Chapter 4

INSTALLATION PROCEDURES

This chapter provides procedures for installing the racks and their internal components. It also provides an overview about installing the antennas used with the NPM basestation.

Before proceeding with this chapter, you must complete all the tasks described in Chapter 3.

Contents

INSTALLING THE NPM RACKS

These procedures describe how to prepare the floor for rack installation, move the racks into place, and secure the racks to each other, to the floor, and to the ceiling.

Table 4.1 shows the actions described in this section.

Table 4.1 Installing the NPM Racks Procedure Summary

NOTE: When you install the NPM racks, finish positioning and leveling the first rack before proceeding to the second rack. This makes leveling the racks easier and minimizes the potential for errors that may occur during rack placement.

The racks are suitable for mounting on concrete or other non-combustible surfaces only.

Prepare the Installation Location

This procedure applies to installing the NPM basestation on a concrete floor and securing the racks using 4-inch concrete expansion bolts (called anchor bolts in this document). These anchor bolts are designed for sites in level 4 seismic zones and may not be suitable for your site. See your field engineering package (FEP) for rack installation procedures specific to your site.

To prepare the installation location

1. Mark with a chalk line the location where you will install the racks. Refer to your field engineering package (FEP) for the required location. If there are overhead requirements, use a plumb line to align the rack vertically.

   Placed together, the NPM racks have a footprint of 1.2 m by 0.6 m (47 1/4 inches by 23 5/8 inches). The racks are 2.11 m (83 inches) in height.

2. Verify that there is adequate space for the racks:

   i. Move both racks to the intended installation location.

   ii. Ensure that you have room for both racks, their cabling, and enough space for airflow and the insertion and removal of components.

   See page 28 for airflow requirements.

   iii. Remove the racks.

3. Place the isolation pad in the precise location designated for the first rack using the chalk line as your guide.

   The base of each rack hangs over the edge of its isolation pad by 1 mm (1/32 inch).

4. Trace the anchor hole locations on the concrete floor using the cutouts on the isolation pad as your guide. Use the four outer locations and trace the entire shape of the anchor holes.

5. Remove the isolation pad.

6. Punch the concrete in the outer edge of each anchor guide using the concrete punch. This will make drilling the anchor holes easier.

7. Drill an anchor hole 101 mm (4 inches) deep on the outer edge of each anchor hole using a hammer drill with an 3/4-inch carbide-tipped masonry bit.

8. If the drill bit hits a metal reinforcement bar, move the hole location to the inner edge of the anchor guide and repeat steps 6 and 7.

9. Ensure that the holes are 101 mm (4 inches) deep; otherwise, the anchor bolts will not sit properly.

10 Clean each anchor hole thoroughly using a vacuum cleaner with a narrow nozzle attachment that can reach into the hole and remove the debris.

11 Cover the anchor holes with tape to prevent debris from entering them.

12 Repeat steps 3 to 11 for the second rack.

Position the Racks

This procedure describes how to position and level the racks.

To position the racks

1 Install two eyelet bolts in the top of each rack if you intend to use a crane to move the racks.

2 If you are using anchor bolts, remove the tape from the anchor holes.

3 Place the isolation pad back in the precise location designated for the rack using the chalk line and optional drilled holes as your guide.

4 Position the rack directly over the isolation pad. Take care not to move the isolation pad. When viewed from the front, the radio rack must be installed to the left of the RF rack.

Figure 4.1 shows the correct positions of the NPM racks.

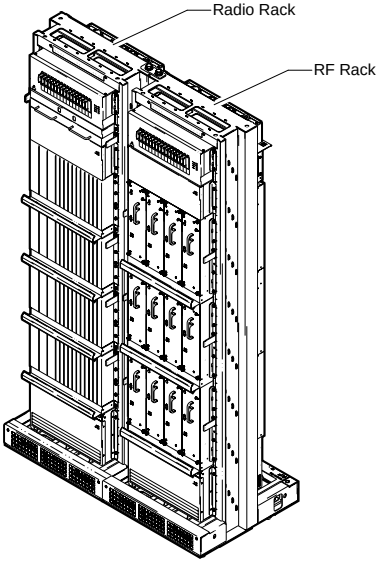

Figure 4.1 NPM Rack Positions

5 Ensure that the rack is vertically aligned, side-to-side and front-to-rear within 0.25 cm (0.1 inches), using a torpedo level. Add shims as needed until the rack is level.

6 Repeat steps 3 to 5 for the second rack.

Secure the Racks

This procedure describes how to secure the radio and RF racks in place. The racks may be secured to the ground, to the ceiling, and to each other.

Figure 4.2 shows the location of the junction bar and the support bolt holes.

