N2-X Ethernet Extender
Installation and Operations Manual

Part Number 281-104101-201
Version 0.1
February 1999

Wireless, Inc.
19 Davis Drive
Belmont, CA 94002-3001

Notice

Information in this document is subject to change without notice. No part of this document may be reproduced or transmitted in any form or by any means, electronic or mechanical, for any purpose, without the express written permission of Wireless, Inc.

N2-Ethernet Extender™ and ACCESS™ Series are trademarks of Wireless, Inc.

Table of Contents

Figures

Tables

Welcome!

Welcome to the Wireless, Inc. N2-ACCESS℠ Series product family. This manual is designed to introduce you to the N2- *X Ethernet Extender*™, and to provide you with information necessary to plan, install, operate and maintain a N2- *X Ethernet Extender* wireless communication system.

The N2-*X Ethernet Extender* is intended for **professional installation only**. This manual, however, is also designed for personnel who plan, operate and administrate the N2- *X Ethernet Extender* communication system. Please review the entire manual before powering up or deploying any N2- *X Ethernet Extender*.

Updates to this manual will be posted on the Wireless, Inc. Customer Service Website at *http://www.wire-less-inc.com*. Registered Wireless customers can access Wireless' on-line information and support service, available 24 hours a day, 7 days a week. Our on-line service provides users with a wealth of up-to-date information, with documents being added or updated each month.

Radiation Warnings

Microwave Radio Radiation Warning

Under normal operating conditions, N2- *X Ethernet Extender* radio equipment complies with the limits for human exposure to radio frequency (RF) fields adopted by the Federal Communications Commission (FCC). All Wireless, Inc. microwave radio equipment is designed so that under normal working conditions, microwave radiation directly from the radio is negligible when compared with the permissible limit of continuous daily exposure recommended in the United States by ANSI/IEEE C95.1-1991 (R1997), Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

Microwave signal levels that give rise to hazardous radiation levels can exist within transmitter power amplifiers, associated RF multiplexers, and antenna systems.

Never look into the open end of a Waveguide as eyes are particularly vulnerable to radiation.

Do not disconnect RF coaxial connectors, open microwave units, or break down any microwave screening while the radio equipment is operating.

Microwave Antenna Radiation Warning

Designed for point-to-point operation, an N2- *X Ethernet Extender* microwave radio system will use directional antennas to transmit and receive microwave signals. These directional antennas are usually circular or rectangular in shape, are generally located outdoors, and are usually mounted on a tower or mast.

Referencing OET Bulletin 65 (Edition 97-01, August 1997) from the Federal Communication Commission's Office of Engineering & Technology, limits for maximum permissible exposure (MPE) to microwave signals have been adopted by the FCC for both Occupational/Controlled environments and General Population/Uncontrolled environments. These limits are 5.0 mW/cm^2 and 1.0 mW/cm^2, respectively, with averaging times of six-minutes and thirty-minutes, respectively.

The closer you are to the front center-point of a microwave antenna, the greater the power density of its transmitted microwave signal. Unless you are very close, however, microwave exposure levels will fall far below the MPE limits. To determine how close to a microwave antenna you can be and still remain below the MPE limits noted above, "worst case" predictions of the field strength and power density levels in the vicinity of an N2- *X Ethernet Extender*™ microwave antenna can be made from the following calculations. The equation is generally accurate in the far-field of an antenna, and will **over-predict** power density in the near-field (i.e. close to the antenna).

$$S = PG/4\pi R^2$$

where: S = power density (in mW/cm^2)
P = power input to the antenna (mW)
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna (cm)

Note that G, the power gain factor, is usually expressed in logarithmic terms (i.e., dB), and must be converted using the following equation:

$$G = 10^{dB/10}$$

For example, a logarithmic power gain of 24 dB is equal to a numeric gain of 251.19.

Assuming (1) maximum output power from the N2- *X Ethernet Extender* (+3.5 dBm [2.238 mW]), (2) no signal loss in the cable connecting the N2-*X Ethernet Extender* to the antenna, and (3) the use of a 27 dBi gain parabolic antenna, the 5.0 mW/cm^2 and 1.0 mW/cm^2 MPE power density limits would be reached at distances of approximately 4.22 cm and 9.44 cm, respectively.

Wireless, Inc. fully supports the FCC's adopted MPE limits, and recommends that personnel maintain appropriate distances from the front of all directional microwave antennas. Should you have questions about N2-*X Ethernet Extender*™ microwave signal radiation, please contact the Wireless, Inc. Customer Service Department.

Notice Regarding Operation pursuant to FCC part 15 Rules

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

1.0 General Overview

1.1 N2-ACCESS Series Product Family

All N2-X Ethernet Extender radios are members of the N2-ACCESS Series radio product family. The N2- ACCESS Series is designed to provide an economical wireless solution for local access telecommunication requirements.

The N2-ACCESS Series radio product family consists of several product offerings, to include both the N2-ACCESS Link. This manual addresses, in detail, the operation of the N2-X Ethernet Extender. For detailed information on other N2-X Ethernet Extender radios or other members of the N2-ACCESS Series, please refer to the appropriate Operation Manual(s).

1.2 Introduction to the N2-X Ethernet Extender

The N2-X Ethernet Extender series of radios are designed for operation in two of the Unlicensed National Infrastructure at frequencies of 5,250 - 5,350 MHz or 5,725 - 5,825 MHz.

Each N2-X Ethernet Extender is comprised of a pole mounted RF/antenna unit. Each link is powered by means of a AC wall transformer (optional DC powering available) located with the indoor terminal unit. The system has a data transmission capacity of 16 Mb/s. Refer to the N2-X Ethernet Extender data sheets for information relating to product offerings and specifications.

1.3 Regulatory Information

In January 1997, the FCC made available 300 MHz of spectrum for Unlicensed National Information Infrastructure (U-NII) devices. The FCC believes that the creation of the U-NII band will stimulate the development of new unlicensed digital products which will provide efficient and less expensive solutions for local access applications.

The U-NII band is divided into three sub bands at 5.15 - 5.25, 5.25 - 5.35 and 5.725 - 5.825 GHz. The first band is strictly allocated for indoor use and is consistent with the European High Performance Local Area Network (HIPERLAN). The second and third bands are intended for high speed digital local access products for “campus” and “short haul” microwave applications.

Table 1.1 - FCC U-NII Bands

	Band 1	Band 2	Band 3
Frequency	5.15 to 5.25 GHz	5.25 to 5.35 GHz	5.725 to 5.825 GHz
Power (Max)	200 milliwatts EIRP	1 watt EIRP	4 watts (EIRP)*
Intended Use	Indoor Use Only	Campus	Approx 10 miles

WL035901

* Note: A recent FCC memorandum opinion and order (M00) revised on June 24, 1998 allows the use of a directional antenna with 23 dBi gain and a maximum transmitter output power of 1 watt in the 5.725 - 5.825 U-NII band.

2.0 N2-X Ethernet Extender Product Profile

2.1 General Overview

The N2-X Ethernet Extender series of microwave radio products provides digital capacities for 16 Mb/s data rates for short-haul applications up to 10 km. The radio terminal operates in the newly allocated Unlicensed National Information Infrastructure (U-NII) spectrum with a revolutionary Split Modulation system architecture that provides full duplex operation in the 5.3/5.7 GHz U-NII frequency bands.

The N2-X Ethernet Extender series provides the unique advantage of a very robust digital transmission scheme.

Split Modulation uses two separate 100 MHz bands within the U-NII frequency spectrum. Within these bands, the N2-X Ethernet Extender series operates in one of many independent channels providing for frequency reuse and network flexibility, ideal for dense network applications.

Synthesized RF channel selection is field configurable, as are the power output options for the selection of antenna sizes. Frequency coordination and installation guidelines are provided in the appendix section of this manual.

Complying with all aspects of FCC Rules Subpart 15.401-15.407, the transmission characteristics of the N2-X Ethernet Extender series are ideally suited to meet the peak power spectral density requirements of the U-NII 5.250 - 5.350 and 5.725 - 5.825 GHz bands.

Note: From this point on in this Operations Manual, unless specified otherwise, the term N2-X Ethernet Extender refers to the 5.3/5.7 GHz N2-X Ethernet Extender radio.

The N2-X Ethernet Extender as been designed for complete front access to all interfaces, controls and displays. Information in this manual will familiarize you with all of these items. Figure 2.1 illustrates two (2) N2-X Ethernet Extender terminals in a point-to-point configuration.

This Page Left Blank Intentionally

Figure 2.1 Z-fold (WL035902) goes here

Figure 2.1 Z-fold (WL035902) goes here

2.2 Specifications

2.2.1 General

Frequency Band	Full-duplex operation in both 5.2 and 5.7 GHz U-NII Bands
Regulations	Complies with FCC Rules Part 15.407, U-NII
Frequency Range	5,250 - 5,350 MHz and 5,725 - 5,825 MHz
Frequency agility	Tunable in 10.24 MHz steps
Low Band	5.2608 to 5.34016 GHz
High Band	5.73568 to 5.81504 GHz
Channel Pairs	8 x 16 MHz 5.2608/5.73568 GHz 5.27104/5.74592 GHz 5.28128/5.75616 GHz 5.29152/5.7664 GHz 5.30176/5.77664 GHz 5.31200/5.78688 GHz 5.32224/5.79712 GHz 5.33248/5.80736 GHz
Capacity	16 Mbps (8 Mbps when operated in half duplex Ethernet Mode)
Modulation	BPSK

2.2.2 Digital Interface

Ethernet Interference

2.2.3 Transmitter

Frequency Bands	Low Band -5.250 to 5.350 GHz High Band -5.725 to 5.825 GHz
Output Power (Max)	Low Band - -1.5 or +3.5 dBm High Band - +1.5 or +3.5 dBm
Power Spectral Density Requirements for BW <20 MHz	Low Band -12.5 mW/MHz High Band -50 mW/MHz
Inband Emissions	Low Band -34 dB attenuation High Band -40 dB attenuation
Out of Band Emissions	Low Band -44 dB attenuation High Band -50 dB attenuation
Frequency Tolerance	±5 ppm

2.2.4 Receiver

Type	Coherent Detection
Sensitivity, BER 10 E-6	-82 dBm
Maximum Rx Input	-30 dBm to meet 1 x10^{-10} BER Without Rx Damage -0 dBm
Co-channel Interference	+15 dB
Adjacent Channel Interference (±10 MHz)	+5 dB
Semi-Adjacent Channel Interference (±20 MHz)	-12 dB

2.2.5 Antenna

General Specifications and Performance

Input	RG-8 Female connector
Regulatory Compliance	FCC Part 15
Frequency Range	5.2 - 5.9 GHz
E-plane Polarization	±1 deg.

2 ft. Single Polarization

Gain (mid-band)	27 dBi
Beamwidth, 3 dB	6.0 degrees
Cross Pol Disc.	28 dB
Front/Back Ratio	36 dB
VSWR	1.35:1 (RL)/16.5 dB

Mechanical/Environmental

Wind Loading	EIA/TIA-195C and EIA/TIA-222E
Operational	112 km/hr (70 mph) 25 mm (1”)
Survival	201 km/hr (125 mph) 25 mm (1”)

2.2.6 Diagnostics

ODU Alarm Indicators (for MFG and Maintenance)	Normal Operation - Green LED (and no red LEDs) Link Alarm - Red LED Local Alarm - Red LED Loss of Signal (LOS) - Red LED Page Indicator - Red LED RSSI - Red LED
ODU Performance Monitoring	RSSI - A voltage provided through a BNC connector on the outside of the ODU. The RSSI port is used for antenna alignment during installation and for periodic measurement of Receiver/ Path performance. The RSSI voltage is related to BER from -30 dBm to -90 dBm. Remote Loopback - Accessed from the ODU Local Loopback - Accessed from the ODU

2.2.7 Power Requirements

Primary power supply	
DC	±20 to ±60 V
AC	14 to 29V
	103 to 127V 60 Hz with external transformer
	206 to 265V 50/60 Hz with external transformer
Power Consumption	Maximum 12 Watts

2.2.8 Environmental Specifications

Outdoor Unit	Temperature Range -30 to +55°C
	Altitude -4,500 meters max
	Humidity - Outdoor, all-weather enclosure

2.2.9 Mechanical

Dimensions (HxWxD)	356 x 203 x 76 mm
Weight	3.5 kg

2.3 User Interfaces

The N2-X Ethernet Extender provides user interfaces for fused DC power connection, electrical grounding, radio frequency (RF) antenna connection, digital signal input/output, radio configuration and status, andRSSI output. The following provides information on each interface.

