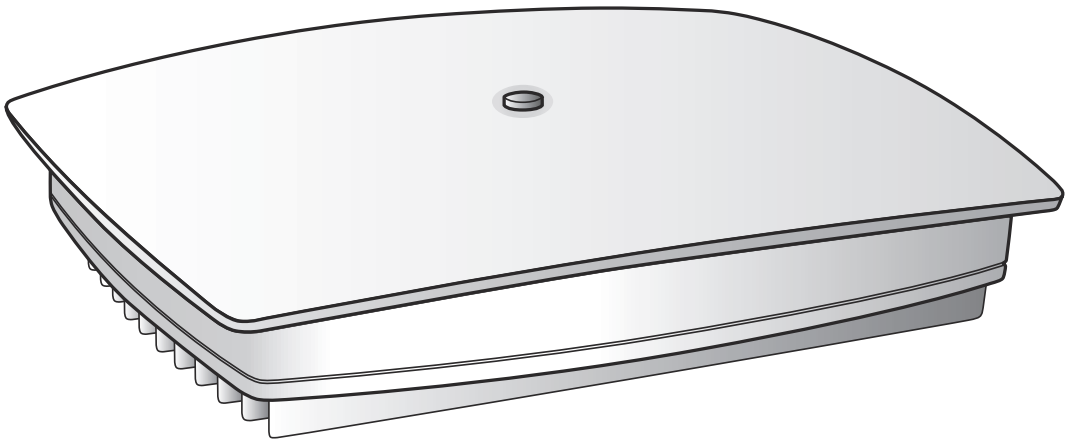
SpiderCloud® Radio Node - SCRN-200 Hardware Installation Guide



SpiderCloud Wireless

Part number: DOC-SCRN-HW-05
Published: April 2012

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 20 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.

Industry Canada Statements

This Class [A/B] digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe [A/B] est conforme à la norme NMB-003 du Canada.

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Table of Contents

System Overview 5
Services Provided 5
Radio Node System Isometric Top View and Bottom View 6
System Specifications 7
Frequency Bands of Operation 7
Size and Dimensions 7
Environmental Requirements 7
Power 8
Compliance 8
Antennas 8
Ports and LEDs 9
Input Power 10
Select the Radio Node Location 12
Installation and Mount Bracket Assembly 13
Bracket Mounting and Cabling Guidelines 13
Installing the Radio Node 14
Installing the Radio Node (Method 1) 14
Installing the Radio Node (Method 2) 15
Completing the Installation 17
Detaching the Radio Node from the Mount Bracket 18
Boot Sequence and Services Node Communication 18
Related Documents 19
Appendix, Antenna Patterns 21
Index 25

System Overview

The SpiderCloud® 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.

The radio node enables mobile operators to offer dedicated, in-building coverage and capacity for UMTS services. It is easy to install and connects to the existing enterprise LAN using standard Ethernet cabling or to a dedicated LAN infrastructure deployed for use by the operator. Radio nodes are managed by the SpiderCloud Services Node 8000 (SCSN-8000) access controller, typically installed in the enterprise DMZ.

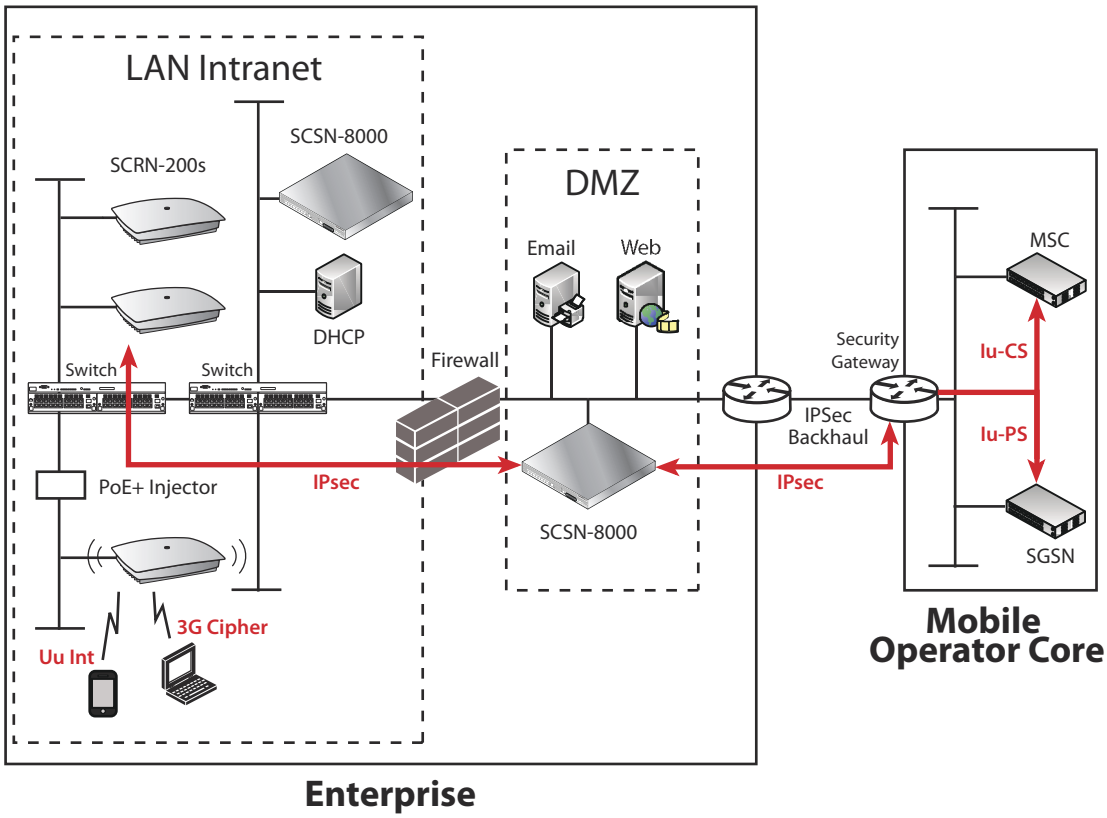


Figure 1 Radio Node Relationship to Enterprise and Mobile Operator Core Networks

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 radio node ships with either two internal antennas, or with two TNC connectors for use with external antennas. The following drawings display an isometric top and bottom views of the radio node with internal antennas:

