

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.

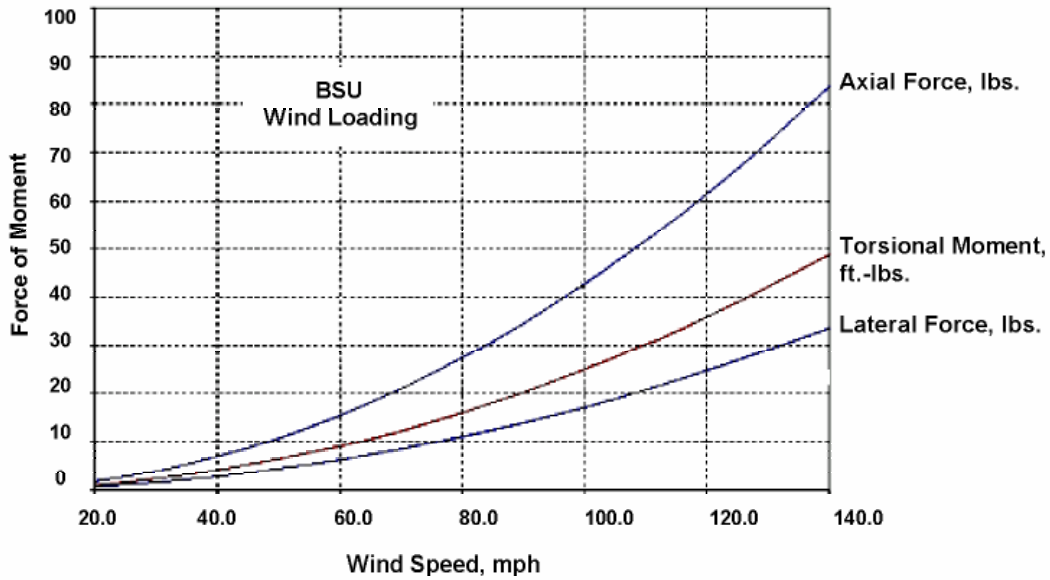


Figure 1. BSU Wind Loading Analysis

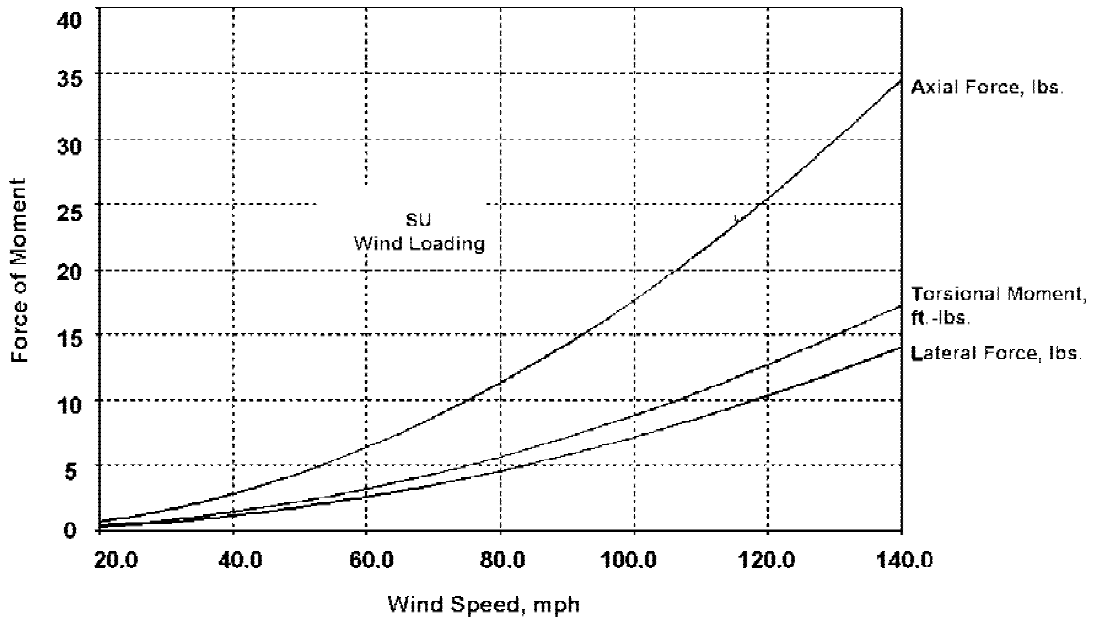


Figure 2. SU Wind Loading Analysis

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

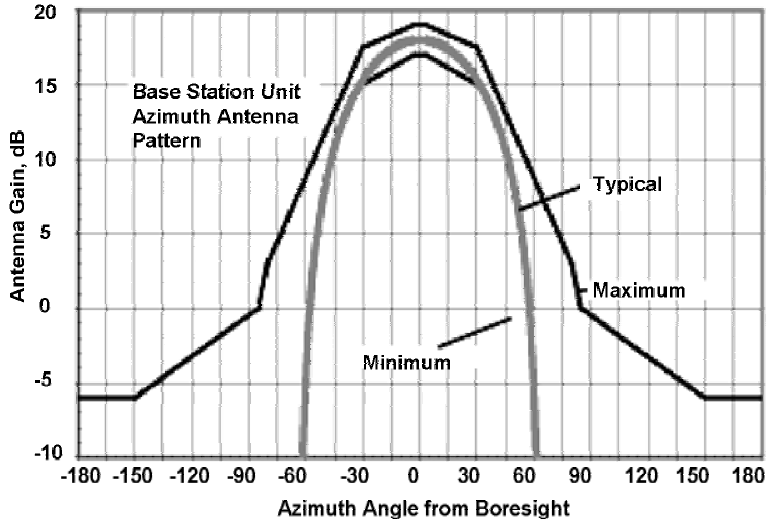


