

## **Exhibit 8 Analog Fixed Unit User Manual**

# Globalstar™



## *Installation Guide, Globalstar Analog Fixed User Terminal GSP-2900*

May 4, 1999

80-98052-1 X1

**QUALCOMM Proprietary:** For Employees of Globalstar L.P., AirTouch Communications, DASA, TESAM, HYUNDAI/DACOM, VODASTAR LTD., Alenia Spazio USA, Inc., Lockheed Martin WDL, SS/Loral, and Lockheed Martin Space Mission Systems Eyes Only. Release to other parties is not authorized without QUALCOMM's written permission.

**QUALCOMM®**

---

QUALCOMM Incorporated  
6455 Lusk Blvd.  
San Diego, CA, 92121-2779  
U.S.A.

© QUALCOMM, Incorporated 1999.

All rights reserved. Printed in the United States of America.

All data and information contained in or disclosed by this document are confidential and proprietary information of QUALCOMM Incorporated and all rights therein are expressly reserved. By accepting this material the recipient agrees that this material and the information contained therein are held in confidence and in trust and will not be used, copied, reproduced in whole or in part, nor its contents revealed in any manner to others without the express written permission of QUALCOMM Incorporated.

This technology is controlled by the United States Government. Diversion contrary to U.S. law prohibited.

**© 1999 QUALCOMM Proprietary:** For Employees of Globalstar L.P., AirTouch Communications, DASA, TESAM, HYUNDAI/DACOM, VODASTAR LTD., Alenia Spazio USA, Inc., Lockheed Martin WDL, SS/Loral, and Lockheed Martin Space Mission Systems Eyes Only. Release to other parties is not authorized without QUALCOMM's written permission.

Globalstar™ is a registered trademark of Loral Qualcomm Satellite Services, Inc.

Installation Guide, Globalstar Analog Fixed User Terminal  
GSP-2900

80-98052-1 X1

May 4, 1999



## Table of Contents

Introduction .....	5	References .....	35
General sequence for installing the RAU .....	7	Appendix: Operating Specifications .....	36
Step 1. Safety considerations .....	8	RF Specifications .....	36
Step 2. Check the contents of the RAU package .....	9	Power Specifications .....	36
Step 3. Make sure you have all supplies and equipment .....	11	Mechanical Specifications .....	36
Basic Kit .....	11	Environmental Specifications .....	36
Extended Kit .....	11		
Grounding Accessories .....	11		
Step 4. Plan where to position the components .....	13		
Radio Antenna Unit .....	13		
Junction Box .....	13		
Power Source .....	14		
Step 5. Prepare the RAU .....	15		
Security Module .....	16		
Step 6. Attach the RAU to a pole or wall .....	17		
Mounting the RAU to a wall .....	19		
Step 7. Install the junction box .....	20		
Step 8. Run indoor wiring for the telephone and data .....	23		
Selecting a Phone .....	24		
Step 9. Make sure that all cables are connected and operate properly .....	25		
Step 10. Standard practices for grounding .....	26		
Step 11. Ground the entire system .....	28		
Pole Mount .....	28		
Lightning Protection .....	28		
Step 12. Connect power supply .....	31		
Motor Generator .....	31		
AC to DC Converter .....	31		
Battery Power .....	31		
31			
QUALCOMM power supply .....	31		
Solar Power .....	32		
Step 13. Connect power and test .....	33		
Final check .....	33		
Step 14. Troubleshooting .....	34		
Terminology .....	35		

## List of Figures and Tables

Figure 1. General RAU pole mount installation .....	5
Figure 2. General RAU roof mount installation.....	6
Figure 3. RAU .....	9
Figure 4. Junction box .....	9
Figure 5. Detail of mounting kit.....	9
Figure 6. Wall mounting bracket. See Figure 16 on page 19 for how to use this bracket. ....	10
Figure 7. Roof mounted RAU .....	13
Figure 8. Pole mounted RAU.....	13
Figure 9. RAU with cover removed .....	15
Figure 10. Detail of P clip .....	15
Figure 11. Detail of RAU inside .....	16
Figure 12. SM Card and holder.....	16
Figure 13. Lift the socket cover .....	16
Figure 14. Insert the SM into the socket cover .....	16
Figure 15. Attach the RAU to the pole .....	17
Figure 16. RAU with wall mounting bar in place .....	19
Figure 17. Junction box with cover opened and service provider access closed. ....	20
Figure 18. Junction box with cover opened and service provider access open. ....	21
Figure 19. Junction Box - Wiring Detail.....	22
Figure 20. Daisy chain configuration.....	23
Figure 21. Star configuration .....	23
Figure 22. Junction box wiring details for power supply.....	24
Figure 23. Grounding the RAU .....	28
Figure 24. Detail of ground wire/ground rod connection .....	28
Figure 25. Recommended grounding when building is protected by a pre-existing lightning protection system.....	30
Figure 26. Connect wiring for power supply .....	31
Figure 27. Suggested installation for solar power .....	32
Figure 28. Troubleshooting .....	34

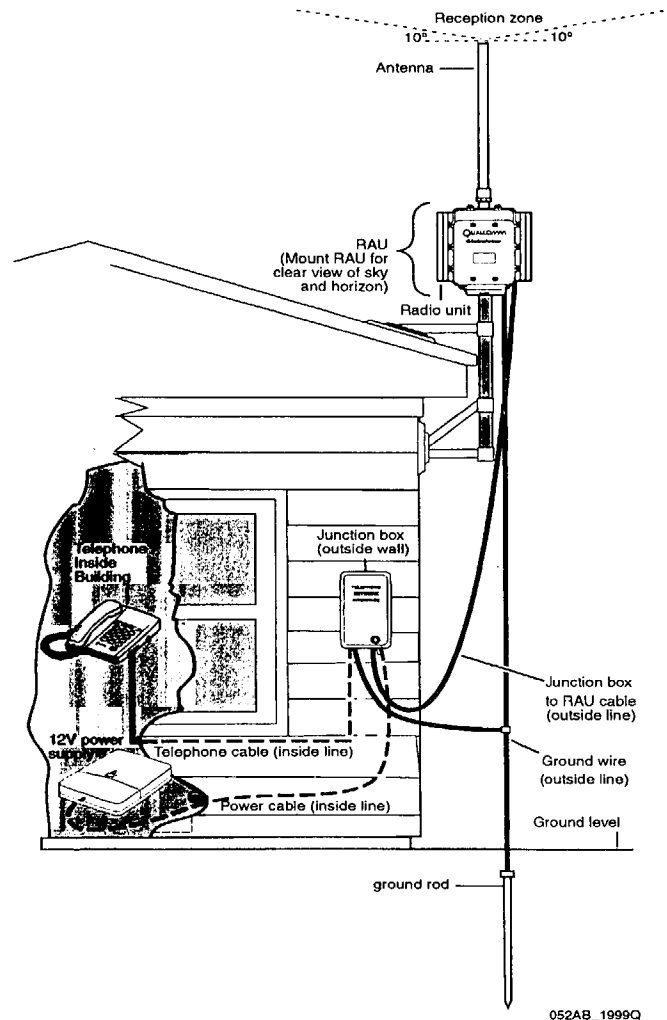
Table 1. Exterior wiring .....	11
Table 2. Interior wiring .....	12
Table 3. Grounding Supplies .....	12
Table 4. Other items .....	12
Table 5. Connections .....	15
Table 6. Wiring from RAU to junction box .....	21
Table 7. Wiring from interior to junction box .....	23
Table 8. NFPA* 780** Class 1 material requirements for RAU and junction box .....	29

# Introduction

This guide explains how to install the various components of the Globalstar Analog Fixed User Terminal.

With the Analog Fixed User Terminal you can use the Globalstar Satellite Network System to make and receive calls.

Figure 1 shows an example of how the Radio Antenna Unit (RAU) and junction box might be installed using a pole mounted outside the building.



052AB\_1999Q

**Figure 1. General RAU pole mount installation**



### Note

The RAU must be mounted to ensure that the antenna is located such that satellites at or above 10 degrees above the horizon may be clearly visible.

For optimal performance, the antenna should have an unobstructed view that is 10 degrees from horizontal, and a 360 degree view of the horizon (see Figure 1). There should be no obstruction to the view.

A single nearby lightning rod meeting the separation and height constraints as described in Figure 25, will not impair antenna performance.

Figure 2 shows an example of how the Radio Antenna Unit (RAU) and junction box might be installed using a pole mounted on the roof of a the building.

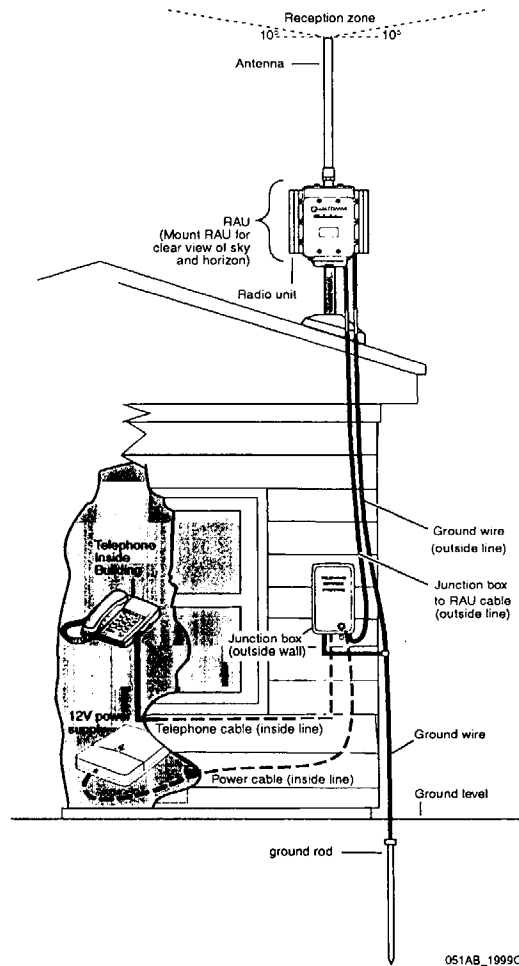


Figure 2. General RAU roof mount installation

## General sequence for installing the RAU

The following sequence presents an overview of the steps to follow in a typical installation of the Globalstar Analog Fixed User Terminal. Following this listing, each step is described in detail.

- Step 1. Read the Safety considerations.
- Step 2. Check the contents of the Analog User Terminal packages to be sure that nothing is missing. Check for signs of physical damage.
- Step 3. Make sure that you have all grounding accessories, interior wiring and wall jacks, and installation tools. These materials are provided by the installer.
- Step 4. Determine where to position the components.
- Step 5. Prepare the RAU.
- Step 6. Attach the RAU to a pole or wall.
- Step 7. Install the junction box.
- Step 8. Run indoor wiring for the telephones.
- Step 9. Make sure that all cables are connected and are undamaged.
- Step 10. Read standard practices for grounding the system.
- Step 11. Ground the entire system.
- Step 12. Connect 12 V universal AC input power supply (if included in this kit).
- Step 13. Connect and test the power.
- Step 14. Troubleshoot the installation, if required.

For a list of terms, see Terminology on page 35. For references, see References on page 35.



### WARNING

Carefully read and follow all installation instructions, especially grounding instructions. If the RAU, junction box, or wiring are improperly installed, or if the system is not properly grounded, there is, in extreme circumstances, significant risk of fire, personal injury, or death.



### WARNING

**ELECTRICAL STORMS.** For reasons of personal safety, we recommend that you do not work on the RAU during electrical storms. Do not service, program, or install the User Terminal during electrical storms.



### WARNING

**POWER LINES.** Avoid any AC power lines that may be in the vicinity. Avoid installing the RAU and its connecting cables in any location where accidental contact with AC power lines may occur.



### WARNING

**CODES.** Installation of this User Terminal must meet the local codes and regulations for lightning installation.



## Step 1. Safety considerations

We recommend that installation, repair, and maintenance of the GSP-2900 Analog Fixed User Terminal (UT) be performed by technically qualified service personnel; that is, those selected and trained by the service provider or QUALCOMM.

We recommend that you do not make phone calls with the UT equipment, connect a computer to the phone for the purposes of UT service programming, or modify the UT or related equipment during an electrical storm.



### WARNING

Failure to follow the warnings and instructions included in this guide can lead to serious personal injury or death and possible property damage.



### CAUTION

Changes or modifications not expressly approved in this guide could void the warranty for the Analog Fixed UT.



### CAUTION

There are no end-user serviceable parts internal to the equipment. Repairs should be made by the service provider or a QUALCOMM qualified repair center.



### CAUTION

We recommend that before installing the equipment, you remove jewelry and other metallic objects from your person. These items can cause electrical shock or burns.



### WARNING

High current 12 volt power supplies and batteries can be dangerous if improperly installed. Install all cables and wiring and complete all connections before applying power. Never run wiring or work with wires when power is connected.



### WARNING

Even though the Analog Fixed UT includes grounding and circuitry to help minimize damage to equipment, facilities, and personnel from nearby lightning, lightning is a highly unpredictable and dangerous phenomenon. It is impossible to completely protect equipment and personnel from lightning strikes. Do not use the phone during a thunderstorm, except possibly for brief emergency calls.



### WARNING

Do not store unsealed lead-acid batteries inside the building. If the Analog Fixed UT is powered from an alternate source, such as a car battery, the installer must provide suitable overcurrent protection, as well as venting, to safely dissipate flammable hydrogen gas, which might leak from lead-acid car batteries. Overcurrent protection must be certified and rated at least 20 V DC and no more than 3 A.



