



# Remote Terminal Installation and User Manual

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***For important standards compliance information, see appendix B.***

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# About this manual

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This manual provides instructions for installing and using AIReach™ Broadband point-to-multipoint remote terminal (RT) equipment.

## User qualifications

This manual is intended for use by qualified equipment installers. Installers must understand:

- Electronics fundamentals
- Cabling and connection practices
- Electrical circuits and grounding practices
- The importance of safety precautions

Installers must also be familiar with:

- Radio frequency (RF) fundamentals
- Applicable electrical, building, fire, and safety codes and regulations

**Note:** HNS recommends a team of two installers to install the AIReach Broadband indoor and outdoor equipment.

## Organization

The instructions in this manual are organized according to tasks and are intended to be followed in sequential order.

## Related publications

For site preparation instructions, see:

- *Hub and Remote Terminal Site Preparation Guide*, document number 1027032-0001

For hub site installation instructions, see:

- *Hub Installation and User Manual*, document number 1027145-0001

## HNS- and customer-provided equipment

This manual primarily describes equipment manufactured and/or provided by Hughes Network Systems (HNS), but in some cases also refers to equipment that may be supplied by another vendor. **HNS equipment deliverables are defined in the customer contract.** Some equipment referred to in this manual may be provided by the customer, as stated in the customer's contract.

# Revision record

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<b>Revision</b>	<b>Date of issue</b>	<b>Scope</b>
A	April 21, 1999	Released for UL approval.
B	June 8, 1999	Added new and updated information.
C	August 9, 1999	Added troubleshooting and maintenance information.



# Important safety information

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For your own safety and protection, read this safety section carefully. Keep this safety information where you can refer to it if necessary.

## Types of warnings used in this manual

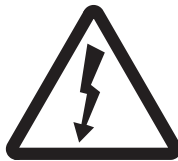
This section introduces the types of warnings used in this manual to alert you to possible safety hazards that could be encountered while installing AIReach Broadband equipment.



### DANGER

**Fall hazard:** Where you see this symbol and DANGER heading, strictly follow the warning instructions to avoid personal injury or death from falling.

---



### DANGER

**Electric shock hazard:** Where you see this symbol and DANGER heading, strictly follow the warning instructions to avoid electric shock injury or death.

---



### WARNING

**Potential radio frequency (RF) hazard:** Where you see this alert symbol and WARNING heading, strictly follow the warning instructions to avoid injury to eyes or other personal injury.

---



### WARNING

Where you see this symbol and WARNING heading, strictly follow the warning instructions to avoid personal injury.

---

## Warnings appearing in this manual

This manual includes the following safety warnings:



### DANGER

If you have to walk on a roof or use a ladder to access an installation site or equipment, follow these precautions to prevent personal injury or death:



- Do not walk near the edge of the roof.
- Watch out for overhead power lines. Stay at least 6 meters (20 feet) from power lines.
- Walk only on sound roof structures.
- Do not work on a roof or ladder in high wind, rain, lightning, or other adverse weather conditions.
- Follow all safety precautions from the ladder or antenna manufacturer.
- Do not walk on a roof if a storm is visible—even if the storm is distant. Lightning can travel and strike in advance of a storm.



### WARNING

If you need to hoist materials to the installation location, observe these precautions to avoid personal injury:

- Use a rope strong enough to support all of the materials that need to be hoisted.
  - Never stand under the rope while materials are being hoisted.
  - Hoist one concrete block at a time.
  - Pass the rope through the *center* hole of each concrete block. If you use the hole on either end, the end can break off, allowing the concrete block to fall.
  - Be advised that the contents of the mount kit can fall through the end of the box if the box is tilted—especially if the box has been damaged.
  - Use a back brace.
-



### WARNING

Potential radio frequency (RF) hazard:

- Keep away from the front of the outdoor unit (ODU) antenna while the ODU is operating. Note that you cannot tell from outward appearance whether the ODU is operating or not.
- Be careful with respect to the ODU you are installing and ODUs that may already be operating in the installation area.

Failure to observe these warnings could result in injury to eyes or other personal injury.

---



### WARNING

To avoid the risk of electric shock and exposure to potentially harmful radio frequency (RF) waves, make sure the IDU is turned off, if already installed, before installing the mechanical attenuator. Failure to observe these warnings could result in personal injury.



### WARNING

To help avoid death, injury, or damage from a lightning strike, you *must* install a lightning arrester where the IFL enters the building.

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*The warning immediately below applies only to IDUs with a dual ac or dc power supply:*



### WARNING

Multiple power connectors. Disconnect both ac and dc power before servicing.

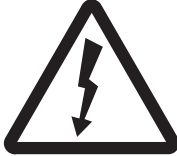
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**WARNING**

To avoid the risk of electric shock, remove power from the power circuit before connecting power cables to the IDU power supply.

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**WARNING**

The IDU chassis must be solidly bonded to a low-impedance ground (earth) source. To avoid the risk of electric shock and/or equipment damage, do not apply power to the IDU chassis without a ground reference.

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**WARNING**

To avoid the risk of electric shock, make sure the dc power source breaker is off before installing a remote power-off circuit. Use a continuity tester to verify that power is off.

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# Installation summary

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This chapter includes:

- Remote terminal (RT) reference drawing – page 1–2
- RT installation summary and checklist – page 1–3

The installation summary previews the entire RT installation process and serves as a quick reference. For detailed information, see chapters 2 through 8.

## Remote terminal (RT) reference drawing

Figure 1-1 is provided as a reference. It illustrates the main RT components:

- Outdoor unit (ODU)
- Intrafacility link (IFL)
- Indoor equipment

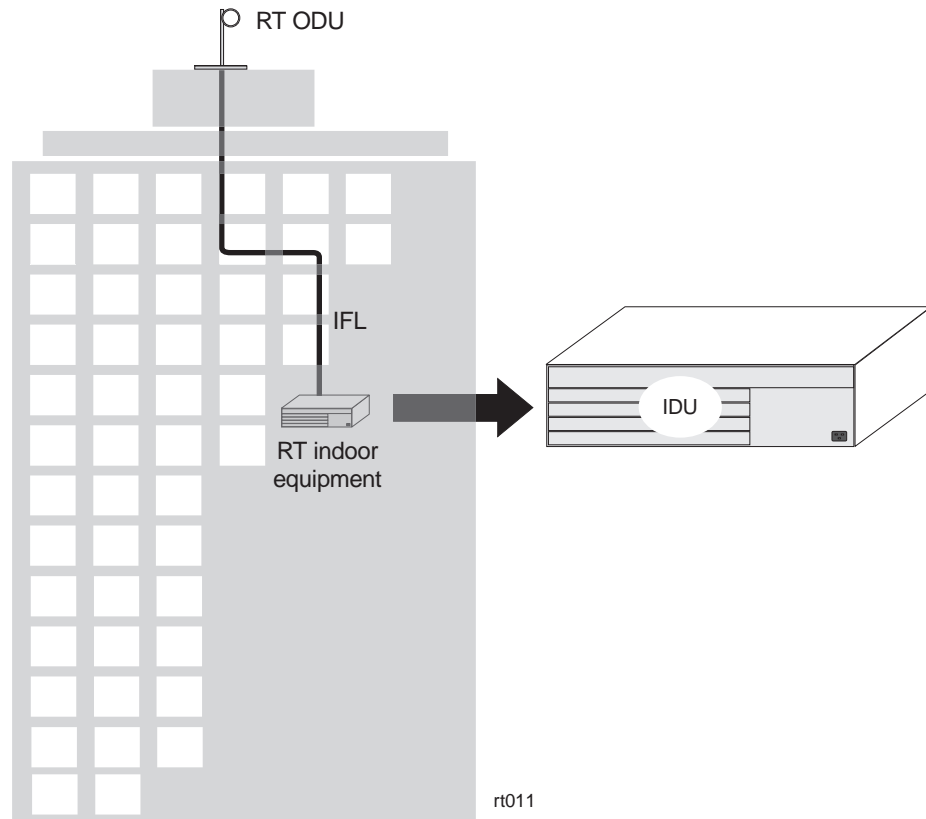


Figure 1-1 RT equipment

## Installation summary and checklist

### ***Components to be installed***

The following AIReach Broadband components are installed at the RT site:

- ODU(s) – Integrated antenna and transceiver
- IFL
- Indoor unit(s) (IDU), including:
  - IDU channel and control module (CCM)
  - IDU service-specific interfaces (SSIs)

### ***Summary of installation steps***

RT installation consists of the following main tasks:

- Ground the rack (if a rack is used) – page 3–2
- Install IDU chassis – page 3–3
- Ground the IDU chassis – page 3–12 (ac) or 3–15 (dc)
- Connect power to power supply – page 3–13 (ac) or 3–15 (dc)
- Install CCM – page 3–24
- CCM power-on test – page 3–26
- Install SSIs – page 3–28
- Install expansion IDUs (EIDUs) (if used) – page 3–34
- Determine IFL cable route – page 4–6
- Install the IFL cable (inside the building) – page 4–9
- Install IFL lightning arrestor – page 4–10
- Ground the lightning arrestor– page 4–13
- Install the IFL cable (on the roof) – page 4–14
- Test the IFL cable – page 4–16

- Install the mast mount – page 5–4
- Install the antenna mount – page 6–10
- Attach the antenna to the mount – page 6–12
- Adjust the antenna azimuth – page 6–15
- Adjust the antenna elevation – page 6–17
- Install the mechanical attenuator (if required) – page 6–19
- Attach the transceiver to the antenna – page 6–21
- Ground the ODU – page 6–23
- Connect the IFL to the ODU – page 6–25
- Connect the IFL to the CCM (IDU) – page 7–3
- Point the antenna (with voltmeter) – page 7–10
- Tighten the mount – page 7–11
- Remove the installation tools – page 7–13
- Verify HT acquisition – page 7–14
- Check component status – page 7–14
- Weatherproof connections – page 8–2
- Obtain customer signoff – page 8–3

For detailed installation instructions, see chapters 2 through 8.



## Chapter 2

# Prerequisites

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This chapter discusses steps that are required prior to installation of AIReach Broadband™ equipment. It includes:

- Reviewing site data and plans – page 2–1
- Planning ahead for building access – page 2–2
- Tools needed for installation – page 2–3
- Prerequisites for commissioning – page 2–7

### 2.1

---

#### Review site data and plans

Before you begin installing the equipment, review all previously collected site data and site plans for information you will need to install the indoor and outdoor equipment, including the IFL (intrafacility link). For more information on the equipment to be installed, see section 1.1.

Review:

- The completed Site Data Record from the *Hub and Remote Terminal Site Preparation Guide* – The Site Data Record is completed during and after the pre-installation site survey. It includes the site address, planned services, information concerning potential sources of interference, IFL information, and much other information.
- Site drawings and photographs – These should include information about the site environment, existing equipment and building features, equipment to be installed, IFL routing, customer equipment to be connected to AIReach Broadband equipment, and other information.
- *Planning the ODU location*, a section in the *Hub and Remote Terminal Site Preparation Guide* – The ODU location should already be selected; however, this section contains information that is useful for the installer to know.

---

## Plan ahead for building access

Before you go to the installation site, **make sure you have all necessary information (such as contact names and phone numbers) for accessing all parts of the building you will need to visit** (roof, equipment rooms—which may be in the basement), and other locations. This information should be available in the Site Data Record, which is completed as part of the site survey.

*Recommendations:*

- Know who to contact for assistance (name, phone number, working hours).
- Get good directions or a building map or floor plan, if possible.
- You may need a key or pass code to gain access to the roof.
- Make all necessary arrangements for facility support and building access *before you go to the installation site.*

## Tools needed for installation

To install and commission AIReach Broadband remote terminal equipment, you need the tools listed in table 2-1 . You may need general-purpose tools in addition to the specific tools listed here.

**Table 2-1 Tools required for RT installation**  
(includes tools for IFL installation, antenna pointing, and initial testing)

√	Item	Purpose (or other comments)
<input type="checkbox"/>	Ladder	May or may not be required; depends on building
<input type="checkbox"/>	Rope	To hoist tools and equipment up ladders. Rope must be long enough for ladders at the site. Must be able to hold <i>at least</i> 35 pounds (16 kilograms). This is the ODU weight. IFL cable is likely to weigh more.
<input type="checkbox"/>	Snow shovel or heavy-duty push broom	To move roof gravel away from the ODU installation site
<input type="checkbox"/>	1/2-inch drill	Cordless drill preferred for work on roof. Drill with power cord required for heavy-duty work (such as mounting a rack to the floor).
<input type="checkbox"/>	Drill with bits for wood and masonry.	May be needed for IFL installation
<input type="checkbox"/>	Combination wrenches: 7/16 inch, 9/16 inch 10 millimeter, 13 millimeter	For installing the mast mount and antenna mount
<input type="checkbox"/>	Ratchet wrench with 9/16-inch socket	For installing the mast mount
<input type="checkbox"/>	3/8-inch torque wrench with 13-millimeter deep socket	Required for installing the antenna mount
<input type="checkbox"/>	5/32-inch (4-millimeter) torque hex key wrench	Used to tighten the radome band clamp
<input type="checkbox"/>	Custom wrench: Sealcon part number 1.500.4200.04	Required to tighten IFL cable restraining fitting. Available from Sealcon, 14853 East Hinsdale Ave., Suite D, Englewood, CO 80112-4240
<input type="checkbox"/>	No. 6 Phillips screwdriver	Needed to attach IDU chassis mounting ears if IDU chassis is rack mounted
<input type="checkbox"/>	1000° heat gun	For applying shrink wrap tubing to protect cable terminations
<input type="checkbox"/>	Cable cutters	

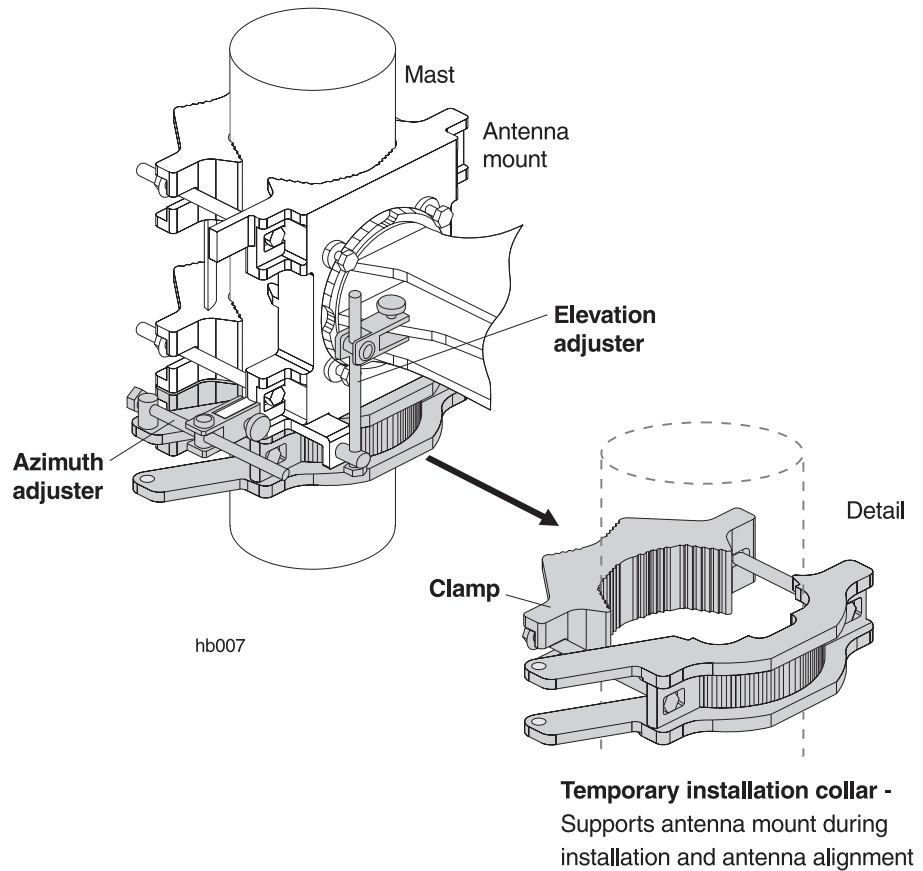
**Table 2-1 Tools required for RT installation – Cont’d.**  
(includes tools for IFL installation, antenna pointing, and initial testing)

√	Item	Purpose (or other comments)
<input type="checkbox"/>	Diagonal cutters (wire cutters)	
<input type="checkbox"/>	Flush mount cutters	
<input type="checkbox"/>	Excelta CX-1-78-1 cable stripping tool	Manufacturer: Excelta Corp., Buellton, CA
<input type="checkbox"/>	Crimp tool for #2 and #6 AWG ground lugs	Manufacturer: Thomas & Betts, Memphis, TN
<input type="checkbox"/>	HCT-231 crimp tool	For terminating N-type connectors
<input type="checkbox"/>	Channel locks	
<input type="checkbox"/>	Soft jaw pliers	Grip tool with soft surface, for gripping and turning N-type connectors
<input type="checkbox"/>	Band cutters	To remove shipping bands from mast mount pieces
<input type="checkbox"/>	Carpenter's knife	
<input type="checkbox"/>	Splicer's knife	To terminate cables
<input type="checkbox"/>	Binoculars	Suggested, for RT installation, if the HT is too far to see
<input type="checkbox"/>	Flashlight	Primarily for IFL installation
<input type="checkbox"/>	100-foot tape measure (metric equivalent: 30.5 meters)	For measuring cable runs
<input type="checkbox"/>	ODU installer tool kit (HNS 1024668-0024)	<p>This kit consists of several specialized tools as shown in figure 2-1:</p> <ul style="list-style-type: none"> <li>• Temporary installation collar and clamp – These support the antenna mount and ODU/antenna during installation and pointing.</li> <li>• Two azimuth/elevation adjuster assemblies – Used to adjust the antenna azimuth and elevation.</li> </ul> <p>The ODU installer tool kit is available from HNS.</p>
<input type="checkbox"/>	Large backpack or padded bag	To haul ODU transceiver and antenna to the roof

**Table 2-1 Tools required for RT installation – Cont’d.**  
(includes tools for IFL installation, antenna pointing, and initial testing)

√	Item	Purpose (or other comments)
<input type="checkbox"/>	Digital voltmeter	For pointing and testing dc voltage measurement accuracy: 0.3%
<input type="checkbox"/>	Test cable terminated with F–connector and alligator clips	Used to connect voltmeter to ODU for antenna pointing
<input type="checkbox"/>	Detailed local map	Used to locate the HT. Must show true north, streets, buildings, and landmarks. Helpful if the map shows magnetic declination (or magnetic north versus true north). A U.S. Geological Survey map is recommended. A travel map will suffice if it shows sufficient detail.
<input type="checkbox"/>	Ruler or straight edge	Used to mark directions on map
<input type="checkbox"/>	Pencil or broad–tip pen	Used to add markings to local map
<input type="checkbox"/>	Protractor	May be useful as an aid in pointing the antenna. Must show 0° increments from 0° to 180°.
<input type="checkbox"/>	Compass	May be useful as an aid in pointing the antenna. Must be accurate to within ±1°
<input type="checkbox"/>	Personnel safety lines	For safety on roof
<input type="checkbox"/>	Back brace	To protect against back injury while hoisting or lifting equipment and installation materials
<p><b>Note:</b> Vendor names, model numbers, and part numbers identify equipment known to be suitable. Other comparable equipment may also be suitable.</p>		

Figure 2-1 shows the specialized tools included in the ODU installer tool kit (HNS 1024668-0024). These tools can also be ordered separately: Temporary installation collar with clamp – HNS 1024668-0022; one azimuth/elevation adjuster (interchangeable) – HNS 1024668-0023. These tools are removed after mount installation and pointing so they can be reused for subsequent installations.



**Figure 2-1 Tools included in ODU installer tool kit (shaded)**

---

## Prerequisites for commissioning

You will not be able to commission the RT (as detailed in chapter 7) unless the Element Management System (EMS) is operational. Specific requirements for commissioning are:

- The EMS hardware and software must be installed and operational.
- The EMS database must be loaded and operational.
- The EMS operator has to enter the hub MAC address into the EMS database.
- The hub and HT are installed and operational. **The HT must be properly aligned.**

*Additional prerequisites for commissioning are listed in chapter 7. The additional prerequisites are satisfied when the RT is properly installed. **The prerequisites listed above must be accomplished prior to RT installation—or commissioning will be delayed until they are accomplished.***

# Installing indoor RT equipment

---

This chapter includes:

- Rack grounding
- Installing indoor units (IDUs)
- Power supplies – page 3–8
- Installing the CCM – page 3–24
- CCM power–on test – page 3–26
- SSIs – page 3–28
- Installing expansion IDUs (EIDUs) – page 3–34

*For IDU standards compliance information, see appendix B (page B–3).*

- All of the tasks in this chapter are done inside.



## Rack grounding

If the RT IDU will be mounted in a rack, the rack must be grounded, as shown in figure 3-1:

1. Run a ground wire from the rack location to the master ground bar in the equipment room. This wire must be No. 2 AWG, green, stranded, and shielded.
2. Ground the rack by connecting a No. 6 AWG wire from the rack to the No. 2 AWG ground wire.

Use a 2-hole lug to connect the No. 6 AWG wire to the rack. Remove paint and apply anti-oxidant as shown in the illustration.

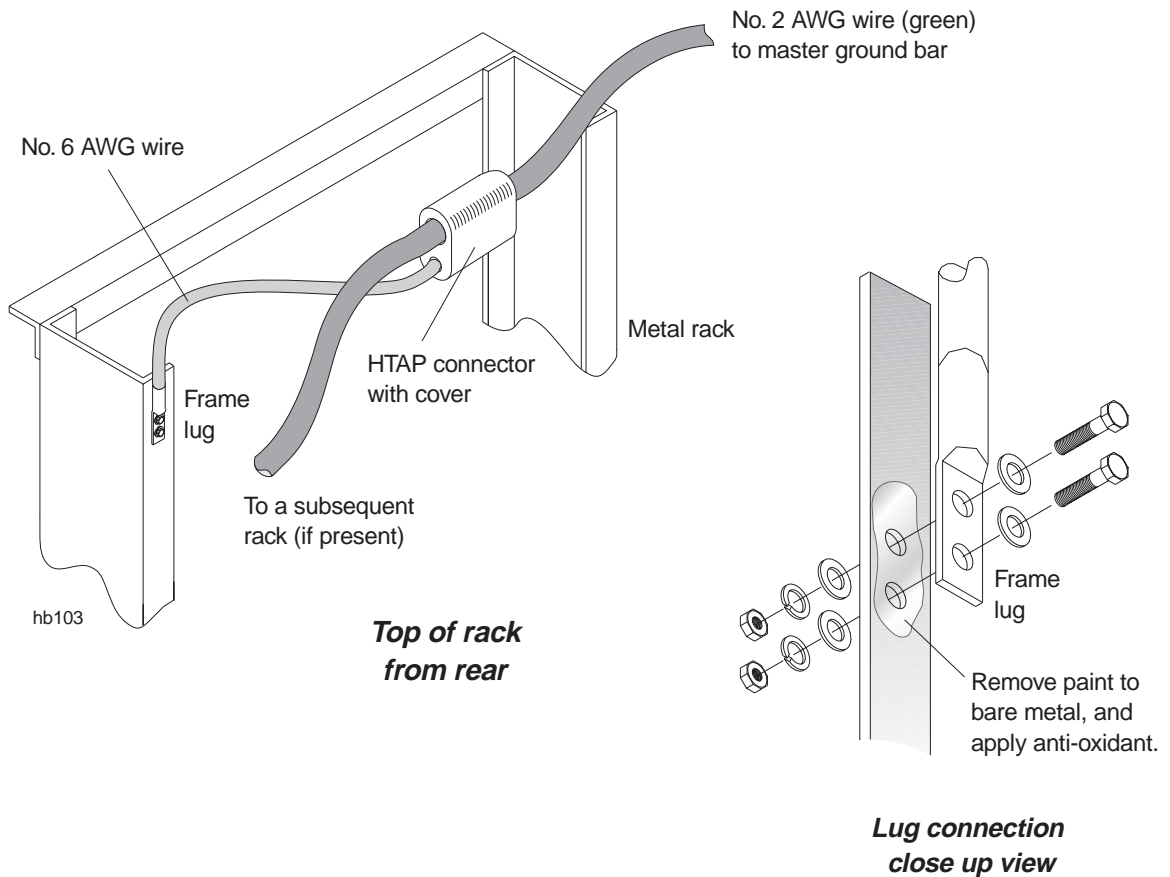


Figure 3-1 Rack ground connections

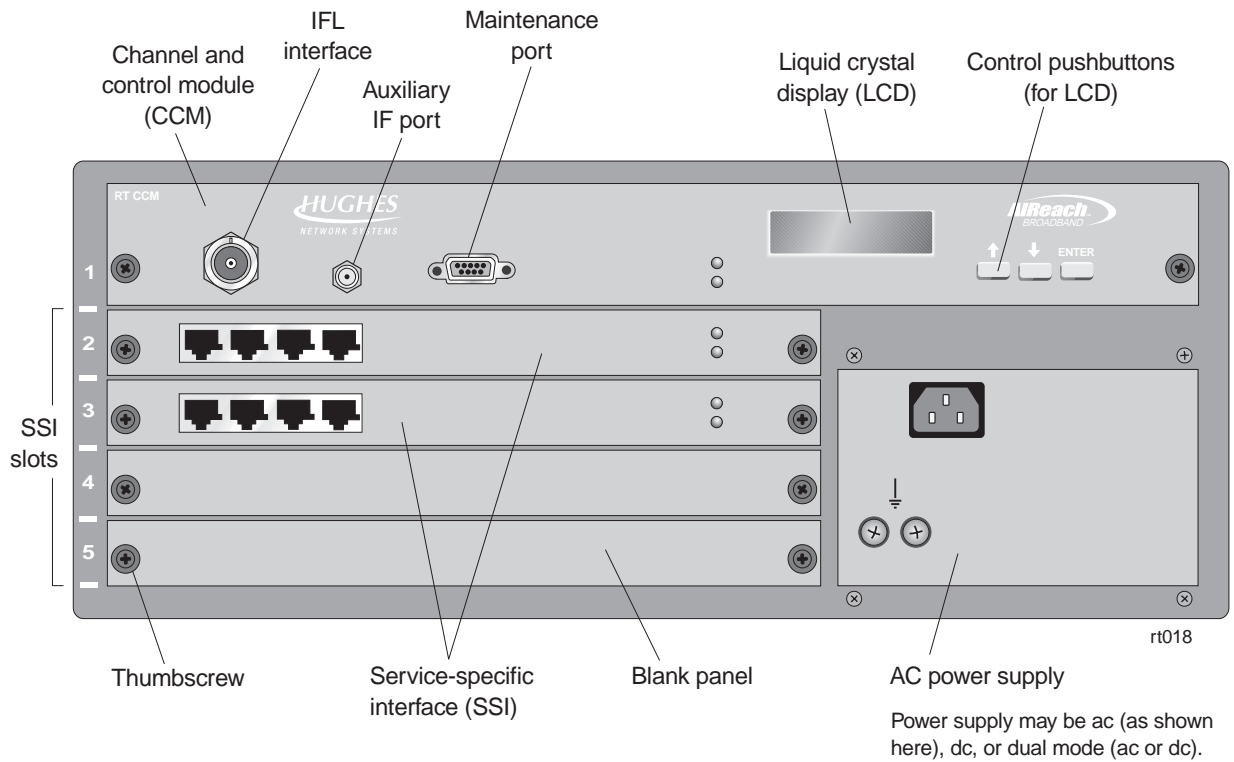
## Installing IDUs

Figures 3-2 and 3-3 show the RT indoor unit (IDU), which houses the channel and control module (CCM) and service-specific interfaces (SSIs). The IDU chassis is shipped with the power supply installed, but the CCM and SSIs are not installed.

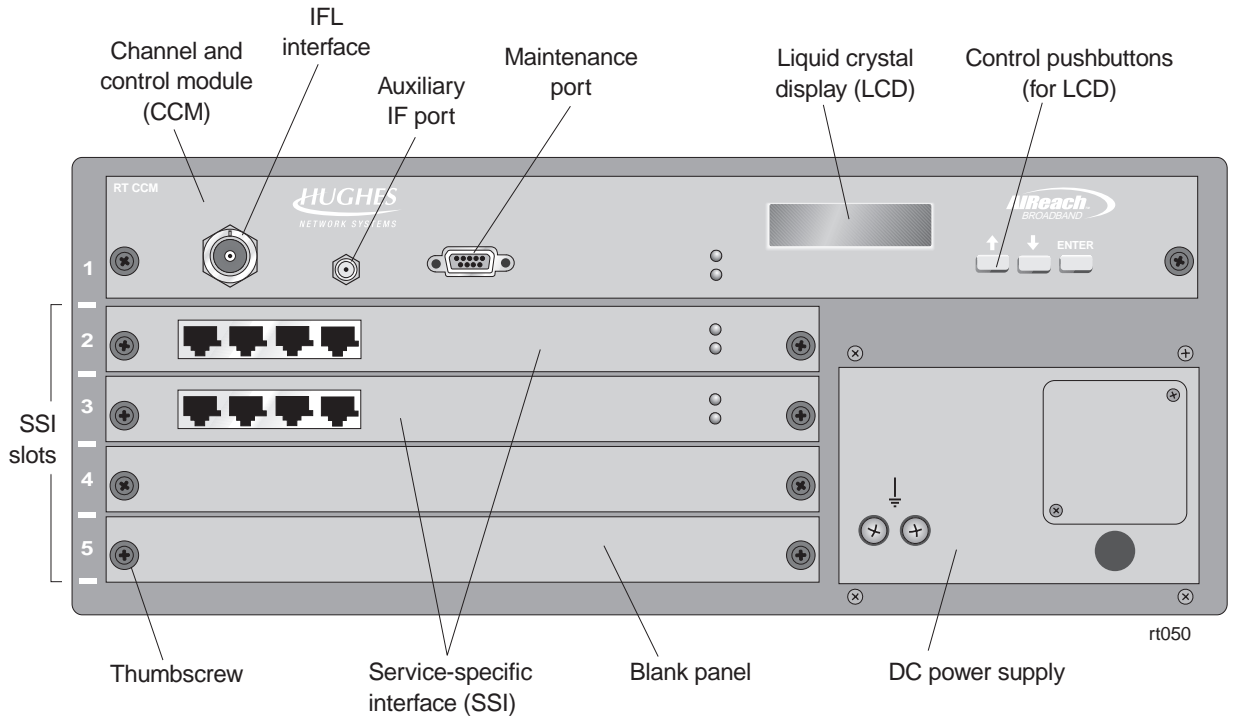
*For IDU standards compliance information, see appendix B (page B-3).*

### IDU components

Figures 3-2 and 3-3 identify the main IDU components.



**Figure 3-2 RT IDU main components (shown: IDU with ac power supply)**



**Figure 3-3** RT IDU with dc power supply

### IDU chassis types

Three IDU chassis types are available, each with a different power supply option:

**Table 3-1** IDU types

IDU type	HNS part number
IDU chassis with ac power supply	1026356-0001
IDU chassis with dc power supply (-48 Vdc)	1026356-0002
IDU chassis with dual mode (ac or dc) power supply	1026356-0003

The power supply is not user replaceable.

### Prerequisites

Before you install the IDU chassis, make sure a power source is available. If it is not, you may have to select a different location for the IDU or install an electrical receptacle.

**Note:** The IDU is an industrial product. For safety and security reasons, it must be installed in an area that is accessible only to authorized servicing personnel.

## Mounting options

The IDU can be used on a tabletop or installed in a 19-inch (48.3-centimeter) rack. With optional adapter brackets, the IDU can also be installed in a 23-inch (58.4-centimeter) rack.

## Rack mounting

### ***Safety guidelines***

Observe these guidelines from Underwriters Laboratories Inc. (UL) when you install IDU chassis in a rack (any rack):

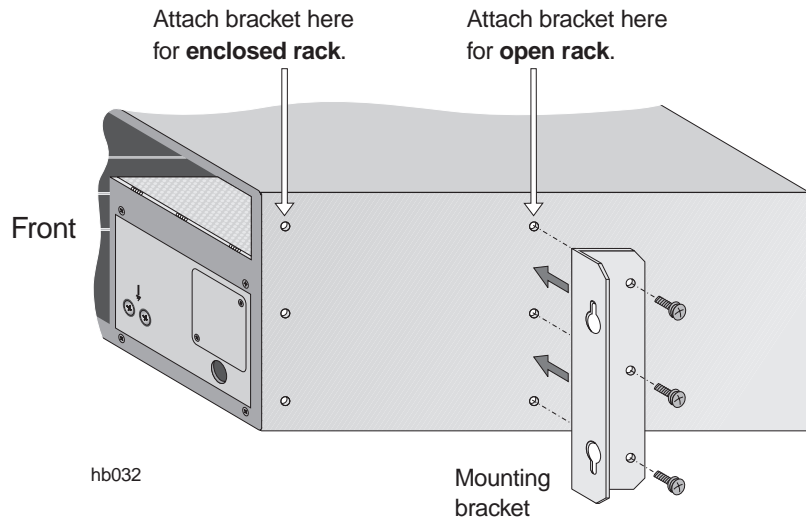
- Make sure the power requirements of the IDU chassis plus the cumulative power draw of other equipment in the rack do not overload the supply circuit and/or wiring of the rack.
- The IDU weighs about 20 pounds (about 9 kilograms). Have someone help you when you lift the IDU chassis to install it in the rack.
- Always load the rack from bottom to top to ensure a stable and safe rack.
- Installation of the IDU chassis within the rack system should not reduce air-flow within the rack.
- The maximum recommended ambient temperature for the IDU chassis is 50 °C (122°F).
- While installing the IDU chassis into the rack, make sure you maintain a proper earth grounding for the equipment.

### ***Rack mounting instructions***

To mount the IDU chassis in a rack, you need the rack mounting brackets included in HNS kit 1027191-0001. This kit includes two brackets and six Phillips SEMS screws for attaching the bracket to the IDU.

To mount the IDU chassis in a rack, follow these steps:

1. Attach the rack mounting brackets as shown in figure 3-4. Be sure to use the correct sets of holes (front or midpoint) for each bracket, as indicated in figure 3-4.

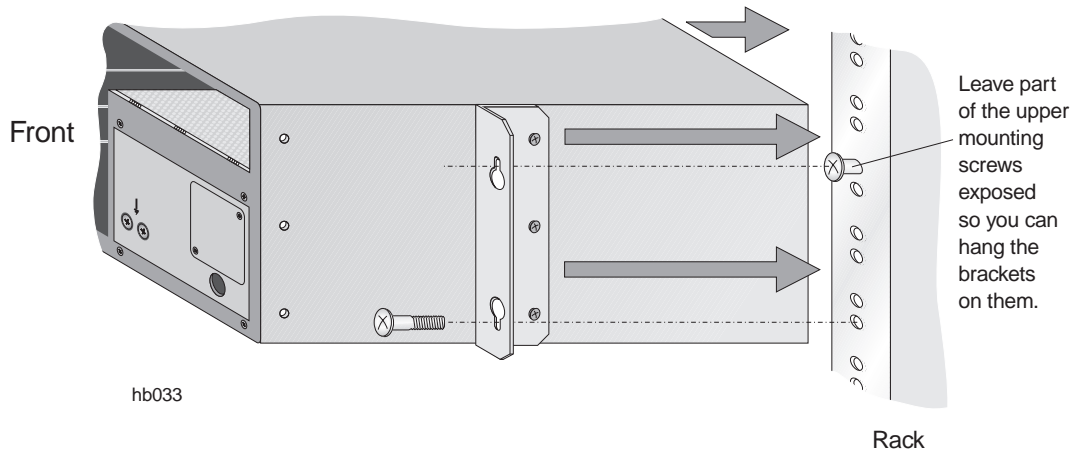


**Figure 3-4 Attaching rack mounting brackets to the IDU chassis**

2. Screw the two upper mounting screws into the rack (one on each side), at the desired installation height. Refer to figure 3-5.

Do not tighten the screws all the way—this allows you to hang the chassis by the top “teardrop” holes on the brackets (in step 3).

(The four mounting screws that screw into the rack should be provided with the rack.)



**Figure 3-5** Installing the IDU chassis in a rack

3. Place the chassis into the rack, and slip the top hole of each bracket over the heads of the upper mounting screws in the rack.
4. Support the chassis with one hand while you install and tighten the two lower screws.
5. Tighten the two upper screws.

## Power supplies

The IDU power supply is installed in the chassis at the factory. However, you need to make sure the power supply is grounded and connect power to the power supply. Detailed instructions for these steps follow.

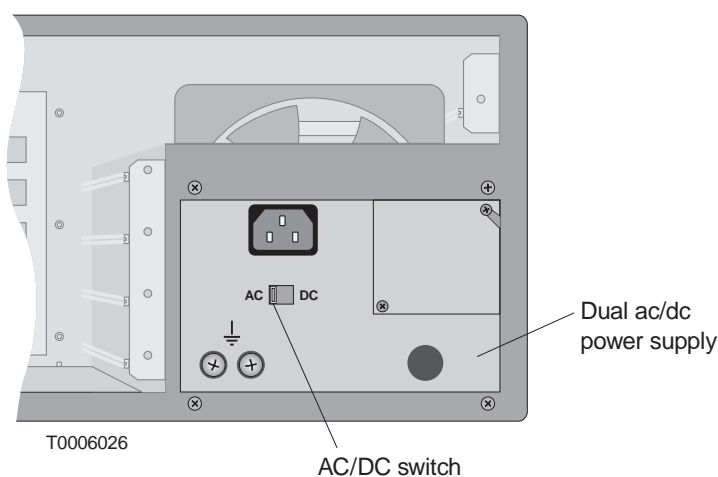
### Power supply options

The IDU chassis may be equipped with an ac, dc, or dual (ac or dc) power supply, depending on the local power environment. In the following sections, make sure you follow all instructions for the type of power supply your IDU chassis has.

**Do not attempt to replace or substitute power supplies.** If there is a problem with a power supply, return the chassis to HNS for repair or replacement.

### Dual (ac or dc) power supply

The dual ac or dc power supply (figure 3-6) can be used with an ac or dc power source. A recessed switch on the front of the power supply is used to select ac or dc operation.



**Figure 3-6** Dual ac or dc power supply

#### **Selecting ac or dc power**

Follow these instructions to set the power supply for ac or dc operation:

*To use the dual power supply with ac power:*

**Make sure the switch is in the ac position;** then follow the instructions below for ac power supplies.

**Note:** The ac–dc switch is recessed to prevent accidental switching. Use a flathead screwdriver to change the switch position.

*To use the dual power supply with dc power:*

**Make sure the switch is in the dc position;** then follow the instructions below for dc power supplies.

### ***Selecting ac or dc power***

Follow these instructions to set the power supply for ac or dc operation:

*To use the dual power supply with ac power:*

**Make sure the switch is in the ac position;** then follow the instructions below for ac power supplies.

**Note:** The ac/dc switch is recessed to prevent accidental switching. Use a flathead screwdriver to change the switch position.

