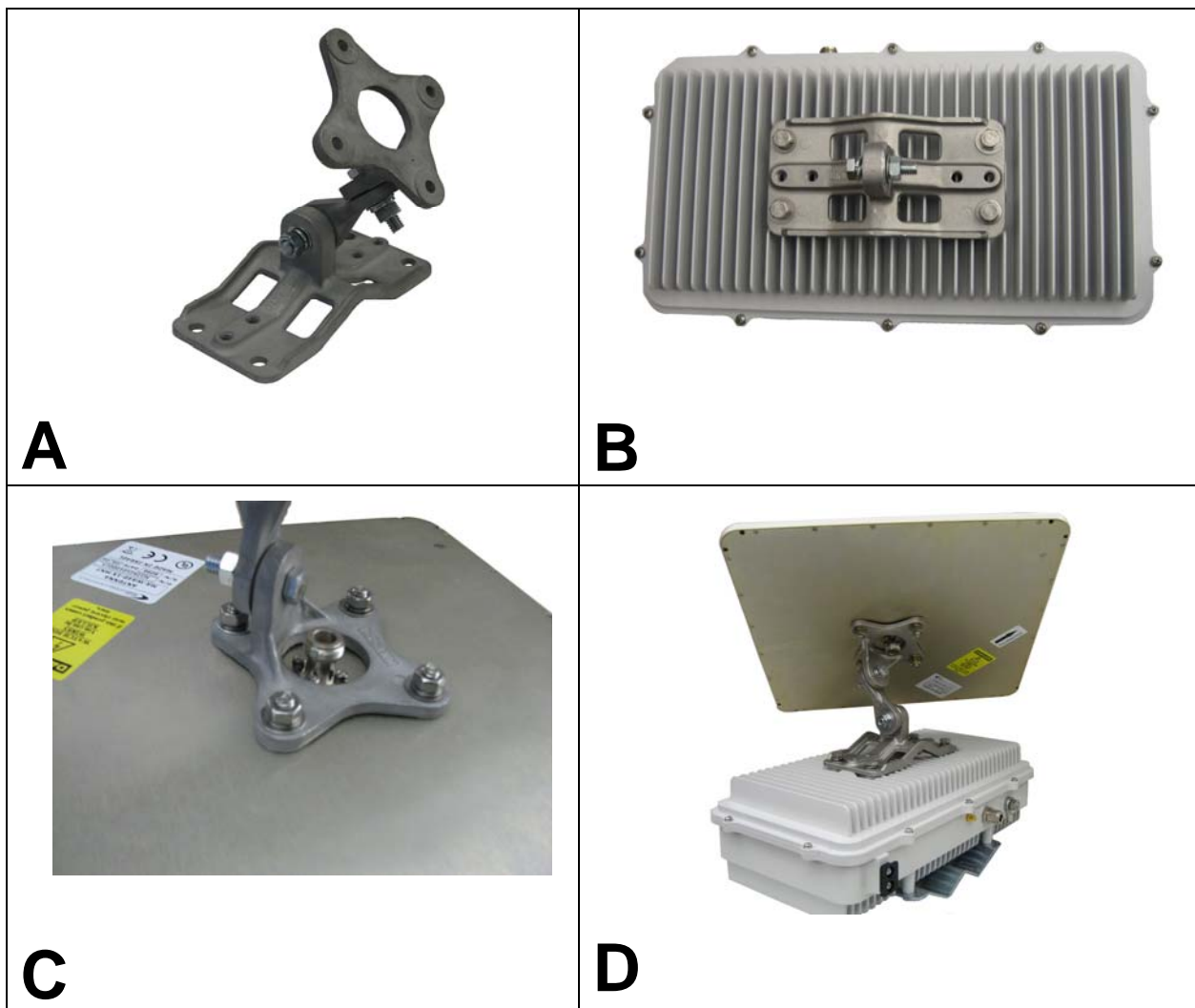
Figure 6-5: Mounting a Directional Antenna to a unit (VIDA Broadband Base Station shown)

6.8.3 Remotely Mounting an Antenna

When installing an antenna remotely, always observe best practices and the antenna manufacturer's recommendations.

6.8.3.1 Mounting an Omnidirectional Antenna on a Pole

The omnidirectional antenna can also be mounted on a pole using the following procedure:

1. Attach mounting bracket to pole using hardware provided with bracket.

2. Remove antenna mounting hardware from antenna base.

3. Insert antenna into mounting bracket and secure with hardware removed in previous step. Do not over tighten.

4. Connect the optional lightning suppressor, if required, to the base station RF antenna port.

5. Connect a short RF cable between the antenna and the base station RF port (or lightning suppressor, if installed in previous step).
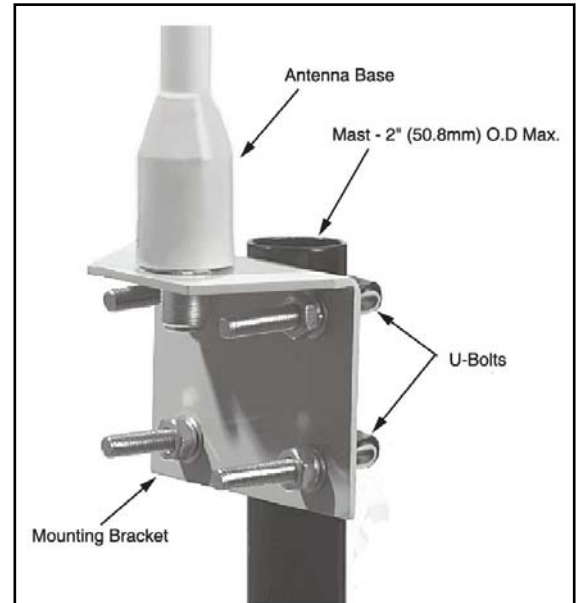
Figure 6-6: Pole Mounted Omni Antenna Example

6.8.3.2 Mounting a Directional Antenna on a Pole

1. Disassemble the universal antenna mounting bracket.

2. Attach the antenna panel bracket assembly to the antenna panel.

3. Attach the mounting section to the pole using an adjustable pipe clamp (part of MNT-2 kit), as shown in Figure 6-7

4. Attach the two bracket assemblies together with the universal knuckle.

5. Connect an RF cable between the antenna and the antenna port. Keep cable as short as possible. Install grounding straps are required.
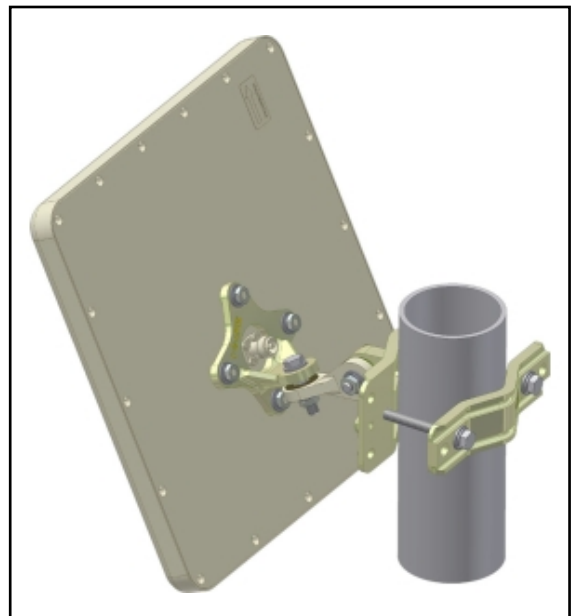
Figure 6-7: Pole Mounted Directional Antenna Example

6.9   GPS ANTENNA INSTALLATION

The base station performs time synchronization through GPS. Although there are many GPS antennas on the market, we recommend the M/A-COM GPS Antenna kit (Part # MAMROS0023). This antenna can be mounted directly onto the base station, or alternatively attached to any surface with an unobstructed view to the sky.
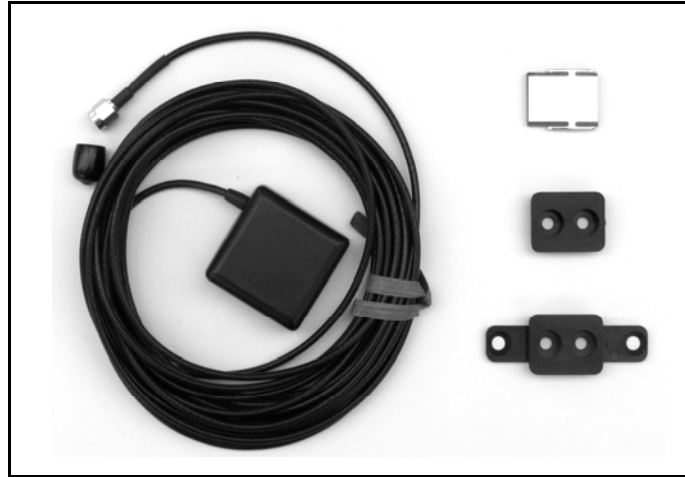

Figure 6-8: MAMROS0023 GPS Antenna Kit

To Install the Optional GPS Antenna

1.   Connect the SMA-type plug of the GPS antenna cable to the SMA receptacle on the base station. Hand tighten the connector, this is a temporary connection until the installation is complete.

2.   If you are using the optional lightning protection device, install it between the antenna cable and the base station GPS antenna connector.

