Cisco Industrial Routers and Industrial Wireless Access Points Antenna Guide

January 2020

Cisco Systems, Inc.
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Cisco Industrial Routers and Industrial Wireless Access Points Antenna Guide

This document provides the descriptions and installation instructions for wireless antennas supported on the Cisco Industrial Series Routers and Industrial Wireless Access Points. This guide is not intended to replace existing hardware installation guides, software configuration guides, or other sources of information that are product specific. Instead, this guide is intended to provide a single source of antenna information and supported platforms for the Industrial Routers and Industrial Wireless Access Points.

This guide does not cover antenna or accessories compatibility with indoor enterprise products, although it does cover a number of indoor use cases for industrial products.

Antennas might be installed into the host router prior to delivery or ordered separately as a field-replaceable unit. Please consult your products Hardware Installation Guide for details.

This chapter covers the following topics:

- Overview
- Safety Precautions
- Installation Requirements
- General Installation Instructions for Mounting Antennas
- Obtaining Technical Assistance
- Additional Information

Overview

Deciding which antenna to use involves many factors such as coverage area, maximum distance, indoor location, outdoor location, and antenna height.

When antennas are used indoors, the building geometry, construction materials, ceiling height, and internal obstructions must be considered. In outdoor environments, obstructions such as trees, vehicles, buildings, and hills must be considered.

Safety Precautions

**WARNING:** Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.: NFPA 70, National Electrical Code, Article 810, Canada: Canadian Electrical Code, Section 54). Statement 1052

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.
**WARNING:** For your safety, and to help you achieve a good installation, please read and follow these safety precautions. *They may save your life!*

For your safety, read and follow these safety precautions.

- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

- Find someone to help you—installing an antenna is often a two-person job.

- Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

- Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.

- Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

- When installing your antenna, follow these guidelines:
  - Do not use a metal ladder.
  - Do not work on a wet or windy day.
  - Do dress properly—wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.

- If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.

- If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.

- If an accident should occur with the power lines, call for qualified emergency help immediately.

## Installation Requirements

This section describes the factors to consider when planning an installation:

- **Installation Location**
- **Antenna Connections**
- **Optimum Performance**

### Installation Location

**WARNING:** Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.:NFPA 70, National Electrical Code, Article 810, Canada:Canadian Electrical Code, Section 54). Statement 1052
The location of the antenna is important. Objects such as metal columns, walls, and so on, reduce efficiency. Best performance is achieved when antennas are mounted at the same height and in a direct line of sight with no obstructions. If this is not possible and reception is poor, you should try different mounting positions to optimize reception.

If the antenna is designed to create an omnidirectional broadcast pattern, the antenna should be mounted clear of any obstructions to the sides of the radiating element.

Antenna installation and replacement should only be performed at one of the following, certified location types:

- Cisco DF facility
- Customer premises field depot

Before installing your antenna, determine the optimum location for safety and performance. Follow these steps to determine a safe distance from wires, power lines, and trees:

1. Measure the height of your antenna.
2. Add this length to the length of your tower or mast, then double this total for the minimum safe clearance distance from wires, power lines, and trees.

**CAUTION:** If you are unable to maintain this safe distance, stop and get professional technical assistance for a mounting alternative.

**Antenna Connections**

Before you install or replace antennas, make sure the router is:

- Powered off
-Disconnected from all power sources
- Removed from a pole-top installation

**NOTE:** Caps on the RF-connectors are installed to protect them from the environment. They must only be removed to install a chassis-mounted antenna or external RF cable.

**Optimum Performance**

The higher your antenna is above the ground, the better it performs, generally. If your antenna is connected to the router with external RF cables, it is good practice to install your antenna about 5 to 10 foot (1.5 to 3 meters) above the roof line and away from all power lines and obstructions. If possible, find a mounting place directly above your wireless device so that the lead-in cable can be as direct as possible.

Vehicle mounted antennas must be mounted on a flat surface on the roof away from any obstructions.

Antennas transmit and receive radio signals which are susceptible to RF obstructions and common sources of interference that can reduce throughput and range of the device to which they are connected. Follow these guidelines to ensure the best possible performance:

- Install the antenna vertically and mount it with the cables pointing towards the ground.
- Keep the antenna away from metal obstructions such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use a rigid conduit to lower the antenna away from these obstructions.
- The density of the materials used in surrounding buildings’ construction impacts antenna signal strength. Consider the following...
– Signals penetrate paper and vinyl walls with little change to signal strength.
– Signals penetrate only one or two solid and pre-cast concrete walls without degrading signal strength.
– Signals penetrate three or four concrete and wood block walls without degrading signal strength.
– Signals penetrate five or six walls constructed of drywall or wood without degrading signal strength.
– Signals are likely to reflect off a thick metal wall and not penetrate it at all.
– Signals are likely to reflect off a chain link fence or a wire mesh with spaces of 1 to 1-1/2 in (2.5 to 3.8 cm).

Microwave ovens and 2-GHz cordless phones can cause signal interference because they operate in the same frequency range as the WiFi radios.

Before installing the antenna according to the installation procedures in the following chapters, you must complete these steps:
– Remove any plug or connector that is installed in the antenna port.
– Verify the correct antenna port for installation, based on the antenna model you are installing.

See the installation document for your router regarding the correct antenna port location. Antennas must be installed in the correct antenna port for ease of installation and optimal performance.

Vehicle mounted antennas must be separated by at least 18 in (45 cm) to reduce interference between radios. A greater separation is preferred.

**General Installation Instructions for Mounting Antennas**

**CAUTION:** For outside installations, make sure you do not mount the antenna upside down or block the bottom of the antenna at the cable exit. The correct mounting position is with the cable pointing down (towards the ground) so that any moisture will drain through the antenna drain holes. The antenna ships with a yellow mounting instruction label temporarily attached to the antenna radome.

The following instructions are common to most mast mounted installations. For specific installation instructions for each antenna, see the antenna data-sheet and the router hardware installation guide.

1. Assemble your new antenna on the ground or a level surface at the installation site.
2. Connect its coaxial cable while you are on the ground and attach the antenna to the mast.
3. Ensure that the mast does not fall as you raise or remove it. Use a durable non-conductive rope secured at each two foot level as the mast is raised. Have an assistant tend the rope, ready to pull the mast clear of any hazards (such as power lines) should it begin to fall.
4. Use the mounting bracket provided with the antenna.
5. If the installation will use guy wires:
   a. Install guy anchor bolts.
   b. Estimate the length of guy wire and cut it before raising the mast.
   c. Attach guy wires to a mast using guy rings.
6. Carefully connect the antenna and mast assembly to its mounting bracket and tighten the clamp bolts.

In the case of a guyed (tall, thin mast) installation, you must have at least one assistant to hold the mast upright while the guy wires are attached and tightened to the anchor bolts.
7. Attach a “DANGER” label at eye level on the mast.

8. Install ground rods to remove any static electricity buildup and connect a ground wire to the mast and ground rod. Use ground rods designed for that purpose, not a spare piece of pipe.

Unused Antenna Ports

Port plugs must be installed in any unused antenna ports.

The weatherproof caps on the connectors protect the router interior from environmental elements including water, heat, cold, and dust. They are installed on unused ports before the router is shipped.

When you install a new antenna in a port with an N-connector:

- Chassis-mounted antennas—Remove the weather proof cap before installing a chassis-mounted antenna.
- External antennas—Remove weatherproof cap, then connect the supported Cisco cable to the connector.

Obtaining Technical Assistance

Cisco provides Cisco.com as a starting point for all technical assistance. Customers and partners can obtain documentation, troubleshooting tips, and sample configurations from online tools by using the Cisco Technical Assistance Center (TAC) Web Site. Cisco.com registered users have complete access to the technical support resources on the Cisco TAC Web Site.

Cisco.com is the foundation of a suite of interactive, network services that provides immediate, open access to Cisco information, networking solutions, services, programs, and resources at any time, from anywhere in the world.

Cisco.com is a highly integrated Internet application and a powerful, easy-to-use tool that provides a broad range of features and services to help you to:

- Streamline business processes and improve productivity
- Resolve technical issues with online support
- Download and test software packages
- Order Cisco learning materials and merchandise
- Register for online skill assessment, training, and certification programs

You can self-register on Cisco.com to obtain customized information and service. To access Cisco.com, go to the following URL: http://www.cisco.com

Additional Information

Antenna Information

For additional documentation, see the following:

- For information about CGR modules, see:
  www.cisco.com/go/cg-modules

- For information on omnidirectional and directional antennas, see:

- Connected Grid Antennas Installation Guide

- Cisco IW3702 Access Point Getting Started Guide

Product Specific Guides for Industrial Routers

- Cisco 807 Industrial Integrated Services Routers
- Cisco 809 Industrial Integrated Services Routers
- Cisco 829 Industrial Integrated Services Routers
- Cisco IR1101 Industrial Integrated Services Routers
- Cisco 1120 Connected Grid Router
- Cisco 1240 Connected Grid Router
- Cisco 1000 Series Connected Grid Routers
- Cisco 500 Series WPAN Industrial Routers
- Cisco 900 Series Industrial Routers
- Cisco Industrial Wireless 3700 Series

Cisco General Information

- Access the most current Cisco documentation at:

- Access the Cisco website at:
  http://www.cisco.com

- Access international Cisco web sites at:
Antenna Selection Table

This section is designed to provide detailed information for each antenna that can be used for Cisco Industrial Routers and Industrial Wireless Access Points. This document also contains selection tables for the Cisco antennas and accessories, as well as basic compatibility information with Cisco Industrial Routers and Access Points Cisco antennas and accessories, as well as installation scenarios, and technical specifications and diagrams of the available antennas. Read all of the safety precautions before you begin installation.

The Antennas section is in three parts:

- **Currently Supported Antennas**
  These are the antennas that are currently fully supported for deployments.

- **Planned EOS Antennas**
  These are the antennas that are planned to reach their End Of Service. They are not recommended for new deployments.

- **EOS Antennas**
  These are antennas that have reached their End Of Service.

The following tables list the currently supported antennas, planned EOS, and EOS antennas for Cisco Industrial Routers and Industrial Wireless Access Points.

### Currently Supported Antennas

All of the currently supported antennas are broken down by functional groups. They are:

- **Cellular 2G/3G/4G Antennas**
- **GPS/GNSS Antennas**
- **WPAN, ISM, and LoRaWan Antennas**
- **Wi-Fi Antennas**
  - Single Band 2.4 GHz Antennas
  - Single Band 5 GHz Antennas
  - Dual Band 2.4 GHz + 5 GHz Antennas

**Note:** In all cases throughout this guide, Indoor Enterprise products are not listed.
## Antenna Selection Table

### Cellular 2G/3G/4G Antennas

<table>
<thead>
<tr>
<th>Part Number / Description</th>
<th>RF Connectors</th>
<th>Antenna Frequency Band Support and Gain</th>
<th>Industrial Products Where Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cisco 5-in-1 Vehicle Mount and Fixed Infrastructure Antenna (ANT-5-4G2WL2G1-O)</strong>.**</td>
<td>2 x 4G LTE, TNC(m) 2 x 2.4/5 GHz WiFi, RPTNC(plug) 1 x GPS SMA(m)</td>
<td>4G LTE 698–960, 1448–1511, 1710–2400, 2500–2700 MHz. 2.4 dBi typical, 2.9 dBi max 698–960 MHz. 4.2 dBi typical, 4.8 dBi max 1448–1511 MHz. 4.9 dBi typical, 6.5 dBi max 1710–2700 MHz.</td>
<td>Good fit for IR829. Can be used with other products such as IR809 or IR807, but has extra WiFi elements not required for those products. Instead consider ANT-3-4G2G1-O for products without WiFi.</td>
</tr>
<tr>
<td>Transportation omnidirectional 5-element antenna for 2G, 3G, 4G cellular, GPS, and dual-band WiFi 2.4 GHz and 5 GHz. Antenna has 2 ports for 2G, 3G, 4G, 2 ports for dual band 2.4 / 5.8 GHz WiFi, and 1 port for GPS.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cisco Cellular and GPS 3-in-1 Vehicle Mount and Fixed Infrastructure Antenna</strong> (ANT-3-4G2G1-O). **</td>
<td>2 x 4G LTE, TNC(m) 1 x GPS SMA(m)</td>
<td>4G LTE 698–960, 1448–1511, 1710–2400, 2500–2700 MHz. 2.6 dBi typical, 3.8 dBi max 698–960 MHz. 3.8 dBi typical, 4.3 dBi max 1448–1551 MHz. 4.6 dBi typical, 5.5 dBi max 1710–2700 MHz.</td>
<td>IR807, IR809, and IR829 IR1101 with P-LTE cellular module C819HG-LTE and C819HG-4G CGM-3G and CGM-4G modules with CGR1120 router CGR1120 use case requires adapters</td>
</tr>
<tr>
<td>** Cisco Cellular and GPS 3-in-1 Vehicle Mount and Fixed Infrastructure Antenna (ANT-3-4G2G1-O). **</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cellular 3-in-1 Two port 2G, 3G, 4G and 1 port GPS Vehicle Mount and Fixed Infrastructure Antenna, with three ports.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cisco Dual LTE-Single GPS Multi-band Antenna Installation Guide (4G-LTE-ANTM-O-3-B).</strong></td>
<td>2 x 4G LTE, TNC(m) 1 x GPS SMA(f)</td>
<td>4G LTE 698–960, 1710–2700 MHz. 2.5 dBi typical 698–960 MHz. 2.5 dBi typical 1710–2700 MHz.</td>
<td>IR1101 with P-LTE cellular module</td>
</tr>
<tr>
<td><strong>Cellular 3-in-1 Two port for 2G, 3G, 4G LTE and one port for GPS</strong> Integrated indoor and outdoor Antenna with three ports.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cisco Cellular 2-in-1 Vehicle Mount and Fixed Infrastructure Antenna (ANT-2-4G2-O).</strong></td>
<td>2 x 4G LTE, TNC(m)</td>
<td>4G LTE 698–960, 1448–1511, 1710–2400, 2500–2700 MHz. 2.6 dBi typical, 3.8 dBi max 698–960 MHz. 3.8 dBi typical, 4.3 dBi max 1448–1511 MHz. 4.6 dBi typical, 5.5 dBi max 1710–2700 MHz.</td>
<td>IR807, IR809, and IR829 IR1101 with P-LTE cellular module C819HG-LTE and C819HG-4G CGM-3G and CGM-4G modules with CGR1120 router CGR1120 use case requires adapters</td>
</tr>
<tr>
<td><strong>Two port 2G, 3G, and 4G antenna with two elements. This dual port LTE antenna does not have an active GPS antenna (compared to ANT–3-4G2G1–O which does), and is useful for cases when there is no GPS required, or when GPS is connected to a completely separate GPS antenna.</strong></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Note:** The table above provides a selection of cellular and GPS antennas suitable for various applications, including industrial products and vehicles. The frequencies and gain specifications are detailed for each antenna model, along with supported industries and potential use cases.
<table>
<thead>
<tr>
<th>Part Number / Description</th>
<th>RF Connectors</th>
<th>Antenna Frequency Band Support and Gain</th>
<th>Industrial Products Where Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cisco Outdoor Omnidirectional Antenna for 2G/3G/4G Cellular</strong> (ANT-4G-OMNI-OUT-N).</td>
<td>N-Type female</td>
<td>1.5 dBi 698–960 MHz 2 dBi 1448–1511 MHz 3.5 dBi 1710–2700 MHz First 7 dBi 1710–2700 MHz</td>
<td>IR807, IR809, and IR829  IR1101 with P–LTE cellular module C819HG–LTE and C819HG–4G CGM–3G and CGM–4G modules with CGR1120 and CGR1240. In most cases adapters or cables are required.</td>
</tr>
<tr>
<td>Outdoor Omnidirectional Antenna for 2G/3G/4G Cellular antenna is designed to cover domestic LTE700/Cellular/PCS/AWS/MDS, WiMAX 2300/2500, and GSM900/GSM1800/UMTS/LTE2600 bands.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cisco Multiband Panel Outdoor 4G MIMO Antenna (ANT-4G-PNL-OUT-N).</strong></td>
<td>Dual type N female direct connector</td>
<td>698–960 MHz 8.0–10.0 dBi 1710–2170 MHz 6.0–8.5 dBi 2200–2400 MHz 6.5–9.5 dBi 2500–2700 MHz 8.5–9.5 dBi</td>
<td>IR807, IR809, and IR829  IR1101 with P–LTE cellular module C819HG–LTE and C819HG–4G CGM–3G and CGM–4G modules with CGR1120 and CGR1240. In most cases adapters or cables are required.</td>
</tr>
<tr>
<td>Multiband Panel Outdoor 4G MIMO dual–port antenna designed to cover cellular 4G bands.</td>
<td></td>
<td>(Antenna is not designed to operate in 1448–1511 MHz Japan band. Does not have high gain.)</td>
<td></td>
</tr>
<tr>
<td><strong>Cisco Multiband Indoor 4G Volcano Antenna (ANT-4G-CM-IN-TNC).</strong></td>
<td>1 x TNC (m)</td>
<td>1 dBi 698–960 MHz 3 dBi 1710–2700 MHz First 3 dBi 698–960 MHz 2 dBi 1448–1511 MHz 3.5 dBi 1710–2700 MHz</td>
<td>IR807, IR809, and IR829  C819HG–LTE and C819HG–4G CGM–3G and CGM–4G modules with CGR1120 and CGR1240. For CGM / CQR use case adapters are required</td>
</tr>
<tr>
<td>Multiband Indoor 4G Ceiling–mount Volcano Antenna.</td>
<td></td>
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</tr>
<tr>
<td><strong>ANT-MP2–I–OUT–M and ANTI–O–SS–M Antenna and Cable Kits.</strong></td>
<td>MCX jack</td>
<td>0.9 dBi typical, 2.8 dBi max 698–960 MHz 3.0 dBi typical, 4.3 dBi max 1710–2700 MHz 4.0 dBi typical, 5.0 dBi max 2300–2700 MHz Note: Degraded performance in Japan 1448–1511 MHz band.</td>
<td>ANTI–MP2–I–O–SS–M kit is compatible with CGM–3G and CGM–4G in CGR1240 chassis. The antennas are not mechanically compatible with the CGR1120 chassis.</td>
</tr>
<tr>
<td>For 4G cellular use you need the ANTI–O–SS–M antenna kit. The kit has qty 2 antennas and cables needed for Main and Aux cellular ports. ANTI–MP2–I–OUT–M is for 915 MHz WPAN, and only has a single antenna and cable in the kit. Designed for direct mounting on the CGR1240 and has an MCX connector.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Part Number / Description**

- Cisco Outdoor Omnidirectional Antenna for 2G/3G/4G Cellular (ANT-4G-OMNI-OUT-N).
- Cisco Multiband Panel Outdoor 4G MIMO Antenna (ANT-4G-PNL-OUT-N).
- Cisco Multiband Indoor 4G Volcano Antenna (ANT-4G-CM-IN-TNC).
- ANTI-POSS-M Antenna and Cable Kits.

**RF Connectors**

- N-Type female
- Dual type N female direct connector
- 1 x TNC (m)
- MCX jack

**Antenna Frequency Band Support and Gain**

- 1.5 dBi 698–960 MHz
- 2 dBi 1448–1511 MHz
- 3.5 dBi 1710–2700 MHz
- 8.0–10.0 dBi 698–960 MHz
- 6.0–8.5 dBi 1710–2170 MHz
- 6.5–9.5 dBi 2200–2400 MHz
- 8.5–9.5 dBi 2500–2700 MHz
- 1 dBi 698–960 MHz
- 3 dBi 1710–2700 MHz
- 0.9 dBi typical, 2.8 dBi max 698–960 MHz
- 3.0 dBi typical, 4.3 dBi max 1710–2700 MHz
- 4.0 dBi typical, 5.0 dBi max 2300–2700 MHz

**Industrial Products Where Supported**

- IR807, IR809, and IR829
- IR1101 with P–LTE cellular module
- C819HG–LTE and C819HG–4G
- CGM–3G and CGM–4G modules with CGR1120 and CGR1240.
- In most cases adapters or cables are required.
- IR807, IR809, and IR829
- IR1101 with P–LTE cellular module
- C819HG–LTE and C819HG–4G
- CGM–3G and CGM–4G modules with CGR1120 and CGR1240.
- In most cases adapters or cables are required.
- IR807, IR809, and IR829
- C819HG–LTE and C819HG–4G
- CGM–3G and CGM–4G modules with CGR1120 and CGR1240.
- For CGM / CQR use case adapters are required.
<table>
<thead>
<tr>
<th>Part Number / Description</th>
<th>RF Connectors</th>
<th>Antenna Frequency Band Support and Gain</th>
<th>Industrial Products Where Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cisco Integrated 4G Low-profile Outdoor Saucer Antenna (ANT-4G-SR-OUT-TNC).</strong></td>
<td>15 foot LMR 195 cable with TNC(m)</td>
<td>0.8 dBi 698–960 MHz</td>
<td>IR807, IR809, and IR829</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5 dBi 1448–1511 MHz</td>
<td>C819HG-LTE and C819HG-4G</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.2 dBi 1710–2700 MHz</td>
<td>CGM-3G and CGM-4G modules with CGR1120 and CGR1240.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>For CGM / CGR use case adapters are required.</td>
</tr>
<tr>
<td><strong>Cisco 3G/4G LTE and LTEA Omnidirectional Dipole Antenna (LTE-ANTM-D).</strong></td>
<td>1 x TNC(m)</td>
<td>2 dBi, 698–960 MHz</td>
<td>IR807, IR809, and IR829</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.8 dBi, 1447–1511 MHz</td>
<td>C819HG-LTE and C819HG-4G</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.7 dBi, 1710–2690 MHz</td>
<td>CGM-3G and CGM-4G modules in CGR1120 (with additional adapters &amp; cable accessories)</td>
</tr>
<tr>
<td><strong>Cisco 4G LTEA, 4G LTE, and 3G Omnidirectional Dipole Antenna (LTE-ANTM-SMA-D).</strong></td>
<td>1 x SMA(m)</td>
<td>2 dBi, 698–960 MHz</td>
<td>IR1101 with P-LTE cellular module</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.8 dBi, 1447–1511 MHz</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.7 dBi, 1710–2690 MHz</td>
<td></td>
</tr>
</tbody>
</table>
## GPS/GNSS Antennas

<table>
<thead>
<tr>
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<th>Industrial Products Where Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cisco 5-in-1 Vehicle Mount and Fixed Infrastructure Antenna (ANT-5-4G2WL2G1-O).</strong></td>
<td><strong>Cellular – TNC male</strong></td>
<td>1 dBi zenith, plus 27dB amplifier gain</td>
<td>Good fit for IR829. Can be used with other products such as IR809 or IR807, but has extra WiFi elements not required for those products. Instead consider ANT-3-4G2G1-O for products without WiFi.</td>
</tr>
<tr>
<td></td>
<td><strong>GPS – SMA male</strong></td>
<td>Plus 1 port GPS, and 2 ports for dual band WiFi.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1575.42 +/- 1 MHz, GPS L1</td>
<td></td>
</tr>
<tr>
<td><strong>Cisco Cellular and GPS 3-in-1 Vehicle Mount and Fixed Infrastructure Antenna (ANT-3-4G2G1-O).</strong></td>
<td><strong>Cellular – TNC male</strong></td>
<td>1 dBi zenith, plus 27dB amplifier gain</td>
<td>IR807, IR809, and IR829 IR1101 with P-LTE cellular module C819HG-LTE and C819HG-4G CGM-3G and CGM-4G modules with CGR1120 router CGR1120 use case requires ANT-ADPTR-Q-TNC adapters, as CGR1120 router has a QMA(f) GPS connector, and CGM-3G and CGM-4G modules have QMA(f) cellular connectors</td>
</tr>
<tr>
<td></td>
<td><strong>GPS – SMA male</strong></td>
<td>Active GPS antenna, 1575.42 +/- 5 MHz</td>
<td></td>
</tr>
</tbody>
</table>
### Antenna Selection Table

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Cisco GPS Antenna (ANT-GPS-OUT-TNC).</td>
<td>Right-angle TNC male</td>
<td>Active GPS antenna, 4.0 dBi min at Zenith, 1575.42 MHz, plus 25dB amplifier gain</td>
<td>CR1120 router use case requires ANT-ADPTR-Q-TNC adapter. Router has a QMA(f) GPS connector. LoRaWAN gateways, IXM-LPWA-800-16-K9, PWA-900-16-K9 directly attached. No adapter needed, as IXM products have TNC(f) GPS connector. IR510 use case requires LTE-ADPT-SM-TF adapter. IR510 has SMA(f) GPS connector. IR1101 with P-LTE cellular module. C819HG-LTE and C819HG-4G IR807, IR809, and IR829 All of these use cases require a LTE-ADPT-SM-TF adapter as these routers have a SMA(f) GPS connector. Instead of a standalone ANT-GPS-OUT-TNC antenna please consider using a multi-element antenna that combines LTE and GPS antennas in a single antenna product such as: ANT-5-4G2WL2G1-O or ANT-3-4G2G1-O.</td>
</tr>
</tbody>
</table>

Active GPS antenna, integrated 15’ LMR-100 cable with RA-TNC(male).

The ANT-GPS-OUT-TNC integrated GPS RF front end is designed to reject collocated RF interference.
## Antenna Selection Table

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<tr>
<th>Part Number / Description</th>
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</thead>
<tbody>
<tr>
<td><strong>Cisco Indoor/Outdoor Active GPS Antenna (GPS-ACT-ANTM-SMA).</strong>&lt;br&gt;Active GPS antenna that can be physically connected to the Cisco Integrated Services Routers (ISRs) and Cisco Enhanced High-Speed WAN Interface Cards (EHWICs) to receive GPS broadcasts from satellites.&lt;br&gt;GPS-ACT-ANTM-SMA has GPS filters, but all the filters are after the LNA. Therefore, antenna may not be suitable for co-location with strong RF transmitters.</td>
<td>SMA male</td>
<td>Active GPS antenna, 4 dBi Zenith, 1575.42 MHz, plus 27dB amplifier gain</td>
<td>IR807, IR809, and IR829 IR1101 with P-LTE cellular module C819HG-LTE and C819HG-4G</td>
</tr>
<tr>
<td><strong>Cisco Dual LTE-Single GPS Multi-band Antenna Installation Guide (4G-LTE-ANTM-O-3-B).</strong>&lt;br&gt;Cellular 3-in-1 Two port for 2G, 3G, 4G LTE and one port for GPS&lt;br&gt;Integrated indoor and outdoor Antenna with three ports.&lt;br&gt;The 4G-LTE-ANTM-O-3-B integrated GPS RF front end is designed to reject collocated RF interference.</td>
<td>SMA-Male</td>
<td>2.5 dBi typical 698–960 MHz 2.5 dBi typical 1710–2700 MHz One port with GPS element.</td>
<td>IR1101 with P-LTE cellular module</td>
</tr>
</tbody>
</table>
## Wi-Fi Antennas

**NOTE:** Cisco has the broadest selection of WiFi antennas in the industry. Not all combinations of antennas and routers are supported or tested. For detailed information about antennas supported please check the documentation available for your router or access point.

For easier reference, this guide splits the WiFi Antennas into 3 different categories:

### Cisco Outdoor 5 dBi Omni Antenna for 863–928 MHz WPAN, LoRaWan, and ISM (ANT-LPWA-DB-O-N-5).

5 dBi Outdoor Omni-directional Antenna for the Cisco WPAN, LoRaWan, ISM modules and routers.

<table>
<thead>
<tr>
<th>Part Number / Description</th>
<th>RF Connectors</th>
<th>Antenna Frequency Band Support and Gain</th>
<th>Industrial Products Where Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco Outdoor 5 dBi Omni Antenna for 863–928 MHz WPAN, LoRaWan, and ISM (ANT-LPWA-DB-O-N-5).</td>
<td>Type N Female</td>
<td>5.2 dBi 860–876 MHz  5.3 dBi 902–928 MHz</td>
<td>IR509, IR510, IR529, and IR530 WPAN CGM-WPAN-FSK-NA and CGM-WPAN-OFDM-FCC modules in CGR1240 and CGR1120 LoRaWAN gateways, IXM-LPWA-800–16-K9 IXM-LPWA-900–16-K9</td>
</tr>
</tbody>
</table>

### Cisco WPAN Dipole Antenna (ANT-WPAN-OD-OUT-N).

Omnidirectional, vertically polarized single-port antenna designed to cover the 860–928 MHz frequency bands for worldwide ISM operation.

<table>
<thead>
<tr>
<th>Part Number / Description</th>
<th>RF Connectors</th>
<th>Antenna Frequency Band Support and Gain</th>
<th>Industrial Products Where Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco WPAN Dipole Antenna (ANT-WPAN-OD-OUT-N).</td>
<td>Type N male</td>
<td>WPAN 860–928 MHz.  1.5 dBi max</td>
<td>IR509, IR510, IR529, and IR530 WPAN CGM-WPAN-FSK-NA and CGM-WPAN-OFDM-FCC modules in CGR1240 and CGR1120</td>
</tr>
</tbody>
</table>

### Cisco Vandal Resistant Omni-directional Dome Antenna for 860–928 MHz ISM, WPAN and LoRaWan (ANT-UN-MP-OUT-QMA).

Vandal Resistant Omni-directional Dome Antenna for ISM, WPAN and LoRaWAN routers.

<table>
<thead>
<tr>
<th>Part Number / Description</th>
<th>RF Connectors</th>
<th>Antenna Frequency Band Support and Gain</th>
<th>Industrial Products Where Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco Vandal Resistant Omni-directional Dome Antenna for 860–928 MHz ISM, WPAN and LoRaWan (ANT-UN-MP-OUT-QMA).</td>
<td>QMA (male), right angle</td>
<td>1.5–2.0 dBi typical 860–928 MHz</td>
<td>IR509 and IR510</td>
</tr>
</tbody>
</table>

### Cisco WPAN Yagi Antenna (ANT-WPAN-Y-OUT-N).

Directional, linearly polarized, mast mount Yagi antenna with a pigtail with N female connector.

<table>
<thead>
<tr>
<th>Part Number / Description</th>
<th>RF Connectors</th>
<th>Antenna Frequency Band Support and Gain</th>
<th>Industrial Products Where Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco WPAN Yagi Antenna (ANT-WPAN-Y-OUT-N).</td>
<td>18” RG8 pigtail with N female connector</td>
<td>WPAN 860–928 MHz.  9 dBi typical, 10 dBi max</td>
<td>Advanced Range Extenders only. IR529UBWP-915D/K9 and IR529UWP-915D/K9 only.</td>
</tr>
</tbody>
</table>

### ANT-MP2-I-OUT-M and ANT-MP2-I-O-SS-M Antenna and Cable Kits.

For 4G cellular use you need the ANT-MP2-I-O-SS-M antenna kit. The kit has qty 2 antennas and cables needed for Main and Aux cellular ports.

ANT-MP2-I-OUT-M is for 915 MHz WPAN, and only has a single antenna and cable in the kit.

Designed for direct mounting on the CGR1240 and has an MCX connector.

<table>
<thead>
<tr>
<th>Part Number / Description</th>
<th>RF Connectors</th>
<th>Antenna Frequency Band Support and Gain</th>
<th>Industrial Products Where Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANT-MP2-I-OUT-M and ANT-MP2-I-O-SS-M Antenna and Cable Kits.</td>
<td>MCX jack</td>
<td>0.9 dBi typical, 2.8 dBi max, 860–928 MHz</td>
<td>CGR1240 Connected Grid Modules ANT-MP2-I-OUT-M kit is compatible with CGM WPAN modules for use with CGR1240 chassis. The antennas are not mechanically compatible with the CGR1120 chassis.</td>
</tr>
</tbody>
</table>
Antenna Selection Table

- Single Band 2.4 GHz Antennas
- Single Band 5 GHz Antennas
- Dual Band 2.4 GHz + 5 GHz Antennas

In addition to the information found in this guide, another detailed source for Cisco WiFi antennas, Access Points and deployment considerations can be found here:

Cisco Aironet Antennas and Accessories Reference Guide
### Single Band 2.4 GHz Antennas

<table>
<thead>
<tr>
<th>Part Number / Description</th>
<th>RF Connectors</th>
<th>Antenna Frequency Band Support and Gain</th>
<th>Industrial Products Where Supported</th>
</tr>
</thead>
</table>
| **Cisco Aironet 2.4 GHz 13-dBi Directional Antenna (AIR-ANT2413P2M-N).**  
2-Element Patch Array designed for outdoor use with Cisco Industrial Wireless Access Points. | Type N Male | WiFi 2.4 Ghz  
13 dBi | IW3702 in FlexPort mode only  
IW3702 use case requires N-type cables.  
Supported on the IR829GW family, not recommended for the IR829-2LTE as the antenna is single band.  
IR829 use case requires cables and adapters.  
IW-6300, ESW-6300  
IW/ESW-6300 must be configured in single band mode. Requires N-type cables. |
| **Cisco Aironet Omnidirectional Antennas**  
AIR-ANT2450V-N, AIR-ANT2450VG-N, AIR-ANT2450V-N-HZ, and AIR-ANT2450HG-N.  
Omnidirectional antennas designed for outdoor use with Cisco Aironet Outdoor Access Points. | Type N Male | WiFi 2.4 GHz  
5 dBi | Cisco Aironet 1552H, 1552S, 1552WU, IW-6300, ESW-6300.  
IW/ESW-6300 must be configured in single band mode. |
| **Cisco Aironet 8-dBi Omnidirectional Antenna (AIR-ANT5180V-N).**  
Omnidirectional antenna designed for outdoor use. | Type N Male | WiFi 2.4 GHz  
8 dBi | IW-6300, ESW-6300  
IW/ESW-6300 must be configured in single band mode. |

### Single Band 5 GHz Antennas
<table>
<thead>
<tr>
<th>Part Number / Description</th>
<th>RF Connectors</th>
<th>Antenna Frequency Band Support and Gain</th>
<th>Industrial Products Where Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cisco Aironet 5-GHz 13-dBi Directional Antenna (AIR-ANT5114P2M-N).</strong></td>
<td>Type N Male</td>
<td>WiFi 5 GHz</td>
<td>IW3702 in FlexPort mode only</td>
</tr>
<tr>
<td>2-Port Directional antenna with N-type connectors designed for use in outdoor environments.</td>
<td></td>
<td>13 dBi</td>
<td>IW3702 use case requires N-type cables.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Supported on the IR829GW family, not recommended for the IR829-2LTE as the antenna is single band.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IR829 use case requires cables and adapters.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IW-6300, ESW-6300</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IW/ESW-6300 must be configured in single band mode.</td>
</tr>
<tr>
<td><strong>Cisco Aironet Omnidirectional Antennas AIR-ANT5150VG-N and AIR-ANT5150HG-N.</strong></td>
<td>Type N Male</td>
<td>WiFi 5 GHz</td>
<td>IW-6300, ESW-6300</td>
</tr>
<tr>
<td>Vertically and horizontally polarized omnidirectional antennas designed for outdoor use.</td>
<td></td>
<td>5 dBi</td>
<td>IW/ESW-6300 must be configured in single band mode.</td>
</tr>
<tr>
<td><strong>Cisco Aironet 8-dBi Omnidirectional Antenna (AIR-ANT5180V-N).</strong></td>
<td>Type N Male</td>
<td>WiFi 5 GHz</td>
<td>IW-6300, ESW-6300</td>
</tr>
<tr>
<td>Omnidirectional antenna designed for outdoor use.</td>
<td></td>
<td>8 dBi</td>
<td>IW/ESW-6300 must be configured in single band mode.</td>
</tr>
</tbody>
</table>
## Dual Band 2.4 GHz + 5 GHz Antennas

<table>
<thead>
<tr>
<th>Part Number / Description</th>
<th>RF Connectors</th>
<th>Antenna Frequency Band Support and Gain</th>
<th>Industrial Products Where Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco Dual Port, Dual Band Vehicle Mount and Fixed Infrastructure WLAN Antenna (ANT-2-WLAN-D-O).</td>
<td>2 x 3 foot LMR-240 cables with RP-TNC plug connectors.</td>
<td>WiFi 2.4G/5G&lt;br&gt;4.0 dBi typical, 5.1 dBi max 2400–2500 MHz&lt;br&gt;6.5 dBi typical, 7.0 dBi max 4900–5875 MHz</td>
<td>IR829</td>
</tr>
<tr>
<td>Dual Port, Dual Band Outdoor Vehicle Mount and Fixed Infrastructure WLAN Antenna, omnidirectional, vertically polarized, 2x2 MIMO, integrated 3 foot long LMR-240 cables with RP-TNC plug connectors.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cisco Aironet Four-Port Dual-Band Polarization-Diverse Antenna (AIR-ANT2513P4M-N).</td>
<td>Type N-Female Bulkhead</td>
<td>WiFi 2.4G / 5G&lt;br&gt;13 dBi&lt;br&gt;2400–2483 MHz&lt;br&gt;5 GHz band: 4 dBi</td>
<td>IW3702, IW-6300, ESW-6300 Requires N-type cables</td>
</tr>
<tr>
<td>Four-port polarization-diverse patch array with an articulating mount for use on flat surfaces and masts, and is adjustable in both the horizontal and vertical planes. Designed for use in indoor and outdoor environments.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cisco Aironet Four-Element, MIMO, Dual-Band Ceiling Mount Omni-Directional Antenna (AIR-ANT2524V4C-R).</td>
<td>RP-TNC</td>
<td>WiFi 2.4 GHz band: 2 dBi&lt;br&gt;5 GHz band: 4 dBi&lt;br&gt;IW3702 use case requires AIR-ACC370-NM-RF coaxial adapters</td>
<td>IW3702</td>
</tr>
<tr>
<td>Four-element, dual-band antenna designed for ceiling-mounting in an indoor environment.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cisco Aironet Dual-Band MIMO Wall-Mounted Omnidirectional Antenna (AIR-ANT2544V4M-R).</td>
<td>RP-TNC</td>
<td>WiFi 2.4 GHz band: 4 dBi&lt;br&gt;5 GHz band: 4 dBi&lt;br&gt;IW3702 use case requires AIR-ACC370-NM-RF coaxial adapters</td>
<td>IW3702</td>
</tr>
<tr>
<td>Four port dual-band wall-mounted omnidirectional antenna designed for indoor or outdoor use.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cisco Aironet Dual-Band Omni-Directional Antenna (AIR-ANT2547V-N, AIR-ANT2547V-N-HZ, and ANT2547VG-N).</td>
<td>Type N-Male</td>
<td>WiFi 4 dBi&lt;br&gt;4200–4283 MHz&lt;br&gt;7 dBi 5250–5875 MHz&lt;br&gt;IR829&lt;br&gt;IR829 use case requires cables and adapters.</td>
<td>IW3702, IW-6300, ESW-6300 IR829</td>
</tr>
<tr>
<td>Single port dual-band omni-directional antenna designed to directly attach to an outdoor access point or bulkhead N female connector.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cisco Aironet 2.4-GHz/5-GHz MIMO 4-Element Patch Antenna (AIR-ANT2566P4W-R).</td>
<td>RP-TNC</td>
<td>WiFi 2.4G/5G&lt;br&gt;6 dBi in both bands&lt;br&gt;IW3702 use case requires AIR-ACC370-NM-RF coaxial adapters</td>
<td>IW3702</td>
</tr>
<tr>
<td>4-Element Patch Antenna designed for indoor and outdoor use.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Antenna Selection Table

<table>
<thead>
<tr>
<th>Part Number / Description</th>
<th>RF Connectors</th>
<th>Antenna Frequency Band Support and Gain</th>
<th>Industrial Products Where Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cisco 5-in-1 Vehicle Mount and Fixed Infrastructure Antenna (ANT-5-4G2WL2G1-O).</strong></td>
<td></td>
<td><strong>Cellular – TNC male</strong></td>
<td>IR829</td>
</tr>
<tr>
<td>Transportation omnidirectional 5-element antenna for 2G, 3G, 4G cellular, GPS, and dual-band WiFi 2.4 GHz and 5 GHz. <strong>Note:</strong> The ANT-5-4G2WL2G1-O antenna is listed under multiple antenna guide sections due to support of multiple technologies.</td>
<td></td>
<td><strong>WLAN – RP-TNC male</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>GPS – SMA male</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Cisco Aironet Dual-band Dipole Antenna (AIR-ANT2524DB-R, AIR-ANT2524DG-R, and AIR-ANT2524DW-R).</strong></td>
<td>RP-TNC plug</td>
<td><strong>WiFi 2.4G/5G</strong></td>
<td>IW3702</td>
</tr>
<tr>
<td>High-performance, dual-band dipole antenna designed for use with Cisco Aironet 2.4 GHz and 5 GHz radio products with dual-band reverse-polarity TNC (RP-TNC) antenna ports.</td>
<td></td>
<td>2 dBi 2.4 GHz</td>
<td>IW3702 use case requires AIR-ACC370-NM-RF coaxial adapters</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 dBi 5. GHz</td>
<td>Matching antenna color is the white AIR-ANT2524DW-R</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IR829</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Matching antenna color is the black AIR-ANT2524DB-R</td>
</tr>
<tr>
<td><strong>Cisco Aironet 2.4 GHz and 5 GHz Dual-Band Polarization-Diverse Directional Array Antenna (AIR-ANT2566D4M-R).</strong></td>
<td>RP-TNC (with coupling ring)</td>
<td><strong>2.4 GHz and 5 GHz</strong></td>
<td>IW3702</td>
</tr>
<tr>
<td>Four port dual-band polarization-diverse directional array antenna. It operates over the 2.4 GHz and 5 GHz Wi-Fi bands. It ships with an articulating mount for use on flat surfaces and masts, and is adjustable in both horizontal and vertical planes.</td>
<td></td>
<td>6 dBi</td>
<td>IW3702 use case requires AIR-ACC370-NM-RF coaxial adapters</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IR829</td>
</tr>
<tr>
<td><strong>Cisco Aironet Dual-Band Omni-Directional Antenna (AIR-ANT2568VG-N).</strong></td>
<td>Type N-Male</td>
<td><strong>2.4 GHz and 5 GHz</strong></td>
<td>IW-6300, ESW-6300</td>
</tr>
<tr>
<td>Single port dual-band omnidirectional antenna designed to directly attach to an outdoor access point or bulkhead N female connector.</td>
<td></td>
<td>6 dBi 2400 – 2483 MHz</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8 dBi 5150 – 5925 MHz</td>
<td></td>
</tr>
<tr>
<td><strong>Cisco Aironet 2.4-GHz/5-GHz 8-dBi Directional Antenna (AIR-ANT2588P3M-N).</strong></td>
<td>Type N-Female Bulkhead</td>
<td><strong>2.4 GHz and 5 GHz</strong></td>
<td>IW-6300, ESW-6300</td>
</tr>
<tr>
<td>Three port directional patch array with an articulating mount for use on flat surfaces and masts and is adjustable in both the horizontal and vertical planes. Designed for use in indoor and outdoor environments.</td>
<td></td>
<td>8 dBi in both bands</td>
<td>IW-6300, ESW-6300</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IW/ESW-6300 must be configured in dual-band mode. The middle port of the antenna is unused. Requires N-type cables.</td>
</tr>
</tbody>
</table>
## Planned EOS Antennas

<table>
<thead>
<tr>
<th>Part Number / Description</th>
<th>RF Connectors</th>
<th>Antenna Frequency Band Support and Gain</th>
<th>Industrial Products Where Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cisco 4G Indoor Ceiling-Mount Omnidirectional Antenna (4G-ANTM-OM-CM).</strong></td>
<td>TNC male</td>
<td>1 and 1.5 dBi 700–960 MHz 2 dBi 1448–1511 MHz 1.7 and 3.2 dBi 1700–2200 MHz 3 and 4 dBi 2500–2700 MHz</td>
<td>IR807, IR809, and IR829 IR1101 with P–LTE cellular module CGM–3G and CGM–4G modules in CGR1120 (with additional adapters &amp; cable accessories)</td>
</tr>
<tr>
<td>Designed for indoor use with Cisco 3G cellular Enhanced High-Speed WAN Interface Cards (EHWICs) and is compatible with Cisco 3G cellular products using a threaded Neill–Concelman (TNC) Male connector.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cisco 4G/3G Omnidirectional Dipole Antenna (4G–ANTM–D).</strong></td>
<td>Articulated TNC male connector</td>
<td>4G LTE 698–960, 1710–2170, 2500–2700 MHz. 2 dBi</td>
<td>IR800</td>
</tr>
<tr>
<td>The 4G–LTE–ANTM–D omnidirectional dipole antenna is designed for indoor use with Cisco 4G and Cisco 3G wireless Integrated Services Routers Generation 2 (ISRs G2) and Enhanced High-Speed WAN Interface Cards (EHWICs).</td>
<td></td>
<td></td>
<td>Connected Grid Modules</td>
</tr>
<tr>
<td><strong>Cisco Indoor Swivel-mount Dipole Antenna (ANT–4G–DP–IN–TNC).</strong></td>
<td>TNC male</td>
<td>4G LTE 698–960, 1710–2400, 2500–2700 MHz. 0.5 dBi 698–960 MHz 2.2 dBi 1710–2700 MHz</td>
<td>IR800</td>
</tr>
<tr>
<td>Indoor Swivel–mount Dipole 3G/4G Antenna supported on the Connected Grid Router 1120 and is designed to support Cellular/PCS/AWS/MDS, WiMAX 2100/2300/2500/2600 and global GSM900/GSM1800/UMTS/LTE2600 bands.</td>
<td></td>
<td></td>
<td>Connected Grid Modules</td>
</tr>
<tr>
<td><strong>Cisco Aironet 6.5–dBi Diversity Patch Antenna (AIR–ANT2465P–R).</strong></td>
<td>RP–TNC</td>
<td>WiFi 2.4G 6.5 dBi</td>
<td>IR829</td>
</tr>
<tr>
<td>(AEOS date 04/30/2019) Diversity patch antenna designed for use with Cisco Aironet access points and bridges but can be used with any 2.4 GHz Cisco Aironet radio device that utilizes an RP–TNC connector.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## EOS Antennas

### Table 2 EOS Antennas

<table>
<thead>
<tr>
<th>Part Number / Description</th>
<th>RF Connectors</th>
<th>Antenna Frequency Band Support and Gain</th>
<th>Industrial Products Where Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor Panel Antenna for WiMAX 1.8, 2.5, and 3.8 GHz.</td>
<td>N female (x2)</td>
<td>WiMAX 1.8, 2.5, 3.8 GHz. 16 +/- 1 dBi</td>
<td>CGR 1000 Connected Grid Modules</td>
</tr>
<tr>
<td>Outdoor Panel Antenna for WiMAX 1.8, 2.5, and 3.8 GHz.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ANT WM INT OUT M</td>
<td>MCX jack</td>
<td>3.3-3.8 GHz N/A</td>
<td>WiMax CGM module only.</td>
</tr>
<tr>
<td>(Similar to ANT MP2 I O SS M, except covering 3.3-3.6 GHz)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cisco Multiband Panel Outdoor 3G Antenna (ANT 3G PNL OUT N).</td>
<td>Type N female</td>
<td>3G 10 dBi 806-960 MHz 11 dBi 1710-2170 MHz</td>
<td>CGM 3G modules only</td>
</tr>
<tr>
<td>Multiband Panel Outdoor 3G antenna designed to cover cellular 3G bands.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cisco Multi-purpose Integrated Antenna (ANT MP INT OUT M).</td>
<td>MCX jack</td>
<td>3G 2.8 dBi 806-960 MHz 3.5 dBi 1710-2170 MHz 4 dBi 2300-2700 MHz</td>
<td>CGM 3G only in CGR1240 chassis. This antenna is not mechanically compatible with CGR1120 chassis</td>
</tr>
<tr>
<td>Multi-purpose integrated monopole antenna, chassis-mounted, omnidirectional, includes non-integrated coaxial cable. No cable (option class).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cisco Outdoor Omni Antenna for 900 MHz WPAN (ANT WPAN OM OUT N).</td>
<td>Type N female</td>
<td>WPAN 902-928 MHz only 4 dBi</td>
<td>IR509, IR510, and IR529 as well as WPAN CGM WPAN FSK NA and CGM WPAN OFDM FCC modules in CGR1240 and CGR1120</td>
</tr>
<tr>
<td>Outdoor Omnidirectional Antenna for the 900 MHz WPAN module.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note: Antenna will eventually be obsoleted in favor of the dual band 5 dBi, ANT LPWA DB O N-5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Cisco RF Cables, Adapters, Lightning Arrestors, Extension Bases and other Accessories

The following is a list of some of the more commonly used cables and accessories with the industrial routers and industrial wireless access points.

Cables
The following tables provide information for the cables supported by Cisco.

- N(m) to N(m) RF cables
- N(m) to QMA(m) RF cables
- N(m) to RPTNC(jack) RF cables
- N(m) to RPTNC(plug) RF cables
- RPTNC(plug)-STR to RPTNC(jack)-STR
- N(m) to TNC(m) RF cable
- TNC(m) to TNC(f) RF cable
- TNC(m) to SMA(m) RF cables

Cellular Antenna Extension Bases
The following tables provide information for the Extension Bases supported by Cisco.

- Extension Bases

Other Accessories
The following table provides information for other accessories supported by Cisco.

