



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

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## Overview

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

Antenna Type	Dual-Band Polarization Diverse Patch Array	
Operating Frequency Ranges	2.4-2.5 GHz	5.15-5.925 GHz
Nominal Input Impedance	50 Ohms	50 Ohms

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

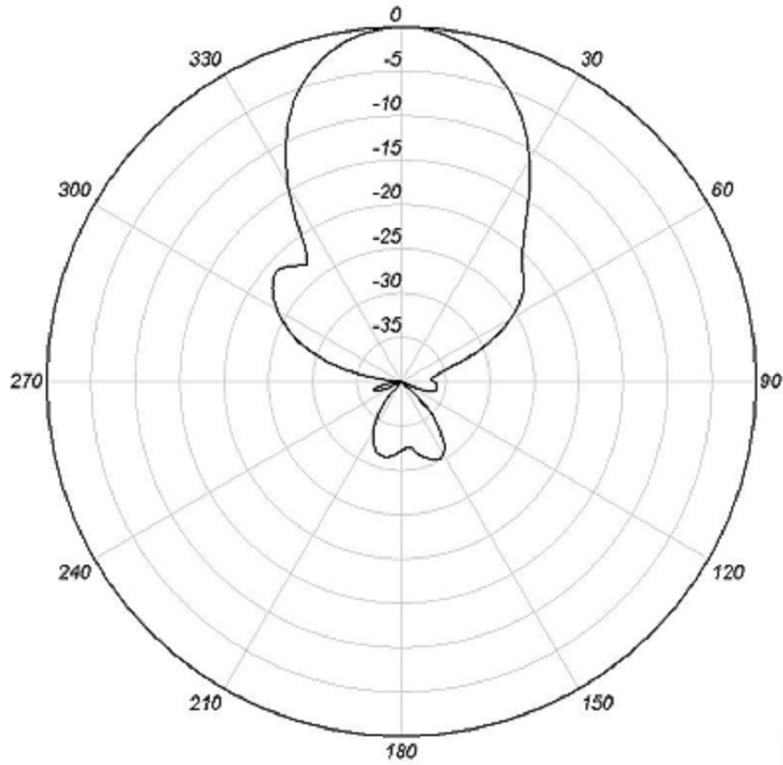
*Figure 1: ANT2513P4M-N front high view*



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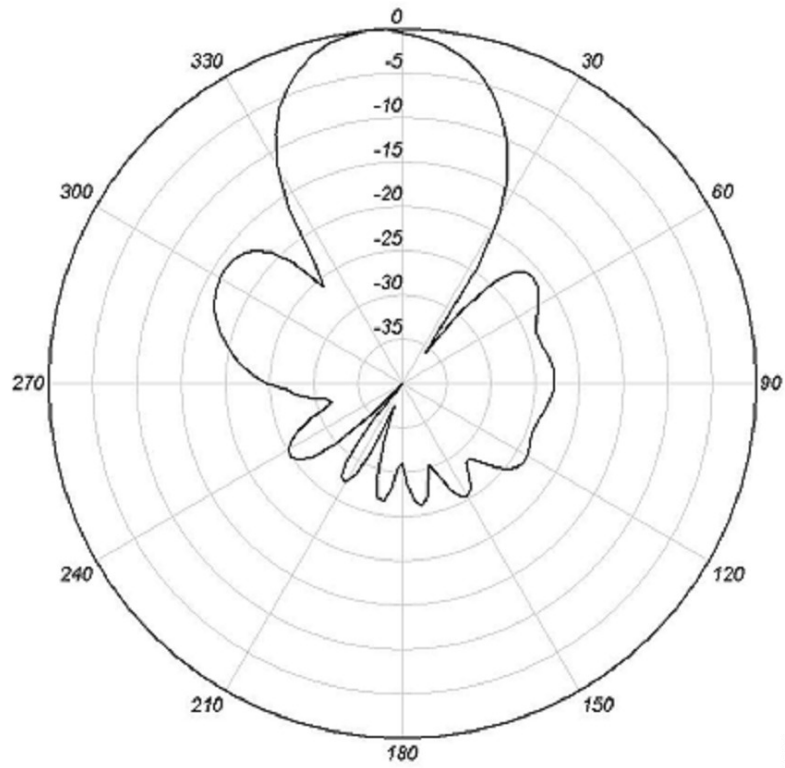
## 2.4 GHz Antenna Radiation Patterns

