Step 3 With two user-provided screws, attach the mount bracket assembly to a wall or ceiling. The screw holes are sized for an M4 (#10) or larger screw. Ensure the screws have a snug fit onto the studs, sheetrock, anchor, or other material you are bolting onto and that you match the screw head with the appropriate cutout hole size on the bracket.

If needed, use a flat washer between the bracket and screw head to ensure a secure fastening.

Step 4 Insert the RJ-45 connector into the Ethernet port as shown in Figure 13:

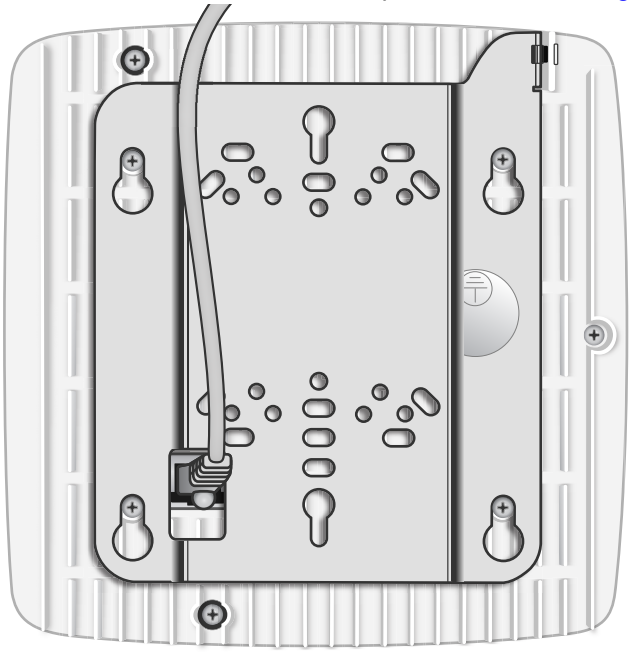


Figure 13 Route and Terminate the Cable

Step 5 Insert the radio node into the mount bracket.

Step 6 Push as much cable back through the wall or ceiling as possible. The mount bracket assembly has room for some cable slack.

Installing the Radio Node (Method 2)

Use this method with the 1.25 inch bracket when routing an exposed Ethernet cable directly to the radio node.

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) or larger screw. Ensure the screws have a snug fit onto the studs, sheetrock, anchor, or other material you are bolting onto and that you match the screw head with the appropriate cutout hole size on the bracket.

If needed, use a flat washer between the bracket and screw head to ensure a secure fastening. Figure 14 shows the 1.25-inch mount bracket.

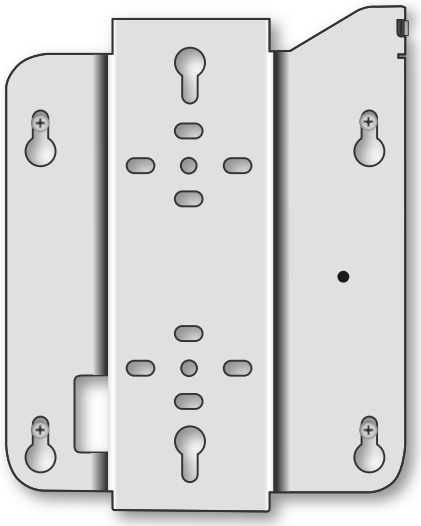


Figure 14 1.25-Inch Mount Bracket

Step 2 Insert the RJ-45 connector through the rectangular bracket opening into the Ethernet port as shown in Figure 15:

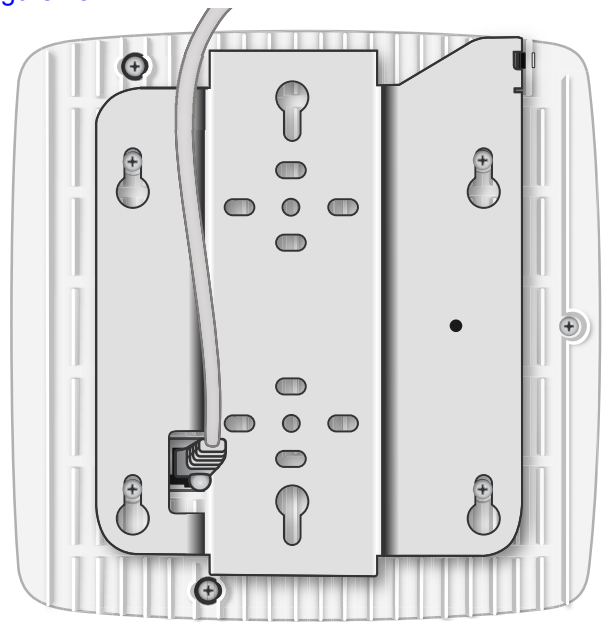


Figure 15 Route and Terminate the Cable

Step 3 Insert the radio node into the mount bracket.

Completing the Installation

Step 1 Attach a padlock or cable tie wrap into the provided slot to secure the unit to the mount bracket.

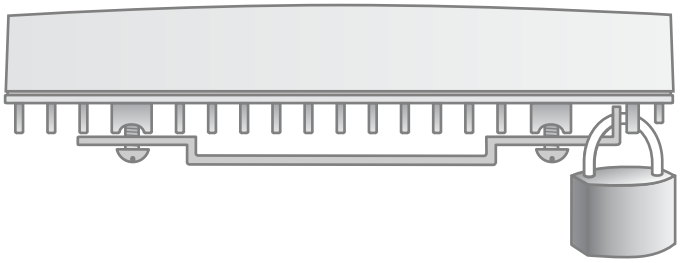


Figure 16 Padlock and Lock Holes

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 2 The radio node boots up and attempts to connect to the services node. Refer to Boot Sequence and Services Node Communication on page 20 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 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. When finished, all devices are reachable. Figure 17 shows the radio node boot sequence:

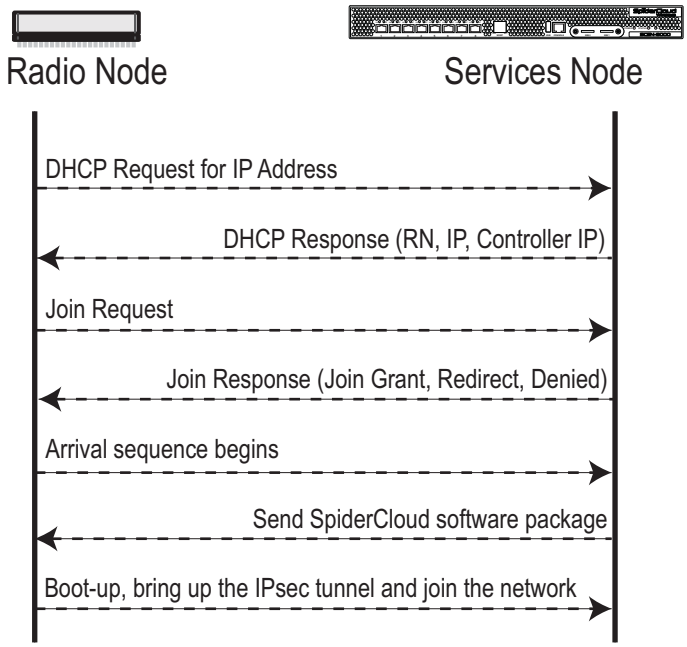


Figure 17 Radio Node Boot Sequence

Boot Sequence:

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. The services node sends the SpiderCloud software image to the radio node.
6. The radio node boots up the received SpiderCloud software package.
7. The radio node establishes an IPsec tunnel with the services node. Based upon the radio configuration, the radio node loads the appropriate protocol elements and joins the network.