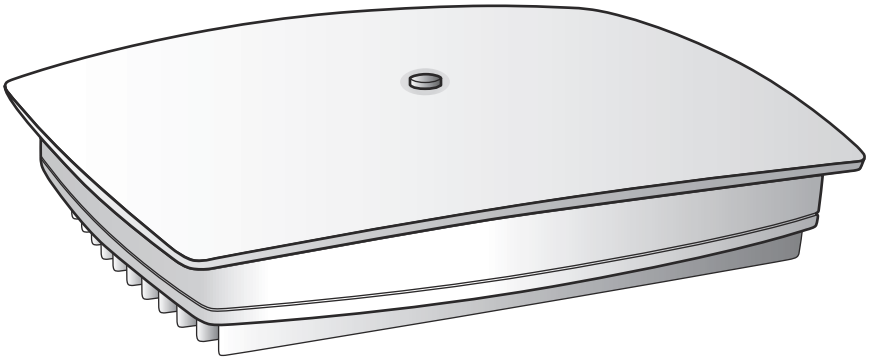


Figure 2 Radio Node Top View

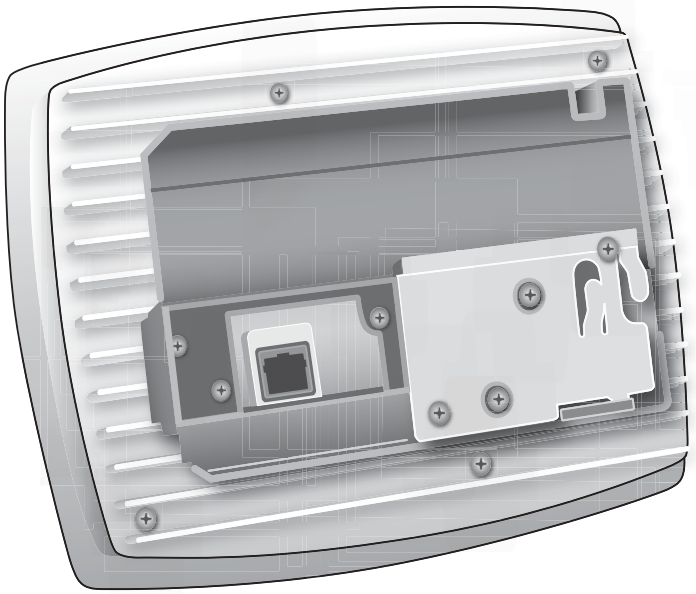


Figure 3 Radio Node Bottom View with Pedestal Base

System Specifications

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

Frequency Bands of Operation

SpiderCloud Wireless provides three versions of the SCRN-200 for operation in the following bands:

- UMTS Band I: Receiver: 1920-1980 MHz, Transmitter: 2110-2170 MHz.
  GSM monitor at 925-960 MHz, 1805-1880 MHz
- UMTS Band II: Receiver: 1850-1910 MHz, Transmitter: 1930-1990 MHz.
  GSM monitor at 869-894, 1930-1990 MHz
- UMTS 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)
- Length: 23.8 centimeters (9.4 inches)
- Weight: (both models):
  - 0.91 kilograms (2 pounds)
  - 1.41 kilograms with mounting bracket (3.1 pounds)

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

Power

The radio node is 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) nominal Equivalent Isotropically Radiated Power (EIRP)

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 (UMTS Band II only)
  - FCC Part 27 (UMTS Band IV only)
- CE Marking
- NRTL 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
- Industry Canada: RSS-133, RSS-139, ICES-003 (Class A)

Antennas

The radio node uses two vertically-polarized, omnidirectional internal 2 dBi nominal gain antennas. Both antennas receive, only one antenna transmits. One model has internal antennas. The other has two antenna ports with TNC connectors for use with external antennas.


Tip

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

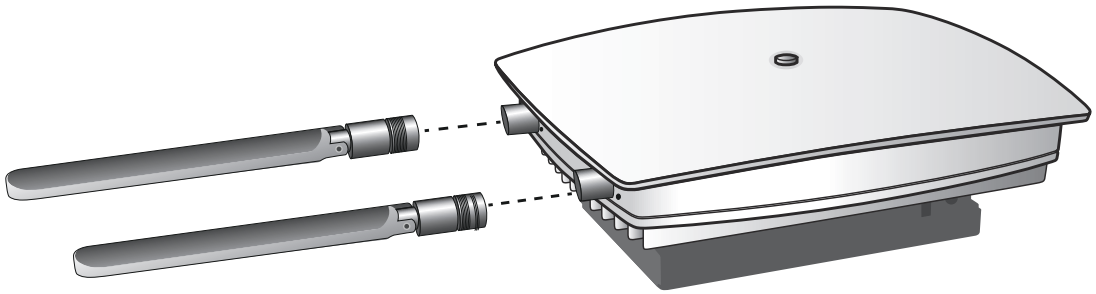


Figure 4 Typical External Antennas

For regulatory compliance, use only antennas certified by SpiderCloud Wireless.

Ports and LEDs

The radio node has one top-panel tricolor LED to indicate power and status. Table 1 shows the LED behavior of the radio node. The LED also supports advanced troubleshooting functions when the system is operational.

Table 1: Radio Node LED Behavior

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

* Refer to the *SpiderCloud 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-5/5e) or better twisted-pair cable with an RJ-45 connector. Figure 5 on page 10 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.

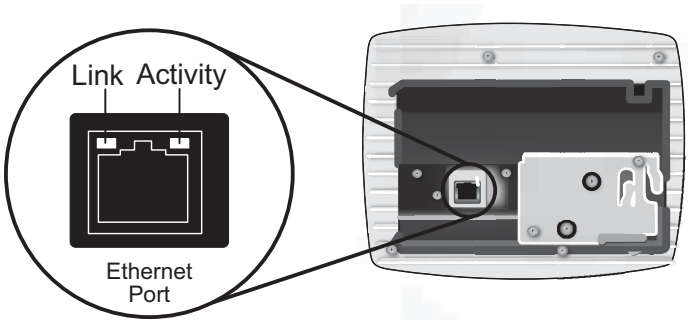


Figure 5 Ethernet Port

The radio node for use with external antennas has two antenna ports with TNC connectors labeled **A** and **B**.

