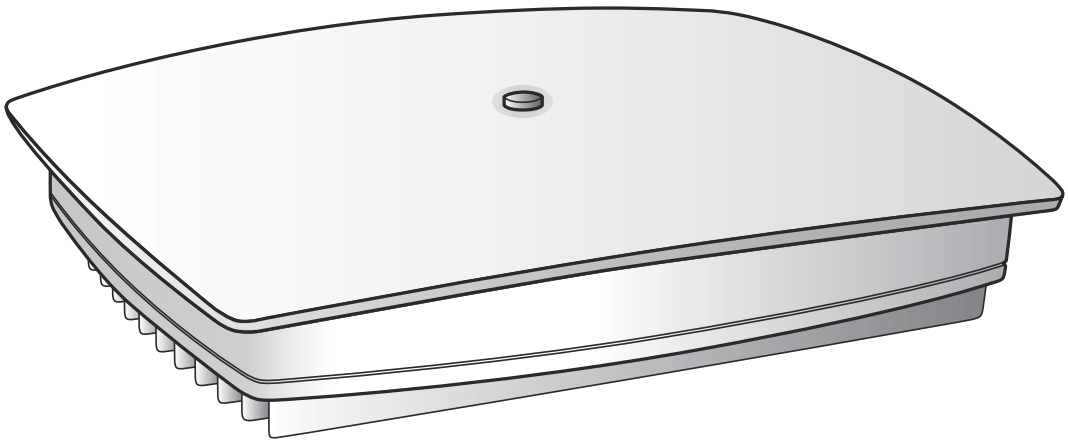
# SmartCloud® Radio Node - SCRN 200 Hardware Installation Guide



SpiderCloud® Wireless

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## FCC Statements

**Warning**: In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, the SCRN 200 must have a minimum distance of 20 cm from the body during normal operation.

Changes or modifications not expressly approved by SpiderCloud Wireless engineering voids the user's authority to operate the equipment.

**Note**: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case, the user will be required to correct the interference at his own expense.

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# System Overview

The SmartCloud® Radio Node 200 (SCRN 200) is a low-cost, low-power (100mW) base station designed for indoor use. The radio node is 3GPP compliant, supporting Universal Mobile Telecommunications System (UMTS) Release 6 software.

The radio node provides enterprises with dedicated coverage and capacity for UMTS services. It is easy to install and connects to the existing enterprise LAN using standard Ethernet cabling. The radio node is managed by the SmartCloud Services Node 8000 (SCSN 8000) access controller.