Outdoor Unit

- **Cable 1** - Ethernet Signal cable
- **Cable 2** - Power cable
- **AGC (RSSI)** - BNC type connector used for RSSI measurement.
- **Antenna (RF) Connector** - N-type connector used for connection with antenna.
- **Ground** - A Ground point for outdoor unit housing.
- **Main Power** - The N2-X Ethernet Extender is designed to work from a power input of 15 VDC provided by a wall type power supply operating from an AC outlet capable of providing 100 - 240 VAC. As an option, the Interface Unit can be powered by means of a DC source. The power connector is industry-standard.
- **Grounding Connector** - The front panel of the N2-X Ethernet Extender is equipped with an M5 ground screw and associated washers. This ground screw serves as the proper chassis-ground connection point for an external ground source. The N2-X Ethernet Extender must be grounded in accordance with the electrical codes, standards, and practices governing the local installation.

Refer to Figure 2.2 and 2.3.

Figure 2.2 - Outdoor Unit, Exterior

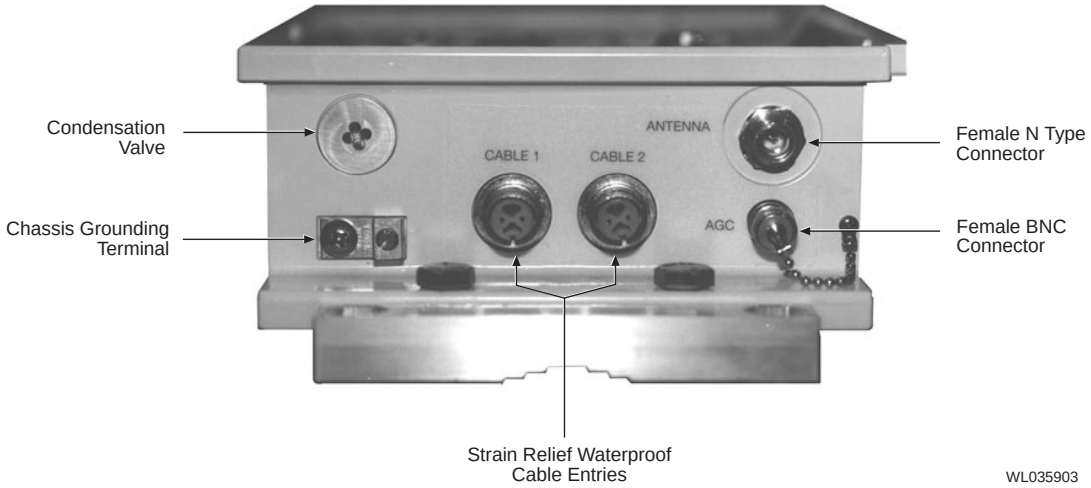
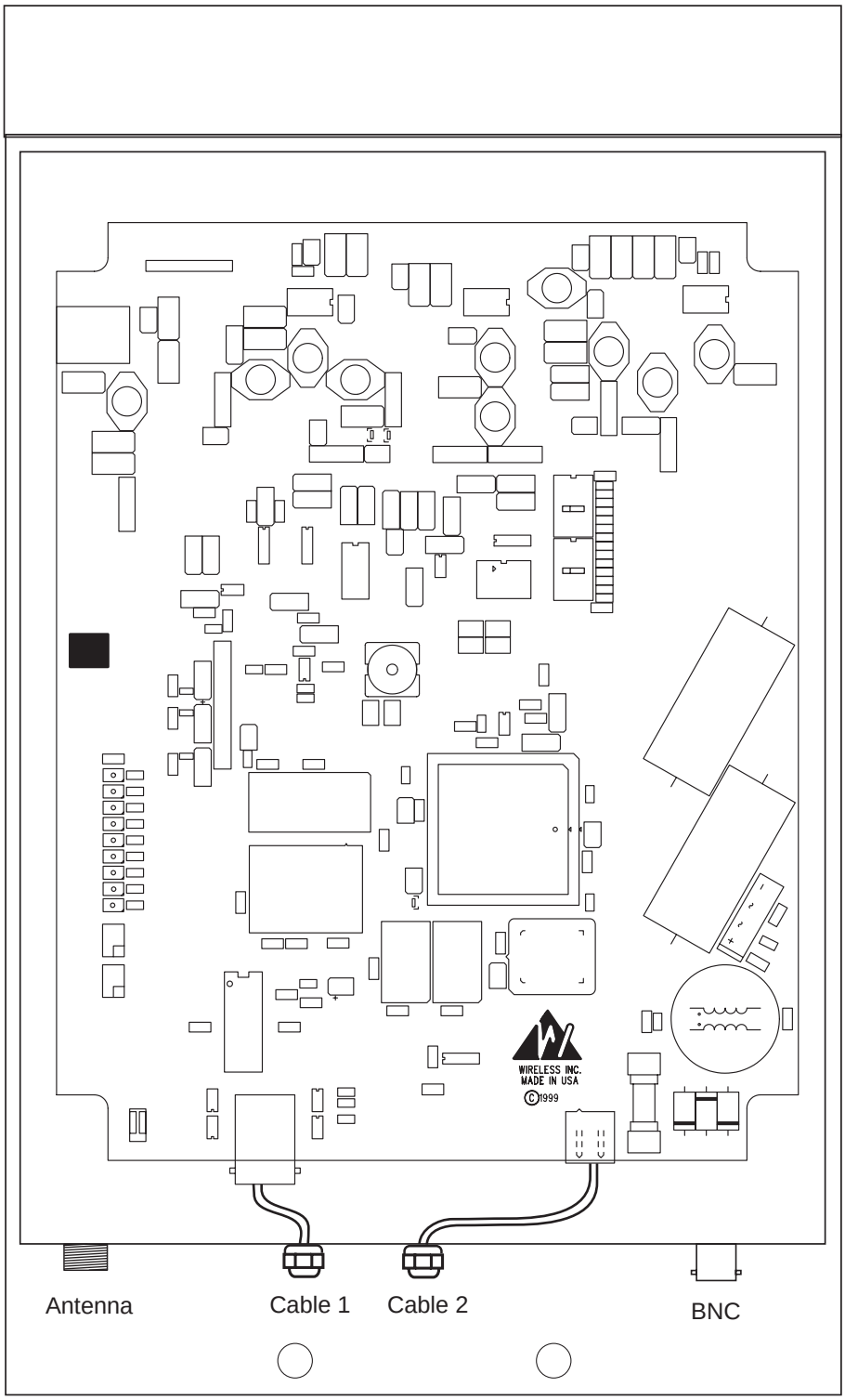


Figure 2.3 - Outdoor Unit, Interior Interfaces



WL035904

2.4 Alarms and Indicators (Terminal Unit)

The N2-X Ethernet Extender Terminal Unit is equipped with diagnostic tools in the form of LED indicators. The following describes the functions of these items as shown in Figure 2.2.

2.4.1 Power LED

The Power LED:

- **Green** - The N2-X Ethernet Extender has proper DC power applied, and the unit is On.
- **Clear/Off -** The N2-X Ethernet Extender is Off or has no DC power supplied.

2.4.2 Local Alarm LED

The Local Alarm LED is a single-color (red) device:

- **Red** - The N2-X Ethernet Extender is registering one or more monitored alarm functions: summary radio alarm, loss of local data input, bipolar violations (BPV) detected on local incoming data, or power supply failure.
- **Clear/Off** - The N2-X Ethernet Extender is not registering any alarm condition.

2.4.3 Link Alarm LED

The Link Alarm LED is a single-color (red) device:

- **Red** - A loss of data signal from the far terminal has occurred.

2.5 Alarms, Indicators and Displays (Outdoor Unit)

The N2-X Ethernet Extender outdoor RF unit is provided with several LED indicators that supply operational status. Figure 2.4 shows the location of each indicator.

2.5.1 ODU Alarm Indicators

- Normal Operation (Green LED) -
- Page 0 (Red LED) - When On (red), indicates that page 0 of the EEPROM has loaded to the FPGA indicating that a reset or start condition has occurred.
- Link Alarm (Red LED) - Indicates that the data signal from the far end terminal is not present.
- Local Alarm (Red LED) - An alarm condition is present at the local terminal.
- Loss of Signal (LOS) Alarm (Red LED) - The signal from the far end terminal has dropped below threshold.
- DRSSI Alarm (Red LED) -

2.5.2 ODU Performance Monitoring

RSSI - A voltage provided through a BNC connector on the outside of the ODU. The RSSI port is used for antenna alignment during installation and for periodic measurement of Receiver/Path performance. The RSSI voltage is related to Rx BER from -30 dBm to -90 dBm.

Remote Loopback - Accessed from the ODU

Local Loopback - Accessed from the ODU

ODU Alarm Indicators

ODU Performance monitoring

2.6 Theory of Operation

2.6.1 N2-X Ethernet Extender Transmitter

This description should be used in conjunction with the system block diagram Figure 2.4.

The data signal and the AC/DC supply voltage are connected to the ODU by means of a power/data cable assembly. The supply voltage passes through a bridge rectifier to a DC to DC converter. The output of this converter is +15V. This +15V supply drives three DC regulators within the ODU.

One regulator provides -5 VDC, the second 11 VDC and the third being a dual output type supplies +5 and +5.8 volts.

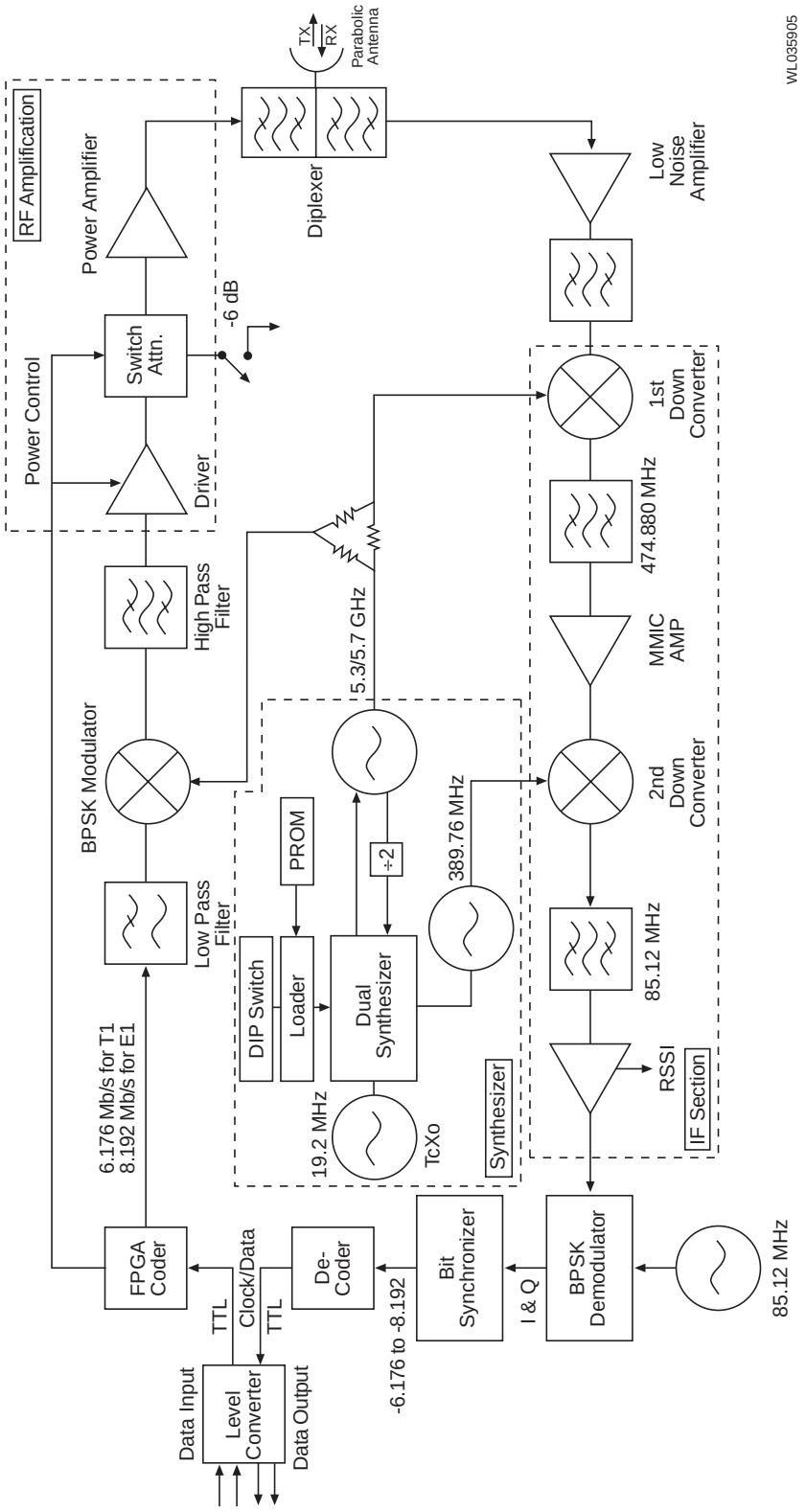
The FPGA coder interleaves and scrambles the TTL data from the coder. The FPGA is programmed to output the data at 4 times the input rate (6.176 MHz for the DS1 rate or 8.192 MHz for E1 rates). This provides a data rate which is optimal with respect to the FCC rules for spectral power densities defined for this frequency allocation.

