



# Wi-Fi 6 (802.11ax) Antennas Specifications Guide

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# Preface

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Read the following topics to learn about:

- The meanings of text formats used in this document.
- Where you can find additional information and help.
- How to reach us with questions and comments.

## Conventions

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To help you better understand the information presented in this guide, the following topics describe the formatting conventions used for notes, text, and other elements.

### Text Conventions



Unless otherwise noted, information in this document applies to all supported environments for the products in question. Exceptions, like command keywords associated with a specific software version, are identified in the text.

When a feature, function, or operation pertains to a specific hardware product, the product name is used. When features, functions, and operations are the same across an entire product family, such as ExtremeSwitching switches or SLX routers, the product is referred to as *the switch* or *the router*.

**Table 1: Notes and warnings**

Icon	Notice type	Alerts you to...
	Tip	Helpful tips and notices for using the product
	Note	Useful information or instructions
	Important	Important features or instructions

**Table 1: Notes and warnings (continued)**

Icon	Notice type	Alerts you to...
	Caution	Risk of personal injury, system damage, or loss of data
	Warning	Risk of severe personal injury

**Table 2: Text**

Convention	Description
screen displays	This typeface indicates command syntax, or represents information as it is displayed on the screen.
The words <i>enter</i> and <i>type</i>	When you see the word <i>enter</i> in this guide, you must type something, and then press the Return or Enter key. Do not press the Return or Enter key when an instruction simply says <i>type</i> .
<b>Key names</b>	Key names are written in boldface, for example <b>Ctrl</b> or <b>Esc</b> . If you must press two or more keys simultaneously, the key names are linked with a plus sign (+). Example: Press <b>Ctrl+Alt+Del</b>
<i>Words in italicized type</i>	Italics emphasize a point or denote new terms at the place where they are defined in the text. Italics are also used when referring to publication titles.
<b>NEW!</b>	New information. In a PDF, this is searchable text.

**Table 3: Command syntax**

Convention	Description
<b>bold text</b>	Bold text indicates command names, keywords, and command options.
<i>italic text</i>	Italic text indicates variable content.
[ ]	Syntax components displayed within square brackets are optional. Default responses to system prompts are enclosed in square brackets.
{ <b>x</b>   <b>y</b>   <b>z</b> }	A choice of required parameters is enclosed in curly brackets separated by vertical bars. You must select one of the options.
<b>x</b>   <b>y</b>	A vertical bar separates mutually exclusive elements.
< >	Nonprinting characters, such as passwords, are enclosed in angle brackets.

**Table 3: Command syntax (continued)**

Convention	Description
...	Repeat the previous element, for example, <i>member [member . . .]</i> .
\	In command examples, the backslash indicates a “soft” line break. When a backslash separates two lines of a command input, enter the entire command at the prompt without the backslash.

## Send Feedback

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The Information Development team at Extreme Networks has made every effort to ensure that this document is accurate, complete, and easy to use. We strive to improve our documentation to help you in your work, so we want to hear from you. We welcome all feedback, but we especially want to know about:

- Content errors, or confusing or conflicting information.
- Improvements that would help you find relevant information.
- Broken links or usability issues.

To send feedback, do either of the following:

- Access the feedback form at <https://www.extremenetworks.com/documentation-feedback/>.
- Email us at [documentation@extremenetworks.com](mailto:documentation@extremenetworks.com).

Provide the publication title, part number, and as much detail as possible, including the topic heading and page number if applicable, as well as your suggestions for improvement.

## Help and Support

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If you require assistance, contact Extreme Networks using one of the following methods:

### Extreme Portal

Search the GTAC (Global Technical Assistance Center) knowledge base; manage support cases and service contracts; download software; and obtain product licensing, training, and certifications.

### The Hub

A forum for Extreme Networks customers to connect with one another, answer questions, and share ideas and feedback. This community is monitored by Extreme Networks employees, but is not intended to replace specific guidance from GTAC.

### Call GTAC

For immediate support: (800) 998 2408 (toll-free in U.S. and Canada) or 1 (408) 579 2826. For the support phone number in your country, visit: [www.extremenetworks.com/support/contact](http://www.extremenetworks.com/support/contact)

Before contacting Extreme Networks for technical support, have the following information ready:

- Your Extreme Networks service contract number, or serial numbers for all involved Extreme Networks products
- A description of the failure
- A description of any actions already taken to resolve the problem
- A description of your network environment (such as layout, cable type, other relevant environmental information)
- Network load at the time of trouble (if known)
- The device history (for example, if you have returned the device before, or if this is a recurring problem)
- Any related RMA (Return Material Authorization) numbers

## Subscribe to Product Announcements

You can subscribe to email notifications for product and software release announcements, Field Notices, and Vulnerability Notices.

1. Go to [The Hub](#).
2. In the list of categories, expand the **Product Announcements** list.
3. Select a product for which you would like to receive notifications.
4. Select **Subscribe**.
5. To select additional products, return to the **Product Announcements** list and repeat steps 3 and 4.

You can modify your product selections or unsubscribe at any time.

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Find Extreme Networks product information at the following locations:

[Current Product Documentation](#)

[Release Notes](#)

[Hardware and software compatibility](#) for Extreme Networks products

[Extreme Optics Compatibility](#)

[Other resources](#) such as white papers, data sheets, and case studies

Extreme Networks offers product training courses, both online and in person, as well as specialized certifications. For details, visit [www.extremenetworks.com/education/](http://www.extremenetworks.com/education/).





# External Antenna Selection and Site Preparation

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[Antenna Connector Types](#) on page 9

[Antenna Selection Criteria](#) on page 11

[Antenna Location Criteria](#) on page 14

Although several antennas may work in a given environment, some will provide better coverage than others. Using the right antenna in the right location will maximize both the performance and coverage of your network. Understanding the key characteristics that describe how an antenna sends and receives radio frequency signals is critical to finding the ideal antenna for your deployment. ExtremeWireless products operate in the 2.4 GHz and 5 GHz Industrial, Scientific and Medical (ISM) bands allocated for unlicensed use.

ExtremeWireless access points support either the 802.11b/g/n/ax or the 802.11a/n/ax standard, or both. Wireless devices conforming to the 802.11b/g/n/ax standard operate in the 2.4 GHz ISM band, while 802.11a/n/ax devices operate in the 5 GHz band. The antennas in this guide are grouped according to the frequency band they support. Some antennas are designed to operate within either band. These antennas, described as dual-band, are connected to radios operating in either the 2.4 GHz or 5 GHz bands.

## Antenna Connector Types

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There are various types of antenna connectors that are present at one end of the indoor and outdoor antennas. The antenna connectors are used to connect the antenna to the connector on an access point.

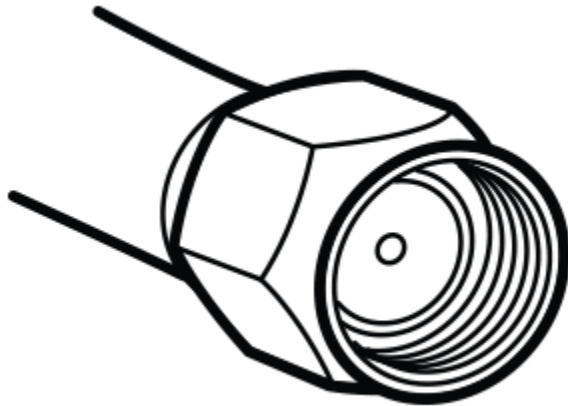
There are various types of antenna connectors, some of which are shown in the following images:



**Figure 1: Reverse polarity (RP)-SMA jack type antenna connector**

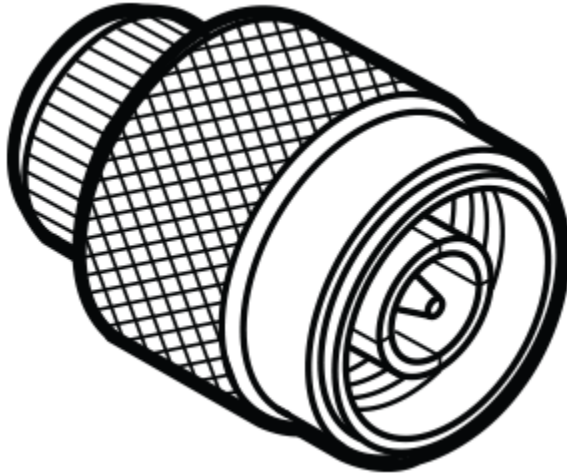
The reverse polarity jack type antenna connector has a center pin and the connector threads are outside the connector shell.

The following antenna connectors are used with indoor access points:



**Figure 2: RP-SMA plug antenna connector**

The reverse polarity plug type connector has a hollow center socket and the connector threads are inside the connector shell.



**Figure 3: N-type standard plug connector**

The small N-type connectors are used during indoor installations and larger connectors are used for outdoor installations.

## Antenna Selection Criteria

In addition to antenna frequency, consider the following criteria when selecting an antenna.

### Mode of use of antennas

There are antennas that can be used for indoor application or outdoor application. One important aspect of an antenna is whether it is weather sealed to protect it from environmental damages.

**Table 4: Difference between indoor and outdoor antennas**

Differences	Indoor antenna	Outdoor antenna
Use	Can only be used in indoor installations. Indoor antennas must not be used for outdoor installations.	Used for indoor as well as outdoor installations. During indoor installations, outdoor antennas can be used in freezers and coolers to handle harsh temperatures.
Connector type	RP-SMA plug	N-plug connector
Lightning protection	Not required	Required. But, lightning protection is not required when the antenna is installed in indoor locations.

## Antenna pattern selection criteria

Antenna pattern	Description
Omni-Directional	Signal radiates from the antenna in all directions on the horizontal plane.
Directional	Signal radiates in a specific direction, typically described as a beam of given width, expressed in degrees in the horizontal and vertical plane.

## Antenna type selection criteria

Antenna type	Description
Panel	A panel antenna is a flat antenna mounted to a wall or other vertical surface and radiates RF energy (radio waves) directionally away from the wall. They usually have gain greater than 5 dBi and are not suitable for omni-directional situations. Ideally suited for long hallways.
Patch	A patch antenna is a flat antenna mounted on the ceiling but whose pattern is omni-directional. Most of the energy goes out horizontally to the sides of the antenna and equal in all directions.
Dipole	A dipole antenna is a tubular antenna that can be either a pipe shape, a straight flexible rod or a paddle. This antenna has an omni-directional pattern when placed in a vertical position. It usually has 2 dBi of gain.
Dipole array	Essentially a dipole, a dipole array is two or more dipoles that are placed one on top of the other, requiring a longer tube to hold them. The advantage of a dipole array is that it has higher gain.
Parabolic grid	A parabolic grid antenna is a very directional, dish-like antenna. Its parabolic reflector focuses the RF energy like a flashlight. Most of the time the radiating element is a dipole, but when combined with the dish, it becomes very directional with gain up to 24 dBi. Usually used in long point-to-point systems.

Antenna type	Description
Yagi	A yagi antenna is a antenna that has an internal structure resembling that of typical antennas used for TV reception (a series of rods perpendicular to a main rod, making a triangular shape). This is a directional antenna with less gain than the PGA, typically around 13 dBi. It can be used in either point-to- point situations, or to cover a very long, narrow area in point-to-multi-point situations.
Polarized panel	A polarized panel antenna is a multi-port panel antenna with different linear polarization alignments on the different ports. Common polarization alignment orientations are Vertical/Horizontal and Vertical/ 45°-Slant. Polarized panel antennas are useful on outdoor Line-of-Sight links, and are also used in indoor deployments for improved coverage uniformity at the expense of slightly reduced range.

### Antenna performance criteria

Antenna characteristics	Description
Frequency	The frequency band within which the antenna performs at the stated specifications.
Gain (dBi)	The relative amplification of the antenna with respect to an equivalent isotropic antenna, expressed on the decibel logarithmic scale.
Cable loss (dBi)	The signal strength loss introduced by the cable connected to the antenna expressed on the decibel logarithmic scale.
Net gain (dBi)	The resulting amplification of the antenna paired with its cable.
Polarization	The orientation of the electrical field which the antenna is optimized to receive. If the transmitting and receiving antennas are both linear polarized, then turning one 90° so that they are cross polarized will reduce the range significantly.

Antenna characteristics	Description
Voltage Standing Wave Ratio (VSWR)	Voltage Standing Wave Ratio (VSWR) is the ratio of maximum voltage to minimum voltage along the line. Expresses the degree of match between the transmission line and the terminating element (antenna). When VSWR is 1:1 the match is perfect, a VSWR of 1.5:1 corresponds to 96% power efficiency.
Azimuth 3dB beamwidth	Width of the antenna beam on the horizontal plane expressed in degrees.
Elevation 3dB beamwidth	Height of the antenna beam on the vertical plane expressed in degrees.

## Antenna Location Criteria

The following factors determine the locations where you can place the antennas relative to one another and the distances between them:

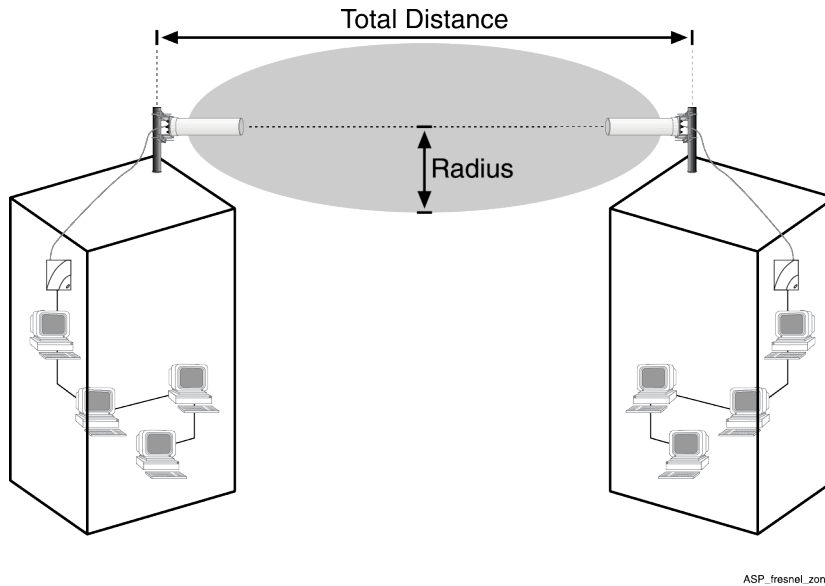
- Type of antennas
- Length of cable connecting the antenna to the access point
- Data rate required
- In a LAN-to-LAN network, the distance between the buildings
- Obstructions in the signal path
- In a wireless infrastructure network, the area around the antenna where clients need to communicate with the access point

Directional and omni-directional antennas are often installed on rooftops. The directional antenna can also be installed on the side of a building. The following sections describe the factors that affect the range of these antennas:

### Line of sight

The shape of the radio beam, defined as the Fresnel zone, is widest in the middle. The Fresnel zone is shown as the gray area between the antennas in Fresnel zone and line of sight clearance. The exact shape and width of the Fresnel zone is determined by the distance between the antenna and frequency of the radio signal.

The radius of the radio beam, shown as the lower half of the Fresnel zone, is the distance from the center of the beam outward in any direction. The length of the radius is not based on the data rate and the type of antenna.



**Figure 4: Fresnel zone and line of sight clearance**

The radius can be calculated using the following formula:

$$r = 8.675\sqrt{D \div f}$$

Where

D = distance between the antennas in kilometers (km)

f = frequency in GHz

60% of the Fresnel zone must be clear of obstructions to be line of sight. In addition to the Fresnel zone height requirement, earth curvature may become a factor in paths longer than 2 km. The additional antenna height can be calculated using the following formula:

$$H = D^2/51499$$

Where

D = distance between the antennas in kilometers

H = height required to overcome earth curvature

**Table 5: Typical antenna height requirements - 2.4 GHz**

Distance between Tx and Rx antennas (km)	Fresnel zone radius (m)	Earth curvature (m)	Minimum antenna height requirements (m)
2	7.9	0.08	7.98
5	12.5	0.49	12.99
10	17.67	1.94	19.61

**Table 5: Typical antenna height requirements - 2.4 GHz (continued)**

Distance between Tx and Rx antennas (km)	Fresnel zone radius (m)	Earth curvature (m)	Minimum antenna height requirements (m)
15	21.64	4.37	26.01
20	25	7.77	32.77
25	28	12.14	40.14
30	30.6	17.48	48.08

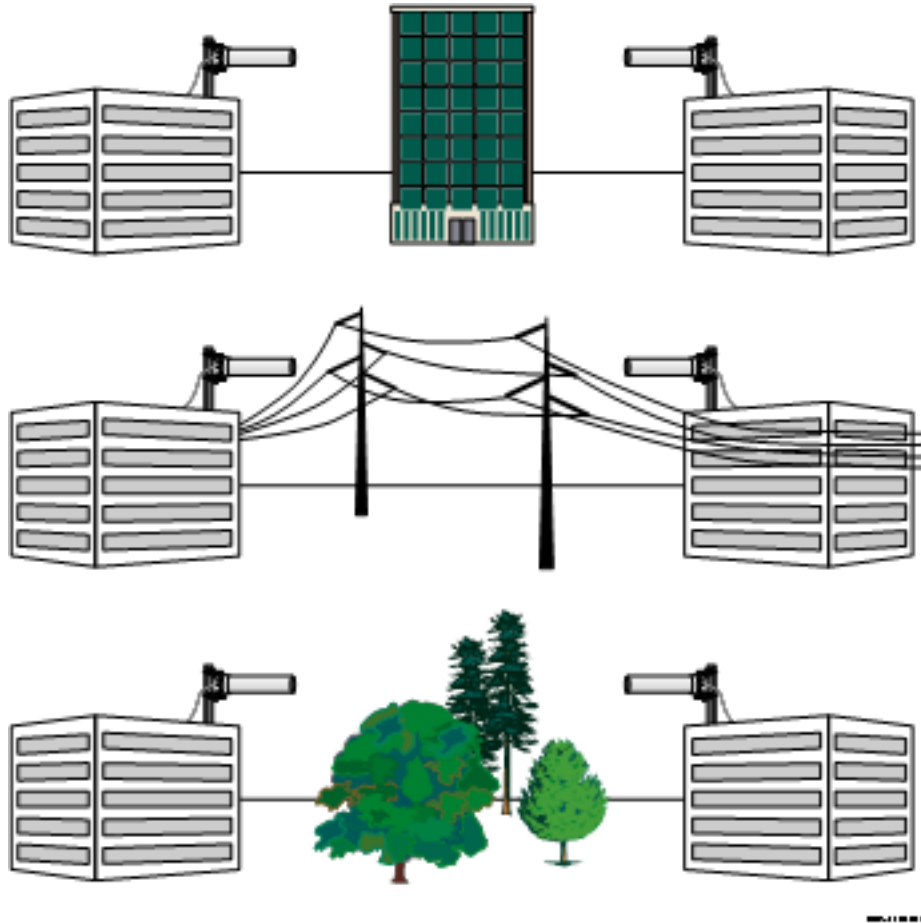
**Table 6: Typical antenna height requirements - 5 GHz**

Distance between Tx and Rx antennas (km)	Fresnel zone radius (m)	Earth curvature (m)	Minimum antenna height requirements (m)
2	5.22	0.08	5.3
5	8.24	0.49	8.73
10	11.67	1.94	13.61
15	14.3	4.37	18.67
20	16.5	7.77	24.27
25	18.46	12.14	30.6
30	20.22	17.48	37.7

For optimal performance, ensure that the antenna products you choose, in combination with the height of the antenna installation above ground, provide sufficient clearance to allow your antenna installation to cover the distance between the two sites.

Obstacles within the line of sight can significantly reduce the distance and performance. Obstructions include neighboring buildings, trees, and power lines, as shown in the following figure:





**Figure 5: Potential obstacles to line of sight (figure not to scale)**

## Additional antenna location requirements

This section describes other requirements to meet before installing the outdoor antennas.

- Lightning protection

A lightning rod must be placed close to the antenna mast or wall bracket. This is required to protect the antenna from direct lightning strikes.

- Grounding System

A grounding system is required when installing an outdoor antenna with an indoor or outdoor access point.

Direct earth grounding of the antenna and the lightning protector is necessary to protect the antenna from lightning and the build-up of static electricity. The access point and the lightning protector must be connected to the same earth ground using separate grounds. The antenna and the mounting structure require separate grounds to the same earth ground, using an equipotential bonding conductor.

Check with a certified antenna installer, or local electrician, to make sure the antenna is properly grounded.

**Note**

Ensure that the cable between the antenna and lightning protector is at least 3.0 ft (0.9 m) away from high-voltage or high-current cable.



# Cable Options

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[Antenna Cables Specifications](#) on page 19

Extreme Networks offers optional low-loss, indoor and outdoor cables. The indoor cables have a RP SMA-type connector. The outdoor cables are used to connect the indoor or outdoor access points to an outdoor antenna. The outdoor cables have a standard polarity type-N plug and type-N jack.

The antennas sold by Extreme Networks come with a LMR cable attached to the antenna. The best practice is to use the cable that comes with the antenna. If the distance between the antenna and the access point is longer, then use LMR cables produced by Extreme Networks.



## Note

Determine the distance between the locations where you intend to mount the external antenna to ensure that you order the right cable length.



## Tip

The best practice is to use a smaller length LMR cable.

Related Topics

[Antenna Cables Specifications](#) on page 19

## Antenna Cables Specifications

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Learn about various cable specifications for indoor and outdoor antenna cables.

## Indoor antenna cables with RP-SMA type connectors

The indoor cables used with the Extreme Wireless antennas use a standard RP-SMA type plug connector. The following table provides details about the cables used with the RP-SMA plug type connector:

Indoor cable details	Reference
10.00 ft (3.05 m) PFP240 cable (WS-CAB240- P10RP)	Table 7
25.00 ft (7.62 m) PFP240 cable (WS-CAB240- P25RP)	

**Table 7: WS-CAB240-P10RP and WS-CAB240-P25RP cable specifications**

Specification	Value
Mechanical	
Length	WS-CAB240-P10RP: 10.00 ft (3.05 m) WS-CAB240-P25RP: 25.00 ft (7.62 m)
Weight	0.002 lb/ft (0.03 kg/m)
Bend radius	0.5 in (12.7 mm)
Tensile strength	40.0 lb (18.2 kg)
Environmental	
Temperature range	Operating: -40°C to +85°C (-40°F to +185°F) Storage: -70°C to +85°C (-94°F to +185°F)
Electrical	
Cutoff frequency	39 GHz
Velocity propagation	83%
Shielding effectiveness	Greater than 90 dBi
DC resistance	Inner Conductor: 5.36 ohms/1000 ft (17.60 ohms/km) Outer Conductor: 4.9 ohms/1000 ft (16.1 ohms/km)
Peak power	2.5 kW
Connector type	Outdoor antennas support optional cables with standard polarity type-N plug and type-N jack. Indoor antennas support optional cables with standard RP-SMA type plug connectors.
Cable loss	2.4 GHz: 3.3 dB 5.3 GHz: 5.0 dB 5.8 GHz: 5.3 dB

## Outdoor antenna cables with standard N-type plug and jack connectors

The outdoor cables used with the Extreme Wireless antennas use a type-N plug and type-N jack; therefore, the part numbers end with "N". The cables used with N-type antenna connectors are listed in the following table:

Outdoor cable details	Reference
20.00 ft (6.10 m) PFP240 cable (WS-CABL200C20N)	Table 8 on page 21
6.00 ft (1.83 m) PFP400 cable (WS-CABL400C06N)	Table 9 on page 22
20.00 ft (6.10 m) PFP400 cable (WS-CABL400C20N)	Table 9 on page 22
50.00 ft (15.24 m) PFP400 cable (WS-CABL400C50N)	Table 9 on page 22
75.00 ft (22.00 m) PFP400 cable (WS-CABL400C75N)	Table 9 on page 22
25.00 ft (7.60 m) PFP600 cable (WS-CABL600C25N)	Table 10 on page 23
50.00 ft (15.24 m) PFP600 cable (WS-CABL600C50N)	Table 10 on page 23

**Table 8: WS-CABL200C20N cable specifications**

Specification	Value
Mechanical	
Length	20.00 ft (6.10 meters)
Weight	0.002 lb/ft (0.03 kg/m)
Bend radius	0.5 in (12.7 mm)
Tensile strength	40.0 lb (18.2 kg)
Environmental	
Temperature range	Operating: -40°C to +85°C (-40°F to +185°F) Storage: -70°C to +85°C (-94°F to +185°F)
Electrical	
Cutoff frequency	39 GHz
Velocity propagation	83%
Shielding effectiveness	Greater than 90 dBi
DC resistance	Inner Conductor: 5.36 ohms/1000ft (17.6 ohms/km) Outer Conductor: 4.9 ohms/1000ft (16.1 ohms/km)
Peak power	2.5 kW

**Table 8: WS-CABL200C20N cable specifications (continued)**

Specification	Value
Connector type	Outdoor antennas support optional cables with standard polarity type-N plug and type-N jack. Indoor antennas support optional cables with standard RP-SMA type plug connectors.
Cable loss	2.4 GHz: 3.3 dB 5.3 GHz: 5.0 dB 5.8 GHz: 5.3 dB

**Table 9: WS-CAB-L400C06N, WS-CAB-L400C20N, WS-CAB-L400C50N, and WS-CAB-L400C75N cable specifications**

Specification	Value
Mechanical	
Length	WS-CAB-L400C06N: 6.00 ft (1.83 m) WS-CAB-L400C20N: 20.00 ft (6.10 m) WS-CAB-L400C50N: 50.00 ft (15.24 m) WS-CAB-L400C75N: 75.00 ft (22.00 m)
Weight	0.068 lb/ft (0.10 kg/m)
Bend radius	1.00 in (25.40 mm)
Tensile strength	160.0 lb (72.6 kg)
Environmental	
Temperature range	Operating: -40°C to +85°C (-40°F to +185°F) Storage: -70°C to +85°C (-94°F to +185°F)
Electrical	
Cutoff frequency	16.2 GHz
Velocity propagation	85%
Shielding effectiveness	Greater than 90 dBi
DC resistance	Inner Conductor: 1.39 ohms/1000 ft (4.6 ohms/km) Outer Conductor: 1.65 ohms/1000 ft (5.4 ohms/km)
Peak power	16 kW

**Table 9: WS-CAB-L400C06N, WS-CAB-L400C20N, WS-CAB-L400C50N, and WS-CAB-L400C75N cable specifications (continued)**

Specification	Value
Connector type	Outdoor antennas support optional cables with standard polarity type-N plug and type-N jack.
Cable loss	50.00 ft: <ul style="list-style-type: none"> <li>• 2.4 GHz: 3.3 dB</li> <li>• 5.3 GHz: 5.2 dB</li> <li>• 5.8 GHz: 5.4 dB</li> </ul> 75.00 ft: <ul style="list-style-type: none"> <li>• 2.4 GHz: 5.0 dB</li> <li>• 5.3 GHz: 7.7 dB</li> <li>• 5.8 GHz: 8.1 dB</li> </ul>

**Table 10: WS-CAB-L600C25N and WS-CAB-L600C50N cable specifications**

Specification	Value
Mechanical	
Length	WS-CAB-L600C25N: 25.00 ft (7.60 m) WS-CAB-L600C50N: 50.00 ft (15.24 m)
Weight	0.131 lb/ft (0.200 kg/m)
Bend radius	1.50 in (38.10 mm)
Tensile strength	350.0 lb (158.9 kg)
Environmental	
Temperature range	Operating: -40°C to +85°C (-40°F to +185°F) Storage: -70°C to +85°C (-94°F to +185°F)
Electrical	
Cutoff frequency	10.3 GHz
Velocity propagation	87%
Shielding effectiveness	Greater than 90 dBi
DC resistance	Inner Conductor: 0.53 ohms/1000 ft (1.70 ohms/km) Outer Conductor: 1.20 ohms/1000 ft (3.90 ohms/km)
Peak power	40 kW

**Table 10: WS-CAB-L600C25N and WS-CAB-L600C50N cable specifications (continued)**

Specification	Value
Connector type	Outdoor antennas support optional cables with standard polarity type-N plug and type-N jack.
Cable loss	25.00 ft: <ul style="list-style-type: none"> <li>• 2.4 GHz: 1.1 dB</li> <li>• 5.3 GHz: 1.7 dB</li> <li>• 5.8 GHz: 1.8 dB</li> </ul> 50.00 ft: <ul style="list-style-type: none"> <li>• 2.4 GHz: 2.2 dB</li> <li>• 5.3 GHz: 3.5 dB</li> <li>• 5.8 GHz: 3.6 dB</li> </ul>





# Antenna Compatibility Matrix

The following tables list the indoor and outdoor antennas, and the corresponding supported access points. You can use this information to guide you when you install your access points.

For more information, see [AP510C/CX and AP305C/CX Access Points Antennas Support Country List](#) on page 29.



### Note

Some deployment scenarios require an adapter. For the adapter technical specifications, see "Supported Antenna Adapters" in the *Enterprise Wireless LAN Antenna Specification Guide*.

## Indoor Antennas

The following table list the indoor antennas, and the corresponding supported access points.



### Note

The indoor antennas listed in the following table are *not* compatible with Extreme outdoor APs, including the AP460e and AP360e.

**Table 11: Indoor Antenna Compatibility Matrix - Indoor APs**

Antenna	Indoor APs					
	Non-Cloud Enabled APs			Cloud Enabled APs		
	AP510e	AP410e	AP310e	AP510C/CX	AP305C/CX	AP3000X
WS-AI-DQ05120	✓	✓	✓	—	—	—
WS-AI-5Q04060 (30703)	✓	✓	—	—	—	—
WS-AI-2Q05060 (30704)	✓	—	—	—	—	—
WS-AI-DE07025 (30705)	✓	✓	✓	—	—	—

**Table 11: Indoor Antenna Compatibility Matrix - Indoor APs (continued)**

Antenna	Indoor APs					
	Non-Cloud Enabled APs			Cloud Enabled APs		
	AP510e	AP410e	AP310e	AP510C/CX	AP305C/CX	AP3000X
WS-AI-5Q05025 (30706)	✓	✓	—	—	—	—
WS-AI-DE10055 (30707)	✓	✓	✓	—	—	—
ML-2452-PTA4M4-036	✓	✓	✓	—	✓	—
ML-2452-PTA2M2-036	✓	✓	✓	—	✓	—
ML-2452-SEC6M4-036	✓	✓	✓	✓	✓	—
ML-2452-APA2-01 (black)	✓	✓	✓	✓	✓	✓
ML-2452-APA2-02 (white)	✓	✓	✓	✓	✓	✓
ML-2452-HPA5-036	✓	✓	✓	—	—	✓
AI-DQ04360S	✓	✓	✓	✓	✓	—
AH-ACC-ANT-AX-KT (pack of 8 dual-band)	✓	✓	✓	✓	✓	✓
AI-DS0305360-RPSMA	—	—	—	—	—	✓
AIO-DD75060-RPSMA	—	—	—	—	—	✓
AIO-DD05120-RPSMA	—	—	—	—	—	✓

## Outdoor Antennas

The following tables list the outdoor antennas, and the corresponding supported access points.



### Note

The ML-2452-SEC6M4-036 and AI-DQ04360S are outdoor-rated indoor antennas. Both the antennas can be used outdoor on AP510CX and AP305CX access points.

**Table 12: Outdoor Antenna Compatibility Matrix - Indoor APs**

Antenna	Indoor APs		
	Non-Cloud Enabled APs	Cloud Enabled APs	
	AP510e, AP410e, and AP310e	AP510C/CX and AP305C/CX	AP3000X
ML-2452-HPAG4A6-01	✓	—	✓ Requires adapter 25-85392-01R for each port
ML-2452-PNA5-01R	✓	—	✓
ML-2452-HPAG5A8-01	✓	—	—
ML-2452-PNA7-01R	✓	—	—
ML-2452-HPA6-01	—	—	—
ML-2452-SEC6M4-036	—	✓	—
AI-DQ04360S	—	✓	—
WS-AO-DQ05120N (30711)	—	—	—
WS-AO-5Q04060N (30712)	—	—	—
WS-AO-5Q05025N (30716)	—	—	—
WS-AO-DQ04360N (30724)	—	—	—

**Table 13: Outdoor Antenna Compatibility Matrix - Outdoor APs**

Antenna	Outdoor APs	
	AP460e	AP360e
ML-2452-HPAG4A6-01	✓	✓
ML-2452-PNA5-01R	✓	✓
ML-2452-HPAG5A8-01	✓	✓
ML-2452-PNA7-01R	✓	✓

**Table 13: Outdoor Antenna Compatibility Matrix - Outdoor APs (continued)**

Antenna	Outdoor APs	
	AP460e	AP360e
<a href="#">ML-2452-HPA6-01</a>	✓	✓
<a href="#">ML-2452-SEC6M4-036</a>	—	—
<a href="#">AI-DQ04360S</a>	—	—
<a href="#">WS-AO-DQ05120N (30711)</a>	✓	✓
<a href="#">WS-AO-5Q04060N (30712)</a>	✓	—
<a href="#">WS-AO-5Q05025N (30716)</a>	✓	—
<a href="#">WS-AO-DQ04360N (30724)</a>	✓	✓



# AP510C/CX and AP305C/CX Access Points Antennas Support Country List

List of AP510C/CX and AP305C/CX antennas certified and supported in various countries.