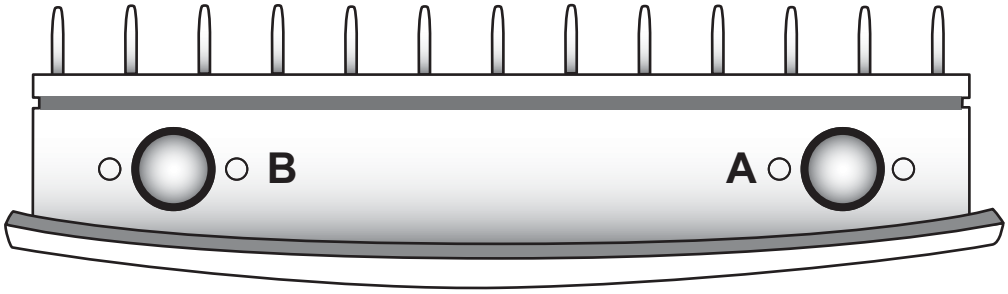


Figure 6 Antenna Port TNC Connectors

Input Power

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. SpiderCloud Wireless recommends PoE+ powering to support future products and functionalities operating at higher power levels.

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 7 shows the valid radio node cabling/powering options:

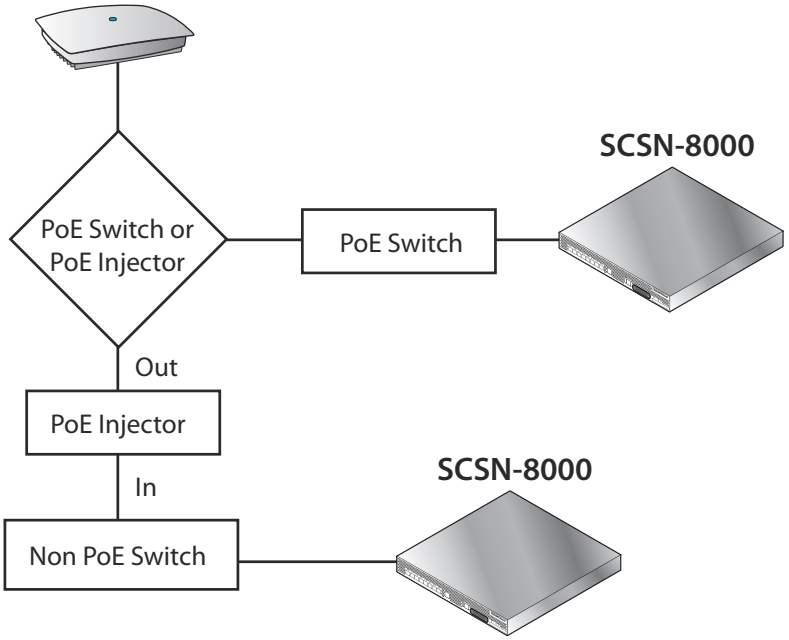


Figure 7 Valid Radio Node Cabling/Powering Options

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

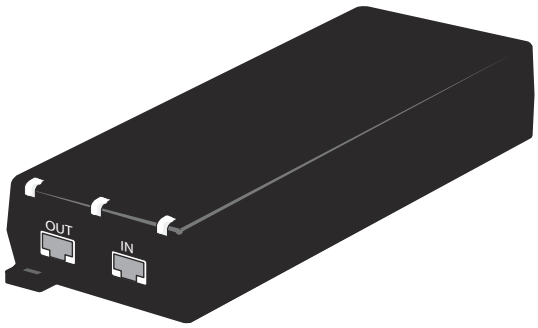


Figure 8 Typical PoE+ Injector

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.

Select the Radio Node Location

Radio nodes can be installed in a wide range of locations including walls, ceilings, and plenum spaces. 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.

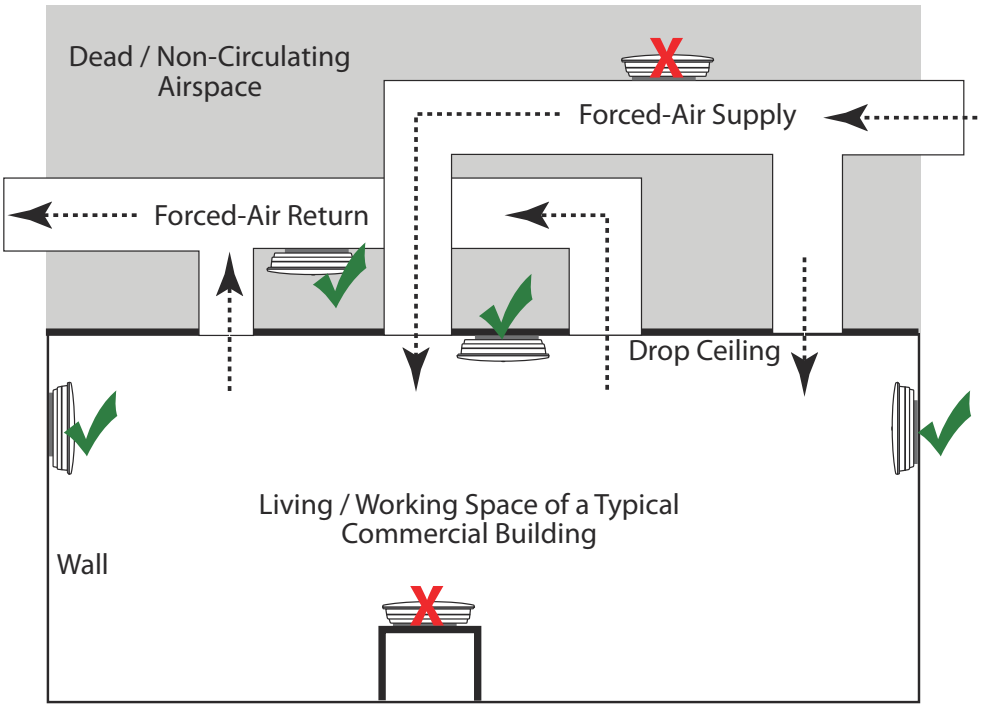


Figure 9 Radio Node Locations

When possible, 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. 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 13 for more information.