3.   Route the cable/antenna to the GPS antenna mounting location.

4.   Install one of the three GPS antenna mounts: show-mount, no-show-mount, or magnetic mount.

No-show mount attached to top of base station
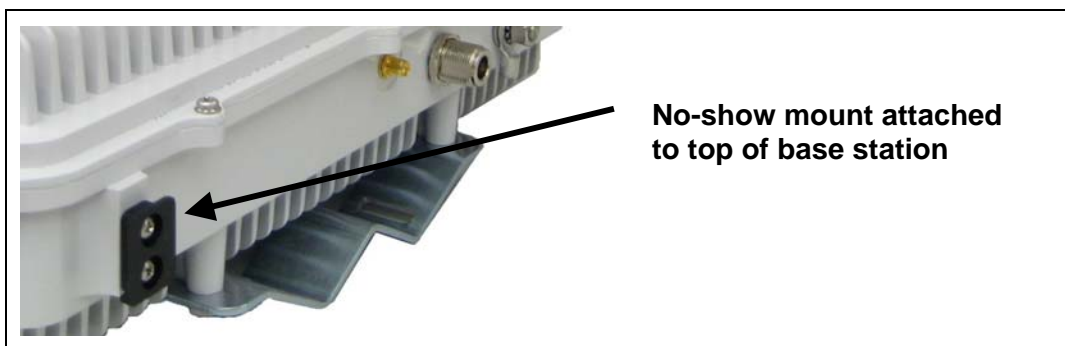
Figure 6-9: GPS Antenna Mounting Example

5.   Attach the antenna to the mount.

6.   After mounting the antenna, dress and secure the cable and tighten connectors.

7. INSTALLING A NOMADIC CLIENT

This section provides general information regarding installation of the VIDA Broadband Client in nomadic station configurations. For best results, the client should be installed by one of the many Tyco Electronics Authorized Service Centers located throughout the United States. Their experienced service personnel can provide a proper radio installation and make any final adjustments that may be needed.

7.1 PLANNING THE INSTALLATION

Before starting the installation, plan carefully to ensure the installation meets the following requirements:

- Safe for the operator and passengers.

- Away from airbag deployment area.

- Convenient for the operator to use.

- Neat, safe and clean.

- Protected from water damage.

- Easy to service.

- Cable connections are accessible.

- Out of the way of auto mechanics.

- Out of the way of passengers.

⚠ WARNING	**Vehicular Electronics - Electronic fuel injection systems, electronic anti-skid braking systems, electronic cruise control systems, etc., are typical of the types of electronic devices which may be prone to malfunction due to the lack of protection from radio frequency energy present when a radio is transmitting. If the vehicle contains such equipment, consult the dealer to determine if such electronic equipment will perform normally when the radio is transmitting.**

⚠ WARNING	**Air Bags – For driver and passenger safety, avoid mounting the radio above or near airbag deployment areas. Note that vehicles may contain front driver and passenger side airbags as well as side airbags. For occupant safety, verify the location of all airbags before installing radio equipment.**

⚠ WARNING	**For passenger safety, mount the radio securely so that the unit will not break loose in the event of a collision. This is especially important in station wagons, vans, and similar type installations where a loose radio could be extremely dangerous to the vehicle occupants.**

When determining a mounting location for the client and associated peripherals, avoid high traffic environments within the passenger compartment, trunk, or other compartment where feet, tools or other objects may accidentally damage cable connections. The client and other peripherals should be mounted such that connectors and other fragile components face away from high traffic areas, yet accessible for servicing.

Also, careful attention must be given to ventilation and heat dissipation. The client should be mounted with the heat sink fins vertically positioned and ample air space around the unit.

7.1.1 Tools Required

The following tools may be required when installing a client in nomadic applications:

- Crimping tool for fuse holder.
- Electric drill for drilling mounting holes.
- Drills, drill bits, 5/16" nut driver bit and circle cutters.
- Phillips and flat-blade screwdrivers.

7.1.2 Recommended Kits and Accessories

We recommend using the following parts and accessories during installation of the client in a nomadic configuration.

7.1.2.1 Nomadic Mounting Bracket

The nomadic mounting bracket FM-010668 shown in Figure 7-1 installs to the bottom of the client and provides easy installation of the client in a variety of nomadic applications. Attach the bracket to the client using the hardware provided.
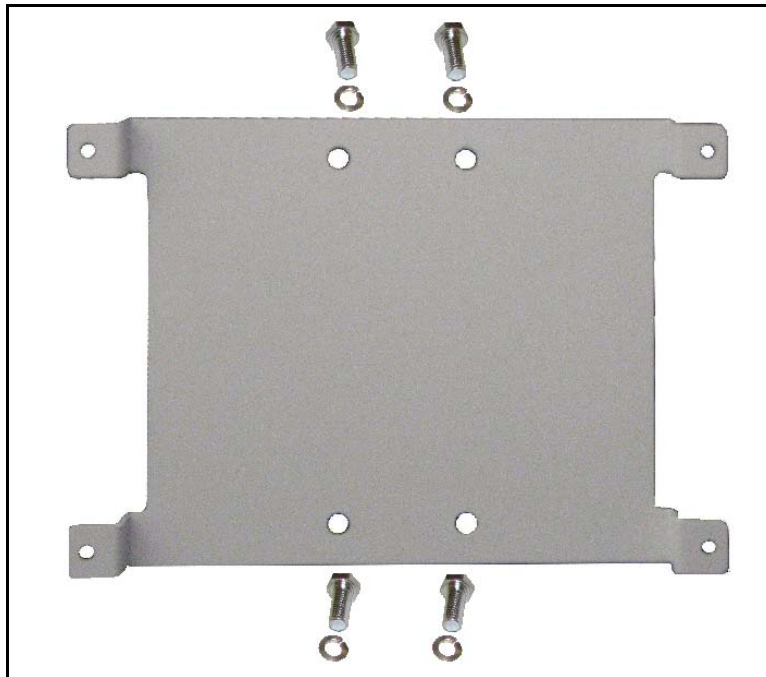
Figure 7-1: Nomadic Mounting Bracket (FM-010668)

7.1.2.2   DC Power Cable Kit

The 4.9 GHz client may be installed ONLY in vehicles where the negative battery post is connected to the chassis of the vehicle (NEGATIVE GROUND ONLY).

The Fuse Distribution Rail Kit FS23057 provides the necessary hardware to wire up the Standard client to a vehicle's power system. This kit provides an ATC style fused common buss lead that is designed to connect to the vehicle's battery. The fused buss lead provides power to a Fuse Distribution Rail assembly. This assembly may be mounted nearby the client and, if necessary, be expanded to power multiple hardware components.

Table 7-1: Fuse Distribution Rail Kit

Kit Number	Description	Pictorial
FS23057	Kit, Fuse Distribution Rail. Includes: (1) Fuse Distribution Rail Assembly (1) In-Line ATC Fuse Holder (1) 15-Amp ATC Fuse (1) 30-Amp ATC Fuse 20 Feet of 10-AWG Red Wire 1 Foot of 10-AWG Black Wire (1) Moisture-Resistant Butt Splice (2) 3/8-Inch Ring Terminals.	
FS23058	Kit, Fuse Distribution Accessory. Includes: (1) Fuse Block (1) Protective Marker (1) Fuse Block Jumper (1) 5-Amp ATC Fuse (1) 15-Amp ATC Fuse	

7.1.2.3   Nomadic Station Antenna Options

The recommended nomadic antenna model (B) MEFC49005HF (see Table 7-2) is an elevated feed, 5.5 dBi gain antenna. Electrically, the antenna requires no ground plane to meet VSWR performance specifications. However, it may be necessary to use this antenna with a ground plane to meet MPE requirements. Low loss high frequency permanent and magnetic mount cable kits are also available and shown in Table 7-2.

For nomadic subscriber station applications, both permanently installed and magnetic antenna mounts are available. Careful consideration of the type of nomadic installation will help determine which mount is most appropriate for a specific installation.

Table 7-2: Nomadic Antenna and Mounts

Part Number	Description	
AN-013386-011 MAXRAD: MEFC49005HF	Antenna, collinear, elevated feed, 5.5 dBi, no ground plane.	
MAXRAD: MHFML195C	Permanent mount, 17 ft. Cable, TNC male (loose).	
MAXRAD: GMHFML195C	Magnetic Mount, 17 ft. Cable, TNC male (attached).	

CAUTION

Be careful to avoid damaging vital parts (fuel tank, transmission housing, etc.) of the vehicle when drilling mounting holes. Always check to see how far the mounting screws will extend below the mounting surface before installing.

CAUTION

If pilot holes must be drilled, remove all metal shavings from drilling holes before installing screws.

7.2   INSTALLING THE NOMADIC CLIENT

Refer to Section 7.1 when choosing a mounting location for the client and other peripherals. Re-check the locations for brake lines, gas tanks, batteries, or other objects located behind the locations where holes will be drilled or screws installed.

1. Install the nomadic mounting bracket to the bottom of the client using four (4) ¼" - 20 x ½" hex head bolts and lock washers.

2. Place the client into the desired mounting location in the vehicle.

3. Secure the client by one of the following methods:

   Use four No. 10 x ¾" self-tapping screws supplied (alternately, use No. 10 x 1-1/2 if needed.); or,

   Use the client as a template to mark locations and pre-drill pilot holes. Install using appropriate hardware.

