HUGHES™

HUGHES NETWORK SYSTEMS

DIRECWAY®

# Assembly Instructions for the .98m Ku-Band Upgradeable Antenna

1035930-0001
Revision 2
December 9, 2004

**TABLE OF CONTENTS**

**SECTION** **PAGE**

**LIST OF FIGURES**

## LIST OF TABLES



## REVISION RECORD

| Revision | Date of Issue | Scope |
|---|---|---|
| Revision 1 | 11/09/04 | Initial release |
| Revision 2 | 12/09/04 | Added instructions for installing shim kit |

## 1.0 WARNINGS IN THIS MANUAL

### IMPORTANT SAFETY INFORMATION

For your safety and protection, read this entire manual before you attempt to install the antenna system. In particular, read this safety section carefully. Keep this safety information where you can refer to it if necessary.

### TYPES OF WARNINGS USED IN THIS MANUAL

#### DANGER

Indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury.

#### WARNING

Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.

#### CAUTION

Indicates potentially hazardous situation, which, if not avoided, may result in minor or moderate injury.

#### CAUTION

Indicates a situation or practice that might result in property damage.

# 2.0 PREFACE

### 2.1 PURPOSE

These DIRECWAY antenna assembly instructions provide information required to assemble the .98 m Ku-band upgradeable receive/transmit satellite antenna and establish contact with the satellite.

### 2.2 AUDIENCE

This guide is intended for an installer experienced in performing the various installation tasks. The installer may be required to:
Use a power drill.
Locate studs or rafters and drill holes in the exact center of them.
Determine whether there are water pipes, electrical wiring, or gas lines hidden near where the antenna will be installed.
Route coaxial cable through foundation, walls, and/or floors.
Ground the antenna and coaxial cable as recommended in the National Electrical Code (published by the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269).
This guide is also intended for use by:
Call Center personnel
Call Center personnel trainers

### 2.3 RELATED DOCUMENTATION

If the antenna will be used in a Ka system, or will later be upgraded for use in a Ka system, refer to the ***Ku/Ka-upgradeable Antenna Site Preparation Guide .98m, 1.2m*** (HNS 1035678-0001)

# 3.0 TOOLS AND EQUIPMENT

### 3.1 TOOLS

The following tools are required for antenna assembly and installation:
7/16-inch open-end wrench
7/16-inch socket
½-inch open-end wrench
½-inch socket
3/8-inch drive ratchet and short extension
7/64 hex key (for RA6-TG)
M7 drive (for RA6-074)
Plastic handle ball driver long length, 3m hex, 6-13/64 inch blade length (recommended for attaching RA6-074 feedhorn to transceiver)

The following table matches the tool size with hardware size:

| Tool Size | Hardware Size |
|---|---|
| 7/16” | ¼” |
| ½” | 5/16” |
| 3/8” drive ratchet | 7/16” and ½” sockets |
| 7/64” hex key | #6-32 sockethead cap screw |
| M7 | M4x20mm screw |

**TABLE 1**

### 3.2 EQUIPMENT

In addition to the tools listed above, the following equipment is recommended to make installation easier:

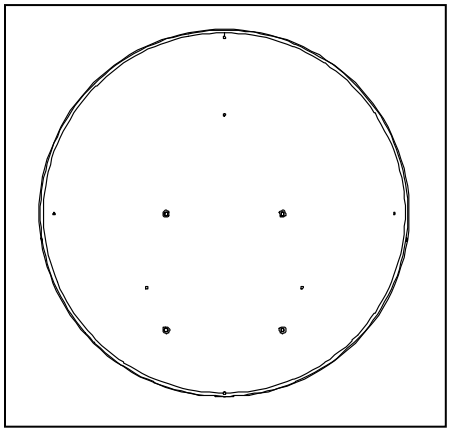
Hand-held magnetic compass
Angle finder or protractor
Torpedo level
Ladder

See ***Ku/Ka-Upgradeable Antenna Site Preparation Guide*** (HNS 1035678) or other site preparation guides for a more complete list of tools and items that may be needed for installation.

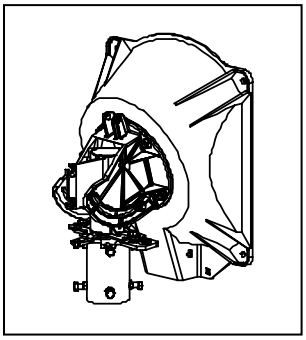
# 4.0 UNPACKING

## 4.1 UNPACKING

As soon as possible, unpack and inspect the antenna containers to ensure that all material has been received and is in good condition. An illustration and description of each major component is shown below. **The front of the reflector is covered with a hydrophobic coating. Handle the reflector so that you do not touch this coating or disturb it in any way. In addition, the feedhorn lens is protected with a styrofoam covering. Do not remove it until after the antenna assembly is installed on the mount. Do not touch the feedhorn lens.**



Reflector



AZ/EL Assembly

2-3/8-inch mast pipe

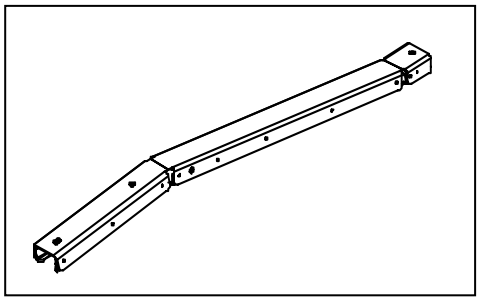
The hardware kit supplied with the antenna contains the following items:

| Item | Quantity |
|---|---|
| 5/16-18 x 2.00-inch carriage bolt | 2 |
| 5/16-18 x 3.00-inch carriage bolt | 2 |
| 5/16-inch flat washer | 4 |
| 5/16-inch lock washer | 4 |
| 5/16-18 hex nut | 4 |

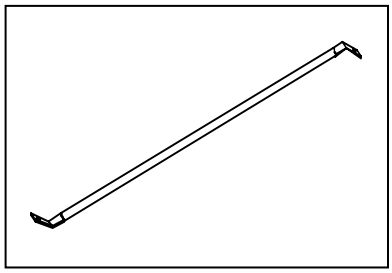
**TABLE 2**

There are two possible feed systems available for the antenna. One feed system for an RA6-074 transceiver and another for an RA6--TG transceiver.

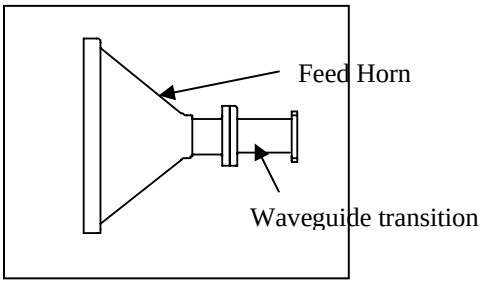
If the antenna is for the **RA6-074** transceiver, the following components are included.



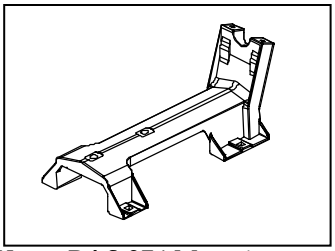
Feed Support



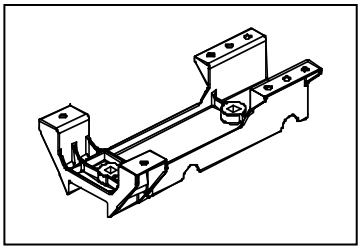
Feed Rods (2)




Feed Horn Assembly
(shown assembled)



Upper RA6-074 Mounting Bracket



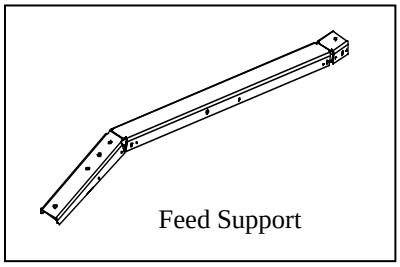
Lower RA6-074 Mounting Bracket

The hardware kit supplied with the RA6-074 feed system contains the following items:

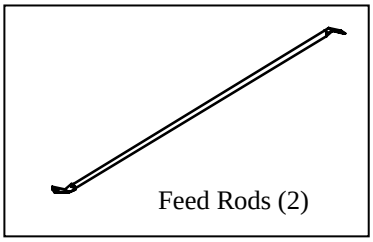
| Item | Quantity |
|---|---|
| ¼-20 x 1.00-inch hex bolt | 5 |
| ¼-20 x 3.00-inch hex bolt | 1 |
| ¼-inch flat washer | 12 |
| ¼-inch lock washer | 10 |
| ¼-20 hex nut | 8 |
| ¼-20 x .750-inch carriage bolt | 4 |
| 5/16-18 x 1.00-inch carriage bolt | 2 |
| 5/16-18 x 1.00-inch hex bolt | 2 |
| 5/16-inch flat washer | 4 |
| 5/16-inch lock washer | 4 |
| 5/16-18 hex nut | 2 |
| O-ring | 2 |
| M4 x 20mm screw | 4 |
| M4 lock washer | 4 |
| Top clamp | 1 |
| #6-32 sockethead cap screw | 6 |
| #6 internal tooth lock washer | 6 |
| Silicone grease capsule | 1 |

**TABLE 3**

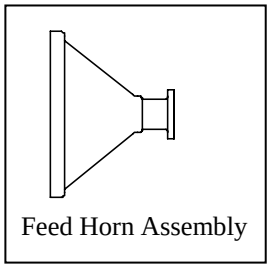
If the antenna is for the **RA6-TG** transceiver, the following components are included.