*To use the dual power supply with dc power:*

**Make sure the switch is in the dc position;** then follow the instructions below for dc power supplies.



***Labels on dual power supply***

A label on the dual ac or dc power supply warns:

**WARNING**  
**MULTIPLE POWER**  
**CONNECTORS.**  
**DISCONNECT BOTH**  
**AC & DC POWER**  
**BEFORE SERVICING.**

**Servicing personnel must heed this warning. Note that the IDU and power supply should be serviced *only* by HNS.**

A second label on the dual ac or dc power supply advises:

**CAUTION**  
**THIS EQUIPMENT HAS A**  
**CONNECTION BETWEEN**  
**THE EARTHED CONDUCTOR**  
**OF THE D.C. SUPPLY CIRCUIT**  
**AND THE EARTHING CONDUCTOR.**  
**SEE EARTHING INSTRUCTIONS**

To disconnect dc power, unplug the terminal block (shown on page 3–17). Do not remove the wires from the terminal block while it is plugged in. If you do, the IDU chassis will not be grounded.

***Additional instructions***

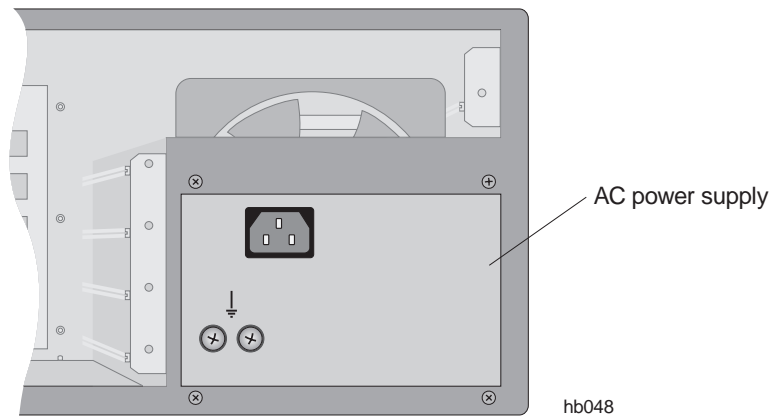
*If the power supply is a dual ac or dc unit, follow the instructions in the following sections for both ac and dc power supplies.*

## AC power supply

IDU chassis with an ac power supply (figure 3-7) or dual ac or dc power supply are equipped with a recessed IEC-320-C13 connector and a 7.5-foot (2.3-meter) power cable (HNS 9003024-0013). The power cable includes a NEMA 5-15-P plug to connect to the power source (receptacle). The cable is rated at 125 Vac, 10 amperes, and is equipped with an internal ground (earth) conductor.

The primary input requirements for the ac power supply are:

<b>Voltage:</b>	100 – 240 Vac
<b>Current:</b>	6.4 amperes maximum
<b>Frequency:</b>	50 – 60 Hz



**Figure 3-7 AC power supply**

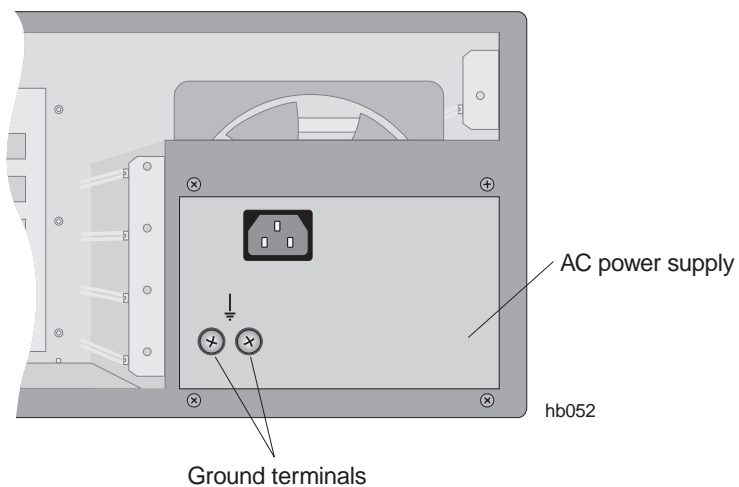
## Grounding the ac IDU chassis

**Important:** In the United States and some international markets, the required ground bond is provided by the grounding conductor in the cable and ac service conductors. If grounding is provided through the grounding conductor and service conductors, *no additional grounding is required.*

**In environments where ac grounding conductors are not available, a separate bonding conductor is required.**

If a separate bonding conductor is required, ground the ac power supply as follows:

1. Use a 2-hole lug to connect a No. 16 AWG ground wire to the ground terminals on the front of the power supply. See figure 3-8.



**Figure 3-8** Ground terminals on ac power supply

2. Connect the other end of the ground wire to the rack ground bar. If the IDU chassis is not rack mounted, connect the ground wire to a ground point such as a water pipe or building steel.

## Connecting ac power



### WARNING

The IDU chassis must be solidly bonded to a low-impedance ground (earth) source. To avoid the risk of electric shock and/or equipment damage, do not apply power to the IDU chassis without a ground reference.



### CAUTION

If the ODU and lightning arrestor are not connected to the IFL, do not power on the IDU chassis without first making sure the IFL is not connected to the IDU chassis. Failure to observe this instruction could result in damage to the equipment.

To connect ac power:

1. **Measure the voltage level of the power source to make sure it can accommodate the total IDU and ODU power requirements.**  
(The IDU supplies power to the ODU through the IFL.)  
If the voltage level cannot accommodate the IDU and ODU, the power source must be upgraded before you can proceed.
2. Connect the power cable to the IEC-320-C13 connector on the power supply.
3. Route and secure the cable to avoid physical damage.
4. Connect the plug end of the cable to a dedicated ac power source.

**Important: In the United States, ac-power IDU chassis must be connected to a dedicated power circuit with a 15-ampere single-pole breaker. The circuit must not include unrelated equipment.**

## DC power supply

Figure 3-9 shows an IDU chassis with a dc power supply.

A power cable is not supplied with the dc IDU chassis because cable requirements vary, depending on where the chassis will be used.

The power input requirement for the dc power supply (and dc portion of the dual ac or dc power supply) is  $-42$  to  $-56$  Vdc.

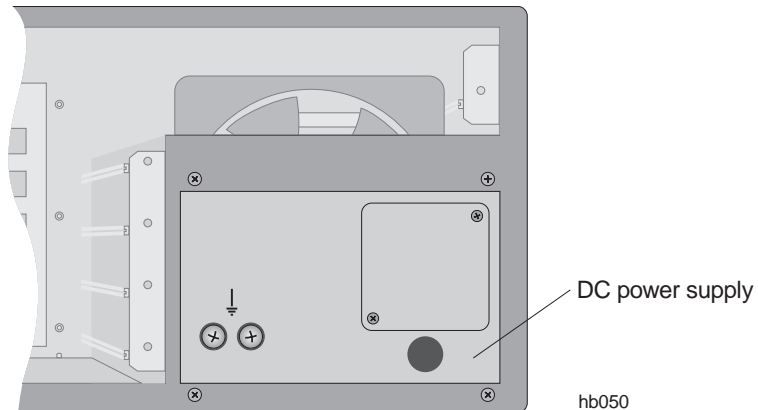


Figure 3-9 DC power supply

### ***Label on dc power supply***

A label on the dc power supply advises:

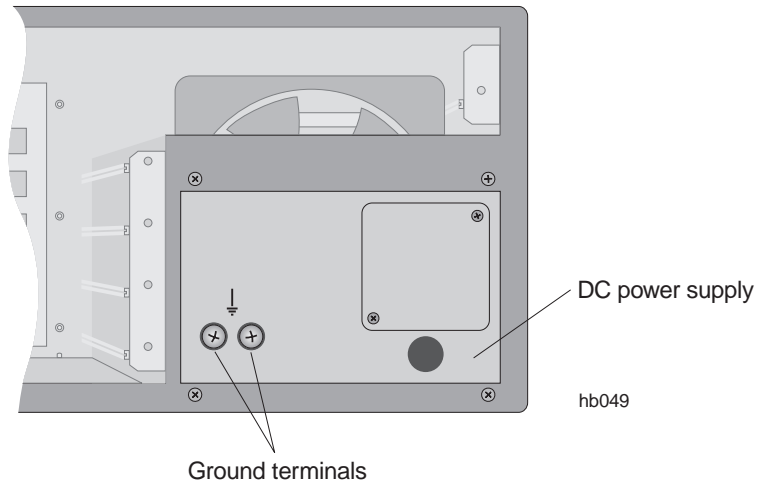
**CAUTION**  
**THIS EQUIPMENT HAS A  
CONNECTION BETWEEN  
THE EARTHED CONDUCTOR  
OF THE D.C. SUPPLY CIRCUIT  
AND THE EARTHING CONDUCTOR.  
SEE EARTHING INSTRUCTIONS**

To disconnect dc power, unplug the terminal block (shown on page 3-17). Do not remove the wires from the terminal block while it is plugged in. If you do, the IDU chassis will not be grounded.

## Grounding the dc IDU chassis

Ground IDU chassis with a dc power supply as follows:

1. Use a 2-hole lug to connect a No. 14 AWG ground wire to the ground terminals on the front of the power supply (figure 3-10).



**Figure 3-10** Ground terminals on dc power supply

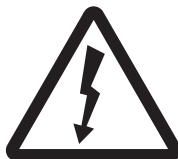
2. Connect the other end of the ground wire to the rack ground bar. If the IDU chassis is not rack mounted, connect the ground wire to a ground point such as a water pipe or building steel.

## Connecting dc power



### WARNING

To avoid the risk of electric shock, remove power from the power circuit before connecting power cables to the IDU chassis power supply.



### WARNING

The IDU chassis must be solidly bonded to a low-impedance ground (earth) source. To avoid the risk of electric shock and/or equipment damage, do not apply power to the IDU chassis without a ground reference.



## CAUTION

If the ODU and lightning arrester are not connected to the IFL, do not power on the IDU chassis without first making sure the IFL is not connected to the IDU chassis. Failure to observe this instruction could result in damage to the equipment.

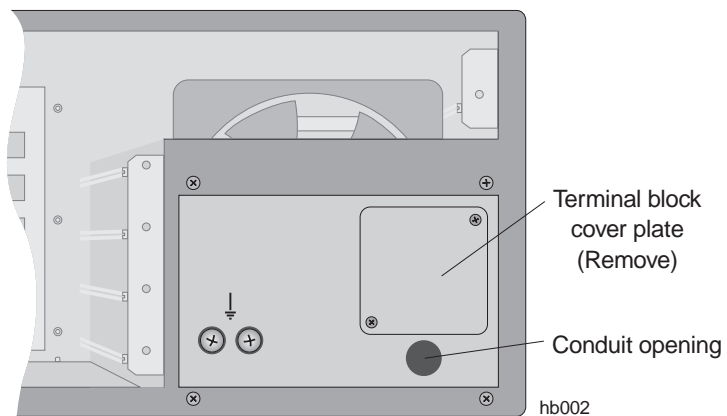
To connect power cables from the dc power source (usually a rectifier) to the dc power supply, follow the steps below.

1. **Measure the voltage level of the power source to verify it can accommodate the total IDU and ODU power requirements.**

(The IDU supplies power to the ODU through the IFL.)

If the voltage level cannot accommodate the IDU and ODU, the power source must be upgraded before you can proceed.

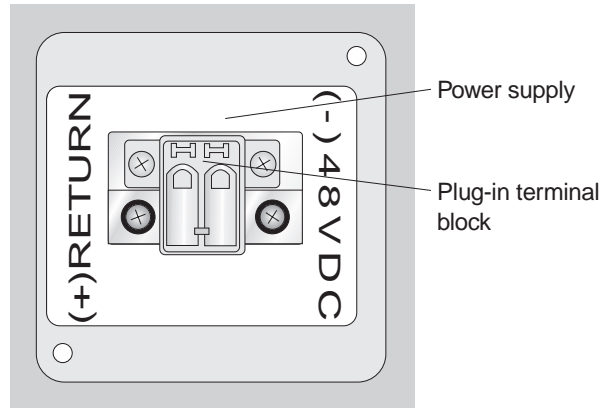
2. Remove power from the power circuit.
3. Loosen the two Phillips screws from the square terminal block cover plate on the front of the power supply.



4. Rotate the protective plate to expose the terminal block.

• Follow steps 5 through 14 to insert the power cable wires into the power supply terminal block:

5. Unplug the terminal block from the power supply socket.



hb108

6. Strip both wires from the power source to about ¼ inch (6 centimeters) from the end.

<b>Note:</b> Wires used with the terminal block must meet these specifications:	
Composition	Solid or stranded
Wire cross-sectional area	0.2 to 2.5 square millimeters
Rated gauge	12 to 24 AWG

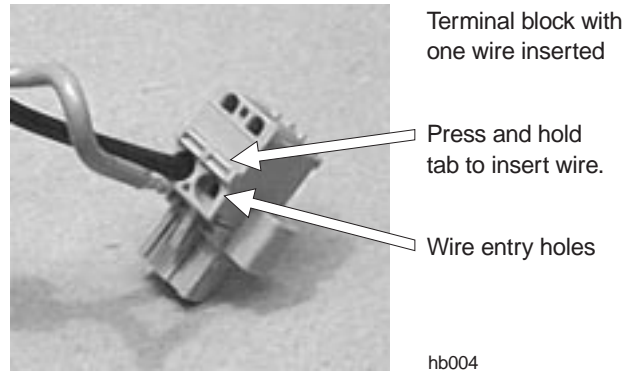
7. Twist the wires as shown in the photo below.
8. Insert both wires through the plastic strain relief bushing (HNS 9005614-0001).



hbph014



9. Lay the terminal block on a flat surface, with the wire entry holes facing up.
10. Use a small, flat-blade screwdriver (or similar tool) to press in the tab above the wire entry hole on the terminal block. Hold the tab in.

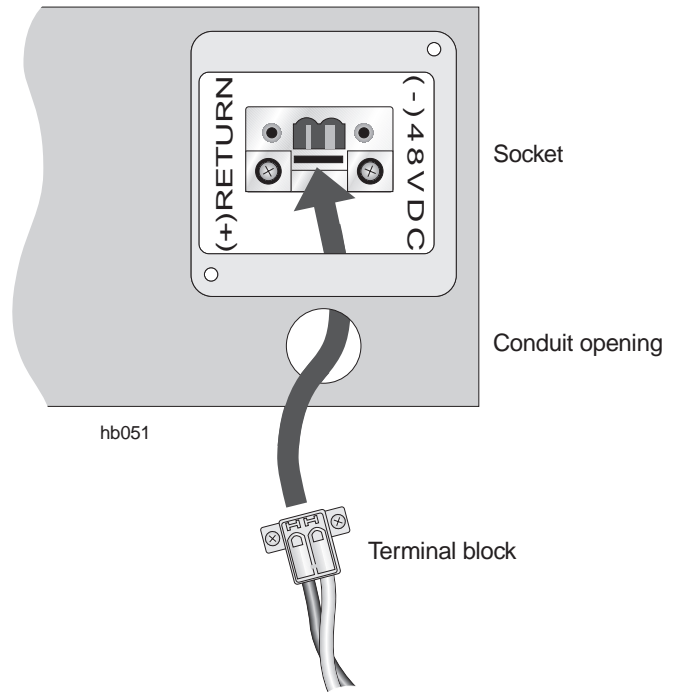


11. While holding the tab in, insert the stripped wire end.

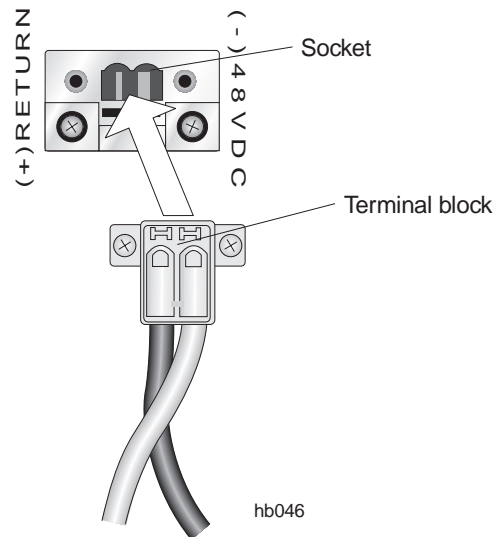
**Important:** Insert the return (+) wire from the dc power source into the terminal block so it will connect to the power supply terminal marked **(+) Return** when the terminal block is plugged in. Likewise, insert the -48 Vdc (-) wire so it will connect to the **-48 VDC (-)** power supply terminal.

12. When the wire is fully inserted, release the tab.
  13. Gently tug the wire to make sure it is securely inserted.
  14. Repeat steps 10 through 13 for the second wire.
- *At this point, both wires are inserted into the terminal block.*

15. Insert the terminal block through the conduit opening and guide it up to the socket.



16. Plug the terminal block into the power supply terminal socket.



17. Snap the strain relief bushing into the conduit opening.
18. Tighten the screw on the strain relief bushing just enough to hold the wires in place. Do not overtighten.
19. Replace the protective plate and tighten the screws.

- *This completes the power connections.*

## **Powering off the dc IDU**

The chassis does not have a power off/on switch. In normal operation, power is always on. If you need to power off the IDU:

- Break the power circuit at the rack fuse panel,
- Break the power circuit at the external fuse or circuit breaker panel, *or*
- Use an optional remote power-off circuit.

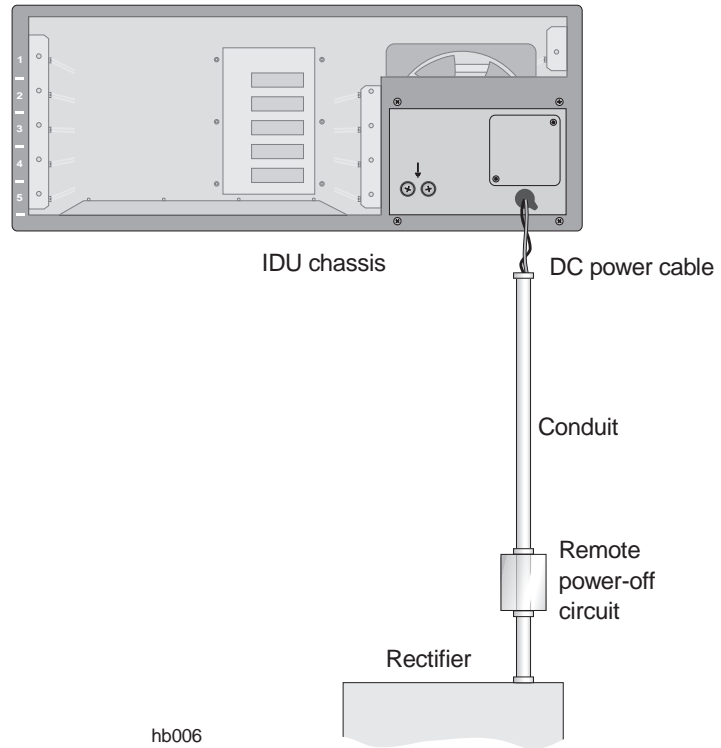
## **Remote dc power-off circuit**

**This section applies only to dc power circuits.**

The circuit from the dc power source (usually rectifiers) to the IDU chassis must include a circuit breaker or other disconnect device that meets the following Underwriters Laboratories (UL) requirements:

**To install dc power for the IDU chassis, a readily accessible disconnect device shall be installed or should be readily available at the site where the IDU chassis is installed. The disconnect device must be a UL-listed circuit breaker rated at 60 Vdc, 6.3 amperes minimum, 15 amperes maximum.**

If the rectifier-to-chassis power circuit does not include a suitable circuit breaker, you can satisfy the disconnect requirement by including a remote power-off switch as shown in figures 3-11 and 3-12. If the power circuit already includes a suitable circuit breaker, skip this section.



**Figure 3-11** The remote power-off circuit (if needed) is installed between the IDU chassis and dc power source.

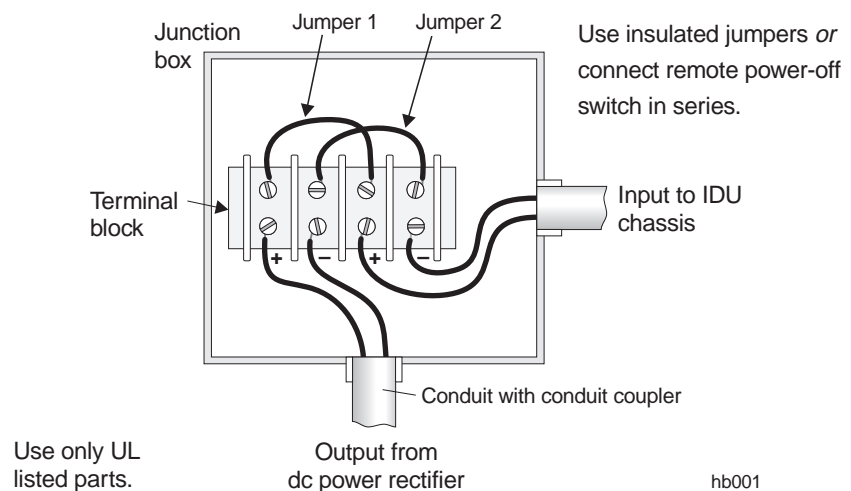


## WARNING

To avoid the risk of electric shock, make sure the dc power source breaker is off before installing a remote power-off circuit. Use a continuity tester to verify that power is off.

To install a power-off circuit (if needed), follow these steps:

1. Make sure the rectifier breaker switch is off.
2. Install a UL-approved terminal block inside a UL-approved electrical junction box as shown in figure 3-12.



**Figure 3-12 Remote power-off circuit**

3. Choose *one* of the following three options:

*If you plan to add a power-off switch later,* install jumpers 1 and 2, and replace the junction box cover. This completes the circuit installation.

*If you are installing a double-pole remote power-off switch,* use a double-pole, single-throw switch rated at 60 Vdc, 15 amperes (minimum):

In place of jumper 1, wire the switch between the (+) terminal from the rectifier and the (+) terminal from the IDU.

In place of jumper 2, wire the switch between the (-) terminal from the rectifier and the (-) terminal from the IDU.

*If you are installing a single-pole remote power-off switch, use a single-pole, single-throw switch rated at 60 Vdc, 15 amperes (minimum):*

Install jumper 1.

In place of jumper 2, wire the switch between the (-) terminal from the rectifier and the (-) terminal from the IDU chassis.

• *If you installed a switch, follow steps 4 through 9 to test the switch:*

4. Place the remote power-off switch in the open position.
5. Replace the junction box cover.
6. Turn on the dc breaker.
7. Close the power-off switch. Confirm that the chassis is receiving power.
8. Open the switch again. Confirm that the chassis is no longer powered. If the switch does not operate correctly, turn the rectifier breaker off and make sure the circuit is connected as shown in figure 3-12.
9. If the switch operates correctly, leave it in the open position with the breaker off.

*Do not install the channel and control module (CCM) or service-specific interfaces (SSIs) yet.*

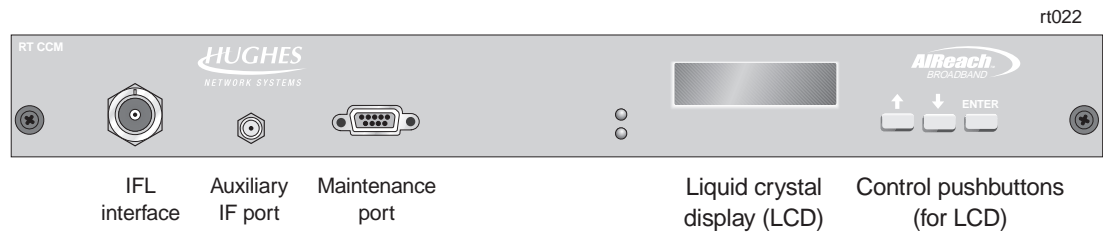
## **Power-on inspection and test**

To test the IDU chassis and power supply, perform these steps *without* a CCM or SSIs:

1. If the IDU chassis is dc powered, inspect the power supply wiring to verify that the polarity is correct.
2. Power on the IDU—*with no modules installed*; then check to make sure no breakers have tripped or fuses have blown.  
**If a breaker trips or fuse blows, be sure to troubleshoot and correct the problem before proceeding.**

## Installing the CCM


A channel and control module (CCM) must be installed in the top slot (slot 1) of the IDU chassis. For an RT IDU, the CCM must be a CCM RT (HNS 1027181-0002), as shown in figure 3-13.



**Figure 3-13 CCM RT**

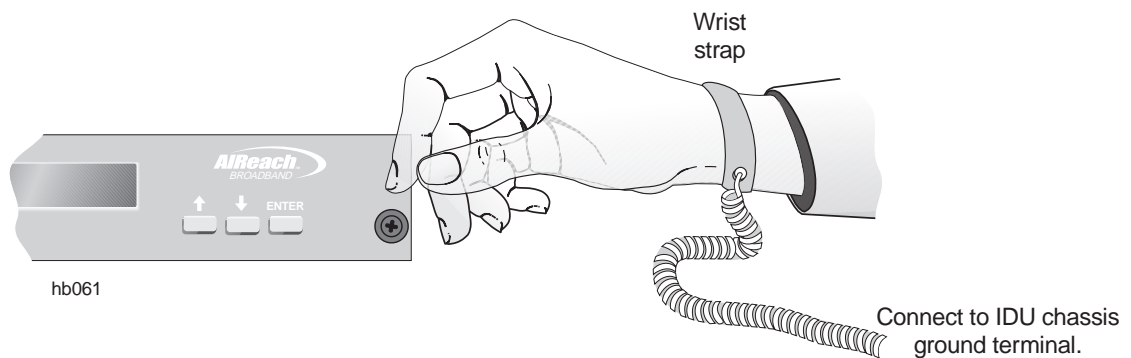
The CCM supports the interface modules installed in the IDU chassis by performing control, bus, upconversion, and downconversion functions. These modules—SSIs—are described in section 3.5.

To install the CCM RT, follow the steps below:



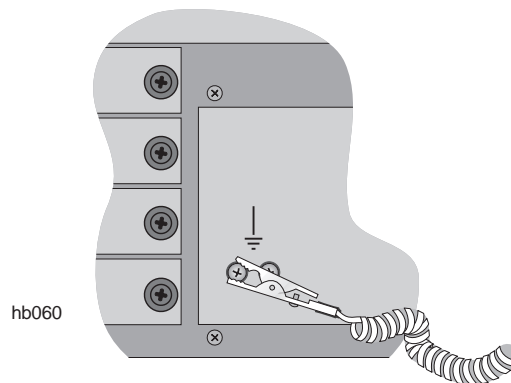
**CAUTION**

Always wear a new or recently tested electrostatic discharge (ESD) wrist strap (figure 3-14) when handling circuit modules. Failure to use a wrist strap may result in damage to components.

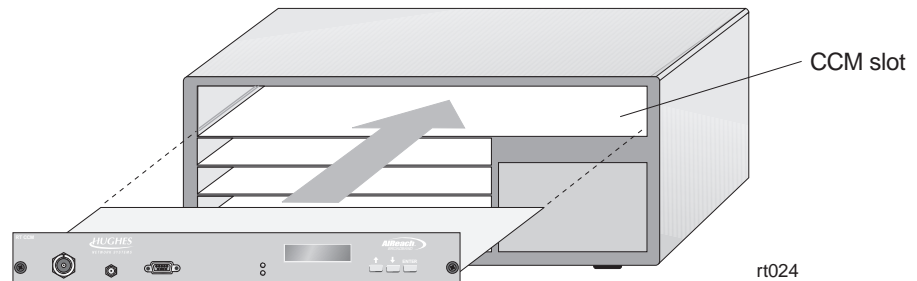


**Figure 3-14 ESD wrist strap**

1. Wrap the ESD strap snugly around your wrist and connect the alligator clip to one of the ground terminals on the IDU chassis power supply.



2. Remove the CCM from its ESD protective packaging. **Retain the packaging in case it is necessary to return the CCM for repair.**
3. Slide the module into the guides on each side of the top chassis module slot (slot 1) and push it firmly into place until the CCM front panel is flush with the front of the chassis.



4. Tighten the thumbscrews at each end of the CCM. To tighten the thumbscrews, push them toward the IDU chassis and turn them clockwise. To fully tighten the thumbscrews, use a Phillips screwdriver.



## CCM power-on test (SUDS)

Test the CCM for proper operation, as follows:

1. Apply power to the IDU chassis.
2. Observe the LEDs on the CCM front panel:
  - **Green** – CCM startup and normal operation
  - **Red** – Failure
3. Also observe the CCM startup diagnostics (SUDS) on the CCM's front panel LCD:  
SUDS start on powerup. While they run, the CCM front panel shows the following messages, in the sequence shown.

**Equipment function is normal when you see the messages shown below and no failure messages.**

### *Initial powerup*

```
SUDS CPU Reg OK
SUDS DRAM   OK
```

CPU registers and dynamic RAM are tested.

### *Timer test*

```
SUDS Timer Test
```

Timers are tested.

### *Watchdog timer test*

```
SUDS WDT Test
```

The watch dog timer is tested.

### *PCI test*

```
SUDS PCI Test
```

The PCI controller is tested.

### *Static dual port RAM test*

```
SUDS SDPRAM Test
```

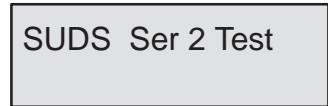
Static dual port RAM is tested.

### *Serial port 1 test*

```
SUDS Ser 1 Test
```

Serial port 1 is tested.

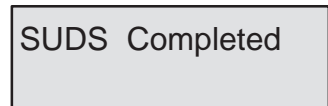
### ***Serial port 2 test***

A rectangular box representing an LCD screen with a light gray background and a black border. The text "SUDS Ser 2 Test" is displayed in a black, sans-serif font, centered on the screen.

Serial port 2 is tested.

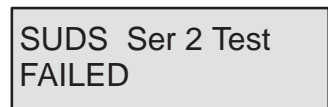
### ***Successful test completion***

**This message indicates that startup diagnostics have successfully completed:**

A rectangular box representing an LCD screen with a light gray background and a black border. The text "SUDS Completed" is displayed in a black, sans-serif font, centered on the screen.

### ***Failure indication***

**If a failure occurs during any of the tests listed above, the LCD message sequence stops.** The LCD shows the test that failed on the first line and **FAILED** (flashing) on the second line, as in the example below.

A rectangular box representing an LCD screen with a light gray background and a black border. The text "SUDS Ser 2 Test" is on the first line and "FAILED" is on the second line, both in a black, sans-serif font.

This screen indicates that serial port 2 failed diagnostics.

The LCD remains inactive unless you power the CCM off, then on. This restarts SUDS.

### **If any CCM component fails, replace the CCM.**

After SUDS are complete, the LCD displays the CCM boot up sequence. At this point, you only need to verify that SUDS have completed.

- Leave power on while you install the SSIs (next).

## SSIs

Service-specific interface modules (SSIs) provide interfaces to support specific network services. SSI types used depend on the needs of the customer network.

■ The following SSIs can be installed in the RT IDU chassis:

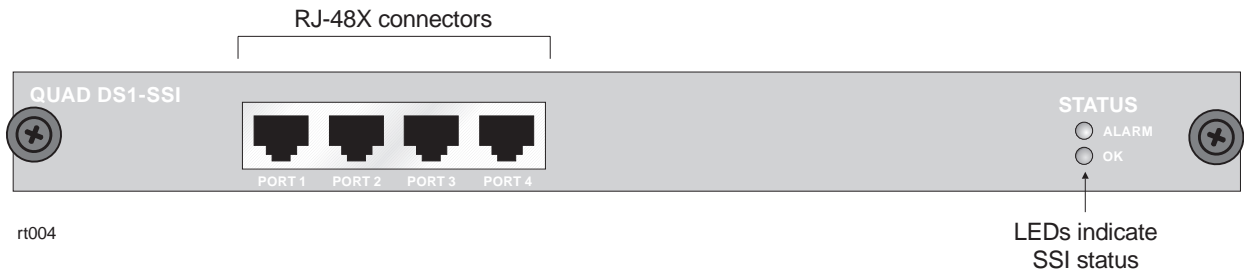
- Quad-DS1 (HNS 1027070-0001)
- DS3-TDM (HNS 1027094-0001)
- Universal-DS1 (HNS 3003132-0001)
- DS3-ATM (HNS 3003136-0002)
- DS3-Transparent (HNS 1027094-0002)

■ The following RT SSIs are currently in development:

- MPEG
- Ethernet 10BaseT/100BaseT

SSIs are installed in slots 2 through 5 in the RT IDU chassis.

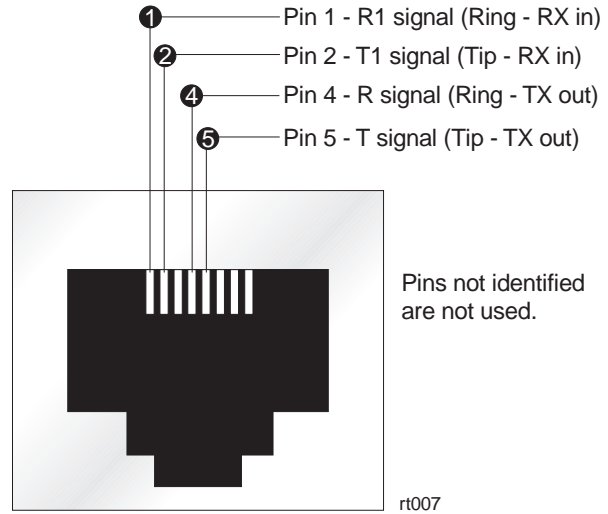
**Quad-DS1** The Quad-DS1 SSI, shown in figure 3-15, provides up to a four T1 or E1 line link between the HT and RT.



**Figure 3-15 Quad-DS1 SSI**

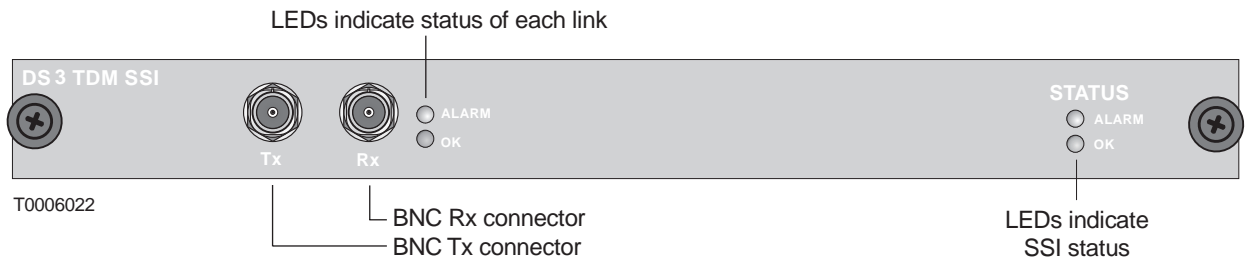
The maximum cable length for a Quad-DS1 SSI is 655 feet (199.6 meters).

The pinouts for the RJ-48X connectors on the Quad-DS1 SSI are shown in figure 3-16.



**Figure 3-16 RJ-48X connector pinouts**

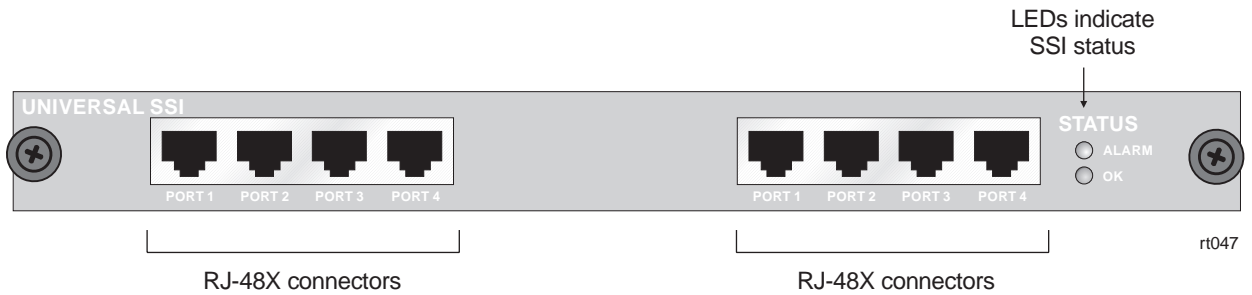
**DS3-TDM** The DS3-TDM SSI, shown in figure 3-17, provides a structured or transparent D3 service link between the HT and RT.



**Figure 3-17 DS3-TDM SSI**

The maximum cable length for a DS3-TDM SSI is 450 feet (137.2 meters).

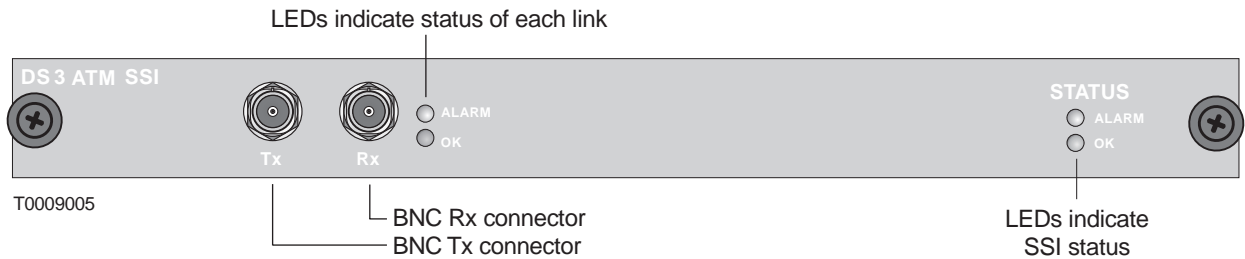
**Universal-DS1** The Universal-DS1 SSI, shown in figure 3-18, provides a link to the HT that can carry up to eight T1 or eight E1 lines.



**Figure 3-18 Universal-DS1 SSI**

The maximum cable length for a Universal-DS1 SSI is 655 feet (199.6 meters).

**DS3-ATM** The DS3-ATM SSI, shown in figure 3-19, provides an ATM link between the RT and the HT.

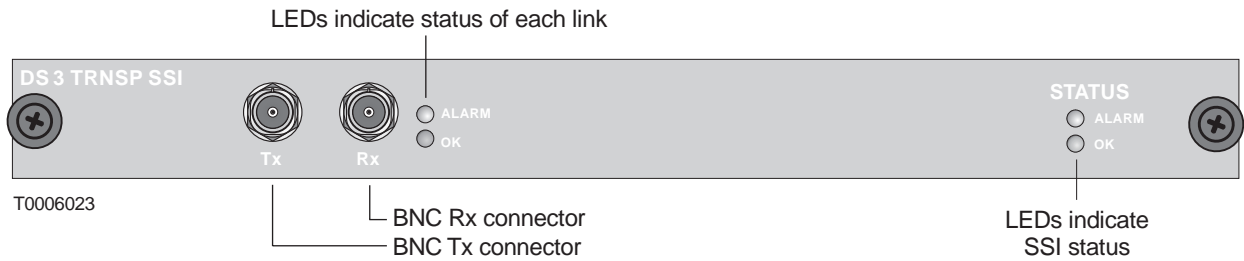


**Figure 3-19 DS3-ATM SSI**

The maximum cable length for a DS3-ATM SSI is 450 feet (137.2 meters).