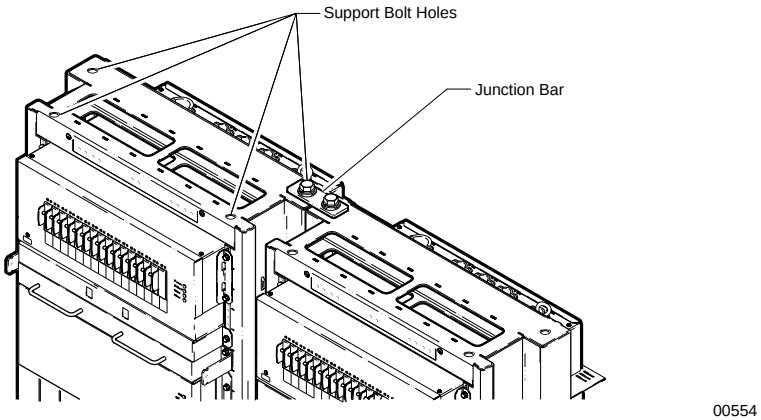

Figure 4.2 Junction Bar and Support Bolt Hole Locations

To secure the racks

1. Ensure that the racks are correctly positioned and vertically aligned.
2. Connect the racks together using the junction bar and two 15/16-inch bolts. If you have trouble inserting the bolts, ensure that the racks are level and located immediately adjacent to each other.
3. If you are securing the racks to the ceiling, consult your MOPs for instructions. Each rack contains four 5/8-inch bolt holes, one on each corner at the top of the rack. These bolt holes may be used to secure the top of the rack.
4. Secure the racks to the floor. If you are using anchor bolts, complete the following steps:
   - **i** Remove any cables attached to the back of the lower cooling unit.
   - **ii** Unscrew the 5/16-inch screws holding the lower cooling unit to the rack.
   - **iii** Slide out the lower cooling unit.
   - **iv** Remove the front grill.

     The front grill is attached to the frame using two half-turn screws. The screws are vertical when open and horizontal when locked.
   - **v** Ensure that the parts in the anchor bolt assemblies are not loose.

vi Ensure that the anchor bolt, spacer sleeve, expansion sleeve, and expansion cone do not have any slack. If any of these parts are loose, tighten the parts by hand to remove any slack. Do not start spreading the expansion sleeve.

vii Place a hold-down plate over the holes in the base of each rack.

viii Loosely insert the anchor bolts through the hold-down plates into the base of the rack and the anchor holes. If necessary, tap the top of each anchor bolt to ensure it is fully seated.

ix Tighten the four anchor bolts in the base of each rack by turning the 3/4-inch washer nut while holding the 1/4-inch anchor bolt in place. The expansion sleeve is forced open, which secures the rack to the floor.

x Reattach the lower cooling units to each frame using the 5/16-inch screws. Torque the screws to 50 inch-pounds.

xi Reattach the front grill to each frame using the grill's two half-turn screws. The screws are vertical when open and horizontal when locked.

ATTACHING GROUND AND POWER CABLES

These procedures describe how to ground and power the NPM basestation. Table 4.2 shows the actions described in this section.

Table 4.2 Attaching Ground and Power Cables Procedure Summary

WARNING: Ensure that all of the circuit breakers on each power distribution panel (PDP) are in the OFF (down) position before attaching any cables. Failure to do so may result in personal injury and cause damage to or destruction of the basestation.

Access to the ground and power terminals is prevented by the rear cover of the PDP. The rear cover should always be attached to the PDP during basestation operation. This prevents foreign objects from accidently coming into contact with the live wires and causing a short.

Check PDP Sector Configuration

The PDP sector configuration switch, located inside the PDP, configures the circuit breakers to support a specific number of radio sectors (1–6). In an NPM basestation supporting fewer than six sectors, some of the circuit breakers are not used and are therefore left in the OFF (down) position. The OAMP software uses the switch to determine if a circuit breaker has tripped or is not used.

The switch is set at the factory and does not normally need to be adjusted.

To check the PDP sector configuration

1. Consult your field engineering package (FEP) to determine the number of sectors your basestation is intended to support.
2. If necessary, remove the PDP rear cover. The rear cover attaches to the PDP using four #1 Phillips screws.
3. Ensure that the PDP sector switch is set to the number of sectors that your basestation is intended to support.

   If the switch is not set correctly, set the switch to the correct value:

   i. Turn screw counter-clockwise as far as possible to find sector 1 position.

   ii. Turn screw clockwise so that slot points to correct number of sectors.

   Figure 4.3 shows the location of the PDP sector switch.