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 bracket for ceiling or wall mounting. SpiderCloud Wireless 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 10:

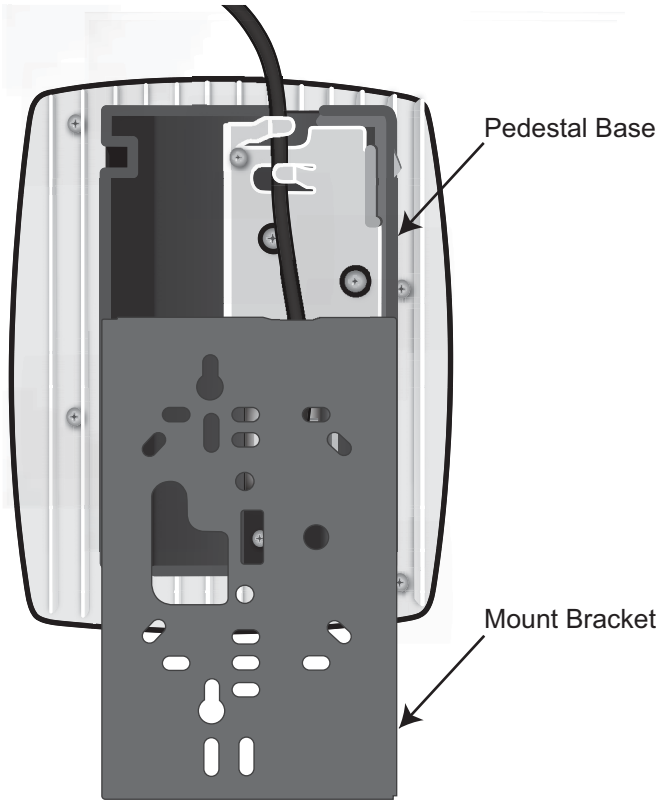


Figure 10 Pedestal Base Slides into Mount Bracket

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.
- When mounting the radio node vertically, orient the bracket with the open end on top and the closed end on the bottom. Figure 11 on page 14 shows the proper vertical orientation.
- When mounting the radio node near a wall or other obstruction, orient the bracket such that the radio node transmit side towards the coverage area. In vertical mountings, this is on the right side of the radio node. Figure 11 on page 14 shows the mounting bracket orientation:

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 route openly or directly through a surface such as a wall or ceiling:

- Refer to Installing the Radio Node (Method 1) on page 14 for open cable routing installation.
- Refer to Installing the Radio Node (Method 2) on page 15 for direct cable routing installation.

Installing the Radio Node (Method 1)

To route the cable openly and mount 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 onto.

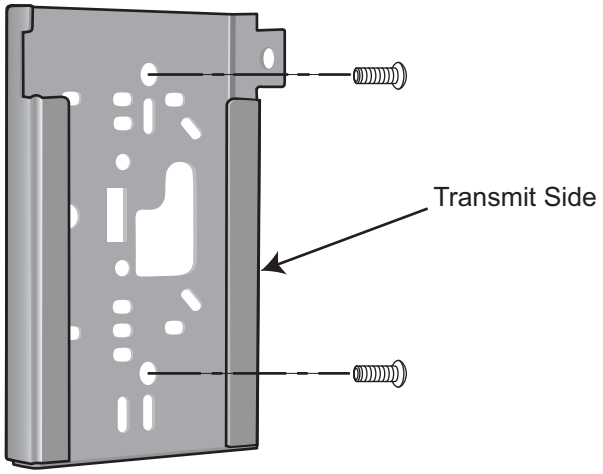


Figure 11 Attach the Mount Bracket

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 12:

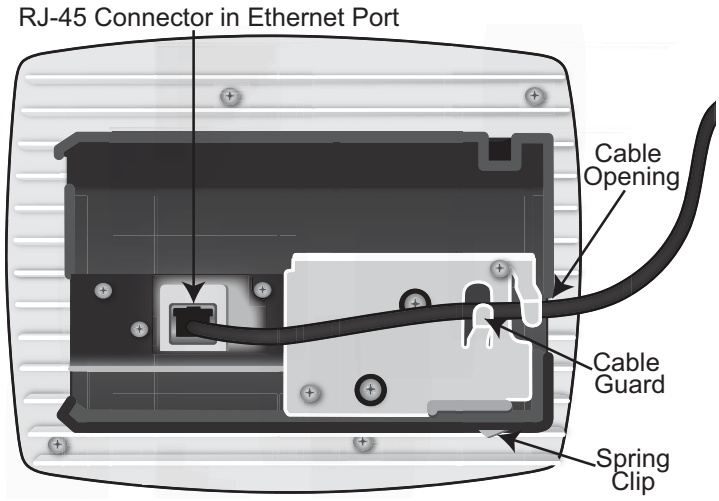


Figure 12 Route and Terminate the Cable

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.

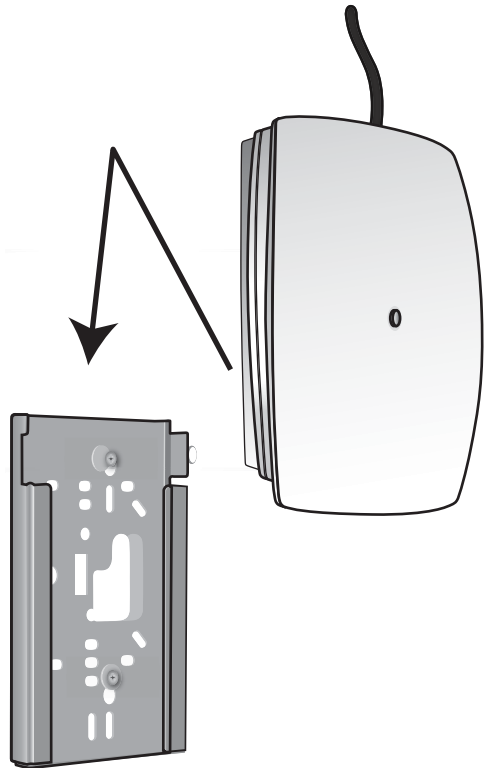


Figure 13 Fully Mounted

Installing the Radio Node (Method 2)

To route the cable directly and mount the radio node

Step 1 Route the Ethernet cable through the large hole in the mounting bracket.