Radio Node LED Boot Sequence

The radio node state machine is sequential and progresses in the following order:

State 0 -> State 1 -> State 2 -> State 3 -> State 4 -> State 5

A normal boot sequence transitions through all these states sequentially and the LED state transitions accordingly. If the radio node fails to transition to the next state, the system restarts the boot sequence, starting with State 0. You can determine the progress during the booting stages by observing the LED color transitions. On failure, the last LED state will display the state that encountered the failure. Table 6 shows the radio node boot sequence and corresponding LED behavior:

Table 6: Radio Node LED Boot Sequence

State	LED Color	Description	Possible Failures and Actions
0. Power On/ Reset	Flashing Green	This is the initial state on startup. The radio node bootup is controlled by firmware in this state. It will go through a lamp test in this state. A lamp test involves cycling through all LED colors.	This state should be very short lived and should transition to the next state immediately. A radio node should not stay in this state indefinitely. Note: Flashing Green is also used to indicate a radio node that has been administratively disabled. This can be determined from the CLI.
1. DHCP	Solid Red	The radio node starts by sending out a DHCP Request. The radio node moves to the next state (State 2) upon receiving a DHCP response and an IP Address.	No DHCP Response, IP Address not allocated. Check cabling, DHCP Server configuration.
2. Join	Solid Blue	The radio node has an IP Address and sends a UDP Join request to the Serving services node. The radio node moves to the next state (State 3) upon getting a JOIN GRANT from the services node.	No IP reachability to the services node. Check IP network between radio node and services node for routing issues.
3. TFTP	Flashing Blue	The radio node proceeds next to download the operating system image from the services node. The radio node moves to the next state (State 4) after the image has been downloaded.	Failure to download TFTP image. Check firewall between radio node and services node.

Table 6: Radio Node LED Boot Sequence *(continued)*

State	LED Color	Description	Possible Failures and Actions
4. Operating System Booting	Flashing Green	The radio node loads the operating system and starts the default platform applications. The radio node moves to the next state (State 5) when it establishes connectivity with the service node.	Failure to start the operating system. This normally points to a software/build issue. Please contact SpiderCloud support.
5. Running	Solid Green	The operating system is running. The radio node continues the startup sequence, but is now controlled by the services node.	The operating system is up and running on the radio node. Any subsequent state transitions can now be tracked from events and logs on the services node.

Radio Node LED Management

The LED display is active by default, but can be deactivated in light-sensitive environments as needed. Even when the display is disabled, the LED will be lighted during the following conditions:

- while the radio node is booting
- if the radio node or cell is in fault state
- if there is an active emergency call
- if the locate radio node feature is active
- if the follow IMSI feature is active

Table 7 shows the default LED behavior of the radio node:

Table 7: Radio Node LED Behavior

LED	Status	Flash Rate
Green: slow flashing	The radio node or radio is 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 UMTS 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 and that IMSI is camped on a UMTS cell in the radio node*	
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.

To disable the LED display

Step 1 From the Configuration Mode, issue the **`set System RadioNode LED DefaultMode Dark`** command to disable the LED display:

```
set System RadioNode LED DefaultMode Dark
```

Step 2 Issue the **`show System RadioNode LED`** command to verify the configuration:

```
show System RadioNode LED
DefaultMode Dark;
```

To re-enable the LED display

Step 1 From the Configuration Mode, issue the **`set System RadioNode LED DefaultMode Standard`** command to re-enable the LED display:

```
set System RadioNode LED DefaultMode Standard
```

Step 2 Issue the **`show System RadioNode LED`** command to verify the configuration:

```
show System RadioNode LED
DefaultMode Standard;
```

The SpiderCloud Documentation Set

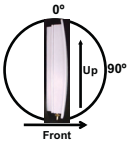
The SpiderCloud documentation set includes:

- 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 Feature Description* provides high-level descriptions of the E-RAN system features, their impact on the product components (services nodes and radio nodes), manageability considerations, and feature benefits.
- The *SpiderCloud OS (SCOS) Administrator Guide* provides procedures for configuring the software environment and internetworking between the services node and radio node devices.
- The *SpiderCloud Services Node Hardware Installation Guide* provides hardware specifications and installation instructions.
- The *SpiderCloud Radio Node Hardware Installation Guide* provides hardware specifications and installation instructions.
- The *E-RAN Deployment Planning Guide* provides information about planning and dimensioning E-RAN systems.
- The *SpiderCloud OS (SCOS) CLI User Guide* provides an introduction to the key features and functionalities of the SpiderCloud Command Line Interface (CLI).
- The *SCOS NB Data Model Reference Guide* provides details about the objects and parameters that comprise the system configuration and operational state.
- The *SpiderCloud OS Faults, Conditions, and Events Reference Guide* provides details about all alarms, conditions, and events in the system.
- The *SpiderCloud System Commissioning Guide* provides information about turning up a SpiderCloud E-RAN with the Local Configuration Interface (LCI) graphical user interface.