Feed Support



Feed Rods (2)



Feed Horn Assembly

The hardware kit supplied with the RA6-TG feed system contains the following items:

| Item | Quantity |
|---|---|
| ¼-20 x 1.00-inch hex bolt | 3 |
| ¼-20 x 3.00-inch carriage bolt | 1 |
| ¼-inch flat washer | 8 |
| 1/4-inch lock washer | 4 |
| ¼-20 hex nut | 4 |
| O-Ring | 1 |
| #6-32 x .50 screw | 6 |
| #6 lock washer | 6 |

**TABLE 4**

## 4.2 RETURNING COMPONENTS

Any damage to materials while in transit should be immediately directed to the freight carrier. They will instruct you on the matters regarding any freight damage claims.

Any questions regarding missing or damaged materials that is not due to freight carrier should be directed to the point of purchase or distributor.

# 5.0 INSTALLATION LOCATIONS

The following antenna installation locations and methods are acceptable:

Non-penetrating mount
Wood frame roofs
Wooden walls
Masonry walls
Pole mount

If the antenna will be used in a Ka system, or will later be upgraded for use in a Ka system, refer to ***Ku/Ka-Upgradeable Antenna Site Preparation Guide .98m, 1.2m*** (HNS 1035678-0001) for instructions on how to select a site and installation method.

The installation method may be specified in the work order or installation specification.

# 6.0 INSTALLATION PROCEDURES

## 6.1 CAUTIONS

WARNING

Only HNS-Certified installers can install DIRECWAY-SP Earth Stations.
All HNS-Certified installers shall have expressly acknowledged the HNS requirements for DIRECWAY-SP installations.

**CAUTION**

The DIRECWAY-SP ANTENNA SYSTEM must be installed in a location or manner not readily accessible to children and in a manner that prevents human exposure to potentially harmful levels of radiation.

DIRECWAY-SP Antennas mounted in the Continental United States, Puerto Rico and any site with greater than a 30 degree elevation angle shall be mounted such that the lower lip of the antenna reflector is at least 1.5 meters (no less than 5 feet) above the high point of any surface, within a radius of 3.0 meters (10 feet)] upon which a person might be expected to stand. DIRECWAY-SP Antennas mounted in Canada, Alaska, Hawaii, and any location with lower than a 30 degree elevation angle shall be installed such that the lower lip of the satellite dish is at least 1.75 meters (5 feet, 9 inches) above any surface in proximity of the antenna upon which a person can be expected to stand. In addition, the Antennas shall be mounted such that no object which could reasonably be expected to support a person is within 2 meters (6 feet, 7 inches) of the edges of a cylinder extending from the antenna reflector in the direction of maximum radiation.

Alternatively, the antenna must mounted in an area inaccessible to the general public, such as a fenced off enclosure or a roof.

**CAUTION**

Unplug indoor power connection before performing maintenance or adding upgrades to any satellite dish components.

**CAUTION**

The surface is covered with hydrophobic coating.

Do not touch or allow anything to come in contact with the front surface of the satellite dish.

Disturbing or damaging the coating can affect satellite dish performance.

**CAUTION**

For enterprise installations, install the satellite dish assembly using a non-penetrating mount unless the customer-specific specification specifies another method.

Roof installations may void the building's roof warranty so extreme care should be exercised. Contact your HNS installation management team if you have any questions.

Follow the non-penetrating mount manufacturer's assembly instructions.

**6.2 PROCEDURES**

Follow the steps below in the order shown to assemble the antenna. The site elevation, azimuth, and polarization values should be predetermined and known at this time. Do not tighten any hardware until instructed to do so. Do not touch the front of the reflector. Remove the protective bag in a way so that you do not touch the reflector. Do not remove the feedhorn lens covering until assembly and installation is complete.

*Installing the AZ/EL assembly onto the mast pipe*

1. Loosen the elevation lock down hardware on both sides of the elevation bracket. See Figure 1.
2. Read the elevation scale and rotate the elevation bracket to the predetermined elevation angle for the site. Snug down the elevation lock down hardware that was loosened in step #1.
3. Use a ½-inch open-end wrench to loosen the eight canister set screws until they are flush with the inside wall of the canister. See Figure 2.
4. Place the canister of the AZ/EL assembly onto the mast pipe.
5. Rotate the AZ/EL assembly until the reflector side is oriented in the general direction of the satellite as shown.
6. Snug the eight canister set screws enough to prevent the assembly from rotating. Do not tighten until instructed to do so later in the assembly.

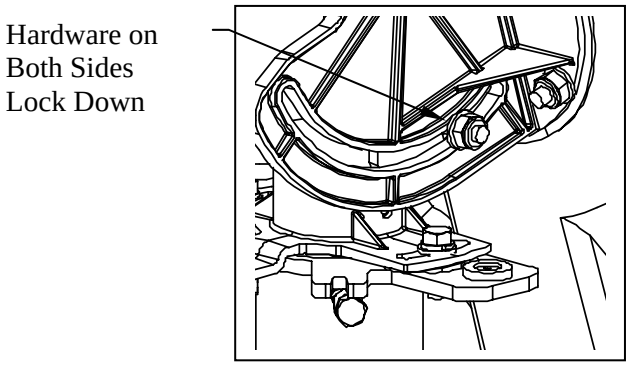



FIGURE 1

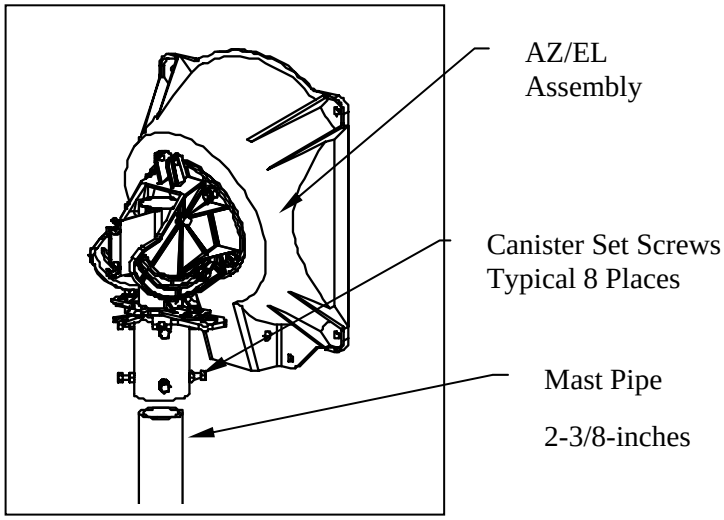



FIGURE 2

*Attaching the reflector*

1. Orient the reflector so that the feed support attachment interface (3-hole pattern) is at the bottom. See Figure 3.
2. Lift the reflector and align the four mounting holes in the reflector with the four mounting holes of the reflector support.
3. Attach by inserting a 5/16-18 x 2.00-inch carriage bolt through each of the two upper reflector holes and a 5/16-18 x 3.00-inch carriage bolt through each of the lower reflector holes from the front to the back and through the mounting holes of the reflector support.