The data is passed through a 7th order low pass filter to reduce unwanted high frequency signal images prior to modulation. A double balanced mixer is used to modulate the data signal on to a CW signal provided by the synthesizer at the desired output frequency. The output of the mixer contains the BPSK modulated signal at the desired frequency.

A high pass filter eliminates spurious noise, rejects harmonic images and insures that the proper bandwidth is maintained prior to being amplified.

The RF output section consists of three main components: a RF driver amplifier, a logic controlled switch attenuator and a RF power amplifier. The driver amplifier provides the first stage of RF amplification, the switch attenuator serves a dual purpose. The first is to provide a customer selectable 6 dB attenuator to reduce output power when needed. Secondly, this circuit acts as an RF impedance matching network between the driver and power amplifier gain stages. The power amplifier provides the amplification required prior to being output through a diplexing filter and ultimately to the antenna.

Figure 2.4 - N2-X Ethernet Extender ***Block Diagram***



2.6.2 N2-X Ethernet Extender Receiver

The description should be used in conjunction with the system block diagram (Figure 2.4).

At the antenna, the received BPSK modulated signal from the opposite terminal is passed through a diplexing filter which is used to isolate the incoming signal from the transmitter output and to bandpass filter the received signal thereby reducing the chance of unwanted signal products from entering the receiver. A low noise amplifier (LNA) detects and amplifies the signal bandpass filter on the output of the LNA provides band limiting of the received spectrum to reject unwanted signal products. The first downconverter combines a CW signal at the receiver frequency from the synthesizer and the incoming signal by means of a mixer to produce the first IF product at 474.880 MHz. A 75 MHz bandpass filter limits the possibility of unwanted out of band products from entering the 2nd IF. The first IF is amplified by a MMIC device and is downconverted by mixer a 389.76 MHz signal from the synthesizer with the 474.880 MHz 1st IF signal. The result is a 85.12 MHz 2nd IF product which is bandpass filtered and fed to an RSSI IF processing DC which derives an RSSI voltage used to determine signal strength.

A BPSK demodulator places the 85.12 MHz 2nd IF and 85.12 MHz varactor diode source out of phase. The resultant product is a DC level I and Q signal of which only the I signal is input to the Bit Synchronizer to re-clock the data. The re-clocked data is decoded and output at TTL level to the DS1/E1 level converter which outputs the data in AMI, B8ZS or HDB3 format as needed. The data is interconnected to the TU and output on the front panel by means of RJ-48C or BNC connector depending on the data format being used.

2.6.3 Synthesizer

The FPGA provides four 22-bit streams in a serial format loaded to the synthesizer. This data provides all of the possible frequencies at which the system can operate. Depending upon the dip switch settings selected, the actual frequency being used is selected. When the reset button is pressed, the FPGA will reload this data to the synthesizer. The PROM contains all of the possible frequency combinations.

3.0 Equipment Installation and Commissioning

3.1 Installation

The N2-X Ethernet Extender has been specifically designed for ease of installation. The following installation instructions should be followed.

1. **Plan the installation** - Decide where each component of the N2-X Ethernet Extender will be placed prior to commencement of any installation activity. Installation considerations for each component in general are as follows:

   a. **Outdoor RF Unit** - Mount as close as practical to the Antenna assembly. The maximum distance is determined by the included interconnect cable which is 1 meter in length. Determine pole mounting details for the Outdoor Unit and Antenna. Adjust output power according to section 4.2.1.
   b. **Antenna Unit -** See Appendix B.

2. **Inventory your equipment and installation materials.**
   To install one (1) terminal you should have the items shown in Table 3.1.

3. **The following tools should be on hand:**

Tool	Purpose
Wire Stripper/Cutter	General wire stripping and cutting purposes
Hand-Held Voltmeter (VOM)	Confirm magnitude, polarity, continuity with standard probes
2 Adjustable Wrenches	Antenna mounting, Outdoor Unit up to 1.5 cm
Flat Screwdriver	Outdoor Unit Grounding

Table 3.1 - Inventory of Equipment and Installation Materials

Item	Part Number	Description	Qty
1a*	251-110019-101	Outdoor Unit 5.250 - 5.350 GHz DS1 rate	1
1b*	251-110019-201	Outdoor Unit 5.250 - 5.350 GHz E1 rate 75 Ohm	1
1c*	251-110019-301	Outdoor Unit 5.250 - 5.350 GHz E1 rate 120 Ohm	1
1d*	251-110019-103	Outdoor Unit 5.725 - 5.825 GHz DS1 rate	1
1e*	251-110019-203	Outdoor Unit 5.725 - 5.825 GHz E1 rate 75 Ohm	1
1f*	251-110019-303	Outdoor Unit 5.725 - 5.825 GHz E1 rate 120 Ohm	1
2		Antenna Assembly (see Appendix C)	1
3		ODU - Antenna Cable	1
4	005-303410-025	Screw, M10 x 25mm, HexHd, SS	4
5	005-303410-120	Screw, M10 x 120mm, HexHd, SS	4
6	005-310410-001	Washer, Flat M10, SS	4
7	005-311410-001	Washer, M10 Split Lock, SS	4
8	005-320410-001	Nut, M10, Hex, SS	4
9	007-390008-001	Seal, Coax, 10” x 1/2” x 3/32”	3
10	008-100028-001	Pole Mount Adapter, Bottom	1
11	008-100029-001	Pole Mount Adapter, Top	1
12	008-100030-001	Pole Mount Adapter, Clamp	2
13	910-410001-001	Converter, AC/DC 110/220V	1

* Note: one required per terminal assembly.

WL035906

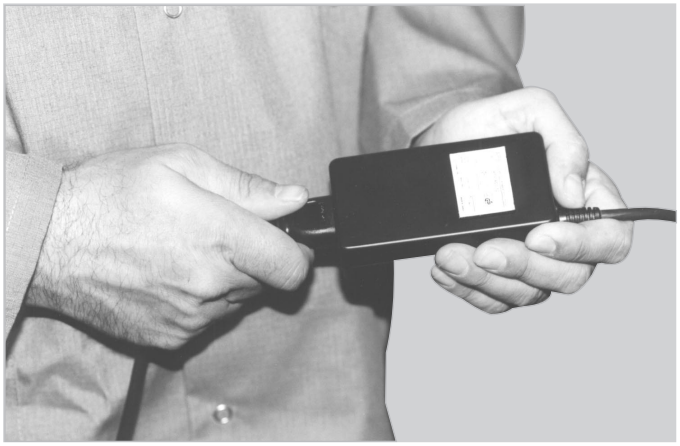
3.2 Ethernet Data Connectors

The Ethernet connections are made to the data side of the power/data cable assembly, normally it is supplied with an RJ48 connector.

3.3 Connect the Wall Transformer to the Terminal Unit

The AC wall transformer is connected to an AC outlet by means of an IEC type power cord. Connect the power cord to the transformer as shown in Figure 3.1.

Figure 3.1- Power Cord Connection

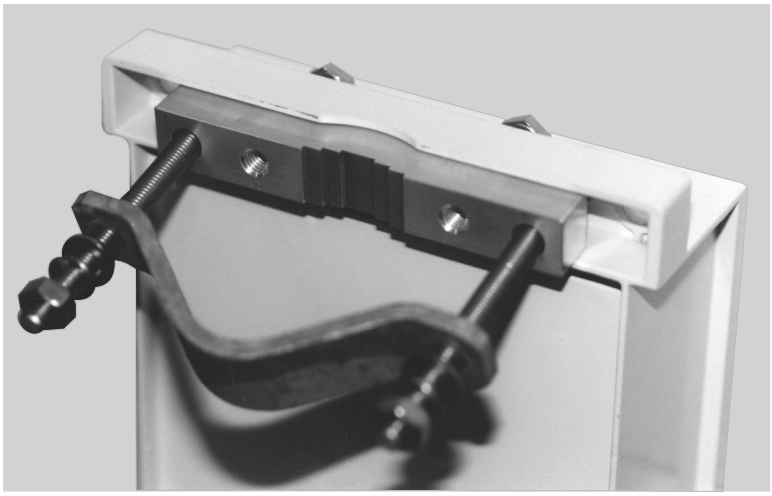


WL035907

3.4 Outdoor RF Unit Installation

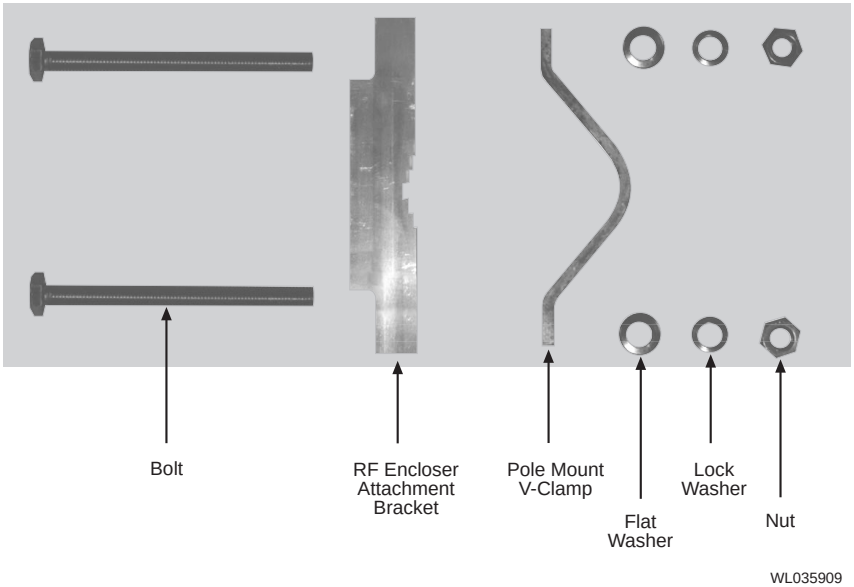
1. Install the upper and lower outdoor unit pole mount adaptor brackets. Figures 3.2a through 3.2d show the upper and lower mounting brackets installed and the equipment involved.
2. Place the outdoor unit against the pole mole and attach to the pole using the V-clamps and hardware as shown in Figures 3.3a and 3.3b.
3. Connect the twin-axial, N-type antenna and ground connections as shown in Figure 3.4.