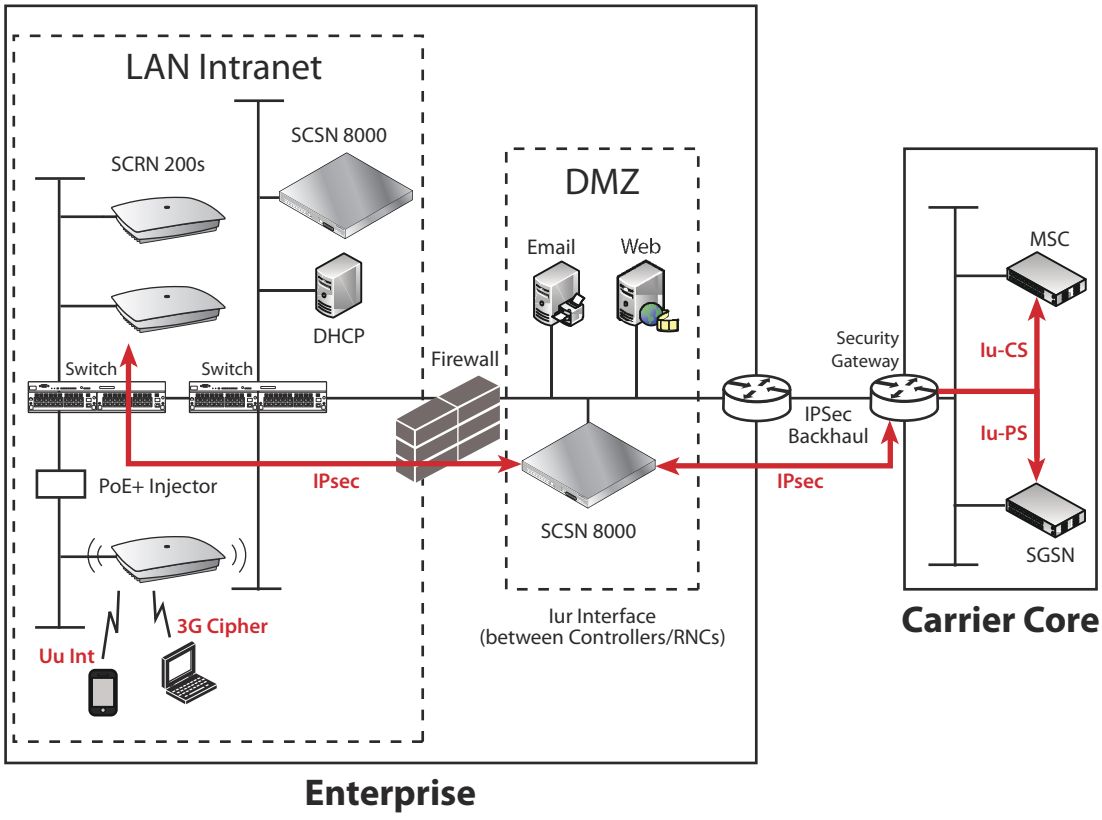


**Figure 1 Radio Node Relationship to Enterprise and Carrier Core Networks**

## Services Provided

The radio node provides the following services:

- Complete enterprise mobility using licensed spectrum
- Radio Frequency (RF) self-calibration for autonomous setup, operation, and management
- Enhanced networking
- Transparent integration into enterprise network environments

## Radio Node System Isometric Top View and Bottom View

The following diagrams display an isometric top and bottom views of the radio node:

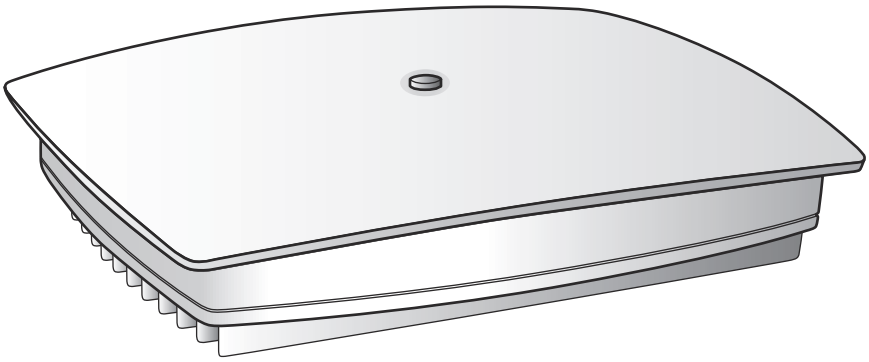

**Figure 2 Radio Node Top View**

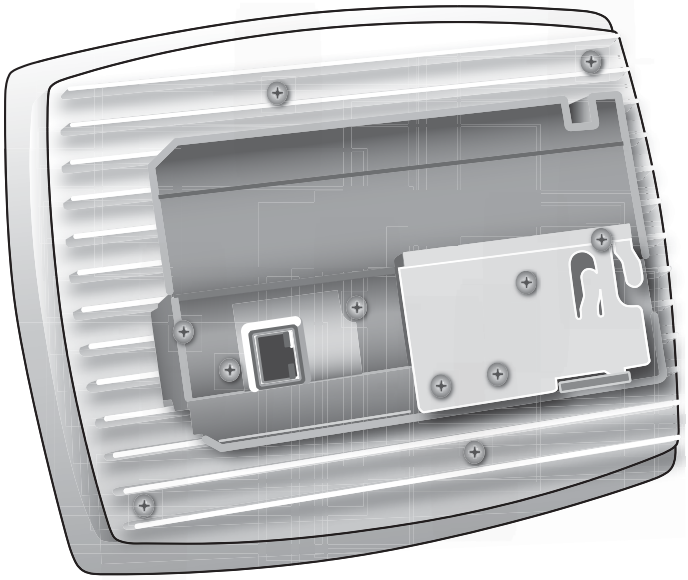

**Figure 3 Radio Node Bottom View with Pedestal Base**

# System Specifications

Following are the system specifications for the radio node frequency bands of operation, system size, power, environmental requirements, and compliance:

