

3.0 Equipment Installation and Commissioning

3.1 System Planning, Analysis and Implementation

System planning is critical to the successful installation, operation and proper performance of any N2-Link communication system. This section of the manual deals with many of the common issues associated with point-to-point, line-of-sight microwave communication systems to include RF path analysis, antenna selection and installation, RF transmission line selection and installation, and N2-Link parameter adjustments.

3.2 Installation

The N2-Link 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-Link will be placed prior to commencement of any installation activity. Installation considerations for each component in general are as follows:
 - a. **Terminal Unit** - Make certain that AC is powered by means of a wall transformer and it is located in proximity to an AC outlet. It must be close enough to the DS1/E1 data cabling as well as grounded using the M5 ground screw on the face of the terminal unit. It must be within 650 cable feet to the outdoor RF unit.
 - b. **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 frequency output power according to section 4.2.1.
 - c. **Antenna Unit** - Refer to Appendix C for detailed antenna installation instructions.
2. Inventory your equipment and installation materials.

To install one(1) terminal you should have the following:

Item	Part Number	Description	Qty
1a	251-11019-XXX	Outdoor Unit 5.250 - 5.350 GHz DS1 rate	1
1b	251-11019-XXX	Outdoor Unit 5.250 - 5.350 GHz E1 rate 75 Ohm	1
1c	251-11019-XXX	Outdoor Unit 5.250 - 5.350 GHz E1 rate 120 Ohm	1
1d	251-11019-XXX	Outdoor Unit 5.725 - 5.825 GHz DS1 rate	1
1e	251-11019-XXX	Outdoor Unit 5.725 - 5.825 GHz E1 rate 75 Ohm	1
1f	251-11019-XXX	Outdoor Unit 5.725 - 5.825 GHz E1 rate 120 Ohm	1
2		Antenna Assembly (see Appendix C)	1
2a	251-11026-XXX	Terminal Unit, DS1 Interface	1
2b	251-11026-XXX	Terminal Unit, E1, 75 Ohm Interface	1
2c	251-11026-XXX	Terminal Unit E1, 120 Ohm Interface	1
3		Cable, Twin Axial	XX
4		ODU - Antenna Cable	1
5	027-351413-001	Conn, Cable, Twinax, Amphenol	5
6	005-303410-025	Screw, M10 x 25mm, HexHd, SS	4
7	005-303410-120	Screw, M10 x 120mm, HexHd, SS	4
8	005-310410-001	Washer, Flat M10, SS	4
9	005-311410-001	Washer, M10 Split Lock, SS	4
10	005-320410-001	Nut, M10, Hex, SS	4
11	007-390008-001	Seal, Coax, 10" x 1/2" x 3/32"	3
12	008-100028-001	Pole Mount Adapter, Bottom	1
13	008-100029-001	Pole Mount Adapter, Top	1
14	008-100030-001	Pole Mount Adapter, Clamp	2
15	910-410001-001	Converter, AC/DC 110/220V	1
16		Rack mount adaptor, short	2
17		Rack mount adaptor, long	1

3. The following tools should be on hand:

Tool	Purpose
Phillips Screwdriver	Rack mount the IDU
Wire Stripper/Cutter	General wire stripping and cutting purposes
Crimp Tool	Installing the twin-axial connector to the twin-axial cable
Hand-Held Voltmeter (VOM) with standard probes	Confirm magnitude, polarity, continuity

