SpiderCloud® Radio Node - SCRN-220 Hardware Installation Guide

FCC Statements

Caution: Any changes or modification cautions to this device not explicitly approved by manufacturer could void your authority to operate this equipment.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum 25 cm between the radiator and your body. This transmitter must not be collocated or operating in conjunction with any other antenna or transmitter unless authorized to do so by the FCC.

This device can be expected to comply with part 15 of the FCC Rules provided it is assembled in exact accordance with the instructions provided with this kit. Operation is subject to the following conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received including interference that may cause undesired operation.

Revision History

Revision	Date	Summary of Changes
1	4/13/2017	Initial document release

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Table of Contents

Contents

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About this Manual

This guide provides the system specifications of the SpiderCloud Wireless® Radio Node 220 (SCRN-220). It includes detailed hardware installation instructions, the boot sequence, and expected LED behavior both during the boot-up and under operating conditions. An appendix shows the radio node antenna patterns.

The primary audience for this guide includes network planners, system administrators and installation personnel. It assumes you have knowledge about networking principles, networking configuration, site preparation, powering, and experience in hardware installation and maintenance.

Product Overview

The SCRN-220 is an integrated LTE small cell with support for Rel13 IOT devices. SpiderCloud's scalable small cell system, called an Enterprise Radio Access Network (E-RAN), hides the complexity of radio management and mobility and provides operators with a single touch point to aggregate and manage a large network of LTE small cells.

Each SCRN-220 supports 2x2 MIMO operation on configurable LTE bands, enabling higher user capacity and average data rates per radio node coverage footprint. Each LTE carrier supports 64 active LTE users and up to 128 RRC Connections. When used with 20 MHz channel bandwidth, an LTE carrier supports a peak downlink rate of 150 Mbps and a peak uplink rate of 50 Mbps.

The radio node implements SON capability by listening to other radio nodes within the E-RAN and neighboring LTE macro cells in multiple frequency bands, and performing continuous self-optimization to provide high-quality radio coverage and mobility.

SpiderCloud radio nodes can be installed on walls or ceilings. Both network connectivity and power are provided over Ethernet. The radio node has no fans and is completely convection cooled. Antennas are built-in for both LTE bands, with an orderable option for QMA connectors for use with external antennas.

SCRN-220 utilizes on-chip Trusted Platform Module (TPM) functions to implement secure boot, and establish certificate- based IPsec tunnel to SpiderCloud services node for all LTE traffic. There is no management or console port on the radio node, and the radio node can be physically locked to prevent theft.
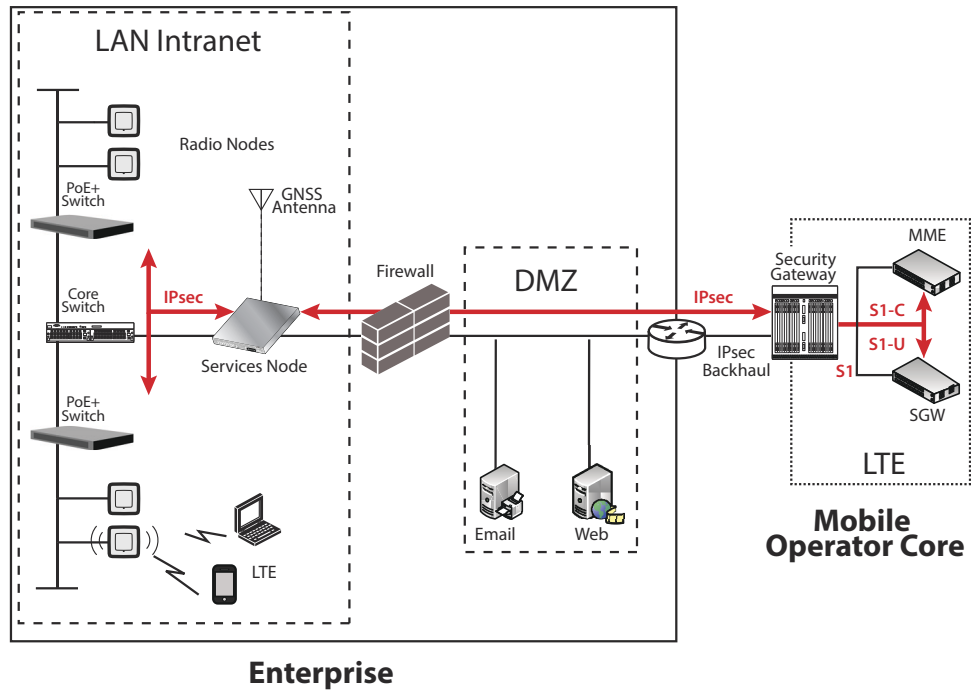
Figure 1 Radio Node Relationship to Enterprise and Mobile Operator Core Networks