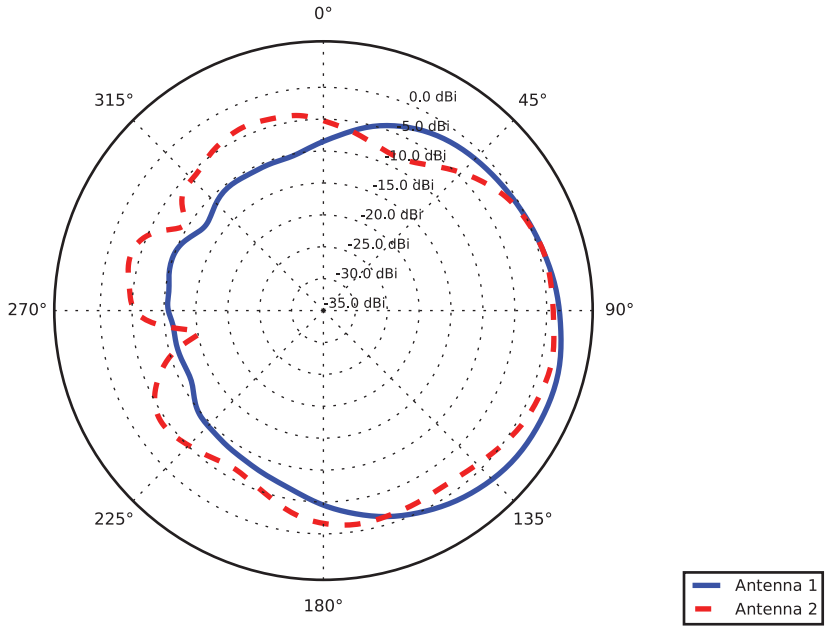
- The *Performance Measurements for Dual-Mode Small-Cell E-RANs* provides a reference guide to UMTS and LTE Key Performance Indicators (KPI) that monitor the health and state of the E-RAN system.
- The *Performance Measurements for LTE Small-Cell E-RANs* provides a reference guide to Key Performance Indicators (KPI) that monitor the health and state of an LTE E-RAN system.
- The *SpiderNet Management System Installation and Administration Guide* provides information about installing the SpiderNet network management server and client and using it to remotely manage E-RAN deployments.
- The *E-RAN Troubleshooting Guide* provides information about diagnosing and correcting problems with installing, provisioning, administering, and maintaining SpiderCloud equipment and services.
- The *Troubleshooting E-RAN Systems with SpiderNet* provides information about diagnosing and correcting problems in the SpiderCloud system with the SpiderNet network management system.
- The *SpiderCloud Time Zone Reference Guide* provides the information required to configure the time zone for SpiderCloud services nodes.
- The *SpiderCloud Call Performance Event Reporting Guide* provides detailed information about call performance events files including the file format, reported events, and event parameters.
- The *SpiderNet NBI Integration Guide* provides information about integrating the SpiderNet network management system into operator's Northbound Interface (NBI) Operations Support Systems (OSSs) to surveil SpiderCloud networks.