## DS3-transparent

The DS3-transparent SSI, shown in figure 3-20, supports an unencumbered DS3 point-to-point service. The DS3 framing structure, clocking, and control bits are transported without visibility to the AIReach Broadband system.



**Figure 3-20 DS3-transparent SSI**

The maximum cable length for a DS3-transparent SSI is 450 feet (137.2 meters).

## SSI physical configuration

Look at the hub network schematic or other configuration document to determine:

- How many SSIs to install
- What type(s) of SSIs to install
- Which SSI to install in each IDU chassis slot

## Installing SSIs

Follow these steps to install SSIs:



### CAUTION

To maintain proper airflow and protect against RF interference, keep any empty chassis slots covered with blank panels.

---

1. If a blank panel is installed in the slot where you will install the SSI, loosen the thumbscrews on the blank panel and remove it.  
Keep the blank panel for future use.



### CAUTION

Always wear a new or recently tested electrostatic discharge (ESD) wrist strap (figure 3-21) when handling circuit modules. Failure to use a wrist strap may result in damage to components.

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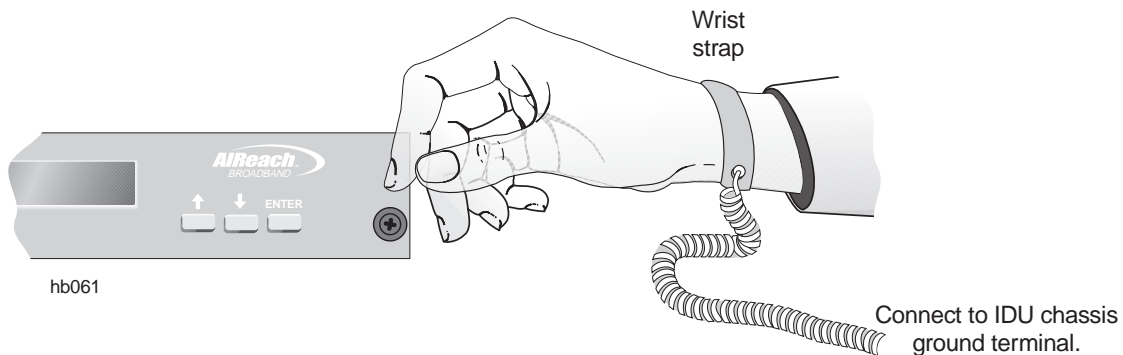
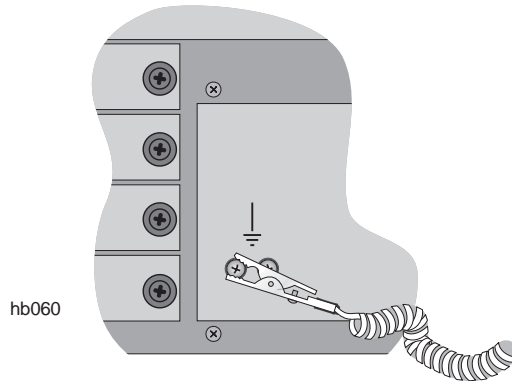


Figure 3-21 ESD wrist strap

2. Wrap the ESD strap snugly around your wrist and connect the alligator clip to one of the ground terminals on the front of the IDU chassis power supply.



3. Remove the SSI from its ESD protective packaging.  
**Retain the packaging in case it is necessary to return the SSI for repair.**
4. Slide the SSI into the guides on each side of the chassis SSI slot and push it firmly into place until the front of the SSI is flush with the front of the IDU chassis.
5. When the SSI receives power through contact with the IDU backplane, it automatically initiates startup diagnostics. Watch the LEDs to see the diagnostic results:

SSI LED indications:	
Green	SSI startup and normal operation
Red	Failure
Flashing red	TDM bus communication failure

6. Tighten the thumbscrews at each end of the SSI.  
To tighten the thumbscrews, push them toward the IDU chassis and turn them clockwise. To fully tighten the thumbscrews, use a Phillips screwdriver.
7. Repeat steps 1 through 6 for each SSI.
8. If any SSI slots are empty, cover the slot with a blank panel.  
(If you need additional blank panels, order HNS part 1026730-0001.)
9. **Remove power from the IDU chassis.**

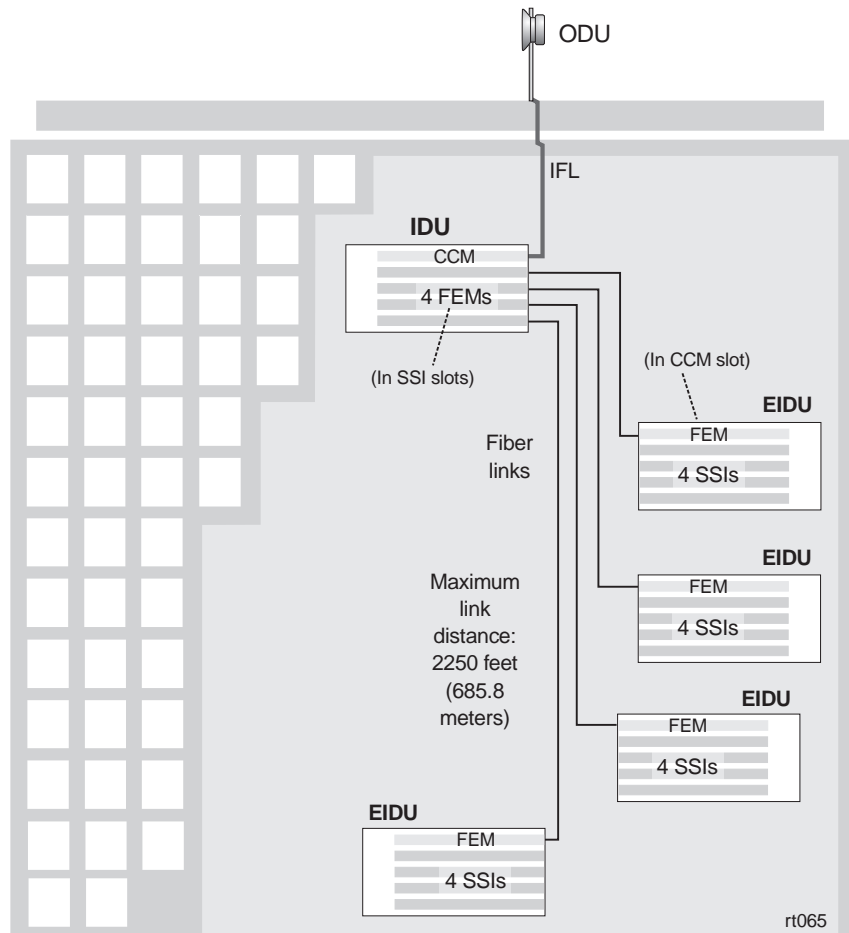
*This completes the IDU installation.*



### Installing expansion IDUs (EIDUs)

If more than 4 SSIs are required at a single site, or SSIs need to be physically distributed (on different floors, for example), one or more expansion IDUs (EIDUs) may be installed, at remote sites only. A single IDU can accommodate up to 4 EIDUs (16 SSI slots) as shown in figure 3-22.

EIDUs are linked to the IDU with fiber extender modules (FEMs). These modules use multimode fiber to carry both ATM and TDM traffic.



**Figure 3-22 EIDUs used to distribute SSIs throughout a remote site building**

## Mounting options

The EIDU can be used on a tabletop or installed in a 19-inch (48.3-centimeter) rack. With optional adapter brackets, the EIDU can also be installed in a 23-inch (58.4-centimeter) rack.

**Note:** HNS does not provide a rack for EIDU installation.

## Rack mounting

If you are installing the EIDU in a rack, refer to the prerequisites, safety guidelines, and instructions provided on pages 3-4 through 3-7.

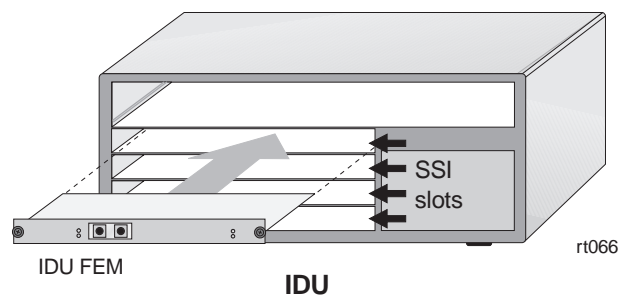
## Power supplies

EIDU power supply specifications and requirements are the same as those for the IDU chassis. To connect power to the EIDU chassis, refer to section 3.3.

## Two type of FEMs

The IDU-EIDU subsystem includes two types of fiber extender modules (FEMs), which facilitate the fiber links between the IDU and the EIDU:

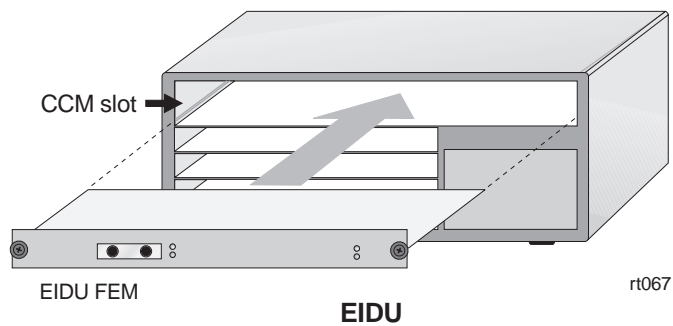
- **IDU FEMs** – IDU FEMs provide the interface on the IDU for the link to/from the EIDU (as shown in figure 3-22). IDU FEMs are installed in SSI slots in the IDU chassis, as shown in figure 3-23. *IDU FEMs and SSIs may be installed in the same chassis.*



**Figure 3-23 IDU FEM (installed in SSI slot)**

- **EIDU FEM** – The EIDU FEM provides the interface on the EIDU for the fiber link to/from the IDU (as shown in figure 3-22).

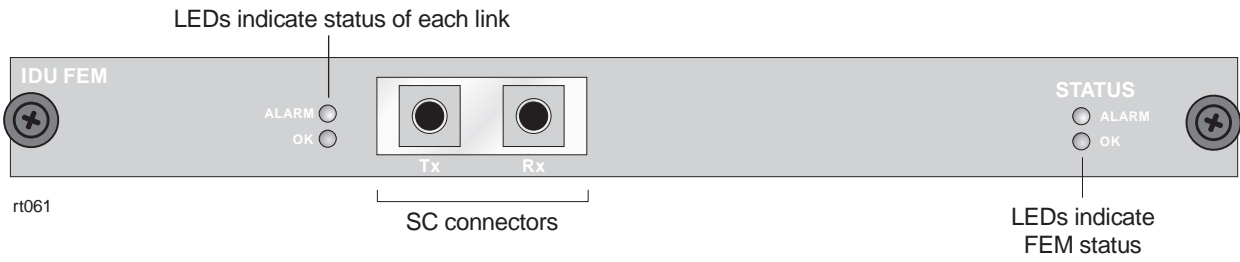
The EIDU FEM is installed in the CCM slot of the EIDU chassis, as shown in figure 3-24.



**Figure 3-24 EIDU FEM (installed in CCM slot)**

### **IDU FEM**

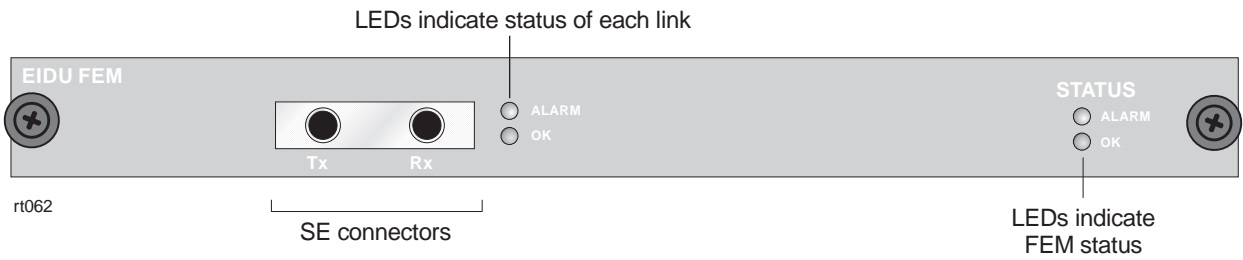
Figure 3-25 shows an IDU FEM.



**Figure 3-25 IDU FEM**

### **EIDU FEM**

Figure 3-26 shows the EIDU FEM.



**Figure 3-26 EIDU FEM**

## Installing FEMs

Follow these steps to install an IDU FEM or EIDU FEM:

1. If a blank panel is installed in the slot where you will install the FEM, loosen the thumbscrews on the blank panel and remove it.



### CAUTION

Always wear a new or recently tested electrostatic discharge (ESD) wrist strap (figure 3-27) when handling circuit modules. Failure to use a wrist strap may result in damage to components.

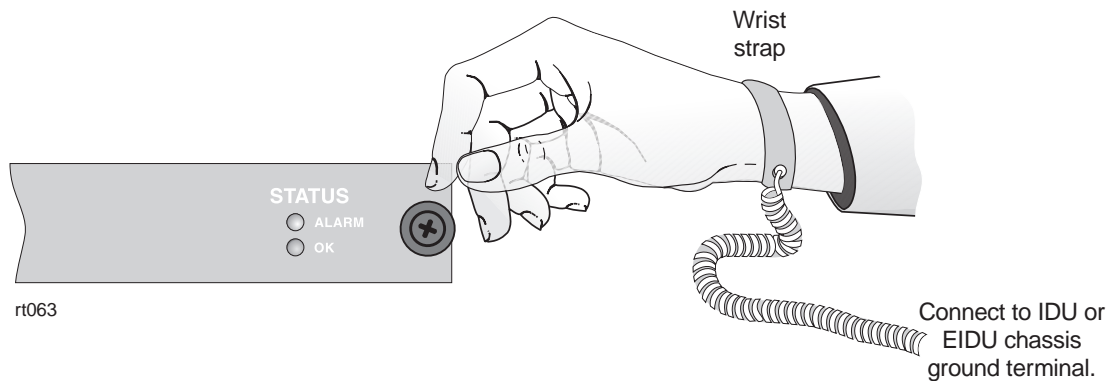
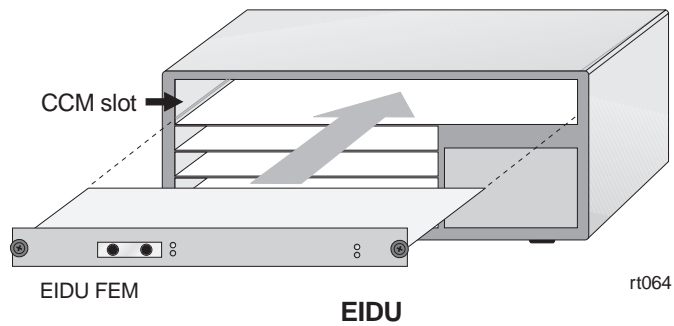
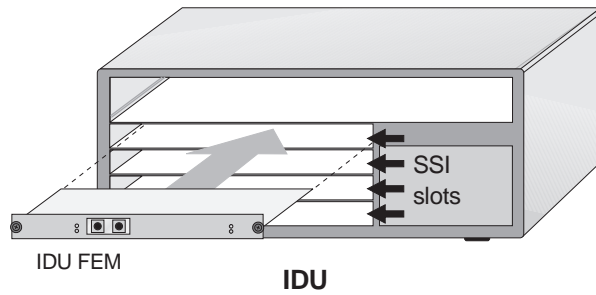


Figure 3-27 ESD wrist strap

2. Wrap the ESD strap snugly around your wrist and connect the alligator clip to one of the ground terminals on the front of the chassis power supply.
3. Remove the FEM from its ESD protective packaging.  
**Retain the packaging in case it is necessary to return the FEM for repair.**

- Slide the FEM into the guides on each side of the chassis slot and push it firmly into place until the front of the FEM is flush with the front of the chassis.



- Tighten the thumbscrews at each end of the FEM. To tighten the thumbscrews, push them toward the IDU chassis and turn them clockwise. To fully tighten the thumbscrews, use a Phillips screwdriver.
- Repeat steps 1 through 5 for each FEM.
- If any chassis slots are empty, cover the slot with a blank panel.  
(If you need additional blank panels, order HNS part 1026730-0001.)

## Chapter 4

# Installing IFL cables

---

This chapter includes:

- Roof and ladder safety – page 4-2
- Handling materials – page 4-3
- IFL cable specifications – page 4-4
- Overview: IFL plan – page 4-5
- Determining the IFL cable route – page 4-6
- Penetrating the roof – page 4-7
- Installing the penetration sleeve – page 4-8
- Installing the IFL cable inside the building – page 4-9
- Installing the remote lightning arrestor – page 4-10
- Installing the IFL cable on the roof – page 4-14
- Testing the IFL cable – page 4-16
- Multiple IFL cables – page 4-17

*Appendix C covers IFL cable termination in detail.*

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## Roof and ladder safety



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### DANGER

If you have to walk on a roof or use a ladder to access an installation site or equipment, follow these precautions to prevent personal injury or death:

- Do not walk near the edge of the roof.
  - Watch out for overhead power lines. Stay at least 6 meters (20 feet) from power lines.
  - Walk only on sound roof structures.
  - Do not work on a roof or ladder in high wind, rain, lightning, or other adverse weather conditions.
  - Follow all safety precautions from the ladder or antenna manufacturer.
  - Do not walk on a roof if a storm is visible—even if the storm is distant. Lightning can travel and strike in advance of a storm.
-

## Handling materials

Depending on the installation location, you may have to hoist the mount kit, ballast (concrete blocks), IFL cable, and tools to the rooftop as shown in figure 4-1. Using two or more people for this task will save considerable time.



hbph001

Figure 4-1 Hoisting materials to the installation location



### WARNING

If you need to hoist materials to the installation location, observe these precautions to avoid personal injury:

- Use a rope strong enough to support all of the materials that need to be hoisted.
- Never stand under the rope while materials are being hoisted.
- Hoist one concrete block at a time.
- Pass the rope through the *center* hole of each concrete block. If you use the hole on either end, the end can break off, allowing the concrete block to fall.
- Be advised that the contents of the mount kit can fall through the end of the box if the box is tilted—especially if the box has been damaged.
- Use a back brace.

If possible, do not hoist the ODU transceiver and antenna on a rope. If possible, carry these components in a backpack or padded bag.



## IFL cable specifications

The intrafacility (IFL) cable specified for AIReach Broadband installations is a Type 3 VSAT coaxial cable, HNS 1010812–0001 (1,000–foot / 305–meter spool). This cable is non plenum, CMG UL/C (UL) approved. An acceptable alternative is LMR–400 plenum cable (available from Times Microwave Systems, Wallingford, CT). For additional specifications, see the *Hub and Remote Terminal Site Preparation Guide*.

The following Underwriters Laboratories (UL) requirement applies to the IFL cable:

**The IFL cable must be installed in a metal conduit and grounded according to NEC article 800–40. If the IFL cable will *not* be installed in a metal conduit, the cable must be a plenum cable, UL/C(UL) approved, with a CMR rating (or higher).**

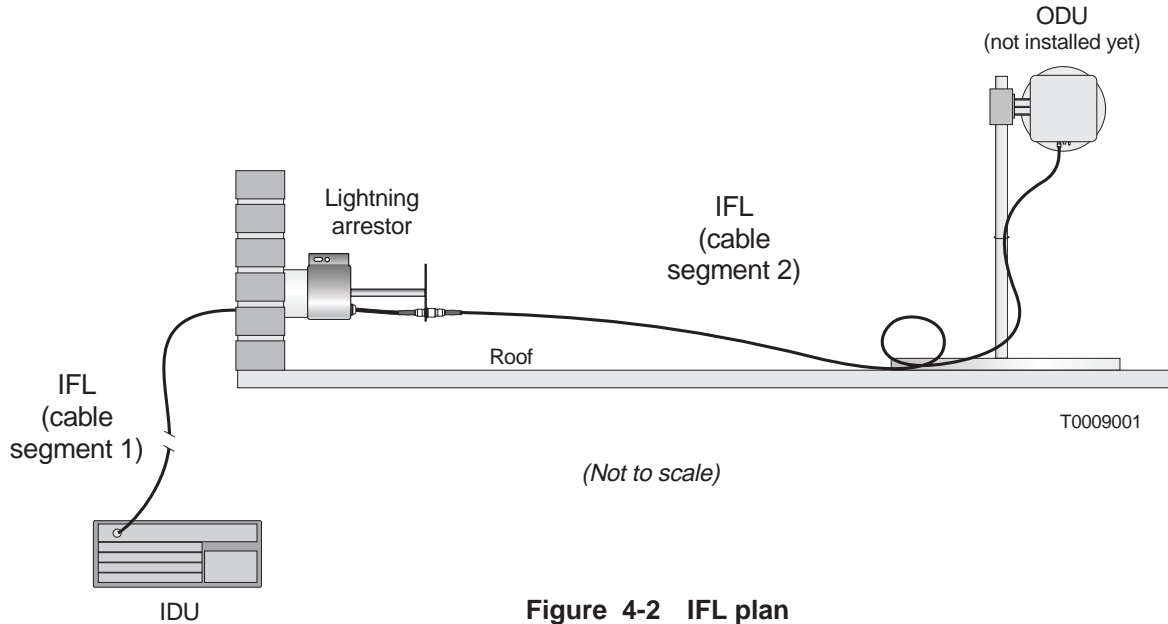
For specific grounding instructions, see *Grounding the lightning arrester* in section 4.9. Refer also to the grounding guidelines included in the *Hub and Remote Terminal Site Preparation Guide*.

**Overview: IFL plan**

Figure 4-2 shows the IFL and required lightning arrester. The lightning arrester is installed on the roof at the IFL building penetration point.

Figure 4-2 shows how the IFL cable is installed in two segments to accommodate the lightning arrester:

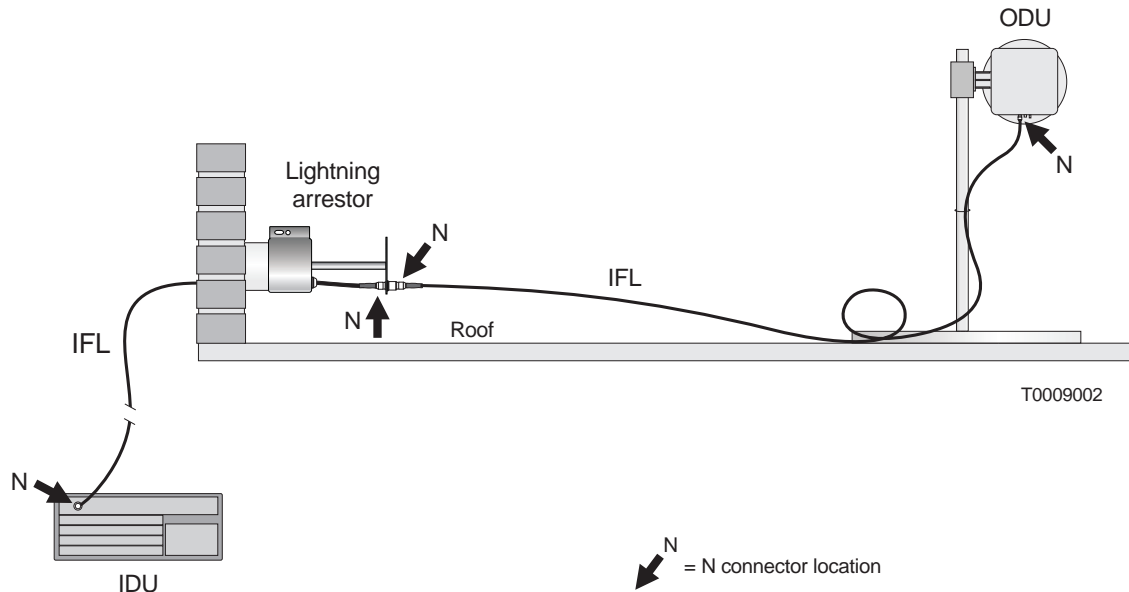
- One segment from the IDU to the rooftop lightning arrester
- One segment from the lightning arrester to the ODU



**Figure 4-2 IFL plan**

**IFL connections**

Because the IFL cable is installed in two segments, it is cut and terminated (with an N-type connector) in four locations, as shown in figure 4-3.



**Figure 4-3 Four locations where N connectors are installed**

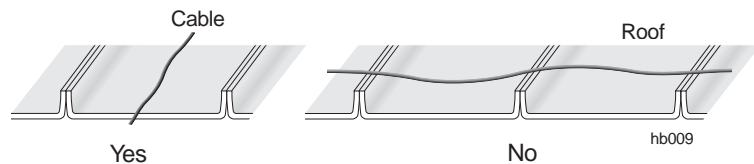
Detailed instructions for installing the IFL and lightning arrestor are included in the following sections.

## 4.5

### Determining the IFL cable route

Determine the IFL cable route, from ODU to IDU. Consider the guidelines below. Every building and rooftop is unique; for this reason, some of these guidelines may not apply to your installation:

- The most important considerations are the ODU and IDU locations and the building entry point. The entry point should be as close as possible to the ODU. Refer to the RT rooftop drawings. (See also page 5–3.)
- The maximum IFL cable length is 1000 feet (305 meters).
- Where possible, use existing conduit.
- You must use a pull box to facilitate pulling cables through conduits if routing cable through bends totaling more than 360°.
- If existing conduits can not be used and the cable will be exposed, refer to building codes to determine proper cable insulation type. For example, plenum rated cable must be used if cable will be run above suspended ceilings.
- **If you are installing the IFL cable(s) inside a conduit that contains power cables, you must use plenum-rated cable.**
- Look for cable routes that will be easily accessible, such as stacked telco closets etc.
- Older buildings may not have stacked telco closets. You may have to route the cable back and forth, from one side of the building to the other.
- Never run the IFL cable across corrugated roofing. Run the cable in the corrugation trough:



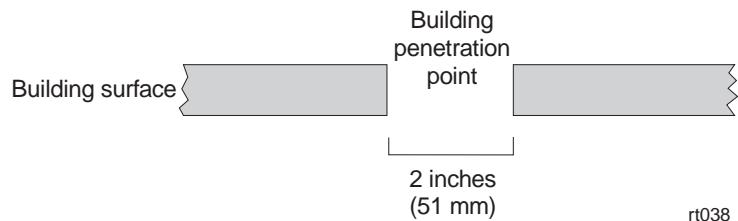
## Penetrating the roof

Follow the steps below to drill a hole for the IFL cable *only when there is not an existing entry you can use.*

1. Go to the roof.
2. Determine where the IFL cable will penetrate the roof.  
Refer to the RT rooftop drawings.

Before you drill, consider these guidelines:

- **Important: Do not penetrate any part of the building structure without first making sure you have the explicit permission of the customer and building owner.**
  - Horizontal penetration is preferable to vertical penetration. (A horizontal hole is less likely to leak.)
  - Take care not to destroy cabling or wiring under the roof or inside the wall.
  - Round penetration holes are preferred over square holes. (They are easier to make and seal.)
3. Drill a 2-inch (51-millimeter) diameter hole at the building penetration point.



rt038

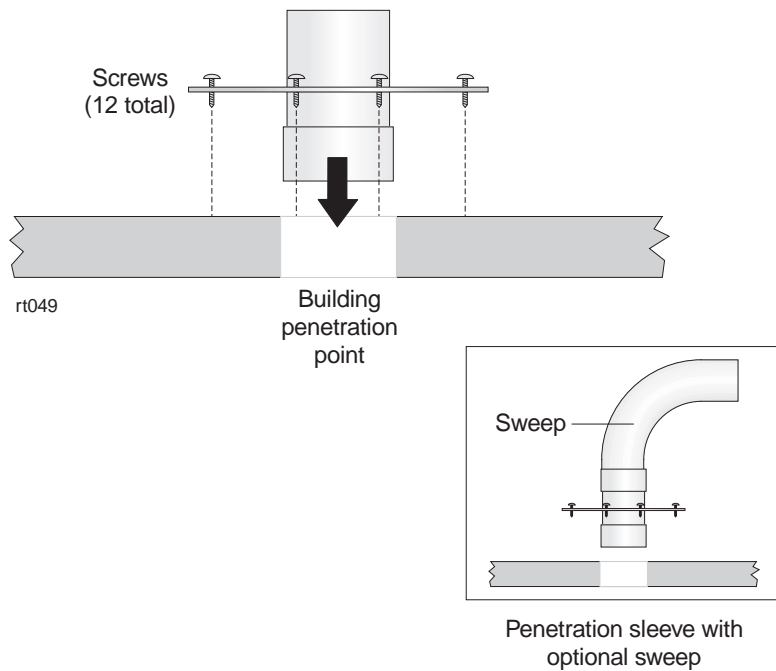
## Installing the penetration sleeve

The IFL cable must be routed through a penetration sleeve before it is connected to the lightning arrester. The lightning arrester is attached to the penetration sleeve after cable installation.

1. Use twelve screws to attach the remote penetration sleeve (sleeve and coupling) to the building surface at the building penetration point. See figure 4-4.

The type of screw used depends on the roof thickness and surface composition. The screws *must* hold the sleeve assembly securely.

**Note:** The penetration sleeve location is site-specific and dependent on the building penetration point. An optional sweep, shown in figure 4-4, is available for use with the penetration sleeve for locations where space is limited.



**Figure 4-4** Installing the remote penetration sleeve

2. Weatherproof the penetration sleeve by applying silicone caulk to the bolt hole areas and the surface of the sleeve plate.

**Note:** Silicone caulk may not be suitable for certain types of roofs. Choose a type of caulk that is appropriate for your type of roof.

## Installing the IFL cable inside the building

You install the IFL cable in two segments, as shown in figure 4-2 (page 4–5). To install the first cable segment—from the IDU chassis location to the lightning arrester—follow the instructions and guidelines below. Because every building has unique features, it is not possible to give exact instructions.

1. Measure the cable run length from the IDU chassis location to the lightning arrester location (IFL building entry point). Allow for routing around obstacles and a service loop (excess cable, in case there is any reason to later cut and re-terminate the cable).
2. Run the cable from the IDU chassis location, through an existing conduit if possible, through the remote penetration sleeve (figure 4-4), to the lightning arrester location. Use a stand so the cable spool spins freely as it is pulled. Leave a service loop.



### CAUTION

Avoid making sharp bends in the IFL cable. The minimum bend radius for IFL cable is 2 inches (51 millimeters). Sharper bends may cause permanent damage to the cable.

3. Cut the cable at the IDU chassis location and at the lightning arrester.

**Important: Cut the cable 2 feet (0.6 meters) beyond the lightning arrester location (building penetration point).**

4. Terminate the cable end at the IDU chassis location with an N-type connector. For detailed instructions for connecting an N connector, see appendix C.

**Important: Sound IFL cable connections are critical for proper operation of the AIReach Broadband system.**

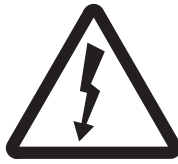
Therefore, be very careful in terminating the cable. Refer to the detailed instructions in appendix C if necessary.

**Attach N connectors *after* you route and install the cable, not before.**

**Note:** The IFL cable installation is completed in section 4.10.

## Installing the remote lightning arrester

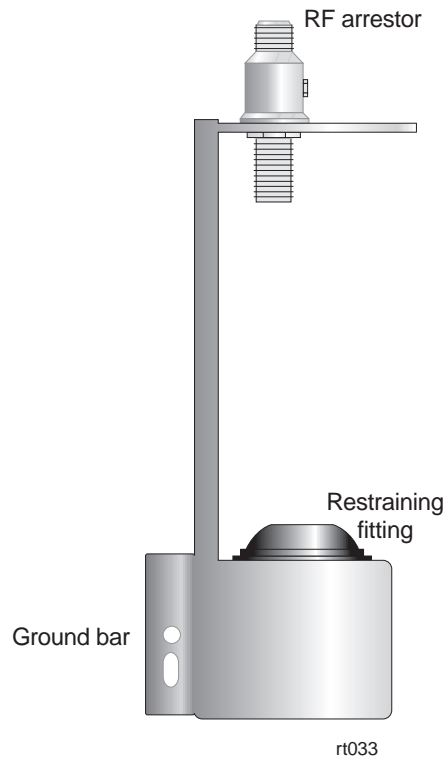
All AIReach Broadband IFL cables must connect to a grounded lightning arrester (provided by HNS) at the building penetration point, as shown in figure 4-2 (page 4-5) and explained in this section. A single remote lightning arrester can be used for IFL cables for two RTs.



### WARNING

To help avoid death, injury, or damage from a lightning strike, you *must* install a lightning arrester where the IFL enters the building.

Figure 4-5 identifies the remote lightning arrester components.



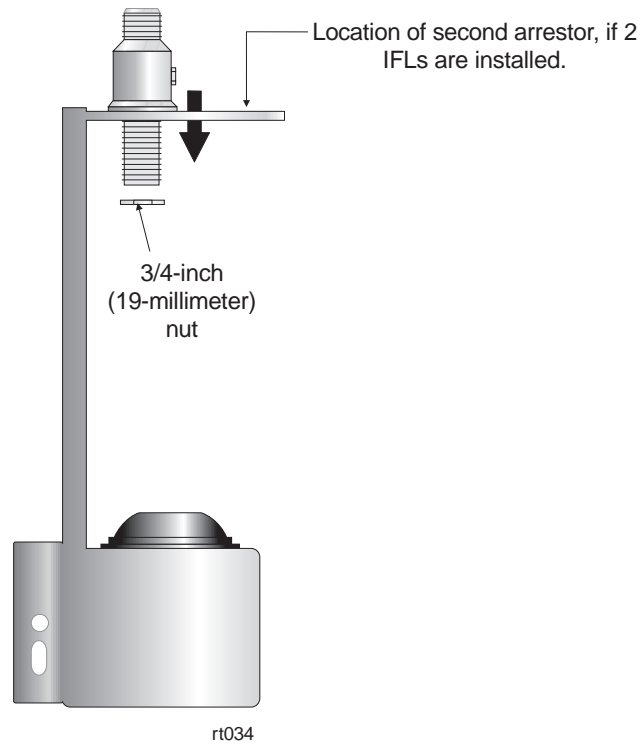
**Figure 4-5 Remote lightning arrester components**

Go to the roof to install the remote lightning arrester.

## Connecting the IFL cable to the RF arrester

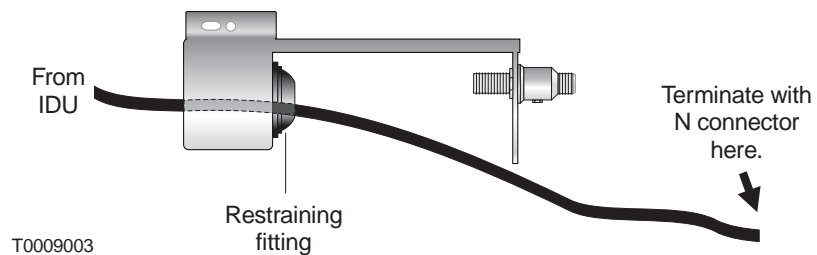
Follow these steps to route the IFL cable through the lightning arrester and then connect the cable to the RF arrester:

1. Attach an RF arrester to the arrester body with a 3/4-inch (19-millimeter) nut. See figure 4-6.



**Figure 4-6 Attaching the arrester to the arrester body**

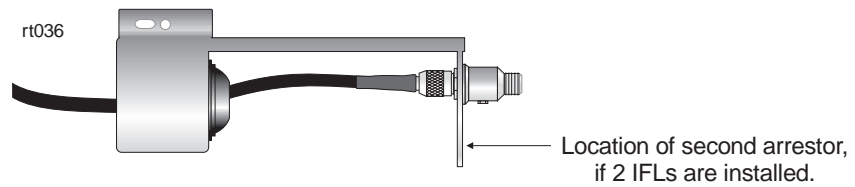
2. Route the cable from the IDU chassis location through the base of the lightning arrester and the restraining fitting, as shown in figure 4-7.



**Figure 4-7 Routing the IFL cable**

3. Terminate the end of the IFL cable with an N connector. For detailed instructions for connecting an N connector, see appendix C.
4. Connect the cable to the RF arrester, as shown in figure 4-8.





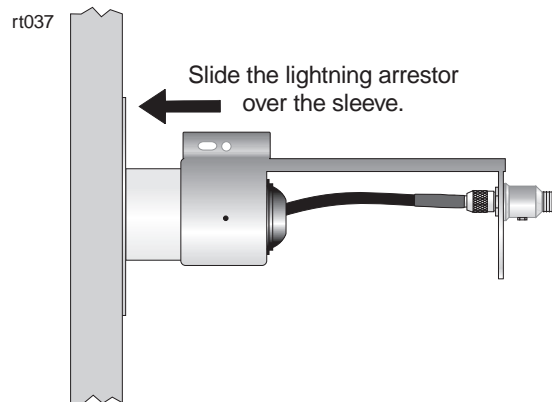
**Figure 4-8 Connecting the IFL cable to the arrester**

5. Working from inside the arrester body, use the Sealcon custom wrench (Sealcon part number 1.500.4200.04) to tighten the restraining fitting to 44.2 inch-pounds.
6. Repeat steps 1 through 5 if you are installing a second IFL cable.

**Attaching the arrester to the penetration sleeve**

Attach the lightning arrester to the penetration sleeve:

1. Slide the lightning arrester over the sleeve, as shown in figure 4-9.
2. Fasten the lightning arrester to the sleeve with a screw.

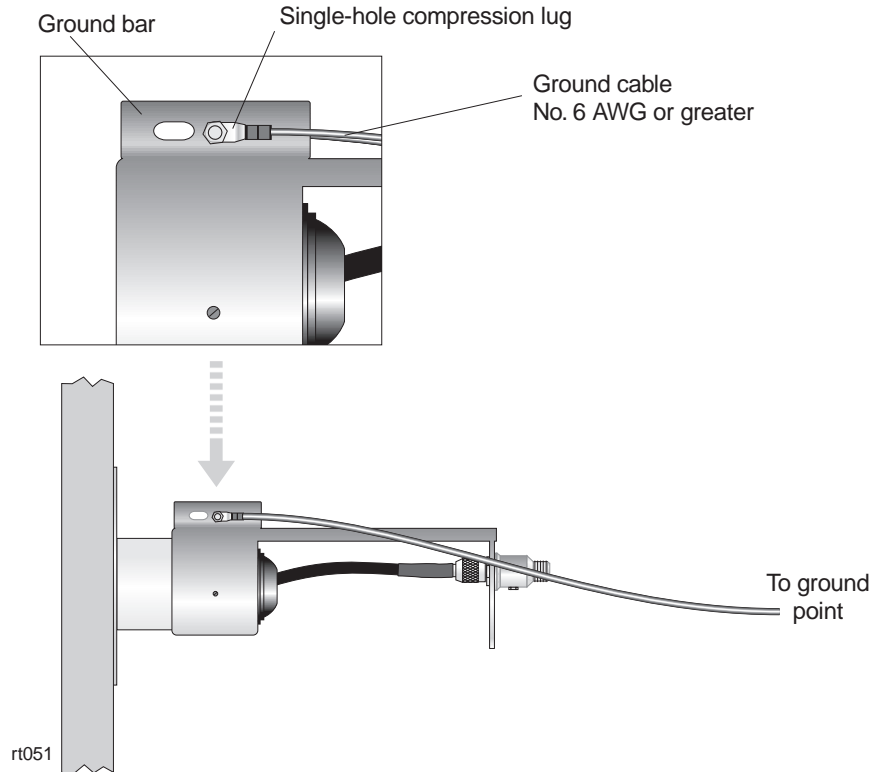


**Figure 4-9 Attaching the arrester assembly to the sleeve**

## Grounding the remote lightning arrester

Follow these steps to ground the lightning arrester:

1. Connect one end of the ground cable (No. 6 AWG or greater, green) to the lightning arrester ground bar, as shown in figure 4-10.