Radio Node Models

Table 1 displays the orderable configuration of the SCRN-220 radio node:

Table 1: SCRN-220 Radio Node Configurations

Radio Node Model	Description	Antenna Type
SCRN-220-020412	Software configurable licensed band with support for LTE Band 2, 4, or 12.	Internal
SCRN-220-020412-E	Software configurable licensed band with support for LTE Band 2, 4, or 12.	External
SCRN-220-020413	Software configurable licensed band with support for LTE Band 2, 4, or 13.	Internal
SCRN-220-020413-E	Software configurable licensed band with support for LTE Band 2, 4, or 13.	External

Radio Node System Isometric Top View and Bottom View

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

Figure 2 Radio Node Top View

Figure 3 Radio Node Bottom View

Antennas

The radio node includes four internal Tx/Rx antennas with a peak gain of 5dBi and operates in 2x2 mode with MIMO or four optional ports with QMA coaxial connectors for external antennas. Both models contain one internal network listen antenna:

Figure 4 shows the location of the LTE antennas:
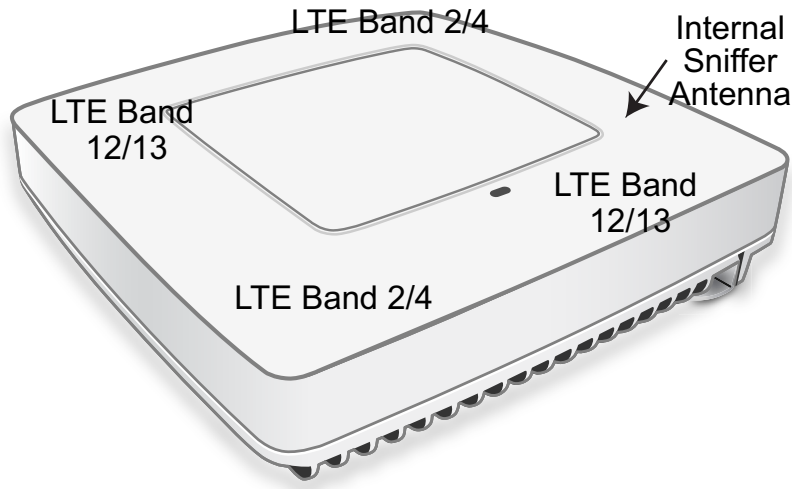

Figure 4 Antenna Band Locations

Figure 5 shows the radio node with external antennas. This view is oriented the same way as Figure 4, so the antenna locations are the same.

Figure 5 External Antenna Locations

Ports

The radio node has one 1 Gigabit Ethernet port that supports a Category 5e (Cat 5e) or better twisted-pair cable with an RJ-45 connector. Figure 6 shows the Ethernet port. There are two LEDs on the connector:

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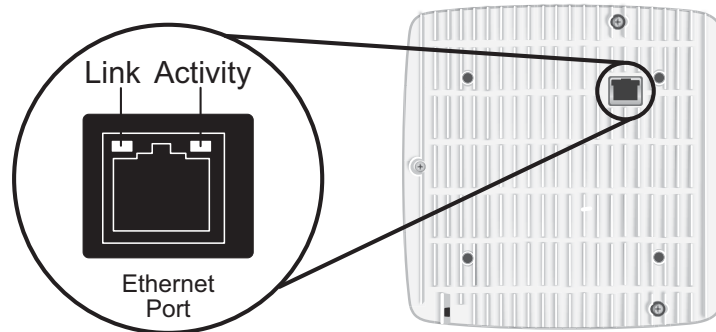- **Activity:** Yellow blinking indicates data activity.