The AP510C/CX and AP305C/CX antennas are supported in the following countries:

Country list	AP510C/CX support	AP305C/CX support
United States of America	✓	✓
Canada	✓	✓
Australia	✓	✓
New Zealand	✓	✓
European Union	✓	✓
Colombia	✓	✓
Russia	✓	✓
United Arab Emirates	✓	✓
Saudi Arabia	✓	✓
South Africa	✓	✓
Guatemala	✓	✓
Kuwait	—	✓
Peru	✓	✓
Ecuador	—	✓
Dominican Republic	✓	✓
Vietnam	—	✓
Costa Rica	✓	✓
El Salvador	✓	✓
Hong Kong	✓	✓
Malaysia	—	✓
Philippines	✓	✓
India	✓	✓

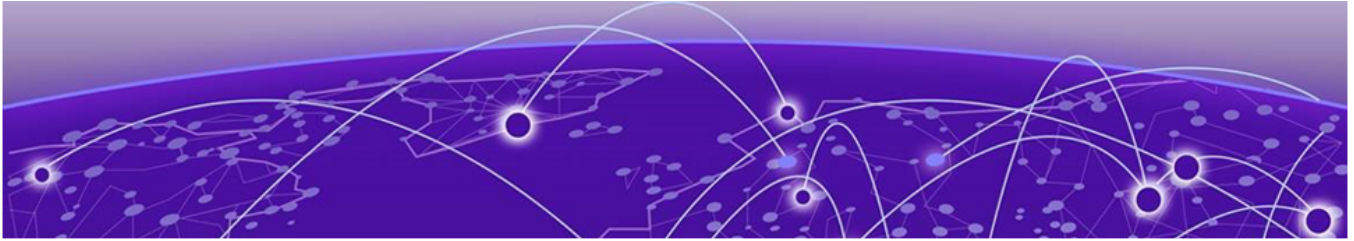
Country list	AP510C/CX support	AP305C/CX support
Singapore	✓	✓
Indonesia	—	✓
United Kingdom	✓	✓

Key	Description
✓	Antenna supported
—	Antenna not supported

## AP305CX Access Point Antennas Supported in Japan and China

The following antennas are supported on the AP305CX access point in Japan and China:

- AH-ACC-ANT-AX-KT antenna - articulated indoor antenna kit (8× dual-band 5dBi antennas)
- ML-2452-APA2-02 - dipole omni; 3.2/4.9 dBi, white color antenna
- ML-2452-APA2-01 - dipole omni; 3.2/4.9 dBi, black color antenna



# External Antenna Connectors

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The "e" model access points and "CX" model cloud access points support external antennas. For legacy access points, refer to [Enterprise Wireless LAN Antenna Specification Guide](#) to determine if your access point supports external antennas.

The following access points support external antennas:

- AP510e
- AP410e
- AP310e
- AP510C/CX
- AP305C/CX
- AP360e
- AP460e

## AP510e external antenna connectors

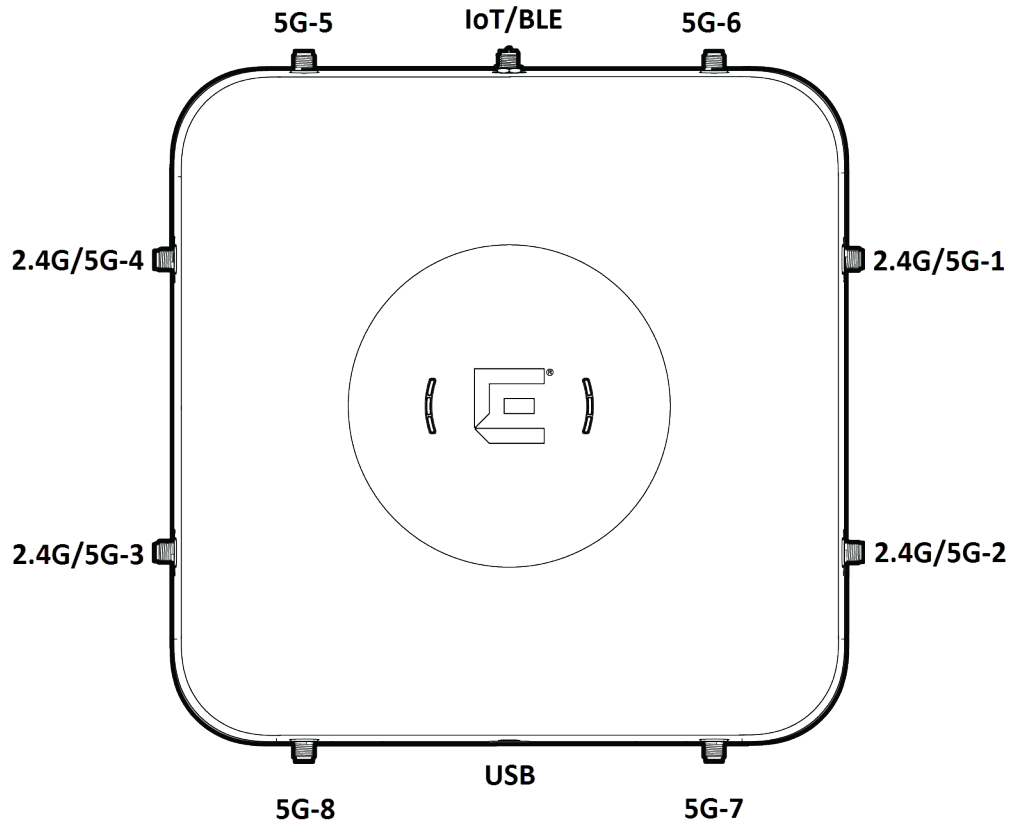
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The AP510e access point is an indoor ceiling mount model access point with external antenna connectors. The antenna connector is a reverse polarity SMA jack type connector, and uses both indoor and outdoor antennas.



### Note

If you are using any of the N-plug antenna on the access point, then you need a jumper cable to convert the N-plug antenna to a RP-SMA connector in order to attach it to the access point.



**Figure 6: AP510e external antenna connector ports**

**Table 14: AP510e antenna configuration**

Software mode	Radio 1	Radio 2	Antenna ports 1, 2, 3, 4	Antenna ports 5, 6, 7, 8
Mode 1	2.4 GHz	5 GHz	Dual-band 2.4/5 GHz	None
Mode 2	Band unlocked sensor	5 GHz	Dual-band 2.4/5 GHz	5 GHz
Mode 3	5 GHz	5 GHz	5 GHz	5 GHz

**Table 15: AP510e BLE antenna information**

Wi-Fi	Part number	Brand	Model name	Description
Panel	ML-2452-PNA7-01R	Extreme	ML-2452-PNA7-01R	2.4G omni and directional support antenna
Omni	ML-2499-HPA8-01	Extreme	ML-2499-HPA8-01	2.4G omni and directional



**Table 15: AP510e BLE antenna information (continued)**

Wi-Fi	Part number	Brand	Model name	Description
				support antenna



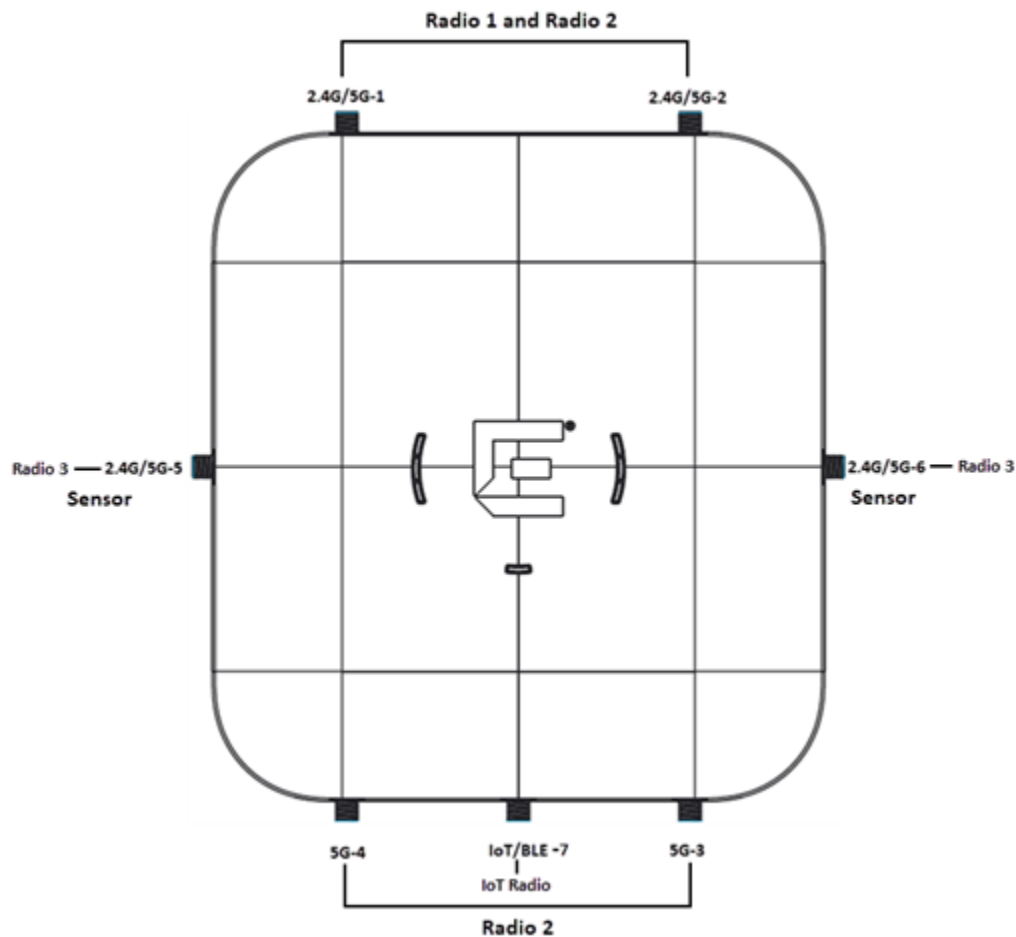
**Note**

The BLE internal antenna is used if no BLE antenna connector is attached to the port.

You can also use any other antenna with lesser gain than 2.4G omni and directional antennas as BLE antenna.

### AP410e external antenna connectors

The AP410e access point is an indoor model access point with external antenna connectors. The access point has six external RP-SMA antenna connectors and one RP-SMA BLE connector.



**Figure 7: AP410e external antenna connector ports**

### Antenna socket radio mapping information

- Radio 1 (R1) - antennas 1 and 2
- Radio 2 (R2) - antennas 1, 2, 3, and 4
- Radio 3 (R3) - antennas 5 and 6
- IoT radio - antenna 7 (IoT or BLE antenna)

## AP310e external antenna connectors

The AP310e access point is an indoor model access point with external antenna connectors. The access point has four external RP-SMA antenna connectors and one RP-SMA BLE connector.



**Figure 8: AP310e access point external antenna connector ports**

### Antenna socket radio mapping information

- Radio 1 (R1) - antennas 1 and 2
- Radio 2 (R2) - antennas 3 and 4
- IoT radio - BLE antenna

## AP510C/CX external antenna connectors

The AP510C/CX is a cloud model indoor access point for use in high-density environments that require HD video streaming and large file transfers. The access point comes with eight external antenna connectors that use dual-band 5 dBi antennas.



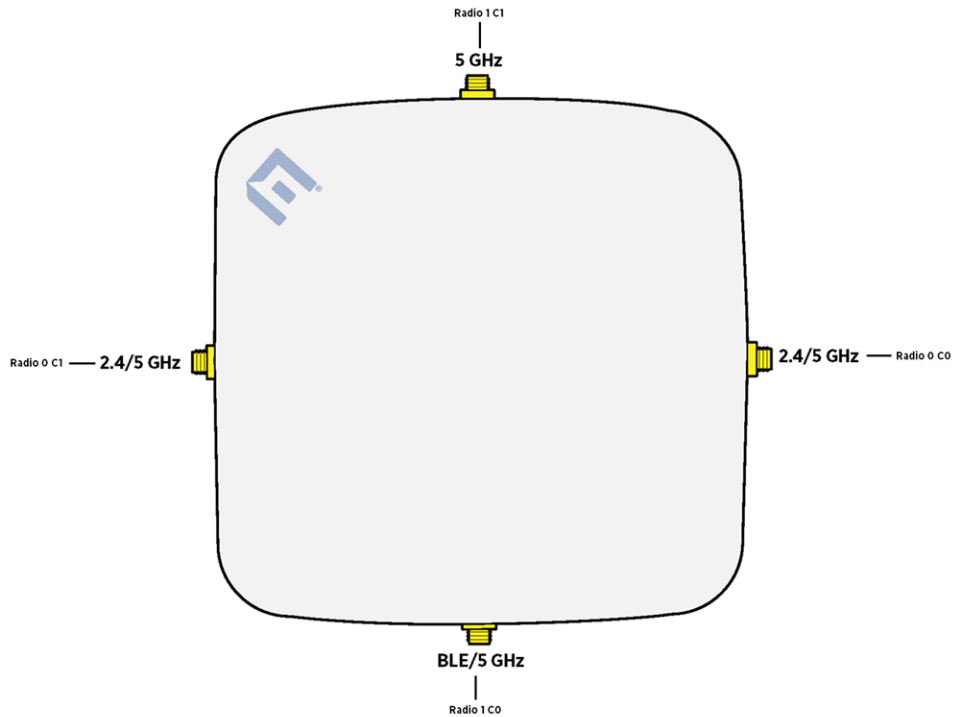
**Figure 9: AP510C/CX external antenna connector ports**

**Table 16: AP510CX antenna ports and radio ports support information**

Radio port	Antenna port	Antenna marking	Radio support
Radio 1 C0	Dual 1	2.4 GHz/5 GHz	2.4G/5G
Radio 1 C1	Dual 2	2.4 GHz/5 GHz	2.4G/5G
Radio 1 C2	Dual 3	2.4 GHz/5 GHz	2.4G/5G
Radio 1 C3	Dual 4	2.4 GHz/5 GHz	2.4G/5G
Radio 2 C0	5G1	5 GHz	5G
Radio 2 C1	5G2	5 GHz	5G
Radio 2 C2	5G3	5 GHz	5G
Radio 2 C3	5G4	5 GHz	5G

## AP305C/CX external antenna connectors

The AP305C/CX access point is an indoor model access point with four external RP-SMA antenna connectors.



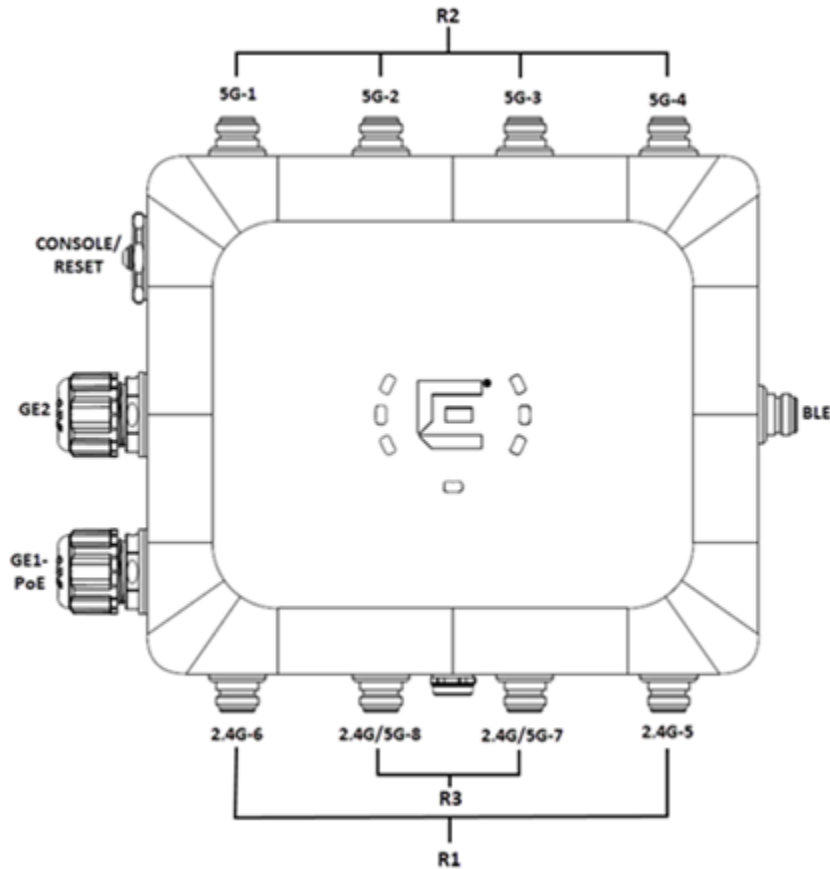
**Figure 10: AP305CX external antenna port connectors**

**Table 17: AP305CX external antenna ports radio information**

Radio modes	Antenna ports				
	Radio 0 C0	Radio 0 C1	Radio 1 C0		Radio 1 C1
Dual-band	2.4G	2.4G	5G (full)	2.4G (BLE)	5G (full)
Dual 5G	5G (low)	5G (low)	5G (high)	2.4G (BLE)	5G (high)

## AP460e external antenna connectors

The AP460e access point is an outdoor model access point with external antenna connectors. The antenna connectors are standard N-type connectors, and uses only outdoor antennas.



**Figure 11: AP460e external antenna connector ports**

#### Antenna socket radio mapping information

- Radio 1 (R1) – antennas 5 and 6
- Radio 2 (R2) – antennas 1, 2, 3, and 4
- Radio 3 (R3) – antennas 7 and 8

The 2.4G and 5G-8 and the 2.4G and 5G-7 are sensor antenna ports.



#### Note

The internal BLE is always used unless you attach an antenna to the BLE antenna connector.

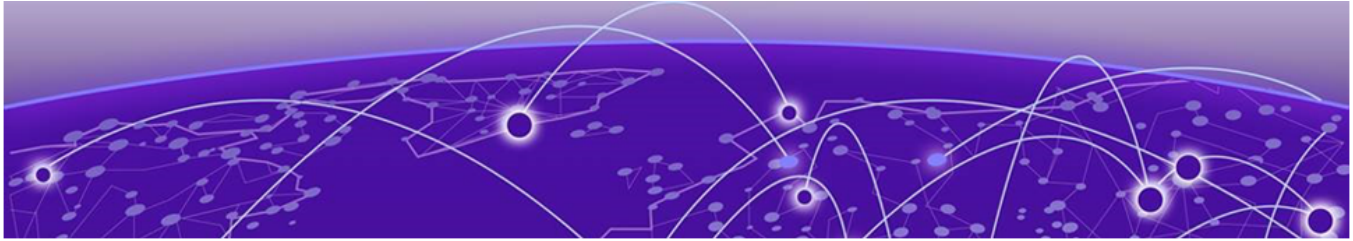


#### Note

The BLE antenna port and the sensor antenna ports come with dust caps installed on them. Do not remove the dust caps until you need to install the antennas.

## AP360e external antenna connectors

The AP360e access point is an outdoor model access point with external antenna connectors. The access point has five standard N-type antenna connectors, and uses only outdoor antennas.



# External Fixed Antenna Specifications and Radiation Patterns

[AP3000X Integrated Antennas](#) on page 38

Learn about the specifications and radiation patterns for the permanently mounted or integrated external antennas used with ExtremeWireless access points.

## AP3000X Integrated Antennas

The AP3000X is an indoor wireless access point that has two Wi-Fi 6 GHz antennas permanently attached or integrated into the AP. The following list shows the antenna specifications:

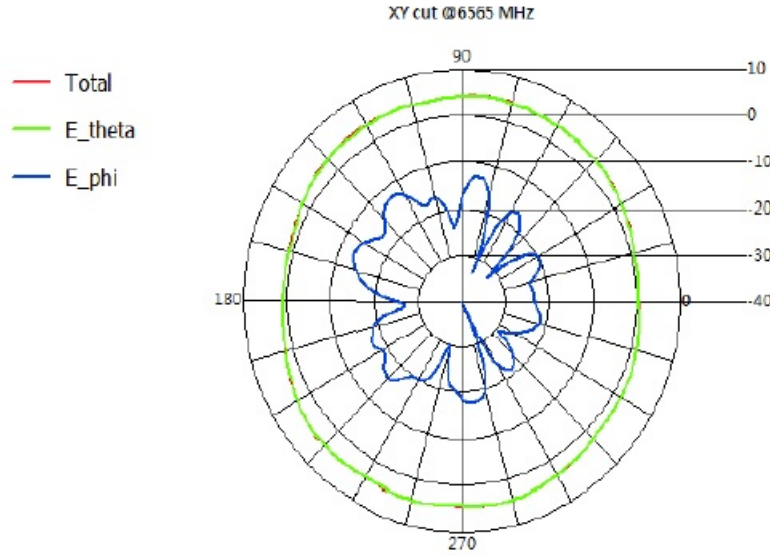
- Antenna type: Dipole array
- Frequency: 5900 ~ 7125 MHz
- Impedance: 50 Ohm Nominal
- VSWR: < 2dB
- Polarization: Linear
- Operating temperature: -40 ~ +80 °C
- Connector: MHF
- Cable type: OD 1.37 L/L

**Table 18: Ports, Gain, and Beam**

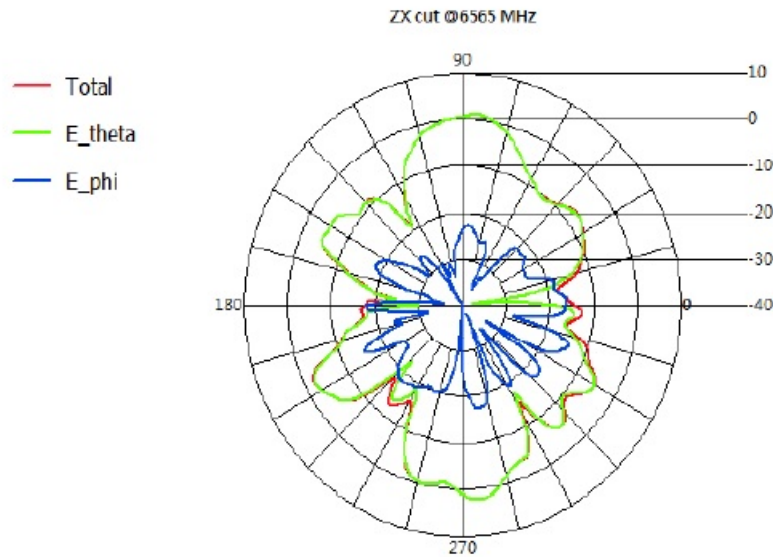
Ports	2.4GHz		5GHz		6GHz	
	Gain	Beam	Gain	Beam	Gain	Beam
1	-	-	-	-	5.49	360

## Radiation patterns

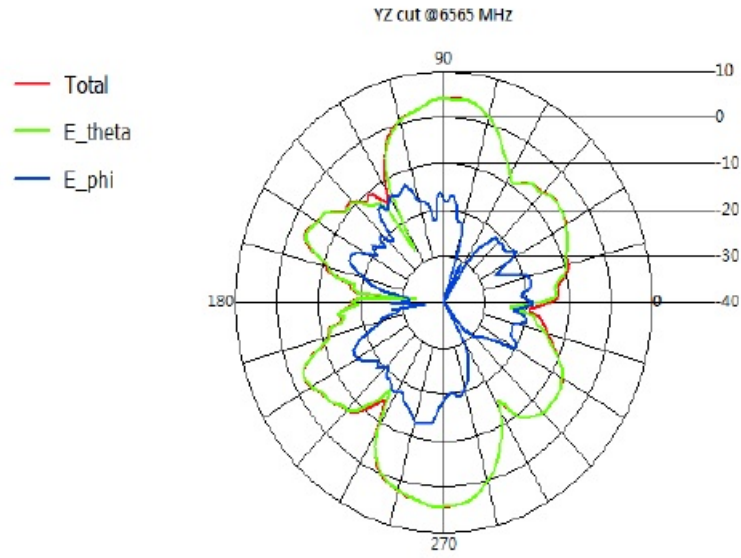
The following diagrams show the radiation patterns for the AP3000X permanently fixed or integrated antennas.



**Figure 12: AP3000X integrated antenna 6.5GHz radiation pattern - horizontal**



**Figure 13: AP3000X integrated antenna 6.5GHz radiation pattern - elevation**



**Figure 14: AP3000X integrated antenna 6.5GHz radiation pattern - vertical**





# External Detachable Antenna Specifications and Radiation Patterns

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[ML-2452-APA2-01 and ML-2452-APA2-02 Antenna Specifications and Radiation Patterns on page 42](#)

[ML-2452-HPA5-036 Antenna Specifications and Radiation Patterns on page 45](#)

[ML-2452-HPA6-01 Antenna Specifications and Radiation Patterns on page 50](#)

[ML-2452-HPAG4A6-01 Antenna Specifications and Radiation Patterns on page 53](#)

[ML-2452-HPAG5A8-01 Antenna Specifications and Radiation Patterns on page 56](#)

[ML-2452-PTA2M2-036 Antenna Specifications and Radiation Patterns on page 59](#)

[ML-2452-PTA4M4-036 Antenna Specifications and Radiation Patterns on page 63](#)

[ML-2452-PNA5-01R Antenna Specifications and Radiation Patterns on page 69](#)

[ML-2452-SEC6M4-036 Antenna Specifications and Radiation Patterns on page 73](#)

[ML-2452-PNA7-01R Antenna Specifications and Radiation Patterns on page 76](#)

[AI-DQ04360S Antenna Specifications and Radiation Patterns on page 79](#)

[WS-AI-DQ05120 Antenna Specifications and Radiation Patterns on page 82](#)

[WS-AI-5Q04060 Antenna Specifications and Radiation Patterns on page 86](#)

[WS-AI-2Q05060 Antenna Specifications and Radiation Patterns on page 89](#)

[WS-AI-DE07025 Antenna Specifications and Radiation Patterns on page 92](#)

[WS-AI-5Q05025 Antenna Specifications and Radiation Patterns on page 96](#)

[WS-AI-DE10055 Antenna Specifications and Radiation Patterns on page 99](#)

[WS-AO-DQ05120N Antenna Specifications and Radiation Patterns on page 103](#)

[WS-AO-5Q04060N Antenna Specifications and Radiation Patterns on page 107](#)

[WS-AO-5Q05025N Antenna Specifications and Radiation Patterns on page 109](#)

[WS-AO-DQ04360N Antenna Specifications and Radiation Patterns on page 112](#)

[AH-ACC-ANT-AX-KT Antenna Specifications and Radiation Patterns on page 116](#)

[AI-DS0305360-RPSMA Antenna Specifications and Radiation Patterns on page 117](#)

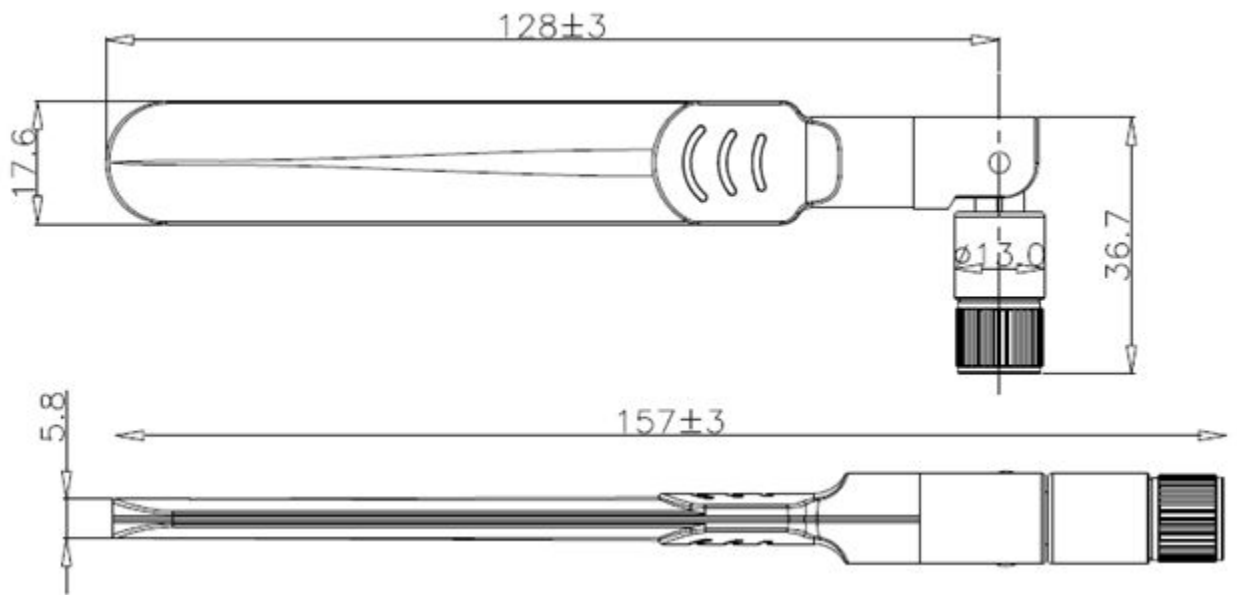
[AI0-DD75060-RPSMA Antenna Specifications and Radiation Patterns on page 120](#)

[AI0-DD05120-RPSMA Antenna Specifications and Radiation Patterns](#) on page 122

Learn about the specifications and radiation patterns for the external detachable antennas used with ExtremeWireless access points.

## ML-2452-APA2-01 and ML-2452-APA2-02 Antenna Specifications and Radiation Patterns

The ML-2452-APA2-01 and ML-2452-APA2-02 are both dipole, dual-band RP-SMA plug connector antennas. The only difference between the antennas is the color. The ML-2452-APA2-01 is a black color antenna whereas the ML-2452-APA2-02 antenna is a white color antenna.