**Figure 4-10 Remote lightning arrester grounding connections**

2. Route the ground cable to the ground point.

When routing the ground cable, you must:

- **Secure the ground cable at 5-foot (1.5-meter) intervals.**
- **Keep the ground cable at least 3 feet (0.9 meters) away from non-grounded metal objects.**
- **Make sure all bends in the cable have a sweeping radius of more than 8 inches (20.3 centimeters).**

3. Connect the remote lightning arrester to the same ground (reference) point as the ODU ground. See section 6.12.
4. Apply anti-oxidant (HNS 9008224-0002) to each ground lug.
5. Apply 1/2-inch (13-millimeter) heat shrink tubing (HNS 9007488-0005) to each ground lug after the connection is complete.

**Important:** You must slip the heat shrink onto the cable *before* you make the connections.

---

## Installing the IFL cable on the roof

To install the second IFL cable segment—from the lightning arrester to the ODU—follow the instructions and guidelines below. Because every rooftop has unique features, it is not possible to give exact instructions.

### Connecting to the lightning arrester

Connect the IFL to the lightning arrester as follows:

1. Measure the cable run length from the lightning arrester to the ODU. Allow for routing around obstacles and a service loop (excess cable, in case there is any reason to later cut and re-terminate the cable).
2. Run the cable from the lightning arrester to the ODU location, and leave enough cable for a service loop.

For now, you must leave the cable unconnected because the ODU is not installed yet. You will connect the IFL to the ODU later, after the ODU is installed.



#### CAUTION

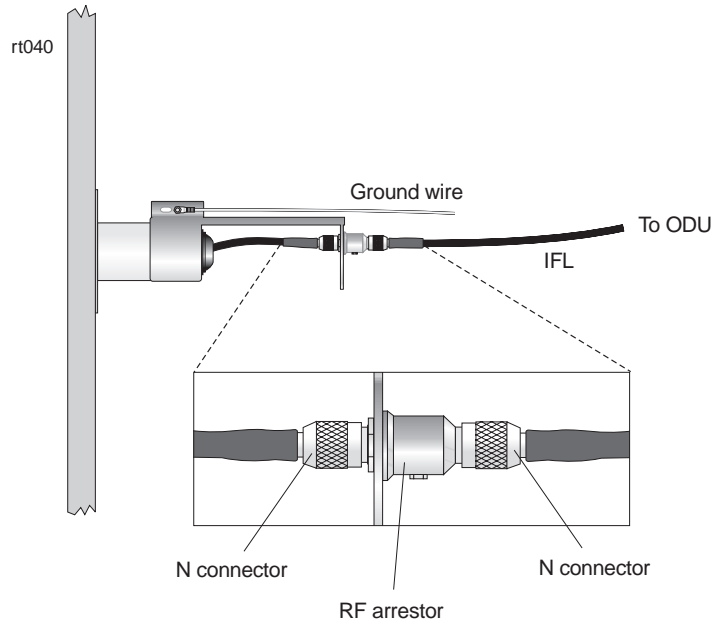
Avoid making sharp bends in the IFL cable. The minimum bend radius for IFL cable is 2 inches (51 millimeters). Sharper bends may cause permanent damage to the cable.

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3. Cut the cable at the lightning arrester and at the ODU.
4. Terminate both ends of the cable segment with N connectors. For detailed instructions for connecting N connectors, see appendix C.

5. Connect the IFL cable to the RF arrester, as shown in figure 4-11.

You connect the other end of the cable to the ODU later, after you install the ODU.



**Figure 4-11 Connecting the IFL to the RF arrester**

**Do not apply weatherproofing compound or tape until the RT has been tested and commissioned. Weatherproofing is covered in section 8.1.**

## **Testing the IFL cable**

Test the IFL cable and connectors as follows:

1. Check each connector: Use a multimeter or continuity tester to check for continuity (a short circuit) *between the center conductor and the connector body (outer shell)*.

If the meter or tester does not indicate an open (no connection), the connector or cable is defective and must be replaced.

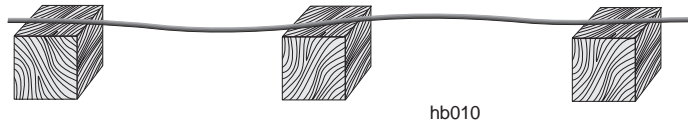
2. Check the connectors and cable:
  - a. Using a small jumper cable, attach a jumper clip to the center conductor of the connector on one end of the cable.
  - b. Attach the other end of the jumper to the connector body, so the center conductor and connector body make electrical contact.
  - c. *At the other end of the cable (at the IDU location)*, use a multimeter to measure the resistance between the center conductor and connector.

Resistance should be less than 10 ohms. If it is greater than that find and correct the problem.

## Finishing the cable installation

After running the cable, finish the cable installation as follows:

1. Support the cable above the roof surface with a cable trough or wood blocks approximately 4 inches by 4 inches by 4 inches (10 centimeters by 10 centimeters by 10 centimeters):



2. Tie down cable runs on the roof and at the IDU location with tie-wraps.
3. Seal the IFL rooftop entry point with weatherproofing caulk.
4. Label both ends of the IFL cable to identify the cable in an appropriate manner. This is especially important if you are installing multiple IFL cables. (To order IFL labels, request HNS part number 9005328-0055.)

## 4.11

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### Multiple IFL cables

If you are installing multiple IFL cables for multiple RTs, follow the instructions in this chapter for each IFL. However, you only need to install one lightning arrestor for up to two IFL cables, because the arrestor design accommodates up to two cables.

# Installing mast mounts

---

This chapter includes:

- Overview – page 5-2
- ODU location – page 5-3
- Roof types – page 5-3
- Mast mount types – page 5-3
- Standard nonpenetrating mount – page 5-4
- Existing structures – page 5-11



## **DANGER**

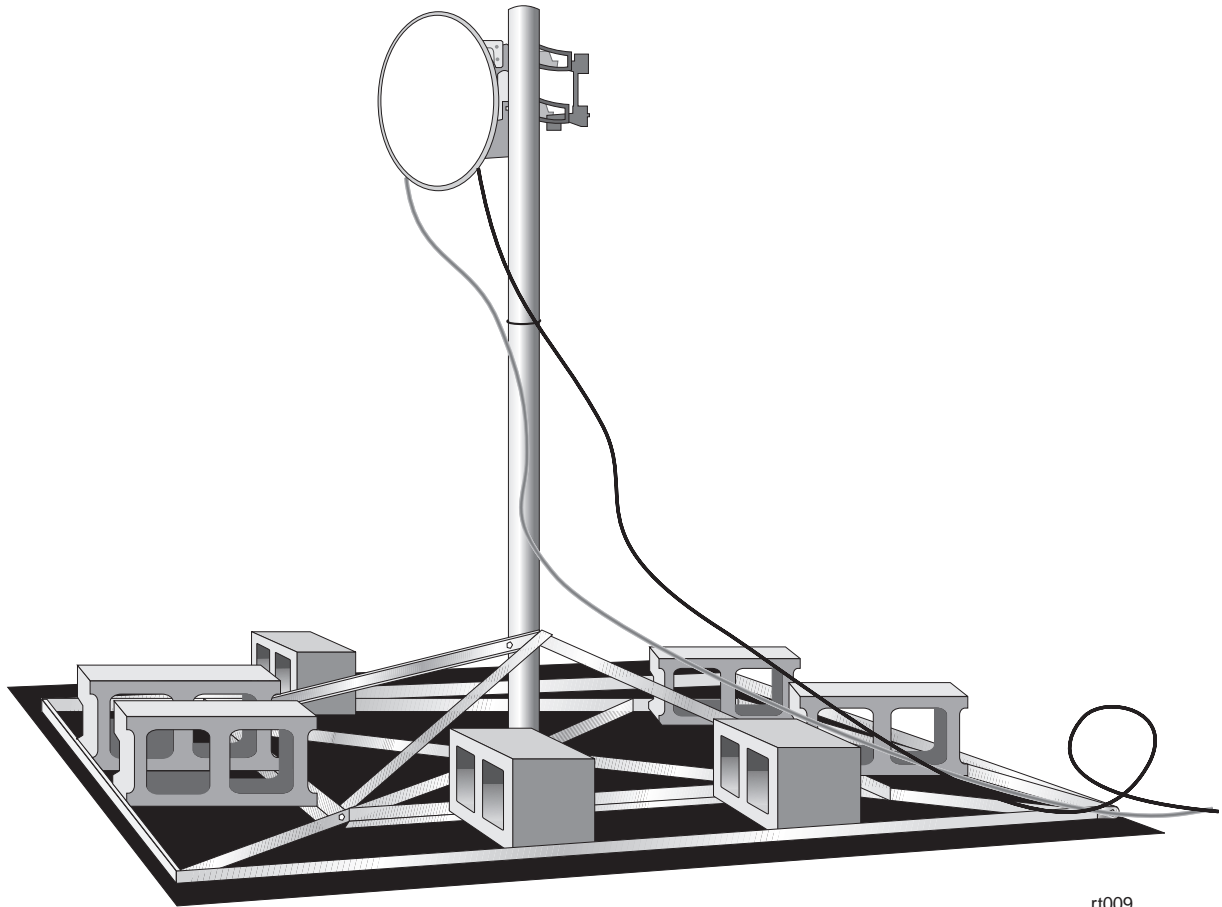
**Do not work on a ladder or roof without first reading the safety warnings on page x of this manual. Failure to observe these warnings could result in personal injury or death.**

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## Overview

Typically, the installers assemble a nonpenetrating roof mount for each ODU to be installed. In some cases, a different type of mast mount may be used, or an existing structure may be used.

The mount supports the mast in a vertical or horizontal position, and the ODU is mounted on the mast, as shown in figure 5-1.



rt009

**Figure 5-1 Mast mount supporting mast and ODU**



## 5.2

---

### ODU location

Site preparation personnel specify the ODU location as part of preparing the RT rooftop drawing.

1. Use the RT rooftop drawing to determine where to install the mount (at the ODU location) and locate IFL entry point.
2. Make sure the roof penetration or entry point for the IFL is suitable.

**Important:** The location(s) used for ODU installation must meet the requirements listed in the *Hub and Remote Terminal Site Preparation Guide*. Key considerations include:

- Line of sight
- Distance from HT
- IFL entry location
- Sources of interference
- Safety
- Ground point location
- Access
- Security

For details, see the *Site Preparation Guide*.

## 5.3

---

### Roof types

Many roof types are suitable for AIReach Broadband ODU installations. Mount installation procedures for the following common roof types are described later in this chapter:

- Rubber cap sheet/ glued rubber cap sheet
- Loose gravel on rubber cap sheet
- Corrugated metal

The roof type is a factor in the type of mast mount selected. Also, some mount installation steps may be different, depending on the roof type.

## 5.4

---

### Mast mount types

The following options are available for mounting a mast to support the ODU:

- **Nonpenetrating roof mount** – This mount, essentially a flat platform assembled from a kit, is suitable for most applications. It can be used on various flat roof types. For details, see section 5.5.
- **Existing structure** – An existing structure such as an antenna tower can be used as a mast, or a mast can be mounted to the structure, if the structure meets the requirements given in the *Hub and Remote Terminal Site Preparation Guide*.

## Standard nonpenetrating mount

The standard nonpenetrating roof mount, HNS 9200375–0001, is a flat, metal–frame mount assembled from a kit. It requires a 6.5–by–6.5–foot space (1.98 by 1.98 meters) and includes a 7–foot (2.1–meter) mast. You install the mount on a rubber pad; concrete blocks are added for ballast.

The standard mount can be used on a variety of flat roof types, as detailed below.

Instructions are given below for various types of roofs. See also the manufacturer’s instructions, which are included in the mount shipping carton.

### Flat roof – rubber sheet (with or without gravel)

Most flat roofs are topped with:

- Glued rubber cap sheet *or*
- Rubber cap sheet with gravel

Follow these instructions for either type of roof:

1. If the cap sheet is covered with gravel, use a push broom or snow shovel to clear the gravel from the area where the mount will be installed, as shown in figure 5-2.

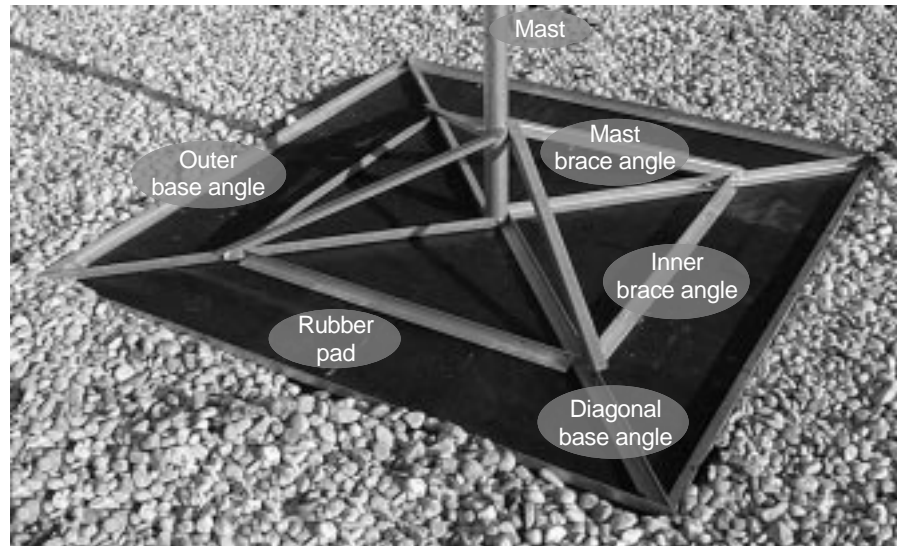


hbph005

**Figure 5-2** Clearing gravel from the installation location

2. Place the rubber pad on the roof surface where the mount will be assembled.

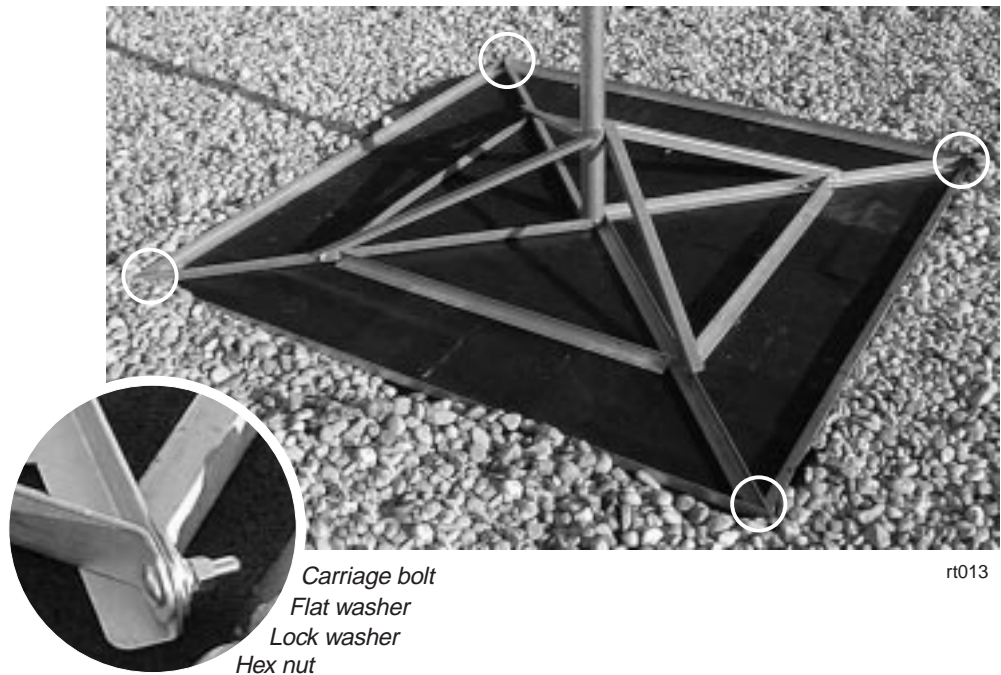
Figure 5-3 identifies the main mount components.



rt015

**Figure 5-3 Mount components**

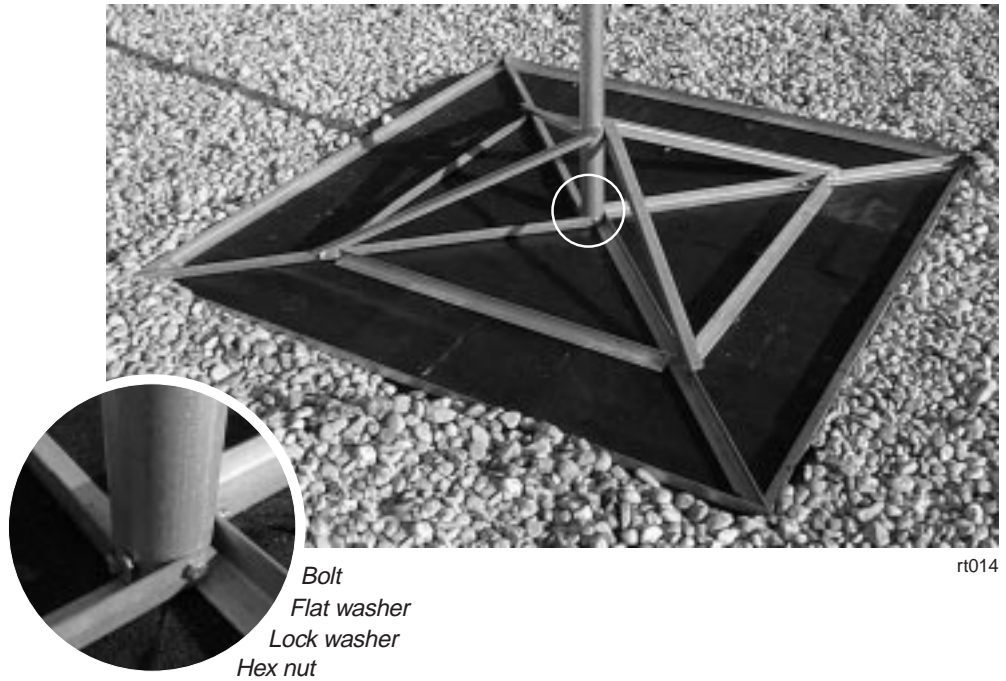
- *Follow steps 3 through 10 to assemble the mount.*
3. Place the mount's four outer base angles on the rubber pad.
  4. Place the mount's diagonal base angles on the rubber pad and connect them to the outer base angles at the locations circled in figure 5-4.



rt013

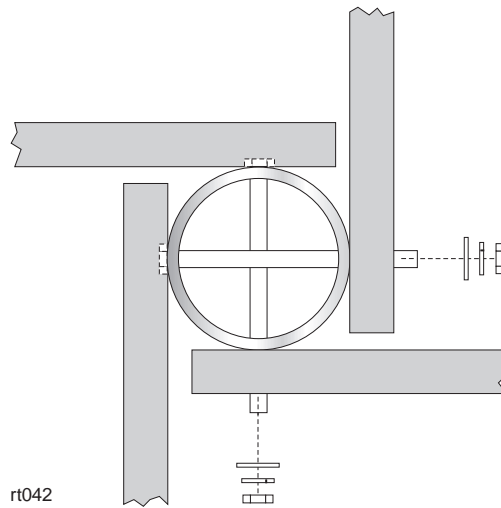
**Figure 5-4 Connecting diagonal base angles to outer base angles**

5. Place the mast between the diagonal base angles. Secure the diagonal base angles to the mast as shown in figure 5-5.

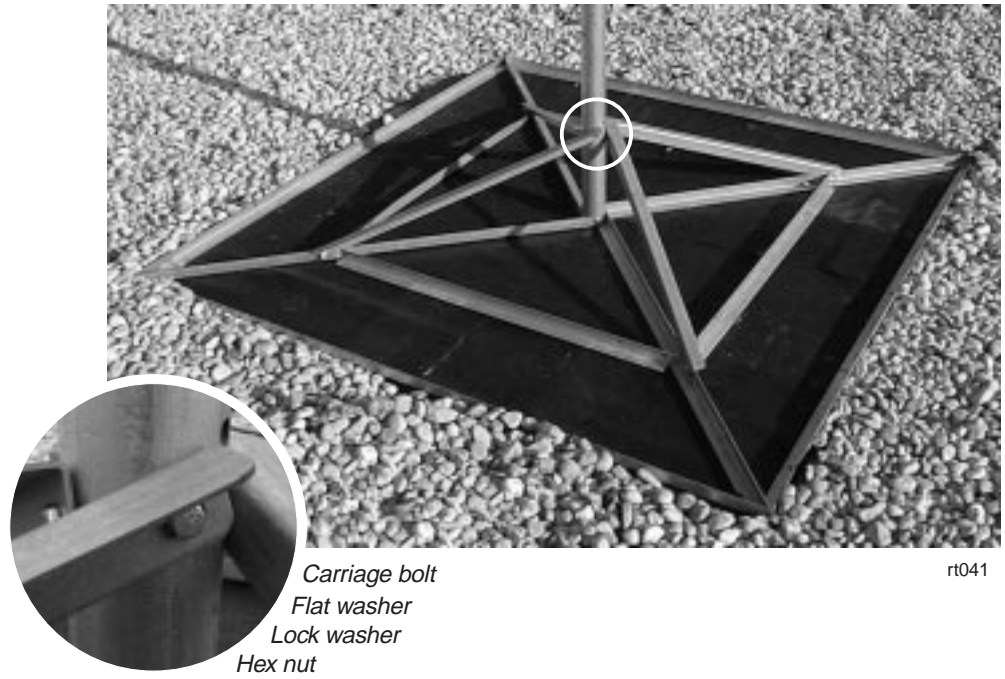


**Figure 5-5 Attaching the diagonal base angles to the mast**

Diagonal base angles opposite each other are secured to the mast with one set of hardware as shown below.

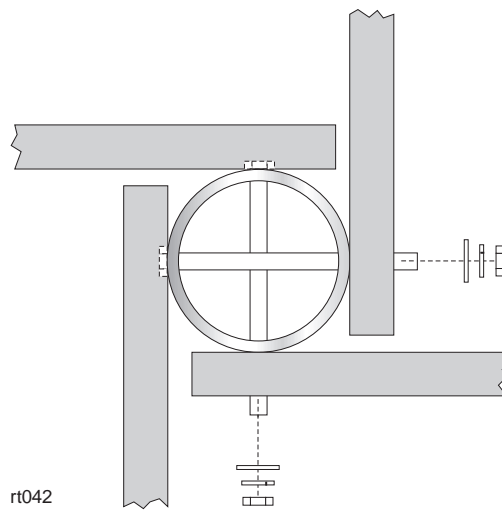


6. Attach the mast brace angles to the mast. See figure 5-6.

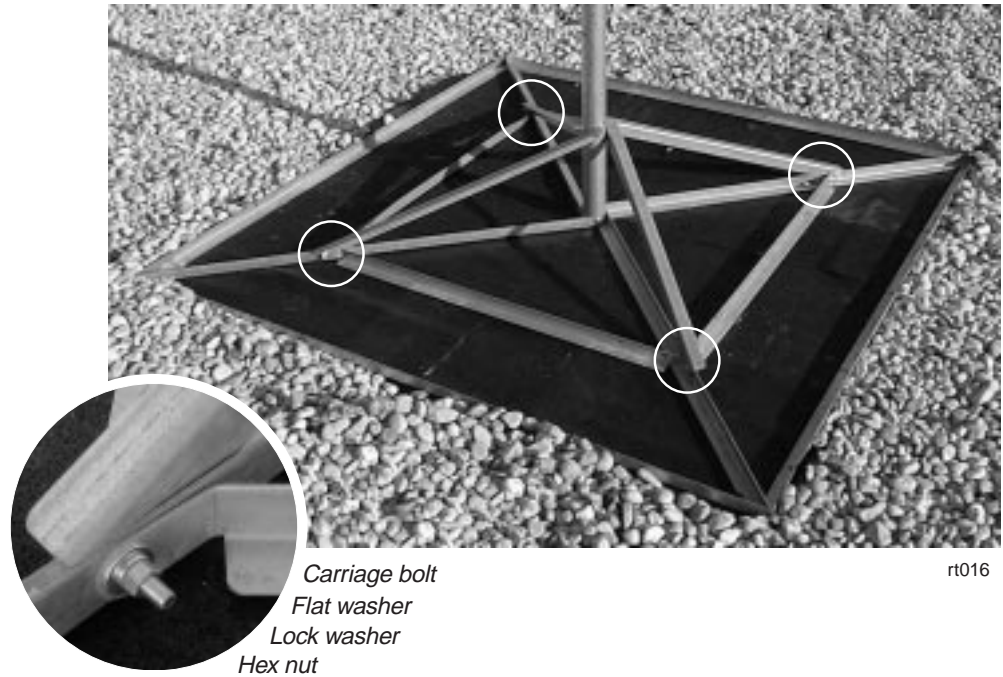


**Figure 5-6 Attaching the mast brace angles to the mast**

Mast brace angles opposite each other are secured to the mast with one set of hardware as shown below.



7. Place the inner brace angles on the rubber pad and connect them to the diagonal base angles and mast brace angles as shown in figure 5-7.



**Figure 5-7 Attaching inner brace angles to diagonal base angles and mast brace angles**

8. Refer to the Site Data Record (from the site survey) to determine how many concrete blocks are required to anchor the mount.

- Place the concrete blocks on the mount so they are evenly spaced, with the ends of each block anchoring both the inner and outer base angles, as shown in figure 5-8.



rtpH010

**Figure 5-8** Proper placement of concrete blocks on the mount

- When the mount installation is complete, if the roof is covered with gravel, replace gravel up to the outside edges of the mount. See figure 5-8.  
Do not replace gravel in the area inside the mount base.  
Leave the rubber pad exposed.

## Corrugated metal

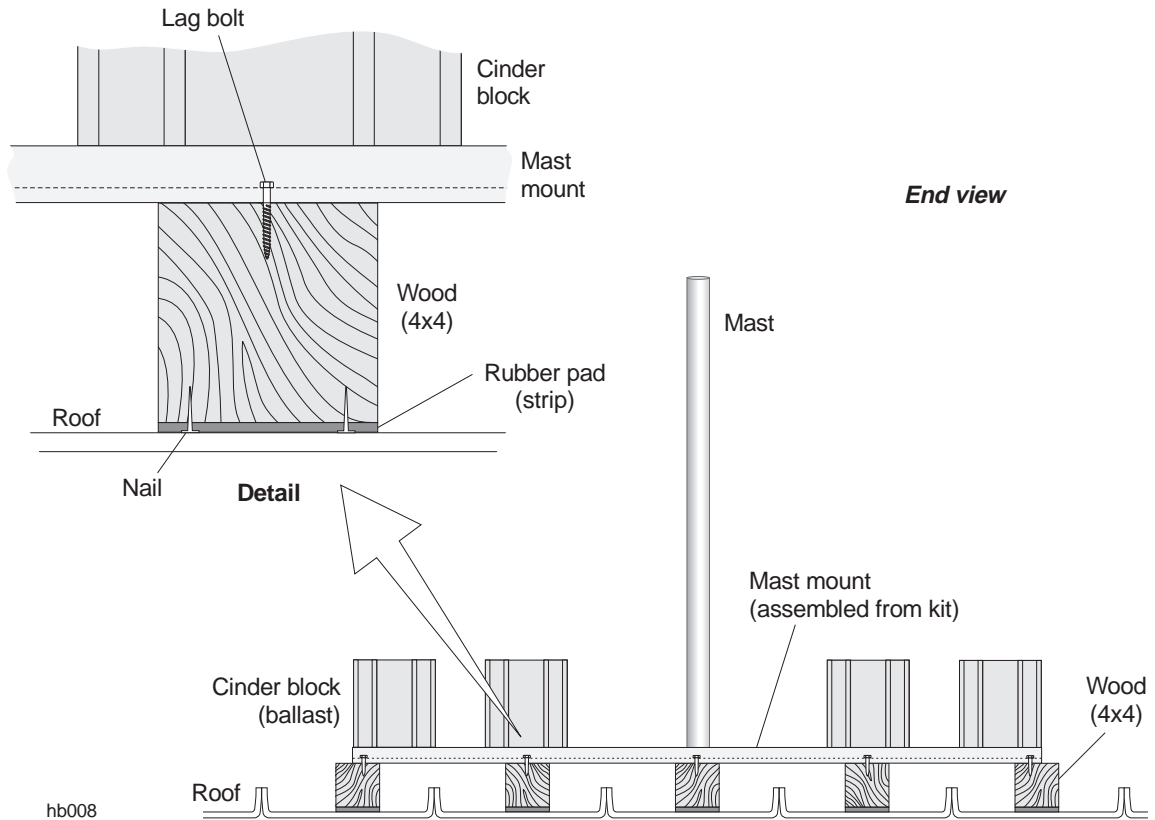
This section explains how to install the standard nonpenetrating roof mount on a corrugated metal roof.

### Special requirements:

- Pressure treated lumber, as specified in step 1 below, and
  - Twelve 1-inch-long (2.5-centimeter) lag bolts.
- Obtain five pieces of pressure treated lumber, each 4 inches by 4 inches by 8 feet long (10 centimeters by 10 centimeters by 2.44 meters long).
  - Important:** Select an area of the roof that is supported by a metal I-beam to install the mount.
  - Cut the rubber pad into strips 4 inches wide by 8 feet long (10 centimeters wide by 2.44 meters long).
  - Use 5-penny shingle nails to nail one strip of rubber pad to one surface of each piece of lumber. See figure 5-9.

5. Lay out the 4 x 4s, as shown in figure 5-9, so that each piece is:
  - In the recessed portion of the roof
  - Parallel to the raised seams
  - Equally spaced to support the mast, mount braces and sides, and concrete blocks, as shown in figure 5-9.

Lay the lumber with the pad side down, so that the pad is between the roof and the lumber.



**Figure 5-9 Supporting the mount on a corrugated aluminum roof**

6. Follow steps 1 through 10 starting on page 5-4 to assemble the mount.  
Assemble the mount on the 4 x 4s so that when completed, the mount is elevated above the aluminum roof.
7. Make sure the mount is evenly positioned on the 4 x 4s, then use lag bolts to bolt the mount to the 4 x 4s.  
Install the bolts through the holes in the mount's outer frame and into the wood. Use one bolt at each end of each piece of lumber (as shown in figure 5-9). Use one bolt at the center of each remaining side of the mount.
8. Add the required number of concrete blocks for ballast. See steps 8 and 9 on page 5-8.



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## Using existing structures as ODU mounts

In some cases, you may be able to mount an ODU to an existing structure, such as a tower built to support communications antennas.

The key factors for determining if an existing structure can be used as mast are that the structure must:

- Be securely attached to the building (and capable of sustaining specified wind loadings).
- Have an outside diameter of 2.0 to 4.5 inches.
- Meet line of sight (LOS) requirements.

**Important:** *In addition to these criteria, the structure must also meet other requirements listed in the *Hub and Remote Terminal Site Preparation Guide*.*

## Chapter 6

# Installing ODUs

---

This chapter explains how to install RT ODUs. It includes:

- Introduction – page 6–2
- Transporting the ODU to the roof – page 6–4
- ODU installation and alignment tools – page 6–5
- Installing the temporary collar – page 6–6
- Installing the antenna mount – page 6–10
- Attaching the antenna to the mount – page 6–12
- Adjusting the antenna azimuth (coarse adjustment) – page 6–15
- Adjusting the antenna elevation (coarse adjustment) – page 6–17
- Checking the radome drain position – page 6–18
- Installing the mechanical attenuator – page 6–19
- Attaching the transceiver to the antenna – page 6–21
- Grounding the ODU – page 6–23
- Connecting the IFL to the ODU – page 6–25
- Adjusting the antenna azimuth (finer adjustment) – page 6–26
- Adjusting the antenna elevation (finer adjustment) – page 6–28

*For ODU standards compliance information, see appendix B (page B–2).*

■ *For ODU location requirements, see page 5–3.*

## Introduction

For conceptual reference, figure 6-1 illustrates how hub terminal (HT) ODUs communicate with remote terminal (RT) ODUs. The remote terminal (RT) outdoor unit (ODU) and integrated antenna attach to a mount installed on a vertical or horizontal mast, as shown in figure 6-2 on page 6-3.

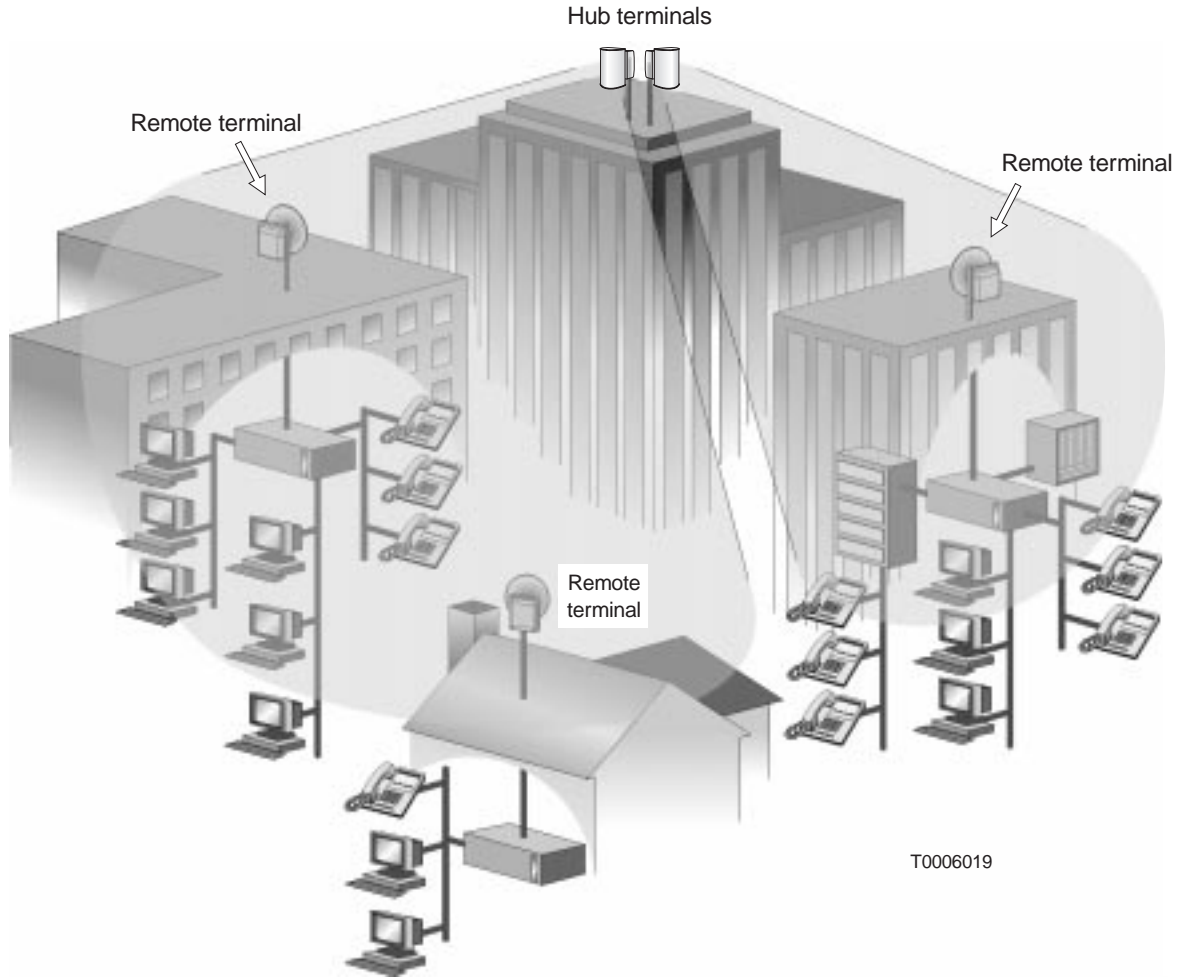


Figure 6-1 Hub ODUs communicating with RT ODUs

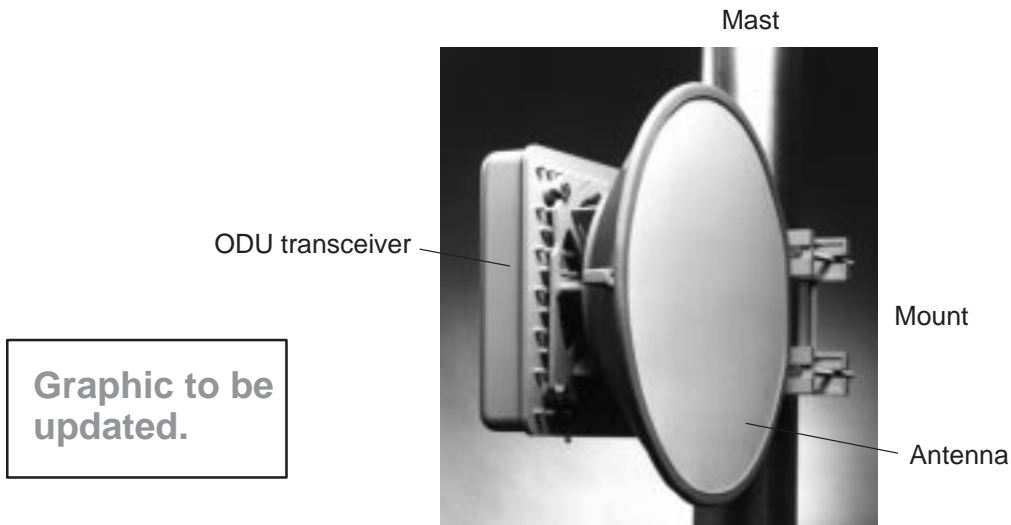


Figure 6-2 ODU (installed)

**Safety warnings**

When installing ODUs, observe the following safety warnings:



**DANGER**

Do not work on a ladder or roof without first reading the safety warnings on page x of this manual. Failure to observe these warnings could result in personal injury or death.



**WARNING**

Potential radio frequency (RF) hazard:

- Keep away from the front of the outdoor unit (ODU) antenna while the ODU is operating. Note that you cannot tell from outward appearance whether the ODU is operating or not.
- Be careful with respect to the ODU you are installing and ODUs that may already be operating in the installation area.

Failure to observe these warnings could result in injury to eyes or other personal injury.

