

Tsunami Multipoint Version 1.3

Installation Manual

CPN 63179

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Take your network further

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Regulatory Notice

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.

Shielded cables and I/O cords must be used for this equipment to comply with the relevant FCC regulations.

Changes or modifications not expressly approved in writing by Proxim Corporation may void the user's authority to operate this equipment.

This device complies with RSS-210 of Industry Canada. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

WARNING! This device must be professionally installed!

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About This Book

The *Tsunami Multipoint Quick Install Guide*, *Installation Manual*, and *Reference Manual* comprise the Tsunami Multipoint Version 1.3 documentation set.

- The *Quick Install* provides just enough information for the experienced professional to install the Tsunami Multipoint system.
- This document, the *Installation Guide*, provides detailed installation information for the less experienced professional to install and initially configure the Tsunami Multipoint system.
- The *Reference Manual* provides conceptual, advanced configuration, and command reference information about the Tsunami Multipoint system. See the Reference Manual for information about:
 - Routing modes
 - Active Interference Rejection (A.I.R.)
 - Priority Queuing
 - Advanced Configuration Options
 - Command Reference
 - Troubleshooting

Required Software and Firmware

The required software and firmware codes for this official release are:

- BSU Console Version 1.4 or Version 1.5
- Subscriber Utility 1.1 (packaged with Console V1.5)
- BSU Firmware Version 1.3 binary code, identified as **PMP_BSU_release1-3.mot**
- SU Firmware Version 1.3 binary code, identified as **PMP_SU_release1-3.mot**

Safety Instructions

WARNING! IMPORTANT SAFETY INSTRUCTIONS: DO NOT DISCARD!

- Review this guide for important installation instructions BEFORE you attempt to install this product.
- This product is intended to be installed, used, and maintained by experienced telecommunications personnel only.
- This product has been evaluated to the U.S. and Canadian (Bi-National) Standard for Safety of Information Technology Equipment, including Electrical Business Equipment, CAN/CSA C22.2, No. 950-95 * UL 1950, Third Edition, including revisions through revision date March 1, 1998, which are based on the Fourth Amendment to IEC 950, Second Edition. In addition, this product was also evaluated to the applicable requirements in UL 1950, Annex NAE.

WARNING! This unit is intended for installation in accordance with Articles 110-18, 110-26, and 110-27 of the United States National Electric Code ANSI/NFPA 70; and per the applicable Articles in the Canadian Electric Code.

- This equipment must be installed in accordance with Article 810 of the United States National Electrical Code.
- Equipment is to be used with, and powered by, the power supplies provided only. A 15-Amp circuit breaker is required at the power source.
- Lightning surge protection is provided by the power supplies included with this product. Do not use any other devices for this purpose.

WARNING! This equipment is intended to be earthed. Use proper grounding methods. A 10 AWG earthing conductor at a minimum is to be used for this purpose.

- Do not connect or disconnect the power cable to the equipment when the power supply is plugged in an AC outlet.
- Servicing of this product should be performed by trained personnel only. Do not disassemble this product. By opening or removing any covers you may expose yourself to hazardous energy parts. Incorrect reassembly of this product can cause a malfunction, and/or electrical shock, when the unit is subsequently used.
- Do not insert any objects of any shape or size inside this product while powered. Objects may contact hazardous energy parts that could result in a risk of fire or personal injury.
- Do not spill any liquids of any kind on or inside this product.
- The maximum room ambient temperature (T_{mra}) for this product is 55°C. Consideration should be given to installing this equipment in an environment compatible with the T_{mra}.
- Equipment is suitable for mounting on concrete or other noncombustible surface only.
- Do not remove or alter the Marking label provided on this product.
- The Base Station Unit operates at -48Vdc/1 A. The Subscriber Unit operates at +28Vdc/0.6 A.