3.3 Desktop Mounting

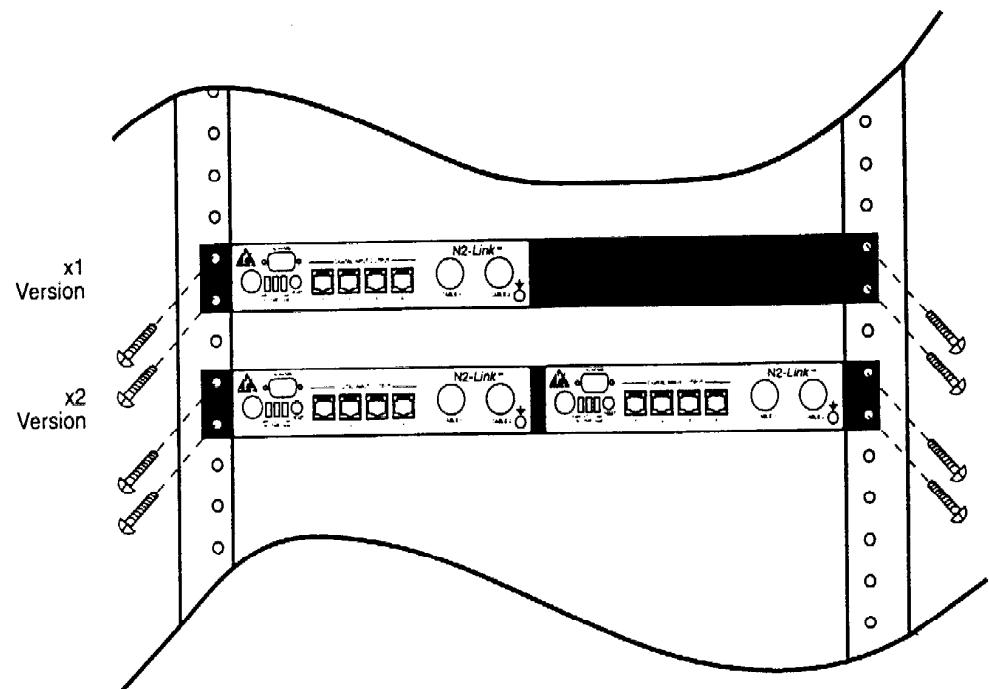
The N2-Link interface panel should be located indoors on a flat surface such as a desk or table top. The unit should be within six feet of an AC outlet, accessible to the DS1/E1 signals and within xx feet to the outdoor RF unit. All connections to the interface unit are front accessible.

3.4 Rack Mounting

Using the appropriate rack mounting brackets as shown in Figure 3.2, the N2-Link Terminal Unit can be mounted in either a standard 19-inch or 23-inch EIA rack in accordance with the standards and practices set forth in ANSI/EIA-310 (Rack, Panels, and Associated Equipment). Two side by side Terminal Units occupy one standard EIA rack mounting space (1 RMS). Owing to its small size and complete front access, the Terminal Units can also be mounted in a variety of electronic cabinets and enclosures.

As the majority of telecommunication equipment racks are designed to utilize either 10-24, 12-32 or M5 mounting screws, the N2-Link mounting brackets' rack mount holes will accommodate all of these sizes. Figure 3.1 shows the rack mount configuration.

Figure 3.1 - N2-Link Rack Mount



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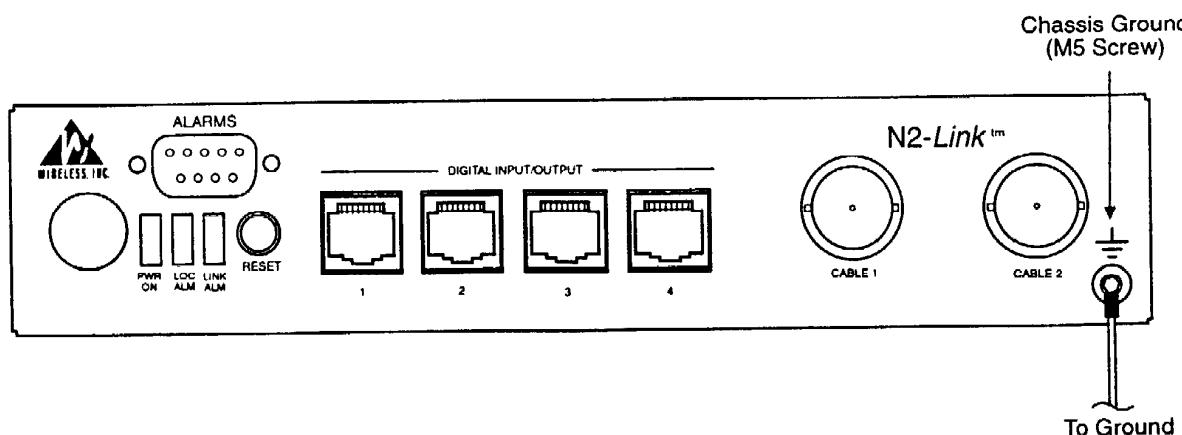
3.5 Grounding the Terminal Unit

Locate the M5 ground screw and associated washers on the front of the Terminal Unit and attach a wire from an external ground source as shown in Figure 3.2. Do not assume that the Terminal Unit is properly or sufficiently grounded through its mounting brackets even when properly mounted in a grounded equipment rack.