## Frequency Bands of Operation

- UMTS Bands
  - Band I: Receiver: 1920-1980 MHz, Transmitter: 2110-2170 MHz. GSM monitor at 925-960 MHz, 1805-1880 MHz
  - Band II: Receiver: 1850-1910 MHz, Transmitter: 1930-1990 MHz. GSM monitor at 869-894, 1930-1990 MHz
  - Band IV: Receiver: 1710-1755 MHz, Transmitter: 2110-2155 MHz. GSM monitor at 869-894, 1930-1990 MHz

## Size and Dimensions

- Height:
  - 4.9 centimeters (1.9 inches)
  - 8.1 centimeters including mount bracket assembly (3.2 inches)
- Width: 19.0 centimeters (7.5 inches)
- Depth: 23.8 centimeters (9.4 inches)
- Weight:
  - 0.91 kilograms (2 pounds)
  - 1.41 kilograms with mounting bracket (3.1 pounds)

## Power

- Compliant with both IEEE 802.3af (PoE) and IEEE 802.3at (PoE+)

  **Note:** SpiderCloud Wireless recommends PoE+ powering so the site can readily support future products operating at higher power levels.
- Power consumption: 12W
- Transmitter output power: 100mW (20 dBm) radiated power Equivalent Isotropically Radiated Power (EIRP) nominal.

## Environmental Requirements

- Operating temperature range:
  - 0° to 50° C (32° to 122° F) vertical mount
  - 0° to 40° C (32° to 104°F) horizontal mount, fins up
- Operating humidity 0 to 90% non-condensing
- Storage temperature range: 0° to 85° C (-40° to 185° F)
- Altitude range: 0 to 1,800 meters (0 to 5,905 feet)
- Storage humidity: 0 to 90% non-condensing

## Compliance

- ETSI
  - EN 301 489-1
  - EN 301 489-23
  - EN 301 908-1
  - EN 301 908-3
  - EN 50385
  - EN 60950-1 (safety)
- IEEE 802.3at PoE+
- FCC
  - FCC Part 15 Class A
  - FCC Part 24
  - FCC Part 27
- CE Marking
- RoHS (Directive 2002/95/EC on RoHS)
- R&TTE (Directive 1999/5/EC on R&TTE)
- CB certification as per IEC 60950-1:2011

# Ports and LEDs

The radio node has one top-panel LED to indicate power and status. Table 1 shows the LED behavior of the radio node:

**Table 1: Radio Node LED Behavior**

| LED | Status |
|---|---|
| Green: slow flashing (approximately ½ second on, 1½ sec. off) | Administratively disabled |
| Green: fast flashing (approximately 1.4 second on/off cycle) | Booting |
| Green: solid | Operational |
| Red: solid | Fault |
| Red: slow flashing (approximately ½ second on, 1½ sec. off) | Administratively disabled |
| Red: fast flashing (approximately 1 second on/off cycle) | One or more emergency calls active |
| Blue: fast flashing (approximately 1 second on/off cycle) | Locate radio node enabled * |
| Blue: solid | Follow IMSI enabled * |
| Off | Powered off or LED disabled |

* Refer to the *SmartCloud OS (SCOS) Administrator Guide* for information about the locate radio node and follow IMSI features.

The radio node has one 10/100 Ethernet port that supports a Category 5 (CAT-5) cable with an RJ-45 connector. Figure 4 shows the 10/100 port. There are two LEDs on the connector:

- **Link:** Steady green state indicates a normal Layer 2 link connection has been established.
- **Activity:** Yellow blinking indicates data activity.