Figure 2: 2.4 GHz Ports AandC Azimuth Plane



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Figure 3: 2.4 GHz Ports AandC Elevation Plane



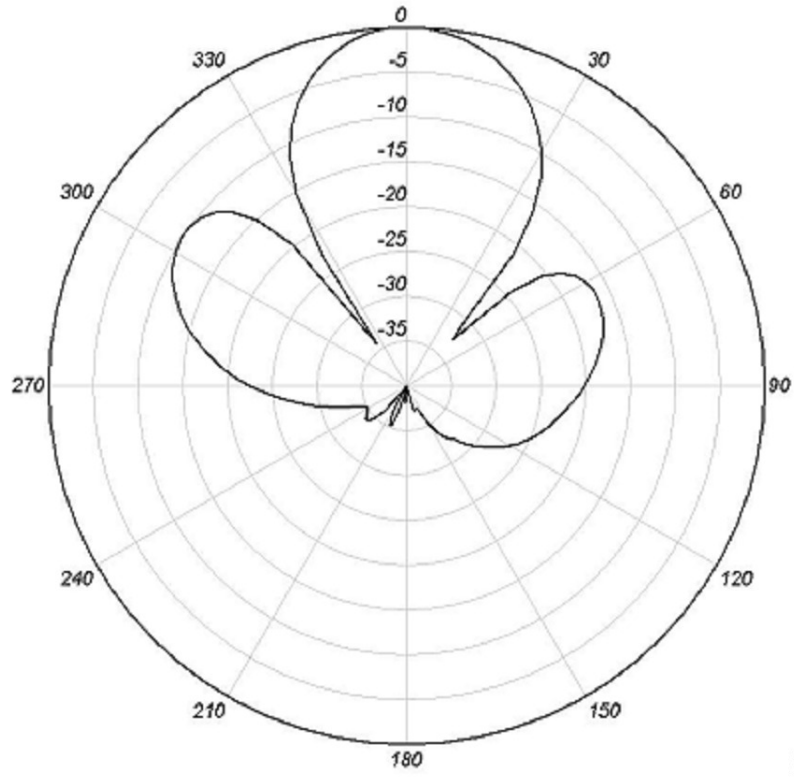
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Figure 4: 2.4 GHz Ports BandD Azimuth Plane



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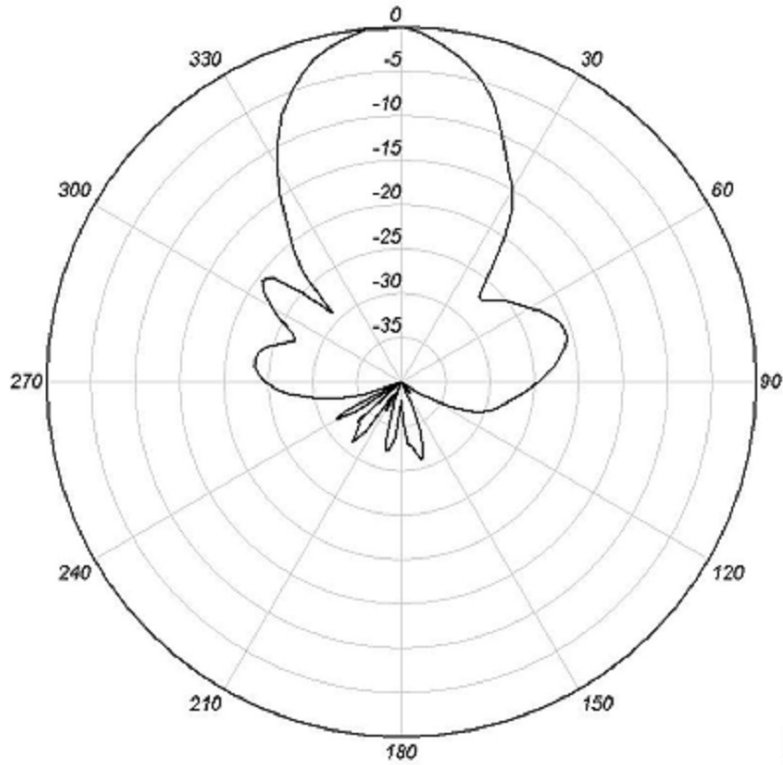
Figure 5: 2.4 GHz Ports BandD Elevation Plane