¼"-20 x ½" Bolts
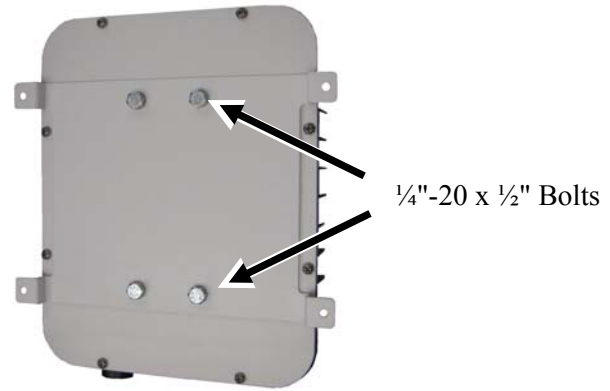
7.3   POWER AND DATA CABLE INSTALLATION

To assure the feasibility of planned cable routing, it is suggested to run the cables before mounting the client. Other associated hardware options such as cameras, nomadic terminals, etc. should be considered when planning cabling. Also, the client may be installed only in vehicles with **Negative Ground** chassis.

Be sure to leave slack in each cable so the radio may be pulled out for servicing. Coil any surplus cables and secure them out of the way. Try to route the cables away from locations where they will be exposed to heat (exhaust pipes, mufflers, tailpipes, etc.), battery acid, sharp edges or mechanical damage or where they will be a nuisance or hazard to automobile mechanics, the driver, or passengers. Keep wiring away from electronic computer modules, other electronic modules, and ignition circuits to help prevent interference between these components and radio equipment.

In addition, try to use existing holes in the firewall, trunk wall and the channels above or beneath doors. Channels through door and window columns that are convenient for running cables may also be used when practical. Again, protect cable runs from accidental damage by avoiding sharp edges and unprotected cable access holes.

7.3.1   Installing the Main Power Cable

Power is supplied to the client through a two-pin Conxall Multi-Con-X connector. The mating connector, part number CN-014934 is supplied with the unit. In nomadic applications, the High and Low Power Standard client will operate from 11 to 30 Vdc, negative ground only. Pre-wire the DC power cable per the following instructions.

7.3.1.1   Install Main Fuse Holder and 10-AWG Red Wire

The main power fuse, its holder, and related items are included in Fuse Distribution Rail Kit FS23057 illustrated in Table 7-1. Follow the procedure in this section to wire fused main power from the vehicle's battery to the location of the radio and the Fuse Distribution Rail Assembly in the vehicle's trunk. The Fuse Distribution Rail Assembly is installed during the subsequent procedure (Section 7.3.1.2).

⚠ CAUTION	**DO NOT** install the fuse holder or the red wire near the engine, transmission or exhaust system. Excessive engine heat can cause permanent damage to these components and can lead to intermittent electrical connection to the battery.
⚠ WARNING	**The 4.9 GHz client may be installed ONLY in vehicles where the negative battery post is connected to the chassis of the vehicle (NEGATIVE GROUND ONLY).**
⚠ WARNING	**A fuse must <u>not</u> be installed in the main fuse holder until all wiring is complete. This will prevent the unit from powering up prematurely and/or causing an in-rush of current that could lead to shorting of the battery, sparks, or even fire.**
⚠ WARNING	**Before making connections to the battery's positive post, carefully disconnect the battery's negative (ground) cable. This will prevent tools or other metallic objects which come in contact with the battery's positive terminal from shorting to vehicle chassis ground, causing sparks or even a fire or an explosion! When disconnecting the negative cable, cover/insulate the positive post if it is not already so a tool cannot short between the posts.**

1. Strip one of the ATC Fuse Holder's wires and crimp a 3/8-inch ring terminal to it. Both items are included in the Fuse Distribution Rail Kit.

2. Verify the fuse is **NOT** in the Fuse Holder.

3. Connect the ring terminal directly to the battery's positive post (or if present, to a stud on the vehicle's main/non-switched power distribution terminal block).

4. Strip the fuse holder's other wire, strip one end of the 20-foot long 10-AWG red wire, and then connect these two wires together using a 10-AWG moisture-resistant butt splice. The red wire and the butt splice for this connection are included in the Fuse Distribution Rail Kit.

> ⚠️ **CAUTION**
>
> Plan the routing of the 10-AWG red wire carefully, using an existing access hole in the vehicle's firewall if possible. Alternately, drill a new hole approximately 3/8-inch in diameter and install a small rubber grommet to protect the wire from chafing on the hole's sharp metal edge.
>
> To prevent fumes and moisture from entering the passenger compartment, this hole/grommet/wire combination must also be sealed with a silicon-based sealer before completing the installation.

5. Route the other (load) end of the 20-foot long red wire through a wire-loom then through the grommet in the firewall. This load end of the red wire will later be connected to a Fuse Block clipped on the Fuse Distribution Rail Assembly (both parts of the Fuse Distribution Rail Kit). The Fuse Distribution Rail Assembly will be located near the radio in the trunk.

6. Continue routing the 20-foot red wire through channels in the vehicle to the location of the client. Remove interior panels, door kick panels, etc. Protect the wire from possible chafing where necessary.

7.3.1.2   Assemble and Install Fuse Distribution Rail Assembly

The Fuse Distribution Rail Assembly must be completely assembled and installed in the vicinity near the client. This rail assembly, included in Fuse Distribution Rail Kit FS23057, comes preassembled with only one (1) Fuse Block on the rail.

The Fuse Distribution Rail Assembly has a DIN-type rail allowing additional Fuse Blocks to be added if fuse expansion is necessary in the future, such as for multiple radio installations. The rail may be cut to decrease its length if necessary, but enough room for additional future expansion should be considered first. Install the rail in accordance with the following procedure:

1. Mount the Fuse Distribution Rail Assembly near the client's mounting location, but where casual contact is not likely. Use self-threading screws (not supplied) and any available mounting slots in the DIN rail to mount the block.

2. Strip one end of the 10-AWG black wire (included with the Fuse Distribution Rail Kit) and crimp a 3/8-inch ring terminal to it.

3. Near the Fuse Distribution Rail Assembly, locate an area of vehicle chassis ground within approximately six (6) inches of the assembly and strip the area of any paint or dirt to expose a bare metal surface.

4. Drill a hole as necessary and connect the ring terminal to chassis ground. Use a self-threading screw or other appropriate hardware to ensure a reliable metal-to-metal contact. Tighten securely.

5. Cut the black wire to a length long enough to reach a green-yellow Grounding Block on the Fuse Distribution Rail Assembly, plus length for a service loop. Strip the end to prepare it to connect to a Grounding Block.

6. The Fuse Distribution Rail Assembly has two green-yellow Grounding Blocks. Each Grounding Block has two wire-clamps with associated wire-clamp release slots. As shown in the photo at the right, insert a #1 or #2 flat-blade screwdriver completely into one of the wire-clamp release slots. Insert the screwdriver until it is captured in a vertical position as shown in the photo in the next step.
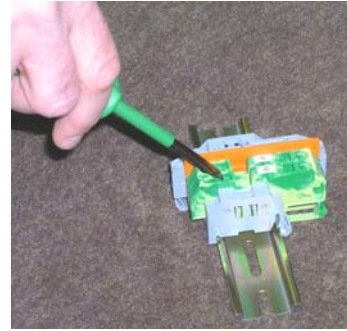

7. Insert the stripped end of the black wire fully into the wire-clamp beside the screwdriver, and then remove the screwdriver to lock the wire in the clamp. The adjacent Grounding Block is electrically connected together, so this black wire grounds both blocks.

8. Prepare to connect the 10-AWG red wire from the Fuse Holder at the vehicle battery to the Fuse Block of the DIN rail assembly by cutting off the excess length and stripping the end. Leave enough wire length for a service loop.

9. As shown in the photo at the right, connect the 10-AWG red wire to the Fuse Block's supply-side wire-clamp.
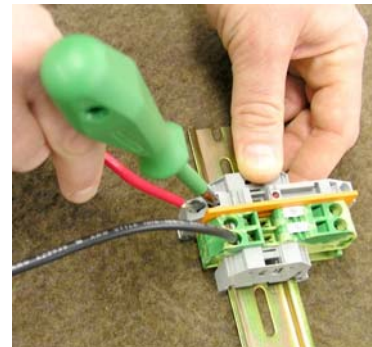
7.3.1.3   Installing the DC Power Cable to the Client

1. Prepare a short 12 to 14 AWG red and black wire (not supplied) to run between the fuse block and the client's DC power connection.