Figure 3.2a - Upper Pole Mounting Bracket



WL035908

Figure 3.2b - Upper Pole Mounting Bracket Equipment



WL035909

Figure 3.2c - Lower Pole Mounting Bracket

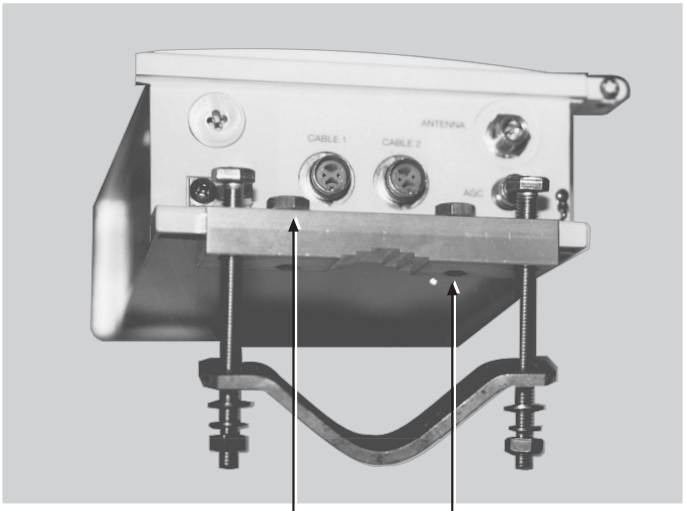


Figure 3.2d - Lower Pole Mounting Bracket Equipment

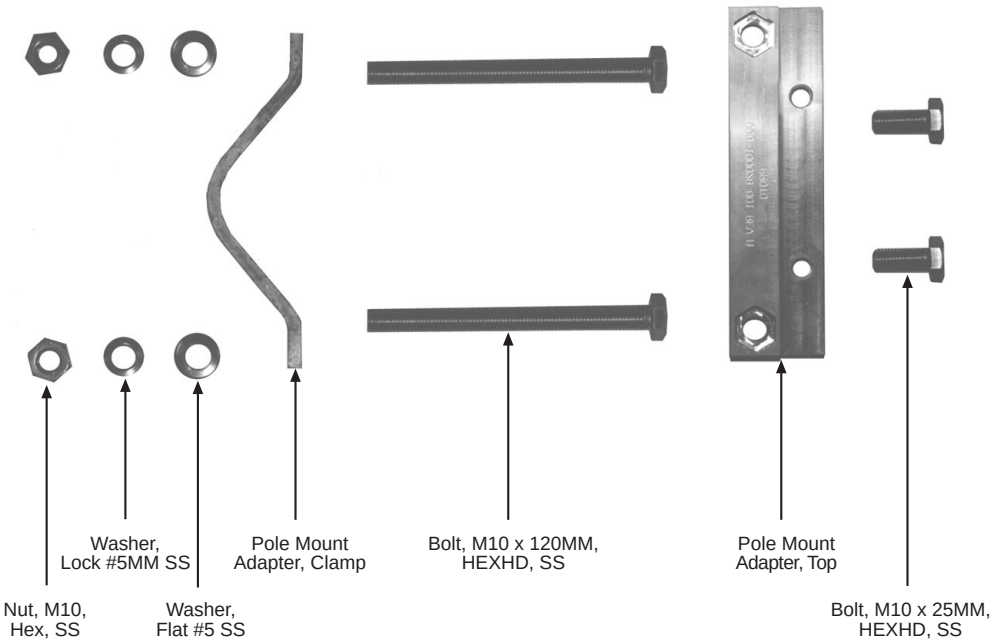
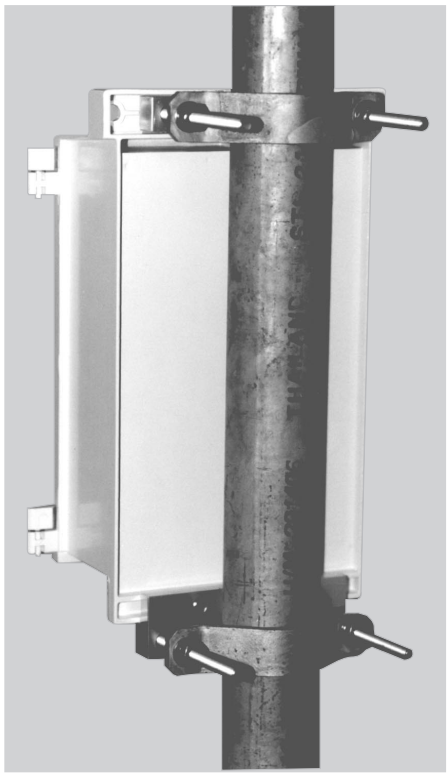


Figure 3.3a - V-Clamps and Hardware

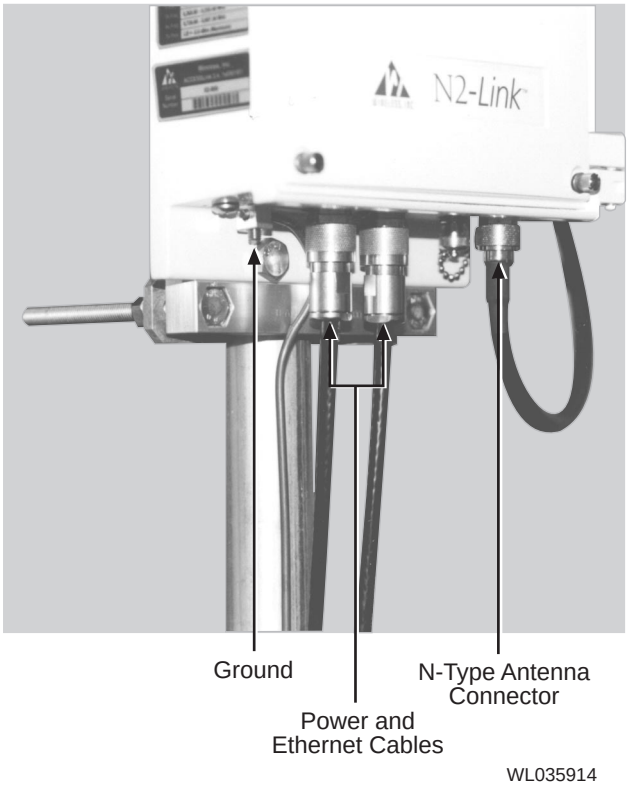
WL035912

Figure 3.3b - V-Clamps and Hardware (Rear View)



WL035913

Figure 3.4 - N-Type Antenna and Ground Connections



3.5 Commissioning

1. Visually verify that the N2-X Ethernet Extender is properly mounted.
2. Verify that the AC power input to the N2-X Ethernet Extender wall transformer is on.
3. Verify that the Power LED is On. If the LED is Off, refer to the Maintenance and Troubleshooting section of the manual.

Refer to Table 3.2.

3.5.1 Configuring N2-X Ethernet Extender System Antennas

The antennas used on an N2-X Ethernet Extender radio system are generally configurable for either vertical or horizontal polarization. It is extremely important to verify that both antennas are configured for the same polarization, and that the appropriate antenna polarization has been selected for the specific radio link.

Table 3.2 - Installation Checklist

Installation Checklist	
Is the rack mounting hardware secure?	
Is the unit properly grounded?	
Is the antenna properly connected?	
Are the data connections in place and correct?	
Is the Power LED On?	

WL035915

3.5.2 Aligning the N2-X Ethernet Extender System Antennas

With the N2-X Ethernet Extender at each site properly configured for operation, antenna alignment must be performed at both sites. Proper antenna alignment is crucial to the proper operation of an N2-X Ethernet Extender radio system, and should only be accomplished by experienced professionals.

The N2-X Ethernet Extender is equipped with a ODU mounted BNC-(f) Link Test connector to which an analog or digital voltmeter can be connected. The voltage range at the test point, between the center conductor of the connector and ground, varies from approximately two VDC to four VDC, serving as a receive signal strength indicator (RSSI). The stronger the receive signal, the higher the RSSI voltage.

Emanating from a microwave antenna is a main beam (or lobe) of RF energy, surrounded by RF side lobes. The beamwidth of the main beam varies with the size and type of antenna, as well as the specific frequency of the RF signal, and is generally defined by the nominal total width of the main beam at the half-power (-3 dB) points. Side lobes surround the main beam at specific angle distances, and will be lower in power than the main beam.

When aligning an antenna system, it is extremely important to verify that the antennas are both aligned on the main beam, not on a side lobe. Referencing Table 3.3, the first side lobe will generally be located at an angle slightly less than twice the antenna beamwidth.

Following the course alignment of an antenna system, a common practice when performing a fine alignment is to slowly swing each antenna (one at a time!) in both vertical (elevation) and horizontal (azimuth) planes to verify that the main beam and first side lobe can be accurately identified. This insures that accurate alignment of the antenna system on the main beam has been accomplished.

Each N2-X Ethernet Extender is shipped with an RSSI test sheet, showing the relationship between the receive signal strength level (in dBm) and the RSSI level (in VDC). These RSSI test sheets are often referred to as AGC Curves. The RSSI test sheets can be used to verify that the calculated receive signal levels match up with the actual receive signal levels. Substantial differences between calculated and actual levels could point to transmission system problems, side lobe alignment, path obstructions, etc.

Table 3.3 - Approximation Table

Antenna Diameter and Style	Gain (dBi)	3 dB Beamwidth (degrees)	1st Side Lobe, Maximum (degrees)	2nd Side Lobe, Maximum (degrees)
2-foot parabolic				
4-foot parabolic				

WL035916

4.0 Maintenance and Troubleshooting

The N2-X Ethernet Extender contains static sensitive components, and has no user-serviceable parts.

4.1 N2-X Ethernet Extender Maintenance

The N2-X Ethernet Extender is designed to operate with no scheduled maintenance activities. From a precautionary perspective, a regular check of power supply input voltages and RSSI voltages should be planned by the user.

4.1.1 RSSI Voltage

The Wireless Customer Service department recommends a monthly check of the N2-X Ethernet Extender's RSSI voltage. Variations in the RSSI voltage could be an indicator of antenna or antenna feed movement, loose or improper RF cabling or connectorization, path obstructions or reflections, etc.

4.2 Identifying and Resolving Receive Signal Strength Issues

There are a great number of items which can affect the transmission of a microwave signal from one site to another. Every microwave path is unique, and must be evaluated for performance before a radio link is installed.

Outside of radio equipment issues, antenna alignment, RF signal blockage, and multipath fading are among the most common transmission problems experienced in the field.

4.2.1 N2-X Ethernet Extender Equipment Issues

Frequency Selection

1. Verify the transmit/receive frequency selection for each N2-X Ethernet Extender radio is set appropriately, and that a “matched pair” of radios has been selected for the system. Each N2-X Ethernet Extender terminal can be set to the frequencies listed in Table 4.1.
2. To reduce the possibility of co -adjacent channel interference, proper frequency coordination and antenna polarization is used to isolate each channel. The concept is to achieve maximum RF isolation between link channels by means of frequency spacing and antenna polarization. In a “star” configuration an optimum frequency and antenna polarization plan is provided to demonstrate an example of maximum isolation between links (See Figure 4.1).

Figure 4.1 - Frequency Selection for the N2-X Ethernet Extender Radio

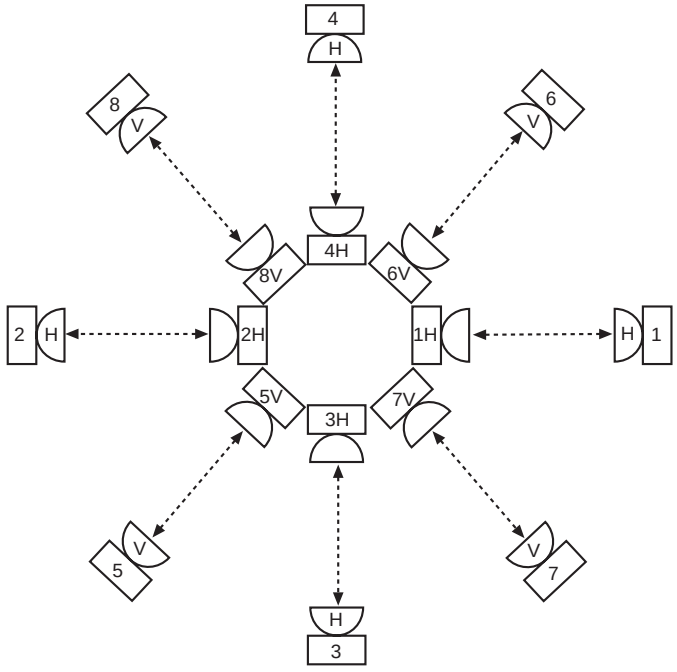


Table 4.1 - Frequencies

Channel No.	Frequency
1	5.2608
1'	5.733568
2	5.27104
2'	5.74592
3	5.28128
3'	5.75616
4	5.29152
4'	5.7664
5	5.30176
5'	5.77664
6	5.31200
6'	5.78688
7	5.32224
7'	5.79712
8	5.33248
8'	5.80736

WL035918

4.3 N2-X Ethernet Extender Digital Board Switch Settings

There are two versions of the N2-X Ethernet Extender Digital Board. Before making switch changes, verify the version of the Digital Board in use. In a working system, the East Radio might be equipped with Version one while the West Radio might be equipped with Version two. The specific version of a N2-X Ethernet Extender's Digital Board will have no effect on the operation of a radio system.

In addition to there being two versions of the Digital Board, there are also two types of Digital Boards: a X Mb/s type and a X Mb/s type. Each type of Digital Board contains different components.

4.3.1 Digital Board Version One

This Board does not have a white silkscreen of the Wireless, Inc. logo above the board number designation 019-XXXXXX-001. It is equipped with three switches:

1. A Red 8-position DIP switch, right-angle, located in the middle of the Board.
2. A small, tow-position switch, located just to the left of the Red 8-position DIP switch.
3. A Black 8-position DIP switch, located at the bottom of the Board, labeled S2.

Red 8-position DIP Switch, Right Angle

The switch positions are read from left to right. On=Up and Off=Down. See Table 4.2.