**Figure 15: ML-2452-APA2-01 and ML-2452-APA2-02 antenna**

**Table 19: ML-2452-APA2-01 and ML-2452-APA2-02 antenna technical specifications**

Parameter	Performance
Maximum power	1 watt
Polarization	Linear, vertical
Nominal impedance	50 Ω
VSWR	2.4–2.5 GHz: ≤ 1.92 5.1–5.8 GHz: ≤ 1.92
Radome material	Acrylonitrile butadiene styrene (ABS) plastic

**Table 19: ML-2452-APA2-01 and ML-2452-APA2-02 antenna technical specifications (continued)**

Parameter	Performance
Cable	RG-178
Mounting method	Direct-attach to the access point

**Table 20: ML-2452-APA2-01 and ML-2452-APA2-02 antenna electrical specifications**

Part number	Freq. range	Typical gain	Peak gain	Azimuth beamwidth	Elev. beamwidth	Connector
ML-2452-APA2-01 and ML-2452-APA2-02	2.4–2.5 GHz	2.73 dBi	3.04 dBi	360°	48°	RP-SMA plug
	5.1–5.4 GHz	4.19 dBi	4.30 dBi	360°	28°	
	5.5–5.7 GHz	4.64 dBi	4.96 dBi	360°	28°	
	5.7–5.8 GHz	4.95 dBi	4.96 dBi	360°	28°	

**Table 21: ML-2452-APA2-01 and ML-2452-APA2-02 mechanical specifications**

Dimensions	Weight	Temperature range
157.0 × 17.6 × 5.8 mm	0.03 lb (0.01 kg)	Storage temperature: -10°C to +70°C (-14°F to +158°F) Operating temperature: -10°C to +60°C (-14°F to +140°F)

ML-2452-APA2-01 and ML-2452-APA2-02 antenna radiation patterns

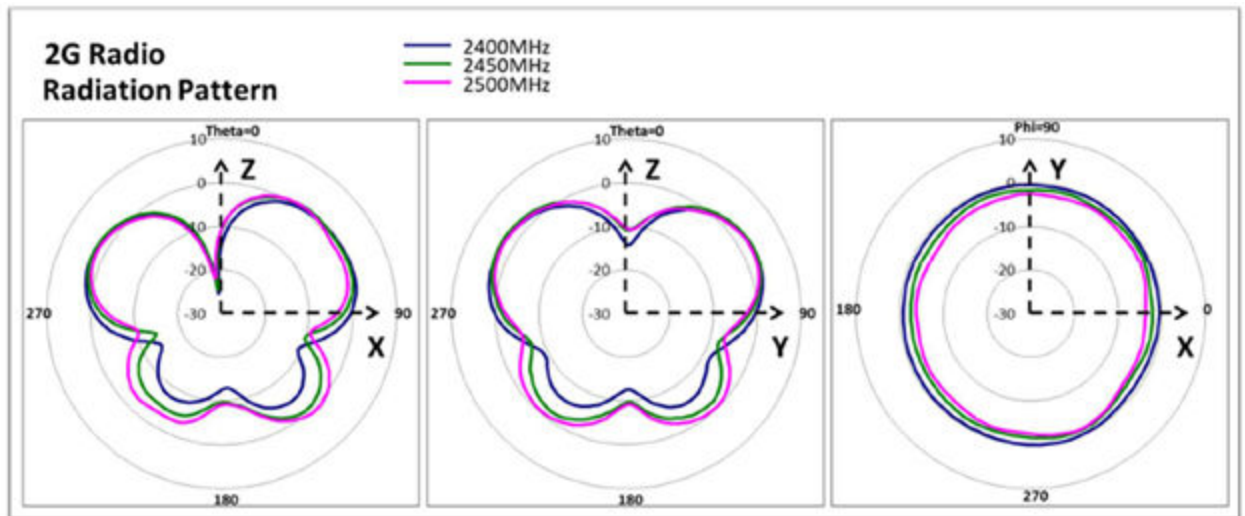


Figure 16: 2G radio radiation pattern

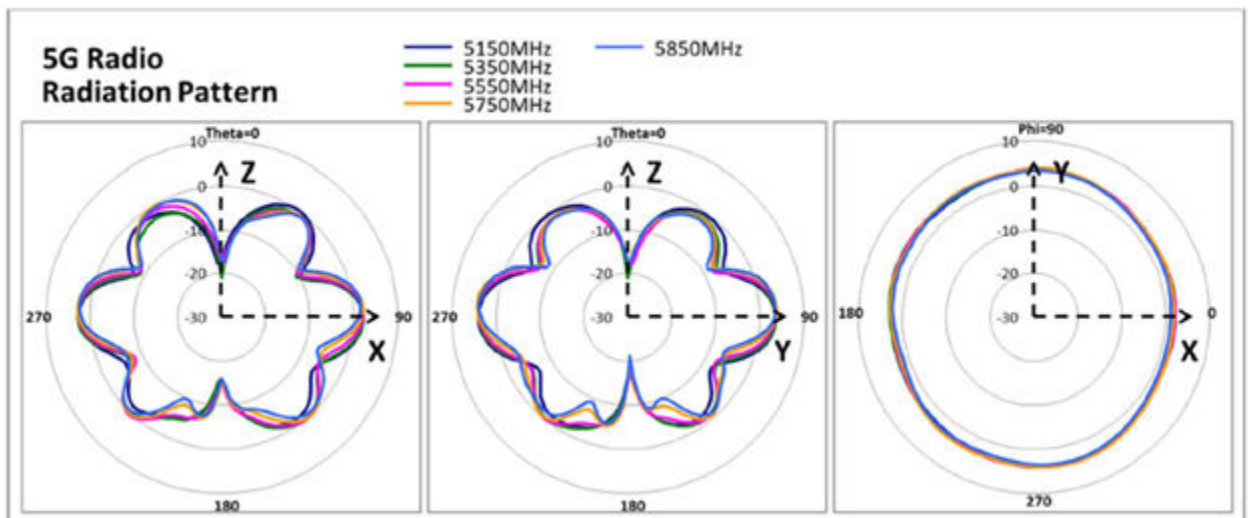
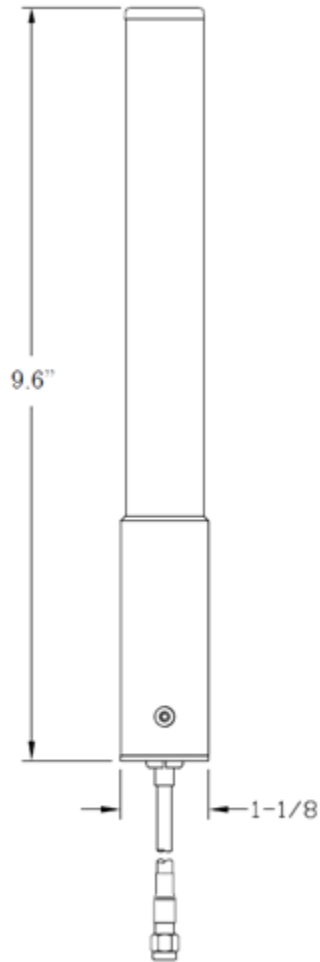


Figure 17: 5G radio radiation pattern

Related Topics

[Install the ML-2452-APA2-01 or ML-2452-APA2-02 Antenna on page 185](#)

## ML-2452-HPA5-036 Antenna Specifications and Radiation Patterns



**Figure 18: ML-2452-HPA5-036 antenna**

**Table 22: ML-2452-HPA5-036 antenna technical specifications**

Parameter	Performance
Maximum power	10 watts
Polarization	Linear, vertical
Nominal impedance	50 Ω
VSWR	2:1
Radome material	Polycarbonate

**Table 22: ML-2452-HPA5-036 antenna technical specifications (continued)**

Parameter	Performance
Cable	36-inches RG-58 plenum-rated cable
Mounting method	Beam, ceiling, or mast mount

**Table 23: ML-2452-HPA5-036 antenna electrical specifications**

Part number	Frequency range	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
ML-2452-HPA5-036	2.4–2.5 GHz	With cable: 2.1 dBi Without cable: 2.9 dBi	3.9 dBi	360°	44°	RP-SMA plug
	5.1–5.9 GHz	With cable: 3.8 dBi Without cable: 4.9 dBi	5.7 dBi		18°	

**Table 24: ML-2452-HPA5-036 antenna mechanical specifications**

Dimensions	Weight	Temperature range
25.4 mm × 245.5 mm	0.30 lb (0.14 kg)	Storage temperature: -40°C to +85°C (-40°F to +185°F) Operating temperature: -30°C to +70°C (-22°F to +158°F)

ML-2452-HPA5-036 antenna radiation patterns

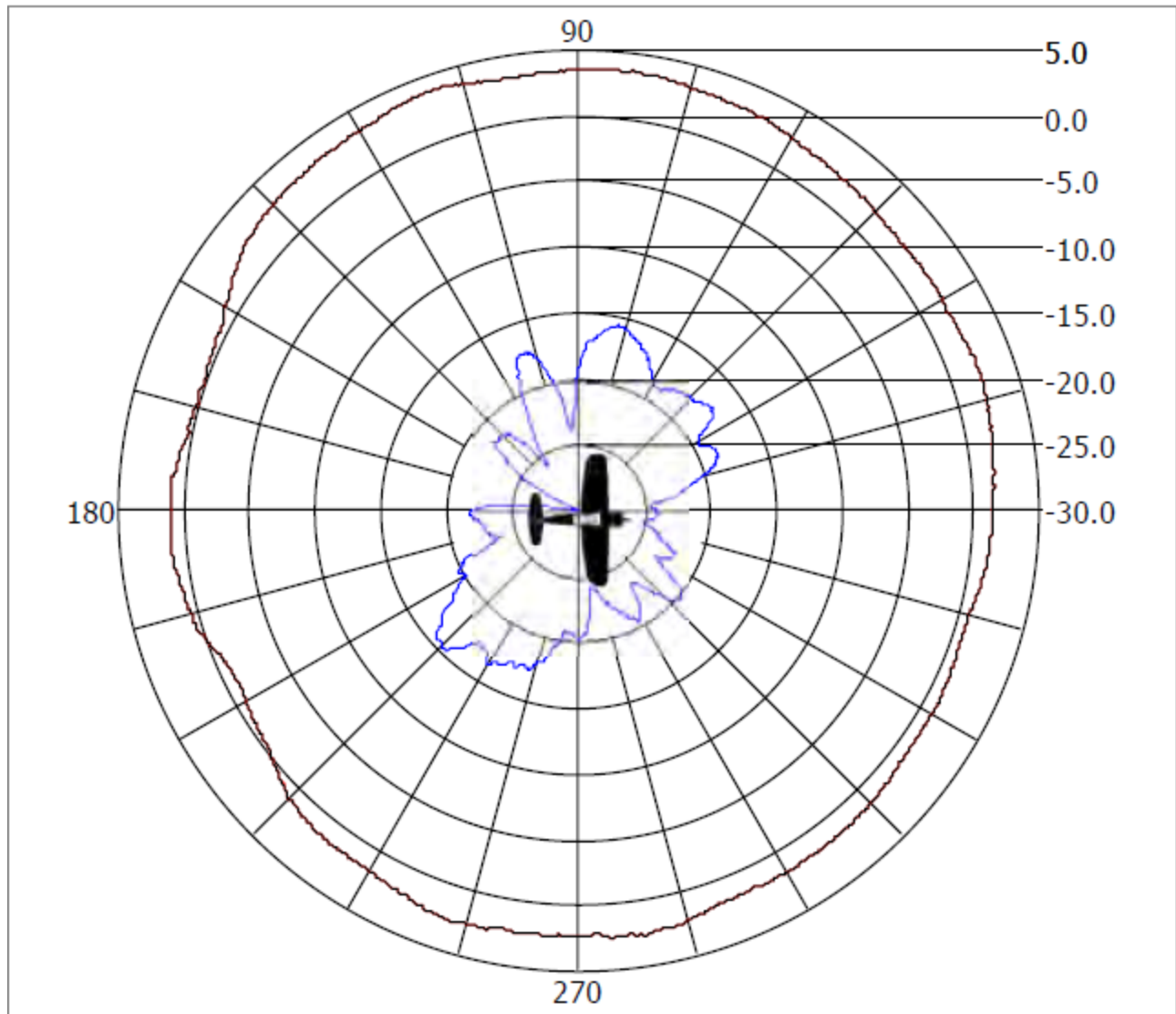
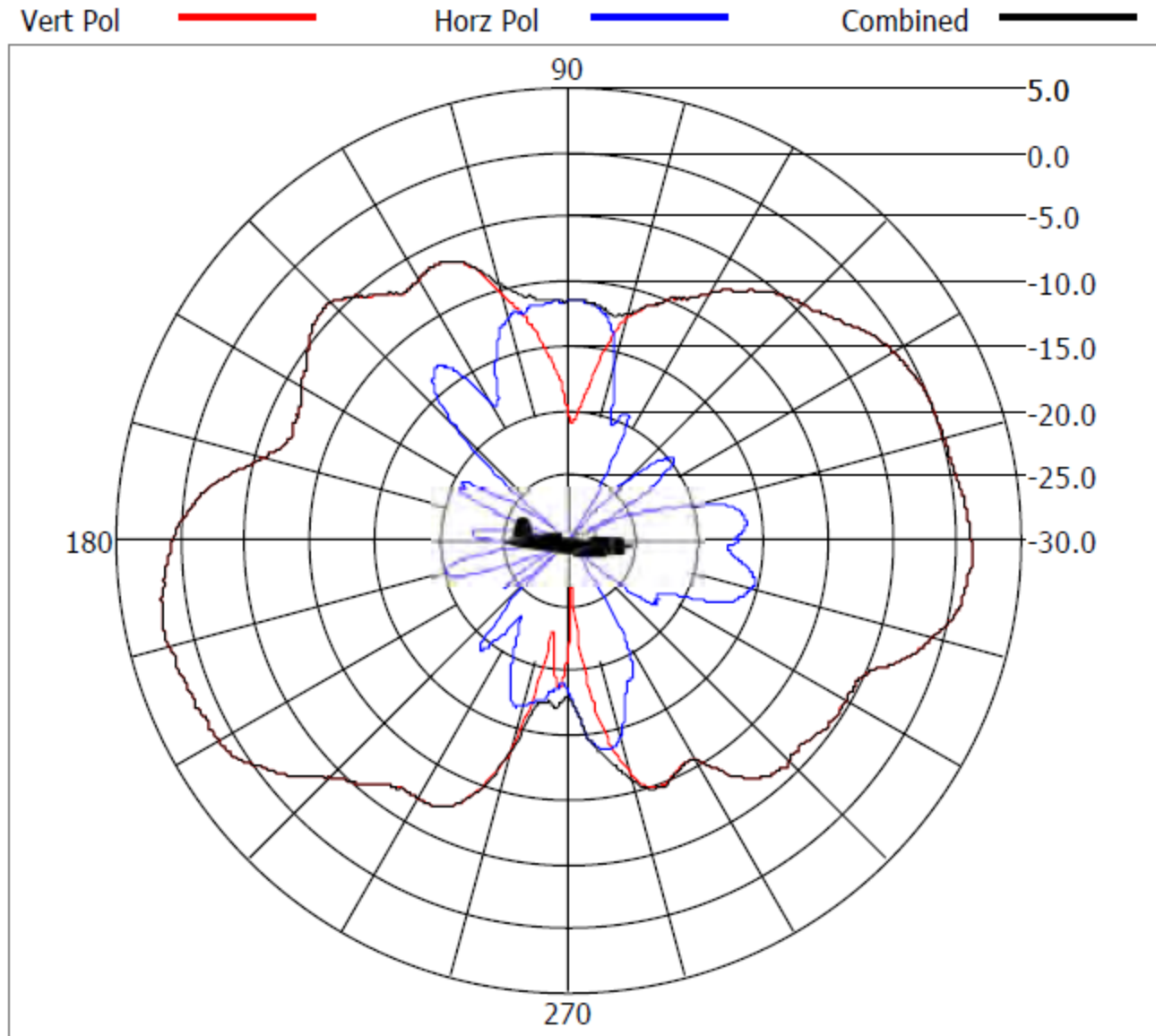
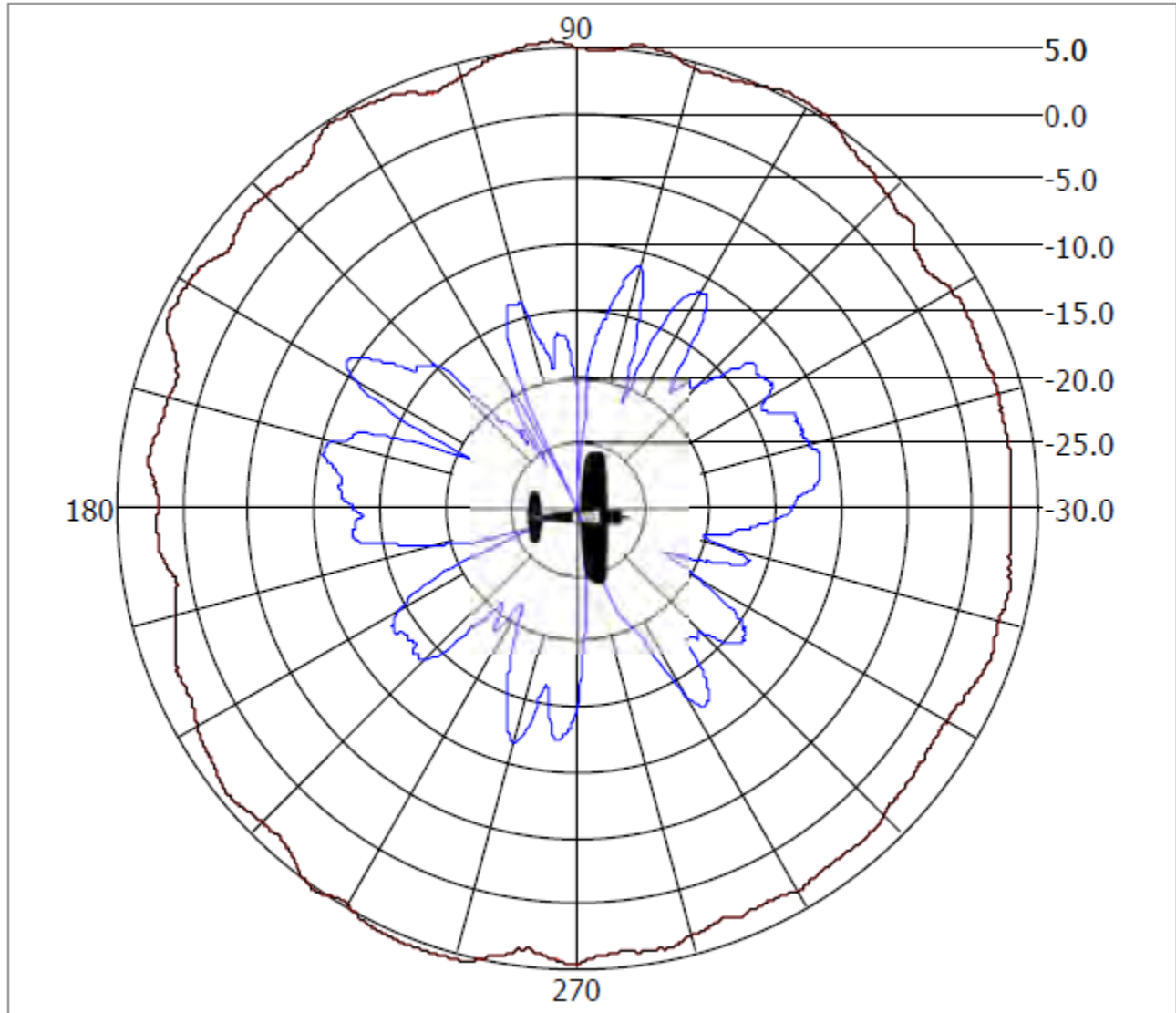


Figure 19: 2.4 GHz azimuth pattern

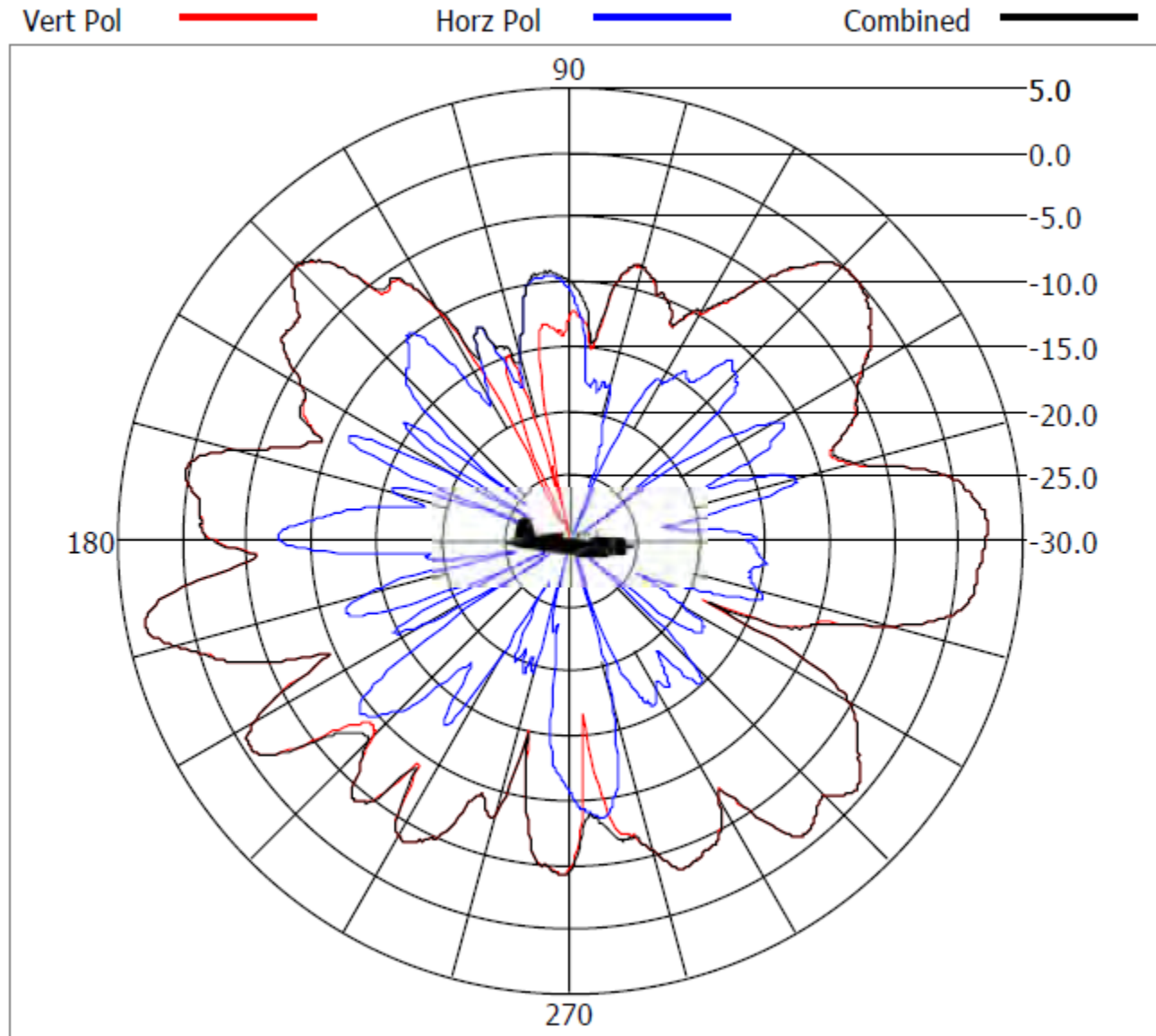


**Figure 20: 2.4 GHz elevation pattern**





**Figure 21: 5.6 GHz azimuth pattern**



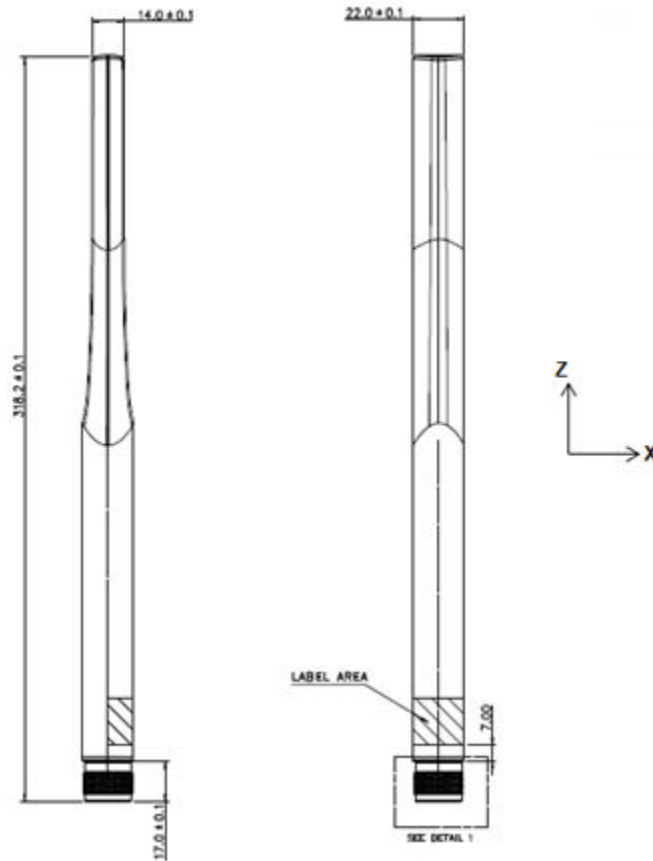
**Figure 22: 5.6 GHz elevation pattern**

Related Topics

[Install the ML-2452-HPA5-036 Antenna](#) on page 187

## ML-2452-HPA6-01 Antenna Specifications and Radiation Patterns

The ML-2452-HPA6-01 is a four feed, dual band outdoor antenna with a standard N-type plug connector.



**Figure 23: ML-2452-HPA6-01 antenna**

**Table 25: ML-2452-HPA6-01 antenna technical specifications**

Item	Description
Polarization	Dipole
VSWR	<2.0
Nominal impedance	50 Ω
Radome material	PC1110U plastic
Cable	RG-178
Mounting method	Direct attach

**Table 26: ML-2452-HPA6-01 antenna electrical specifications**

Part number	Frequency range	Typical gain	Peak gain	Azimuth bandwidth	Elevation bandwidth	Connector
	2.4 GHz – 2.5 GHz	1.1 dBi	5.3 dBi	360°	100°	N-type plug

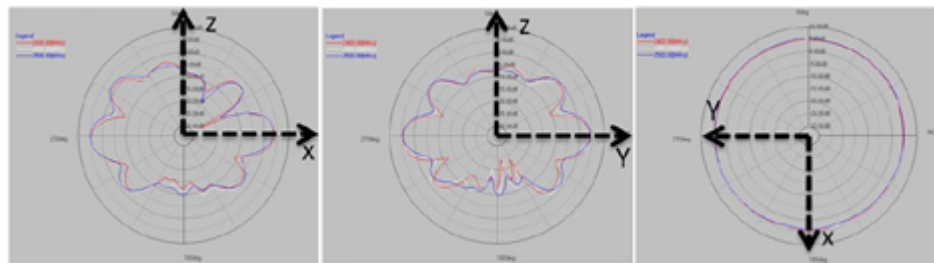
**Table 26: ML-2452-HPA6-01 antenna electrical specifications (continued)**

Part number	Frequency range	Typical gain	Peak gain	Azimuth bandwidth	Elevation bandwidth	Connector
ML-2452-HPA6-01	5.1 GHz – 5.9 GHz	2.5 dBi	6.1 dBi	360°	30°	

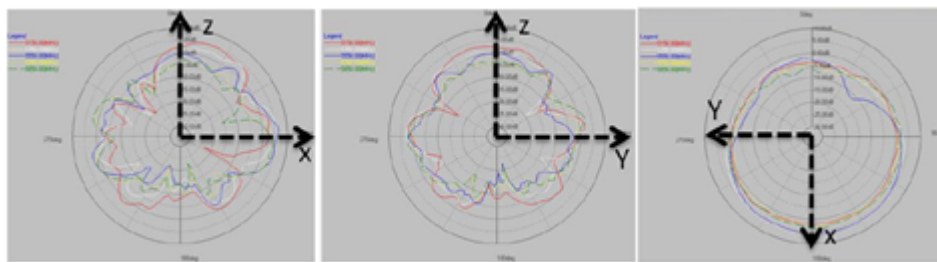
**Table 27: ML-2452-HPA6-01 antenna mechanical specifications**

Dimensions	Weight	Temperature range
318.20 mm × 22 mm	0.235 lbs (0.107 kg)	Storage and operational temperature: -40°C to +85°C (-40°F to +185°F)

ML-2452-HPA6-01 antenna radiation patterns



**Figure 24: 2.4 GHz antenna pattern**



**Figure 25: 5 GHz antenna pattern**

Related Topics

[Install the ML-2452-HPA6-01 Antenna](#) on page 196

ML-2452-HPAG4A6-01 Antenna Specifications and Radiation Patterns

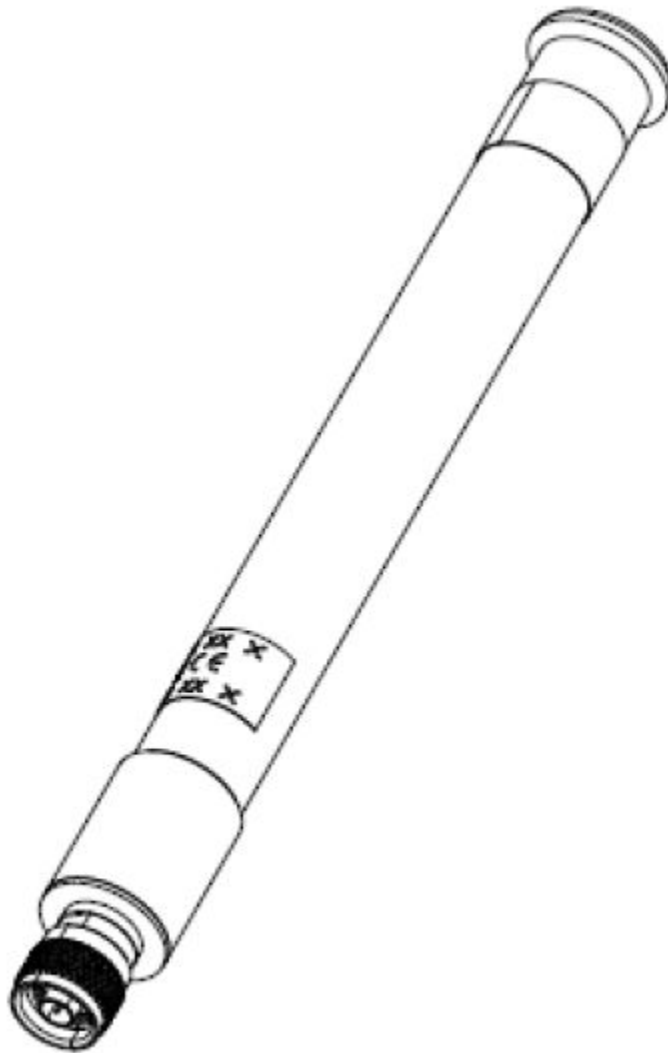
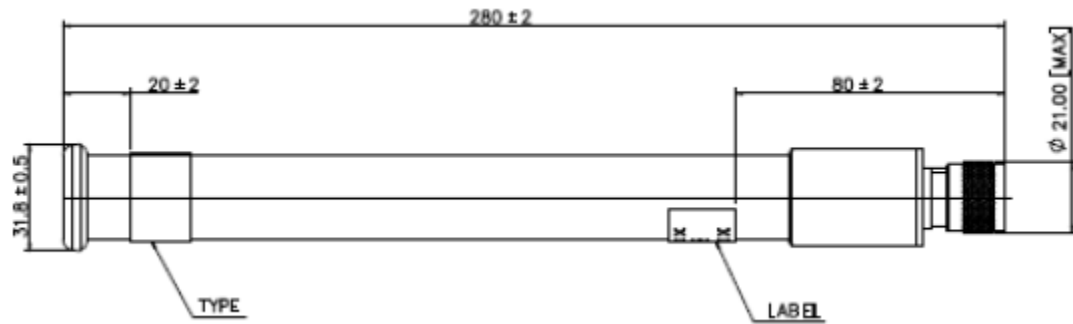


Figure 26: ML-2452-HPAG4A6-01 antenna

Table 28: ML-2452-HPAG4A6-01 technical specifications

Parameter	Performance
Polarization	Linear, vertical
Nominal impedance	50 $\Omega$

**Table 28: ML-2452-HPAG4A6-01 technical specifications (continued)**

Parameter	Performance
VSWR	2.4 GHz – 2.5 GHz: 2 5.1 GHz – 5.9 GHz: 2
Radome material	Polycarbonate (PC) plastic
Cable	N/A
Mounting method	Direct attach Pole attach using the pole mounting kit

**Table 29: ML-2452-HPAG4A6-01 electrical specifications**

Part number	Frequency range	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
ML-2452-HPAG4A6-01	2.4 GHz – 2.5 GHz	3.0 dBi	4.0 dBi	360°	53°–56°	Standard N-plug
	5.1 GHz – 5.9 GHz	6.0 dBi	7.3 dBi	360°	18°–22°	

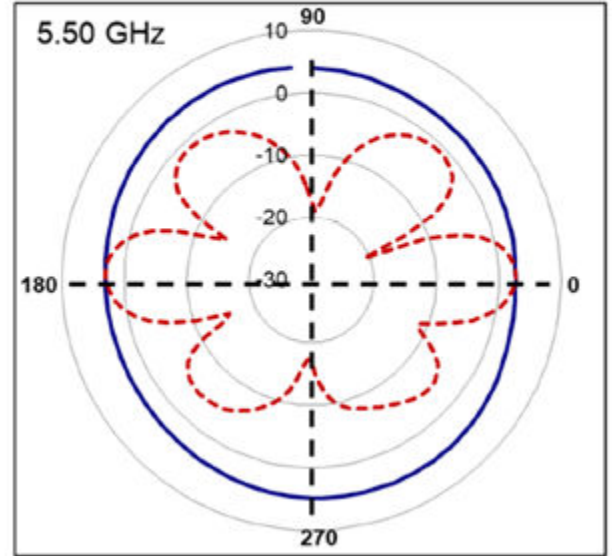
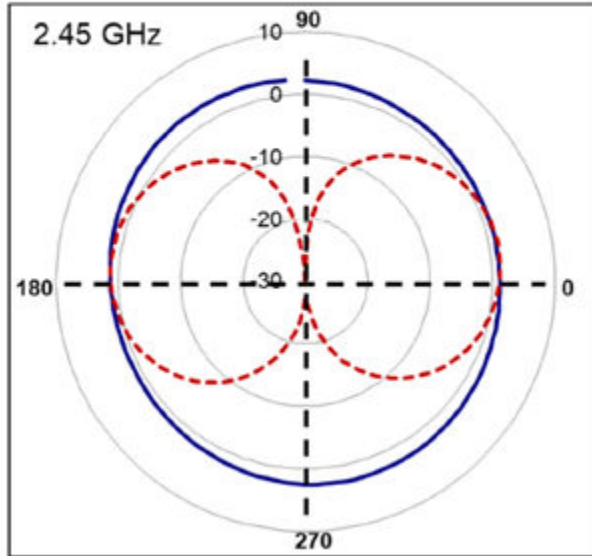
**Table 30: ML-2452-HPAG4A6-01 mechanical specifications**