2. Assemble the mating connector, part number CN-014934 (supplied) as directed in the following steps and shown in Figure 7-2.

   a. Install a Conxall pin on one end of the red wire. Install the red wire into Pin 1 of the Conxall connector.

   c. Install a Conxall pin on one end of the black wire. Install the black wire into Pin 2 of the Conxall connector.

   d. Assemble the shell and strain relief to the connector body.
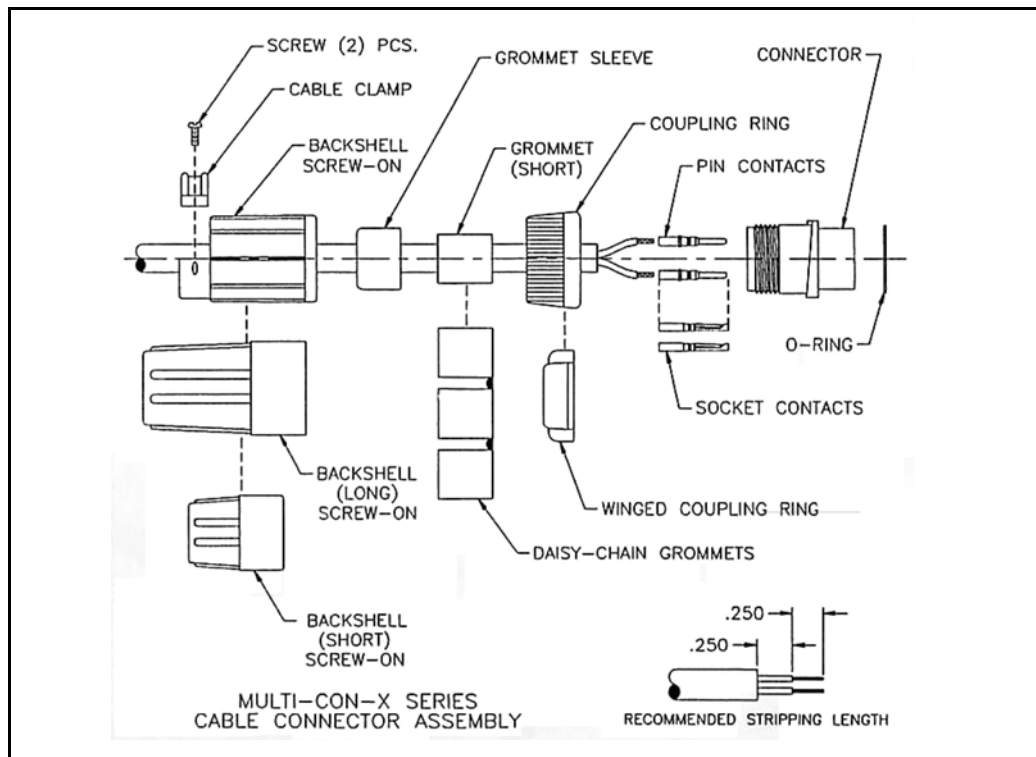
Figure 7-2: Assembling DC Power Connector

3. Mate the assembled connector to the client's 2-pin power connector by visually aligning the key and firmly push and turn the outer locking ring clockwise until it stops. A click will be sensed to confirm proper mating.

4. Prepare the client DC cable by cutting excess length from both wires and stripping the ends. Leave enough wire length for service loops.

5. Connect the red wire to the wire-clamp on the Fuse Block's load-side wire-clamp.

6. Connect the black wire to the wire-clamps on the Grounding Block.
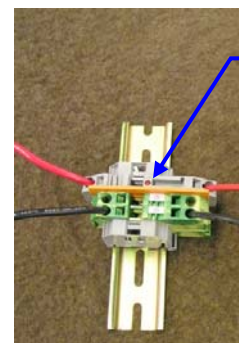
Fuse Blown Indicator Light (on **input** side of ATC Fuse)

DC Power Cable's red power wire (to client)

DC Power Cable's black ground wire (to client)

7. Install a 2 AMP ATC automotive fuse into the Fuse Block.

CAUTION

Installing a fuse with the wrong current rating could cause an unsafe condition and/or a prematurely blown fuse. Verify the correct fuse value for the device being installed.

DO **NOT** install the fuse until the installation is completed and all connections have been checked.
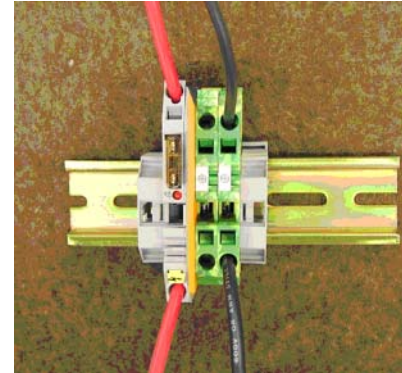
8. Tie and stow all cables and wires as necessary so they remain out of the way of casual contact, and so wire chafe is avoided.

9. Apply the sticker, included in the Fuse Distribution Rail Kit, near the Fuse Block as future reference for service personnel.

7.3.2   Grounding Studs

Grounding studs are located on two sides of the client. While these studs are primarily used for grounding in Fixed Station installations, we recommend connecting a ground strap from one of the ground studs to a nearby chassis ground.

CAUTION

DO NOT connect the Return (PWR-) connection directly to the negative battery post. In the event the negative battery post wiring becomes disconnected from the chassis, this would cause all vehicle current to source back through the client connection to ground, thus causing damage to the client.

7.3.3   Network/Data Connection

The standard client in a nomadic configuration connects to the network using a standard Ethernet RJ-45 protocol. The DATA connector is a Tyco Electronics Industrial Circular Ethernet Connector Part number: 1738607-1 (provided). This is an industrial grade, rugged, UV rated, weatherproof, and dustproof connector made for use in extreme electrical and climatic conditions. The connector meets IP67 industrial standard for weatherproof and dustproof electrical connections. Refer to Appendix D.2 for Ethernet cable or Appendix D.2.5 for Fiber Optic cable information.

The service port has a dust cap which is normally installed to provide sealing when not in use. Sealing of all other ports on the client is provided through mandatory usage connections.

8.   SYSTEM VERIFICATION

8.1   VERIFY BASE STATION CONNECTIONS

Before the signal strength and airlink connection can be verified, the power and network connections must be functional. Power connections may be verified with standard methods using voltmeters and ammeters. The network connection can be initially verified using link lights available on switches and routers. A functional check of packet transfer can then be used to complete the connection verification. Packet transfer function check is performed using the "**ping**" command available in Linux and DOS (**cmd** line in MS-Windows).

1. Verify that power connection has been made and power is applied.

2. Verify that both Ethernet ports are connected from the BS to an accessible Ethernet switch.

3. Plug a laptop, desktop, or rack-mount computer into the switch.

4. Ensure all appropriate link lights are illuminated.

5. Example output from the ping command is shown in the next section. Use the connected computer to Ping the base station:

   ping <*base station ip address*>

8.2   VERIFY SUBSCRIBER CONNECTIONS

1. Verify that power connection has been made and power is applied.

2. Verify that the Ethernet cable is connected to an accessible Ethernet switch.

3. Plug a laptop, desktop, or rack-mount computer into the switch.

4. If a switch is unavailable the subscriber Ethernet cable may be connected to another computer directly if the computer NIC supports auto MDI/MDIX. Otherwise a cross-over patch can be used.

5. Configure the connected computer's Ethernet port to have a static IP address of 10.0.0.10 and a subnet mask of 255.0.0.0 and no default gateway.