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## 5 GHz Antenna Radiation Patterns

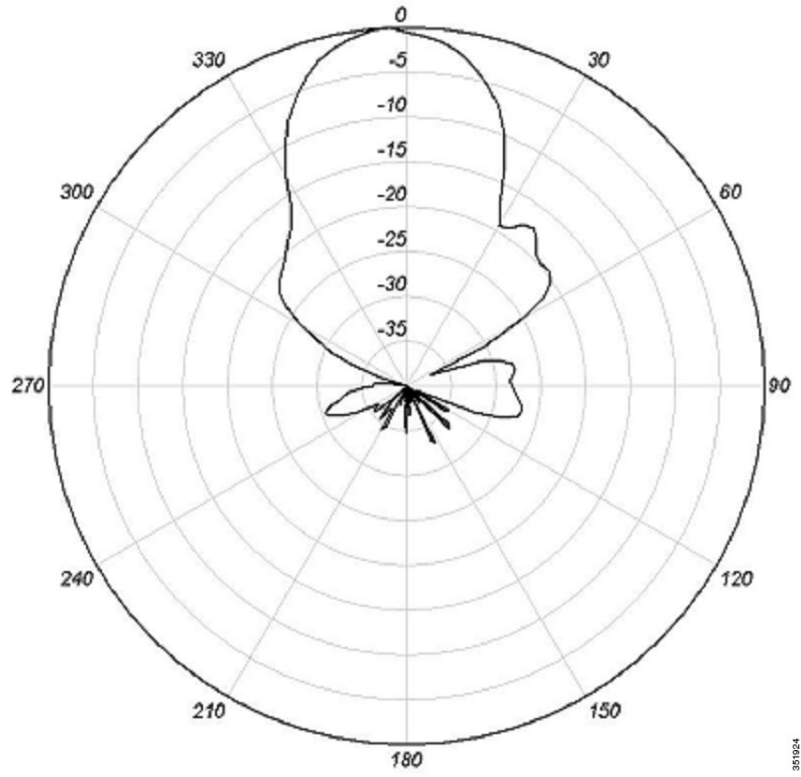
Figure 6: 5 GHz Ports A and C Azimuth Plane



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Figure 7: 5 GHz Ports AandC Elevation Plane



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Figure 8: 5 GHz Ports BandD Azimuth Plane