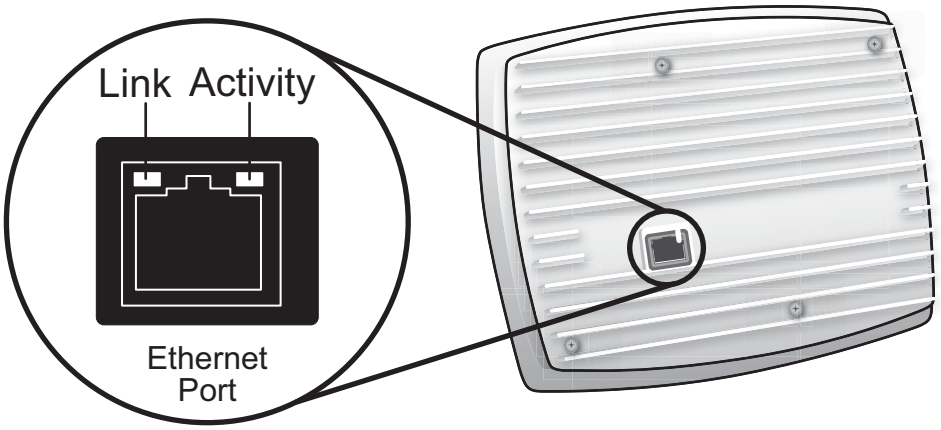


**Figure 4 Ethernet Port**

# Antennas

The radio node has two vertically-polarized, omnidirectional internal antennas. They radiate power in a plane normal to their length: horizontal radiation from vertically-oriented antennas.

The radio node operates over a licensed band so it can be placed anywhere inside the building. However, coverage area is very important. Place the radio node units at strategic points for best coverage.


Tip

To maximize antenna transmission, SpiderCloud Wireless recommends not installing the radio node inside a metallic enclosure.

# PoE+

The radio node receives its power from a standard PoE+ switch (typical) or injector. The radio node is fully compliant with the IEEE 802.3at Power Over Ethernet (PoE+) specification.

Per IEEE 802.3at, use standard CAT-5/5e or better twisted-pair cable with a maximum length restriction of 100 meters (328 feet) for PoE+. This restriction minimizes power loss between the PoE+ power source and the radio node.


**Note**

Power is distributed over two pairs of the four available pairs in CAT-5 cables. The radio node can accept power on either used or un-used pairs.

Figure 5 shows the valid radio node cabling/powering options:

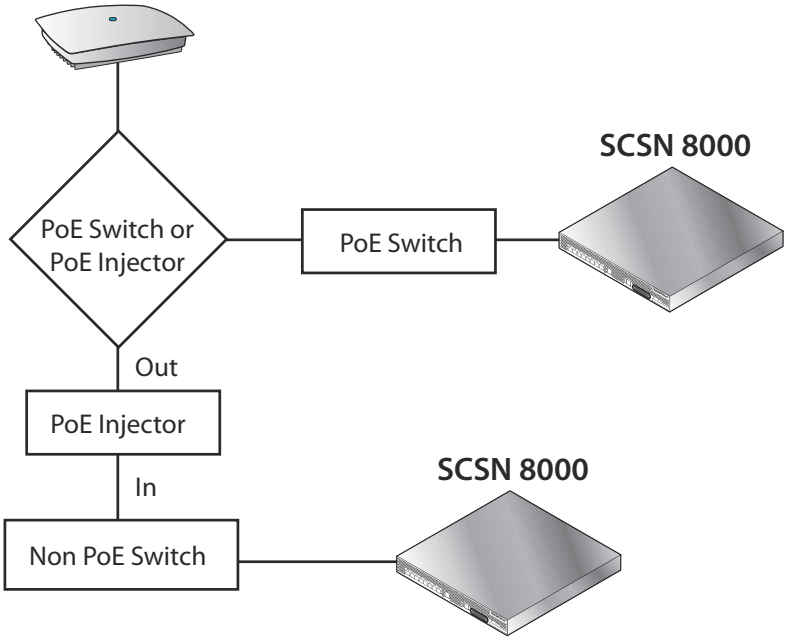


**Figure 5 Valid Radio Node Cabling/Powering Options**

SpiderCloud recommends the third-party Phihong POE36U-1AT single-port PoE+ injector. Use this injector only when a PoE+ Ethernet switch is *not* available.