Appropriate grounding of the Terminal Unit is required for proper operation of the N2-Link, providing both lightning protection and noise suppression. Grounding of the Terminal Unit, to include the application of electrical surge protectors (if necessary and/or required), should always be accomplished in accordance with local codes and practices.

Figure 3.2 - N2-Link Ground Attachment (showing a 4xDS1 option)



3.6 Twin-axial Cable Preparation

Prepare the twin-axial cables 1 and 2 according to the termination instructions provided in Figure 3.3. The maximum cable length between the Terminal and Outdoor Unit is 655 feet.

3.7 DS1/E1 Data Connectors

Connect the appropriate DS1/E1 Data connectors given the site specific configuration.

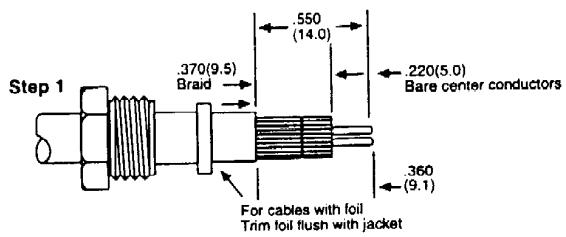
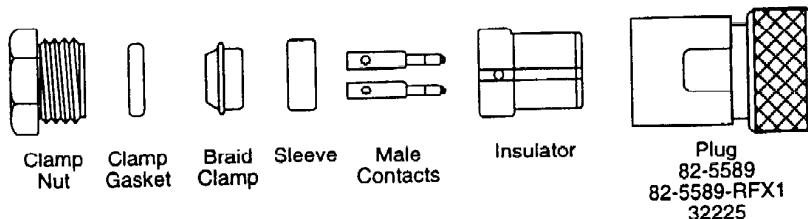
The N2-Link is equipped with an RJ-48C jack connector for balanced 100-ohm DSX-1 and 120-ohm E1 interfaces, and 75-ohm BNC(f) connectors for an unbalanced E1 interface. Please refer to Appendix X for RJ-48C connector pin-out information.

When making unbalanced E1 connections to the N2-Link, the In BNC connector refers to the E1 data input to the Terminal Unit, while the Out BNC connector refers to the E1 data output from the Terminal Unit. For DS1/E1 balanced data connections, Pins 1 and 2 refer to the DS1 data input to the Terminal Unit, while pins 5 and 4 refer to the DS1 data output from the Terminal Unit.

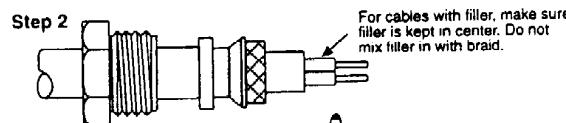


The E1 BNC connectors can be AC coupled to chassis ground or be directly connected to chassis ground. A customer accessible Dip-switch on the front panel of the Terminal Unit (See Figure 3.X) allows customer selection of AC or DC ground connection. When a switch setting is selected for a specific grounding configuration, both the Input and Output E1 BNC connectors are effected. The N2-Link is shipped with the E1 BNC connectors in the DC grounding position. Refer to Appendix X for ground selection information.

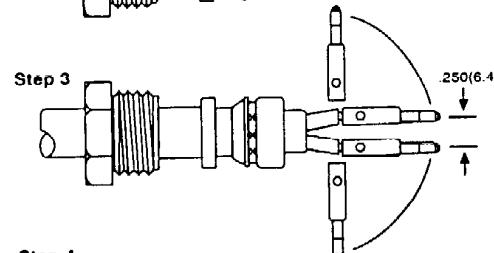
Figure 3.3 -



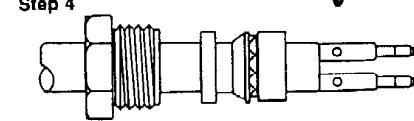
Step 1 Slide clamp nut and clamp gasket over cable end groove in clamp gasket faces toward connector body. Strip cable to dimensions shown. **Important:** Do not nick insulation around center conductors. For solid core cables, lay braid back out of the way while trimming core; then lay braid down again to facilitate Step 2.



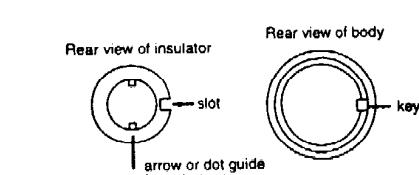
Step 2 Slice braid clamp over braid until inner shoulder butts against jacket. (Note: Sharp edge of braid clamp goes toward V-groove in clamp gasket.) Fold braid back evenly over braid clamp as shown.