- Cisco Lightning Arrestors
- Cisco Coaxial Adapters
<table>
<thead>
<tr>
<th>Antenna Cable Type</th>
<th>Description</th>
<th>RF Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIR-CAB002L240-N</td>
<td>N(m)-STR to N(m)-RA LMR-240, 2 foot RF cable</td>
<td>0.2dB @ 0.7 GHz</td>
</tr>
<tr>
<td></td>
<td>Type: Indoor Interconnect. Not DB, CMR or CMP</td>
<td>0.3dB @ 1.0 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.4dB @ 1.7 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5dB @ 2.4 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8dB @ 5.8 GHz</td>
</tr>
<tr>
<td>AIR-CAB005LL-N</td>
<td>N(m)-STR to N(m)-RA LMR-400, 5 foot RF cable</td>
<td>0.2dB @ 0.7 GHz</td>
</tr>
<tr>
<td></td>
<td>Type: outdoor DB (direct burial)</td>
<td>0.3dB @ 1.0 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.4dB @ 1.7 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5dB @ 2.4 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8dB @ 5.8 GHz</td>
</tr>
<tr>
<td>CAB-L400-5-N-N</td>
<td>N(m)-STR to N(m)-RA LMR-400, 5 foot RF cable</td>
<td>0.2dB @ 0.7 GHz</td>
</tr>
<tr>
<td></td>
<td>Type: outdoor DB (direct burial)</td>
<td>0.3dB @ 1.0 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.4dB @ 1.7 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5dB @ 2.4 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8dB @ 5.8 GHz</td>
</tr>
<tr>
<td>CAB-L400-5-N-NS</td>
<td>N(m)-STR to N(m)-STR LMR-400, 5 foot RF cable</td>
<td>0.2dB @ 0.7 GHz</td>
</tr>
<tr>
<td></td>
<td>Type: outdoor DB (direct burial)</td>
<td>0.3dB @ 1.0 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.4dB @ 1.7 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5dB @ 2.4 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8dB @ 5.8 GHz</td>
</tr>
<tr>
<td>AIR-CAB010LL-N</td>
<td>N(m)-STR to N(m)-RA LMR-400, 10 foot RF cable</td>
<td>0.4dB @ 0.7 GHz</td>
</tr>
<tr>
<td></td>
<td>Type: outdoor DB (direct burial)</td>
<td>0.5dB @ 1.0 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.7dB @ 1.7 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.9dB @ 2.4 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5dB @ 5.8 GHz</td>
</tr>
<tr>
<td>CAB-L400-20-N-N</td>
<td>N(m)-STR to N(m)-RA LMR-400, 20 foot RF cable</td>
<td>0.8dB @ 0.7 GHz</td>
</tr>
<tr>
<td></td>
<td>Type: outdoor DB (direct burial)</td>
<td>1.0dB @ 1.0 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.3dB @ 1.7 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.6dB @ 2.4 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5dB @ 5.8 GHz</td>
</tr>
<tr>
<td>AIR-CAB025HZ-N</td>
<td>N(m)-STR to N(m)-STR LMR-400, 25 foot RF cable</td>
<td>1.0dB @ 0.7 GHz</td>
</tr>
<tr>
<td></td>
<td>Type: outdoor DB (direct burial) with additional resistance to petrochemicals and oils</td>
<td>1.2dB @ 1.0 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.6dB @ 1.7 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.0dB @ 2.4 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.1dB @ 5.8 GHz</td>
</tr>
<tr>
<td>CAB-L600-30-N-N</td>
<td>N(m)-STR to N(m)-RA LMR-600, 30 foot RF cable</td>
<td>0.8dB @ 0.7 GHz</td>
</tr>
<tr>
<td></td>
<td>Type: outdoor DB (direct burial)</td>
<td>0.9dB @ 1.0 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.3dB @ 1.7 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.6dB @ 2.4 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.6dB @ 5.8 GHz</td>
</tr>
</tbody>
</table>
### Table 2  \(N(m)\) to QMA(m) RF cables

<table>
<thead>
<tr>
<th>Antenna Cable Type</th>
<th>Description</th>
<th>RF Loss</th>
</tr>
</thead>
</table>
| CAB-L240-10-Q-N    | N(m)-STR to QMA(m)-RA  
LMR-240, 10 foot RF cable  
Type: FR/CMR (Communication Cable Riser) | 0.8dB @ 0.7 GHz  
0.9dB @ 1.0 GHz  
1.2dB @ 1.7 GHz  
1.5dB @ 2.4 GHz  
2.4dB @ 5.8 GHz |
| CAB-L240-15-Q-N    | N(m)-STR to QMA(m)-RA  
LMR-240, 15 foot RF cable  
Type: FR/CMR (Communication Cable Riser) | 1.1dB @ 0.7 GHz  
1.4dB @ 1.0 GHz  
1.8dB @ 1.7 GHz  
2.2dB @ 2.4 GHz  
3.5dB @ 5.8 GHz |
| CAB-L240-20-Q-N    | N(m)-STR to QMA(m)-RA  
LMR-240, 20 foot RF cable  
Type: FR/CMR (Communication Cable Riser) | 1.5dB @ 0.7 GHz  
1.8dB @ 1.0 GHz  
2.4dB @ 1.7 GHz  
2.9dB @ 2.4 GHz  
4.7dB @ 5.8 GHz |

### Table 3  \(N(m)\) to RPTNC(jack) RF cables

<table>
<thead>
<tr>
<th>Antenna Cable Type</th>
<th>Description</th>
<th>RF Loss</th>
</tr>
</thead>
</table>
| CAB-L240-10-N-R    | N(m)-RA to RPTNC(jack)-STR  
LMR-240, 10 foot RF cable  
Type: outdoor DB (direct burial) | 1.5dB @ 2.4 GHz  
2.4dB @ 5.8 GHz |
| CAB-L400-20-N-R    | N(m)-RA to RPTNC(jack)-STR  
LMR-400, 20 foot RF cable  
Type: outdoor DB (direct burial) | 1.6dB @ 2.4 GHz  
2.5dB @ 5.8 GHz |

### Table 4  \(N(m)\) to RPTNC(plug) RF cables

<table>
<thead>
<tr>
<th>Antenna Cable Type</th>
<th>Description</th>
<th>RF Loss</th>
</tr>
</thead>
</table>
| AIR-CAB005LL-R-N   | N(m)-RA to RPTNC(plug)-STR  
LMR-240, 5 foot RF cable  
Type: outdoor DB (direct burial) | 0.5dB @ 2.4 GHz  
0.8dB @ 5.8 GHz |

### Table 5  RPTNC(plug)-STR to RPTNC(jack)-STR

<table>
<thead>
<tr>
<th>Antenna Cable Type</th>
<th>Description</th>
<th>RF Loss</th>
</tr>
</thead>
</table>
| AIR-CAB005PL-R     | RPTNC (plug)-STR to RPTNC (jack)-STR  
LMR-195, 5 foot RF cable  
Type: Plenum | 1.1dB @ 2.4 GHz  
1.8dB @ 5.8 GHz |
| AIR-CAB005LL-R     | RPTNC (plug)-STR to RPTNC (jack)-STR  
LMR-400, 5 foot RF cable  
Type: outdoor DB (direct burial) | 0.5dB @ 2.4 GHz  
0.8dB @ 5.8 GHz |
| CAB-L400-10-R      | RPTNC (plug)-RA to RPTNC (jack)-STR  
LMR-400, 10 foot RF cable  
Type: outdoor DB (direct burial) | 0.8dB @ 2.4 GHz  
1.4dB @ 5.8 GHz |
| AIR-CAB020LL-R     | RPTNC (plug)-STR to RPTNC (jack)-STR  
LMR-400, 20 foot RF cable  
Type: outdoor DB (direct burial) | 1.3dB @ 2.4 GHz  
2.5dB @ 5.8 GHz |
<table>
<thead>
<tr>
<th>Antenna Cable Type</th>
<th>Description</th>
<th>RF Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIR-CAB050LL-R</td>
<td>RPTNC (plug)-STR to RPTNC (jack)-STR LMR-400, 50 foot RF cable Type: outdoor DB (direct burial)</td>
<td>3.4dB @ 2.4 GHz 5.75dB @ 5.8 GHz</td>
</tr>
<tr>
<td>AIR-CAB100ULL-R</td>
<td>RPTNC (plug)-STR to RPTNC (jack)-STR LMR-600, 100 foot RF cable Type: outdoor DB (direct burial)</td>
<td>4.4dB @ 2.4 GHz 7.25dB @ 5.8 GHz</td>
</tr>
</tbody>
</table>
### Table 6  \( \text{N(m)} \) to \( \text{TNC(m)} \) RF cable

<table>
<thead>
<tr>
<th>Antenna Cable Type</th>
<th>Description</th>
<th>RF Loss</th>
</tr>
</thead>
</table>
| CAB-L400-20-TNC-N  | TNC(m)-RA to N(m)-STR  
LMR-400, 20 foot RF cable  
Type: outdoor DB (direct burial) | 0.8dB @ 0.7 GHz  
1.0dB @ 1.0 GHz  
1.3dB @ 1.7 GHz  
1.6dB @ 2.4 GHz |
| CAB-L400-50-TNC-N  | TNC(m)-RA to N(m)-STR  
LMR-400, 50 foot RF cable  
Type: outdoor DB (direct burial) | 1.9dB @ 0.7 GHz  
2.3dB @ 1.0 GHz  
3.1dB @ 1.7 GHz  
3.8dB @ 2.4 GHz |

### Table 7  \( \text{TNC(m)} \) to \( \text{TNC(f)} \) RF cable

<table>
<thead>
<tr>
<th>Antenna Cable Type</th>
<th>Description</th>
<th>RF Loss</th>
</tr>
</thead>
</table>
| 4G-CAB-LMR400-10   | TNC(m)-RA to TNC(f)-STR  
LMR-400, 10 foot RF cable  
Type: outdoor DB (direct burial) | 0.4dB @ 0.7 GHz  
0.5dB @ 1.0 GHz  
0.7dB @ 1.7 GHz  
0.8dB @ 2.4 GHz |
| 4G-CAB-ULL-20      | TNC(m)-RA to TNC(f)-STR  
LMR-400, 20 foot RF cable  
Type: Plenum | 0.8dB @ 0.7 GHz  
1.0dB @ 1.0 GHz  
1.3dB @ 1.7 GHz  
1.6dB @ 2.4 GHz |
| 4G-CAB-LMR240-25   | TNC(m)-RA to TNC(f)-STR  
LMR-240, 25 foot RF cable  
Type: Plenum | 1.9dB @ 0.7 GHz  
2.3dB @ 1.0 GHz  
3.0dB @ 1.7 GHz  
3.6dB @ 2.4 GHz |
| 4G-CAB-LMR240-50   | TNC(m)-RA to TNC(f)-STR  
LMR-240, 50 foot RF cable  
Type: Plenum  
**Note:** The cable is not recommended for longer distance links due to high loss of 50 foot LMR240 at most cellular frequencies. The customer may need to do a site survey to validate whether the cable allows sufficient signal-to-noise ratio to or from cell tower. | 3.7dB @ 0.7 GHz  
4.5dB @ 1.0 GHz  
5.9dB @ 1.7 GHz  
7.2dB @ 2.4 GHz |
| 4G-CAB-ULL-50      | TNC(m)-RA to TNC(f)-STR  
LMR-400, 50 foot RF cable  
Type: Plenum | 1.9dB @ 0.7 GHz  
2.3dB @ 1.0 GHz  
3.1dB @ 1.7 GHz  
3.8dB @ 2.4 GHz |
| 4G-CAB-LMR240-75   | TNC(m)-RA to TNC(f)-STR  
LMR-240, 75 foot RF cable  
Type: Plenum  
**Note:** The cable is not recommended for high throughput or longer distance links due to high loss of 75 foot LMR240 at most cellular frequencies. The customer may need to do a site survey to validate whether the cable allows sufficient signal-to-noise ratio to or from cell tower. | 5.5dB @ 0.7 GHz  
6.7dB @ 1.0 GHz  
8.8dB @ 1.7 GHz  
10.7dB @ 2.4 GHz |
### Table 8  TNC(m) to SMA(m) RF cables

<table>
<thead>
<tr>
<th>Antenna Cable Type</th>
<th>Description</th>
<th>RF Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAB-L240-10-SM-TM</td>
<td>SMA(m)-STR to TNC(m)-STR LMR-240, 10ft RF cable Type: outdoor DB (direct burial)</td>
<td>0.8dB @ 0.7 GHz 0.9dB @ 1.0 GHz 1.2dB @ 1.7 GHz 1.5dB @ 2.4 GHz 1.6dB @ 2.7 GHz</td>
</tr>
<tr>
<td>CAB-L240-15-SM-TM</td>
<td>SMA(m)-STR to TNC(m)-STR LMR-240, 15ft RF cable Type: outdoor DB (direct burial)</td>
<td>1.1dB @ 0.7 GHz 1.4dB @ 1.0 GHz 1.8dB @ 1.7 GHz 2.2dB @ 2.4 GHz 2.3dB @ 2.7 GHz</td>
</tr>
<tr>
<td>CAB-L240-20-SM-TM</td>
<td>SMA(m)-STR to TNC(m)-STR LMR-240, 20ft RF cable Type: outdoor DB (direct burial)</td>
<td>1.5dB @ 0.7 GHz 1.8dB @ 1.0 GHz 2.4dB @ 1.7 GHz 2.9dB @ 2.4 GHz 3.1dB @ 2.7 GHz</td>
</tr>
</tbody>
</table>
# Cellular Antenna Extension Bases

The following tables provide information for the Extension Bases supported by Cisco.

## Table 9  Extension Bases

<table>
<thead>
<tr>
<th>Extension Base PID</th>
<th>Description</th>
<th>RF Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>4G-AE010-R</td>
<td>TNC(m)-STR to TNC(f)-STR LMR-195, 10 foot RF cable Type: Plenum Antenna extension bases</td>
<td>1.1dB @ 0.7 GHz 1.4dB @ 1.0 GHz 1.8dB @ 1.7 GHz 2.1dB @ 2.4 GHz 2.3dB @ 2.7 GHz</td>
</tr>
<tr>
<td>4G-AE015-R</td>
<td>TNC(m)-STR to TNC(f)-STR LMR-195, 15 foot RF cable Type: Plenum Antenna extension bases</td>
<td>1.7dB @ 0.7 GHz 2.0dB @ 1.0 GHz 2.6dB @ 1.7 GHz 3.2dB @ 2.4 GHz 3.4dB @ 2.7 GHz</td>
</tr>
<tr>
<td>LTE-AE-MAG-SMA</td>
<td>TNC(f)-STR to SMA(f)-STR LMR-195, 1ft RF cable Type: Plenum Antenna extension bases</td>
<td>0.2dB @ 0.7 GHz 0.2dB @ 1.0 GHz 0.3dB @ 1.7 GHz 0.3dB @ 2.4 GHz 0.3dB @ 2.7 GHz</td>
</tr>
</tbody>
</table>
## Accessories

### Table 10  Cisco Lightning Arrestors

<table>
<thead>
<tr>
<th>Cisco PID</th>
<th>Connectors Type</th>
<th>Arrester Type and Frequency Range (MHz)</th>
</tr>
</thead>
</table>
| CGR-LA-NM-NF   | N(m)-STR to N(f)-STR      | DC to 6000 MHz  
GDT type  
Supports active GNSS antennas, passes DC |
| ACC-LA-H-NM-NF | N(m)-STR to N(f)-STR      | 698 to 2700 MHz  
High power, ultra low shunt impedance, HPF type  
Does not pass DC, no support for active GNSS antennas |
| CGR-LA-NF-NF   | N(f)-STR to N(f)-STR      | DC to 6000 MHz  
GDT type  
Supports active GNSS antennas, passes DC |
| AIR-ACC245LA-R | RPTNC(jack)-STR to RPTNC(jack)-STR | DC to 6000 MHz  
GDT type  
Passes DC, but the RPTNC connectors are not commonly used with GNSS. |
| 4G-ACC-OUT-LA  | TNC(f)-STR to TNC(m)-STR  | 698 to 2700 MHz  
HPF type, medium power  
Does not pass DC, no support for active GNSS |
| ACC-LA-G-TM-TF | TNC(f)-STR to TNC(m)-STR  | DC to 6000 MHz  
GDT type  
Supports active GNSS antennas, passes DC |
| ACC-LA-G-TF-TF | TNC(f)-STR to TNC(f)-STR  | DC to 6000 MHz  
GDT type  
Supports active GNSS antennas, passes DC |

### Table 11  Cisco Coaxial Adapters

<table>
<thead>
<tr>
<th>Cisco PID</th>
<th>Connectors Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIR-ACC370-NM-RF</td>
<td>N(m)-STR to RPTNC(jack)-STR</td>
</tr>
<tr>
<td>AIR-ACC370-NF-NF</td>
<td>N(f)-STR to N(f)-STR</td>
</tr>
<tr>
<td>ANT-ADPTR-Q-TNC</td>
<td>QMA(m)-STR to TNC(f)-STR</td>
</tr>
<tr>
<td>LTE-ADPT-SM-TF</td>
<td>SMA(m)-STR to TNC(f)-STR</td>
</tr>
</tbody>
</table>
Cisco 4G Indoor Ceiling-Mount Omnidirectional Antenna (4G-ANTM-OM-CM)

This document outlines the specifications and describes the 4G-ANTM-OM-CM multiband omnidirectional ceiling-mount antenna and contains the following sections:

- Overview
- System Requirements
- Installation Notes
- Safety Instructions
- Installation Instructions
- Obtaining Documentation

Overview

The 4G-ANTM-OM-CM antenna is a ceiling-mount omnidirectional antenna that operates in any of the 3G or 4G bands. These bands cover the following frequencies: 700, 800, 900, 1700, 1800, 1900, 2100, and 2600 MHz.

This antenna is designed for use with Cisco 3G cellular Enhanced High-Speed WAN Interface Cards (EHWICs) and is compatible with Cisco 3G cellular products using a threaded Neill-Concelman (TNC) Male connector.
Figure 1 shows a front view of the 4G-ANTM-OM-CM antenna. The green circle around the Cisco logo means that this is a 4G antenna.
Figure 2 shows a side view of the 4G-ANTM-OM-CM antenna.

**Figure 2** Cisco 4G-ANTM-OM-CM Antenna (Side View)

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mounting screws and anchors (#6 x 1-1/4&quot;) for mounting on a hard ceiling</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Self-adhesive screw covers</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>Flat washer (wide series)</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>Curved spring washer</td>
<td>8</td>
</tr>
</tbody>
</table>
Figure 3 shows a top view of the 4G-ANTM-OM-CM antenna.

Figure 3  Cisco 4G-ANTM-OM-CM Antenna (Top View)

Technical Specifications

The following table lists the technical specifications for the 4G-ANTM-OM-CM antenna.
### Antenna type
Low profile, ceiling-mount omnidirectional

### Operating frequency range
- 698–806 MHz
- 824–894 MHz
- 925–960 MHz
- 1575 MHz
- 1710–1885 MHz
- 1920–1980 MHz
- 2110–2170 MHz
- 2500–2690 MHz

### Nominal Impedance
50 Ohms

### Voltage Standing Wave Ratio (VSWR)
- 2.0:1
- 3.01:1 or less for GPS

### Gain
- 700–960 MHz (1 and 1.5 dBi)
- 1700–2200 MHz (1.7 and 3.2 dBi)
- 2500–2700 MHz (3 and 4 dBi)

### Radiation Pattern:
**Vertical plane (-3 dB beam-width)**
- 700–960 MHz (80 and 95 degrees)
- 1700 MHz (80 and 90 degrees)
- 1800 MHz (75 and 95 degrees)
- 1900 MHz (65 and 90 degrees)
- 2100 MHz (50 and 65 degrees)
- 2500–2700 MHz (50 and 65 degrees)

### Azimuth plane ripple
3.5 dB over all frequencies

### Efficiency
70–85% over all supported frequencies

### Connector type
TNC-Male

### Polarization
Linear (vertical)

### Power withstanding
3 W

### Weight
0.7 lb (0.34 kg)

### Color
White

### Flammability
UL94 V0

### Environment
Indoor

### Mounting
Nut, flat washer, curved spring washer, #6 x 1-1/4” mounting screws and anchors to be used for mounting to a hard ceiling, self adhesive screw covers.

### Operating temperature
-22° to 158°F (-30° to 70°C)

### Storage temperature
-40° to 185°F (-40° to 85°C)
Figure 4 shows the azimuth plane patterns for the 700 MHz band for the 4G-ANTM-OM-CM antenna.

Figure 4  Azimuth Plane Patterns for the 700 MHz Band
Figure 5 shows the azimuth plane patterns for the 800 MHz band for the 4G-ANTM-OM-CM antenna.

Figure 5  Azimuth Plane Patterns for the 800 MHz Band
Figure 6 shows the azimuth plane patterns for the 900 MHz band for the 4G-ANTM-OM-CM antenna.

**Figure 6  Azimuth Plane Patterns for the 900 MHz Band**
Figure 7 shows the azimuth plane patterns for the 1700 MHz band for the 4G-ANTM-OM-CM antenna.

Figure 7  Azimuth Plane Patterns for the 1700 MHz Band
Figure 8 shows the azimuth plane patterns for the 1800 MHz band for the 4G-ANTM-OM-CM antenna.

Figure 8  Azimuth Plane Patterns for the 1800 MHz Band
Figure 9 shows the azimuth plane patterns for the 1900 MHz band for the 4G-ANTM-OM-CM antenna.

Figure 9  Azimuth Plane Patterns for the 1900 MHz Band
Figure 10 shows the azimuth plane patterns for the 2100 MHz band for the 4G-ANTM-OM-CM antenna.

Figure 10  Azimuth Plane Patterns for the 2100 MHz Band
Figure 11 shows the azimuth plane patterns for the 2600 MHz band for the 4G-ANTM-OM-CM antenna.
Figure 12 shows the elevation plane patterns (\( \Phi = 0 \) degree plane cut) for the 700 MHz band for the 4G-ANTM-OM-CM antenna.

**Figure 12  Elevation Plane Patterns (\( \Phi = 0 \) degree Plane Cut) for the 700 MHz Band**
Figure 13 shows the elevation plane patterns (\(\Phi = 0\) degree plane cut) for the 800 MHz band for the 4G-ANTM-OM-CM antenna.

Figure 13  Elevation Plane Patterns (\(\Phi = 0\) degree Plane Cut) for the 800 MHz Band
Figure 14 shows the elevation plane patterns (Phi = 0 degree plane cut) for the 900 MHz band for the 4G-ANTM-OM-CM antenna.

Figure 14  Elevation Plane Patterns (Phi = 0 degree Plane Cut) for the 900 MHz Band
Figure 15 shows the elevation plane patterns (\(\Phi = 0\) degree plane cut) for the 1700 MHz band for the 4G-ANTM-OM-CM antenna.

**Figure 15**  Elevation Plane Patterns (\(\Phi = 0\) degree Plane Cut) for the 1700 MHz Band
Figure 16 shows the elevation plane patterns (\(\Phi = 0\) degree plane cut) for the 1800 MHz band for the 4G-ANTM-OM-CM antenna.

Figure 16  Elevation Plane Patterns (\(\Phi = 0\) degree Plane Cut) for the 1800 MHz Band
Figure 17 shows the elevation plane patterns (\(\Phi = 0\) degree plane cut) for the 1900 MHz band for the 4G-ANTM-OM-CM antenna.

**Figure 17  Elevation Plane Patterns (\(\Phi = 0\) degree Plane Cut) for the 1900 MHz Band**
Figure 18 shows the elevation plane patterns (\(\Phi = 0\) degree plane cut) for the 2100 MHz band for the 4G-ANTM-OM-CM antenna.

Figure 18  Elevation Plane Patterns (\(\Phi = 0\) degree Plane Cut) for the 2100 MHz Band
Figure 19 shows the elevation plane patterns (\(\Phi = 0\) degree plane cut) for the 2600 MHz band for the 4G-ANTM-OM-CM antenna.

**Figure 19  Elevation Plane Patterns (\(\Phi = 0\) degree Plane Cut) for the 2600 MHz Band**
Figure 20 shows the elevation plane patterns (Phi = 90 degree plane cut) for the 700 MHz band for the 4G-ANTM-OM-CM antenna.

**Figure 20  Elevation Plane Patterns (Phi = 90 degree Plane Cut) for the 700 MHz Band**
Figure 21 shows the elevation plane patterns (Phi = 90 degree plane cut) for the 800 MHz band for the 4G-ANTM-OM-CM antenna.

**Figure 21  Elevation Plane Patterns (Phi = 90 degree Plane Cut) for the 800 MHz Band**
Figure 22 shows the elevation plane patterns (Phi = 90 degree plane cut) for the 900 MHz band for the 4G-ANTM-OM-CM antenna.

Figure 22  Elevation Plane Patterns (Phi = 90 degree Plane Cut) for the 900 MHz Band
Figure 23 shows the elevation plane patterns (Phi = 90 degree plane cut) for the 1700 MHz band for the 4G-ANTM-OM-CM antenna.

Figure 23  Elevation Plane Patterns (Phi = 90 degree Plane Cut) for the 1700 MHz Band
Figure 24 shows the elevation plane patterns (\(\phi = 90\) degree plane cut) for the 1800 MHz band for the 4G-ANTM-OM-CM antenna.

**Figure 24  Elevation Plane Patterns (\(\phi = 90\) degree Plane Cut) for the 1800 MHz Band**
Figure 25 shows the elevation plane patterns (Phi = 90 degree plane cut) for the 1900 MHz band for the 4G-ANTM-OM-CM antenna.

Figure 25  Elevation Plane Patterns (Phi = 90 degree Plane Cut) for the 1900 MHz Band
Figure 26 shows the elevation plane patterns (Phi = 90 degree plane cut) for the 2100 MHz band for the 4G-ANTM-OM-CM antenna.
**System Requirements**

The 4G-ANTM-OM-CM antenna requires a Cisco 3G EHWIC that uses a TNC-Male connector.

**Installation Notes**

**NOTE:** This antenna is designed to be mounted indoors on a ceiling. The antenna is mountable to ceiling tiles less than 1” thick or to hard ceilings with the included installation accessories.

Follow these guidelines to ensure the best possible performance:

The antenna must be mounted to a ceiling to maximize its omnidirectional propagation characteristics. Mounting it on a wall may noticeably decrease the antenna range and overall performance.

- Wherever possible, mount the EHWIC and antenna where the wireless devices would be within sight and avoid physical obstructions. Barriers along the line of sight between antenna and EHWIC degrades the wireless radio signals.
The density of the materials used in a building’s construction determines the number of walls the signal must pass through and still maintain adequate coverage. Consider the following before choosing the location to install your antenna:

- Paper and vinyl walls have very little effect on signal penetration.
- Solid and precast concrete walls limit signal penetration to one or two walls without degrading coverage.
- Concrete and wood block walls limit signal penetration to three or four walls.
- A signal can penetrate five or six walls constructed of drywall or wood.
- A thick metal wall or wire-mesh stucco walls causes signals to reflect back and cause poor penetration.

Avoid mounting the antenna next to a column or vertical support that could create a shadow zone and reduce the coverage area.

Keep the antenna away from reflective metal objects such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use an extension cable to relocate the antenna away from these obstructions.

CAUTION: Install the EHWIC and any antennas away from appliances that share the same frequency bands. Microwave ovens, cordless telephones, and security monitors can temporarily interfere with wireless performance.

CAUTION: We recommend you avoid installing wireless antennas in or near rack-mounted installations that include networking equipment and computer servers whose radiated noise emissions can severely degrade radio performance.

Safety Instructions

Follow these safety instructions when installing your antenna:

- Plan your installation procedure carefully and completely before you begin.
- If you are installing an antenna for the first time, for your own safety as well as that of others, seek professional assistance. Consult your dealer, who can explain which mounting method to use for the location where you intend to install the antenna.
- Choose your installation site with safety as well as performance in mind. Remember that electric power cables and telephone lines look alike. For your safety, assume that any line is an electric power line until determined otherwise.
- Call your local power company or building maintenance organization if you are unsure about cables close to your mounting location.
- When installing your antenna, do not use a metal ladder. Do dress properly: shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.
- If an accident or emergency occurs with the power lines, call for qualified emergency help immediately.

WARNING: In order to comply with FCC radio frequency (RF) exposure limits, antennas should be located at a minimum of 7.9 inches (20 cm) or more from the body of all persons. Statement 332

CAUTION: Do not work on the system or connect or disconnect cables during periods of lightning activity. Statement 1001

CAUTION: This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024

CAUTION: Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

CAUTION: Do not use this product near water; for example, near a bath tub, wash bowl, kitchen sink or laundry tub, in a wet basement, or near a swimming pool. Statement 1035
CAUTION: Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations. Statement 1036

CAUTION: Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface. Statement 1037

CAUTION: To report a gas leak, do not use a telephone in the vicinity of the leak. Statement 1039

CAUTION: Do not locate the antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, because they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.:NFPA 70, National Electrical Code, Article 810, Canada: Canadian Electrical Code, Section 54). Statement 1052

CAUTION: This product is not intended to be directly connected to the Cable Distribution System. Additional regulatory compliance and legal requirements may apply for direct connection to the Cable Distribution System. This product may connect to the Cable Distribution System ONLY through a device that is approved for direct connection. Statement 1078

Installation Instructions

To install the Cisco 4G-ANTM-OM-CM antenna on a ceiling:

1. Drill a 3/4” diameter hole in the ceiling where you want to mount the antenna.
2. (Optional) Drill three pilot holes and insert the supplied screw anchors.
   
   NOTE: You can secure the antenna in place using only the mounting nut. However, for additional support, you can also use the supplied mounting screws. To use the mounting screws, you must first drill three pilot holes and insert the supplied screw anchors in place.
   
   a. Insert the antenna’s cable and thread through the hole you drilled in Step 1 until the base of the antenna is flush with the ceiling.
   b. Using a pencil or pen, mark the screw positions on the ceiling.
   c. Remove the antenna from the ceiling.
   d. Using a 3/16" drill bit, drill three holes for the screw anchors.
   e. Properly insert the three screw anchors into the pilot holes.
3. Insert the antenna’s cable and thread through the hole you drilled in Step 1 until the base of the antenna is flush with the ceiling.
4. From above the ceiling:
   a. Thread the supplied flat washer through the antenna’s cable and thread.
   b. Thread the supplied spring washer through the antenna’s cable and thread.
   c. Thread the supplied mounting nut through the antenna’s cable.
   d. Attach the mounting nut to the antenna’s thread by manually turning the nut clockwise until the antenna is secured in place.
   e. (Optional) Insert the mounting screws, then cover them with the white screw covers.
5. Connect the antenna’s cable to one of the supported extension cables.
To extend the coaxial cable included with your antenna, we recommend an ultra-low-loss coaxial cable for installation flexibility without a significant loss in range. The following table lists insertion loss information about ULL extension coaxial cables available from Cisco.

<table>
<thead>
<tr>
<th>Cisco Product Number</th>
<th>Cable Length</th>
<th>Frequency Range</th>
<th>Insertion Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>3G-CAB-ULL-20</td>
<td>20 foot (6 m)</td>
<td>500-2000 MHz</td>
<td>-1.50 dB, maximum</td>
</tr>
<tr>
<td>3G-CAB-ULL-50</td>
<td>50 foot (15 m)</td>
<td>500-2000 MHz</td>
<td>-3.50 dB, maximum</td>
</tr>
<tr>
<td>3G-CAB-LMR240-25</td>
<td>25 foot (7.5 m)</td>
<td>2200 MHz</td>
<td>-3.50 dB, maximum</td>
</tr>
<tr>
<td>3G-CAB-LMR240-50</td>
<td>50 foot (15 m)</td>
<td>2200 MHz</td>
<td>-6.90 dB, maximum</td>
</tr>
<tr>
<td>3G-CAB-LMR240-75</td>
<td>75 foot (23 m)</td>
<td>2200 MHz</td>
<td>-10.50 dB, maximum</td>
</tr>
</tbody>
</table>
Figure 28 shows the installation instructions. The callouts in this figure correspond to the steps in Installation Instructions.

Figure 28  Installation Instructions for the Cisco 4G-ANTM-OM-CM Antenna

Obtaining Documentation

Cisco documentation and additional literature are available on Cisco.com. Cisco also provides several ways to obtain technical assistance and other technical resources. These sections explain how to obtain technical information from Cisco Systems.
Cisco.com

You can access the most current Cisco documentation at this URL:

http://www.cisco.com/univercd/home/home.htm

You can access the Cisco website at this URL:

http://www.cisco.com

You can access international Cisco websites at this URL:


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Cisco 4G/3G Omnidirectional Dipole Antenna (4G-LTE-ANTM-D)

This document outlines the specifications, describes the Cisco 4G/3G Omnidirectional Dipole Antenna (4G-LTE-ANTM-D), and contains the following sections:

- Overview, page 84
- Specifications, page 86
- System Requirements, page 92
- Installation Notes, page 92
- Safety Instructions, page 93

Overview

The 4G-LTE-ANTM-D omnidirectional dipole antenna is designed for indoor use with Cisco 4G and Cisco 3G wireless Integrated Services Routers Generation 2 (ISRs G2) and Enhanced High-Speed WAN Interface Cards (EHWICs).

The 4G-LTE-ANTM-D antenna is marked with a green band and the product ID (PID) to indicate that it supports 4G Long Term Evolution (LTE) networks. It has the following hardware features:

- **Articulating Joint**—It can be rotated 360 degrees and is capable of maneuvering into three stop positions: 0 degrees, 45 degrees, and 90 degrees.

- **Male threaded Neill-Concelman (TNC) Connector**—It lets you directly mount the antenna to any Cisco 4G and Cisco 3G wireless Integrated Services Router (ISR) EHWIC with a TNC connector (Figure 1). The threads on the connector must comply with the ANSI 7/16-28 UNEF 2B thread specification.

Cisco Systems, Inc.  www.cisco.com
Figure 1   Cisco 4G-LTE-ANTM-D Ominidirectional Dipole Antenna, TNC Connector, and Articulation Joint

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0 degree position</td>
</tr>
<tr>
<td>2</td>
<td>45 degree position</td>
</tr>
<tr>
<td>3</td>
<td>90 degree position</td>
</tr>
<tr>
<td>4</td>
<td>Articulating joint</td>
</tr>
</tbody>
</table>
Specifications

Table 1  Specifications for Cisco 4G-LTE-ANTM-D Antenna

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum input power</td>
<td>3W</td>
</tr>
<tr>
<td>Connector</td>
<td>TNC male</td>
</tr>
<tr>
<td>VSWR</td>
<td>2.5:1 or less</td>
</tr>
<tr>
<td>Characteristic impedance</td>
<td>50 ohm</td>
</tr>
<tr>
<td>Antenna base and radome color</td>
<td>Cisco Raven Black</td>
</tr>
<tr>
<td>Antenna dimensions</td>
<td>9 (L) x 1.2 (W) x 7/16 in (D) (229 x 30.5 x 11 mm)</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-22° to 158°F (-30° to 70°C)</td>
</tr>
<tr>
<td>Operating frequency ranges</td>
<td>- 698-806 MHz</td>
</tr>
<tr>
<td></td>
<td>- 824-894 MHz</td>
</tr>
<tr>
<td></td>
<td>- 925-960 MHz</td>
</tr>
<tr>
<td></td>
<td>- 1710-1885 MHz</td>
</tr>
<tr>
<td></td>
<td>- 1920-1980 MHz</td>
</tr>
<tr>
<td></td>
<td>- 2110-2170 MHz</td>
</tr>
<tr>
<td></td>
<td>- 2500-2690 MHz</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Antennas were designed and tested to high RF efficiency in all supported cellular bands. Detailed technical specifications can be obtained through your Cisco authorized partner or Cisco account representative.</td>
</tr>
<tr>
<td>Maximum Peak Gain</td>
<td>2 dBi</td>
</tr>
</tbody>
</table>
Cisco 4G/3G Omnidirectional Dipole Antenna (4G-LTE-ANTM-D)
Figure 3  Elevation Cut (AMPS) Phi 90 Degree Plane for Cisco 4G-LTE-ANTM-D
Figure 4  Azimuth Cut (AMPS) for Cisco 4G-LTE-ANTM-D
Figure 5   Elevation Cut (PCS) Phi 0 Degree Plane for Cisco 4G-LTE-ANTM-D
Figure 6  Elevation Cut (PCS) Phi 90 Degree Plane for Cisco 4G-LTE-ANTM-D
System Requirements

The Cisco 4G/3G omnidirectional dipole antenna is designed to be used with any Cisco 4G and Cisco 3G wireless ISRs G2 and EHWICs with a TNC antenna connector. The threads on this connector must comply with ANSI 7/16-28 UNEF 2B thread specification. The antenna is designed to be used only indoors.

Installation Notes

This antenna is designed to be mounted directly to any Cisco 4G and Cisco 3G wireless ISR and EHWIC with a TNC connector by simply threading it onto the mating connector. Mount and deploy the antenna at the 0-degree position, 45-degree position, or the 90-degree position, and then change that position at will. The rotation of the antenna into the proper position can take place while the antenna is still loose on the mating connector. No software is required for this installation.

Caution: Do not install this antenna in an outdoor environment.

In addition to the antenna orientation, the installation location of the wireless EHWIC plays a significant role in determining overall network performance with respect to all the wireless clients. Clients at the farthest coverage points might have 10 to 50 percent of the bandwidth available to clients close to the antenna. Wireless network coverage in one area or location might need to be lowered to improve the performance for clients in other areas or locations.

Because antennas both transmit and receive radio signals, their performance can be adversely affected by the surrounding environment, including physical obstructions or radio frequency (RF) interference.
Follow these guidelines to ensure the best possible performance:

- When used on an EHWIC, always mount the antenna on an appropriate extension cable and antenna stand. The antenna performance will not be optimal if mounted directly to an EHWIC. Mounting directly to a fixed router (without an EHWIC) is allowed.

- Space multiple antennas apart by at least 17 inches (43 cm). Interference may occur when placed closely together.

- Observe the radiation patterns in Figures 2 through 7 to position the antennas for best coverage.

- Wherever possible, mount the EHWIC and antenna where the wireless devices are within sight and without physical obstructions. Barriers along the line of sight between the device and the local base station will degrade the wireless radio signals. EHWICs and antennas should be installed above floor level in office environments or near the ceiling for better performance because most obstructions tend to be near floor level.

- The density of the materials used in a building’s construction determines the number of walls the signal must pass through while still maintaining adequate coverage. Consider the following before choosing the location for installing your antenna:
  - Paper and vinyl walls have very little effect on signal penetration.
  - Solid and precast concrete walls limit signal penetration to one or two walls without degradation of coverage.
  - Concrete and wood block walls limit signal penetration to three or four walls.
  - A signal can penetrate five or six walls constructed of drywall or wood.
  - A thick metal wall or wire-mesh stucco wall causes signals to reflect back and causes poor penetration.

- Avoid mounting the antenna next to a column or vertical support that could create a shadow zone and reduce the coverage area.

- Keep the antenna away from reflective metal objects such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use an extension cable to relocate the antenna away from these obstructions.

**Caution**: Install the EHWIC and any antennas away from appliances that share the same frequency bands. Microwave ovens, cordless telephones, and security monitors can temporarily interfere with wireless performance.

**Caution**: We recommend avoiding installing wireless antennas in or near rack-mounted equipment that include networking equipment and computer servers whose radiated noise emissions can severely degrade radio performance.

**Note**: If the desired installation site has a marginally acceptable level of radiated noise emissions, consider using a remote-mounted antenna, such as a wall-mount or ceiling-mount antenna, for better radio performance and coverage.

### Safety Instructions

Follow these safety instructions when installing your antenna.

**Warning**: In order to comply with FCC radio frequency (RF) exposure limits, antennas should be located at a minimum of 7.9 inches (20 cm) or more from the body of all persons. Statement 332

**Warning**: This equipment must be connected to an indoor antenna only. Statement 373

- Plan your installation procedure carefully and completely before you begin.

- If you are installing an antenna for the first time, for your own safety as well as that of others, seek professional assistance. Consult your dealer, who can explain which mounting method to use for the location where you intend to install the antenna.

- Choose your installation site with both safety and performance in mind.
Caution: Remember that electric power cables and telephone lines look alike. For your safety, assume that any line is an electric power line until determined otherwise.

- Call your local power company or building maintenance organization if you are unsure about cables close to your mounting location.
- When installing your antenna, do not use a metal ladder. Do dress properly: wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.
- If an accident or emergency occurs with the power lines, call for qualified emergency help immediately.
Cisco Dual LTE–Single GPS Multi-band Antenna Installation Guide (4G-LTE-ANTM-O-3-B)

This document provides the description, supported features, and installation instructions of the Cisco Dual LTE-Single GPS Multi-band (4G-LTE-ANTM-O-3-B) Antenna.

Caution: Read the information in Safety Precautions before installing or replacing antennas.

This document contains the following sections:

- Overview of the 4G-LTE-ANTM-O-3-B Antenna
- Supported Antennas
- Supported Antenna Accessories
- Antenna Options by Deployment Type
- Safety Precautions
- Installation Instructions
- Deployment Scenarios
- Related Documentation
- Obtaining Documentation and Submitting a Service Request

Overview of the 4G-LTE-ANTM-O-3-B Antenna

Deciding which antenna to use involves multiple factors, such as coverage area, maximum distance, indoor location, outdoor location, and antenna height.

When an antenna is used indoors, the building construction, ceiling height, and internal obstructions must be considered. In outdoor environments, obstructions such as trees, vehicles, buildings, and hills must be considered. Distance is the primary factor when using outdoor–wireless communications. However, coverage area also becomes important when you use wireless client devices to communicate with a wireless device.

4G-LTE-ANTM-O-3-B antenna is an integrated 3-in-1- indoor and outdoor antenna. It comes with two Long Term Evolution (LTE) antennas and one Global Positioning System (GPS) antenna in a single radome. Figure 1 shows the 4G-LTE-ANTM-O-3 antenna.
Parts List

The shipment of your antenna includes the following items:

- One Antenna Unit
- Two SMA-Female to TNC-Male Adapters
- Installation Guide

Features of the 4G-LTE-ANTM-O-3-B Antenna

The 4G-LTE-ANTM-O-3-B antenna supports the following features:

- No tune, multiband coverage, dual 4G LTE, and GPS L1 frequencies.
- Metal 5/8-inch stud mount with serrated face nut provides single cable exit for easier installation or antenna replacement.
- Attractive low-profile housing for added overhead clearance.
- IP67-compliant design provides maximum protection against water or dust under severe environmental conditions.
- High-performance, low-loss cable, and high-quality connectors for maximum Radio Frequency (RF) system efficiency.
- UV-resistant red, blue, black, or white radome.

Technical Specifications

Table 1 lists the specifications for the RF antenna.
Table 1  Specifications of RF antenna

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Frequencies</td>
<td>698-960 MHz</td>
</tr>
<tr>
<td></td>
<td>1710-2700 MHz</td>
</tr>
<tr>
<td>Polarization</td>
<td>Vertical, linear</td>
</tr>
<tr>
<td>Nominal Impedance</td>
<td>50 Ohms</td>
</tr>
<tr>
<td>Gain¹ (Typical)</td>
<td>2.5 dBi</td>
</tr>
<tr>
<td>Maximum Power</td>
<td>3 Watts</td>
</tr>
<tr>
<td>VSWR²</td>
<td>&lt; 2.5:1</td>
</tr>
<tr>
<td>Elevation Plane (3 dB Beamwidth)</td>
<td>30° (nominal)</td>
</tr>
<tr>
<td>Azimuth Plane (3 dB Beamwidth)</td>
<td>Omni-directional</td>
</tr>
<tr>
<td>Connector type</td>
<td>SMA-Male</td>
</tr>
<tr>
<td>Cable</td>
<td>4 foot RG174 VW-1 compliant</td>
</tr>
<tr>
<td>Height</td>
<td>90 mm</td>
</tr>
<tr>
<td>Base Diameter</td>
<td>137 mm</td>
</tr>
<tr>
<td>Color</td>
<td>White, Black, Red or Blue</td>
</tr>
<tr>
<td>Flammability</td>
<td>UL-94 V0</td>
</tr>
<tr>
<td>Environment</td>
<td>Indoor and outdoor</td>
</tr>
<tr>
<td>Mounting</td>
<td>5/8 inch lug with serrated face nut, optional adhesive backing (peel-off), 17 sq. inches area (minimum) on a flat smooth surface, 5/8 inch diameter hole through mounting surface</td>
</tr>
<tr>
<td>Operating and storage temperature</td>
<td>-40 to +85 degree C</td>
</tr>
<tr>
<td>Ingress Protection³</td>
<td>IP67</td>
</tr>
</tbody>
</table>

1. Total gain, free space test when mounted on a 1-foot diameter ground plane with unused ports loaded.
2. Free space Voltage Standing Wave Ratio (VSWR) over all operating frequency ranges when mounted on a 1-foot diameter ground plane with unused ports loaded.
3. When mounted per installation instructions.

Table 2 lists the specifications for the GPS Antenna.
Table 2 Specifications of the GPS Antenna

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Band</td>
<td>1575.42 MHz (GPS L1)</td>
</tr>
<tr>
<td>Amplifier Gain</td>
<td>26 dBC ± 3 dB</td>
</tr>
<tr>
<td>Nominal Impedance</td>
<td>50 Ohms</td>
</tr>
<tr>
<td>Output VSWR</td>
<td>1.5:1 typical</td>
</tr>
<tr>
<td>DC Current</td>
<td>20 mA nominal; &lt; 30 mA @ -40° C to +85° C</td>
</tr>
<tr>
<td>DC Voltage</td>
<td>3.3–5 V</td>
</tr>
<tr>
<td>Noise Figure</td>
<td>1.8 dB typical</td>
</tr>
<tr>
<td>Filtering</td>
<td>&gt; 40 dB rejection @ ± 50 MHz from center frequency</td>
</tr>
</tbody>
</table>

Figure 2 shows the parts of 4G-LTE-ANTM-O-3-B Antenna.

Figure 2 Parts of 4G-LTE-ANTM-O-3-B Antenna

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GPS and 2 LTE antennas inside</td>
</tr>
<tr>
<td>2</td>
<td>Radome available in 4 colors: White, Black, Red or Blue (Indoor or Outdoor)</td>
</tr>
<tr>
<td>3</td>
<td>Gasket</td>
</tr>
<tr>
<td>4</td>
<td>Mounting stud</td>
</tr>
<tr>
<td>5</td>
<td>Cables</td>
</tr>
</tbody>
</table>

Figure 3 shows the antenna with cable labels.
Figure 3  The Antenna with Cable Labels

<table>
<thead>
<tr>
<th></th>
<th>MPN LABEL</th>
<th>LTE-ID LABEL 2EA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>GPS ID LABEL</td>
<td></td>
</tr>
</tbody>
</table>

Figure 4 shows the Low Band 698–960 MHz EL (PHI=0).
Figure 4  Low band 698-960 MHz EL (PHI=0)

Figure 5 shows the Low Band 698-960 MHz EL (PHI=90).
Figure 5  Low band 698-960 MHz EL (PHI=90)

Figure 6 shows the Low Band 698-960 MHz AZ (THETA=90).
Figure 6  Low Band 698-960 MHz AZ (THETA=90)

Figure 7 shows High Band 1710-2700 MHz EL (PHI=0).
Figure 7 shows High Band 1710-2700 MHz EL (PHI=0).

Figure 8 shows High Band 1710-2700 MHz EL (PHI=90).
Figure 8  High Band 1710–2700 MHz EL (PHI=90)

Figure 9 shows High Band 1710–2700 MHz AZ (THETA=90).
Figure 9  High Band 1710-2700 MHz AZ (THETA=90)

Table 3 lists the supported antennas.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4G-LTE-ANTM-O-3-W</td>
<td>Indoor or outdoor low-profile antenna with 4-foot dongle, white radome.</td>
</tr>
<tr>
<td>4G-LTE-ANTM-O-3-B</td>
<td>Indoor or outdoor low-profile antenna with 4-foot dongle, black radome.</td>
</tr>
<tr>
<td>4G-LTE-ANTM-O-3-R</td>
<td>Indoor or outdoor low-profile antenna with 4-foot dongle, red radome.</td>
</tr>
<tr>
<td>ANT-4G-SR-OUT-TNC</td>
<td>Multiband low-profile saucer outdoor 4G Antenna</td>
</tr>
<tr>
<td>4G-LTE-ANTM-O-3-C</td>
<td>Indoor or outdoor low-profile antenna with 4-foot dongle, blue radome.</td>
</tr>
</tbody>
</table>
Supported Antenna Accessories

Table 4 lists the supported antenna accessories.

Table 4  Supported Antenna Accessories

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Cable Length</th>
<th>Maximum Insertion Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>4G-CAB-LMR240-25</td>
<td>25 foot (7.5 m)</td>
<td>2.1 dB @ 700 MHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.0 dB @ 2.6 GHz</td>
</tr>
<tr>
<td>4G-CAB-LMR240-50</td>
<td>50 foot (15 m)</td>
<td>4.1 dB @ 700 MHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.4 dB @ 2.6 GHz</td>
</tr>
<tr>
<td>4G-CAB-LMR240-75</td>
<td>75 foot (23 m)</td>
<td>6.1 dB @ 700 MHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.0 dB @ 2.6 GHz</td>
</tr>
<tr>
<td>4G-CAB-ULL-20</td>
<td>20 foot (6 m)</td>
<td>0.90 dB @ 700 MHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.8 dB @ 2.6 GHz</td>
</tr>
<tr>
<td>4G-CAB-ULL-50</td>
<td>50 foot (15 m)</td>
<td>2.2 dB @ 700 MHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.3 dB @ 2.6 GHz</td>
</tr>
</tbody>
</table>

Antenna Options by Deployment Type

Table 5 lists the antenna options by deployment type.

Table 5  Antenna Options by Deployment Type

<table>
<thead>
<tr>
<th>Deployment Type</th>
<th>Description</th>
<th>Antenna Accessories Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indoor</td>
<td>The antenna is installed indoors on a grounded metal surface and attached directly to a router.</td>
<td>None</td>
</tr>
</tbody>
</table>
| Indoor, with extension| The antenna is installed on a grounded metal surface and attached to a router with extension cables. | ▪ 4G-CAB-LMR240-25  
                           |                                                                                           | ▪ 4G-CAB-LMR240-50  
                           |                                                                                           | ▪ 4G-CAB-LMR240-75  
                           |                                                                                           | ▪ 4G-CAB-ULL-20     
                           |                                                                                           | ▪ 4G-CAB-ULL-50     |
| Outdoor flush         | The antenna is installed outdoors to a grounded metal surface and attached directly to a router mounted indoors. | None                                          |
Safety Precautions

This section contains the following warning statements. A warning means danger. You are in a situation that could cause bodily injury. Before working on an equipment, be aware of the hazards involved with electrical circuitry and standard safety practices to prevent accidents.

Statement 1052—Installing and Grounding the Antenna

Warning: Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, refer to national and local codes (for example, U.S.:NFPA 70, National Electrical Code, Article 810, Canada:Canadian Electrical Code, Section 54).

Statement 1024—Ground Conductor

Warning: This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.

Statement 1025—Use Copper Conductors Only

Warning: Use copper conductors only.

Statement 1046—Installing or Replacing the Unit

Warning: When installing or replacing the unit, the ground connection must always be made first and disconnected last.

Caution: For your physical safety, and to help you install your antenna successfully, follow these safety precautions.

- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type of antenna you are about to install.

- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

- Find someone to help you—installing an antenna is often a two-person job.

- Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

- Contact your electric power company. Tell them your plans and ask them to come and look at your proposed installation.

- Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

- When installing your antenna, follow these guidelines:
  - Do not use a metal ladder.
  - Do not work on a wet or windy day.
  - Do dress properly—wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.
If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.

If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.

If an accident should occur with the power lines, call for qualified emergency help immediately.

Installation Instructions

The following section contains steps for installing the 4G-LTE-ANTM-O-3-B antenna:

1. While choosing the location, keep the following in mind:
   - Attempt to center the antenna on a flat plane.
   - Attempt to position the antenna so that it has 8 inches of flat plane in any given direction.
   - Attempt to space at least 16 inches from an adjacent antenna or metallic structure and choose a location with gentle surface curves to ensure proper sealing.
   - Ensure that there is a space that is 2 inches deep and 2 inches in diameter below the mounting surface to allow sufficient clearance for the mounting stud, hardware, and cables.
   - Ensure that the diameter of the hole is 5/8 inch.

2. Drill a hole through the mounting surface where the center of the antenna is located, as shown in Figure 10.

   Note: Ensure that the hole is deburred of sharp edges to prevent cable damage during installation.

   **Figure 10  Drill the Mounting Surface**

3. Clean the mounting surface around the hole. The surface must be free of any debris, which would otherwise prevent the antenna’s inner foam gasket from adhering to or the outer rubber gasket from forming a seal.

4. Remove the nut from the mounting stud and cables one by one.

5. Insert the mounting stud through the hole and then thread the cables through the serrated face nut one by one.
**Warning**: It is important that the orientation of the serrated face nut should be correct. Otherwise, the serrated part of the lock nut will not bite into the mounting stud.

Figure 11 shows the bottom view of the antenna.

**Figure 11  Bottom View of the Antenna**

6. Position the antenna onto the mounting surface and tighten the nut hand-tight, as shown in Figure 12. Tighten it further using a wrench until the antenna is fully seated. Visually inspect the outer rubber antenna gasket to ensure that it has been compressed and sealed tightly against the mounting surface and radome.

**Figure 12  Tighten the Nut after the Antenna is fully seated**
Deployment Scenarios

Figure 13 shows the deployment of the 4G-LTE-ANTM-O-3-B antenna on an ATM with a single router.

Note: All the three antenna cables are SubMiniature version A (SMA-male) connectors, but the MAIN and the Diversity (DIV) of the router has the Threaded Neill-Concelman (TNC-female) connectors, and the GPS has an SMA-female connector. In this case, an SMA-female to TNC-male adapter needs to be used to connect the SMA-male connectors to the MAIN and DIV of the router because they cannot be connected to the SMA-male connectors directly.

Figure 13  Deployment of an Antenna with One Router

Figure 14 shows the deployment of 4G-LTE-ANTM-O-3-B on an ATM with dual routers.
Figure 14  Deployment of an Antenna with Dual Routers

Related Documentation

- For information about antennas and modules, see:
  www.cisco.com/go/cg-modules

- For information about omnidirectional and directional antennas, see:

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly What’s New in Cisco Product Documentation, which also lists all new and revised Cisco technical documentation, at:


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Cisco Aironet 2.4 GHz 13-dBi Directional Antenna (AIR-ANT2413P2M-N)

This document outlines the specifications for the Cisco Aironet AIR-ANT2413P2M-N 2.4 GHz 13-dBi 2-Port Directional antenna with N-type connectors and provides instructions for mounting it. The antenna operates in the 2.4 GHz frequency band and is designed for use in outdoor environments.

The following information is provided in this document.

- Technical Specifications
- System Requirements
- Safety Precautions
- Installation Guidelines
- Installing the Antenna
Technical Specifications

<table>
<thead>
<tr>
<th>Antenna type</th>
<th>2-Element Patch Array</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range</td>
<td>2400 to 2500 MHz</td>
</tr>
<tr>
<td>Nominal input impedance</td>
<td>50 Ohms</td>
</tr>
<tr>
<td>Peak gain</td>
<td>13 dBi</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linear, Dual</td>
</tr>
<tr>
<td>Elevation plane 3-dB beamwidth</td>
<td>30°</td>
</tr>
<tr>
<td>Azimuth plane 3-dB beamwidth</td>
<td>30°</td>
</tr>
<tr>
<td>Sidelobe level</td>
<td>&lt; -20 dBC</td>
</tr>
<tr>
<td>Front-to-back ratio</td>
<td>&gt; 25 dB</td>
</tr>
<tr>
<td>Cable length and type</td>
<td>30 in. (76.2 cm)</td>
</tr>
<tr>
<td>Connector type</td>
<td>N Male</td>
</tr>
<tr>
<td>Length</td>
<td>7.8 in. (19.8 cm)</td>
</tr>
<tr>
<td>Width</td>
<td>7.8 in. (19.8 cm)</td>
</tr>
<tr>
<td>Height</td>
<td>1.2 in. (3 cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>21.6 oz. (0.61 kg)</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-40°F to 131°F (-40°C to 55°C)</td>
</tr>
</tbody>
</table>

Elevation and Azimuth Plane Patterns

System Requirements

This antenna is designed for use with Cisco Aironet access points and bridges but can be used with any 2.4-GHz Cisco Aironet radio device that uses an N-male connector.
Safety Precautions

**WARNING:** Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

**WARNING:** This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.

**WARNING:** In order to comply with international radio frequency (RF) exposure limits, dish antennas should be located at a minimum of 8.7 inches (22 cm) or more from the bodies of all persons. Other antennas should be located a minimum of 7.9 inches (20 cm) or more from the bodies of all persons.

**WARNING:** Do not work on the system or connect or disconnect cables during periods of lightning activity.

**WARNING:** This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.

**WARNING:** Do not locate the antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (e.g. U.S.: NFPA 70, National Electrical Code, Article 810, in Canada: Canadian Electrical Code, Section 54).

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution but did not take adequate steps to avoid the hazard.

For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!

1. If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

2. Select your installation site with safety, as well as performance in mind. Remember, electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

3. Call your electric power company. Tell them your plans and ask them to come look at your proposed installation. This is a small inconvenience considering your life is at stake.

4. Plan your installation carefully and completely before you begin. Successful raising of a mast or tower is largely a matter of coordination. Each person should be assigned to a specific task and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

5. When installing your antenna, remember:
   a. Do not use a metal ladder.
   b. Do not work on a wet or windy day.
   c. Do dress properly—shoes with rubber soles and heels, rubber gloves, long sleeved shirt or jacket.

6. If the assembly starts to drop, get away from it and let it fall. Remember, the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current. Even the slightest touch of any of these parts to a power line complete an electrical path through the antenna and the installer: you!

7. If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company. They will remove it safely.

8. If an accident should occur with the power lines call for qualified emergency help immediately.
Installation Guidelines

Because the antennas transmit and receive radio signals, they are susceptible to RF obstructions and common sources of interference that can reduce throughput and range of the device to which they are connected. Follow these guidelines to ensure the best possible performance:

- Mount the antenna as high as possible to take advantage of its propagation characteristics.
- Keep the antenna away from metal obstructions such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use a rigid conduit to lower the antenna away from these obstructions.
- The density of the materials used in a building’s construction determines the number of walls the signal must pass through and still maintain adequate coverage. Consider the following before choosing the location in which to install your antenna:
  - Paper and vinyl walls have very little affect on signal penetration.
  - Solid and pre-cast concrete walls limit signal penetration to one or two walls without degrading coverage.
  - Concrete and wood block walls limit signal penetration to three or four walls.
  - A signal can penetrate five or six walls constructed of drywall or wood.
  - A thick metal wall causes signals to reflect, causing poor penetration.
- Install the antenna away from 5-GHz cordless phones. These products can cause signal interference because they operate in the same frequency range as the device your antenna is connected to.

Site Selection

Before attempting to install your antenna, determine where you can best place the antenna for safety and performance.

Follow these steps to determine a safe distance from wires, power lines, and trees.

1. Measure the height of your antenna.
2. Add this length to the length of your tower or mast and then double this total for the minimum recommended safe distance.

**CAUTION:** If you are unable to maintain this safe distance, stop and get professional help.

3. Generally, the higher an antenna is above the ground, the better it performs. Good practice is to install your antenna about 5 to 10 feet (1.5 to 3 m) above the roof line and away from all power lines and obstructions. If possible, find a mounting place directly above your wireless device so that the lead-in cable can be as short as possible.

Installing the Antenna

You can install the antenna on a pole from 1.63" to 2.3" pipe O.D. The mounting options allow the antenna to be vertically or horizontally polarized.

Tools and Equipment Required

An installation kit is shipped with the antenna and consists of the panel antenna with adjustable mount and hardware, including:

- Antenna mount bracket
- Elevation adjustable bracket
Azimuth adjustable bracket
Four 1/4-in. 20x3/4 carriage bolts
Six 1/4-in. 20 hex nuts
Six 1/4-in. 20 spring lock washers
Six 1/4-in. 20 flat washers
Two pipe clamps

To attach the mount to the antenna and secure it to the pole, you need the following tools and equipment, which are not provided.