6. Ensure all appropriate link lights are illuminated.

7. For Windows XP go to the START tab and select the run command.

8. When the run dialog box appears, enter **cmd** and then press enter.

9. Open a command line window and issue the following command: **ping 10.0.0.1**

10. You should get a response similar to the following:

    ```
    Pinging 10.0.0.1 with 32 bytes of data:
    Reply from 10.0.0.1: bytes=32 time <2 ms TTL=64
    Reply from 10.0.0.1: bytes=32 time <2 ms TTL=64
    Reply from 10.0.0.1: bytes=32 time <2 ms TTL=64
    ```

```
Reply from 10.0.0.1: bytes=32 time <2 ms TTL=64

Ping statistics for 10.0.0.1:

Packets: Sent = 4, Received = 4, Lost 0 (0% loss),

Approximate round trip time in milliseconds:

Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

11. The connection to the subscriber has been verified by the 0% packet loss.

12. Remove the connected computer from the switch or subscriber.

8.3 VERIFY ANTENNA ALIGNMENT

The task of antenna alignment is to physically align the antenna's azimuth and elevation for maximum signal transfer in a radio link. The antenna alignment for short distance links can most often be accomplished solely by a manual visual adjustment with line-of-sight to the target. Longer distance links require additional optimization to maximize signal transfer.

For an omnidirectional antenna, the azimuth pattern is uniform and only antenna tilt needs to be controlled. Omnidirectional antennas are typically whip-type monopoles. Alignment is accomplished by holding the antenna in a vertical orientation. A spirit level can be used to ensure the antenna is vertical.

Directional antennas provide more gain at the expense of a narrow azimuth beamwidth and so it is the directional antenna which requires alignment in both axes. Directional antennas can be adjusted by visually sighting the target and pointing the major lobe of the antenna pattern at the target. A certain amount of experience is useful in this task, but with good line-of-sight, optimized links can be achieved.

Directional antenna alignment can also be achieved by calculating the bearing between the two ends of the link and then using a compass to align the antennas. The elevation may be set with an angle finder level used by tradesmen.

After visual alignment, the link should be functional and can be used immediately to verify signal levels or to optimize and accurately align the antennas. This is a preferred method because no additional equipment is needed and it simultaneously verifies the airlink as well as the network. The subscriber Signal Parameters Web page (see Section 8.3) provides a wealth of information such as downlink signal strength, signal-to-noise ratio, and uplink transmitted power and modulation. The base station also provides signal quality parameters of subscribers entered into the network.

The subscriber received signal strength and signal-to-noise ratio are reported through the command line. This method benefits from using cell-phones or two-way radios to communicate with a partner viewing the subscriber signal Web page or base station stats from a distant location while the antenna is being adjusted. Of course this method requires that all power and network connections are functional.

Optimization can also be accomplished by Received Signal Strength (RSS) alignment. The RSS Indicator is a handheld instrument (see Figure 8-1) that allows you to accurately align the antenna of a VIDA Broadband Client to a base station. When connected to the service port of the client the RSS Indicator provides a visual indication of the RSS from the base station. The instrument's LEDs provide an indication of DC power and signal strength.

The RSS Indicator has two 15-pin D-type connectors: the Radio port connector (DB15M) connects to the client through a DB15F-to-RJ45 adapter. Any straight-through CAT5 cable may be used to connect the adapter to the client service port. The DB15F connector on the RSS Indicator provides pass-through connection and is unused in this application.

Figure 8-1: RSS Indicator EA-015564

The following procedure is based on having a transmitting base station within reception distance and clear line-of-sight and a client with settings to scan the frequency at which the base station is transmitting.

Antenna Alignment Procedure Using the RSS Indicator:

1. Visually align the antennas using one of the methods described in the previous section.

2. Apply power to the client.

3. Uncover the service port by turning the dust cap counter-clockwise.