**Prerequisites** ■ Before you can install and commission the outdoor RT equipment:

- The hub must be installed and operational.
- The RT ESN (electronic serial number) must be entered in the EMS database.
- The mast must be installed.

The mast must have an outside diameter of 2.0 to 4.5 inches (5.5 to 11.4 centimeters) and must be securely mounted in a vertical or horizontal position. **If the mast is not installed, you will need to install it before you proceed.** For additional details concerning the mast, see the *AIReach Broadband Hub and Remote Terminal Site Preparation Guide*.

Before starting, make sure you have:

- Antenna mount
- Antenna
- Transceiver
- 3/8-inch torque wrench with 13-millimeter deep socket
- 5/32-inch (4-millimeter) torque hex key wrench

## 6.2

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### Transporting the ODU to the roof

Unpack the ODU transceiver and antenna before going up to the roof. Carry the transceiver and antenna to the roof (in separate trips) in a backpack or padded bag. Make sure the transceiver or antenna is secured in the backpack or bag.

## ODU installation and alignment tools

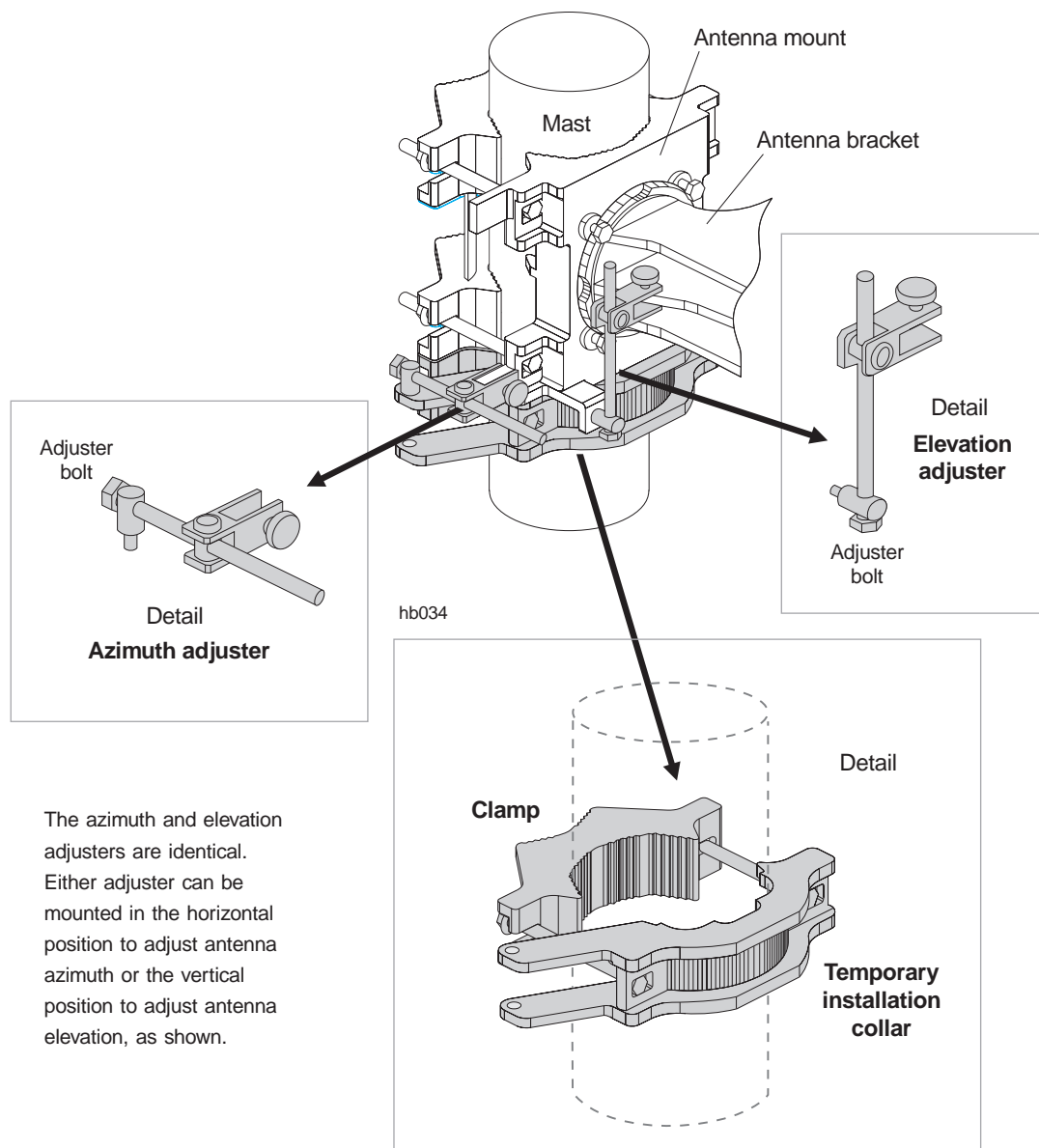
Figure 6-3 shows the specialized tools included in the AIReach Broadband ODU installer tool kit (HNS 1024668–0024).

You use these tools during installation and pointing to:

- Support the antenna mount and ODU and
- Adjust the antenna azimuth and elevation

Instructions for these procedures are included in the following sections.

When installation and pointing are complete, you remove the temporary installation collar, clamp, and adjusters so you can reuse them for subsequent installations.

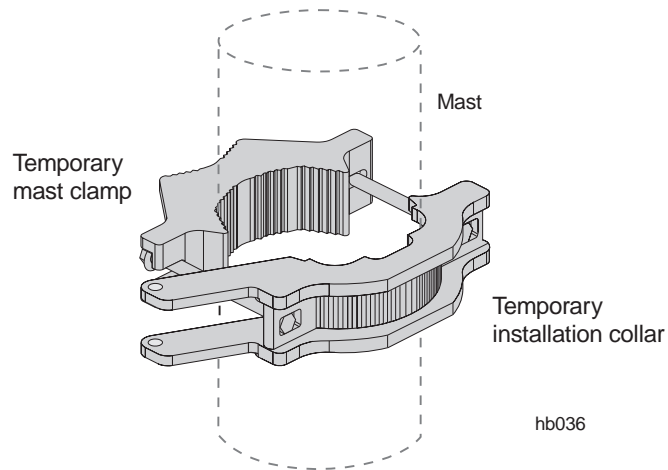


**Figure 6-3 ODU installer tool kit (all shaded parts)**

## Installing the temporary collar

**Important:** To correctly install the antenna mount, read and carefully follow *all* instructions in sections 6.4 through 6.8.

The temporary installation collar (HNS 1024668–0022; figure 6-4) supports the antenna mount and ODU during installation (as shown in figure 6-3).

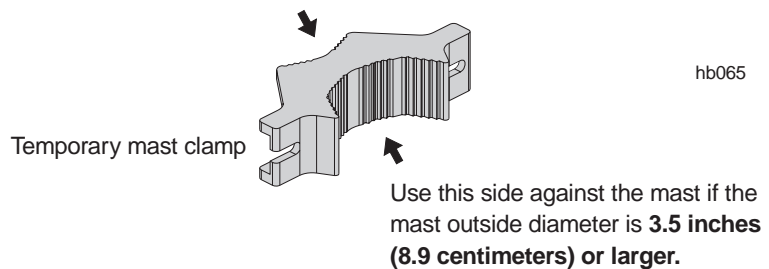


**Figure 6-4** Temporary installation collar

*Before you install the temporary installation collar:*

1. Refer to the illustration below to determine which side of the temporary mast clamp to use:

Use this side against the mast if the mast outside diameter is **less than 3.5 inches (8.9 centimeters)**.



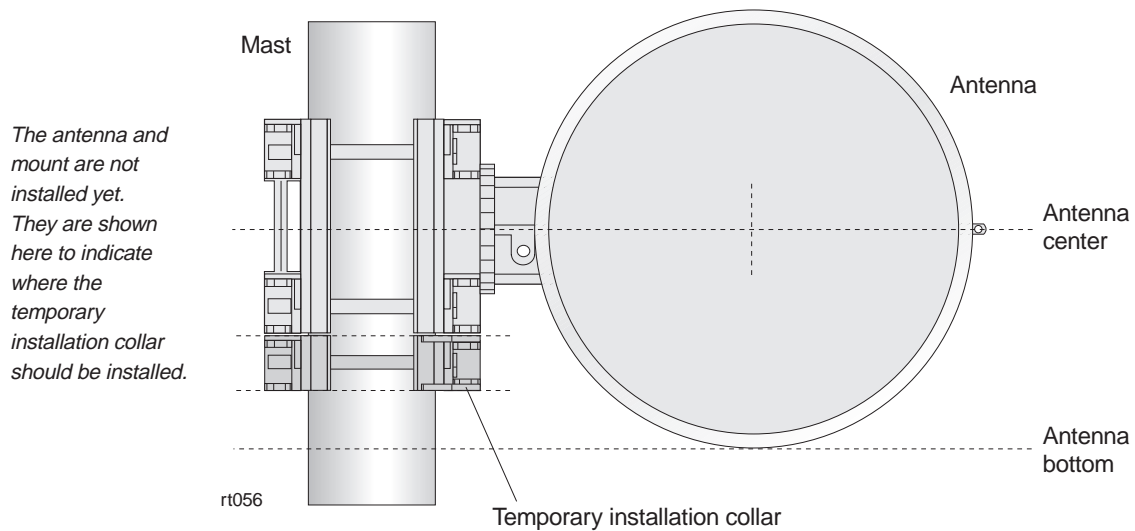
2. Determine (approximately) how high on the mast to install the temporary installation collar:
  - a. Determine the approximate desired antenna installation height:



**The ODU/antenna must be installed in line of sight with the hub terminal (HT), with no obstructions.** As a general rule, install the RT ODU as high as possible on the mast to avoid obstructions, unless the work order or RF survey specifies the ODU height.

- b. Refer to figure 6-5 for the collar position relative to the installed antenna position.

As shown in figure 6-5, when the antenna is installed (later), the top of the collar is below the antenna center and above the bottom of the antenna.

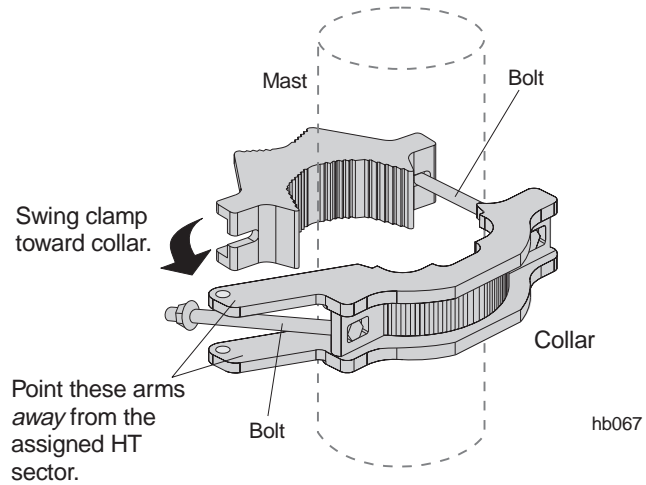


**Figure 6-5 Collar height relative to desired antenna height**



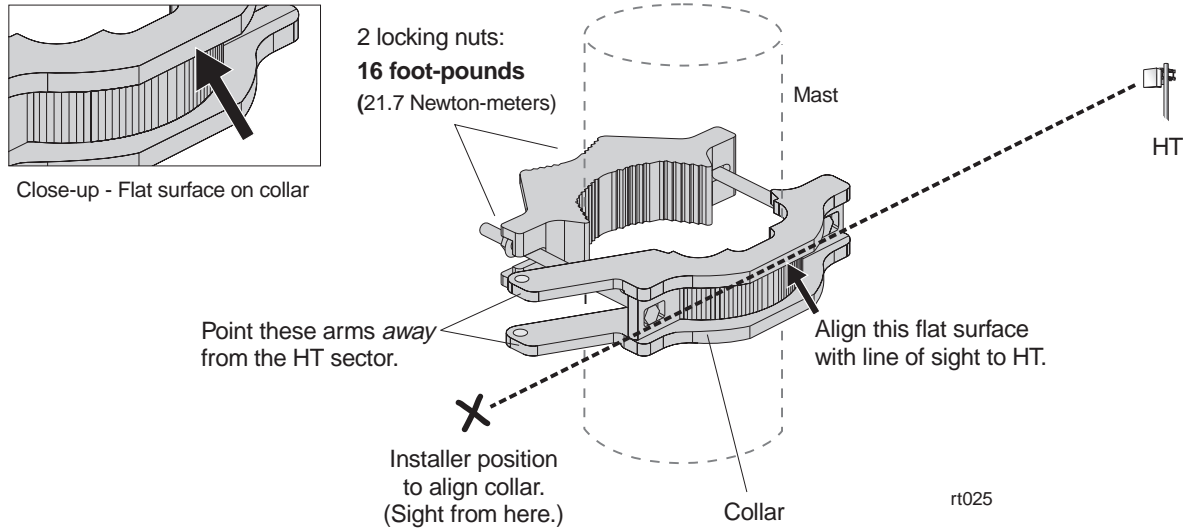
Attach the temporary installation collar to the mast, as follows:

1. Point the two long arms *away* from the direction of the HT, as shown in figures 6-6 and 6-7.
2. Position the collar and clamp on opposite sides of the mast, and swing the clamp toward the collar until you can “capture” the clamp by swiveling the free–swinging bolt into the slot in the clamp.



**Figure 6-6 Attaching the temporary installation collar to the mast**

3. Align the collar with respect to the target HT as shown in figure 6-7.
4. **Using a torque wrench with a deep socket, tighten the temporary installation collar locking nuts to 16 foot-pounds torque (21.7 Newton-meters).**



**Figure 6-7** Aligning the temporary installation collar



### CAUTION

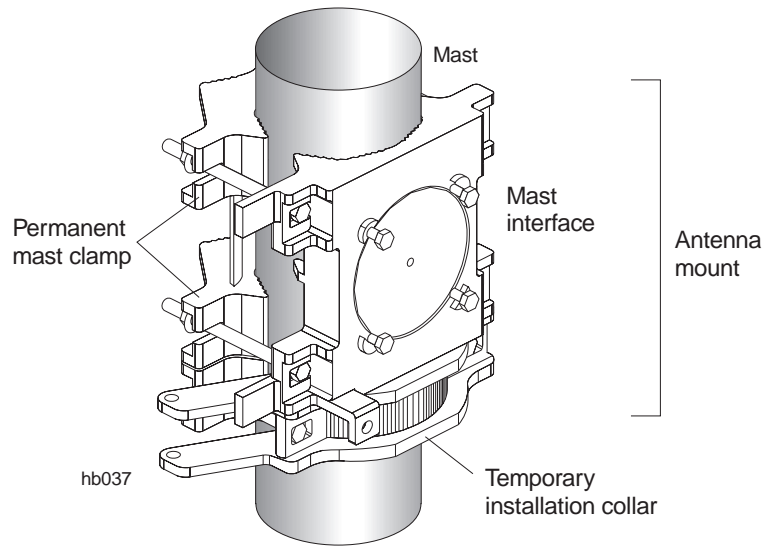
Correct torque is *essential* for successful installation and adjustment. Tighten nuts to the exact torque stated. Incorrect torque may result in damage to equipment.

**Important:** Due to planned enhancements to the antenna mount design, the specified torque settings are subject to change. Verify the torque settings with the HNS Wireless Networks Division (WND) Technical Assistance Center (TAC) before installing the antenna and mount.

**Important:** The temporary collar, clamp, and adjusters are not removed until the RT is commissioned and verified as operational. Commissioning the RT is discussed in chapter 7.

## Installing the antenna mount

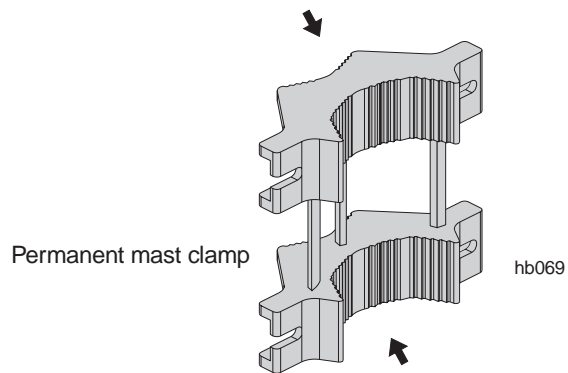
The antenna mount (HNS 1024668–0025) consists of a mast interface and permanent mast clamp, as shown in figure 6-8. Follow the steps below to install the antenna mount.



**Figure 6-8 Antenna mount**

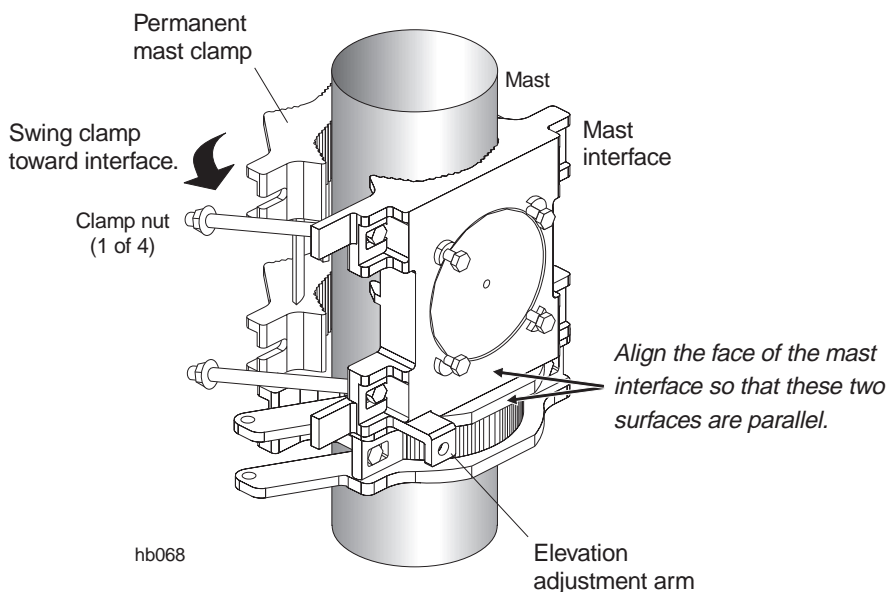
1. Determine which side of the permanent mast clamp to use:

Use this side against the mast if the mast outside diameter is **less than 3.5 inches (8.9 centimeters)**.



Use this side against the mast if the mast outside diameter is **3.5 inches (8.9 centimeters) or larger**.

2. Position the mast interface and permanent mast clamp on opposite sides of the mast, with the interface on the same side as the temporary collar, as shown in figure 6-9.  
Allow the bottom surface of the mast interface to rest on the top surface of the temporary installation collar.



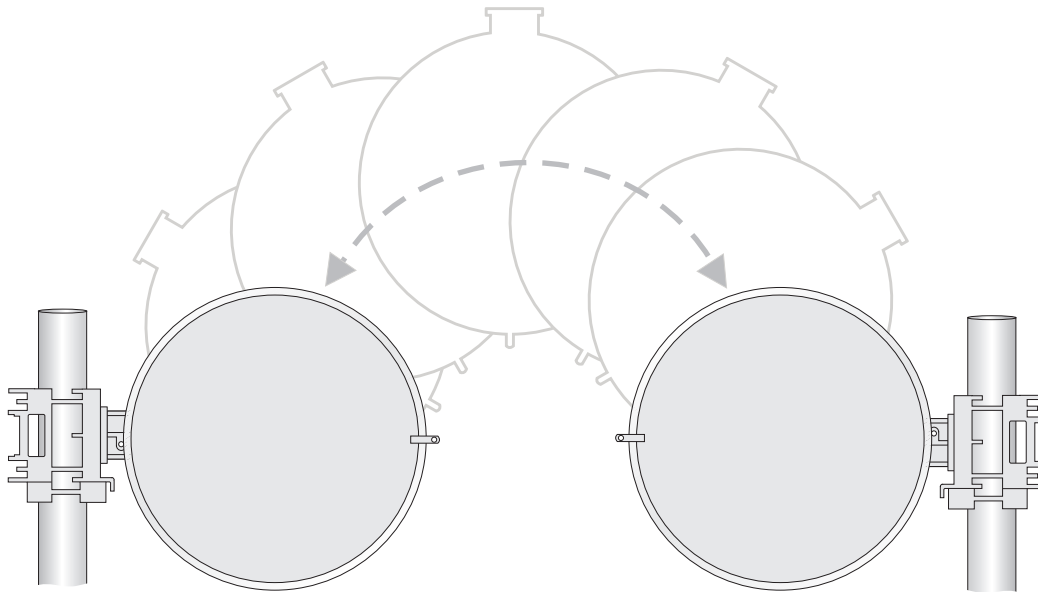
**Figure 6-9** Installing the antenna mount

3. Swing the clamp toward the interface until you can “capture” the clamp by swiveling the free–swinging bolts into the two slots in the clamp, as shown in figure 6-9.  
The elevation adjustment arm (shown in figure 6-9) must be behind the antenna (not installed yet). This means it will be on the side of the interface that is farthest from the HT.  
In some cases, to point the antenna in the right direction, it is necessary to install the mount upside down, with the elevation adjustment arm at the top of the mast interface. This is acceptable, as long as the mount is installed so the elevation adjustment arm will be behind the antenna.
4. Align the mast interface and temporary installation collar so the rectangular face of the interface is parallel with the flat surface of the collar, as shown in figure 6-9.
5. **Finger tighten** the four mast clamp nuts so the mast interface and permanent mast clamp are snug and without excess movement.  
You should be able to smoothly pivot the mast interface and mast clamp around the mast to permit coarse azimuth adjustment.  
(You fully tighten the mast clamp nuts later, after completing all adjustments.)

## Attaching the antenna to the mount

1. With the radome facing the HT direction, position the round, flat surface of the antenna bracket approximately 1 inch (2.5 centimeters) from the mast interface.

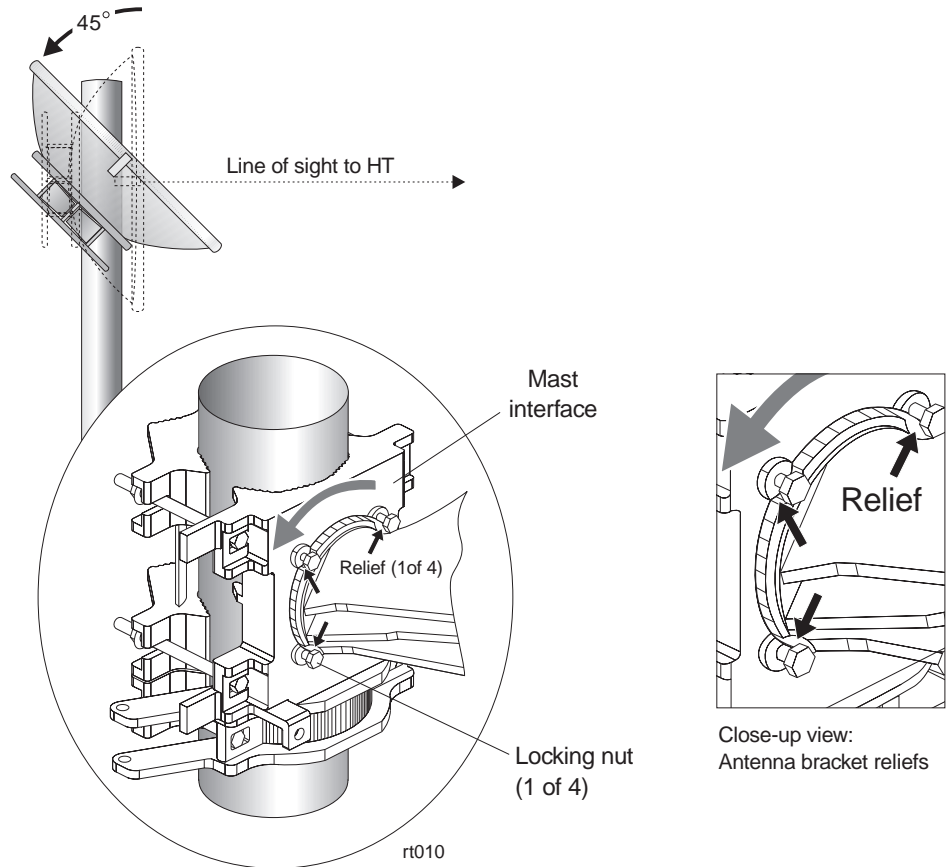
**Note:** The RT antenna can be rotated 180°, as shown below, to attach to a mount to the right or left.



T0009004

**Figure 6-10** The RT antenna can be rotated to attach to the right or left

2. Rotate the antenna approximately  $45^\circ$  away from the HT until the antenna bracket reliefs (curved indentations) are aligned with the four nuts on the mast interface, as shown in figure 6-11.

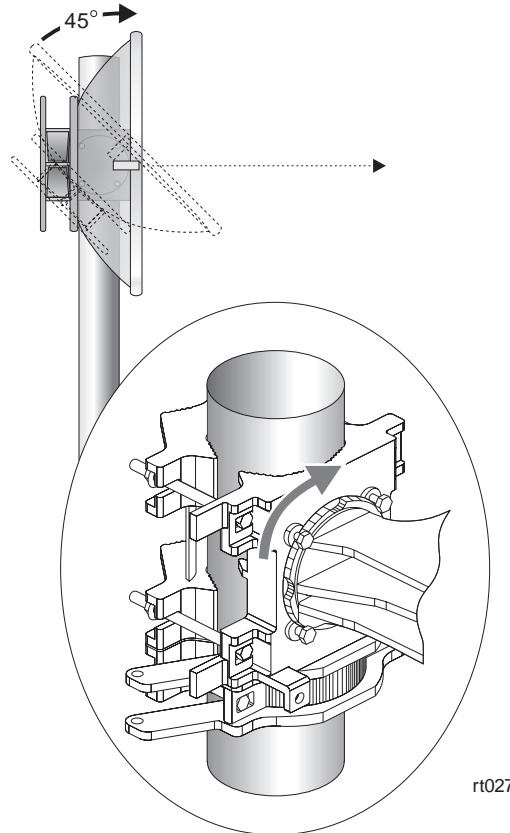


**Figure 6-11 Rotating the antenna so the antenna bracket can be placed against the mast interface**

3. Press the antenna against the mast interface.

4. Rotate the antenna approximately  $45^\circ$  toward the HT, to the upright position, as shown in figure 6-12—then **finger tighten** the antenna bracket locking nuts so the antenna is snug and without excess movement.

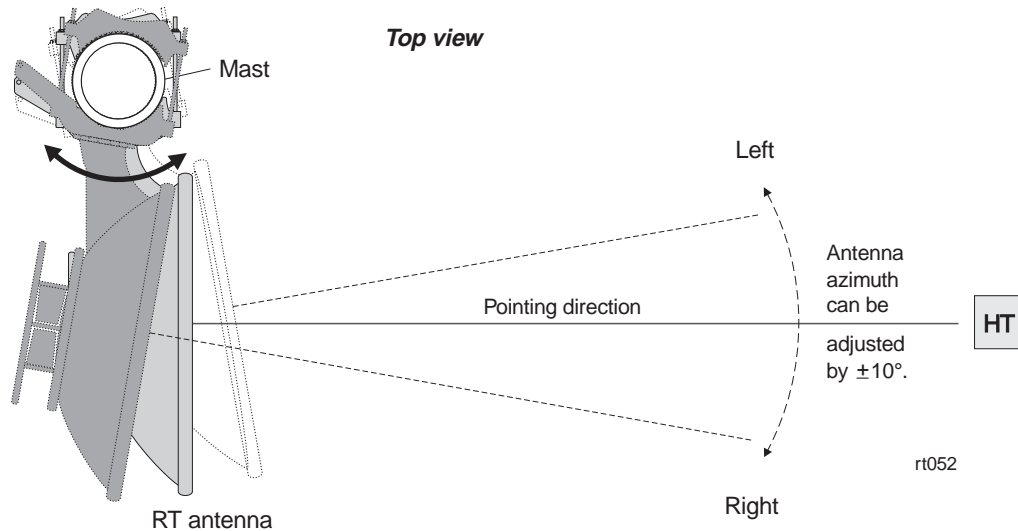
The antenna is now “captured” by the antenna mount. However, because the antenna bracket nuts are not fully tightened, you can adjust the antenna elevation.



**Figure 6-12 Rotating the antenna to the upright installation position**

## Initial (coarse) antenna azimuth adjustment

To adjust the antenna azimuth (horizontal pointing direction), you move the antenna to the left or right, as illustrated in figure 6-13. You adjust the azimuth until the antenna is pointed at the HT.



**Figure 6-13** Antenna azimuth adjustment (to right or left)

You adjust the antenna azimuth in three stages:

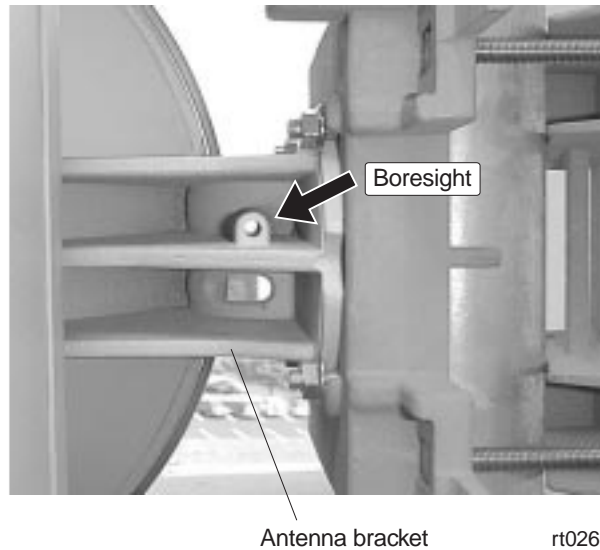
1. Coarse adjustment, using only the built-in antenna boresight (steps 1 through 4, on page 6-16)
2. Finer adjustment, using the boresight and azimuth adjuster tool (section 6.14)—after you attach the transceiver, ground cable, and IFL cable.
3. Electronic pointing, using a voltmeter and integrated system software (section 7.4). This procedure, a part of the RT commissioning process, refines the azimuth adjustment to point the antenna as accurately as possible.



## Coarse azimuth adjustment

Obtain a coarse azimuth adjustment as follows:

1. Using the antenna boresight for reference (see figure 6-14), rotate the antenna mount (and antenna) around the mast until you can see the HT in the boresight.

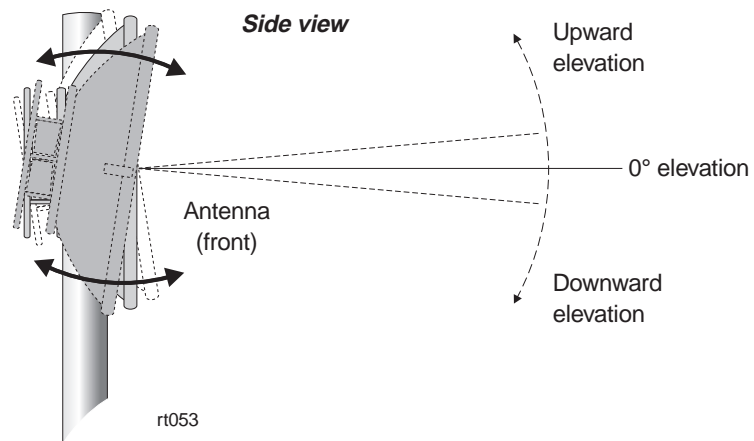


**Figure 6-14 Boresight location**

2. **Using a torque wrench with a deep socket, tighten the four mast clamp nuts to 20 foot-pounds torque (27.1 Newton-meters). Tighten each bolt a little at a time, moving from bolt to bolt in an X pattern.**
3. Loosen the temporary installation collar and re-align the collar with the mast interface, as shown in figure 6-9.
4. Tighten the correctly aligned temporary installation collar to **16 foot-pounds torque (21.7 Newton-meters).**

## Initial (coarse) antenna elevation adjustment

To adjust the antenna elevation (upward or downward pointing direction), you rotate the antenna upward or downward, as illustrated in figure 6-15, until the elevation is set as desired.



**Figure 6-15 Antenna elevation adjustment (upward or downward adjustment)**

You adjust the antenna elevation in three stages:

1. Coarse adjustment, using only the built-in antenna boresight (steps 1 through 4, on page 6-18)
2. Finer adjustment, using the boresight and elevation adjuster tool (section 6.15)—after you attach the transceiver, ground cable, and IFL cable.
3. Electronic pointing, using a voltmeter and integrated system software (section 7.4). This procedure, a part of the RT commissioning process, refines the elevation adjustment to point the antenna as accurately as possible.

### Coarse elevation adjustment

Obtain a coarse elevation adjustment as follows:

1. Using the boresight for reference, rotate the antenna until a coarse alignment is obtained.

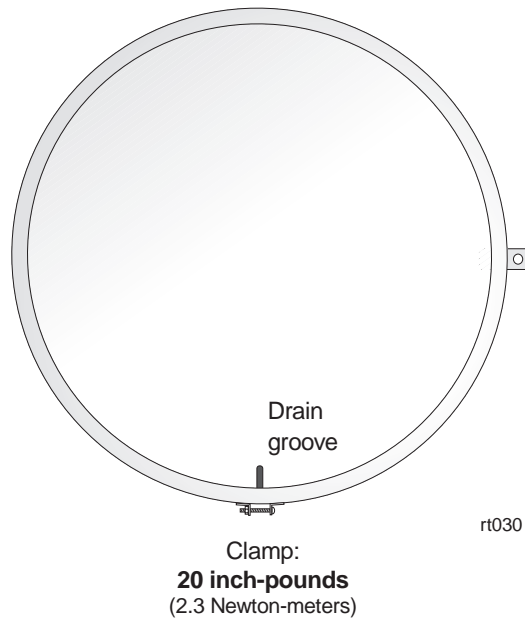
When the elevation is properly adjusted, you should be able to see all of the HT in the boresight.

If the antenna does not rotate freely, loosen each of the antenna bracket nuts *slightly*.

2. **Finger tighten the reflector bracket locking nuts (again), so the antenna is snug and without excess movement.**

## Checking the radome drain position

Check to make sure the radome drain groove is at the bottom of the antenna.



**Figure 6-16 Radome drain groove**

*If the radome drain groove is at the bottom of the antenna, proceed to section 6.10.*

*If the drain groove is not at the bottom of the antenna, rotate the radome panel as follows:*

1. Using a 5/32-inch (4-millimeter) torque hex key wrench, loosen the radome band clamp locking nut.
2. Rotate the radome panel until the band clamp screw assembly and drain groove are located at the bottom of the antenna.
3. **Tighten the radome band clamp locking nut to 20 inch-pounds torque (2.3 Newton-meters).**
4. Look through the boresight to make sure the antenna is remains (coarsely) pointed.

Section 6.11 explains how to attach the transceiver to the antenna.

## Installing the mechanical attenuator

You must use a mechanical attenuator, shown in figure 6-17, if:

- The RT is within 328 feet to 1,312 feet (100 to 400 meters) of the HT.
- The RT pointing voltage, obtained from a voltmeter, exceeds 4.1 volts.
- The installation work order instructs you to use it.

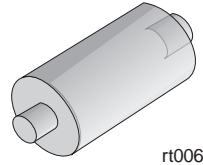


Figure 6-17 Mechanical attenuator



### WARNING

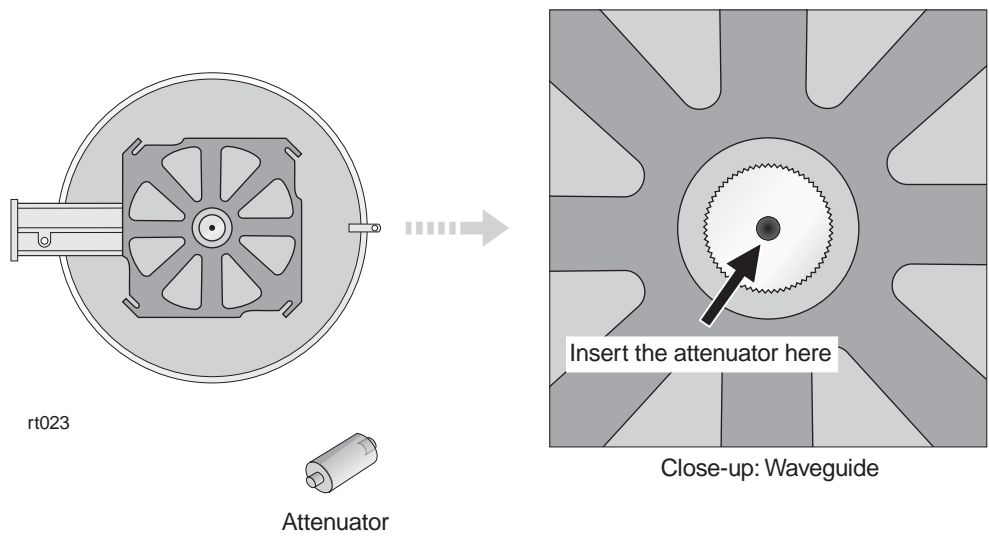
To avoid the risk of electric shock and exposure to potentially harmful radio frequency (RF) waves, make sure the IDU is turned off, if already installed, before installing the mechanical attenuator. Failure to observe these warnings could result in personal injury.

Use the attenuator size (in decibels) specified in the installation work order and/or Site Data Record.

Follow these steps to install the mechanical attenuator:

1. Locate the circular waveguide on the rear of the antenna. See figure 6-18.
2. Insert the mechanical attenuator in the circular waveguide, as shown in figure 6-18.

**Important:** Do not fully insert the mechanical attenuator. Ensure that part of the attenuator is exposed so it can be removed if necessary.



**Figure 6-18** Installing the mechanical attenuator

## Attaching the transceiver to the antenna

Follow these steps to attach the transceiver to the antenna:

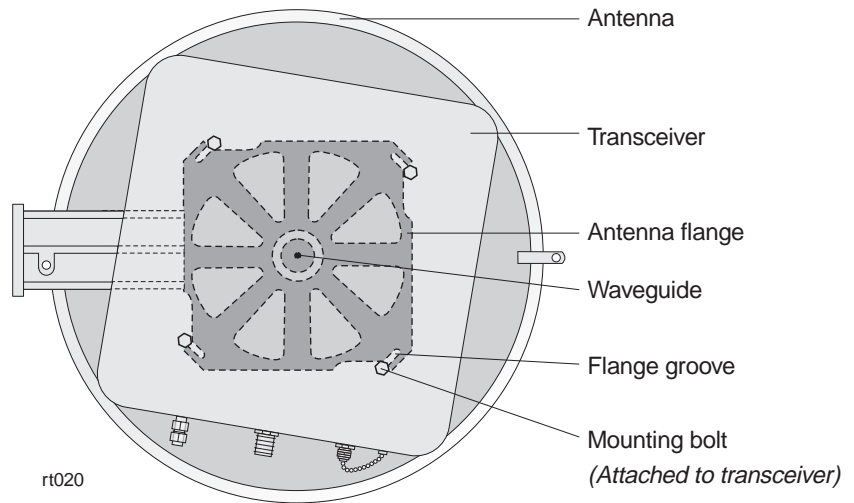
1. Remove the plastic plug from the antenna waveguide and the plastic cap from the transceiver coupling.