- 7/16-in wrench
- 5/16-in nut driver or flat head screwdriver for pipe clamps

The following sections contain typical procedures for installing the antenna on a pole. Your installation may vary. Before you begin, you may want to refer to Figure 1.

Mounting on a Pole

Follow these steps to mount your antenna on a pole.

1. Remove antenna and mount kit from packaging.

2. Attach antenna mount bracket to the back of the antenna as shown applying a maximum nut-tightening torque of 55 in-lbf (6.2 Nm).
3. Attach elevation adjustable bracket as shown and loosely secure hardware. The carriage bolt square holes must be on the inside.
4. Attach azimuth adjustable bracket to pipe routing band clamps as shown. Tighten the pipe clamps to a torque of 43–51 in-lbf (4.9–5.8 Nm).

<table>
<thead>
<tr>
<th></th>
<th>Elevation adjustable bracket</th>
<th></th>
<th>1/4-in. spring lock washer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/4-in. 20x3/4 carriage bolt</td>
<td>2</td>
<td>1/4-in. 20 hex nut</td>
</tr>
<tr>
<td>3</td>
<td>1/4-in. flat washer</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>
5. Attach antenna assembly to azimuth bracket on pipe.
6. Adjust the position of the antenna to the desired azimuth and elevation angles and tighten all pivot hardware (4 places) to a maximum torque of 55 in–lb (6.2 Nm). The bracket allows the antenna position to be adjustable to +/-45 degrees azimuth and +/-60 degrees elevation.
NOTE: Cisco recommends grounding the antenna. See the Grounding the Antenna for details.

Installing the Optional Mounting Bracket Kit

Using an optional antenna mounting bracket kit, the AIR-ANT2413P2M-N antenna can be mounted directly on an access point in a strand mount or pole mount environment. The antenna bracket kit contains four bracket sections and fasteners that you can assemble in multiple configurations to position and aim the directional antenna in a range of positions. For more information on mounting the antenna with the optional mounting bracket, refer to Installing Antenna Brackets on Cisco 1550 Series Outdoor Mesh Access Points.

Mounting on a Vertical Surface

The antenna can be wall mounted. Hardware is not included for wall-mount installation.

Follow these steps to mount your antenna on a vertical surface.

1. Remove antenna and mount kit from packaging.

2. Attach antenna mount bracket to the back of the antenna as shown in Figure 1, applying a maximum nut-tightening torque of 55 in-lbf (6.2 Nm).

3. Attach elevation adjustable bracket as shown in Figure 2 and loosely secure hardware. The carriage bolt square holes must be on the inside.

4. Using the appropriate customer-supplied anchors and screws, attach the azimuth adjustable bracket to the wall as shown:
5. Attach antenna assembly to azimuth bracket, as shown in Figure 4.
6. Adjust the position of the antenna to the desired azimuth and elevation angles and tighten all pivot hardware (4 places) to a maximum torque of 55 in-lbf (6.2 Nm). The bracket allows the antenna position to be adjustable to +/-45 degrees azimuth and +/-60 degrees elevation.

**NOTE:** Cisco recommends grounding the antenna. See the *Grounding the Antenna* for details.

### Antenna Cable Information

If the antenna is used with the Cisco 1552CU or 1552EU access point, the port A of the antenna must be connected to port 4 of the access point, port B of the antenna must be connected to port 6 of the access point, and port 5 of the access point must be capped with the cap enclosed with the antenna.

**NOTE:** Coaxial cable loses efficiency as the frequency increases, resulting in signal loss. The cable should be kept as short as possible because cable length also causes signal loss (the longer the run, the greater the loss).

**NOTE:** The antenna cable has a 0.5 in. (12.7 mm) bend radius. Sharply bending or crimping the cable may cause a degradation in performance.

The antenna terminates with an N-male plug after a short, 2.5-foot (0.76-m) cable. The mating connector to the antenna is an appropriate N-female jack. The connector on the opposite end will vary according to the type of equipment used.

After the cable is attached to the antenna, make sure that the connections are sealed (if outdoors) to prevent moisture and other weathering elements from affecting performance. Cisco recommends using a coax seal (such as CoaxSeal) for outdoor connections. Silicone sealant or electrical tape are not recommended for sealing outdoor connections.

### Grounding the Antenna

Follow these steps to ground the antenna in accordance with national electrical code instructions.

1. Use No. 10 AWG copper or No. 8 or larger copper-clad steel or bronze wire as ground wires for both mast and lead-in. Securely clamp the wire to the bottom of the mast.

2. Secure the lead-in wire to an antenna discharge unit and the mast ground wire to the building with stand-off insulators spaced from 4 foot (1.2 m) to 8 foot (2.4 m) apart.

3. Mount the antenna discharge unit as close as possible to where the lead-in wire enters the building.

4. Drill a hole in the building’s wall as close as possible to the equipment to which you will connect the lead-in cable.

5. There may be wires in the wall. Make sure your drilling location is clear of any obstructions or other hazards.

6. Pull the cable through the hole and form a drip loop close to where it enters the building.

7. Thoroughly waterproof the lead-in area.

8. Install a lightning arrester.

9. Connect the lead-in cable to the equipment.

### Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly What’s New in Cisco Product Documentation, which also lists all new and revised Cisco technical documentation, at:

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Cisco Aironet Omnidirectional Antennas
AIR-ANT2450V-N, AIR-ANT2450VG-N, AIR-ANT2450V-N-HZ, and AIR-ANT2450HG-N

This document describes the Cisco Aironet AIR-ANT2450V-N, AIR-ANT2450VG-N, AIR-ANT2450V-N-HZ, and AIR-ANT2450HG-N omnidirectional antennas and provides instructions for mounting. The antennas are designed for outdoor use with Cisco Aironet Outdoor Access Points (hereafter referred to as access points) with radios operating in the 2.4 GHz frequency band.

These antennas are functionally the same, and will be referred to as a singular antenna throughout the rest of this guide. The antennas are:

Table 1 Antenna SKUs

<table>
<thead>
<tr>
<th>Antenna SKU</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIR-ANT2450V-N</td>
<td>White-Vertical polarization</td>
</tr>
<tr>
<td>AIR-ANT2450VG-N</td>
<td>Gray-Vertical polarization</td>
</tr>
<tr>
<td>AIR-ANT2450HG-N</td>
<td>Gray-Horizontal polarization</td>
</tr>
<tr>
<td>AIR-ANT2450V-N-HZ</td>
<td>White-Vertical polarization, Hazardous Locations</td>
</tr>
</tbody>
</table>

The following information is provided in this document:

- Technical Specifications
- System Requirements
- Safety Precautions
- Installation Notes
- Obtaining Documentation and Submitting a Service Request
Technical Specifications

<table>
<thead>
<tr>
<th>Antenna Type</th>
<th>Omnidirectional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Frequency Range</td>
<td>2400–2500 MHz</td>
</tr>
<tr>
<td>VSWR</td>
<td>2:1</td>
</tr>
<tr>
<td>Nominal Input Impedance</td>
<td>50 Ω</td>
</tr>
<tr>
<td>Gain</td>
<td>5 dBi</td>
</tr>
<tr>
<td>Polarization</td>
<td>AIR-ANT2450VG-N: Vertical</td>
</tr>
<tr>
<td></td>
<td>AIR-ANT2450HG-N: Horizontal</td>
</tr>
<tr>
<td>Azimuth Plane Ripple</td>
<td>2 dB (Max)</td>
</tr>
<tr>
<td>Elevation Plane 3 dB Beamwidth</td>
<td>30° (2400 – 2483 MHz)</td>
</tr>
<tr>
<td>Azimuth Plane 3 dB Beamwidth</td>
<td>Omnidirectional</td>
</tr>
<tr>
<td>Length</td>
<td>12.9 in (328.5 mm)</td>
</tr>
<tr>
<td>Diameter</td>
<td>1.5 in (38.1 mm)</td>
</tr>
<tr>
<td>Weight</td>
<td>AIR-ANT2450VG-N: 5.3 oz. (0.15 kg)</td>
</tr>
<tr>
<td></td>
<td>AIR-ANT2450HG-N: 6.4 oz. (0.18 kg)</td>
</tr>
<tr>
<td>Connector</td>
<td>N-Male</td>
</tr>
<tr>
<td>Operational Temperature</td>
<td>-40° to +158° F (-40° C to +70° C)</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-40° to +185° F (-40° C to +85° C)</td>
</tr>
<tr>
<td>Water/Foreign Body Ingress</td>
<td>IP67</td>
</tr>
<tr>
<td>Wind Rating (Operational)</td>
<td>100 mph (161 kph)</td>
</tr>
</tbody>
</table>

Radiation Patterns

The AIR-ANT2450V-N, AIR-ANT2450VG-N, and AIR-ANT2450V-N-HZ, share the same radiation patterns. The AIR-ANT2450HG-N has a different pattern.
AIR-ANT2450V-N, AIR-ANT2450VG-N, and AIR-ANT2450V-N-HZ

Figure 1  Azimuth Radiation Pattern

Figure 2  Elevation Radiation Pattern
AIR-ANT2450HG-N

System Requirements

This antenna is designed for use with the Cisco Aironet outdoor access points.

Safety Precautions

**WARNING:** Do not locate the antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (e.g. U.S.: NFPA 70, National Electrical Code, Article 810, Canada: Canadian Electrical Code, Section 54). Statement 280

For your safety, read and follow these safety precautions.

1. Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

2. Find someone to help you—installing an antenna is often a two-person job.

3. Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

4. Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.

5. Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

6. When installing your antenna, follow these guidelines:
   a. Do not use a metal ladder.
   b. Do not work on a wet or windy day.
c. Do dress properly—wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.

7. If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.

8. If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.

9. If an accident should occur with the power lines, call for qualified emergency help immediately.

Installation Notes

The antenna is designed to connect to a dedicated antenna port on the access point. No special tools are required to install the antenna.

The antenna is resistant to the full range of outdoor environments. After the antenna is attached to the access point, seal the connections to prevent moisture and other weathering elements from affecting performance. Cisco recommends using a coax seal (such as CoaxSeal) for outdoor connections. Silicone sealant or electrical tape are not recommended for sealing outdoor connections.

Choosing a Mounting Location

The antenna is designed to create an omnidirectional broadcast pattern. To achieve this pattern, the access point should be mounted clear of any obstructions to the sides of the radiating element. If the mounting location is on the side of a building or tower, the antenna pattern is degraded on the building or tower side.

Generally, the higher an antenna is above the ground, the better it performs. A practice is to install your antenna about 5 to 10 foot (1.5 to 3 m) above the roof line and away from all power lines and obstructions.

Tools and Equipment Required

No tools are required to mount the antenna to the access point. However, you may need a ¾-in. (19-mm) open end or combination wrench (or adjustable wrench) to remove the antenna port covers.

For information about tools required to mount the access point, see the appropriate access point documentation.

Mounting the Antenna

To connect the antenna to the access point, follow these steps:

1. If necessary, remove the antenna port cover.

2. Align the antenna’s N connector with the appropriate antenna port.

3. Gently push the antenna into the port.

4. Hand-tighten the antenna.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly What’s New in Cisco Product Documentation, which also lists all new and revised Cisco technical documentation, at:
Subscribe to the What's New in Cisco Product Documentation as a Really Simple Syndication (RSS) feed and set content to be delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS Version 2.0.

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Cisco Aironet 6.5-dBi Diversity Patch Antenna (AIR-ANT2465P-R)

This describes the AIR-ANT2465P-R 6-dBi patch antenna specifications and mounting instructions. The antenna operates in the 2.4-GHz frequency range and is designed for use in both indoor and outdoor environments.

These topics are discussed.

- Technical Specifications
- System Requirements
- Installation Guidelines
- Installing the Antenna
- Communications, Services, and Additional Information
Technical Specifications

<table>
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<th>Specification</th>
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<td>50 Ohms</td>
</tr>
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<td>E-plane 3-dB beamwidth</td>
<td>65°</td>
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<tr>
<td>H-plane 3-dB beamwidth</td>
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<td>15 dB</td>
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<tr>
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<td>15 dB</td>
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<tr>
<td>Cable length and type</td>
<td>36 in. (91.4 cm) Times AA-9303 or equivalent (plenum rated)</td>
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<td>Connector type</td>
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<td>4.4 in. (11.1 cm)</td>
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<td>Width</td>
<td>6.6 in. (16.7 cm)</td>
</tr>
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<td>Height</td>
<td>1 in. (2.5 cm)</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-22°F to 158°F (-30°C to 70°C)</td>
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<td>-40°F to 185°F (-40°C – 85°C)</td>
</tr>
<tr>
<td>Environment</td>
<td>Indoor/outdoor</td>
</tr>
</tbody>
</table>

System Requirements

This antenna is designed for use with Cisco Aironet access points and bridges but can be used with any 2.4-GHz Cisco Aironet radio device that utilizes an RP-TNC connector.
Safety Precautions

Translated versions of the following safety warnings are provided in the Safety Warnings for Cisco Aironet Antennas, which is available at http://www.cisco.com.

Warning: This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071

SAVE THESE INSTRUCTIONS

Warning: In order to comply with RF exposure limits established in the ANSI C95.1 standards, it is recommended when using a laptop with a PC card client adapter that the adapter’s integrated antenna is positioned more than 2 inches (5 cm) from your body or nearby persons during extended periods of transmitting or operating time. If the antenna is positioned less than 2 inches (5 cm) from the user, it is recommended that the user limit exposure time. Statement 254

Warning: Do not work on the system or connect or disconnect cables during periods of lightning activity. Statement 1001

Warning: Do not locate the antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, because they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.:NFPA 70, National Electrical Code, Article 810, Canada: Canadian Electrical Code, Section 54). Statement 1052

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.

For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!

1. If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

2. Select your installation site with safety, as well as performance in mind. Remember: electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

3. Call your electric power company. Tell them your plans and ask them to come look at your proposed installation. This is a small inconvenience considering your life is at stake.

4. Plan your installation carefully and completely before you begin. Successful raising of a mast or tower is largely a matter of coordination. Each person should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

5. When installing your antenna, remember:
   a. Do not use a metal ladder.
   b. Do not work on a wet or windy day.
   c. Dress properly—shoes with rubber soles and heels, rubber gloves, long sleeved shirt or jacket.

6. If the assembly starts to drop, get away from it and let it fall. Remember, the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current. Even the slightest touch of any of these parts to a power line complete an electrical path through the antenna and the installer: you!
7. If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company. They will remove it safely.

8. If an accident should occur with the power lines call for qualified emergency help immediately.

Installation Guidelines

Because the antenna transmits and receives radio signals, they are susceptible to RF obstructions and common sources of interference that can reduce throughput and range of the device to which they are connected. Follow these guidelines to ensure the best possible performance:

- Mount the antenna to utilize its propagation characteristics. One way to do this is to orient the antenna vertically and mount it as high as possible.

- Keep the antenna away from metal obstructions such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use a rigid conduit to lower the antenna away from these obstructions.

- The density of the materials used in the building construction determines the number of walls the signal must pass through and still maintain adequate coverage. Consider the following before choosing the location to install your antenna:
  - Paper and vinyl walls have very little affect on signal penetration.
  - Solid and pre-cast concrete walls limit signal penetration to one or two walls without degrading coverage.
  - Concrete and wood block walls limit signal penetration to three or four walls.
  - A signal can penetrate five or six walls constructed of drywall or wood.
  - A thick metal wall causes signals to reflect off, causing poor penetration.
  - A chain link fence or wire mesh spaced between 1 and 1 1/2 in. (2.5 and 3.8 cm) acts as a harmonic reflector that blocks a 2.4-GHz radio signal.

- Install the antenna away from microwave ovens and 2-GHz cordless phones. These products can cause signal interference because they operate in the same frequency range as the device your antenna is connected to.

- Install the antenna in a vertical orientation to maximize signal propagation.

Site Selection

Before attempting to install your antenna, determine where you can best place the antenna for safety and performance. Follow these steps to determine a safe distance from wires, power lines, and trees.

1. Measure the height of your antenna.

2. Add this length to the length of the structure on which you are mounting the antenna and then double this total for the minimum recommended safe distance.

  Caution: If you are unable to maintain this safe distance, stop and get professional help.

Generally, the higher an antenna is above the ground, the better it performs. Good practice is to install your antenna about 5 to 10 foot (1.5 to 3 m) above the roof line and away from all power lines and obstructions. If possible, find a mounting place directly above your wireless device so that the lead-in cable can be as short as possible.
Installing the Antenna

You can install the antenna on any flat indoor or outdoor vertical surface. Hardware for mounting the antenna on drywall is provided. If you intend to install your antenna on another surface, you must provide the appropriate hardware.

Note: Four mounting screws are provided to mount the antenna. To ensure a safe, reliable, and long-standing installation, you must use all four screws to mount the antenna.

Tools and Equipment Required

A mounting installation kit is shipped with the antenna and consists of the following hardware:

- Four #8 x ¾ screws
- Four #8 plastic anchors
- Four end caps

You need the following tools and equipment, which are not provided.

- A Phillips screwdriver
- A drill
- A #29 (0.136-in (3.45 mm)) drill bit (For drywall installation, other surfaces may require a different size.)
- A pencil
- A small mallet or hammer

Mounting on a Vertical Surface

This procedure describes mounting the antenna on a drywall surface. If you are mounting the antenna on any other type of surface, your procedure may vary slightly.

To mount your antenna on a vertical surface:

1. Determine the location where you will mount the antenna.
2. Use the antenna as a template to mark the locations of the four mounting holes.
3. Use a drill and #29 drill bit to drill four holes at the locations you marked in Step 2.
4. Start a plastic anchor into each hole.
5. Use a mallet or small hammer to seat the anchors into the wall.
6. Align the antenna’s mounting holes with the anchors.
7. Start a #8 x ¾ screw into each antenna mounting hole.
8. Use a Phillips screwdriver to secure the antenna to the wall. Do not overtighten.
9. Install the end caps into the antenna mounting holes.
10. Remove the yellow outdoor installation warning label from the antenna radome.
Outdoor Installations

You can mount this antenna outdoors. If you mount the antenna outdoors, you must provide the mounting hardware. For outdoor installations, follow the instructions printed on the back of the antenna.

**Caution:** An orientation arrow is printed on the back of the antenna that indicates the orientation for outdoor installations. You must install the antenna with the orientation arrow pointing down to prevent any water intrusion and to provide a drain for any moisture that may accumulate inside the antenna.

Suggested Cable

Cisco recommends a high-quality, low-loss cable for use with the antenna.

**Note:** Coaxial cable loses efficiency as the frequency increases, resulting in signal loss. The cable should be kept as short as possible because cable length also determines the amount of signal loss (the longer the run, the greater the loss).

The antenna terminates with a RP-TNC plug after a short, 3 foot (0.91 m) cable. The mating connector to the antenna is an appropriate RP-TNC jack. The connector on the opposite end will vary depending on the type of equipment used.

After the cable is attached to the antenna, ensure that the connections are sealed (if outdoors) to prevent moisture and other weathering elements from affecting performance. Cisco recommends using a coax seal (such as CoaxSeal) for outdoor connections. Silicon sealant or electrical tape are **not** recommended for sealing outdoor connections.

Grounding the Antenna

Follow these steps to ground the antenna in accordance with national electrical code instructions.

1. Use No. 10 AWG copper or No. 8 or larger copper-clad steel or bronze wire as a ground wire.

2. Secure the ground wire to a static discharge unit (lightning arrester, Cisco Aironet AIR-ACC245LA-R or equivalent) and then to a suitable building ground. If possible, route the ground wire from the discharge unit to the ground using stand-off insulators spaced from 4 foot (1.2 m) to 8 foot (2.4 m) apart.

3. Mount the antenna discharge unit as close as possible to where the antenna cable enters the building.

4. Drill a hole in the building’s wall as close as possible to the access point to which you will connect the antenna cable.

   **Caution:** There may be wires in the wall. Ensure that your drilling location is clear of any obstructions or other hazards.

5. Pull the cable through the hole and form a drip loop close to where it enters the building.

6. Thoroughly waterproof the lead-in area.

7. Connect the antenna cable to the access point.

Communications, Services, and Additional Information

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- To submit a service request, visit Cisco Support.
- To discover and browse secure, validated enterprise-class apps, products, solutions and services, visit Cisco Marketplace.
Cisco Bug Search Tool

To obtain general networking, training, and certification titles, visit Cisco Press.

To find warranty information for a specific product or product family, access Cisco Warranty Finder.

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The following information is for FCC compliance of Class B devices: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If the equipment causes interference to radio or television reception, which can be determined by turning the equipment off and on, users are encouraged to try to correct the interference by using one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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Cisco Aironet 8-dBi Omni-Directional Antenna (AIR-ANT2480V-N)

This describes the Cisco Aironet AIR-ANT2480V-N 8 dBi Omni-directional Antenna, and provides specifications and mounting instructions. The antenna operates in the 2400 MHz frequency range and is designed for outdoor use with Cisco Aironet 1500 Series Lightweight Outdoor Mesh Access Points.

These topics are discussed:

- Technical Specifications, page 141
- System Requirements, page 143
- Safety Precautions, page 143
- Installation Notes, page 143
- Communications, Services, and Additional Information, page 145
## Technical Specifications

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<td><strong>VSWR</strong></td>
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<td><strong>Wind rating</strong></td>
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Table 2 on page 142 lists the minimum required attenuation between the access point radio and the antenna when using the lowest RF power setting. Using a higher RF power setting will require additional attenuation (for a given antenna).
The attenuation can be in the form of an attenuator, coax cable loss, or both. This attenuation is required for the system to meet the regulatory requirements of the indicated country. Failure to install the minimum amount of attenuation shown results in non-compliant operation. *Table 2 on page 142* shows the required attenuation in dB.

**Note:** X indicates that the antenna is not authorized for use in that country.

### Table 2 Required Attenuation in dB

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<th>2.4 GHz Antennas (802.11 B /G)</th>
<th>5 GHz Antennas (802.11 A)</th>
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<td>AIR-ANT2410 Y-R 2.4 GHZ 10 dBi Yagi</td>
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</tbody>
</table>

### Asia

- **Australia**: None
- **China**: None
- **Hong Kong**: None
- **India**: None
- **Japan**: X
- **Korea**: X
- **New Zealand**: None
- **Singapore**: None
- **Taiwan**: X
- **Thailand**: None

### EU

- **Belgium**: None
- **Denmark**: None
- **Finland**: None
- **France**: None
- **Germany**: None
- **Italy**: None
- **Netherlands**: None
- **Norway**: None
- **Spain**: None
- **Sweden**: None
- **Switzerland**: None
- **United Kingdom**: None

### North America

- **United States**: None
- **Canada**: None
- **Mexico**: None

### South America

- **Brazil**: None

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System Requirements

This antenna is designed for use with Cisco Aironet access points and bridges but can be used with any Cisco Aironet radio device that uses an N-connector.

Safety Precautions

Warning: Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution but did not take adequate steps to avoid the hazard.

For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!

1. If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

2. Select your installation site with safety, as well as performance in mind. Remember: electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

3. Call your electric power company. Tell them your plans and ask them to come look at your proposed installation. This is a small inconvenience considering your life is at stake.

4. Plan your installation carefully and completely before you begin. Successful raising of a mast or tower is largely a matter of coordination. Each person should be assigned a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

5. When installing your antenna, remember:
   a. Do not use a metal ladder.
   b. Do not work on a wet or windy day.
   c. Dress properly—shoes with rubber soles and heels, rubber gloves, long sleeved shirt or jacket.

6. If the assembly starts to drop, get away from it and let it fall. Remember, the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current. Even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer: You!

7. If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company. They will remove it safely.

8. If an accident should occur with the power lines call for qualified emergency help immediately.

Installation Notes

The antenna is designed to mount on a dedicated mounting panel on the access point. No special tools are required.

The antenna is resistant to the full range of outdoor environments. Therefore, Cisco does not recommend using cable or antenna waterproofing materials. Using such materials may cause important drainage holes to be blocked. The antenna base has four drain holes.

There are also drain holes located under the cap at the top of the antenna. These holes allow proper drainage if the antenna is deployed with the cap pointing towards the ground.

Note: Ensure that the cap is not damaged.
Figure 1 on page 144 shows the location of the drain holes in both the antenna base and under the antenna cap.

Choosing a Mounting Location

The antenna is designed to create an omni-directional broadcast pattern. To achieve this pattern, the access point should be mounted clear of any obstructions to the sides of the radiating element. If the mounting location is on the side of a building or tower, the antenna pattern is degraded on the building or tower side.

Generally, the higher an antenna is above the ground, the better it performs. Good practice is to install your antenna about 5 to 10 ft (1.5 to 3 m) above the roof line and away from all power lines and obstructions.

Tools and Equipment Required

No tools are needed to secure the antenna on the 2.4 GHz antenna mounting panel on the access point.

For information about the tools required to mount the access point, reference your access point documentation.

Mounting the Antenna

To mount the antenna on the access point, position the antenna below the antenna connector on the access point and thread it hand tight, as shown in Figure 2 on page 145.
The following information is for FCC compliance of Class A devices: 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 users will be required to correct the interference at their own expense.

The following information is for FCC compliance of Class B devices: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If the equipment causes interference to radio or television reception, which can be determined by turning the equipment off and on, users are encouraged to try to correct the interference by using one or more of the following measures:
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Modifications to this product not authorized by Cisco could void the FCC approval and negate your authority to operate the product.

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Cisco Aironet Four-Port Dual-Band Polarization-Diverse Antenna (AIR-ANT2513P4M-N)

This document describes the AIR-ANT2513P4M-N antenna and provides electrical specifications and mounting instructions. The antenna is a four-port polarization-diverse patch array that operates over the 2.4-GHz and 5-GHz Wi-Fi bands. It ships with an articulating mount for use on flat surfaces and masts and is adjustable in both the horizontal and vertical planes. The radome is paintable using commonly available non-conductive spray paints, such as Krylon or Rust-Oleum. The antenna is designed for use in indoor and outdoor environments with Cisco Aironet 3702P and 1570 series access points.

The following information is provided in this document:

- Technical Specifications,
- System Requirements
- Safety Instructions
- Installation Notes
- Choosing a Mounting Location
- Installing the Antenna
- Painting the Antenna
- Obtaining Documentation and Submitting a Service Request
Technical Specifications

<table>
<thead>
<tr>
<th></th>
<th>AIR-ANT2513P4M-N</th>
<th>AIR-ANT2513P4M-N</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antenna Type</strong></td>
<td>Dual-Band Polarization Diverse Patch Array</td>
<td>Dual-Band Polarization Diverse Patch Array</td>
</tr>
<tr>
<td><strong>Operating Frequency Ranges</strong></td>
<td>2.4-2.5 GHz</td>
<td>5.15-5.925 GHz</td>
</tr>
<tr>
<td><strong>Nominal Input Impedance</strong></td>
<td>50 Ohms</td>
<td>50 Ohms</td>
</tr>
<tr>
<td><strong>VSWR</strong></td>
<td>1.6:1</td>
<td>1.5:1 (above 5.7 GHz to 5.9 GHz)</td>
</tr>
<tr>
<td><strong>VSWR</strong></td>
<td>1.6:1</td>
<td>2:1 (from 5.15 GHz to 5.7 GHz)</td>
</tr>
<tr>
<td><strong>Peak Gain</strong></td>
<td>13 dBi</td>
<td>13 dBi</td>
</tr>
<tr>
<td><strong>Polarization (Ports A &amp; C)</strong></td>
<td>Vertical</td>
<td>Vertical</td>
</tr>
<tr>
<td><strong>Polarization (Ports B &amp; D)</strong></td>
<td>Horizontal</td>
<td>Horizontal</td>
</tr>
<tr>
<td><strong>Nominal Elevation Plane 3-dB Beamwidth</strong></td>
<td>33 Degrees</td>
<td>27 Degrees</td>
</tr>
<tr>
<td><strong>Nominal Azimuth Plane 3-dB Beamwidth</strong></td>
<td>31 Degrees</td>
<td>31 Degrees</td>
</tr>
<tr>
<td><strong>V-Pol Maximum Sidelobe Level</strong></td>
<td>-15 dBC</td>
<td>-12 dBC</td>
</tr>
<tr>
<td><strong>H-Pol Maximum Sidelobe Level</strong></td>
<td>-10 dBC</td>
<td>-12 dBC</td>
</tr>
<tr>
<td><strong>Front-to-Back Ratio</strong></td>
<td>&gt; 30 dB</td>
<td>&gt; 30 dB</td>
</tr>
<tr>
<td><strong>Connector Type</strong></td>
<td>N-Female Bulkhead</td>
<td>N-Female Bulkhead</td>
</tr>
<tr>
<td><strong>Length</strong></td>
<td>14.5 in. (36.8 cm)</td>
<td>14.5 in. (36.8 cm)</td>
</tr>
<tr>
<td><strong>Width</strong></td>
<td>20 in. (50.7 cm)</td>
<td>20 in. (50.7 cm)</td>
</tr>
<tr>
<td><strong>Height</strong></td>
<td>0.8 in. (2.11 cm)</td>
<td>0.8 in. (2.11 cm)</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>81.1 oz. (2.3 kg)</td>
<td>81.1 oz. (2.3 kg)</td>
</tr>
<tr>
<td><strong>Water/Foreign Body Ingress</strong></td>
<td>IP67</td>
<td>IP67</td>
</tr>
<tr>
<td><strong>Operational Wind</strong></td>
<td>100 MPH</td>
<td>100 MPH</td>
</tr>
<tr>
<td><strong>Operating Temperature Range</strong></td>
<td>-40° C to 85° C</td>
<td>-40° C to 85° C</td>
</tr>
</tbody>
</table>

Figure 1  ANT2513P4M-N front high view

2.4 GHz Antenna Radiation Patterns
5 GHz Antenna Radiation Patterns
Antenna and Bracket Dimensions

Figure 2 and Figure 3 show the overall dimensions of the antenna and bracket.
Figure 2  Antenna and Bracket Dimensions (in millimeters)

Figure 3  Rear View of Antenna (dimensions in millimeters)
System Requirements

This antenna is designed for use with Cisco Aironet 3702P and 1570 series access points. The antenna can be mounted on a wall, a ceiling, or a pole with a maximum diameter of 5 inches (12.7 cm).

Safety Instructions

**WARNING:** IMPORTANT SAFETY INSTRUCTIONS This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071

**WARNING:** SAVE THESE INSTRUCTIONS Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

Follow these safety instructions when installing your antenna.

- Plan your installation procedure carefully and completely before you begin.
- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Consult your dealer, who can explain which mounting method to use for the location where you intend to install the antenna.
Select your installation site with safety, as well as performance, in mind. Remember that electric power cables and telephone lines look alike. For your safety, assume that any line is an electric power line until determined otherwise.

Call your local power company or building maintenance organization if you are unsure about cables close to your mounting location.

When installing your antenna, do not use a metal ladder. Do dress properly: shoes with rubber soles and heels, rubber gloves, and a long sleeved shirt or jacket.

If an accident or emergency occurs with the power lines, call for qualified emergency help immediately.

Installation Notes

Because antennas transmit and receive radio signals, they are susceptible to RF obstructions and common sources of interference that can reduce throughput and range of the device to which they are connected. Follow these guidelines to ensure the best possible performance:

Mount the antenna to utilize its propagation characteristics. This antenna is designed to radiate energy in a somewhat narrow beam from the front of the antenna. It should be aimed into the intended coverage area.

Keep the antenna away from metal obstructions such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use a rigid conduit to lower the antenna away from these obstructions.

The density of the materials used in a building’s construction determines the number of walls the signal must pass through and still maintain adequate coverage. Consider the following before choosing the location to install your antenna:

- Signals penetrate paper, vinyl and drywall the easiest. A signal can penetrate five or six walls constructed of drywall or wood.
- Signals are more heavily attenuated passing through concrete and solid-wood walls.
- Signals often reflect off thick metal walls and may not penetrate at all.

Install the antenna away from microwave ovens and 2-GHz cordless phones. These products can cause signal interference because they operate in the same frequency range as the device to which your antenna is connected.

Choosing a Mounting Location

The antenna should be mounted clear of any obstructions to the side or front of the enclosure. Keep in mind that this antenna should be aimed into the intended coverage area, so you should mount the antenna so that the desired mechanical tilt can be achieved. If possible, mount the antenna near the access point so you can use the shortest possible connecting cables.

Installing the Antenna

You can install the antenna on any flat surface or on a pole with a minimum diameter of 2 inches (5.08 cm) and a maximum diameter of 5 inches (12.7 cm). The antenna and one mounting flange are connected together when shipped. When mounting the antenna you need to assemble the bracket hardware, connect the antenna and bracket to the mounting surface, and adjust the antenna orientation.

Contents of Antenna Bracket Kit

Figure 4 shows the parts included with the antenna bracket.
Figure 4 Antenna Bracket Kit Contents

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mounting flange</td>
</tr>
<tr>
<td>2</td>
<td>Mounting arm</td>
</tr>
<tr>
<td>3</td>
<td>Arm attachment bolts (5/16-18 x 1-5/8”)</td>
</tr>
<tr>
<td>4</td>
<td>Serrated washers</td>
</tr>
<tr>
<td>5</td>
<td>Flat washers</td>
</tr>
<tr>
<td>6</td>
<td>Lock washers</td>
</tr>
<tr>
<td>7</td>
<td>Arm attachment nuts (5/16-18)</td>
</tr>
<tr>
<td>8</td>
<td>Hose clamps (50 – 135 mm adjustment)</td>
</tr>
</tbody>
</table>

NOTE: One flange (not pictured here) ships attached to the antenna. The flange pictured here is the one that you attach to the wall or the pole.

Tools and Equipment Required

You will need these tools to loosen and tighten the adjustment bolts on the bracket:

- A 1/2 in. (13-mm) wrench or socket

To mount the antenna on a wall or ceiling, you will need these supplies:

- Four mounting screws or bolts and wall anchors

NOTE: The fasteners and mounting surface should be capable of maintaining a minimum pullout force of 150 pounds (68 kg) to support the weight of the antenna and bracket plus the potential wind loading on the antenna.
To mount the antenna on a pole or mast, you will need either or both of these supplies:

- Slotted screwdriver to tighten the screws on the hose clamps
- A 5/16 in. (8mm) socket or box wrench

**NOTE:** The pole or mast must be rigid enough to hold the weight of the antenna plus the associated forces produced by wind loads. In addition, the pole or mast must be structurally strong enough to withstand the clamping force of the hose clamps.

You may need the following tools and equipment, which are not provided:

- A drill and drill bit
- A pencil

### Mounting on a Wall or Ceiling

Follow these steps to mount your antenna on a wall or ceiling.

1. Remove the antenna and bracket hardware from the shipping container.

2. Determine the mounting location for the antenna.

   **NOTE:** The fasteners and mounting surface should be capable of maintaining a minimum pullout force of 150 pounds (68 kg) to support the weight of the antenna plus the potential wind loading on the antenna.

3. Attach the mounting bracket to the wall or ceiling using four screws or bolts and anchors through the holes on the bracket. **Figure 5** shows the wall-mount bracket.

**Figure 5  Wall-Mount Bracket and Dimensions (in millimeters)**

4. Assemble the bracket hardware as shown in **Figure 6**.
5. Make sure you orient the antenna correctly (note the arrow on the back of the antenna that indicates the top of the antenna). Use a 1/2 in. (13-mm) wrench to loosen the elevation adjustment bolt and the elevation pivot bolt.

6. Adjust the azimuth (side-to-side position) and elevation (up-and-down position) of the antenna. Loosen the adjustment bolts slightly to allow for adjustment. Azimuth angle can be adjusted ±25 degrees and elevation can be adjusted ±60 degrees. You can use the azimuth and elevation markings on the mounting arm and the wall flange as a guide.

7. After you adjust the antenna position, tighten the adjustment bolts and the pivot bolts. Tighten all bolts to 18.7 +/- 5 lb-ft (25.4 Nm).

8. Connect the antenna cables to the access point. The antenna ports are labeled A through D, from left to right.

   – On the AP3702P, connect the antenna port A to connector A on the access point, antenna port B to connector B, and so on.

   – On the AP1570, connect antenna port A to Port 1 on the AP, antenna port B to port 2 on the AP, and so on.

See the Suggested Cable section for cable recommendations.
Mounting on a Pole or Mast

The antenna can be mounted on a pole or mast using two hose clamps.

**NOTE:** The pole or mast must be rigid enough to hold the weight of the antenna plus the associated forces produced by wind loads. In addition, the mast must be structurally strong enough to withstand the clamping force of the hose clamps.

To mount the antenna on a pole or mast, follow these steps.

1. Follow steps 1 and 2 from the Mounting on a Wall or Ceiling section.
2. Position and mount the mounting flange (Figure 4) onto the pole or mast using the hose clamps provided in the kit. The hose clamps should pass through the slots on the mounting flange (Figure 5).
3. Tighten the clamps only enough to hold the flange and antenna in place until the antenna is positioned to its final position.
4. Assemble the antenna and bracket to the flange as shown in Figure 6.
5. Position the antenna, mounting bracket, and hose clamps on the mast.
6. Tighten the hose clamps until the antenna is fully secure on the mast. Ensure that the antenna cannot rotate about the mast.
7. After the antenna is secured on the mast, adjust the azimuth and elevation.
   
   To adjust the azimuth and elevation, use a 1/2 in. (13-mm) wrench to loosen the adjustment bolts. Azimuth can be adjusted ±25 degrees and elevation can be adjusted ±60 degrees.
8. After you adjust the antenna position, tighten the adjustment bolts. Tighten all bolts to 18.7 +/- 5 lb-ft (25.4 Nm).
9. Connect the antenna cables to the access point. The antenna ports are labeled A through D, from left to right. Connect the antenna port A to connector A on the access point, antenna port B to connector B on the access point, and so on. See the Suggested Cable section for cable recommendations.

Suggested Cable

Cisco recommends a high-quality, low-loss cable for use with the antenna, such as Cisco AIR-CAB005LL-R-N= (5 foot low-loss cable with RP-TNC and N-type connectors) for AP3702P, or AIR-CAB005LL-N= or AIR-CAB010LL-N= (5 foot and 10 foot N-type connectors, respectively) for AP1570. Four cables are required.

**NOTE:** Coaxial cable loses efficiency as the frequency increases, resulting in signal loss. The cable should be kept as short as possible because cable length also determines the amount of signal loss (the longer the run, the greater the loss).

Painting the Antenna

Painting the antenna and the bracket does not affect its performance if you use standard exterior-grade, oil-based or latex paint. Do not use metallic or metallic-flake paints, which will degrade antenna performance.

**NOTE:** Before painting the antenna, cover the pressure-release vent on the rear, lower-left of the antenna with masking tape to prevent clogging (Figure 3).

Cisco recommends Krylon Fusion for Plastic or Rust-Oleum for Plastic (which might require a primer coat). For best results, follow the surface preparation suggestions from the paint manufacturer.
Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly What’s New in Cisco Product Documentation, which also lists all new and revised Cisco technical documentation, at:


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Cisco Aironet Four-Element, MIMO, Dual-Band Ceiling Mount Omni-Directional Antenna (AIR-ANT2524V4C-R)

This describes the AIR-ANT2524V4C-R antenna, and provides specifications and mounting instructions. The antenna is a four-element, MIMO, dual-band antenna that operates in the 2.4 and 5 GHz frequency ranges. The antenna is designed for ceiling-mounting in an indoor environment.

These topics are discussed:

- Technical Specifications
- System Requirements
- Safety Instructions
- Installation Notes
- Choosing a Mounting Location
- Installing the Antenna
- Obtain Documentation and Submit a Service Request
## Technical Specifications

*Figure 1*

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antenna type</strong></td>
<td>4-Element, Dual-band, Low Profile Omni</td>
</tr>
<tr>
<td><strong>Operating frequency ranges</strong></td>
<td>2400–2484 MHz 5150–5850 MHz</td>
</tr>
<tr>
<td><strong>VSWR</strong></td>
<td>2:1 or less in both bands</td>
</tr>
<tr>
<td><strong>Peak gain</strong></td>
<td>2.4-GHz band: 2 dBi 5-GHz band: 4 dBi</td>
</tr>
<tr>
<td><strong>Polarization</strong></td>
<td>Linear</td>
</tr>
<tr>
<td><strong>Azimuth plane 3 dB beamwidth</strong></td>
<td>Omni-directional</td>
</tr>
<tr>
<td><strong>Elevation plane 3 dB beamwidth</strong></td>
<td>2.4 GHz band: 69° 5 GHz band: 60°</td>
</tr>
<tr>
<td><strong>Length</strong></td>
<td>7.25 in (18.4 cm)</td>
</tr>
<tr>
<td><strong>Width</strong></td>
<td>7.25 in (18.4 cm)</td>
</tr>
<tr>
<td><strong>Depth</strong></td>
<td>1 in (2.5 cm)</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>1.3 lb (0.59 kg)</td>
</tr>
<tr>
<td><strong>Cable</strong></td>
<td>3 foot (91.4 cm) plenum rated, UV stable</td>
</tr>
<tr>
<td><strong>Connector</strong></td>
<td>RP-TNC</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td>Indoor</td>
</tr>
<tr>
<td><strong>Temperature range</strong></td>
<td>32–133°F (0–56°C)</td>
</tr>
</tbody>
</table>
2.4 GHz Element 1 Azimuth and Elevation Plane Patterns

5 GHz Element 1 Azimuth and Elevation Plane Patterns

2.4 GHz Element 2 Azimuth and Elevation Plane Patterns

5 GHz Element 2 Azimuth and Elevation Plane Patterns
System Requirements

This antenna is for indoor use with any Cisco Aironet radio device with dual-band (2.4 and 5 GHz) RP-TNC antenna ports. The antenna can be mounted on suspended ceiling tiles having a thickness between ½ in. (1.27 cm) and 1 in. (2.54 cm).
Safety Instructions

Follow these safety instructions when installing your antenna.

- Plan your installation procedure carefully and completely before you begin.
- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Consult your dealer, who can explain which mounting method to use for the location where you intend to install the antenna.
- Select your installation site with safety, as well as performance, in mind. Remember that electric power cables and telephone lines look alike. For your safety, assume that any line is an electric power line until determined otherwise.
- Call your local power company or building maintenance organization if you are unsure about cables close to your mounting location.
- When installing your antenna:
  - Do not use a metal ladder.
  - Dress properly: shoes with rubber soles and heels, rubber gloves, and a long sleeved shirt or jacket.
- If an accident or emergency occurs with the power lines, call for qualified emergency help immediately.

Installation Notes

Because antennas transmit and receive radio signals, they are susceptible to RF obstructions and common sources of interference that can reduce throughput and range of the device to which they are connected. Follow these guidelines to ensure the best possible performance:

- Mount the antenna to utilize its propagation characteristics. A way to do this is to orient the antenna horizontally as high as possible at or near the center of its coverage area.
- Keep the antenna away from metal obstructions such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use a rigid conduit to lower the antenna away from these obstructions.
- The density of the materials used in a building’s construction determines the number of walls the signal must pass through and still maintain adequate coverage. Consider the following before choosing the location to install your antenna:
  - Paper and vinyl walls have very little affect on signal penetration.
  - Solid and pre-cast concrete walls limit signal penetration to one or two walls without degrading coverage.
  - Concrete and wood block walls limit signal penetration to three or four walls.
  - A signal can penetrate five or six walls constructed of drywall or wood.
  - A thick metal wall causes signals to reflect off, causing poor penetration.
  - A wire mesh spaced between 1 and 1 1/2 in. (2.54 and 3.81 cm) acts as a harmonic reflector that blocks a 2.4 GHz radio signal.
- Install the antenna away from microwave ovens and 2-GHz cordless phones. These products can cause signal interference because they operate in the same frequency range as the device to which your antenna is connected.
- Install the antenna horizontally to maximize signal propagation.
Choosing a Mounting Location

Mount the antenna mounted clear of obstructions to the sides of the radiating elements. Generally, the higher an antenna is above the floor, the better it performs. If possible, mount the antenna on the ceiling panel within 12 in. (30.5 cm) of the access point so you can connect its cables directly to the access point. If you must mount the antenna farther away from the access point, try to make the distance as short as possible.

Installing the Antenna

You can install the antenna on a ceiling tile having a thickness between ½ in. (1.27 cm) and 1 in. (2.54 cm).

Tools and Equipment Required

The following tools and equipment are not provided:

- 1" (2.54 cm) hole saw to create a hole in the suspended ceiling tile.
- A step ladder high enough to access your ceiling safely.

Installing the Antenna

The antenna is installed to a suspended ceiling tile with a supplied 1 in. (2.54 cm) plastic nut. See Ceiling Tile Mounting Details for details.

The antenna cables terminate with a straight RP-TNC plug connector after a 36 in. (91.44 cm) cable. The mating connector to the antenna on the access point is an RP-TNC jack.
Mounting the Antenna on a Ceiling Tile

To mount the antenna on a suspended ceiling tile:

1. Mark the mounting location on the ceiling tile.
2. Remove the ceiling tile from the ceiling grids.
3. Use a 1" (2.54 cm) hole saw to cut a hole in the ceiling tile.
4. Insert the antenna cables, one at a time, through the hole in the ceiling tile.
5. Insert the antenna cables, one at a time, through the hole in the plastic nut as shown in Ceiling Tile Mounting Details.
Note: Do not use the rubber gasket when you mount the antenna on a ceiling tile. The gasket is not required for ceiling tile installations.

6. Ensure that the antenna is properly positioned on the ceiling tile and then tighten the plastic nut hand-tight.

7. Reinstall the ceiling tile.

8. Connect the antenna cables to the access point.

Note: The 5 GHz antenna cables are identified by a orange collar near the connectors. Ensure that you connect these cables to the 5 GHz antenna connection on the access point.

Suggested Cable

We recommend using a high-quality, low-loss cable with the antenna.

Note: Coaxial cable loses efficiency as the frequency increases, resulting in signal loss. Keep the cable as short as possible as cable length determines the amount of signal loss (the longer the run, the greater the loss).

Obtain Documentation and Submit a Service Request

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The following information is for FCC compliance of Class B devices: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If the equipment causes interference to radio or television reception, which can be determined by turning the equipment off and on, users are encouraged to try to correct the interference by using one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
Consult the dealer or an experienced radio/TV technician for help.

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Cisco Aironet Dual-Band MIMO Wall-Mounted Omnidirectional Antenna (AIR-ANT2544V4M-R)

This document outlines the specifications for the Cisco Aironet 2.4-GHz/5-GHz Dual-Band MIMO Wall-Mounted Omnidirectional Antenna (AIR-ANT2544V4M-R) and provides instructions for mounting it. The antenna operates in the 2.4- and 5-GHz frequency ranges and is designed for indoor or outdoor use.

The following information is provided in this document.

- Technical Specifications
- System Requirements
- Safety Precautions
- Installation Notes
- Installing the Antenna
- Suggested Cable
- Obtain Documentation and Submit a Service Request
### Technical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antenna type</strong></td>
<td>4-element MIMO omnidirectional</td>
</tr>
<tr>
<td><strong>Operating frequency range</strong></td>
<td>2400–2484 MHz</td>
</tr>
<tr>
<td></td>
<td>5150–5850 MHz</td>
</tr>
<tr>
<td><strong>Nominal input impedance</strong></td>
<td>50 Ohms</td>
</tr>
<tr>
<td><strong>VSWR</strong></td>
<td>2:1 or less</td>
</tr>
<tr>
<td><strong>Peak gain</strong></td>
<td>2.4-GHz band: 4 dBi</td>
</tr>
<tr>
<td></td>
<td>5-GHz band: 4 dBi</td>
</tr>
<tr>
<td><strong>Polarization</strong></td>
<td>Linear, vertical</td>
</tr>
<tr>
<td><strong>Azimuth plane (3 dB beamwidth)</strong></td>
<td>Ominidirectional</td>
</tr>
<tr>
<td><strong>Elevation plane (3 dB beamwidth)</strong></td>
<td>2.4-GHz band: 60°</td>
</tr>
<tr>
<td></td>
<td>5-GHz band: 33°</td>
</tr>
<tr>
<td><strong>Length</strong></td>
<td>8.6 in (21.8 cm)</td>
</tr>
<tr>
<td><strong>Diameter</strong></td>
<td>6.3 in (16 cm)</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>Antenna: 1.48 lb. (671.5 g); Cable: 3 foot (91.4 cm) plenum</td>
</tr>
<tr>
<td><strong>Connector</strong></td>
<td>RP-TNC</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td>Indoor/outdoor</td>
</tr>
<tr>
<td><strong>Temperature range</strong></td>
<td>-22° F to 158° F (-30° C to 70° C)</td>
</tr>
</tbody>
</table>

The figures below show the azimuth plane patterns (indicated by red lines) and elevation plane patterns (indicated by blue lines) for each element in the antenna.
Cisco Aironet Dual-Band MIMO Wall-Mounted Omnidirectional Antenna (AIR-ANT2544V4M-R)

2.4-GHz Antenna 1 Azimuth and Elevation Plane Patterns

5-GHz Antenna 1 Azimuth and Elevation Plane Patterns

2.4-GHz Antenna 2 Azimuth and Elevation Plane Patterns

5-GHz Antenna 2 Azimuth and Elevation Plane Patterns
## System Requirements

This antenna is designed for indoor and outdoor use with any Cisco Aironet radio device with dual-band (2.4- and 5-GHz) RP-TNC connectors.
Safety Precautions

CAUTION: Do not locate the antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (e.g. U.S.: NFPA 70, National Electrical Code, Article 810, Canada: Canadian Electrical Code, Section 54). Statement 280

For your safety, read and follow these safety precautions.

1. Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

2. Find someone to help you—installing an antenna is often a two-person job.

3. Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

4. Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.

5. Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

6. When installing your antenna, follow these guidelines:
   a. Do not use a metal ladder.
   b. Do not work on a wet or windy day.
   c. Do dress properly—wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.

7. If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.

8. If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.

9. If an accident should occur with the power lines, call for qualified emergency help immediately.

Installation Notes

Antennas transmit and receive radio signals which are susceptible to RF obstructions and common sources of interference that can reduce throughput and range of the device to which they are connected. Follow these guidelines to ensure the best possible performance:

- Install the antenna vertically and mount it with the cables pointing towards the ground.

- Keep the antenna away from metal obstructions such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use a rigid conduit to lower the antenna away from these obstructions.

- The density of the materials used in a building’s construction determines the number of walls the signal can pass through and still maintain adequate signal strength. Consider the following before choosing the location for your antenna:
  - Signals penetrate paper and vinyl walls with little change to signal strength.
  - Signals penetrate only one or two solid and pre-cast concrete walls without degrading signal strength.
— Signals penetrate three or four concrete and wood block walls without degrading signal strength.
— Signals penetrate five or six walls constructed of drywall or wood without degrading signal strength.
— Signals will likely reflect off a thick metal wall and may not penetrate it at all.
— Signals will likely reflect off a chain link fence or wire mesh spaced between 1 and 1 1/2 in. (2.5 and 3.8 cm). The fence acts as a harmonic reflector that blocks the signal.

Install the antenna away from microwave ovens and 2-GHz cordless phones. These products can cause signal interference because they operate in the same frequency range as the device to which your antenna is connected.

Choosing a Mounting Location

The antenna should be mounted clear of any obstructions to the sides of the radiating elements. Generally, the higher an antenna is above the floor, the better it performs. If possible, find a mounting place directly above your wireless device to ensure the lead-in cable can be as short as possible.

Installing the Antenna

You can install the antenna on any flat vertical surface, on a pole, or on a ceiling. All hardware for mounting the antenna on a wall or ceiling is provided. If you intend to install your antenna on another surface, you must provide the appropriate hardware.

Tools and Equipment Required

A mounting installation kit is included with the antenna and consists of the following hardware:

- Mount interface bracket
- Mount base
- Wall bracket
- One 1/4-20 x ½-in. cap screw
- One 1/4-20 wing screw
- Two #10 x ¾-in. screws
- Two #10 x ½-in. screws
- One screen mesh washer
- One spherical washer
- 3/16 allen wrench
- Rubber gasket
- Jam nut

You may need the following tools and equipment, which are not provided.

- A #2 Phillips screwdriver
- A drill and drill bit
- A pencil
Two hose clamps

Mounting on a Vertical Surface

Follow these steps to mount your antenna on a vertical surface.

1. Attach the antenna bracket to the antenna using the jam nut provided (Figure 1).

Figure 1 Antenna Bracket

2. With the screen mesh washer between the two brackets, attach the antenna bracket to the mounting bracket using the spherical washer and wing bolt provided (Figure 2).
3. Determine the mounting location for the antenna.

4. Attach the wall bracket to the wall using the two screws provided (Figure 3).
5. Slide the mounting bracket onto the wall bracket and secure it in place (optional) with the two screws provided (Figure 4).

Once the antenna is secured on the wall, you can adjust the azimuth and elevation.

6. To adjust the azimuth and elevation, loosen the bolt that attaches the antenna bracket to the mounting bracket (Figure 5). Azimuth can be adjusted ±90 degrees. Elevation can be adjusted +15 degrees and -35 degrees.
Outdoor Installations

You can mount this antenna outdoors. If you mount the antenna outdoors, you must ensure that the antenna cables exit from the bottom to prevent any water intrusion and to provide a drain for any moisture that may accumulate inside the antenna.

Mounting on a Ceiling

To mount the antenna on a ceiling, follow these steps:

1. Drill a hole in the ceiling approximately 1.25 in. in diameter.
2. Fit the rubber gasket onto the bottom of the antenna.
3. Insert the antenna shaft through the hole in the ceiling.
4. Thread the jam nut onto the antenna shaft and tighten.

Figure 6 shows the ceiling mount process.
Mounting on a Mast

The antenna can be mounted on a mast rather than on a wall using two 1/2 inch-wide hose clamps (not provided).

To mount the antenna on a mast, follow these steps:

1. Follow Steps 1 and Step 2 from the Mounting on a Vertical Surface.

2. Position the antenna, mounting bracket, and hose clamps on the mast.

3. Tighten the hose clamps until the antenna is secure on the mast.

   Once the antenna is secured on the mast, you can adjust the azimuth and elevation.

4. To adjust the azimuth and elevation, loosen the bolt that attaches the antenna bracket to the mounting bracket (Figure 5). Azimuth can be adjusted ±90 degrees. Elevation can be adjusted +15 degrees and -35 degrees.
Suggested Cable

Cisco recommends a high-quality, low-loss cable for use with the antenna.

**NOTE:** Coaxial cable loses efficiency as the frequency increases, resulting in signal loss. The cable should be kept as short as possible because cable length also determines the amount of signal loss (the longer the run, the greater the loss).