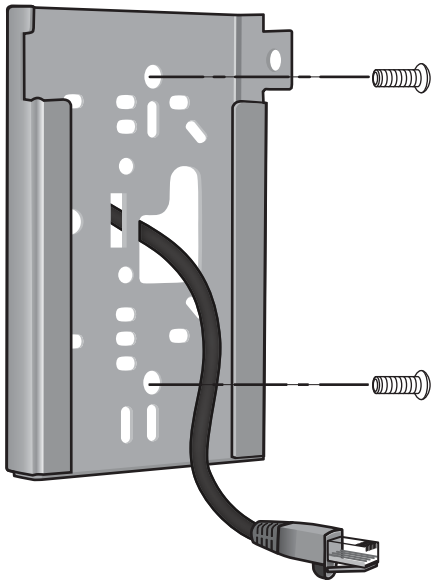


Figure 14 Mount Bracket with Direct Cable Routing

Step 2 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 onto.

Step 3 Insert the RJ-45 connector into the Ethernet port as shown in Figure 15:

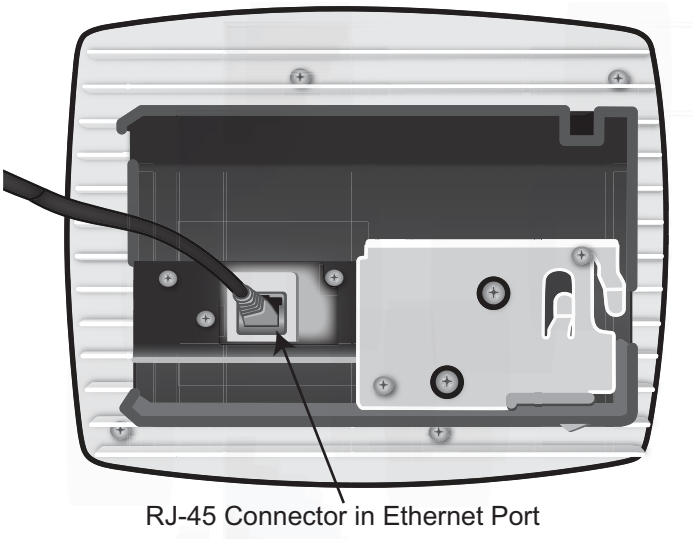


Figure 15 Route and Terminate the Cable

Step 4 Push as much cable back through the wall or ceiling as possible. The mount bracket assembly has room for some cable slack.

Step 5 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.

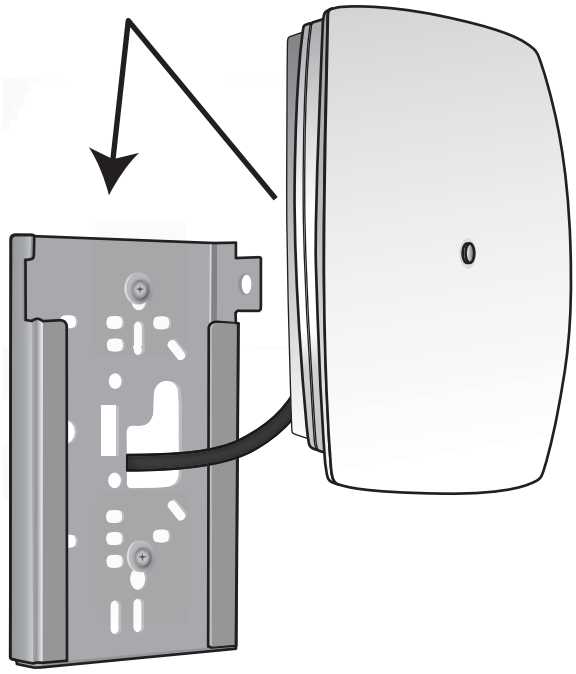


Figure 16 Fully Mounted

Completing the Installation

Step 1 For radio nodes for use with external antennas, attach the antennas to the TNC connectors. If the radio node is mounted on a horizontal surface, direct the antennas downward. If it is mounted on a vertical surface, orient the antennas upward.

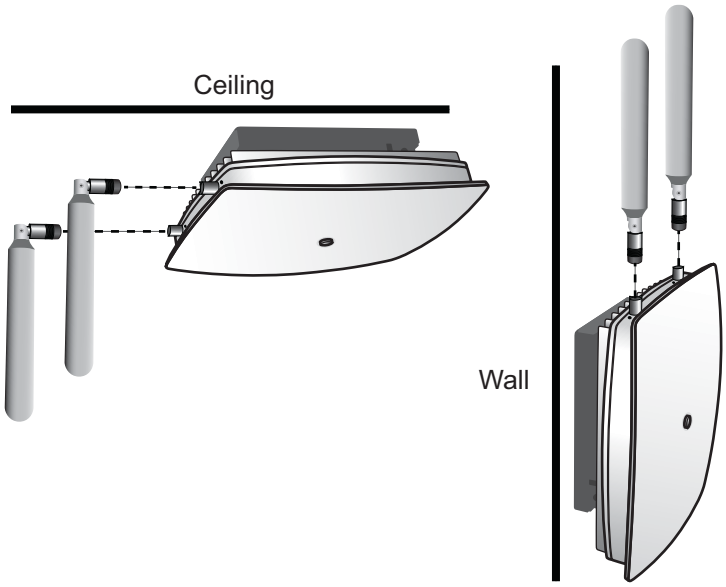


Figure 17 External Antenna Orientation

Step 2 Attach a padlock or cable tie wrap through the cutout lock holes in the mount bracket and pedestal base.