### CAUTION

Always keep the waveguide and coupling plugs in place when the transceiver is detached from the antenna, to keep dust or other contamination out.

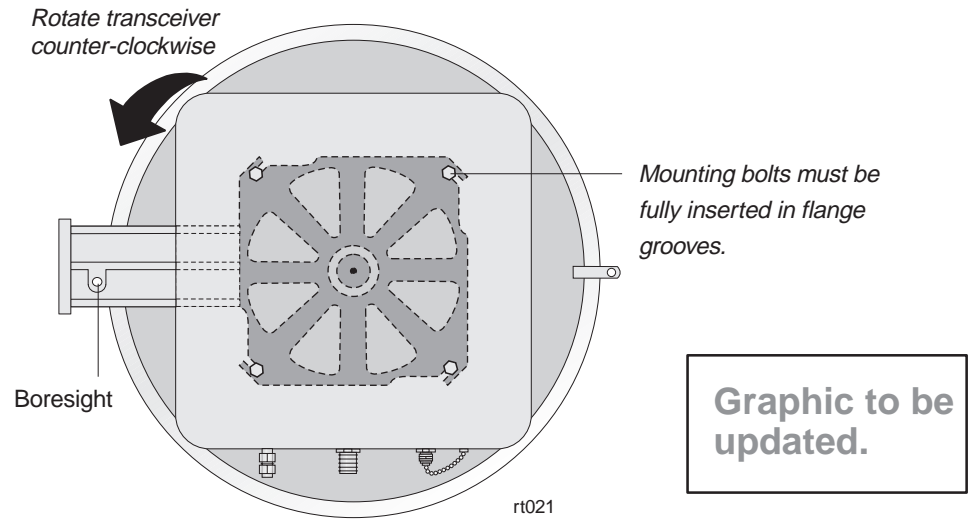
2. Position the transceiver so its four mounting bolts are aligned with the four grooves on the antenna flange, as shown in figure 6-19.



Graphic to be updated.

Figure 6-19 Aligning the transceiver mounting bolts

3. Rotate the transceiver, making sure the transceiver's mounting bolts slide into the grooves in the antenna flange. (The direction of rotation depends on the orientation of the antenna bracket—to the right or left.) If the mounting bolts will not slide into the grooves, loosen the bolts. See figure 6-20.



**Figure 6-20 Transceiver (installed)**

4. Fully tighten the mounting bolts.
5. After tightening the transceiver, look through the boresight to make sure the antenna is still accurately pointed at the HT. See figure 6-20 for boresight location.

## Grounding the ODU

Grounding the ODU requires several connections, as shown in figure 6-21. In making the ground connections, *follow these practices*:

- For all ODU ground connections, use compression connectors (such as compression lugs or compression clamps).
- For all threaded ground connections, use a flat washer and lock washer (with the lock washer next to the nut).

Ground the ODU as follows:

1. Connect one end of the ground cable (No. 6 AWG or greater, green) to the ODU ground connector, which is shown in figure 6-21.
2. Connect the ground cable to a bolted joint on the mast mount.

**Important:** For this connection, strip the cable but **do not cut it**. See figure 6-21. The cable continues from the bolted joint to the ground point.

3. Connect the ground cable to a suitable ground point on the rooftop.

The best ground point for the ODU is an earth-referenced roof ring conductor that follows the perimeter of the building, constructed according to the requirements of NFPA 780 or a similar regulatory code. However, such a conductor is not always present. Other alternatives are acceptable, as long as they comply with the grounding requirements detailed in the *Hub and Remote Terminal Site Preparation Guide*.

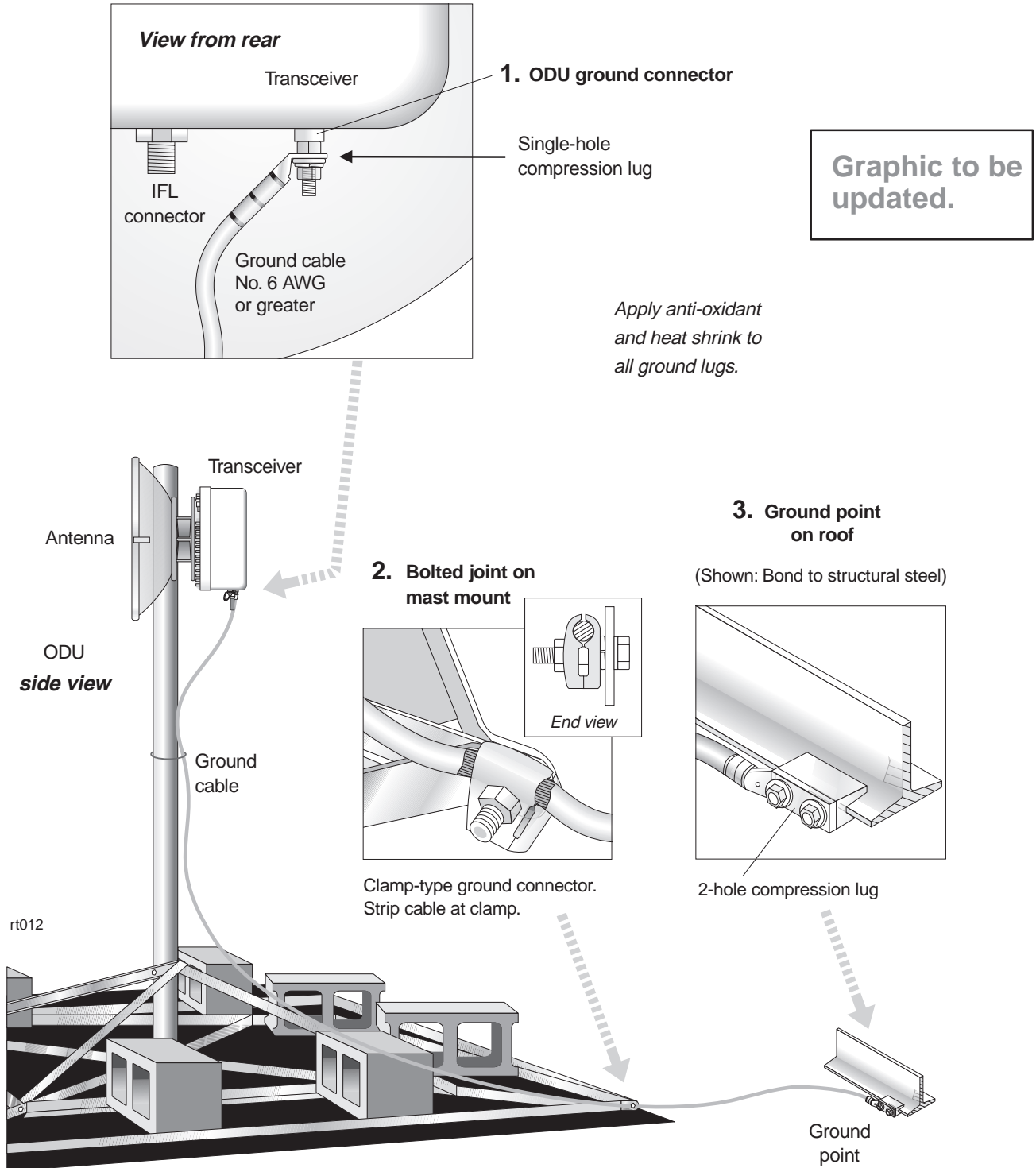
Building steel can also be used as a ground point. **However, before using building steel, verify that the steel structure is electrically continuous throughout the entire building and that it is properly connected to earth ground.** For detailed grounding requirements, see the *Hub and Remote Terminal Site Preparation Guide*.

4. Apply anti-oxidant (HNS 9008224-0002) to each ground lug (points 1, 2, and 3 in figure 6-21).
5. Apply 1/2-inch (13-millimeter) heat shrink tubing (HNS 9007488-0005) to each ground lug after the connection is complete.

**Important:** You must slip the heat shrink onto the cable *before* you make the connections.

**Note:** A resistance of less than 5 ohms is desirable from the ODU to earth, including the earth field.





**Figure 6-21 ODU grounding connections**

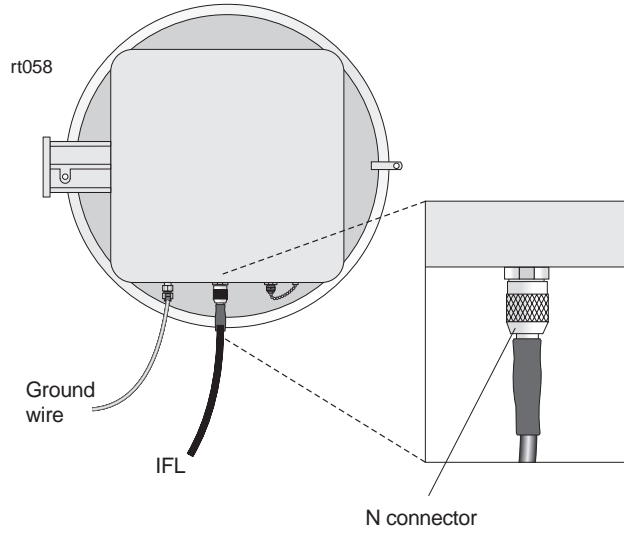
**Lightning protection**

Lightning protection is provided by grounding the ODU as stated above and installing a lightning arrester where the IFL cable enters the roof (as explained in section 4.9). **The ODU ground and IFL lightning arrester must both be bonded to the same ground (reference) point.**

### Connecting the IFL to the ODU

Connect the IFL to the ODU as shown in figure 6-22.

Graphic to be updated.



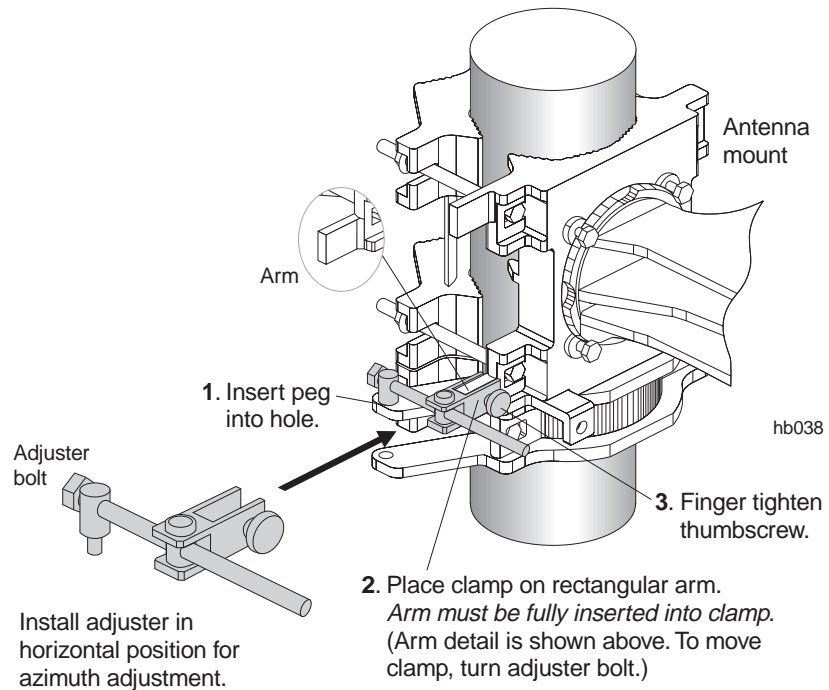
**Figure 6-22 Connecting the IFL to the ODU**

**Do not apply weatherproofing compound or tape until the RT has been tested and commissioned. Weatherproofing is covered in section 8.1.**

## Finer antenna azimuth adjustment

Now that the transceiver and cables are attached to the ODU, adjust the antenna azimuth more precisely, as follows:

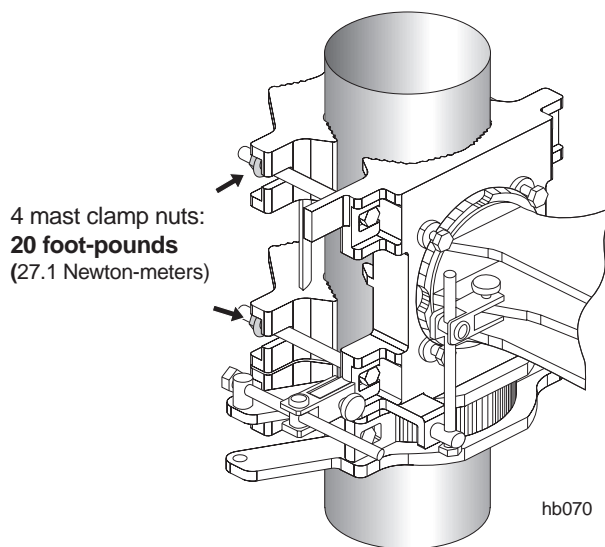
1. Install the azimuth adjuster as shown in figure 6-23.  
The azimuth/elevation adjusters are identical. Use either one as the azimuth adjuster or elevation adjuster. Two adjusters are provided for installation convenience. The part number for one adjuster is HNS 1024668-0023.



**Figure 6-23** Installing the first adjuster, for azimuth adjustment

**Note:** Do not remove the adjusters until the antenna is accurately pointed (after electronic pointing using the voltmeter).

- Using a torque wrench with a deep socket, verify that the torque of the four mast clamp nuts is 20 foot-pounds (27.1 Newton-meters).



**Figure 6-24 Tightening the mast clamp nuts**

- Loosen each nut by one full rotation.*  
(The mount stays in position, but will move when you turn the azimuth adjuster with a wrench.)
- Using a wrench, rotate the adjuster bolt on the azimuth adjuster until the antenna azimuth is properly aligned. Azimuth is properly adjusted when you can see the HT in the boresight with no shadow inside the boresight to the left or right. See figure 6-25.

**Graphic to be updated.**



rt028

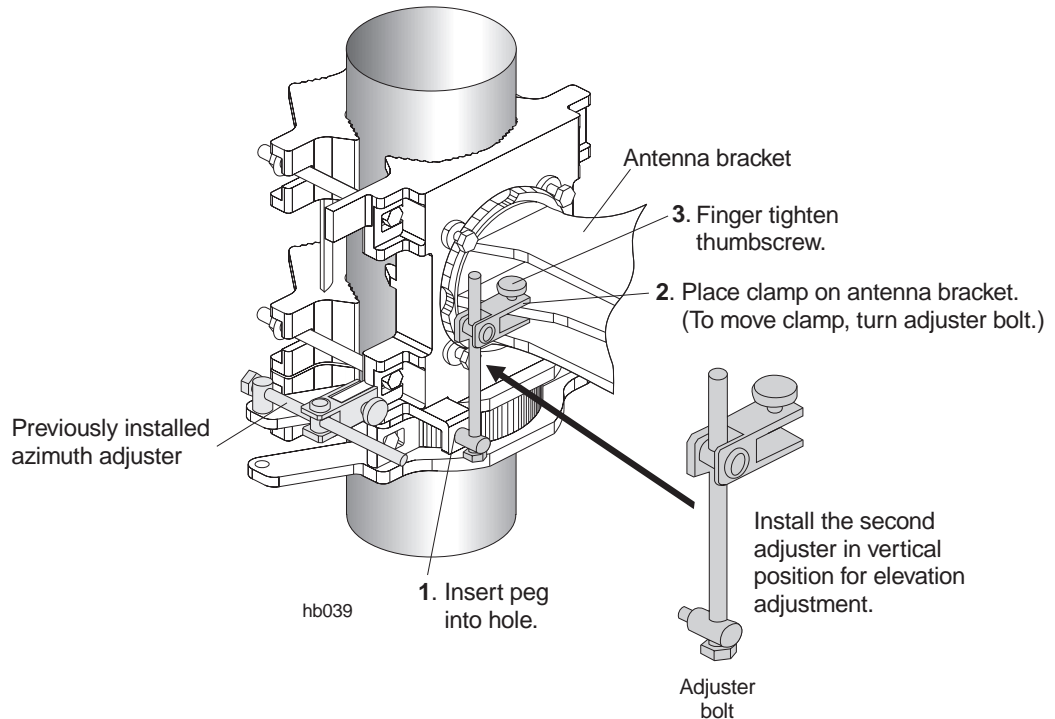
**Figure 6-25 Using the boresight to adjust azimuth**

- When the azimuth is properly adjusted, tighten the mast clamp nuts to 20 foot-pounds torque (27.1 Newton-meters).

## Finer antenna elevation adjustment

Adjust the antenna elevation more precisely, as follows:

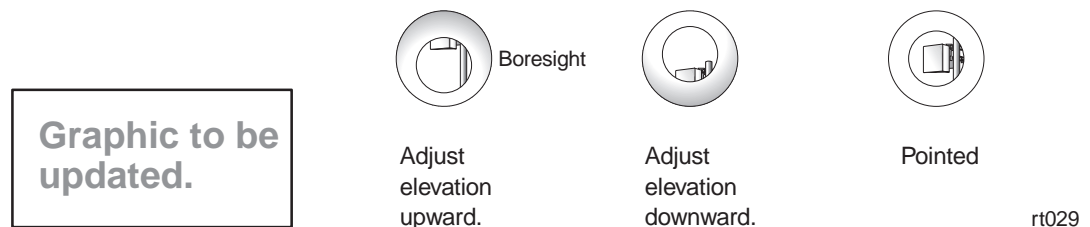
1. Install the second azimuth/elevation adjuster as shown in figure 6-26.



**Figure 6-26** Installing the second adjuster, for elevation adjustment

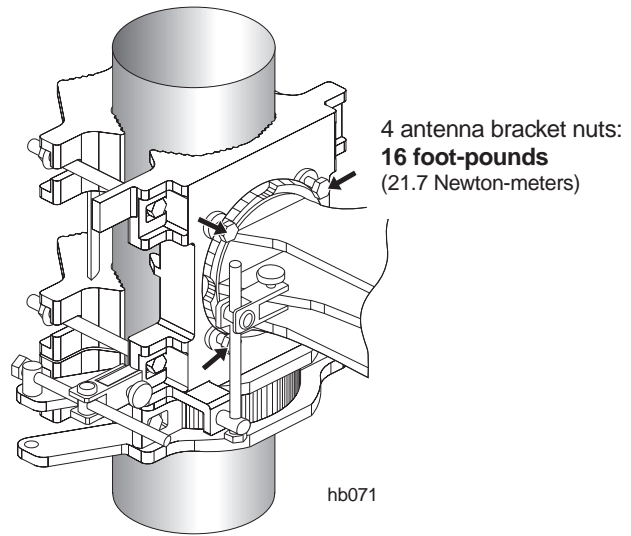
2. Using a wrench, rotate the adjuster bolt until the proper elevation alignment is achieved.

Elevation is properly adjusted when you can see the HT in the boresight with no shadow inside the top or bottom of the boresight. See figure 6-25.



**Figure 6-27** Using the boresight to adjust elevation

3. When the elevation is properly adjusted, tighten the antenna bracket locking nuts to 16 foot-pounds torque (21.7 Newton-meters).



**Figure 6-28 Tightening the antenna bracket nuts**

At this point, antenna installation is complete, and the antenna is *visually* pointed. Later, when you commission the RT, you will use a voltmeter to electronically point the antenna as accurately as possible.

# Commissioning the RT

---

This chapter includes:

- Prerequisites for commissioning – page 7-2
- Connecting the IFL to the CCM – page 7-3
- Front panel LCD operation – page 7-4
- Pointing the antenna – page 7-8
- Removing the installation tools – page 7-13
- Verifying HT acquisition – page 7-14
- Checking component status – page 7-14
- RT to HT connection tests – page 7-19

Commissioning refers to verification procedures to ensure that the newly installed RT is operational.

**Note:** Each RT must be commissioned separately.

## Safety warnings

Observe these safety warnings while commissioning RTs:



### DANGER

Do not work on a ladder or roof without first reading the safety warnings on page x of this manual. Failure to observe these warnings could result in personal injury or death.

---



### WARNING

Potential radio frequency (RF) hazard:

- Keep away from the front of the outdoor unit (ODU) antenna while the ODU is operating. Note that you cannot tell from outward appearance whether the ODU is operating or not.
- Be careful with respect to the ODU you are installing and ODUs that may already be operating in the installation area.

Failure to observe these warnings could result in injury to eyes or other personal injury.

---

## Prerequisites for commissioning

To ensure successful commissioning, you must verify that the prerequisites listed below have been accomplished. These tasks must all be completed *prior to* commissioning. If any of them has not been done, make sure they are completed before you proceed with commissioning.

- The RT ODU, IFL, and IDU must be installed and connected.

If you have followed all previous instructions, this prerequisite is satisfied when you connect the IFL to the CCM (IDU), as instructed on page 7-4.

- The Element Management System (EMS) hardware and software must be installed and operational.

- All physical LAN connections between the RT and EMS must be completed.

- The EMS database must be loaded and operational.

- The EMS operator has entered the RT electronic serial number (ESN) into the EMS database.

The RT ESN is printed on a tag attached to the CCM and can also be read from the CCM LCD—from the Main Menu ESN display.

- The installer must know the (RT) ODU frequency to be used and the identification number of the HT the RT will communicate with. These are provided by network planning personnel.

- The hub and HT must be installed and operational. **The HT must be properly aligned.**

- CCM must be installed in the IDU as specified in the configuration documents. (SSIs are not required for commissioning.)

- The RT cannot be located closer than 109 yards (100 meters) from the HT.



## Connecting the IFL to the CCM (IDU)

Connect the IFL cable to the CCM (IDU):

1. Go to the IDU location.
2. **Make sure power to the IDU is off (or disconnected).**
3. Using a 90° adapter, connect the IFL (N connector) to the CCM IFL interface, as shown in figure 7-1.

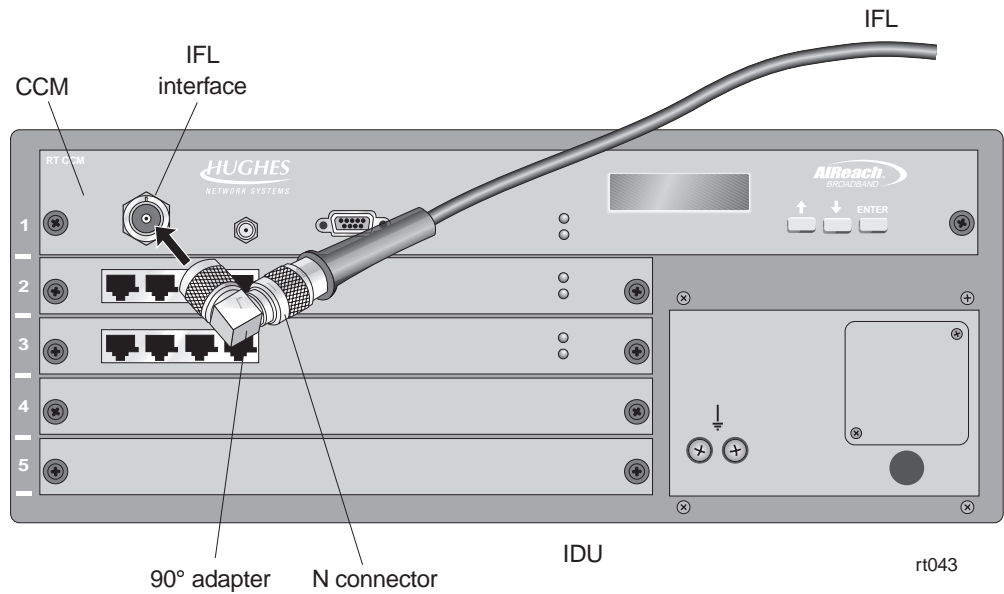


Figure 7-1 Connecting the IFL cable

4. Power on the IDU.

## Front panel LCD operation

This section describes how to use the LCD and buttons on the CCM front panel (figure 7-2). **You need to use the LCD to commission the RT.**

The LCD:

- Shows CCM startup diagnostics (SUDS) tests as they occur
- Shows the system boot up sequence
- Shows the software loading sequence
- Indicates the status and operational state of system components
- Provides functions necessary for commissioning the RT

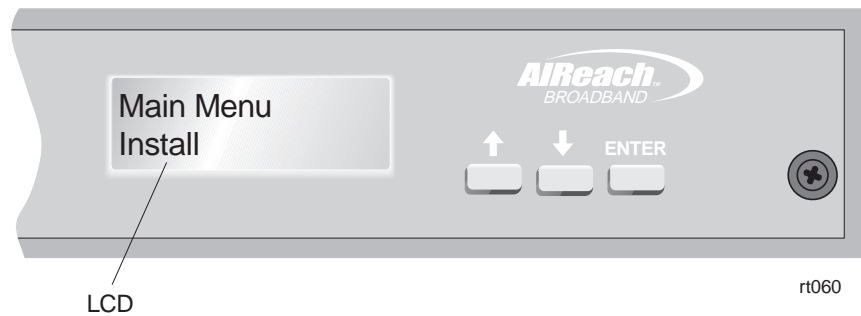
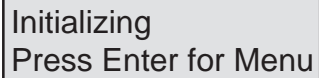


Figure 7-2 CCM front panel LCD

## Accessing the LCD Main Menu

When the CCM/ IDU is powered up or reset:

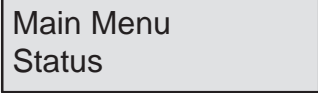
- SUDS run automatically.
- When SUDS are completed, the CCM LCD displays a **SUDS Completed** message.
- The LCD then displays:



Initializing  
Press Enter for Menu

To access the CCM LCD Main Menu, press the ENTER button on the CCM front panel while the **Initializing** screen is displayed.

This puts the IDU into diagnostic mode. The LCD shows the Main Menu:



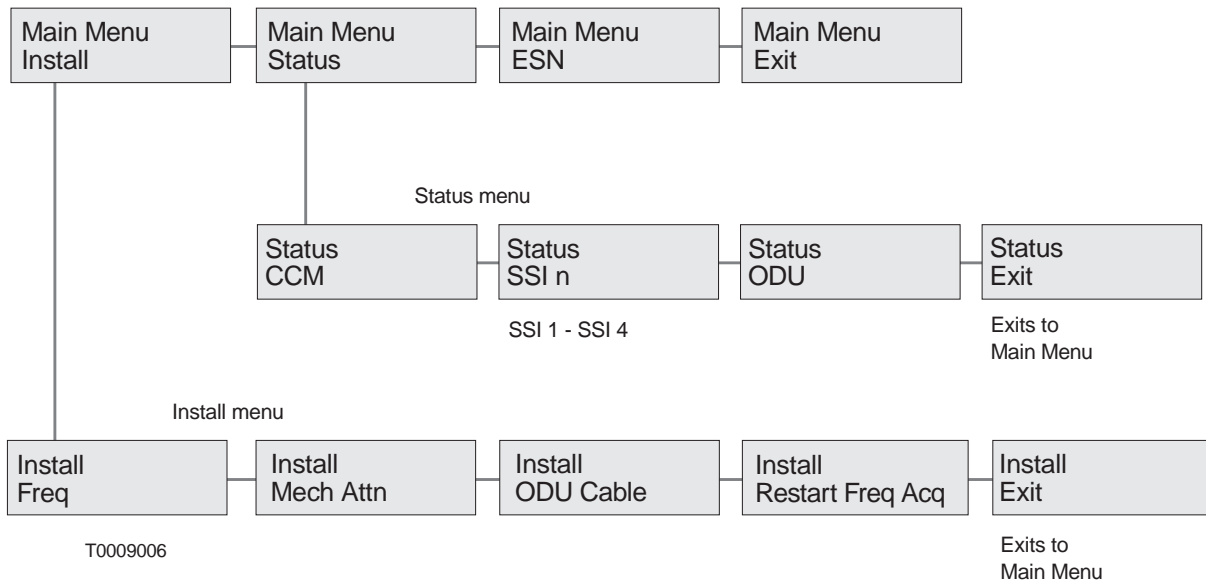
Main Menu  
Status

**Note:** After the CCM downloads its software and is operational (when it displays **RT Enabled**), you can access the Main Menu by pressing Enter.

## LCD menu map

The menu map (figure 7-3) shows the available menu options for RTs.

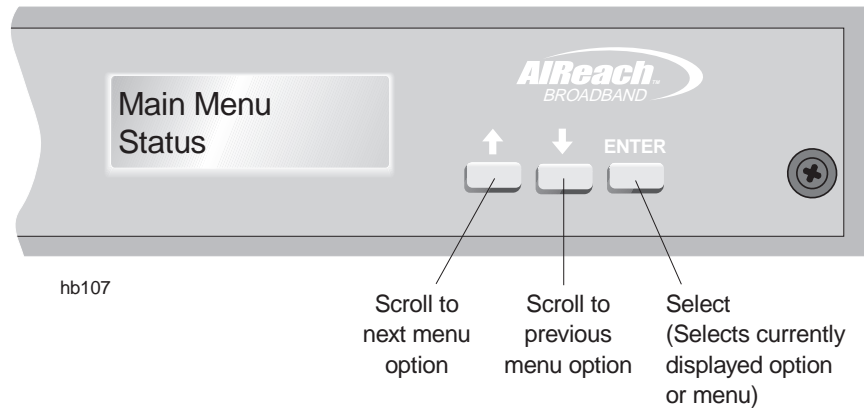
**Note:** Menu options are not the same for RTs and HTs.



**Figure 7-3** LCD menu map for RT CCM

**Note:** You will not see ODU status information when the ODU is not connected (via the IFL) to the IDU. (The status will be Unknown.)

**CCM button functions** The CCM button functions are explained in figure 7-4:



**Figure 7-4 CCM front panel button functions**

### ***Exit options***

If you select Exit from the Main Menu . . .

*. . . while the system is operating, it remains in operational mode.*

*. . . when the system is not in operational mode, the CCM reboots.*

If you select Exit from the Status or Install menu, the display returns to the Main Menu.

## Pointing the antenna

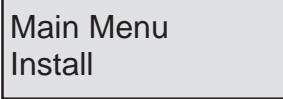
### Selecting the ODU frequency

Following the RT antenna installation instructions in chapter 6, you pointed the antenna approximately toward the HT, using the boresight. This section explains how you more accurately point the RT antenna, using a digital voltmeter.

*To point the antenna, follow steps 1 through 13 below.*

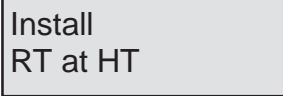
Before you can point the antenna using the voltmeter, you must first put the IDU into Install mode and select the (RT) ODU frequency, as follows:

1. From the IDU (CCM) LCD main menu, select **Install** mode, and press the Enter button.



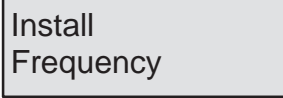
```
Main Menu
Install
```

The LCD displays:



```
Install
RT at HT
```

2. Press Enter, select **No**, and press Enter again.
3. Select **Frequency** (frequency function) and press Enter.



```
Install
Frequency
```

4. The LCD displays **Freq** and a frequency value:



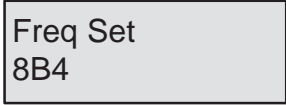
```
Freq
8B4
```

The frequencies displayed on the bottom line are preset, based on the installed ODU. The correct RT frequency is the same as the HT frequency, except “B” (indicating remote), as in **8B4**, replaces “A”.

5. Scroll to the correct ODU frequency. Scroll up (up arrow) for a higher frequency; scroll down (down arrow) for a lower frequency.

**Important:** If you do not see the correct frequency on the LCD, you may have installed the wrong ODU for the site (high band instead of low band, or vice versa). In this case, the LCD will not display the correct frequency as one of the available choices. If the wrong ODU is installed, you will not be able to proceed until the correct ODU is installed.

6. Press Enter when the LCD shows the correct frequency, for example:



A rectangular box representing an LCD screen. Inside the box, the text "Freq Set" is on the top line and "8B4" is on the bottom line.

The LCD shows Freq Acq in Prog (frequency acquisition in progress) and then Acq Ack: HT 2 (acquisition acknowledged—in this example, frequency acquired from HT 2).

**Note:** The LCD will display Acq Denied (acquisition denied) if:

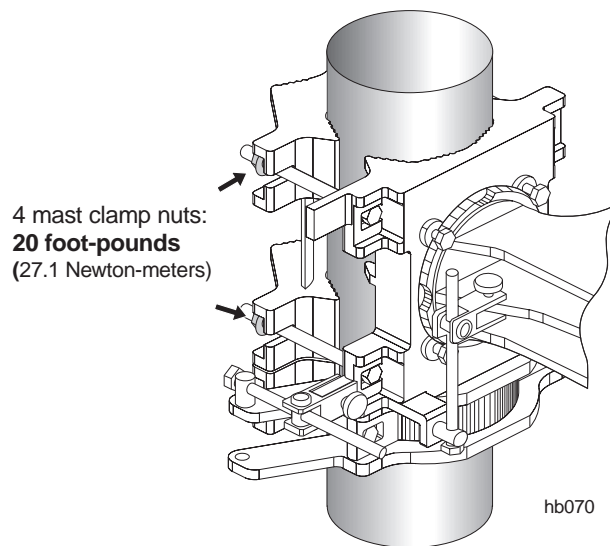
- The RT's ESN has not been entered in the EMS database, *or*
- The RT is pointed toward the wrong HT.

*Go to the roof and proceed with steps 7 through 13.*

## Voltmeter pointing and final adjustments

Follow these steps to fine-tune the azimuth and elevation adjustments made when the antenna was installed (sections 6.7 and 6.8).

7. Take the digital voltmeter and torque wrench (with deep socket) to the ODU.
8. **Using a torque wrench with a deep socket, verify that the torque of the four mast clamp nuts on the antenna mount is 20 foot-pounds (27.1 Newton-meters).** See figure 7-5.

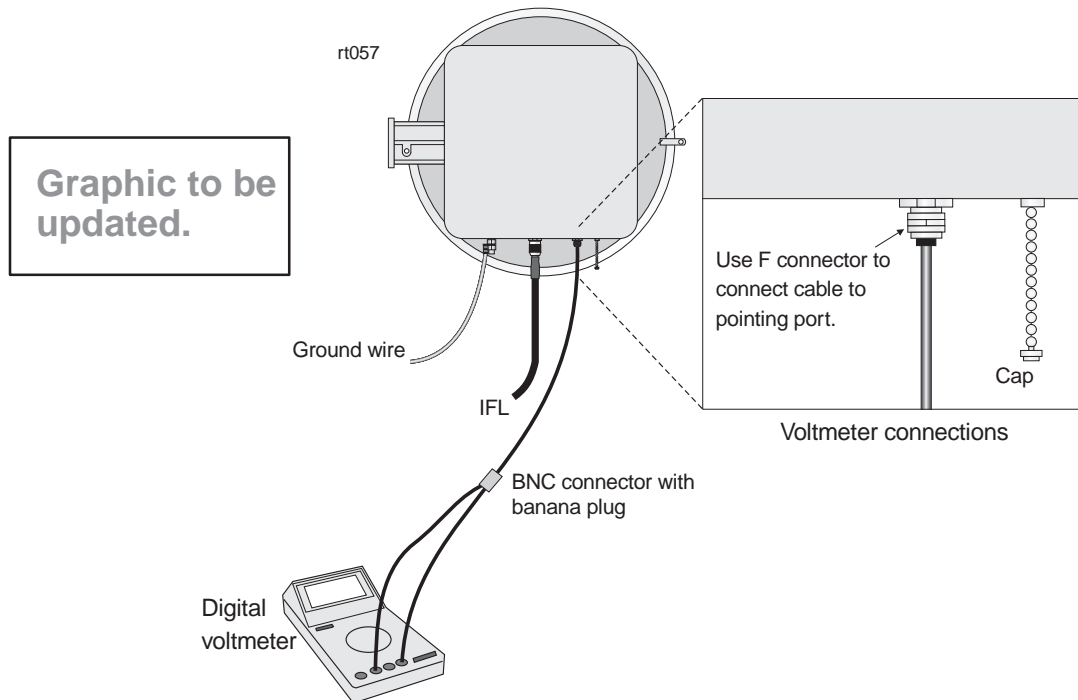


**Figure 7-5** Verifying torque of the mast clamp nuts

9. ***Loosen each nut by one full rotation.***  
(The mount stays in position, but will move when you turn the azimuth adjuster with a wrench.)



- Connect a digital voltmeter to the F connector on the ODU, as shown in figure 7-6, and select the 0 to 10 volt or 0 to 5 volt range.



**Figure 7-6 Connecting the digital voltmeter to the ODU**

- Observe the reading on the voltmeter.
- Use a wrench to rotate the adjuster bolt on the azimuth adjuster to slowly adjust the antenna azimuth. Stop turning the adjuster bolt when you obtain a steady, peak reading between 0.2 volts and 3.9 volts.

### Final antenna tightening

- When the voltage reading remains steady between 0.2 volts and 3.9 volts, tighten the mast clamp nuts (shown in figure 7-5) to 20 foot-pounds (27.1 Newton-meters) torque.**

***If you cannot obtain a voltmeter reading between 0.2 volts and 3.9 volts, refer to table 7-1 for the appropriate corrective action.***

**Table 7-1 Voltage indications for RT antenna pointing**

Voltmeter reading	Indication	Corrective action
Current voltage level with oscillation up to 4.1 V. ( <i>The reading intermittently peaks at the current voltage level for 2 seconds and then rises to 4.1 V for 1 second.</i> )	HT not acquired	HT acquisition has not occurred. Continue pointing the antenna.
0.2 V to 3.9 V with no oscillation	Correct HT acquired	(Corrective action is not required.) Continue with the installation.
3.9 V to 4.1 V with no oscillation	Correct HT acquired	HT acquisition has occurred but you must install a mechanical attenuator before continuing with the installation, refer to section 6.10.
Current voltage level with oscillation to 0 V. ( <i>The reading intermittently peaks at the current voltage level for 2 seconds and then drops to 0 V for 1 second.</i> )	Wrong HT acquired	RT has been denied acquisition by the wrong HT. You must follow the procedures listed in <i>Repointing the RT antenna</i> below before proceeding.

**Repointing the RT antenna**

Follow the steps below to repoint the RT antenna *only if the ODU has acquired the wrong HT.*

(If you successfully pointed the antenna in step 13—with a steady voltmeter reading between 0.2 volts and 3.9 volts—you *do not* need to follow steps 1 and 2 below; go on to section 7.5.)