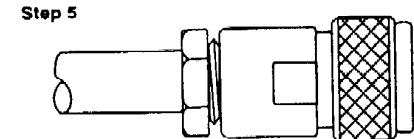
Step 3 Slide sleeve over cable so that braid bottoms inside sleeve solder contacts to conductors, using minimum heat. Remove any excess solder. Alternative method: Crimp center contacts using CTL Series tool number CTL-4 cavities B&C, or by using Die Set 227-1414 cavities B&C in tool frame 227-1414 or in Pneumatic Tool 227-50. Bend conductors and contacts out and back to obtain 250(6.4) spacing between contacts.



Step 4 Insert contacts into rear of insulation. (Note: for Belden 9207 and similar solid core cables, contact on bare copper conductor [or for Belden 9227 and similar solid core cable, contact on bare copper conductor air dielectric cables the contact on white insulated conductor] goes into the hole with the dot next to it.) Slide insulator to butt against sleeve as shown.



Step 5 Insert assembly into connector body, aligning slot of insulator with polarizing key in body. Tighten clamp nut to 50 in lbs. (5.7 N.m) torque. Do not twist connector body.



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3.8 Commissioning

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

Reference Table 3.1.

3.8.1 Configuring N2-Link System Antennas

The antennas used on an N2-Link 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 3.1 - 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?	
Is the Power LED Green?	

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3.8.2 Aligning the N2-Link System Antennas

With the N2-Link 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-Link radio system, and should only be accomplished by experienced professionals.

The N2-Link 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 TBD VDC to TBD VDC, serving as a receive signal strength indicator (RSSI). The stronger the receive signal, the higher the RSSI voltage. The N2-Link's receiver automatically adjusts to the level of the incoming RF signal by varying its automatic gain control (AGC) level.

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 3.2, the first side lobe will generally be located at an angle slightly less than twice the antenna beamwidth.

Following the coarse 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-Link 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 3.2 - 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				
6-foot parabolic				
8-foot parabolic				

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4.0 Maintenance and Troubleshooting

The N2-Link contains static sensitive components, and has no user-serviceable parts. Warranty will be voided if a non-Wireless, Inc. employee, without the written authorization of Wireless, Inc., opens the N2-Link enclosure.

4.1 N2-Link Maintenance

The N2-Link 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 Power Supply Input Voltage

As this item is under the control of the user, Wireless' Customer Service recommends that the input voltage to the N2-Link be checked on a monthly basis. Degradation or variation of the input voltage could indicate power supply problems, grounding problems, wiring problems, load problems, etc.

4.1.2 RSSI Voltage

The Wireless Customer Service department recommends a monthly check of the N2-Link'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

As noted in the **System Planning, Analysis and Implementation** section of this manual, 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. These items will be dealt with later in this section.

4.2.1 N2-Link Equipment Issues

Frequency Selection

1. Verify the transmit/receive frequency selection for each N2-Link radio is set appropriately, and that a "matched pair" of radios has been selected for the system. Each N2-Link terminal can be set to the frequencies listed in Table 4.1. The Dip switch is located within the ODU housing as shown in Figure 4.1.

Output Power Selection

TBD

Table 4.1 -

SW2					Ch #	Tx Lo (Rx Hi)	Tx Hi (Rx Lo)
5	4	3	2	1			
0	0	0	0	0	1	5.26080	5.73568
0	0	1	0	0	2	5.27104	5.74592
0	1	0	0	0	3	5.28128	5.75616
0	1	1	0	0	4	5.29152	5.76640
1	0	0	0	0	5	5.30176	5.77664
1	0	1	0	0	6	5.31200	5.78688
1	1	0	0	0	7	5.32224	5.79712
1	1	1	0	0	8	5.33248	5.80736

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Figure 4.1 -

TBD

OPV
Picture showing
dip switch

4.3 Replacing Failed Hardware

4.4 Documentation Updates

4.5 Before Seeking Further Assistance

4.6 Technical Support

In the event that a problem still exists after troubleshooting the system and further technical assistance is required, contact the Wireless, Inc. Customer Service Department at (650) 595-3300 or through the Wireless, Inc. website at www.wire-less-inc.com. Should return of the unit become necessary a Return Materials Authorization Number will be issued for the unit by a service technician. Please note this number on the outside of the shipping container and in all correspondence regarding the return.