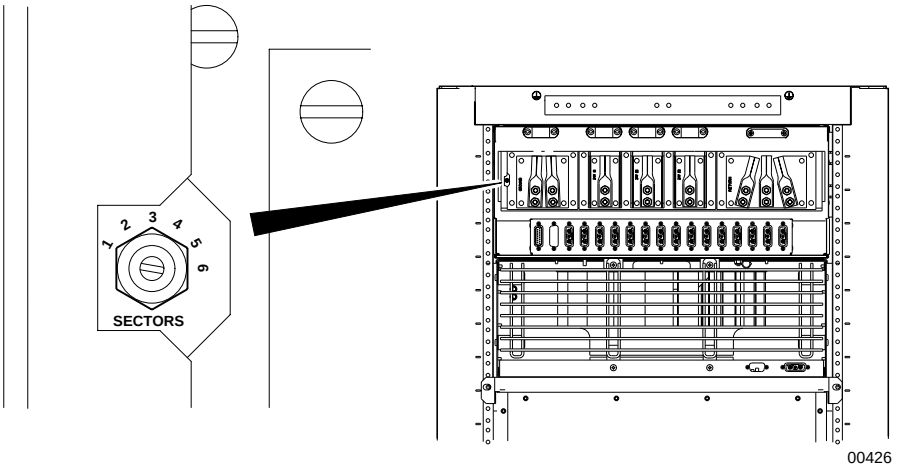

Figure 4.3 PDP Sector Switch

Ground the NPM Racks

Each rack requires a ground cable connecting the PDP to the building's grounding system. A frame ground cable connects the NPM frame to the PDP, ensuring that the frame and its attached components are grounded.

Figure 4.4 shows the cables used to ground the racks. For clarity, the PDP rear cover is not depicted.

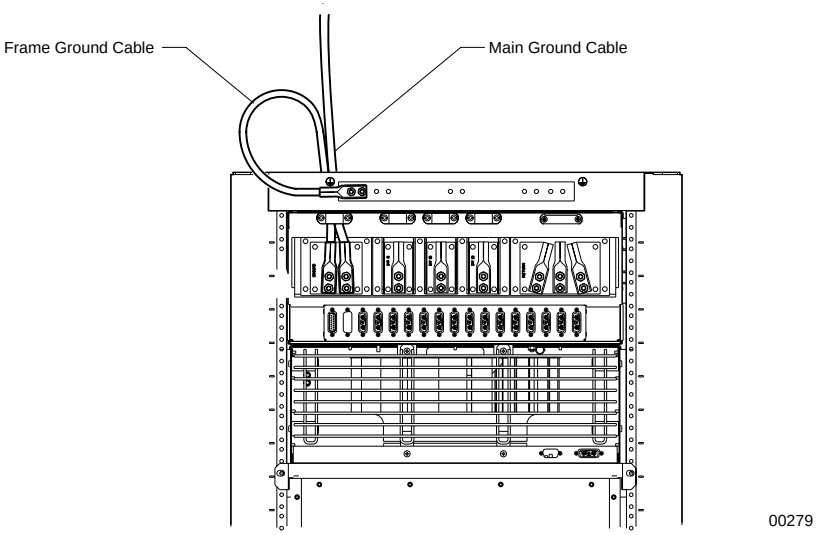

Figure 4.4 Ground Cables

To ground the NPM racks

1. If necessary, remove the PDP rear cover. The rear cover attaches to the PDP using four #1 Phillips screws.
2. Ensure that all the circuit breakers on the PDP are in the OFF (down) position.
3. Connect the main ground cable to the building's grounding system using a minimum of #6 AWG stranded copper wire.
4. Terminate the main ground cable with a two-hole compression lug. Apply an anti-oxidant solution to the cable before attaching the compression lug.

> **NOTE:** When crimping the compression lug, ensure that you are using the appropriate tool. Compression lugs for #6 AWG wire are colored blue and require that a blue die be used with the crimping tool.

Figure 4.5 shows the dimensions of the compression lugs.

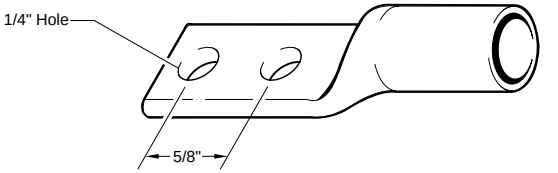

Figure 4.5 Compression Lug Dimensions

5 Apply an anti-oxidant solution to the ground terminals on the PDP.

6 Connect the compression lug on the main ground cable to one of the two ground terminals, as shown in Figure 4.6. Use a 1/4-inch hex nut with a 1/4-inch split-lock washer when securing the cable. Torque each 1/4-inch hex nut to 78 inch-pounds.