Chapter 1. Site Planning

The installation of a wireless network requires much the same basic planning as any wired network. The main difference is that the wireless signal requires some additional planning. This planning includes RF path planning, site preparation, and installation of outdoor components, such as outdoor units, antennas, lightning protection devices, and cabling suitable for outdoor conditions.

Although the technology implemented in this broadband fixed wireless system can make use of multi-path signals to reduce the effect of obstructions in the path, the characteristics of the path must be carefully examined. With this knowledge, components and network requirements can be correctly planned for your specific application.

This section provides insight into the planning necessary to prepare your site for your broadband fixed wireless system.

General Considerations

A basic consideration is the physical location of the sites at each end of the link. Because microwave signals travel in a straight line, a clear line-of-sight between antennas is ideal. Frequently, however, the locations of the desired links are fixed. When you cannot achieve a clear line-of-sight, you must plan accordingly.

Other general site considerations include:

- Whether a tower must be constructed (and whether permits are required)
- Possibility of future obstructions
 - Will trees grow high enough to interfere with the signal? Are there plans to erect buildings between the sites that may obstruct the path?
- Availability of grounding
 - Good grounding is important. Also, in areas prone to lightning, a lightning arrestor is strongly recommended.
- Distance between the indoor portion of the system and the user's network.
- Whether the SU may potentially be served by different BSUs. Prior to installation, try to determine the best BSU access and available sighting location.
- Whether strong RF interference exists in the neighborhood, within or adjacent to the operating frequency.

The following sections are provided to help you determine which information is critical to your site, and to aid in the decision-making process.

Specific Considerations

Weather

You should research any unusual weather conditions common to the site location. These conditions can include excessive amounts of rain, wind velocity, or extreme temperature ranges. If extreme conditions exist that may affect the integrity of the radio link, take these conditions into consideration early in the planning process.

Rain

Except in extreme conditions, attenuation (weakening of the signal) due to rain does not require serious consideration for frequencies up to the range of 6 GHz. When microwave frequencies are at the 10-12 GHz range or higher, attenuation due to rain becomes much more of a concern, especially in areas where rainfall is of high density and long duration. The systems discussed in this manual operate at frequencies below 6 GHz, so rain is not a concern.

Temperature

Temperature can adversely affect the radio link when phenomena such as temperature inversion or very still air accompanied by stratification occur. Temperature inversion can negate clearances; still air, along with stratification, can cause severe refractive or reflective conditions, with unpredictable results.

Temperature inversions and stratification can also cause ducting, which may increase the potential for interference between systems that do not normally interfere with each other. Where these conditions exist, you should use shorter paths and adequate clearance.

Wind

Any system components mounted outdoors are subject to the effect of wind. You should know the direction and velocity of the wind common to the site. Antennas and their supporting structures must be able to prevent these forces from affecting the antenna or causing damage to the building or tower on which the components are mounted. Antenna designs react differently to wind forces. This is known as *wind loading*.

BSU and SU Wind Loading

Maximum operational wind speed during operation of BSUs and SUs is 50 m/s (112mph).

Survivable wind speed (tested to equivalent speed) is 90m/s (200mph).

The wind loading effect of the BSU and SU on their respective mounting masts is provided in Figure 1 (BSU) and Figure 2 (SU). The units of force in pounds can be converted to metric units by multiplying by

4.45 to obtain newtons, or by 0.45 to obtain kilograms of force. Similarly, foot-pounds can be multiplied by 1.36 to obtain Newton-meters, or by 0.138 to obtain kgm-meters.

Note: For definitions of wind loading specifications for antennas and towers, refer to TIA/EIA-195 (for antennas) or TIA/EIA-222 (for towers) specifications.