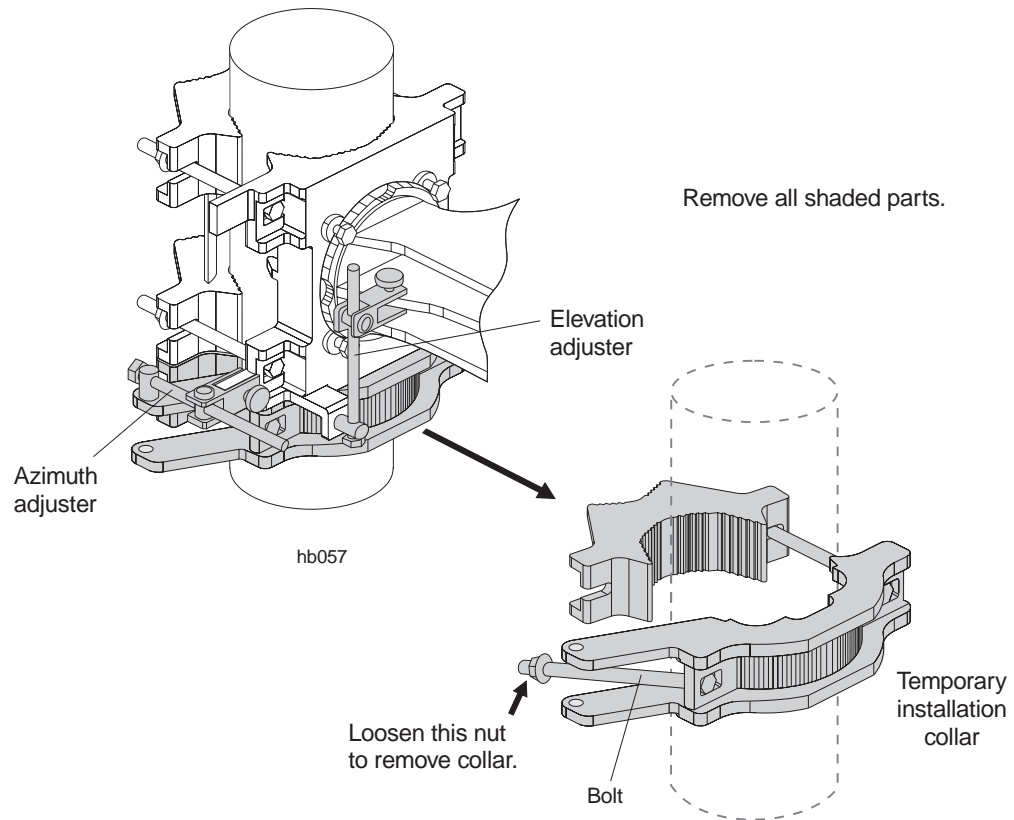
1. Repeat steps 7 through 13 (voltmeter pointing and final adjustments).
2. If you cannot obtain the correct voltmeter readings because the antenna is grossly mispointed, you may have to repeat the azimuth and elevation procedures explained in sections 6.7 and 6.8 (respectively).

**Troubleshooting**

If you encounter problems in pointing the antenna that are not addressed above, refer to chapter 9. See the chart titled *Troubleshooting: RT antenna pointing.*

## Removing the installation tools

When the antenna is pointed correctly, remove the temporary collar, clamp, and adjusters (shaded parts in figure 7-7) and **retain these tools for future installations.**



**Figure 7-7** Removing the temporary collar, clamp, and adjusters

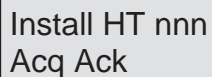
## 7.6

### Verifying HT acquisition

Return to the IDU location to verify that the RT has acquired the RT and then take the IDU out of Install mode:

1. Observe the LCD on the CCM to verify that the HT has been successfully acquired.

The following display indicates that the RT has successfully acquired the HT.



Install HT nnn  
Acq Ack

nnn = HT ID

2. Use the buttons and LCD on the CCM to select **Exit** and press the Enter button to take the IDU out of Install mode.



Install  
Exit

## 7.7

### Checking component status

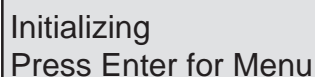
Use the LCD Status option to check the status of the CCM, SSIs, and ODU:

(You can only perform these checks after the RT's ODU frequency has been selected, as explained in section 7.4.)

#### Check CCM status

Check the CCM status as follows:

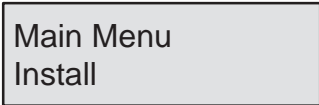
1. Press Enter on the CCM front panel while the Initializing screen shown below is displayed:



Initializing  
Press Enter for Menu

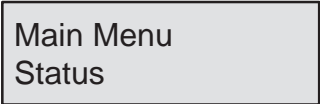
(This screen is displayed only after powerup or reset, after SUDS.)

This puts the IDU into diagnostic mode. The LCD shows the Main Menu:



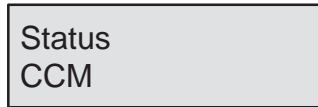
Main Menu  
Install

2. Use the up arrow to scroll to **Main Menu / Status**:

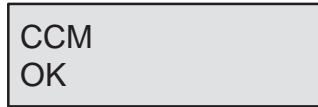


Main Menu  
Status

3. Press Enter, to go to (select) the Status menu:



4. Press Enter to show the CCM status:



The possible status conditions for CCMs, SSIs, and the ODU are:

OK	The component is operational.
Degraded	The component is not fully operational. *
Failed	The component has failed.
Unknown	The CCM cannot communicate with the component.

***Action for “Failed” or “Degraded” status***

**If the LCD shows Failed for any component, replace the component.**

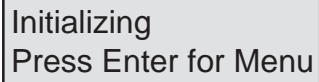
If you see Degraded during installation, replace the component. However, if you see Degraded while the system is operation, under some circumstances you may not need to replace the component (for example, if a failed port is not needed).

## Check SSI status

Check the status of the installed SSIs as follows:

(Note that SSIs are not required for commissioning. They can be installed after RT commissioning.)

1. Press Enter on the CCM front panel while the Initializing screen shown below is displayed:

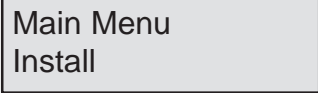


Initializing  
Press Enter for Menu

(This screen is displayed only after powerup or reset, after SUDS.)

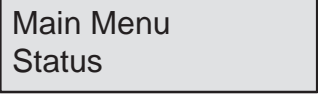
This puts the IDU into diagnostic mode. The LCD shows the Main Menu:

The LCD shows:



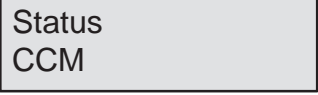
Main Menu  
Install

2. Use the up arrow to scroll to Main Menu / Status:



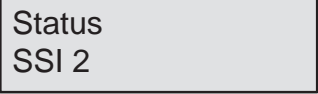
Main Menu  
Status

3. Press Enter, to go to (select) the Status menu:



Status  
CCM

4. Press the up arrow button to scroll to the SSI status menu:



Status  
SSI 2

5. Use the arrow button(s) to scroll to the SSI you want to check:

Status  
SSI 3

**Note:** SSIs are numbered SSI 1 through SSI 4, according to their positions in the IDU chassis:

Chassis slot	SSI number
2	1
3	2
4	3
5	4
Slot 1 is occupied by the CCM.	

6. Press Enter to show the status of the selected SSI:

SSI 3  
OK

The possible status conditions for CCMs, SSIs, and the ODU are:

OK  
Degraded  
Failed  
Unknown

(as explained on page 7–15)

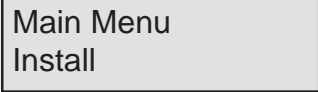
**Check the status of each installed SSI.**

## Check ODU status

Check the status of the ODU as follows:

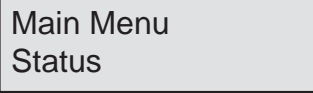
1. Press Enter on the CCM front panel. (The CCM must be in operational mode, as indicated by RT Enabled on the LCD.)

The LCD shows:



Main Menu  
Install

2. Use the up arrow to scroll to Main Menu / Status:



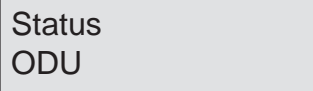
Main Menu  
Status

3. Press Enter, to go to (select) the Status menu:



Status  
CCM

4. Press the up arrow button twice to scroll to the ODU status option:



Status  
ODU

5. Press Enter to show the ODU status:



ODU  
OK

The possible status conditions for CCMs, SSIs, and the ODU are:

OK  
Degraded  
Failed  
Unknown

(as explained on page 7–15)

To exit the Status menu, scroll to **Exit**, and then press Enter.

If a failure is indicated for any component, replace that component. Run SUDS again, and check the status of the new component.



At this point, RT commissioning is complete, except for the RT to HT tests described in section 7.8. You may or may not be able to complete these tests, depending on whether or not other network components are installed and operational. (See the test requirements listed in section 7.8.)

**Leave the RT powered on for testing and operation.**

## 7.8

### RT to HT connection tests

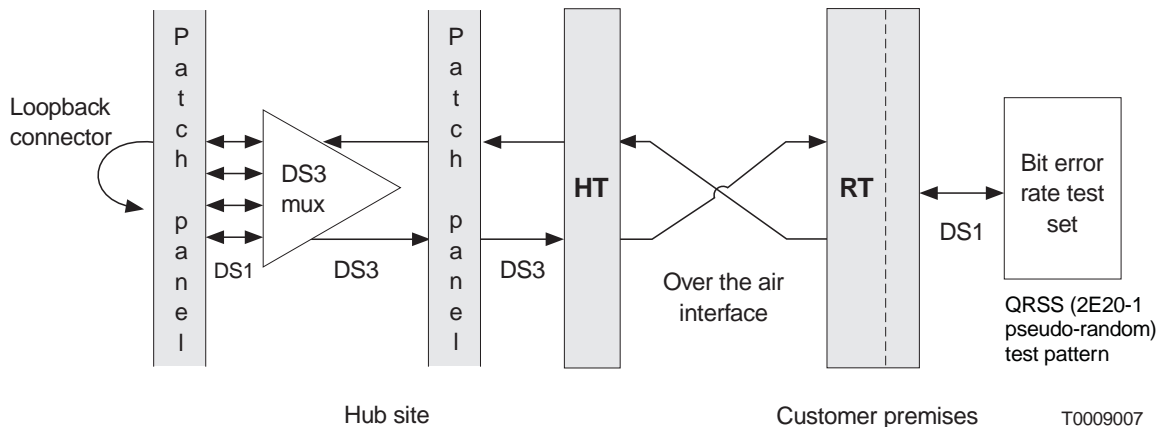
Perform the applicable tests described below if the newly installed RT meets the listed requirements. If the RT/network does not yet meet these requirements, perform the tests at a later time.

**DS1 test** This test verifies the DS1 connection from the RT to the HT.

#### Requirements

The DS1 test described below requires the following:

- The RT must be fully installed, commissioned, and in contact with the EMS through the hub.
- The HT must be operational and in contact with the EMS.
- DS1 services must be configured and provisioned.
- There must be no alarms present at the RT location.
- A loopback connector must be connected to the input/output port of the patch panel, as illustrated in figure 7-8.



**Figure 7-8 RT to HT connection test setup**

#### Test procedure

1. Connect a DS1 test set to the out/input points at DS1 RJ-48 port on the SSI board.
2. Select:
  - QRSS (quasi random signal source) test pattern
  - Recovered clock
  - DS1 interface
3. Run the test for 1 hour.

**Results**

The RT passes if there are no errors and no clock or frame slips during the test.

Record the results on the form on the following page (or make a photocopy).

**RT to HT DS1 test results**

RT location: \_\_\_\_\_

Test successful?  Yes  No RSSI \_\_\_\_\_

If not successful, complete:

Bit error rate \_\_\_\_\_ Frame slips \_\_\_\_\_

Frame errors \_\_\_\_\_ Clock slips \_\_\_\_\_

Trouble report generated?  Yes  No

If yes, report number: \_\_\_\_\_

If applicable: Faulty module part number \_\_\_\_\_

Serial number \_\_\_\_\_

If applicable: Replacement board part number \_\_\_\_\_

Serial number \_\_\_\_\_

BER test printout attached?  Yes  No

Comments:

\_\_\_\_\_  
\_\_\_\_\_

Tested by (print name and sign): \_\_\_\_\_

Customer (print name and sign): \_\_\_\_\_

Date \_\_\_\_\_

**DS3 test** This test verifies the DS3 connection from the RT to the HT.

**Requirements**

The DS3 test described below requires the following:

- The RT must be fully installed, commissioned, and in contact with the EMS through the hub.
- The HT must be operational and in contact with the EMS.
- DS3 services must be configured and provisioned.
- There must be no alarms present at the RT location.
- A loopback connector must be connected to the input/output port at the patch panel nearest to the HT. (Figure 7-8 indicates a loopback connector but also shows the patch panel nearest to the HT.)

**Test procedure**

1. Connect a DS1 test set to the out/input connector on the Universal SSI board.
2. Select:
  - Correct coding
  - Correct framing
  - Recovered clock
  - DS1 interface

The configured DS0 may be dropped from the DS1 data stream and tested using QRSS test patten.

3. Run the test for 1 hour.

**Results**

The RT passes if there are no errors and no clock or frame slips during the test.

Record the results on the form on the following page (or make a photocopy).

**RT to HT DS3 test results**

RT location: \_\_\_\_\_

Number of configured DS0: \_\_\_\_\_

Test successful?  Yes  No RSSI \_\_\_\_\_

If not successful, complete:

Bit error rate \_\_\_\_\_ Frame slips \_\_\_\_\_

Frame errors \_\_\_\_\_ Clock slips \_\_\_\_\_

Trouble report generated?  Yes  No

If yes, report number: \_\_\_\_\_

If applicable: Faulty module part number \_\_\_\_\_

Serial number \_\_\_\_\_

If applicable: Replacement board part number \_\_\_\_\_

Serial number \_\_\_\_\_

BER test printout attached?  Yes  No

Comments:

\_\_\_\_\_  
\_\_\_\_\_

Tested by (print name and sign): \_\_\_\_\_

Customer (print name and sign): \_\_\_\_\_

Date \_\_\_\_\_

## **Fractional DS3 test**

This test verifies the fractional DS3 connection from the HT to the RT.

### **Requirements**

The fractional DS3 test described below requires the following:

- The RT must be fully installed, commissioned, and in contact with the EMS through the hub.
- The HT must be operational and in contact with the EMS.
- Fractional DS3/DS1 services must be configured and provisioned.
- There must be no alarms present at the RT location.
- A loopback connector must be connected at the HT, either at the input/out port connector of the HT DS3 SSI or at the DS3 patch panel. (Refer to figure 7-8.)

### **Test procedure**

1. Connect a DS3 test set to the out/input connector on the RT DS3 SSI.
2. Select:
  - C bit framing
  - Recovered clock
  - DS3 interface

Fractional DS1 services may be dropped from the DS3 data stream and tested using QRSS test pattern.

3. Run the test for 1 hour.

### **Results**

The RT passes if there are no errors and no clock or frame slips during the test.

Record the results on the form on the following page (or make a photocopy).

**RT to HT fractional DS3 test results**

RT location: \_\_\_\_\_

Number of DS1s tested \_\_\_\_\_

Test successful?  Yes  No RSSI \_\_\_\_\_

If not successful, complete:

Bit error rate \_\_\_\_\_ Frame slips \_\_\_\_\_

Frame errors \_\_\_\_\_ Clock slips \_\_\_\_\_

Trouble report generated?  Yes  No

If yes, report number: \_\_\_\_\_

If applicable: Faulty module part number \_\_\_\_\_

Serial number \_\_\_\_\_

If applicable: Replacement board part number \_\_\_\_\_

Serial number \_\_\_\_\_

BER test printout attached?  Yes  No

Comments:

\_\_\_\_\_  
\_\_\_\_\_

Tested by (print name and sign): \_\_\_\_\_

Customer (print name and sign): \_\_\_\_\_

Date \_\_\_\_\_

## Chapter 8

# Final steps

---

This chapter describes the final steps to take before you leave the customer site after completing the installation:

- Weatherproofing – page 8–2
- Inspection, cleanup, and customer sign-off – page 8–3
- Connecting customer equipment – page 8–3

### Safety warnings

Observe these safety warnings while performing final inspections and related tasks:



#### DANGER

Do not work on a ladder or roof without first reading the safety warnings on page x of this manual. Failure to observe these warnings could result in personal injury or death.

---



#### WARNING

Potential radio frequency (RF) hazard:

- Keep away from the front of the outdoor unit (ODU) antenna while the ODU is operating. Note that you cannot tell from outward appearance whether the ODU is operating or not.
- Be careful with respect to the ODU you are installing and ODUs that may already be operating in the installation area.

Failure to observe these warnings could result in injury to eyes or other personal injury.

---

## Weatherproofing

After the RT has been successfully commissioned, go to the ODU and seal all outdoor IFL connections (including connections to the lightning arrestor assembly). Use weatherproofing compound and tape to protect against moisture penetration:

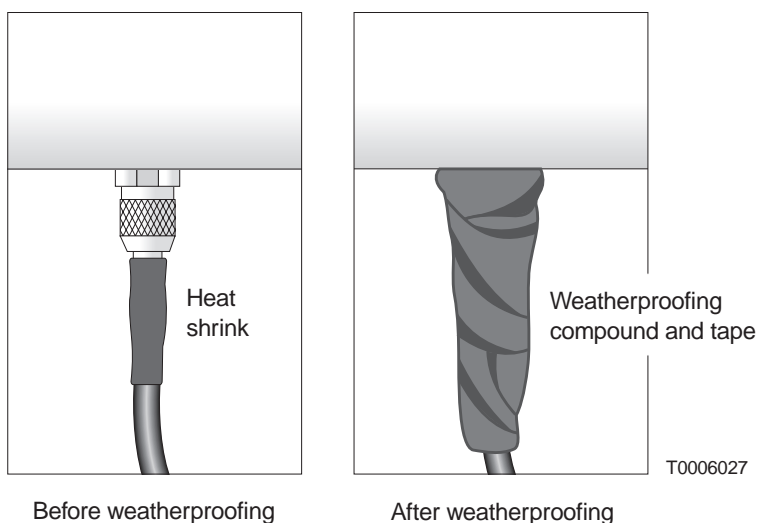
See figure 8-1.

1. Starting at the connector end, wrap electrical tape around the connector and part of the cable.
2. Cover the electrical tape with weatherproofing compound, and work the compound into all joints and cracks where water could enter.
3. Smooth the weatherproofing compound, giving the connection a tapered appearance, as shown in figure 8-1.
4. Again starting at the connector end, wrap a second layer of electrical tape around (on top of) the weatherproofing compound.
5. Press the tape into the weatherproofing compound.  
The resulting seal should be tight and compact, with no loose tape ends.



### CAUTION

Outdoor connectors are subject to moisture contamination. Even minute amounts of water vapor can condense and cause a short circuit. Thoroughly seal all outdoor IFL connections with weatherproofing compound and tape.



**Figure 8-1** Applying weatherproofing compound and tape



## 8.2

---

### **Inspection, cleanup, and sign-off**

After all equipment is installed and commissioned, visit each installation area to inspect the equipment and make sure the area is left clean and orderly.

#### **Inspection**

Inspect all equipment to make sure:

- All cables are dressed (as necessary) and not bent excessively.
- All connections are secure.
- IFL connections are properly waterproofed.
- IDUs, racks, and ODUs are properly grounded.
- Antenna mount bolts are tightened.
- ODU adjusters and the temporary installation collar have been removed for future use.

#### **Cleanup**

Clean up all installation areas:

- Make sure no tools or other objects are left on or near the equipment.
- Remove or neatly store any excess materials.
- Remove all debris.

#### **Customer sign-off**

Before leaving the site, notify the appropriate customer representative that the work has been completed. Ask the representative to sign the work order, indicating that the equipment has been installed and has passed the initial loopback verification test(s).

## 8.3

---

### **Connecting customer equipment**

The customer is responsible for connecting customer equipment to the AIReach Broadband equipment through connections to service-specific interface modules (SSI) modules. Refer to section 3.5 for information on the services and specific interfaces provided by each SSI type.

# Chapter 9

## Troubleshooting

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This chapter includes:

- Troubleshooting flow charts – page 9–1
- Service information – page 9–6

### 9.1

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#### Troubleshooting flow charts

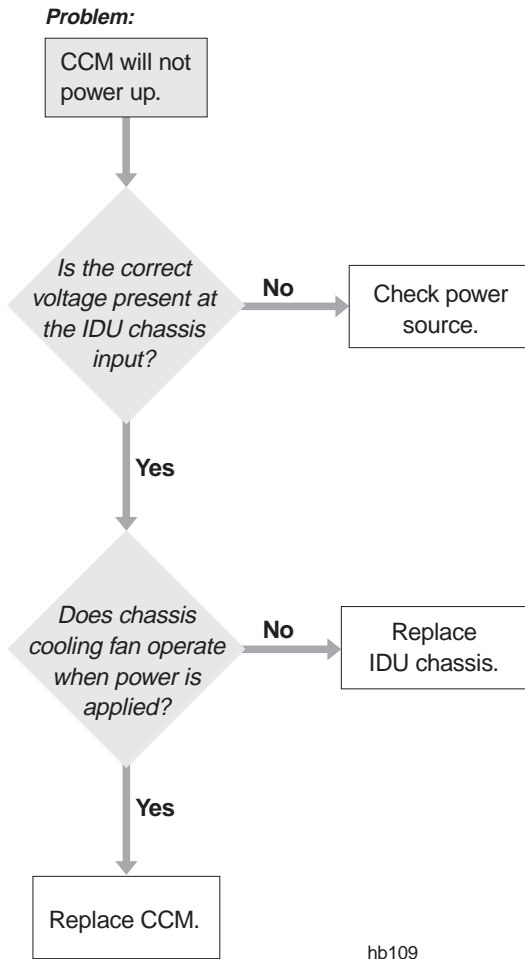
The troubleshooting flow charts in this chapter will help isolate most problems you might encounter during installation and operation of the AIReach Broadband system.

Each flow chart begins with a specific problem, then leads you to specific corrective actions you should take. **Where actions are numbered in these charts, you may not need to perform all of the actions.** Perform the actions in order, and check after each action to see if the problem has been resolved. **Proceed to the next action only if the previous action did not correct the problem.**

The information in this chapter is intended for use by technicians experienced in electronics troubleshooting. Therefore, it suggests corrective actions but does not include detailed instructions for each action.

## Troubleshooting the CCM

---



## Troubleshooting the CCM - *Continued*

---

**Problem:**

CCM failed startup diagnostics (SUDS).



Replace CCM.

**Problem:**

During CCM bootup / hardware initialization, LCD displays any of the following messages, indicating a device failure:

- Host Cfg Failed
- PLX Failed
- PLX IO Failed
- LAN Failed
- RCC FPGA Failed
- BSB FPGA Failed
- QPIG FPGA Failed
- Tim syn Failed

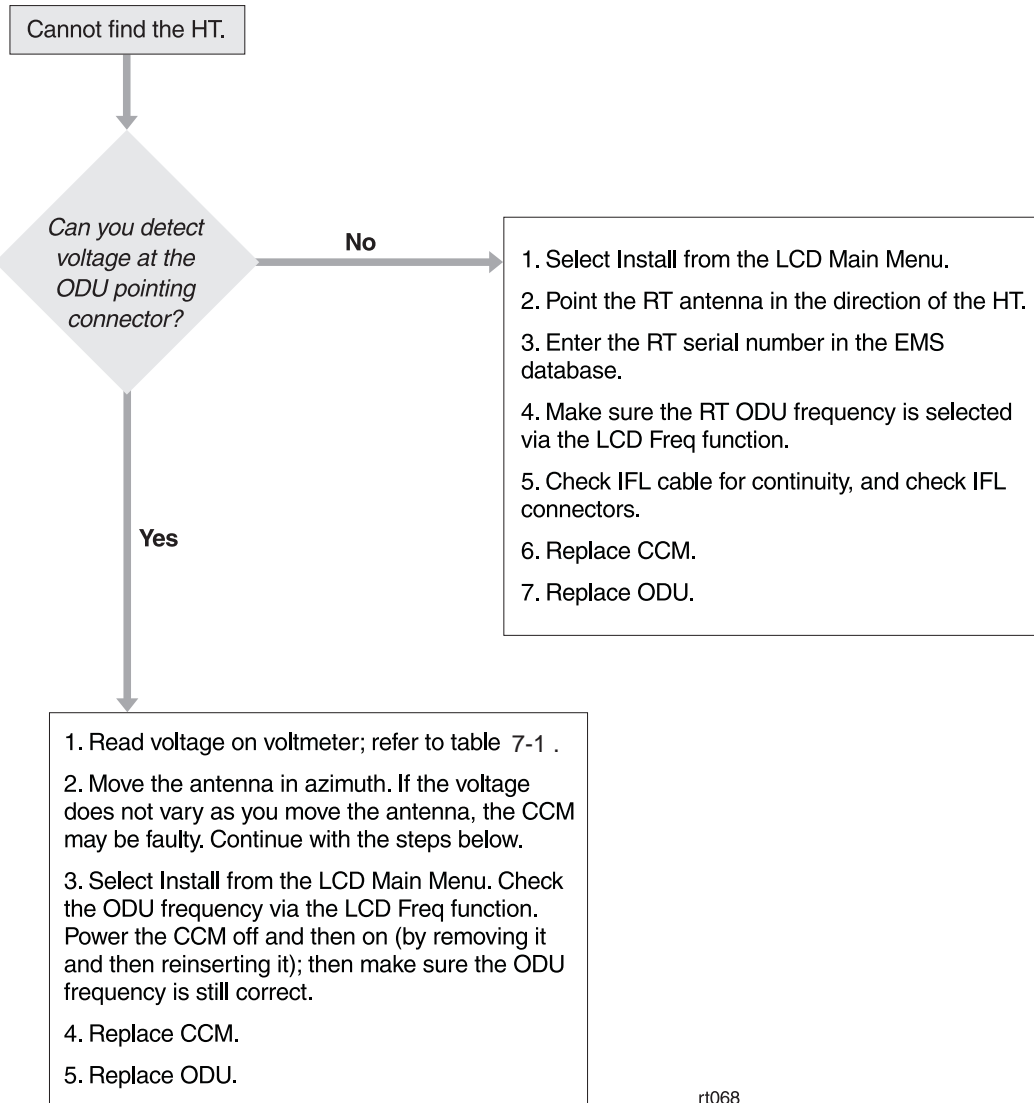


Replace CCM.

hb110

## Troubleshooting: RT antenna pointing

**Problem:**



rt068

## Troubleshooting: CCM won't download

---

**Problem:**

CCM will not download its software over the air (No "Loading Software" message on LCD.)

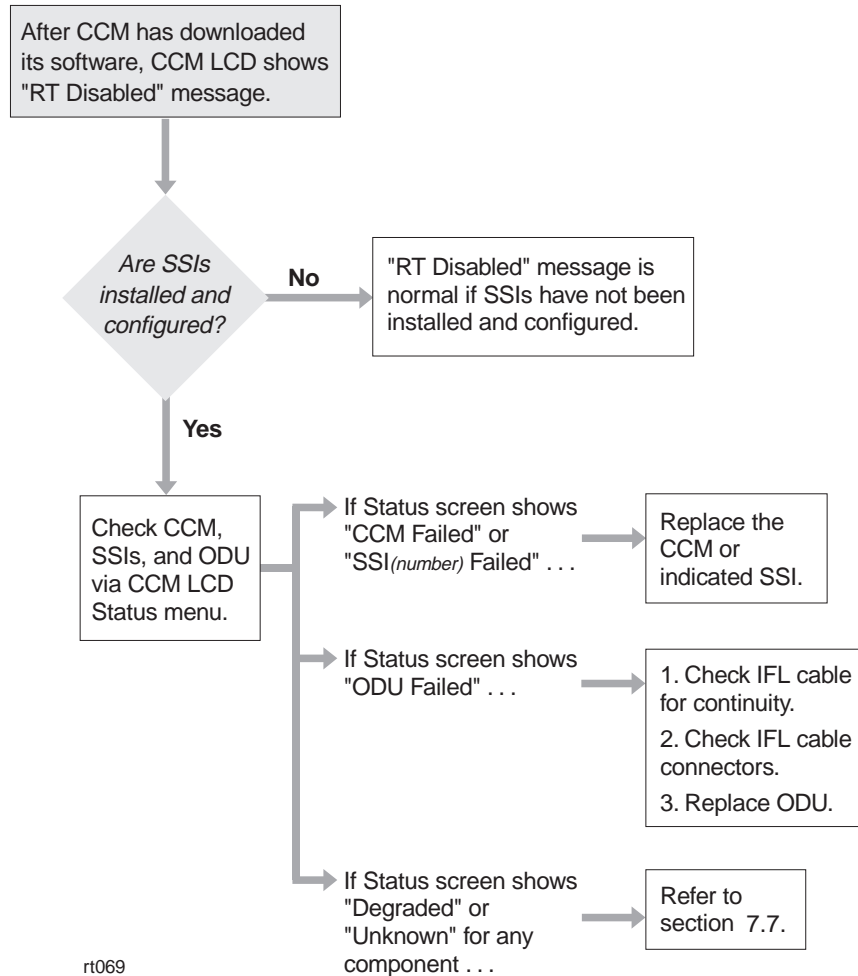


1. Replace ODU.
2. Replace CCM.

rt070

## Troubleshooting: "RT Disabled"

**Problem:**



### 9.2

#### Additional troubleshooting information

**IDU chassis fan doesn't work.** If the chassis is a dc powered unit, make sure the polarity of the wires to the power supply is not reversed..

### 9.3

#### Repair or replacement service

If you find a faulty component, contact your contract administrator to arrange for repair or replacement.

## Chapter 10

# Maintenance

---

The AIReach Broadband physical system requires no routine maintenance. However, to facilitate expansion, reconfiguration, or repairs, you may need to add, move, or replace components. This chapter includes instructions for:

- Adding or moving SSIs – page 10–2
- Replacing components – page 10–3
- Replacing the ODU – page 10–3
- Replacing the IDU chassis – page 10–10
- Replacing the CCM – page 10–12
- Replacing SSIs – page 10–13
- Replacing the IFL – page 10–14
- Dismantling an RT – page 10–16



---

## Adding or moving SSIs

**Notify the EMS operator before you add or move SSIs.** Make sure the EMS operator has performed any prerequisite steps that may be necessary before you add or move an SSI.

*For instructions on replacing SSIs, see section 10.6.*



### CAUTION

**Always wear a new or recently tested electrostatic discharge (ESD) wrist strap (figure 3-14) when handling circuit modules. Failure to use a wrist strap may result in damage to components.**

---

### Adding SSIs

You can install additional SSIs while the system is powered on. To add an SSI, follow the instructions in section 3.5 (page 3–28).

After installing an SSI, use the CCM LCD Status function to check its operational status. The LCD should display OK. (For an explanation of the CCM LCD Status function, see section 7.7.)

### Moving SSIs

SSIs are hot-swappable, meaning you can move them from one slot to another or to another chassis while the chassis are powered on.

To move an SSI:

1. Loosen the thumbscrews at each end of the SSI.
2. Using an ESD wrist strap connected to a chassis ground terminal, slide the SSI out of its slot.
3. Move the SSI to its new location and insert it into the slot.
4. Tighten the thumbscrews at each end of the SSI.
5. Use the CCM LCD to check the SSI status. (For details, see section 7.7).

## 10.2

---

### Replacing components

The following RT components can be replaced at the installation site if a problem is attributed to the component:

- ODU
- IDU chassis
- CCM
- SSIs
- IFL

Specific instructions for replacing each component follow, in sections 10.3 through 10.7.

## 10.3

---

### Replacing the ODU

If the ODU is faulty, you normally replace the transceiver only (which contains the ODU electronics). Replace the antenna only if it is physically damaged (for example, wind or water damage) or has some other known problem.



#### **DANGER**

**Do not work on a ladder or roof without first reading the safety warnings on page x of this manual. Failure to observe these warnings could result in personal injury or death.**

---



#### **WARNING**

**Potential radio frequency (RF) hazard:**

- **Keep away from the front of the outdoor unit (ODU) antenna while the ODU is operating. Note that you cannot tell from outward appearance whether the ODU is operating or not.**
- **Be careful with respect to the ODU you are installing and ODUs that may already be operating in the installation area.**

**Failure to observe these warnings could result in injury to eyes or other personal injury.**

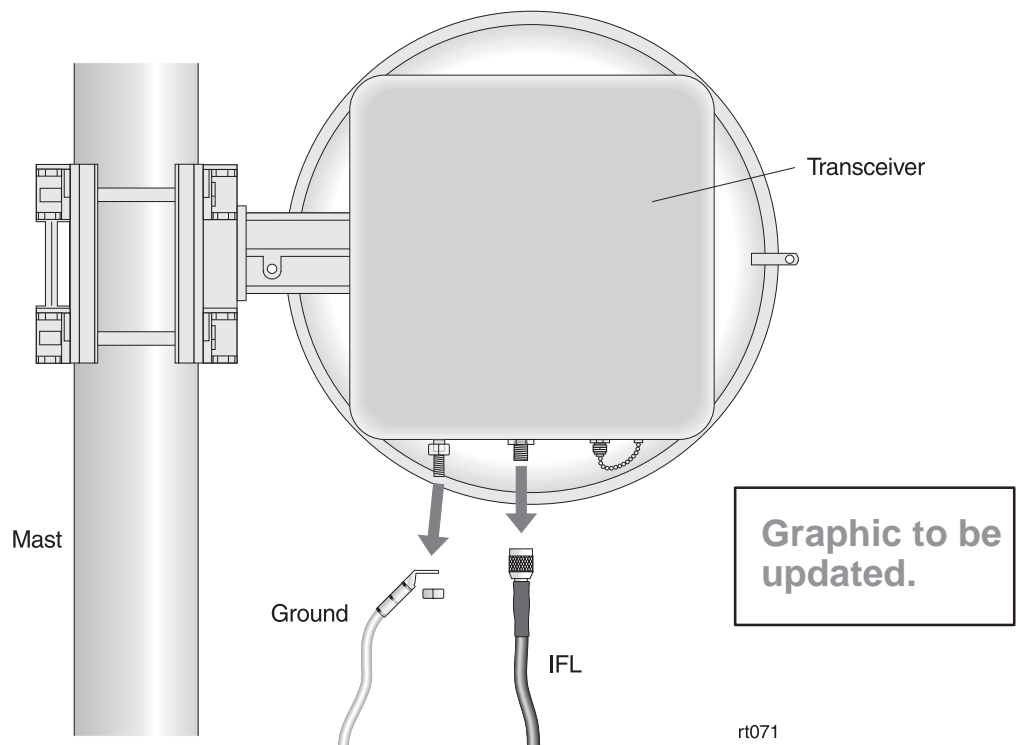
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## Replacing the transceiver

To replace the transceiver, follow these steps:

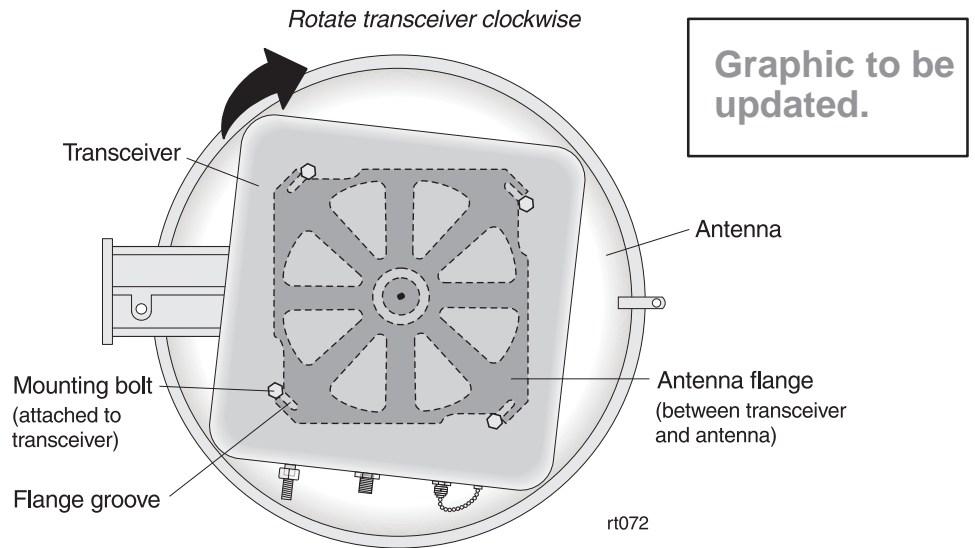
### **Removing the existing transceiver**

1. **Make sure the EMS operator has taken the RT out of service.**
2. **At the IDU location: Remove power from the IDU chassis power supply.**
3. **On the roof: Disconnect the ground cable and IFL from the ODU transceiver, as shown in figure 10-1.**



**Figure 10-1** Disconnecting the ODU ground and IFL cables

4. Loosen the four transceiver mounting bolts (shown in figure 10-2).



**Figure 10-2 Removing the transceiver**

5. Rotate the transceiver until the bolts slide out of the four grooves in the antenna bracket. (The direction of rotation depends on the orientation of the antenna bracket—to the right or left.) If the mounting bolts will not slide into the grooves, loosen the bolts. See figure 10-2.

**Important:** A mechanical attenuator may be installed (previously) in the antenna waveguide. If an attenuator is installed, make sure it does not get lost or misplaced. Leave the attenuator in the waveguide.

6. Cover the transceiver coupling (center hole) with a plastic coupling plug (if available) or tape to prevent contamination.

### ***Installing the replacement transceiver***

7. To install the replacement transceiver, follow the steps in section 6.11 (page 6–21).  
**Important:** If a mechanical attenuator was previously installed in the antenna waveguide, make sure it is still in place in the waveguide before you attach the transceiver to the antenna.
8. Connect the IFL cable to the IFL connector on the transceiver.
9. Ground the ODU, as explained in section 6.12 (page 6–23).
10. After you replace the transceiver:
  - Go to the next subsection (*Replacing the antenna*) only if you need to replace the antenna.
  - Apply power to the IDU chassis power supply.
  - Use the CCM LCD to check the ODU status. (For details, see section 7.7).
  - Notify the EMS operator that the RT is ready to resume service.

If you are replacing the transceiver only, you should not need to repoint the antenna.