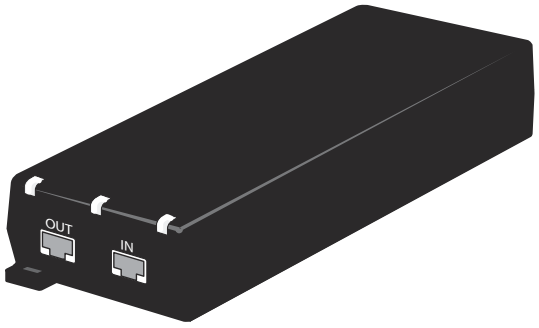


**Figure 6 Phihong POE36U-1AT PoE+ Injector**

### To connect the PoE+ injector to a radio node

**Step 1** Attach the injector power cord to a power source.

**Step 2** Connect an unpowered Ethernet cable from a switch to the **IN** port on the injector.

**Step 3** Connect an Ethernet cable from the injector's **OUT** port to the radio node. The injector will now inject power onto a pair of wire pairs in the cable. The radio node will expect a nominal 48V DC input (57V max) from the PoE+ injector. The Phihong POE36U-1AT PoE+ power injector typically supplies 57V maximum.

# Select the Radio Node Location

Select a location for the radio node. The unit can be installed in a wide range of locations including walls, ceilings, and plenum spaces. Follow the installation guidelines for choosing appropriate mounting locations for the unit. When mounting a radio node vertically, align the fins vertically for superior cooling.

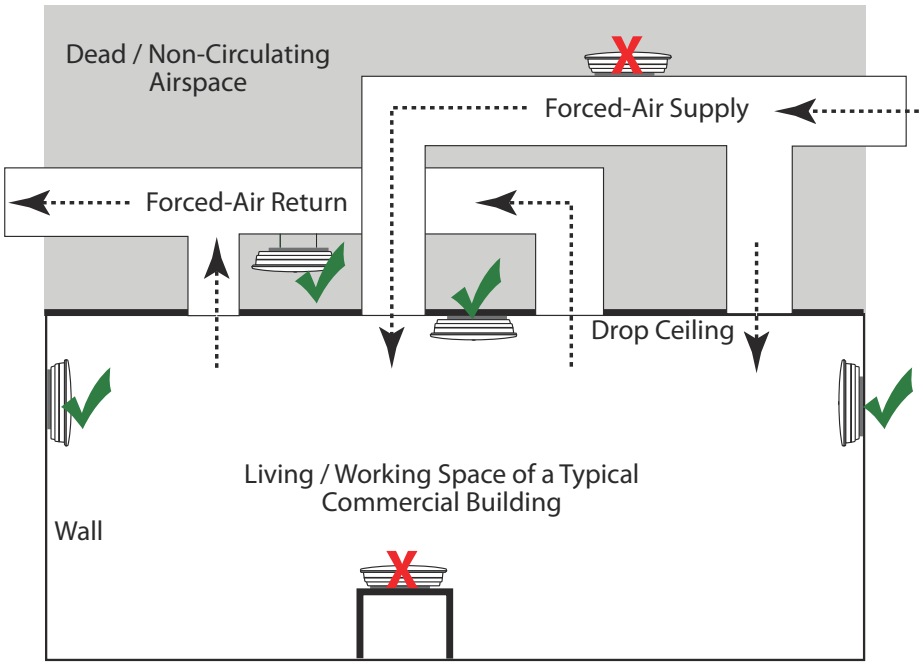


**Figure 7 Radio Node Locations**

Locate radio node units at least 5 meters (16 feet) from an external wall. This distance maximizes indoor coverage and minimizes RF leakage outside the building.

Use Table 2 to determine the maximum distance between radio node units. Greater separation may affect coverage or system performance.