Table 4.2 - DIP Switches

SW-1	
SW-2	
SW-3	Factory Use Only - Always On
SW-4	Factory Use Only - Always On
SW-5	Factory Use Only - Always On
SW-6	
SW-7	
SW-8	

WL035919

Small, 2-Position Switch, Power Output Attenuator

On = Toward edge of board. Off = Toward Center of Board. When the 6 dB Attenuator is on, transmitter output power will drop by 6 dB. On= 6 dB Power Output Attenuator is On (Lowers output power by 6 dB). Off = 6 dB Power Output Attenuator is Off.

Black 8-Position DIP Switch ("S2")

The switch positions are read from left to right. On= Up and Off = Down. See Tables 4.3 and 4.4.

Table 4.3 - DIP Switches

SW-1	Frequency Selection
SW-2	Frequency Selection
SW-3	Frequency Selection
SW-4	Frequency Selection
SW-5	Frequency Selection
SW-6	Factory Use Only - Always Off
SW-7	Factory Use Only - Always Off
SW-8	Factory Use Only - Always Off

WL035920

Table 4.4 - Transmitter Frequency Selection

Channel	Tx Low (GHz)	Tx High (GHz)	SW-1	SW-2	SW-3	SW-4	SW-5
1	5.26080	5.73768	On	On	On	On	On
2	5.27104	5.74592	On	On	Off	On	On
3	5.28128	5.75616	On	On	On	Off	On
4	5.29152	5.76640	On	On	Off	Off	On
5	5.30176	5.77664	On	On	On	On	Off
6	5.31200	5.78688	On	On	Off	On	Off
7	5.32224	5.79712	On	On	On	Off	Off
8	5.33248	5.80736	On	On	Off	Off	Off

WL035921

4.3.2 Digital Board Version Two

This Board does have a white silkscreen of the Wireless, Inc. logo above the board number designation 019-XXXXXX-001. The logo will be similar to the one on the cover of this manual. This Board is equipped with two switches:

1. S black 8-position DIP switch, located in the middle of the Board, labeled S3.
2. A black 10-position DIP switch, located at the bottom of the Board, labeled S2.

Black 8-Position DIP Switch ("S3")

The switch positions are read from left to right. On = Up and Off = Down. See Table 4.5.

Table 4.5 - DIP Switches

SW-1	
SW-2	
SW-3	Factory Use Only - Always On
SW-4	Factory Use Only - Always On
SW-5	Factory Use Only - Always On
SW-6	
SW-7	
SW-8	

WL035919

Black 1-Position DIP Switch ("S2")

The switch positions are read from left to right. On = Up and Off = Down. When the 6 dB is on, transmitter output power will drop by 6 dB. See Tables 4.6 through 4.8.

Table 4.6 - DIP Switches

SW-1	Frequency Selection
SW-2	Frequency Selection
SW-3	Frequency Selection
SW-4	Frequency Selection
SW-5	Frequency Selection
SW-6	Factory Use Only - Always Off
SW-7	Factory Use Only - Always Off
SW-8	Factory Use Only - Always Off
SW-9	Factory Use Only - Always Off
SW-10	Power Output Attenuator

WL035923

Table 4.7 - Transmitter Frequency Selection

Channel	Tx Low (GHz)	Tx High (GHz)	SW-1	SW-2	SW-3	SW-4	SW-5
1	5.26080	5.73768	On	On	On	On	On
2	5.27104	5.74592	On	On	Off	On	On
3	5.28128	5.75616	On	On	On	Off	On
4	5.29152	5.76640	On	On	Off	Off	On
5	5.30176	5.77664	On	On	On	On	Off
6	5.31200	5.78688	On	On	Off	On	Off
7	5.32224	5.79712	On	On	On	Off	Off
8	5.33248	5.80736	On	On	Off	Off	Off

WL035921

Table 4.8 - Power Output Attenuator Selection

6 dB Attenuator	SW-10
On	Off
Off	On

WL035925

4.4 Where To Get Further Assistance

Your primary source of assistance is the support staff of the organization from which you purchased this product. The Wireless, Inc. support staff should only be contacted directly if you purchased this product directly from Wireless, Inc., or if you are unable to obtain sufficient assistance from your primary support contact.

General Product and Company Information

Wireless, Inc.
19 Davis Drive
Belmont, CA 94002-3001
USA
Tel.: +650 595 3300
Fax: +650 595 4907
E-mail: info@wire-less-inc.com
Website: www.wire-less-inc.com

Detailed Product Information, Sales/Pricing Information and Pre-Sales Technical Support

Wireless, Inc.
Sales Department
19 Davis Drive
Belmont, CA 94002-3001
USA
Tel: +650 595 3300
Fax: +650 595 2417
E-mail: sales@wire-less-inc.com
Website: www.wire-less-inc.com

Post-Sales Technical Support (Customer Service)

To assist you with field issues and, if necessary, to arrange for repair services, Wireless, Inc.'s Customer Service department can be reached via telephone, facsimile, e-mail, mail, or through our Website.

4.5 Return Procedure

All material returned to Wireless, Inc. must be accompanied by a Return Material Authorization (RMA) number from Wireless, Inc.'s Customer Service department. If you purchased your Wireless, Inc. product through a distributor, the Wireless RMA number should be obtained through the distributor. An RMA number is necessary to assure proper tracking and handling of returned material at the factory. Wireless, Inc. reserves the right to refuse shipments not accompanied by an RMA number. Refused shipments will be returned to the shipper via collect freight.

To obtain an RMA number, contact Wireless, Inc. as follows:

Telephone: +650 595 3300
Fax: +650 595 4907
E-mail: customerservice@wire-less-inc.com

The following information will be required to issue an RMA number:

- Part Number
- Serial Number
- Failure Description
- Contact person, telephone, and fax numbers
- Ship-to address
- Bill-to address*
- Customer purchase order* (P.O.) or reference number

* Required for non-warranty repair services. For non-warranty repair services, an RMA number will be issued when Wireless, Inc. acknowledges the purchase order.

Important - All non-U.S. returns must include 5 copies of proforma/customs invoice for each shipment which lists:

- RMA number
- Value of items
- Description of items (including the Wireless model or part number)

Please send all returns to:

Wireless, Inc.
Attn: RMA Department
19 Davis Drive
Belmont, CA 94002-3001
USA
RMA No. _____

The customer is responsible to properly label and package repairs and prepay shipping to Wireless, Inc. If possible, the original packaging material should be used to return electronic parts. The RMA number must be visible on the outside of all packages returned. Unless other arrangements have been made, all repairs are shipped back to the customer prepaid via ground carrier.

Appendix A Network Management

Table A.1 - Alarm Connector Pinouts

1	Link Alarm	Normally Open
2	Local Alarm	Normally Open
3	Not Used	
4	Link Alarm	Common
5	Not Used	
6	Link Alarm	Normally Closed
7	Local Alarm	Common
8	Local Alarm	Normally Closed
9		Ground

WL035926

Appendix B Installation Instructions

Read the instructions completely before assembling or installing the antenna. This installation can be dangerous and requires qualified personnel familiar with microwave assembly and installation.

Site Planning

1. For antenna mounting and planning dimensions, see Figure B.1 and Table B.1.
2. The antenna is normally assembled with an elevation adjustment range of +50 degrees to -5 degrees. By inverting the mount, it can be assembled with a +5 degree to -50 degree range. In either configuration, the antenna centerline can be offset right or left, relative to the vertical mast pipe (See Figure B.2) by inverting the Horizontal Tube Assembly.

Figure B.1 - Two Foot Diameter Antenna

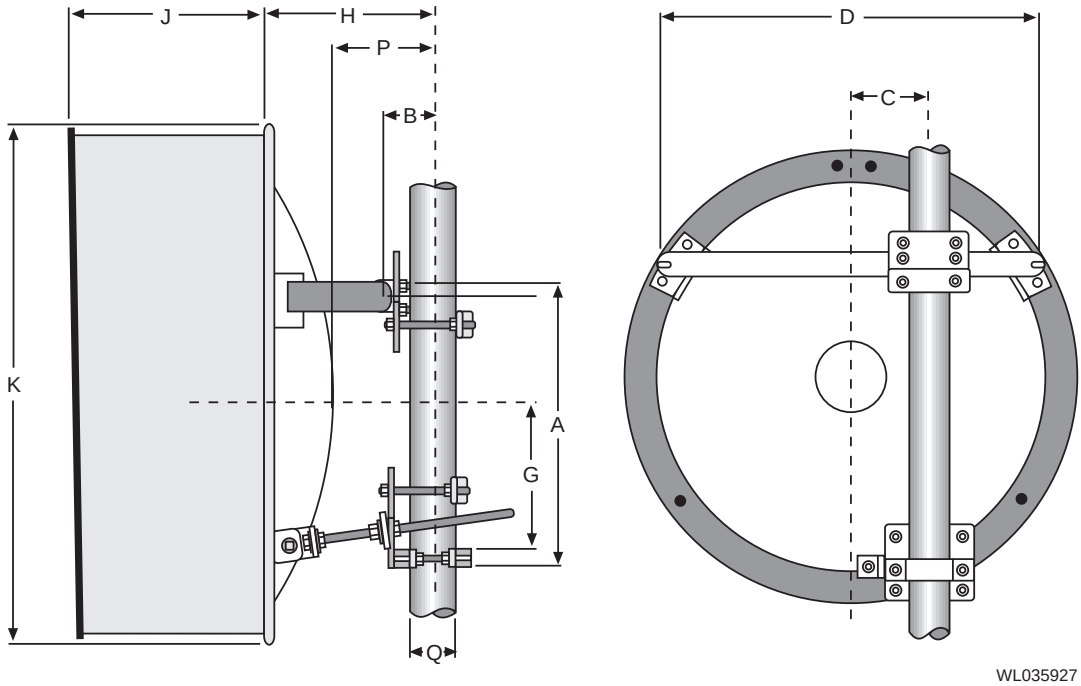
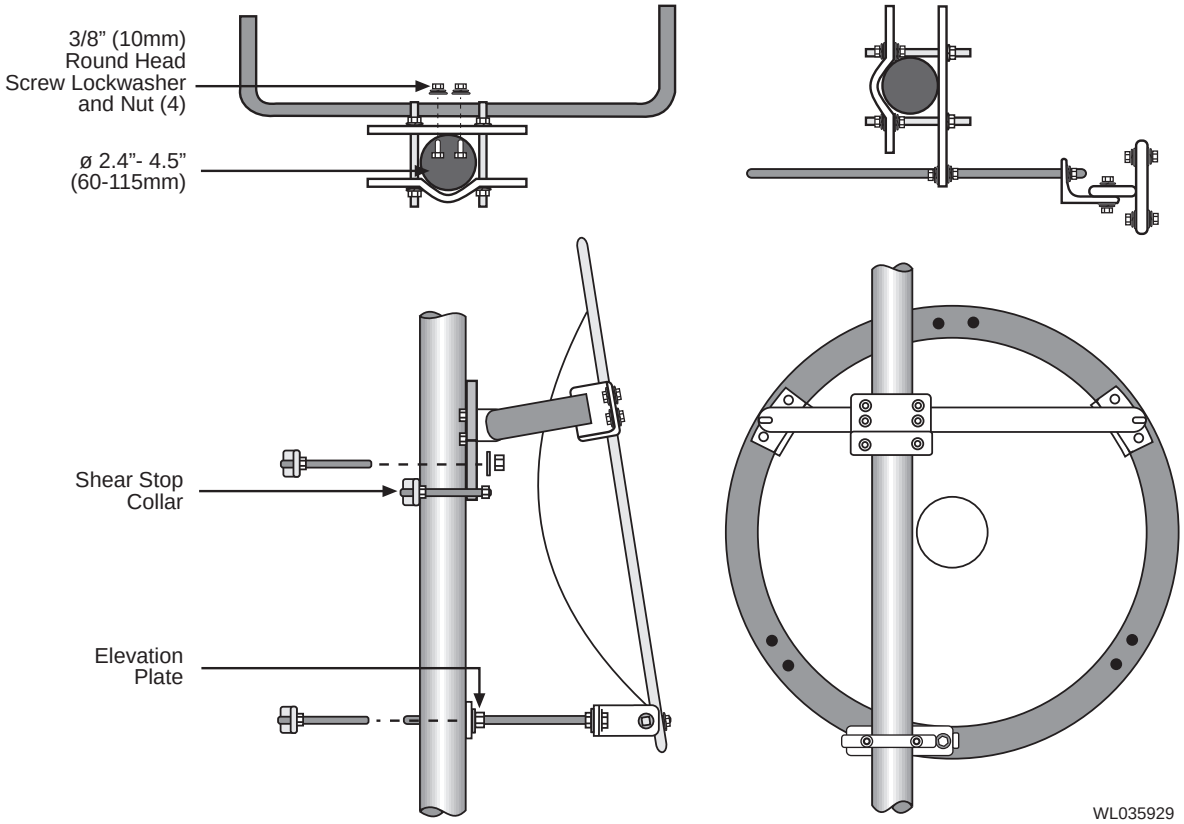