Obtain Documentation and Submit a Service Request

For information on obtaining documentation, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see *What’s New in Cisco Product Documentation*.

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Cisco Aironet Dual-Band Omni-Directional Antenna (AIR-ANT2547V-N, AIR-ANT2547V-N-HZ, and ANT2547VG-N)

This describes the Cisco Aironet AIR-ANT2547V-N, AIR-ANT2547V-N-HZ, and ANT2547VG-N dual-band omni-directional antennas and provides specifications and mounting instructions. These antennas are designed for outdoor use with Cisco Aironet Outdoor Access Points with radios operating in the 2.4 GHz and 5 GHz frequency bands.

These three antennas are functionally the same, and will be referred to as a singular antenna throughout the rest of this guide. The three antennas are:

<table>
<thead>
<tr>
<th>Table 1 Antenna SKUs</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIR-ANT2547V-N</td>
</tr>
<tr>
<td>AIR-ANT2547VG-N</td>
</tr>
<tr>
<td>AIR-ANT2547V-N-HZ</td>
</tr>
</tbody>
</table>

These topics are discussed:

- Technical Specifications
- System Requirements
- Safety Precautions
- Installation Notes
# Technical Specifications

<table>
<thead>
<tr>
<th>Table 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antenna type</strong></td>
<td>Omni-directional colinear array</td>
</tr>
<tr>
<td><strong>Operating frequency range</strong></td>
<td>2400–2483 MHz; 5150–5875 MHz</td>
</tr>
<tr>
<td><strong>2:1 VSWR bandwidth</strong></td>
<td>2400–2483 MHz; 5150–5875 MHz</td>
</tr>
<tr>
<td><strong>Nominal input impedance</strong></td>
<td>50 Ohms</td>
</tr>
<tr>
<td><strong>Gain (2400–2483 MHz)</strong></td>
<td>4-dBi</td>
</tr>
<tr>
<td><strong>Gain (5250–5875 MHz)</strong></td>
<td>7-dBi</td>
</tr>
<tr>
<td><strong>Polarization</strong></td>
<td>Linear</td>
</tr>
<tr>
<td><strong>E-plane 3-dB beamwidth</strong></td>
<td>2.4 GHz: 30° for 5 GHz 14°</td>
</tr>
<tr>
<td><strong>H-plane 3-dB bandwidth</strong></td>
<td>Omni-directional</td>
</tr>
<tr>
<td><strong>Length</strong></td>
<td>11.1 in. (28.2 cm)</td>
</tr>
<tr>
<td><strong>Diameter</strong></td>
<td>1.25 in. (3.17 cm)</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>6.0 oz. (170.0 g)</td>
</tr>
<tr>
<td><strong>Connector type</strong></td>
<td>N-Male</td>
</tr>
<tr>
<td><strong>Mounting</strong></td>
<td>To mast mount the antenna you must purchase the U-bolt bracket from a third party</td>
</tr>
<tr>
<td><strong>Operating temperature</strong></td>
<td>-40–185°F (-40–85°C)</td>
</tr>
<tr>
<td><strong>Water/Foreign Body Ingress</strong></td>
<td>IP66, IP67</td>
</tr>
<tr>
<td><strong>Wind rating</strong></td>
<td>100 mph (161 kph) operational 165 mph (265 kph) survival</td>
</tr>
</tbody>
</table>
System Requirements

This antenna is designed for use with the Cisco Aironet Outdoor Access Points, specifically Cisco Aironet 1550 Series Outdoor Access Points.

Safety Precautions

**WARNING:** Do not locate the antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (e.g. U.S.: NFPA 70, National Electrical Code, Article 810, Canada: Canadian Electrical Code, Section 54). Statement 280
For your safety, read and follow these safety precautions.

1. Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

2. Find someone to help you—installing an antenna is often a two-person job.

3. Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

4. Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.

5. Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

6. When installing your antenna, follow these guidelines:
   a. Do not use a metal ladder.
   b. Do not work on a wet or windy day.
   c. Dress properly: wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.

7. If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.

8. If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.

9. If an accident should occur with the power lines, call for qualified emergency help immediately.

Installation Notes

The antenna is designed to connect to a dedicated antenna port on the access point. No special tools are required to install the antenna directly to the access point. The antenna can also be mounted on a mast. To mast mount the antenna, you must purchase a suitable U-bolt bracket from a third party.

The antenna is resistant to the full range of outdoor environments. After the antenna is attached to the access point, seal the connections to prevent moisture and other weathering elements from affecting performance. Cisco recommends using a coax seal (such as CoaxSeal) for outdoor connections. Silicone sealant or electrical tape are not recommended for sealing outdoor connections.

Choosing a Mounting Location

The antenna is designed to create an omni-directional broadcast pattern. To achieve this pattern, mount the access point clear of obstructions to the sides of the radiating element. If the mounting location is on the side of a building or tower, the antenna pattern is degraded by the building or tower side. Generally, the higher an antenna is above the ground, the better it performs. Install your antenna about 5 to 10 foot (1.5 to 3 m) above the roof line and away from all power lines and obstructions.

Tools and Equipment Required

No tools are required to mount the antenna directly to the access point. However, you may need a ¾-in. (19-mm) open end or combination wrench (or adjustable wrench) to remove the antenna port covers. To mast mount the antenna, you must purchase the U-bolt bracket from a third party.
For information about tools required to mount the access point, see the appropriate access point documentation.

Mounting the Antenna

To connect the antenna to the access point:

1. If necessary, remove the antenna port cover.
2. Align the antenna’s N connector with the appropriate antenna port.
3. Gently push the antenna into the port.
4. Tighten the antenna hand tight.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see What’s New in Cisco Product Documentation.

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The following information is for FCC compliance of Class B devices: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference to radio communications. Operation of this equipment in a residential installation is likely to cause harmful interference, which can be determined by turning the equipment off and on, users are encouraged to try to correct the interference by using one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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Cisco Aironet 2.4 GHz and 5 GHz Dual-Band Polarization-Diverse Directional Array Antenna (AIR-ANT2566D4M-R)

This document describes the Cisco Aironet 2.4 GHz and 5 GHz Dual-Band Polarization-Diverse Directional Array Antenna (AIR-ANT2566D4M-R), and provides electrical specifications and mounting instructions.

The AIR-ANT2566D4M-R antenna is a four-port polarization-diverse array that operates over the 2.4 GHz and 5 GHz Wi-Fi bands. It ships with an articulating mount for use on flat surfaces and masts, and is adjustable in both horizontal and vertical planes. The radome can be painted using commonly available non-conductive spray paints, such as Krylon or Rust-Oleum.

The antenna is designed for use in indoor and outdoor environments with an approved Cisco Aironet access point that requires four dual-band antennas.

The following information is provided in this document:

- Technical Specifications
- Azimuth and Elevation Radiation Patterns
- Safety Precautions
- Installation Notes
- Contents of the Antenna and Bracket Kit
- Dimensions of the Antenna and Brackets
- Installing the Antenna
- Obtain Documentation and Submit a Service Request
## Technical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>2.4–2.5 GHz</th>
<th>5.15–5.925 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antenna Type</strong></td>
<td>Dual-Band Polarization-Diverse Directional Array</td>
<td></td>
</tr>
<tr>
<td><strong>Operating Frequency Ranges</strong></td>
<td>2.4–2.5 GHz</td>
<td>5.15–5.925 GHz</td>
</tr>
<tr>
<td><strong>Nominal Input Impedance</strong></td>
<td>50 Ohms</td>
<td>50 Ohms</td>
</tr>
<tr>
<td><strong>Voltage Standing Wave Ratio (VSWR)</strong></td>
<td>2:1</td>
<td>2:1</td>
</tr>
<tr>
<td><strong>Peak Gain</strong></td>
<td>6 dBi</td>
<td>6 dBi</td>
</tr>
<tr>
<td><strong>Polarization (Ports A &amp; C)</strong></td>
<td>Vertical</td>
<td>Vertical</td>
</tr>
<tr>
<td><strong>Polarization (Ports B &amp; D)</strong></td>
<td>Horizontal</td>
<td>Horizontal</td>
</tr>
<tr>
<td><strong>Nominal Elevation Plane 3-dB Beamwidth</strong></td>
<td>65°</td>
<td>60°</td>
</tr>
<tr>
<td><strong>Nominal Azimuth Plane 3-dB Beamwidth</strong></td>
<td>65°</td>
<td>55°</td>
</tr>
<tr>
<td><strong>Front-to-Back Ratio</strong></td>
<td>&gt; 12 dB</td>
<td>&gt; 20 dB</td>
</tr>
<tr>
<td><strong>Port-to-Port Isolation</strong></td>
<td>&gt; 30 dB</td>
<td>&gt; 30 dB</td>
</tr>
<tr>
<td><strong>&gt; or = 30º Elevation Peak Gain</strong></td>
<td>3 dBi</td>
<td></td>
</tr>
<tr>
<td><strong>Connector Type</strong></td>
<td>RP-TNC (with coupling ring)</td>
<td></td>
</tr>
<tr>
<td><strong>Cable Length</strong></td>
<td>3 foot</td>
<td></td>
</tr>
<tr>
<td><strong>Length</strong></td>
<td>10 in. (25.4 cm)</td>
<td></td>
</tr>
<tr>
<td><strong>Width</strong></td>
<td>10 in. (25.4 cm)</td>
<td></td>
</tr>
<tr>
<td><strong>Height</strong></td>
<td>1.61 in. (4.1 cm)</td>
<td></td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>2.5 lbs. (1.13 kg)</td>
<td></td>
</tr>
<tr>
<td><strong>Water/Foreign Body Ingress</strong></td>
<td>IP-67</td>
<td></td>
</tr>
<tr>
<td><strong>Operational Wind</strong></td>
<td>100 MPH</td>
<td></td>
</tr>
<tr>
<td><strong>Operating Temperature Range</strong></td>
<td>-40º C to 70º C</td>
<td></td>
</tr>
<tr>
<td><strong>Storage Temperature Range</strong></td>
<td>-40º C to 85º C</td>
<td></td>
</tr>
</tbody>
</table>
Azimuth and Elevation Radiation Patterns

Safety Precautions

**WARNING:** Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

Each year, hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.

For your safety, and to help you achieve a good installation, read and follow these safety precautions. *They may save your life!*

- If you are installing an antenna for the first time, for your own safety as well as that of others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type of antenna you are about to install.
Select your installation site with safety as well as performance in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

Call your electric power company. Tell them your plans and ask them to come and look at your proposed installation. This is a small inconvenience considering your life is at stake.

Plan your installation carefully and completely before you begin. Successful raising of a mast or tower is largely a matter of coordination. Each person should be assigned a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

When installing your antenna, remember:

- Do not use a metal ladder.
- Do not work on a wet or windy day.
- Do dress properly—shoes with rubber soles and heels, rubber gloves, long sleeved shirt or jacket.

If the assembly starts to drop, get away from it and let it fall. Remember, the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current. Even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer: You!

If any part of the antenna system should come in contact with a power line, don’t touch it or try to remove it yourself. Call your local power company. They will remove it safely.

If an accident occurs with the power lines, call for qualified emergency help immediately.

For a listing of all the warning statements and their translations, see Translated Safety Warnings for Cisco Aironet Access Points at:


Installation Notes

Antennas transmit and receive radio signals that are susceptible to RF obstructions and common sources of interference that can reduce throughput and the range of the device to which they are connected. Follow these guidelines to ensure the best possible performance:

- Install the antenna vertically and mount it with the cables pointing towards the ground.
- Keep the antenna away from metal obstructions such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use a rigid conduit to lower the antenna away from these obstructions.
- The density of the materials used in a building’s construction determines the number of walls the signal can pass through and still maintain adequate signal strength. Consider the following before choosing the location for your antenna:
  - Signals penetrate paper and vinyl walls with little change to signal strength.
  - Signals penetrate only one or two solid and precast concrete walls without degrading signal strength.
  - Signals penetrate three or four concrete and wood block walls without degrading signal strength.
  - Signals penetrate five or six walls constructed of drywall or wood without degrading signal strength.
  - Signals are likely to reflect off a thick metal wall and may not penetrate it at all.
  - Signals are likely to reflect off a chain link fence or wire mesh spaced between 1 and 1 1/2 inch. (2.5 and 3.8 cm). The fence acts as a harmonic reflector that blocks the signal.
Install the antenna away from microwave ovens and 2-GHz cordless phones. These products can cause signal interference because they operate in the same frequency range as the device to which your antenna is connected.

Contents of the Antenna and Bracket Kit

Figure 1  Contents of the Antenna Bracket Kit

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>One of two articulating mount flanges required for the installation. The other flange comes attached to the back of the antenna.</td>
</tr>
<tr>
<td>2</td>
<td>Articulating mount arm.</td>
</tr>
<tr>
<td>3</td>
<td>1/4-20 x 1.25-inch stainless steel screws. Two are included in the kit.</td>
</tr>
<tr>
<td>4</td>
<td>1/4 inch flat washers. Two are included in the kit.</td>
</tr>
<tr>
<td>5</td>
<td>1/4-inch split-lock washers. Two are included in the kit.</td>
</tr>
<tr>
<td>6</td>
<td>1/4-20 Hex nuts. Two are included in the kit.</td>
</tr>
<tr>
<td>7</td>
<td>One of two worm-gear type hose clamps. Each has a range of 50–135mm</td>
</tr>
</tbody>
</table>

Dimensions of the Antenna and Brackets

The dimensions noted in the following illustrations are all in mm, unless noted otherwise.
Figure 2  Dimensions of the Antenna with Brackets and Cables

4X Φ 4.50 THRU ALL

36" ± 1"
FROM BOTTOM EDGE OF RADOME

254.0
240.0
240.0
254.0

41.0
(176.0)
(217.0)
Figure 3  Locations of Screw Holes and Pressure Vent at the Back of the Antenna
Installing the Antenna

You can install the antenna on a wall or ceiling (must be a flat surface), or on a pole with a minimum diameter of 2 inches (5.08 cm) and a maximum diameter of 5 inches (12.7 cm). The antenna and one mounting flange are connected together when shipped.

To install the antenna:

1. Decide on a mounting location. See the Deciding on a Mounting Location.

2. Ensure that you have the requisite tools and fasteners ready. See the Tools and Equipment Required.

3. Proceed with mounting the antenna. When mounting the antenna, assemble the bracket hardware, connect the antenna and bracket to the mounting surface, and adjust the antenna orientation.

The mounting options available are:

1. Mounting on a Wall or Ceiling.

2. Mounting on a Pole or Mast.

3. Flush Mounting on a Wall Without Mount Brackets.

4. (Optional) Paint the antenna. See Painting the Antenna.
Deciding on a Mounting Location

The antenna should be mounted clear of any obstructions to the side or front of the enclosure, which contains the radiating elements. Keep in mind that this antenna should be aimed at the intended coverage area. Therefore, you should mount the antenna such that the desired mechanical tilt is achieved. If possible, mount the antenna near the access point so that you can use the shortest possible connecting cables.

CAUTION: For outdoor installations, install the antenna with cables exiting downward. This will help prevent water from accumulating around the cable exit points.

Tools and Equipment Required

WARNING: The fasteners and the mounting surface should be capable of maintaining a minimum pullout force of 150 pounds (68 kg) to support the weight of the antenna and bracket along with the potential wind loading on the antenna.

WARNING: The pole or mast must be rigid enough to hold the weight of the antenna along with the associated forces produced by wind loads. Also, the pole or mast must be structurally strong enough to withstand the clamping force of the hose clamps.

Before you start with mounting the antenna, go through the mounting procedure for each kind of installation and ensure that you have all tools and fasteners mentioned therein ready. The following is a general list of fasteners and tools which are not included in the antenna and brackets kit.

- To loosen and tighten the adjustment bolts on the brackets, you need a flat-blade screwdriver.
- To mount the antenna on a wall or ceiling, you need four mounting 4 mm or #8 screws or bolts and wall anchors.
- To mount the antenna on a pole or mast, you will need either or both of these supplies:
  - Slotted screwdriver to tighten the screws on the hose clamps
  - A 5/16 inch (8mm) socket or box wrench
- You may also need the following tools and equipment, which are not provided as part of the kit:
  - A drill and drill bit
  - A pencil
  - A small mallet or hammer, to hammer
  - A Phillips screwdriver

Mounting on a Wall or Ceiling

1. The fasteners and mounting surface should be capable of maintaining a minimum pullout force of 150 pounds (68 kg) to support the weight of the antenna along with the potential wind loading on the antenna.

2. Determine the mounting location for the antenna.

3. Attach the free articulating mount flange to the wall or ceiling using four 4 mm or #8 screws and fasteners, through the holes on the bracket.

One of the two required articulating mount flange brackets come attached to the back of the antenna (see Figure 1). The other flange bracket, included in the kit, is the one used in this step.

1. Assemble the bracket hardware, as shown in Figure 5. Use a flat blade screwdriver to tighten the 1/4 20 x 1.25" screws on the brackets.
2. Orient the antenna correctly (note the arrow on the back of the antenna that indicates the top of the antenna). Use a flat-blade screwdriver to loosen or tighten the fasteners at the azimuth and elevation adjustment pivots.

3. Adjust the azimuth (side-to-side position) and elevation (up-and-down position) of the antenna. Loosen the adjustment pivot bolts slightly to allow for adjustment.

The azimuth angle can be adjusted ±90 degrees (Figure 7) and elevation can be adjusted ±55 degrees (Figure 8).

Use the azimuth and elevation markings on the articulating mounting arm and the flange brackets as a guide. See Figure 6.

1. After adjusting the antenna position, tighten the pivot bolts. Tighten all the bolts to not more than 30 lbf.in. (3.4 Nm).

2. Connect the antenna cables to the access point. The antenna ports are labeled A through D. Connect the antenna port A to connector A on the access point, antenna port B to connector B on the access point, and so on.

For the recommended cable type, see Recommended Cable.
### Figure 5  Exploded View of Antenna and Bracket Hardware Assembly

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The articulating mount flange bracket that comes attached to the back of the antenna.</td>
</tr>
</tbody>
</table>
| 2 | The azimuth adjustment pivot.  
   Here, a 1/4 20 x 1.25-inch stainless steel screw, a 1/4-inch split-lock washer, a 1/4-inch flat washer, and a 1/4-20 Hex nut (in that order) fasten the articulating mount arm to the flange bracket at the back of the antenna. |
| 3 | The end of the articulating mount arm, which attaches to the flange bracket fixed to the wall or ceiling.|
| 4 | The elevation adjustment pivot.  
   Here, a 1/4 20 x 1.25-inch stainless steel screw, a 1/4-inch split-lock washer, a 1/4-inch flat washer, and a 1/4-20 Hex nut (in that order) fasten the articulating mount arm to the flange bracket fixed to the wall or ceiling. |
Figure 6  Close-Up View of the Azimuth and Elevation-Adjustment Pivots

ANGULAR MARKINGS EVERY 5°, LABELS AT 30° & 60°

ANGULAR DETENTS EVERY 5°
Figure 7  Azimuth Adjustment
Mounting on a Pole or Mast

NOTE: The pole or mast must be rigid enough to hold the weight of an antenna along with the associated forces produced by wind loads. In addition, the mast must be structurally strong enough to withstand the clamping force of the hose clamps.

1. Determine the mounting location for the antenna on the pole or mast.

2. Position and mount the mounting flange bracket on to the pole or mast using the hose clamps provided in the kit. The hose clamps should pass through the slots on the free mounting flange bracket.

One of the two required articulating mount flange brackets come attached to the back of the antenna (see Figure 1). The other flange bracket, included in the kit, is the one used in this step.

3. Tighten the hose clamps only to the extent that they can hold the flange bracket and the antenna in place until the antenna is positioned at its final position. Use a slotted screwdriver to tighten the screws on the hose clamps.

4. Assemble the antenna and bracket to the flange bracket. See Figure 5.

5. Position the antenna, mounting bracket, and hose clamps on the mast. See Figure 9 for reference.

6. Tighten the hose clamps until the antenna is fully secure on the mast. Ensure that the antenna cannot rotate about the mast.
7. After the antenna is secured on the mast, adjust the azimuth (side-to-side position) and elevation (up-and-down position) of the antenna. Loosen the adjustment pivot bolts slightly to allow for adjustment.

Azimuth angle can be adjusted ±90 degrees (Figure 7) and elevation can be adjusted ±55 degrees (Figure 8).

You can use the azimuth and elevation markings on the articulating mounting arm and the flange brackets as a guide. See Figure 6.

8. After you adjust the antenna position, tighten the adjustment bolts. Tighten all the bolts to not more than 30 lbf.in. (3.4 Nm).

9. Connect the antenna cables to the access point. The antenna ports are labeled A through D. Connect the antenna port A to connector A on the access point, antenna port B to connector B on the access point, and so on.

For the recommended cable type, see Recommended Cable.

Figure 9  Antenna Bracket Hose Clamp Assembly for Pole Mounting

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Articulating mount flange attached to the back of the antenna.</td>
</tr>
<tr>
<td>2</td>
<td>Articulating mount arm.</td>
</tr>
<tr>
<td>3</td>
<td>Articulating mount flange that is fastened to the pole or mast using hose clamps.</td>
</tr>
<tr>
<td>4</td>
<td>Worm-gear-type hose clamp (50–135mm) for mounting the assembly on a pole or mast.</td>
</tr>
<tr>
<td>5</td>
<td>Cables connecting the antenna to an access point.</td>
</tr>
</tbody>
</table>
Flush Mounting on a Wall Without Mount Brackets

You can flush mount the antenna on a wall. For this, you will need to discard the articulating mount flange brackets from the installation.

**NOTE:** The following procedure describes how to mount the antenna on a drywall. If you intend to install your antenna on another surface other than a drywall, the following procedure may vary slightly and you should procure the necessary hardware.

1. Remove the articulating mount flange bracket that comes attached to the back of the antenna.
2. Determine the location where you will mount the antenna.
3. Use the antenna as a template to mark the location of the four mounting holes. See Figure 10 for the locations of the holes.
4. Using a drill and #29 drill bit, drill four holes at the locations you have marked in 3. For drywall installations a #29 (0.136 inch or 45 mm) drill bit is enough. Other surfaces may require a different size.
5. Insert 8-inch plastic wall anchors into each hole.
6. Using a mallet or small hammer, properly seat the plastic anchors into the wall.
7. Align the antenna’s mounting holes with the anchors.
8. Insert an 8 x 1¼-inch screw, through each mounting hole and into its anchor.
10. Connect the antenna cables to the access point. The antenna ports are labeled A through D. Connect the antenna port A to connector A on the access point, antenna port B to connector B on the access point, and so on.

For the recommended cable type, see Recommended Cable.
Figure 10  Back of the Antenna with Flush Mounting Screw-Holes Locations

1  Screw holes for flush mounting on a wall. Each hole takes an 8 x 1¼-inch screw. 
   See Figure 2 for the distances between these holes.  

2  Spot where the preinstalled articulating flange mount was removed from.  

3  Pressure release vent.  

Recommended Cable

This antenna comes with four 3 foot long cables with RP-TNC connectors. If you need a longer cable reach, use AIR-CAB005LL-R= to extend the length by an additional 5 feet.
NOTE: A coaxial cable loses efficiency as the frequency increases, resulting in signal loss. The cable should be kept as short as possible because cable length also determines the amount of signal loss (the longer the cable, the greater the loss).

Painting the Antenna

Painting the antenna and the bracket does not affect its performance if you use standard exterior-grade, oil-based, or latex paint. Do not use metallic or metallic-flake paints, which will degrade antenna performance.

NOTE: Before painting the antenna, cover the pressure-release vent on the rear, lower-left of the antenna with masking tape to prevent clogging. Ensure that you remove the tape afterwards.

We recommend that you use Krylon Fusion for Plastic or Rust-Oleum for Plastic (which might require a primer coat). For best results, follow the surface preparation suggestions from the paint manufacturer.

Obtain Documentation and Submit a Service Request

For information on obtaining documentation, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see What’s New in Cisco Product Documentation.

To receive new and revised Cisco technical content directly to your desktop, you can subscribe to the What’s New in Cisco Product Documentation RSS feed. The RSS feeds are a free service.

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Cisco Aironet 2.4–GHz/5–GHz MIMO 4–Element Patch Antenna (AIR-ANT2566P4W-R)

This document outlines the specifications for the Cisco Aironet 2.4–GHz/5–GHz MIMO 4–Element Patch Antenna (AIR-ANT2566P4W-R) and provides mounting instructions. The antenna operates in both the 2.4–GHz and 5–GHz frequency ranges and is designed for indoor and outdoor use.

The following information is provided in this document.

- Technical Specifications
- System Requirements
- Safety Precautions
- Installation Notes
- Installing the Antenna
- Obtain Documentation and Submit a Service Request
## Technical Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antenna type</strong></td>
<td>4-element dual-band MIMO</td>
</tr>
<tr>
<td><strong>Operating frequency range</strong></td>
<td>2.400 to 2.484 MHz 5150–5850 MHz</td>
</tr>
<tr>
<td><strong>VSWR</strong></td>
<td>2:1 or less</td>
</tr>
<tr>
<td><strong>Gain</strong></td>
<td>6 dBi in both bands</td>
</tr>
<tr>
<td><strong>Polarization</strong></td>
<td>Linear, vertical</td>
</tr>
<tr>
<td><strong>Azimuth Plane 3-dB Beamwidth</strong></td>
<td>2.4 GHz band: 105° 5 GHz band: 110°</td>
</tr>
<tr>
<td><strong>Elevation Plane 3-dB Beamwidth</strong></td>
<td>2.4 GHz band: 65° 5 GHz band: 55°</td>
</tr>
<tr>
<td><strong>Length</strong></td>
<td>6.3 in. (16 cm)</td>
</tr>
<tr>
<td><strong>Width</strong></td>
<td>11 in. (27.9 cm)</td>
</tr>
<tr>
<td><strong>Depth</strong></td>
<td>1.2 in. (3.05 cm)</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>1.4 lbs</td>
</tr>
<tr>
<td><strong>Cable length and type</strong></td>
<td>3 foot (91.4 cm) plenum rated</td>
</tr>
<tr>
<td><strong>Connector</strong></td>
<td>RP-TNC</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td>Indoor/outdoor</td>
</tr>
<tr>
<td><strong>Water/Foreign Body Ingress</strong></td>
<td>IP54</td>
</tr>
<tr>
<td><strong>Operating temperature range</strong></td>
<td>-40° to 158° F -40° to 70° C</td>
</tr>
</tbody>
</table>
Figure 1  Azimuth and Elevation Radiation Patterns - 2.4 GHz Band
System Requirements

This antenna is designed for indoor and outdoor use with any Cisco Aironet access point that requires four (4) dual-band antennas.

Safety Precautions

Translated versions of the following safety warnings are provided in the Safety Warnings for Cisco Aironet Antennas, which is available at http://www.cisco.com.

WARNING: Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution but did not take adequate steps to avoid the hazard.

WARNING: For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!

1. If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.
2. Select your installation site with safety as well as performance in mind. Remember: electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

3. Call your electric power company. Tell them your plans and ask them to come look at your proposed installation. This is a small inconvenience considering your life is at stake.

4. Plan your installation carefully and completely before you begin. Successful raising of a mast or tower is largely a matter of coordination. Each person should be assigned a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

5. When installing your antenna, remember:
   a. Do not use a metal ladder.
   b. Do not work on a wet or windy day.
   c. Do dress properly—shoes with rubber soles and heels, rubber gloves, long sleeved shirt or jacket.

6. If the assembly starts to drop, get away from it and let it fall. Remember, the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current. Even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer: You!

7. If any part of the antenna system should come in contact with a power line, don't touch it or try to remove it yourself. Call your local power company. They will remove it safely.

8. If an accident occurs with the power lines, call for qualified emergency help immediately.

Installation Notes

Antennas transmit and receive radio signals which are susceptible to RF obstructions and common sources of interference that can reduce throughput and range of the device to which they are connected. Follow these guidelines to ensure the best possible performance:

- Install the antenna vertically and mount it with the cables pointing towards the ground.
- Keep the antenna away from metal obstructions such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use a rigid conduit to lower the antenna away from these obstructions.
- The density of the materials used in a building’s construction determines the number of walls the signal can pass through and still maintain adequate signal strength. Consider the following before choosing the location for your antenna:
  - Signals penetrate paper and vinyl walls with little change to signal strength.
  - Signals penetrate only one or two solid and pre-cast concrete walls without degrading signal strength.
  - Signals penetrate three or four concrete and wood block walls without degrading signal strength.
  - Signals penetrate five or six walls constructed of drywall or wood without degrading signal strength.
  - Signals will likely reflect off a thick metal wall and may not penetrate it at all.
  - Signals will likely reflect off a chain link fence or wire mesh spaced between 1 and 1 1/2 in. (2.5 and 3.8 cm). The fence acts as a harmonic reflector that blocks the signal.
- Install the antenna away from microwave ovens and 2-GHz cordless phones. These products can cause signal interference because they operate in the same frequency range as the device to which your antenna is connected.
Choosing a Mounting Location

The antenna should be mounted clear of any obstructions to the sides of the radiating elements. Generally, the higher an antenna is above the floor, the better it performs. If possible, find a mounting place directly above your wireless device to ensure the lead-in cable can be as short as possible.

Installing the Antenna

You can install the antenna on any wall. If you intend to install your antenna on another surface, you must provide the appropriate hardware.

**NOTE:** Four mounting screws are provided to mount the antenna. To ensure a safe, reliable, and long-standing installation, you must use all four screws to mount the antenna.

Tools and Equipment Required

A mounting installation kit is shipped with the antenna and consists of the following hardware:

- Four #8 x 1¼ screws
- Four #8 plastic anchors
- Four end caps

You may need the following tools and equipment, which are not provided.

- A Phillips screwdriver
- A drill
- A #29 (0.136-in. (3.45 mm)) drill bit (for drywall installation, other surfaces may require a different size).
- A pencil
- A small mallet or hammer

Mounting on a Vertical Surface

Follow these steps to mount your antenna on a vertical surface. This procedure describes mounting the antenna on a drywall surface. If you are mounting the antenna on any other type of surface, your procedure may vary slightly.

1. Determine the location where you will mount the antenna.
2. Use the antenna as a template to mark the location of the four mounting holes.
3. Use a drill and #29 drill bit to drill four holes at the locations you marked in 2.
4. Start a plastic anchor into each hole.
5. Use a mallet or small hammer to seat the anchors into the wall.
6. Align the antenna's mounting holes with the anchors.
7. Start a #8 x 1¼ screw into each antenna mounting hole.
8. Use a Phillips screwdriver to secure the antenna to the wall. Do not overtighten.
9. Install the end caps into the antenna mounting holes.
10. Remove the yellow outdoor installation warning label from the antenna radome.

Outdoor Installations

You can mount this antenna outdoors. If you mount the antenna outdoors, you must provide the mounting hardware. For outdoor installations, follow the instructions printed on the back of the antenna.

**CAUTION:** An orientation arrow is printed on the back of the antenna that indicates the proper orientation for the antenna for outdoor installations. You must install the antenna so the arrow points up to prevent any water intrusion and to provide a drain for any moisture that may accumulate inside the antenna.

Suggested Cable

Cisco recommends a high-quality, low-loss cable for use with the antenna.

**NOTE:** Coaxial cable loses efficiency as the frequency increases, resulting in signal loss. The cable should be kept as short as possible, because cable length also determines the amount of signal loss (the longer the run, the greater the loss).

Obtain Documentation and Submit a Service Request

For information on obtaining documentation, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see *What’s New in Cisco Product Documentation*.

To receive new and revised Cisco technical content directly to your desktop, you can subscribe to the *What’s New in Cisco Product Documentation* RSS feed. The RSS feeds are a free service.
Cisco Aironet Dual-Band Omni-Directional Antenna (AIR-ANT2568VG-N)

This describes the Cisco Aironet AIR-ANT2568VG-N dual-band omni-directional antenna, and provides specifications and mounting instructions. The antenna is designed for outdoor use with Cisco Aironet Outdoor Access Points with radios operating in the 2.4 GHz and 5 GHz frequency bands.

These topics are discussed:

- Technical Specifications, page 212
- System Requirements, page 214
- Safety Precautions, page 214
- Installation Notes, page 214
# Technical Specifications

<table>
<thead>
<tr>
<th>Antenna Type</th>
<th>Omni-directional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Frequency Range</td>
<td>2400–2483 MHz; 5150–5925 MHz</td>
</tr>
<tr>
<td>VSWR</td>
<td>1.5:1 (2400–2483 MHz)</td>
</tr>
<tr>
<td></td>
<td>2:1 (5150–5925 MHz)</td>
</tr>
<tr>
<td>Nominal Input Impedance</td>
<td>50 Ohms</td>
</tr>
<tr>
<td>Gain</td>
<td>6 dBi (2400–2483 MHz)</td>
</tr>
<tr>
<td></td>
<td>8 dBi (5150–5925 MHz)</td>
</tr>
<tr>
<td>Polarization</td>
<td>Vertical</td>
</tr>
<tr>
<td>Azimuth Plane Ripple</td>
<td>2 dB (Max)</td>
</tr>
<tr>
<td>Elevation Plane 3 dB Beamwidth</td>
<td>24° (2400–2483 MHz)</td>
</tr>
<tr>
<td></td>
<td>11° (5150–5925 MHz)</td>
</tr>
<tr>
<td>Azimuth Plane 3 dB Beamwidth</td>
<td>Omni-directional</td>
</tr>
<tr>
<td>Length</td>
<td>14.8 in (377 mm)</td>
</tr>
<tr>
<td>Diameter</td>
<td>1.25 in (31.75 mm)</td>
</tr>
<tr>
<td>Weight</td>
<td>7.2 oz. (204.1 g)</td>
</tr>
<tr>
<td>Connector</td>
<td>N-Male</td>
</tr>
<tr>
<td>Operational Temperature</td>
<td>-22–158°F (-30–70°C)</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-40–185°F (-40–85°C)</td>
</tr>
<tr>
<td>Water/Foreign Body Ingress</td>
<td>IP67</td>
</tr>
<tr>
<td>Wind Rating (Operational)</td>
<td>100 mph (161 kph)</td>
</tr>
<tr>
<td>Wind Rating (Survival)</td>
<td>136 mph (218 kph)</td>
</tr>
</tbody>
</table>
Azimuth Radiation Pattern (2.4 GHz)

Elevation Radiation Pattern (2.4 GHz)

Azimuth Radiation Pattern (5 GHz)

Elevation Radiation Pattern (5 GHz)
System Requirements

This antenna is designed for use with the Cisco Aironet Outdoor Access Points.

Safety Precautions

Warning: Do not locate the antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (e.g. U.S.: NFPA 70, National Electrical Code, Article 810, Canada: Canadian Electrical Code, Section 54). Statement 280

For your safety, read and follow these safety precautions.

1. Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

2. Find someone to help you—installing an antenna is often a two-person job.

3. Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

4. Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.

5. Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

6. When installing your antenna, follow these guidelines:
   a. Do not use a metal ladder.
   b. Do not work on a wet or windy day.
   c. Dress properly: wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.

7. If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.

8. If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.

9. If an accident should occur with the power lines, call for qualified emergency help immediately.

Installation Notes

The antenna is designed to connect to a dedicated antenna port on the access point. No special tools are required to install the antenna.

The antenna is resistant to the full range of outdoor environments. After the antenna is attached to the access point, seal the connections to prevent moisture and other weathering elements from affecting performance. Cisco recommends using a coax seal (such as CoaxSeal) for outdoor connections. Silicone sealant or electrical tape are not recommended for sealing outdoor connections.
Choosing a Mounting Location

The antenna is designed to create an omni-directional broadcast pattern. To achieve this pattern, the access point should be mounted clear of any obstructions to the sides of the radiating element. If the mounting location is on the side of a building or tower, the antenna pattern is degraded on the building or tower side.

Generally, the higher an antenna is above the ground, the better it performs. A practice is to install your antenna about 5 to 10 ft (1.5 to 3 m) above the roof line and away from all power lines and obstructions.

Tools and Equipment Required

No tools are required to mount the antenna to the access point. However, you may need a ¾ in. (19 mm) open end or combination wrench (or adjustable wrench) to remove the antenna port covers.

For information about tools required to mount the access point, see the appropriate access point documentation.

Mounting the Antenna

To connect the antenna to the access point:

1. If necessary, remove the antenna port cover.
2. Align the antenna N connector with the appropriate antenna port.
3. Gently push the antenna into the port.
4. Tighten the antenna hand tight.

Communications, Services, and Additional Information

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- To submit a service request, visit Cisco Support.
- To discover and browse secure, validated enterprise-class apps, products, solutions and services, visit Cisco Marketplace.
- To obtain general networking, training, and certification titles, visit Cisco Press.
- To find warranty information for a specific product or product family, access Cisco Warranty Finder.

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The following information is for FCC compliance of Class B devices: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular
installation. If the equipment causes interference to radio or television reception, which can be determined by turning the
equipment off and on, users are encouraged to try to correct the interference by using one or more of the following
measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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Cisco Aironet 2.4-GHz/5-GHz 8-dBi Directional Antenna
(AIR-ANT2588P3M-N)

This describes the Cisco Aironet AIR-ANT2588P3M-N 2.4/5-GHz 8-dBi 3-port directional antenna with N-connectors, and provides specifications and mounting instructions. The antenna operates in both the 2.4 GHz and 5 GHz frequency bands and is designed for outdoor use.

These topics are discussed:

- Technical Specifications, page 218
- Azimuth and Elevation Radiation Patterns, page 220
- System Requirements, page 221
- Safety Precautions, page 221
- Installation Guidelines, page 222
- Installing the Antenna, page 223
Technical Specifications

The following table provides technical specifications:
## Table 1  Technical Specifications

<table>
<thead>
<tr>
<th>Antenna type</th>
<th>3-element dual-polarized patch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range</td>
<td>2400–2500 MHz</td>
</tr>
<tr>
<td></td>
<td>5150–5900 MHz</td>
</tr>
<tr>
<td>Nominal input impedance</td>
<td>50 Ohms</td>
</tr>
<tr>
<td>VSWR</td>
<td>2:1 or less</td>
</tr>
<tr>
<td>Peak gain</td>
<td>8 dBi (both bands)</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linear, Dual</td>
</tr>
<tr>
<td>Sidelobe level</td>
<td>&lt; –20 dBC</td>
</tr>
<tr>
<td>Front-to-back ratio</td>
<td>&gt; 10 dB</td>
</tr>
<tr>
<td>Length</td>
<td>12 in. (30.48 cm)</td>
</tr>
<tr>
<td>Width</td>
<td>7 in. (17.78 cm)</td>
</tr>
<tr>
<td>Height</td>
<td>1.1 in. (2.79 cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>16 oz. (0.45 kg)</td>
</tr>
<tr>
<td>Connector type</td>
<td>N-Female Bulkhead (x3)</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>–40–131° F</td>
</tr>
<tr>
<td></td>
<td>(–40–55° C)</td>
</tr>
<tr>
<td>Environment rating</td>
<td>IP67</td>
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</table>

## Table 2  Half Power Beamwidth

<table>
<thead>
<tr>
<th>Plane</th>
<th>2400–2500 MHz</th>
<th>5150–5900 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azimuth Plane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V-Polarized Port (Typical)</td>
<td>95°</td>
<td>115°</td>
</tr>
<tr>
<td>H-Polarized Port (Typical)</td>
<td>140°</td>
<td>155°</td>
</tr>
<tr>
<td>Elevation Plane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V-Polarized Port (Typical)</td>
<td>45°</td>
<td>26°</td>
</tr>
<tr>
<td>H-Polarized Port (Typical)</td>
<td>36°</td>
<td>25°</td>
</tr>
</tbody>
</table>
Azimuth and Elevation Radiation Patterns

2.4 GHz Band - Horizontal Polarization

![2.4 GHz Band - Horizontal Polarization](image1)

5 GHz Band - Horizontal Polarization

![5 GHz Band - Horizontal Polarization](image2)

2.4 GHz Band - Vertical Polarization

![2.4 GHz Band - Vertical Polarization](image3)

5 GHz Band - Vertical Polarization

![5 GHz Band - Vertical Polarization](image4)
System Requirements

This antenna is designed for outdoor use with any Cisco Aironet access point that requires three (3) dual-band antennas.

Safety Precautions

Translated versions of the following safety warnings are provided in the Safety Warnings for Cisco Aironet Antennas, which is available at http://www.cisco.com.

Warning: Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

Warning: This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.

Warning: In order to comply with international radio frequency (RF) exposure limits, dish antennas should be located at a minimum of 8.7 inches (22 cm) or more from the bodies of all persons. Other antennas should be located a minimum of 7.9 inches (20 cm) or more from the bodies of all persons.

Warning: Do not work on the system or connect or disconnect cables during periods of lightning activity.

Warning: This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.

Warning: Do not locate the antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (e.g. U.S.:NFPA 70, National Electrical Code, Article 810, in Canada: Canadian Electrical Code, Section 54).

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution but did not take adequate steps to avoid the hazard.

For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!

1. If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

2. Select your installation site with safety as well as performance in mind. Remember, electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

3. Call your electric power company. Tell them your plans and ask them to come look at your proposed installation. This is a small inconvenience considering your life is at stake.

4. Plan your installation carefully and completely before you begin. Successful raising of a mast or tower is largely a matter of coordination. Each person should be assigned a specific task and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

5. When installing your antenna, remember:
   a. Do not use a metal ladder.
   b. Do not work on a wet or windy day.
Installation Guidelines

c. **Do** dress properly: wear shoes with rubber soles and heels, rubber gloves, long sleeved shirt or jacket.

6. If the assembly starts to drop, get away from it and let it fall. Remember, the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current. Even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer: **You!**

7. If any part of the antenna system should come in contact with a power line, **do not touch it or try to remove it yourself. Call your local power company.** They will remove it safely.

8. If an accident occurs with the power lines, call for qualified emergency help immediately.

**Installation Guidelines**

Because the antennas transmit and receive radio signals, they are susceptible to RF obstructions and common sources of interference that can reduce throughput and range of the device to which they are connected. Follow these guidelines to ensure the best possible performance:

- Mount the antenna as high as possible to take advantage of its propagation characteristics.

- Keep the antenna away from metal obstructions such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use a rigid conduit to lower the antenna away from these obstructions.

- The density of the materials used in a building’s construction determines the number of walls the signal must pass through and still maintain adequate coverage. Consider the following before choosing the location in which to install your antenna:
  - Paper and vinyl walls have very little affect on signal penetration.
  - Solid and pre-cast concrete walls limit signal penetration to one or two walls without degrading coverage.
  - Concrete and wood block walls limit signal penetration to three or four walls.
  - A signal can penetrate five or six walls constructed of drywall or wood.
  - A thick metal wall causes signals to reflect, causing poor penetration.

- Install the antenna away from 5 GHz cordless phones. These products can cause signal interference because they operate in the same frequency range as the device your antenna is connected to.

**Site Selection**

Before attempting to install your antenna, determine where you can best place the antenna for safety and performance.

To determine a safe distance from wires, power lines, and trees:

1. Measure the height of your antenna.

2. Add this length to the length of your tower or mast and then double this total for the minimum recommended safe distance.

  **Caution:** If you are unable to maintain this safe distance, stop and get professional help.

Generally, the higher an antenna is above the ground, the better it performs. Good practice is to install your antenna about 5 to 10 ft (1.5 to 3 m) above the roof line and away from all power lines and obstructions. If possible, find a mounting place directly above your wireless device so that the lead-in cable can be as short as possible.
Installing the Antenna

You can install the antenna on a pole from 1.63" to 2.3" pipe O.D. The mounting options allow the antenna to be vertically or horizontally polarized.

Tools and Equipment Required

- Antenna mount bracket
- Elevation adjustable bracket
- Azimuth adjustable bracket
- Two 1/4 in. 20 azimuth and elevation adjustment bolts and nuts with 1/4 in. flat washers and lock washers
- Two pipe clamps

The following tools and equipment are not provided:

- 5/16 in wrench
- 1/4 in flat head screwdriver
- 5/16 in nut driver or flat head screwdriver for pipe clamps

Mounting on a Pole

To mount your antenna on a pole:

1. Remove antenna and mount kit from packaging.
2. Attach antenna mount bracket to the back of the antenna as shown applying a maximum nut-tightening torque of 12 in lbf (1.1 Nm).
Installing the Antenna

**Figure 2  Attaching Antenna Mount Bracket**

1. Antenna
2. Stud nut
3. Antenna mount bracket

3. Attach elevation adjustable bracket as shown and loosely secure hardware.
Installing the Antenna

**Figure 3 Attach elevation adjustable bracket**

1. Elevation adjustable bolt
2. Lock washer
3. 1/4-in. flat washer
4. Elevation adjustable bracket
5. Hex nut

4. Attach azimuth adjustable bracket to pipe routing band clamps as shown. Tighten the pipe clamps to a torque of 35–45 in lbf (4.0–5.1 Nm).
Installing the Antenna

Figure 4 Attaching Azimuth Adjustable Bracket

5. Attach the antenna assembly to the azimuth adjustable bracket on pipe.

1  Pipe clamps                     2  Azimuth adjustable bracket
Installing the Antenna

**Figure 5  Attaching Antenna Assembly**

6. Adjust the position of the antenna to the desired azimuth and elevation angles and tighten all pivot hardware (2 places) to a maximum torque of 30 in-lbf (3.4 Nm). The bracket allows the antenna position to be adjustable to +/-45 degrees azimuth and +/-60 degrees elevation.

**Note:** Cisco recommends grounding the antenna. See *Grounding the Antenna, page 229.*

**Mounting on a Vertical Surface**

The antenna can be wall mounted. Hardware is not included for wall-mount installation.

To mount your antenna on a vertical surface:

1. Remove antenna and mount kit from packaging.

2. Attach antenna mount bracket to the back of the antenna as shown in *Figure 2,* applying a maximum nut-tightening torque of 12 in. lbf (1.1 Nm).

3. Attach elevation adjustable bracket as shown in *Figure 3* and loosely secure hardware.

4. Using the appropriate customer-supplied anchors and screws, attach the azimuth adjustable bracket to the wall as shown:
Installing the Antenna

Figure 6  Wall Mounting

Figure 7 shows, in inches, the distance between the bracket mounting holes.

Figure 7  Distance Between Bracket Mounting Holes

5. Attach antenna assembly to azimuth bracket, as shown in Figure 5.

6. Adjust the position of the antenna to the desired azimuth and elevation angles and tighten all pivot hardware (two places) to a maximum torque of 30 in. lbf (3.4 Nm). The bracket allows the antenna position to be adjustable to +/-45 degrees azimuth and +/-60 degrees elevation.
Antenna Cable Information

The antenna is to be used with the Cisco 1552E access point. The port-to-port designations are as follows: port A of
the antenna must be connected to port 4 of the access point, port B of the antenna must be connected to port 6 of the
access point, and port C of the antenna must be connected to port 5 of the access point.

Note: Coaxial cable loses efficiency as the frequency increases, resulting in signal loss. The cable should be kept as short
as possible, because cable length also determines the amount of signal loss (the longer the run, the greater the loss).

Cisco offers low-loss 5 ft. and 10 ft. coaxial cables, parts AIR-CAB005LL-N and AIR-CAB010LL-N, respectively, for
connection from the antenna to the access point. These cables have one straight male type-N connector and one right
angle male type-N connector. To use all of the ports on the AIR-ANT2588P3M-N three cables will be needed.

After the cable is attached to the antenna, make sure that the connections are sealed (if outdoors) to prevent moisture
and other weathering elements from affecting performance. Cisco recommends using a coax seal (such as CoaxSeal)
for outdoor connections. Silicone sealant or electrical tape are not recommended for sealing outdoor connections.

Grounding the Antenna

Follow these steps to ground the antenna in accordance with national electrical code instructions.

1. Use No. 10 AWG copper or No. 8 or larger copper-clad steel or bronze wire as ground wires for both mast and
lead-in. Securely clamp the wire to the bottom of the mast.

2. Secure the lead-in wire to an antenna discharge unit and the mast ground wire to the building with stand-off
insulators spaced from 4 ft (1.2 m) to 8 ft (2.4 m) apart.

3. Mount the antenna discharge unit as close as possible to where the lead-in wire enters the building.

4. Drill a hole in the building’s wall as close as possible to the equipment to which you will connect the lead-in cable.
   Caution: There may be wires in the wall. Ensure that your drilling location is clear of obstruction or other hazards.

5. Pull the cable through the hole and form a drip loop close to where it enters the building.

6. Thoroughly waterproof the lead-in area.

7. Install a lightning arrester.

8. Connect the lead-in cable to the equipment.

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equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with
Installing the Antenna

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 users will be required to correct the interference at their own expense.

The following information is for FCC compliance of Class B devices: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If the equipment causes interference to radio or television reception, which can be determined by turning the equipment off and on, users are encouraged to try to correct the interference by using one or more of the following measures:

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- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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Cisco Aironet 5-GHz 13-dBi Directional Antenna (AIR-ANT5114P2M-N)

This describes the Cisco Aironet AIR-ANT5114P2M-N 5-GHz 13-dBi 2-Port Directional antenna with N-type connectors, and provides specifications and mounting instructions. The antenna operates in the 5 GHz frequency band and is designed for use in outdoor environments.

These topics are discussed:

- Technical Specifications
- Elevation and Azimuth Plane Patterns
- System Requirements
- Safety Precautions
- Installation Guidelines
- Installing the Antenna
- Obtain Documentation and Submit a Service Request
Technical Specifications

Table 1

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Antenna type</td>
<td>2-Element Patch Array</td>
</tr>
<tr>
<td>Operating frequency range</td>
<td>5150–5900 MHz</td>
</tr>
<tr>
<td>Nominal input impedance</td>
<td>50 Ohms</td>
</tr>
<tr>
<td>Peak gain</td>
<td>13 dBi (see note below)</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linear, Dual</td>
</tr>
<tr>
<td>Elevation plane 3-dB beamwidth</td>
<td>30°</td>
</tr>
<tr>
<td>Azimuth plane 3-dB beamwidth</td>
<td>30°</td>
</tr>
<tr>
<td>Sidelobe level</td>
<td>&lt; −15 dBC</td>
</tr>
<tr>
<td>Front-to-back ratio</td>
<td>&gt; 25 dB</td>
</tr>
<tr>
<td>Cable length and type</td>
<td>30 in. (76.2 cm) outdoor rated Coax</td>
</tr>
<tr>
<td>Connector type</td>
<td>N Male</td>
</tr>
<tr>
<td>Length</td>
<td>7.8 in. (19.8 cm)</td>
</tr>
<tr>
<td>Width</td>
<td>7.8 in. (19.8 cm)</td>
</tr>
<tr>
<td>Height</td>
<td>1.2 in. (3 cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>21.6 oz. (0.61 kg)</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-40–131°F (-40–55°C)</td>
</tr>
</tbody>
</table>

Note: The AIR-ANT5114P2M-N antenna may be referred to as a +14 dBi antenna in variety of Cisco documents. The actual gain of the AIR-ANT5114P2M-N product is +13 dBi, confirmed over many samples of the AIR-ANT5114P2M-N antenna. The gain of the raw antenna element inside AIR-ANT5114P2M-N is just under 14 dBi, but due to 1dB RF loss of the integrated 30° length coaxial RF cable, the actual gain of the AIR-ANT5114P2M-N antenna product is 13 dBi maximum.
Elevation and Azimuth Plane Patterns

System Requirements

This antenna is designed for use with Cisco Aironet access points and bridges, but can be used with any 5 GHz Cisco Aironet radio device that uses an N-male connector.

Safety Precautions

**WARNING:** Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

**WARNING:** The warning means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.

**WARNING:** In order to comply with international radio frequency (RF) exposure limits, dish antennas should be located at a minimum of 8.7 inches (22 cm) or more from the bodies of all persons. Other antennas should be located a minimum of 7.9 inches (20 cm) or more from the bodies of all persons.

**WARNING:** Do not work on the system or connect or disconnect cables during periods of lightning activity.

**WARNING:** This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.

**WARNING:** Do not locate the antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (e.g. U.S.:NFPA 70, National Electrical Code, Article 810, in Canada: Canadian Electrical Code, Section 54).

**WARNING:** Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution but did not take adequate steps to avoid the hazard.
**WARNING:** For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!

1. If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

2. Select your installation site with safety, as well as performance in mind. Remember, electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

3. Call your electric power company. Tell them your plans and ask them to come look at your proposed installation. This is a small inconvenience considering your life is at stake.

4. Plan your installation carefully and completely before you begin. Successful raising of a mast or tower is largely a matter of coordination. Each person should be assigned to a specific task and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

5. When installing your antenna, remember:
   a. **Do not** use a metal ladder.
   b. **Do not** work on a wet or windy day.
   c. Dress properly: wear shoes with rubber soles and heels, rubber gloves, long sleeved shirt or jacket.

6. If the assembly starts to drop, get away from it and let it fall. Remember, the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current. Even the slightest touch of any of these parts to a power line complete an electrical path through the antenna and the installer: you!

7. If any part of the antenna system should come in contact with a power line, **do not touch it or try to remove it yourself. Call your local power company.** They will remove it safely.

8. If an accident should occur with the power lines call for qualified emergency help immediately.

**Installation Guidelines**

Because the antennas transmit and receive radio signals, they are susceptible to RF obstructions and common sources of interference that can reduce throughput and range of the device to which they are connected. Follow these guidelines to ensure the best possible performance:

- Mount the antenna as high as possible to take advantage of its propagation characteristics.

- Keep the antenna away from metal obstructions such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use a rigid conduit to lower the antenna away from these obstructions.

- The density of the materials used in the building construction determines the number of walls the signal must pass through and still maintain adequate coverage. Consider the following before choosing the location in which to install your antenna:
  - Paper and vinyl walls have very little affect on signal penetration.
  - Solid and pre-cast concrete walls limit signal penetration to one or two walls without degrading coverage.
  - Concrete and wood block walls limit signal penetration to three or four walls.
  - A signal can penetrate five or six walls constructed of drywall or wood.
  - A thick metal wall causes signals to reflect, causing poor penetration.
Install the antenna away from 5-GHz cordless phones. These products can cause signal interference because they operate in the same frequency range as the device your antenna is connected to.

Site Selection

Before attempting to install your antenna, determine where you can best place the antenna for safety and performance.

To determine a safe distance from wires, power lines, and trees:

1. Measure the height of your antenna.
2. Add this length to the length of your tower or mast and then double this total for the minimum recommended safe distance.

Caution: If you are unable to maintain this safe distance, stop and get professional help.

Generally, the higher an antenna is above the ground, the better it performs. Good practice is to install your antenna about 5 to 10 foot (1.5 to 3 m) above the roof line and away from all power lines and obstructions. Mount place your wireless device as close to the antenna as possible, so that the lead-in cable is as short as possible.