Wind rating	Dimensions	Weight	Temperature range
134 mph	280.2 × 24.8 mm	0.31 lb (0.14 kg)	Storage temperature: -40°C to +80°C (-40°F to +176°F)

ML-2452-HPAG4A6-01 antenna radiation patterns

Cut: Az/EI  
Pol: Vertical

Az - solid line  
EI - broken line



Related Topics

[Install the ML-2452-HPAG4A6-01 Antenna](#) on page 196

ML-2452-HPAG5A8-01 Antenna Specifications and Radiation Patterns

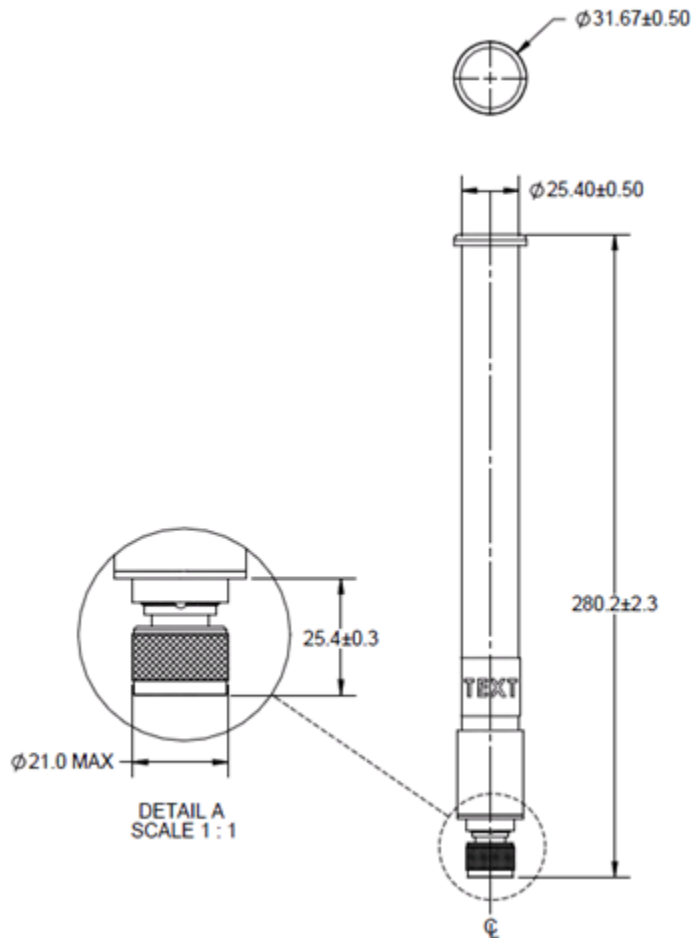


Figure 27: ML-2452-HPAG5A8-01 antenna

Table 31: ML-2452-HPAG5A8-01 antenna technical specifications

Parameter	Performance
Maximum power	10 watts
Polarization	Vertical
Nominal impedance	50 $\Omega$
VSWR	<ul style="list-style-type: none"> <li>• 2.4 GHz – 2.5 GHz: 2</li> <li>• 4.9 GHz – 5.1 GHz: 2.3</li> <li>• 5.1 GHz – 5.9 GHz: 2</li> </ul>



**Table 31: ML-2452-HPAG5A8-01 antenna technical specifications (continued)**

Parameter	Performance
Radome material	Polycarbonate (PC)
Mounting method	Direct mount Pole mount using pole mount kit

**Table 32: ML-2452-HPAG5A8-01 antenna electrical specifications**

Part number	Frequency range	Typical gain	Peak gain	Azimuth bandwidth	Elevation beamwidth	Connector
ML-2452-HPAG5A8-01	2.4 GHz – 2.5 GHz	4.0 dBi	4.7 dBi	360°	28°	Standard N-plug
	4.9 GHz – 5.1 GHz	6.9 dBi	7.1 dBi	360°	17°	
	5.1 GHz – 5.9 GHz	7.5 dBi	8.0 dBi	360°	15°	

**Table 33: ML-2452-HPAG5A8-01 antenna mechanical specifications**

Wind rating	Dimension	Weight	Temperature
134 mph	280.2 × 24.8 mm	0.33 lb (0.15 kg)	Storage temperature: -40°C to +85°C (-40°F to +185°F)
			Operating temperature: -30°C to +70°C (-22°F to +158°F)

ML-2452-HPAG5A8-01 antenna radiation patterns

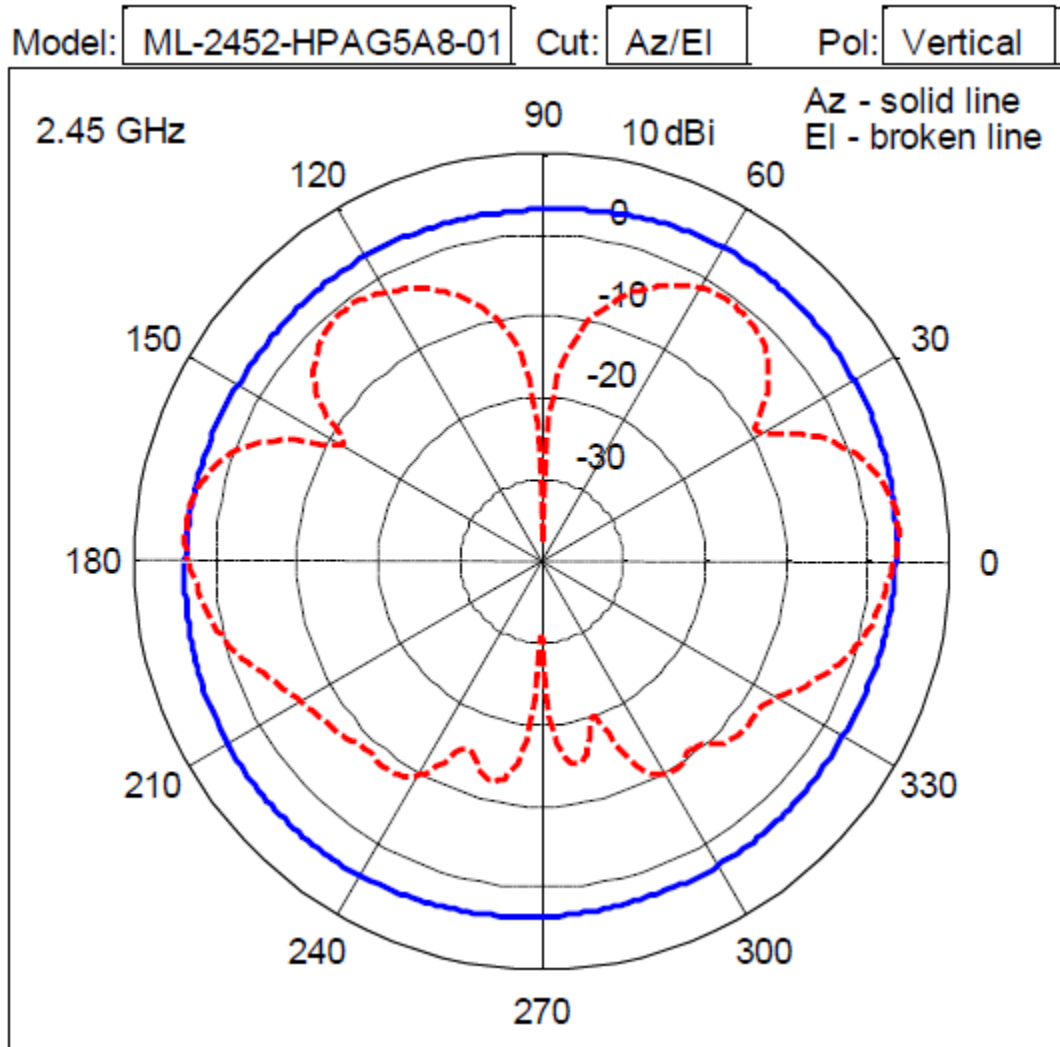
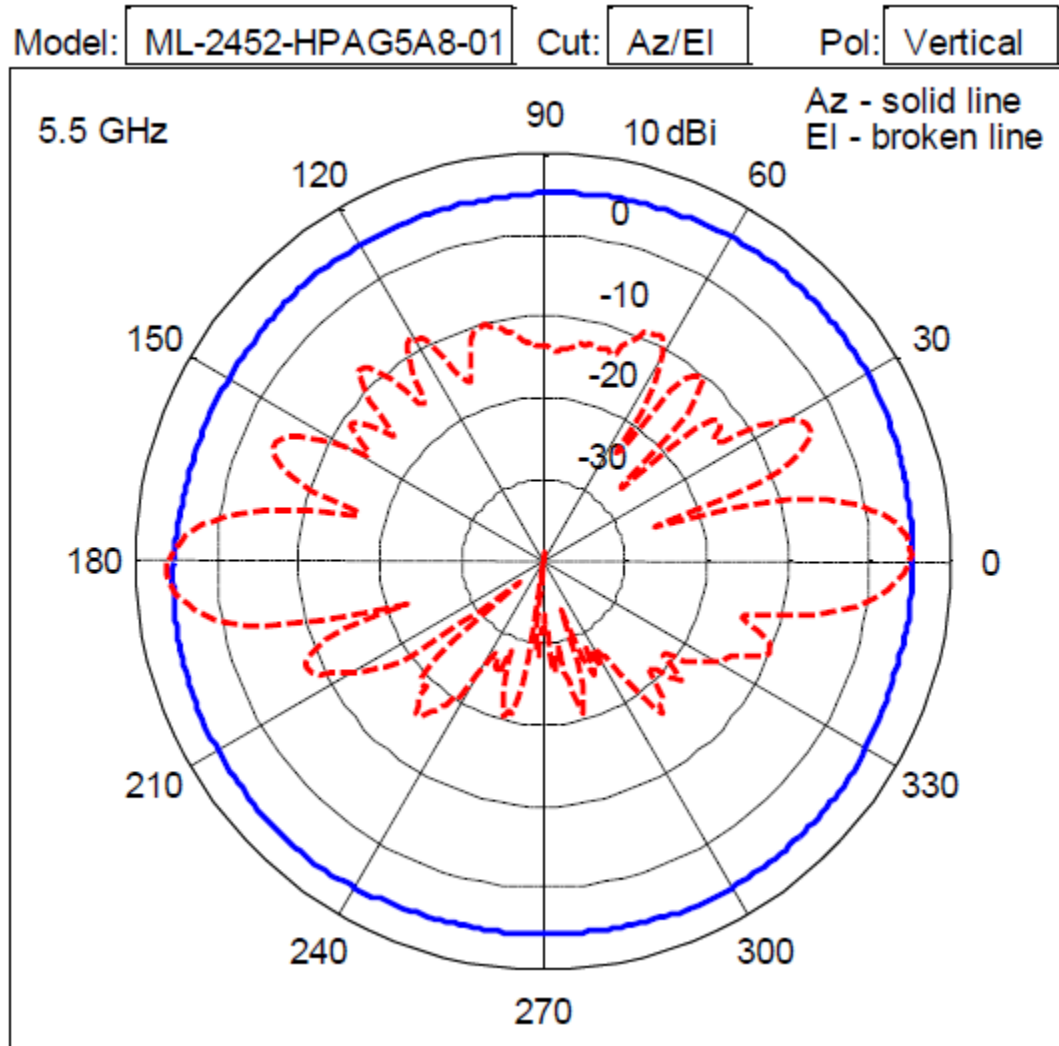


Figure 28: 2.45 GHz azimuth and elevation pattern



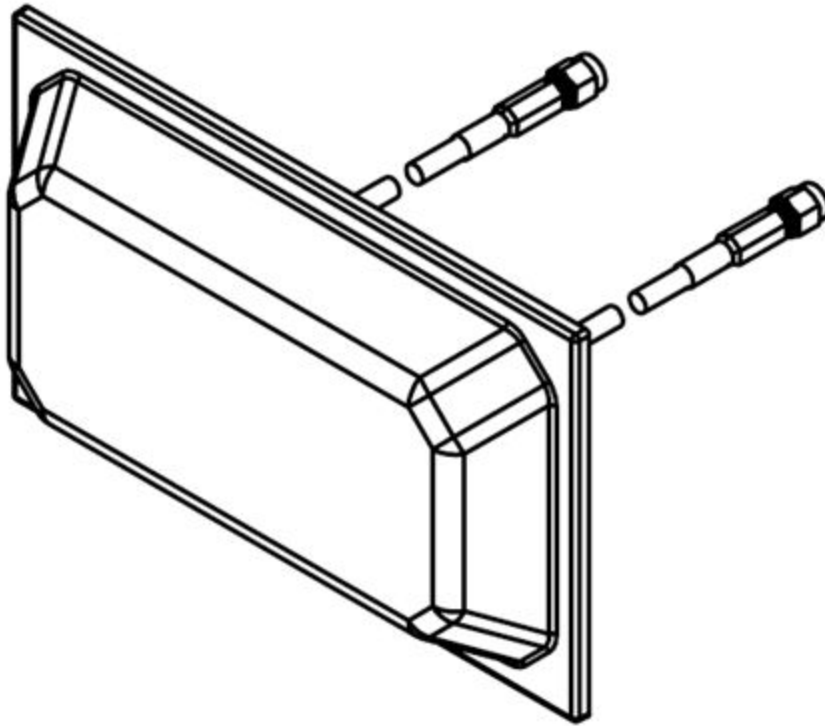
**Figure 29: 5.5 GHz azimuth and elevation pattern**

Related Topics

[Install the ML-2452-HPAG5A8-01 Antenna](#) on page 198

## [ML-2452-PTA2M2-036 Antenna Specifications and Radiation Patterns](#)

ML-2452-PTA2M2-036 is a two-port, dual-band patch array external antenna used with indoor model access points. The antenna is not outdoor rated.



**Figure 30: ML-2452-PTA2M2-036 antenna**

**Table 34: ML-2452-PTA2M2-036 antenna technical specifications**

Parameter	Description
Maximum power	2 watts
Polarization	Linear, vertical
VSWR	2:1
Cable	RG-58
Mounting method	Ceiling mount

**Table 35: ML-2452-PTA2M2-036 antenna electrical specifications**

Part number	Frequency	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
	2.4 GHz – 2.5 GHz	3.0 dBi	4.0 dBi	Omnidirectionality	60°	RP-SMA plug

**Table 35: ML-2452-PTA2M2-036 antenna electrical specifications (continued)**

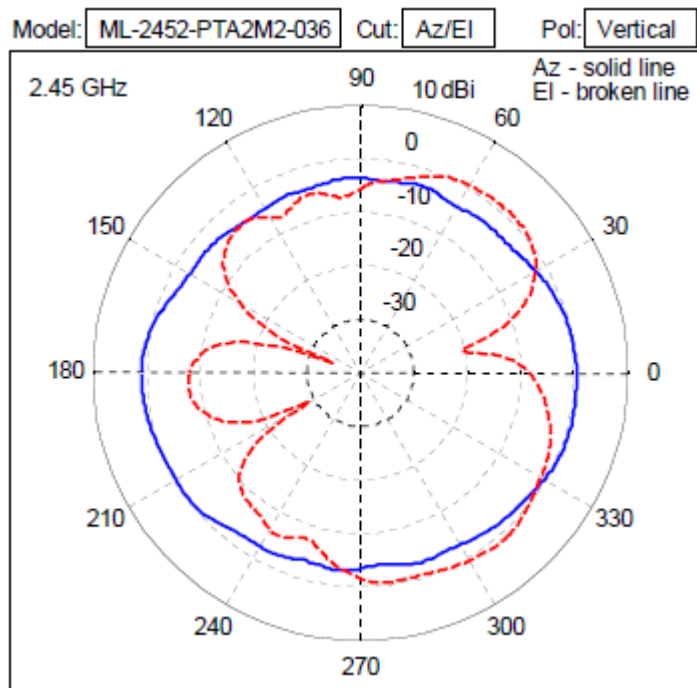
Part number	Frequency	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
ML-2452-PTA2M2-036	4.9 GHz – 5.9 GHz	4.0 dBi	5.0 dBi	Omnidirectionality	60°	

6

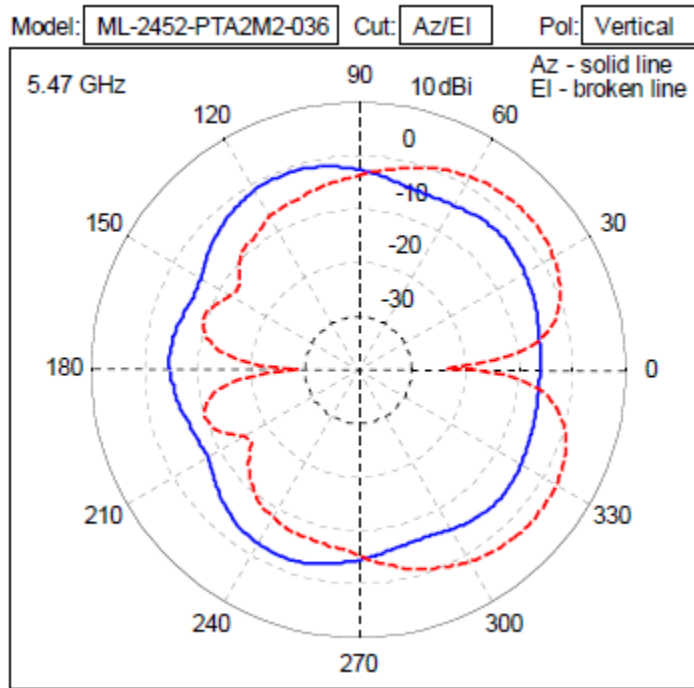
**Table 36: ML-2452-PTA2M2-036 antenna mechanical specifications**

Weight	Temperature
0.50 lb (0.23 kg)	Storage and operating temperature: -30°C to +70°C (-22°F to +158°F)

ML-2452-PTA2M2-036 antenna radiation patterns



**Figure 31: 2.4 GHz azimuth and elevation patterns**

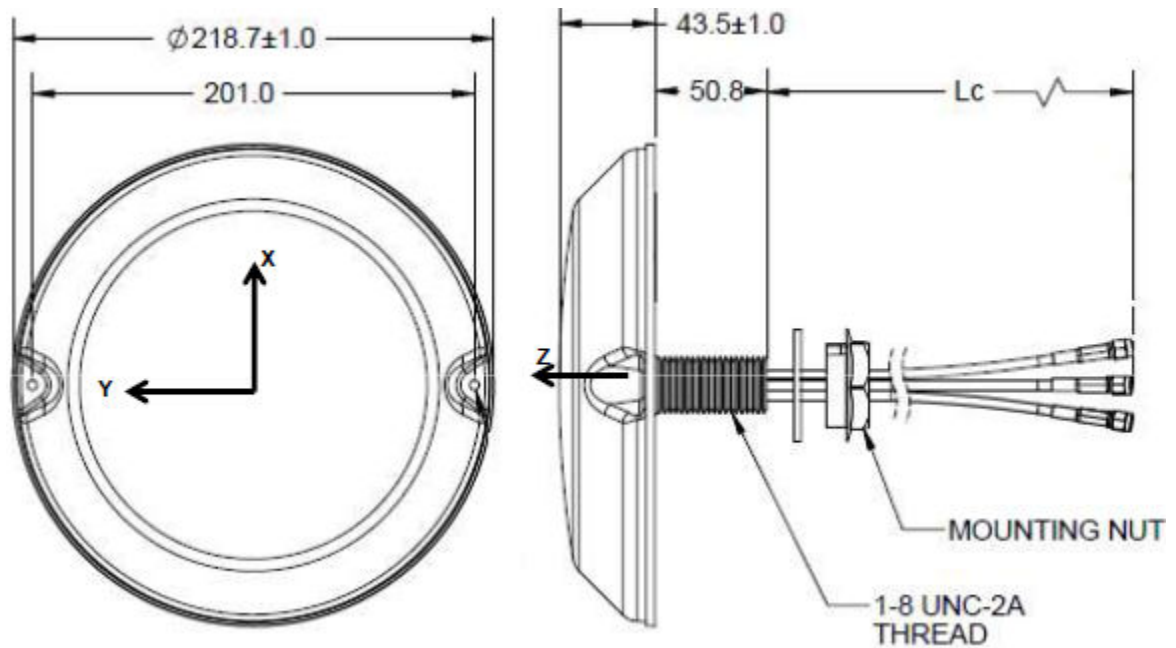


**Figure 32: 5 GHz azimuth and elevation pattern**

Related Topics

[Install the ML-2452-PTA2M2-036 Antenna](#) on page 200

## ML-2452-PTA4M4-036 Antenna Specifications and Radiation Patterns



**Figure 33: ML-2452-PTA4M4-036 antenna**

**Table 37: ML-2452-PTA4M4-036 antenna technical specifications**

Parameter	Performance
Maximum power	5 watts
Polarization	Linear, omnidirectional
Nominal impedance	50 $\Omega$
VSWR	2:1
Radome material	Acrylic styrene acrylonitrile (ASA)
Cable	36-inches RG-58 plenum-rated cable
Mounting method	Ceiling mount

**Table 38: ML-2452-PTA4M4-036 antenna electrical specifications**

Part number	Frequency	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
	2.4 GHz – 2.5 GHz	4.0 dBi	5.0 dBi	Omnidirectionality	70°	RP-SMA plug

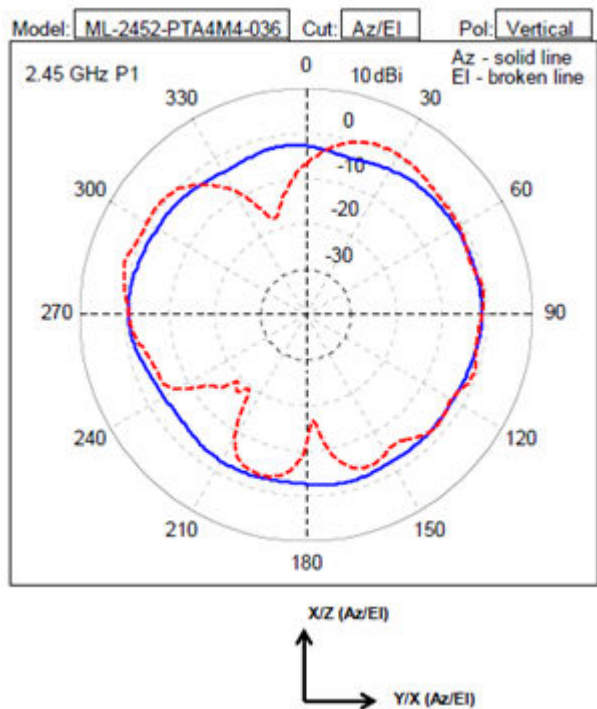
**Table 38: ML-2452-PTA4M4-036 antenna electrical specifications (continued)**

Part number	Frequency	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
ML-2452-PTA4M4-036	5.1 GHz – 5.9 GHz	5.7 dBi	6.6 dBi	Omnidirectionality	50°	

**Table 39: ML-2452-PTA4M4-036 antenna mechanical specifications**

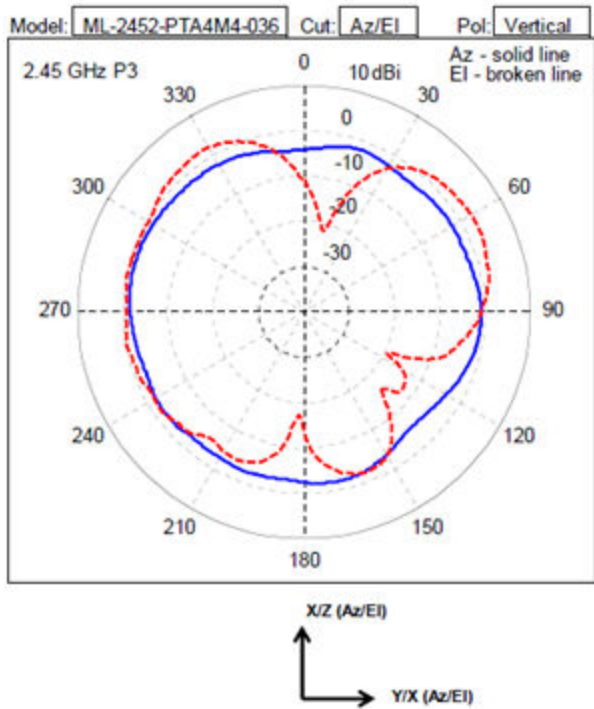
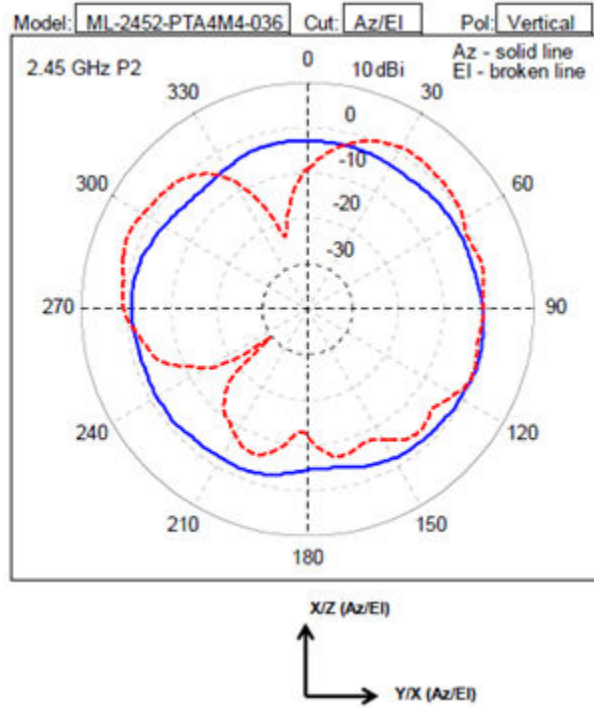
Weight	Temperature
1.10 lb (0.50 kg)	Storage and operating temperature: -40°C to +70°C (-40°F to +158°F)

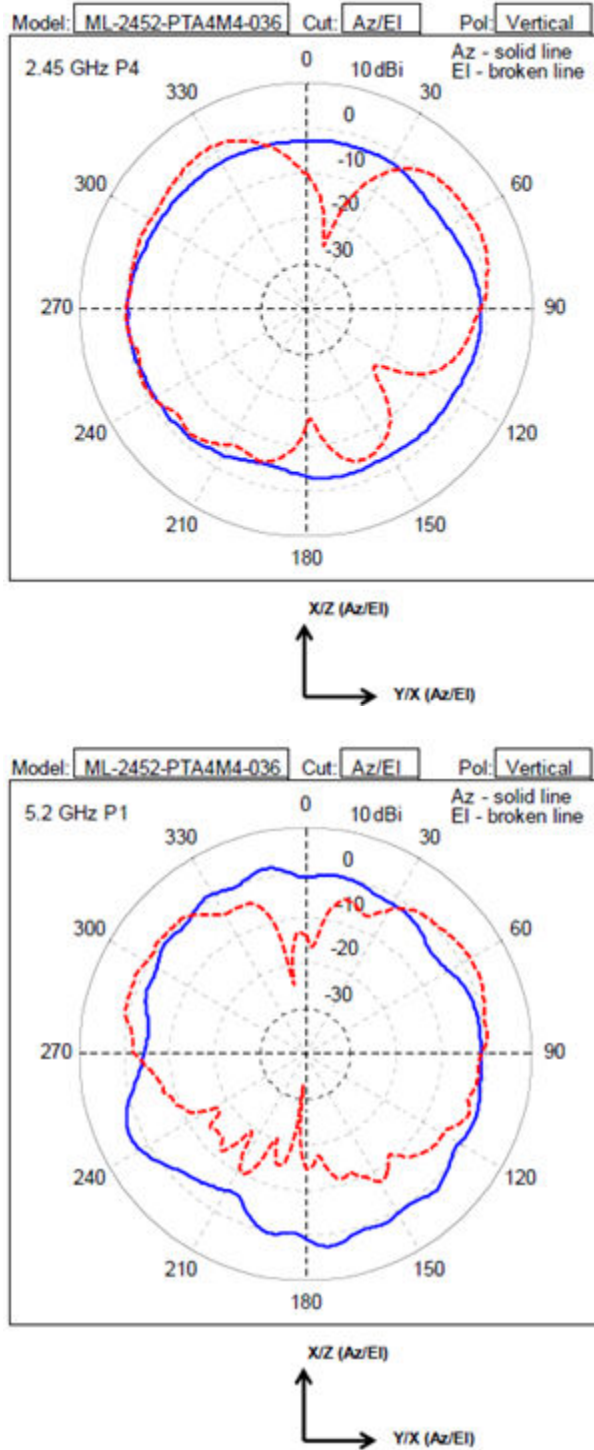
ML-2452-PTA4M4-036 antenna radiation patterns



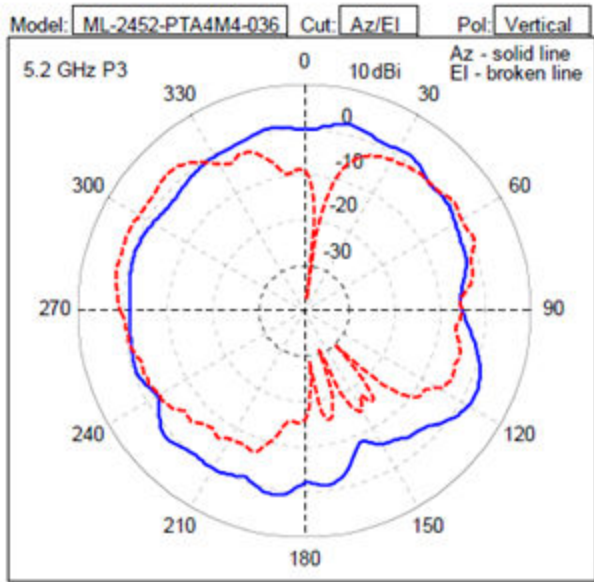
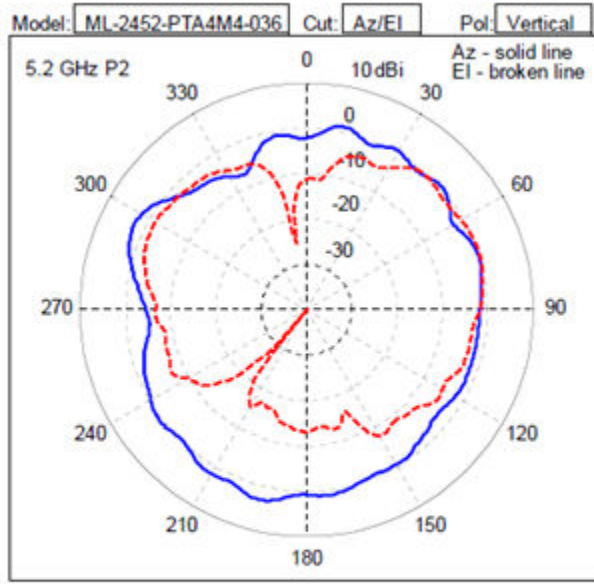
**Figure 34: 2.4 GHz azimuth and elevation patterns**