### WARNING

We recommend that you never insert objects through openings in the equipment. Conductive foreign objects can produce a short circuit that could cause fire, electrical shock, or damage to the equipment.



### WARNING

In areas of severe lightning activity, QUALCOMM recommends use of a separate primary lightning protection system such as a lightning rod to protect the antenna unit and associated equipment from lightning strikes. Failure to properly install the RAU or to include a separate lightning protection system may cause electrical shock, fire, or damage to equipment. See Figure 25 for recommended installation.

## Step 2. Check the contents of the RAU package

The RAU is a QUALCOMM-manufactured aluminum housing containing Globalstar radio electronics and an integrated mast antenna protruding from the top of the housing.

Two kits are available:

- A base kit containing the RAU, junction box, and 10 crimp rings
- An extended kit that contains all items of the base kit, plus telephone, cabling, and power supply.

The following items are part of the RAU installation:

- One radio unit with attached antenna, the RAU (Figure 3).

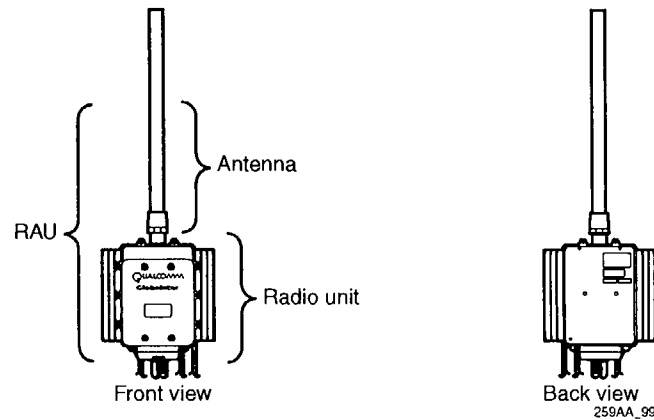


Figure 3. RAU

- One junction box (Figure 4).

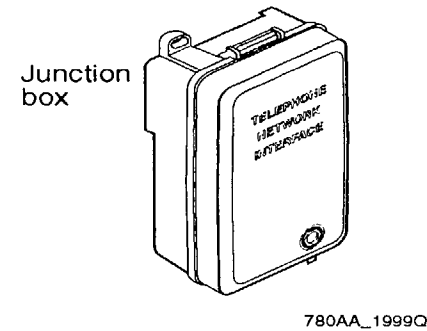


Figure 4. Junction box

- A mounting kit that includes one U bolt for use in mounting to a pipe which will accommodate pipe sizes ranging from 38 mm (1.50 inch) outside diameter (OD) to 48 mm (1.90 inch) OD, two M6 x 60 mm pan head screws, two M6 x 16 mm pan head screws, one mounting bracket, one mounting clamp, and associated nuts and washers (Figure 5).

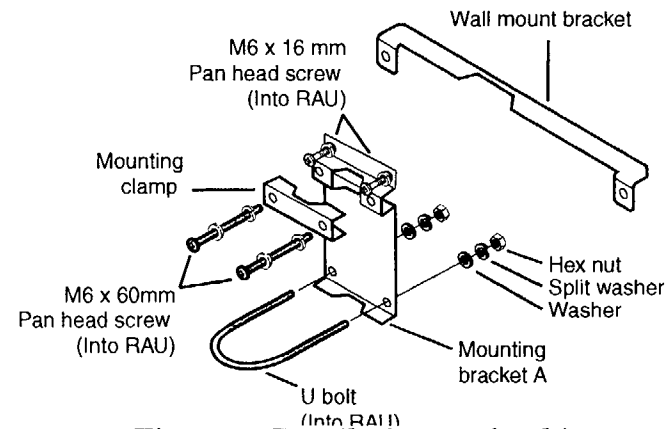
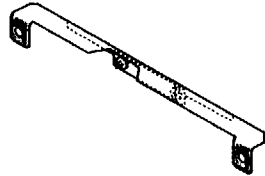


Figure 5. Detail of mounting kit

- A mounting bracket for mounting the RAU to a wall is included in the mounting kit (Figure 6).



781AA\_1999Q

**Figure 6. Wall mounting bracket. See Figure 16 on page 19 for how to use this bracket.**

- One security module (SM) card. Note that the SM card may already have been installed in the factory. If not provided, your service provider should supply this component.
- If you have the enhanced kit, the RAU comes with 15 meters (50 feet) of wiring to connect the junction box to the RAU. The wire can be shortened, if desired.
- In addition, the following optional accessories are available separately, and are provided as standard items in the enhanced kit:
  - QUALCOMM power supply with 2.44 meter (8 foot) line cord (two line cords with Euro and US plugs are included in the kit)
  - Battery backup for QUALCOMM power supply
  - Telephone with RJ-11 connector



**Note**

**CRIMP RINGS.** Use crimp rings to connect wires to a terminal or other screw. Crimp rings are not required, but are used to keep the wires under control while making a good connection. To use:

- Strip 1/2 inch (XX cm) of covering from the wires
- Slide crimp ring over wire ends, making sure you cover the bare wires
- Using pliers or a similar tool, crimp the ring over the wires so it forms a unit with the wires
- Connect the wires to screws using the rounded metal end.

### Step 3. Make sure you have all supplies and equipment

Check to see which QUALCOMM kit you are installing. Depending on the kit purchased, you may need additional items to complete the installation.

#### **Basic Kit**

The basic kit contains the RAU, a junction box, crimp rings, and cabling.

#### **Extended Kit**

The extended kit contains the items in the basic kit plus a phone, a power supply, and 15 meters (50 ft) of RAU-junction box cable. You can cut this cable to achieve the best installation for the site.

#### **Grounding Accessories**

The following grounding accessories are available from electrical supply companies, and, depending on the installation, may be required to ground the RAU and junction box. Quantities required in a typical installation are shown in Table 1.

**Table 1. Exterior wiring**

Accessory*	Quantity needed	Source and Part Number, when available
#2 AWG seven-strand copper primary ground wire	Amount needed depends on site	
#2 AWG (brown) ground lug	1 each	
#6 AWG solid copper ground wire used to ground junction box	0.5 meter	
Copper crimper C-clamp (#2 to #6 AWG wire, pink)	1 each	
2.7 meter (8 foot) ground rod	1 each	
#2 to #6 AWG copper ground rod clamp, screw type	1 each	
Junction box to RAU cable (provided by QUALCOMM or the equivalent cable)	Amount needed depends on the installation. QUALCOMM supplies 15 m (50 feet).	
Consider also: <ul style="list-style-type: none"> <li>• AWG of 4 wires</li> <li>• type of wires</li> <li>• insulation type</li> <li>• length, max</li> <li>• O.D.</li> </ul>		
*Use American Wire Gauge or equivalent wire.		

Table 2 lists the wires and jacks recommended for use in installing the interior wiring.

**Table 2. Interior wiring**

Recommended item	Quantity needed	Source
Category 3, 8-conductor unshielded twisted pair (EIA-568 or EIA-570)	As needed to a maximum of 182 meters (xx feet)	
6-position modular jack, wall mount (EIA-568 or EIA-520) RJ-11	As needed	
Wiring boxes	1 each	

Table 3 lists supplies needed for grounding. Note that these supplies are not supplied by QUALCOMM.

**Table 3. Grounding Supplies**

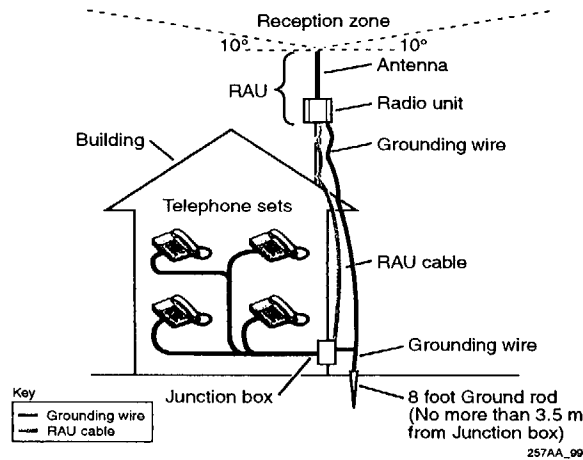
Recommended item	Quantity needed	Source
#2 and #6 stranded copper grounding wire	As needed	
Nonconductive pole for RAU	One for each RAU	
Bolts to secure wiring to rod	As needed	
Wall mounting brackets and fittings	If needed	

Table 4 lists other items needed to complete the installation.

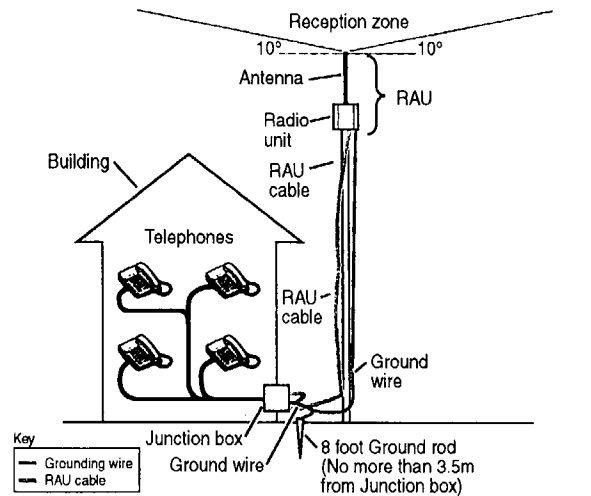
**Table 4. Other items**

Item	Quantity needed	Source
Telephone (supplied by QUALCOMM or an equivalent phone)	As needed	
Tools for installation <ul style="list-style-type: none"> <li>• Crimping tool</li> <li>• Phillips screwdriver (#2)</li> <li>• Cable ties</li> <li>• Needle-nose pliers</li> <li>• Socket wrench set, metric and standard sockets</li> <li>• Bubble level</li> <li>• Plumb line</li> </ul>	As needed	
Power supply: 12 volt, 3 amp. Possible other power sources that can be used are: <ul style="list-style-type: none"> <li>• Solar panel producing 12 volts DC with optional backup battery</li> <li>• Motor generator (2-wire terminal for 12 volt DC)</li> <li>• AC to DC converter operating at 100 to 240 V AC, 50/60 Hz with 12 V DC output</li> </ul>	One choice	SunWise* Atlantic Solar*
Mounting hardware for junction box: wood and metal screws with nuts and bolts.	As needed	
* QUALCOMM recommends these supplies. Their products have been tested. They are considered suitable for use with QUALCOMM's Analog Fixed User Terminal.		

## Step 4. Plan where to position the components



**Figure 7. Roof mounted RAU**



**Figure 8. Pole mounted RAU**

Determine where to position the RAU components. Figure 7 and Figure 8 show two recommended mounting configurations. Figure 25 on page 30 shows how to install the RAU when there is an existing lightning protection system. Decide which mount is best suited to the current work site. Read the restrictions below to be certain that cable lengths will be adequate.

### Radio Antenna Unit

1. When installing the RAU, ensure that the antenna is vertical.
2. Mount the RAU on a roof or pole high enough to ensure that the antenna has a clear view of the horizon in all directions for maximum satellite visibility. The antenna can acquire satellites that appear 10 degrees or more above the horizon.



### Note

If mounted on the roof, the antenna must be above the roof so as to have an unobstructed overhead view and a 360 degree view of the horizon. It is acceptable to mount the RAU in proximity to a lightning rod that may be taller than the RAU. See Figure 25.

3. Ensure that the RAU is located within 15 meters (50 feet) of the bottom (cable entry side) of the junction box.

### Junction Box

1. Secure the junction box to the outside of the building. The junction box is the demarcation point between the indoor (telephone and cabling) and the outdoor (RAU and cabling) components. The junction box and ground rod provide the user with protection against lightning strikes both to the RAU and outdoor cabling. The junction box should be mounted to the dwelling at the point of entry of wiring into the building.
2. Using suitable fastening hardware, mount the junction box on the outside of the building at the point where indoor cabling is to be run to the outer wall. Mounting hardware is not provided with the junction box. Ensure that all cabling designed for use

indoors is kept inside the premises and all cabling designed for use outdoors is kept outside the premises. It is acceptable for outdoor cabling to enter the interior of the premises, however interior cabling should never be used outdoors.

3. Install the junction box so that the bottom of the junction box is within 15 meters (50 feet) of the RAU.

The configuration should also consider

- The maximum length telephone wire is 182 meters (600 feet)
- The maximum number of telephones that can be installed is limited to five REN-B per Bellcore TA-NWT-909
- The RAU requires a 12 volt DC, 3 amp power supply for operation (10.5 to 16 volts as measured at the junction box).

### ***Power Source***

The power source is determined by the user or the service provider. Possible power sources are

- Solar panel producing 12 volts DC (nominal) with optional backup battery and capable of sourcing at least 3A
- Motor generator (2-wire terminal for 12 volt DC), with 3 A output source capability
- AC to DC converter operating at 110V to 220V AC, 50/60 Hz, with 12 V DC nominal output, capable of sourcing at least 3A.