The return address is:

Wireless, Inc.
19 Davis Drive
Belmont, CA 94002-3001
Attn: Customer Service
RMA no. _____

Appendix A Connector Pin-out Information

TBD

Appendix B Network Management

TBD

Appendix C Antenna Mounting Instructions

Key Features

- Ease of installation, requiring only one person
- Optional molded ABS randomes for standard parabolic antennas
- Rugged and light weight case aluminum mount with coarse and fine adjustment for both azimuth and elevation
- Left or right pole mountable
- Compact size, Antennas are designed to minimize size yet keep high performance
- All materials are of coated aluminum, hot dipped galvanized steel and stainless steel for corrosion resistance.

Mechanical Specifications

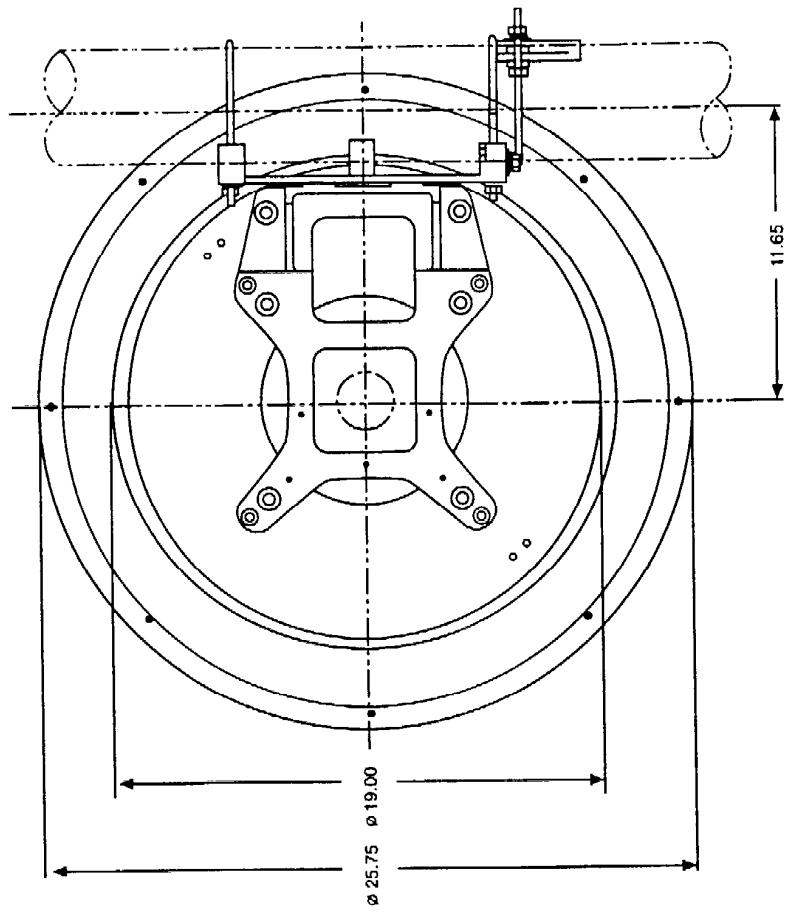
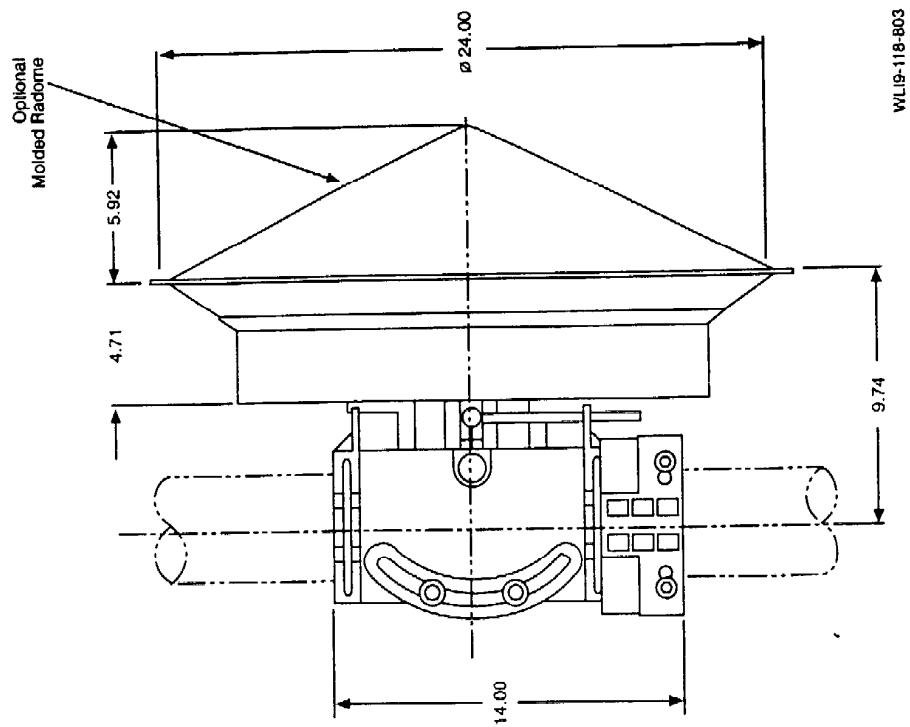
- Elevation Range:
Coarse: $\pm 25^\circ$
Fine: $\pm 10^\circ$
- Azimuth Range:
Coarse: $\pm 180^\circ$
Fine: $\pm 10^\circ$
- Mounts to 3-1/2" to 4-1/2" outside diameter vertical pipemast
- Weight (including mount):
Antenna Size: 2 ft. (60 cm)
SP Series: 22 lb. (9.9 kg)
SP w/Randome: 25 lb. (11.25 kg)