Installing the Antenna

You can install the antenna on a pole from 1.63” to 2.3” pipe O.D. The mounting options allow the antenna to be vertically or horizontally polarized.

Required Tools and Equipment

An installation kit is shipped with the antenna and consists of the panel antenna with adjustable mount and hardware, including:

- Antenna mount bracket
- Elevation adjustable bracket
- Azimuth adjustable bracket
- Four 1/4 in. 20x3/4 carriage bolts
- Six 1/4 in. 20 hex nuts
- Six 1/4 in. 20 spring lock washers
- Six 1/4 in. 20 flat washers
- Two pipe clamps

The following tools and equipment are not provided:

- 7/16 in wrench
- 5/16 in nut driver or flat head screwdriver for pipe clamps

The following sections contain typical procedures for installing the antenna on a pole. Your installation may vary. Before you begin, refer to Figure 1.
Mounting on a Pole

To mount your antenna on a pole:

1. Remove antenna and mount kit from packaging.

2. Attach antenna mount bracket to the back of the antenna as shown applying a maximum nut-tightening torque of 55 in lbf (6.2 Nm).

Figure 1 Attaching Antenna Mount Bracket

1. Antenna mount bracket
2. 1/4-in. flat washer
3. 1/4-in. spring lock washer
4. 1/4-in. 20 hex nut

3. Attach elevation adjustable bracket as shown and loosely secure hardware. The carriage bolt square holes must be on the inside.
Figure 2    Attaching Elevation Adjustable Bracket

1. Elevation adjustable bracket
2. 1/4 in. 20x3/4 carriage bolt
3. 1/4 in. flat washer
4. 1/4 in. spring lock washer
5. 1/4 in. 20 hex nut

4. Attach azimuth adjustable bracket to pipe routing band clamps as shown. Tighten the pipe clamps to a torque of 43–51 in lbf (4.9–5.8 Nm).
5. Attach antenna assembly to azimuth bracket on pipe.
6. Adjust the position of the antenna to the desired azimuth and elevation angles and tighten all pivot hardware (4 places) to a maximum torque of 55 in lbf (6.2 Nm). The bracket allows the antenna position to be adjustable to +/-45 degrees azimuth and +/-60 degrees elevation.
NOTE: We recommend grounding the antenna. See Grounding the Antenna.

Installing the Optional Mounting Bracket Kit

Using an optional antenna mounting bracket kit, the AIR-ANT5114P2M-N antenna can be mounted directly on an access point in a strand mount or pole mount environment. The antenna bracket kit contains four bracket sections and fasteners that you can assemble in multiple configurations to position and aim the directional antenna in a range of positions. For more information on mounting the antenna with the optional mounting bracket, refer to Installing Antenna Brackets on Cisco 1550 Series Outdoor Mesh Access Points.

Mounting on a Vertical Surface

The antenna can be wall mounted. Hardware is not included for wall-mount installation.

To mount your antenna on a vertical surface:

1. Remove antenna and mount kit from packaging.

2. Attach antenna mount bracket to the back of the antenna as shown in Figure 1, applying a maximum nut-tightening torque of 55 in lbf (6.2 Nm).

3. Attach elevation adjustable bracket (B) as shown in Figure 2 and loosely secure hardware. The carriage bolt square holes must be on the inside.

4. Using the appropriate customer-supplied anchors and screws, attach the azimuth adjustable bracket to the wall as shown:
5. Attach antenna assembly to azimuth bracket, as shown in Figure 4.
6. Adjust the position of the antenna to the desired azimuth and elevation angles and tighten all pivot hardware (4 places) to a maximum torque of 55 in lbf (6.2 Nm). The bracket allows the antenna position to be adjustable to +/-45 degrees azimuth and +/-60 degrees elevation.

**NOTE:** We recommend grounding the antenna. See Grounding the Antenna.

**Antenna Cable Information**

If the antenna is used with the Cisco 1552CU or 1552EU access point, the port A of the antenna must be connected to port 1 of the access point, port B of the antenna must be connected to port 3 of the access point, and port 2 of the access point must be capped with the cap enclosed with the antenna.

**Note:** Coaxial cable loses efficiency as the frequency increases, resulting in signal loss. Keep the cable as short as possible because cable length also causes signal loss (the longer the run, the greater the loss).

**Note:** The antenna cable has a 0.5 in. (12.7 mm) bend radius. Sharply bending or crimping the cable may cause a degradation in performance.

The antenna terminates with an N-male plug after a short, 2.5 foot (0.76 m) cable. The mating connector to the antenna is an appropriate N-female jack. The connector on the opposite end will vary according to the type of equipment used.

After the cable is attached to the antenna, ensure that the connections are sealed (if outdoors) to prevent moisture and other weathering elements from affecting performance. Cisco recommends using a coax seal (such as CoaxSeal) for outdoor connections. Silicone sealant or electrical tape are **not** recommended for sealing outdoor connections.

**Grounding the Antenna**

To ground the antenna in accordance with national electrical code instructions:

1. Use No. 10 AWG copper or No. 8 or larger copper-clad steel or bronze wire as ground wires for both mast and lead-in. Securely clamp the wire to the bottom of the mast.

2. Secure the lead-in wire to an antenna discharge unit and the mast ground wire to the building with stand-off insulators spaced from 4 foot (1.2 m) to 8 foot (2.4 m) apart.

3. Mount the antenna discharge unit as close as possible to where the lead-in wire enters the building.

4. Drill a hole in the building wall as close as possible to the equipment to which you will connect the lead-in cable.
   
   **Caution:** There may be wires in the wall. Ensure that your drilling location is clear of obstruction or other hazards.

5. Pull the cable through the hole and form a drip loop close to where it enters the building.

6. Thoroughly waterproof the lead-in area.

7. Install a lightning arrestor.

8. Connect the lead-in cable to the equipment.

**Obtain Documentation and Submit a Service Request**

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The following information is for FCC compliance of Class B devices: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If the equipment causes interference to radio or television reception, which can be determined by turning the equipment off and on, users are encouraged to try to correct the interference by using one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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Cisco Aironet 5-GHz 13-dBi Directional Antenna (AIR-ANT5114P2M-N)
Cisco Aironet Omnidirectional Antennas
AIR-ANT5150VG-N and
AIR-ANT5150HG-N

This document describes the Cisco Aironet AIR-ANT5150VG-N and AIR-ANT5150HG-N Omnidirectional Antennas and provides instructions for mounting. The antennas are designed for outdoor use with Cisco Aironet Outdoor Access Points (hereafter referred to as access points) with radios operating in the 5 GHz frequency band.

The following information is provided in this document:

- Technical Specifications, page 246
- System Requirements, page 248
- Safety Precautions, page 248
- Installation Notes, page 249
- Obtaining Documentation and Submitting a Service Request, page 250
**Technical Specifications**

<table>
<thead>
<tr>
<th></th>
<th>AIR-ANT5150VG-N</th>
<th>AIR-ANT5150HG-N</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antenna Type</strong></td>
<td>Omnidirectional</td>
<td>Omnidirectional</td>
</tr>
<tr>
<td><strong>Operating Frequency Range</strong></td>
<td>5150 - 5925 MHz</td>
<td>5150 - 5925 MHz</td>
</tr>
<tr>
<td><strong>Maximum VSWR</strong></td>
<td>2:1</td>
<td>2:1</td>
</tr>
<tr>
<td><strong>Gain</strong></td>
<td>5 dBi</td>
<td>5 dBi</td>
</tr>
<tr>
<td><strong>Polarization</strong></td>
<td>Vertical</td>
<td>Horizontal</td>
</tr>
<tr>
<td><strong>Maximum Azimuth Plane Ripple</strong></td>
<td>3.3 dB</td>
<td>3.3 dB</td>
</tr>
<tr>
<td><strong>Elevation Plane 3 dB Beamwidth</strong></td>
<td>33°</td>
<td>35°</td>
</tr>
<tr>
<td><strong>Azimuth Plane 3 dB Beamwidth</strong></td>
<td>Omnidirectional</td>
<td>Omnidirectional</td>
</tr>
<tr>
<td><strong>Length</strong></td>
<td>7.88 in (200.2 mm)</td>
<td>7.88 in (200.2 mm)</td>
</tr>
<tr>
<td><strong>Diameter</strong></td>
<td>1.0 in (25.4 mm)</td>
<td>1.0 in (25.4 mm)</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>3.5 oz. (0.1 kg)</td>
<td>3.5 oz. (0.1 kg)</td>
</tr>
<tr>
<td><strong>Connector</strong></td>
<td>N-Male</td>
<td>N-Male</td>
</tr>
<tr>
<td><strong>Operational Temperature</strong></td>
<td>-40° to +158° F (-40°C to +70°C)</td>
<td>-40° to +158° F (-40°C to +70°C)</td>
</tr>
<tr>
<td><strong>Storage Temperature</strong></td>
<td>-40° to +185° F (-40°C to +85°C)</td>
<td>-40° to +185° F (-40°C to +85°C)</td>
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<tr>
<td><strong>Water/Foreign Body Ingress</strong></td>
<td>IP67</td>
<td>IP67</td>
</tr>
<tr>
<td><strong>Wind Rating (Operational)</strong></td>
<td>100 mph (161 kph)</td>
<td>100 mph (161 kph)</td>
</tr>
</tbody>
</table>
Cisco Aironet Omnidirectional Antennas AIR-ANT5150VG-N and AIR-ANT5150HG-N
System Requirements

This antenna is designed for use with the Cisco Aironet Outdoor Access Points.

Safety Precautions

**WARNING:** Do not locate the antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (e.g. U.S.: NFPA 70, National Electrical Code, Article 810, Canada: Canadian Electrical Code, Section 54). Statement 280

For your safety, read and follow these safety precautions.

1. Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

2. Find someone to help you—installing an antenna is often a two-person job.
3. Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

4. Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.

5. Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

6. When installing your antenna, follow these guidelines:
   a. Do not use a metal ladder.
   b. Do not work on a wet or windy day.
   c. Do dress properly—wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.

7. If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.

8. If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.

9. If an accident should occur with the power lines, call for qualified emergency help immediately.

Installation Notes

The antenna is designed to connect to a dedicated antenna port on the access point. No special tools are required to install the antenna.

The antenna is resistant to the full range of outdoor environments. After the antenna is attached to the access point, seal the connections to prevent moisture and other weathering elements from affecting performance. Cisco recommends using a coax seal (such as CoaxSeal) for outdoor connections. Silicone sealant or electrical tape are not recommended for sealing outdoor connections.

Choosing a Mounting Location

The antenna is designed to create an omnidirectional broadcast pattern. To achieve this pattern, the access point should be mounted clear of any obstructions to the sides of the radiating element. If the mounting location is on the side of a building or tower, the antenna pattern is degraded on the building or tower side.

Generally, the higher an antenna is above the ground, the better it performs. A practice is to install your antenna about 5 to 10 ft (1.5 to 3 m) above the roof line and away from all power lines and obstructions.

Tools and Equipment Required

No tools are required to mount the antenna to the access point. However, you may need a ¾-in. (19-mm) open end or combination wrench (or adjustable wrench) to remove the antenna port covers.

For information about tools required to mount the access point, see the appropriate access point documentation.
Mounting the Antenna

To connect the antenna to the access point, follow these steps:

1. If necessary, remove the antenna port cover.
2. Align the antenna’s N connector with the appropriate antenna port.
3. Gently push the antenna into the port.
4. Hand-tighten the antenna.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly "What’s New in Cisco Product Documentation", which also lists all new and revised Cisco technical documentation, at:


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Cisco Aironet 8-dBi Omnidirectional Antenna (AIR-ANT5180V-N)

This document describes the Cisco Aironet AIR-ANT5180V-N 8-dBi Omnidirectional Antenna and provides instructions for mounting it. The antenna operates in the 5-GHz frequency range and is designed for outdoor use with the Cisco Aironet 1520 Series Outdoor Mesh Access Point (hereafter referred to as the access point).

The following information is provided in this document.

- Technical Specifications, page 252
- System Requirements, page 252
- Safety Precautions, page 253
- Installation Notes, page 253
Technical Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna type</td>
<td>Omnidirectional colinear array</td>
</tr>
<tr>
<td>Operating frequency range</td>
<td>4900–5850 MHz</td>
</tr>
<tr>
<td>1.7:1 VSWR bandwidth</td>
<td>4900–5850 MHz</td>
</tr>
<tr>
<td>Nominal input impedance</td>
<td>50 Ohms</td>
</tr>
<tr>
<td>Gain (4900–5000 MHz)</td>
<td>7–dBi</td>
</tr>
<tr>
<td>Gain (5400–5850 MHz)</td>
<td>8–dBi</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linear</td>
</tr>
<tr>
<td>E-plane 3-dB beamwidth</td>
<td>16°</td>
</tr>
<tr>
<td>H-plane 3-dB bandwidth</td>
<td>Omnidirectional</td>
</tr>
<tr>
<td>Length</td>
<td>11.0 in. (27.9 cm)</td>
</tr>
<tr>
<td>Diameter</td>
<td>1.0 in. (2.54 cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>6.0 oz. (160.0 g)</td>
</tr>
<tr>
<td>Connector type</td>
<td>N-Male</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>–22°F - 158°F (%30° C - 70° C)</td>
</tr>
<tr>
<td>Wind rating</td>
<td>125 mph (201 kmh) operational</td>
</tr>
<tr>
<td></td>
<td>165 mph (265 kmh) survival</td>
</tr>
</tbody>
</table>

**Azimuth Radiation Pattern**

**Elevation Radiation Pattern**

System Requirements

This antenna is designed for use with the Cisco Aironet 1520 Outdoor Mesh Access Points. The antenna is compatible with Cisco Aironet 1505 and 1510 Outdoor Mesh Access Points.
Safety Precautions

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution but did not take adequate steps to avoid the hazard.

For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!

1. If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

2. Select your installation site with safety, as well as performance in mind. Remember: electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

3. Call your electric power company. Tell them your plans and ask them to come look at your proposed installation. This is a small inconvenience considering your life is at stake.

4. Plan your installation carefully and completely before you begin. Successful raising of a mast or tower is largely a matter of coordination. Each person should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

5. When installing your antenna, remember:
   a. Do not use a metal ladder.
   b. Do not work on a wet or windy day.
   c. Do dress properly—shoes with rubber soles and heels, rubber gloves, long sleeved shirt or jacket.

6. If the assembly starts to drop, get away from it and let it fall. Remember, the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current. Even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer: You!

7. If any part of the antenna system should come in contact with a power line, don’t touch it or try to remove it yourself. Call your local power company. They will remove it safely.

8. If an accident should occur with the power lines call for qualified emergency help immediately.

Installation Notes

The antenna is designed to connect to a dedicated antenna port on the access point. No special tools are required to install the antenna.

The antenna is resistant to the full range of outdoor environments. Therefore, Cisco does not recommend using cable or antenna waterproofing materials. Using such materials may cause important drainage holes to be blocked. Two drain holes are located on the antenna base.

Three drain holes are also located under the cap at the top of the antenna. These holes allow for proper drainage if the antenna is deployed with the cap pointing towards the ground.

Note: Ensure that the cap is not damaged.

Figure 1 shows the location of the drain holes in both the antenna base and under the antenna cap.
Choosing a Mounting Location

The antenna is designed to create an omnidirectional broadcast pattern. To achieve this pattern, the access point should be mounted clear of any obstructions to the sides of the radiating element. If the mounting location is on the side of a building or tower, the antenna pattern is degraded on the building or tower side.

Generally, the higher an antenna is above the ground, the better it performs. Good practice is to install your antenna about 5 to 10 ft (1.5 to 3 m) above the roof line and away from all power lines and obstructions.

Tools and Equipment Required

No tools are required to mount the antenna to the access point. However, you may need a ¾-in. (19-mm) open end or combination wrench (or adjustable wrench) to remove the antenna port covers.

For information about tools required to mount the access point, see the appropriate access point documentation.

Mounting the Antenna

Figure 2 identifies and shows the locations of the antenna ports when looking at the access point from the hinged cover side.
Installing the antennas depends on which type access point you are using. Two configurations are available: cable strand mount and pole mount. Table 1 shows the antenna port usage for these configurations.

### Table 1  Antenna Port Usage Table

<table>
<thead>
<tr>
<th>Antenna Port</th>
<th>Product Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cable Strand Mount</td>
</tr>
<tr>
<td></td>
<td>(Two Antenna Receive MRC Access and One Backhaul)</td>
</tr>
<tr>
<td>Pole Mount</td>
<td>(Three Antenna Receive MRC Access and One Backhaul)</td>
</tr>
<tr>
<td>1</td>
<td>2.4-GHz receive only</td>
</tr>
<tr>
<td>2</td>
<td>5-GHz transmit and receive</td>
</tr>
<tr>
<td>3</td>
<td>2.4-GHz transmit and receive</td>
</tr>
<tr>
<td>4</td>
<td>No connection</td>
</tr>
<tr>
<td>5</td>
<td>No connection</td>
</tr>
<tr>
<td>6</td>
<td>No connection</td>
</tr>
<tr>
<td>7</td>
<td>2.4-GHz transmit and receive</td>
</tr>
</tbody>
</table>

Follow these steps to connect the antenna to the access point.

1. If necessary, remove the antenna port covers.
2. Using Table 1 as a guide, align the antenna’s N connector with the appropriate 5-GHz antenna port.
3. Gently push the antenna into the port.
4. Tighten the antenna hand tight.
Cisco Aironet 8-dBi Omnidirectional Antenna (AIR-ANT5180V-N)

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Cisco Cellular 2-in-1 Vehicle Mount and Fixed Infrastructure Antenna (ANT-2-4G2-O)

This chapter describes the technical specifications and installation instructions for the Cisco Cellular 2-in-1 Vehicle Mount and Fixed Infrastructure Antenna, hereafter referred to as the antenna. The antenna is a two port antenna with two elements designed to cover the 698–960, 1448–1511, and 1710–2700 MHz cellular bands. The antenna can be mounted on the roof of a vehicle or fixed structure. The antenna meets or exceeds a variety of environmental ruggedization specifications for transportation applications.

CAUTION: Read the information in Safety Precautions before installing or replacing antennas.

The topics included are:

- Antenna Overview
- Technical Specifications
- Installing the Antenna
- Obtaining Documentation and Submitting a Service Request

Antenna Overview

- Antenna Features
- Antenna Model
- Antenna Assembly

Antenna Features

The antenna features:

- Two cellular antenna elements within one radome
- Outdoor and transportation ready
- Roof mount installation
- Dual cellular elements supporting 698–960, 1448–1511 and 1710–2700 MHz
  - Omnidirectional, vertically polarized, MIMO
  - Integrated 2 foot cables with TNC male connectors
- LTE elements are interchangeable, either one can be connected to Main or Aux.
The antenna may require RF extension cables. A shorter 2 foot cable length was selected on LTE WAN to allow you to optimize LTE WAN performance and wireless range. If you require a cable length longer than 2 foot with the antenna, then you would need to select RF extension cables of appropriate length and type.

Thicker RF cables, such as LMR-600, LMR-400, or LMR-240, result in lower loss, higher RF performance and longer range of wireless network than thinner cables such as LMR-195, LMR-200. The trade-off is that thicker cables are more difficult to bend and route.

For optimal performance, the length of thin cables needs to be kept as short as possible. For example, 2 foot and 10 foot lengths of LMR-195 cable at 2700 MHz frequency would have losses of 0.5dB and 2.3dB respectively. In this example at 2700 MHz the area covered by the wireless system with the 10 foot cable is reduced by 34% compared to 2 foot cable. Radius of communication is degraded by 20% in 10 foot vs 2 foot case.

**NOTE**: Loss with the 17 foot GPS cable is compensated by the gain of the active GPS antenna and has little impact on GPS performance.

### Antenna Model

<table>
<thead>
<tr>
<th>Antenna Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANT-2-4G2-O</td>
<td>Cisco Cellular 2-in-1 Vehicle Mount and Fixed Infrastructure Antenna</td>
</tr>
</tbody>
</table>

### Antenna Assembly

**Figure 1**  [Cisco ANT-2-4G2-O Antenna](#)
Figure 2  Cisco ANT-2-4G2-O Mechanical Details

Note: All dimensions are in millimeters [inches] unless explicitly stated otherwise in the drawing.

Technical Specifications

- Radio Frequency Specifications
- Antenna Radiation Patterns
- Environmental and Operational Specifications
- Mechanical Specifications
- Power Specifications
Cisco Cellular 2-in-1 Vehicle Mount and Fixed Infrastructure Antenna (ANT-2-4G2-O)

## Radio Frequency Specifications

### Antenna Radiation Patterns
- 698 MHz Cellular Antenna Radiation Patterns
- 880 MHz Cellular Antenna Radiation Patterns
- 960 MHz Cellular Antenna Radiation Patterns
- 1470 MHz Cellular Antenna Radiation Patterns
- 1710 MHz Cellular Antenna Radiation Patterns
- 2170 MHz Cellular Antenna Radiation Patterns

### Figure 3  Cellular Antenna Radio Frequency Specification

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna type</td>
<td>Dual element, omnidirectional, 2x2 MIMO</td>
</tr>
<tr>
<td>Frequency</td>
<td>- 698 to 960 MHz&lt;br&gt;- 1448 to 1511 MHz&lt;br&gt;- 1710 to 2700 MHz</td>
</tr>
<tr>
<td>Nominal impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>VSWR</td>
<td>- 2.1:1 maximum-698 to 960 MHz&lt;br&gt;- 2.4:1 maximum at 1448 MHz edge, 2.2:1 typical 1448-1511 MHz&lt;br&gt;- 2.0:1 maximum-1710 to 2700 MHz</td>
</tr>
<tr>
<td>Gain</td>
<td>The gain values (dBi) for each frequency range are:&lt;br&gt;- 2.6 dBi typical, 3.8 dBi maximum-698 to 960 MHz&lt;br&gt;- 3.8 dBi typical, 4.3 dBi maximum 1448 to 1511 MHz&lt;br&gt;- 4.6 dBi typical, 5.5 dBi maximum-1710 to 2700 MHz</td>
</tr>
<tr>
<td>Isolation</td>
<td>- 15 dB minimum - 698 to 960 MHz&lt;br&gt;- 20 dB minimum - 1448 to 1511 MHz&lt;br&gt;- 20 dB minimum - 1710 to 2700 MHz</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Antennas were designed and tested to high RF efficiency in all supported cellular bands. Detailed technical specifications can be obtained through your Cisco authorized partner or Cisco account representative.</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linear, Vertical</td>
</tr>
<tr>
<td>Radiation Pattern</td>
<td>Omnidirectional</td>
</tr>
</tbody>
</table>
2700 MHz Cellular Antenna Radiation Patterns
698 MHz Cellular Antenna Radiation Patterns

![Graphs showing radiation patterns for 698 MHz](image)

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (→)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (←)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

880 MHz Cellular Antenna Radiation Patterns

![Graphs showing radiation patterns for 880 MHz](image)

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (→)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (←)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

960 MHz Cellular Antenna Radiation Patterns

![Graphs showing radiation patterns for 960 MHz](image)

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (→)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (←)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>
### 1470 MHz Cellular Antenna Radiation Patterns

**Figure 5  1470 MHz Cellular Antenna Radiation Patterns**

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (—)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (—)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

### 1710 MHz Cellular Antenna Radiation Patterns

**Figure 6  1710 MHz Cellular Antenna Radiation Patterns**

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (—)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (—)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>
Line Color | Description
---|---
Blue (—I) | Port 1
Red (—) | Port 2

2170 MHz Cellular Antenna Radiation Patterns

**Figure 7**  2170 MHz Cellular Antenna Radiation Patterns

Line Color | Description
---|---
Blue (—I) | Port 1
Red (—) | Port 2

2700 MHz Cellular Antenna Radiation Patterns

**Figure 8**  2700 MHz Cellular Antenna Radiation Patterns
Environmental and Operational Specifications

Table 1  Environmental and Operational Specifications for the Cisco ANT-2-4G2-O Antenna

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature range</td>
<td>-40 to 158°F (-40 to 70°C)</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>-40 to 185°F (-40 to 85°C)</td>
</tr>
<tr>
<td>Altitude</td>
<td>15,000 feet. (4.5 km)</td>
</tr>
<tr>
<td>Humidity</td>
<td>5 to 95%</td>
</tr>
<tr>
<td>Vibration, Shock, Thermal, Corrosion, Seismic</td>
<td>Outdoor IP67. Tested to a variety of appropriate industrial, vehicular, transportation, and mil-spec standards.</td>
</tr>
</tbody>
</table>

Mechanical Specifications

Table 2  Mechanical Specifications for the Cisco ANT-2-4G2-O Antenna

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mount style</td>
<td>Roof mount, bulkhead</td>
</tr>
<tr>
<td>Location</td>
<td>Outdoor</td>
</tr>
<tr>
<td>Connector</td>
<td>TNC male</td>
</tr>
<tr>
<td>Cable type</td>
<td>RG-58</td>
</tr>
<tr>
<td>Cable length</td>
<td>2 foot. (61 cm)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>7.1 in. (18.0 cm) diameter, 2.4 in. (6.05 cm) height</td>
</tr>
<tr>
<td>Weight</td>
<td>1.48 lbs (0.67 kg)</td>
</tr>
<tr>
<td>IP rating</td>
<td>IP67</td>
</tr>
</tbody>
</table>
Installing the Antenna

The antenna installation includes the following procedures:

- Contents of the Antenna Kit
- Safety Warnings
- Safety Precautions
- Tools and Equipment Required
- Mounting the Antenna
- Connecting the Antenna to the Router

Contents of the Antenna Kit

The antenna kit contains:

- 1 x Cisco ANT-2-4G2-O antenna

Safety Warnings

**WARNING:** Avoid using or servicing any equipment that has outdoor connections during an electrical storm. There may be a risk of electric shock from lightning. Statement 1088

**WARNING:** Do not work on the system, or connect or disconnect cables, during periods of lightning activity. Statement 1001

**WARNING:** Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.: NFPA 70, National Electrical Code, Article 810; Canada: Canadian Electrical Code, Section 54). Statement 1052

**WARNING:** This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024
WARNING: Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

WARNING: To report a gas leak, do not use a telephone in the vicinity of the leak. Statement 1039

WARNING: This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071. SAVE THESE INSTRUCTIONS.

WARNING: This product is not intended to be directly connected to the Cable Distribution System. Additional regulatory compliance and legal requirements may apply for direct connection to the Cable Distribution System. This product may connect to the Cable Distribution System ONLY through a device that is approved for direct connection. Statement 1078

Safety Precautions

WARNING: Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.

For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!

For your safety, read and follow these safety precautions.

- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

- Find someone to help you—installing an antenna is often a two-person job.

- Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

- Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.

- Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

- When installing your antenna, follow these guidelines:
  - Do not use a metal ladder.
  - Do not work on a wet or windy day.
  - Do dress properly—wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.

- If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.

- If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.

- If an accident should occur with the power lines, call for qualified emergency help immediately.
Tools and Equipment Required

In addition to the parts included in the antenna kit described in the section Contents of the Antenna Kit, you must provide the following tool to install the antenna on the router:

- Open-ended wrench
- Electric drill

NOTE: This list does not include the tools and equipment required to assemble and erect the tower, mast, or other structure you intend to mount your antenna on.

Mounting the Antenna

NOTE: A clean, flat surface at least 20 x 20 cm (8 x 8 in.) area is required for mounting the antenna.

Follow these instructions to mount the antenna:

1. Mark the desired location where you plan to mount the antenna and create a hole through the surface. The diameter of the hole must be at least 0.75 in. (1.91 cm).

2. Thread the cables through the hole and insert the aluminum stud on the underside of the antenna into the hole. Ensure that the foam gasket on the underside of the antenna sits flush against the mounting surface.

3. Inside the vehicle, place the rubber sealing washer around the stud. Then place the metal washer and the metal nut onto the stud. Tighten the nut.

Connecting the Antenna to the Router

To attach the router-end of the cable to your router, please see the respective hardware guide for your router.

NOTE: Coaxial cable loses efficiency as the frequency increases, resulting in signal loss. The cable should be kept as short as possible because cable length also determines the amount of signal loss—the longer the cable length or run, the greater the loss.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly What’s New in Cisco Product Documentation, which also lists all new and revised Cisco technical documentation, at:


Subscribe to the What's New in Cisco Product Documentation as an RSS (Really Simple Syndication) feed, and set it so content is delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS Version 2.0.

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Cisco Dual Port, Dual Band Vehicle Mount and Fixed Infrastructure WLAN Antenna (ANT-2-WLAN-D-O)

This chapter describes the technical specifications and installation instructions for the Cisco Dual Port, Dual Band Outdoor Vehicle Mount and Fixed Infrastructure WLAN Antenna, hereafter referred to as the antenna. The antenna is a dual-port antenna designed to cover 2.4 GHz and 5 GHz WLAN bands. The antenna can be mounted on the roof of a vehicle or fixed structure. The antenna meets or exceeds a variety of environmental ruggedization specifications for transportation applications.

**CAUTION:** Read the information in *Safety Precautions* before installing or replacing antennas.

The topics included are:

- Antenna Overview
- Technical Specifications
- Installing the Antenna
- Obtaining Documentation and Submitting a Service Request

**Antenna Overview**

- Antenna Features
- Antenna Model
- Antenna Assembly

**Antenna Features**

The antenna features:

- 2.4 and 5 GHz dual band support
- Omnidirectional, vertically polarized, 2x2 MIMO
- Outdoor and transportation ready
- Roof mount installation
- Integrated 3 foot long LMR-240 cables with RP-TNC plug connectors
- The two WiFi elements are interchangeable.
Antenna Model

<table>
<thead>
<tr>
<th>Antenna Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANT-2-WLAN-D-O</td>
<td>Cisco Dual Port, Dual Band Vehicle Mount and Fixed Infrastructure WLAN Antenna</td>
</tr>
</tbody>
</table>

Antenna Assembly

Figure 1  Cisco ANT-2-WLAN-D-O Antenna

Details for the ANT-2-WLAN-D-O are shown in Figure 2.
Figure 2   ANT-2-WLAN-D-O Mechanical Details

Note: All dimensions are in millimeters [inches] unless explicitly stated otherwise in the drawing.

Technical Specifications

- Radio Frequency Specifications
- Antenna Radiation Patterns
- Environmental and Operational Specifications
- Mechanical Specifications
- Power Specifications
Radio Frequency Specifications

**Figure 3  Antenna Radio Frequency Specification**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna type</td>
<td>Dual element, omnidirectional, 2x2 MIMO</td>
</tr>
<tr>
<td>Connectors and cables</td>
<td>Quantity: 2 x 3foot LMR-240 cables with RP-TNC(plug) connectors</td>
</tr>
<tr>
<td>Frequency</td>
<td>2400 to 2500 MHz</td>
</tr>
<tr>
<td></td>
<td>4900 to 5875 MHz</td>
</tr>
<tr>
<td>Nominal impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>VSWR</td>
<td>2.0:1 Maximum</td>
</tr>
<tr>
<td>Gain</td>
<td>The gain values (dBi) for each frequency range are:</td>
</tr>
<tr>
<td></td>
<td>4.0 dBi typical, 5.1 dBi maximum at 2400 to 2500 MHz</td>
</tr>
<tr>
<td></td>
<td>6.5 dBi typical, 7.0 dBi maximum at 4900 to 5875 MHz</td>
</tr>
<tr>
<td>3 dB beamwidth (vertical plane)</td>
<td>40 degrees-2400 to 2500 MHz</td>
</tr>
<tr>
<td></td>
<td>30 degrees-4900 to 5875 MHz</td>
</tr>
<tr>
<td>3 dB beamwidth (horizontal plane)</td>
<td>Omnidirectional</td>
</tr>
<tr>
<td>Isolation</td>
<td>15 dB minimum at 2400 to 2500 MHz</td>
</tr>
<tr>
<td></td>
<td>15 dB minimum at 4900 to 5875 MHz</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linear, Vertical</td>
</tr>
<tr>
<td>Radiation Pattern</td>
<td>Omnidirectional</td>
</tr>
</tbody>
</table>

Antenna Radiation Patterns

- 2.46 GHz Antenna Radiation Patterns
- 4.9 GHz Antenna Radiation Pattern
- 5.55 GHz Antenna Radiation Patterns
- 5.9 GHz Antenna Radiation Patterns

2.46 GHz Antenna Radiation Patterns

- 2.46 GHz Antenna Radiation Pattern–Horizontal Plane, page 273
- 2.46 GHz Antenna Radiation Patterns–Vertical Plane
2.46 GHz Antenna Radiation Pattern-Horizontal Plane

Figure 4  2.46 GHz Antenna Radiation Pattern-Horizontal Plane

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (—)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (—)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

2.46 GHz Antenna Radiation Patterns-Vertical Plane

Figure 5  2.46 GHz Antenna Radiation Patterns-Vertical Plane
<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (→)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (←)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

4.9 GHz Antenna Radiation Pattern

- 4.9 GHz Antenna Radiation Pattern—Horizontal Plane
- 4.9 GHz Antenna Radiation Patterns—Vertical Plane
4.9 GHz Antenna Radiation Pattern—Horizontal Plane

Figure 6 4.9 GHz Antenna Radiation Pattern—Horizontal Plane

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (—)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (——)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

4.9 GHz Antenna Radiation Patterns—Vertical Plane

Figure 7 4.9 GHz Antenna Radiation Patterns—Vertical Plane
<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (−)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (−)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

5.55 GHz Antenna Radiation Patterns

- 5.55 GHz Antenna Radiation Pattern–Horizontal Plane
- 5.55 GHz Antenna Radiation Patterns–Vertical Plane
5.55 GHz Antenna Radiation Pattern-Horizontal Plane

**Figure 8  5.55 GHz Antenna Radiation Pattern-Horizontal Plane**

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (—)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (—)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

5.55 GHz Antenna Radiation Patterns-Vertical Plane

**Figure 9  5.55 GHz Antenna Radiation Patterns-Vertical Plane**
## 5.9 GHz Antenna Radiation Patterns

- 5.9 GHz Antenna Radiation Pattern–Horizontal Plane
- 5.9 GHz Antenna Radiation Patterns–Vertical Plane
5.9 GHz Antenna Radiation Pattern—Horizontal Plane

**Figure 10** 5.9 GHz Antenna Radiation Pattern—Horizontal Plane

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (−)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (−)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

5.9 GHz Antenna Radiation Patterns—Vertical Plane

**Figure 11** 5.9 GHz Antenna Radiation Patterns—Vertical Plane
Line Color | Description
-----------|-------------
Blue (⁻)  | Port 1
Red (⁻)  | Port 2

Environmental and Operational Specifications

Table 1  Environmental and Operational Specifications for the Cisco ANT-2-WLAN-D-O Antenna

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature range</td>
<td>-40 to 176°F (−40 to 80°C)</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>-40 to 185°F (−40 to 85°C)</td>
</tr>
<tr>
<td>Altitude</td>
<td>15,000 feet. (4.5 km)</td>
</tr>
<tr>
<td>Humidity</td>
<td>5 to 95%</td>
</tr>
<tr>
<td>Vibration, Shock, Thermal, Corrosion, Seismic</td>
<td>Outdoor IP67. Tested to a variety of appropriate industrial, vehicular, transportation, and mil-spec standards.</td>
</tr>
</tbody>
</table>

Mechanical Specifications

Table 2  Mechanical Specifications for the Cisco ANT-2-WLAN-D-O Antenna

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mount style</td>
<td>Roof mount, bulkhead</td>
</tr>
<tr>
<td>Location</td>
<td>Outdoor</td>
</tr>
<tr>
<td>Connector</td>
<td>Reverse Polarity TNC (RP-TNC) plug</td>
</tr>
<tr>
<td>Cable type</td>
<td>RG-58</td>
</tr>
<tr>
<td>Cable length</td>
<td>2 foot. (61 cm)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>5.0 in. (12.7 cm) diameter, 1.5 in. (3.9 cm) height</td>
</tr>
<tr>
<td>Weight</td>
<td>0.584 lbs (0.265 kg)</td>
</tr>
<tr>
<td>IP rating</td>
<td>IP67</td>
</tr>
<tr>
<td>Radome</td>
<td>Polycarbonate, UV resistant, black</td>
</tr>
<tr>
<td>Material substance compliance</td>
<td>ROHS compliant</td>
</tr>
</tbody>
</table>

Power Specifications

Table 3  Power Specifications for the Cisco ANT-2-WLAN-D-O Antenna

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>Maximum input power per port</td>
<td>25 watts</td>
</tr>
</tbody>
</table>

Installing the Antenna
The antenna installation includes the following procedures:

- Contents of the Antenna Kit
- Safety Warnings
- Safety Precautions
- Tools and Equipment Required
- Mounting the Antenna
- Connecting the Antenna to the Router

Contents of the Antenna Kit

The antenna kit contains:

- 1 x Cisco ANT-2-WLAN-D-O antenna

Safety Warnings

**WARNING:** Avoid using or servicing any equipment that has outdoor connections during an electrical storm. There may be a risk of electric shock from lightning. Statement 1088

**WARNING:** Do not work on the system, or connect or disconnect cables, during periods of lightning activity. Statement 1001

**WARNING:** Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.:NFPA 70, National Electrical Code, Article 810, Canada:Canadian Electrical Code, Section 54). Statement 1052

**WARNING:** This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024

**WARNING:** Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

**WARNING:** To report a gas leak, do not use a telephone in the vicinity of the leak. Statement 1039

**WARNING:** This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071. SAVE THESE INSTRUCTIONS.

**WARNING:** This product is not intended to be directly connected to the Cable Distribution System. Additional regulatory compliance and legal requirements may apply for direct connection to the Cable Distribution System. This product may connect to the Cable Distribution System ONLY through a device that is approved for direct connection. Statement 1078

Safety Precautions

**WARNING:** Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.
For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!

For your safety, read and follow these safety precautions.

- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

- Find someone to help you—installing an antenna is often a two-person job.

- Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

- Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.

- Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

- When installing your antenna, follow these guidelines:
  - Do not use a metal ladder.
  - Do not work on a wet or windy day.
  - Do dress properly—wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.

- If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.

- If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.

- If an accident should occur with the power lines, call for qualified emergency help immediately.

Tools and Equipment Required

In addition to the parts included in the antenna kit described in the section Contents of the Antenna Kit, you must provide the following tool to install the antenna on the router:

- Open-ended wrench
- Electric drill

NOTE: This list does not include the tools and equipment required to assemble and erect the tower, mast, or other structure you intend to mount your antenna on.

Mounting the Antenna

NOTE: A clean, flat surface at least 15 x 15 cm (6 x 6 in.) in area is required for mounting the antenna.

Follow these instructions to mount the antenna:

1. Mark the desired location where you plan to mount the antenna and create a hole through the surface. The diameter of the hole must be at least 0.75 in. (1.91 cm).
2. Thread the cables through the hole and insert the aluminum stud on the underside of the antenna into the hole. Ensure that the foam gasket on the underside of the antenna sits flush against the mounting surface.

3. Inside the vehicle, place the rubber sealing washer around the stud. Then place the metal washer and the metal nut onto the stud. Tighten the nut.

Connecting the Antenna to the Router

To attach the router-end of the cable to your router, please see the respective hardware guide for your device.

**NOTE:** Coaxial cable loses efficiency as the frequency increases, resulting in signal loss. The cable should be kept as short as possible because cable length also determines the amount of signal loss—the longer the cable length or run, the greater the loss.

Obtaining Documentation and Submitting a Service Request

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Subscribe to the *What's New in Cisco Product Documentation* as an RSS (Really Simple Syndication) feed, and set it so content is delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS Version 2.0.

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Cisco Cellular and GPS 3-in-1 Vehicle Mount and Fixed Infrastructure Antenna (ANT-3-4G2G1-O)

This chapter describes the technical specifications and installation instructions for the Cisco Cellular 3-in-1 Vehicle Mount and Fixed Infrastructure Antenna, hereafter referred to as the antenna. The antenna is a three port antenna with two elements designed to cover the 698-960, 1448-1511 and 1710-2700 MHz cellular bands and one GPS element. The antenna can be mounted on the roof of a vehicle or fixed structure. The antenna meets or exceeds a variety of environmental ruggedization specifications for transportation applications.

CAUTION: Read the information in Safety Precautions before installing or replacing antennas.

The topics included are:
- Antenna Overview
- Technical Specifications
- Installing the Antenna
- Obtaining Documentation and Submitting a Service Request

Antenna Overview
- Antenna Features
- Antenna Model
- Antenna Assembly

Antenna Features

The antenna features:
- Three antenna elements within one radome: two cellular and one GPS
- Outdoor and transportation ready
- Roof mount installation
- Dual cellular elements supporting 698-960, 1448-1511 and 1710-2700 MHz
  - Omnidirectional, vertically polarized, MIMO
  - Integrated 2 foot cables with TNC male connectors
  - LTE elements are interchangeable, either one can be connected to Main or Aux
- Active GPS antenna has integrated 17 foot cable with SMA male connector
The antenna may require RF extension cables. A shorter 2 foot cable length was selected on LTE WAN to allow you to optimize LTE WAN performance and wireless range. If you require a cable length longer than 2 feet with the antenna, then select RF extension cables of appropriate length and type.

Thicker RF cables, such as LMR-600, LMR-400, or LMR-240 result in lower loss, higher RF performance and longer range of wireless network than thinner cables such as LMR-195, LMR-200. The trade-off is that thicker cables are more difficult to bend and route.

For optimal performance, the length of thin cables needs to be kept as short as possible. For example, 2 foot and 10 foot lengths of LMR-195 cable at 2700 MHz frequency would have losses of 0.5dB and 2.3dB respectively. In this example at 2700 MHz the area covered by the wireless system with the 10 foot cable is reduced by 34% compared to 2 foot cable. Radius of communication is degraded by 20% in 10 foot vs 2 foot case.

### Antenna Model

<table>
<thead>
<tr>
<th>Antenna Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANT-3-4G2G1-O</td>
<td>Cisco Cellular and GPS 3-in-1 Vehicle Mount and Fixed Infrastructure Antenna</td>
</tr>
</tbody>
</table>

### Antenna Assembly

**Figure 1**  
Cisco ANT-3-4G2G1-O Antenna

**NOTE:** GPS cable (center) is 17 feet. It is shown shorter in the Figure for illustration purposes.
Figure 2  Cisco ANT-3-4G2G1-O Mechanical Details

Note: All dimensions are in millimeters [inches] unless explicitly stated otherwise in the drawing.

Technical Specifications

- Radio Frequency Specifications
- Environmental Specifications
- GPS Antenna Radiation Patterns
- Environmental Specifications
- Mechanical Specifications
- Power Specifications

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Radio Frequency Specifications

**Table 1  Cellular Antenna Radio Frequency Specification**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna type</td>
<td>Dual element, omnidirectional, 2x2 MIMO</td>
</tr>
<tr>
<td>Frequency</td>
<td>- 698 to 960 MHz</td>
</tr>
<tr>
<td></td>
<td>- 1448 to 1511 MHz</td>
</tr>
<tr>
<td></td>
<td>- 1710 to 2700 MHz</td>
</tr>
<tr>
<td>Nominal impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>VSWR</td>
<td>- 2.1:1 maximum at 698 to 960 MHz</td>
</tr>
<tr>
<td></td>
<td>- 2.4:1 maximum at 1448 MHz edge, 2.2:1 typical 1455 to 1511 MHz</td>
</tr>
<tr>
<td></td>
<td>- 2.0:1 maximum at 1710 to 2700 MHz</td>
</tr>
<tr>
<td>Gain</td>
<td>The gain values (dBi) for each frequency range are:</td>
</tr>
<tr>
<td></td>
<td>- 2.6 dBi typical, 3.8 dBi maximum-698 to 960 MHz</td>
</tr>
<tr>
<td></td>
<td>- 3.8 dBi typical, 4.3 dBi maximum-1448 to 1551 MHz</td>
</tr>
<tr>
<td></td>
<td>- 4.6 dBi typical, 5.5 dBi maximum-1710 to 2700 MHz</td>
</tr>
<tr>
<td>Isolation</td>
<td>- 14 dB minimum-698 to 960 MHz</td>
</tr>
<tr>
<td>cellular to cellular (Main to Aux)</td>
<td>20 dB minimum-1448 to 1551 MHz</td>
</tr>
<tr>
<td></td>
<td>20 dB minimum-1710 to 2700 MHz</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linear, Vertical</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Antennas were designed and tested to high RF efficiency in all supported cellular bands. Detailed technical specifications can be obtained through your Cisco authorized partner or Cisco account representative.</td>
</tr>
<tr>
<td>Radiation Pattern</td>
<td>Omnidirectional</td>
</tr>
</tbody>
</table>

**Table 2  GPS Antenna Radio Frequency Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna type</td>
<td>Patch</td>
</tr>
<tr>
<td>Frequency</td>
<td>1575.42 ± 1 MHz (GPS L1)</td>
</tr>
<tr>
<td>Nominal impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>VSWR</td>
<td>2.0:1 maximum</td>
</tr>
<tr>
<td>Amplifier Gain</td>
<td>27 dB</td>
</tr>
<tr>
<td>DC current</td>
<td>20 mA maximum</td>
</tr>
<tr>
<td>Specification</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>DC voltage</td>
<td>2.7 to 12 V</td>
</tr>
<tr>
<td>Isolation, cellular to GPS</td>
<td>10 dB minimum. 1574.42 to 1576.42 MHz.</td>
</tr>
<tr>
<td></td>
<td>Cellular coexistence tested over multiple bands, GPS includes coexistence filters.</td>
</tr>
<tr>
<td>Polarization</td>
<td>RHCP</td>
</tr>
<tr>
<td>Radiation pattern</td>
<td>Hemispherical</td>
</tr>
</tbody>
</table>
Environmental Specifications

Table 3  Environmental Specifications for the Cisco ANT-3-4G2G1-O Antenna

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature range</td>
<td>-40 to 158°F (−40 to 70°C)</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>-40 to 185°F (−40 to 85°C)</td>
</tr>
<tr>
<td>Altitude</td>
<td>15,000 feet (4.5 km)</td>
</tr>
<tr>
<td>Humidity</td>
<td>5 to 95%</td>
</tr>
<tr>
<td>Vibration, Shock, Thermal, Corrosion, Seismic</td>
<td>Outdoor IP67. Tested to a variety of appropriate industrial, vehicular, transportation, and mil-spec standards.</td>
</tr>
</tbody>
</table>

Mechanical Specifications

Table 4  Mechanical and Operational Specifications for the Cisco ANT-3-4G2G1-O Antenna

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mount style</td>
<td>Roof mount, bulkhead</td>
</tr>
<tr>
<td>Location</td>
<td>Outdoor</td>
</tr>
<tr>
<td>Connector</td>
<td>Cellular – TNC male</td>
</tr>
<tr>
<td></td>
<td>GPS – SMA male</td>
</tr>
<tr>
<td>Cable type</td>
<td>Cellular – RG-58</td>
</tr>
<tr>
<td></td>
<td>GPS – RG-174</td>
</tr>
<tr>
<td>Cable length</td>
<td>Cellular – 2 foot. (61 cm)</td>
</tr>
<tr>
<td></td>
<td>GPS – 17 foot. (518 cm)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>7.1 in. (18.0 cm) diameter, 2.4 in. (6.05 cm) height</td>
</tr>
<tr>
<td>Weight</td>
<td>1.48 lbs (0.67 kg)</td>
</tr>
<tr>
<td>IP rating</td>
<td>IP67</td>
</tr>
<tr>
<td>Radome</td>
<td>Polycarbonate, UV resistant, black</td>
</tr>
<tr>
<td>Material substance compliance</td>
<td>ROHS compliant</td>
</tr>
</tbody>
</table>

Power Specifications

Table 5  Power Specifications for the Cisco ANT-3-4G2G1-O Antenna

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>Maximum input power per port</td>
<td>5 watts</td>
</tr>
</tbody>
</table>

Antenna Radiation Patterns

- 698 MHz Cellular Antenna Radiation Patterns
- 880 MHz Cellular Antenna Radiation Patterns
- 960 MHz Cellular Antenna Radiation Patterns
- 1470 MHz Cellular Antenna Radiation Patterns
- 1710 MHz Cellular Antenna Radiation Patterns
- 2170 MHz Cellular Antenna Radiation Patterns
- 2700 MHz Cellular Antenna Radiation Patterns
- 1575 MHz GPS Antenna Radiation Patterns

698 MHz Cellular Antenna Radiation Patterns
880 MHz Cellular Antenna Radiation Patterns

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (→)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (→)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

960 MHz Cellular Antenna Radiation Patterns

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (→)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (→)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>
1470 MHz Cellular Antenna Radiation Patterns

Figure 4  1470 MHz Cellular Antenna Radiation Patterns

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (−)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (−)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

1710 MHz Cellular Antenna Radiation Patterns

Figure 5  1710 MHz Cellular Antenna Radiation Patterns

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (−)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (−)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

2170 MHz Cellular Antenna Radiation Patterns

Figure 6  2170 MHz Cellular Antenna Radiation Patterns
### 2700 MHz Cellular Antenna Radiation Patterns

**Figure 7  2700 MHz Cellular Antenna Radiation Patterns**

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (-)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (-)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

### GPS Antenna Radiation Patterns

**1575 MHz GPS Antenna Radiation Patterns**

**Figure 8  1575 MHz GPS Antenna Radiation Patterns**
Installing the Antenna

The antenna installation includes the following procedures:

-Contents of the Antenna Kit
- Safety Warnings
- Safety Precautions
- Tools and Equipment Required
- Mounting the Antenna
- Connecting the Antenna to the Router

Contents of the Antenna Kit

The antenna kit contains:

- 1 x Cisco ANT-3-4G2G1-O antenna

Safety Warnings

**WARNING:** Avoid using or servicing any equipment that has outdoor connections during an electrical storm. There may be a risk of electric shock from lightning. Statement 1088

**WARNING:** Do not work on the system, or connect or disconnect cables, during periods of lightning activity. Statement 1001
**WARNING:** Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.: NFPA 70, National Electrical Code, Article 810, Canada: Canadian Electrical Code, Section 54). Statement 1052

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**WARNING:** To report a gas leak, do not use a telephone in the vicinity of the leak. Statement 1039

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**Safety Precautions**

**WARNING:** Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.

For your safety, and to help you achieve a good installation, please read and follow these safety precautions. **They may save your life!**

For your safety, read and follow these safety precautions.

- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

- Find someone to help you—installing an antenna is often a two-person job.

- Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

- Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.

- Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

- When installing your antenna, follow these guidelines:
  - Do not use a metal ladder.
  - Do not work on a wet or windy day.
  - Do dress properly—wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.
If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.

If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.

If an accident should occur with the power lines, call for qualified emergency help immediately.

Tools and Equipment Required

In addition to the parts included in the antenna kit described in the section Contents of the Antenna Kit, you must provide the following tool to install the antenna on the router:

- Open-ended wrench
- Electric drill

**NOTE:** This list does not include the tools and equipment required to assemble and erect the tower, mast, or other structure you intend to mount your antenna on.

Mounting the Antenna

**NOTE:** A clean, flat surface at least 20 x 20 cm (8 x 8 in.) in area is required for mounting the antenna.

Follow these instructions to mount the antenna:

1. Mark the desired location where you plan to mount the antenna and create a hole through the surface. The diameter of the hole must be at least 0.75 in. (1.91 cm).
2. Thread the cables through the hole and insert the aluminum stud on the underside of the antenna into the hole. Ensure that the foam gasket on the underside of the antenna sits flush against the mounting surface.
3. Inside the vehicle, place the rubber sealing washer around the stud. Then place the metal washer and the metal nut onto the stud. Tighten the nut.

Connecting the Antenna to the Router

To attach the router-end of the cable to your router, please see the Hardware Installation Guide for your particular device.

**NOTE:** Coaxial cable loses efficiency as the frequency increases, resulting in signal loss. The cable should be kept as short as possible because cable length also determines the amount of signal loss—the longer the cable length or run, the greater the loss.

Obtaining Documentation and Submitting a Service Request

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Subscribe to the What’s New in Cisco Product Documentation as an RSS (Really Simple Syndication) feed, and set it so content is delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS Version 2.0.
The Multiband Panel Outdoor 3G antenna is designed to cover cellular 3G bands. This document provides the antenna specifications and mounting instructions.

Caution: Read the information in Safety Warnings before installing or replacing antennas.

This chapter covers the following topics:

- Technical Specifications
- Contents of the Antenna Kit
- Safety Warnings
- Antenna Installation
- Connecting the Lightning Arrestor
- Connecting the Antenna to the Router
- Obtaining Documentation and Submitting a Service Request

Technical Specifications

The Multiband Panel Outdoor 3G directional panel antenna features the following:

- Flame retardant
- Low-profile housing
- Indoor and outdoors
- Adjustable mounting brackets
- Type N female connector
RF Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range</td>
<td>806 to 960 MHz</td>
</tr>
<tr>
<td></td>
<td>1710 to 2170 MHz</td>
</tr>
<tr>
<td>Nominal gain</td>
<td>10 dBi (806 to 960 MHz)</td>
</tr>
<tr>
<td></td>
<td>11 dBi (1710 to 2170 MHz)</td>
</tr>
<tr>
<td>3 dB horizontal beamwidth</td>
<td>40 degrees (806 to 960 MHz)</td>
</tr>
<tr>
<td></td>
<td>30 degrees (1710 to 2170 MHz)</td>
</tr>
<tr>
<td>3 dB vertical beamwidth</td>
<td>52 degrees (806 to 960 MHz)</td>
</tr>
<tr>
<td></td>
<td>66 degrees (1710 to 2170 MHz)</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linear</td>
</tr>
<tr>
<td>Nominal impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>Nominal VSWR</td>
<td>&lt; 1.8:1</td>
</tr>
<tr>
<td>Front to back ratio</td>
<td>&gt;/= 25</td>
</tr>
<tr>
<td>Radiation Pattern</td>
<td>Directional</td>
</tr>
</tbody>
</table>

Mechanical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Directional panel</td>
</tr>
<tr>
<td>Mount style</td>
<td>Pipe or wall mount, adjustable mount</td>
</tr>
<tr>
<td>Environment</td>
<td>Outdoor</td>
</tr>
<tr>
<td>Connector</td>
<td>Type N female</td>
</tr>
<tr>
<td>Antenna length (height)</td>
<td>14.5” x 1” (36.8 cm x 2.45 cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>3.5 lbs (1.6 kg)</td>
</tr>
<tr>
<td>Dimensions (height x outside dimensions)</td>
<td>14.5” x 14.5” x 1.75” (340 x 340 x 30 mm)</td>
</tr>
<tr>
<td>Temperature Range (Operating)</td>
<td>-40 to 185-degrees F (-40 to 85-degrees C)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40 to 185-degrees F (-40 to 85-degrees C)</td>
</tr>
</tbody>
</table>
The Multiband Panel Outdoor 3G antenna has Azimuth radiation patterns:

**Figure 2**  Outdoor 3G Antenna Radiation Patterns

![AMPS Azimuth](image1.png)  ![PCS Azimuth](image2.png)

**Contents of the Antenna Kit**

The contents of the multi-purpose integrated antenna are listed in the following table:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Power</td>
<td>20 watts</td>
</tr>
<tr>
<td>Radome material</td>
<td>UL94-V0 ASA radome</td>
</tr>
</tbody>
</table>
Safety Warnings

**WARNING:** Avoid using or servicing any equipment that has outdoor connections during an electrical storm. There may be a risk of electric shock from lightning. Statement 1088

**WARNING:** Do not work on the system, or connect or disconnect cables, during periods of lightning activity. Statement 1001

**WARNING:** Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.:NFPA 70, National Electrical Code, Article 810, Canada:Canadian Electrical Code, Section 54). Statement 1052

**WARNING:** This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024

**WARNING:** Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

**WARNING:** To report a gas leak, do not use a telephone in the vicinity of the leak. Statement 1039

**WARNING:** This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071. **SAVE THESE INSTRUCTIONS.**

**WARNING:** This product is not intended to be directly connected to the Cable Distribution System. Additional regulatory compliance and legal requirements may apply for direct connection to the Cable Distribution System. This product may connect to the Cable Distribution System ONLY through a device that is approved for direct connection. Statement 1078

**WARNING:** This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.

Safety Precautions

Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.
WARNING: For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!