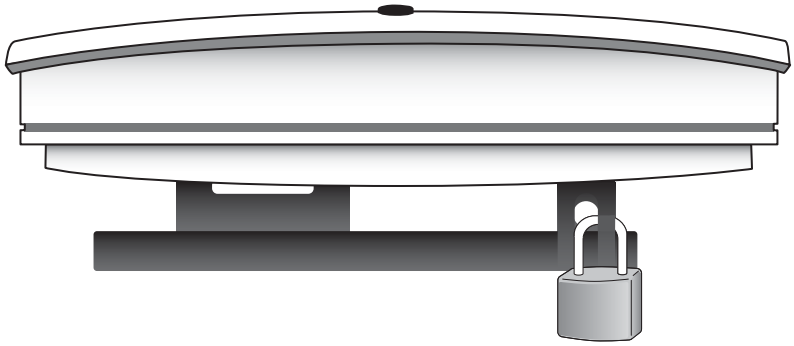


Figure 18 Padlock and Lock Holes

Note

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

Step 3 The radio node boots up and attempts to connect to the services node. Refer to Boot Sequence and Services Node Communication below for more information.

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:

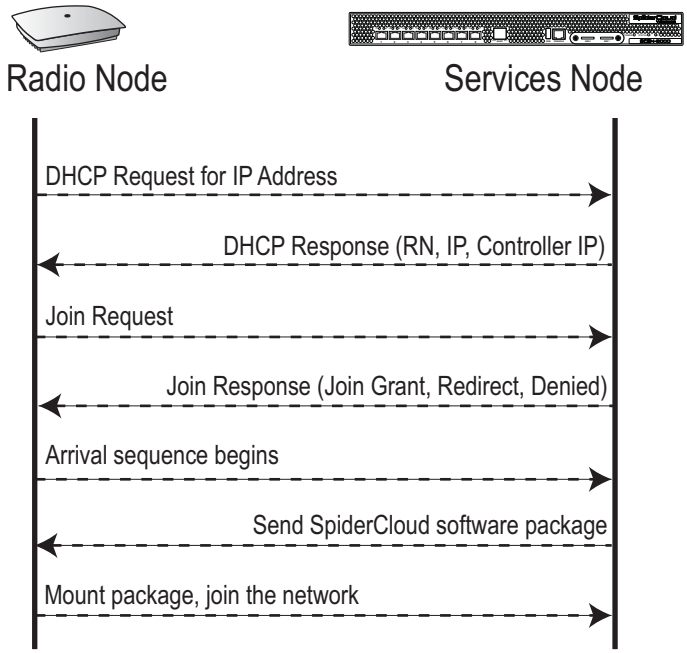


Figure 19 Radio Node Boot Sequence

Sequence description:

1. When the radio node is powered on, the device sends a DHCP Request to the services node DHCP server to get IP information. The DHCP server is configured on the services node to respond only to DHCP requests from SpiderCloud Wireless radio nodes. Refer to the *SpiderCloud OS (SCOS) Administrator Guide* for more information about the services node DHCP server configuration.
2. The server responds with the IP addresses of the radio node and the services node (the master of the radio node).
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 services node responds with a Join Response message indicating whether the radio node is allowed to join the network or not.

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.

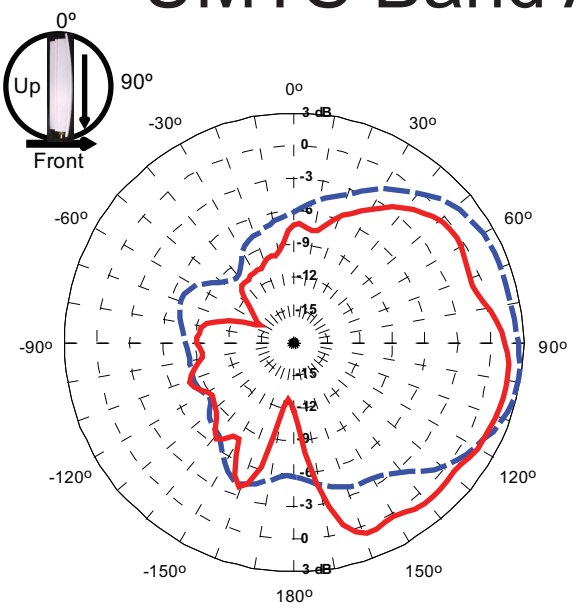
Related Documents

Refer to the following documents for more information:

- The *SpiderCloud System Description* provides an overview of how the SpiderCloud 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 *SpiderCloud OS (SCOS) Administrator Guide* to configure the software environment and internetworking between the services node and radio node devices.
- The *SpiderCloud Services Node - SCSN-8000 Hardware Installation Guide* for hardware specifications and installation instructions.
- The *SpiderCloud Cluster Deployment Planning Guide* for information about planning the SpiderCloud small cell cluster.
- The *SpiderCloud System Dimensioning and Planning Guide* for information specifically targeted for pre-installation, planning, and network design.
- The *SpiderCloud OS (SCOS) CLI User Guide* for an introduction to the key features and functionalities of the SpiderCloud Command Line Interface (CLI).
- The *SCOS NB Data Model Reference Guide* for details about objects and parameters that comprise the system configuration and operational state.

