Install the GPS Antennas

This procedure describes how to install two Zyfer GPS antennas on top of 1-inch-diameter, hollow pipes using the supplied hardware. Consult your field engineering package (FEP) for any site-specific GPS antenna installation requirements.

The NPM basestation uses two GPS antennas for redundancy purposes—they do not affect each other's operation and they can be installed in close proximity to each other.

Figure 4.20 shows the Zyfer GPS antenna assembly.

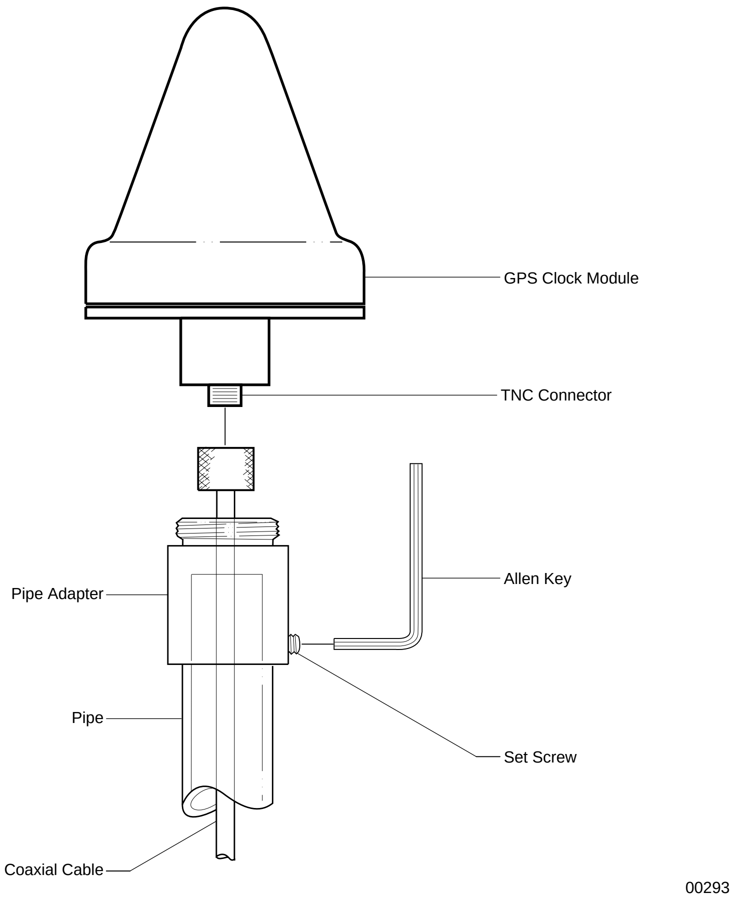


Figure 4.20 GPS Antenna Assembly

Before You Begin

Before you begin to install the GPS antennas:

- Select an installation location away from any objects that might obstruct satellite visibility to 10° of the horizon. Obstructions may cause a degradation of the GPS clock module's performance.
- Ensure that the type and length of cabling used to connect the GPS antenna to the GPS clock module meets your attenuation and shielding requirements.

To install the GPS antennas

1. Run the two coaxial cables supplied with each antenna from the NPM racks to the intended location of the GPS antennas, such as the basestation's roof or tower.

   NOTE: Ensure that the cable remains clear of any sources of potential interference, such as transmitting equipment or power lines.

2. Vertically install two 1-inch-diameter pipes in a location that provides the maximum unobstructed view of the sky.
3. Run a coaxial cable through the center of each pipe.
4. Attach a pipe adapter to the top of each pipe. Ensure that the pipe adapters are connected tightly to the pipes by tightening the set screw. Use a 5/32-inch Allen key to tighten the set screw.
5. Attach a GPS antenna to the end of each coaxial cable.

   The GPS antennas use female TNC connectors.
6. Attach the GPS antennas to each pipe adapter.

Install the Main and Diversity Antennas

This procedure describes the general process for installing the main and diversity antennas. Consult your field engineering package (FEP) for any site-specific antenna installation requirements.

Figure 4.21 shows the configuration of the main or diversity antenna).

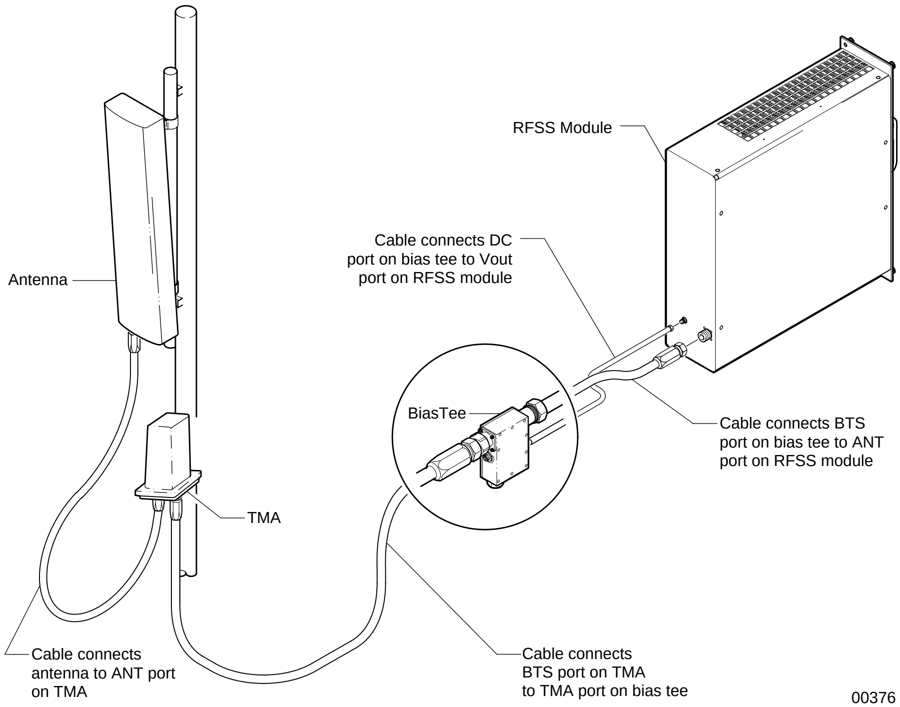


Figure 4.21 RFSS with TMA Antenna Configuration

Before You Begin

Before you install the antennas:

- Select an installation location away from any objects that might obstruct the RF signals. Although the NPM basestation has non-line-of-site RF capability, obstructions may reduce the strength of the transmission or reception signals.
- Ensure that the type and length of cabling used to connect the main and diversity antennas to the RFSS modules meet your attenuation and shielding requirements.