4. Connect the CAT5 cable from the RSS Indicator to the service port.

5. Verify the power LED on the RSS Indicator is illuminated.

    • Check DC power to the client if the power LED is not illuminated.

6. One of following conditions should exist:

    • A fixed set of LEDs are lit indicating RSS from the BS.

    • The RSS LEDs are cycling indicating that a frequency scan is being performed.

      Allow the frequency scan to complete as indicated by a fixed RSS indication. RSS Alignment can only proceed after scanning has completed.

7. Align the client antenna to maximize the number of RSS LEDs illuminated.

   - Once aligned, tighten the alignment bolts of the antenna mount.

8. Antenna alignment by RSS is complete.

9. Disconnect the CAT5 cable and cover the client service port with the dust cap.

The number of solidly illuminated LEDs corresponds to a quantitative value of RSS. The following table gives the value of RSS power for a given set of illuminated LEDs.

Table 8-1: RSSI Relative Power Indications

LEDs Illuminated	RSS Range (dBm)	
	min	max
1	-93	-90
2	-89	-86
3	-85	-82
4	-81	-78
5	-77	-74
6	-73	-70
7	-69	-66
8	-65	--
Cycling	Scanning	

Example 1:

The client is receiving a signal from the base station at a power level of -75 dBm. The RSS Indicator will have 5 LEDs illuminated.

Example 2:

The RSS Indicator has 7 LEDs illuminated. We know the client is receiving a signal from the base station at a power level between -69 and -66 dBm.

8.4   VERIFY LINK PERFORMANCE

The BS has a built in Web page that you can use to monitor SS connectivity and link performance. The BS Web page monitors activity between that base station and up to 16 subscriber stations connected to that base station and it displays this information in real time.   This includes the subscriber station connectivity, signal strength, SNR, link throughput, and the GPS synchronization status of the base station.   This tool enables you to verify expected link performance and functionality.   For additional details on setting up and using the Web Page, please refer to Appendix A.

8.4.1   <u>Link Verification</u>

To access the Web page, enter the base station's IP address (for example: 192.168.11.108) in the browser's address bar. The browser will open a BS Network Status page similar to the page shown in Figure 8-2.

Figure 8-2: Network Status Showing BS Status and Connected Subscriber Stations

The Network Status page lists the subscriber stations connected to the Base Station.   If the SS is highlighted green, the BS and SS are communicating properly.   If the SS is highlighted red, it is not properly communicating with the BS.

If the SS is highlighted red, check the following:

- Verify that the SS is associated with the BS in the UAS

- Verify the SS has SF's associated with it in the UAS.

- Make sure the SS MAC address in the UAS matches the MAC address of the unit.

Once the SS is highlighted green on the Web page, you review the SS details. To view the details for a particular SS, click the ⊞ symbol next to the SS entry and expand the selected SS properties, as shown in Figure 8-3. Expanding the selected SS will display the Service Flows and Classifier Rules that are associated with the SS. The SFs, CRs, SS IP, and MAC address should match up with the SS configuration defined in the UAS.
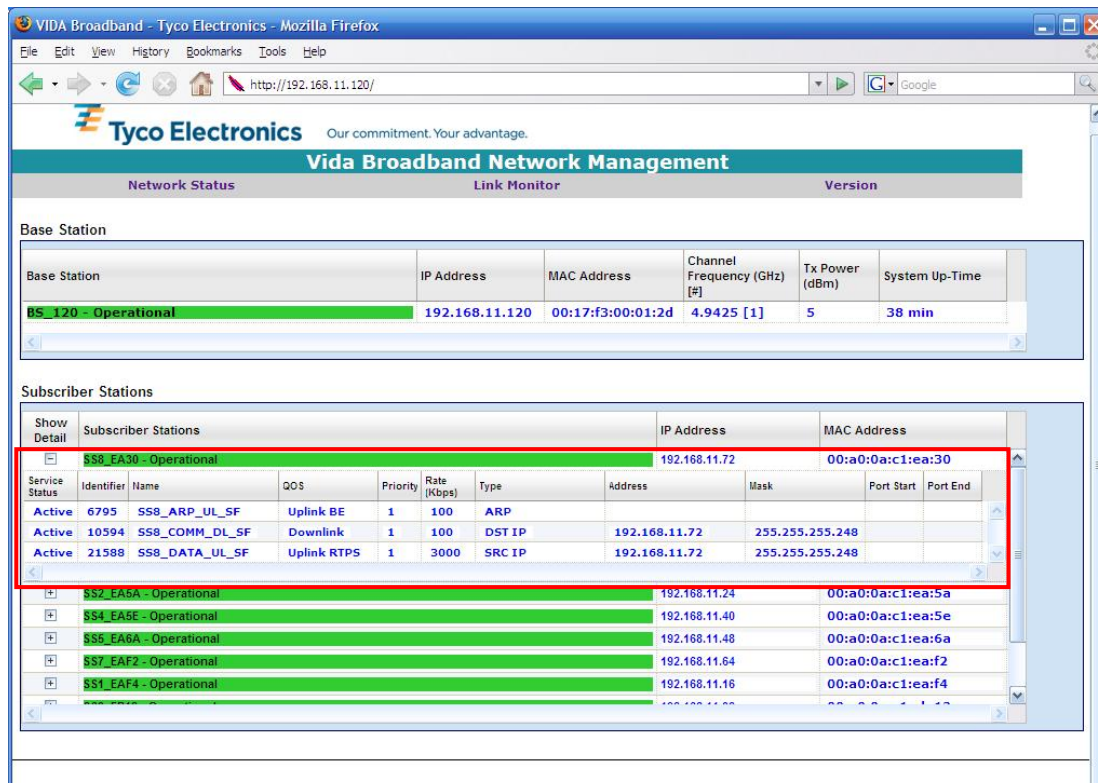
Figure 8-3: Network Status Showing Subscriber Station Details

8.4.2 Link Performance

Click on the Link Monitor hyperlink in the VIDA Broadband Network Management menu bar. This will open a Link Monitor Web page similar to the page shown in Figure 8-4.

The Link Monitor page displays a number of link characteristics; such as UL modulation type, UL RX power, UL SNR, UL Traffic Rate, and UL and DL utilization.

Make sure that the RF characteristics of the link match the RF characteristics you expect. If you are sending video over the link, the throughput monitor should display the application data rate plus link overhead. This overhead is automatically built into the Link Design Spreadsheet so the UL Traffic Rate shown on the Web page should closely match the calculated Traffic Rate from the Spreadsheet. The DL and UL utilization percentage should also closely match the calculated values from the Spreadsheet. If these values do not closely match, make sure the reported UL/DL Modulation is the same as the UL/DL modulation used in the Spreadsheet.
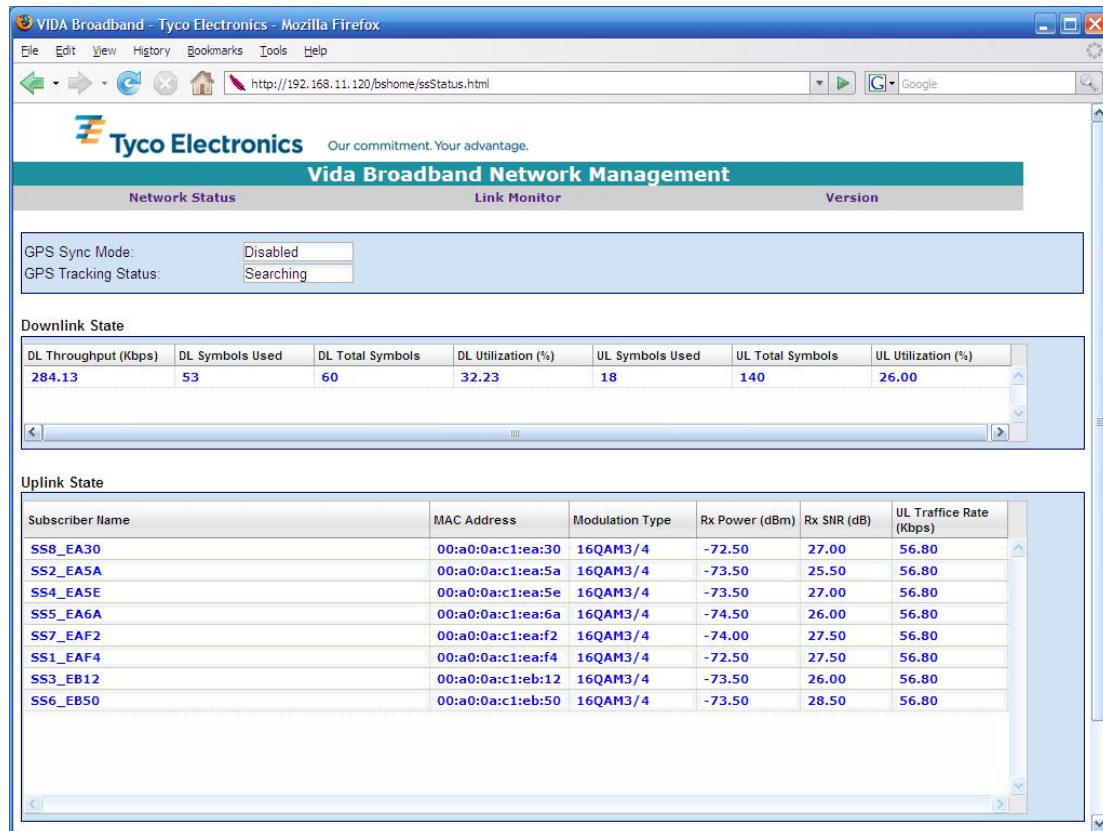
Figure 8-4: Link Monitor Showing UL and DL Link Performance