4. Secure with a flat washer, lock washer, and hex nut on each of the four carriage bolts.
5. Tighten securely.

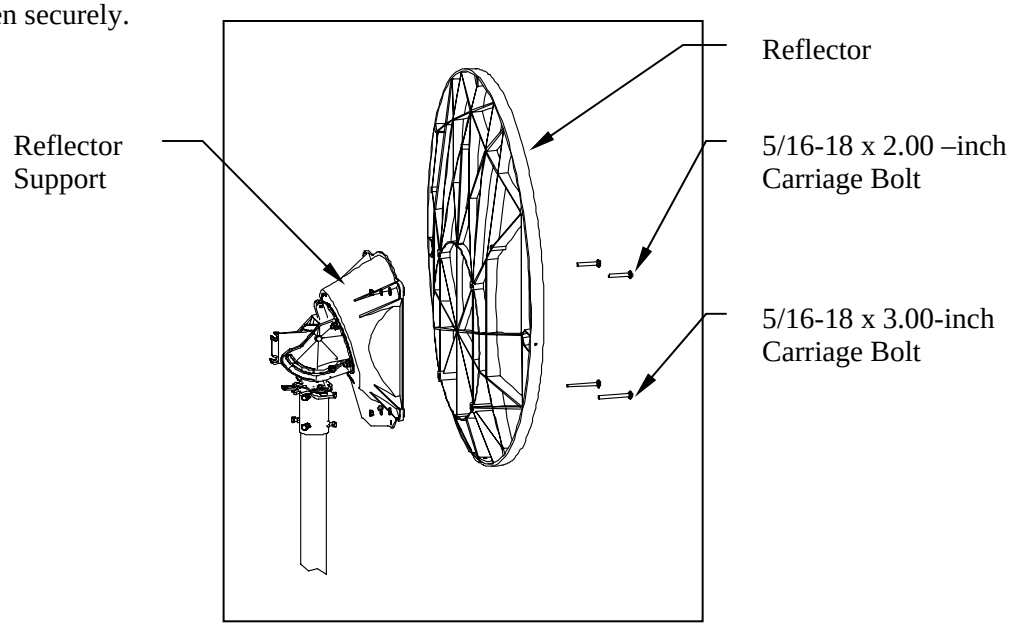



FIGURE 3

*Installing the feed support, **RA6-074 Radio Assembly Model**s Feed System*

1. Place the feed support (length: 34.7 inches) at the bottom of the reflector and align the mounting hole in the feed support with the center hole in the bottom of the reflector. See Figure 4.
2. Insert a ¼-20 x 1.00-inch hex bolt and flat washer through the hole in the feed support and the center hole in the bottom of the reflector.
3. Secure with a flat washer, lock washer and hex nut on the back of the reflector. See Figure 5.
4. Attach one end of each of the (2) feed rods (length: 29.5 inches) to the mounting hole in the side of the reflector using a ¼-20 x 1.00-inch hex bolt and flat washer. See Figure 6.
5. Secure with a flat washer, lock washer and hex nut on the inside rim of the reflector.
6. Align the opposite end of each feed rod with the mounting hole in the feed support and connect with a ¼-20 x 3.00-inch hex bolt and flat washer.
7. Secure with a flat washer, lock washer and hex nut on the bolt.
8. Securely tighten these four bolts at this time.

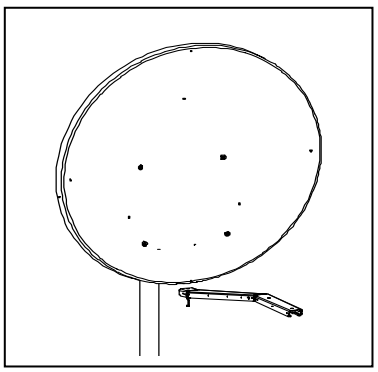


FIGURE 4

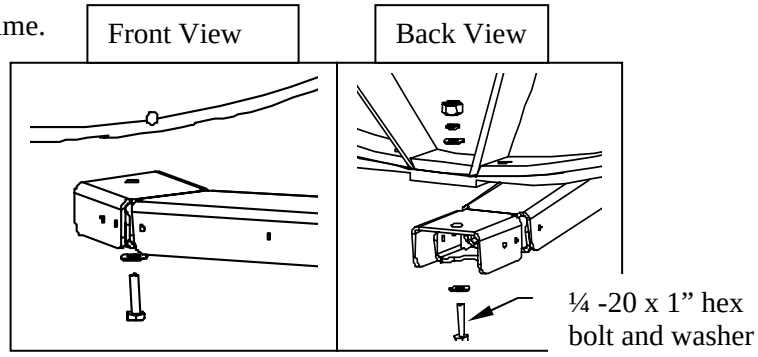



FIGURE 5

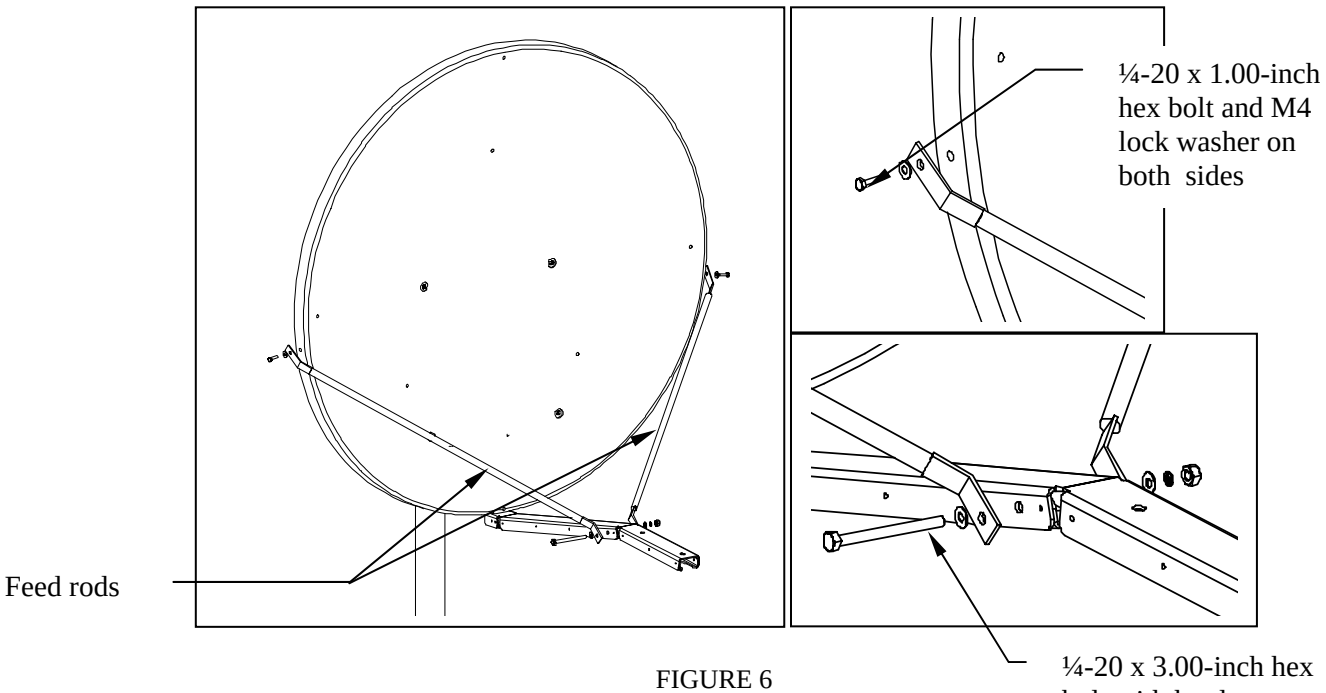



FIGURE 6

*Attaching the radio assembly*

If you need to change the radio's polarization, refer to Chapter 8 for instructions.

1. If the feed horn assembly is disassembled, you must assemble it. Apply silicone grease to the feed horn O-ring groove. Then place the O-ring in the groove.

2. Attach the waveguide transition to the feed horn using the six #6-32 sockethead cap screws and #6 internal tooth lock washers. The feed horn assembly is now complete.

3. Place the O-ring in O-ring groove in the feed horn assembly mounting flange. See Figure 7.

4. Attach the feed horn assembly to the RA6-074 transceiver using the four M4 x 20mm screws and M4 lock washers in the four holes of the feed horn assembly. Using a plastic handle ball driver long length, 3mm hex, 6-13/64-inch blade length, makes it easier to reach the screws.

5. Tighten securely.

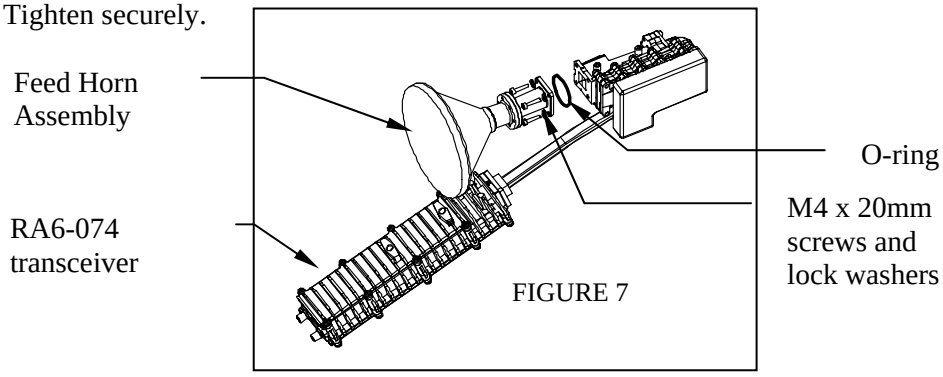



FIGURE 7

6. Place the feed horn/RA6-074 transceiver into the upper mounting bracket and secure with (2) 5/16-18 x 1.00-inch hex bolts, flat washers, and lock washers. Tighten securely. See Fig. 8.