60 cm/2 ft. Antenna Mounting Procedure

The following describes the general installation practices that apply to the antenna mount and antenna assembly.

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

Figure C.1 -



Unpacking and Preparation

Carefully unpack the antenna assembly and mount parts from its shipping carton.

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

List of Contents

Refer to Table C.1.

Antenna Mount Assembly (100654)

Note: Refer to Figure C.2 while performing this procedure.

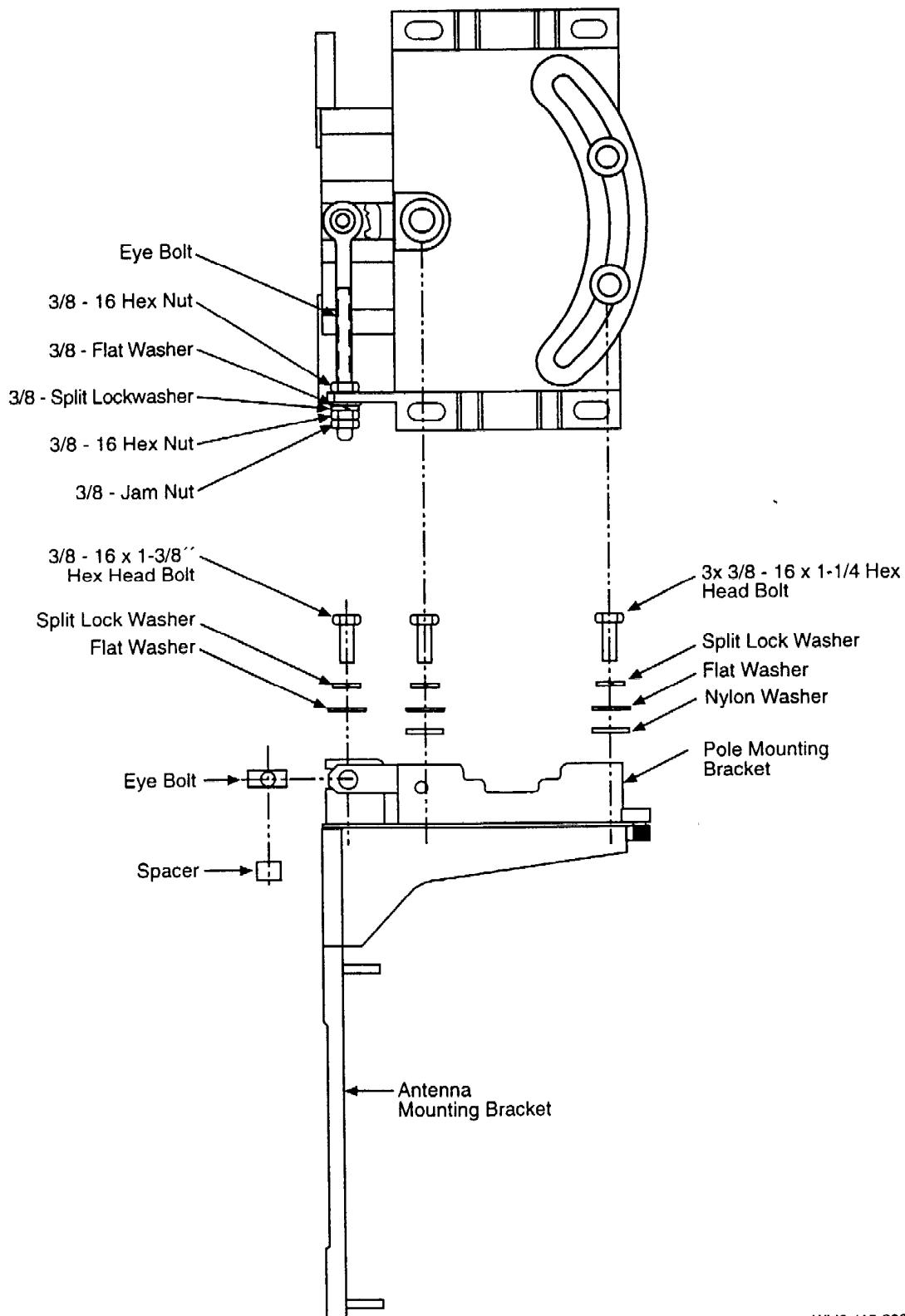
1. Attach the eye bolt to the pole mounting bracket with a 3/8-16 x 1-3/8 long hex head bolt, flat and split lock washer. Install one 3/8-16 nut onto eye bolt approximately 2" up on threads.
2. Assemble the pole mounting bracket and antenna mounting bracket (pay special attention to the insert end of the eye bolt into the clearance hole on the antenna mounting bracket prior to assembly). Align the holes of the two brackets and attach with the three 3/8-16 x 1-1/4 long hex head bolts, nylon, flat and split lockwashers; hand tighten.