Figure 6 Ethernet Port

The Top-Panel LED

The radio node has one top-panel tricolor (RGB) LED to indicate power and status. This is the only LED visible under normal operating conditions. When the radio node initially boots the LED cycles through a number of colors and flashing behaviors until it is fully operational. Status indications: boot, normal, disabled, fault, emergency call, radio node tracking.
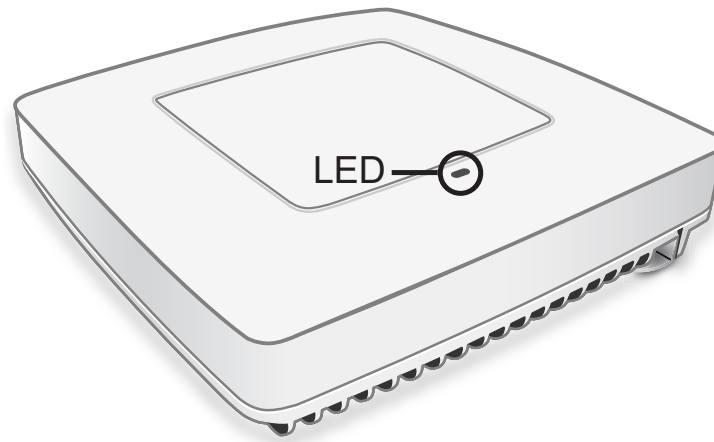

Figure 7 Radio Node Tricolor LED

Input Power

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

Per IEEE 802.3at, use standard Cat 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 5e or better cables. The radio node can accept power on either used or un-used pairs.

When connecting the radio node to a PoE+ switch, ensure that the switch port is statically configured to deliver minimum 25W of power.

Note	Some PoE switches may be factory configured to deliver lower power per port. If this is the case change the configuration during installation.

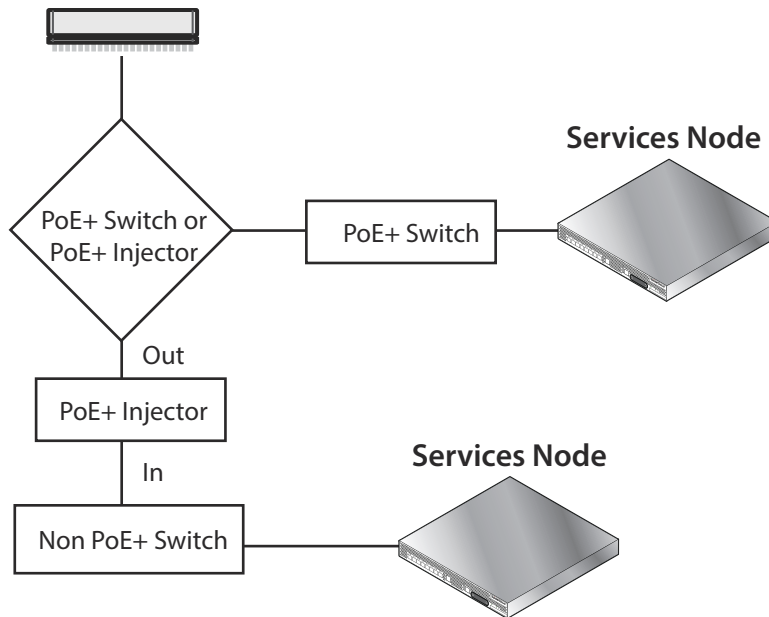Figure 8 shows the valid radio node cabling/powering options:

Figure 8 **Valid Radio Node Cabling/Powering Options**

The illustration below shows a generic single-port PoE+ injector. Use this injector only when a PoE+ Ethernet switch is *not* available.
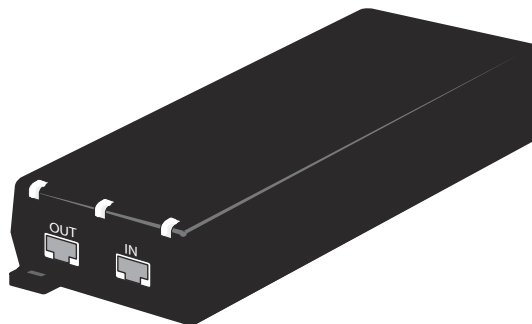

Figure 9 **Typical PoE+ Injector**

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 a typical PoE+ injector.