Also, make sure that the application is not pulling more data than expected. For example, make sure the IndigoVision Control Center is not pulling more than one stream of video. Verify that when you increase the number of video streams, the Web page indicates the same increase. For example, if the encoder is streaming at 600 kbps and only one stream is being pulled by the Control Center, the Web page should indicate between 600-800 kbps throughput. If you open a second stream in the Control Center, the Web page should now report a throughput between 1200-1600 kbps. This throughput will vary depending on how much data the encoder is actually sending at any given time.

8.4.3   GPS Synchronization

The BS Link Monitor Web page also indicates the GPS synchronization. When configuring the BS, GPS synchronization was set to either none, TX, or RX. If the BS acquires a GPS signal, the BS Web page will indicate the type of synchronization being used. For instance, if the Web page reports no GPS synchronization, the GPS antenna may not be attached to the BS or could be malfunctioning. If the Web page reports TX or RX, the BS is synchronized to the GPS signal, meaning that the GPS antenna installation was successful.

It is important to remember that GPS synchronization only confirms the BS is locked onto a GPS signal. It does not necessarily mean that the BS is properly configured for the collocated equipment.

8.5   VERIFY SUBSCRIBER STATION SIGNAL STRENGTHS

Each subscriber station (client) has a pre-configured IP address that is used to access the SS Web page. This Web page communicates with the Web server software embedded in the client. Verification of the subscriber station signals involves monitoring both the BS and SS Web pages. For additional details on setting up and using the BS Web Page and SS Web page, please refer to Appendix A and Appendix B, respectively.

8.5.1   Check Downlink SS Signal Levels

1. Log onto SS Web page using your network browser.

    http://192.168.11.61 (use the IP of your SS)

    If connected to the SS, the SS Web Page - System Page will open.

2. Select the **Signal Parameters** option from the menu bar.

    The browser will display the Signal Parameters page.

Figure 8-5: SS Web Page – Signal Parameters Page

3. Evaluate downlink parameters.
    -   Ensure that downlink signal strength and SNR are reasonable.

8.5.2   <u>Check Uplink SS Signal Levels</u>

The section describes the procedure to ensure the BS receive power is optimal, and the BS optimal received power should be between -90 dBm and -70 dBm. The procedure contains two steps: calculate the expected BS receive power and confirm the actual BS receive power.

1. Calculate expected BS receive power.

    a. The system signal loss is defined as the difference between the BS transmit power and the SS receive power. The BS transmit power is configured in the installation, and the typical value is 27 dBm. The SS receive power can be retrieved from the SS Web page.

        System Signal Loss = BS Tx Power – SS Rx Power

    b. Assume the channel is symmetric, which means the downlink signal loss is equal to uplink signal loss, then the BS receive power is equal to:

        BS Rx Power = SS Tx Power – System Signal Loss

        The SS transmit power can be retrieved from the SS Web page.

        For example, if BS Tx Power = 26 dBm

From SS web page	SS Rx Power	-48 dBm	-53 dBm
	Loss	74 dB	79 dB
	SS Tx Power	5 dBm	9 dBm
	BS Rx Power	-69 dBm	-70 dBm

2. Confirm actual BS receive power.

    The actual BS receive power can be obtained from the BS using the BS Web page described in the following steps.

    a. To access the Web page, enter the BS's IP address in a browser.

        A window similar to Figure 8-6 should be loaded.

    b. Click on Link Monitor at the top of the page in order to open the BS link Monitor.

        A page similar to Figure 8-7 should be loaded. Each SS reports an RX power on this page.

    c. Review the received power from each SS.

        The RX Power value should be within 5 dBm of the expected BS receive power calculated in Step 1. If the RX Power is not what you expected; you should suspect RF interference.
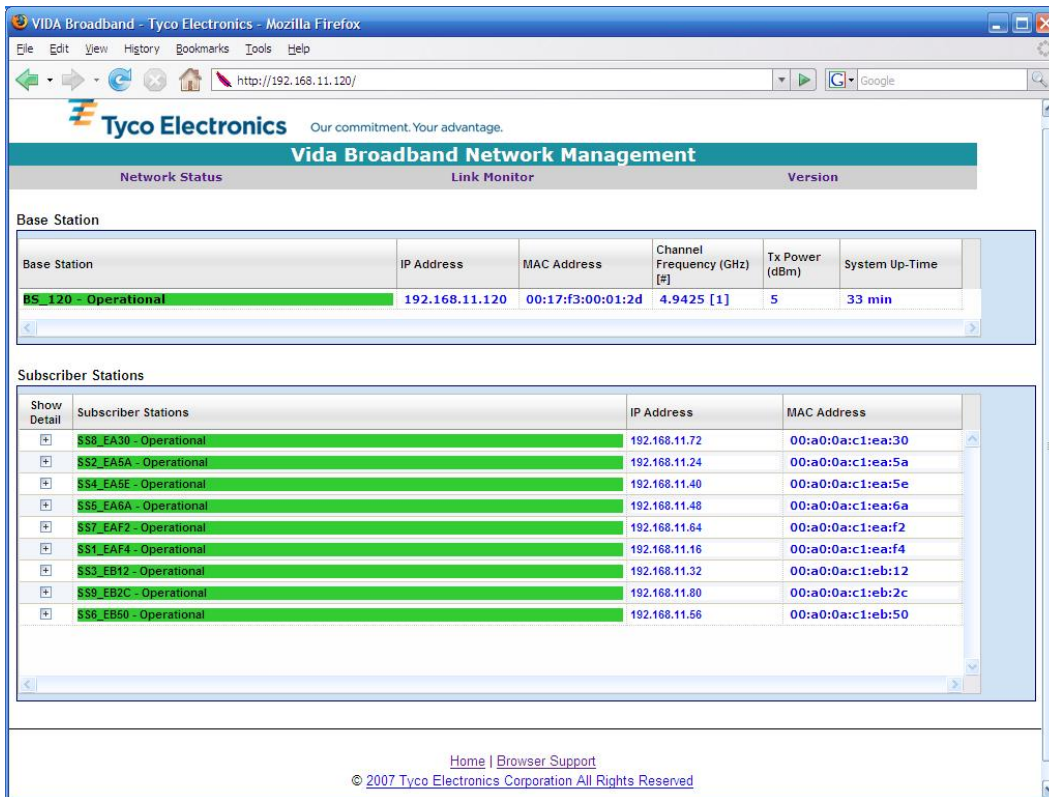
Figure 8-6: BS Web Page – Network Status
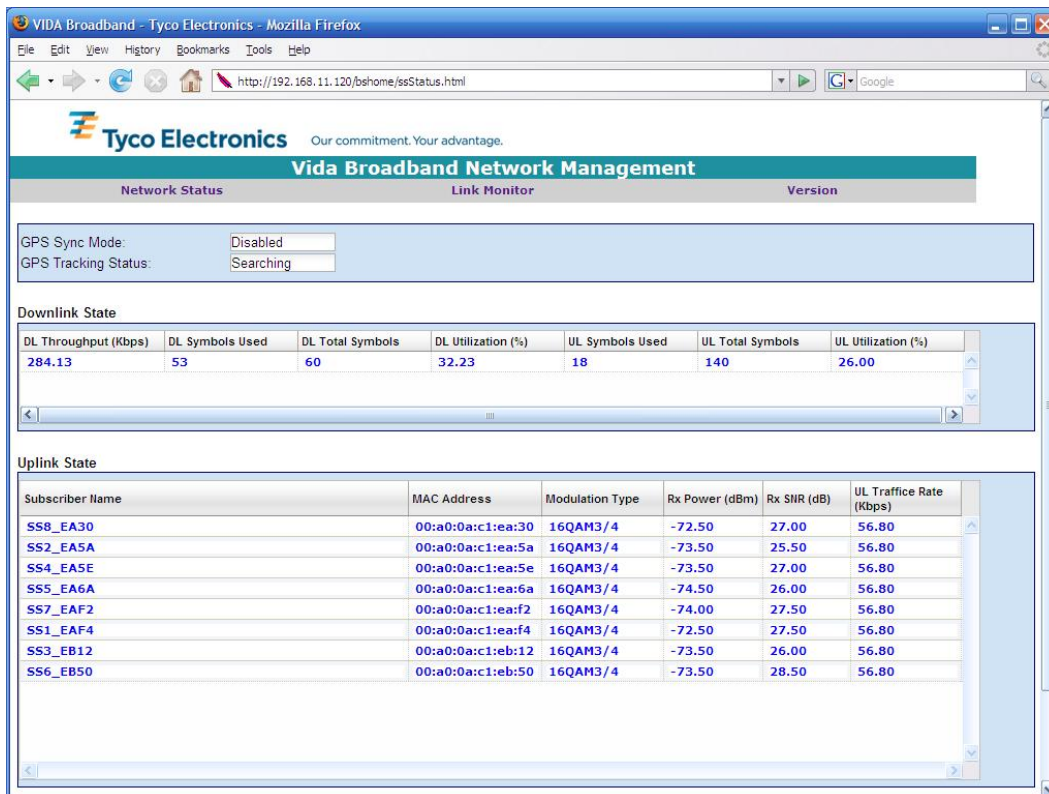
Figure 8-7: BS Web Page – Link Monitor

8.5.3   Check Device Connectivity

1. Ping from network computer to each device/subnet (i.e. IP camera) that is connected to each SS.

    If Ping fails:

    - Check that the MAC/IP addresses for endpoints are in computer ARP.

    - Evaluate the link to ensure it is up/good RF state.