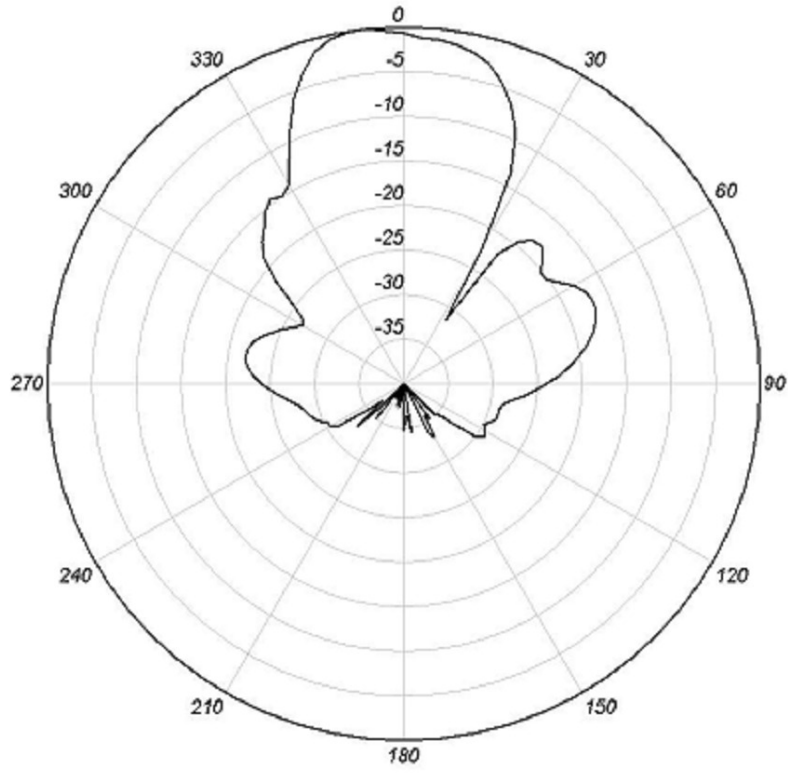
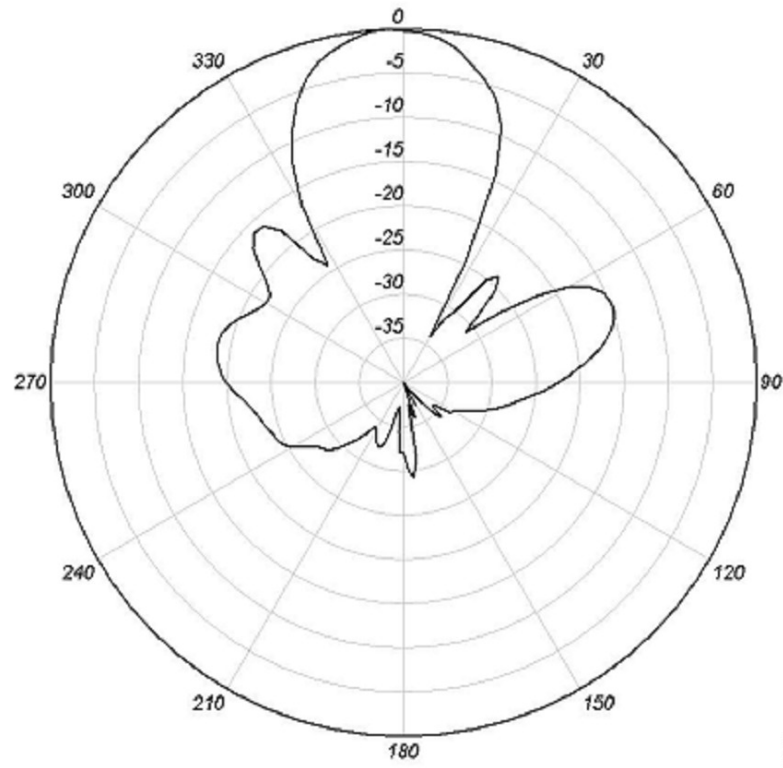


Figure 9: 5 GHz Ports BandD Elevation Plane

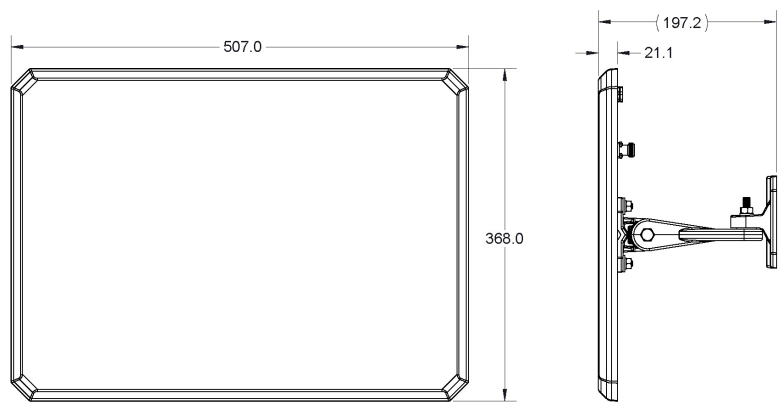


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## Antenna and Bracket Dimensions

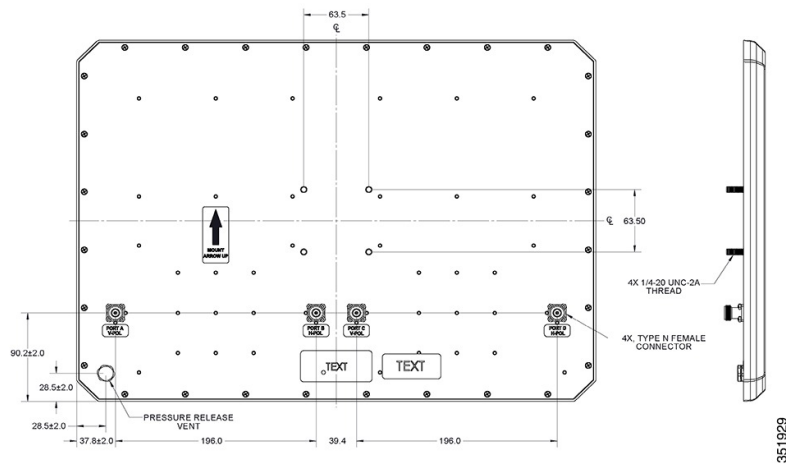
The following figures show the overall dimensions of the antenna and bracket.