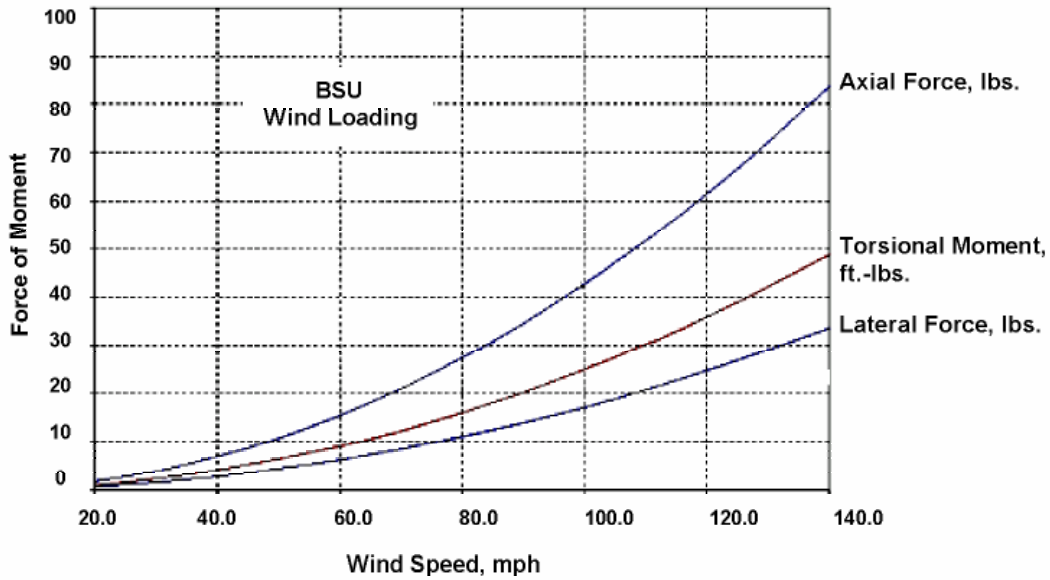


Figure 1. BSU Wind Loading Analysis

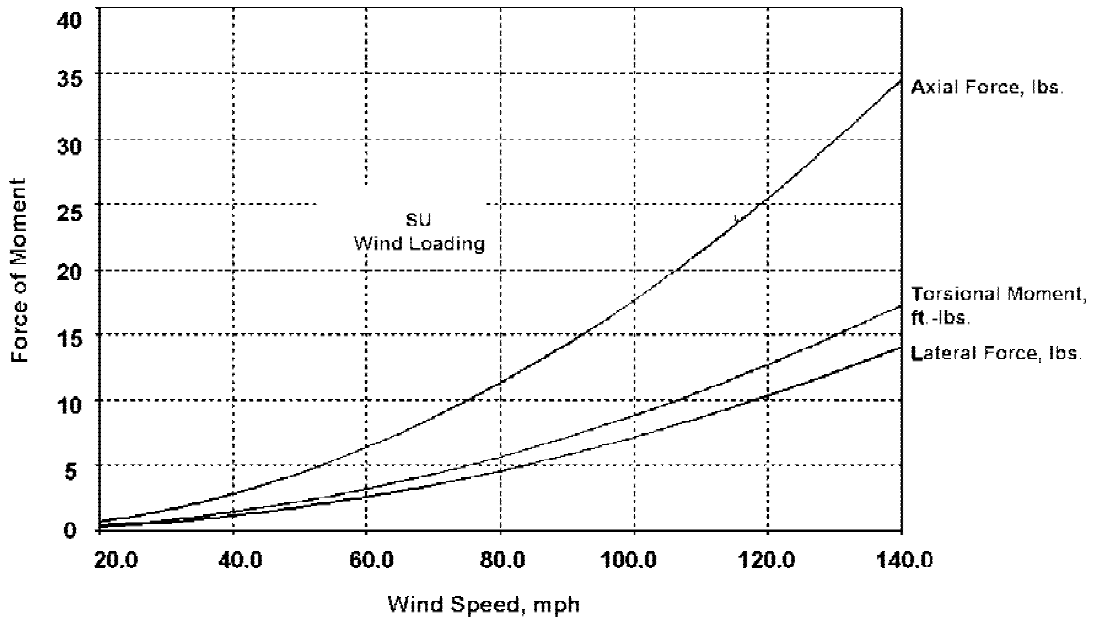


Figure 2. SU Wind Loading Analysis

Lightning

You should always consider the potential for lightning damage to radio equipment when planning a wireless link. A variety of lightning-protection and grounding devices are available for use on buildings, towers, antennas, cables, and equipment that could be damaged by a lightning strike, whether located inside or outside the site.