### **Note**

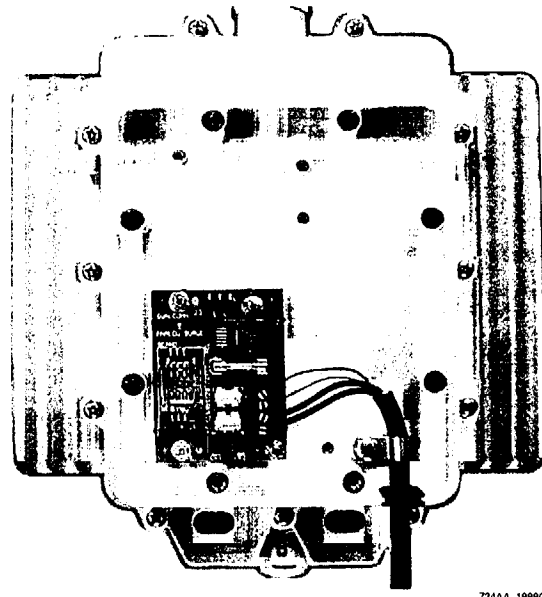
QUALCOMM recommends using the shortest length of wire practical between the power supply and the RAU to keep voltage drop between the two to a minimum, particularly if the supply voltage is closer to 10.5 volts.

Regardless of wire length, the installer must ensure that supply voltage is not less than 10.5 volts or more than 16 volts at the junction box. The RAU draws a load that varies between 0 and 3 amps.

If the installer uses the 15-meter (50 foot) cable, and the power supply maintains an output of at least 10.5 volts, proper voltage at the RAU is assured.

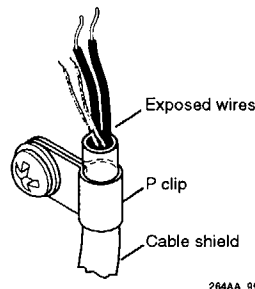
If it is necessary to extend the cables, connect the cables with wire nuts.

## Step 5. Prepare the RAU



734AA\_19990

**Figure 9. RAU with cover removed**



264AA\_99

**Figure 10. Detail of P clip**

1. Remove the access cover from the RAU by unscrewing the thumbscrews at the bottom of the unit.



### Note

The thumbscrews will release the cover, but are designed to be captive to the cover.

2. Run the RAU cable from the bottom of the junction box to the RAU. Connect the wire to the RAU using Table 5. See Figure 11 on page 16 for details.

**Table 5. Connections**

Wire	Screw Terminal	Signal
Blue with white	T	Tip
Blue	R	Ring
Red	+1	+12 V supply
Black	-1	-12 V supply return

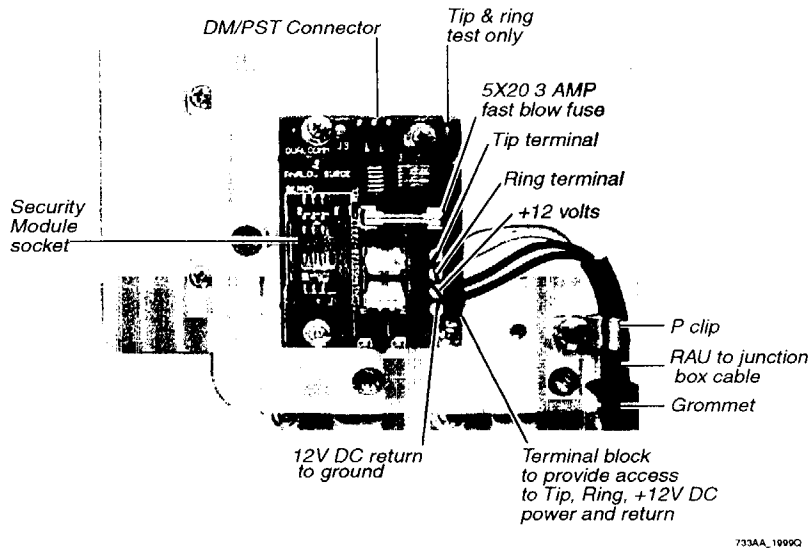
3. Remove the split grommet at the bottom right of the RAU and slip it over the free end of the cable at the end near the connectors, as shown in Figure 9.
4. The P clip secures the cables in the RAU housing. Using a Phillips screwdriver, loosen the P clip (Figure 10). Push the cable through the bottom of the RAU and through the P clip so that the P clip encircles the cable jacket. Screw down the P clip loosely.
5. When steps 1 through 4 are complete, torque the P clip screw to 170 +/- 20 N-cm (15 +/- 1.8 in lb).





**Note**

Do not tighten the P clip until all other connections are in place. This allows some flexibility while you make other connections. Tighten the P clip when ready to close the cover. When the connectors are in place, ensure that the split grommet is in place in the hole on the bottom right side of the RAU.



**Figure 11. Detail of RAU inside**



**WARNING**

**POWER.** Do not apply 12 volt power until all electrical connections are made. Do not allow the +12 volt line to contact the ground wire or any other metallic object. Should a short occur, there is a risk of injury, fire, or damage to power supply, and explosive venting of any backup battery.

**Security Module**

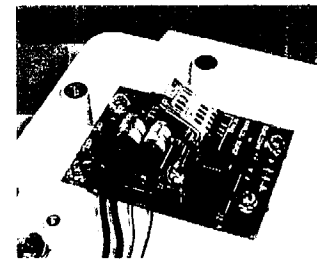
If not already done in the factory, insert and secure the security module (SM) card in the socket provided. Refer to Figure 13, Figure 13, and Figure 14 for placement.

1. Open the ESD bag and take out the SM Card. On the left side of the card, gently punch out the SM.



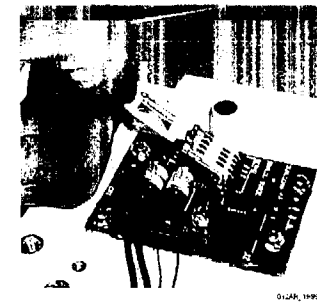
**Figure 12. SM Card and holder**

2. Locate the socket for the security module and gently lift it up.
3. Take the SM, hold it Globalstar side up with the cropped corner toward the hinge of the cover.



**Figure 13. Lift the socket cover**

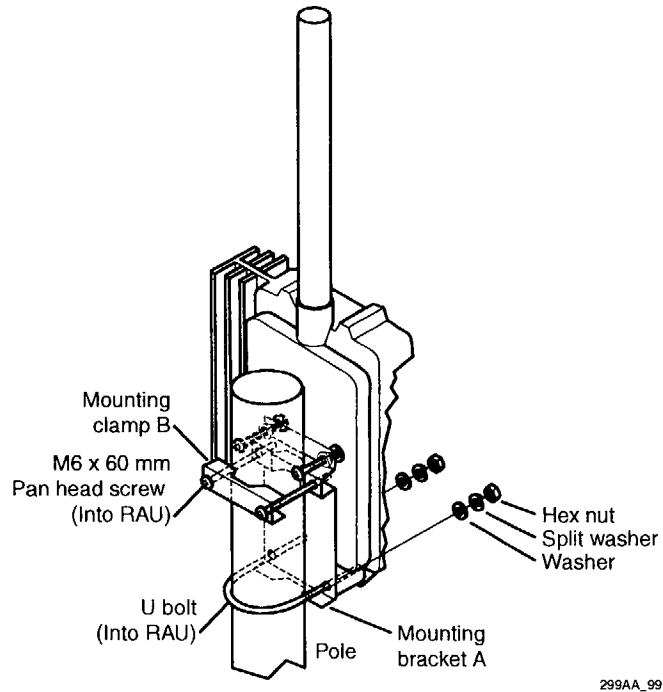
4. Gently slide the SM into the cover of the socket. You will find a holder for it under the cover.
5. When the SM is secure in the socket cover, close it until the cover clicks into place.
6. If you have inserted the SM correctly, a small amount of the SM will show outside the cover.



**Figure 14. Insert the SM into the socket cover**

## Step 6. Attach the RAU to a pole or wall

### *Mounting the RAU to a pole*



**Figure 15. Attach the RAU to the pole**

The RAU is approximately 50 cm (19.7 in.) tall and weighs 2.9 kg (6.4 lb.), not including cables or mounting hardware. The RAU can be mounted to a user-provided pole. The chosen pole must be capable of supporting the RAU and associated cabling during periods of severe inclement weather.

The installation kit contains the appropriate connectors for mounting the RAU to a pole ranging in size from 1.50 inch (3.8 cm) OD through 1.90 inch (4.8 cm) OD. To install the RAU on a pole, you will need the U bolt, assorted screws, and the metal mount (2 pieces). Figure 15 shows a typical pole connection.

You will need a #2 Phillips screwdriver. In addition, the following tools may be useful: needle-nose pliers and a 9/16 socket wrench for tightening the hex nuts.



#### **WARNING**

Ensure that the RAU and the pole are located a safe distance from AC power lines. Use caution when working with ladders and other equipment around power lines.



#### **CAUTION**

While installing the RAU on the pole, support the RAU until all mounting hardware is in place and secured and the RAU is securely mounted on the pole.

1. Take the larger piece of the mount (Mounting bracket A on Figure 15) and use the short M6 screws to attach it directly to the RAU, using the holes provided on the back of the RAU.

Washers are provided for the screws. Place the split lock washer next to the screw head followed by the flat washer before inserting the screws. Tighten the M6 x 16 mm screws to 300 +/- 30 N-cm (26.6 +/- 2.7 In lb). Using Figure 15 as a placement guide, be sure that the large oval holes on the mounting pieces and the RAU are lined up.

2. Washers are provided for the screws. Place the split lock washer next to the screw head followed by the flat washer before inserting the screws. Using the smaller piece of mount (mounting clamp B on Figure 15), thread the two long M6 screws through it. As shown in Figure 15, connect the mounting clamp B with mounting bracket A using the long M6 screws to connect the two pieces. Note that the nuts for the long M6 screws are already included as part of mounting bracket A. Do

not tighten the screws completely until you have mounted the RAU on the pole.

3. Fit the U bolt through the oval holes in the mounting bracket A, then push the U bolt through the RAU until the threaded ends appear at the bottom front of the RAU. Place the large flat washers, the large split washers, then the hex nuts on the ends of the U bolt with stack-up shown in Figure 15.
4. If mounting on a pole, slip the RAU assembly over the top of the pole. Tighten the long M6 screws to 300 +/- 30 N-cm (26.6 +/- 2.7 In lb). Tighten the U bolt hex nuts to 1536.5 +/- 248.6 N-cm (136 +/- 22 In lb). Ensure that now the RAU cannot move while on the pole.



#### Note

Ensure that the pole, the RAU, and the antenna are vertical and that the antenna has a clear view of the sky and a 360 degree view of the horizon. Ensure that the entire length of the antenna portion of the RAU lies above the top of the pole.

Ensure that there is no possibility that the RAU can move or slip while mounted on the pole.

5. To close the access cover, hook the cover in the recess at the top of the RAU front housing. Draw the cover down over the access opening and tighten the thumb screws at the four corners of the cover to 19.5 +/- 2.7 In lb (220 +/- 30 N-cm), exerting pressure at the top and bottom, if necessary, to compress the seal.

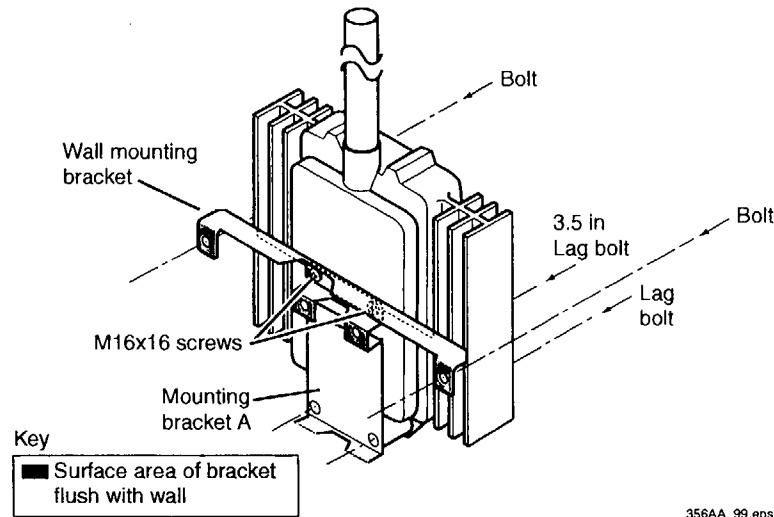


#### Note

It is important to ensure that the access cover is sealed. The access cover hooks into a groove on the upper part of the RAU. This groove positions the access cover so it will seal tightly. To close the access cover, first hook the access cover into this groove, then press the access cover down and back to close. This compresses the seal and helps line up the screws that secure the cover. Screw the thumb screws down firmly. Be careful not to screw the screws too tightly as this may damage the screw mechanism.

6. If desired, use a padlock to secure the cover and prevent theft of the SM card and RAU.

### ***Mounting the RAU to a wall***



**Figure 16. RAU with wall mounting bar in place**

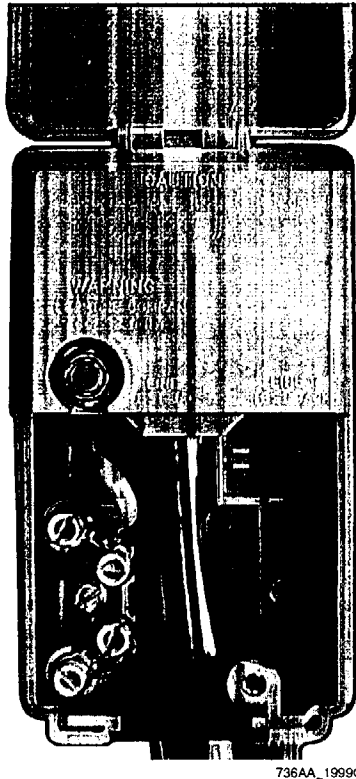
If desired, the RAU may be mounted to a wall with the optional wall mounting bracket shown in Figure 16. A wall mounting bar is included in the mounting kit

1. You need mounting bracket A, the wall mounting bracket, the short M6 X 16 screws, bolts to attach the mounting bracket to the wall of the building, and xx cm (2.75 in.) lag bolts.
2. Attach mounting bracket A to the RAU and attach the wall mounting bar using the same screws, as shown in Figure 15. A detail of the mounting bar is shown in Figure 6.
3. Attach the bottom of mounting bracket A to the RAU using lag bolts at least xx cm (2.75 in.) long. Start the lag bolts from the front of the RAU and continue through the oval holes and on through mounting bracket A.