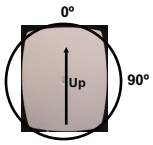
Appendix A: LTE Antenna Patterns

LTE Band 2

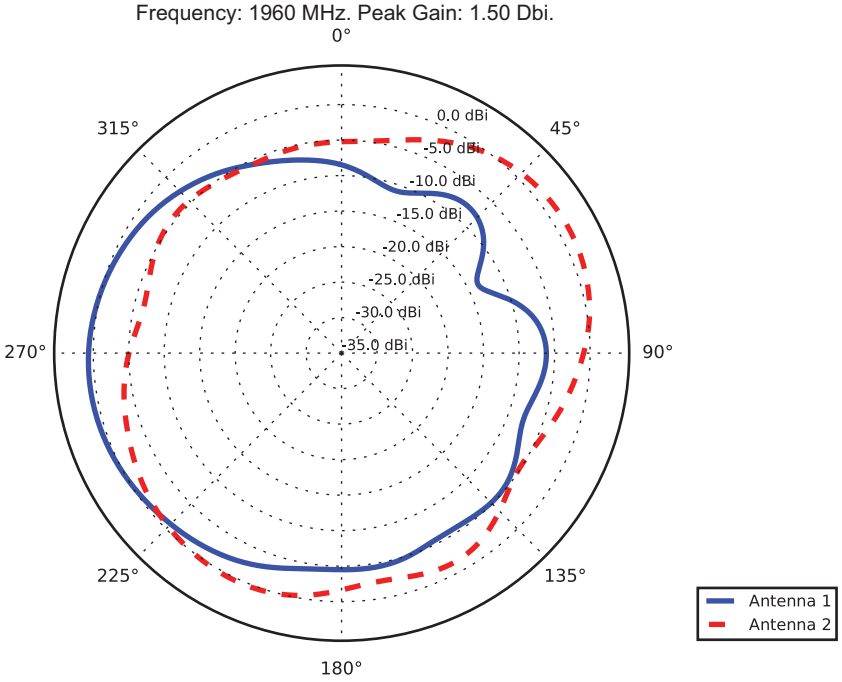


Frequency: 1960 MHz. Peak Gain: 3.21 Dbi.

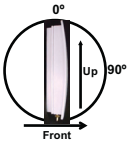




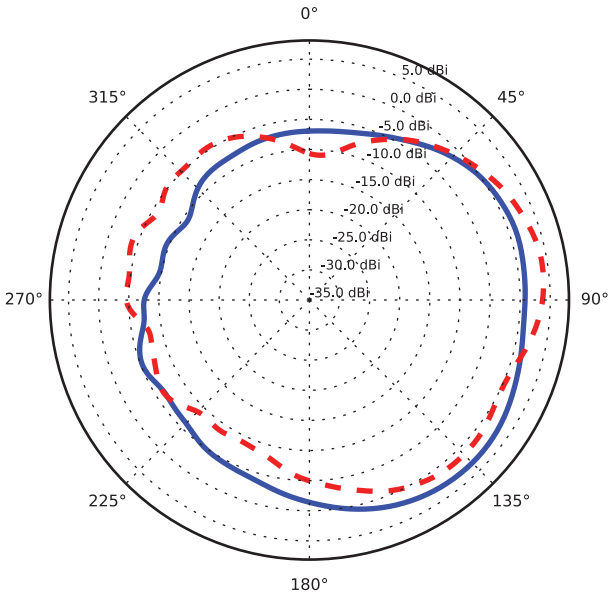
Frequency: 1960 MHz. Peak Gain: 1.50 Dbi.

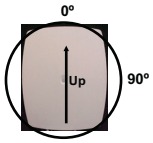


LTE Band 4

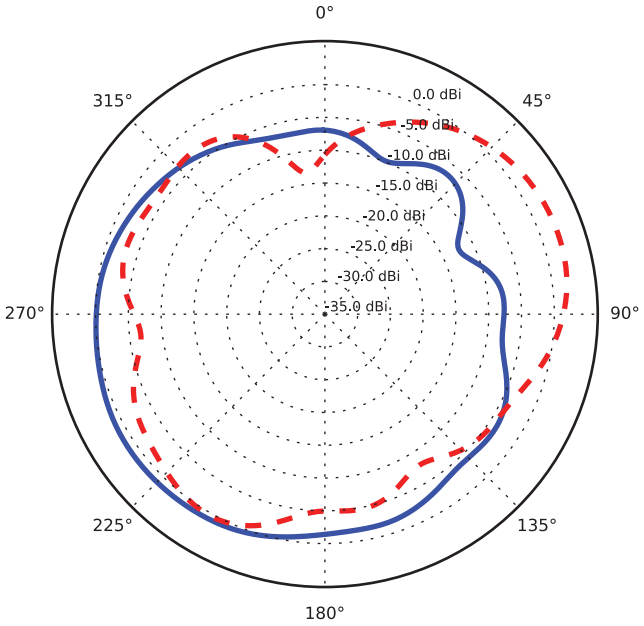


Frequency: 2145 MHz. Peak Gain: 4.10 Dbi.