Figure 10: Antenna and Bracket Dimensions (in millimeters)



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Figure 11: 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).

## General Safety Precautions



### 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**



### 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**

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**

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.

## General Installation Guidelines and Tips for Optimal Performance

This section contains the following:

## Installation Guidelines



### 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.

- Assemble your new antenna on the ground or a level surface at the installation site.
- Connect its coaxial cable while you are on the ground and attach the antenna to the mast.
- 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.
- Use the mounting bracket provided with the antenna.
- If the installation will use guy wires:
  - Install guy anchor bolts.
  - Estimate the length of guy wire and cut it before raising the mast.
  - Attach guy wires to a mast using guy rings.
- Carefully connect the antenna and mast assembly to its mounting bracket and tighten the clamp bolts.
  - In the case of a 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.
- Attach a “DANGER” label at eye level on the mast.
- 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.

## Tips for Optimal Performance

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.



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

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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.

## 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.

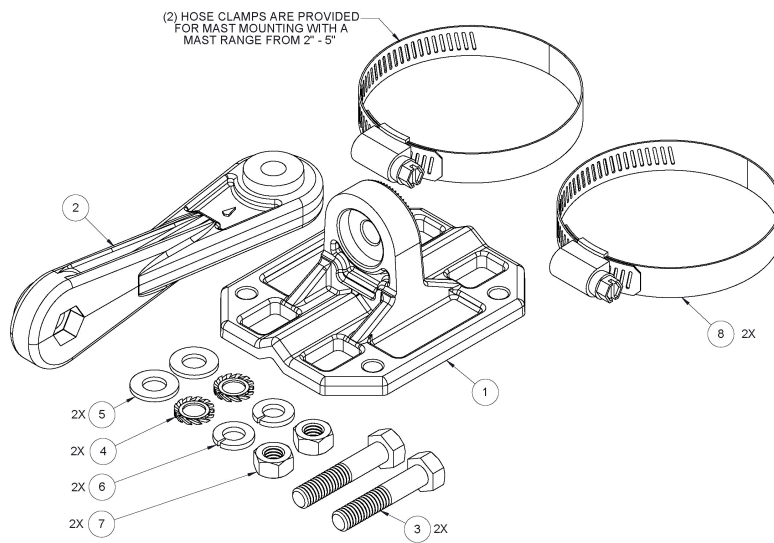
## Installing the Antenna

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

The following figure shows the parts included with the antenna bracket.

**Figure 12: Antenna Bracket Kit Contents**



1	Mounting flange	5	Flat washers
2	Mounting arm	6	Lock washers
3	Arm attachment bolts (5/16-18 x 1-5/8")	7	Arm attachment nuts (5/16-18)
4	Serrated washers	8	Hose clamps (50 – 135 mm adjustment)



**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



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**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.

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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



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**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

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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.

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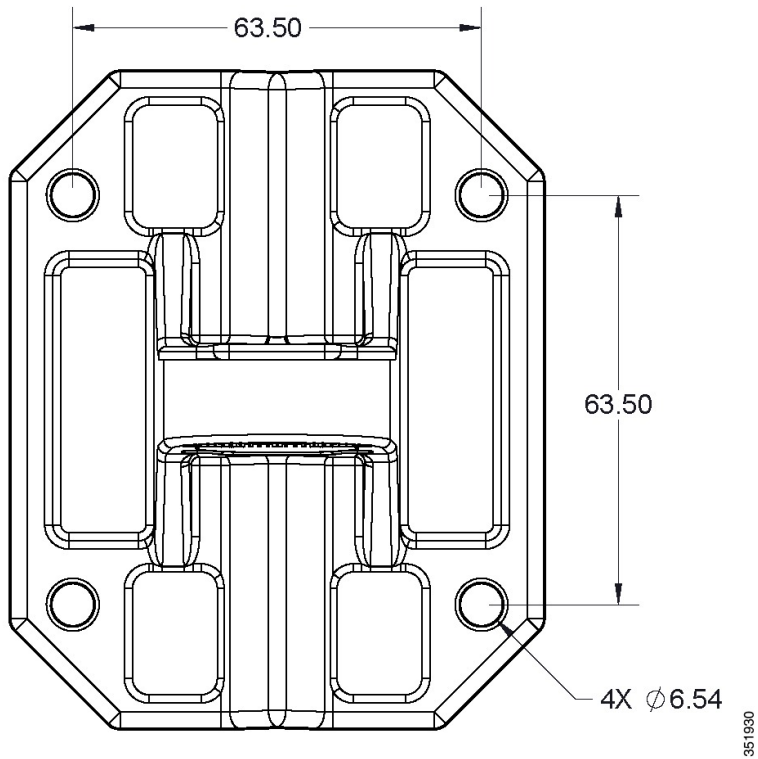
**Step 1** Remove the antenna and bracket hardware from the shipping container.