7. Place the top clamp over the neck of the feed horn and secure with a ¼-20 x 1.00-inch hex bolt and lock washer on each side. Tighten securely. See Figure 9.

8. Place the lower mounting bracket onto the end of the feed support and secure with a 5/16-18 x 1.00-inch carriage bolt from above and flat washer, lock washer, and hex nut from below in each of the (2) mounting holes. Tighten securely. See Figure 10.

9. Place the feed horn/transceiver/upper bracket assembly from step #4 onto the lower bracket.

10. Assemble by placing a ¼-20 x .750-inch carriage bolt and flat washer through each of the four mounting holes and secure with a flat washer, lock washer, and hex nut on the bottom.

11. Tighten securely.

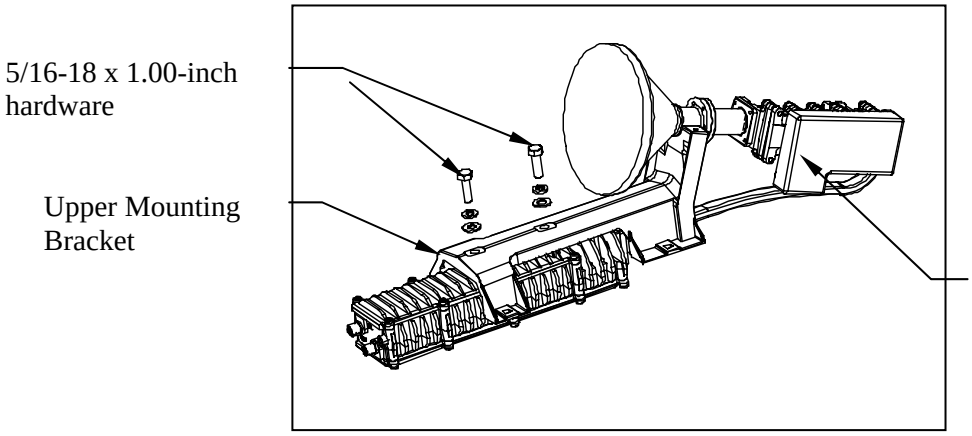



FIGURE 8

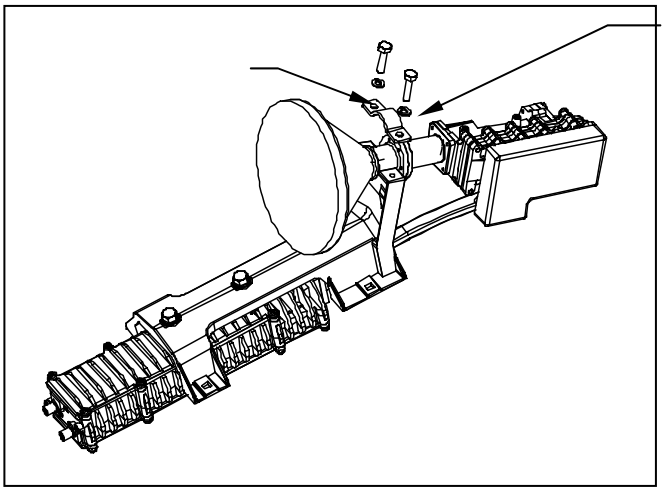



FIGURE 9

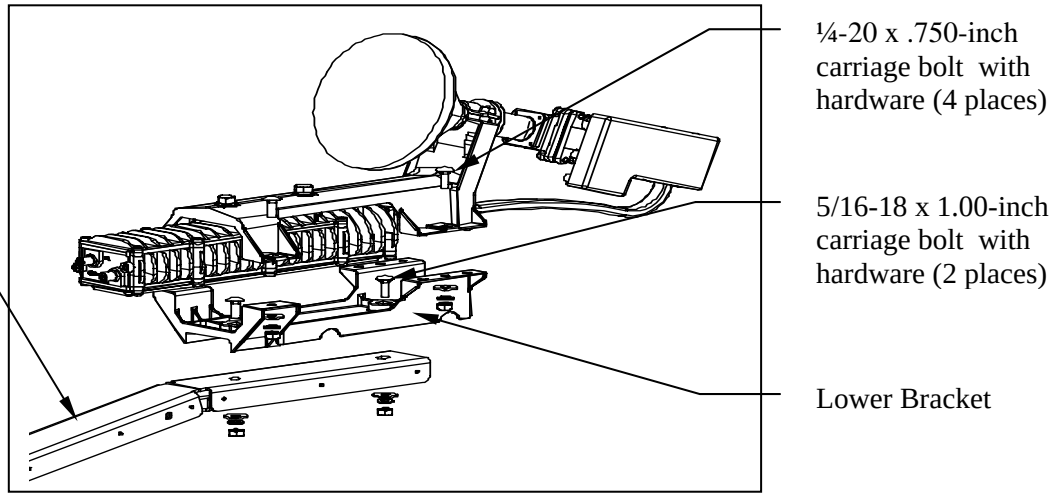



FIGURE 10

*Installing the feed support,* ***RA6-TG Radio Assembly Models*** *Feed System*

1. Place the feed support (length: 37.6 inches) at the bottom of the reflector and align the mounting hole in the feed support with the center hole in the bottom of the reflector. See Figure 11.
2. Insert a ¼-20 x 1.00-inch hex bolt and flat washer through the hole in the feed support and the center hole in the bottom of the reflector.
3. Secure with a flat washer, lock washer and hex nut on the back of the reflector.
4. Attach one end of each of the (2) feed rods (length: 35.4 inches) to the mounting hole in the side of the reflector using a ¼-20 x 1.00-inch hex bolt and flat washer. See Figure 12.
5. Secure with a flat washer, lock washer and hex nut on the inside rim of the reflector.
6. Align the opposite end of each feed rod with the mounting hole in the feed support and connect with a ¼-20 x 3.00-inch hex bolt and flat washer.
7. Secure with a flat washer, lock washer and hex nut on the bolt.
8. Securely tighten these four bolts at this time.