Lightning protection requirements are based upon the exposure at the site, the cost of link down-time, and local building and electrical codes. If the link is critical and the site is in an active lightning area, attention to thorough lightning protection and grounding is critical.

Lightning Protection

To provide effective lightning protection, install antennas in locations that are unlikely to receive direct lightning strikes, or install lightning rods to protect antennas from direct strikes. Make sure that cables and equipment are properly grounded to provide low-impedance paths for lightning currents. Install surge suppressors on adjacent telephone lines and power lines.

Users should provide additional lightning protection for cables leading to the wireless radio as well as to and from the power supply in regions that have extreme lightning occurrences. This optional lightning protection should be placed at points close to where the cable passes through the bulkhead into the building, as well as near the BSU/SU. A grounding screw is provided on the BSU and SU.

For indoor applications, you can use the Erico LAN-RJ45 Local Area Network Protector (see Erico's web site, <http://www.erico.com> for information); for outdoor applications, you can use lightning protectors from PolyPhaser (see the Polyphaser web site, <http://www.polyphaser.com>).

See "Appendix E. Lightning Protection Recommendations" on page 70 for more information.

Category 5 Cable

When the entire power and Ethernet cable is encased in steel conduit from the building entrance to the radio, no surge arrestors are required. Otherwise, each power and Ethernet cable requires one surge arrestor within two feet of the building entrance.

Interference and How to Avoid It

An important part of planning your broadband fixed wireless system is the avoidance of interference. Interference can be caused by effects outside the system. Good RF planning can overcome most interference challenges.

Note: The Tsunami Multipoint product line includes a BSU that provides spectrum shielding. This BSU model can reject interference at the uplink location. If interference from other systems is a problem, Proxim recommends you use a BSU equipped with this feature.

Co-Channel and Adjacent Channel Interference

Co-channel interference results when another RF link is using the same channel frequency. Adjacent-channel interference results when another RF link is using an adjacent channel frequency. In selecting a site, a spectrum analyzer can be used to determine whether any strong signals are present and, if present, determine how close they are to the desired frequency. The further removed from your proposed frequency, the less likely they are to cause a problem.

Antennas

Antennas frequently play a key role in reducing the potential for interference. They come in a variety of configurations that have different performance characteristics in the areas of gain and direction. Antennas that transmit/receive in all directions are known as **omni-directional**, while those that transmit/receive in one specific direction are categorized as **directional**. Antennas also vary in beamwidth, which is the aperture to which they can “see” signals. Larger antennas typically provide narrower beamwidths and can diminish interference from nearby transmitters by:

- Focusing RF energy from the intended destination
- Reducing the power of interfering sources not directly aligned to the antenna

Tsunami Multipoint Ethernet Systems use integrated directional antennas that transmit and receive a relatively narrow beamwidth of radio energy, improving system performance by reducing the likelihood that surrounding RF clutter will interfere with reception. The antennas with this system are directional and cannot be detached.