To install the main and diversity antennas

1. Verify that you have the right type of antennas, both in terms of frequency and direction.
2. Run the antenna cable from the NPM racks to the intended location of each antenna. See your field engineering package (FEP) and installation MOP for antenna cable specifics.

NOTE: Ensure that the cable remains clear of any sources of potential interference, such as transmitting equipment or power lines.

3. Attach each antenna to your tower or building using the required mounting hardware.
4. Orient each antenna to the correct azimuth (direction) and tilt. See your field engineering package (FEP) to determine the antenna's correct orientation.

CAUTION: Failure to orient the antennas according to the specifications listed in the installation MOP may seriously affect the performance of your wireless network.

5. Tighten and secure each antenna.
6. Connect the antenna to the RFSS module:

   i. Install each TMA within 3 m (10 feet) of its antenna. The TMAs should be installed as close to the antennas as possible in order to ensure optimal NPM performance. Consult the documentation that ships with the TMA for the correct mounting procedures.

   ii. Connect the ANT port on each TMA to its antenna using a suitable coaxial cable. Torque each 7/16 DIN connector to 17 foot-pounds and ensure each connector is properly weatherproofed.

CAUTION: Do not over-tighten connectors. Overtightening the connectors may damage the cable and degrade the RF signal.

   iii. Install each bias tee (also called a CIN) inside or outside the basestation building, as specified in your field engineering package (FEP). Connect the ANT port on each bias tee to the BTS port on each TMA. Torque each 7/16 DIN connector to 17 foot-pounds and ensure each connector is properly weatherproofed.

CAUTION: Do not over-tighten connectors. Overtightening the connectors may damage the cable and degrade the RF signal.

iv Connect the BTS port on each bias tee to the ANT port on each RFSS module. The ANT port is located on the rear side of the RFSS module.

v Connect the CIN port (also called Vout) on the rear side of the RFSS module to the DC port on the bias tee.

Measuring VSWR and Return Loss

Voltage standing wave ratio (VSWR) is a ratio of the maximum to minimum voltage as measured along the length of a mismatched RF transmission line. VSWR indicates the level of impedance matching between RF equipment (such as amplifiers, cabling, and antennas). When the impedances of the RF equipment are mismatched, some of the RF energy is reflected back along the transmission line. Reflected energy causes inefficiencies in the transmission power output.

A VSWR of 1:1, as measured from antenna cable to the antenna, indicates that 100% of the power output is being radiated by the antenna. During a cable sweep, Amosphere RF equipment should show a VSWR of 1.5:1 or less, as measured from 1850–1990 MHz. A VSWR greater than 1.5:1 indicates potential problems with the RF equipment.

A high VSWR may be caused by one or more of the following conditions:

- Moisture in the external cables or connectors
- Faulty equipment
- Poor connections between components
- Damaged cables or connectors
- An open- or short-circuit in RF equipment or cables

Return Loss

Return loss is closely related to VSWR. Return loss is a measure in decibels (dB) of the ratio of forward to reflected power. For example, if a load has a return loss of 10 dB, then 1/10 of the forward power is reflected. The higher the return loss, the less energy is being reflected.

Table 4.19 shows the correlation between VSWR, return loss, and the percentage of reflected power.

VSWR	Return Loss (dB)	Power Being Reflected (%)
1:1	N/A (infinite value)	0
1.25:1	19.1	1.2
1.5:1	14	4.0
1.75:1	11.3	7.4
2:1	9.5	11.1
5:1	3.5	44.7
N/A (infinite value)	0	100.0

Table 4.19 VSWR, Return Loss, and Reflected Power Conversions

To measure the VSWR of RF equipment

1 Power on and calibrate your cable sweep analyzer.

2 Power off the RFSS module connected to the RF equipment you want to test.

See page 116 for a list of circuit breakers.

3 Carefully disconnect the RF equipment and cables you want to test.

WARNING: Extreme care must be taken when connecting or disconnecting the coaxial antenna cable to avoid damage to the center pins. Connectors should be torqued to a maximum of 17 foot-pounds and be free of dirt or moisture. Do not over-torque the connectors as this can damage the center pin and cause cable faults and other RF problems.

4 Connect the cable sweep analyzer to the equipment and cables you want to test.

> **NOTE:** Be careful not to damage any cables or connectors when connecting the analyzer to the RF equipment.
>
> Due to the use of the tower-mounted amplifier (TMA), all cable sweeps must measure the total length of the cable run (including all connectors, jumpers, and CIN), using a DIN adapter (female-female) in place of the TMA.

5 Perform the cable sweeps.

See the documentation that comes with your analyzer for information about performing the cable sweep and interpreting the results.

6 Record the results from the cable sweeps according to the MOPs of your site. Keeping records of periodic cable sweeps makes troubleshooting future problems easier.

7 Carefully disconnect the analyzer from the RF equipment.

8 Reconnect the RF equipment and cables back to the RFSS module.

9 If any of the connectors are outdoors, ensure that they are resealed according to the procedures of your site.

10 Reconnect the RF equipment to the RFSS module.

11 Power on the RFSS module. See page 116 for a list of circuit breakers.

Measuring the Distance to a Fault

Distance to fault (DTF) is a measurement of VSWR or return loss based on distance. A DTF test indicates the distance to a short, open, or load. Perform a DTF test whenever a VSWR test reveals that the antenna system is not operating within specifications.

To accurately interpret the results from a DTF cable sweep, you need to know the lengths of your cables and the location of any devices or connectors attached to those cables. Comparing the results of the test with the layout of your antenna system will help you to determine if problems are caused by faulty devices, connectors, or cables.

To measure the distance to fault

1. Power on and calibrate your cable sweep analyzer.
2. Power off the RFSS module connected to the RF equipment you want to test. See page 116 for a list of circuit breakers.
3. Carefully disconnect the RF equipment and cables you want to test.
4. Connect the cable sweep analyzer to the equipment and cables you want to test.