For your safety, read and follow these safety precautions.

- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.
- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.
- Find someone to help you—installing an antenna is often a two-person job.
- Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.
- Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.
- Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.
- When installing your antenna, follow these guidelines:
  - Do not use a metal ladder.
  - Do not work on a wet or windy day.
  - Do dress properly—wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.
- If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.
- If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.
- If an accident should occur with the power lines, call for qualified emergency help immediately.

Antenna Installation

The antenna installation includes the following procedures:

- Tools and Equipment Required
- Installing the Antenna

Tools and Equipment Required

In addition to the parts included in the antenna kit described in the section Contents of the Antenna Kit, you must provide the following tool to install the antenna on the router:

- A flathead screwdriver
- 3/4 in. open-end wrench
- LMR-400 with male end-to-end RF cable (weatherized)
Coax seal

**Note:** This list does not include the tools and equipment required to assemble and erect the tower, mast, or other structure you intend to mount your antenna on.

### Installing the Antenna

Follow these instructions to install the antenna:

1. Choose the mounting polarization configuration that you prefer.

   - **Note:** Your connector type, location and quantity might differ from what is shown.

2. Attach the antenna mount bracket to the back of the antenna by using two sets of flat washers, lock washers, and hex nuts. Tighten the nut to a torque rating of 55 in-lbf (6.2 Nm).
3. Attach the elevation adjustable bracket to the mount bracket using two sets of carriage bolts, washers, lock washers, and hex nuts. Position the bolts so the carriage bolt square holes are positioned on the inside. Do not tighten fully. Allow the bracket to move freely.

4. Position the azimuth adjustable (pipe) bracket to the pipe with the flanges away from the pipe. Secure each bracket to the pipe first by routing the band clamps around the pipe, then through the two holes. Tighten to a maximum torque rating.
5. Attach the antenna assembly to the installed azimuth bracket. Position each of the two flanges on elevation adjustable bracket (on the antenna) over the flanges on the azimuth (pipe) bracket.
6. Adjust to the desired azimuth and elevation angles. Tighten all nuts and bolts to a torque rating of 55 in-lbf.

7. Attach the lightning arrestor to the router.

8. Attach the RF cable to the antenna by connecting the ends of the LMR-400 cables to the two receptacles on the rear of the antenna panel.

**NOTE:** The 3G panel has only one connector per antenna.
9. Seal the cable connections on the router and the back of the antenna by using weatherproof sealing tape (coax seal) at the connector junction. Start wrapping at the top of the antenna connector, wrap downward 3 times and end about 2 inches downward from the center of the connector junction. Then wrap upwards another 3 times to reach the top of the antenna connector.

10. To attach the router-end of the cable to your device, please refer to the appropriate Hardware Installation Procedures for the model of hardware you are installing. Links to hardware installation guides and other information may be found in Chapter 1, “Additional Information”.

Connecting the Lightning Arrestor

To install a lightning-protection device, please refer to the appropriate Hardware Installation Procedures for the model of hardware you are installing. Links to hardware installation guides and other information may be found in Chapter 1, “Additional Information”.

Connecting the Antenna to the Router

To attach the router-end of the cable to your device, please refer to the appropriate Hardware Installation Procedures for the model of hardware you are installing. Links to hardware installation guides and other information may be found in Chapter 1, “Additional Information”.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly What’s New in Cisco Product Documentation, which also lists all new and revised Cisco technical documentation, at:

Subscribe to the *What's New in Cisco Product Documentation* as an RSS (Really Simple Syndication) feed, and set it so content is delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS Version 2.0.

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Cisco Multiband Indoor 4G Volcano Antenna (ANT-4G-CM-IN-TNC)

This document describes the Cisco Multiband Indoor 4G Ceiling-mount Volcano Antenna. It supports frequencies of 698 to 960 MHz, 1575 MHz, and 1710 to 2700 MHz for the GSM, DCS, UMTS, and LTE/WiMAX frequency bands. In addition, this document provides the antenna specifications and mounting instructions of the antenna.

CAUTION: Read the information in Overview before installing or replacing antennas.

This chapter covers the following topics:

- Technical Specifications
- Contents of the Antenna Kit
- Installation Requirements
- Safety Warnings
- Antenna Installation
- Obtaining Documentation and Submitting a Service Request

Technical Specifications

The 4G Volcano Antenna features the following:

- Indoor ceiling mount
- Radiation pattern shaped to perform optimally for a ceiling-mount antenna
- Low-profile, aesthetically neutral housing
- Performance optimized using proprietary RF optimization tools
- Excellent flame rating
Figure 1 4G Volcano Antenna

RF Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range</td>
<td>698 to 960 MHz</td>
</tr>
<tr>
<td></td>
<td>1575 MHz</td>
</tr>
<tr>
<td></td>
<td>1710 to 2700 MHz</td>
</tr>
<tr>
<td>Peak gain</td>
<td>1 dBi (698 to 960 MHz)</td>
</tr>
<tr>
<td></td>
<td>2 dBi (1575 MHz)</td>
</tr>
<tr>
<td></td>
<td>3 dBi (1710 to 2700 MHz)</td>
</tr>
<tr>
<td>VSWR</td>
<td>2.0:1 (698 to 960 MHz)</td>
</tr>
<tr>
<td></td>
<td>2.5:1 (1575 MHz)</td>
</tr>
<tr>
<td></td>
<td>2.0:1 (1710 to 2700 MHz)</td>
</tr>
<tr>
<td>H-plane (3 dB beamwidth)</td>
<td>Omnidirectional</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Antennas were designed and tested to high RF efficiency in all supported cellular bands. Detailed technical specifications can be obtained through your Cisco authorized partner or Cisco account representative.</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linear, vertical</td>
</tr>
</tbody>
</table>

Mechanical Specifications
Cisco Multiband Indoor 4G Volcano Antenna (ANT-4G-CM-IN-TNC)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Omnidirectional</td>
</tr>
<tr>
<td>Mount Style</td>
<td>Ceiling mount</td>
</tr>
<tr>
<td>Environment</td>
<td>Indoor</td>
</tr>
<tr>
<td>Dimensions</td>
<td>Diameter 199 mm x height 86 mm</td>
</tr>
<tr>
<td>RF connector</td>
<td>TNC (m)</td>
</tr>
<tr>
<td>Cable</td>
<td>305 mm, plenum rated</td>
</tr>
<tr>
<td>Enclosure</td>
<td>PC/ABS, UV stable</td>
</tr>
<tr>
<td>Antenna weight</td>
<td>0.34 kg</td>
</tr>
<tr>
<td>Power</td>
<td>3 watts</td>
</tr>
<tr>
<td>Mounting</td>
<td>Ceiling mount (flush), screws, anchors, threaded stem</td>
</tr>
<tr>
<td>Nominal impedance</td>
<td>50 ohm</td>
</tr>
<tr>
<td>Operational temperature</td>
<td>-22 to 158 degrees F (-30 to 70 degrees C)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40 to 185 degrees F (-40 to 85 degrees C)</td>
</tr>
<tr>
<td>Material substance compliance</td>
<td>RoHS 6/6</td>
</tr>
<tr>
<td>Flammability rating</td>
<td>UL-94V0 materials</td>
</tr>
</tbody>
</table>

**Radiation Patterns**

The following graphics show the radiation patterns of the Volcano antenna for the supported frequency.
Contents of the Antenna Kit

The Cisco Multiband Indoor 4G Ceiling-mount Volcano Antenna Kit contains the following items:
Ceiling-mount Volcano antenna, with integrated TNC cable
- Antenna bracket
- Flat washer
- Curved spring washer
- Mounting nut
- Three #6 x 1-1/4” mounting screws with anchors
- Three self-adhesive screw covers

Installation Requirements

Antenna Connections

Before you install or replace antennas, make sure the router is:

- Powered off
- Disconnected from all power sources
- Disconnected from the Field Area Network (FAN)
- Removed from a pole-top installation

Optimum Performance

Antennas transmit and receive radio signals which are susceptible to RF obstructions and common sources of interference that can reduce throughput and range of the device to which they are connected. Follow these guidelines to ensure the best possible performance:

- Keep the antenna away from metal obstructions such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use a rigid conduit to lower the antenna away from these obstructions.

- The density of the materials used in surrounding buildings’ construction impacts antenna signal strength. Consider the following
  - Signals penetrate paper and vinyl walls with little change to signal strength.
  - Signals penetrate only one or two solid and pre-cast concrete walls without degrading signal strength.
  - Signals penetrate three or four concrete and wood block walls without degrading signal strength.
  - Signals penetrate five or six walls constructed of drywall or wood without degrading signal strength.
  - Signals are likely to reflect off a thick metal wall and not penetrate it at all.
  - Signals are likely to reflect off a chain link fence or a wire mesh with spaces of 1 to 1-1/2 in. (2.5 to 3.8 cm). The fence acts as a harmonic reflector that blocks the signal.

- Microwave ovens and 2-GHz cordless phones can cause signal interference because they operate in the same frequency range as the device to which your antenna is connected.
For instructions on installing or replacing a Cisco Connected Grid module, see the corresponding installation and configuration guide for each module.

For detailed instructions on opening the door, see the installation guide of your router. Before installing the antenna according to the Installing the Antenna, you must complete these steps:

- Open the router chassis door.
- Remove any plug or connector that is installed in the antenna port.
- Verify the correct antenna port for installation, based on the antenna model you are installing.

See the installation document for your router regarding the correct antenna port location. Antennas must be installed in the correct antenna port for ease of installation and optimal performance.

NOTE: Ensure that you are able to access the antenna port from inside the router. If an installed module prevents you from reaching the antenna port, you might have to remove the module before installing the antenna, then reinstall the module. See the corresponding module installation and configuration guide for each module.

Safety Warnings

WARNING: Do not work on the system, or connect or disconnect cables, during periods of lightning activity. Statement 1001

WARNING: Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.:NFPA 70, National Electrical Code, Article 810, Canada:Canadian Electrical Code, Section 54). Statement 1052

WARNING: This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024

WARNING: Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

WARNING: To report a gas leak, do not use a telephone in the vicinity of the leak. Statement 1039

WARNING: This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071. SAVE THESE INSTRUCTIONS.

WARNING: This product is not intended to be directly connected to the Cable Distribution System. Additional regulatory compliance and legal requirements may apply for direct connection to the Cable Distribution System. This product may connect to the Cable Distribution System ONLY through a device that is approved for direct connection. Statement 1078

WARNING: This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.

Safety Precautions

For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!

For your safety, read and follow these safety precautions.
If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

Find someone to help you—installing an antenna is often a two-person job.

Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

Antenna Installation

The antenna installation includes the following procedures:

- Tools and Equipment Required
- Installing the Antenna

Tools and Equipment Required

In addition to the parts included in the antenna kit described in the section Contents of the Antenna Kit, you must provide the following tool to install the antenna on the router:

- Phillips screwdriver
- Open-end wrench
- Drill
- Marker or pencil

Installing the Antenna

Follow these instructions to install the antenna:

1. Determine where on the ceiling you want to install the antenna.
2. Create the center hole to accommodate the 3/4"-16 threaded center rod on the Volcano antenna.
3. Position the Volcano antenna onto the ceiling. Mark on the ceiling the location of the three holes.
4. Remove the antenna and drill the three holes. Place the screw anchors into the holes.
5. Position the antenna in place. Secure the antenna onto the ceiling with the 3 screws using a Phillips #2 screwdriver.
6. From inside the ceiling space, place, in order, the flat washer and curved spring washer onto the center rod. Secure the antenna with the mounting nut.
7. Place the self-adhesive screw covers (3) over the screw holes on the antenna.

8. Attach the cable to the antenna connector.

9. Attach the router-end of the cable to your router.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly What’s New in Cisco Product Documentation, which also lists all new and revised Cisco technical documentation, at:

Cisco Indoor Swivel-mount Dipole Antenna (ANT-4G-DP-IN-TNC)

This document provides the antenna specifications and mounting instructions for the Cisco Indoor Swivel-mount Dipole 3G/4G Antenna supported on the Connected Grid Router 1120 and is designed to support Cellular/PCS/AWS/MDS, WiMAX 2100/2300/2500/2600 and global GSM900/GSM1800/UMTS/LTE2600 bands.

CAUTION: Read the information in Safety Warnings before installing or replacing antennas.

This chapter covers the following topics:

- Technical Specifications
- Installation Requirements
- Safety Warnings
- Antenna Installation
- Obtaining Documentation and Submitting a Service Request

**Figure 1** Swivel-mount Indoor Dipole Antenna

Technical Specifications

- Low-profile blade style sheath
- Applicable for both 3G and 4G solutions
- Domestic LTE 700 and global LTE 2600 bands
- Domestic cellular and global GSM
- Conformance to RoHS
- Complete cellular and 3G/4G data communications in a single antenna
- Articulating arm that allows antenna positioning to provide maximal coverage
RF Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency ranges</td>
<td>698 to 806 MHz</td>
</tr>
<tr>
<td></td>
<td>824 to 894 MHz</td>
</tr>
<tr>
<td></td>
<td>880 to 960 MHz</td>
</tr>
<tr>
<td></td>
<td>1710 to 1880 MHz</td>
</tr>
<tr>
<td></td>
<td>1850 to 1990 MHz</td>
</tr>
<tr>
<td></td>
<td>1920 to 2170 MHz</td>
</tr>
<tr>
<td></td>
<td>2100 to 2500 MHz</td>
</tr>
<tr>
<td></td>
<td>2500 to 2690 MHz</td>
</tr>
<tr>
<td>Peak gain (dBi)</td>
<td>0.5 dBi (698 to 960 MHz)</td>
</tr>
<tr>
<td></td>
<td>2.2 dBi (1710 to 2700 MHz)</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Antennas were designed and tested to high RF efficiency in all supported cellular bands. Detailed technical specifications can be obtained through your Cisco authorized partner or Cisco account representative.</td>
</tr>
<tr>
<td>VSWR</td>
<td>&lt; 2.5:1</td>
</tr>
<tr>
<td>Nominal impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linear</td>
</tr>
</tbody>
</table>

Mechanical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Dipole</td>
</tr>
<tr>
<td>Size (L x W x D)</td>
<td>229 mm x 30.5 mm x 15 mm</td>
</tr>
<tr>
<td>Mount style</td>
<td>Direct mount</td>
</tr>
<tr>
<td>Environment</td>
<td>Indoor</td>
</tr>
<tr>
<td>RF Connector</td>
<td>TNC (m)</td>
</tr>
<tr>
<td>Antenna weight</td>
<td>49 g</td>
</tr>
<tr>
<td>Operational temperature</td>
<td>-31 to 158 degrees F (-35 to +70 degrees C)</td>
</tr>
<tr>
<td>Maximum input power</td>
<td>3 watts</td>
</tr>
<tr>
<td>Material substance compliance</td>
<td>RoHS compliant</td>
</tr>
</tbody>
</table>
TYPICAL RADIATION PATTERNS

698 MHz BAND

824 MHz BAND

880 MHz BAND

960 MHz BAND

1710 MHz BAND

1880 MHz BAND

2170 MHz BAND

2400 MHz BAND

2500 MHz BAND

2700 MHz BAND

Installation Requirements
Installation Location
Antenna installation and replacement should only be performed at one of the following, certified location types:

- Utility maintenance and repair depot
- Cisco DF facility
- Customer premises field depot

Antenna Connections
Before you install or replace antennas, make sure the router is:

- Powered off
- Disconnected from all power sources
- Disconnected from the Field Area Network (FAN)
- Removed from a poletop installation

For Optimum Performance
Antennas transmit and receive radio signals which are susceptible to RF obstructions and common sources of interference that can reduce throughput and range of the device to which they are connected. Follow these guidelines to ensure the best possible performance:

- Install the antenna vertically and mount it with the cables pointing towards the ground.
- Keep the antenna away from metal obstructions such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use a rigid conduit to lower the antenna away from these obstructions.
- The density of the materials used in surrounding buildings’ construction impacts antenna signal strength. Consider the following
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  - Signals are likely to reflect off a chain link fence or a wire mesh with spaces of 1 to 1-1/2 in. (2.5 to 3.8 cm). The fence acts as a harmonic reflector that blocks the signal.
- Microwave ovens and 2-GHz cordless phones can cause signal interference because they operate in the same frequency range as the device to which your antenna is connected.
- For instructions on installing or replacing a Cisco Connected Grid module, see the corresponding installation and configuration guide for each module.
- Before installing the antenna according to the Antenna Installation, you must complete these steps:
  - Remove any plug or connector that is installed in the antenna port.
Verify the correct antenna port for installation, based on the antenna model you are installing.

See the installation document for your router regarding the correct antenna port location. Antennas must be installed in the correct antenna port for ease of installation and optimal performance.

**NOTE:** Ensure that you are able to access the antenna port from inside the router. If an installed module prevents you from reaching the antenna port, you might have to remove the module before installing the antenna, then reinstall the module. See the corresponding module installation and configuration guide for each module.

**Safety Warnings**

**WARNING:** Do not work on the system, or connect or disconnect cables, during periods of lightning activity. Statement 1001

**WARNING:** Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.:NFPA 70, National Electrical Code, Article 810, Canada:Canadian Electrical Code, Section 54). Statement 1052

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**WARNING:** Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

**WARNING:** To report a gas leak, do not use a telephone in the vicinity of the leak. Statement 1039

**WARNING:** This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071. **SAVE THESE INSTRUCTIONS.**

**WARNING:** This product is not intended to be directly connected to the Cable Distribution System. Additional regulatory compliance and legal requirements may apply for direct connection to the Cable Distribution System. This product may connect to the Cable Distribution System ONLY through a device that is approved for direct connection. Statement 1078

**WARNING:** IMPORTANT SAFETY INSTRUCTIONS

This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071

**WARNING:** SAVE THESE INSTRUCTIONS

**Safety Precautions**

**WARNING:** Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.

For your safety, and to help you achieve a good installation, please read and follow these safety precautions. **They may save your life!**

For your safety, read and follow these safety precautions.
If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

Find someone to help you—installing an antenna is often a two-person job.

Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.

Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

When installing your antenna, follow these guidelines:

- Do not use a metal ladder.
- Do not work on a wet or windy day.
- Do dress properly—wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.

If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.

If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.

If an accident should occur with the power lines, call for qualified emergency help immediately.

Antenna Installation

This antenna is designed to be mounted directly to the access point. For information about orienting the dipole antenna, see the hardware installation guide for your access point.

In addition to antenna orientation, wireless access point installation location with respect to all wireless clients plays a significant role in determining overall network performance. Clients at the furthest coverage points might have 10% to 50% of the bandwidth of clients close to it. Wireless network coverage in one area or location might need to be lowered to improve the performance of other clients.

Because antennas transmit and receive radio signals, their performance can be adversely affected by the surrounding environment including distance between access point and client, physical obstructions, or radio frequency (RF) interference.

Follow these guidelines to ensure the best possible performance:

- Wherever possible, mount the AP HWIC and antenna where the wireless devices would be within sight and avoid physical obstructions. Barriers along the line of sight between client and access point will degrade the wireless radio signals. AP HWICs and antennas can be installed above floor level in office environments or near the ceiling for better performance since most obstructions tend to be near floor level.

- The density of the materials used in a building’s construction determines the number of walls the signal must pass through and still maintain adequate coverage. Consider the following before choosing the location to install your antenna:
  - Paper and vinyl walls have very little effect on signal penetration.
– Solid and precast concrete walls limit signal penetration to one or two walls without degrading coverage.
– Concrete and wood block walls limit signal penetration to three or four walls.
– A signal can penetrate five or six walls constructed of drywall or wood.
– A thick metal wall or wire-mesh stucco walls causes signals to reflect back and cause poor penetration.

- Avoid mounting the antenna next to a column or vertical support that could create a shadow zone and reduce the coverage area.
- Keep the antenna away from reflective metal objects such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use an extension cable to relocate the antenna away from these obstructions.

CAUTION: Install the AP HWIC and any antennas away from appliances that share the same frequency bands. Microwave ovens, cordless telephones, and security monitors can temporarily interfere with wireless performance.

CAUTION: We recommend you avoid installing wireless antennas in or near rack-mounted installations that include networking equipment and computer servers whose radiated noise emissions can severely degrade radio performance.

NOTE: If the desired installation site has a marginally acceptable level of radiated noise emissions, consider using a remote-mounted antenna, such as a wall-mount or ceiling-mount antenna, for better radio performance and coverage.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly What’s New in Cisco Product Documentation, which also lists all new and revised Cisco technical documentation, at:


Subscribe to the What’s New in Cisco Product Documentation as a Really Simple Syndication (RSS) feed and set content to be delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS Version 2.0.
The Cisco Outdoor Omnidirectional Antenna for 2G/3G/4G Cellular antenna is designed to cover domestic LTE700/Cellular/PCS/AWS/MDS, WiMAX 2300/2500, and GSM900/GSM1800/UMTS/LTE2600 bands. This document provides the antenna specifications and mounting instructions.

CAUTION: Read the information in Safety Warnings before installing or replacing antennas.

This chapter covers the following topics:

- Technical Specifications
- Antenna Kit
- Safety Warnings
- Antenna Installation
- Obtaining Documentation and Submitting a Service Request

Technical Specifications

The Outdoor Omnidirectional antenna features the following:

- UV stable radome
- Mast mount bracket
- Covers all cellular 2G, 3G and 4G LTE bands in the following frequency ranges: 698-960 MHz, 1448-1511 MHz and 1710-2700 MHz
Cisco Outdoor Omnidirectional Antenna for 2G/3G/4G Cellular (ANT-4G-OMNI-OUT-N)

**Figure 1  Outdoor Omnidirectional Antenna**

![Diagram of the antenna with dimensions 25.7 mm diameter and 249 mm height, and a 2 x drain slot]

**RF Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency ranges</td>
<td>- 698 to 960 MHz</td>
</tr>
<tr>
<td></td>
<td>- 1480 to 1511 MHz</td>
</tr>
<tr>
<td></td>
<td>- 1710 to 2170 MHz</td>
</tr>
<tr>
<td></td>
<td>- 2300 to 2700 MHz</td>
</tr>
<tr>
<td>Nominal gain (dBi)</td>
<td>- 698 to 960 MHz: 1.5 dBi</td>
</tr>
<tr>
<td></td>
<td>- 1448 to 1511 MHz: 2 dBi</td>
</tr>
<tr>
<td></td>
<td>- 1710 to 2700 MHz: 3.5 dBi</td>
</tr>
<tr>
<td>3 dB beamwidth (E plane)</td>
<td>- 698 to 960 MHz: 81 degrees</td>
</tr>
<tr>
<td></td>
<td>- 1480 to 1511 MHz: 78 degrees</td>
</tr>
<tr>
<td></td>
<td>- 1710 to 2170 MHz: 75 degrees</td>
</tr>
<tr>
<td></td>
<td>- 2300 to 2700 MHz: 100 degrees</td>
</tr>
<tr>
<td>3 dB beamwidth (H plane)</td>
<td>360 degrees, omnidirectional</td>
</tr>
</tbody>
</table>
Efficiency was designed and tested to high RF efficiency in all supported cellular bands. Detailed technical specifications can be obtained through your Cisco authorized partner or Cisco account representative.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polarization</td>
<td>Vertical, linear</td>
</tr>
<tr>
<td>Normal impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>VSWR</td>
<td>- &lt; 2.5:1 (698 to 960 MHz)</td>
</tr>
<tr>
<td></td>
<td>- &lt; 1.5:1 (1448 to 1511 MHz)</td>
</tr>
<tr>
<td></td>
<td>- &lt; 2.0:1 (1710 to 2690 MHz)</td>
</tr>
<tr>
<td>Radiation Pattern</td>
<td>Omnidirectional</td>
</tr>
</tbody>
</table>
Mechanical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mount style</td>
<td>Mast mount, upright position only, connector on bottom (due to drain holes located only on antenna bottom)</td>
</tr>
<tr>
<td>Environment</td>
<td>Outdoor IP55 with drain holes</td>
</tr>
<tr>
<td>Connector</td>
<td>N-Type female</td>
</tr>
<tr>
<td>Antenna length (height)</td>
<td>9.8” x 1” (24.9 cm x 2.45 cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>1.5 lbs (.68 kg)</td>
</tr>
<tr>
<td>Dimensions (height x outside dimensions)</td>
<td>9.8” x 1” (248 x 24.5 mm)</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-22 to 158-degrees F (-30 to +70-degrees C)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40 to 185 degrees F (-40 to 85 degrees C)</td>
</tr>
<tr>
<td>Maximum power</td>
<td>10 watts</td>
</tr>
<tr>
<td>Radome</td>
<td>Polycarbonate, UV, white</td>
</tr>
<tr>
<td>Material substance compliance</td>
<td>ROHS compliant</td>
</tr>
</tbody>
</table>

Radiation Patterns
Cisco Outdoor Omnidirectional Antenna for 2G/3G/4G Cellular (ANT-4G-OMNI-OUT-N)

Frequency = 824 MHz

Frequency = 960 MHz

Frequency = 1490 MHz
Cisco Outdoor Omnidirectional Antenna for 2G/3G/4G Cellular (ANT-4G-OMNI-OUT-N)

Frequency = 1710 MHz

Frequency = 2170 MHz

Frequency = 2500 MHz
Antenna Kit

The contents of the multi-purpose integrated antenna are listed in Table 1:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Antenna-mount bracket</td>
</tr>
<tr>
<td>4</td>
<td>1/4&quot;-20x3/4 carriage bolt</td>
</tr>
<tr>
<td>6</td>
<td>1/4&quot;-20 hex nut</td>
</tr>
<tr>
<td>6</td>
<td>1/4&quot;-20 spring lock washer</td>
</tr>
<tr>
<td>6</td>
<td>1/4&quot;-20 flat washer</td>
</tr>
<tr>
<td>2</td>
<td>Pipe clamps</td>
</tr>
<tr>
<td>1</td>
<td>ANT-4G-OMNI-OUT-N Antenna</td>
</tr>
</tbody>
</table>

Safety Warnings

**WARNING:** Avoid using or servicing any equipment that has outdoor connections during an electrical storm. There may be a risk of electric shock from lightning. Statement 1088

**WARNING:** Do not work on the system, or connect or disconnect cables, during periods of lightning activity. Statement 1001

**WARNING:** Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.:NFPA 70, National Electrical Code, Article 810, Canada:Canadian Electrical Code, Section 54). Statement 1052

**WARNING:** This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024

**WARNING:** Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030
WARNING: To report a gas leak, do not use a telephone in the vicinity of the leak. Statement 1039

WARNING: This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071. SAVE THESE INSTRUCTIONS.

WARNING: This product is not intended to be directly connected to the Cable Distribution System. Additional regulatory compliance and legal requirements may apply for direct connection to the Cable Distribution System. This product may connect to the Cable Distribution System ONLY through a device that is approved for direct connection. Statement 1078

Safety Precautions

WARNING: Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.

For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!

For your safety, read and follow these safety precautions.

- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

- Find someone to help you—installing an antenna is often a two-person job.

- Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

- Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.

- Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

- When installing your antenna, follow these guidelines:
  - Do not use a metal ladder.
  - Do not work on a wet or windy day.
  - Do dress properly—wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.

- If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.

- If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.

- If an accident should occur with the power lines, call for qualified emergency help immediately.
Antenna Installation

The antenna installation includes the following procedures:

- Tools and Equipment Required
- Installing the Antenna

Tools and Equipment Required

In addition to the parts included in the antenna kit described in the section Antenna Kit, you must provide the following tool to install the antenna on the router:

- A flathead screwdriver
- 3/4 in. open-end wrench

**NOTE:** This list does not include the tools and equipment required to assemble and erect the tower, mast, or other structure you intend to mount your antenna on.

Installing the Antenna

The antenna is provided with a mounting kit consisting of a mounting bracket and hose clamp. This kit allows you to mount the antenna to masts from 1.25 inches (3.2 centimeters) to 2 inches (5.1 cm). Cisco recommends that a 1.5 inch (3.8 centimeter) or larger tubing mast be used.

The antenna is vertically polarized. Since the antenna has vertical gain, it is very important to mount the antenna in a vertical (not leaning) position for optimal performance.

Follow these steps to mount the antenna onto a mast:

1. Place the connector end of the antenna through the hole in the antenna bracket.
2. Place the pipe clamps into the grooves on the bracket.

3. Attach the bracket to the top of the mast. The top surface of the mounting mast must not exceed the top surface of the mounting bracket. Securely tighten hose clamps.

4. Route the cable to the router and attach the cable to the antenna port of the router.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly What’s New in Cisco Product Documentation, which also lists all new and revised Cisco technical documentation, at:

Cisco Multiband Panel Outdoor 4G MIMO Antenna (ANT-4G-PNL-OUT-N)

This chapter describes the technical specifications and installation instructions for the Cisco Multiband Panel Outdoor 4G MIMO antenna, hereafter referred to as the antenna. The antenna is a dual-port antenna designed to cover cellular 4G bands. The supported bands are:

- LTE700/Cellular/PCS/AWS/MDS
- Global GSM900/GSM1800/UMTS/LTE2600
- WiMAX 2300/2500

**CAUTION**: Read the information in Safety Precautions before installing or replacing antennas.

The topics included are:

- Antenna Overview
- Technical Specifications
- Installing the Antenna
- Obtaining Documentation and Submitting a Service Request

**Antenna Overview**

- Antenna Features
- Antenna Model
- Antenna Assembly

**Antenna Features**

The antenna features:

- 3G, 4G, and WiMAX 2300/2500 operation
- 698–960, 1710–2700 MHz band support
- 4G directional panel, dual-polarized/MIMO
- Indoor or outdoor location
- Wall mount or mast mount installation
- Dual type N female connector
Antenna Model

Figure 1  Cisco Multiband Panel Outdoor 4G MIMO antenna

<table>
<thead>
<tr>
<th>Antenna Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANT-4G-PNL-OUT-N</td>
<td>Cisco Multiband Panel Outdoor 4G MIMO antenna</td>
</tr>
</tbody>
</table>

Antenna Assembly

Figure 2  Cisco ANT-4G-PNL-OUT-N Antenna

Technical Specifications

- Radio Frequency Specifications
- Antenna Radiation Patterns
- Environmental Specifications
- Mechanical Specifications
- Power Specifications
Radio Frequency Specifications

Figure 3  Antenna Radio Frequency Specification

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna type</td>
<td>4G directional panel, dual-polarized/MIMO</td>
</tr>
<tr>
<td>Frequency</td>
<td>- 698 to 960 MHz&lt;br&gt;- 1710 to 2700 MHz</td>
</tr>
<tr>
<td>Nominal impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>VSWR</td>
<td>2.0:1 Maximum</td>
</tr>
<tr>
<td>Gain</td>
<td>The gain values (dBi) for each frequency range are:&lt;br&gt;- 698 to 960 MHz&lt;~8.0 to 10.0 dBi&lt;br&gt;- 1710 to 2170 MHz&lt;~6.0 to 8.5 dBi&lt;br&gt;- 2200 to 2400 MHz&lt;~6.5 to 9.5 dBi&lt;br&gt;- 2500 to 2700 MHz&lt;~8.5 to 9.5 dBi</td>
</tr>
<tr>
<td>3 dB beamwidth (vertical plane)</td>
<td>- 55 to 70 degrees&lt;698 to 960 MHz&lt;br&gt;- 53 to 98 degrees&lt;1710 to 2200 MHz&lt;br&gt;- 60 to 70 degrees&lt;2200 to 2500 MHz&lt;br&gt;- 55 to 70 degrees&lt;2500 to 2700 MHz</td>
</tr>
<tr>
<td>3 dB beamwidth (horizontal plane)</td>
<td>- 55 to 70 degrees&lt;698 to 960 MHz&lt;br&gt;- 50 to 90 degrees&lt;1710 to 2200 MHz</td>
</tr>
<tr>
<td>F/B ratio</td>
<td>&gt; 15 dB, typical 20 dB&lt;~698 to 960 MHz&lt;br&gt; &gt; 17 dB, typical 23 dB&lt;~1700 to 2700 MHz</td>
</tr>
<tr>
<td>Isolation</td>
<td>&gt; 30 dB</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Antennas were designed and tested to high RF efficiency in all supported cellular bands. Detailed technical specifications can be obtained through your Cisco authorized partner or Cisco account representative.</td>
</tr>
<tr>
<td>Polarization</td>
<td>Slant +/- 45 degrees</td>
</tr>
<tr>
<td>Radiation Pattern</td>
<td>Directional</td>
</tr>
</tbody>
</table>

Antenna Radiation Patterns

- 698 MHz Antenna Radiation Pattern
- 880 MHz Antenna Radiation Pattern
- 960 MHz Antenna Radiation Pattern
- 1710 MHz Antenna Radiation Pattern
- 1950 MHz Antenna Radiation Pattern
- 2170 MHz Antenna Radiation Pattern
- 2700 MHz Antenna Radiation Pattern, page 351

**698 MHz Antenna Radiation Pattern**
- 698 MHz Antenna Radiation Pattern—Horizontal Plane
- 698 MHz Antenna Radiation Pattern—Vertical Plane

698 MHz Antenna Radiation Pattern—Horizontal Plane

*Figure 4  698 MHz Antenna Radiation Pattern—Horizontal Plane*
698 MHz Antenna Radiation Pattern—Vertical Plane

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (←)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (→)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

880 MHz Antenna Radiation Pattern

- 880 MHz Antenna Radiation Pattern—Horizontal Plane
- 880 MHz Antenna Radiation Pattern—Vertical Plane
880 MHz Antenna Radiation Pattern—Horizontal Plane

**Figure 6** 880 MHz Antenna Radiation Pattern—Horizontal Plane

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (→)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (←)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

880 MHz Antenna Radiation Pattern—Vertical Plane

**Figure 7** 880 MHz Antenna Radiation Pattern—Vertical Plane
Cisco Multiband Panel Outdoor 4G MIMO Antenna (ANT-4G-PNL-OUT-N)

960 MHz Antenna Radiation Pattern

- 960 MHz Antenna Radiation Pattern—Horizontal Plane
- 960 MHz Antenna Radiation Pattern—Vertical Plane

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (––)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (––)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>
960 MHz Antenna Radiation Pattern—Horizontal Plane

Figure 8  960 MHz Antenna Radiation Pattern—Horizontal Plane

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (—)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (—)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

960 MHz Antenna Radiation Pattern—Vertical Plane

Figure 9  960 MHz Antenna Radiation Pattern—Vertical Plane
1710 MHz Antenna Radiation Pattern

- 1710 MHz Antenna Radiation Pattern—Horizontal Plane
- 1710 MHz Antenna Radiation Pattern—Vertical Plane
1710 MHz Antenna Radiation Pattern—Horizontal Plane

**Figure 10**  1710 MHz Antenna Radiation Pattern—Horizontal Plane

- **Line Color** | **Description**
- Blue (→) | Port 1
- Red (→) | Port 2

1710 MHz Antenna Radiation Pattern—Vertical Plane

**Figure 11**  1710 MHz Antenna Radiation Pattern—Vertical Plane
1950 MHz Antenna Radiation Pattern

- 1950 MHz Antenna Radiation Pattern—Horizontal Plane
- 1950 MHz Antenna Radiation Pattern—Vertical Plane

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (.—)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (—)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>
1950 MHz Antenna Radiation Pattern—Horizontal Plane

**Figure 12** 1950 MHz Antenna Radiation Pattern—Horizontal Plane

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (—)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (—)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

1950 MHz Antenna Radiation Pattern—Vertical Plane

**Figure 13** 1950 MHz Antenna Radiation Pattern—Vertical Plane
Line Color | Description
----------|------------
Blue (--) | Port 1
Red (--)  | Port 2

2170 MHz Antenna Radiation Pattern

- 2170 MHz Antenna Radiation Pattern—Horizontal Plane
- 2170 MHz Antenna Radiation Pattern—Vertical Plane
2170 MHz Antenna Radiation Pattern—Horizontal Plane

**Figure 14  2170 MHz Antenna Radiation Pattern—Horizontal Plane**

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (—)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (—)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

2170 MHz Antenna Radiation Pattern—Vertical Plane

**Figure 15  2170 MHz Antenna Radiation Pattern—Vertical Plane**
<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (✓)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (✓)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

2700 MHz Antenna Radiation Pattern

- 2700 MHz Antenna Radiation Pattern—Horizontal Plane
- 2700 MHz Antenna Radiation Pattern—Vertical Plane
2700 MHz Antenna Radiation Pattern—Horizontal Plane

**Figure 16** 2700 MHz Antenna Radiation Pattern—Horizontal Plane

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (—)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (—)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

2700 MHz Antenna Radiation Pattern—Vertical Plane

**Figure 17** 2700 MHz Antenna Radiation Pattern—Vertical Plane
Cisco Multiband Panel Outdoor 4G MIMO Antenna (ANT-4G-PNL-OUT-N)

Environmental Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature range</td>
<td>-40 to 158°F (-40 to 70°C)</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>-40 to 185°F (-40 to +85°C)</td>
</tr>
</tbody>
</table>

Mechanical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mount style</td>
<td>Wall or mast mount</td>
</tr>
<tr>
<td>Location</td>
<td>Indoor or outdoor</td>
</tr>
<tr>
<td>Connector</td>
<td>Dual type N female direct connect</td>
</tr>
<tr>
<td>Dimensions (width x length x height)</td>
<td>11.61 x 11.61 x 3.23 in. (29.5 x 29.5 x 82 cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>3.22 lbs (1.46 kg)</td>
</tr>
</tbody>
</table>
Installing the Antenna

The antenna installation includes the following procedures:

- Contents of the Antenna Kit
- Safety Warnings
- Safety Precautions
- Tools and Equipment Required
- Preparing the Antenna for Installation
- Mounting the Antenna
- Connecting the Lightning Arrestor
- Connecting the Antenna to the Router

Contents of the Antenna Kit

The antenna kit contains:

- 1 x Cisco ANT-4G-PNL-OUT-N antenna
- 1 x mounting bracket

Safety Warnings

**WARNING:** Avoid using or servicing any equipment that has outdoor connections during an electrical storm. There may be a risk of electric shock from lightning. Statement 1088

**WARNING:** Do not work on the system, or connect or disconnect cables, during periods of lightning activity. Statement 1001
WARNING: Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.: NFPA 70, National Electrical Code, Article 810, Canada: Canadian Electrical Code, Section 54). Statement 1052

WARNING: This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024

WARNING: Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

WARNING: To report a gas leak, do not use a telephone in the vicinity of the leak. Statement 1039

WARNING: This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071. SAVE THESE INSTRUCTIONS.

WARNING: This product is not intended to be directly connected to the Cable Distribution System. Additional regulatory compliance and legal requirements may apply for direct connection to the Cable Distribution System. This product may connect to the Cable Distribution System ONLY through a device that is approved for direct connection. Statement 1078

Safety Precautions

WARNING: Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.

For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!

For your safety, read and follow these safety precautions.

- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

- Find someone to help you—installing an antenna is often a two-person job.

- Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

- Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.

- Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

- When installing your antenna, follow these guidelines:
  - Do not use a metal ladder.
  - Do not work on a wet or windy day.
  - Do dress properly—wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.
If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.

If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.

If an accident should occur with the power lines, call for qualified emergency help immediately.

### Tools and Equipment Required

In addition to the parts included in the antenna kit described in the section Contents of the Antenna Kit, you must provide the following tool to install the antenna on the router:

- Phillips screwdriver
- Open-ended wrench
- Electric drill

**NOTE:** This list does not include the tools and equipment required to assemble and erect the tower, mast, or other structure you intend to mount your antenna on.

### Preparing the Antenna for Installation

**NOTE:** Before mounting the antenna on a mast or wall:
- the antenna must be attached to the mounting bracket.
- the signal cable must be attached to the antenna.

To prepare the antenna for installation:

1. Attach the antenna to the mounting bracket.
2. To attach the signal cable to the antenna:
   a. Loosely hand-tighten the antenna nut so that the cable can be attached with ease.
   b. Attach the cable to the antenna.
   c. Hand tighten the N-connector to the antenna.
   d. Tighten the antenna nut securely after the cable is installed.
   e. Use weatherproof sealing tape (coax seal) at the connector junction. Start wrapping at the top of the antenna connector, wrap downward 3 times and end about 2 inches downward from the center of the connector junction. Then wrap upwards another 3 times to reach the top of the antenna connector.
3. Decide if the antenna is to be mounted on a wall or mast. Perform the following steps where relevant:
   a. If the antenna is going to be mast mounted, install the clamps provided in the mounting bracket. Align the antenna so the top of the metal bracket is even with or slightly above the top of the mast tubing.
   b. If the antenna is to be wall mounted, use the screws provided.
   c. Use both clamps and screws for extra security if required.
Mounting the Antenna

Follow these instructions to mount the antenna:

1. Mark the desired location where you plan to mount the antenna and create a hole to receive the antenna.

   **NOTE:** The rubber washer is not required for ceiling tile installations.

2. Make sure that the antenna is properly positioned, then tighten the washer and plastic nut to secure the antenna.

Connecting the Lightning Arrestor

To install a lightning-protection device, please refer to the appropriate Hardware Installation Procedures for the model of hardware you are installing. Links to hardware installation guides and other information may be found in Chapter 1, “Additional Information”.

Connecting the Antenna to the Router

To attach the router-end of the cable to your device, please refer to the appropriate Hardware Installation Procedures for the model of hardware you are installing. Links to hardware installation guides and other information may be found in Chapter 1, “Additional Information”.

**NOTE:** Coaxial cable loses efficiency as the frequency increases, resulting in signal loss. The cable should be kept as short as possible because cable length also determines the amount of signal loss—the longer the cable length or run, the greater the loss).

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly What’s New in Cisco Product Documentation, which also lists all new and revised Cisco technical documentation, at:


Subscribe to the What’s New in Cisco Product Documentation as an RSS (Really Simple Syndication) feed, and set it so content is delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS Version 2.0.

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Cisco Integrated 4G Low-profile Outdoor Saucer Antenna (ANT-4G-SR-OUT-TNC)

This document describes the Cisco Integrated 4G Low-profile Outdoor Saucer Antenna. It supports frequencies of 698 to 960 MHz, 1575 MHz, and 1710 to 2700 MHz for the GSM, DCS, UMTS, and LTE/WiMAX frequency bands. In addition, this document provides the antenna specifications and mounting instructions of the antenna.

CAUTION: Read the information before installing or replacing antennas.

This chapter covers the following topics:

- Technical Specifications
- Installation Requirements
- Safety Warnings
- Antenna Installation
- Obtaining Documentation and Submitting a Service Request

Technical Specifications

The Integrated 4G Low-profile Outdoor Saucer Antenna features the following:

- Applicable for both 3G and 4G solutions
- Domestic LTE 700 band and Global LTE 2600 band
- Domestic Cellular and Global GSM
- Weatherproof UV stable radome
- Performance optimized
- Excellent flame rating
RF Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range</td>
<td>698 to 960 MHz</td>
</tr>
<tr>
<td></td>
<td>1448 to 1511 MHz</td>
</tr>
<tr>
<td></td>
<td>1710 to 2700 MHz</td>
</tr>
<tr>
<td>Peak gain w/15 foot cable</td>
<td>0.8 dBi (698 to 960 MHz)</td>
</tr>
<tr>
<td></td>
<td>0.5 dBi (1448 to 1511 MHz)</td>
</tr>
<tr>
<td></td>
<td>0.2 dBi (1710 to 2700 MHz)</td>
</tr>
<tr>
<td>Average efficiency w/15 foot cable</td>
<td>60 percent (698 to 960 MHz)</td>
</tr>
<tr>
<td></td>
<td>50 percent (1448 to 1511 MHz)</td>
</tr>
<tr>
<td></td>
<td>40 percent (1710 to 2700 MHz)</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linear, vertical</td>
</tr>
<tr>
<td>Nominal impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>VSWR (maximum)</td>
<td>2.0:1 (698 to 960 MHz)</td>
</tr>
<tr>
<td></td>
<td>1.9:1 (1448 to 1511 MHz)</td>
</tr>
<tr>
<td></td>
<td>2.0:1 (1710 to 2700 MHz)</td>
</tr>
<tr>
<td>H-plane (3 dB beamwidth)</td>
<td>Omnidirectional</td>
</tr>
</tbody>
</table>

Mechanical Specifications
Cisco Integrated 4G Low-profile Outdoor Saucer Antenna (ANT-4G-SR-OUT-TNC)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-plane 3 dB beamwidth</td>
<td>Omnidirectional</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linear, vertical</td>
</tr>
<tr>
<td>Nominal impedance</td>
<td>50 ohm</td>
</tr>
<tr>
<td>Power</td>
<td>3 watts</td>
</tr>
<tr>
<td>Cable</td>
<td>15 foot LMR 195</td>
</tr>
<tr>
<td>RF connector</td>
<td>TNC(m)</td>
</tr>
<tr>
<td>Mount Style</td>
<td>Stud mount, 5/8-18-NF mounting stud, mount on the roof or suitable flat surface</td>
</tr>
<tr>
<td>Radome</td>
<td>PC/ABS, UV stable, black</td>
</tr>
<tr>
<td>Material substance compliance</td>
<td>RoHS compliant</td>
</tr>
<tr>
<td>Operational temperature</td>
<td>-22 to 158 degrees F (-40 to 70 degrees C)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40 to 185 degrees F (-40 to 85 degrees C)</td>
</tr>
<tr>
<td>Environment</td>
<td>Outdoor, IP67, IK-08</td>
</tr>
<tr>
<td>Dimensions (ht x OD)</td>
<td>3.4 inches x 7.9 inches (87 mm x 200 mm)</td>
</tr>
<tr>
<td>Weight</td>
<td>0.75kg</td>
</tr>
</tbody>
</table>

Radiation Patterns

The following graphics show the radiation patterns of the saucer antenna.
Figure 2  Low-profile Saucer Antenna Radiation Patterns

698-960 MHz Band

1710-2200 MHz Band

2400-2700 MHz Band

Installation Requirements
Antenna Connections

Before you install or replace antennas, make sure the router is:

- Powered off
- Disconnected from all power sources
- Disconnected from the Field Area Network (FAN)
- Removed from a pole-top installation

Optimum Performance

Antennas transmit and receive radio signals which are susceptible to RF obstructions and common sources of interference that can reduce throughput and range of the device to which they are connected. Follow these guidelines to ensure the best possible performance:

- Keep the antenna away from metal obstructions such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use a rigid conduit to lower the antenna away from these obstructions.

- The density of the materials used in surrounding buildings’ construction impacts antenna signal strength. Consider the following
  - Signals penetrate paper and vinyl walls with little change to signal strength.
  - Signals penetrate only one or two solid and pre-cast concrete walls without degrading signal strength.
  - Signals penetrate three or four concrete and wood block walls without degrading signal strength.
  - Signals penetrate five or six walls constructed of drywall or wood without degrading signal strength.
  - Signals are likely to reflect off a thick metal wall and not penetrate it at all.
  - Signals are likely to reflect off a chain link fence or a wire mesh with spaces of 1 to 1-1/2 in. (2.5 to 3.8 cm). The fence acts as a harmonic reflector that blocks the signal.

- Microwave ovens and 2-GHz cordless phones can cause signal interference because they operate in the same frequency range as the device to which your antenna is connected.

- For instructions on installing or replacing a Cisco Connected Grid module, see the corresponding installation and configuration guide for each module.

- For detailed instructions on opening the door, see the installation guide of your router. Before installing the antenna according to the Installing the Antenna, you must complete these steps:
  - Open the router chassis door.
  - Remove any plug or connector that is installed in the antenna port.
  - Verify the correct antenna port for installation, based on the antenna model you are installing.

- See the installation document for your router regarding the correct antenna port location. Antennas must be installed in the correct antenna port for ease of installation and optimal performance.

NOTE: Ensure that you are able to access the antenna port from inside the router. If an installed module prevents you from reaching the antenna port, you might have to remove the module before installing the antenna, then reinstall the module. See the corresponding module installation and configuration guide for each module.
Safety Warnings

**WARNING:** Avoid using or servicing any equipment that has outdoor connections during an electrical storm. There may be a risk of electric shock from lightning. Statement 1088

**WARNING:** Do not work on the system, or connect or disconnect cables, during periods of lightning activity. Statement 1001

**WARNING:** Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.:NFPA 70, National Electrical Code, Article 810, Canada:Canadian Electrical Code, Section 54). Statement 1052

**WARNING:** This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024

**WARNING:** Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

**WARNING:** To report a gas leak, do not use a telephone in the vicinity of the leak. Statement 1039

**WARNING:** This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071. **SAVE THESE INSTRUCTIONS.**

**WARNING:** This product is not intended to be directly connected to the Cable Distribution System. Additional regulatory compliance and legal requirements may apply for direct connection to the Cable Distribution System. This product may connect to the Cable Distribution System ONLY through a device that is approved for direct connection. Statement 1078

Safety Precautions

**WARNING:** For your safety, and to help you achieve a good installation, please read and follow these safety precautions. **They may save your life!**

For your safety, read and follow these safety precautions.

- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

- Find someone to help you—installing an antenna is often a two-person job.

- Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

Antenna Installation

The antenna installation includes the following procedures:

- **Tools and Equipment Required**

- **Installing the Antenna**
Tools and Equipment Required

In addition to the parts included in the antenna kit, you must provide the following tool to install the antenna on the router:

- Phillips screwdriver
- Open-end wrench
- Drill
- Marker or pencil

Installing the Antenna

Follow these instructions to install the antenna:

**NOTE:** The following example is for a CGR 1120 router with a CGM cellular module.

1. Determine the installation location on the wall of the utility cabinet.
2. Create the center hole to accommodate the threaded center rod and the three mounting holes of the saucer antenna. Secure the antenna onto the ceiling with the 3 screws using a Phillips #2 screwdriver.
3. From inside the utility cabinet space, secure the antenna.
4. Connect the TNC (m) connector end of the antenna cable to the TNC(f)-to-QMA(m) connector adapter (ANT-ADPTR-Q-TNC).

5. Attach the adapter to the QMA (f) connector of the CGR 1120 port.

---

**Obtaining Documentation and Submitting a Service Request**

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly What's New in Cisco Product Documentation, which also lists all new and revised Cisco technical documentation, at:


Subscribe to the *What's New in Cisco Product Documentation* as an RSS (Really Simple Syndication) feed, and set it so content is delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS Version 2.0.

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Cisco 5-in-1 Vehicle Mount and Fixed Infrastructure Antenna (ANT-5-4G2WL2G1-O)

This chapter describes the technical specifications and installation instructions for the Cisco 5-in-1 Vehicle Mount and Fixed Infrastructure Antenna, hereafter referred to as the antenna. The antenna is a five port antenna with two elements designed to cover the 698-960, 1448-1511 and 1710-2700 MHz cellular bands, two elements designed to cover the 2.4-2.5 and 4.9-5.85 GHz WLAN bands and one GPS element. The antenna can be mounted on the roof of a vehicle or fixed structure. The antenna meets or exceeds a variety of environmental ruggedization specifications for transportation applications.

CAUTION: Read the information in Safety Precautions before installing or replacing antennas.

The topics included are:

- Antenna Overview
- Technical Specifications
- Installing the Antenna
- Obtaining Documentation and Submitting a Service Request

Antenna Overview

- Antenna Features
- Antenna Model
- Antenna Assembly

Antenna Features

The antenna features:

- Five antenna elements within one radome: two cellular, two WLAN and one GPS
- Outdoor and transportation ready
- Roof mount installation
- Dual cellular elements supporting 698-960, 1448-1511 and 1710-2700 MHz
  - Omnidirectional, vertically polarized MIMO
  - Integrated 2 foot cables with TNC male connectors
  - LTE elements are interchangeable, either one can be connected to Main or Aux.
- Dual WLAN elements supporting 2400-2500 and 4900-5875 MHz
- Omnidirectional, vertically polarized, 2x2 MIMO
- WiFi elements are interchangeable.
- Integrated 2 foot cables with RP-TNC plug connectors

Active GPS element has integrated 17 foot cable with SMA male connector

The antenna may require RF extension cables. A shorter 2 foot cable length was selected on LTE WAN and WiFi WLAN to allow you to optimize LTE WAN and WiFi WLAN RF performance and wireless range. If you require a cable length longer than 2 feet with the antenna, you will need to select RF extension cables of appropriate length and type. Thicker RF cables, such as LMR-600, LMR-400, or LMR-240 result in lower loss, higher RF performance and longer range of wireless network than thinner cables such as LMR-195, LMR-200. The trade-off is that thicker cables are more difficult to bend and route. For optimal performance, the length of thin cables needs to be kept as short as possible.

For example, 2 foot and 10 foot lengths of LMR-195 cable at 2700 MHz frequency would have losses of 0.5dB and 2.3dB respectively. In this example at 2700 MHz the area covered by the wireless system with the 10 foot cable is reduced by 34% compared to the 2 foot cable. Radius of communication is degraded by 20% in 10 foot vs. the 2 foot case. At 5825 MHz WiFi frequency, 2 foot and 10 foot lengths of LMR-195 would have losses of 0.8dB and 3.4dB respectively. In this example at 5825 MHz, the area covered by the wireless system with the 10 foot cable is reduced by 45% compared to the 2 foot cable. Radius of communication is degraded by 26% in the 10 foot vs. the 2 foot case.