BSU Antenna Characteristics

Polarization: LHCP (Left-Hand Circular Polarization)

Azimuth Beamwidth: 60-degree

Elevation Beamwidth: 6-degree

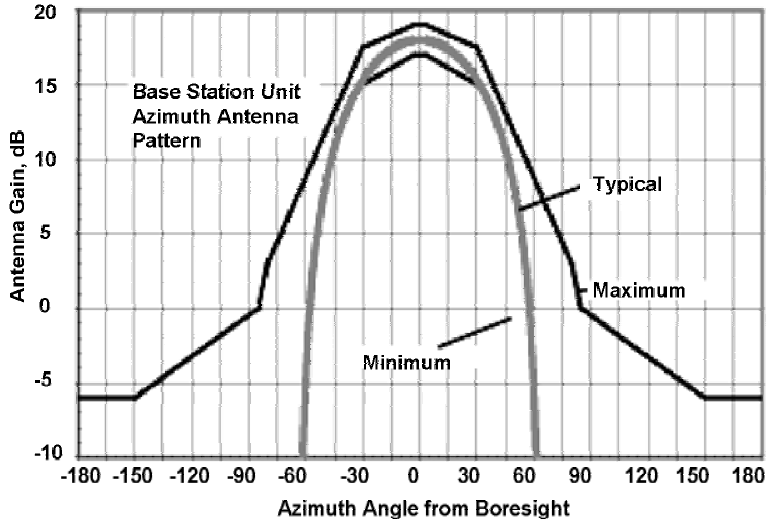


Figure 3. BSU Azimuth Antenna Pattern

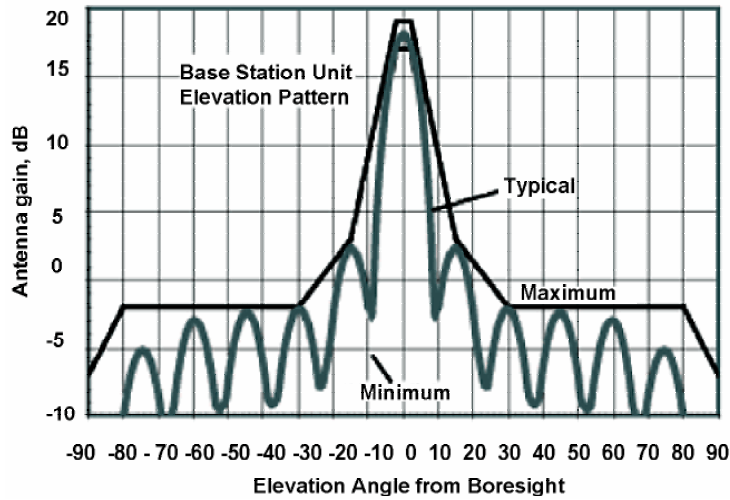


Figure 4. BSU Elevation Antenna Pattern

SU Antenna Characteristics

Polarization: LHCP

Beamwidth (Azimuth/Elevation): 10-degree

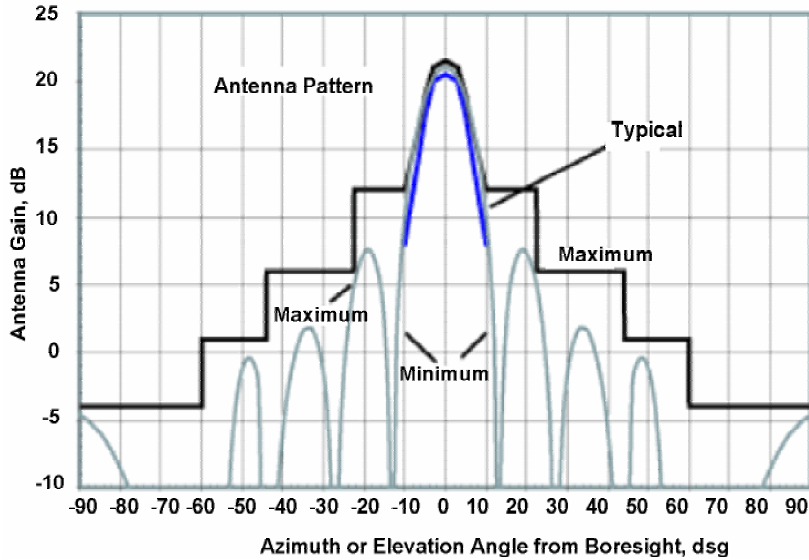


Figure 5. SU Antenna Pattern

Even when other licensees are not an issue, if you are using a network deployment using the “cell” approach, all these considerations are still important for reducing interference between your own adjacent installations. Antennas are tuned to operate on a specific group of frequencies.