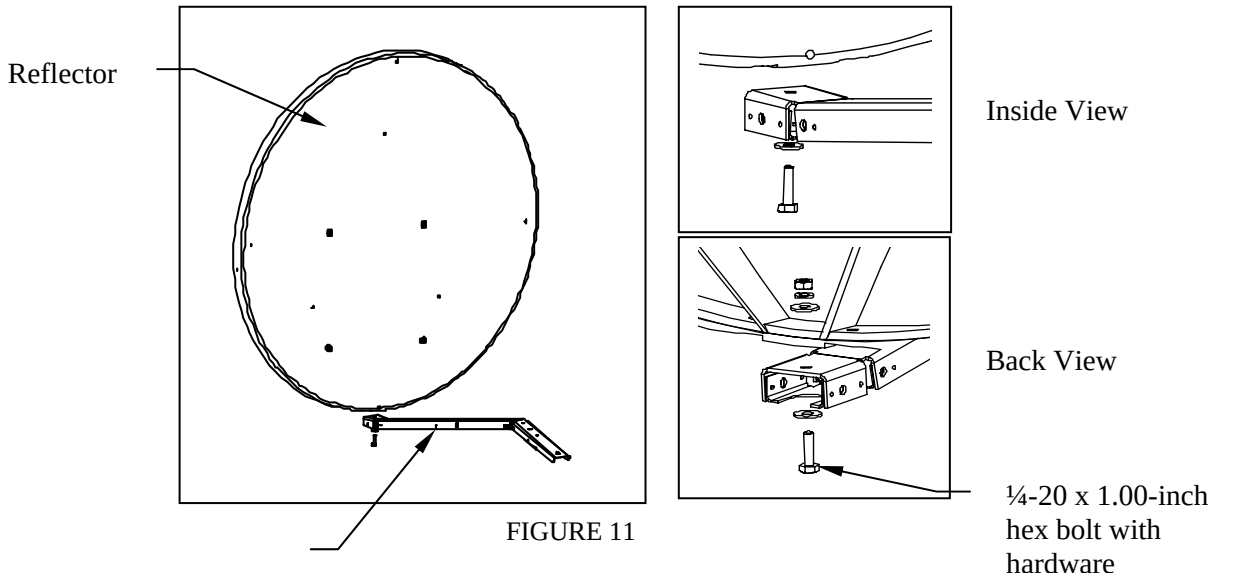



FIGURE 11

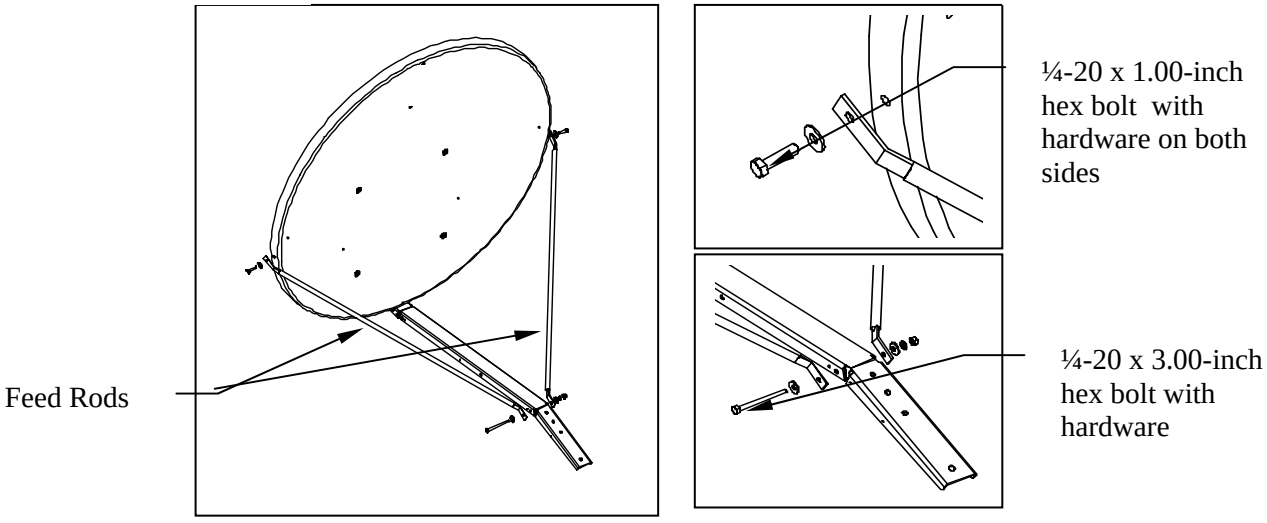



FIGURE 12

*Attaching the radio assembly*

1. Check the polarization-setting dial on the rear of the RA6-TG transceiver. See Figure 14. Make sure that it is set to 0°. If not, set it to 0° now. Reference documents provided with transceiver for instructions for this procedure.
2. Place the O-ring into the O-ring groove in the mounting flange of the feed horn assembly. See Figure 13.
3. Attach the feed horn assembly to the RA6-TG transceiver using the (6) #6-32 x ½-inch screws and lock washers.
4. Tighten securely.

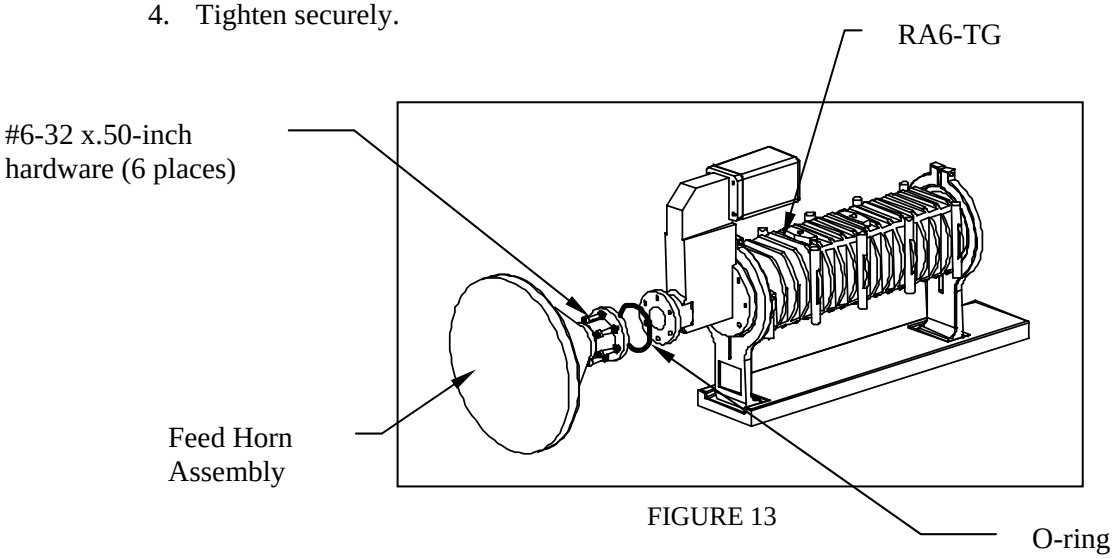



FIGURE 13

5. Place the feed horn/RA6-TG transceiver assembly onto the end of the feed support. See Figure 14.
6. Align the mounting holes in the transceiver bracket with the holes in the feed support. Secure with the hardware supplied with the transceiver.
7. Tighten securely.

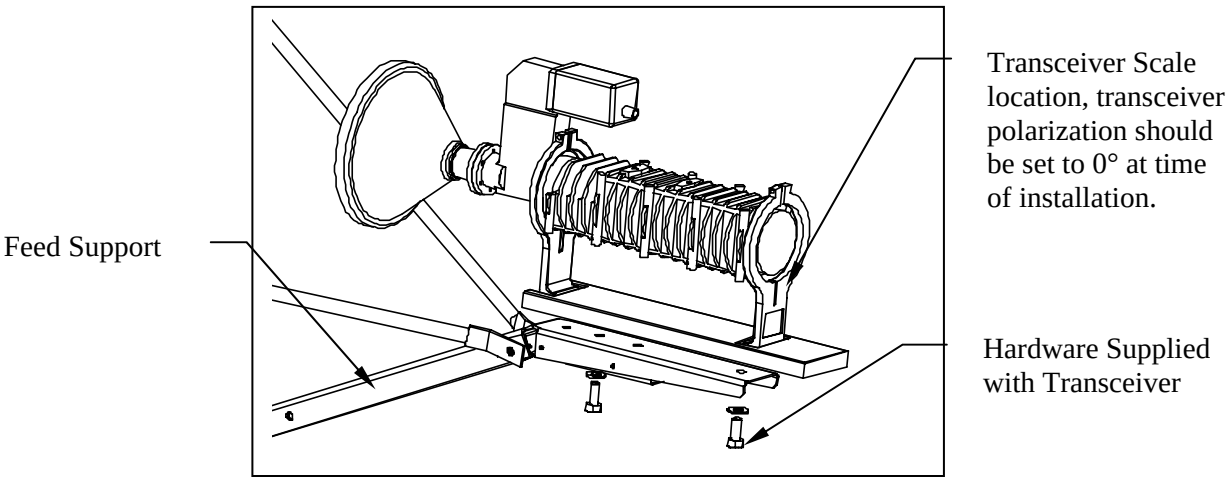



FIGURE 14

# 7.0 ANTENNA POINTING

## 7.1 POINTING PROCEDURES

This section describes how to point the antenna at the satellite. Correct alignment is critical to the operation of the system. When the antenna is pointed directly at the satellite, it receives a strong signal. If it is not positioned properly, the signal may be weak, and errors may result during data transfers. The signal quality would also deteriorate on cloudy, windy, or rainy days.

The predetermined elevation angle, azimuth heading, and polarization angle should be accurate enough to allow the antenna to acquire the satellite signal. You may need to refer to the indoor unit (IDU) manual for other pointing or peaking information

*Pre-setting elevation, azimuth, and polarization*

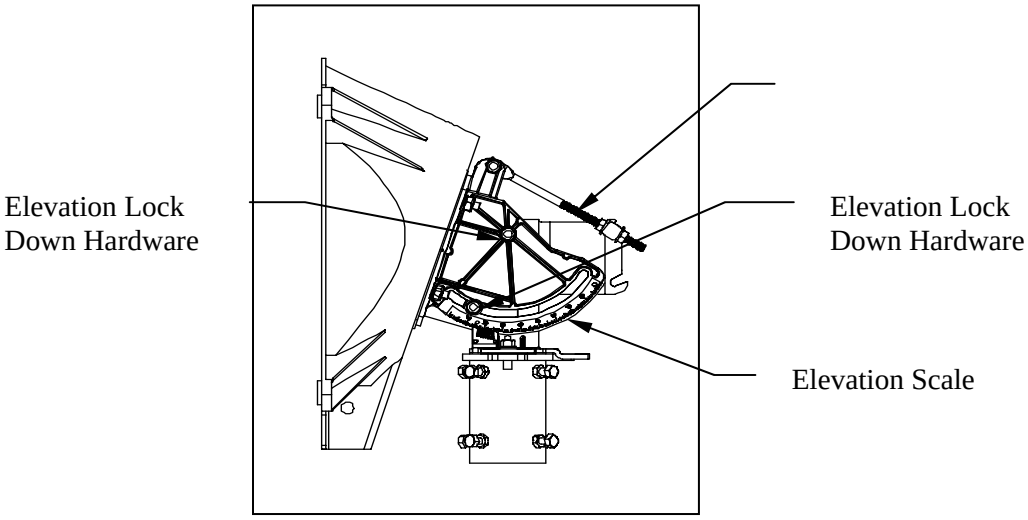



FIGURE 15

1. Using the predetermined elevation angle, which was roughly preset during antenna assembly, raise or lower the antenna until the angle is read on the elevation scale. Raising the antenna increases elevation. Lowering it decreases elevation. Rotate the top hex nut on the elevation adjustment rod sufficiently away from the pinion. Raise the antenna by turning the lower hex nut of the elevation adjustment rod clockwise. Lower the antenna by turning the hex nut counter-clockwise.