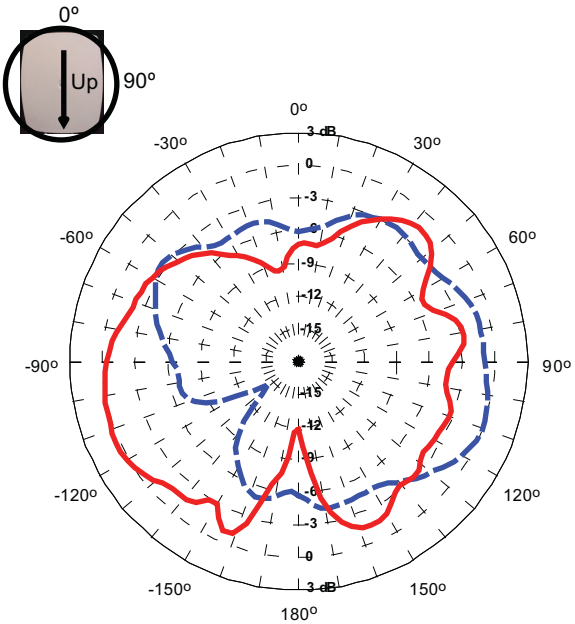
Appendix, Antenna Patterns

UMTS Band Antenna Patterns



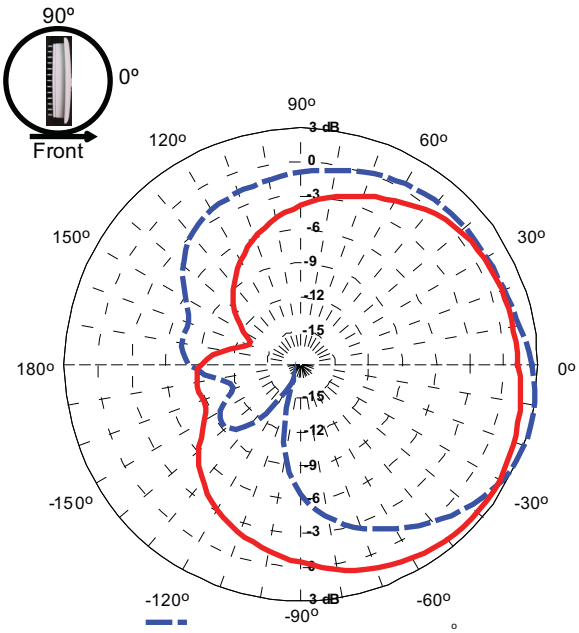
AUT$_1$=2140 MHz | Max Gain$_1$= 2.84 dBi at 99º
AUT$_2$=2140 MHz | Max Gain$_2$= 1.82 dBi at 102º

EL1 Cut (Front-to-Back)



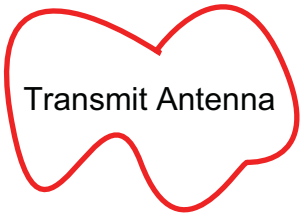
AUT$_1$=2140 MHz | Max Gain$_1$= 0.02 dBi at 111º
AUT$_2$=2140 MHz | Max Gain$_2$= 0.38 dBi at -117º

EL2 Cut (Side-to-Side)

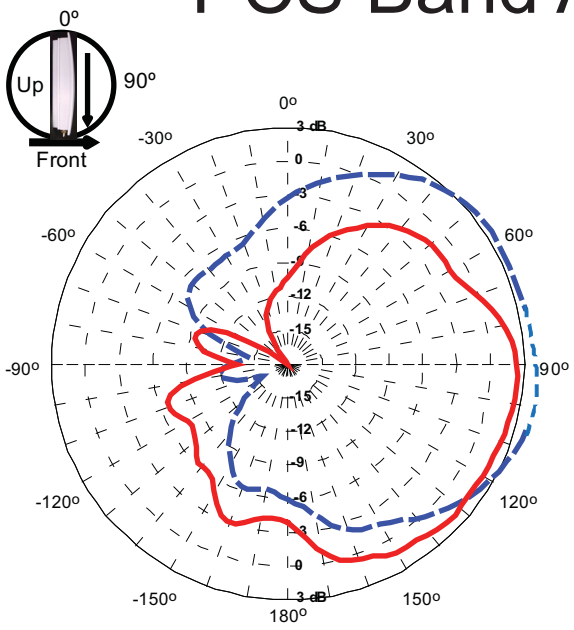


AUT$_1$=2140 MHz | Max Gain$_1$= 3.13 dBi at -15º
AUT$_2$=2140 MHz | Max Gain$_2$= 2.46 dBi at -36º

AZ Cut

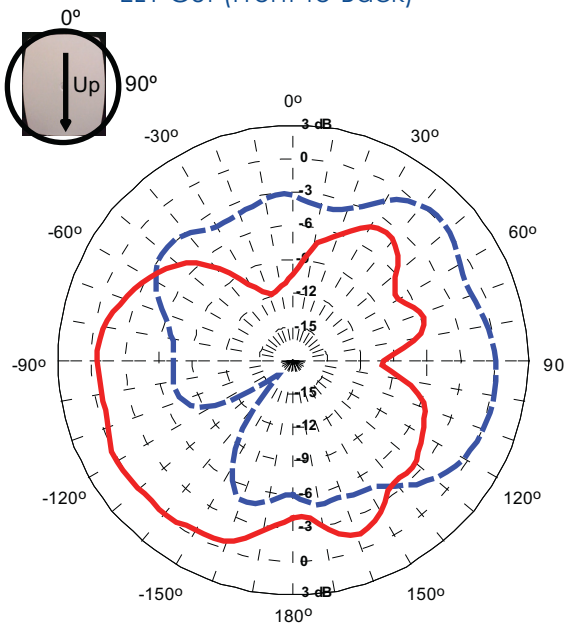


PCS Band Antenna Patterns



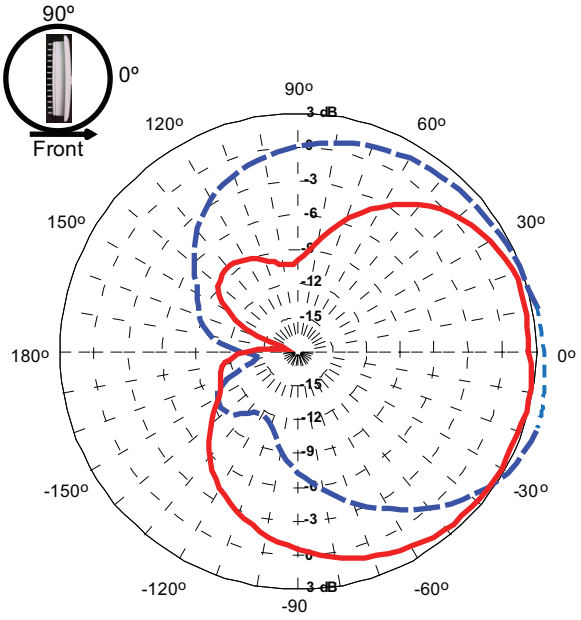
AUT$_1$=1960 MHz | Max Gain$_1$= 4.42 dBi at 93º
AUT$_2$=1960 MHz | Max Gain$_2$= 2.47 dBi at 93º

EL1 Cut (Front-to-Back)



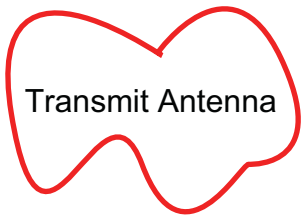
AUT$_1$=1960 MHz | Max Gain$_1$= 0.24 dBi at 44º
AUT$_2$=1960 MHz | Max Gain$_2$= 0.17 dBi at -120º