Table C.1 - Contents List

Quantity	Part Number	Description
1	100653-1	Pole Attachment Hardware Kit
1	100797-1	Bracket AZ Adjust
2	100602-1	Eye Bolt
3	100603-1	U-Bolt -3/8 -16 Thread
1	100654-2	Antenna Mount Kit
1	904645-2	Pole Mounting Bracket
1	904647-2	Antenna Mounting Bracket
1		Antenna Assembly

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Figure C.2 - Antenna Mount Assembly



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Attaching Pole Mount Kit to Pole (100653-1)

Note: Refer to Figure C.3 while performing this procedure.

1. Attach the azimuth fine adjust plate to the mounting pole with one u-bolt, through the bottom set of holes, using the 3/8-16 hardware provided; hand tighten. The plate should be mounted roughly perpendicular to the final azimuth direction.
2. Attach the eye bolt to the pole mount kit with 3.8-16 x 1-3/8 long hex head bolt, flat and split lock washer. Install one 3/8-16 nut and washers onto eyebolt approximately 2" up on threads.
3. The antenna mounting assembly should now be mounted to the pole with two u-bolts and 3/8-16 hardware. This is easily done if the top u-bolt is installed first (special attention should be taken when the assembly is being mounted to the pole to insert the azimuth adjustment eye bolt through the top hole in the azimuth fine adjustment plate). The mounting hardware should be tightened until the unit is snug to the pole (do not fully torque hardware at this time).
4. Important: attach the antenna to mount paying special attention that the drip hole is located at the bottom.