**Table 2: Recommended Radio Node Separation Distances**

| Type of Building | Max Recommended Separation |
|---|---|
| Warehouses and large open-spaced buildings | 70 m (230 feet) |
| Open-plan offices | 45 m (148 feet) |
| Closed-plan offices (e.g., individual rooms - plasterboard) | 30 m (98 feet) |
| Closed-plan offices (e.g., individual rooms - stone/brick/concrete) | 20 m (66 feet) |

# Installation and Mount Bracket Assembly

The radio node has a pedestal base that slides into a long “U” shaped bracket for ceiling or wall mounting. SpiderCloud pre-bolts the pedestal base onto the extrusion plate on the radio node. However you must attach the pedestal base to the mount bracket as shown in Figure 8:

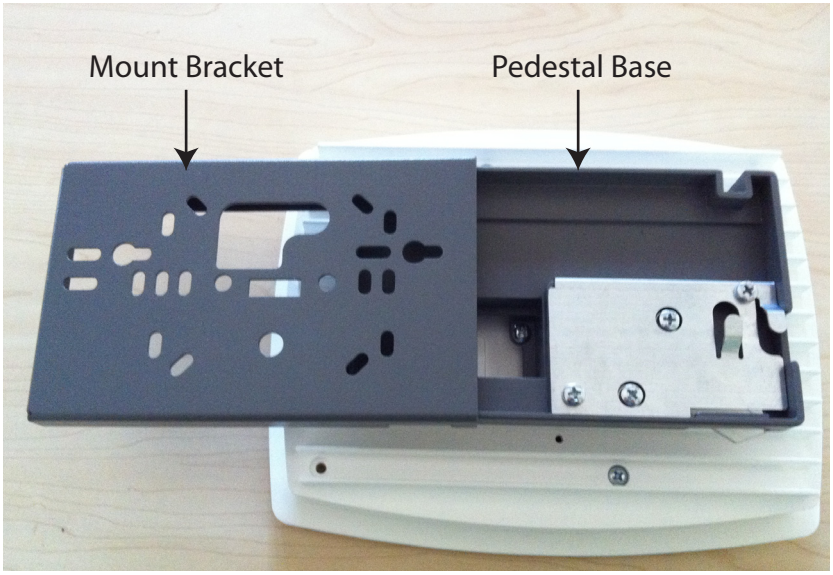


**Figure 8 Pedestal Base Slides into Mount Bracket**

## Bracket Mounting and Cabling Guidelines

Incorrectly cabling and mounting a radio node can result in crushed cables and loss of communications to the unit. Follow these guidelines in cabling the radio node and mounting it on the bracket:

- Ensure that the cabling is properly routed and dressed.
- Ensure that the pedestal base is fully inserted into the mount bracket so that it locks into place and is flush. A correctly installed cable should at no time during installation impede inserting the pedestal base into the mount bracket.
- Secure the pedestal base to the mount bracket with a padlock or tie wrap to provide physical security.

## Installation Procedure

The radio node receives its power source over powered Ethernet. If your wiring closet does not have existing PoE+ equipment, SpiderCloud recommends a PoE+ power injector for the radio node. See section PoE+ on page 9.

## To install the radio node:

**Step 1** With two user-provided screws, attach the mount bracket assembly to a wall or ceiling. The screw holes are sized for an M4 (#10) screw. Ensure the screws have a snug fit onto the studs, sheetrock, anchor, or other material you are bolting to:

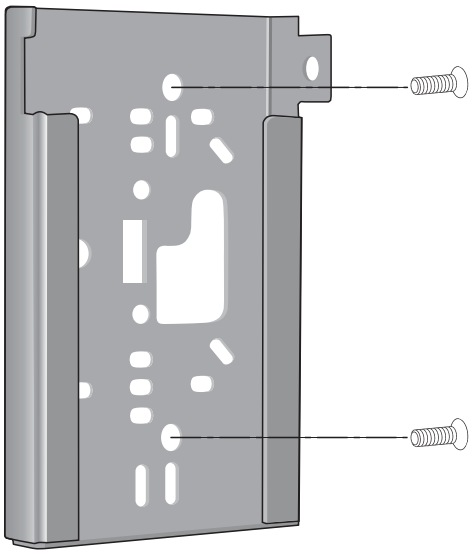

**Figure 9 Attach the Mount Bracket**

**Step 2** Route the Ethernet cable through the pedestal base cable opening and through the cable guards. Insert the RJ-45 connector into the Ethernet port as shown in Figure 10:

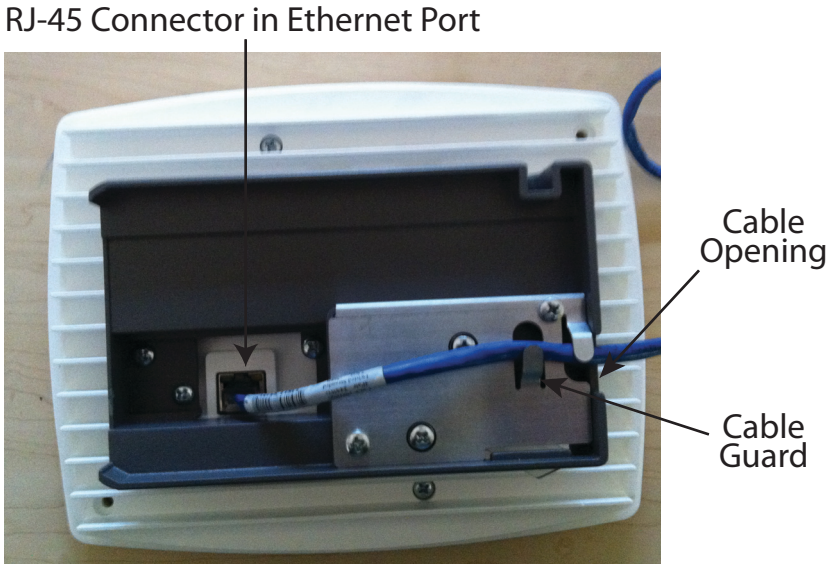


**Figure 10 Route and Terminate the Cable**

**Step 3** Slide the pedestal base of the radio node into the groove opening in the mount bracket. When the pedestal reaches the end of the trough, a spring clip will secure the unit into place:

**Figure 11 Slide the Mount Bracket onto the Pedestal Base**

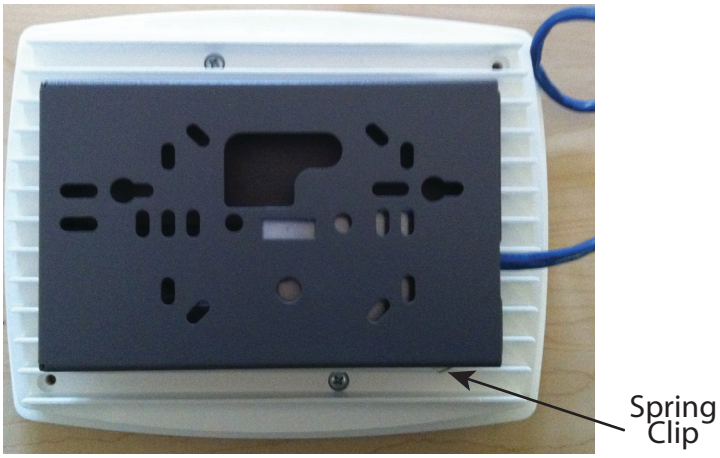


**Figure 12 Fully Mounted**

**Step 4** Attach a padlock or cable tie wrap through the cutout lock holes in the mount bracket and pedestal base:


**Figure 13 Lock Holes**

Note

The lock in the above figure is shown schematically. The orientation is for illustration purposes (not accurate) since the bracket is wall or ceiling mounted.

**Step 5** The radio node boots up and attempts to connect to the services node. See Boot Sequence and Services Node Communication on page 15 for details.

## Detaching the Radio Node from the Mount Bracket

### To remove the radio node from the bracket assembly

**Step 1** If needed, remove the padlock or cable tie wrap securing the radio node.

**Step 2** Depress the spring clip on the pedestal base and slide the radio node out of the mount bracket.

**Step 3** Detach the RJ-45 clip from the Ethernet port and remove the cable from cable brackets and cable opening.

# Boot Sequence and Services Node Communication

On initial boot, the radio node performs the following boot sequence and communicates with the services node. This sequence takes about one minute to complete. When completed, all devices are reachable:

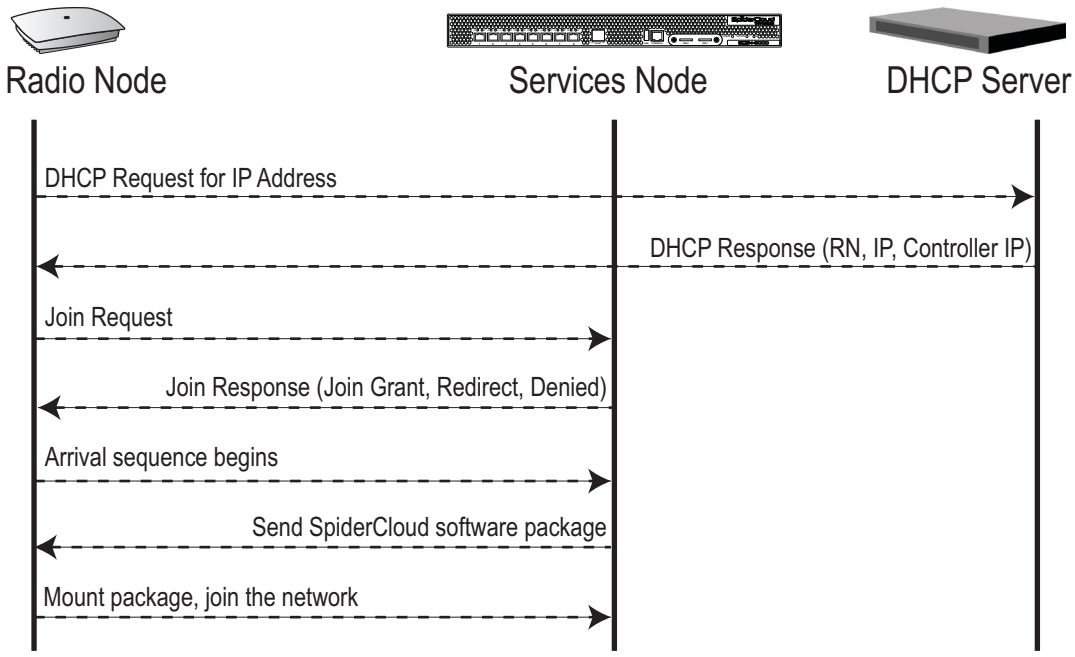


**Figure 14 Radio Node Boot Sequence**

### Sequence description:

1. When the radio node is powered on, the device sends a DHCP Request to the network DHCP server to get IP information.
2. The DHCP server is configured to use vendor Option 43. The server responds with the IP addresses of the radio node and the services node (the master of the radio node). The following example shows a sample configuration from a DHCP server, where *10.1.30.99* is the IP address of the radio node's controlling services node:

```
option space SPIDERCLOUD;
option SPIDERCLOUD.access-controller code 102 = string;
option SPIDERCLOUD.access-controller "10.1.30.99;";
```

3. Using its own IP address, the radio node sends a Join Request message to the services node. The radio node seeks to join the cellular network.
4. The Join Response from the services node will be one of the following:
   - **Join Grant:** Permit the radio node to join the services node.
   - **Redirect:** Redirect the radio node to join a different services node if you have multiple services node units configured in the network.
   - **Denied:** The security signature on the radio node does not match what the services node expects. The client is untrusted and treated as a rogue device.
5. The arrival sequence begins. Based on the configuration of the radio node, the radio node will join the system and get its configuration. The services node sends the SpiderCloud software image (the system image and configuration settings) to the radio node.
6. The radio node reboots and mounts the SpiderCloud software image as a RAM-based file system.
7. The radio node contacts the services node and joins the network.

# Related Documents

Refer to the following documents for more information:

- The *SmartCloud System Description* provides an overview of how the SmartCloud system fits within an operator's network and in an enterprise, describes key features of the system, and provides specifications for the services and radio nodes.
- The *SmartCloud OS (SCOS) Administrator Guide* to configure the software environment and internetworking between the services node and radio node devices.
- The *SmartCloud Services Node - SCSN 8000 Hardware Installation Guide* for hardware specifications and installation instructions.
- The *SCOS NB Data Model Reference* for details about objects and parameters that comprise the system configuration and operational state.

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