   NOTE: Be careful not to damage any cables or connectors when connecting the analyzer to the RF equipment.

5. Perform the cable sweeps.

   See the documentation that comes with your analyzer for information about performing the cable sweep and interpreting the results.
6. Document the results from the cable sweeps according to the MOPs of your site. Keeping records of periodic cable sweeps will make troubleshooting future problems easier.
7. Carefully disconnect the analyzer from the RF equipment.
8. Reconnect the RF equipment and cables back to the RFSS module.

   If any of the connectors are outdoors, ensure that they are resealed according to the procedures of your site.
9. Power on the RFSS module. See page 116 for a list of circuit breakers.

Chapter 5

POWER-ON PROCEDURES

This chapter provides step-by-step procedures for powering on the NPM basestation and verifying basic functionality.

Contents

Power On the Basestation

The power for the NPM basestation is controlled by circuit breakers in the PDP, located at the top of each rack. Each power supply, RFSS module, cooling unit, and GPS clock module has its own circuit breaker, which means it can be powered on and off independently of the other devices.

To power on the basestation

1. Ensure that your main +24V DC power supply is powered on and is providing a power source that meets the electrical requirements listed on page 29.
2. Power on the upper and lower cooling units. On each rack, set breakers CB 01 and CB 14 to the ON (up) position.

   The fans will start turning. If the fans do not start, ensure that the SGNL port on each cooling unit is connected to the alarm wiring card. The fans will turn only when the alarm cable is present.
3. Power on each power supply in the utility and radio shelves separately.

> **NOTE:** The red OUTPUT FAIL light on each power supply turns off within 3 s. If the OUTPUT FAIL light remains on or flickers continuously, power down the shelf immediately and replace the power supply.
>
> Table 5.1 shows the circuit breakers for each power supply.

Power Supply	Circuit Breaker
Bottom radio shelf, left power supply (slots 0–1)	Radio rack PDP, CB 02
Bottom radio shelf, middle power supply (slots 2–3)	Radio rack PDP, CB 03
Bottom radio shelf, right power supply (slots 4–5)	Radio rack PDP, CB 04
Middle radio shelf, left power supply (slots 0–1)	Radio rack PDP, CB 05
Middle radio shelf, middle power supply (slots 2–3)	Radio rack PDP, CB 06
Middle radio shelf, right power supply (slots 4–5)	Radio rack PDP, CB 07
Top radio shelf, left power supply (slots 0–1)	Radio rack PDP, CB 08
Top radio shelf, middle power supply (slots 2–3)	Radio rack PDP, CB 09
Top radio shelf, right power supply (slots 4–5)	Radio rack PDP, CB 10
Utility shelf, left power supply (slots 0–1)	Radio rack PDP, CB 11
Utility shelf, middle power supply (slots 2–3)	Radio rack PDP, CB 12
Utility shelf, right power supply (slots 4–5)	Radio rack PDP, CB 13

Table 5.1 Utility and Radio Shelf Power Supply Circuit Breaker Summary

4 Power on the GPS clock module by setting CB 15 to the ON (up) position.

The GPS clock module will perform its internal diagnostics and begin to acquire and track satellites. It may take up to 30 min for the GPS receivers to acquire a rough position and time. The accuracy of the receivers improves as the satellites are tracked.

See *AccuSync-R GPS Synchronized Time and Frequency Instrument User's Manual (377-8006),* available from Zyfer Inc., for information about the GPS clock module.

5 Power on each RFSS module in the RF rack separately. Table 5.2 shows the circuit breakers for the RFSS modules.

RFSS Module	Circuit Breaker
RF shelf 0, RFSS module 0	RF rack PDP, CB 02
RF shelf 0, RFSS module 1	RF rack PDP, CB 03
RF shelf 0, RFSS module 2	RF rack PDP, CB 04
RF shelf 0, RFSS module 3	RF rack PDP, CB 05
RF shelf 1, RFSS module 0	RF rack PDP, CB 06
RF shelf 1, RFSS module 1	RF rack PDP, CB 07
RF shelf 1, RFSS module 2	RF rack PDP, CB 08
RF shelf 1, RFSS module 3	RF rack PDP, CB 09
RF shelf 2, RFSS module 0	RF rack PDP, CB 10
RF shelf 2, RFSS module 1	RF rack PDP, CB 11
RF shelf 2, RFSS module 2	RF rack PDP, CB 12
RF shelf 2, RFSS module 3	RF rack PDP, CB 13

Table 5.2 RFSS Module Circuit Breaker Summary

If the basestation has already been configured in the OAMP software, the basestation will automatically start its call processing and enable the SOMA Air Interface. Any SOMAports powered on within the supported sectors will acquire the basestation and establish a connection.

If the basestation has not been configured in the OAMP software, the red error lights on the PDPs and the RFSS modules will light up. The basestation will not enable the SOMA Air Interface.

6 After powering on the basestation, proceed to Chapter 6, "On-Site Software Installation and Configuration Procedures" for procedures on optimizing the cards.

Chapter 6

On-Site Software Installation and Configuration Procedures

This chapter describes how to optimize the individual cards in the NPM basestation and explains the remaining steps required to make the basestation fully operation.

Contents

Optimize the GPS Clock Module

To ensure accurate timing, you must optimize the operation of the GPS clock module. Optimizing the operation of the GPS clock module involves compensating for the signal delay caused by the length of the GPS antenna wiring.

Consult with your cable manufacturer for the delay characteristics of your cable type. You need to express the delay values in nanoseconds per meter (ns/m).

NOTE: Different lengths and types of cables may be used, as long as the signal loss at 1575 MHz is less than 30 dB.

See the *Zyfer AccuSync-R GPS Synchronized Time and Frequency Instrument User's Manual* for the average delay values of common types of GPS antenna cabling.

In order to use a standard serial cable when connecting a terminal, you require a custom adapter. Figure 6.1 shows the wiring and connections for the custom adapter.