4. Attach the wall mounting bracket to the wall. The screws used to connect the wall mounting bracket to the wall must fit the bracket and be of the appropriate length and type for the composition of the wall at the chosen installation site.

Keep in mind that the RAU must have a clear view of the sky and the horizon in order to operate correctly.

## Step 7. Install the junction box



**Figure 17. Junction box with cover opened and service provider access closed.**



### Note

The outside screw on the junction box disables the locking mechanism. When you open the cover, be careful not to lose the lock.



### WARNING

Run indoor wiring from the junction box directly into structure in the shortest distance practical. Wires from the junction box to the building interior should enter the building almost immediately after exiting the junction box.

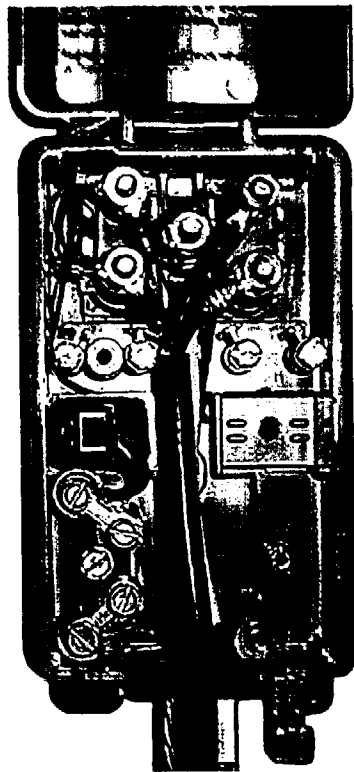


### WARNING

Do not run RAU or junction box ground cables inside a building. The junction box is the interface between the outside cables and the inside cables. The junction box must be located on the outside of the building immediately at the point where the indoor cables reach the outside of the building.

When properly grounded, the junction box minimizes damage to the telephone set in the event the RAU or its cabling are struck by lightning in an electrical storm. The junction box may not adequately protect the user if the RAU or its cabling are struck by lightning while the phone is in use. Therefore, never operate or handle the equipment during an electrical storm.

Even though the Analog Fixed User Terminal includes grounding and circuitry to protect equipment, facilities, and personnel from nearby lightning, lightning is a highly unpredictable and dangerous phenomenon. It is impossible to completely protect equipment and personnel from lightning.



737AA\_1999Q

**Figure 18. Junction box with cover opened and service provider access open.**

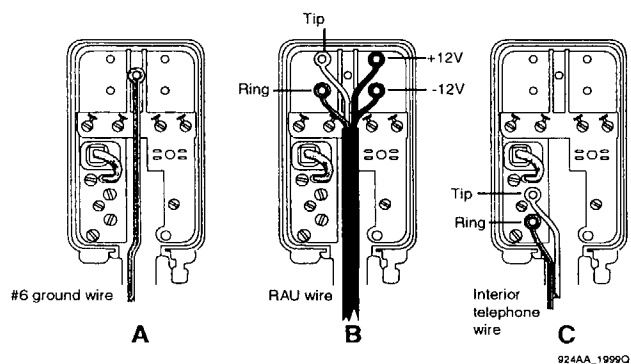
1. The junction box is the interface between the outside and the inside cabling. The junction box must be located on the outside of the building immediately at the point where the indoor cables reach the outside of the building.
2. With appropriate screws, mount the junction box upright on the outside of the building so that the cables exit from the bottom of the junction box. This position ensures that the junction box components are not harmed by weather, especially rain.
3. Connect the #6 ground wire to the ground lug in the junction box as shown in Figure 19, view A, on page 22.
4. Connect the RAU wire to the junction box as shown in Figure 19, view B. Refer to Table 6.

**Table 6. Wiring from RAU to junction box**

Wire	Signal
Blue with white	Tip
Blue	Ring
Red	+12 V supply
Black	-12 V supply return

5. Secure all outdoor cables to stationary objects using cable ties (not included) to ensure that the cables are secured to the building and are not damaged by wind, animals, or vandals.
6. Close the cover to protect the contents from weather and vandals.
7. Junction box details are provided in Figure 19 on page 22.

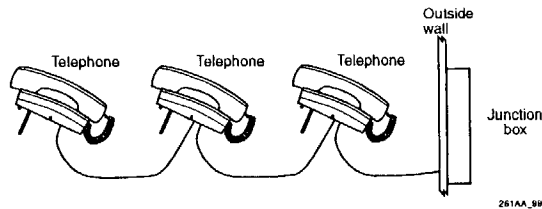
- 8. Run 8-conductor 100 ohm unshielded twisted-pair wire, EIA 568 standard (not provided) from the junction box to the interior rooms where the telephones will be located. See Figure 19, view C on page 22. The wire distance between the junction box and the telephone farthest from the junction box should be no longer than 182 meters (550 feet).



**Figure 19. Junction Box - Wiring Detail**

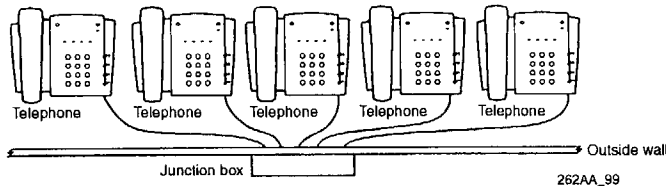
## Step 8. Run indoor wiring for the telephone and data

The wiring instructions given here are all accomplished inside the building. Do not run wires designed for inside use on the outside of the building. You can connect as many as 5 phones in either a daisy chain (Figure 20) or star configuration (Figure 21).



**Figure 20. Daisy chain configuration**

The daisy chain configuration has wiring going from the junction box to one telephone, and then to another.



**Figure 21. Star configuration**

The star configuration has a wire for each telephone that goes from the junction box to the telephone.

1. The premises wiring should be connected to the junction box tip and ring terminals and wired to interior jacks as shown in Table 5 on page 15.

**Table 7. Wiring from interior to junction box**

Wire	Interior RJ-11 Jack
Tip (white)	Pin 4
Ring (blue)	Pin 3

2. Run all wiring before connecting to the junction box. Wire telephones using category 5, 8-strand cable.
3. Connect interior wiring to junction box as shown in Figure 19, view C on page 22.



### Note

Total wire length from RAU to farthest telephone must not exceed 182 meters (550 feet).

Total REN is not to exceed five REN-B per Bellcore TA-NWT-000909.

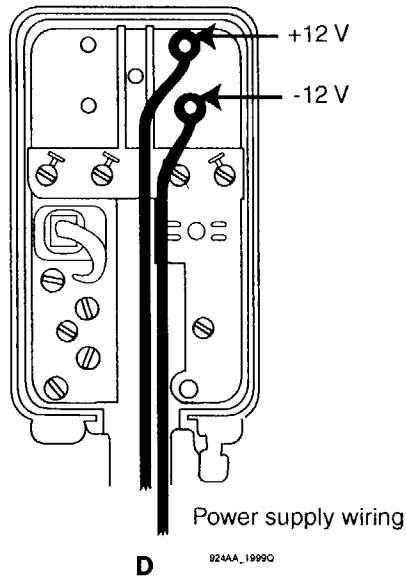


### Note

For best voice quality, avoid running the telephone wiring in close proximity to power lines or appliances.



4. After all wiring is complete, connect the telephones:
5. With power to RAU off, connect the short phone cable inside the junction box to the RJ-11 receptacle marked with the handset icon. (See Figure 22.)



**Figure 22. Junction box wiring details for power supply**



**Note**

Do not apply power until you have completed grounding, step 11.

**Selecting a Phone**

QUALCOMM supplies a phone with the enhanced kit. If you are selecting your own phone, look for a phone that best fits these guidelines. For satisfactory results, a phone should:

- Use tones, not pulses, for dialing. This is a requirement.
- Have good voice quality. Excellent sound is determined by the phone itself as well as signal reception.
- Provide good performance. To enjoy the results, use a quality phone.

## **Step 9. Make sure that all cables are connected and operate properly**

Before proceeding further, it is important to verify the following items:

- Is the RAU mounted securely?
- Does the antenna have a clear, unobstructed view of the sky and the horizon in all directions?
- Is the junction box mounted on the outside wall?
  - Are all inside cables located inside the building?
  - Are all outside cables located on the outside of the building?
- Is the wiring for the building complete and tested?
- Are all cables and jacks correctly connected and in place?
- Are all cables tied down?
- Do a visual check. Does everything appear to be in order?
- Are telephones and their wiring installed?
- Make corrections as needed.

## Step 10. Standard practices for grounding

This information is provided for added safety and should be used in conjunction with step 11.

The following standard practices are provided as good manufacturing processes for grounding. It is strongly recommended that you follow these practices for the RAU primary ground connection.

### A. Ground terminals

Each down conductor shall terminate at a ground terminal dedicated to the lightning protection system. The design, size, depth, and number of ground terminals used shall comply with sections B through D.

### B. Ground rods

Ground rods shall be not less than 12.7 mm (1/2 inch) in diameter and at least 2.4 meters (8 feet) long. Rods shall be copper-clad steel, solid copper, hot-dipped galvanized steel, or stainless steel. Rods shall be free of paint or other nonconducting coatings. Note that some types of soil may require a longer ground rod.



#### Note

Research has been presented warning that stainless steel is very susceptible to corrosion in many soil conditions. Use extreme caution and conduct proper soil analysis when this type of rod is used.

### C. Electrical system

Electrical system and telecommunication grounding electrodes shall not be used in lieu of lightning ground rods. This shall not prohibit the required bonding together of grounding electrodes of different systems.



#### Note

IN NORTH AMERICA for further information see NFPA 70, *National Electrical Code*® and NFPA 780, *Standard for Installation of Lightning Protection Systems*, 1995 Edition®, which contain detailed information on the grounding of electrical systems.

IN OTHER COUNTRIES refer to the local lightning and electrical codes.

### D. Ground rod terminations

The down conductor shall be attached to the ground rod by bolting, brazing, welding, or using high-compression connectors listed for the purpose. Clamps shall be suitable for direct soil burial.

#### — Deep moist clay soil

The lightning conductors or ground rods shall extend vertically not less than 3 meters (10 feet) into the earth. The earth shall be compacted and made tight against the length of the conductor or ground rod.

#### — Sandy or gravelly soil

In sand or gravel, two or more ground rods, at not less than 3 meters (10 feet) spacings, shall be driven vertically to a minimum depth of 3 meters (10 feet) below grade.

#### — Shallow topsoil

Where bedrock is near the surface, the conductor shall be laid in trenches extending away from the building at each down conductor. These trenches shall be not less than 3.7 meters (12 feet) in length and from 0.3 to 0.6 meter (1 to 2 feet) in depth in clay soil. In sandy or gravelly soil, the trench shall be not less than 7.5 meters (24 feet) in length and 0.6 meter (3 feet) in depth. If these methods should prove impractical, an acceptable alternative would be to carry the lightning protection cable (or grounding cable) in trenches of a depth

specified above. If this is impossible, carry the lightning protection cable directly on bedrock, a minimum distance of 0.6 meter (2 feet) from the foundation or exterior footing and terminate by attaching it to a buried copper ground plate at least 0.8 mm (0.032 inch) thick and having a minimum surface area of 0.18 square meter (2 square feet).

— **Soil less than 0.3 meter (1 foot) deep**

If the soil is less than 0.3 meter (1 foot) in depth, down conductors shall be connected to a loop conductor installed in a trench or in rock crevices around the structure. The loop conductor shall be the equivalent of, or greater than, a main size lightning conductor. Optional plate electrodes may be attached to the loop conductor to enhance its earth contact where the measured grounding resistance is found to be too high to provide effective grounding.