2. Note that there are two possible pinion mounting slots in the az/el assembly. See Figure 16. The assembly is shipped with the pinion in the upper mounting slot. This position is for elevation angles from 0 degrees up to 55 degrees. Fro elevation angles greater than 55 degrees, it will be necessary to move the pinion to the lower mounting slot before setting elevation.

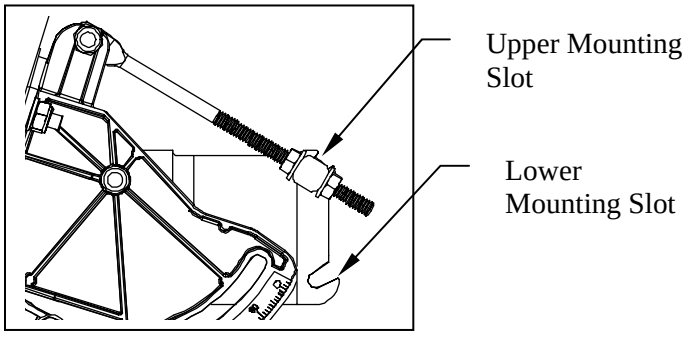



FIGURE 16

3. Use the vernier scale to accurately set the elevation within 0.1°. See Figure 17. For example, to set the elevation at 17.3°, align the "17" degree tick mark of the scale (seven tick marks past the "10°"mark) with the "0" mark of the vernier. Continue to slowly raise the antenna until the "3" tick mark on the vernier scale aligns with the next closest mark of the elevation scale. The elevation is now set at 17.3° elevation.

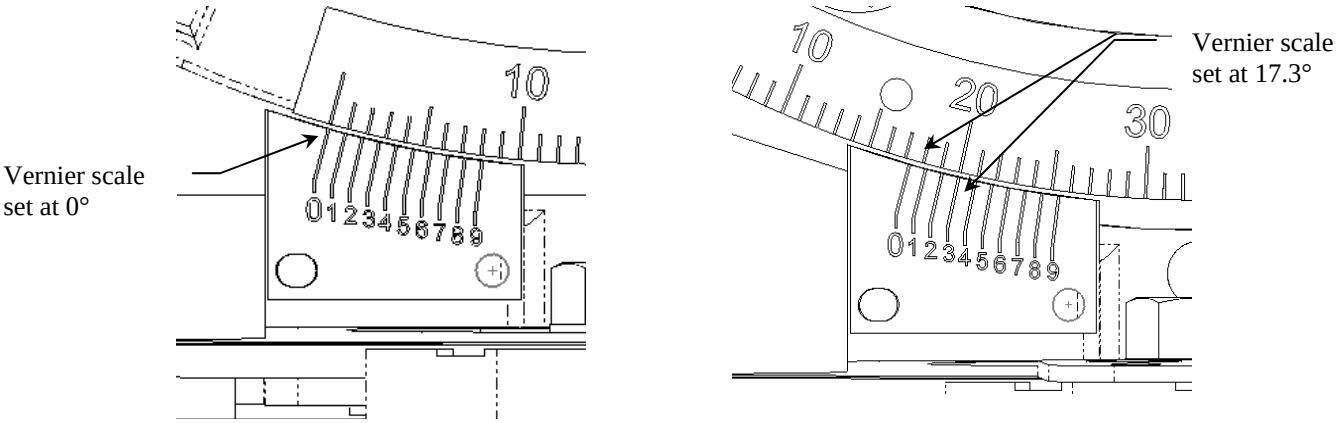



FIGURE 17

4. Use a compass to locate and line up the predetermined azimuth bearing.

5. Loosen the eight canister set screws enough to allow the antenna to rotate about the mast pipe. See Figure 18.

6. Rotate the antenna in azimuth until pointed in the direction determined in step #4.

7. Place a bubble level into the hole in the top of the AZ/EL assembly.

8. Alternately tighten the eight canister set screws until all are tight and the bubble is in the center circle of the level.

9. Once level and all set screws are tight, tighten the jam nuts against the canister at each of the eight locations.

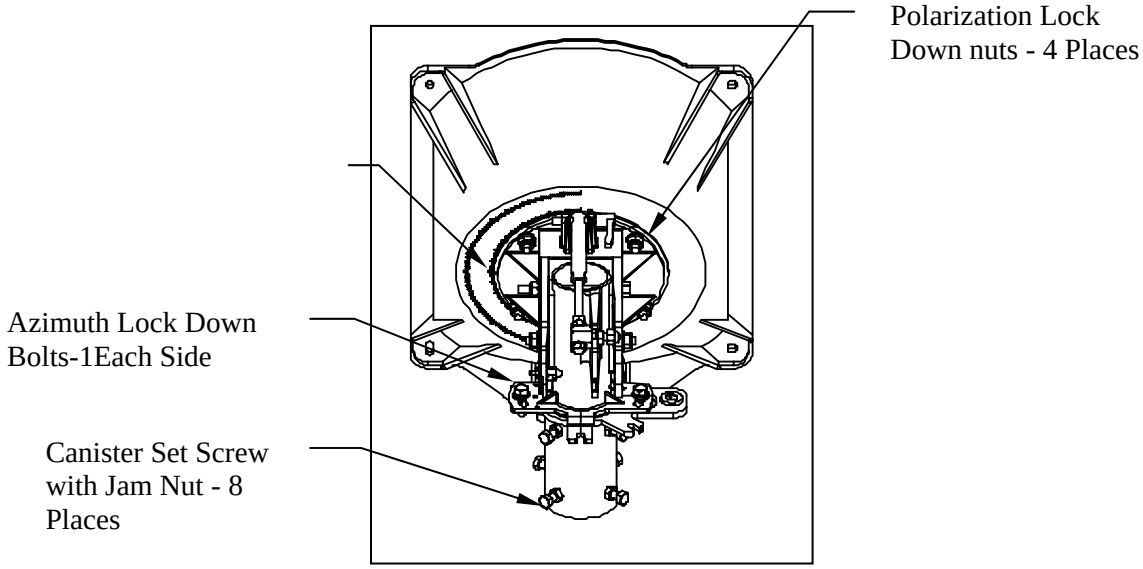



FIGURE 18

10. Polarization adjustment is acomplished by Loosening the four 5/16-inch polarization lock down nuts on the reflector support. See Figure 18. Rotate the reflector in polarization until the correct polarization setting is read on the scale. From behind the antenna, rotate the reflector clockwise for positive polarization angles and counter-clockwise for negative angles. Securely tighten the four bolts after the correct angle is set.

*Locating the satellite*

1. With elevation and polarization set and the antenna leveled and pointed in the correct general direction, locate the satellite by sweeping azimuth.

2. To sweep azimuth, loosen the two azimuth lock down bolts in the AZ/EL assembly. See Figure 18.

3. Slowly sweep the antenna left and right in azimuth by hand until signal is detected. The adjustment slots will allow ±15° of azimuth sweep. This amount should be sufficient to locate the satellite from the coarse azimuth heading. See Figure 19.

4. If no signal is detected, raise or lower the elevation setting in small increments and repeat the azimuth sweep until a signal is found.

5. After the satellite is located, turn the hex nut of the elevation adjustment rod to slowly raise and lower the antenna until maximum signal strength is achieved. See Figure 20.