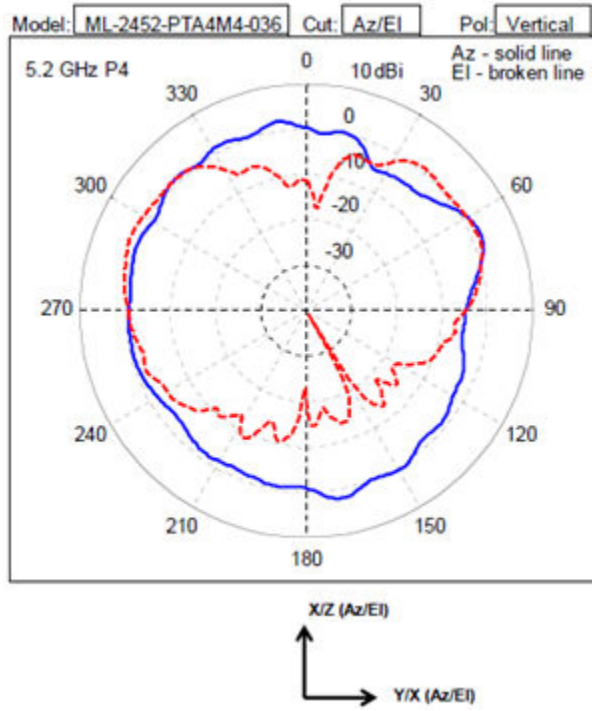






**Figure 35: 5.2 GHz azimuth and elevation patterns**

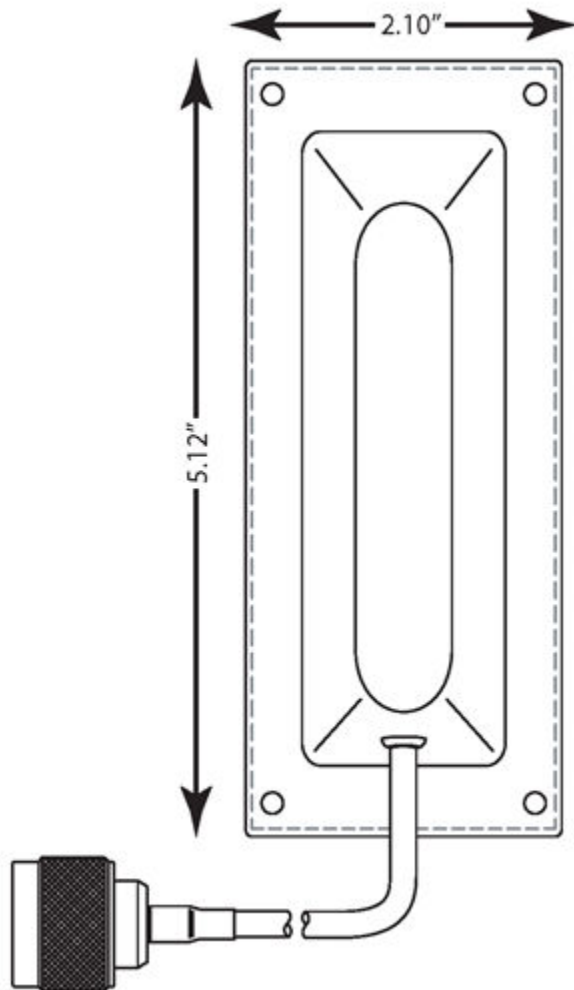




Related Topics

[Install the ML-2452-PTA4M4-036 Antenna on page 201](#)

ML-2452-PNA5-01R Antenna Specifications and Radiation Patterns



**Figure 36: ML-2452-PNA5-01R antenna**

**Table 40: ML-2452-PNA5-01R antenna technical specifications**

Parameter	Performance
Maximum power	5 watts
Polarization	Linear, vertical
Nominal impedance	50 Ω
VSWR	2:1
Radome material	KYDEX® 100 thermoplastic

**Table 40: ML-2452-PNA5-01R antenna technical specifications (continued)**

Parameter	Performance
Cable	12-inches RG-58 plenum-rated cable
Mounting method	Wall mount Pole mount

**Table 41: ML-2452-PNA5-01R antenna electrical specifications**

Part number	Frequency range	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
ML-2452-PNA5-01R	2.4–2.5 GHz	3.0 dBi	4.5 dBi	120°	60°	Standard N-plug connector
	4.9–5.9 GHz	3.5 dBi	5.0 dBi	120°	60°	

**Table 42: ML-2452-PNA5-01R antenna mechanical specifications**

Wind rating	Dimensions	Weight	Temperature
100 mph	131.06 mm × 54.86 mm × 35.05 mm	0.20 lb (0.09 kg)	Storage and operating temperature: -30°C to +70°C (-22°F to +158°F)

ML-2452-PNA5-01R antenna radiation patterns

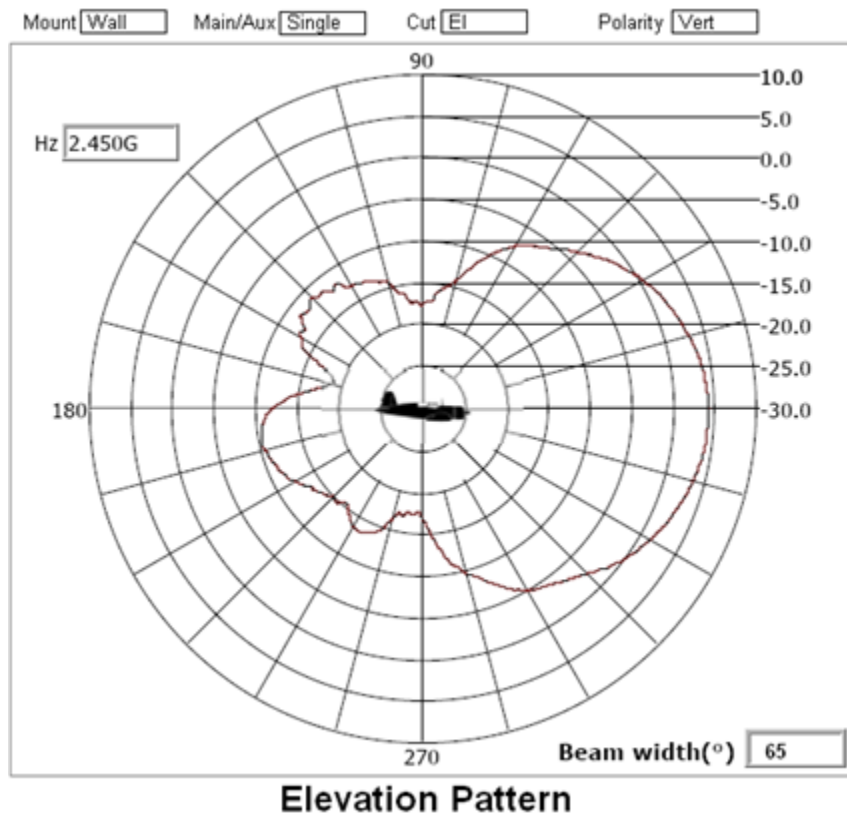
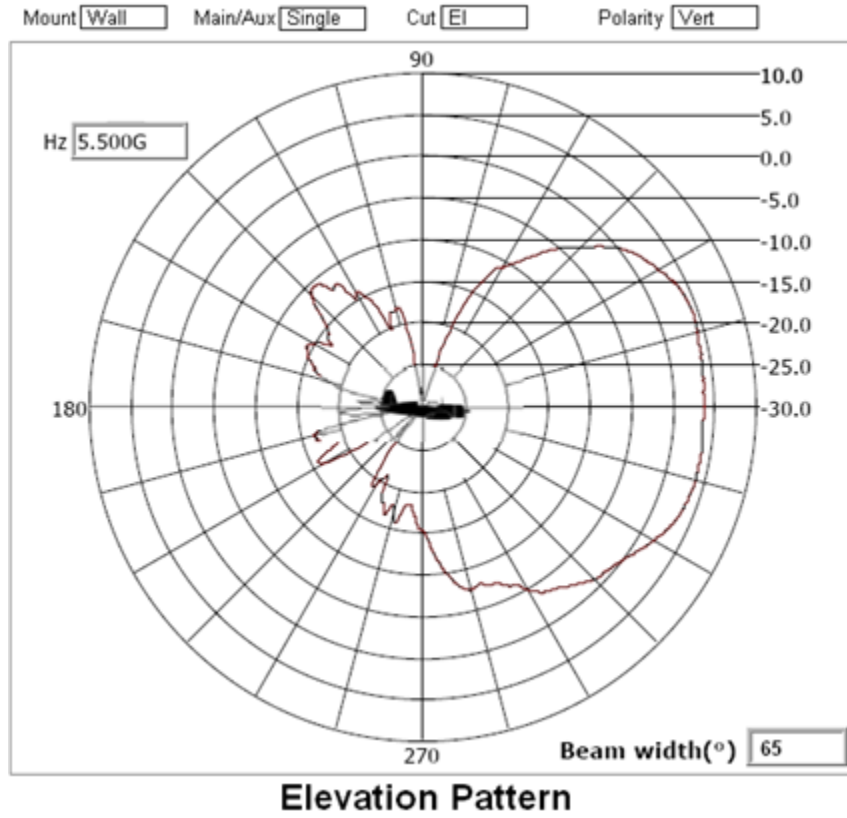


Figure 37: 2.4 GHz elevation pattern



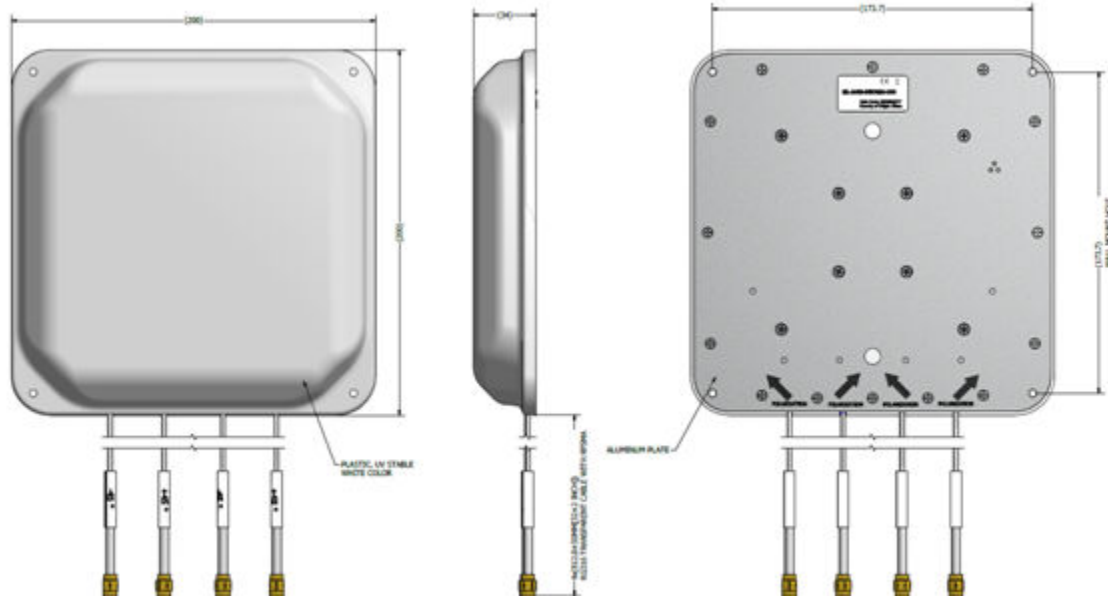
**Figure 38: 5.5 GHz elevation pattern**

Related Topics

[Install the ML-2452-PNA5-01R Antenna](#) on page 202



## ML-2452-SEC6M4-036 Antenna Specifications and Radiation Patterns



**Figure 39: ML-2452-SEC6M4-036 antenna**

**Table 43: ML-2452-SEC6M4-036 antenna technical specifications**

Parameter	Performance
Maximum power	20 watts
Polarization	Linear, vertical
VSWR	2
Radome material	UV stable plastic
Cable	32-inches RG316 plenum-rated transparent cable
Mounting method	Wall mount

**Table 44: ML-2452-SEC6M4-036 antenna electrical specifications**

Part number	Description	2.4 GHz gain (typical)	2.4 GHz gain (peak)	5 GHz gain (typical)	5 GHz gain (peak)	Frequency range	Azimuth beamwidth	Elevation beamwidth	Connector
ML-2452-	Four port sector	6.3	7.0	6.1	7.3	2.4 GHz – 2.5 GHz	100°	90°	RP-SMA plug

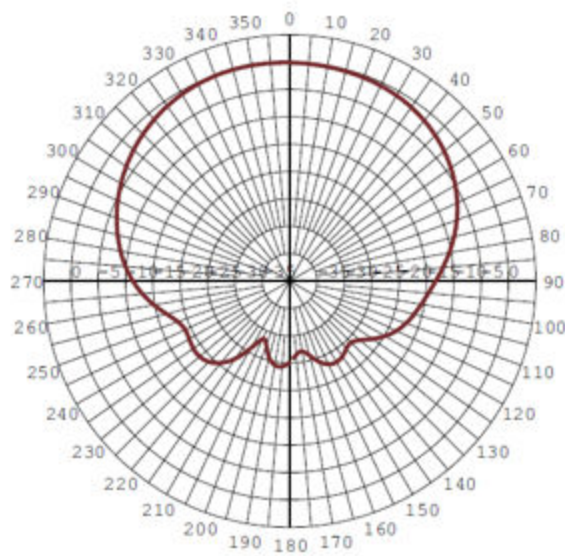
**Table 44: ML-2452-SEC6M4-036 antenna electrical specifications (continued)**

Part number	Description	2.4 GHz gain (typical)	2.4 GHz gain (peak)	5 GHz gain (typical)	5 GHz gain (peak)	Frequency range	Azimuth beamwidth	Elevation beamwidth	Connector
SEC6M4-036						5.1 GHz – 5.9 GHz	80°	65°	

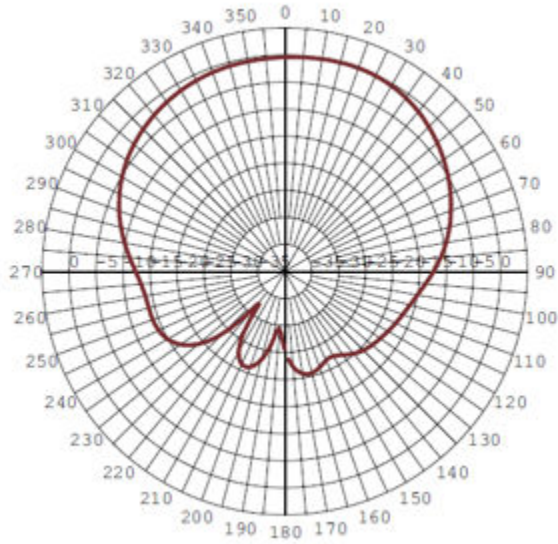
**Table 45: ML-2452-SEC6M4-036 antenna mechanical specifications**

Weight	Temperature range
1.00 lb (0.45 kg)	Storage and operating temperature: -40°C to +70°C (-40°F to +158°F)

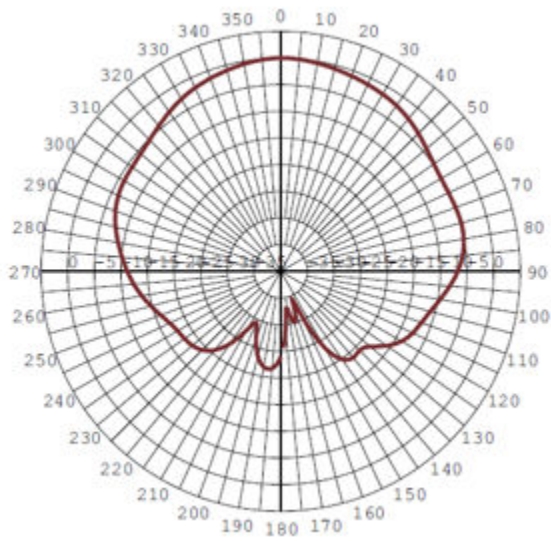
ML-2452-SEC6M4-036 antenna radiation patterns



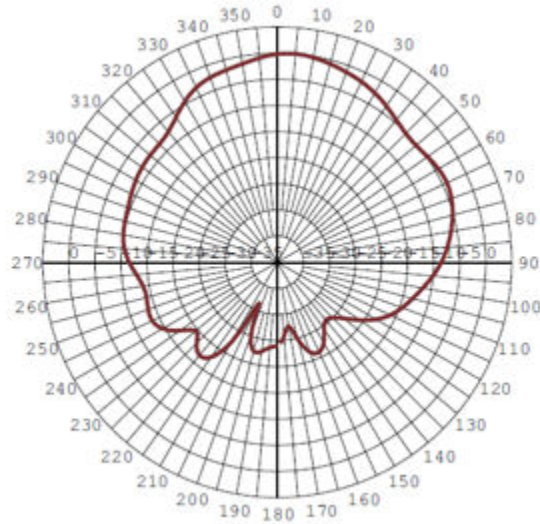
**Figure 40: 2.5 GHz azimuth pattern**



**Figure 41: 2.5 GHz elevation pattern**



**Figure 42: 5 GHz azimuth pattern**



**Figure 43: 5 GHz elevation pattern**

Related Topics

[Install the ML-2452-SEC6M4-036 Antenna](#) on page 209

## ML-2452-PNA7-01R Antenna Specifications and Radiation Patterns

**Table 46: ML-2452-PNA7-01R antenna technical specifications**

Parameter	Performance
Maximum power	2 watts
Polarization	Linear, vertical
Nominal impedance	50 Ω
VSWR	2:1
Radome material	ASA

**Table 46: ML-2452-PNA7-01R antenna technical specifications (continued)**

Parameter	Performance
Cable	12-inches RG-58 plenum-rated cable
Mounting method	Wall or pole mount

**Table 47: ML-2452-PNA7-01R antenna electrical specifications**

Part number	Frequency range	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
ML-2452-PNA7-01R	2.4–2.5 GHz	7.0 dBi	7.3 dBi	68°	66°	Standard N-plug connector
	4.9–5.9 GHz	10.5 dBi	12.0 dBi	52°	60°	

**Table 48: ML-2452-PNA7-01R antenna mechanical specifications**

Wind rating	Dimensions	Weight	Temperature
100 mph	105.66 mm × 105.6 mm × 35.05 mm	0.50 lb (0.23 kg)	Storage temperature: –40°C to +85°C (–40°F to +185°F) Operating temperature: –30°C to +70°C (–22°F to +158°F)

ML-2452-PNA7-01R antenna radiation patterns

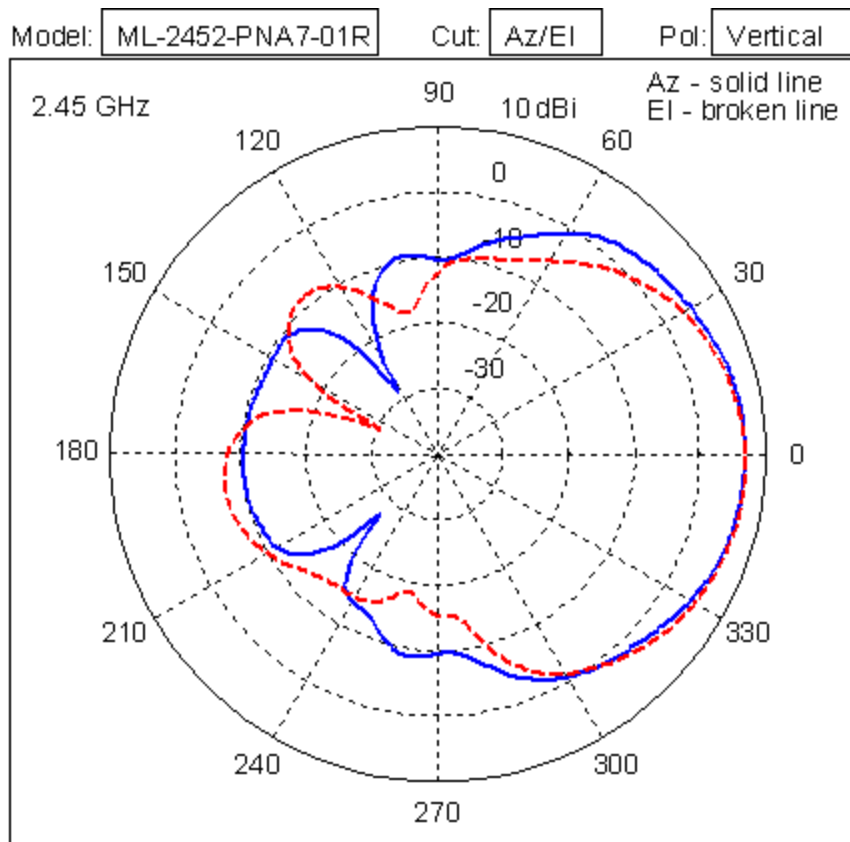
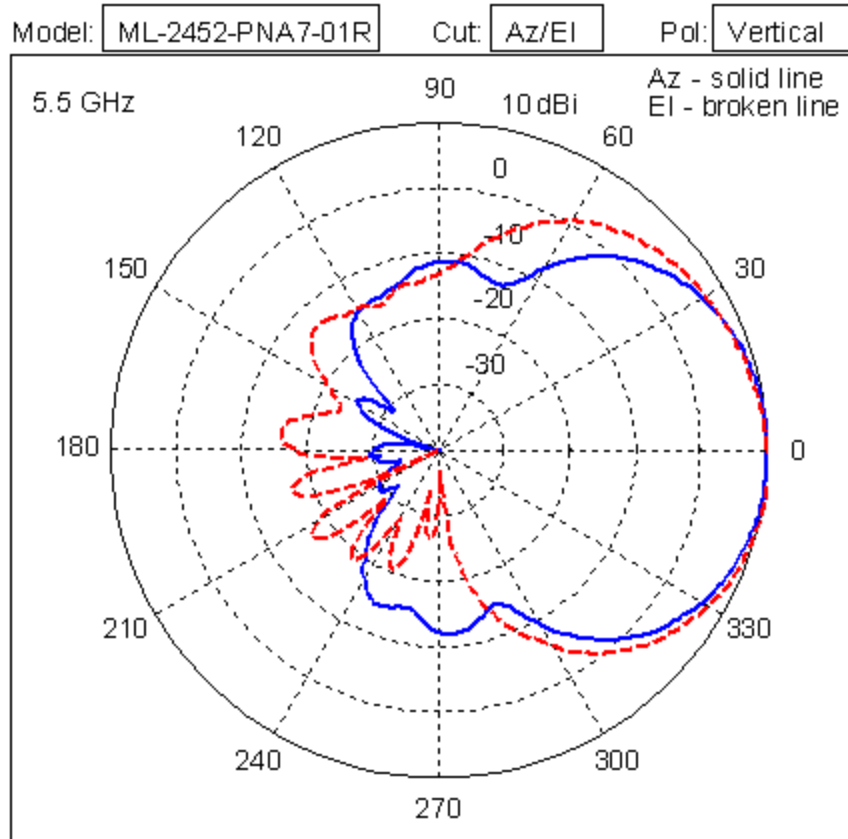


Figure 44: 2.4 GHz azimuth and elevation patterns



**Figure 45: 5.5 GHz azimuth and elevation patterns**

Related Topics

[Install the ML-2452-PNA7-01R Antenna](#) on page 212

## AI-DQ04360S Antenna Specifications and Radiation Patterns

The AI-DQ04360S is a dual-band, 4-port omnidirectional antenna, used with 802.11ac MIMO applications. The antenna covers both 2.4–2.5 GHz and 5.1–5.9 GHz in one radome. The antenna has UL94 V-0 radome and PC board, and conforms to UL’s high burn flame retardant rating.



**Figure 46: AI-DQ04360S antenna front view**

**Table 49: AI-DQ04360S antenna technical specifications**

Parameter	Performance
Maximum power	5 watts
Polarization	Linear, vertical
Nominal impedance	50 Ω
VSWR	2:1
Radome material	UV protected plastic
Cable	Four, 36-inches RG-58/U plenum-rated cables
Mounting method	Wall or mast mount

**Table 50: AI-DQ04360S antenna electrical specifications**

Part number	Frequency range	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
AI-DQ04360S	2.4–2.5 GHz	4.25 dBi	5.5 dBi	Omni-directional	60°	RP-SMA plug
	5.1–5.9 GHz	5 dBi	6 dBi		33°	

**Table 51: AI-DQ04360S antenna mechanical specifications**

Wind rating	Dimensions	Weight	Temperature range
125 mph	218 mm × 160 mm	3.20 lb (1.45 kg)	Operating and Storage temperature: -40°C to +85°C (-40°F to +185°F)



AI-DQ04360S antenna radiation patterns

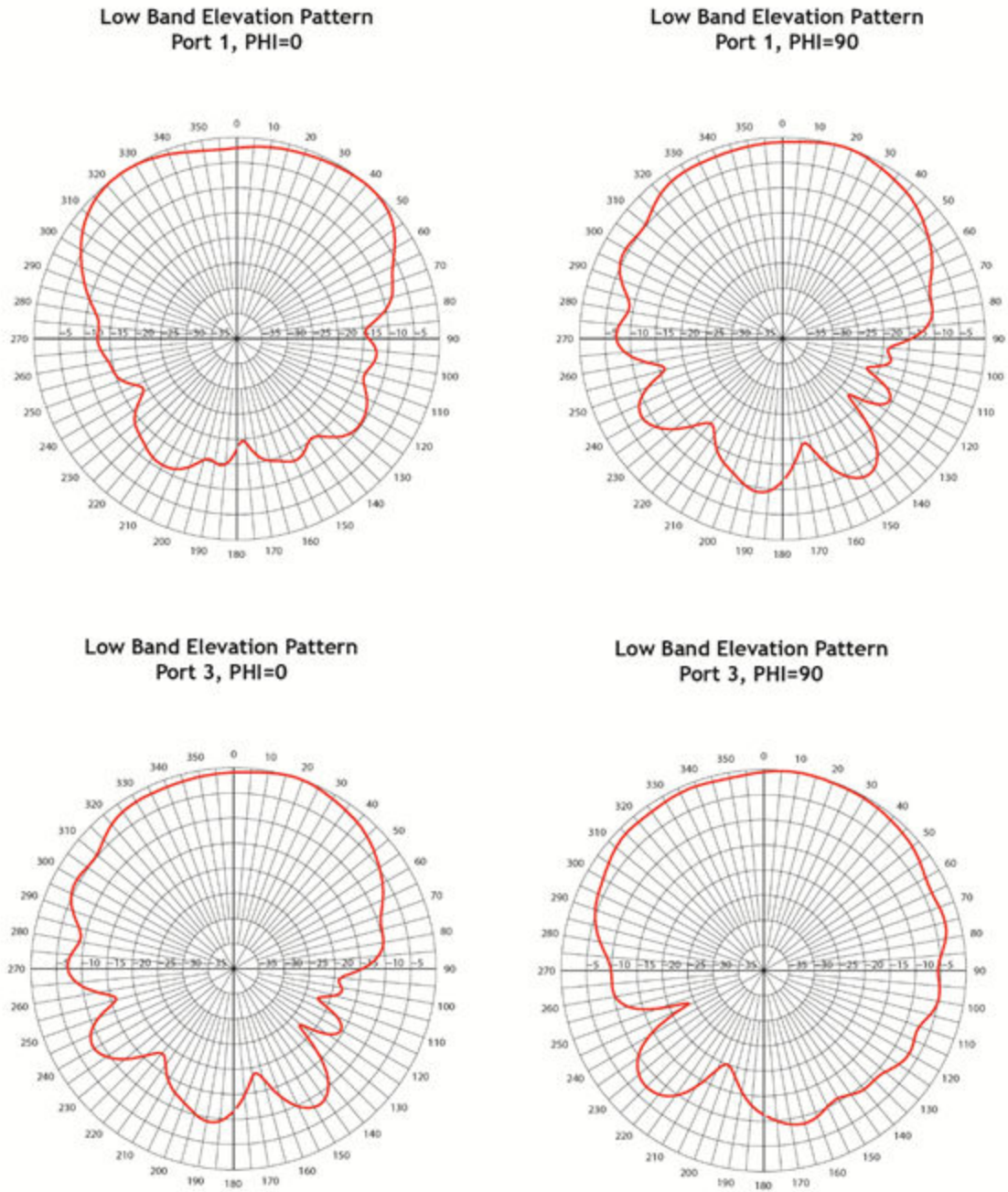
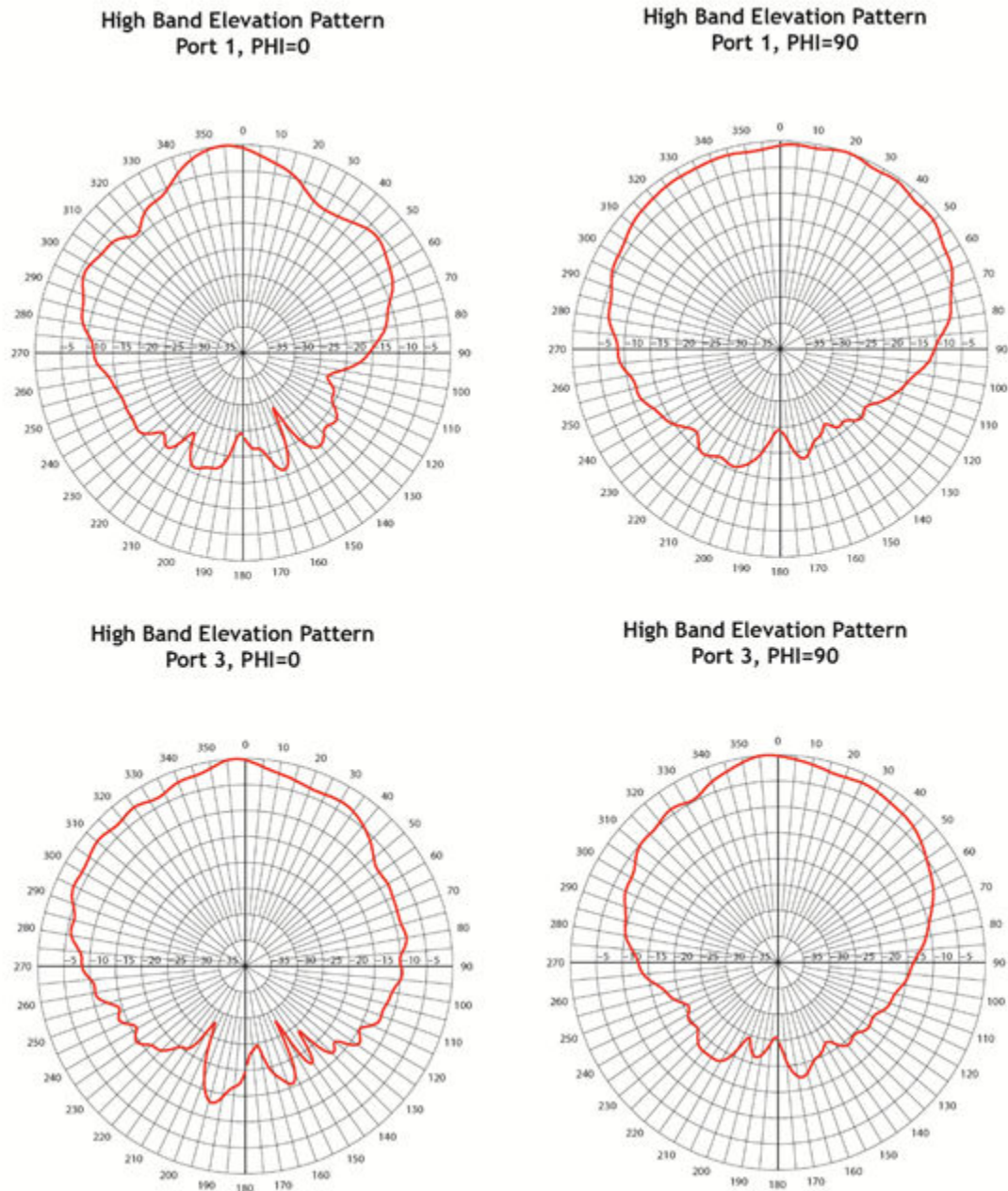


Figure 47: 2.4 GHz elevation patterns



**Figure 48: 5 GHz elevation patterns**

Related Topics

[Install the AI-DQ04360S Antenna](#) on page 217

## WS-AI-DQ05120 Antenna Specifications and Radiation Patterns

The WS-AI-DQ05120 is an indoor 4-port sector antenna used for 802.11ac MIMO applications. The antenna covers both 2.4-2.5 GHz and 5.1-5.9 GHz in one radome. The four elements can also be used individually or in combination for use with legacy 802.11 access points. The antenna has UL94-HB radome and PC board, and conforms to UL's high burn flame retardant rating.