**NOTE:** Loss of the 17foot GPS cable is compensated by the gain of the active GPS antenna, and has little impact on GPS performance.
Antenna Model

<table>
<thead>
<tr>
<th>Antenna Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANT-5-4G2WL2G1-O</td>
<td>Cisco 5-in-1 Vehicle Mount and Fixed Infrastructure Antenna</td>
</tr>
</tbody>
</table>

Antenna Assembly

Figure 1  Cisco ANT-5-4G2WL2G1-O Antenna

**NOTE:** The GPS cable (center in the diagram) is 17 feet long. It is shown shorter for illustration purposes.
Note: All dimensions are in millimeters [inches] unless explicitly stated otherwise in the drawing.

Technical Specifications

- Radio Frequency Specifications
- Power Specifications
- WLAN WiFi Antenna Radiation Patterns
- Installing the Antenna
- Mechanical Specifications
- Installing the Antenna
## Radio Frequency Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna type</td>
<td>Dual element, omnidirectional, 2x2 MIMO</td>
</tr>
<tr>
<td>Frequency</td>
<td>- 698 to 960 MHz</td>
</tr>
<tr>
<td></td>
<td>- 1448 to 1511 MHz</td>
</tr>
<tr>
<td></td>
<td>- 1710 to 2700 MHz</td>
</tr>
<tr>
<td>Nominal impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>VSWR</td>
<td>- 2.1:1 maximum at 698 to 960 MHz</td>
</tr>
<tr>
<td></td>
<td>- 2.4:1 maximum at 1448 MHz edge, 2.2:1 typical at 1448-1511 MHz</td>
</tr>
<tr>
<td></td>
<td>- 2.0:1 maximum at 1710 to 2700 MHz</td>
</tr>
<tr>
<td>Gain</td>
<td>The gain values (dBi) for each frequency range are:</td>
</tr>
<tr>
<td></td>
<td>- 2.4 dBi typical, 2.9 dBi maximum at 698 to 960 MHz</td>
</tr>
<tr>
<td></td>
<td>- 4.2 dBi typical, 4.8 dBi maximum at 1448-1511 MHz</td>
</tr>
<tr>
<td></td>
<td>- 4.9 dBi typical, 6.5 dBi maximum at 1710 to 2700 MHz</td>
</tr>
<tr>
<td>Isolation, cellular to cellular (Main to Aux)</td>
<td>14 dB minimum–698 to 960 MHz</td>
</tr>
<tr>
<td></td>
<td>20 dB minimum–1448-1511 MHz</td>
</tr>
<tr>
<td></td>
<td>20 dB minimum–1710 to 2700 MHz</td>
</tr>
<tr>
<td>Isolation, WLAN to cellular</td>
<td>25 dB minimum–698 to 960 MHz</td>
</tr>
<tr>
<td></td>
<td>20 dB minimum–1448 to 1511 MHz</td>
</tr>
<tr>
<td></td>
<td>15 dB minimum–1710 to 2700 MHz</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Antennas were designed and tested for high RF efficiency in all supported cellular bands. Detailed technical specifications can be obtained through your Cisco authorized partner or Cisco account representative.</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linear, Vertical</td>
</tr>
<tr>
<td>Radiation Pattern</td>
<td>Omnidirectional</td>
</tr>
</tbody>
</table>
Table 2  WLAN Antenna Radio Frequency Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna type</td>
<td>Dual element, omnidirectional, 2x2 MIMO</td>
</tr>
<tr>
<td>Frequency</td>
<td>2400 to 2500 MHz</td>
</tr>
<tr>
<td></td>
<td>4900 to 5875 MHz</td>
</tr>
<tr>
<td>Nominal impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>VSWR</td>
<td>2.0:1 maximum</td>
</tr>
<tr>
<td>Gain</td>
<td>4.8 dBi typical, 5.5 dBi maximum at 2400 to 2500 MHz</td>
</tr>
<tr>
<td></td>
<td>5.8 dBi typical, 7.0 dBi maximum at 4900 to 5875 MHz</td>
</tr>
<tr>
<td>Isolation, WLAN to WLAN</td>
<td>20 dB minimum-2400 to 2500 MHz</td>
</tr>
<tr>
<td></td>
<td>20 dB minimum-4900 to 5875 MHz</td>
</tr>
<tr>
<td>Isolation, cellular to WLAN</td>
<td>15 dB minimum-1710 to 2700 MHz</td>
</tr>
<tr>
<td></td>
<td>18 dB minimum-2400 to 2500 MHz</td>
</tr>
<tr>
<td></td>
<td>20 dB minimum-1448 to 1511 MHz</td>
</tr>
<tr>
<td></td>
<td>25 dB minimum-4900 to 5875 MHz</td>
</tr>
<tr>
<td></td>
<td>25 dB minimum-698 to 960 MHz</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linear, Vertical</td>
</tr>
<tr>
<td>Radiation pattern</td>
<td>Omnidirectional</td>
</tr>
</tbody>
</table>
Table 3  GPS Antenna Radio Frequency Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna type</td>
<td>Patch</td>
</tr>
<tr>
<td>Frequency</td>
<td>1575.42 ± 1 MHz (GPS L1)</td>
</tr>
<tr>
<td>Nominal impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>VSWR</td>
<td>2.0:1 maximum</td>
</tr>
<tr>
<td>Amplifier Gain</td>
<td>27 ± 3 dB</td>
</tr>
<tr>
<td>DC currant</td>
<td>20 mA maximum</td>
</tr>
<tr>
<td>DC voltage</td>
<td>2.7 to 12 V</td>
</tr>
<tr>
<td>Isolation, Cellular to GPS</td>
<td>10 dB minimum–1574.42 to 1576.42 MHz</td>
</tr>
<tr>
<td></td>
<td>Cellular coexistence tested over multiple bands, GPS includes coexistence filters.</td>
</tr>
<tr>
<td>Polarization</td>
<td>RHCP</td>
</tr>
<tr>
<td>Radiation pattern</td>
<td>Hemispherical</td>
</tr>
</tbody>
</table>

Environmental and Operational Specifications

Table 4  Environmental and Operational Specifications for the Cisco ANT-5-4G2WL2G1-O Antenna

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature range</td>
<td>-40 to 158°F (~-40 to 70°C)</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>-40 to 185°F (~-40 to 85°C)</td>
</tr>
<tr>
<td>Altitude</td>
<td>15,000 feet. (4.5 km)</td>
</tr>
<tr>
<td>Humidity</td>
<td>5 to 95%</td>
</tr>
<tr>
<td></td>
<td>Tested to a variety of appropriate industrial, vehicular, transportation, and mil-spec standards.</td>
</tr>
</tbody>
</table>

Mechanical Specifications

Table 5  Mechanical Specifications for the Cisco ANT-5-4G2WL2G1-O Antenna

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mount style</td>
<td>Roof mount, bulkhead</td>
</tr>
<tr>
<td>Connector</td>
<td>- Cellular – TNC male</td>
</tr>
<tr>
<td></td>
<td>- WLAN – RP-TNC male</td>
</tr>
<tr>
<td></td>
<td>- GPS – SMA male</td>
</tr>
<tr>
<td>Cable type</td>
<td>- Cellular – RG-58</td>
</tr>
<tr>
<td></td>
<td>- WLAN – RG-58</td>
</tr>
<tr>
<td></td>
<td>- GPS – RG-174</td>
</tr>
</tbody>
</table>
Table 5  Mechanical Specifications for the Cisco ANT-5-4G2WL2G1-O Antenna

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable length</td>
<td>- Cellular – 2 foot. (61 cm)</td>
</tr>
<tr>
<td></td>
<td>- WLAN – 2 foot. (61 cm)</td>
</tr>
<tr>
<td></td>
<td>- GPS – 17 foot. (518 cm)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>7.1 in. (18.0 cm) diameter, 2.48 in. (6.3 cm) height</td>
</tr>
<tr>
<td>Weight</td>
<td>1.48 lbs (0.67 kg)</td>
</tr>
<tr>
<td>IP rating</td>
<td>IP67</td>
</tr>
<tr>
<td>Radome</td>
<td>Polycarbonate, UV resistant, black</td>
</tr>
<tr>
<td>Material substance compliance</td>
<td>ROHS compliant</td>
</tr>
</tbody>
</table>

Power Specifications

Table 6  Power Specifications for the Cisco ANT-5-4G2WL2G1-O Antenna

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>Maximum input power per port</td>
<td>5 watts</td>
</tr>
</tbody>
</table>

Antenna Radiation Patterns

- 698 MHz Cellular Antenna Radiation Patterns
- 880 MHz Cellular Antenna Radiation Patterns
- 960 MHz Cellular Antenna Radiation Patterns
- 1470 MHz Cellular Antenna Radiation Patterns
- 1710 MHz Cellular Antenna Radiation Patterns
- 2170 MHz Cellular Antenna Radiation Patterns
- 2700 MHz Cellular Antenna Radiation Patterns
- 2400 MHz WLAN Antenna Radiation Patterns
- 2500 MHz WLAN Antenna Radiation Patterns
- 4900 MHz WLAN Antenna Radiation Patterns
- 5150 MHz WLAN Antenna Radiation Patterns
- 5275 MHz WLAN Antenna Radiation Patterns
- 5875 MHz WLAN Antenna Radiation Patterns
- GPS Radiation Patterns
698 MHz Cellular Antenna Radiation Patterns

880 MHz Cellular Antenna Radiation Patterns

960 MHz Cellular Antenna Radiation Patterns

Figure 3  960 MHz Cellular Antenna Radiation Patterns
Cisco 5-in-1 Vehicle Mount and Fixed Infrastructure Antenna (ANT-5-4G2WL2G1-O)

1470 MHz Cellular Antenna Radiation Patterns

**Figure 4  1470 MHz Cellular Antenna Radiation Patterns**

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (---)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (----)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

1710 MHz Cellular Antenna Radiation Patterns

**Figure 5  1710 MHz Cellular Antenna Radiation Patterns**

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (---)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (----)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>
Line Color | Description
--- | ---
Blue (−) | Port 1
Red (−) | Port 2

2170 MHz Cellular Antenna Radiation Patterns

**Figure 6  2170 MHz Cellular Antenna Radiation Patterns**

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (−)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (−)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

2700 MHz Cellular Antenna Radiation Patterns

**Figure 7  2700 MHz Cellular Antenna Radiation Patterns**
WLAN WiFi Antenna Radiation Patterns

2400 MHz WLAN Antenna Radiation Patterns

Figure 8 2400 MHz WLAN Antenna Radiation Patterns

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (—)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (—)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

2500 MHz WLAN Antenna Radiation Patterns

Figure 9 2500 MHz WLAN Antenna Radiation Patterns

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (—)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (—)</td>
<td>Port 2</td>
</tr>
<tr>
<td>Line Color</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Blue (—)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (—)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

**4900 MHz WLAN Antenna Radiation Patterns**

**Figure 10  4900 MHz WLAN Antenna Radiation Patterns**

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (—)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (—)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

**5150 MHz WLAN Antenna Radiation Patterns**

**Figure 11  5150 MHz WLAN Antenna Radiation Patterns**
Cisco 5-in-1 Vehicle Mount and Fixed Infrastructure Antenna (ANT-5-4G2WL2G1-O)

5275 MHz WLAN Antenna Radiation Patterns

**Figure 12** 5275 MHz WLAN Antenna Radiation Patterns

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (—)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (—)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>

5875 MHz WLAN Antenna Radiation Patterns

**Figure 13** 5875 MHz WLAN Antenna Radiation Patterns

<table>
<thead>
<tr>
<th>Line Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (—)</td>
<td>Port 1</td>
</tr>
<tr>
<td>Red (—)</td>
<td>Port 2</td>
</tr>
</tbody>
</table>
Installing the Antenna

The antenna installation includes the following procedures:
Contents of the Antenna Kit

The antenna kit contains:

- 1 x Cisco ANT-5-4G2WL2G1-O antenna

Safety Warnings

**WARNING:** Avoid using or servicing any equipment that has outdoor connections during an electrical storm. There may be a risk of electric shock from lightning. Statement 1088

**WARNING:** Do not work on the system, or connect or disconnect cables, during periods of lightning activity. Statement 1001

**WARNING:** Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.: NFPA 70, National Electrical Code, Article 810, Canada: Canadian Electrical Code, Section 54). Statement 1052

**WARNING:** This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024

**WARNING:** Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

**WARNING:** To report a gas leak, do not use a telephone in the vicinity of the leak. Statement 1039

**WARNING:** This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071. SAVE THESE INSTRUCTIONS.

**WARNING:** This product is not intended to be directly connected to the Cable Distribution System. Additional regulatory compliance and legal requirements may apply for direct connection to the Cable Distribution System. This product may connect to the Cable Distribution System ONLY through a device that is approved for direct connection. Statement 1078

Safety Precautions

**WARNING:** Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.

For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!
For your safety, read and follow these safety precautions.

- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

- Find someone to help you—installing an antenna is often a two-person job.

- Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

- Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.

- Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

- When installing your antenna, follow these guidelines:
  - Do not use a metal ladder.
  - Do not work on a wet or windy day.
  - Do dress properly—wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.

- If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.

- If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.

- If an accident should occur with the power lines, call for qualified emergency help immediately.

### Tools and Equipment Required

In addition to the parts included in the antenna kit described in the section Contents of the Antenna Kit, you must provide the following tool to install the antenna on the router:

- Open-ended wrench
- Electric drill

**NOTE:** This list does not include the tools and equipment required to assemble and erect the tower, mast, or other structure you intend to mount your antenna on.

### Mounting the Antenna

**NOTE:** A clean, flat surface at least 20 x 20 cm (8 x 8 in.) in area is required for mounting the antenna.

Follow these instructions to mount the antenna:

1. Mark the desired location where you plan to mount the antenna and create a hole through the surface. The diameter of the hole must be at least 0.75 in. (1.91 cm).

2. Thread the cables through the hole and insert the aluminum stud on the underside of the antenna into the hole. Ensure that the foam gasket on the underside of the antenna sits flush against the mounting surface.
3. Inside the vehicle, place the rubber sealing washer around the stud. Then place the metal washer and the metal nut onto the stud. Tighten the nut.

Connecting the Antenna to the Router

To attach the router-end of the cable to your router, please see the Cisco 800 Series Industrial Integrated Services Routers page and view the respective Hardware Installation Guide.

NOTE: Coaxial cable loses efficiency as the frequency increases, resulting in signal loss. The cable should be kept as short as possible because cable length also determines the amount of signal loss—the longer the cable length or run, the greater the loss.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly What’s New in Cisco Product Documentation, which also lists all new and revised Cisco technical documentation, at:


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Cisco Aironet Dual-band Dipole Antenna (AIR-ANT2524DB-R, AIR-ANT2524DG-R, and AIR-ANT2524DW-R)

This describes the Cisco Aironet high-performance, dual-band dipole antenna, and provides specifications and mounting instructions. The antenna operates in both the 2.4 GHz and 5 GHz frequency bands, and is designed for use with Cisco Aironet 2.4 GHz and 5 GHz radio products with dual-band reverse-polarity TNC (RP-TNC) antenna ports. The antenna has a nominal gain of 2 dBi in the 2.4 GHz frequency band and 4 dBi in the 5 GHz frequency band. The three antennas covered in this document are electrically the same. They differ physically by the color of the radome, which is specified by the product part number shown in Table 1.

<table>
<thead>
<tr>
<th>Antenna Part Numbers</th>
<th>Radome Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIR-ANT2524DB-R</td>
<td>Black</td>
</tr>
<tr>
<td>AIR-ANT2524DG-R</td>
<td>Gray</td>
</tr>
<tr>
<td>AIR-ANT2524DW-R</td>
<td>White</td>
</tr>
</tbody>
</table>

These topics are discussed:

- Technical Specifications
- System Requirements
- Features
- Installing the Antenna
- Obtain Documentation and Submit a Service Request
Technical Specifications

Table 2  AIR-ANT2524Dx-R Series Dual-band Dipole Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna type</td>
<td>Dual-band dipole</td>
</tr>
<tr>
<td>Operating frequency range</td>
<td>2400 to 2500 MHz, 5150 to 5850 MHz</td>
</tr>
<tr>
<td>Nominal input impedance</td>
<td>50 Ohms</td>
</tr>
<tr>
<td>VSWR</td>
<td>Less than 2:1</td>
</tr>
<tr>
<td>Peak Gain @ 2.4 GHz</td>
<td>2 dBi</td>
</tr>
<tr>
<td>Peak Gain @ 5 GHz</td>
<td>4 dBi</td>
</tr>
<tr>
<td>Elevation plane 3dB beamwidth @ 2.4 GHz</td>
<td>63 degrees</td>
</tr>
<tr>
<td>Elevation plane 3dB beamwidth @ 5 GHz</td>
<td>39 degrees</td>
</tr>
<tr>
<td>Connector type</td>
<td>RP-TNC plug</td>
</tr>
<tr>
<td>Antenna length</td>
<td>6.63 in. (168.5 mm)</td>
</tr>
<tr>
<td>Antenna width</td>
<td>0.83 in. (21 mm)</td>
</tr>
<tr>
<td>Radome length</td>
<td>4.88 in. (124 mm)</td>
</tr>
<tr>
<td>Weight</td>
<td>1.3 oz</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-4° to 140° F (-20°C to 60°C)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40° F to 185° F (-40°C to 85°C)</td>
</tr>
<tr>
<td>Environment</td>
<td>Indoor, office</td>
</tr>
</tbody>
</table>

Azimuth and Elevation Plane Patterns for 2.4 GHz

Azimuth and Elevation Plane Patterns for 5 GHz

System Requirements
This antenna is designed for use with Cisco Aironet access points that support simultaneous operation in the 2.4 GHz band and the 5 GHz band and that have dual-band antenna ports, labeled in orange text.

Features

The antenna has an articulated base that can be rotated 360 degrees at the connection point and from 0 to 90 degrees at its joint.

Installing the Antenna

**CAUTION:** The AIR-ANT2524Dx-R series of antennas are dual-band antennas, meaning that they operate in both the 2.4 GHz and 5 GHz frequency bands. The AIR-ANT2524Dx-R series antennas have an orange ID band on them to indicate their dual-band functionality. Connect these antennas only to dual-band antenna ports, which are identified with orange text on Cisco Aironet access points. Using these antennas on Cisco Aironet access points that employ single-band antennas might result in lower performance.

To install the antenna:

1. Verify that the connector to which you are connecting the antenna is a dual-band antenna port, identified by orange text on the access point.
2. Align the antenna connector with the RP-TNC connector on the access point.
3. Engage the antenna connector threads with the RP-TNC connector on the access point.
4. Tighten the antenna by hand. Do not use a wrench or any other tool to tighten the antenna.
5. Adjust the antenna articulating joint to the desired position.

Obtain Documentation and Submit a Service Request

For information on obtaining documentation, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see [What’s New in Cisco Product Documentation](#).

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The following information is for FCC compliance of Class B devices: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio
communications. However, there is no guarantee that interference will not occur in a particular installation. If the equipment causes interference to radio or television reception, which can be determined by turning the equipment off and on, users are encouraged to try to correct the interference by using one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Modifications to this product not authorized by Cisco could void the FCC approval and negate your authority to operate the product.

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Cisco GPS Antenna
(ANT-GPS-OUT-TNC)

The Cisco GPS Antenna is designed to cover a domestic frequency of 1575 MHz.

This antenna is compatible with any Cisco device that uses GPS, and is compatible with active GPS antennas with DC specifications given below. Connector adapters may be required from TNC(m) to the required interface. The antenna is a rugged outdoor antenna, and is IP67 rated.

**CAUTION**: Read the information in *Overview* before installing or replacing antennas.

This chapter covers the following topics:

- Technical Specifications
- Safety Warnings
- Antenna Installation
- Obtaining Documentation and Submitting a Service Request

**Technical Specifications**

The GPS antenna features the following:

- Outdoor
- Low-profile housing
- Integrated LMR-100 cable with right-angle TNC(m) male connector
RF Specifications

The following is a summary of the antenna radio frequency (RF) specifications:

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GPS antenna</td>
</tr>
<tr>
<td>2</td>
<td>Mounting bracket</td>
</tr>
<tr>
<td>3</td>
<td>LMR-100 cable (15')</td>
</tr>
<tr>
<td>4</td>
<td>Right-angle TNC male connector</td>
</tr>
<tr>
<td>5</td>
<td>Pipe (mast)</td>
</tr>
<tr>
<td>6</td>
<td>U-bolt connected to U-bracket</td>
</tr>
</tbody>
</table>
Cisco GPS Antenna (ANT-GPS-OUT-TNC)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Cisco GPS Antenna (ANT-GPS-OUT-TNC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Patch, active</td>
</tr>
<tr>
<td>Operating frequency range</td>
<td>1575.42 MHz +/- 5 MHz</td>
</tr>
<tr>
<td>Impedance</td>
<td>50 ohm, nominal</td>
</tr>
<tr>
<td>VSWR</td>
<td>2.0 max. in band</td>
</tr>
<tr>
<td>Gain</td>
<td>4.0 dBi min. @ Zenith</td>
</tr>
<tr>
<td>Minimum gain</td>
<td>1 dBi @ 10-degrees elevation</td>
</tr>
<tr>
<td>Pattern type</td>
<td>Hemispherical</td>
</tr>
<tr>
<td>Polarization</td>
<td>Circular RHCP</td>
</tr>
<tr>
<td>LNA gain</td>
<td>25 dB +/-2 dB</td>
</tr>
<tr>
<td>Front end GPS filter</td>
<td>This antenna features a GPS RF filter in front of the LNA to enable co-location with other radios.</td>
</tr>
<tr>
<td>Out-of-band attenuation</td>
<td>20 dB min. at 1575 +/- 50 MHz</td>
</tr>
<tr>
<td>DC voltage</td>
<td>3 to 5 VDC</td>
</tr>
<tr>
<td>Current draw</td>
<td>20 mA max. @ 3.3 VDC +/- .3 VDC</td>
</tr>
</tbody>
</table>

### Mechanical and Environmental Specifications

The following is a summary of the mechanical and environmental antenna specifications:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Cisco GPS Antenna (ANT-GPS-OUT-TNC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment</td>
<td>Outdoor (IP67)</td>
</tr>
<tr>
<td>Height</td>
<td>0.87 in. (2.21 cm)</td>
</tr>
<tr>
<td>Diameter (maximum, at base)</td>
<td>2.0 in. (5.0 cm)</td>
</tr>
<tr>
<td>Connector</td>
<td>Right-angle TNC(m)</td>
</tr>
<tr>
<td>Cable</td>
<td>LMR-100A, 15ft (4.57m)</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-40 to 185 degrees Fahrenheit (-40 to 85 degrees Centigrade)</td>
</tr>
<tr>
<td>Wind speed rating</td>
<td>165 MPH</td>
</tr>
<tr>
<td>Compliance</td>
<td>ROHS</td>
</tr>
</tbody>
</table>

### Safety Warnings

**WARNING:** Avoid using or servicing any equipment that has outdoor connections during an electrical storm. There may be a risk of electric shock from lightning. Statement 1088

**WARNING:** Do not work on the system, or connect or disconnect cables, during periods of lightning activity. Statement 1001

**WARNING:** Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.:NFPA 70, National Electrical Code, Article 810, Canada:Canadian Electrical Code, Section 54). Statement 1052
**WARNING:** This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024

**WARNING:** Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

**WARNING:** To report a gas leak, do not use a telephone in the vicinity of the leak. Statement 1039

**WARNING:** This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071. SAVE THESE INSTRUCTIONS.

**WARNING:** This product is not intended to be directly connected to the Cable Distribution System. Additional regulatory compliance and legal requirements may apply for direct connection to the Cable Distribution System. This product may connect to the Cable Distribution System ONLY through a device that is approved for direct connection. Statement 1078

### Safety Precautions

**WARNING:** Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.

For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!

For your safety, read and follow these safety precautions.

- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

- Find someone to help you—installing an antenna is often a two-person job.

- Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

- Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.

- Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

- When installing your antenna, follow these guidelines:
  - Do not use a metal ladder.
  - Do not work on a wet or windy day.
  - Do dress properly—wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.

- If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.

- If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.
If an accident should occur with the power lines, call for qualified emergency help immediately.

Antenna Installation

Follow these steps to install the GPS antenna onto the router:

**NOTE:** These installation steps are for the CGR1120 router.

1. Mount the antenna in its proper location by using the provided antenna bracket.

2. Route and connect the LMR-100 cable to the TNC-to-N-connector adapter installed at the building entry panel.

3. At the inside of the entry panel, install the LMR-100 cable to the N-connector on the adapter.

4. Route the cable to the router and attach to the antenna connector.
Note: All Dimensions are in millimeters (mm).
Figure 3   Tolerance Table

<table>
<thead>
<tr>
<th>Dimension (mm)</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 - 6</td>
<td>±0.05</td>
</tr>
<tr>
<td>6 - 30</td>
<td>±0.10</td>
</tr>
<tr>
<td>30 - 120</td>
<td>±0.15</td>
</tr>
<tr>
<td>120 - 400</td>
<td>±0.30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimension of shorter side (millimeter)</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 10</td>
<td>±1&quot;</td>
</tr>
<tr>
<td>10 - 50</td>
<td>±0.30&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Radius, chamfer height</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 - 3</td>
<td>±0.2</td>
</tr>
<tr>
<td>3 - 6</td>
<td>±0.5</td>
</tr>
</tbody>
</table>

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly What's New in Cisco Product Documentation, which also lists all new and revised Cisco technical documentation, at:


Subscribe to the What's New in Cisco Product Documentation as an RSS (Really Simple Syndication) feed, and set it so content is delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS Version 2.0.

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Cisco Outdoor 5 dBi Omni Antenna for 863-928 MHz WPAN, LoRaWan, and ISM (ANT-LPWA-DB-O-N-5)

This document describes the 5 dBi Outdoor Omni-directional Antenna for the Cisco WPAN, LoRaWan, ISM modules and routers operating in frequency ranges between 863-928 MHz, such as 863-876 MHz ETSI, or 902-928 MHz ISM bands. In addition, this document provides the antenna specifications and mounting instructions for the antenna.

CAUTION: Read the information in Safety Warnings before installing or replacing antennas.

This chapter covers the following topics:

- Technical Specifications
- Antenna Installation
- Antenna Radiation Patterns
- Safety Warnings

Technical Specifications

The Outdoor Omni-directional Antenna features the following:

- UV-resistant fiberglass radome
- Heavy duty mounting bracket
- Gold anodized sleeve and top cap with N (female) connector
- DC-grounded for ESD protection

NOTE: Antenna data sheets often claim lightning protection, while in reality only providing a DC ground path for ESD protection. Cisco recommends use of a lightning arrester for all antennas potentially exposed to lightning strikes.
Specifications

Table 1 provides RF and Mechanical Specification.

**Table 1 Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Bands</td>
<td><strong>863-876 MHz</strong></td>
</tr>
<tr>
<td></td>
<td><strong>902-928 MHz</strong></td>
</tr>
<tr>
<td>Peak Gain (dBi) Typical</td>
<td>5.2 dBi</td>
</tr>
<tr>
<td></td>
<td>5.4 dBi</td>
</tr>
<tr>
<td>Peak Gain (dBi) Max</td>
<td>5.3 dBi</td>
</tr>
<tr>
<td></td>
<td>5.6 dBi</td>
</tr>
<tr>
<td>Efficiency</td>
<td>74%-81%</td>
</tr>
<tr>
<td></td>
<td>75%-83%</td>
</tr>
<tr>
<td>VSWR (Avg)</td>
<td>1.5:1</td>
</tr>
<tr>
<td></td>
<td>1.5:1</td>
</tr>
<tr>
<td>VSWR (Max)</td>
<td>1.65:1</td>
</tr>
<tr>
<td></td>
<td>1.65:1</td>
</tr>
<tr>
<td>Azimuth 3 dB Beam width</td>
<td>360°</td>
</tr>
<tr>
<td></td>
<td>360°</td>
</tr>
<tr>
<td>Elevation 3 dB Beam width</td>
<td>28°-30°</td>
</tr>
<tr>
<td></td>
<td>27°-29°</td>
</tr>
<tr>
<td>Azimuth Ripple (Max), dB</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>0.8</td>
</tr>
<tr>
<td>Nominal Impedance</td>
<td>50 Ohms</td>
</tr>
<tr>
<td>Polarization</td>
<td>Vertical</td>
</tr>
<tr>
<td>Anti–Static Protection</td>
<td>DC Grounded</td>
</tr>
<tr>
<td>Max Power (Ambient 25°C)</td>
<td>10 Watts</td>
</tr>
<tr>
<td>Antenna Dimension (H x Diameter)</td>
<td>692 x 33.3 mm (27.2” x 1.3”)</td>
</tr>
</tbody>
</table>
Cisco Outdoor 5 dBi Omni Antenna for 863-928 MHz WPAN, LoRaWan, and ISM (ANT-LPWA-DB-O-N-5)

**Specification** | **Description**
---|---
Connector | Type N Female
Weight | 0.79 kg (1.7 lbs)
Antenna Color | White
Radome | Fiberglass
Wind Operational | 161 km/h (100 mph)
Wind Survival | 266 km/h (165 mph)
Operating Temperature | -40°C to +70°C (-40°F to +158°F)
Storage Temperature | -40°C to +85°C (-40°F to +185°F)
Ingression Protection | IP67
Material Substance Compliance | RoHS
Environmental Testing | Antenna passed extensive environmental and mechanical tests appropriate for mast mount applications.

**NOTE:** Antenna must be mounted vertically to obtain omni-directional coverage horizontally. Please see antenna radiation pattern.
Dimensions

Figure 2 shows the Antenna Dimensions.

Figure 2  Dimensions

**NOTE:** Antenna dimensions are shown in Millimeters.

Antenna Installation

The antenna installation includes the following procedures:

- **Tools and Equipment Required**
- **Mounting Components**
Tools and Equipment Required

In addition to the parts included in the antenna kit, you must provide the following tools to install the antenna on the router:

- 1/2" & 7/16" open-end wrench

**NOTE:** This list does not include the tools and equipment required to assemble and erect the tower, mast, or other structure you intend to mount your antenna on.

Mounting Components

The antenna can be mounted on a 1-1/2" to 2-1/2" (3.81 to 6.35 cm) pole, extension arm, or mast. The antenna and mounting components are shown in the following figure.
Figure 3  Antenna Mounting Components

Figure 4  Antenna Mounting Details
<table>
<thead>
<tr>
<th>Item Number</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>External Bracket, AL, FOR FM2</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>V-Bolt Clamp, 1/4-20, ST, NF</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Fits a 1-1/2&quot; to 2-1/2&quot; (3.81 to 6.35 cm) pole.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Flat Washer, 1/4 in, SS, PA</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Split-lock Washer, 1/4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Hex Nut, [1/4-20], SS, PA</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Hex Bolt, 5/16-18x1/2, SS, NF</td>
<td>2</td>
</tr>
</tbody>
</table>
Antenna Radiation Patterns

The following sequence of illustrations show the different antenna radiation patterns. The azimuth radiation plane is shown on the left, and elevation plane pattern is shown on the right.
Figure 5  863 MHz Radiation Pattern

Figure 6  869 MHz Radiation Pattern

Figure 7  876 MHz Radiation Pattern
Figure 8  902 MHz Radiation Pattern

Figure 9  914 MHz Radiation Pattern
Figure 10  928 MHz Radiation Pattern

Safety Warnings

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**WARNING:** Do not work on the system, or connect or disconnect cables, during periods of lightning activity. Statement 1001

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**WARNING:** To report a gas leak, do not use a telephone in the vicinity of the leak. Statement 1039

**WARNING:** This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071. SAVE THESE INSTRUCTIONS.

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---

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- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

- Find someone to help you—installing an antenna is often a two-person job.

- Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

- Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.

- Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

- When installing your antenna, follow these guidelines:
  - Do not use a metal ladder.
  - Do not work on a wet or windy day.
  - Do dress properly—wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.

- If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.

- If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.
If an accident should occur with the power lines, call for qualified emergency help immediately.
The Cisco ANT-MP2-I-OUT-M and ANT-MP2-I-O-SS-M antennas and cable kits are designed to cover frequencies from 698 to 960 MHz and 1710 to 2700 MHz.

The antennas are designed for direct mounting on the CGR1240 and have an MCX connector.

**CAUTION:** Read the information in Overview before installing or replacing antennas.

This chapter covers the following topics:

- Technical Specifications
- Integrated Antenna Kits
- Safety Warnings
- Antenna Installation
- Obtaining Documentation and Submitting a Service Request

**Technical Specifications**

The Multi-purpose Integrated Antenna features the following:

- Indoors and outdoors operation, IP67 rated
- Low-profile housing
- Supports 3G and 4G, 915 MHz ISM, and 2.4 GHz WiFi and other bands
- High performance 698–960, 1710–2700 MHz antenna
RF Specifications

The following is a summary of the monopole Radio Frequency (RF) antenna specifications:
Mechanical Specifications

The following is a summary of the monopole antenna specifications:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic radome</td>
<td>PC/polyester blend, .110 thick min.</td>
</tr>
<tr>
<td>Flammability</td>
<td>UL94 V-0</td>
</tr>
<tr>
<td>Color</td>
<td>Cisco gray</td>
</tr>
<tr>
<td>Ingress protection</td>
<td>IP67</td>
</tr>
<tr>
<td>Weight</td>
<td>90 g</td>
</tr>
<tr>
<td>Wind-loading</td>
<td>165 MPH</td>
</tr>
<tr>
<td>Overall length</td>
<td>3.04 inches</td>
</tr>
<tr>
<td>Installation torque</td>
<td>6 to 9 ft/lbs</td>
</tr>
<tr>
<td>Installation tool</td>
<td>Recommended strap wrench, similar to McMaster Car P/N: 5448A31</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-40 to 185 degrees F (-40 to 85 degrees C)</td>
</tr>
</tbody>
</table>

Radiation Patterns

All radiation patterns, gain, and VSWR were measured with the antenna mounted at the center of a 12-by-12-inch ground plane.
Figure 2  Radiation Pattern—Vertical Plane

Figure 3  Radiation Pattern—Vertical Plane

Figure 4  Radiation Pattern—Vertical Plane
Figure 5  Radiation Pattern—Horizontal Plane

Figure 6  Radiation Pattern—Horizontal Plane
Figure 7  Radiation Pattern—Horizontal Plane

Figure 8  VSWR
Integrated Antenna Kits

Antennas are only sold as antenna + cable kits. The kit will contain one or more antennas, gaskets, and coaxial cables. See Figure 11.
ANT-MP2-I-OUT-M and ANT-MP2-I-O-SS-M Antenna and Cable Kits

Integrated Antenna Kit Inventory
The antenna and other items contained in all of the kits are identical. Quantity changes depending on the kit selected.

- Antenna
- Coax seal
- Tie wrap

<table>
<thead>
<tr>
<th></th>
<th>Antenna quantity</th>
<th>Gasket quantity</th>
<th>10.5&quot; RF Cable quantity</th>
<th>Tie Wrap quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANT-MP2-I-OUT-M</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>ANT-MP2-I-O-SS-M</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Safety Warnings

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**WARNING:** Do not work on the system, or connect or disconnect cables, during periods of lightning activity. Statement 1001

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Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.

For your safety, and to help you achieve a good installation, please read and follow these safety precautions. *They may save your life!*

For your safety, read and follow these safety precautions.

**WARNING:** In order to comply with FCC radio frequency (RF) exposure limits, antennas should be located at a minimum of 7.9 inches (20 cm) or more from the body of all persons. Statement 332

- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

- Plan your installation procedure carefully and completely before you begin.

- Choose your installation site with safety performance in mind. Remember that electric power cables and telephone lines look alike. For your safety, assume that any line is an electric power line until determined otherwise.

- Call your local power company or building maintenance organization if you are unsure about cables close to your mounting location.

- When installing your antenna, do not use a metal ladder. Dress in rubber soled shoes and heels, rubber gloves, and a long-sleeved shirt or jacket.

- If an accident or emergency occurs with the power lines, call for qualified emergency help immediately.

- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

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If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.

If an accident occurs with the power lines, call for qualified emergency help immediately.

**Antenna Installation**

This section covers the following topics:

- Installation Notes
- Tools and Equipment Required
- Install the Antenna onto the CGR 1240 Router

**Installation Notes**

This Cisco Multi-purpose Integrated Antenna is designed to be mounted directly onto the router. In addition to antenna orientation, wireless access point installation location with respect to all wireless clients plays a significant role in determining overall network performance.

Because antennas transmit and receive radio signals, their performance can be adversely affected by the surrounding environment including distance between the Field Area Router (FAR) and cellular base station, physical obstructions, or radio frequency (RF) interference.

Follow these guidelines to ensure the best possible performance:

- Install the router with antenna without physical obstructions. Barriers along the line of sight between the FAR and cellular base station degrade the wireless radio signals.

- The density of the materials used in a building’s construction determines the number of walls the signal must pass through and still maintain adequate coverage. Consider the following before choosing the location to install your antenna:
  - Paper and vinyl walls have very little effect on signal penetration.
  - Solid and precast concrete walls limit signal penetration to one or two walls without degrading coverage.
  - Concrete and wood block walls limit signal penetration to three or four walls.
  - A signal can penetrate five or six walls constructed of drywall or wood.
  - A thick metal wall or wire-mesh stucco walls causes signals to reflect back and cause poor penetration.

- Avoid mounting the antenna next to a column or vertical support that could create a shadow zone and reduce the coverage area.

- Keep the antenna away from reflective metal objects such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use an extension cable to relocate the antenna away from these obstructions.

**CAUTION:** Install the router and antenna away from appliances that share the same frequency bands. Microwave ovens, cordless telephones, and security monitors can temporarily interfere with wireless performance.

**CAUTION:** Avoid installing wireless antennas in or near rack-mounted installations that include networking equipment and computer servers whose radiated noise emissions can severely degrade radio performance.
NOTE: If the desired installation site has a marginally acceptable level of radiated noise emissions, consider using a remote-mounted antenna, such as a wall-mount or ceiling-mount antenna, for better radio performance and coverage.

Tools and Equipment Required

In addition to the parts included in the antenna kit described in the section Integrated Antenna Kits, you must provide the following tool to install the antenna on the router:

- Strap wrench
- 13 mm socket wrench

Install the Antenna onto the CGR 1240 Router

Follow these steps to install the antenna onto the router:

1. Remove the plug on the antenna connector if one is present.

2. Attach the monopole antenna to your desired antenna port. Do not tighten the antenna completely—stop tightening so that the antenna is not fully installed.

3. From the chassis interior, the antenna MCX jack should be visible in the plug. With one hand, position the right-angle end of the antenna cable to the antenna’s MCX jack. With your other hand, push the cable end so it inserts into the MCX jack of the antenna.
4. From the exterior of the router, tighten the antenna using the torque wrench. Tighten to 6 to 7 ft-lbs.

5. From the interior of the router, install the coaxial end of the cable to the appropriate connector on your installed module. The antenna and module ports should be the same color (red, yellow, or green).

**NOTE:** Some modules require two antennas: a main antenna and a diversity antenna. These modules have two antenna connectors on the front panel, labeled MAIN and DIV. Be sure to connect the main and diversity antennas to the correct module connectors.

**Obtaining Documentation and Submitting a Service Request**

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Cisco Multi-purpose Integrated Antenna (ANT-MP-INT-OUT-M)

The Cisco Multipurpose Integrated Antenna is designed to cover domestic frequencies from 806 to 960 MHz and 1710 to 2700 MHz.

This antenna is designed for direct mounting on the CGR1240 and has an MCX connector.

CAUTION: Read the information in Safety Warnings before installing or replacing antennas.

This chapter covers the following topics:
- Technical Specifications
- Integrated Antenna Kit
- Safety Warnings
- Antenna Installation
- Obtaining Documentation and Submitting a Service Request

Technical Specifications

The Multi-purpose Integrated Antenna features the following:
- Indoors and outdoors
- Low-profile housing
- Adjustable mounting brackets
- Supports 3G and 4G
RF Specifications

The following is a summary of the monopole Radio Frequency (RF) antenna specifications:
Cisco Multi-purpose Integrated Antenna (ANT-MP-INT-OUT-M)

Mechanical Specifications

The following is a summary of the monopole antenna specifications:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic radome</td>
<td>PC/polyester blend, Makroblend EL 703, .110 think min.</td>
</tr>
<tr>
<td>Flammability</td>
<td>UL94 V-0</td>
</tr>
<tr>
<td>Color</td>
<td>Cisco gray</td>
</tr>
<tr>
<td>Ingress protection</td>
<td>IP67</td>
</tr>
<tr>
<td>Weight</td>
<td>90 g</td>
</tr>
<tr>
<td>Wind-loading</td>
<td>165 MPH</td>
</tr>
<tr>
<td>Overall length</td>
<td>3.04 inches</td>
</tr>
<tr>
<td>Installation torque</td>
<td>6 to 9 ft/lbs</td>
</tr>
<tr>
<td>Installation tool</td>
<td>Recommended strap wrench, similar to McMaster Car P/N: 5448A31</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-40 to 185 degrees F (-40 to 85 degrees C)</td>
</tr>
</tbody>
</table>

Radiation Patterns

All radiation patterns, gain, and VSWR are measured with the antenna mounted at the center of a 12-by-12-inch ground plane.
Figure 2  Radiation Pattern—Vertical Plane

Figure 3  Radiation Pattern—Vertical Plane
Figure 4  Radiation Pattern—Vertical Plane
Figure 5  Radiation Pattern—Horizontal Plane
Figure 6  Radiation Pattern—Horizontal Plane
Figure 7  Radiation Pattern—Horizontal Plane
Figure 8  Radiation Pattern—Horizontal Plane
Cisco Multi-purpose Integrated Antenna (ANT-MP-INT-OUT-M)
Figure 9 Radiation Pattern—VSWR

![VSWR Graph](image-url)
Figure 10  Radiation Pattern–Peak Gain

![Graph showing Peak Gain vs Frequency](image)
Integrated Antenna Kit

The multi-purpose integrated antenna is shown here but the kit is identical for all antenna models.
Integrated Antenna End Kit Inventory

The multi-purpose integrated antenna kit is identical for all antenna models.

- Antenna-to-module coaxial cable (MCX-to-QMA, 10.5”)
- Coax seal
- Tie wrap

Mounted Antenna End Kit Inventory

- N-connector
- Weather-proof coaxial seal
- Electrical joint compound
- Universal MCX-to-QMA cable (10.5”)
- Tie wraps
- Cap

Safety Warnings

**WARNING:** Avoid using or servicing any equipment that has outdoor connections during an electrical storm. There may be a risk of electric shock from lightning. Statement 1088

**WARNING:** Do not work on the system, or connect or disconnect cables, during periods of lightning activity. Statement 1001
WARNING: Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.: NFPA 70, National Electrical Code, Article 810, Canada: Canadian Electrical Code, Section 54). Statement 1052

WARNING: Do not work on the system or connect or disconnect cables during periods of lightning activity. Statement 1001

WARNING: This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024

WARNING: Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

WARNING: To report a gas leak, do not use a telephone in the vicinity of the leak. Statement 1039

WARNING: This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071. SAVE THESE INSTRUCTIONS.

WARNING: This product is not intended to be directly connected to the Cable Distribution System. Additional regulatory compliance and legal requirements may apply for direct connection to the Cable Distribution System. This product may connect to the Cable Distribution System ONLY through a device that is approved for direct connection. Statement 1078

Safety Instructions

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.

WARNING: For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!

For your safety, read and follow these safety precautions.

WARNING: In order to comply with FCC radio frequency (RF) exposure limits, antennas should be located at a minimum of 7.9 inches (20 cm) or more from the body of all persons. Statement 332

- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

- Plan your installation procedure carefully and completely before you begin.

- Choose your installation site with safety performance in mind. Remember that electric power cables and telephone lines look alike. For your safety, assume that any line is an electric power line until determined otherwise.

- Call your local power company or building maintenance organization if you are unsure about cables close to your mounting location.

- When installing your antenna, do not use a metal ladder. Dress in rubber soled shoes and heels, rubber gloves, and a long-sleeved shirt or jacket.

- If an accident or emergency occurs with the power lines, call for qualified emergency help immediately.

- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

- Find someone to help you—installing an antenna is often a two-person job.
Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.

Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.

If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.

If an accident occurs with the power lines, call for qualified emergency help immediately.

Antenna Installation

This section covers the following topics:

- Installation Notes
- Tools and Equipment Required
- Install the Antenna onto the CGR 1240 Router

Installation Notes

This Cisco Multi-purpose Integrated Antenna is designed to be mounted directly onto the router.

In addition to antenna orientation, wireless access point installation location with respect to all wireless clients plays a significant role in determining overall network performance.

Because antennas transmit and receive radio signals, their performance can be adversely affected by the surrounding environment including distance between the Field Area Router (FAR) and cellular base station, physical obstructions, or radio frequency (RF) interference.

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  - A thick metal wall or wire-mesh stucco walls causes signals to reflect back and cause poor penetration.

- Avoid mounting the antenna next to a column or vertical support that could create a shadow zone and reduce the coverage area.
Keep the antenna away from reflective metal objects such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use an extension cable to relocate the antenna away from these obstructions.

**CAUTION:** Install the router and antenna away from appliances that share the same frequency bands. Microwave ovens, cordless telephones, and security monitors can temporarily interfere with wireless performance.

**CAUTION:** Avoid installing wireless antennas in or near rack-mounted installations that include networking equipment and computer servers whose radiated noise emissions can severely degrade radio performance.

**NOTE:** If the desired installation site has a marginally acceptable level of radiated noise emissions, consider using a remote-mounted antenna, such as a wall-mount or ceiling-mount antenna, for better radio performance and coverage.

### Tools and Equipment Required

In addition to the parts included in the antenna kit described in the section Integrated Antenna Kit, you must provide the following tool to install the antenna on the router:

- Strap wrench
- 13 mm socket wrench

### Install the Antenna onto the CGR 1240 Router

Follow these steps to install the antenna onto the router:

1. Remove the plug on the antenna connector if one is present.
2. Attach the monopole antenna to your desired antenna port. Do not tighten the antenna completely—stop tightening so that the antenna is not fully installed.

**Figure 13**  Insert Base of Antenna into Router Antenna Port

3. From the chassis interior, the antenna MCX jack should be visible in the plug. With one hand, position the right-angle end of the antenna cable to the antenna’s MCX jack. With your other hand, push the cable end so it inserts into the MCX jack of the antenna.
4. From the exterior of the router, tighten the antenna using the torque wrench. Tighten to 6 to 7 ft-lbs.

5. From the interior of the router, install the coaxial end of the cable to the appropriate connector on your installed module. The antenna and module ports should be the same color (red, yellow, or green).

**NOTE:** Some modules require two antennas: a main antenna and a diversity antenna. These modules have two antenna connectors on the front panel, labeled MAIN and DIV. Be sure to connect the main and diversity antennas to the correct module connectors.

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Cisco Vandal Resistant Omni-directional Dome Antenna for 860–928 MHz ISM, WPAN and LoRaWAN (ANT-UN-MP-OUT-QMA)

This document describes the Vandal Resistant Omni-directional Dome Antenna for 860–928 MHz ISM, WPAN and LoRaWAN routers. In addition, this document provides the antenna specifications and mounting instructions for the antenna.

CAUTION: Read the information in Safety Warnings before installing or replacing antennas.

This chapter covers the following topics:

- Technical Specifications, page 438
- Antenna Installation, page 442
- Antenna Radiation Patterns, page 445
- Safety Warnings, page 450
- Obtaining Documentation and Submitting a Service Request, page 451

Technical Specifications

This section covers the following topics:

- Specifications, page 439
- Vandal Resistance, page 441
- Dimensions, page 441
Specifications

Table 1 provides the RF Specifications.

Table 2 provides the Mechanical, Environmental, and Other Specifications.

Note: While many antenna datasheets emphasize peak gain, in most outdoor applications gain at horizon is much more important. For low profile antennas from any vendor, it is important to evaluate gain at horizon prior to selecting the antenna for deployment.
Table 1 RF Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
<th>863-876 MHz ETSI</th>
<th>902-928 MHz ISM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Operating Frequency Range, MHz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(See Note 1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Gain (dBi) Typical</td>
<td>+1.7</td>
<td>+3</td>
<td>+1.5</td>
</tr>
<tr>
<td>(See Note 2)</td>
<td></td>
<td></td>
<td>+1.9</td>
</tr>
<tr>
<td>Gain on Horizon (dBi) Average</td>
<td>+0.1</td>
<td>-1.2</td>
<td>+0.6</td>
</tr>
<tr>
<td>Gain on Horizon (dBi) Minimum</td>
<td>-2.0</td>
<td>-2.0</td>
<td>-2.0</td>
</tr>
<tr>
<td>(See Note 3)</td>
<td></td>
<td></td>
<td>-3.5</td>
</tr>
<tr>
<td>Efficiency</td>
<td>65%</td>
<td>76%</td>
<td>67%</td>
</tr>
<tr>
<td>VSWR (Worst Case)</td>
<td>1.7:1</td>
<td>1.2:1</td>
<td>1.5:1</td>
</tr>
<tr>
<td>Elevation 3 dB Beamwidth (HPBW), degrees</td>
<td>65</td>
<td>66</td>
<td>75</td>
</tr>
<tr>
<td>Azimuth 3 dB Beamwidth (HPBW), degrees</td>
<td>360</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal Impedance, ohms</td>
<td>50 ohms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polarization</td>
<td>Vertical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RF Cable Length (ft)</td>
<td>5 foot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(See Note 4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RF Connector</td>
<td>QMA (male), right angle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max RF Power (at 25°C), Watts</td>
<td>10 Watts</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note 1: Antenna has been designed and tested to have excellent performance with and without a ground plane over the full 860–928 MHz frequency range. It can be installed on a metallic or non-metallic surface. RF parameters in the table are provided for both cases of ground plane vs no ground plane.

Note 2: Peak gain of monopole antennas installed on a finite size ground plane will not be at horizon, and will be elevated above the horizon. In contrast, typical terrestrial radio deployments with omni-directional antennas involve communications near the horizon. Therefore, in the most common deployment scenarios the gain at horizon is a more useful parameter than peak gain.

Note 3: The minimum horizon gain specification shows whether an antenna has radiation nulls in azimuth. Nulls are directions in which the antenna has poor gain (e.g. -6 dBi, -10 dBi, -20 dBi or worse), and nulls often result in severe transmit and receive signal loss in the direction of the null. The ANT-UN-MP-OUT-QMA antenna has a smooth horizon or azimuth radiation pattern, and does not have azimuth pattern nulls. When evaluating omni-directional antennas, it is important to ensure that the antenna pattern does not have nulls in azimuth, to ensure good transmission and reception signal quality in all directions at horizon.

Note 4: All provided RF specifications include the RF loss of the integrated 5 foot cable.
Table 2  Mechanical, Environmental, and Other Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-Static Protection</td>
<td>DC Grounded</td>
</tr>
<tr>
<td>(See Note 1)</td>
<td></td>
</tr>
<tr>
<td>Antenna Dimensions (Diameter x Height), mm, inch</td>
<td>147mm x 47mm, 5.8”x1.85”</td>
</tr>
<tr>
<td>Weight, kg (lbs)</td>
<td>0.6kg (1.35 lb)</td>
</tr>
<tr>
<td>Antenna Radome Color</td>
<td>Electrical utility box green color</td>
</tr>
<tr>
<td>UV resistance</td>
<td>UV resistant, UV stable material</td>
</tr>
<tr>
<td>Wind Operational &amp; Survival</td>
<td>150mph minimum</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40 to +70C (-40 to +158F)</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-40 to +85C (-40 to +185F)</td>
</tr>
<tr>
<td>Ingression Protection</td>
<td>IP67 when properly mounted to a flat surface</td>
</tr>
<tr>
<td>Material Substance Compliance</td>
<td>ROHS</td>
</tr>
<tr>
<td>Impact Resistance</td>
<td>Higher than IK10 or IK10+</td>
</tr>
<tr>
<td>Environmental Testing</td>
<td>Antenna passed extensive environmental and mechanical tests appropriate for deployment on an outdoor electrical utility box.</td>
</tr>
</tbody>
</table>

Note 1: Antenna data sheets often claim lightning protection, while in reality only providing a DC ground path for ESD protection. Cisco recommends use of a dedicated, high quality lightning arrestor for all antennas potentially exposed to lightning strikes.

Vandal Resistance

Antenna has been specifically designed to withstand opportunistic direct impacts from all angles, from more commonly carried vandalism objects or tools, such as aluminum or wooden baseball bats, skateboards, scooters, small knives and similar objects, assuming proper installation of the antenna on a flat surface.

Antenna is not resistant to damage caused by intentional or unintentional tampering with professional tools used in isolation or in combination, such as long (e.g. 40”) steel crowbars or pry bars, power drills, welding torches, axes, chainsaws, heavy duty sledge hammers and similar.

Additionally, while the antenna is resistant to occasional, opportunistic, impulsive vandalism with common items - it should be understood that a persistent, skilled and focused individual with the right common tools and given enough time will be able to damage or tamper with the antenna.

Dimensions

Figure 2 shows the Antenna Dimensions.
NOTE: Antenna Dimensions are shown in millimeters, except where explicitly specified in inches denoted by " or [ ].

Antenna Installation

The antenna installation includes the following procedures:

- **Tools and Equipment Required**
- **Mounting Components**

**Tools and Equipment Required**

In addition to the parts included in the antenna kit, you must provide the following tools to install the antenna on the router:

- 1-5/16" (1.3125"), or 33.34mm open-end wrench. Recommended torque is 50-65 ft-lb or 68-88 Nm.
- McMaster Carr Double-D Hole Punch P/N 3449A85 or equivalent. Alternatively, you can drill or use a circular hole punch to create a 0.91" diameter hole.
Mounting Components

Table 3  Antenna Mounting Components

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HEX NUT, THIN, 7/8-14, SS, PA</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>WASHER, EXT SERRATED, 7/8&quot;, SS, PA</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 3  Mounting Nut and Washer

Mounting the Antenna

A clean, flat surface at least 15 x 15 cm (6 x 6 in.) in area is required for mounting the antenna. Antenna mounting stud has a Double-D cross-section compatible with the McMaster Carr Double-D Hole Punch P/N 3449A85. The Double-D prevents antenna from rotating while the mounting nut is torqued. It also provides additional vandal resistance by not allowing the antenna to rotate around the axis.

Follow these instructions to mount the antenna. See Figure 4 for a conceptual mounting illustration.

1. Mark the desired location where you plan to mount the antenna, and create a hole through the surface using a McMaster Carr Double-D Hole Punch P/N 3449A85, or equivalent punch tool. Alternatively, it is possible to drill a circular hole 0.91" in diameter.

2. Thread the cables through the hole and insert the Double-D mounting stud into the hole. Ensure that the gasket on the underside of the antenna sits flush against the mounting surface.