System Specifications

The SCRN-220 radio node has the following chassis measurements, power requirements, and environmental requirements, and complies with the following standards. Refer to the feature guide for your services node software release for release-specific features and specifications.

Table 2: Radio Node Specifications

Dimensions	Height:1.83 cm (7.2 in.) Width: 1.83 cm (7.2 in.) Depth: 36 cm (1.4 in.)
Weight	1.23 kg. (2.7 lbs)
Active Sessions per Radio Node	Up to 64 active LTE users 128 RRC connected users
Peak Data Rate	Downlink 150 Mbps; Uplink 50 Mbps (at 20 MHz)
Voice Services	VoLTE; 4 data bearers per UE
Power Requirements	Maximum transmit power: 2x250 mW (27 dBm)
Input Power	Power over Ethernet (PoE+) draws approximately 18W
Channel Size	5, 10, 15, 20 MHz
Ciphering	SNOW 3G and AES air interface encryption

Table 2: Radio Node Specifications *(continued)*

Security	Secure boot and secure key storage using Trusted Platform Module (TPM) functions
	IPsec tunneling to services node
	X.509 certificate-based authentication
Environmental Requirements	Operating temperature range: 0° to 40^oC (32° to 104^oF)
	Non-operating temperature range: 0 to 85^oC (32 to 185^oF)
	Relative humidity: Operating and storage: 0% RH to 90% RH non-condensing
	Ingress protection rating: IP30
Physical Interfaces	1 x Gigabit Ethernet 1000 Base-T with an RJ-45 connector
LEDs	1 top-panel tricolor (RGB) LED to indicate power and status
Mounting	Wall, Ceiling, Plenum
Antenna	Four internal Tx/RX antennas that operate in 2x2 mode with MIMO One internal network listen antenna *or* Four antenna ports with QMA coaxial connectors for external antennas One internal network listen antenna
Synchronization	IEEE 1588v2-based PTP based frequency synchronization to services node Cellular network listen for phase synchronization to LTE macro eNodeBs
MTBF	1,363,791 hours at +40°C (104°F)

SCRN-220 Bracket Specifications

The SCRN-220 radio node connects to one of two brackets for ceiling or wall mounting:

- a quarter-inch (0.64 centimeter) deep for cabling through a surface such as a wall or ceiling
- a 1.25 inch (3.18 centimeters) deep for exposed cabling along a hard surface such as brick or cinder block

Table 3 shows the specification for these brackets:

Table 3: Radio Node Specifications

0.25-Inch Bracket

Dimensions	Height:1.57 cm (6.2 in.) Width: 1.3 cm (5.1 in.) Depth: 0.64 cm (0.25 in.)
Weight	0.17 kg. (5.8 oz)

Table 3: Radio Node Specifications *(continued)*

1.25-Inch Bracket	
Dimensions	Height:1.57 cm (6.2 in.) Width: 1.3 cm (5.1 in.) Depth: 3.18 cm (1.25 in.)
Weight	0.24 kg. (8.2 oz)

Compliance

The SCRN-220 complies with the following standards:

Table 4: SCRN-220 Compliance

Safety	EN 60950-160950
	CB certification (IEC 60950, UL 60950-1)
EMC/Radio (FCC)	FCC Part 15B (Class A)
	FCC Part 24
	FCC Part 27
R&TTE	Directive 1999/5/EC:
	• EN 301 489-1, 301 489-23
	• EN 301 908-1, 301 908-3, 301 908-14
	• EN 50385 and EN 62311 (SAR)
RoHS	Directive 2011/65/EU
General	CE and NRTL marking

Radio Specifications

The SCRN-220 has the following variants:

Table 5: Radio Node Specifications

Radio Node Model	Operating Mode	Network Listen Bands
SCRN-220-020412	LTE Band 2, 4, or 12	LTE 700/1900/2100MHz
SCRN-220-020412-E	LTE Band 2, 4, or 12	LTE 700/1900/2100MHz
SCRN-220-020413	LTE Band 2, 4, or 13	LTE 700/1900/2100MHz
SCRN-220-020413-E	LTE Band 2, 4, or 13	LTE 700/1900/2100MHz

Select the Radio Node Location

Radio nodes can be installed in a wide range of locations including walls, ceilings, and spaces above the ceiling. Follow the installation guidelines for selecting appropriate mounting locations for the unit. When mounting a radio node vertically, align the bottom-side fins vertically for superior cooling.