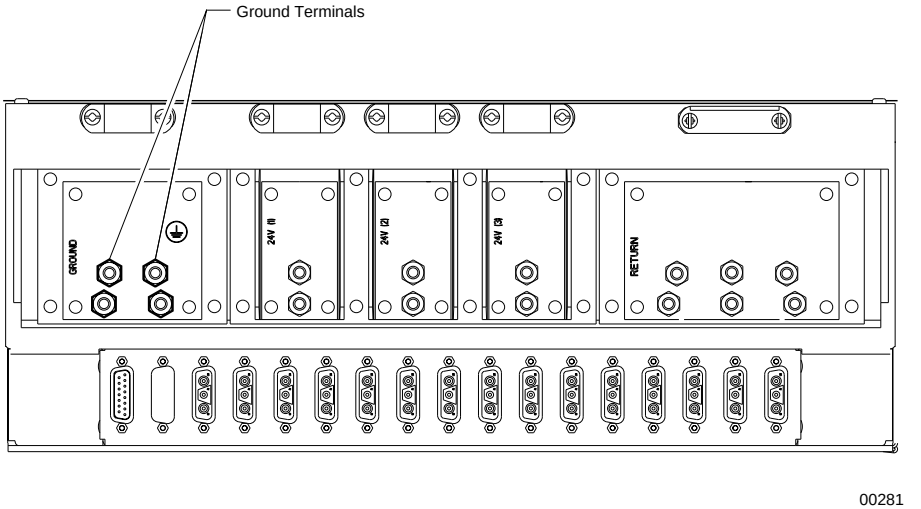

Figure 4.6 Ground Terminals on the PDP

7 Connect the frame ground cable to the second ground terminal on the PDP using a minimum of #6 AWG stranded copper wire.

8 Connect the other end of the frame ground cable directly to the top-left corner (when viewed from behind) of the rack:

i Punch a hole in the grounding tape for each compression lug screw location.

ii Attach the compression lug using two 5/16-inch hex screws with locking and external tooth washers.

9 Repeat steps 1 to 8 for the second rack.

10 Dress and label the ground cables according to the standards and requirements of your site.

Attach the Main and Return Power Cables

Refer to the MOPs before scheduling or beginning any work involving the site's main power. Before proceeding with this procedure, ensure that all the necessary site cable layout, runaway, and grid work has been completed.

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.

Ensure that the +24V DC power supply and the NPM basestation are powered off before you begin this procedure. Failure to turn off the power supply may result in personal injury or death and cause damage to or destruction of the basestation and surrounding equipment.

To attach the main and return power cables

1. If necessary, remove the PDP rear cover. The rear cover attaches to the PDP using four #1 Phillips screws.
2. Ensure that all the circuit breakers on the PDP are in the OFF (down) position.
3. Ensure that the main +24V DC power supply is powered off.
4. Connect each of the three main power cables to the positive terminals of your +24V DC power supply using a minimum of #2 AWG stranded copper wire.
5. Connect each of the three return power cables to the negative terminals on your +24V DC power supply using a minimum of #2 AWG stranded copper wire.
6. Terminate each of the cables with a two-hole compression lug with the dimensions shown in Figure 4.5 on page 60. Apply an anti-oxidant solution to each cable before attaching the compression lug.

   NOTE: When crimping the compression lug, ensure that you are using the appropriate tool. Compression lugs for #2 AWG wire are colored brown and require that a brown die be used with the crimping tool.

7. Apply an anti-oxidant solution to the main and return terminals on the PDP.
8. Connect the compression lugs on the return power cables to the three return terminals shown in Figure 4.7. Use 1/4-inch hex nuts with 1/4-inch split-lock washers when securing the cables. Torque each hex nut to 78 inch-pounds.
9. Connect the compression lugs on the main power cables to the three +24V DC power terminals shown in Figure 4.7. Use 1/4-inch hex nuts with 1/4-inch split-lock washers when securing the cables. Torque each hex nut to 78 inch-pounds.