## Step 11. Ground the entire system

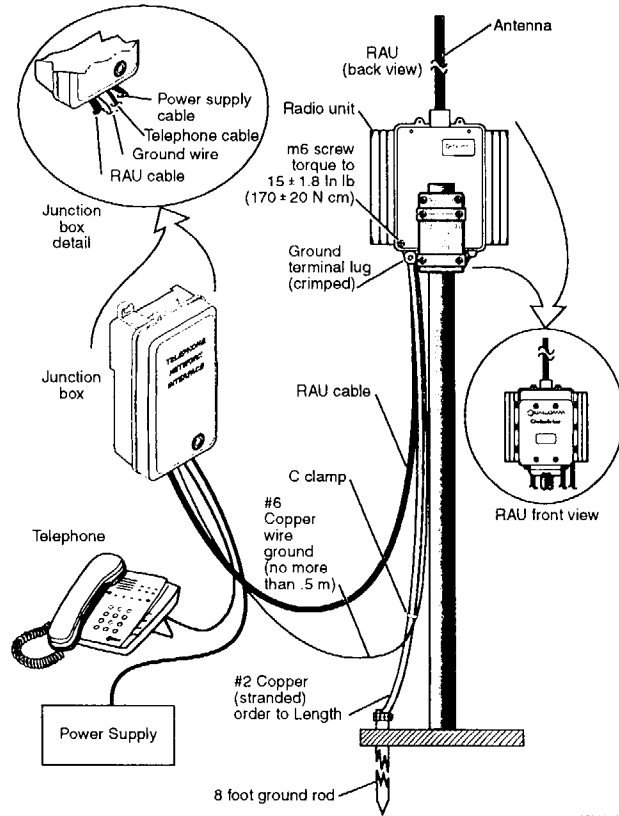


Figure 23. Grounding the RAU

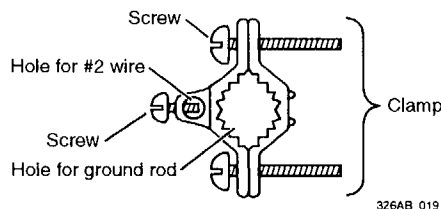


Figure 24. Detail of ground wire/ground rod connection

### ⚠ WARNING

The RAU is a metal object that is typically located high on a pole with full view of the horizon. There is significant probability that it may be hit by lightning. Therefore, it is mandatory that you ground the RAU as described here and in detail in Step 10. Standard practices for grounding on page 26.

To ground the RAU and its components, follow these instructions carefully.

- Connect the RAU ground wire to the RAU chassis using the ground screw on the lower rear face of the RAU. The screw holds the lug of the ground wire in rigid metal-to-metal contact with the chem-filmed surface of the chassis surrounding the screw head.

### Pole Mount

If the RAU is mounted on a metal pole whose lower end is buried in the ground, run the grounding wire directly from the RAU and bolt it to the pole. (See Figure 23 for details).

### Lightning Protection

- If the RAU is mounted on a building that is not lightning protected or on a nonconductive pole, run the grounding wire from the RAU down the pole next to the RAU cable and route it past the junction box. Then bolt it to a grounding rod, that is, a rod specifically designed to ground in this situation. Refer to Figure 23 and Step 10. Standard practices for grounding on page 26. Connect the 0.5 meter 6 AWG ground conductor from the junction box to the RAU ground cable using a compression tap.
- If the RAU is mounted on a building that is lightning protected, run the grounding wire from the RAU past the junction box, then attach the junction box ground wire to the building lightning ground rod within the ground rod pit (see Figure 25). Connect the #6 AWG junction box ground wire to the #2 AWG ground wire between the RAU and junction box using the provided 2 to 6 AWG grounding clamp.



**Note**

QUALCOMM recommends using #2 AWG seven-strand copper grounding wire for the RAU ground cable and #6 AWG copper wire to secure the junction box grounding screw to the RAU ground cable. An H-type compression tap is recommended to bond the #6 junction box ground cable to the #2 RAU ground cable. The #6 junction box ground wire should be as short as possible. Other grounding options are aluminum cable or metal strips. See Table 8 for the specific requirements.



**CAUTION**

The total length of cable (#6 and #2) from the junction box to earth ground must be less than 3.5 meters (0.5 meters from the junction box to the RAU ground cable plus 3 meters [10 feet] from the tap [or splice] to the ground rod). If this is simply not possible for a particular installation, the RAU should be protected by a primary lightning protection system (lightning rod). The lightning rod is typical installed as a building lightning protection system.

The lightning rod must have its own separate down conductor, and it should be mounted at least 3 meters (10 feet) but not more than 25 meters (85 feet) away from the RAU with the lightning rod extending the same distance vertically above the tip of the RAU antenna as the horizontal distance between the lightning rod and the RAU.



**CAUTION**

The upper bound on the lightning rod distance is driven by consideration of the 43 meter (150 feet) lightning arc striking distance. The lower bound is driven by consideration of minimizing the effects of the lightning rod on the RAU antenna pattern. A lightning rod of 2 inch diameter, with no guy wire is acceptable at a distance of 3 meters (10 feet) from the RAU. See Figure 25.



**CAUTION**

If the RAU is hit by lightning, both it and the junction box will very likely be permanently damaged. In areas of high lightning activity, a separate lightning rod is recommended. Refer to local codes for any additional requirements on proper installation with respect to lightning protection and grounding.

**Table 8. NFPA\* 780\*\* Class 1 material requirements for RAU and junction box**

Type of Conductor		Copper		Aluminum	
		Standard	Metric	Standard	Metric
<b>RAU ground</b> solid or stranded cable	Minimum size per strand	17 AWG	1.35 mm	14 AWG	1.85 mm
	Cross sectional area	57,400 CM	29 mm <sup>2</sup>	98,600 CM	50 mm <sup>2</sup>
<b>RAU ground</b> solid strip	Thickness	0.051 inch	1.30 mm	0.064 inch	1.63 mm
	Width	1 inch	25.4 mm	1 inch	25.4 mm
<b>Junction box ground</b> solid or stranded cable	Minimum size per strand	17 AWG	1.35 mm	14 AWG	1.85 mm
	Cross sectional area	26,240 CM		41,100 CM	
<b>Junction box ground</b> solid strip	Thickness	0.051 inch	1.30 mm	0.064 inch	1.63 mm
	Width	1/2 inch	12.7 mm	1/2 inch	12.7 mm

\*National Fire Protection Association.

\*\*NFPA 780 regulations, *Standards for the Installation of Lightning Protection Systems*, 1995, page 780-7, tables 3-4 and 3-5.

Note: These details are for buildings not exceeding 23 meters (75 feet) in height.

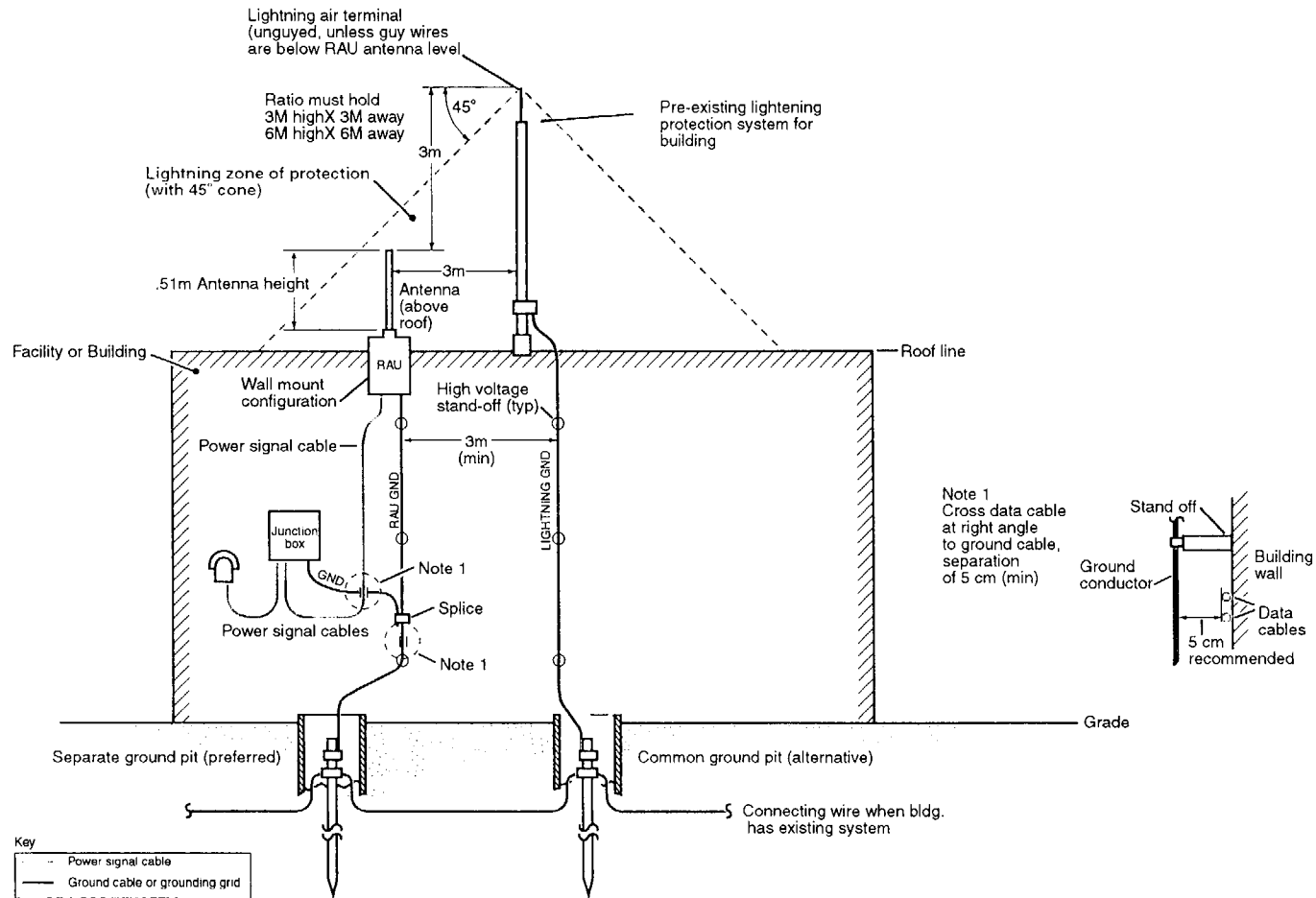


Figure 25. Recommended grounding when building is protected by a pre-existing lightning protection system

## Step 12. Connect power supply

The power source is determined by the user or the service provider. Possible power sources are

- Solar panel producing 12 volts DC (nominal) with optional backup battery
- Motor generator (2-wire terminal for 12 volt DC)
- AC to DC converter operating at 100 to 240V AC, 50/60 Hz, with output rated 12 V DC, 3 amp (5 amp maximum).

Each source of power requires installation that is unique to the type of power source. Follow the instructions provided with the power supply. In this section, we try to offer solutions that are suitable to the Globalstar Analog Fixed User Terminal.

With the exception of solar power, the power cord goes from the power source to the junction box. Normally, the power supply should provide 12 volts and at least 3 amps. Voltage as measured at the +12 V terminal of the junction box must be between 10.5 and 16 volts DC.

Connect the power supply wires to the junction box as shown in Figure 26.

### **Motor Generator**

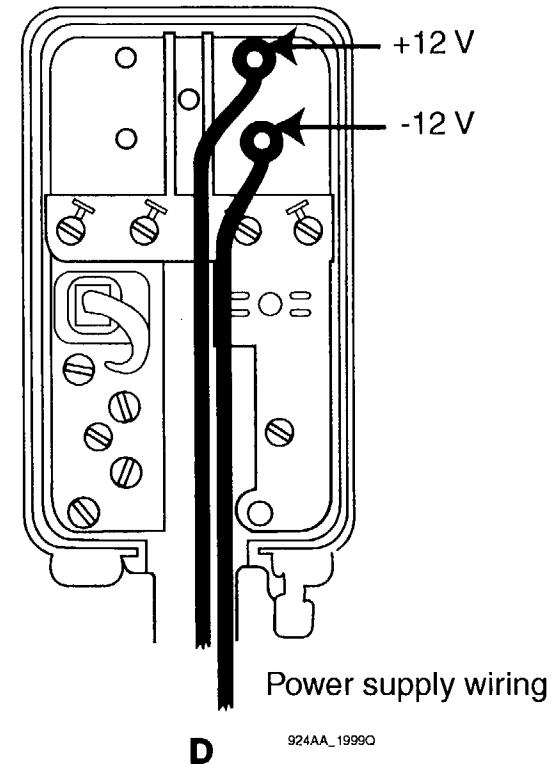
A motor generator requires 2-wire terminal for 12 volt DC.

### **AC to DC Converter**

An AD/DC converter should operate at 100 to 240V AC, 50/60 Hz, with output rated 12 V DC, 3 amp (5 amp maximum).

### **Battery Power**

If you are using a battery for a power supply, use the instructions supplied with the battery.



**Figure 26. Connect wiring for power supply**

### **QUALCOMM power supply**

This is the power supply sold with the enhanced kit. It includes:

- Two 2.44 meter (8 foot) line cords for use in the US, South America, and Europe.
- XX Amp/hour backup battery.



### Solar Power

The solar panel must produce 12 volts DC and may have an optional 12 volt backup battery.

If you are using solar power, a configuration of the type shown in Figure 27 is recommended. Note that a larger pole is used to support the extra equipment.

#### Note

If using a solar panel, depending on the installation it may be practical to run power and ground wire from the RAU to solar panel to junction box, instead of running power and ground from the RAU to junction box to solar panel to the junction box.