Refer to the *E-RAN Deployment Planning Guide* for information about mounting positioning and the affects on cellular coverage. Always consult local codes about mounting and wiring SpiderCloud Wireless equipment.
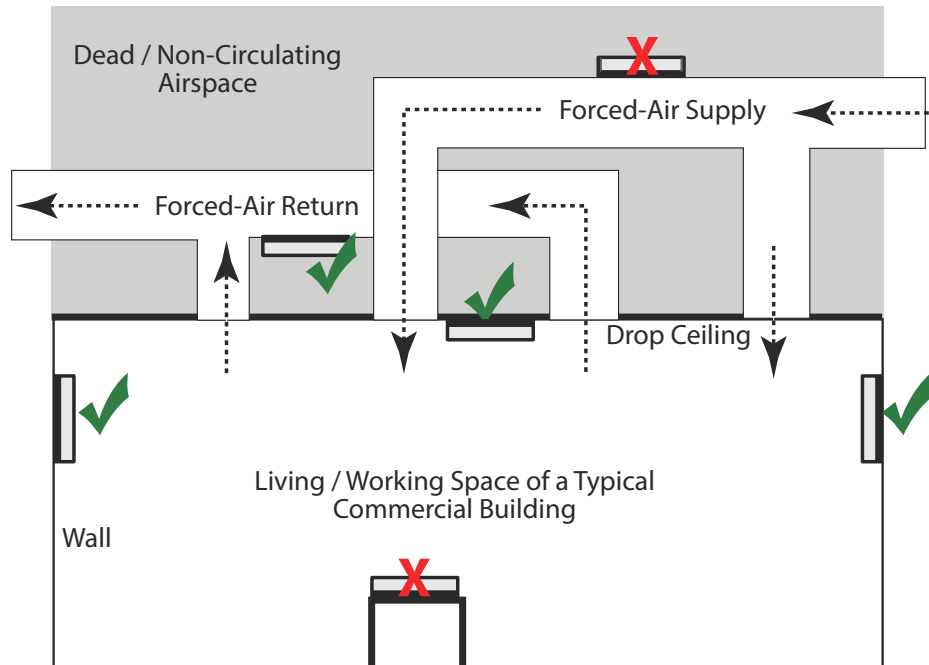

Figure 10 Radio Node Locations

When possible, locate radio node units at least 6 meters (20 feet) from an external wall. This distance maximizes indoor coverage and minimizes RF leakage outside the building. Refer to the *E-RAN Deployment Planning Guide for Dual-Mode Systems* and *E-RAN Deployment Planning Guide for LTE Systems* for more information about radio node placement.

When mounting near a wall or other obstruction, orient the mounting bracket such that the transmit antenna faces towards the coverage area and faces away from the wall. Refer to Bracket Mounting and Cabling Guidelines on page 15 for more information.

Installation and Mount Bracket Assembly

The radio node slides into one of two brackets for ceiling or wall mounting:

• a quarter-inch (0.64 centimeter) deep for cabling through a surface such as a wall or ceiling

• a 1.25 inch (3.18 centimeters) deep for exposed cabling along a hard surface such as brick or cinder block

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 radio node 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 radio node into the mount bracket.

- Secure the radio node to the mount bracket with a padlock or tie wrap to provide physical security.

- When mounting the radio node vertically, orient the bracket such that the bracket keyholes have the narrow side up as shown in Figure 11.

Typical Radio Node Mounting Options

Radio nodes can be mounted on a wide number of surfaces including the following typical surfaces:

- **Light grill:** Use bolts, nuts, and washers to secure the universal mount bracket using holes in the light grill. Adjust the universal mounting bracket until the bracket and light grill holes align.