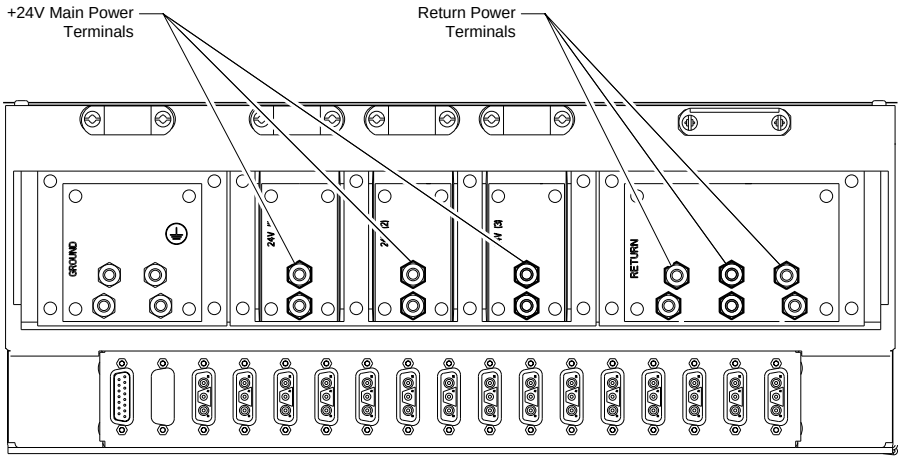

Figure 4.7 Main and Return Power Terminals

10 Ensure the main and return power cables are connected to the main power supply correctly by performing a continuity test on each cable.

11 Dress and label the main and return power cables according to the standards and requirements of your site.

> **NOTE:** Ensure that the main and return power cables are tied in a manner that minimizes the potential for creating electromagnetic fields. When tied together, the main and return power cables should be arranged in an alternating order.

12 Repeat steps 1 to 9 for the second rack.

13 Reattach the rear cover to each rack's PDP using four #2 Phillips screws. Torque each screw to 12 inch-pounds.

Test Power Supply Voltage and Ground

This procedure tests the voltage levels and grounds of the NPM basestation and the main power supply. The test ensures that the main power supply is providing +24V DC and that the power supply and racks are properly grounded.

Figure 4.8 shows the pins of the basestation power cables.

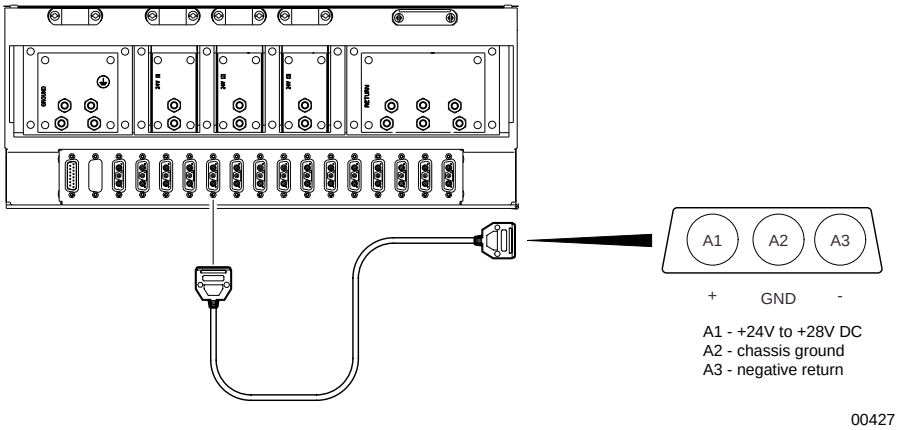

Figure 4.8 Power Cable Pins

WARNING: When CB 11 is in the ON (up) position, pin A1 is hot (+24V DC). Never short-circuit pin A1 with any other pins or objects. Failure to heed this warning may cause damage to or destruction of the basestation.

To test the power supply voltage and ground

1. Ensure that all circuit breakers (CB) are in the OFF (down) position.
2. Remove the three fuses from the PDP on the radio rack by using a 1/4-inch flathead screwdriver.
3. Configure your multimeter to read DC voltage. Autoscaling may be used.
4. If the basestation has a pre-installed utility shelf, disconnect the CB 11 power cable from the PS0 connector on utility shelf. Leave the power cable connected to CB 11 connector.
5. Test the voltage potential between the ground and return pins:
   - i Connect the multimeter probes to pins A2 (ground) and A3 (–). Either probe may go to either pin.

ii Observe the voltage reading on the multimeter. The voltage should be less than 0.5mV from 0.

If the voltage is greater than ±0.5mV, there may be a grounding problem. See the documentation that ships with your power supply for troubleshooting procedures. Do not power on the basestation until the problem has been resolved.

6 Test the voltage potential between the +24V and return (–) pins:

i Flip CB 11 on the radio rack to the ON (up) position.

ii Connect the black multimeter probe (–) to pin A3 (–).

iii Connect the red multimeter probe (+) to pin A1 (+24V).

iv Observe the voltage reading on the multimeter. The voltage should be between +24V and +28V.

If the voltage is not between +24V and +28V, there may be a problem with the main power supply. See the documentation that ships with your power supply for troubleshooting procedures. Do not power on the basestation until the problem has been resolved.