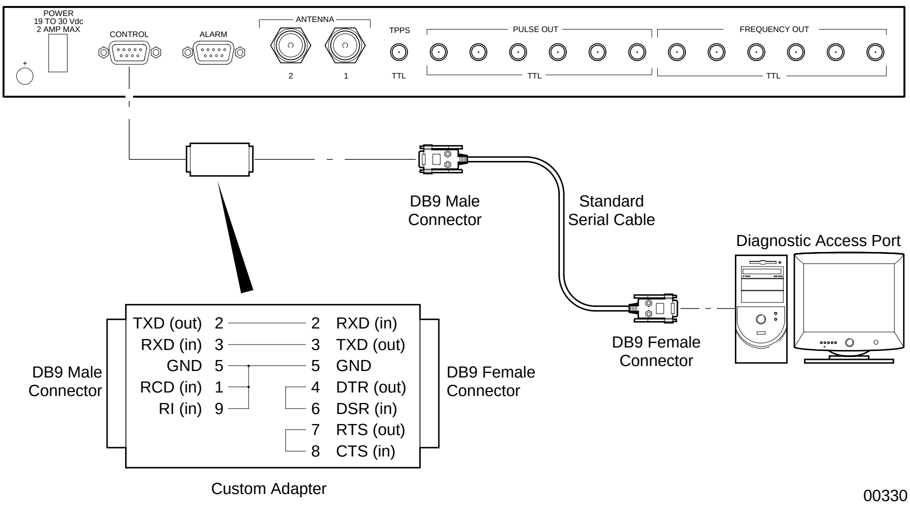


Figure 6.1 GPS Serial Interface Adapter

To optimize the GPS clock module

1. Connect a PC to the GPS clock module using a custom adapter and a standard serial cable.

   NOTE: Using a standard serial or null modem cable without a custom adapter will not work.

2. Start a serial terminal session using the settings shown in Table 6.1.

Parameter	Setting
Baud	9600 bits/s
Data bits	8
Parity	None
Stop bits	1
Flow control	None
ASCII setup	Send linefeeds, local character echo on

Table 6.1 GPS Clock Module Serial Port Settings

   NOTE: See the *Amosphere NPM Maintenance Procedures* for additional information about connecting a serial terminal to the GPS clock module.

3. Calculate the cable delay by multiplying the total cable length by the delay value. For example, if the delay value of the cable is 4.36 ns/m and there is 15 m of cable, then the cable delay would be 15 m x 4.36 ns/m = 65.4 ns. Round the result to the nearest nanosecond. In this case, the result would be 65 ns.

4. Set the cable delay for the first GPS plug-in module. This example uses a cable delay of 65 ns. Replace the 65 in the following command with your own calculated cable delay value:

   $ANT1,65* ↵

5. Set the cable delay for the second GPS plug-in module. Again, replace the 65 in the following command with your own calculated cable delay value:

   $ANT2,65* ↵

   The GPS clock module briefly enters coasting mode as it recalculates its position.

Configure the Ethernet Switches

In order to operate in the NPM basestation, the Ethernet switches require custom settings. You need to configure the Ethernet switches only once; the configuration is stored in the switch's nonvolatile memory.

You can connect to the Ethernet switch by connecting a custom serial cable with a null modem adapter to the console port located on the front panel.

Figure 6.1 shows the connections for the Ethernet switch serial cable.

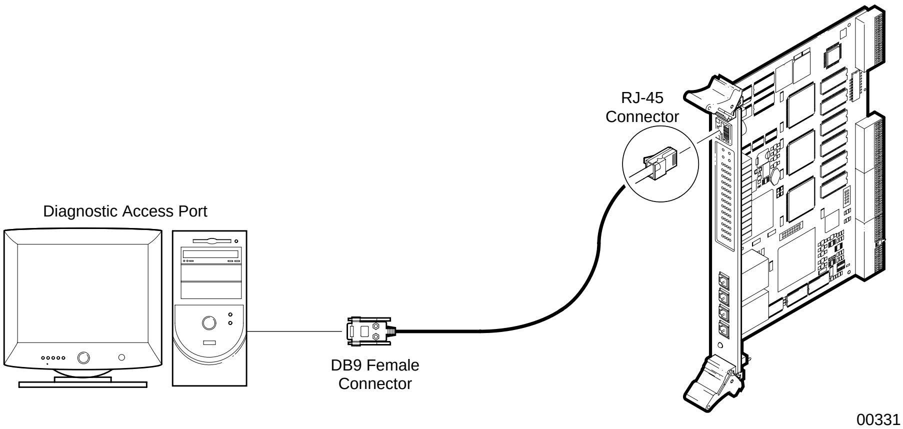


Figure 6.2 Ethernet Switch Serial Cable

Table 6.2 shows the pin assignments for the RJ-45 serial connector.

RJ-11 Pin Number	Signal Name	DCE DB-9 Connector Number Equivalent	DCE DB-9 Connector Number Equivalent
1	—	—	—
2	GND	5	5
3	RX	3	2
4	TX	2	3
5	GND		
6	—	—	—

Table 6.2 Ethernet Switch RJ-45 Serial Connector Pin Assignments

To configure the Ethernet switches

1 Establish a serial connection with the Ethernet switch:

i Connect a PC to the Ethernet switch using the supplied RJ-11 to DB-9 serial cable with a null modem adapter. See Table 6.2 for pin assignments.

ii Start a serial terminal session using the settings shown in Table 6.3.

Parameter	Setting
Baud	9600 bits/s
Data bits	8
Parity	None
Stop bits	1
Flow control	None

Table 6.3 Ethernet Switch Serial Port Settings

2 Log in to the Ethernet switch.

3 Restore the default settings for the Ethernet switch by typing:

```
switch defaults ↵
```

The Ethernet switch reboots.