Antenna Polarization

The Tsunami Multipoint system uses **left-hand circular polarization**. As a result, the signal is successfully received regardless of the orientation of the antenna. Circular polarization also provides protection against multi-path degradation of the signal quality.

Towers

When planning antenna placement, it might be necessary to build a free-standing tower for the antenna. Regulations and limitations define the height and location of these towers with respect to airports, runways, and airplane approach paths. These regulations are controlled by the FAA. In some circumstances, the tower installations must be approved by the FAA, registered with the FCC, or both.

To ensure compliance, review the current FCC regulations regarding antenna structures. These regulations (along with examples) are on the FCC web site at <http://wireless.fcc.gov/antenna/> .

Path Planning

To get the most value from a wireless system, path planning is essential. In addition to the fact that radio signals dissipate as they travel, many other factors operate on a microwave signal as it moves through space. All of these must be taken into account, because any obstructions in the path can attenuate the signal.

Calculating a Link Budget

A **link budget** is a rough calculation of all known elements of the link to determine whether the signal will have the proper strength when it reaches the other end of the link. To make this calculation, consider the following information.

- A signal degrades as it moves through space. The longer the path, the more loss it experiences. This free-space path loss is a factor in calculating the link viability. Free-space path loss is easily calculated for miles or kilometers.
- Availability represents the quality of a link. It is the ratio of the time that the link is available to the total time. This serves as a guide to the service you can expect, on the average, over a period of one year.

You can lower the bit error rate (BER), resulting in greater reliability, by reducing the data throughput or reducing the distance between the BSU and the SU.

Note: In terrestrial communication, path loss does not necessarily follow 20dB per decade degradation as used in free-space loss. Instead, 25-35 dB per decade is more common in a metropolitan near-line-of-sight environment.

Unlicensed Frequencies (U-NII)

The FCC has identified the frequencies from 5.725 to 5.825 GHz as Unlicensed National Information Infrastructure (U-NII). This band can be used by anyone without having to obtain a license. However, you must use radio equipment that is "type approved" by the FCC or local government for use within the specific band.

PMP Radio Information

The following sections provide information about the Tsunami Multipoint radio components. See "Appendix C. Technical Specifications" on page 57 for product technical specifications.

Channel/Frequency Plans

Tsunami Multipoint offers several frequency plans to provide a means for overcoming interference. If one part of the 5.8 GHz spectrum is occupied when you deploy the product, you can select a different frequency plan to bypass the interfering frequency. Plan 4 is the default. Operating frequencies in the 5 and 6 plans overlap. See "Change the Frequency Plan and Operating Frequency" on page 50 for more information.

Bandwidth

The Tsunami Multipoint offers four modulation modes: QAM16 (60 Mbps), QAM8 (40 Mbps), QPSK3Q (30 Mbps), and QPSK1H (20 Mbps) with equal bandwidth occupancy (3 dB BW at 20.75MHz, 26dB BW at 26MHz). Downlink and uplink signals are divided into time slots, with the number of slots per frame varying, depending upon the current modulation mode and data rate. Furthermore, the ratio of slots assigned to downlink and uplink is commandable (within limits; see "setFirstInboundSlot" in the *Tsunami Multipoint Version 1.3 Reference Manual* for details)

Tx Power and Antenna Specifications

See "Tx Power," "txPowerLevel," and "Antennas" in the *Tsunami Multipoint Version 1.3 Reference Manual*.

Power Control

Each SU automatically adjusts its transmit power so the strength of its signal at the BSU does not exceed the limitation imposed by the Inbound Power Control (IPC) margin. This ensures fair access for all SUs regardless of distance from the BSU. In addition, IPC can be increased to overcome interference. See the "IPC" command in the *Tsunami Multipoint Version 1.3 Reference Manual* for more information.