**Figure 49: WS-AI-DQ05120 antenna**

**Table 52: WS-AI-DQ05120 antenna technical specifications**

Item	Description
Maximum power	20 watts
Polarization	Dual-slat linear $\pm 45^\circ$
Nominal impedance	50 $\Omega$
Voltage Standing Wave Ratio (VSWR)	1.5 typical 2.0 maximum
Front-to-back ratio	>20 dB
Radome material	UV protected plastic
Cable	Four 58 in. and 2 UL94 RG-316
Mounting method	Wall or pipe mount

**Table 53: WS-AI-DQ05120 antenna electrical specifications**

Part number	Frequency range	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
	2.4 GHz – 2.5 GHz	5.0 dBi	5.5 dBi	100°	90°	RP-SMA plug

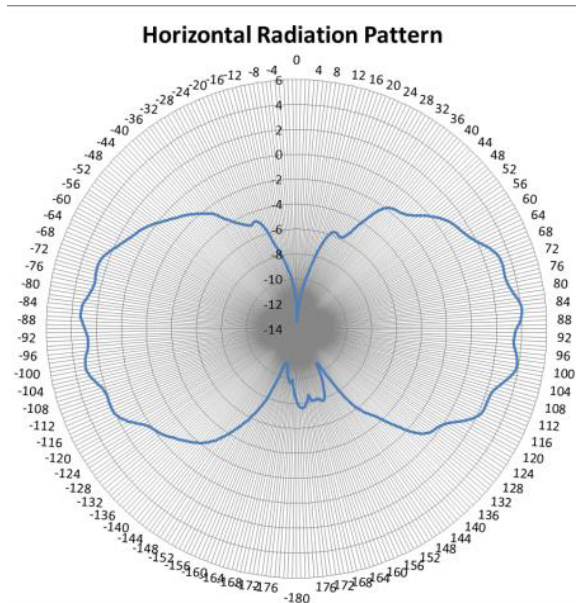
**Table 53: WS-AI-DQ05120 antenna electrical specifications (continued)**

Part number	Frequency range	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
WS-AI-DQ05120 (30702)	5.1 GHz – 5.9 GHz	4.5 dBi	5.5 dBi	80°	65°	

**Table 54: WS-AI-DQ05120 antenna mechanical specifications**

Part number	Dimensions	Weight	Temperature
WS-AI-DQ05120 (30702)	200 mm × 200 mm × 34 mm	1.00 lb (0.45 kg)	Storage temperature: -40°C to +70°C (-40°F to +158°F)

WS-AI-DQ05120 antenna radiation patterns



**Figure 50: 2.4 GHz azimuth pattern**

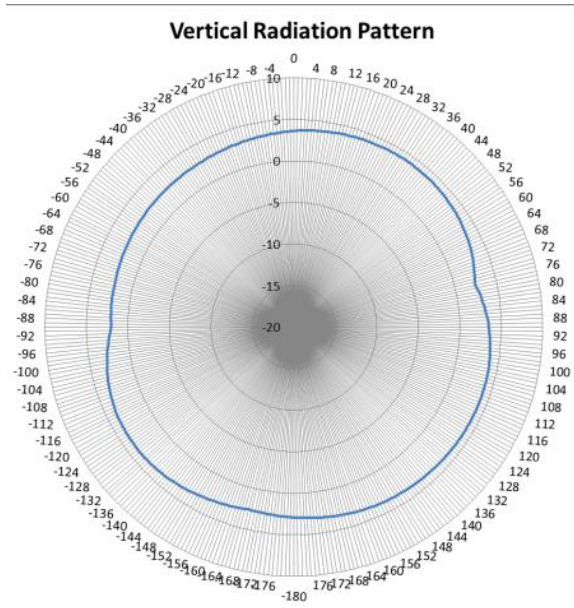


Figure 51: 2.4 GHz elevation pattern

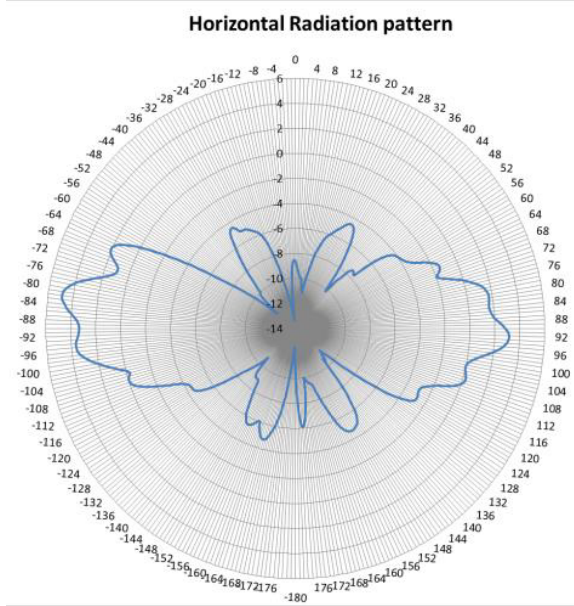
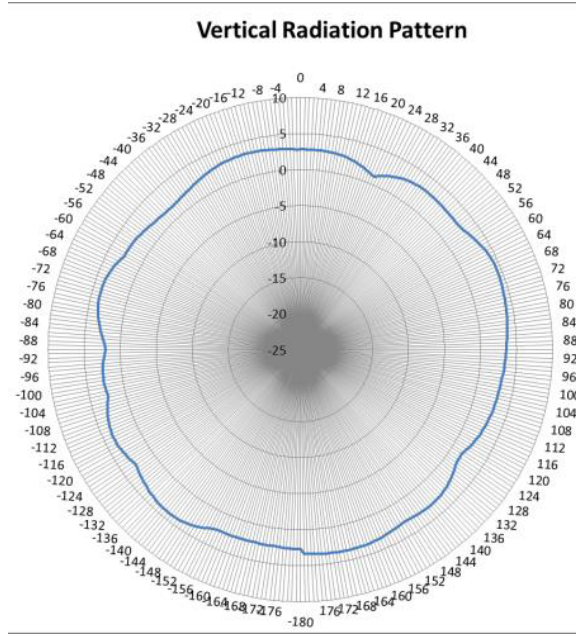


Figure 52: 5 GHz azimuth pattern



**Figure 53: 5 GHz elevation pattern**

Related Topics

[Install the WS-AI-DQ05120, WS-AI-DE07025, WS-AI-DE10055, or WS-AO-DQ05120N Antenna](#) on page 225

## WS-AI-5Q04060 Antenna Specifications and Radiation Patterns

The WS-AI-5Q04060 is a 4-port sector antenna and can be used for 802.11ac MIMO applications. The radome is constructed from lightweight, durable, UV stable plastic. The four ports can be used individually or in combination for use with 802.11 legacy access points.



**Figure 54: WS-AI-5Q04060 antenna front view**

**Table 55: WS-AI-5Q04060 antenna technical specifications**

Item	Description
Maximum power	20 watts
Polarization	Dual-slant linear $\pm 45^\circ$
Nominal impedance	50 $\Omega$
Voltage Standing Wave Ratio (VSWR)	1.5 typical 2.0 maximum
Mounting method	Wall mount or pipe mount

**Table 56: WS-AI-5Q04060 antenna electrical specifications**

Part number	Frequency	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
	4.9 GHz – 6.1 GHz	3.0 dBi	4.0 dBi	50°	33°	RP-SMA plug

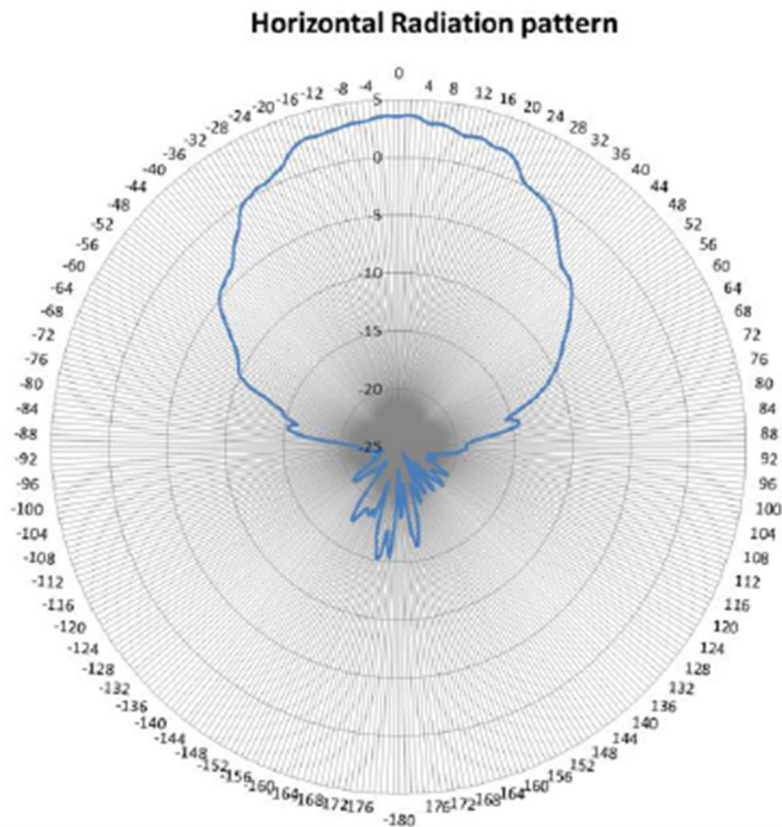
**Table 56: WS-AI-5Q04060 antenna electrical specifications (continued)**

Part number	Frequency	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
WS-AI-5Q04060 (30703)						

**Table 57: WS-AI-5Q04060 antenna mechanical specifications**

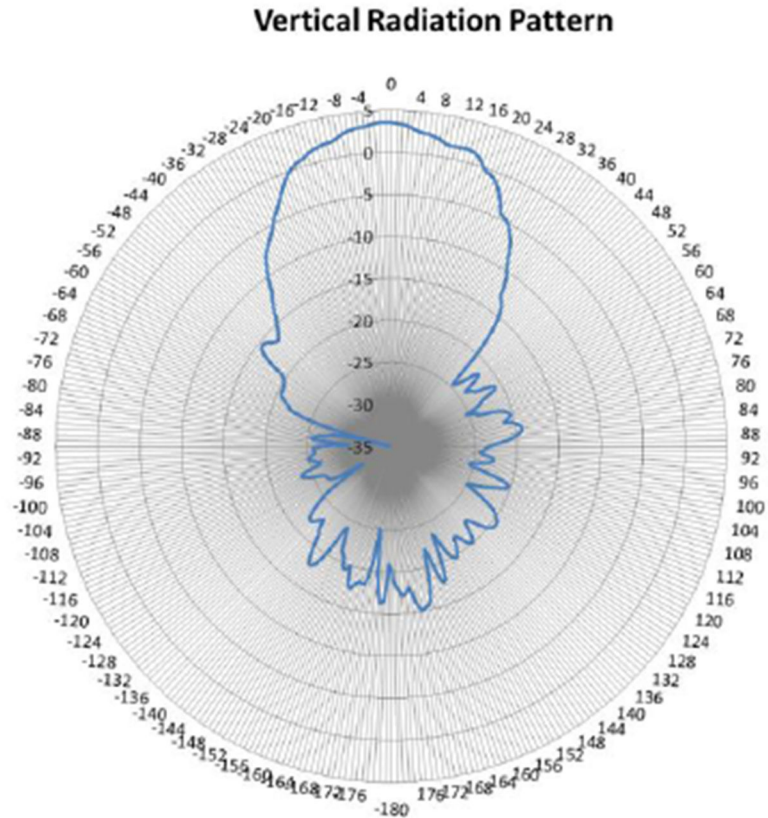
Part number	Dimensions	Weight	Temperature
WS-AI-5Q04060 (30703)	200 mm × 200 mm × 34 mm	1.00 lb (0.45 kg)	Storage temperature: -40°C to +70°C (-40°F to +158°F)

WS-AI-5Q04060 antenna radiation patterns



**Figure 55: 5 GHz azimuth pattern**





**Figure 56: 5 GHz elevation pattern**

## WS-AI-2Q05060 Antenna Specifications and Radiation Patterns

The WS-AI-2Q05060 is a 4-port sector antenna and can be used for 802.11ac MIMO applications. The radome is constructed from lightweight, durable, UV-stable plastic. The four ports can be used individually or in combination for use with 802.11 legacy access points.



**Figure 57: WS-AI-2Q05060 antenna front view**

**Table 58: WS-AI-2Q05060 antenna technical specifications**

Item	Description
Maximum power	20 watts
Polarization	Dual-slant linear $\pm 45^\circ$
Nominal impedance	50 $\Omega$
Voltage Standing Wave Ratio (VSWR)	1.5 typical 2.0 maximum
Mounting method	Wall or pipe mount

**Table 59: WS-AI-2Q05060 antenna electrical specifications**

Part number	Frequency	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
	2.4 GHz	4.0 dBi	5.0 dBi	73°	34°	RP-SMA plug

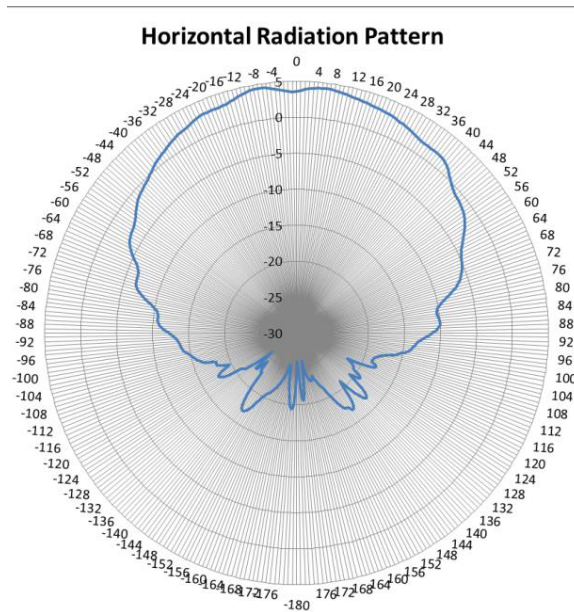
**Table 59: WS-AI-2Q05060 antenna electrical specifications (continued)**

Part number	Frequency	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
WS-AI-2Q05060 (30704)						

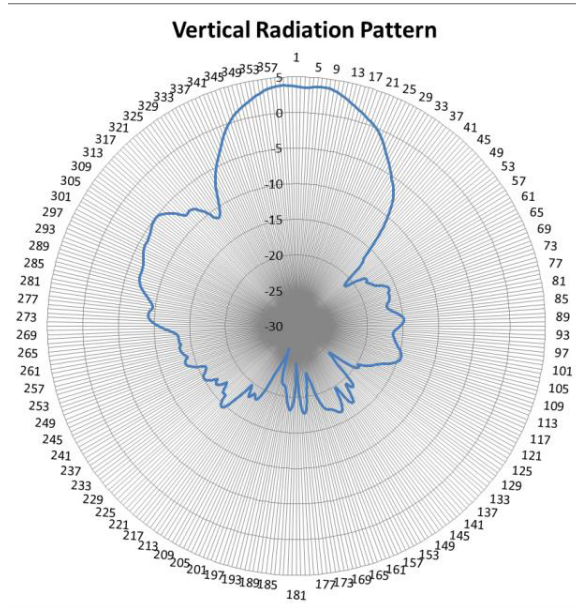
**Table 60: WS-AI-2Q05060 antenna mechanical specifications**

Dimension	Weight	Temperature
200 mm × 200 mm × 34 mm	1.00 lb (0.45 kg)	Storage temperature: -40°C to +70°C (-40°F to +158°F)

WS-AI-2Q05060 antenna radiation patterns



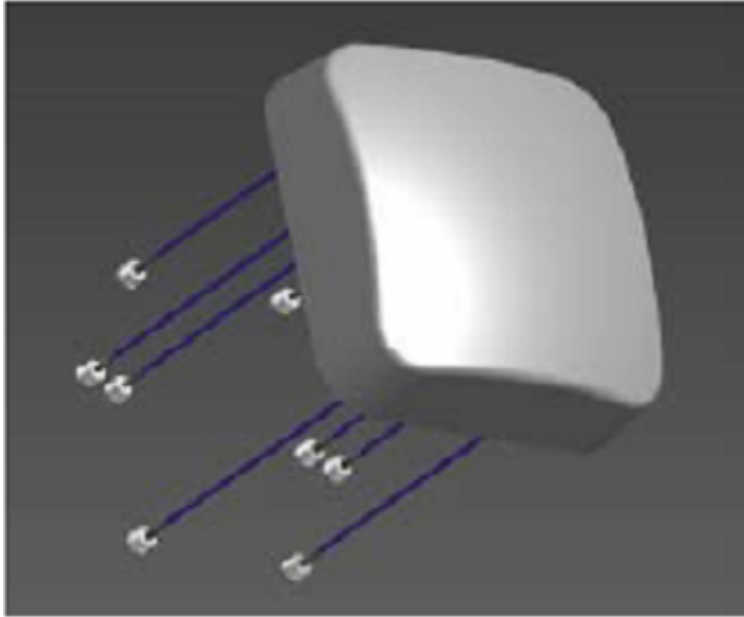
**Figure 58: 2.4 GHz azimuth pattern**



**Figure 59: 2.4 GHz elevation pattern**

## WS-AI-DE07025 Antenna Specifications and Radiation Patterns

The WS-AI-DE07025 antenna is an 8-port sector antenna used for 802.11ac MIMO applications. The antenna covers both 2.4–2.5 GHz and 5.1–5.9 GHz in one radome. The elements can be used individually or in combination for use with legacy 802.11 access points. The UL-listed radome and PC board materials conform to UL's high burn flame-retardant rating.



**Figure 60: WS-AI-DE07025 antenna**

**Table 61: WS-AI-DE07025 antenna technical specifications**

Item	Description
Maximum power	25 watts
Polarization	Dual linear
Nominal impedance	50 $\Omega$
VSWR	<2.25:1
Front-to-back-ratio	>22 dB at 2.4 GHz >25 dB at 5 GHz
Front-to-side-ratio	17 dB at 2.4 GHz 15 dB at 5 GHz
Radome material	White, UL 94-HB plastic

**Table 61: WS-AI-DE07025 antenna technical specifications (continued)**

Item	Description
Cable	Eight 58 in. ± 2RG-58PLW plenum
Mounting method	Wall or pipe mount

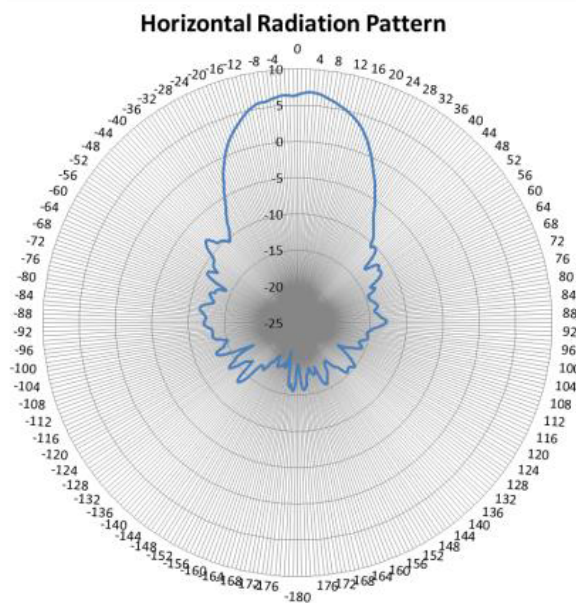
**Table 62: WS-AI-DE07025 antenna electrical specifications**

Part number	Frequency range	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
30705	2.4 GHz – 2.5 GHz	6.5 dBi	7.5 dBi	31°	43°	RP-SMA plug
	5.1 GHz – 5.9 GHz	5.5 dBi	6.5 dBi	29°	37°	

**Table 63: WS-AI-DE07025 antenna mechanical specifications**

Dimensions	Weight	Temperature range
305.0 mm × 305.0 mm × 110.5 mm	5.00 lbs (2.27 kg)	Storage temperature: -30°C to +80°C (-22°F to +176°F)

WS-AI-DE07025 antenna radiation patterns



**Figure 61: 2.4 GHz azimuth pattern**

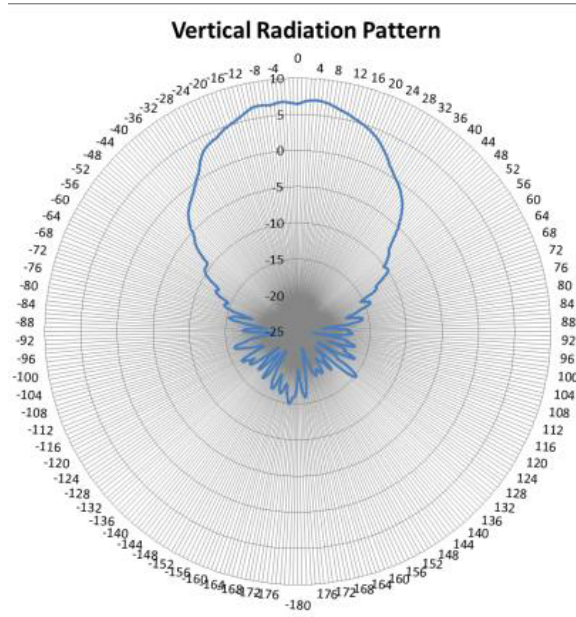


Figure 62: 2.4 GHz elevation pattern

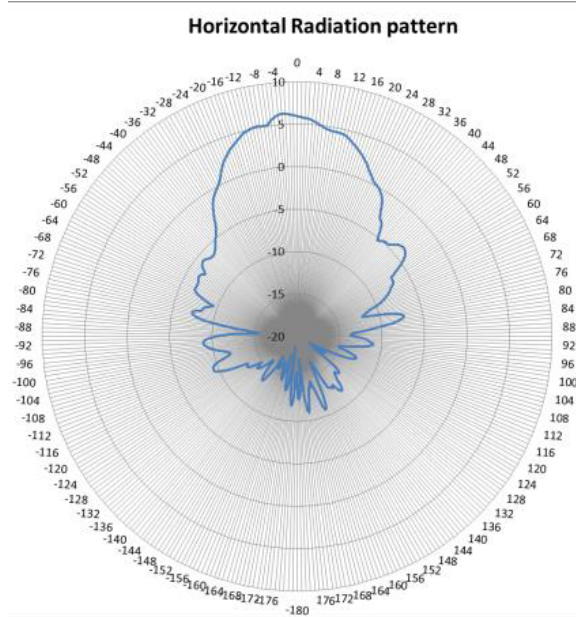
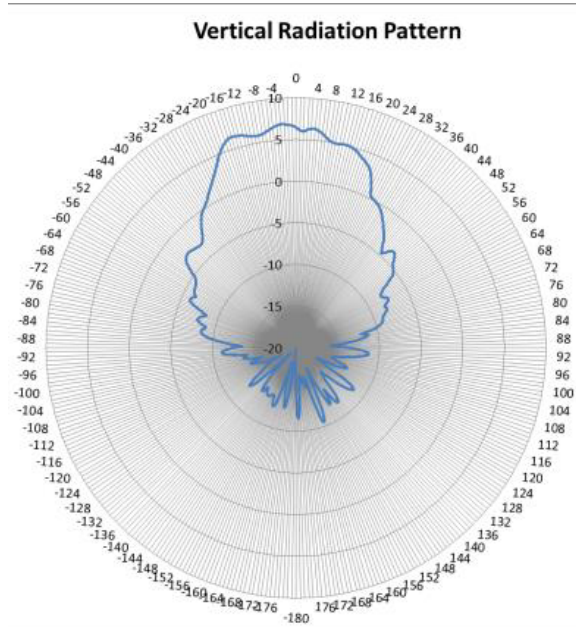


Figure 63: 5 GHz azimuth pattern



**Figure 64: 5 GHz elevation pattern**

Related Topics

[Install the WS-AI-DQ05120, WS-AI-DE07025, WS-AI-DE10055, or WS-AO-DQ05120N Antenna on page 225](#)

## WS-AI-5Q05025 Antenna Specifications and Radiation Patterns

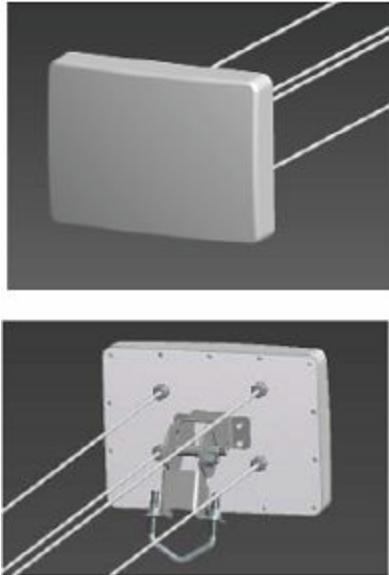
The WS-AI-5Q05025 antenna is a four port sector antenna and can be used for 802.11ac MIMO applications that operate in the 5.1-5.9 GHz frequency range. The four elements can be used individually or in combination for use with legacy 802.11 access points.



**Note**

An adjustable articulating mounting bracket is included with the antenna.





**Figure 65: WS-AI-5Q05025 antenna front and back views**

**Table 64: WS-AI-5Q05025 antenna technical specifications**

Item	Description
Maximum power	25 watts
Polarization	Dual-linear
Nominal impedance	50 Ω
Voltage Standing Wave Ratio (VSWR)	1.0 typical 2.0 maximum
Front to back ratio	> 20dB
Radome material	UL 94-HB plastic
Cable	Four, 58 in. ±2 RG-58PLW, plenum
Mounting method	Adjustable mounting bracket for wall or pipe mounting

**Table 65: WS-AI-5Q05025 antenna electrical specifications**

Part number	Frequency	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
	5.1 GHz – 5.9 GHz	3.5 dBi	4.5 dBi	30°	40°	RP-SMA plug

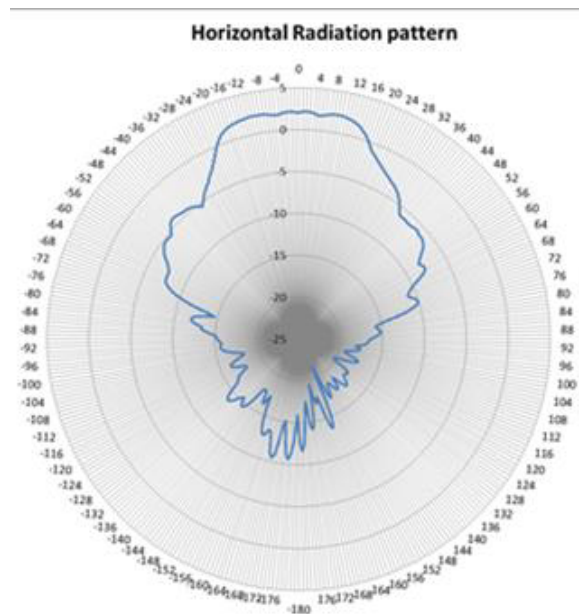
**Table 65: WS-AI-5Q05025 antenna electrical specifications (continued)**

Part number	Frequency	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
WS-AI-5Q05025 (30706)						

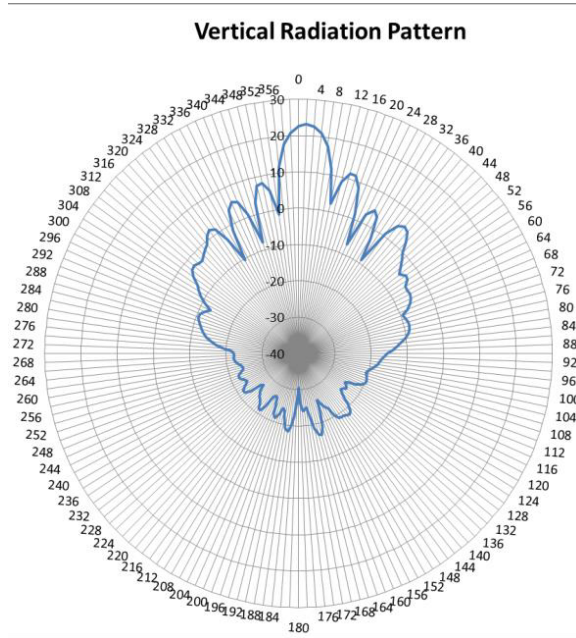
**Table 66: WS-AI-5Q05025 antenna mechanical specifications**

Dimension	Weight	Temperature
181 mm × 249 mm × 129 mm	3.00 lbs. (1.36 kg)	-30°C to +80°C (-22°F to +176°F)

WS-AI-5Q05025 antenna radiation patterns



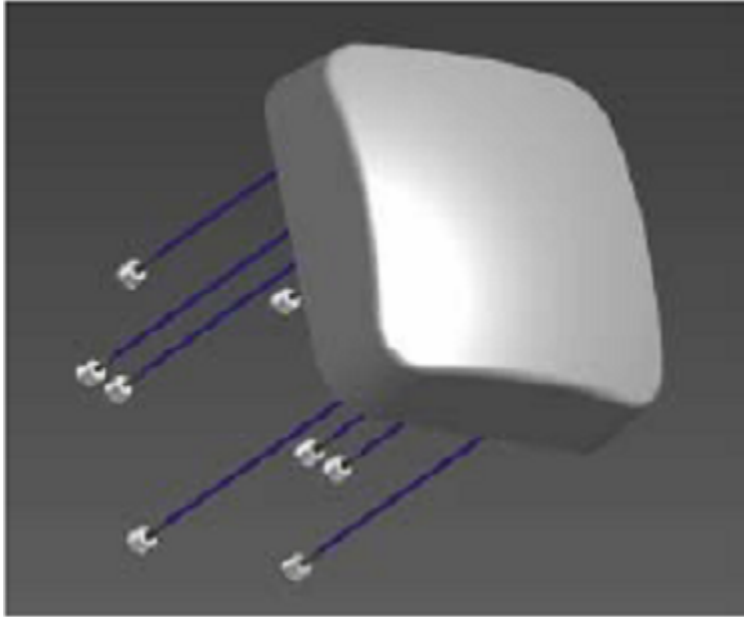
**Figure 66: 5 GHz azimuth pattern**



**Figure 67: 5 GHz elevation pattern**

## WS-AI-DE10055 Antenna Specifications and Radiation Patterns

This dual-band 8-port sector antenna can be used for 802.11ac MIMO applications. The antenna covers both 2.4–2.5 GHz and 5.1–5.9 GHz in one radome. The radome can be used individually or in combination for use with legacy 802.11 access points.



**Figure 68: WS-AI-DE10055 antenna**

**Table 67: WS-AI-DE10055 antenna technical specifications**

Item	Description
Maximum power	25 watts
Polarization	Dual linear
Nominal impedance	50 $\Omega$
VSWR	<2.25:1
Front-to-back ratio	>21 dB at 2.4 GHz >14 dB at 5 GHz
Front-to-side ratio	15 dB at 2.4 GHz 14 dB at 5 GHz
Radome material	White, UL 94-HB plastic

**Table 67: WS-AI-DE10055 antenna technical specifications (continued)**

Item	Description
Cable	Eight 58 in. ±2 RG-58PLW plenum
Mounting method	Wall or pipe mount

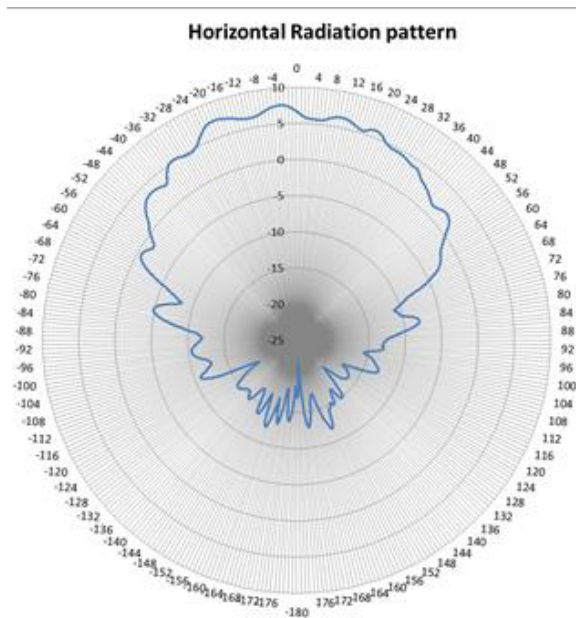
**Table 68: WS-AI-DE10055 antenna electrical specifications**

Part number	Frequency range	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
30707	2.4 GHz – 2.5 GHz	10.0 dBi	10.5 dBi	51°	44°	RP-SMA plug
	5.1 GHz – 5.9 GHz	6.0 dBi	7.5 dBi	53°	43°	

**Table 69: WS-AI-DE10055 antenna mechanical specifications**

Dimensions	Weight	Temperature range
305.0 mm × 305.0 mm × 110.5 mm	5.00 lbs (2.30 kg)	Storage temperature: -30°C to +80°C (-22°F to +176°F)

WS-AI-DE10055 antenna radiation patterns



**Figure 69: 2.4 GHz azimuth pattern**

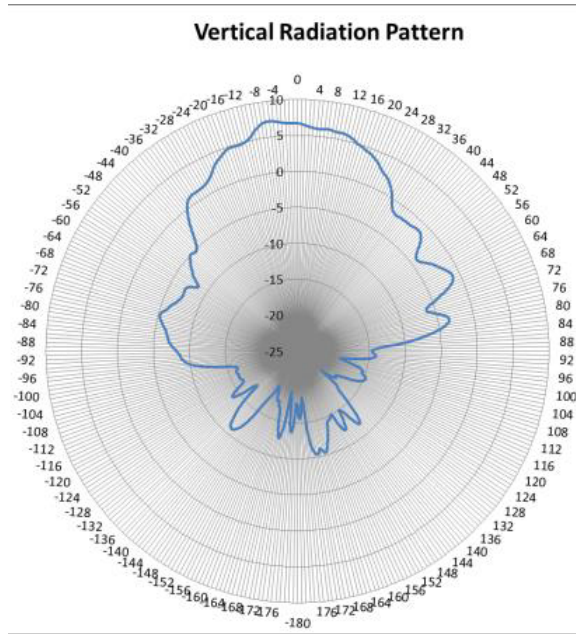


Figure 70: 2.4 GHz elevation pattern

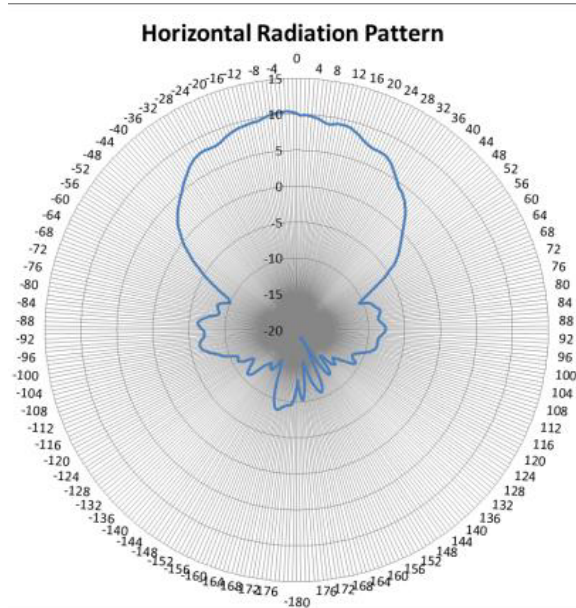
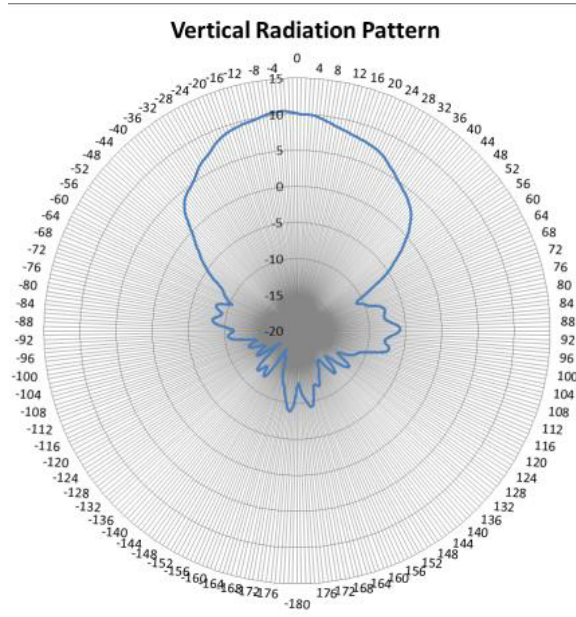


Figure 71: 5 GHz azimuth pattern



**Figure 72: 5 GHz elevation pattern**

Related Topics

[Install the WS-AI-DQ05120, WS-AI-DE07025, WS-AI-DE10055, or WS-AO-DQ05120N Antenna on page 225](#)

## [WS-AO-DQ05120N Antenna Specifications and Radiation Patterns](#)

The WS-AO-DQ05120N is an outdoor 4-port sector antenna, and can be used for 802.11ac MIMO applications. The four ports can be used individually or in combination with legacy 802.11 access points.