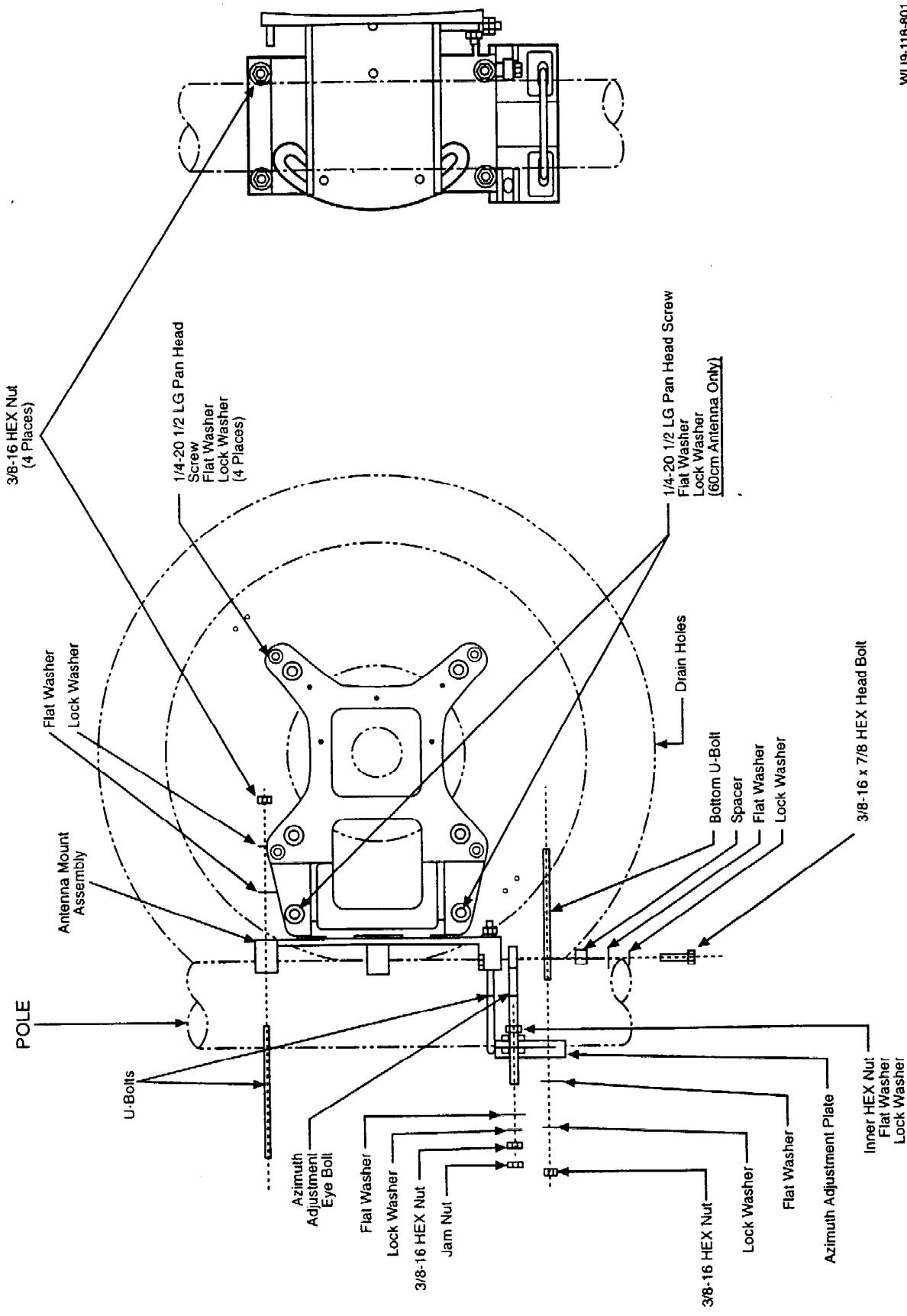
Feed Information (Polarization Adjustment)

The feed is normally attached to the rear of the antenna in the vertical polarization position, Type N Connector facing down. Horizontal polarization is set by removing the four 8-32 pan head screws and washers, rotating the feed assembly 90 degrees.

Azimuth and Elevation Adjust

1. Rotate (in a horizontal plane) the antenna assembly and azimuth fine adjustment plate for a coarse azimuth location. When the antenna is in the approximate azimuth position (± 10 degrees), adjust the azimuth fine adjustment plate to be perpendicular to this direction and so that the adjustment rod is horizontal. The U-bolt in the plate should now be securely tightened to the pole.
2. Tighten the center bolt and the two outer clamping bolts to be snug and to eliminate any excessive movement. To initially position the elevation, loosen the top and bottom hex nuts on the adjustment rod and move the antenna either up or down the coarse position. The antenna system is designed for elevation angles of ± 25 degrees.

Figure C.3 - Pole Mount Assembly



Inspection and Maintenance

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

General Nut Tightening Procedures

1. Table C.2 has the recommended tightening torque's for nuts used on stainless steel bolts, U-bolts, galvanized bolts without the ASTM - A325 marking on the head.

Table C.2 - Nut Torque Recommendations

Nominal Bolt Size, Inches	Nut Torque
1/4	50 in-lb
5/16	102 in-lb.
3/8	15 ft-lb.
7/16	24 ft-lb.
1/2	37 ft-lb.

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Appendix D Link Evaluation Monitoring

TBD

Appendix E Antenna Compliance Testing

Antennas to be tested with the Wireless, Inc. N2-Link:

Manufacturer	Part Number	Description
Radio Waves	SPB2-5.2	2' parabolic
Radio Waves	SP4-5.2	4' parabolic