EL2 Cut (Side-to-Side)

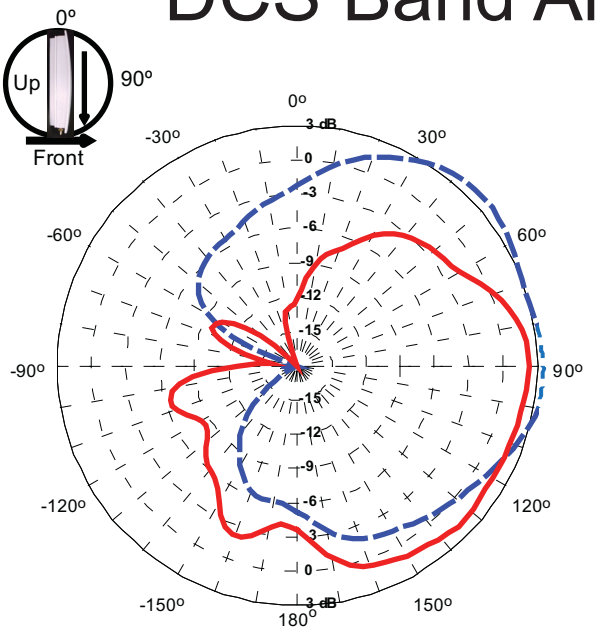


AUT$_1$=1960 MHz | Max Gain$_1$= 4.49 dBi at -6º
AUT$_2$=1960 MHz | Max Gain$_2$= 2.68 dBi at -12º

AZ Cut

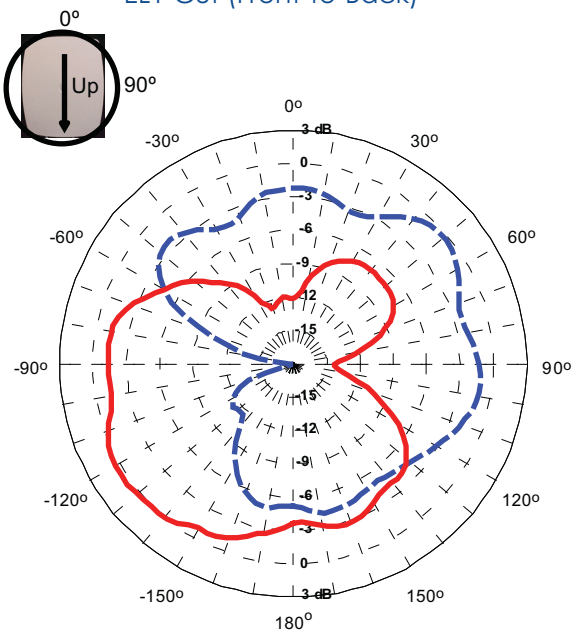


DCS Band Antenna Patterns



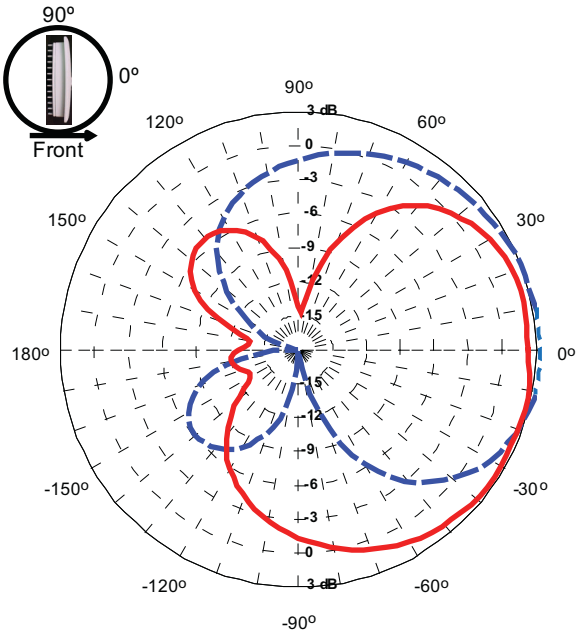
AUT$_1$=1884 MHz | Max Gain$_1$= 3.95 dBi at 48°
AUT$_2$=1884 MHz | Max Gain$_2$= 2.3 dBi at -123°

EL1 Cut (Front-to-Back)



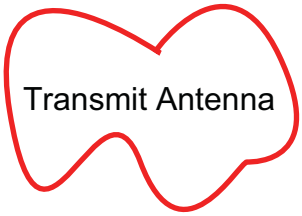
AUT$_1$=1884 MHz | Max Gain$_1$= -0.34 dBi at 48°
AUT$_2$=1884 MHz | Max Gain$_2$= 0.49 dBi at -123°

EL2 Cut (Side-to-Side)



AUT$_1$=1884 MHz | Max Gain$_1$= 3.74 dBi at 3°
AUT$_2$=1884 MHz | Max Gain$_2$= 2.79 dBi at -12°

AZ Cut



Index

A

activity LED **9**
altitude range **7**
antenna
    external **6**
    external orientation **17**
    ports **10**
antennas **8**

B

boot sequence **18**
bottom view **6**

C

cabling guidelines **13**
CB certification **8**
CE marking **8**
compliance **8**
connector, TNC **6**

D

detaching **18**
DHCP request **18**

E

EIRP compliance **8**
environmental requirements **7**

F

FCC compliance **8**
frequency bands of operation **7**

H

height **7**

I

Industry Canada
    RSS-133, RSS-139, ICES-003 (Class A) **8**

L

LED behavior **9**
length **7**
link LED **9**, **10**
locating **12**

M

mount bracket **13**

N

NRTL Marking **8**

O

operating humidity range **7**
operating temperature range **7**

P

pedestal base **13**
ports, antenna **10**
power **8**

R

R&TTE compliance **8**
related documentation **19**
relative humidity range **7**
RoHS compliance **8**

S

separation distances **12**
services **5**
specifications **7**
storage temperature range **7**
system diagram **5**
system specifications **7**

T

TNC connector **6**
top view **6**

U

UMTS bands **7**

W

weight **7**
width **7**