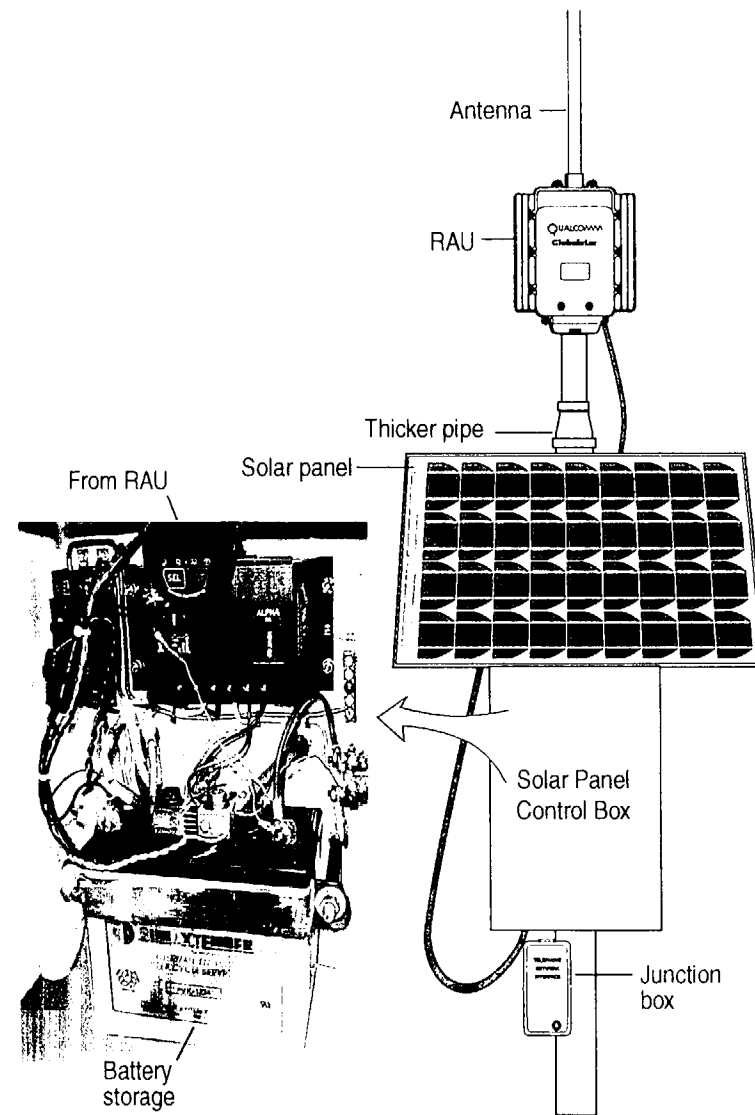


Figure 27. Suggested installation for solar power

## Step 13. Connect power and test

Do not supply power to the RAU or components until all the steps of assembly are complete. Use the following checklist to ensure that assembly is complete.

- The RAU and the junction box are properly grounded using a grounding rod and #2 and #6 cable (See Step 10. Standard practices for grounding on page 26 for guidelines).
- The junction box is installed.
- The RAU is connected to the junction box and the P clip inside the access cover of the RAU is tightened down.
- The power supply is installed (follow instructions provided with the power supply).
- The 12 volt power wires are run to the power source.
- The inside wiring for the telephone is installed.
- The inside wiring is connected to the junction box.
- Access covers for the RAU and junction box are secured.



### Note

It is safe to connect the telephone prior to or subsequent to applying power.



### WARNING

Do not allow the +12 volt line to contact the ground wire or any other metallic object. Should a short occur, there is a risk of injury, fire, damage to the power supply, and explosive venting of any backup

When the checklist is done and you are confident that the equipment is installed correctly, turn on the power and perform power checks.

- Once the RAU has powered up and acquired the Globalstar system, listen for a dial tone from the telephone receiver.
- Use a multimeter, or the equivalent, to ensure that the voltage at the junction box is between 10.5 and 16 volts DC.



### WARNING

**POWER.** Do not apply 12 volt power until all electrical connections are made. Do not allow the +12 volt line to contact the ground wire or any other metallic object. Should a short occur, there is a risk of injury, fire, damage to the power supply, and explosive venting of any backup battery.



### WARNING

**FUSE.** For continued protection against the risk of fire, replace a blown fuse only with an identically rated, certified fuse. The fuse is an IEC certified 3 amp, 250 volt, 5 X 20 fast acting ferrule fuse contained in a fuse holder. The fuse is on the Surge CCA inside the front RAU access cover.

### *Final check*

If needed, do the following:

- Close and lock the RAU.
- Close and lock the junction box.
- “Dress” the cables and secure to pole, etc.
- Connect the telephones to the telephone jacks.

## Step 14. Troubleshooting

If one or more telephones fail to work, use the following troubleshooting procedure. These procedures should be used only by a qualified service technician.

1. If one telephone fails to work, check the wiring to that telephone.
2. If more than one telephone fails to operate,
  - Disconnect the premises wiring from the RAU at the junction box. Do this by disconnecting the short cable in the junction box.
  - Connect a known good telephone to the RJ-11 jack in the junction box. See Figure 28.

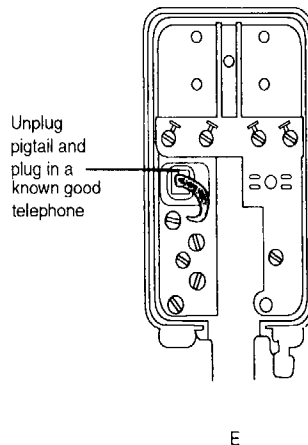


Figure 28. Troubleshooting

If the telephone works, the problem is in the house wiring.

If the telephone still fails to work,

- Disconnect the telephone.
- Remove power from the RAU.
- Check the fuse on the power supply. If blown, check the power supply wiring before replacing the fuse.
- Open the junction box and check all connections.



### Note

For continued protection against the risk of fire, replace a blown fuse only with an identically rated, certified fuse. The fuse is an IEC certified 3 amp, 250 volt, 5 X 20 fast acting ferrule fuse contained in a fuse holder.

3. If you fail to find a problem, reapply power to the RAU and check the voltage on the power supply screw terminals in the junction box. The voltage must be between 10.5 and 16 volts DC.
4. If you still fail to find a problem,
  - Remove power to the RAU.
  - Open the RAU access cover and double check the connections within the RAU.
  - Check the RAU fuse. If blown, double-check the power supply wiring before replacing the fuse.
5. If you have followed this procedure and still have not found the source of this problem, remove the unit and return it to your service provider or a repair service designated by the service provider for evaluation and repair.

## Terminology

AWG	American Wire Gauge, a measurement of wire size
Analog Fixed User Terminal	A phone installation that uses Globalstar and CDMA technology and is fixed in place; that is, not portable
Daisy chain	A method of connecting telephones where the wiring goes from the junction box to one telephone, and then to the next.
Down conductor	The wiring that conducts electricity down into the ground
Ground terminals	Terminals for the purpose of grounding wires
NFPA	National Fire Protection Association
OD	Outer diameter, used to measure pipe
RAU	Radio Antenna Unit
SM	Security module, a device that authenticates the user of the telephone on the Globalstar system.
Star configuration	A method of connecting telephones where each telephone is connected individually to the junction box.

## References

- *Installation of Lightning Protection Systems*, 1995 Edition<sup>®</sup>.
- NFPA 780 Regulations, *Standards for the Installation of Lightning Protection Systems*, 1995 edition.
- NFPA 70, *National Electrical Code*<sup>®</sup>

## Appendix: Operating Specifications

### *RF Specifications*

Operating Mode	CDMA
TBD	TBD

### *Power Specifications*

Power source	10.5 to 16.0 V DC, 3 Amps
Power consumption	36 Watts maximum

### *Mechanical Specifications*

Width	6.7 in (17.0 cm)
Length	8.6 in. (21.8 cm) With antenna, <b>xx in (xx cm)</b>
Height	2.4 in. (6.1 cm)
Weight	2.2 lb (1.0 kg)

### *Environmental Specifications*

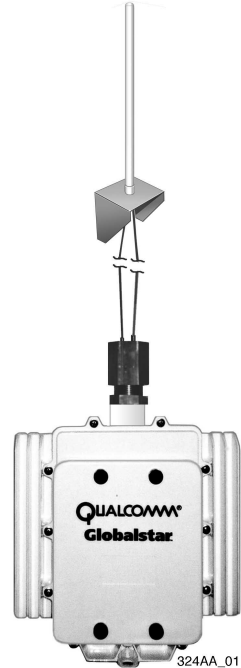
Operating temperature	TBD
Storage temperature	TBD
Humidity	TBD

# ***Exhibit 7 Remote Analog Fixed Phone Installation Manual***

---



RELEASED INTERNAL USE ONLY



## Remote Antenna Fixed Phone Rework and Installation Instructions

**Globalstar**

RELEASED INTERNAL USE ONLY

QUALCOMM Incorporated  
5775 Morehouse Drive  
San Diego, CA 92121-1714  
U.S.A.

Copyright © 2001 QUALCOMM Incorporated.  
All rights reserved. Printed in the United States of America.

All data and information contained in or disclosed by this document are confidential and proprietary information of QUALCOMM Incorporated and all rights therein are expressly reserved. By accepting this material the recipient agrees that this material and the information contained therein are held in confidence and in trust and will not be used, copied, reproduced in whole or in part, nor its contents revealed in any manner to others without the express written permission of QUALCOMM Incorporated.

This technology was exported from the United States Government. Diversion contrary to U.S. law prohibited.

QUALCOMM is a registered trademark of QUALCOMM Incorporated.

Globalstar™ is a trademark of Loral Qualcomm Satellite Services, Inc.

All other trademarks and registered trademarks are the property of their respective owners.

Remote Antenna Fixed Phone Rework Instructions

80-99438-1EN Rev. -

June 29, 2001



# Contents

- 1. Converting a fixed phone to a remote antenna fixed phone ..... 1**
- 2. Converting the fixed phone Radio Antenna Unit (RAU) ..... 1**
  - 2.1 Modifying the Fixed Phone Radio Antenna Unit (RAU) to use the brass plug with antenna cables..... 1
- 3. Modifying your fixed phone antenna..... 9**
  - 3.1 Converting the antenna from OSX connectors to SMA connectors ..... 10
    - 3.1.1 Before you begin ..... 10
  - 3.2 Changing connectors..... 11
  - 3.3 Installation cabling requirements..... 14
- 4. Hooking up your Remote Antenna Fixed Phone ..... 15**
  - 4.1 With quadrifilar helix antenna ..... 16
  - 4.2 With dome-shaped antenna..... 18

This page intentionally left blank.

RELEASED INTERNAL USE ONLY

## Tables

Table 3-1. Cable types for quadrifilar helix antenna .....14  
Table 3-2. Cable types for small dome-like antenna .....15

## Figures

Figure 1. RAU .....2  
Figure 2. RAU with access cover removed.....2  
Figure 3. RAU with interface CCA removed .....3  
Figure 4. RAU with top housing tilted.....3  
Figure 5. Yellow ribbon and black and white wire disconnected.....4  
Figure 6. Module exposed.....4  
Figure 7. Back housing with Tx and Rx antenna connectors .....5  
Figure 8. Threading out the antenna.....6  
Figure 9. Inserting the brass plug .....6  
Figure 10. Brass plug connectors connected.....7  
Figure 11. Module replaced .....7  
Figure 12. Module reconnected to top housing.....8  
Figure 13. RAU top housing replaced.....8  
Figure 14. Interface CCA reinstalled.....9  
Figure 15. RAU with access cover replaced.....9  
Figure 16. Wire stripped.....10  
Figure 17. Parts needed for conversion .....11  
Figure 18. Shrink tubing .....11  
Figure 19. Ferrule.....11  
Figure 20. Insulation jacket stripped off .....12  
Figure 21. Ends of coax flared.....12  
Figure 22. Teflon stripped off .....12  
Figure 23. Pin over wire .....13  
Figure 24. Female connector on and showing pin inside connector .....13  
Figure 25. Crimping the ferrule.....14  
Figure 26. Shrink tubing over ferrule.....14  
Figure 27. Sample mounting location for RAU and antenna .....16

Figure 28. Quadrifilar helix antenna, connectors, and bracket..... 17  
Figure 29. Remote Antenna Fixed Phone with quadrifilar helix antenna..... 18  
Figure 30. Dome-shaped antenna ..... 19  
Figure 31. Remote Antenna Fixed Phone with dome-shaped antenna ..... 20

RELEASED INTERNAL USE ONLY

RELEASED INTERNAL USE ONLY

## **1. Converting a fixed phone to a remote antenna fixed phone**

This document tells you how to convert a QUALCOMM Globalstar GSP-2800/2900 Fixed Satellite Phone to a Remote Antenna Fixed Phone (RAFP). Two conversion options are available: the fixed phone quadrifilar helix antenna remotely located or the module dielectric resonator antenna remotely located. To use either of these options, you need to convert the Fixed Phone Radio Antenna Unit (RAU). If you intend to use the Fixed Phone quadrifilar helix antenna, you will need to modify this antenna as well.

Before you start you will need a kit that contains the following parts:

- RAU Brass Plug with Antenna Cables
- Module ODU or Bracket, Nut, and Washer
- New labels, as required

## **2. Converting the fixed phone Radio Antenna Unit (RAU)**

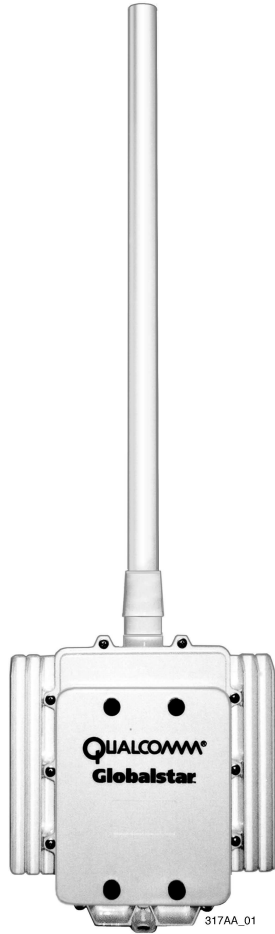
### **2.1 Modifying the Fixed Phone Radio Antenna Unit (RAU) to use the brass plug with antenna cables**

**Caution**

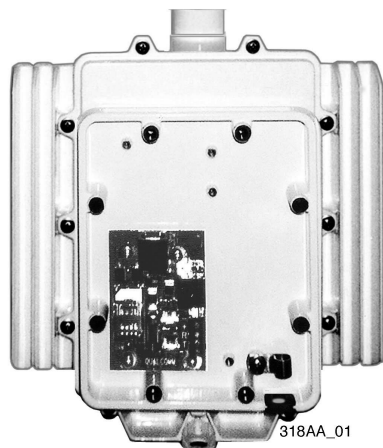
Ensure that proper electrostatic discharge (ESD) equipment is used to avoid damage to circuit cards, modules, and other electronic components.