7 Test the voltage potential between the +24V and ground pins:

i Ensure that CB 11 on the radio rack is in the ON (up) position.

ii Connect the black multimeter probe (–) to pin A2 (ground).

iii Connect the red multimeter probe (+) the pin A1 (+24V).

iv Observe the voltage reading on the multimeter. The voltage should be between +24V and +28V.

v If the voltage is not between +24V and +28V, there may be a problem with the ground or the main power supply. See the documentation that ships with your power supply for troubleshooting procedures. Do not power on the basestation until the problem has been resolved.

8 Test the voltage potential between the ground and return pins while the circuit is powered on:

i Ensure that CB 11 on the radio rack is in the ON (up) position.

ii Connect the black multimeter probe (–) to pin A2 (ground).

iii Connect the red multimeter probe (+) the pin A3 (–).

iv Observe the voltage reading on the multimeter. The voltage should be less than ±0.5mV.

If the voltage is not between +24V and +28V, there may be a problem with the grounding or the main power supply. See the documentation that ships with your power supply for troubleshooting procedures. Do not power on the basestation until the problem has been resolved.

9 If all the tests described in steps 5–8 passed, then the rack is properly grounded and the main power supply is operating correctly.

If any if the tests failed, investigate and correct the problem. Repeat this procedure after corrective action is taken. Do not power on the basestation if any of the tests failed.

10 Disconnect both probes from the power cable.

11 Power off CB 11 on the radio rack by setting it to the OFF (down) position.

12 Reconnect the power cable to the PS0 connector on the utility shelf.

13 Reinstall the three fuses in the PDP in the radio rack by using a 1/4-inch flathead screwdriver.

ATTACHING THE SHELVES AND MODULES

These procedures describe how to attach the shelves and modules to the NPM racks.

Table 4.3 shows the actions described in this section.

Table 4.3 Attaching the Shelves and Modules Procedure Summary

Radio Rack Layout

The utility and radio shelves and the GPS clock module slide into their respective bays and bolt directly to the rack using 5/16-inch screws. The recommended torque value for each 5/16-inch screw is 50 inch-pounds.

Figure 4.9 shows the layout of the radio rack.