Table B.1 - Two Foot Diameter Antenna Dimensions

Dimension	Description	2ft. (0.6mm) Antenna	2.5ft. (0.8mm) Antenna
A	Mount Length	22.4" (570mm)	27.9" (710mm)
B	Pivot Point	4.2" (105mm)	4.2" (105mm)
C	Center Line Offset	5.0" (125mm)	5.0" (125mm)
D	Horizontal Mount Strut	N/A	N/A
E	Pvt. Pt. Vertical Mount Strut	8.8" (175mm)	8.3" (210mm)
F	Horizontal Fixed Side Strut	N/A	N/A
G	Antenna Centerline	13.6" (345mm)	16.8" (425mm)
H	Reflector Length	12.3" (315mm)	14.3" (360mm)
J	Short Shroud Length	12.5" (320mm)	14.3" (360mm)
	Long Shroud Length	15.1" (385mm)	15.8" (350mm)
K	Antenna Diameter	29.0" (735mm)	35" (890mm)
L	Radome Length (Standard)	13.4" (340mm)	16.8" (425mm)
N	Mount Strut Depth	N/A	N/A
P	Reflector Vertex	7.6" (190mm)	8.7" (220mm)
Q	Mast Diameter	2.4" 4.5" (60-115mm)	2.4" 4.5" (60-115mm)
	Azimuth Adjustable Range	+/- 5°	+/- 5°
	Elevation Adjustment Ranges	+50° /-5°	+50° /-5°

WL035928

Figure B.2 - Mount Configuration



Unpacking and Preparation

1. Carefully unpack the reflector, mount, shroud (if any), radome (if any) and feed from the crate. For correct antenna performance, handle all components with care. Set aside the packaged feed and any shroud or radome. See Figures B.3 through B.6.

Caution: The reflector spinning has been formed to a very close-toleranced parabolic shape. Careful handling and assembly is required to avoid denting or deforming the reflector, which would degrade the antenna's performance.

2. Inspect for any damaged parts. See Tables B.2a-B.2d for an inventory of the parts and hardware shipped with the antenna.

Shroud Attachment

Attach the shroud assembly that is provided with high-performance antennas to the reflector. The installation procedure is covered by another instruction sheet supplied with the shroud.

Note: Some models have the shroud factory installed.

Table B.2a- Contents List, Reflector Assembly

Part Number	Description	Qty.	Check
23832-3	Refl. Assy. SE 2' Open-2A	1	

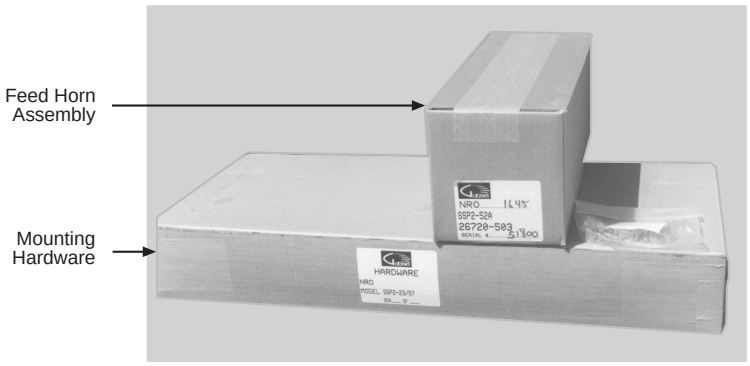
WL035930

Table B.2b- Contents List, Feed Assembly

Part Number	Description	Qty.
25736-1	Feed Mounting Clamp	4
26716-503	Feed S/A 5.250-5.850	1
AD T5170	RR Track Butyl 3/16x7//8x40'DSS170	1
FW X0050	Washer 1/4" W 0.734x.065	4
II-221	Installation Instructions	1
NU X0060	Hex Nut	4
SW X0050	Split Washer	4

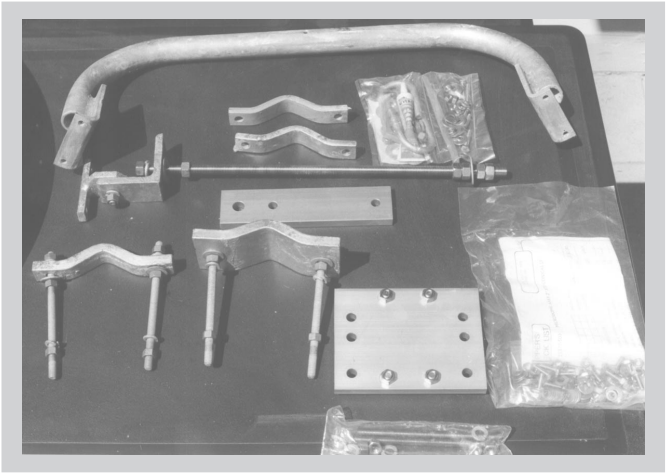
WL035931

Figure B.3 - Mounting Hardware Packed



WL035932

Figure B.4 - Mounting Hardware Unpacked



WL035933

Table B.2c- Contents List, Mount Assembly

Part Number	Description	Qty
25675-501	**Horizontal Pipe Assembly**	1
25725-505	**Mast Clamping Assembly**	1
22316-2	Threaded Rod Galv	2
24525-5	Mast Clamp Half 1"	1
FW G0120	Washer Galv	2
NU G0121	Washer Galv	6
SW G0090	Split Washer Galv	4
23725-509	**Mast Clamping Assy**	1
22316-2	Threaded Rod Galv	2
24525-8	Mast Clamp Half	1
FW G0120	Washer Galv	2
NU G0120	Hex Nut	6
SW G0090	Split Washer Galv	4
25727-504	**Shear Stop Assy**	1
23285-3	Threaded Rod	2
24525-2	AZ Clamp Half-Short	2
NU X0130	Hex Nut	6
SW G0090	Split Washer Galv	4
25730-503	**Elevation Rod Assy**	1
23611-6	Elevation Rod	1
23842-501	Elevation Rod Brkt Assy	1
25666-1	Elevation Support Angle	1
BO G0080	Hex Bolt Galv	1
FW G0120	Washer Galv	1
FW G0140	Washer Galv	1
NU G0120	Hex Nut Galv	1
NU X0195	Hex Nut SS	4
SW G0090	Split Washer Galv	1
SW G0100	Split Washer Galv	1

WL035934

Table B.2d- Contents List, Mount Assembly

Part Number	Description	Qty.
25733-501	Mount Hardware Kit	1
10749-54	U-Bolt Galv.	2
23561-2	Spacer	2
AD M0005	Anti-Seize 1 oz. Tube	1
BO X0921	Hex Bolt	6
FW G0120	Washer	4
FW X00050	Washer	12
NU G0120	Hex Nut Galv.	4
NU X0060	Hex Nut Galv.	6
PN G0090	Palnut	4
SW X0050	Split Washer Galv.	6
26590-1	Elevation Plate	1
26591-1	Azimuth Plate	1
BO X1186	RND HD Screw	4
NU X0130	Hex Nut	4
SW X0080	Split Washer	4
II-232	Installation Instructions	1

WL035935

Figure B.5 - Parabolic Reflector

WL035936

Figure B.6 - Unpacking the Radome

WL035937

Mount Assembly and Attachment

1. The reflector should be placed face down, either on the shroud or blocked up on packing lumber. Locate the Top and Bottom markings stenciled onto the back of the reflector.
2. Loosely attach Top Support Angles to the Horizontal Tube Assembly as shown in Figure B.7 and B.8.
3. For desired mount configuration (refer to Figure B.2), attach the Vertical Tube Assembly to the Horizontal Tube Assembly as shown in Figure B.7 and B.8.
4. Verify proper assembly of the elevation rod hardware as shown in Figure B.9. Remove outer hardware and insert rod through elevation plate.

Important: For elevation angles grater than ±20°, Beveled Washers, shown in Figure B.9, must be used. However, beveled washers may be used for elevation angles greater than ±10°.

5. Carefully place mount assembly onto antenna backring, taking care not to damage the reflector. Loosely fasten the Top Support Angles and the Elevation Support Angle to the antenna backring using 1/2" hardware as shown in Figure B.7.
6. Verify alignment of the Vertical Assembly with the vertical axis of the reflector and secure the Top Support Angles and the Elevation Support Angle to the ring.

Figure B.7 - Antenna Mount Assembly

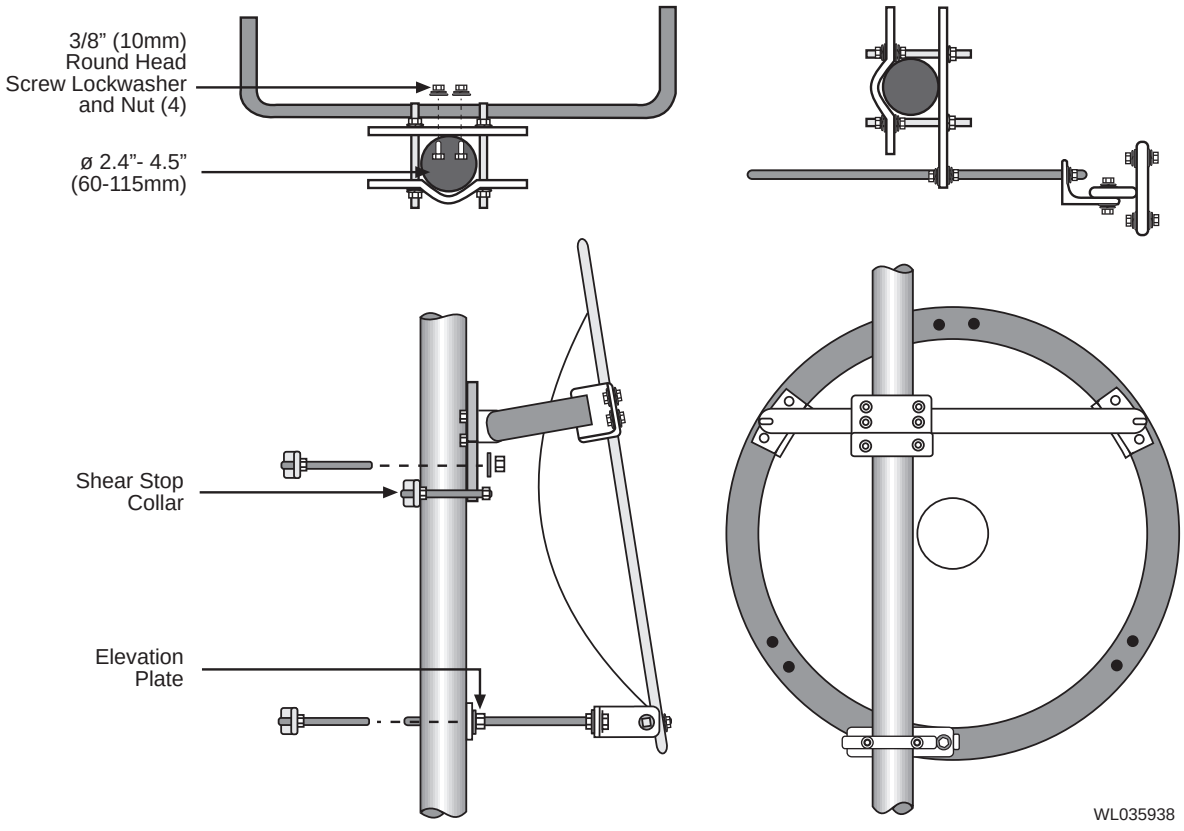
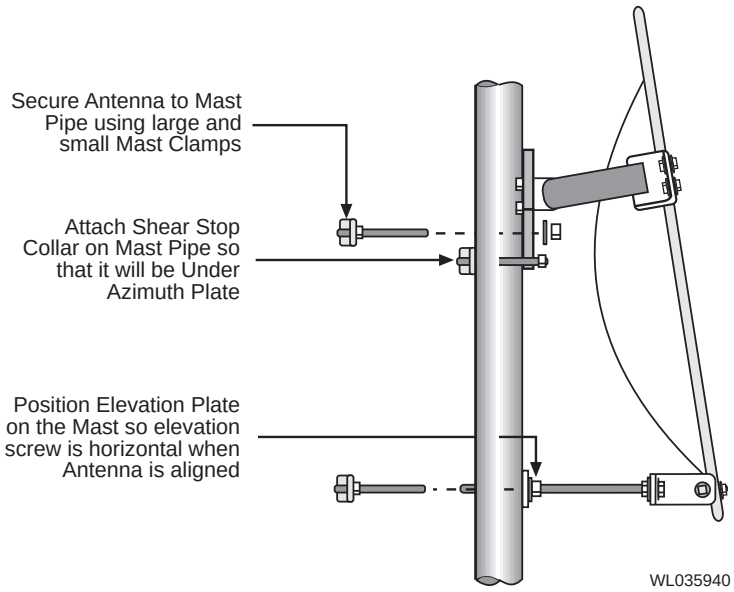


Figure B.8 - Antenna Mount Assembly

WL035939

Figure B.9 - Elevation Rod Assembly



WL035940

Feed Installation

Following the instructions provided with the feed assembly, install the feed in the reflector. Refer to Figures B.10 through B.14.