Figure 3. BSU Azimuth Antenna Pattern

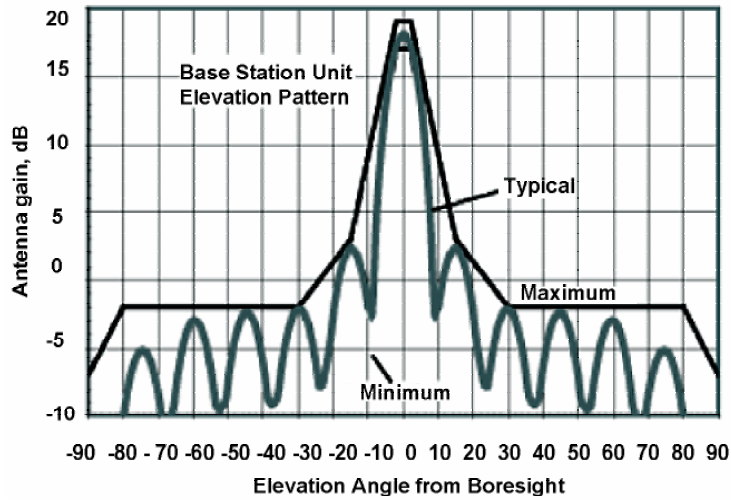


Figure 4. BSU Elevation Antenna Pattern

SU Antenna Characteristics

Polarization: LHCP

Beamwidth (Azimuth/Elevation): 10-degree

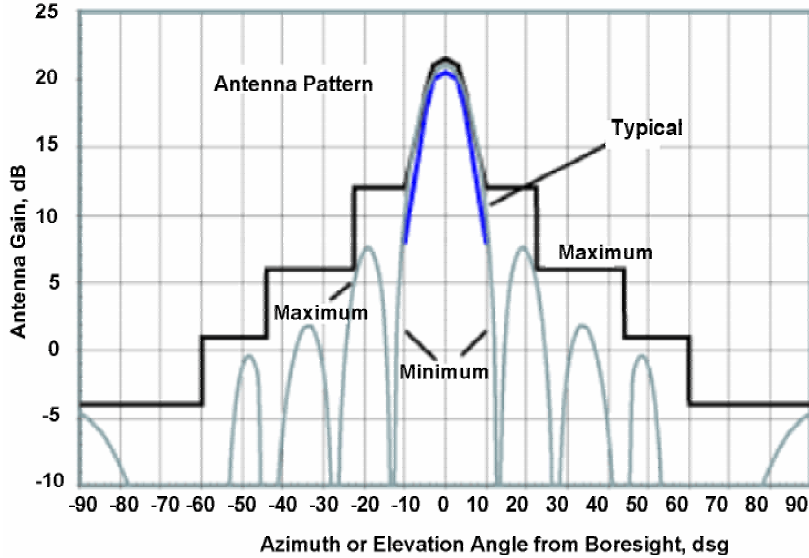


Figure 5. SU Antenna Pattern

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.