4 Log in to the Ethernet switch.

5 Configure the switch by typing:

```
port config 1-2 off 100 full false ↵
port config 3-24 off 100 half false ↵
span port enable 1-26 on ↵
span port fast 1-26 on ↵
bootp enable off ↵
dhcp server enable off ↵
dhcp client enable switch_name off ↵
cos queuing algorithm strict ↵
cos queuing map 0 0 ↵
cos queuing map 1 0 ↵
cos queuing map 2 0 ↵
cos queuing map 3 0 ↵
cos queuing map 4 1 ↵
cos queuing map 5 2 ↵
cos queuing map 6 3 ↵
cos queuing map 7 3 ↵
gvrp enable off ↵
ip config switch_name switch_ip_address 255.255.255.0 1 ↵
ip gateway router0-0_ip_address ↵
tftpd sessions 0 ↵
save ↵
```

save ↵
save ↵

where:

switch_name is either sw0 or sw1
switch_ip_address is the IP address of the Ethernet switch
router0-0_ip_address is the IP address of the primary router

6 Reboot the Ethernet switch by typing:

switch reset ↵

7 Repeat steps 1 to 6 for the other Ethernet switch.

Post-Installation Activities

After the installation of the NPM basestation is complete, the following steps may be required in order to make the basestation fully functional:

- **Upgrade the NPM software** – Amosphere NPM software is typically pre-installed at the factory. It may be necessary to upgrade the software to achieve full functionality. See the *Amosphere OAMP Guide* for information about installing new software loads.
- **Commission the basestation in the OAMP software** – The basestation must be added to the Amosphere network in the Configuration Management (CM) tool. Adding the basestation involves configuring the new NPM subnet as well as setting the operating parameters. See the *Amosphere OAMP Guide* for information about using the CM tool.
- **Configure and optimize RF settings** – To permanently enable the air interface, you must configure the RF settings in the CM tool. With the CM tool, you can enable the antennas, select the broadcast frequency, and optimize the output power. See the *Amosphere OAMP Guide* for information.

  For testing purposes during initial deployment, you can use the radio sector controller's `ifcrd_cfg` command to quickly configure and enable the air interface. Changes made with `ifcrd_cfg` are temporary and are lost if the radio sector controller is rebooted or powered off. See the *Amosphere Maintenance Procedures* for more information.

Appendix A

NPM DECOMMISSIONING

This appendix describes how to safely take an NPM basestation out of service.

Contents

Decommissioning a Basestation

Decommissioning occurs whenever a basestation is taken out of service or moved to a new location.

WARNING: Ensure that the necessary requirements and procedures have been reviewed prior to the start of any power-related activity. Refer to your power cut-over MOP for procedures specific to your site.

To decommission a basestation

1 Shutdown the radio sector controllers:

i Establish an SSH session with each card, as described in the *Amosphere Maintenance Procedures*.

ii Shutdown each card by typing:

`shutdown now` ↵

2 Shutdown the application hosts using the procedure described in step 1.

3 Shutdown the standby utility bus controller using the procedure described in step 1.

A utility bus controller is in standby mode when the USR2 status light is off.

4 Shutdown the active utility bus controller using the procedure described in step 1.

A utility bus controller is in active mode when the USR2 status light is green.

5 Power off the basestation by setting CB01 through CB14 to the OFF (down) position.

6 Power off the main power supply for the basestation. With most power bays, circuit breakers control the three +24V DC feeds to each rack. Ensure that the main power is removed for both the radio and RF racks.

See the documentation that accompanies your main power supply for specific instructions on powering off the +24V DC feeds to the basestation.

After the main power supply is powered off, it is safe to prepare the racks for shipment or storage.

7 Package the racks according to the procedures specific to your site. If you remove the cards from their shelves, ensure that the cards are stored in antistatic packaging and that the required documentation is included.

Appendix B

ADDING ADDITIONAL SECTORS

This appendix describes how to add additional sectors to an NPM basestation to increase capacity.

Contents

Pre-Upgrade Preparation

Before you begin upgrading the NPM basestation, ensure that the following preparations are performed. These preparations are intended to minimize the interruption of service.

Site-Specific Documentation

Before upgrading the basestation, ensure that the documentation described in Table B.1 is updated, reviewed, and verified.

Document	Description
field engineering package (FEP)	Provides site-specific configuration about the basestation, such as antenna orientation, cabling requirements, and inventory
Method of Procedure (MOP) for adding sectors	Describes the sequence and timing of procedures required for the upgrade
Site-specific fall-back plan	Describes any events or triggers that require that the technicians return the basestation to its original configuration.

Table B.1 Sector Upgrade Documentation Requirements

RF Planning

RF planners should develop a preliminary RF plot of the new sector configuration that accounts for the location of existing and future users. A change in antenna sector layout may affect the RF planning for the entire network.

After the RF plot is finalized, it should be added to the field deployment (E1) package.

Install Additional Antennas and Cabling

Install the new antennas and associated cabling. Each new sector requires two antennas (main and diversity). See "Install the Main and Diversity Antennas" on page 108 for information.

After installing the antennas and cabling, perform a cable sweep on each and ensure results are within the specifications defined in the field deployment (E1) package.

HVAC Requirements

Ensure that the heating, ventilation, and air-conditioning (HVAC) system for the site has the capacity to handle the additional heat produced by the additional sectors. See "Heat Output" on page 28 for information.

Main and Backup Power Supplies

Ensure that the power supplies for the site have the capacity to handle the additional sectors. See "Electrical Requirements" on page 29 for information. Additional rectifier modules must be installed and tested prior to basestation upgrading.

Backhaul Capacity

Verify that the backhaul connecting the basestation to the network core has the capacity to handle the additional traffic.

Edge and Core Router Capacity

If the backhaul is upgraded, the edge and core routers may require changes to their physical interface cards (PIC). Any changes must be implemented and tested prior to basestation upgrading.

Adding Sectors to a Basestation

This procedure describes how to add additional sectors to a basestation. See your updated field engineering package (FEP) for site-specific information about the upgrade.

To add sectors to a Basestation

1. Install any additional radio shelves. See "Attach the Radio Shelves to the Radio Rack" on page 70.
2. Install any additional CompactPCI power supplies for the radio shelves. See "Insert CompactPCI Power Supplies" on page 82.
3. Install the additional cards. See "Insert the Radio and Utility Shelf Cards" on page 85.
4. Cover any unused card slots with filler panels. See "Cover Unused Card Slots" on page 87.
5. Install the additional RFSS modules. See "Install the RFSS Modules" on page 74.
6. Cover any unused RFSS module slots with filler panels. See "Cover Empty RFSS Slots" on page 75.
7. Install the power, Ethernet, signal, clock, and RF cabling for the new sectors. See "Connecting the Cables" on page 89.
8. Perform a quality audit on the basestation hardware as described in the field deployment (E1) package.
9. Review the condition of the status lights to ensure correct operation. See the *NPM Maintenance Procedures* for information.

Performing the Cutover and Power-On

Switching to the new antenna configuration will result in a service interruption. The cutover should occur during a scheduled maintenance window.