1. Remove the access cover from the RAU by unscrewing the captive thumbscrews on the front of the access cover at the top and bottom.

RELEASED INTERNAL USE ONLY



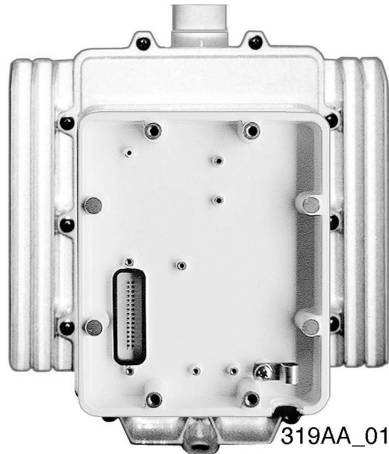
**Figure 1. RAU**



**Figure 2. RAU with access cover removed**

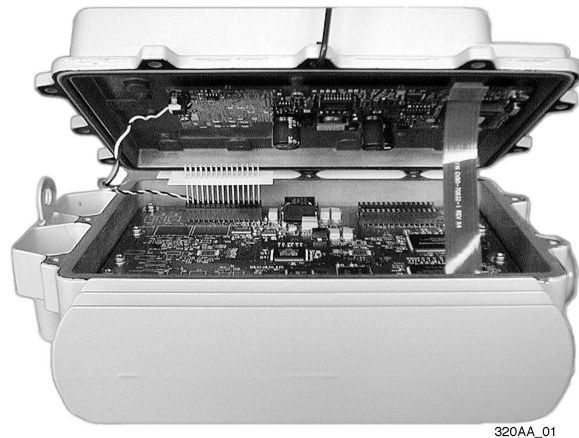
RELEASED INTERNAL USE ONLY

2. Remove the four screws holding the interface CCA in place and slowly lift the interface CCA straight up until it is removed from the pins on the connector under the CCA.



**Figure 3. RAU with interface CCA removed**

3. Unscrew the 11 Phillips head screws, holding the top housing of the RAU in place, and slowly tilt the top housing to the right, being careful not to jerk the two cables between the CCA on the cover and the CCA in the unit.



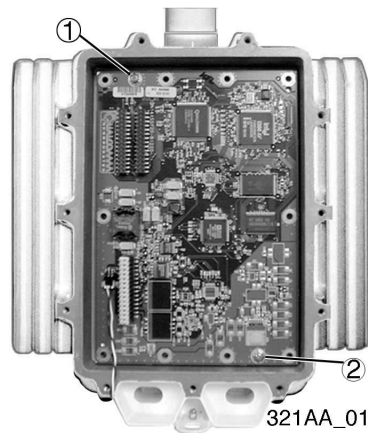
**Figure 4. RAU with top housing tilted**

4. Disconnect the yellow flex ribbon cable by unlocking J1. Disconnect the black and white wire from J5.



**Figure 5. Yellow ribbon and black and white wire disconnected**

5. Place the front housing off to the side with the attached CCA up. Do not remove the CCA from the front housing.
6. Unscrew the 10 Phillips head screws holding the module (two boards on a mounting plate) in place and slowly lift it up to reveal the connections to the antenna. Be careful not to jerk up on the module as this may damage the two cables connected to the boards on the under side of the module.

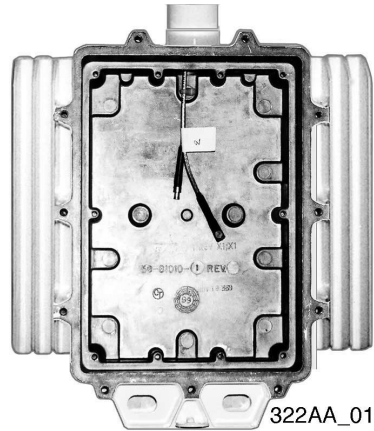


**Figure 6. Module exposed**

**Note**

Do not unscrew the two Phillips head screws that keep the module together. When the antenna is pointed up, this screw is the one in the second position from the left at the top of the module (1) and the second position from the right at the bottom of the module (2).

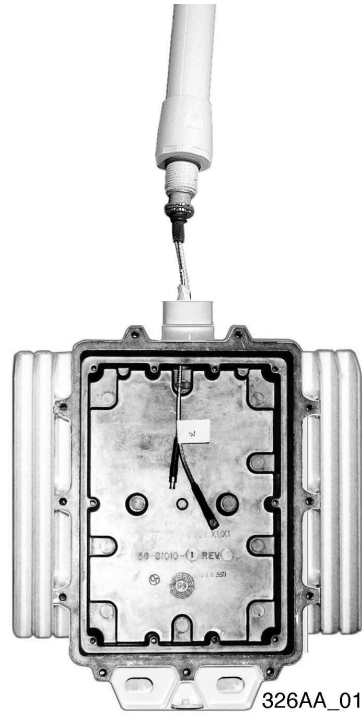




**Figure 7. Back housing with Tx and Rx antenna connectors**

7. Clip the tie.
8. If you plan to reuse the Fixed Phone quadrifilar helix antenna, tag the cable connected to J6 in such a way that you will remember it is the Tx cable.
9. Remove the antenna connectors from J6 (Tx) and J4 (Rx).
10. Unscrew the antenna. It threads out. Carefully remove the antenna from the housing, taking care not to damage the cables as they come through the hole at the top of the housing.

RELEASED INTERNAL USE ONLY



**Figure 8. Threading out the antenna**

11. Take the brass plug, insert it into the rear housing, and screw it in. Torque to 35 ft. lbs.



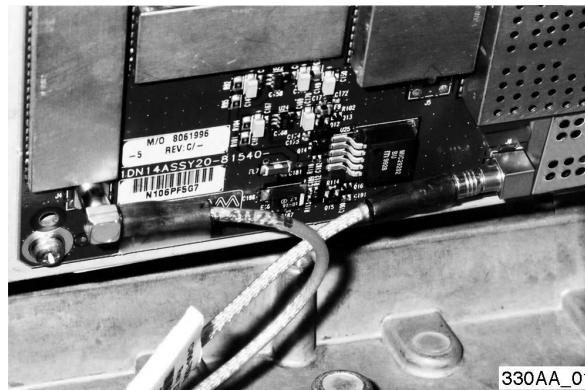
**Figure 9. Inserting the brass plug**

RELEASED INTERNAL USE ONLY

**Note**

It is very important to distinguish between the Tx and Rx cables and connect them correctly. They are marked on the brass plug. Connecting them in reverse can damage the unit.

12. Connect the brass plug connectors to J6 (Tx) and J4 (Rx) on the module, and tie them together with a plastic tie.



**Figure 10. Brass plug connectors connected**

13. Place the module back into the rear housing and screw down the 10 Phillips head screws that hold it in place.

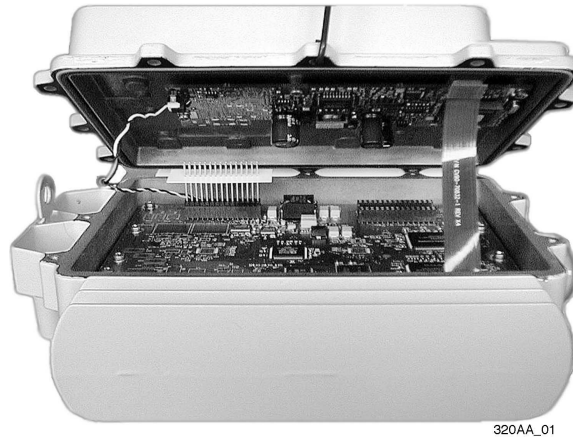


**Figure 11. Module replaced**

RELEASED INTERNAL USE ONLY

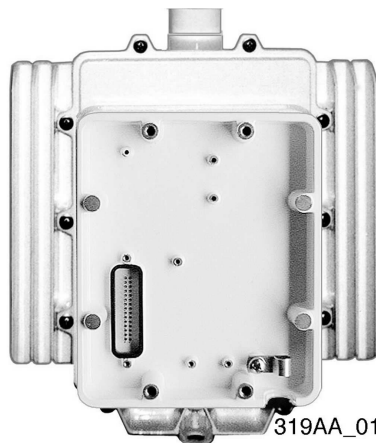
RELEASED INTERNAL USE ONLY

14. Reconnect the module to the top housing by connecting the black and white wire to J5 and securing (push down) the yellow flex ribbon cable to J1.



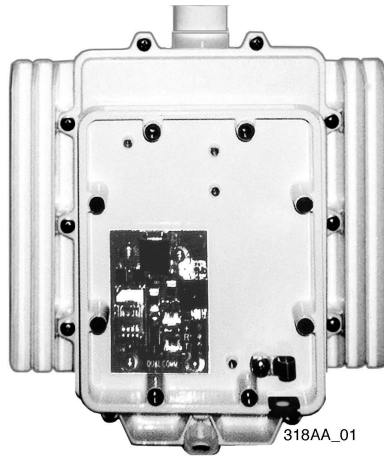
**Figure 12. Module reconnected to top housing**

15. Replace the front housing and the 11 screws.



**Figure 13. RAU top housing replaced**

16. Carefully reinstall the interface CCA making sure the 30-pin connector is correctly located over the 30 pins sticking through the opening in the front housing. Fasten it down with the four screws.



**Figure 14. Interface CCA reinstalled**

17. Place the access cover on the unit and tighten down the four thumbscrews.



**Figure 15. RAU with access cover replaced**

### **3. Modifying your fixed phone antenna**

RELEASED INTERNAL USE ONLY

RELEASED INTERNAL USE ONLY

**Note**

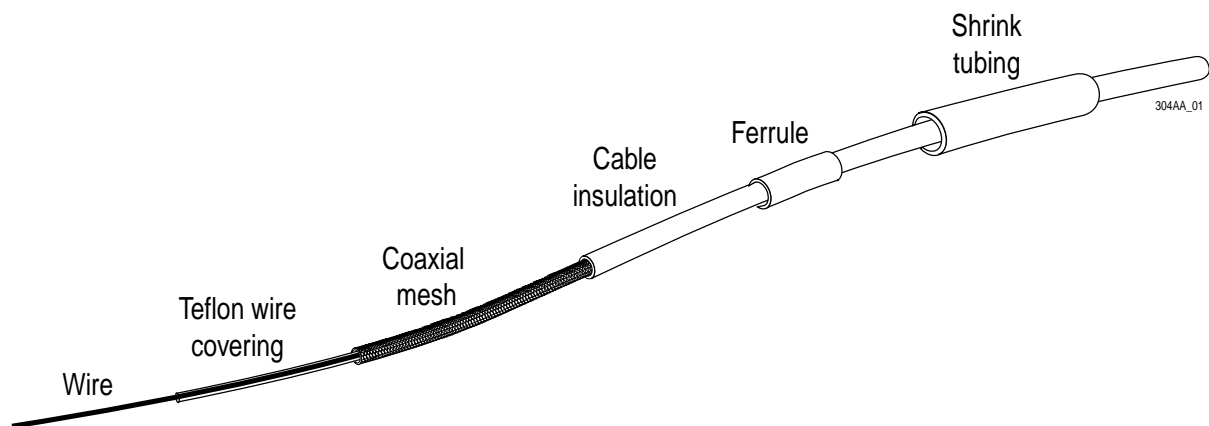
Follow Section 3.1 if you are using the quadrifilar helix antenna for your installation; otherwise go to Section 4.0 if you are using the dome shaped antenna.

### 3.1 Converting the antenna from OSX connectors to SMA connectors

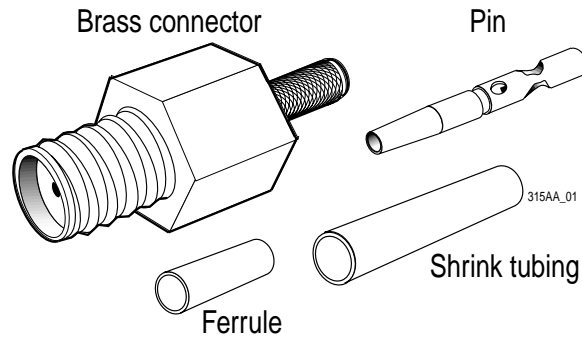
#### 3.1.1 Before you begin

Before you start the conversion, be sure to mark the transmission (Tx) cable on the antenna with a paper tag or in some way so that you will know it is the Tx cable later. This way you will not mix up the cables when changing the connectors. You will need the following parts for the conversion:

- Shrink tubing
- 2 ferrules
- 2 pins
- 2 SMA female connectors
- Tools to strip the wire and crimp the pin and ferrules



**Figure 16. Wire stripped**

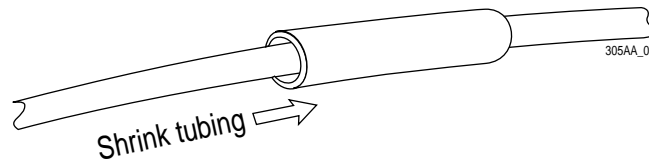


**Figure 17. Parts needed for conversion**

### 3.2 Changing connectors

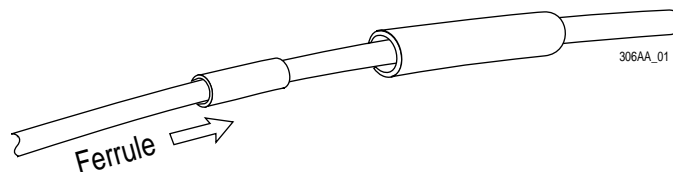
You will be changing the two existing OSX connectors to two identical female SMA connectors.