    - Check classifier rules/service flows in UAS for SS to ensure they are properly configured.

2. Once connectivity to endpoints is established, run network applications (i.e. IP video).

    If Ping succeeds, but network applications do not run:

    - Check that service flows can pass maximum packet size for application (relevant to UGS).

    - Check that classifier rules are properly configured for application traffic.

    Refer to the *VBB Basic Network Applications Programming Guide, MM-014641-001*, for additional information.

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APPENDIX A   BASE STATION EMBEDDED WEB SERVER

This section provides instructions for setting up and using the base station embedded web server.

A.1   SETTING UP THE BROWSER

This section provides details for accessing and viewing the Web pages residing in the VIDA Broadband Base Station.

When accessing the Web Page we recommend using Mozilla Firefox 2.0 (or higher), or Microsoft Internet Explorer 6.0 (or higher). In addition, before you can access the BS Web Page, you need to ensure that your Web browser's settings will enable access to the tool. The following procedure describes how to configure the browsers for this purpose.

A.1.1 Configuring the Browser

For Internet Explored Browser:

1. Start Internet Explorer.

2. From the **IE** menu, select **Tools → Internet Options**.

3. In the Internet Options window, click the **General** tab, and then in the "Temporary Internet Files" group, click the **Settings** button. The Settings window opens.

4. In response to "Check for newer versions of stored pages", select the "Every visit to the page" option, and then click **OK**. This ensures you will always view current information.
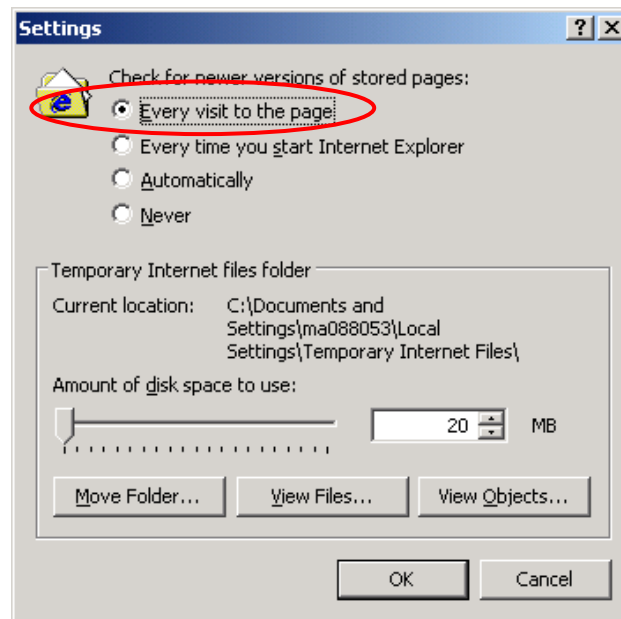
5. Click on the **Connections** tab and then click the **LAN Settings** button. Select the desired configuration settings, and then click **OK**.

> **NOTE**
>
> For permanent access to the BS web pages, without affecting your overall web access, you may need to contact your IT department and have them add the Base Station's IP Address to the bypass list.

For temporary access to the BS, you can simply uncheck the "**Use automatic configuration script**" box. You will not be able to access the internet while this box is unchecked.
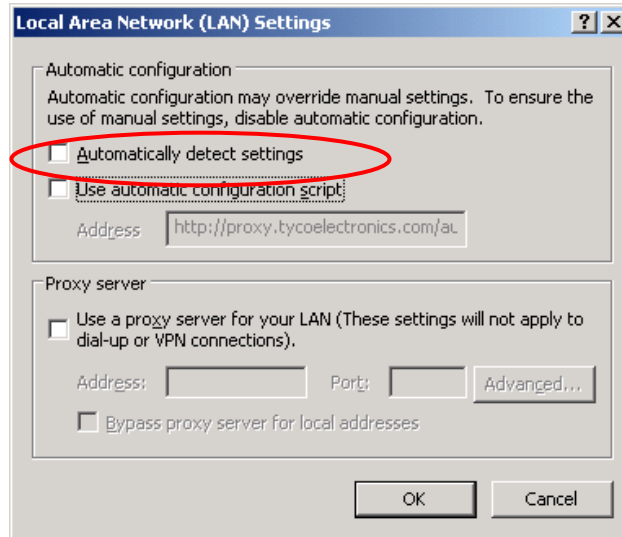
6. In the Internet Options window, click the **Apply** button, and then click **OK**.

Read this section and follow carefully if you are accessing the base station from a laptop connected to a corporate network or from a laptop configured to a proxy.

For Mozilla Firefox Browser:

1. Open the Mozilla Firefox browser.

2. From the main menu, select **Tools** → **Options**.

3. Click the **Advanced** icon and then the **Network** tab.

4. Click the Settings button to open the "Connections Settings" window.
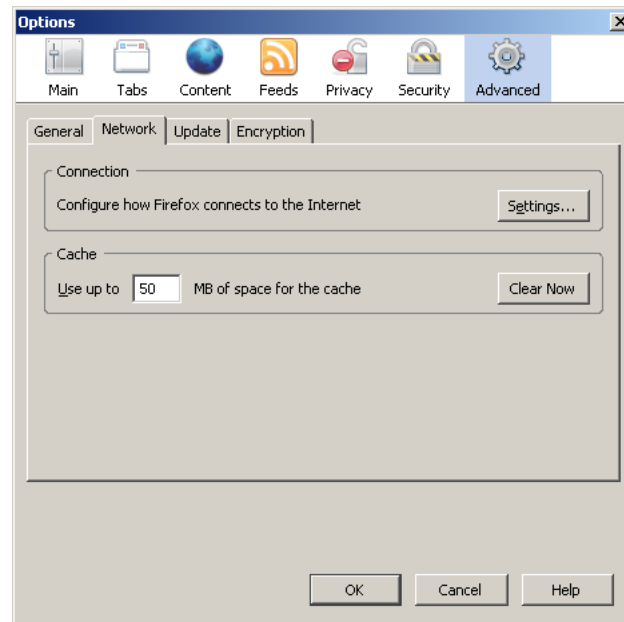
5. Select "**Manual proxy configuration**" and add the Base Station's IP Address to the "**No Proxy for:**" field, as shown below and click **OK**.
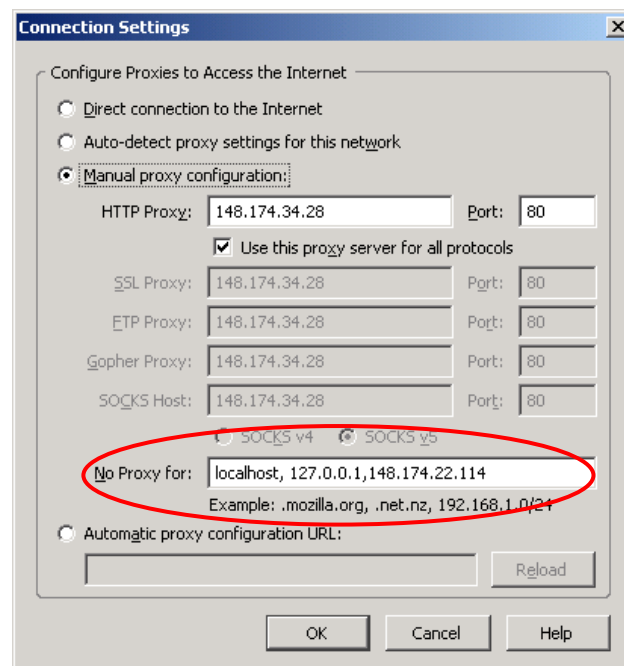
A.2 ACCESSING THE BASE STATION EMBEDDED WEB SERVER

A.2.1 Opening the Base Station Web Server

1. Open a Web browser session.

2. Enter the base station's IP address in the URL address field and press the <**Enter**> key or click the **Go** button to open the Base Station "Network Status" page.

    Format: http://<*ip address of the base station*>

    Example: http://192.168.11.120

Figure A-1: BS Web Page – Home Page

3. To view the details for a particular Subscriber Station, click the ⊞ symbol to expand the selected SS properties as shown in Figure A-2.

    The page shown in Figure A-3 is an example of a Subscriber Station failing to communicate with the base station. Note the SS entry is highlighted in red, indicating a problem.
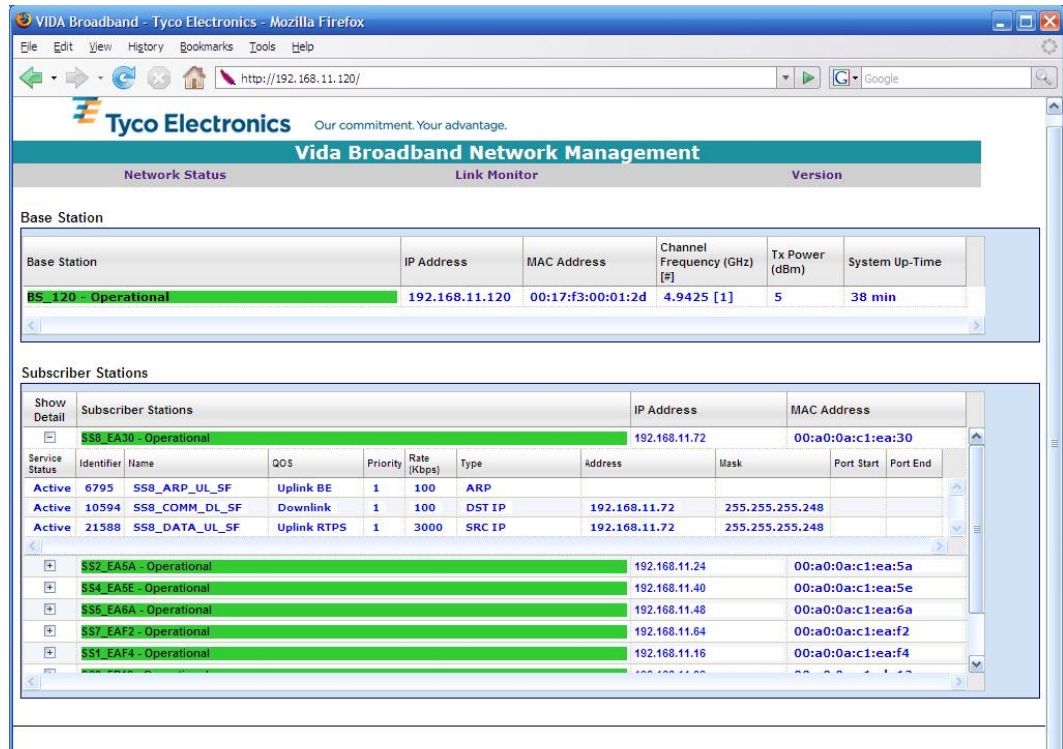
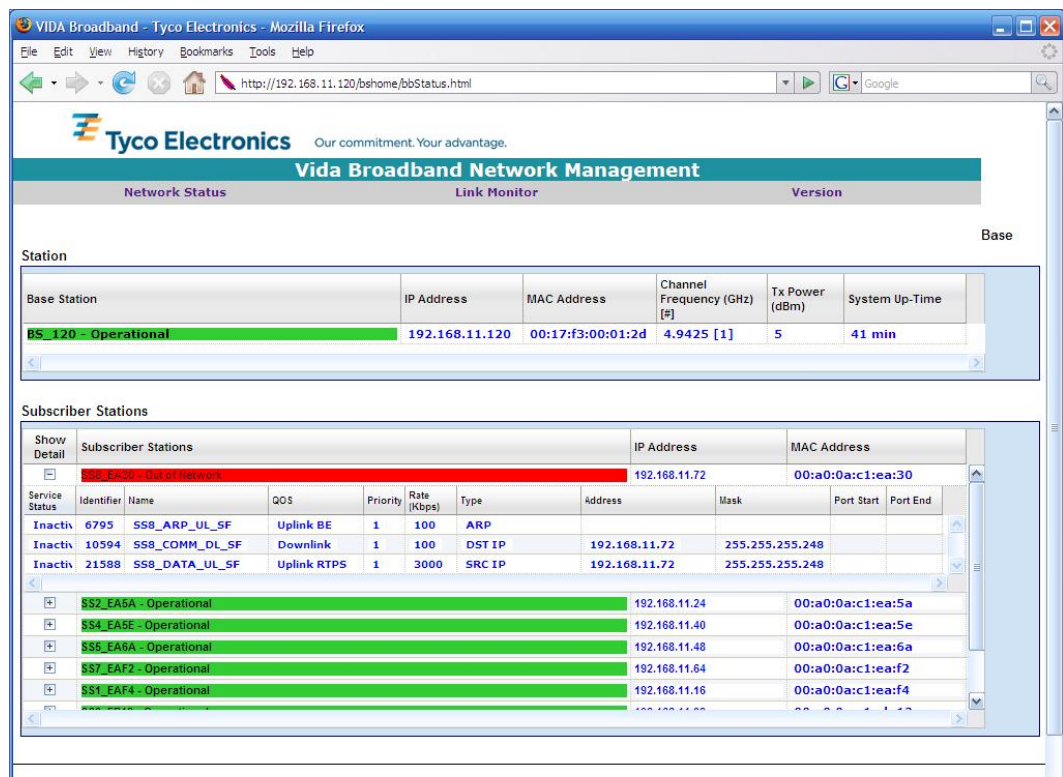**Figure A-2: BS Web Page – Subscriber Station Details**

Figure A-3: BS Web Page – Subscriber Station Not Communicating

A.2.2 Viewing the Base Station Software Version

1. On the VIDA Broadband Network Management menu bar, click the **Version** tab.

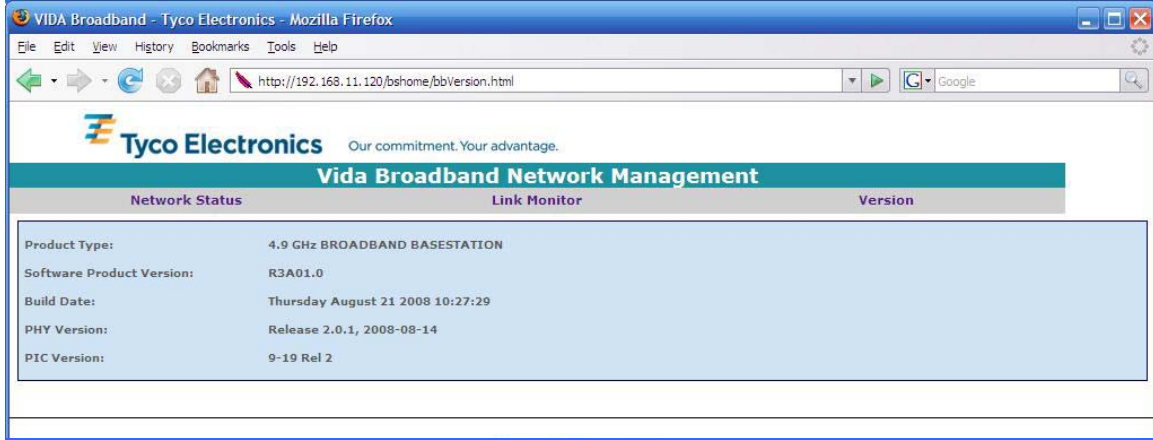   The "Version" page lists details about the software running on the Base Station.

Figure A-4: BS Web Page – Version Page

A.2.3 Monitoring the Uplink and Downlink Performance
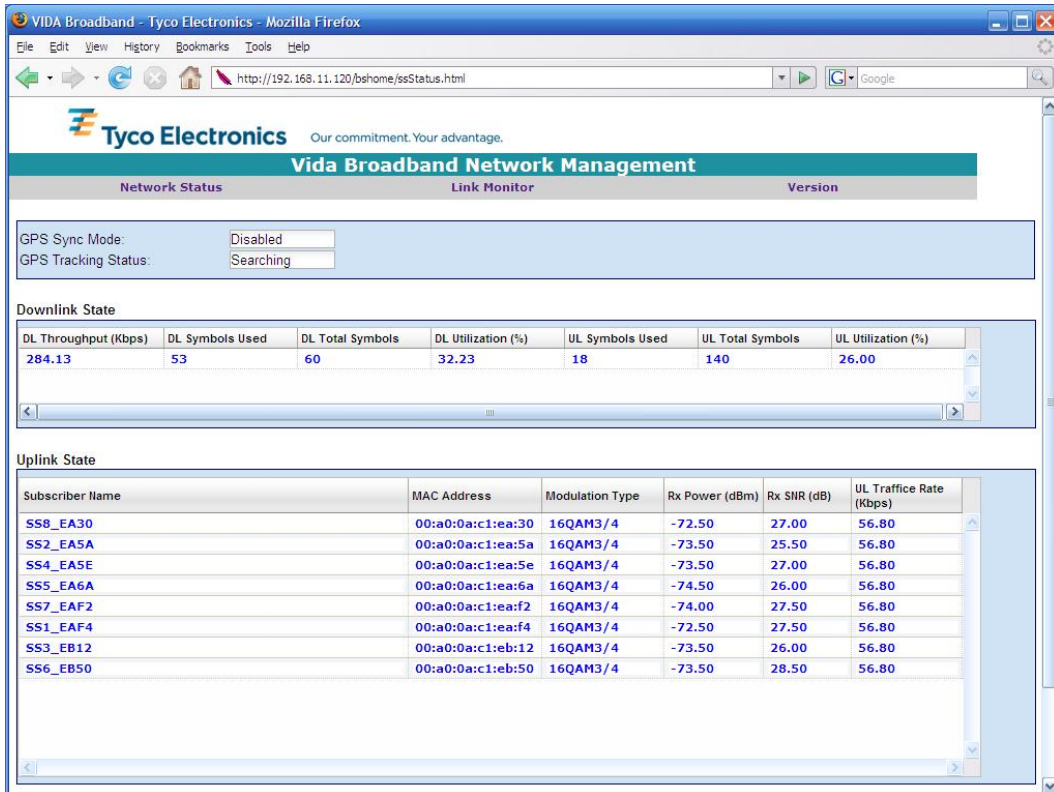
1. On the VIDA Broadband Network Management menu bar, click the **Link Monitor** tab.

Figure A-5: BS Web Page – Link Monitor