CAUTION: Before performing this procedure, ensure that a quality audit has been performed on the system, as described in “Adding Sectors to a Basestation” on page 132.

This procedure will cause a service interruption. During this procedure, all SOMAports in the affected sectors will be forced to reacquire.

Estimated time of service interruption: 10 min
Estimated time to completion: 30 min

To perform the cutover and power-on

1. Power off the RFSS modules. See “Power On the Basestation” on page 116 for information about RFSS module circuit breakers.
2. Disconnect the antenna cables from the old antennas.
3. Connect the new antennas.
4. Power on the RFSS modules.
5. Perform the acceptance test plan (ATP) to ensure correct operation and functionality. See “Acceptance Test Plan for Basestation Upgrade” on page 134 for information.

Acceptance Test Plan for Basestation Upgrade

After completing the upgrade, review the acceptance test plan (ATP) to verify the functionality and performance of the new configuration.

Site Coverage Verification

Immediately after performing the cutover and quality audit, verify the RF site coverage to identify possible problems with the antenna subsystem, such as antenna radiation patterns, azimuth, tilt, or cabling errors.

Coverage verification includes performing a drive test on non-service-affecting channels, such as the pilot channel (PICH). Service interrupt may be required if adjustments to the antenna subsystem are required.

Voice and Data Functionality and Performance

The ATP should include procedures that test the functionality and performance of the voice and data services.

RF Network Coverage Optimization

RF network coverage optimization should be performed after the upgrade is completed for all planned sites within the market area in order to secure high service quality and subscriber satisfaction.

Network optimization typically requires:

- Monitoring network statistics to identify areas or users with service quality degradation
- Drive testing (pilot channel scan) to identify areas with coverage problems

Collected data should be analyzed and, if necessary, appropriate site configuration changes implemented (such as antenna orientation, down tilt, base station power setting, individual channel power allocation, or parameter tuning).

In situations where a configuration change for a large number of sites is planned, sector upgrades should occur in several phases. The entire network should be divided in clusters of sites and sectorization performed for each cluster individually. Coverage optimization should be performed for each cluster after sectorization is completed. Network wide optimization will be performed after entire network is reconfigured.

Appendix C

DISCONTINUED NPM EQUIPMENT

This appendix describes the cards used in previous release 1.2 version of the NPM basestation. The cards are compatible with the current release.

Contents

ZT5550 Configuration

The ZT5550 is used in release 1.2 equipment for the utility bus controllers and radio sector controllers. It may be necessary to modify the configuration switches on the ZT5550, as the basestation uses a configuration of these cards that differs from the manufacturer's original settings.

NOTE: If the controller cards are pre-installed in the shelves, then they have already been configured and this procedure is not required.

Table C.1 shows the correct settings of the configuration switches.

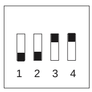
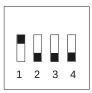
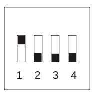
Switch	Setting	Appearance	Description
SW3	SW3-1: ON SW3-2: OFF SW3-3: OFF SW3-4: OFF	Closed (ON)  Open (OFF)	SW3-1 and SW3-2 enable battery-backup of the CMOS memory. SW3-1 must be left ON; SW3-2 must be left OFF. The other switches must be left OFF.
SW4	SW4-1: OFF SW4-2: OFF SW4-3: ON SW4-4: ON	Closed (ON)  Open (OFF)	SW4-1 and SW4-2 route Ethernet channels to the location set in the BIOS. These switches must be left OFF. The other switches must be left ON.
SW5	SW5-1: ON SW5-2: OFF SW5-3: OFF SW5-4: OFF	Closed (ON)  Open (OFF)	SW5-1 causes the card to boot its BIOS from the on-board flash memory. This switch must be left ON. The other switches must be left OFF.
SW6	SW6-1: ON SW6-2: OFF SW6-3: OFF SW6-4: OFF	Closed (ON)  Open (OFF)	SW6-1 enables console redirection for the serial port and must be left ON. The other switches are software-defined and must be left OFF.

Table C.1 ZT5550 Card Configuration Switch Settings

To configure the ZT5550 cards

1 Remove cards from their antistatic packaging at a grounded work area. Ensure that you are properly grounded with a wrist or boot strap before handling the cards. Depending on the configuration of your basestation, you may have up to eight cards that need to be configured.

2 On each card, set the SW6-1 switch to the closed (ON) position. Figure C.1 shows the location of the switch.

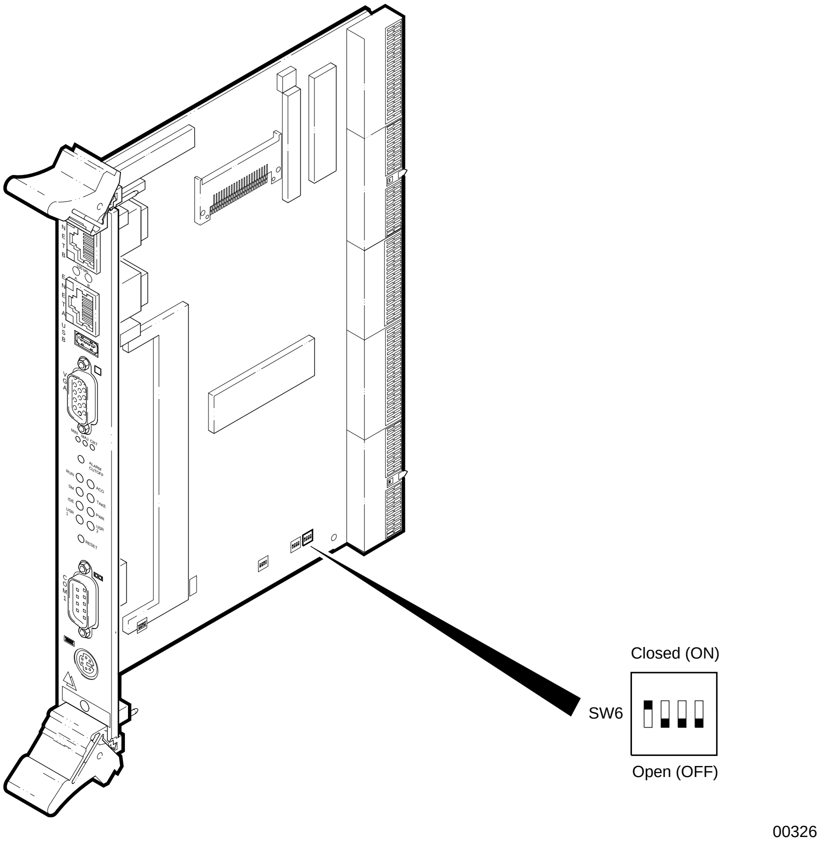


Figure C.1 Controller Card Switch Configuration

3 Ensure that the other switches are configured as shown in Table C.1.

4 Place the cards back in their antistatic packaging until you are ready to install them in the shelves.

ZT5541 Configuration

The ZT5541 is used in release 1.2 equipment for the application hosts. It may be necessary to modify the configuration switches on the ZT5541, as the basestation uses a configuration of these cards that differs from the manufacturer's original settings.