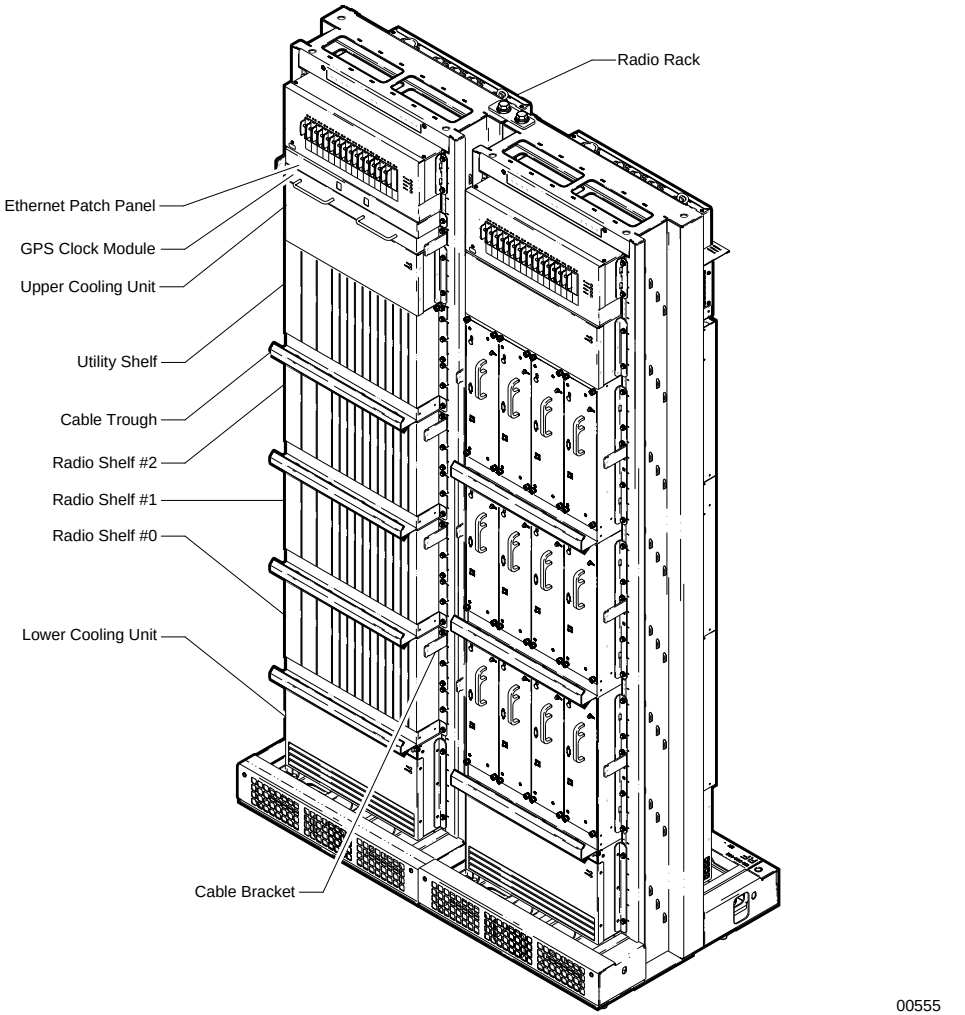

Figure 4.9 Radio Rack Layout

RF Rack Layout

The RFSS modules slide into their respective slots and bolt to each RF shelf using #2 Phillips thumb screws. In basestations that have less than 12 RFSS modules, the empty slots are covered with filler panels.

Figure 4.10 shows the location of the RFSS modules and filler panels in a basestation that supports three sectors.

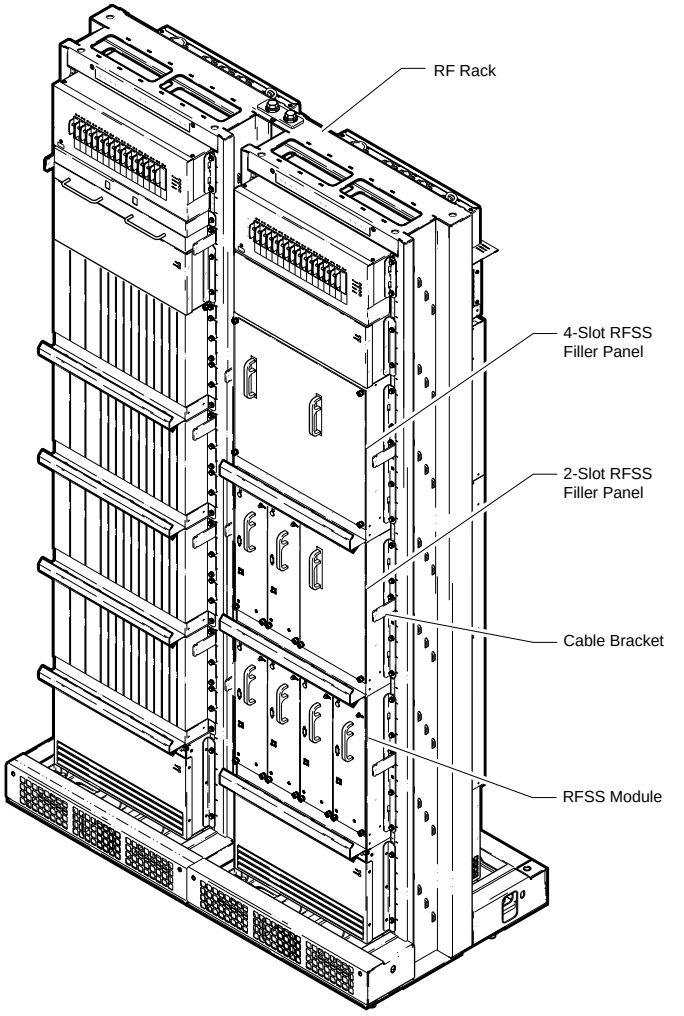

Figure 4.10 RF Rack Layout

Attach the Radio Shelves to the Radio Rack

Depending on the configuration of your NPM basestation, there may be one, two, or three radio shelves that need to be installed. The radio shelves are installed in the bottom three bays in the radio rack. If your basestation uses fewer than three radio shelves, you need to add dummy shelves to the empty bays to ensure the required airflow to the occupied bays.

WARNING: Your basestation may arrive with the utility and radio shelves already populated with cards. If this is the case, ensure that you are properly grounded before handling the shelves. Failure to do so may damage the cards.

To attach the radio shelves to the radio rack

1 Remove the radio shelf from its protective bag.

> **NOTE:** Each shelf weighs approximately 6.3 kg (14 pounds) before it is filled with cards.
>
> You can distinguish the radio shelves from the utility shelf by reading the manufacturer's label on the shelf.

2 Slide the radio shelf into the lowest available radio shelf bay in the radio rack.

If the bay is too tight to accommodate the radio shelf, loosen the 5/16-inch screws that hold the cable troughs to the rack. This should provide enough space for you to slide in the radio shelf.

If any of the cable brackets interfere with the insertion of the radio shelf, remove them. The cable brackets attach to the rack using 5/16-inch screws.