Chapter 2. Deploying the Base Station Unit (BSU)

This chapter describes how to mount and deploy the Base Station Unit including the GPS Antenna (required when you install multiple BSUs at the same location).

Unpacking the System

The product's shipping boxes should be left intact and sheltered until arrival at the installation site. If the shipping container shows signs of damage, immediately notify the transportation company. Upon receipt, inspect contents to make sure no parts are missing or damaged.

Proxim recommends that you retain all the packaging materials (including all internal boxes). In the unlikely event that the equipment must be returned to the factory, use the original packing materials for return shipment. The packaging materials are also recommended for transporting the equipment from location to location.

Unpack the following items from the contents of the shipping box. In addition to these items, you will require an additional Cat 5 cross-over or straight-through cable (see step 5) and a BSU power adapter (the BSU's power supply is ordered and shipped separately; the power supply's CPN number is 58526).



Figure 6. Base Station Unit Components

The product's shipping boxes should be left intact and sheltered until arrival at the installation site. If the shipping container shows signs of damage, immediately notify the transportation company. Upon receipt, inspect contents to make sure no parts are missing or damaged.

Proxim recommends that you retain all the packaging materials (including all internal boxes). In the unlikely event that the equipment must be returned to the factory, use the original packing materials for return shipment. The packaging materials are also recommended for transporting the equipment from location to location.

Mounting the Base Station Unit

You can mount the outdoor component of your Tsunami Multipoint Base Station Unit directly to a pole with an outside diameter of 1- ½ to 4- ½ inches.

Mounting the BSU is essentially a two-step process:

1. Assemble the BSU’s mounting components on the ground (ground work).
2. Mount the BSU to a pole using the mounting components.

Tsunami Base Station Unit System		
Title	Part Number	Quantity
BSU Installation Kit, consisting of the following: CD-Tsunami Multipoint Base Station CD Assembly Cable, WAC, Cat 5, 50 M Contact Kit, Positronic Contact Kit, AMP Mounting hardware (see the following table)	58686 100-00844-02 100-00861-00 100-00862-00	1 each 1 each 1 each 1 each 1 set

BSU Mounting Hardware		
Mounting Hardware	Part Number	Quantity
Mounting Bracket Galvanized (U-Shaped)	200-01114-00	2 each
Screw, 3/8-16 x 1" Full Thread, Hex Head, SS316	720-01130-00	4 each
Washer, Split Lock, # 3/8, SS 316	730-01131-00	4 each
Notched Bracket	200-01115-00	1 each
Bracket, Downtilt	200-01116-00	1 each
Screw, 3/8-16 x 1 ¼ Full Thread, Hex Head, Galvanized	720-01120-00	6 each
Washer, Split Lock, #3/8, Galvanized	730-01122-00	10 each
Lockwasher, Int. and Ext., #3/8, Galvanized	730-01123-00	2 each
Nut, Hex, 3/8-16, Galvanized	740-01125-00	10 each
Bracket, Clamp (M-Shaped)	200-01117-00	2 each
Strap, Clamp	200-01118-00	2 each
Screw, 3/8-16 x 1" Full Thread, Hex Head	720-01119-00	4 each
Screw, 2/1-13 x 7 ½ Full Thread, Hex Head, Galvanized	720-01121-00	4 each
Washer, Split Lock, #1/2, Galvanized	730-01124-00	4 each
Nut, Hex, ½-13, Galvanized	740-01126-00	8 each
Screw, Machine, SEM, #10-32 x 3/8, Int Star	720-00580-00	5 each
Bracket, GPS Antenna Mtg	200-01083-00	1 each
GPS Antenna, WAC Transceiver	100-00754-00	1 each
Clamp, Band, 2" – 5" Diameter, SS Quick Rel	720-01127-00	1 each