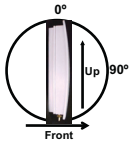


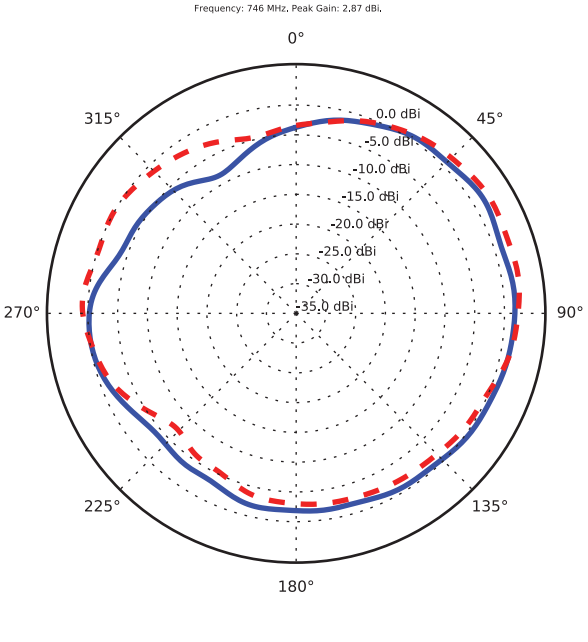


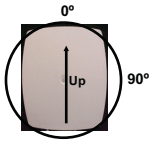
Frequency: 2145 MHz. Peak Gain: 2.63 Dbi.

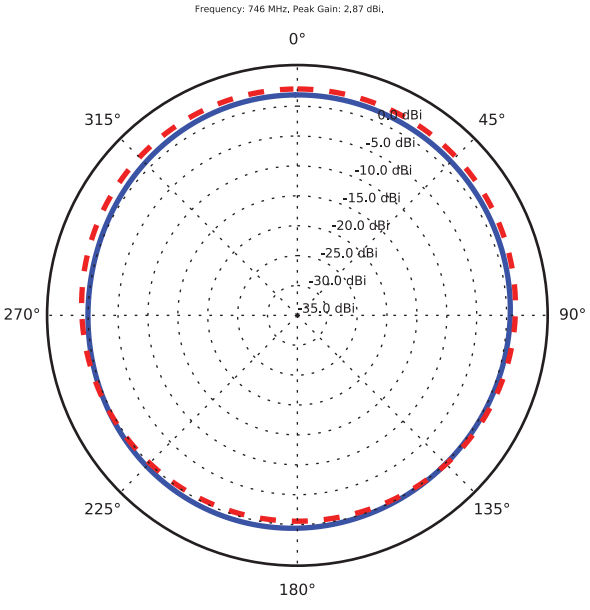


LTE Band 13


0°
Up
90°
Front


Frequency: 746 MHz, Peak Gain: 2.87 dBi,
0°
45°
90°
135°
180°
225°
270°
315°
0.0 dBi
-5.0 dBi
-10.0 dBi
-15.0 dBi
-20.0 dBi
-25.0 dBi
-30.0 dBi
-35.0 dBi
Antenna 1
Antenna 2


0°
Up
90°


Frequency: 746 MHz, Peak Gain: 2,87 dBi,
0°
45°
90°
135°
180°
225°
270°
315°
-5.0 dBi
-10.0 dBi
-15.0 dBi
-20.0 dBi
-25.0 dBi
-30.0 dBi
-35.0 dBi
Antenna 1
Antenna 2