3 Puncture a hole in the grounding tape for each radio shelf screw location.

4 Secure the radio shelf to the rack using eight 5/16-inch screws. Torque each screw to 50 inch-pounds.

5 Reattach any cable brackets you removed.

6 Retighten the 5/16-inch screws on any loosened cable troughs.

7 Repeat steps 1 to 6 for the remaining radio shelves.

Cover Empty Radio Bays

Depending on the configuration of your NPM basestation, there may be empty bays on the radio rack. Your basestation may arrive with the unused radio bays already occupied with dummy shelves. If this is not the case or if the configuration of your basestation has changed, you need to add dummy shelves to any empty bays to ensure the required airflow to the occupied bays.

To cover the empty radio bays

1. Slide the dummy shelf into the lowest empty radio shelf bay in the radio rack. If the bay is too tight to accommodate the dummy shelf, loosen the 5/16-inch screws that hold the cable troughs to the rack. This should provide enough space for you to slide in the dummy shelf.
2. Puncture a hole in the grounding tape for each dummy shelf screw location.
3. Secure the dummy shelf to the rack using eight 5/16-inch screws. Torque each screw to 50 inch-pounds.
4. Retighten the 5/16-inch screws on any loosened cable troughs.
5. Repeat steps 1 to 4 for any remaining empty bays in the radio rack.

Attach the Utility Shelf to the Radio Rack

The utility shelf is installed in the top-most bay in the radio rack.

To attach the utility shelf to the radio rack

1. Remove the utility shelf from its protective bag. You can distinguish the utility shelf from the radio shelves by reading the manufacturer's label on the inside of the shelf.
2. Slide the utility shelf into the top bay in the radio rack.

   If the bay is too tight to accommodate the utility shelf, loosen the 5/16-inch screws that hold the upper cooling unit and the cable trough to the rack. This should provide enough space for you to slide in the utility shelf.

   If any of the cable brackets interfere with the insertion of the radio shelf, remove them. The cable brackets attach to the rack using 5/16-inch screws.
3. Puncture a hole in the grounding tape for each utility shelf screw location.
4. Attach the utility shelf to the rack using eight 5/16-inch screws. Torque each screw to 50 inch-pounds.
5. Reattach any cable brackets you removed.
6. Retighten any 5/16-inch screws on the upper cooling unit and the cable trough.

Install the GPS Clock Module

The Global Positioning System (GPS) clock module consists of a 1U module that contains two plug-in GPS receivers. The GPS clock module requires two GPS antennas. GPS antenna installation is described on page 106.

To install the GPS clock module

1. Remove the GPS clock module from its antistatic packaging.
2. If necessary, attach the plug-in modules and the rack-mount brackets to the GPS clock module using the hardware supplied in the shipping kit.
3. Orient the GPS clock module so that the text on the front panel is right-side up.
4. Slide the GPS clock module into the radio rack directly above the upper cooling unit.

   The GPS clock module is located between the Ethernet patch panel and the upper cooling unit.
5. Puncture a hole in the grounding tape for each GPS clock module screw location.
6. Attach the GPS clock module to the rack using four 5/16-inch mounting screws. Torque each screw to 50 inch-pounds.

Install the RFSS Modules

If the configuration of your NPM basestation does not require a full complement of RFSS modules, some slots may be covered with filler panels.

CAUTION: Each RFSS module weighs approximately 14.1 kg (31 pounds).

To insert the RFSS modules in the RF rack

1. Remove the RFSS module from its protective bag.
2. Orient the RFSS module so that the text on the front panel is right-side up.
3. Slide the RFSS module into the first available RFSS slot. The slots should be filled from bottom to top, left to right.
4. Secure the module in the slot using four #2 Phillips thumb screws, one in each corner. Torque the thumb screws to 12 inch-pounds.
5. Ensure that the RFSS module is secure by grasping the handle on the front panel and pulling lightly. The RFSS module should not move.

   If the RFSS module does move, ensure that the mounting screws are attached to the shelf assembly and that the module is seated correctly. If necessary, remove the module and repeat this procedure.
6. Repeat steps 1 to 5 for the remaining RFSS modules.

Cover Empty RFSS Slots

Any empty slots in the RF shelves should be covered with RFSS filler panels. The RFSS filler panels protect the other RFSS modules from dust and ensure the required air flow to the installed RFSS modules.

To cover unused slots with RFSS filler panels

1. Remove the RFSS filler panel from its protective bag.
2. Orient the filler panel so that the text on the front panel is right-side up.
3. Secure the filler panel over the RFSS slots using four #2 Phillips screws, one on each corner. Torque the screws to 12 inch-pounds.
4. Ensure that the filler panel is secure by grasping the handle on the front panel and pulling lightly. The filler panel should not move.

   If the filler panel does move, ensure that the mounting screws are attached to the RF shelf assembly. If necessary, remove the filler panel and repeat this procedure.
5. Repeat steps 1 to 4 until all the empty slots are covered with filler panels.