6. Carefully move azimuth left and right until maximum signal is achieved.

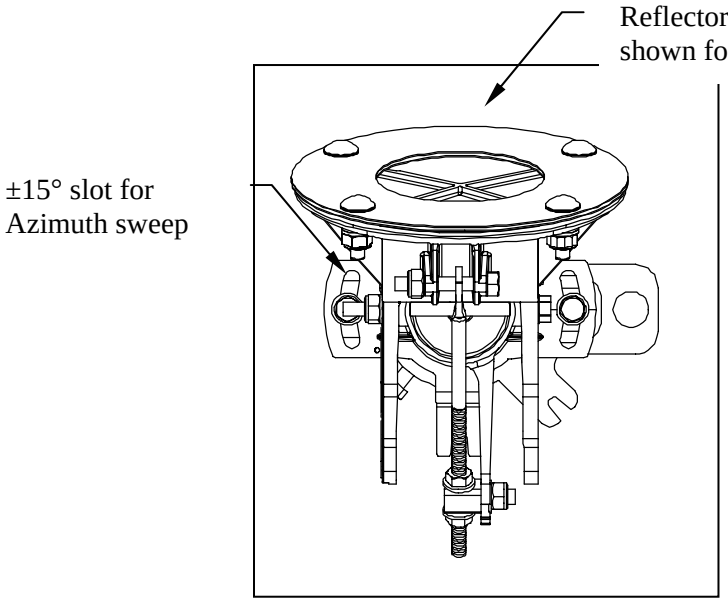



FIGURE 19

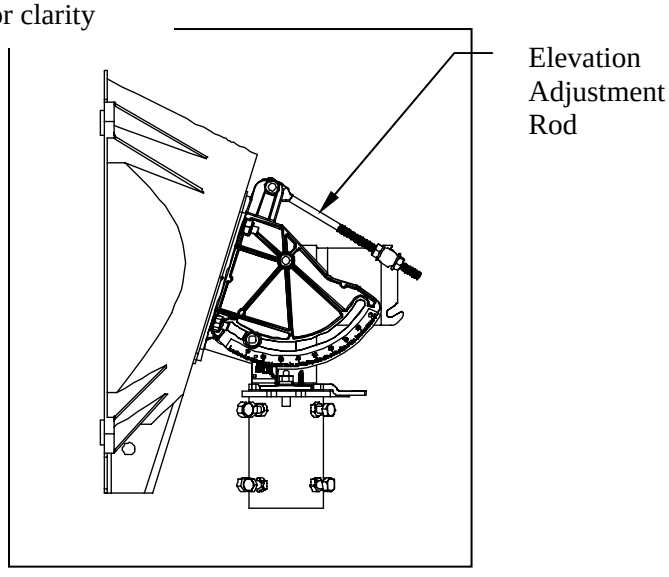



FIGURE 20

*Azimuth, elevation, and polarization lock down*

1. After the antenna is peaked, lock down the azimuth hardware by tightening the two 5/16-inch bolts in the AZ/EL assembly. See Figure 21.

2. Lock down the elevation hardware by tightening the three 5/16-inch bolts in the elevation bracket.

3. If installing an RA6-074 system, lock down the polarization by tightening the four 5/16-inch bolts in the reflector support.

4. If installing an RA6-TG system, lock down polarization by tightening the transceiver bracket screws. See Figure 14, and refer to documents provided with the transceiver for additional instruction.

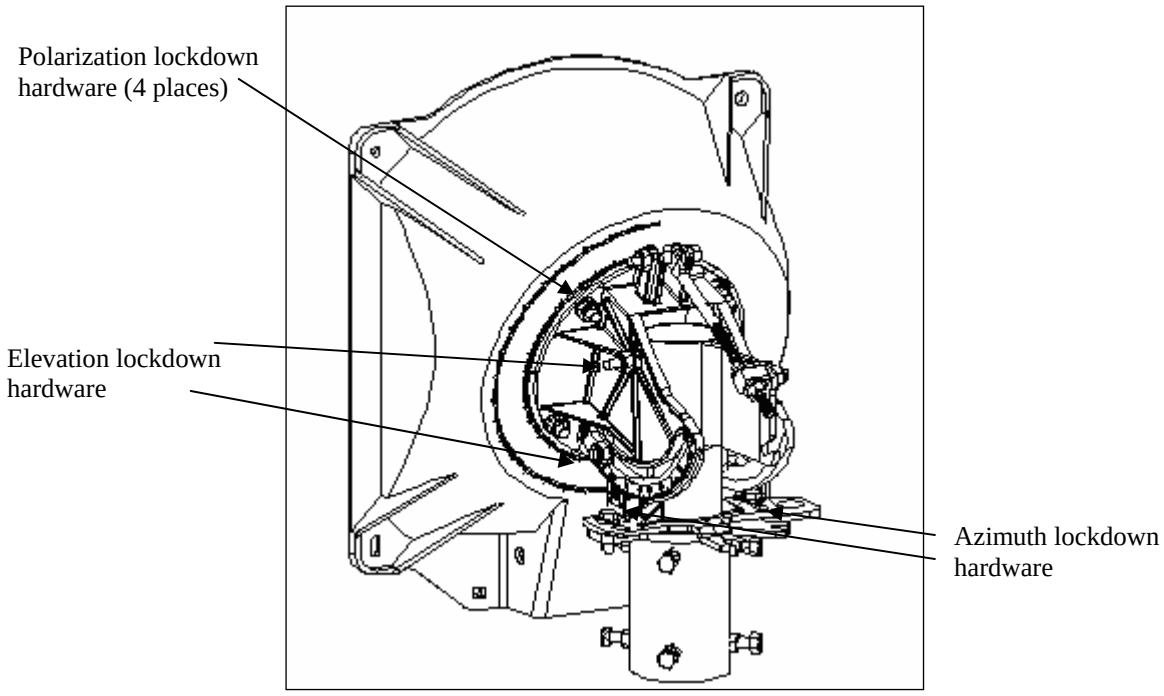



FIGURE 21

# 8.0 INSTALLAING VERTICAL SHIM KIT FOR THE RA6-074 RADIO

Out of the box the radio assembly is configured to transmit with horizontal polarization. However, the radio assembly can be reconfigured in the field to transmit with vertical polarization. A Vertical TX Shim Kit, HNS model # VTX-SHIM-KIT, is necessary to make this transformation and is typically packaged separately from the radio assembly. Figure 22 illustrates the vertical shim kit. If your specifications require a vertical transmit polarization, follow the instructions below.

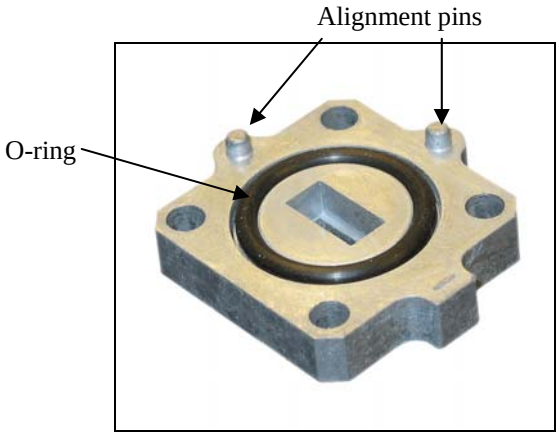



FIGURE 22

1. If the radio assembly is already attached to the feed arm you must remove it by removing the screws and bolts shown in Figure 23.

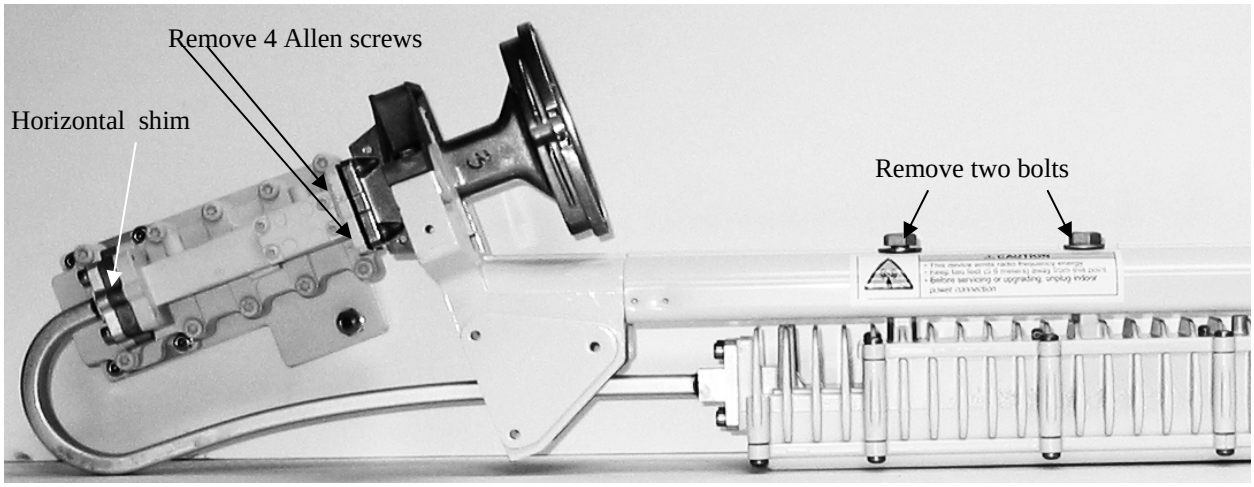



FIGURE 23

2. Once the radio assembly is removed from the feed arm, remove the four Allen screws that attach the feed horn to the horizontal shim and TRIA (Transmit Receive Isolation Assembly). See Figure 24. Figure 25 shows the orientation of the TRIA with a horizontal shim attached. The TRIA would be rotated 90 degrees if a vertical shim were attached.