- **Directly on the wall or ceiling:** Use drywall screws to secure the universal mount bracket directly to sheetrock or plasterboard on the wall or ceiling.

- **Mud or plaster ring:** Secure the universal mount bracket directly on the wall or ceiling as above with a 3 1/4 inch (8.25 centimeter) mud or plaster ring between the mount bracket and the mounting service and run the Ethernet cable through ring's hole.

- **Existing infrastructure:** Secure the universal mount bracket to existing infrastructure as long as the radio node RF propagation or existing installed equipment is not adversely impacted.

- **Non-metal tiles:** Use bracing for rear support and mount the radio node in the center of the tile for even weight distribution. Ensure that the bracing is the same width as the tile.

- **Drop ceiling:** Contact your SpiderCloud Wireless representative for recommendations of supported third-party brackets and clamps.

Installing the Radio Node

The radio node receives its power source over powered Ethernet. If your wiring closet does not have existing PoE+ equipment, SpiderCloud Wireless recommends a PoE+ power injector for the radio node. See section Input Power on page 10.

The Ethernet cable can directly through a surface such as a wall or ceiling or route the cable openly:

- Refer to Installing the Radio Node (Method 1) on page 16 for direct cable routing installation through an opening behind the mount bracket using the shorter mount bracket.

- Refer to Installing the Radio Node (Method 2) on page 17 for open cable routing installation using the taller mount bracket.

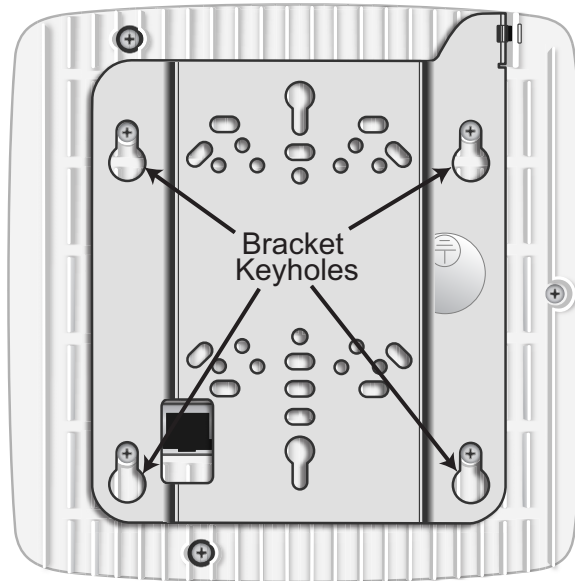Attach the mount bracket to the radio node as shown in Figure 11:

Figure 11 Radio Node Slides into Mount Bracket

Installing the Radio Node (Method 1)

Use this method with the quarter-inch bracket when routing the Ethernet cable through an opening where the bracket will be mounted.

To route the cable directly and mount the radio node

Step 1 Cut a hole in the ceiling or wall to route the Ethernet cable through. Align the hole with the bracket Ethernet cable entry hole.

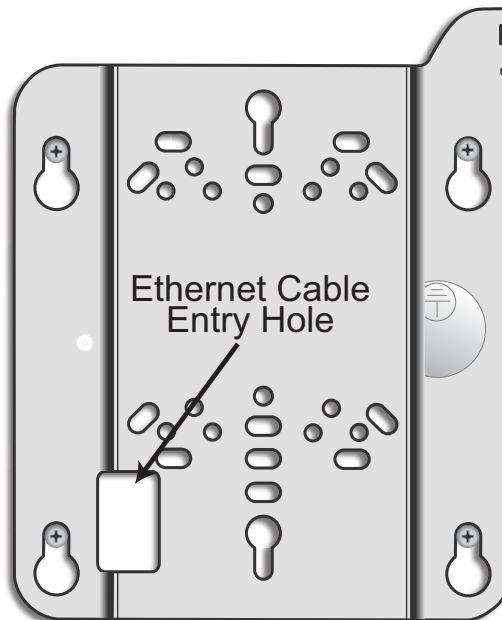**Step 2** Route the Ethernet cable through the rectangular hole in the mounting bracket.

Figure 12 Mount Bracket with Direct Cable Routing