3. Place the metal washer and the metal nut onto the stud. Tighten the nut to a torque of 50–65 ft-lb or 68–88 Nm.

Figure 4 shows the vandal resistant antenna mounted to a matching color outdoor electrical utility enclosure of a simple rectangular box shape. Many outdoor enclosures come in much more complicated shapes, with a number of rectangular boxes and compartments joined together. In general, it is recommended that the antenna be installed on the highest surface of the electrical enclosure box. In this manner, the radiation in the upper hemisphere is not obstructed by other nearby geometrical features of the enclosure.

In many deployments the nodes need to communicate to other nodes located near horizon. Placing the antenna on the highest enclosure surface is a good way to ensure that horizon communication is not obstructed. If it is not possible or feasible to place the antenna on the highest surface of the enclosure, please contact your Cisco account representative for support or 3rd party qualified RF (radio-frequency) professional with experience in antenna installation and siting.
Using the McMaster Carr Stud Driven Hole Punch

This section describes the McMaster Carr Stud Driven Hole Punch for 0.76” Long, 0.91” Wide Double-D Shape. Information in this section is adapted by Cisco and published with written permission from McMaster Carr Supply Company. In duplicating the information Cisco seeks to achieve an antenna datasheet that is standalone, and seeks to ensure that if the 3449A85 McMaster product is changed or discontinued, a copy of the original information is available with the ANT-UN-MP-OUT-QMA antenna datasheet.

Note: Cisco is providing 3449A85 information for reference purposes only, and does not sell, distribute or provide technical support for the 3449A85 punch tool. For technical support and the most up to date information please contact McMaster Carr, and reference the information located in the McMaster Carr 3449A8 datasheet.

Also known as chassis punches, these tools cut through sheet metal to create holes for installing switches and instruments. They have an automatic centering design for accurate alignment. Drill pilot holes slightly larger than the size of the stud. All punches can be used with a manual wrench or hydraulic driver, but require a stud adapter (sold separately) when used with a hydraulic driver.
Figure 5  McMaster Carr Stud Driven Hole Punch

![McMaster Carr Stud Driven Hole Punch](image)

Table 4  Tool Details

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Punching Action</td>
<td>Stud Driven</td>
</tr>
<tr>
<td>Shape</td>
<td>Double-D Shape</td>
</tr>
<tr>
<td>Hole Length</td>
<td>0.76&quot;</td>
</tr>
<tr>
<td>Hole Width</td>
<td>0.91</td>
</tr>
<tr>
<td>Maximum Steel Thickness</td>
<td>1/16&quot;</td>
</tr>
<tr>
<td>Tool Material</td>
<td>Steel</td>
</tr>
<tr>
<td>For Use On</td>
<td>Aluminum, Brass, Copper, Steel</td>
</tr>
<tr>
<td>Pilot Hole Required</td>
<td>Yes</td>
</tr>
<tr>
<td>Kit Includes</td>
<td>Punch, Die, Stud, Nut</td>
</tr>
<tr>
<td>Individual/Set</td>
<td>Individual</td>
</tr>
<tr>
<td>Related Products</td>
<td>Hydraulic Driver Stud Adapter 3449A172</td>
</tr>
<tr>
<td></td>
<td>11-Ton Straight Hydraulic Driver 3448A1</td>
</tr>
<tr>
<td></td>
<td>8-Ton Straight Hydraulic Driver 3484A15</td>
</tr>
<tr>
<td></td>
<td>8-Ton Right-Angle Hydraulic Driver 3490A21</td>
</tr>
</tbody>
</table>

Antenna Radiation Patterns

The following sequence of illustrations show the different antenna radiation patterns.

**Note:** The pattern plots that follow show measurements for two different samples of the antenna, labeled S1 (Sample 1) and S2 (Sample 2).
Figure 6  863 MHz Radiation Pattern - No Ground Plane

Theta 90°  Phi = 0°  Phi 90°

Figure 7  863 MHz Radiation Pattern - With Ground Plane

Theta 90°  Phi = 0°  Phi 90°
Figure 8  876 MHz Radiation Pattern – No Ground Plane

Theta 90°

Phi = 0°

Phi 90°

Figure 9  876 MHz Radiation Pattern – With Ground Plane

Theta 90°

Phi = 0°

Phi 90°

Figure 10  902 MHz Radiation Pattern – No Ground Plane
Figure 11  902 MHz Radiation Pattern - With Ground Plane

Figure 12  915 MHz Radiation Pattern - No Ground Plane
Figure 13  915 MHz Radiation Pattern – With Ground Plane

Figure 14  928 MHz Radiation Pattern – No Ground Plane

Figure 15  928 MHz Radiation Pattern – With Ground Plane
Safety Warnings

**WARNING:** Avoid using or servicing any equipment that has outdoor connections during an electrical storm. There may be a risk of electric shock from lightning. Statement 1088

**WARNING:** Do not work on the system, or connect or disconnect cables, during periods of lightning activity. Statement 1001

**WARNING:** Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.:NFPA 70, National Electrical Code, Article 810, Canada:Canadian Electrical Code, Section 54). Statement 1052

**WARNING:** This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024

**WARNING:** Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

**WARNING:** To report a gas leak, do not use a telephone in the vicinity of the leak. Statement 1039

**WARNING:** This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071. SAVE THESE INSTRUCTIONS.

**WARNING:** This product is not intended to be directly connected to the Cable Distribution System. Additional regulatory compliance and legal requirements may apply for direct connection to the Cable Distribution System. This product may connect to the Cable Distribution System ONLY through a device that is approved for direct connection. Statement 1078

Safety Precautions

**WARNING:** Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.
For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!

For your safety, read and follow these safety precautions.

- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

- Find someone to help you—installing an antenna is often a two-person job.

- Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

- Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.

- Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.

- When installing your antenna, follow these guidelines:
  - Do not use a metal ladder.
  - Do not work on a wet or windy day.
  - Do dress properly—wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.

- If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.

- If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.

- If an accident should occur with the power lines, call for qualified emergency help immediately.

Obtaining Documentation and Submitting a Service Request

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Cisco WPAN Dipole Antenna (ANT-WPAN-OD-OUT-N)

This chapter describes the technical specifications and installation instructions for the Cisco WPAN dipole antenna. The antenna is a single-port antenna designed to cover the 863–928 MHz frequency bands for worldwide ISM operation.

CAUTION: Read the information in Safety Warnings before installing or replacing antennas.

This chapter covers the following topics:

- Antenna Overview
- Technical Specifications
- Installing the Antenna
- Obtaining Documentation and Submitting a Service Request

Antenna Overview

The Cisco WPAN Dipole antenna (ANT-WPAN-OD-OUT-N) has the following features:

- 863 - 928 MHz support
- Omnidirectional, vertically polarized
- Indoor or outdoor location
- Direct chassis-mount installation
- Type N male connector
Figure 1 shows the Antenna Assembly.

Figure 1  Cisco ANT-WPAN-OD-OUT-N Antenna

Technical Specifications

This section contains the following:

- RF Specifications
Cisco WPAN Dipole Antenna (ANT-WPAN-OD-OUT-N)

- Radiation Patterns
- Environmental and Mechanical Specifications

RF Specifications

The following are the Radio Frequency (RF) antenna specifications for the Cisco ANT-WPAN-OD-OUT-N Antenna:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna Type</td>
<td>Dipole</td>
</tr>
<tr>
<td>Operating frequency range</td>
<td>863 to 928 MHz</td>
</tr>
<tr>
<td>Nominal impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>VSWR</td>
<td>2.0:1 maximum</td>
</tr>
<tr>
<td>Gain</td>
<td>1.5 dBi maximum</td>
</tr>
<tr>
<td>3 dB beamwidth (vertical plane)</td>
<td>84 degrees</td>
</tr>
<tr>
<td>3 dB beamwidth (horizontal plane)</td>
<td>360 degrees</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linear, vertical</td>
</tr>
<tr>
<td>Radiation Pattern</td>
<td>Omnidirectional</td>
</tr>
<tr>
<td>Maximum input power</td>
<td>20 Watts</td>
</tr>
</tbody>
</table>

Radiation Patterns

The following diagrams illustrate the radiation patterns for the Cisco ANT-WPAN-OD-OUT-N Antenna:
Environmental and Mechanical Specifications

The following are the Environmental and Mechanical Specifications for the Cisco ANT-WPAN-OD-OUT-N Antenna:
Cisco WPAN Dipole Antenna (ANT-WPAN-OD-OUT-N)

Installing the Antenna

This section contains the following:

- Contents of the Antenna Kit
- Safety Warnings
- Safety Instructions
- Tools and Equipment Required
- Mounting the Antenna

Contents of the Antenna Kit

The antenna kit contains:

- 1 x Cisco ANT-WPAN-OD-OUT-N Antenna

Safety Warnings

**WARNING:** Avoid using or servicing any equipment that has outdoor connections during an electrical storm. There may be a risk of electric shock from lightning. Statement 1088

**WARNING:** Do not work on the system, or connect or disconnect cables, during periods of lightning activity. Statement 1001

**WARNING:** Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.: NFPA 70, National Electrical Code, Article 810, Canada: Canadian Electrical Code, Section 54). Statement 1052

**WARNING:** This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature range</td>
<td>-40 to 185°F (-40 to 85°C)</td>
</tr>
<tr>
<td>Mount style</td>
<td>Direct chassis or bulkhead mount</td>
</tr>
<tr>
<td>Location</td>
<td>Outdoor</td>
</tr>
<tr>
<td>Connector</td>
<td>Type N male</td>
</tr>
<tr>
<td>Dimensions</td>
<td>7.70 in. length x 1.02 in. diameter (19.56 cm length x 2.60 cm diameter)</td>
</tr>
<tr>
<td>Weight</td>
<td>0.26 lbs (120 g)</td>
</tr>
<tr>
<td>Wind rating</td>
<td>265 km/hr (165 mph)</td>
</tr>
<tr>
<td>IP rating</td>
<td>IP67</td>
</tr>
<tr>
<td>Radome</td>
<td>Polyester/Fiberglass, UV resistant, white</td>
</tr>
<tr>
<td>Material substance compliance</td>
<td>RoHS compliant</td>
</tr>
</tbody>
</table>
WARNING: Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

WARNING: To report a gas leak, do not use a telephone in the vicinity of the leak. Statement 1039

WARNING: This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071. SAVE THESE INSTRUCTIONS.

WARNING: This product is not intended to be directly connected to the Cable Distribution System. Additional regulatory compliance and legal requirements may apply for direct connection to the Cable Distribution System. This product may connect to the Cable Distribution System ONLY through a device that is approved for direct connection. Statement 1078

Safety Instructions

WARNING: Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.

For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!

For your safety, read and follow these safety precautions.

- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.
- Plan your installation procedure carefully and completely before you begin.
- Choose your installation site with safety performance in mind. Remember that electric power cables and telephone lines look alike. For your safety, assume that any line is an electric power line until determined otherwise.
- Call your local power company or building maintenance organization if you are unsure about cables close to your mounting location.
- When installing your antenna, do not use a metal ladder. Dress in rubber soled shoes and heels, rubber gloves, and a long-sleeved shirt or jacket.
- If an accident or emergency occurs with the power lines, call for qualified emergency help immediately.
- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.
- Find someone to help you—installing an antenna is often a two-person job.
- Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.
- Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.
- Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.
- If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.
- If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.
If an accident occurs with the power lines, call for qualified emergency help immediately.

Tools and Equipment Required

No tools are required to install the antenna. This does not include the tools and equipment required to install the router or to assemble the tower, mast, or other structure you intend to mount the router and antenna on.

Mounting the Antenna

Follow these instructions to mount the antenna.

- If installing the antenna on an IR529UWP-915S/K9 or IR529UBWP-915S/K9, screw the antenna’s N male connector onto the N female connector on the chassis. Ensure that the connection is tight. See Single Antenna Advanced Range Extender—Direct Connect Antenna Configuration in the Cisco IR500 Series WPAN Gateway and WPAN Range Extender Installation and Configuration Guide.

- If installing the antenna to a bulkhead adapter or lightning arrestor, install the lightning arrestor or adapter to the side of the enclosure first, then screw the antenna onto the N female connector of the lightning arrestor or adapter. See Gateway Enclosure Mounted Antenna Configuration in the Cisco IR500 Series WPAN Gateway and WPAN Range Extender Installation and Configuration Guide.

NOTE: Coaxial cable loses efficiency as the frequency increases, resulting in signal loss. If a cable is used it should be kept as short as possible because cable length also determines the amount of signal loss—the longer the cable length or run, the greater the loss.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly What’s New in Cisco Product Documentation, which also lists all new and revised Cisco technical documentation, at:


Subscribe to the What’s New in Cisco Product Documentation as an RSS (Really Simple Syndication) feed, and set it so content is delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS Version 2.0.

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This document describes the Outdoor Omnidirectional Antenna for the 900 MHz WPAN module. In addition, this document provides the antenna specifications and mounting instructions of the antenna.

The Omnidirectional Outdoor Antenna is compatible with only the 900 MHz WPAN module that uses a N-connector and requires a mast-mounted outdoor antenna.

CAUTION: Read the information in Overview before installing or replacing antennas.

This chapter covers the following topics:

- Technical Specifications
- Safety Warnings
- Antenna Installation
- Obtaining Documentation and Submitting a Service Request

Technical Specifications

The Outdoor Omnidirectional Antenna features the following:

- UV-resistant pultruded fiberglass radome
- Heavy duty mounting bracket
- Thick-walled aluminum mounting base
- DC-grounded for ESD protection
RF Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range</td>
<td>902 to 928 MHz</td>
</tr>
<tr>
<td>Nominal gain (dBi)</td>
<td>4 dBi</td>
</tr>
<tr>
<td>Vertical beamwidth</td>
<td>30 degrees</td>
</tr>
<tr>
<td>Horizontal beamwidth</td>
<td>360 degrees</td>
</tr>
<tr>
<td>Normal impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>Polarization</td>
<td>Vertical, linear</td>
</tr>
<tr>
<td>VSWR</td>
<td>1.5 typical, 2.0 max</td>
</tr>
<tr>
<td>Radiation pattern</td>
<td>Omnidirectional</td>
</tr>
</tbody>
</table>

Mechanical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mount style</td>
<td>Adjustable mast or wall mount</td>
</tr>
<tr>
<td>Environment</td>
<td>Outdoor</td>
</tr>
<tr>
<td>Connector</td>
<td>Type N female</td>
</tr>
<tr>
<td>Antenna length</td>
<td>23.25&quot; (59.1 cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>1.5 lbs (.68 kg)</td>
</tr>
<tr>
<td>Temperature range</td>
<td>-40 to 185-degrees F (~40 to 85 degrees C)</td>
</tr>
<tr>
<td>Bending moment at rated wind</td>
<td>4.7 lbf</td>
</tr>
</tbody>
</table>
Cisco Outdoor Omni Antenna for 900 MHz WPAN (ANT-WPAN-OM-OUT-N)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equivalent flat plate area</td>
<td>.12 sf</td>
</tr>
<tr>
<td>Rated wind</td>
<td>125 mph</td>
</tr>
<tr>
<td>Maximum power</td>
<td>150 watts</td>
</tr>
</tbody>
</table>
Figure 2  Outdoor Omnidirectional Antenna Frequency Pattern

Figure 3  Outdoor Omnidirectional Antenna Radiation Pattern
Safety Warnings

**WARNING:** Avoid using or servicing any equipment that has outdoor connections during an electrical storm. There may be a risk of electric shock from lightning. Statement 1088

**WARNING:** Do not work on the system, or connect or disconnect cables, during periods of lightning activity. Statement 1001

**WARNING:** Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.:NFPA 70, National Electrical Code, Article 810, Canada:Canadian Electrical Code, Section 54). Statement 1052

**WARNING:** This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024

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Safety Precautions

**WARNING:** Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.

For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!

For your safety, read and follow these safety precautions.

- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.

- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

- Find someone to help you—installing an antenna is often a two-person job.

- Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.

- Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.

- Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.
When installing your antenna, follow these guidelines:

- Do not use a metal ladder.
- Do not work on a wet or windy day.
- Do dress properly—wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.

If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.

If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.

If an accident should occur with the power lines, call for qualified emergency help immediately.

Antenna Installation

The antenna installation includes the following procedures:

- Tools and Equipment Required
- Attaching the Mounting Bracket

Tools and Equipment Required

In addition to the parts included in the antenna kit, you must provide the following tool to install the antenna on the router:

- A #2 Phillips screwdriver
- A hose clamp (shipped with your antenna)
- 3/4 in. open-end wrench

NOTE: This list does not include the tools and equipment required to assemble and erect the tower, mast, or other structure you intend to mount your antenna on.

Attaching the Mounting Bracket

The antenna is provided with a mounting kit consisting of a mounting bracket and hose clamp. This kit allows you to mount the antenna to masts from 1.25 inches (3.2 centimeters) to 2 inches (5.1 cm). Cisco recommends that a 1.5 inch (3.8 centimeter) or larger tubing mast be used.

The antenna is vertically polarized. Since the antenna has vertical gain, it is very important to mount the antenna in a vertical (not leaning) position for optimal performance.

Follow these steps to mount the antenna onto a mast:

1. Place the connector end of the antenna through the hole in the antenna bracket.
2. Place the pipe clamps into the grooves on the bracket.

3. Attach the bracket to the top of the mast. The top surface of the mounting mast must not exceed the top surface of the mounting bracket. Securely tighten hose clamps.

4. Attach the cable to the antenna connector.

Installing the Module into the Router

If the corresponding module is not already installed in the router, install it according to the installation and configuration guide for the module.

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Cisco WPAN Yagi Antenna (ANT-WPAN-Y-OUT-N)

This chapter describes the technical specifications and installation instructions for the Cisco WPAN Yagi antenna. The antenna is a single-port antenna designed to cover the 860 – 876 and 902 – 928 MHz ISM bands.

CAUTION: Read the information in Safety Warnings before installing or replacing antennas.

This chapter covers the following topics:

- Antenna Overview
- Technical Specifications
- Installing the Antenna
- Obtaining Documentation and Submitting a Service Request

Antenna Overview

The Cisco WPAN Yagi antenna (ANT-WPAN-Y-OUT-N) has the following features:

- 860 – 960 MHz operation
- Directional, linearly polarized
- Outdoor location
- Mast mount installation
- Pigtail with N female connector

Figure 1 shows the Antenna Assembly.
Technical Specifications

This section contains the following:
- RF Specifications
- Radiation Patterns
- Environmental and Mechanical Specifications

RF Specifications

The following are the Radio Frequency (RF) antenna specifications for the Cisco ANT-WPAN-Y-OUT-N Antenna:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna Type</td>
<td>Yagi antenna</td>
</tr>
<tr>
<td>Operating frequency range</td>
<td>860 to 960 MHz</td>
</tr>
<tr>
<td>Nominal impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>VSWR</td>
<td>1.5:1 maximum</td>
</tr>
<tr>
<td>Gain</td>
<td>9 dBi typical, 10 dBi maximum</td>
</tr>
<tr>
<td>3 dB beamwidth (vertical plane)</td>
<td>76 degrees</td>
</tr>
<tr>
<td>3 dB beamwidth (horizontal plane)</td>
<td>57 degrees</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linear</td>
</tr>
<tr>
<td>Radiation Pattern</td>
<td>Directional</td>
</tr>
<tr>
<td>Maximum input power</td>
<td>100 Watts</td>
</tr>
</tbody>
</table>

Radiation Patterns

The following diagrams illustrate the radiation patterns for the Cisco ANT-WPAN-Y-OUT-N Antenna:
- 860 MHz Antenna Radiation Pattern
- 902 MHz Antenna Radiation Pattern
- 910 MHz Antenna Radiation Pattern
- 928 MHz Antenna Radiation Pattern
- 960 MHz Antenna Radiation Pattern

860 MHz Antenna Radiation Pattern

Figure 2  860 MHz Antenna Radiation Pattern – Horizontal Plane
Figure 3  860 MHz Antenna Radiation Pattern – Vertical Plane
902 MHz Antenna Radiation Pattern

Figure 4  902 MHz Antenna Radiation Pattern – Horizontal Plane
Figure 5  902 MHz Antenna Radiation Pattern – Vertical Plane
910 MHz Antenna Radiation Pattern

Figure 6  910 MHz Antenna Radiation Pattern – Horizontal Plane
Figure 7  910 MHz Antenna Radiation Pattern — Vertical Plane
928 MHz Antenna Radiation Pattern

Figure 8  928 MHz Antenna Radiation Pattern – Horizontal Plane
Figure 9   928 MHz Antenna Radiation Pattern – Vertical Plane
960 MHz Antenna Radiation Pattern

Figure 10  960 MHz Antenna Radiation Pattern – Horizontal Plane
Environmental and Mechanical Specifications

The following are the Environmental and Mechanical Specifications for the Cisco ANT-WPAN-Y-OUT-N Antenna:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature range</td>
<td>-40 to 158°F (-40 to 70°C)</td>
</tr>
<tr>
<td>Mount style</td>
<td>Mast mount</td>
</tr>
<tr>
<td>Location</td>
<td>Outdoor</td>
</tr>
<tr>
<td>Connector</td>
<td>18&quot; RG8 pigtail with N female connector</td>
</tr>
<tr>
<td>Dimensions</td>
<td>19.7 x 11.61 x 3.23 in. (50 x 29.5 x 82 cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>2.4 lbs (1.1 kg)</td>
</tr>
<tr>
<td>Wind rating</td>
<td>201 km/hr (125 mph)</td>
</tr>
<tr>
<td>IP rating</td>
<td>IP67</td>
</tr>
<tr>
<td>Material substance compliance</td>
<td>RoHS compliant</td>
</tr>
</tbody>
</table>

Installing the Antenna

This section contains the following:
Contents of the Antenna Kit

The antenna kit contains:

- 1 x Cisco ANT-WPAN-Y-OUT-N Antenna
- 1 x Mounting bracket with washers and nuts
- 2 x U-bolts with washers and nuts
- 1 x Weatherproofing kit

Safety Warnings

**WARNING:** Avoid using or servicing any equipment that has outdoor connections during an electrical storm. There may be a risk of electric shock from lightning. Statement 1088

**WARNING:** Do not work on the system, or connect or disconnect cables, during periods of lightning activity. Statement 1001

**WARNING:** Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.:NFPA 70, National Electrical Code, Article 810, Canada:Canadian Electrical Code, Section 54). Statement 1052

**WARNING:** This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024

**WARNING:** Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

**WARNING:** To report a gas leak, do not use a telephone in the vicinity of the leak. Statement 1039

**WARNING:** This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071. SAVE THESE INSTRUCTIONS.

**WARNING:** This product is not intended to be directly connected to the Cable Distribution System. Additional regulatory compliance and legal requirements may apply for direct connection to the Cable Distribution System. This product may connect to the Cable Distribution System ONLY through a device that is approved for direct connection. Statement 1078
Safety Instructions

**WARNING:** Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.

For your safety, and to help you achieve a good installation, please read and follow these safety precautions. **They may save your life!**

For your safety, read and follow these safety precautions.

- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.
- Plan your installation procedure carefully and completely before you begin.
- Choose your installation site with safety performance in mind. Remember that electric power cables and telephone lines look alike. For your safety, assume that any line is an electric power line until determined otherwise.
- Call your local power company or building maintenance organization if you are unsure about cables close to your mounting location.
- When installing your antenna, do not use a metal ladder. Dress in rubber soled shoes and heels, rubber gloves, and a long-sleeved shirt or jacket.
- If an accident or emergency occurs with the power lines, call for qualified emergency help immediately.
- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.
- Find someone to help you—installing an antenna is often a two-person job.
- Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.
- Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.
- Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.
- If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.
- If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.
- If an accident occurs with the power lines, call for qualified emergency help immediately.

Tools and Equipment Required

In addition to the parts included in the antenna kit described in the Contents of the Antenna Kit, you must provide the following tool to install the antenna on the router:

- Open-ended wrench

**NOTE:** This list does not include the tools and equipment required to assemble and erect the tower, mast, or other structure you intend to mount your antenna on.
Preparing the Antenna for Installation

**NOTE**: Before mounting the antenna on a mast or pole, the antenna must be attached to the mounting bracket.

To prepare the antenna for installation:

- Attach the bracket to the antenna support beam. Tighten the four nuts tight enough to stabilize the antenna. Torque to 45 in.-lbs. (5.1 N-m). The bracket should be toward the back of the antenna support beam.

Mounting the Antenna

Follow these instructions to mount the antenna.

1. Attach the antenna assembly to the pole using the two U-bolts provided. The antenna elements should be vertical for vertical polarization.
2. Tighten the nuts evenly and enough to secure the antenna on the pole. Torque the nuts to 60 in.-lbs. (6.8 N-m).
3. Connect the RF cable to the pigtail and weatherproof the connection. Be sure to secure the cable to the pole using UV resistant tie wraps.

Connecting the Lightning Arrestor

To attach the router-end of the cable to your router, see the Dual Antenna Advanced Range Extender—Dual Antenna Configuration section of the Cisco IR500 Series WPAN Gateway and WPAN Range Extender Installation and Configuration Guide.

Connecting the Antenna to the Router

To attach the router-end of the cable to your router, see the Dual Antenna Advanced Range Extender—Dual Antenna Configuration section of the Cisco IR500 Series WPAN Gateway and WPAN Range Extender Installation and Configuration Guide.

**NOTE**: Coaxial cable loses efficiency as the frequency increases, resulting in signal loss. The cable should be kept as short as possible because cable length also determines the amount of signal loss—the longer the cable length or run, the greater the loss.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly What’s New in Cisco Product Documentation, which also lists all new and revised Cisco technical documentation, at:


Subscribe to the *What’s New in Cisco Product Documentation* as an RSS (Really Simple Syndication) feed, and set it so content is delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS Version 2.0.

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Cisco Indoor/Outdoor Active GPS Antenna (GPS-ACT-ANTM-SMA)

The Cisco indoor/outdoor, active GPS antenna (GPS-ACT-ANTM-SMA) can be physically connected to the Cisco Integrated Services Routers (ISRs) and Cisco Enhanced High-Speed WAN Interface Cards (EHWICs) to receive GPS broadcasts from satellites.

- Specifications
- Installing the Cisco Active GPS Antenna
- Obtaining Documentation and Submitting a Service Request
## Specifications

Figure 1 Specifications for the Cisco GPS-ACT-ANTM-SMA Antenna

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum RF input power</td>
<td>1 W</td>
</tr>
<tr>
<td>Power Supply</td>
<td>3–5VDC, 20mA typical @3V, 30mA typical @5V</td>
</tr>
<tr>
<td>Amplifier Gain</td>
<td>27dB typical @25°C</td>
</tr>
<tr>
<td>Amplifier Filter Topology</td>
<td>Antenna-LNA1-BPF1-LNA2-cable-SMA(m) connector. Due to a topology without front end filter immediately following the antenna, antenna has the benefit of lower noise figure, but may not be suitable for collocation with a high power wireless transceiver.</td>
</tr>
<tr>
<td>Connector</td>
<td>SMA male</td>
</tr>
<tr>
<td>VSWR¹</td>
<td>2:1 or less</td>
</tr>
<tr>
<td>Noise Figure</td>
<td>1.5dB typical @25°C</td>
</tr>
<tr>
<td>Amplifier Filter Topology</td>
<td>Antenna-LNA1-BPF1-LNA2-cable-SMA(m) connector. Due to a topology without front end filter immediately following the antenna, antenna has the benefit of lower noise figure, but may not be suitable for collocation with a high power wireless transceiver.</td>
</tr>
<tr>
<td>Characteristic impedance</td>
<td>50 Ohm</td>
</tr>
<tr>
<td>Antenna base and radome color</td>
<td>Black</td>
</tr>
<tr>
<td>Antenna dimensions</td>
<td>1.7 (L) x 1.4 (W) x 0.55 (H) in. (44 x 36 x 14mm)</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>–40° to 185° F (–40° to 85°C)</td>
</tr>
<tr>
<td>Operating frequency ranges</td>
<td>1574.42–1576.42 MHz</td>
</tr>
<tr>
<td>Polarization</td>
<td>RHCP²</td>
</tr>
<tr>
<td>Maximum peak gain (at Boresight)</td>
<td>4 dBiC</td>
</tr>
<tr>
<td>Shocks</td>
<td>50G</td>
</tr>
<tr>
<td>Drop test</td>
<td>10x3 axis / 1 meter drop 6 axis</td>
</tr>
<tr>
<td>Cable Length</td>
<td>17 foot (5.18 meters)</td>
</tr>
<tr>
<td>Mount Bracket</td>
<td>Metal</td>
</tr>
<tr>
<td>Anchor</td>
<td>1 inch. The anchor drill size is 3/16.</td>
</tr>
<tr>
<td>Screws</td>
<td>3 stainless-steel screws that are self-drilling pan head #2 Phillips.</td>
</tr>
</tbody>
</table>

1. VSWR = voltage standing wave ratio.
2. RHCP = right hand circularly polarized.
Installing the Cisco Active GPS Antenna

- Installation Guidelines for the Cisco Active GPS Antenna
- Mounting the Cisco Active GPS Antenna Without Bracket
- Mounting the Cisco Active GPS Antenna With the Bracket

Installation Guidelines for the Cisco Active GPS Antenna

- The antenna must be placed so that the radome has a clear site to just above the horizon and a clear view of the horizon.
- Antenna performance can be adversely affected by the surrounding environment such as physical obstructions or radio frequency (RF) interference.
- Avoid mounting the antenna next to a column or vertical support that could create a shadow zone and reduce the coverage area.
- Keep the antenna away from reflective metal objects that block cellular signal and make reception poor, such as heating and air conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use an extension cable to relocate the antenna away from these obstructions.
- If installing the antenna indoors, make sure it is near a window.

NOTE: The Cisco logo and product ID are printed onto the GPS-ACT-ANTM-SMA antenna radome. Position the antenna as shown in the Figure 2.

Figure 2  Wall-Mounted Antenna

Mounting the Cisco Active GPS Antenna Without Bracket

Attach the antenna radome to any magnetic metal surface or stick the antenna radome onto a non-metalic surface using the sticky back.
Mounting the Cisco Active GPS Antenna With the Bracket

1. Use the supplied metal bracket, screws and wall anchors (if necessary) to mount the antenna to a wall, as shown in Figure 3.

2. Insert the cable through the hole on top of the bracket and seat the antenna radome on the bracket as shown in Figure 3.

Figure 3   Attaching the Antenna Wall-mount

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Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly What’s New in Cisco Product Documentation, which also lists all new and revised Cisco technical documentation:


Subscribe to the What’s New in Cisco Product Documentation as an RSS feed and set content to be delivered directly to your desktop using a reader application. The RSS feeds are a free service. Cisco currently supports RSS Version 2.0.

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Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.
Cisco 4G LTEA, 4G LTE, and 3G Omnidirectional Dipole Antenna (LTE-ANTM-SMA-D)

Last Updated: 2/12/2018

This document provides the description, supported features, and installation instructions for the Cisco 3G/4G LTE and LTEA Omnidirectional Dipole Antenna (LTE-ANTM-SMA-D).

Caution: Read the information in Safety Instructions, page 493 before installing or replacing antennas.

This document contains the following sections:

- Overview, page 485
- Specifications, page 486
- Antenna Radiation Patterns, page 488
- Safety Instructions, page 493
- Installation Instructions, page 494
- Related Documentation, page 495

Overview

The LTE-ANTM-SMA-D omnidirectional dipole antenna is designed for indoor use with Cisco 4G Long Term Evolution (LTE) and Long Term Evolution Advanced (LTEA) Service Routers (ISRs) and Pluggable Modules with an SMA connector.

The LTE-ANTM-SMA-D antenna is marked with a dual green band to indicate that it supports Cisco LTEA routers and modules.

This antenna has the following features:

- Support for frequencies of 698-960, 1448-1511, and 1710-2690 MHz.
- Standalone antenna peak gain of less than 3.7 dBi in the supported frequency bands.
- Articulating joint that can maneuver into three stop positions: 0°, 45°, and 90°.
- Male SubMiniature A connector that allows direct mounting of the antenna to any Cisco supported router or Pluggable Module with an SMA connector.
- The SMA connector design has added rotational frictional torque to ensure the SMA interface stays properly mated, and to reduce chances of a disconnect. The design is also more finger friendly compared to a classic SMA hex nut design.

For optimal performance, we strongly recommend that you use two antennas to take full advantage of MIMO technology on all Cisco cellular routers that support MIMO (4G LTE and later releases).
Figure 1  Cisco LTE-ANTM-SMA-D Omnidirectional Dipole Antenna, SMA Connector and Articulating Joint:

1  0° position
2  45° position
3  90° position
4  Articulating joint
5  SMA connector
6  Dual green band
7  Product ID

Specifications

Table 1  Specifications of the LTE-ANTM-SMA-D antenna:

<table>
<thead>
<tr>
<th>Operating Frequencies</th>
<th>698–960 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1447–1511 MHz</td>
</tr>
<tr>
<td></td>
<td>1710–2690 MHz</td>
</tr>
<tr>
<td>Polarization</td>
<td>Vertical, linear</td>
</tr>
<tr>
<td>Nominal Impedance</td>
<td>50 Ohms</td>
</tr>
<tr>
<td>Peak Gain</td>
<td>2.0 dBi (698–960 MHz)</td>
</tr>
<tr>
<td></td>
<td>2.8 dBi (1447–1511 MHz)</td>
</tr>
<tr>
<td></td>
<td>3.7 dBi (1710–2690 MHz)</td>
</tr>
</tbody>
</table>

Note: The standalone antenna peak gain numbers are provided above. When you install an antenna close to metallic objects or directly on chassis, the peak gain will be affected. We recommend that you keep antennas away from very large chassis and metallic objects. You can install antennas directly on smaller or medium size chassis. In all cases, we recommend that you keep different antennas away from each other and from various known sources of electromagnetic radiation.
Cisco 4G LTEA, 4G LTE, and 3G Omnidirectional Dipole Antenna (LTE-ANTM-SMA-D)

Table 1 Specifications of the LTE-ANTM-SMA-D antenna:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSWR</td>
<td>≤ 2.5:1 (698-960 MHz)</td>
</tr>
<tr>
<td></td>
<td>≤ 2.5:1 (1447-1511 MHz)</td>
</tr>
<tr>
<td></td>
<td>≤ 2.0:1 (1710-2690 MHz)</td>
</tr>
<tr>
<td>Maximum RF Input Power</td>
<td>5 W</td>
</tr>
<tr>
<td>DC Power</td>
<td>No DC power required for LTE-ANTM-SMA-D antenna operation.</td>
</tr>
<tr>
<td>Dimensions</td>
<td>9” (L) x 1.46” (W) x 0.43” (D) (229 x 37 x 11 mm)</td>
</tr>
<tr>
<td>Weight</td>
<td>56.8 grams</td>
</tr>
<tr>
<td>Efficiency</td>
<td>LTE-ANTM-SMA-D antennas have high standalone efficiency, and maintain high efficiency when directly installed on front plate of a small or medium size Cisco router. However, depending on chassis size and a variety of other electromagnetic considerations, installing the antenna directly on the chassis is not always recommended.</td>
</tr>
<tr>
<td>Temperature Range</td>
<td>-30°C to + 70°C (Operating)</td>
</tr>
<tr>
<td></td>
<td>-40°C to + 85°C (Storage)</td>
</tr>
</tbody>
</table>
Antenna Radiation Patterns

Figure 2  698, 824, 960 MHz Cellular Antenna Radiation Pattern (dBi), Azimuth

698MHz
Avg (dBi) = 0.72
Peak (dBi) = 1.31
Avg -3 (deg) = 360

824MHz
Avg (dBi) = -1.37
Peak (dBi) = 0.02
Avg -3 (deg) = 235

960MHz
Avg (dBi) = -0.87
Peak (dBi) = 0.52
Avg -3 (deg) = 305
Figure 3  698, 824, 960 MHz Cellular Antenna Radiation Pattern (dBi), Elevation, Phi = 0

- **698MHz**
  - Avg (dBi) = -5.08
  - Peak (dBi) = 1.35
  - Avg -3 (deg) = 140

- **824MHz**
  - Avg (dBi) = -5.14
  - Peak (dBi) = 1.28
  - Avg -3 (deg) = 120

- **960MHz**
  - Avg (dBi) = -5.22
  - Peak (dBi) = 1.42
  - Avg -3 (deg) = 95
Figure 4  698, 824, 960 MHz Cellular Antenna Radiation Pattern (dBi), Elevation, Phi = 90

YZ Plane

698MHz
Avg (dBi) = -5.14
Peak (dBi) = 1.45
Avg -3 (deg) = 125

824MHz
Avg (dBi) = -5.38
Peak (dBi) = 1.31
Avg -3 (deg) = 105

960MHz
Avg (dBi) = -6.08
Peak (dBi) = 1.51
Avg -3 (deg) = 95
Figure 5 1710, 2170, 2690 MHz Antenna Radiation Pattern (dBi), Azimuth

XY Plane

1710MHz
Avg (dBi) = -3.45
Peak (dBi) = -0.89
Avg -3 (deg) = 230

2170MHz
Avg (dBi) = -2.26
Peak (dBi) = -0.77
Avg -3 (deg) = 295

2690MHz
Avg (dBi) = -1.54
Peak (dBi) = 0.64
Avg -3 (deg) = 250

Gain (dBi)

Phi Angle (°)

0 30 60 90

0 150 180 210 240 270 300 330

1710MHz
2170MHz
2690MHz

365634
Figure 6  1710, 2170, 2690 MHz Antenna Radiation Pattern (dBi), Elevation, Phi = 0

1710MHz
Avg (dBi) = -2.36
Peak (dBi) = 1.23
Avg -3 (deg) = 185

2170MHz
Avg (dBi) = -2.90
Peak (dBi) = 2.1
Avg -3 (deg) = 155

2690MHz
Avg (dBi) = -3.26
Peak (dBi) = 2.8
Avg -3 (deg) = 125
Figure 7  1710, 2170, 2690 MHz Antenna Radiation Pattern (dBi), Elevation, Phi = 90

Safety Instructions

**Warning:** IMPORTANT SAFETY INSTRUCTIONS

A warning means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.

SAVE THESE INSTRUCTIONS

Follow these safety instructions when installing the antenna.

Antenna Installation Warning

**Warning:** In order to comply with FCC radio frequency (RF) exposure limits, antennas should be located at a minimum of 7.9 inches (20 cm) or more from the body of all persons.

**Warning:** When installing or replacing the unit, the ground connection must always be made first and disconnected last.
Caution: Do not install the antenna in an outdoor environment.

Caution: For your physical safety, and to help you install your antenna successfully, follow these safety precautions.

- Plan your installation procedure carefully and completely before you begin.
- Choose your installation site with both safety and performance in mind.
- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type of antenna you are about to install.
- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.

Installation Instructions

The following section contains information for installing the LTE-ANTM-SMA-D antenna:

This antenna is designed to be mounted either directly or on an antenna extension stand to any Cisco 3G/4G wireless ISR, LTE and LTEA router with an SMA(f) connector by threading it onto the mating connector. Refer to the routers technical documentation for recommendations of direct mounting of antenna to the router versus installing the antenna on an antenna extension stand. Mount and deploy the antenna at the 0° position, 45° position, or the 90° position, and then change that position at will. The rotation of the antenna into the proper position can take place while the antenna is still loose on the mating connector. No software is required for this installation.

In addition to the antenna orientation, the installation location of 4G routers and cellular modules play a significant role in determining overall network performance. Routers located at the farthest coverage points might have 10 to 50 percent of the bandwidth available compared to routers located closer to the cellular base station tower.

Because antennas transmit and receive radio signals, their performance can be adversely affected by the surrounding environment, including physical obstructions. Radio frequency (RF) interference may occur between wireless systems located close to each other, especially if the antennas of these systems are located close to each other.

Follow these guidelines to ensure the best possible performance:

- When you use the antenna on a modular router with an LTE pluggable module, always mount the antenna on an appropriate extension cable and antenna stand. The antenna performance, and therefore that of the router, will not be optimal if mounted directly to the pluggable module.
- Mounting of the antenna directly to smaller physical size routers is allowed.
- For optimal performance, space multiple antennas apart by at least 17 inches (43 cm).
- The lowest LTE frequency of 700 MHz 17 inches represents 1 wavelength. Spacing of 0.5 wavelength or 8.5 inch (22.5cm) results in good performance.
- Spacing of less than 8.5 inch may result in significantly reduced MIMO performance.
- Spacing antennas close to each other (e.g. 3") results in antennas detuning from their original designed performance due to antenna coupling.
- Wherever possible, mount the ISR cellular router or the pluggable LTE module and antenna where the cellular base station or tower are within sight and without physical obstructions. Barriers along the line of sight between the device and the local base station will degrade the wireless radio signals. Install ISR cellular routers, pluggable modules and antennas above floor level in office environments or near the ceiling for better performance because most obstructions tend to be near the floor level.
The density of the materials used in a building’s construction determines the number of walls the signal must pass through while still maintaining adequate coverage. Consider the following before choosing the location for installing your antenna:

- Paper and vinyl walls have very little effect on signal penetration.
- Solid and precast concrete walls limit signal penetration to one or two walls without degradation of coverage.
- Concrete and wood block walls limit signal penetration to three or four walls.
- A signal can penetrate five or six walls constructed of drywall or wood.
- A thick metal wall or wire-mesh stucco wall causes signals to reflect back and causes poor penetration.

Avoid mounting the antenna next to a column or vertical support that could create a shadow zone and reduce the coverage area.

Keep the antenna away from reflective metal objects such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use an extension cable to relocate the antenna away from these obstructions.

Related Documentation

- For information about antennas and modules, see:
  http://www.cisco.com/go/cg-modules
- For information about omnidirectional and directional antennas, see:

Communications, Services, and Additional Information

- To receive timely, relevant information from Cisco, sign up at Cisco Profile Manager.
- To get the business impact you’re looking for with the technologies that matter, visit Cisco Services.
- To submit a service request, visit Cisco Support.
- To discover and browse secure, validated enterprise-class apps, products, solutions and services, visit Cisco Marketplace.
- To obtain general networking, training, and certification titles, visit Cisco Press.
- To find warranty information for a specific product or product family, access Cisco Warranty Finder.

Cisco Bug Search Tool

Cisco Bug Search Tool (BST) is a web-based tool that acts as a gateway to the Cisco bug tracking system that maintains a comprehensive list of defects and vulnerabilities in Cisco products and software. BST provides you with detailed defect information about your products and software.
Outdoor Panel Antenna for WiMAX 1.8, 2.5, and 3.8 GHz

The Outdoor Panel Antenna for WiMAX is designed to cover frequencies from 1.8 to 3.x GHz and support the Cisco CGR 1240 and the 1120 routers. This document provides the antenna specifications and mounting instructions.

- WiMAX 1.8 GHz is designed to cover frequencies from 1.8 to 1.83GHz (ANT-1.8-PNL-OUT-N)
- WiMAX 2.5 GHz is designed to cover frequencies from 2.3 to 2.7 GHz (ANT-2.X-PNL-OUT-N)
- WiMAX 3.x GHz is designed to cover frequencies from 3.3 to 3.8 GHz (ANT-3.X-PNL-OUT-N)

This chapter covers the following topics:

- WiMAX 1.8 GHz Technical Specifications
- WiMAX 2.5 GHz Technical Specifications
- WiMAX 3.8 GHz Technical Specifications
- Safety Warnings
- Antenna Installation
- Connecting the Antenna to the Router
- Obtaining Documentation and Submitting a Service Request

**Figure 34-1  Flat Panel WiMAX Antenna**

WiMAX 1.8 GHz Technical Specifications

The WiMAX 1.8 GHz antenna features the following:

- Low profile
- Wall mount, pipe mount
- Indoor and outdoors
Outdoor Panel Antenna for WiMAX 1.8, 2.5, and 3.8 GHz

- Panel mounted type N female connector
- Adjustable mounting brackets for outdoor installations

This section lists the technical information for the Flat Panel Outdoor WiMAX Antenna.

RF Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>1.8 to 1.83 GHz</td>
</tr>
<tr>
<td>VSWR</td>
<td>&lt; 1.5</td>
</tr>
<tr>
<td>Nominal gain</td>
<td>16 +/- 1 dBi</td>
</tr>
<tr>
<td>3 dB horizontal beamwidth</td>
<td>22'</td>
</tr>
<tr>
<td>3 dB vertical beamwidth</td>
<td>22'</td>
</tr>
<tr>
<td>F/B ratio total power</td>
<td>&gt; 20 dB</td>
</tr>
<tr>
<td>Polarization</td>
<td>Dual linear (vertical and horizontal) or slant +/- 45 degrees</td>
</tr>
<tr>
<td>Nominal impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>Radiation pattern</td>
<td>Directional</td>
</tr>
</tbody>
</table>

Mechanical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Directional panel</td>
</tr>
<tr>
<td>Polarization</td>
<td>Dual linear</td>
</tr>
<tr>
<td>Mount style</td>
<td>Wall or pipe mount (adjustable mount included)</td>
</tr>
<tr>
<td>Environment</td>
<td>Outdoor</td>
</tr>
<tr>
<td>Termination</td>
<td>N female (x2)</td>
</tr>
<tr>
<td>Antenna size</td>
<td>14.5 x 14.5 x 1.75 in. (36.8 x 36.8 x 4.4 cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>3.5 lbs (1.6 kg)</td>
</tr>
<tr>
<td>Temperature range (operating)</td>
<td>-40 to 185-degrees F (-40 to 85-degrees C)</td>
</tr>
<tr>
<td>Maximum input power</td>
<td>20 Watts</td>
</tr>
<tr>
<td>Radome material</td>
<td>UL94-V0 ASA radome</td>
</tr>
<tr>
<td>Material substance compliance</td>
<td>ROHS compliant</td>
</tr>
</tbody>
</table>

WiMAX 2.5 GHz Technical Specifications

The WiMAX 2.5 antenna Panel Outdoor 3G directional panel antenna features the following:

- Low profile
- Wall mount, pipe mount
- Indoor and outdoors
This section lists the technical information for the Flat Panel Outdoor WiMAX Antenna.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Directional panel</td>
</tr>
<tr>
<td>Frequency</td>
<td>2.3 to 2.7 GHz</td>
</tr>
<tr>
<td>Nominal gain</td>
<td>16 dBi, (2.3 to 2.4 GHz)</td>
</tr>
<tr>
<td></td>
<td>18 dBi (2.4 to 2.7 GHz)</td>
</tr>
<tr>
<td>Polarization</td>
<td>Dual linear (vertical and horizontal) or slant +/- 45 degrees</td>
</tr>
<tr>
<td>Maximum input power</td>
<td>25 Watts</td>
</tr>
<tr>
<td>Antenna</td>
<td>14.5 x 14.5 x 1.75 in. (36.8 x 36.8 x 4.4 cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>3.5 lbs (1.6 kg)</td>
</tr>
<tr>
<td>Connector</td>
<td>Dual type N female</td>
</tr>
<tr>
<td>Mount style</td>
<td>Wall or pipe mount</td>
</tr>
<tr>
<td>Environment</td>
<td>Outdoor</td>
</tr>
<tr>
<td>Temperature range</td>
<td>-40 to 185-degrees F (-40 to 85-degrees C)</td>
</tr>
<tr>
<td>Radiation pattern</td>
<td>Directional</td>
</tr>
</tbody>
</table>

The Flat Panel Outdoor WiMAX Antenna has Azimuth radiation patterns:
WiMAX 3.8 GHz Technical Specifications

The WiMAX 3.8 GHz antenna features the following:

- Low profile
- Wall mount, pipe mount
- Indoor and outdoors
- 2 x type N female connector

This section lists the technical information for the Flat Panel Outdoor WiMAX Antenna.
Safety Warnings

**WARNING:** Avoid using or servicing any equipment that has outdoor connections during an electrical storm. There may be a risk of electric shock from lightning. Statement 1088

**WARNING:** Do not work on the system, or connect or disconnect cables, during periods of lightning activity. Statement 1001

**WARNING:** Do not locate the outdoor antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.:NFPA 70, National Electrical Code, Article 810, Canada:Canadian Electrical Code, Section 54). Statement 1052

**WARNING:** This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024

**WARNING:** Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

**WARNING:** To report a gas leak, do not use a telephone in the vicinity of the leak. Statement 1039

**WARNING:** This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071. **SAVE THESE INSTRUCTIONS.**

**WARNING:** This product is not intended to be directly connected to the Cable Distribution System. Additional regulatory compliance and legal requirements may apply for direct connection to the Cable Distribution System. This product may connect to the Cable Distribution System ONLY through a device that is approved for direct connection. Statement 1078

**WARNING:** This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.

### Specification

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Directional panel</td>
</tr>
<tr>
<td>Frequency</td>
<td>3.3 to 3.8 GHz</td>
</tr>
<tr>
<td>Nominal gain</td>
<td>18 dBi</td>
</tr>
<tr>
<td>Polarization</td>
<td>Dual linear (vertical and horizontal) or slant +/- 45 degrees</td>
</tr>
<tr>
<td>Maximum input power</td>
<td>25 Watts</td>
</tr>
<tr>
<td>Antenna size</td>
<td>14.5 x 14.5 x 1.75 in. (36.8 x 36.8 x 4.4 cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>3.5 lbs (1.6 kg)</td>
</tr>
<tr>
<td>Connector</td>
<td>Dual type N female</td>
</tr>
<tr>
<td>Mount Style</td>
<td>Wall or pipe mount</td>
</tr>
<tr>
<td>Environment</td>
<td>Outdoor</td>
</tr>
<tr>
<td>Temperature range (operating)</td>
<td>-40 to 185–degrees F (-40 to 85–degrees C)</td>
</tr>
<tr>
<td>Radiation pattern</td>
<td>Directional</td>
</tr>
</tbody>
</table>
Safety Precautions

**WARNING:** Installation of this antenna near power lines is dangerous. For your safety, follow the installation directions.

**WARNING:** Each year hundreds of people are killed or injured when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.

**WARNING:** For your safety, and to help you achieve a good installation, please read and follow these safety precautions. They may save your life!

For your safety, read and follow these safety precautions.

- If you are installing an antenna for the first time, for your own safety as well as others, seek professional assistance. Your Cisco sales representative can explain which mounting method to use for the size and type antenna you are about to install.
- Before you install an antenna, contact your Cisco account representative to explain which mounting method to use for the size and type of antenna that you are about to install.
- Find someone to help you—installing an antenna is often a two-person job.
- Select your installation site with safety, as well as performance, in mind. Remember that electric power lines and phone lines look alike. For your safety, assume that any overhead line can kill you.
- Contact your electric power company. Tell them your plans and ask them to come look at your proposed installation.
- Plan your installation carefully and completely before you begin. Each person involved in an installation should be assigned to a specific task, and should know what to do and when to do it. One person should be in charge of the operation to issue instructions and watch for signs of trouble.
- When installing your antenna, follow these guidelines:
  - Do not use a metal ladder.
  - Do not work on a wet or windy day.
  - Do dress properly—wear shoes with rubber soles and heels, rubber gloves, and a long-sleeved shirt or jacket.
- If the assembly starts to drop, move away from it and let it fall. Because the antenna, mast, cable, and metal guy wires are all excellent conductors of electrical current, even the slightest touch of any of these parts to a power line completes an electrical path through the antenna and the installer.
- If any part of the antenna system should come in contact with a power line, do not touch it or try to remove it yourself. Call your local power company to have it removed safely.
- If an accident should occur with the power lines, call for qualified emergency help immediately.

Antenna Installation

The antenna installation includes the following procedures:

- **Tools and Equipment Required**
- **Installing the Antenna**

Tools and Equipment Required

In addition to the parts included in the antenna kit, you must provide the following tool to install the antenna on the router:
A flathead screwdriver
- 3/4 in. open-end wrench
- LMR-400-DB RF coaxial cable with N (m) to N (m) connectors
- Coax seal

**NOTE:** This list does not include the tools and equipment required to assemble and erect the tower, mast, or other structure you intend to mount your antenna on.

**Installing the Antenna**

Follow these instructions to install the antenna:

1. Choose the mounting configuration that you prefer.

2. Attach the antenna mount bracket to the back of the antenna by using two sets of flat washers, lock washers, and hex nuts. Tighten the nut to a torque rating of 55 in-lbf (6.2 Nm).

**NOTE:** Your connector type, location and quantity might differ from what is shown.
3. Attach the elevation adjustable bracket to the mount bracket using two sets of carriage bolts, washers, lock washers, and hex nuts. Position the bolts so the carriage bolt square holes are positioned on the inside. Do not tighten fully. Allow the bracket to move freely.

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/4”-20 hex nut</td>
</tr>
<tr>
<td>2</td>
<td>1/4”-20 spring lock washer</td>
</tr>
<tr>
<td>3</td>
<td>1/4”-20 flat washer</td>
</tr>
<tr>
<td>4</td>
<td>Antenna mount bracket</td>
</tr>
</tbody>
</table>
4. Position the azimuth adjustable (pipe) bracket to the pipe with the flanges away from the pipe. Secure each bracket to the pipe first by routing the band clamps around the pipe, then through the two holes. Tighten to a maximum torque rating.

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/4&quot;-20 hex nut</td>
</tr>
<tr>
<td>2</td>
<td>1/4&quot;-20 spring lock washer</td>
</tr>
<tr>
<td>3</td>
<td>1/4&quot;-20 flat washer</td>
</tr>
<tr>
<td>4</td>
<td>Elevation adjustable bracket</td>
</tr>
<tr>
<td>5</td>
<td>Antenna-mount bracket</td>
</tr>
<tr>
<td>6</td>
<td>1/4&quot;-20x3/4 carriage bolt</td>
</tr>
</tbody>
</table>
5. Attach the antenna assembly to the installed azimuth bracket. Position each of the two flanges on elevation adjustable bracket (on the antenna) over the flanges on the azimuth (pipe) bracket.
6. Adjust to the desired azimuth and elevation angles. Tighten all nuts and bolts to a torque rating of 55 in-lbf.

7. Attach the lightning arrestor to the router.

8. Attach the two RF cables to the antenna by connecting the ends of the LMR-400 (male) cables to the two receptacles on the rear of the antenna panel.
9. Seal the cable connections on the router and the back of the antenna by using weatherproof sealing tape (coax seal) at the connector junction. Start wrapping at the top of the antenna connector, wrap downward 3 times and end about 2 inches downward from the center of the connector junction. Then wrap upwards another 3 times to reach the top of the antenna connector.

10. Attach the router-end of the cable to your router.

Connecting the Antenna to the Router

To attach the router-end of the cable to your device, please refer to the appropriate Hardware Installation Procedures for the model of hardware you are installing. Links to hardware installation guides and other information may be found in Chapter 1, “Additional Information”.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly What’s New in Cisco Product Documentation, which also lists all new and revised Cisco technical documentation, at:


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