> **NOTE:** If the application hosts are pre-installed in the shelves, then they have already been configured and this procedure is not required.

Table C.2 shows the correct settings of the configuration switches.

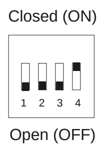
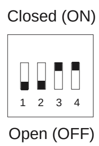
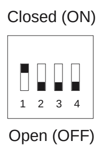
Switch	Setting	Appearance	Description
SW2	SW2-1: OFF SW2-2: OFF SW2-3: OFF SW2-4: ON		SW2-4 disables the PCI backplane reset and must be left ON. The other switches must be left OFF.
SW3	SW3-1: OFF SW3-2: OFF SW3-3: ON SW3-4: ON		SW3-3 enables console redirection for the serial port and must be left ON. SW3-4 causes the Reset Request button on the rear I/O card to function as a hard reset and must be left ON. The other switches must be left OFF.
SW4	SW4-1: ON SW4-2: OFF SW4-3: OFF SW4-4: OFF		SW4-1 and SW4-2 enable battery-backup of the CMOS memory. SW4-1 must be left ON and SW4-2 must be left OFF. The other switches must be left OFF.

Table C.2 Application Host Configuration Switch Settings

To configure the application hosts

1. Remove the application hosts from their antistatic packaging at a grounded work area. Ensure that you are properly grounded with a wrist or boot strap before handling the cards. Depending on the configuration of your basestation, you may have up to eight application hosts that need to be configured.
2. On each card, set SW3-3, SW3-4, and SW2-4 to the closed (ON) position. Figure C.1 shows the locations of the switches.

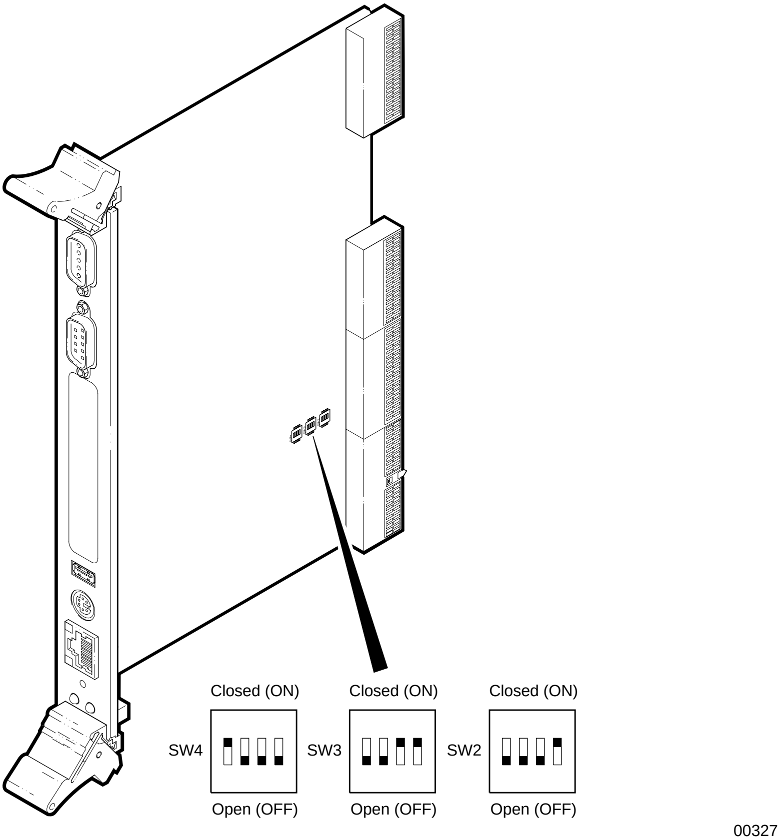


Figure C.2 Application Host Switch Configuration

3. Ensure that the other switches are configured as shown in Table C.2.
4. Place the cards back in their antistatic packaging until you are ready to install them in the shelves.

List of Abbreviations

Abbreviation	Expansion
AH	application host
AWG	American wire gauge
BTU	British thermal unit
CFM	cubic feet per minute
CSU	customer service unit
dB	decibel
DIV	diversity
ES	Ethernet switch
GPS	Global Positioning System
IP	Internet Protocol
modem	modulator–demodulator
MOP	methods of procedure
NC	not connected
NEBS	network equipment-building system
NOC	network operations center
NPM	Network Port Manager
OAMP	operations, administration, maintenance, and provisioning
PDP	power distribution panel
RF	radio frequency
RFSS	radio frequency subsystem
RS	radio shelf

Abbreviation	Expansion
RSC	radio sector controller
RX	receive
TX	transmit
UBC	utility bus controller
WCS	wireless communications services

GLOSSARY

A

air interface
The standards governing radio transmission between two elements of a wireless system, such as an NPM and a SOMAport.

The interface typically specifies the frequency band (for example, PCS), multiple-access scheme (for example, CDMA), modulation scheme and coding (for example, QPSK and rate 1/2), power control mechanisms, and protocols for setting up and managing communications.

attenuation
The reduction of signal magnitude over a medium. Attentuation is usually measured in dB per unit of distance, or as a ratio of input to output magnitude in dB. The less the attenuation, the more efficient the medium.

Attentuation is also called signal loss.

AWG (American wire gauge)
A standard for measuring wire thickness. The thicker the wire, the smaller AWG it has and typically, the higher current it can carry.