Figure B.10 - Feed Horn Installation

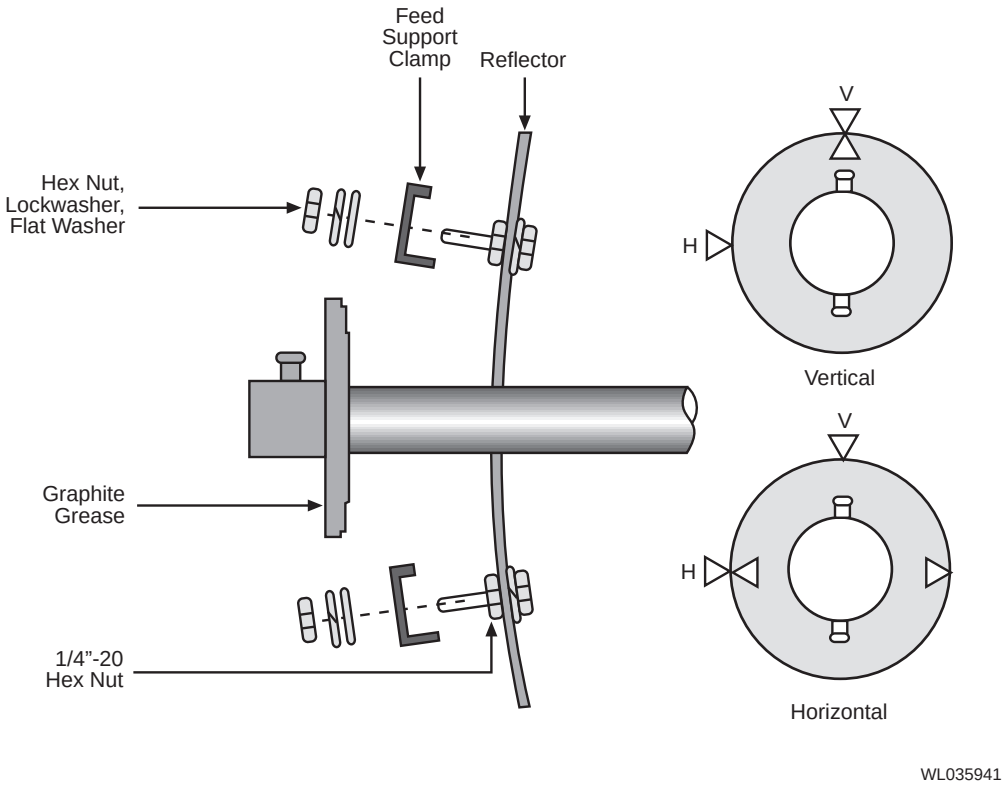


Figure B.11 - Feed Horn Polarization Markings

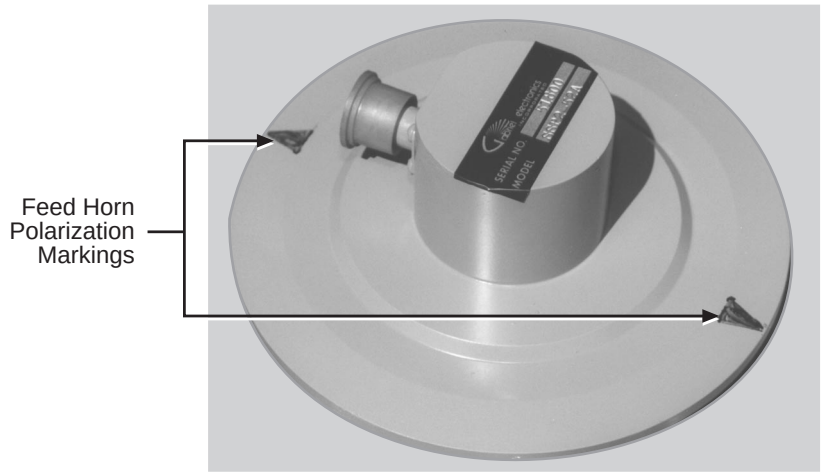


Figure B.12 - Parabola Rear View Showing Polarization Reference Markers

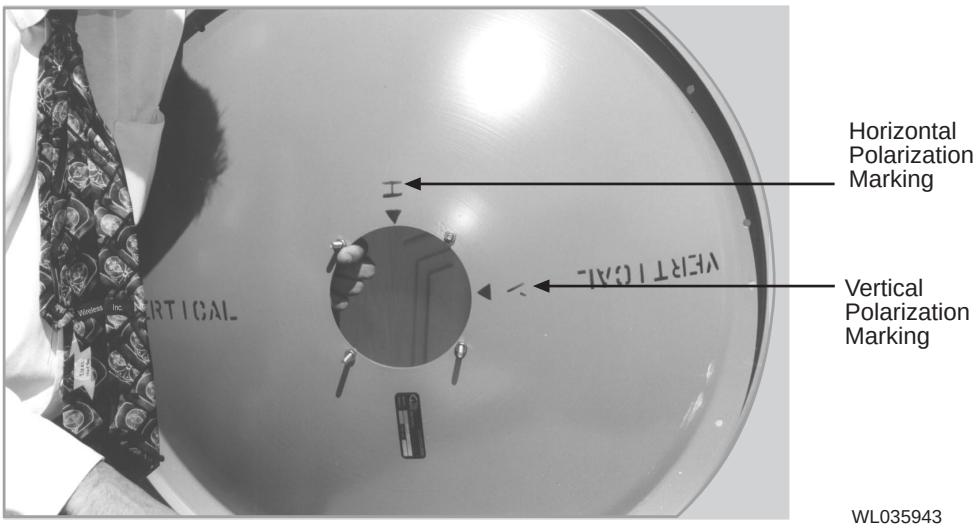
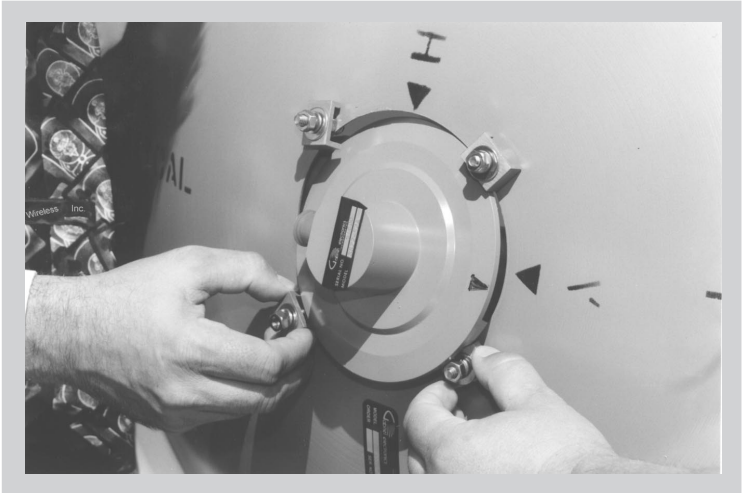


Figure B.13 - Feed Horn Installation



WL035944

Figure B.14 - Feed Horn Installation for Vertical Polarized Operation

WL035945

Radome Installation

Molded Radomes (normally optional on standard antennas) should be installed following the instructions provided.

Azimuth Adjustment Clamp/Shear Stop Installation

1. Verify proper assembly of the azimuth clamp/shear stop clamp as shown in Figure B.15 and B.16. Securely attach the shear stop clamp to the mast pipe as shown, orienting it as nearly as possible to the antenna boresight direction, and square to the mast axis. Note that the shear stop clamp used on the two foot antennas also provides the azimuth adjustment.
2. Refer to Figure B.1 for the position of the antenna centerline relative to the shear stop clamp. The clamp must be mounted to provide support during installation and azimuth adjustment.

Figure B.15 - Azimuth Clamp/Shear Stop Assembly

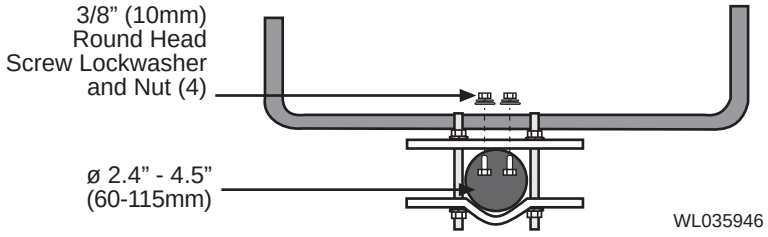


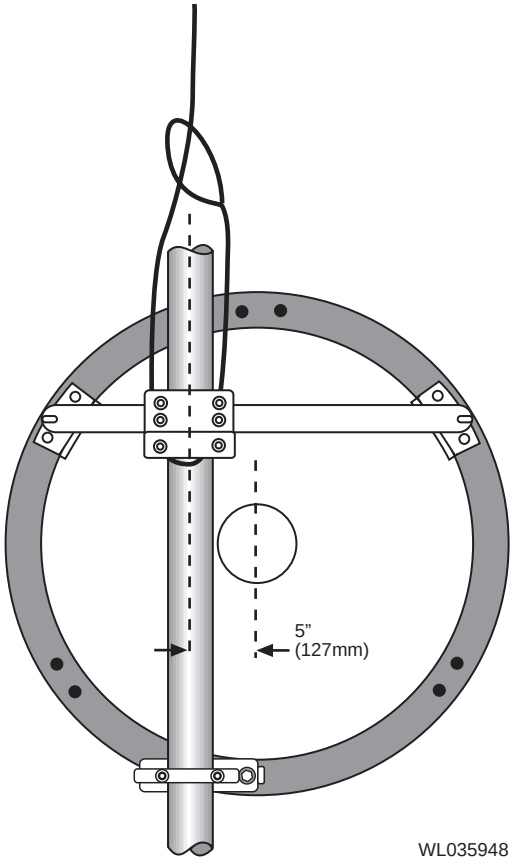
Figure B.16- Azimuth Adjustment Clamp Assembly

WL035947

Antenna Hoisting and Installation

1. Attach a hoist strap around the vertical assembly or the horizontal assembly as shown in Figure B.17. Do not hoist by the elevation rod. Make sure that the vertical assembly is unobstructed where it will mount against the mast pipe.
2. Attach tag lines and carefully lift the antenna into position, resting the vertical assembly on the shear stop clamp.
3. Fasten the mount to the mast pipe with 1/2” U-bolts. The antenna must be free to rotate during azimuth adjustment, so tighten only enough to close the gap between the mast and vertical channel. Do not leave the antenna loose for any extended period of time, i.e. overnight.

Figure B.17- Hoisting the Antenna



General Antenna Alignment Procedures

Normally the antenna is aligned by performing azimuth and elevation adjustments and elevation adjustments as necessary until the peak signal is obtained. It may be helpful to re-peak one adjustment before finalizing or locking down the other. See Figure B.18.

Warning: Damage to the antenna can occur if azimuth or elevation adjustments are attempted without loosening the proper connections as described in the following steps.

Azimuth Adjustment

1. Be sure the mast pipe U-bolts are just loose enough to allow mount rotation while maintaining complete contact between the mount and the mast pipe.
2. Turn the long stainless steel azimuth screws against the mounting channel. By alternately turning one azimuth adjustment screw out and the other in, the antenna can be rotated to the desired azimuth angle. Approximately 1 turn changes the azimuth direction by 1°. Avoid adjusting the antenna beyond the ±5° provided by the azimuth clamp as this can damage the adjusting hardware. Fasten the antenna to the mast pipe and reposition the clamp if needed.

Note: By securing the mount to the mast pipe and realigning the azimuth clamp with the antenna boresight, more reliable and precise azimuth adjustments can be achieved.