## Replacing the antenna

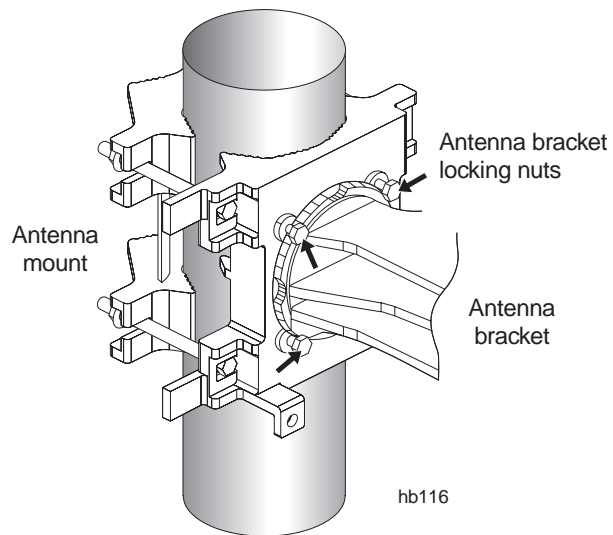
If you need to replace the antenna, follow these steps:

### **Removing the existing antenna**

1. Remove the transceiver (steps 1 through 6 above, beginning on page 10–4). **Be sure to remove power from the IDU chassis power supply.**

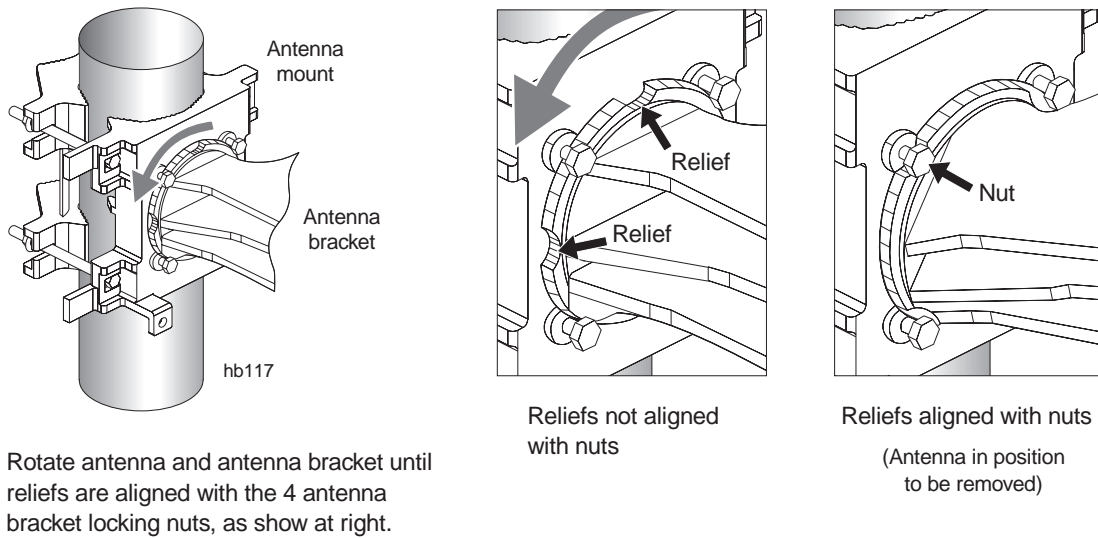
**Important:** A mechanical attenuator may be installed (previously) in the antenna waveguide. If an attenuator is installed, make sure it does not get lost or misplaced. Leave the attenuator in the waveguide.

2. Loosen the four antenna bracket locking nuts.



**Figure 10-3** Antenna bracket locking nuts

3. Rotate the antenna (clockwise or counterclockwise) until the antenna bracket reliefs (curved indentations) are aligned with the four nuts on the mast interface, as shown in figure 10-4.



**Figure 10-4 Removing the antenna**

4. Move the antenna away from the mast interface.
5. Cover the antenna waveguide (center hole) with a plastic plug or tape to protect against contamination.

### ***Installing the replacement antenna***

6. Install a temporary installation collar below the antenna mount, as explained in section 6.4 (page 6–6).  
You need the temporary installation collar so you can point the replacement antenna.
7. Attach the replacement antenna to the mount, as explained in section 6.6 (page 6–12).
8. Point the replacement antenna by adjusting the azimuth and elevation as detailed in chapter 6.
9. Attach the transceiver to the antenna, as explained in section 6.11 (page 6–21).  
**Important:** If a mechanical attenuator was previously installed in the antenna waveguide, make sure it is still in place in the waveguide before you attach the transceiver to the antenna.
10. Connect the IFL cable to the IFL connector on the transceiver.
11. Ground the ODU, as explained in section 6.12 (page 6–23).
12. Apply power to the IDU chassis power supply (section 3.3, page 3–8).
13. Use the CCM LCD to check the ODU status. (For details, see section 7.7).
14. Re-commission the RT as detailed in chapter 7.
15. Notify the EMS operator that the RT is ready to resume service.



## Replacing the IDU chassis

Do not attempt to service or replace the IDU chassis power supply. **If there is a problem with the power supply, replace the entire IDU chassis.**

To replace the IDU chassis, follow these steps:

*If you need additional details concerning the instructions below, see chapter 3.*

### Removing the existing IDU chassis

1. **Make sure the EMS operator has taken the RT out of service.**
2. **Remove power from the IDU chassis power supply.**
3. Mark each cable or otherwise note where each cable is connected.
4. Remove all cables from all modules.
5. Remove the CCM:
  - a. Loosen the thumbscrews at each end.
  - b. Using an ESD wrist strap connected to a chassis ground terminal, slide the CCM out of its slot, as shown in figure 10-5.



### CAUTION

Always wear a new or recently tested electrostatic discharge (ESD) wrist strap (figure 3-14) when handling circuit modules. Failure to use a wrist strap may result in damage to components.

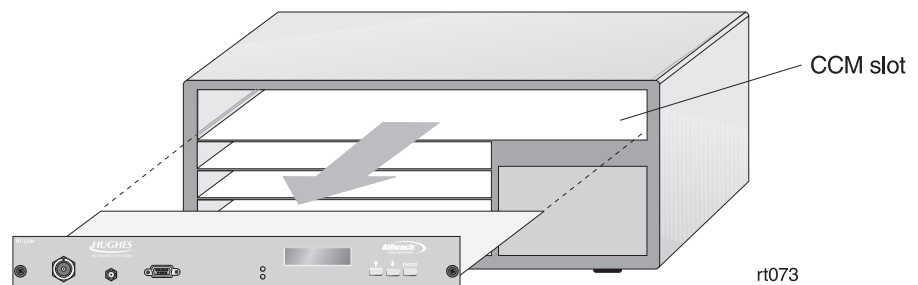


Figure 10-5 Removing the CCM

6. Place the CCM in its ESD protective packaging.
7. Remove all SSIs:
  - a. Using a piece of tape on the SSI front panel, mark the slot number where each SSI was installed.
  - b. Loosen the thumbscrews at each end.
  - c. Using an ESD wrist strap connected to a chassis ground terminal, slide the SSI out of its slot.
8. Place each SSI in ESD protective packaging.
9. If the IDU chassis is rack mounted, remove the four mounting screws and remove the chassis from the rack.
10. Remove the rack mounting brackets from the chassis.

### ***Installing the replacement IDU chassis***

Refer to the instructions in chapter 3 to:

11. Install the replacement chassis in a rack, if the original chassis was installed in a rack (section 3.2).
12. Re-connect power to the IDU chassis power supply (section 3.3).
13. Conduct a power-on test (section 3.3).
14. Re-install the CCM (section 3.4).
15. Re-install the SSIs (section 3.5).  
Install each SSI in the slot it was in before. Refer to the slot numbers you marked on the tape on each SSI.
16. Re-connect the IFL cable and all other cables to the CCM and SSIs.

## Replacing the CCM

If you need to replace the CCM, follow these steps:

*If you need additional details concerning the instructions below, see section 3.4 (page 3–24).*

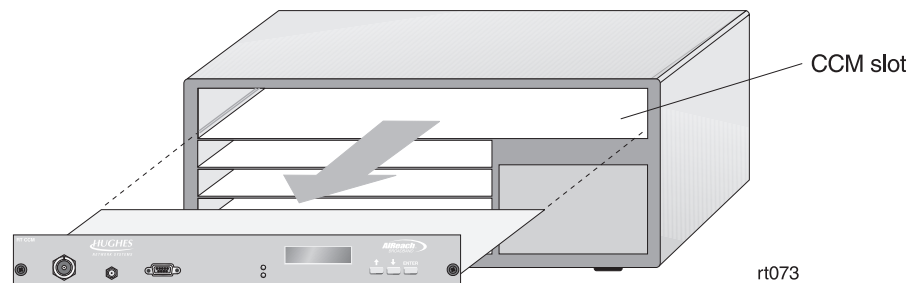
### Removing the existing CCM

1. **Make sure the EMS operator has taken the RT out of service.**
2. **Remove power from the IDU chassis power supply.**
3. Loosen the thumbscrews at each end of the (existing) CCM.
4. Using an ESD wrist strap connected to a chassis ground terminal, slide the CCM out of its slot, as shown in figure 10-6.



### CAUTION

Always wear a new or recently tested electrostatic discharge (ESD) wrist strap (figure 3-14) when handling circuit modules. Failure to use a wrist strap may result in damage to components.



**Figure 10-6 Removing the CCM**

5. Place the CCM in ESD protective packaging.

### Installing the replacement CCM

6. Slide the replacement CCM into the CCM slot (slot 1).
7. Tighten the thumbscrews at each end of the CCM.
8. Apply power to the IDU chassis power supply.
9. Use the CCM LCD to check the CCM status. (For details, see section 7.7).
10. Notify the EMS operator that the RT is ready to resume service.

---

## Replacing SSIs

To replace an SSI, follow the steps below.

SSIs are hot swappable, so you do not need to power off the IDU to replace an SSI. *If you need additional details concerning the instructions below, see section 3.5 (page 3–28).*

### **Removing the SSI**

1. Note which slot the SSI to be replaced is in.
2. Loosen the thumbscrews at each end of the SSI.
3. Using an ESD wrist strap connected to a chassis ground terminal, slide the SSI out of its slot.



### **CAUTION**

Always wear a new or recently tested electrostatic discharge (ESD) wrist strap (figure 3-14) when handling circuit modules. Failure to use a wrist strap may result in damage to components.

---

4. Place the SSI in ESD protective packaging.

### **Installing the replacement SSI**

5. Slide the replacement SSI into the slot from which you removed the previously installed SSI.
6. Tighten the thumbscrews at each end of the SSI.
7. Use the CCM LCD to check the SSI status. (For details, see section 7.7).
8. Notify the EMS operator that the replacement SSI is ready for service.

---

## Replacing the IFL

If you suspect problems with the IFL, check all IFL connections and then test the IFL. Replace the IFL only if there is a known problem that cannot be corrected any other way.



### DANGER

Do not work on a ladder or roof without first reading the safety warnings on page x of this manual. Failure to observe these warnings could result in personal injury or death.

---



### WARNING

Potential radio frequency (RF) hazard:

- Keep away from the front of the outdoor unit (ODU) antenna while the ODU is operating. Note that you cannot tell from outward appearance whether the ODU is operating or not.
- Be careful with respect to the ODU you are installing and ODUs that may already be operating in the installation area.

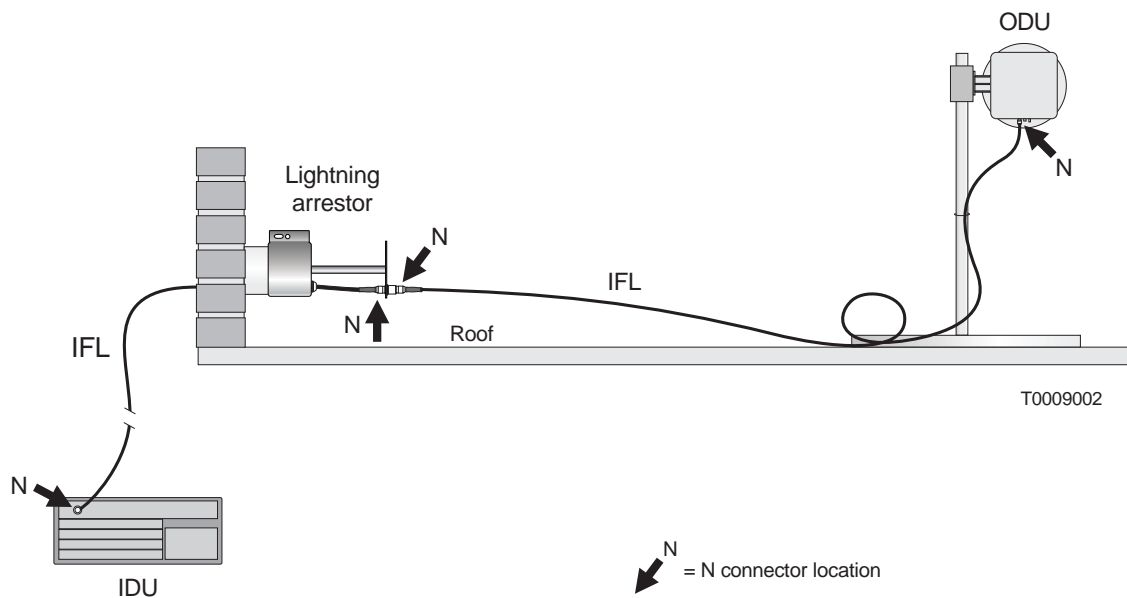
Failure to observe these warnings could result in injury to eyes or other personal injury.

---

Environments where IFLs are installed vary widely. Therefore, use the general instructions below as guidelines.

If you need to replace the IFL:

1. **Make sure the EMS operator has taken the RT out of service.**
2. **Remove power from the IDU chassis power supply.**
3. Disconnect all four IFL N connectors, as shown in figure 10-7:
  - 1 connector at the IDU
  - 1 connector at the ODU
  - 2 connectors at the lightning arrester



**Figure 10-7 Disconnect N connectors at the four locations shown here**

4. Remove the two IFL cable segments:
  - From IDU to the lightning arrester
  - From the lightning arrester to the ODU
5. Install the replacement IFL cable according to the instructions in chapter 4.

## Dismantling an RT

If you need to dismantle an entire RT, follow the steps below.



### DANGER

Do not work on a ladder or roof without first reading the safety warnings on page x of this manual. Failure to observe these warnings could result in personal injury or death.



### WARNING

Potential radio frequency (RF) hazard:

- Keep away from the front of the outdoor unit (ODU) antenna while the ODU is operating. Note that you cannot tell from outward appearance whether the ODU is operating or not.
- Be careful with respect to the ODU you are installing and ODUs that may already be operating in the installation area.

Failure to observe these warnings could result in injury to eyes or other personal injury.

Follow these steps:

1. **Make sure the EMS operator has taken the RT out of service.**
2. **Remove power from the IDU chassis power supply.**
3. *On the roof:* Disconnect the IFL and ground cable from the ODU. See section 10.3.
4. Remove the transceiver. See section 10.3.
5. Remove the antenna. See section 10.3.
6. Disassemble the mast and mast mount.
7. *At the IDU location:* Remove all cables from all modules. If the cables will be reused, mark them to identify them.
8. *Optional:* Remove the CCM and SSIs from the chassis. (Depending on what you will do with the equipment, you might want to leave the CCM and SSIs installed.) See sections 10.5 and 10.6.
9. Remove the IDU chassis.
10. Remove the IFL cable and lightning arrestor (unless the lightning arrestor is being used for another RT or will be reused).

# Acronyms and abbreviations

---

**ac** – alternating current

**ATM** – asynchronous transfer mode

**AWG** – American wire gauge

**BER** – bit error rate

**BSP** – baseband signal processor

**C** – Celsius

**CCM** – channel and control module

**cm** – centimeter

**CMR** – communication riser

**CPU** – central processing unit

**dc** – direct current

**DRAM** – dynamic RAM

**EIDU** – expansion indoor unit

**EMS** – Element Management System

**ESD** – electrostatic discharge

**ESN** – electronic serial number

**F** – Fahrenheit

**FCC** – Federal Communications Commission

**FEM** – fiber extender module

**FRAD** – frame relay access device

**ft** – foot

**HNS** – Hughes Network Systems

**HT** – hub terminal

**Hz** – hertz

**ID** – identification

**IDU** – indoor unit

**IEC** – International Electrotechnical Commission

**IF** – intermediate frequency

**IFL** – intrafacility link

**in.** – inch

**LAN** – local area network

**lb** – pound(s)

**LCD** – liquid crystal display

**LED** – light emitting diode

**LOS** – line of sight

**m** – meter

**MAC** – media access control

**mm** – millimeter

**NEBS** – Network Equipment Building Standards

**NEC** – National Electric Code

**NEMA** – National Electrical Manufacturing Association

**NFPA** – National Fire Protection Association

**ODU** – outdoor unit

**PC** – personal computer

**PCI** – PC interface

**PMP** – point-to-multipoint

**RAM** – random-access memory

**RF** – radio frequency

**ROM** – read-only memory

**RT** – remote terminal

**SC** – signaling controller

**SDRAM** – static dual port RAM

**SSI** – service-specific interface

**SUDS** – startup diagnostics

**TAC** – Technical Assistance Center

**TDM** – time division multiplexing

**UL** – Underwriters Laboratories



**V** – volt

**Vac** – volt, alternating current

**Vdc** – volt, direct current

**VSAT** – very small aperture terminal

**WND** – Wireless Networks Division

**WDT** – watch dog timer

# **Standards compliance**

---

This appendix includes standards compliance information for the AIReach Broadband outdoor unit (ODU) and ac power indoor unit (IDU). Information is included for:

- Interference standards compliance
- Underwriters Laboratories, Inc., safety compliance
- RF, electrical fast transient, and ESD immunity

---

**Outdoor unit**

This section provides information on the AIReach Broadband **outdoor unit (ODU)**.

**FCC compliance**

This equipment complies with Part 15 of United States Federal Communication Commission (FCC) Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a **Class A digital device**, pursuant to Part 15 of 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 this instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause interference, in which case the user will be required to correct the interference at the user's own expense.

Type acceptance: FCC Part 101

**Canadian interference compliance**

This class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

**Underwriters Laboratories (UL)**

This equipment has been evaluated by Underwriters Laboratories Inc. (UL) and determined to be in compliance with the Standard for Safety of Information Technology Equipment Including Electrical Business Equipment, **UL 1950**, third edition; and Canadian Standards Association **CAN/CSA C22.2 No. 950-95**, third edition. This equipment is UL listed and UL certified for Canada as Information Technology Equipment.

**Immunity**

The ODU complies with the following immunity standards of the International Electrotechnical Commission (IEC):

- Radio frequency immunity – IEC 801-3 (3 V/m)
- Electrical fast transient immunity – IEC 801-4
- Electrostatic discharge immunity – 25 KV level tested using method in IEC 801-2

**National Electric Code (NEC)**

The ODU complies with requirements of the National Electric Code (NEC), article 800.

**Emissions**

The ODU complies with EN 55022.

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**Indoor unit (ac)**

This section provides information on the AIReach Broadband **ac power indoor unit (IDU)**.

**FCC compliance**

This equipment complies with Part 15 of United States Federal Communication Commission (FCC) Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a **Class A digital device**, pursuant to Part 15 of 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 this instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause interference, in which case the user will be required to correct the interference at the user's own expense.

**Canadian interference compliance**

This class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

**Underwriters Laboratories (UL)**

This equipment has been evaluated by Underwriters Laboratories Inc. (UL) and determined to be in compliance with the Standard for Safety of Information Technology Equipment Including Electrical Business Equipment, **UL 1950**, third edition; and Canadian Standards Association **CAN/CSA C22.2 No. 950-95**, third edition. This equipment is UL listed and UL certified for Canada as Information Technology Equipment.

**Immunity**

The ODU complies with the following immunity standards of the International Electrotechnical Commission (IEC):

- Radio frequency immunity – IEC 801-3 (3 V/m)
- Electrical fast transient immunity – IEC 801-4
- Electrostatic discharge immunity – 25 KV level tested using method in IEC 801-2

**Emissions**

The ODU complies with EN 55022.

# Terminating the IFL cable

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This appendix explains in detail how to terminate the IFL cable ends by attaching an N-type connector. It includes:

- Cable parts and terminology – page C-2
- Preparing the cable end – page C-3
- Attaching the connector – page C-6
- Applying heat-shrink tubing – page C-11

As part of the RT installation, you attach N connectors in four locations, as shown in figure 4-3 (on page 4-5):

- One N connector at the IDU location
- Two N connectors to connect to the lightning arrester assembly
- One N connector at the ODU location

**Important:** Sound IFL cable connections are critical for proper operation of the AIReach Broadband system.

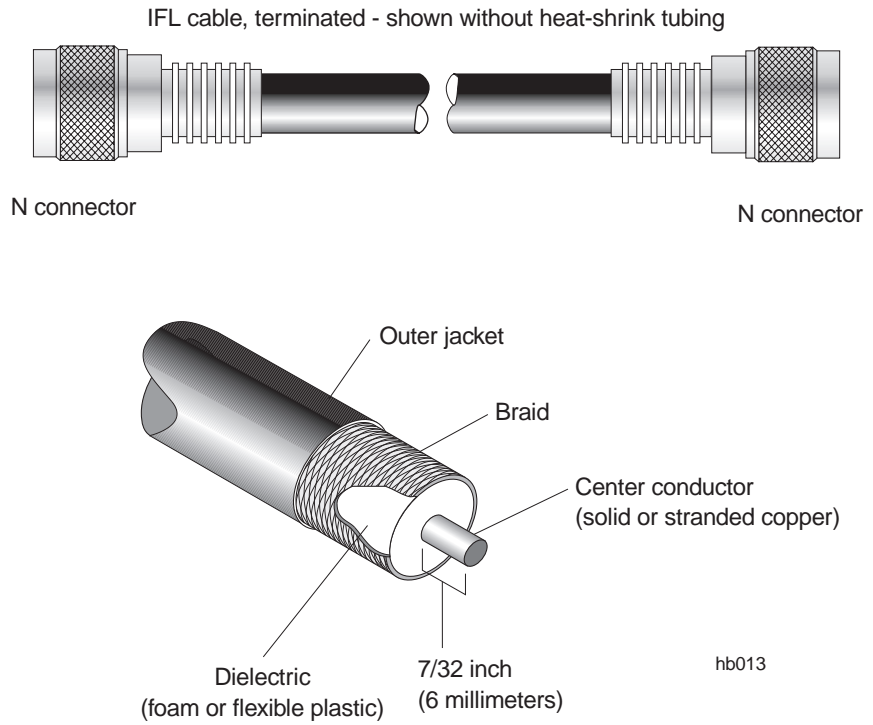
Therefore, be very careful in terminating the cable. If you are unsure about the success of any of the following steps, repeat them.

**Attach N connectors *after* you route and install the cable, not before.**

**Note:** The instructions below are for the connectors in HNS kit 9006284-0002. If you use a different N-type connector, follow the manufacturer's instructions.

## Cable parts and terminology

Figure C-1 shows the main cable components.



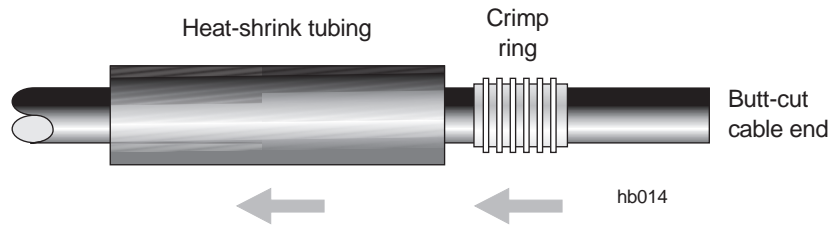
**Figure C-1 IFL cable components**

HNS kit 9006284-0002 contains two N connectors.

## Preparing the cable end

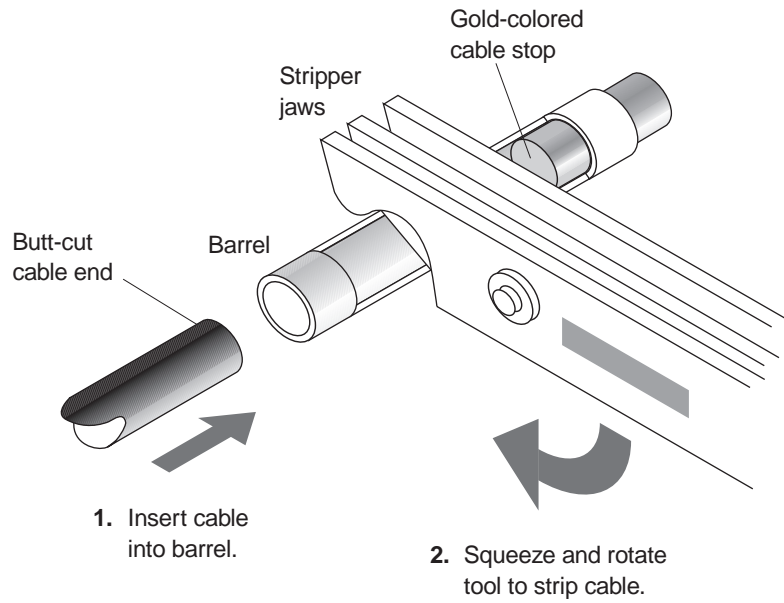
Prepare the cable end as follows:

1. Inspect the cable end for damage from handling and trim off any damaged portions.
2. Cut the cable as cleanly and squarely as possible.
3. Slip the crimp ring and a piece of heat-shrink tubing (HNS9007488-0005) onto the cable, as shown in figure C-2.



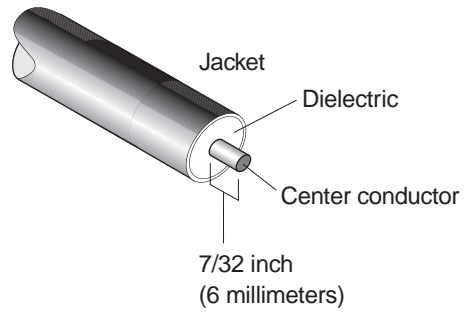
**Figure C-2 Slipping the crimp ring and heat-shrink tubing onto the cable**

4. Use the spin-stripping tool (Excelta CX 1-78-1, gold color-coded) to remove the cable jacket and dielectric, leaving about 7/32 inch (6 millimeters) of the center conductor exposed, as shown in figure C-3.
  - a. Open the stripping jaws of the spin-stripping tool enough to allow the cable end to enter the cable barrel fully. (See figure C-3.)
  - b. While holding the cable firmly in the tool and tightly against the cable stop, squeeze the stripper jaws.
  - c. Rotate the tool around the cable two or three times until the outer cable jacket and dielectric are completely cut through, but *do not score the center conductor*. Rotate the tool in the direction indicated in figure C-3.
  - d. Remove the cut-off end of the cable jacket and dielectric.



3. Remove jacket and dielectric to expose center conductor.

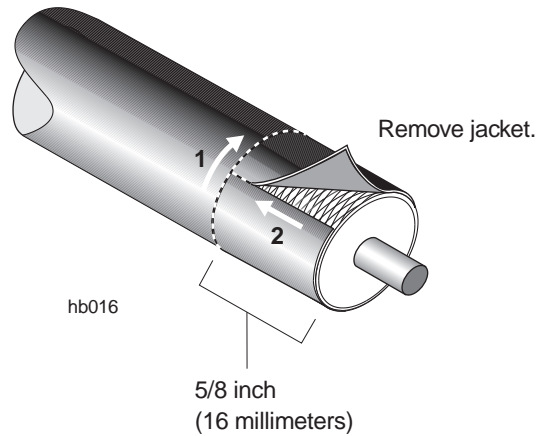
hb012



**Figure C-3 Using the spin-stripping tool to expose the center conductor**



5. Using a razor knife, *carefully* slit the outer jacket as shown in figure C-4.  
Cut around the cable; then cut from the cable end to the first cut. Cut completely through the jacket, *but do not cut into the braid*.
6. Using the razor knife or a pair of diagonal cutters, lift the jacket and peel it away as shown in figure C-4.

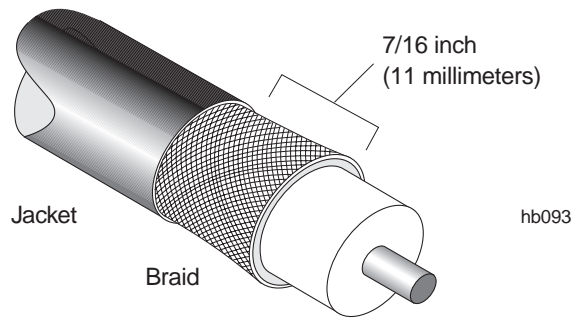


**Figure C-4 Cutting and removing the jacket**

7. Check:
  - Braid for nicked or broken strands
  - Dielectric end for a straight cut
  - Center conductor for nicks and a straight cut

**If you see significant damage to the braid, dielectric, or conductor, you must cut the cable and start over. (Start with step 1.)**

8. Flare the braid *slightly* and trim to 7/16 inch (11 millimeters), as shown in figure C-5.



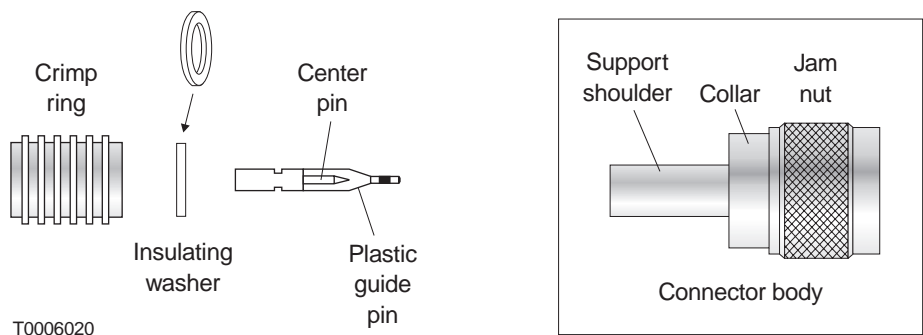
**Figure C-5 Braid, flared and trimmed**

9. Cut approximately 1/4 inch (6 millimeters) of the excess braid so that all braids will be under the crimp ring when the connector is completed.

### C.3

## Attaching the connector

The following steps explain how to attach the IFL (N) connector. The same type of connector is used at both ends. The connector includes a plastic guide pin to protect the dielectric during installation, as shown in figure C-6.



**Figure C-6 IFL (N) connector (HNS 9006284-0002)**

**Do not remove the plastic guide pin until instructed to do so (step 4 on page C-8).**

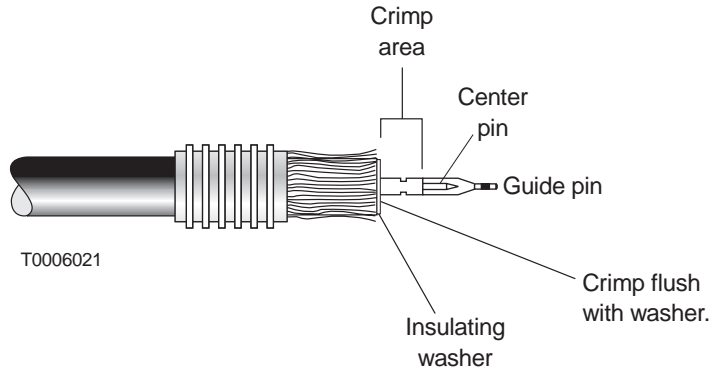


### CAUTION

**Do not install the center pin without the plastic guide pin—doing so will damage the dielectric material inside the connector body.**

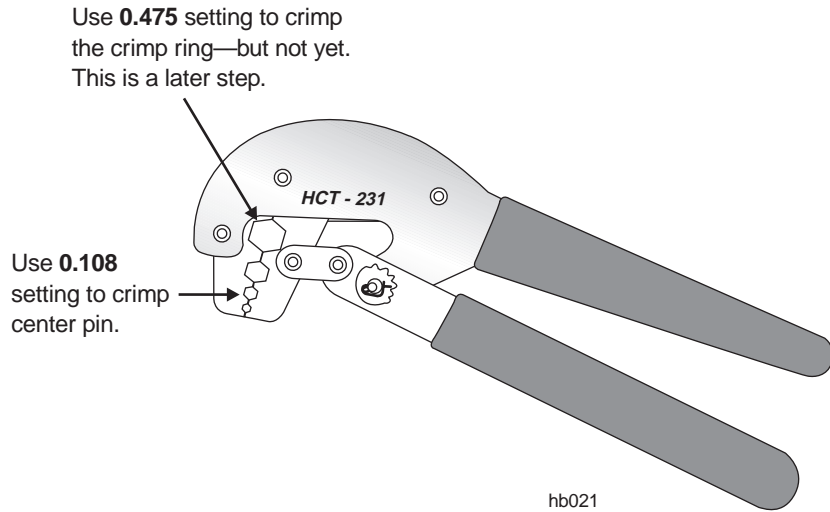
To install the cable connector, follow these steps.

1. Place the insulating washer against the dielectric.
2. Push the center pin (with guide pin attached) over the cable center conductor, as shown in figure C-7.



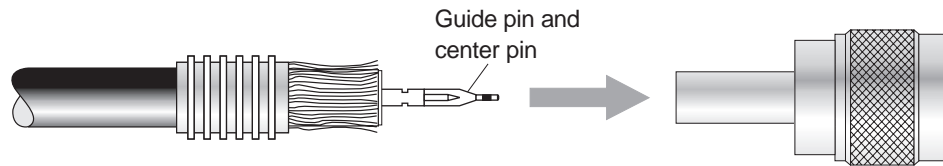
**Figure C-7 Installing the insulator and center pin**

3. Use the HCT-231 crimp tool (figure C-8) to crimp the center pin flush with the washer, as shown in figure C-7. If the center pin is bent after crimping, cut the cable, re-strip it, and attach a new center pin.

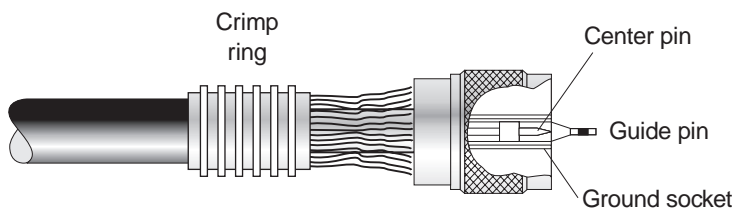


**Figure C-8 Crimping tool**

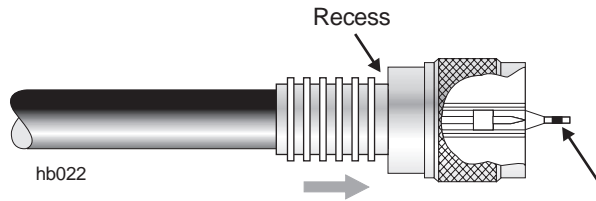
4. Follow the instructions in figure C-9 to install the connector body and crimp ring, and remove the guide pin.



1. Insert guide pin through back of connector body until the cable stops.



Center pin inside connector body



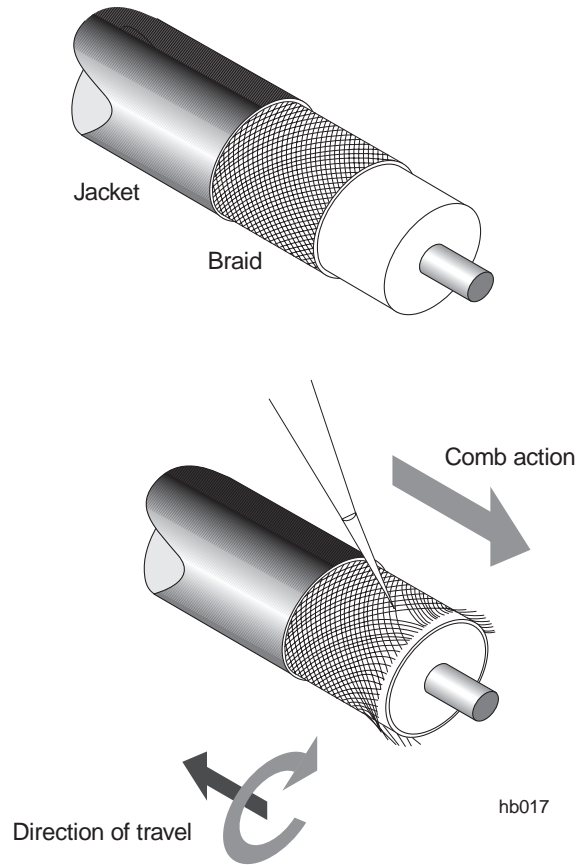
2. Slide crimp ring over braid and into recess.

3. Remove and discard guide pin.

**Figure C-9 Installing the connector body and crimp ring**

5. **Important: Verify that the center pin aligns flush or within 1/64-inch from the ground socket edge.**  
If the pin is not flush or within this range, the connection will probably be faulty.

6. *Comb the braid only if the crimp ring will not fit over the shoulder and braid. If the crimp ring fits over the shoulder and braid, skip to step 7).*
  - a. Insert a pick or scribe into the braid and carefully comb the strands as shown in figure C-10. Start combing at the cut end. Comb the strands around the entire perimeter. Work backward, from the cut end toward the jacket—but always combing away from the jacket, as shown in figure C-10.



**Figure C-10** Combing the braid

**Note:** Comb the braid all the way back to the jacket. If part of the braid is uncombed at the jacket end, stretching will cause the jacket and center pin to become loose, resulting in poor conductivity.

- b. Re-trim the braid to 7/16 inches (6 millimeters), as shown in figure C-5.

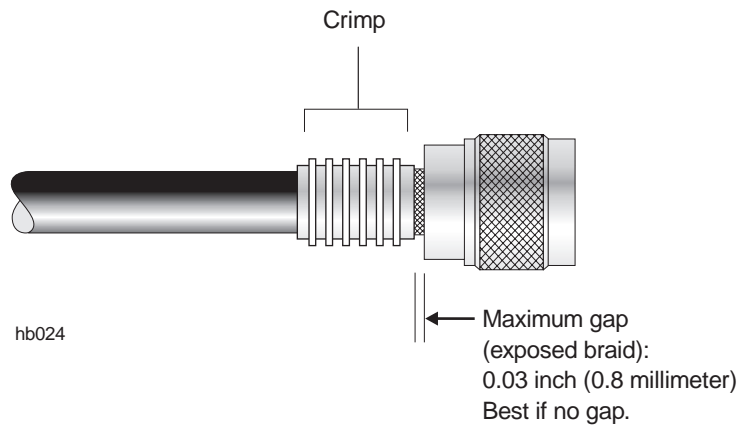
7. While holding the connector assembly together snugly, position the HCT-231 crimping tool, at setting 0.475, onto the area shown in figure C-11 and securely crimp the crimp ring into place.



**CAUTION**

To avoid damaging the connector body, make sure the crimping tool does not touch the connector jam nut.

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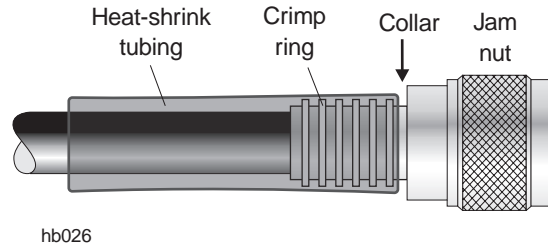
**Figure C-11 Crimp location**

**Note:** If the crimp ring slips and results in a gap greater than 0.03 inch (0.8 millimeter) between the crimp ring and the connector collar, reject the connection. Cut off the connector and start over.

## Applying heat-shrink tubing

Apply the heat-shrink tubing as follows:

1. Position the heat-shrink tubing near (but not touching) the jam nut, so it covers the crimp ring and a portion of the connector collar, as shown in figure C-12.



**Figure C-12 Heat-shrink tubing, properly placed for shrinking**

2. Using a heat gun, heat-shrink the tubing until it snugly fits around the cable, crimp ring, and part of the connector collar.

Point the connector upward. Begin heating at the connector end, and work toward the cable. The adhesive should flow away from the jam nut.



### CAUTION

**Do not allow the cable jacket and dielectric to overheat. This can damage the cable and cause cable failure.**

**During heating, the tubing may shift and the adhesive lining may bleed. Make sure the adhesive does not bleed onto the jam nut and damage the connector.**

*To install another N connector, repeat all steps above, beginning with the section Preparing the cable ends (page C-3).*

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