1. Start by snipping off the connectors on the ends of both wires coming from the antenna. Make sure that both wires are the same length.
2. Once the connectors are snipped off, slip the shrink tubing on each end a little beyond the end of the wire.



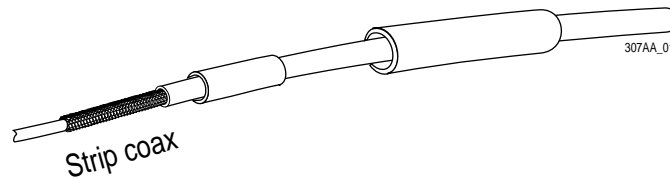
**Figure 18. Shrink tubing**

3. Take two ferrules out of the package and slip one over the end of each cable.



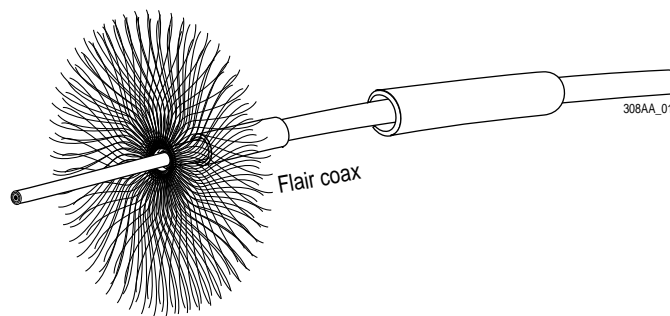
**Figure 19. Ferrule**

4. Before you strip off the insulation jacket on each wire, adjust the wire-stripping tool for the size of the wire so that the wire won't be damaged or nicked.
5. Turn the tool just once so you don't cut through or nick the wire. Strip off the insulation jacket.



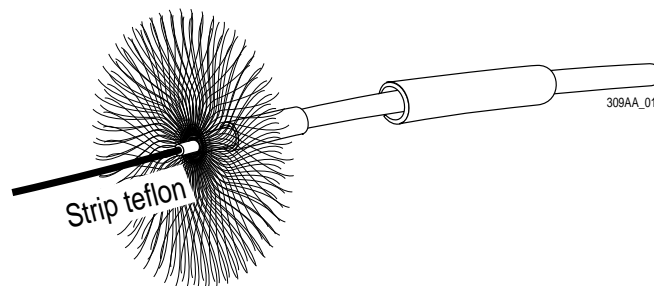
**Figure 20. Insulation jacket stripped off**

6. Flare the ends of the coaxial cable shield.



**Figure 21. Ends of coax flared**

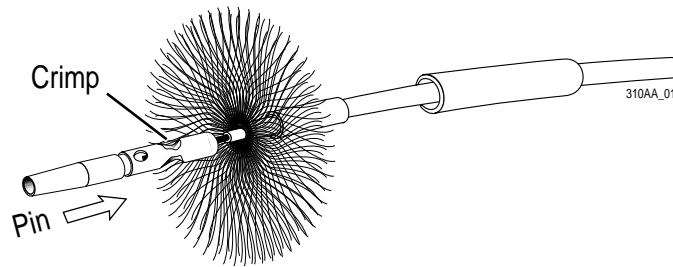
7. Strip off the Teflon inside to get to the wire.



**Figure 22. Teflon stripped off**

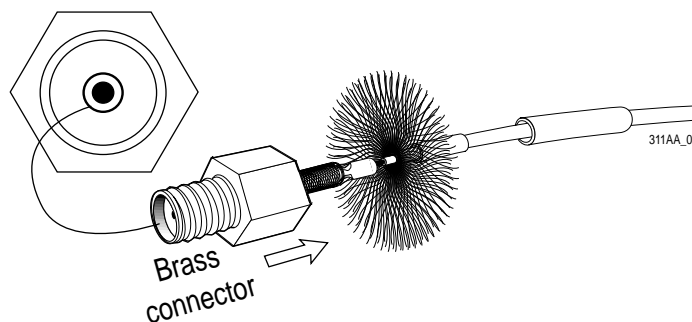
8. Put the pin that goes inside the barrel of the connector over the wire  $\frac{1}{4}$  of an inch from the coax shield. Be sure that you can see the wire in the hole of the pin.





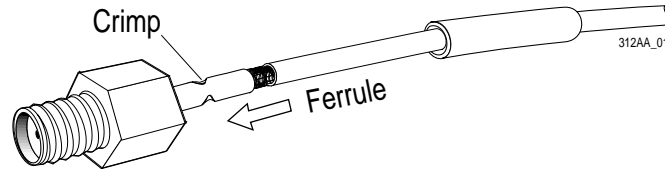
**Figure 23. Pin over wire**

9. Adjust the crimping tool so it makes a proper crimp. If you are using the amp crimp tool, set the tool to number three.
10. Insert the pin in the middle of the crimping tool. Crimp the pin close to its bottom.
11. Take the female connector and push it until you can see the end of the pin in the center hole of the plastic part of the connector. Push down the coax shield over the base of the connector.



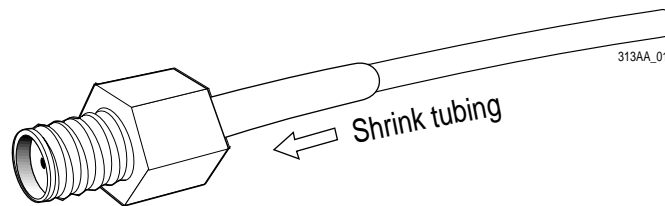
**Figure 24. Female connector on and showing pin inside connector**

12. Adjust the ferrule-crimping tool to ferrule size and put tool on "A" side to crimp the ferrule.
13. Slide the ferrule up to the connector.
14. Check the connector before crimping the ferrule because you can't move the ferrule after you crimp it.
15. Crimp the ferrule in place.



**Figure 25. Crimping the ferrule**

16. Slip the shrink tubing up to the connector over the ferrule. Take the heat device and heat the shrink tubing, turning the heat device around until the shrink tubing shrinks.



**Figure 26. Shrink tubing over ferrule**

### 3.3 Installation cabling requirements

If you are using the bracket and quadrifilar helix antenna for your installation, the following chart will provide you with the appropriate cable type based on your installation length.

**Table 3-1. Cable types for quadrifilar helix antenna**

Cable Type	Min Length (ft.)	Cable Loss	Max Length (ft.)	Cable Loss
LMR-100	8.5ft.	2.7	8.5ft	2.7
LMR-195	8.5ft.	1.2	19ft	2.7
LMR-240	8.5ft.	0.9	26ft	2.7
LMR-300	8.5ft.	0.7	33ft	2.7
LMR-400	8.5ft.	0.5	50ft	2.7

**Note**

In order to maintain proper regulatory performance limits, you must keep the length of your cable within the above referenced minimum and maximum lengths for the cable type used.

If you are using the small dome-like antenna for your installation, the following chart will provide you with the appropriate cable type based on your installation length.

**Table 3-2. Cable types for small dome-like antenna**

Cable Type	Min Length (ft.)	Cable Loss	Max Length (ft.)	Cable Loss
LMR-100	8.5ft	2.7	10.3ft	3.2
LMR-195	16ft	2.3	22ft	3.2
LMR-240	22ft	2.3	31ft	3.2
LMR-300	28ft	2.3	39ft	3.2
LMR-400	43ft	2.3	60ft	3.2

**Note**

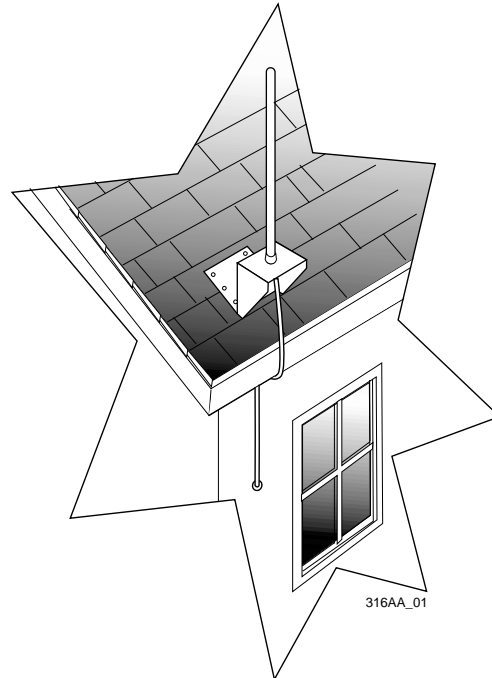
In order to maintain proper regulatory performance limits, you must keep the length of your cable within the above referenced minimum and maximum lengths for the cable type used.

#### 4. Hooking up your Remote Antenna Fixed Phone

**Warning**

Grounding of the entire Remote Antenna Fixed Phone is vital and must be done correctly to protect the RAFP and the people who use it. Be sure to follow the grounding instructions in the QUALCOMM Globalstar GSP 2800/2900 Fixed Satellite Phone Installation Guide.

1. Determine the mounting location for your modified RAU, and mount it following the instructions in the QUALCOMM Globalstar Fixed Satellite Phone Installation Guide (80-98052).
2. Determine a mounting location for your antenna.



**Figure 27. Sample mounting location for RAU and antenna**

**Note**

The brass plug must point towards the sky.

#### **4.1 With quadrifilar helix antenna**

**Caution**

##### **Minimum Separation Distance Requirements**

When the quadrifilar helix antenna (helical antenna) is transmitting, it is necessary that at least a 43 cm (17 inches) line-of-sight separation distance be maintained between the helical antenna and users or bystanders near the Remote Antenna Fixed Phone, above the horizon of the helical antenna (above and to the side of the helical antenna). Maintaining this separation distance will ensure compliance with the maximum permissible exposure (MPE) requirements of the FCC rules and international standards.

1. If you are using the quadrifilar helix antenna, mount the bracket securely to a stable surface so that your antenna will have a clear view of the sky after it is added to the bracket. After the antenna is installed, it should point towards the sky and be perpendicular to the ground.



**Figure 28. Quadrifilar helix antenna, connectors, and bracket**

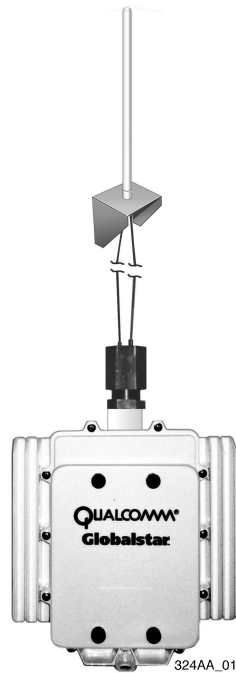
2. Place the threaded base of the quadrifilar helix antenna through the circular hole in the mounting bracket.
3. Place the internal tooth washer on the threaded end of the antenna and screw the nut onto the antenna until it is finger tight. Be careful to tighten the nut but not to over tighten it as this can cause the antenna plastics to crack.
4. Measure the distance between the RAU and the antenna and select the appropriate cable type and length from the chart. See Table 3-1.
5. Screw the SMA connector on one end of the cable to the Tx SMA connector on the top of the brass plug on the RAU.
6. Screw the SMA connector on the other end of the cable to the Tx SMA connector on the end of the Tx cable coming out of the antenna.
7. Repeat steps 5 and 6 for the Rx connection.

**Note**

Do not cross your connections as this can damage your unit.

8. Dress and tie down your cables.

9. Apply power to and test your unit per the instructions in the installation guide.



*Figure 29. Remote Antenna Fixed Phone with quadrifilar helix antenna*

## 4.2 With dome-shaped antenna

### **Caution**

#### **Minimum Separation Distance Requirements**

When the dome-shaped antenna (ODU antenna) is transmitting, it is necessary that at least a 53 cm (20.9 inches) line-of-sight separation distance be maintained between the ODU antenna and users or bystanders near the Remote Antenna Fixed Phone, above the horizon of the ODU antenna (above and to the side of the ODU). Maintaining this separation distance will ensure compliance with the maximum permissible exposure (MPE) requirements of the FCC rules and international standards.

1. If you are using the dome-shaped antenna, mount it in the desired location in such a way as to allow access to the two SMA connectors coming out of the bottom of the antenna.



**Figure 30. Dome-shaped antenna**

2. Measure the distance between the RAU and the dome-shaped antenna and select the appropriate cable type and length from the chart. See Table 3-2.
3. Screw the SMA connector on one end of the cable to the Tx SMA connector on the top of the brass plug on the RAU.
4. Screw the SMA connector on the other end of the cable to the Tx SMA connector on the end of the Tx cable coming out of the dome shaped antenna.
5. Repeat steps 3 and 4 for the Rx connection.
6. Dress and tie down your cables.
7. Apply power to and test your unit per the instructions in the installation guide.



**Figure 31. Remote Antenna Fixed Phone with dome-shaped antenna**

RELEASED INTERNAL USE ONLY

RELEASED INTERNAL USE ONLY



**This page intentionally left blank.**

RELEASED INTERNAL USE ONLY