**Figure 73: WS-AO-DQ05120N antenna**

**Table 70: WS-AO-DQ05120N antenna technical specifications**

Item	Description
Maximum power	20 watts
Polarization	Dual-slant linear $\pm 45$
Nominal impedance	50 $\Omega$
VSWR	1.5–2.0
Mounting method	Wall or pipe mount

**Table 71: WS-AO-DQ05120N antenna electrical specifications**

Frequency	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
	5.0 dBi	5.5 dBi	100°	90°	N-type



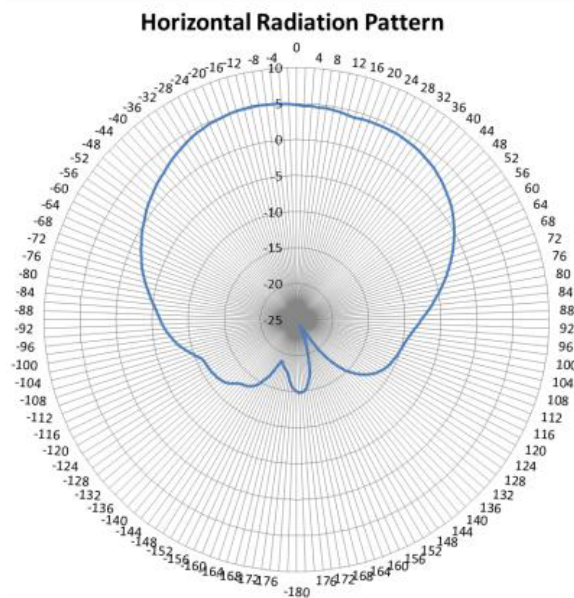
**Table 71: WS-AO-DQ05120N antenna electrical specifications (continued)**

Frequency	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
2.4 GHz – 2.5 GHz					
5.1 GHz – 5.9 GHz	4.5 dBi	5.5 dBi	80°	80°	

**Table 72: WS-AO-DQ05120N antenna mechanical specifications**

Part number	Dimensions	Weight	Temperature
WS-AO-DQ05120N (30711)	200 mm × 200 mm × 34 mm	1.00 lb (0.45 kg)	Operating temperature: -40°C to +70°C (-40°F to +158°F)

WS-AO-DQ05120N antenna radiation patterns



**Figure 74: 2.4 GHz azimuth pattern**

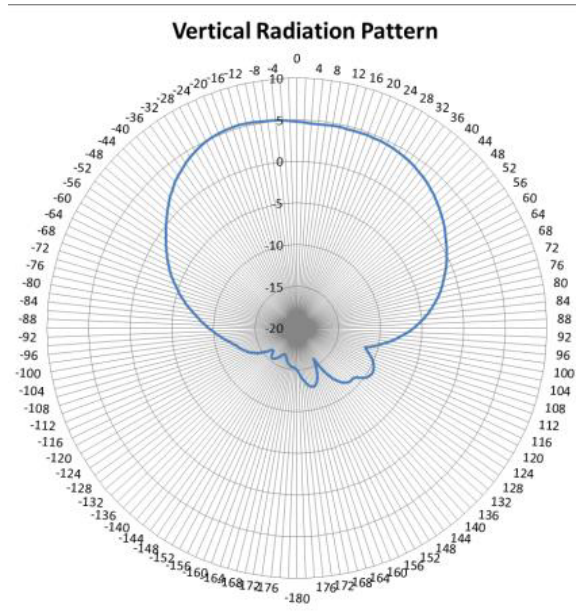


Figure 75: 2.4 GHz elevation pattern

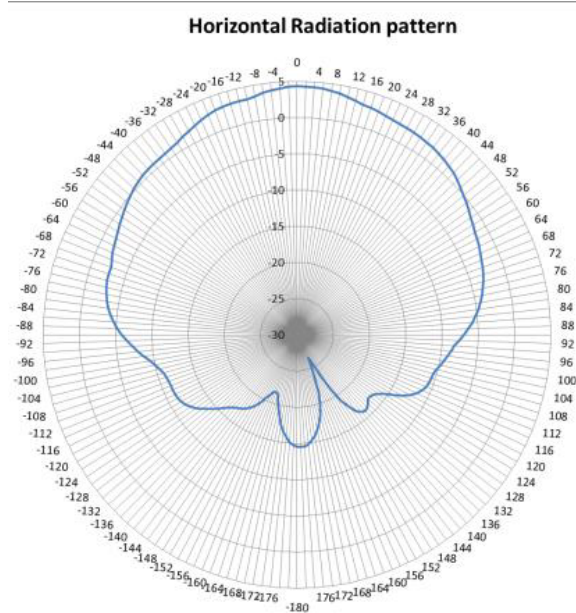
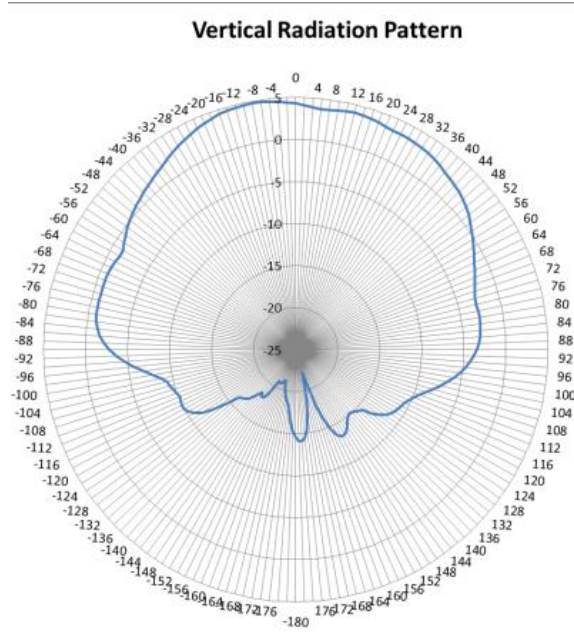


Figure 76: 5 GHz azimuth pattern



**Figure 77: 5 GHz elevation pattern**

## [WS-AO-5Q04060N Antenna Specifications and Radiation Patterns](#)

The WS-AO-5Q04060N is a 4-port sector antenna that can be used for 802.11ac MIMO applications. The four ports can be used individually or in combination with legacy 802.11 access points.



**Figure 78: WS-AO-5Q04060N antenna**

**Table 73: WS-AO-5Q04060N antenna technical specifications**

Item	Description
Maximum power	20 watts
Nominal impedance	50 Ω
VSWR	1.5 typical 2.0 maximum
Polarization	Dual-slant linear ±45°
Mounting method	Wall mount or pipe mount

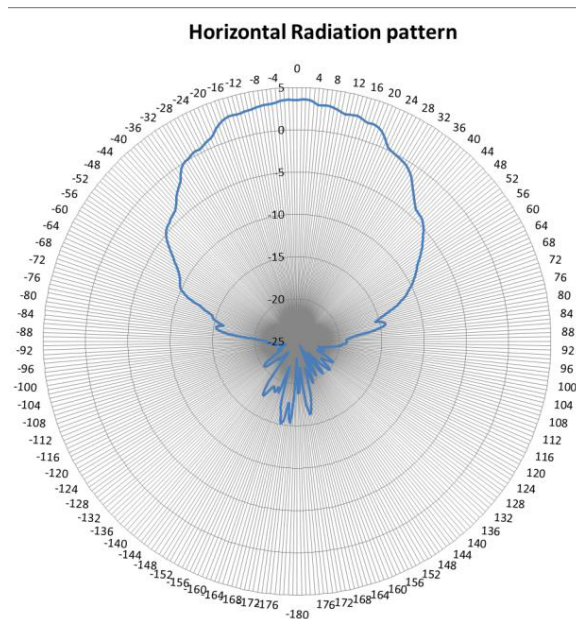
**Table 74: WS-AO-5Q04060N antenna electrical specifications**

Frequency	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector type
5.15 GHz – 5.85 GHz	3 dBi	4 dBi	50°	33°	Standard N-type plug

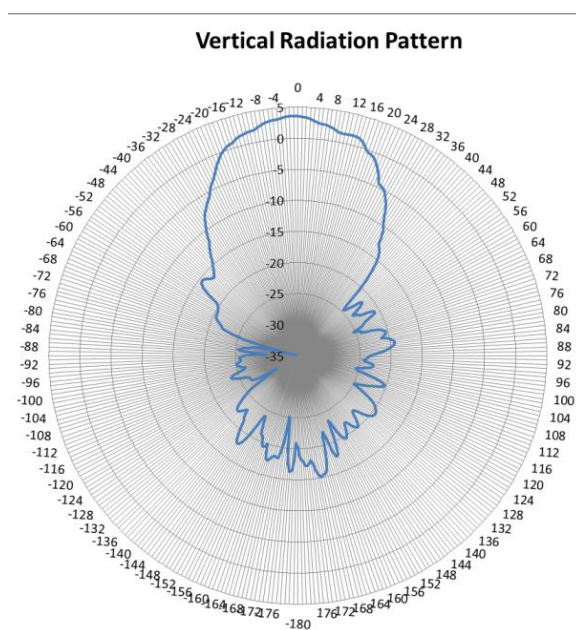
**Table 75: WS-AO-5Q04060N antenna mechanical specifications**

Part number	Dimension	Weight	Temperature
WS-AO-5Q04060N (30712)	200 mm × 200 mm × 34 mm	1.00 lb (0.45 kg)	-40°C to +70°C (-40°F to +158°F)

## WS-AO-5Q04060N antenna radiation patterns



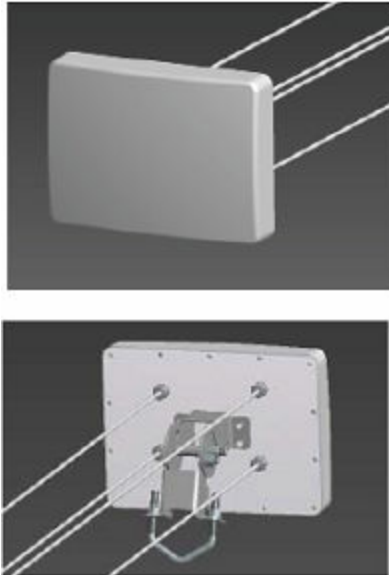
**Figure 79: 5 GHz azimuth pattern**



**Figure 80: 5 GHz elevation pattern**

## WS-AO-5Q05025N Antenna Specifications and Radiation Patterns

The WS-AO-5Q05025N antenna is a four port sector antenna and can be used for 802.11ac MIMO applications that operate in the 5.1-5.9 GHz frequency range. The four elements can be used individually or in combination for use with legacy 802.11 access points.



**Figure 81: WS-AO-5Q05025N antenna front and back views**

**Table 76: WS-AO-5Q05025N antenna technical specifications**

Item	Description
Maximum power	25 watts
Polarization	Dual-linear
Nominal impedance	50 Ω
Voltage Standing Wave Ratio (VSWR)	1.0 typical 2.0 maximum
Front to back ratio	> 20dB
Radome material	UL 94-HB plastic
Cable	Four, 58 in. ±2 RG-58PLW, plenum
Mounting method	Adjustable mounting bracket for wall or pipe mounting

**Table 77: WS-AO-5Q05025N antenna electrical specifications**

Part number	Frequency	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector type
	5.1 GHz – 5.9 GHz	3.5 dBi	4.5 dBi	30°	40°	N connector

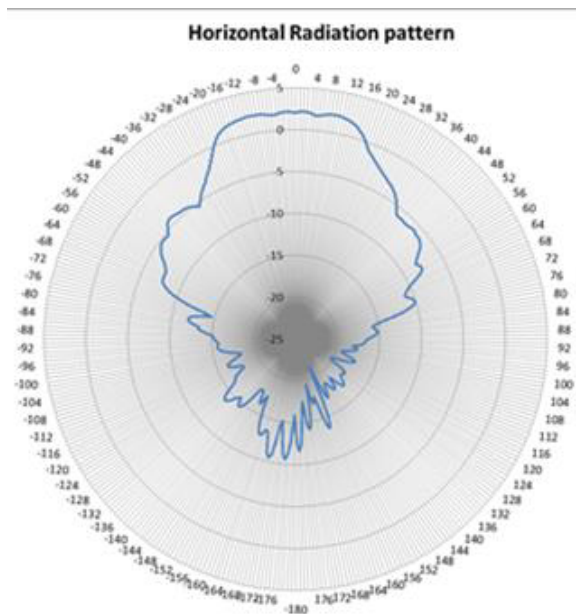
**Table 77: WS-AO-5Q05025N antenna electrical specifications (continued)**

Part number	Frequency	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector type
WS-AO-5Q05025N (30716)						

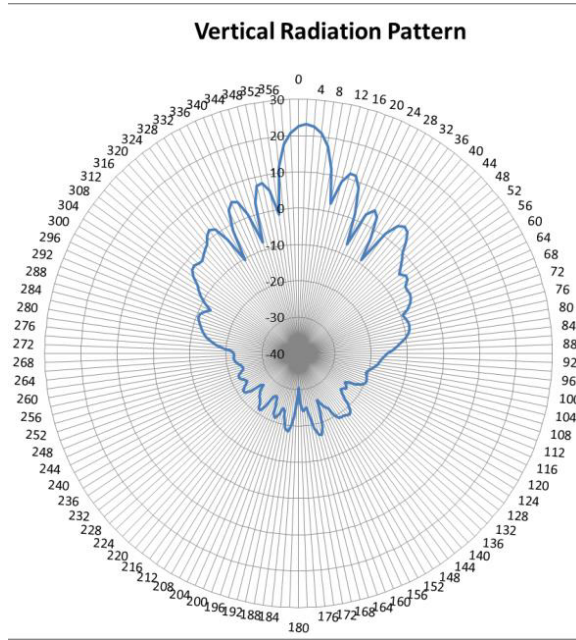
**Table 78: WS-AO-5Q05025N antenna mechanical specifications**

Dimension	Weight	Temperature
181 mm × 249 mm × 129 mm	3.00 lbs. (1.36 kg)	-30°C to +80°C (-22°F to +176°F)

WS-AO-5Q05025N antenna radiation patterns



**Figure 82: 5 GHz azimuth pattern**



**Figure 83: 5 GHz elevation pattern**

Related Topics

[Install the WS-AI-DQ05120, WS-AI-DE07025, WS-AI-DE10055, or WS-AO-DQ05120N Antenna](#) on page 225

[Install the Antenna Using the WS-MB-WALLEXT01 Extension Bracket Kit](#) on page 240

## [WS-AO-DQ04360N Antenna Specifications and Radiation Patterns](#)

The WS-AO-DQ04360N (30724) dual-band, 4-port, omni-directional antenna can be used for 802.11ac MIMO applications. The antenna covers both 2.4–2.5 GHz and 5.1–5.9 GHz in one radome. The antenna can be mounted on a wall or mast, and mount attachments are included.





**Figure 84: WS-AO-DQ04360N antenna**

**Table 79: WS-AO-DQ04360N antenna technical specifications**

Item	Description
Maximum power	5 watts
Polarization	Linear and vertical
Nominal impedance	50 Ω
VSWR	2:1
Radome material	UV protected plastic
Cable	Four, 36 in. RG-58/U plenum-rated
Mounting method	Wall or mast mount

**Table 80: WS-AO-DQ04360N antenna electrical specifications**

Part number	Frequency range	Typical gain	Peak gain	Azimuth beamwidth	Elevation beamwidth	Connector
30724	2.4 GHz – 2.5 GHz	4.25 dBi	5.50 dBi	Omnidirectional	60°	N-plug
	5.1 GHz – 5.9 GHz	5.00 dBi	6.00 dBi		33°	

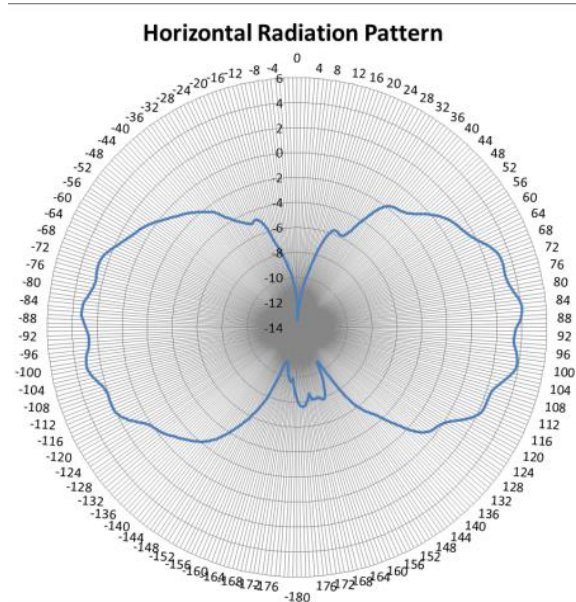
**Table 81: WS-AO-DQ04360N antenna mechanical specifications**

Wind rating	Dimensions	Weight	Temperature range
125 mph	218.44 mm × 160.02 mm	3.20 lbs (1.45 kg)	Storage temperature: -40°C

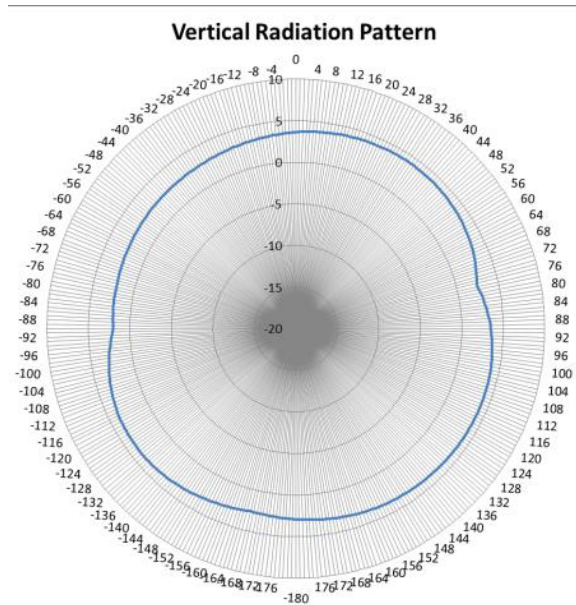
**Table 81: WS-AO-DQ04360N antenna mechanical specifications (continued)**

Wind rating	Dimensions	Weight	Temperature range
			to +85°C (-40°F to +185°F)

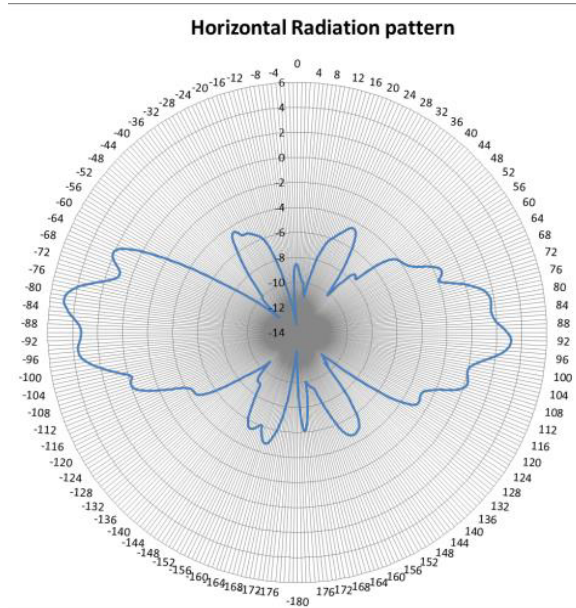
WS-AO-DQ04360N antenna radiation patterns



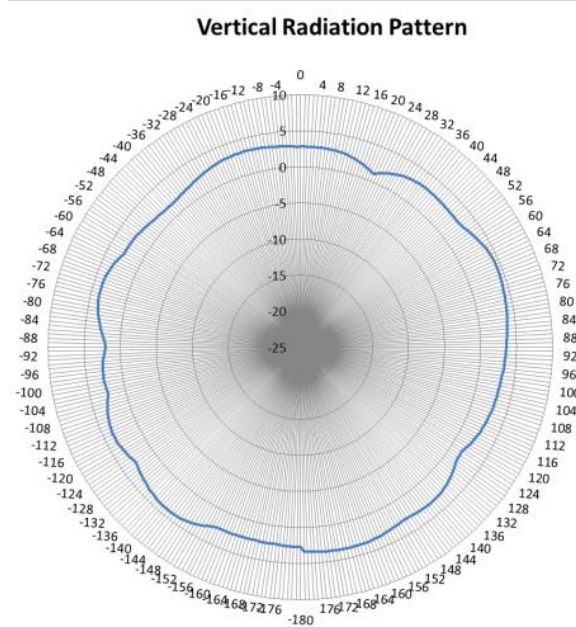
**Figure 85: 2.4 GHz azimuth pattern**



**Figure 86: 2.4 GHz elevation pattern**



**Figure 87: 5 GHz azimuth pattern**



**Figure 88: 5 GHz elevation pattern**

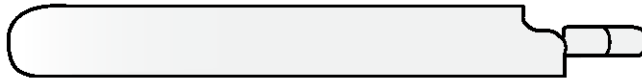
Related Topics

[Install the WS-AO-DQ04360N Antenna](#) on page 231

## AH-ACC-ANT-AX-KT Antenna Specifications and Radiation Patterns

Learn about the AH-ACC-ANT-AX-KT external antenna specifications and radiation patterns.

The AH-ACC-ANT-AX-KT indoor antenna is a dual-band 5 dBi antenna, and the antenna kit comes with eight antennas to be directly attached to the AP305C/CX and AP510C/CX access points.



**Figure 89: AH-ACC-ANT-AX-KT antenna**

**Table 82: AH-ACC-ANT-AX-KT antenna technical specifications**

Item	Description
Maximum power	1 watt
Polarization	Linear and vertical
Nominal impedance	50±10 Ω
VSWR	2
Radome material	Acrylonitrile Butadiene Styrene (ABS)
Mounting method	Direct attach

**Table 83: AH-ACC-ANT-AX-KT antenna electrical specifications**

Frequency range	Typical gain	Azimuth beamwidth	Connector
2.4 GHz – 2.5 GHz	3±0.5 dBi	Omnidirectional	SMA
5.1 GHz – 5.9 GHz	5±0.5 dBi		

**Table 84: AH-ACC-ANT-AX-KT antenna mechanical specifications**

Temperature range
Operating temperature: -20°C to +60°C (-4°F to +140°F) Storage temperature: -20°C to +70°C (-4°F to +158°F)

### AH-ACC-ANT-AX-KT antenna radiation patterns

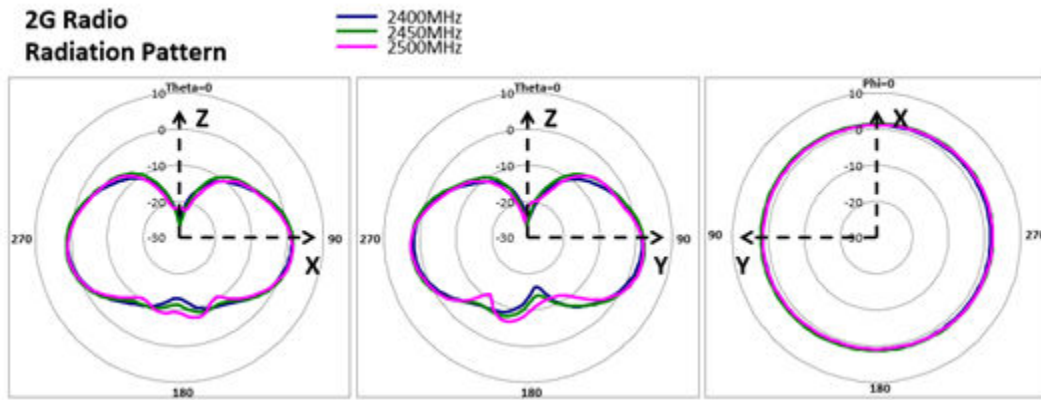


Figure 90: AH-ACC-ANT-AX-KT antenna 2.4G radio radiation pattern

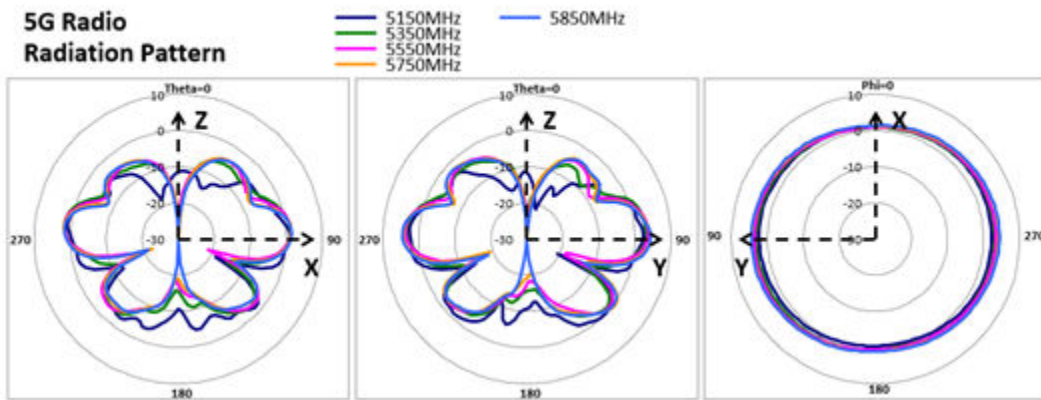


Figure 91: AH-ACC-ANT-AX-KT antenna 5G radio radiation pattern

Related Topics

[Install the AH-ACC-ANT-AX-KT Antenna](#) on page 239

### [AI-DS0305360-RPSMA Antenna Specifications and Radiation Patterns](#)

The AI-DS0305360-RPSMA antenna is a dipole antenna that provides coverage of 2.4 to 2.5 GHz and 5.1 to 5.85 GHz in a single antenna.

Use the information in the following sections when you plan your antenna installation.

## Physical Properties

The following tables show the technical and physical specifications of the AI-DS0305360-RPSMA antenna.

**Table 85: Technical specifications**

Item	Description
Antenna type	Dipole array
Frequency	2400 ~ 2500 MHz 5150 ~ 5850MHz
Impedance	50 Ohm Nominal
VSWR	< 2dB
Gain	2.4G ~ 2.5G @ 3dBi ±0.5dBi 5.15G ~ 5.85G @ 5dBi ±0.5dBi
Efficiency	2.4G ~ 2.5G @ 55~60 per cent 5.15G ~ 5.85G @ 60~70 per cent
Polarization	Linear

**Table 86: Antenna gain**

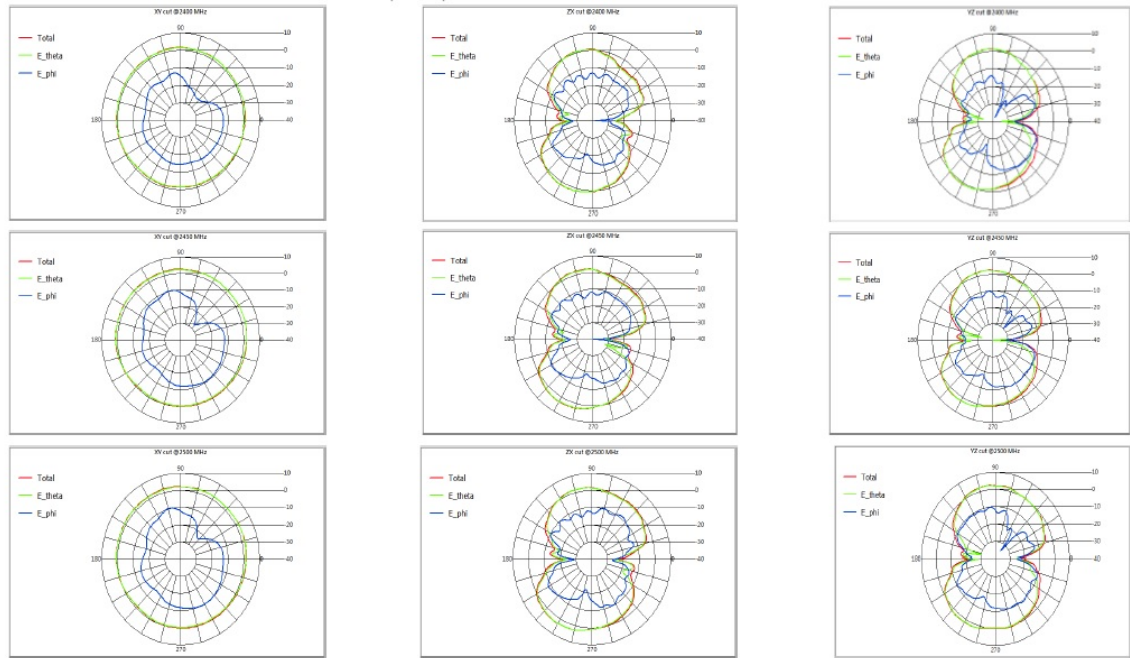
Frequency (MHz)	Peak Gain (dBi)	Efficiency (dB)	Efficiency (percentage)
2400	3.08	-2.20	60.28
2450	3.17	-2.27	59.33
2500	3.23	-2.35	58.15
5150	5.11	-1.90	64.63
5250	4.67	-1.85	65.37
5350	5.02	-1.63	67.75
5470	4.85	-1.95	63.79
5725	5.15	-2.04	62.55
5850	5.22	-2.17	60.64

**Table 87: Physical specifications**

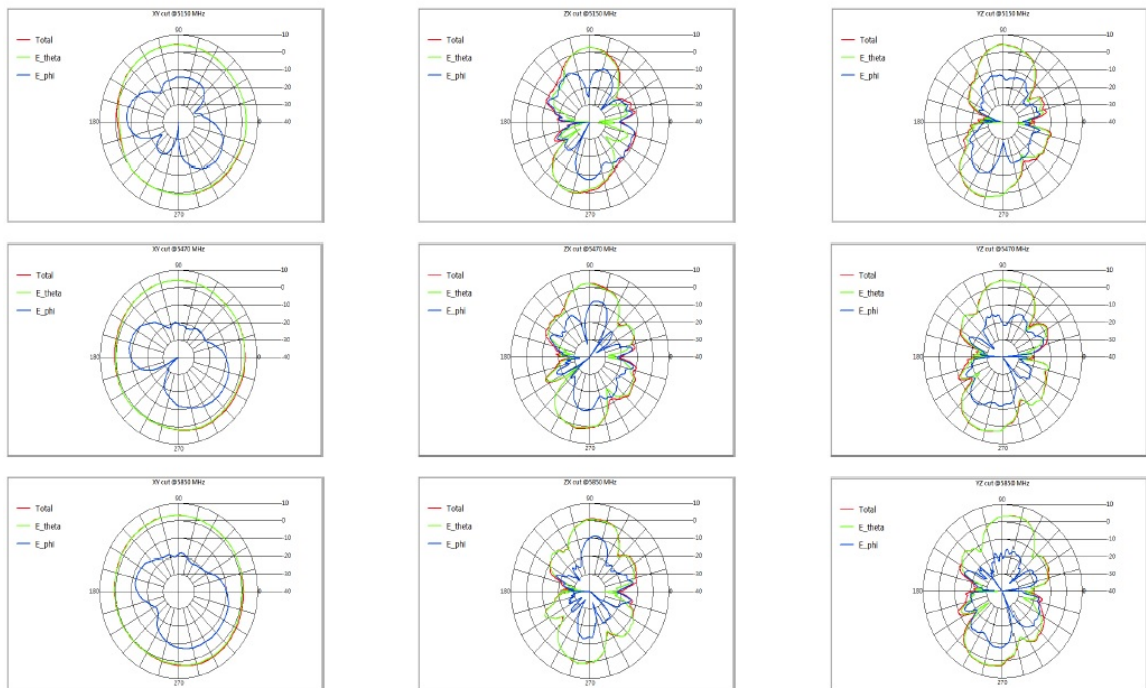
Item	Description
Operating temperature	-40 ~ +80 °C
Storage temperature	-45 ~ +85 °C
Connector	SMA plug connector
Radome material	UV protected plastic

## Radiation Patterns

The following diagrams show the radiation patterns for the AI-DS0305360-RPSMA antenna. Use this information when you pick a location for the antenna.