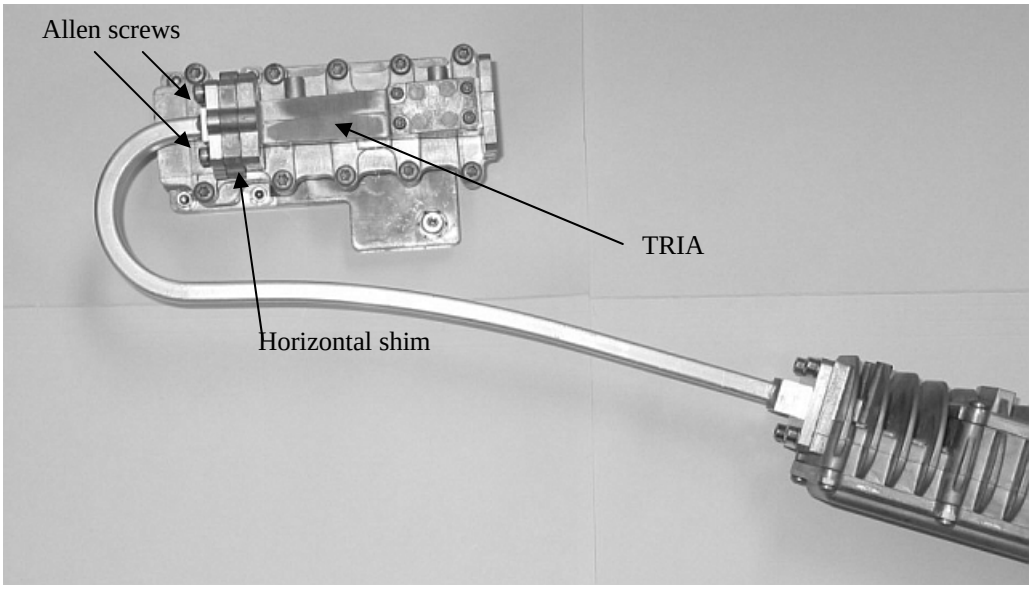



FIGURE 24

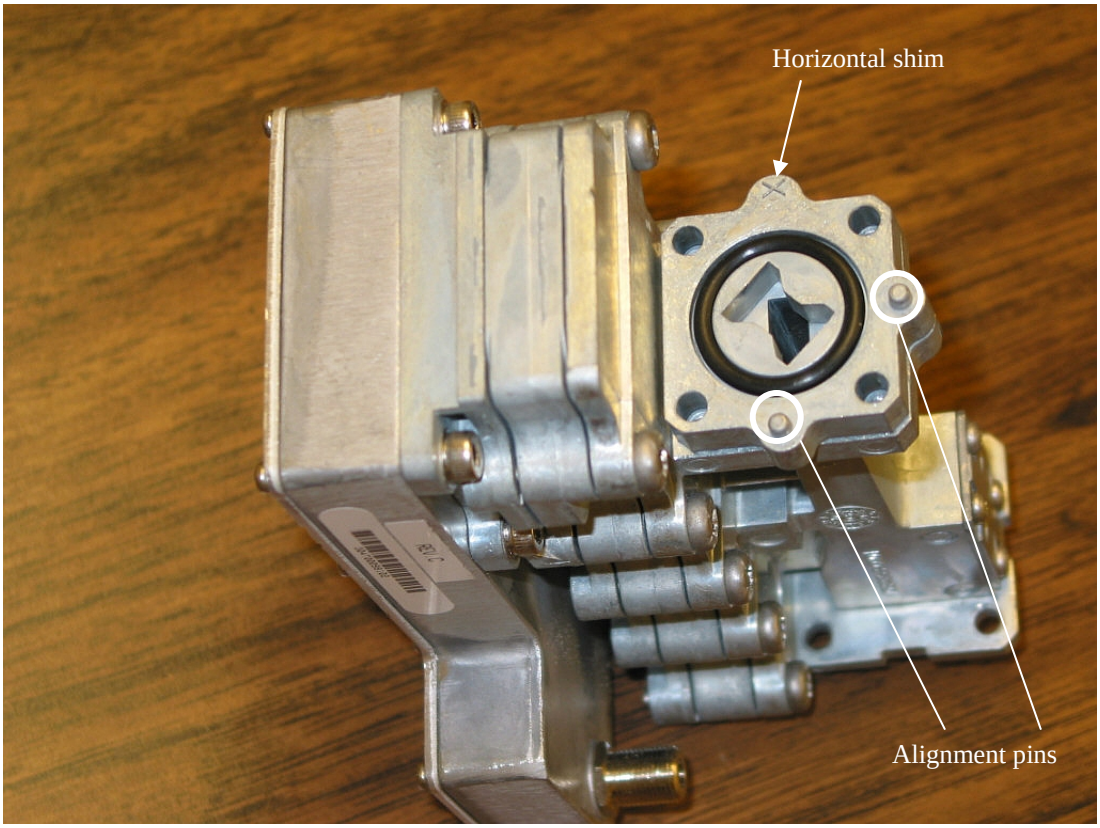



FIGURE 25

3. Remove the horizontal shim and replace it with the vertical shim. The vertical shim can only be positioned one way because of alignment pins in the TRIA. When it is inserted it looks like Figure 26.
4. After the vertical shim is in place, re-connect the feed horn to the TRIA using the four Allen screws previously removed. Because of the position of the alignment pins on the vertical shim, the TRIA must be rotated 90 degrees before it can be reattached to the feed horn. Figure 27 shows the radio assembly with vertical shim in place.

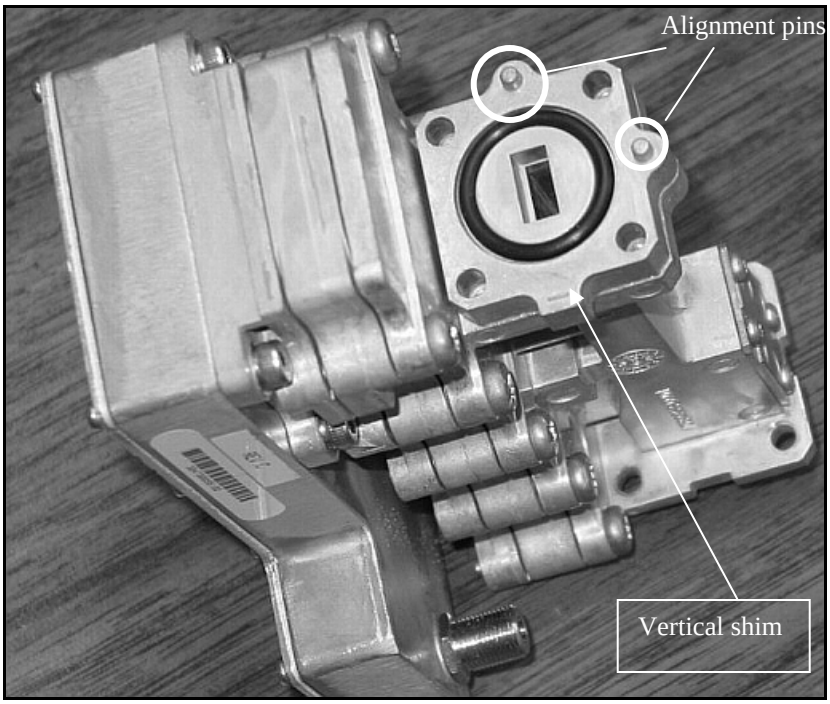



FIGURE 26

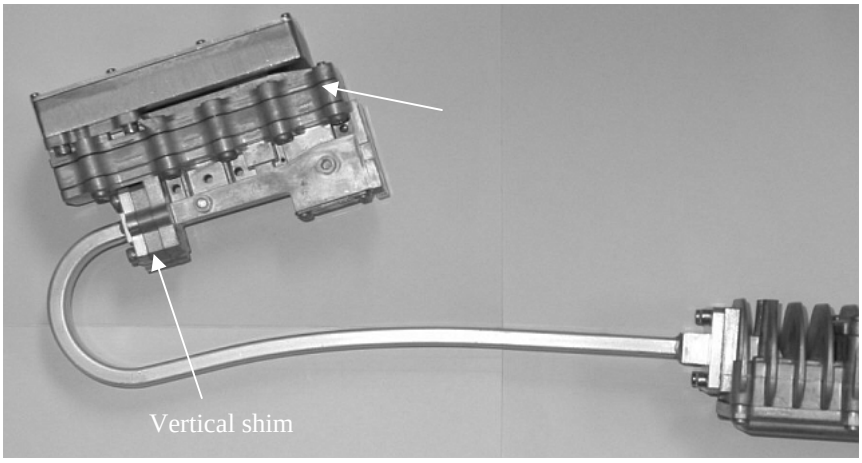



FIGURE 27