**Step 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.

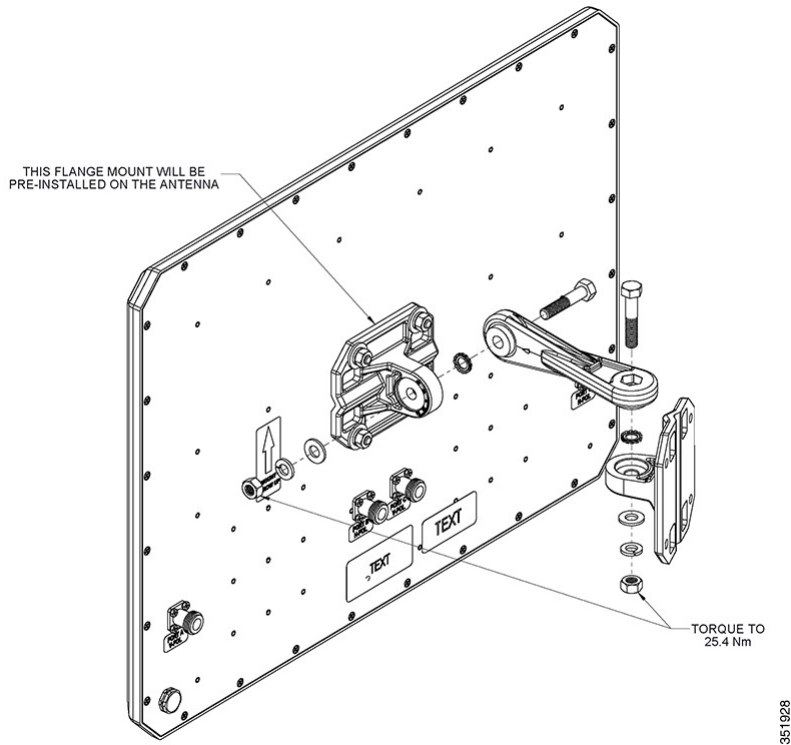
**Step 3** Attach the mounting bracket to the wall or ceiling using four screws or bolts and anchors through the holes on the bracket. The following figure shows the wall-mount bracket.

Figure 13: Wall-Mount Bracket and Dimensions (in millimeters)



**Step 4** Assemble the bracket hardware as shown in the following figure.

Figure 14: Assembling the Bracket Hardware



- Step 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.
- Step 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  $\pm 25$  degrees and elevation can be adjusted  $\pm 60$  degrees. You can use the azimuth and elevation markings on the mounting arm and the wall flange as a guide.
- Step 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).
- Step 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.

### What to do next

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.




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**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.

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- Step 1** Follow steps 1 and 2 from the Mounting on a Wall or Ceiling section.
- Step 2** Position and mount the mounting flange (see Antenna Bracket Kit Contents) 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 (see Wall-Mount Bracket and Dimensions (in millimeters)).
- Step 3** Tighten the clamps only enough to hold the flange and antenna in place until the antenna is positioned to its final position.
- Step 4** Assemble the antenna and bracket to the flange as shown in Figure 6.
- Step 5** Position the antenna, mounting bracket, and hose clamps on the mast.
- Step 6** Tighten the hose clamps until the antenna is fully secure on the mast. Ensure that the antenna cannot rotate about the mast.
- Step 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  $\pm 25$  degrees and elevation can be adjusted  $\pm 60$  degrees.
- Step 8** After you adjust the antenna position, tighten the adjustment bolts. Tighten all bolts to 18.7 +/- 5 lb-ft (25.4 Nm).
- Step 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.
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#### What to do next

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.




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**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)

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## 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.

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.

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