B

backhaul
The network or service that connects remote devices, such as basestations, to the central office. In the SOMA Networks implementation, backhaul refers to the wireline link between the NPM and the network core.

basestation
Equipment deployed by service providers at the center of each cell to communicate with wireless devices. In Amosphere, the NPM basestation communicates with wireless subscriber terminals called SOMAports.

BIOS (basic input/output system)
Software, typically stored in nonvolatile memory, that provides a standardized interface between a computer's hardware and the operating system.

bus
An electrical pathway that connects several devices and provides addressing and data-transfer capabilities.

C

CDMA (code-division multiple access)
A cellular technology that divides a frequency into multiple channels by assigning a pseudo-random digital sequence, or code, to each. CDMA does not assign a specific frequency to each user. Instead, every channel uses the full available spectrum.

cellular
A communications system, originally AMPS, that

divides a geographic area into cells, each of which has its own radio transmitters and receivers. Competing digital cellular systems include GSM and CDMA.

central office
A physical voice and data switching center, also called the local exchange, where local loops are connected to the core network.

CompactPCI
An open, industy-standard architecture based on the PCI architecture. Electrically, CompactPCI is superset of PCI. CompactPCI cards use Eurocard form factors and are typically available in 3U and 6U formats.

The CompactPCI standard is controlled the PCI Industrial Computer Manufactor's Group (PICMG).

core network
Generically, the physical infrastructure at the center of a network with a single administrative entity.

See also "network core".

D

dB (decibel)
A logarithmic expression of the ratio of two electrical qualities. To calculate dB, use the formula: $S_{db} = 10 \log (P_2 / P_1)$. *P* represents power, in watts.

E

E1 Package
A SOMA Networks document that provides Amosphere installation and operation instructions for a specific site.

Ethernet
A LAN protocol that uses CSMA/CD and a bus topology to support data transfer at 10 Mbits/s.

A newer version, called Fast Ethernet or 100Base-T, supports data transfer at 100 Mbits/s, and the IEEE has developed a standard for so-called Gigabit Ethernet (IEEE P802.3z).

Ethernet MAC address
A unique, 48-bit number programmed into every LAN card, usually at the time of manufacture.

Destination and source MAC addresses are contained in LAN packets and are used by bridges to filter and forward packets.

G

gateway
A device that connects two networks together. For example, gateways connect the network to the PSTN and the Internet.

GPS (Global Positioning System)
A satellite-based system used to provide precise terrestial and time information to devices equipmented with a GPS receiver.

H

host
A computer on which operating software resides.

I

IF (intermediate frequency)
A radio signal that will be converted to a new frequency prior to transmission.

IP (Internet Protocol)
The packet-transfer protocol used on the Internet. IP specifies the format of the basic unit of data, the datagram, and defines the addressing scheme used for its transfer.

L

LAN (local area network)
A network of computers, workstations, printers, file servers, and other devices that serves a particular group of users and is usually confined to a small geographical area, such as a building or campus.

latency
The amount of time it takes a packet to travel from source to destination. Network latency refers to the delay introduced when a packet is momentarily stored, analyzed, and then forwarded.

LNA (low-noise amplifier)
A device that increases the amplitude of an RF signal without introducing significant amounts of noise.

M

MAC (medium access control) layer
The network layer protocol that controls access to the physical transmission medium. The MAC layer, defined in IEEE 802, is sometimes called a sublayer because it is equivalent to the lower half of the data link layer in the OSI reference model. It mediates between the physical layer and the logical link control sublayer.

MGB (master ground bar)
The MGB is a bus bar that provides an electrical interface between the building's integrated ground plane and an isolated ground plane.

modem (modulator–demodulator)
A device that performs the conversion between digital data and analog signals.

MOP (methods of procedure)
A SOMA Networks document that describes the work to be done at a customer's site.

N

network core
In a SOMA Networks context, the network core is the switching fabric that interconnects all components and transfers bearer traffic, signaling information, embedded control messages, and network management traffic. The network core could be implemented as a single IP router connecting all components in star topology or could be an arbitrary meshed topology with several routers and routes between systems.

NPM
The SOMA Networks wireless basestation. An NPM serves as a wireless gateway for SOMAports. It transfers subscriber voice and data traffic between the SOMAports and the OpenNet network core. In effect, the NPM combines the functions of a wireless basestation, IP QoS-enabled router, Class 5 switch, and element management system.

The NPM relays voice and data between the air interface and the backhaul network.

O

OS (operating system)
The master control program that runs a computer. The OS is the first program loaded when a computer is turned on, controls software access to resources such as the central processing unit, memory, and peripherals, and runs all of the computer's programs.

P

PSTN (public switched telephone network)
The international telephone system for analog voice traffic. The PSTN refers to the original copper wire telephone infrastructure and services.

R

RF (radio frequency)
Any frequency in the electromagnetic spectrum that is used for radio transmission (typically 1 MHz to 300 GHz).

RJ-45 (registered jack-45)
An 8-wire connector used to connect computers to an Ethernet or a token-ring LAN.

router
A device that forwards packets of any type from one LAN or WAN to another. Routers read the information in packet headers and use routing tables and protocols to determine the optimal route between hosts.

S

sector
A wedge of a radio cell used to increase the capacity of the cell. Radio sectors use directional antennas instead of omnidirectional antennas.

The NPM supports up to six sectors, each of which is managed by a radio sector controller.

SOMAport
The SOMA Networks CPE. The SOMAport is the terminal device that connects a subscriber's telephones and personal computers via a wireless link to the NPM.

switch
In networks, a device that filters and forwards packets based on the address in the packet header. Switches operate at the data link layer of the OSI Reference Model.

T

TCP (Transmission Control Protocol)
A protocol that enables two hosts to establish a connection and reliably exchange streams of data over IP-controlled networks. TCP operates at the transport layer of the OSI Reference Model.

TCP/IP (Transmission Control Protocol/ Internet Protocol)
The suite of communications protocols developed by the United States Department of Defense to connect dissimilar systems. TCP/IP is supported by many operating systems and is the protocol of the Internet. It uses IP addresses to route messages over multiple networks.

U

UPS (uninterruptable power supply)
A battery-powered device that provides power to a system in the event of an interruption to the main power.

W

WAN (wide area network)
A physical or logical data network that spans a relatively large geographical area and that typically connects two or more LANs.

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