After all adjustments are made, tighten both of the azimuth screws against the channel and secure with the lock nuts provided.

3. Tighten the mast pipe U-bolts while maintaining the peak signal by alternating from left to right in 1/4 turn intervals.

Figure B.18 - Antenna Alignment using RSL Output while Adjusting the Antenna

WL035949

Elevation Adjustment

1. Insure that both of the bolts connecting the mount to the Top Support Angles and the pivoting Elevation Angle (refer to Figures B.7 and B.9) are just loose enough to allow resisted rotation. See Figure B.18.
2. Back the outer nuts on the elevation rod away from the bottom mount plate to allow some fine adjustment range.
3. Turn the inside nut (with flat washer) on the elevation rod to adjust the elevation angle. Approximately 5 turns changes the elevation by 1°. Remember, for elevation greater than 20°, install the two beveled washers as shown in Figure B.9.
4. After all adjustments are made, lock the nut against the bottom mount plate. Tighten the angle pivot bolt and support bracket bolts.

Important: Be sure to tighten all hardware after final adjustments and insure that split lockwashers, palnuts, or jam nuts are used where provided.

Inspection and Maintenance

1. Before leaving the installation, check that all hardware on the mount, shroud, radome, and feed is tight and that nuts are locked in place.
2. Inspection of the antenna should be performed at lease once a year to check its condition and to insure safe operation and maintenance. Qualified personnel, knowledgeable and experienced in antenna installations, are required for this inspection.

Supplemental Information

Table B.3 is provided for installers unfamiliar with adequate nut tightening procedures for use on stainless steel bolts, U-bolts, galvanized bolts or any bolts without the ASTM-"A325" marking on the head. Disregard these recommendations when specific tightening requirements are given.

Note: It is not recommended to reuse a palnut that has already been fully tightened or deformed in any way. It should be replaced by a new palnut.

Weather Proofing the Type N Female Connector on Feeds

Remove the protective cover from the end of the feed and mate the connectors, screwing the male connector firmly onto the feed.

Important: After connecting the coaxial cable, wrap the Type N connector with the gray butyl rubber, squeezing it firmly around all joints to make a continuous seal. Finish the weatherproofing by wrapping the butyl rubber with several layers of black PVC tape (not supplied).

Table B.3 - Nut Tightening Procedures

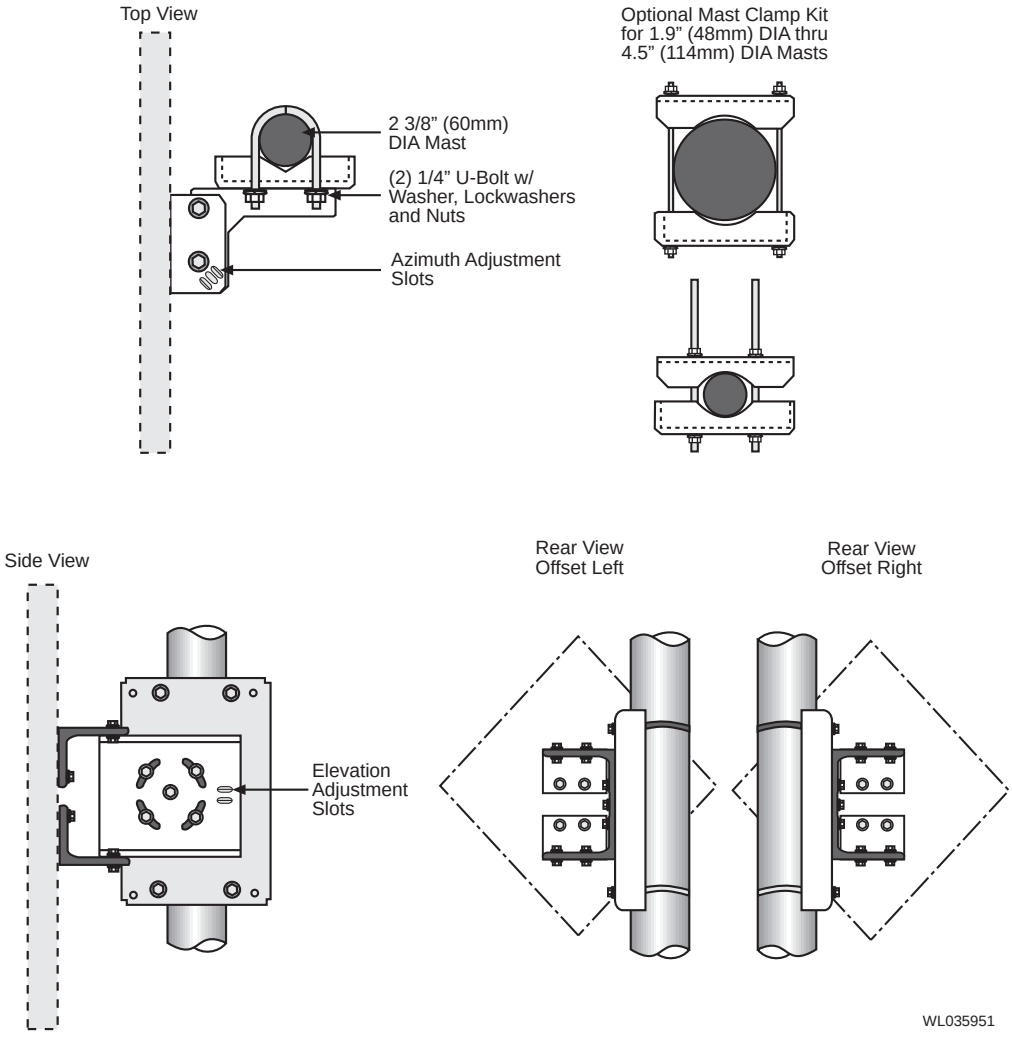
Nominal Bolt Size	Nut Torque	Palnut Locknut Torque
1/4 "	50 in./lb.	40 in./lb.
5/16 "	102 in./lb.	60 in./lb.
3/8 "	15 ft./lb.	85 in./lb.
7/16 "	24 ft./lb.	15 ft./lb.
1/2 "	37 ft./lb.	16 ft./lb.
5/8 "	74 ft./lb.	28 ft./lb.
3/4"	175 ft./lb.	44 ft./lb.
7/8 "	212 ft./lb.	51 ft./lb.
1 "	318 ft./lb.	59 ft./lb.

WL035950

Appendix C Adjustable Panel Antenna Mount

Assemble the panel mount according to Figure C.1. Orient Antenna using instructions supplied with the antenna. Antenna models used with this mount may be circular, square or diamond shaped. To change the offset of the antenna, unbolt the mount from the antenna, invert the mount and reattach to the antenna.

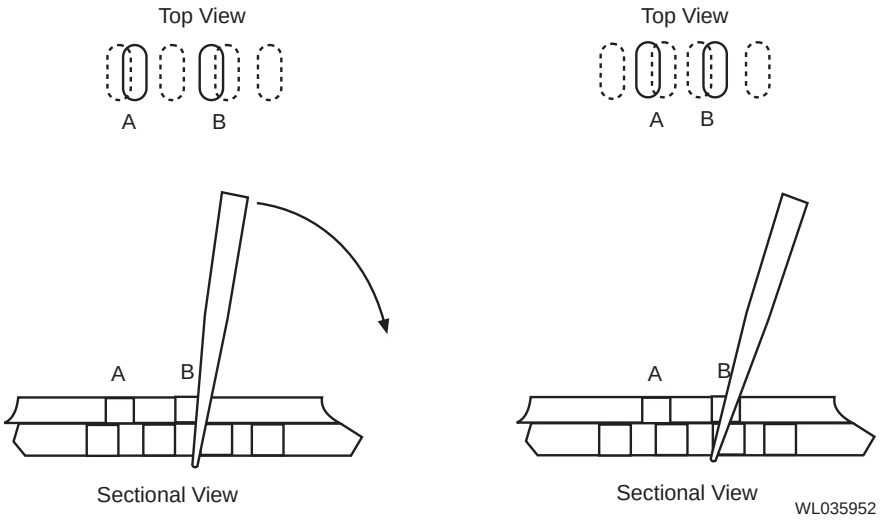
Figure C.1 - Antenna Mount



Loosen the azimuth or elevation locking hardware while maintaining sufficient friction to prevent unwanted slippage. See Figure C.2.

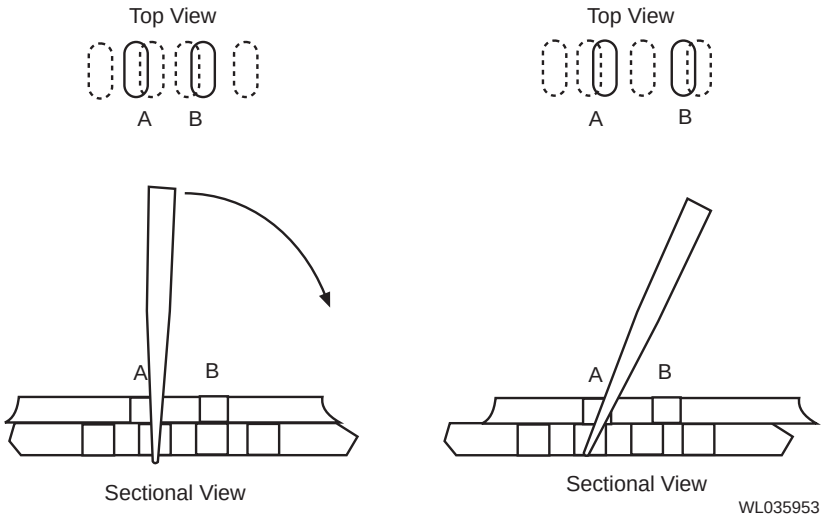
Insert flat blade screw driver into slot “B” and pry in direction of the arrow or into slot “A” and pry in opposite direction, as shown in Figure C.2. Stop prying approximately as new overlapping slot in bottom plate becomes sufficiently visible when viewed through slot “A”.

Figure C.2 - Azimuth and Elevation Planning



Insert Screw Driver into slot “A” and pry in direction of the arrow, as shown in Figure C.3. Stop prying approximately as new slot in bottom plate becomes sufficiently visible when viewed through slot “B”. Continue alternating slots and prying in either direction until desired alignment is obtained. Lock down hardware securely before leaving the site.

Figure C.3- Azimuth and Elevation Planning



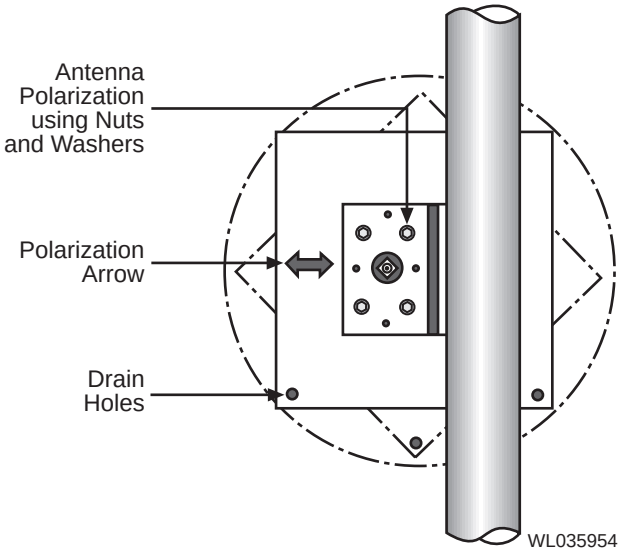
Attach the antenna to the mount as shown in Figure C.4. For antenna polarization, assemble the antenna to the mount using four sets of nuts and washers after desired polarization is selected. In horizontal polarization the arrow sticker should be pointed in a horizontal direction. Likewise, in vertical polarization the arrow sticker should be pointed in a vertical position.

Important: After cable connection is completed, wrap connection with Butyl or other waterproof tape, supplied by the customer.

Each panel antenna has four factory sealed drain holes located on the back of the antenna. After orienting the antenna to its proper polarization, the lower most sealed drain hole(s) must be punctured with a pointed tool. See Figure C.4.

Caution: Do not allow the tool to protrude into the drain hole more than 1/4" (7mm) or damage to the antenna may result.

Figure C.4 - Flat Panel Antenna



Aim the antenna according to Figure C.5. Orient the antenna using instructions supplied with the antenna. Antenna models used with this mount may be circular, square or diamond shaped. To change the offset, unbolt the mount from the antenna, then invert the mount and reattach in the antenna.

Figure C.5 - Adjustable Panel Antenna Mount