**Figure 92: AI-DS0305360-RPSMA 2.4G**

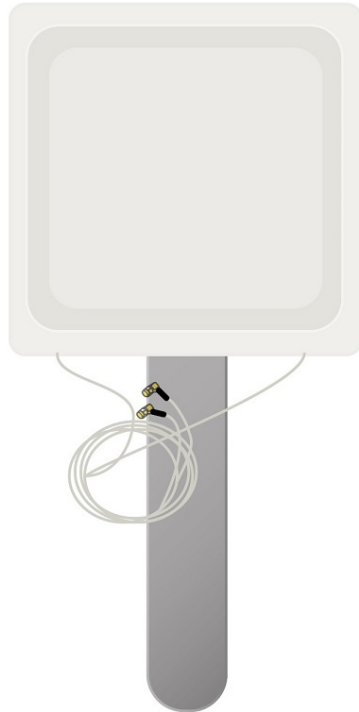


**Figure 93: AI-DS0305360-RPSMA 2.4G con't**

## AIO-DD75060-RPSMA Antenna Specifications and Radiation Patterns

The AIO-DD75060-RPSMA antenna is a dual-band sector antenna that provides coverage of 2.3 to 2.7 GHz and 4.9 to 6.1 GHz in a single antenna radome.

The AIO-DD05120-RPSMA antenna attached to a pole



Use the information in the following sections when you plan your antenna installation.

**Table 88: Electrical specifications**

Item	Description
Frequency range	2.3-2.7 GHz & 4.9-6.1 GHz
GAIN, typ.	2 x 5 dBi
VSWR, max.	2 : 1 (typ. 1.5 : 1)
Polarization	Dual Slant $\pm 45^\circ$
Input power, max.	20 watts
Input Impedance	50 Ohm

**Table 89: Mechanical specifications**

Item	Description
Dimensions (W x L x H)	200 x 200 x 33 mm (7.9 in. x 7.9 in. x 1.25 in.)
Connector	Two RP-SMA



**Table 89: Mechanical specifications (continued)**

Item	Description
Weight	25.91 grams (0.057 lbs)(400 grain)
Back Plane	Aluminum; protected through chemical passivation
Radome	UV Protected Polycarbonate
Water proofing	IP-67
Mount	-

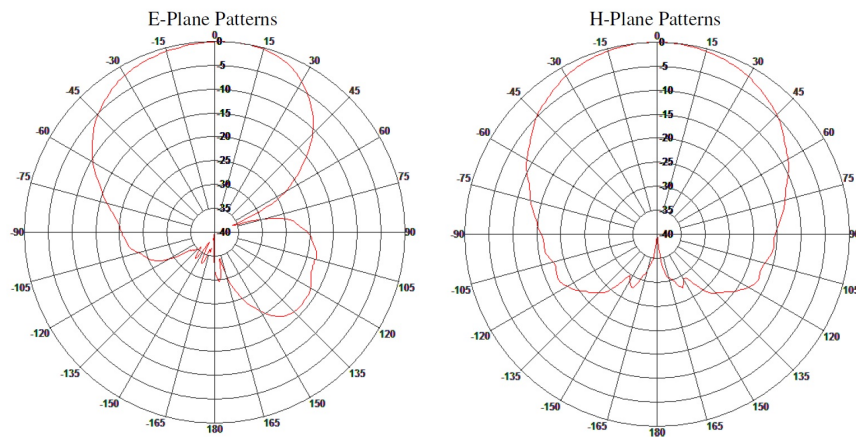
**Table 90: Environmental specifications**

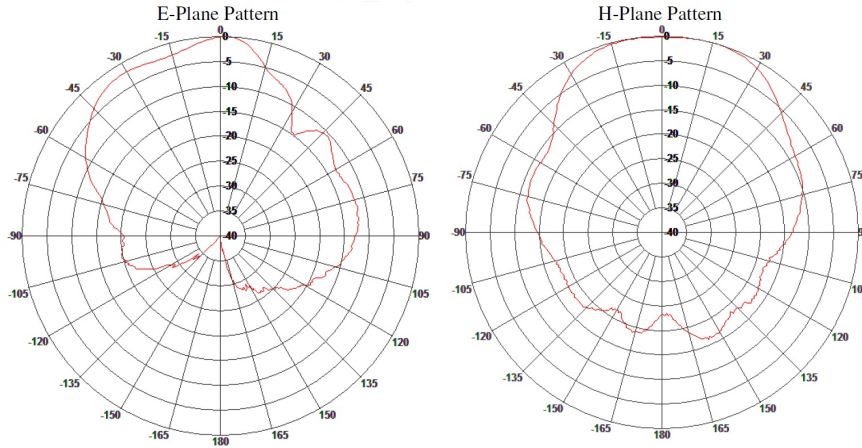
Item	Description
Operating Temperature Range	-40°C to +70°C (-40°F to +158°F)
Vibration	According to IEC 60721-3-4
Flammability	UL94
Humidity	ETS 300 019-1-4, EN 302 085 (annex A.1.1)

## Radiation patterns

The following diagrams show the radiation patterns for the AI0-DD75060-RPSMA antenna. Use this information when you pick a location for the antenna.

**Figure 94: AI0-DD75060-RPSMA 2.4GHz**

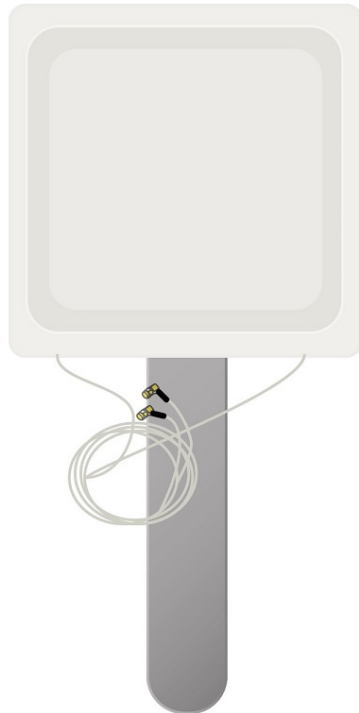




## A10-DD05120-RPSMA Antenna Specifications and Radiation Patterns

The A10-DD05129-RPSMA antenna is a dual band sector antenna that provides coverage of 2.3 to 2.7 GHz and 4.9 to 6.1 GHz in a single antenna radome.

The A10-DD05120-RPSMA antenna attached to a pole



Use the information in the following sections when you plan your antenna installation.

**Table 91: Electrical**

Item	Description
Frequency range	2.3-2.7 GHz & 4.9-6.1 GHz
GAIN, typ.	2 x 5 dBi
VSWR, max.	2 : 1 (typ. 1.5 : 1)
Polarization	Dual Slant $\pm 45^\circ$
3 dB Beam-Width, H-Plane, typ.	120°
3 dB Beam-Width, E-Plane, typ.	70°
Input power, max.	20 watts
Input Impedance	50 Ohm

**Table 92: Mechanical specifications**

Item	Descriptions
Dimensions (W x L x H)	200 x 200 x 33 mm (7.9" x 7.9" x 1.25")
Connector	Two RP-SMA
Weight	25.91 grams (0.057 lbs)(400 grain)
Back Plane	Aluminum; protected through chemical passivation
Radome	UV Protected Polycarbonate
Water Proofing	IP-67

**Table 93: Environmental specifications**

Item	Description
Operating Temperature Range	-40°C to +70°C (-40°F to +158°F)
Vibration	According to IEC 60721-3-4
Flammability	UL94
Humidity	ETS 300 019-1-4, EN 302 085 (annex A.1.1)

## Radiation patterns

The following diagrams show the radiation patterns for the AI0-DD05129-RPSMA antenna. Use this information when you pick a location for the antenna.

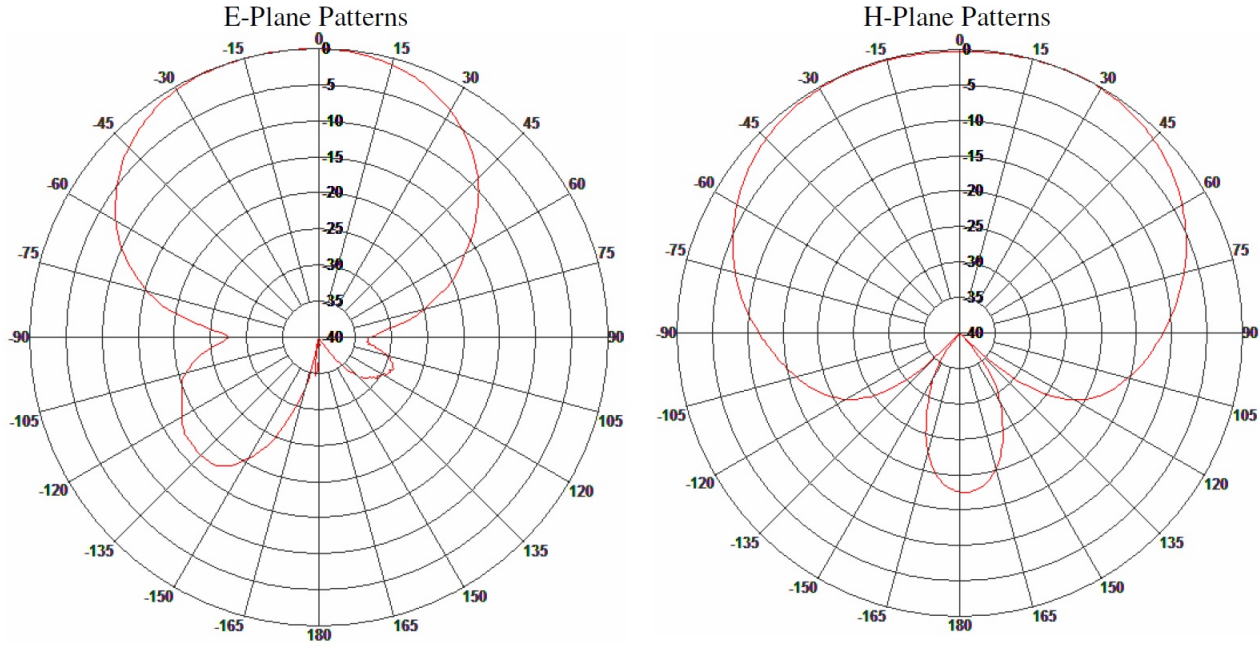


Figure 96: AI0-DD05129-RPSMA 5.5GHz

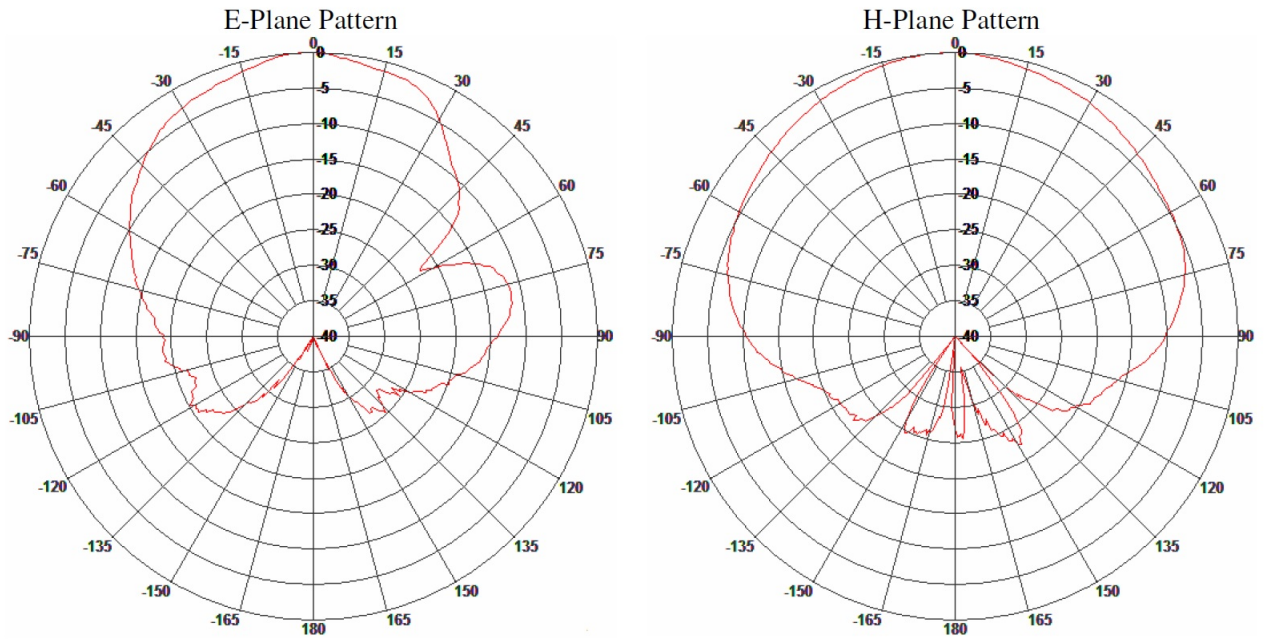
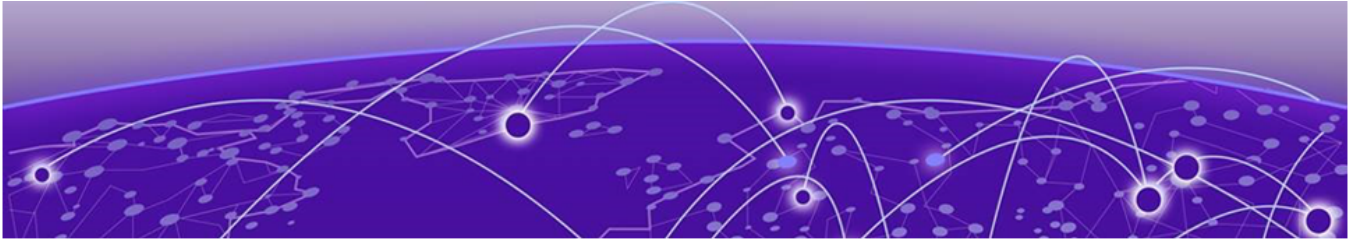


Figure 95: AI0-DD05129-RPSMA 2.5GHz



# Internal Antenna Radiation Patterns

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[AP505i Internal Antenna Radiation Patterns](#) on page 126

[AP510i Internal Antenna Radiation Patterns](#) on page 130

[AP560i Internal Antenna Radiation Patterns](#) on page 136

[AP305C Internal Antenna Radiation Patterns](#) on page 142

[AP410C Internal Antenna Radiation Patterns](#) on page 145

[AP460C Internal Antenna Radiation Patterns](#) on page 149

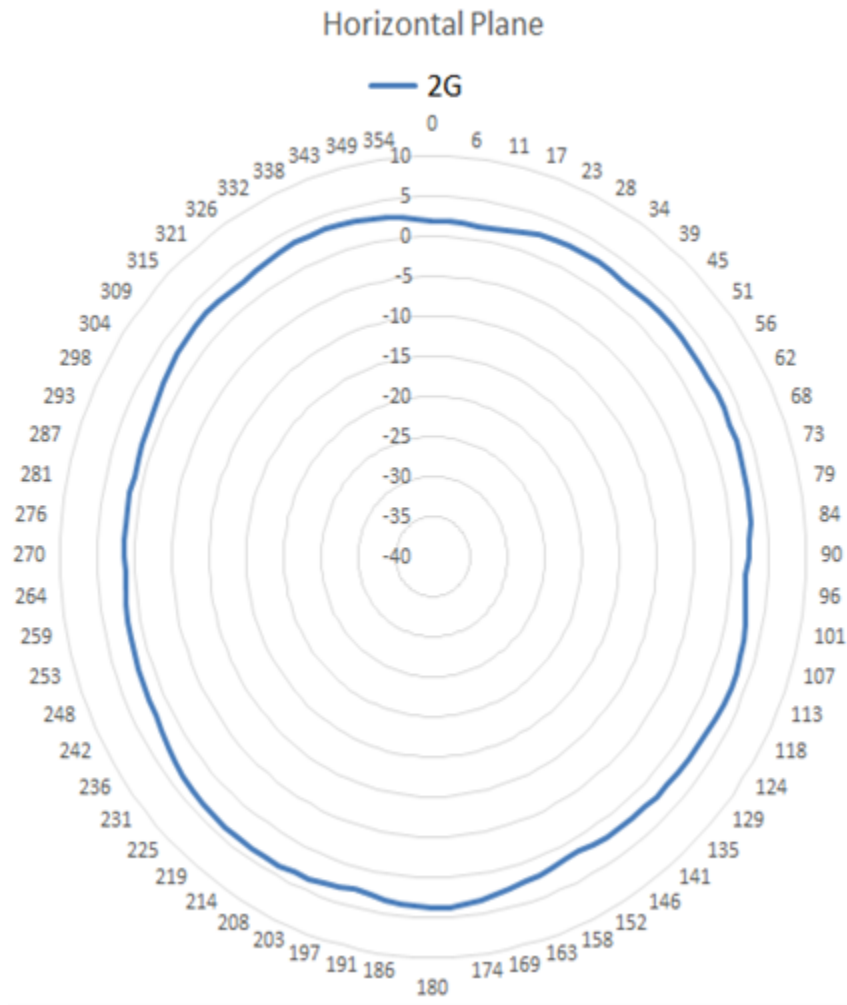
[AP460S6C Internal Antenna Radiation and Sensor Patterns](#) on page 153

[AP460S12C Internal Antenna Radiation and Sensor Patterns](#) on page 163

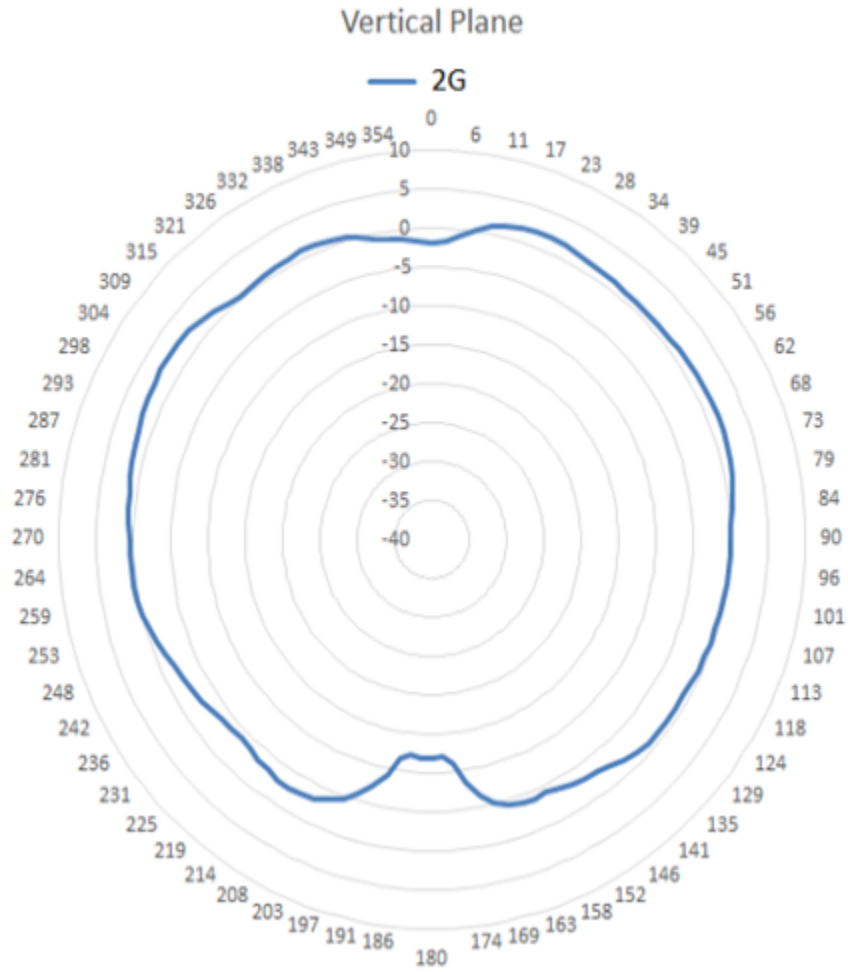
[AP3000 Internal Antenna Specifications and Radiation Patterns](#) on page 172

Details of the radiation patterns for the internal antennas used with ExtremeWireless WiFi6 11.ax indoor access points.

## AP505i Internal Antenna Radiation Patterns



**Figure 97: 2.4 GHz azimuth pattern**



**Figure 98: 2.4 GHz elevation pattern**

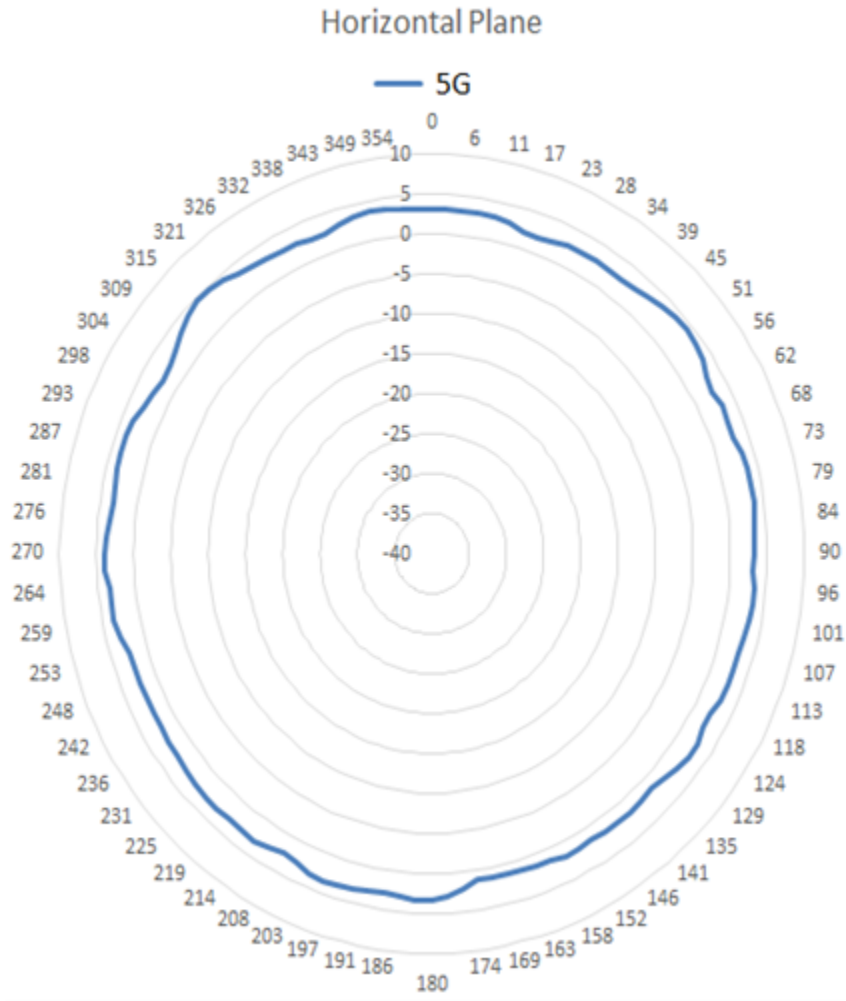


Figure 99: 5 GHz azimuth pattern



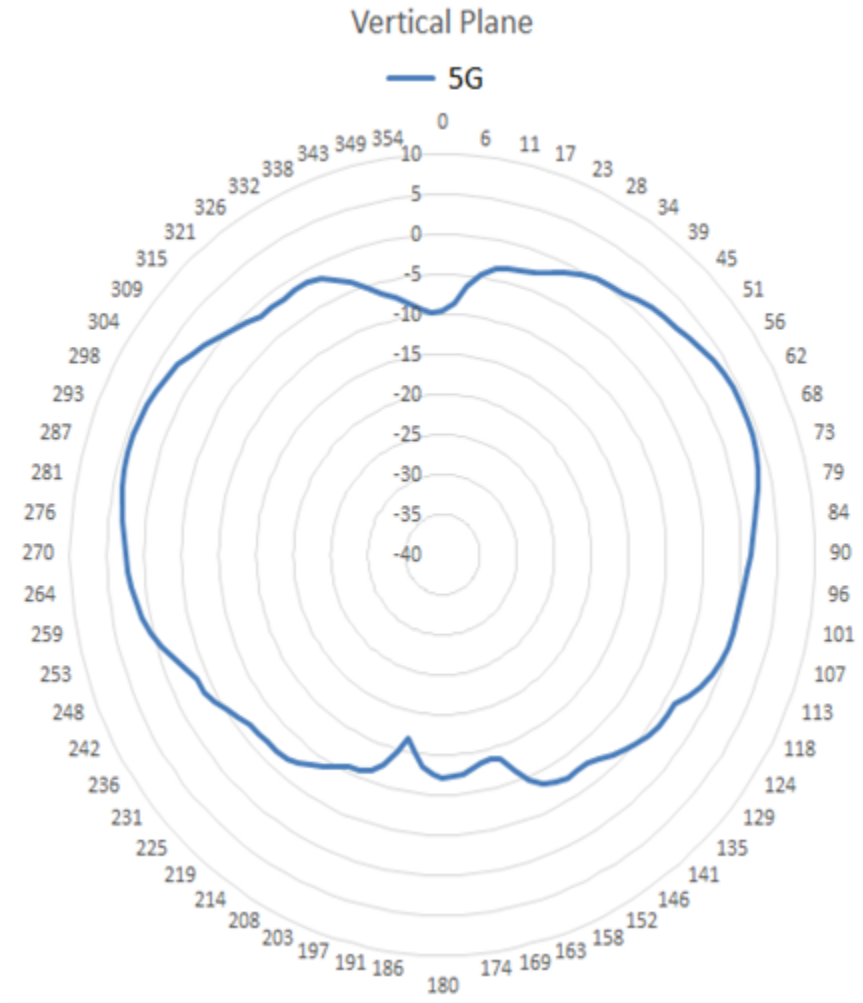
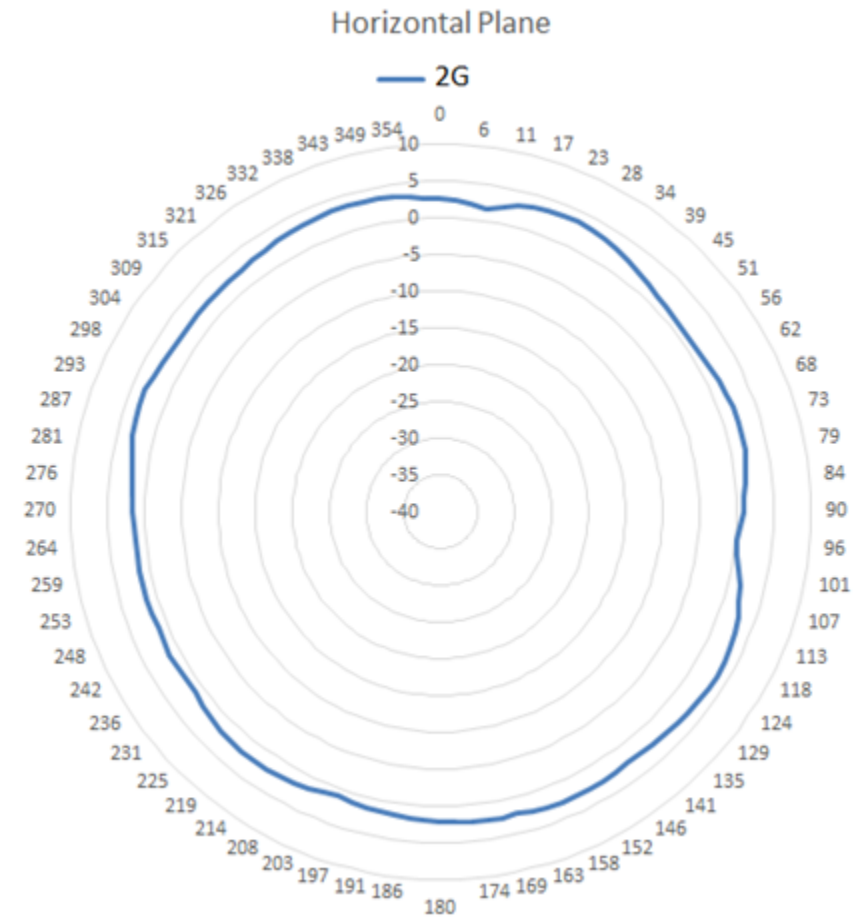
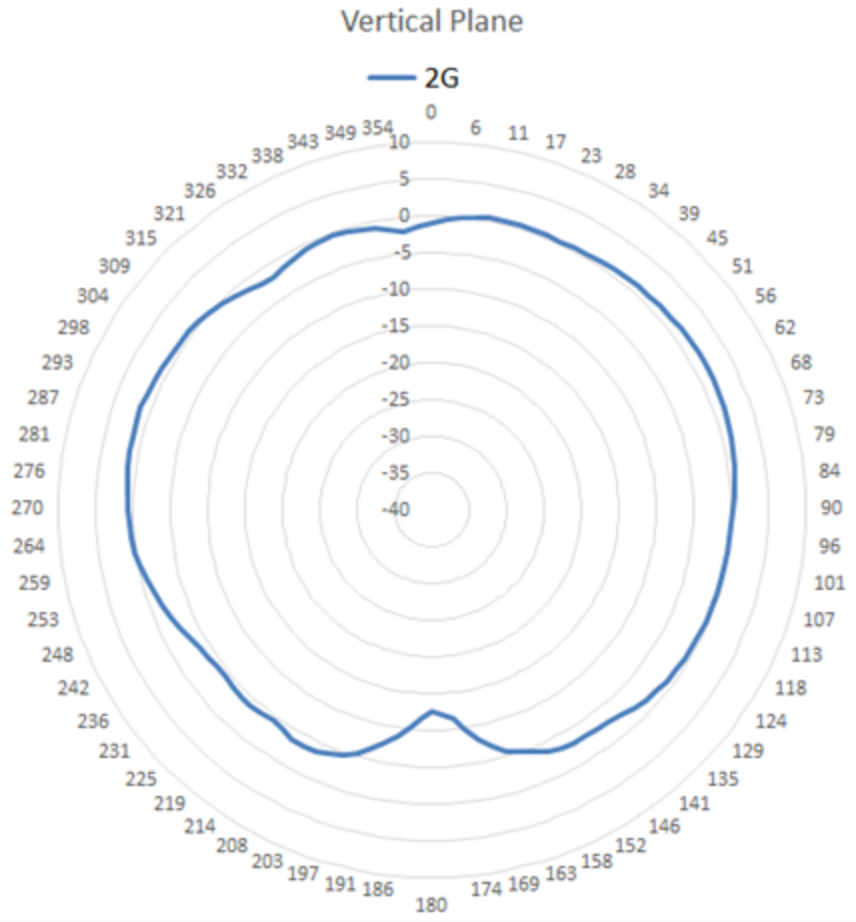


Figure 100: 5 GHz elevation pattern

## AP510i Internal Antenna Radiation Patterns



**Figure 101: 2.4 GHz azimuth pattern**



**Figure 102: 2.4 GHz elevation pattern**

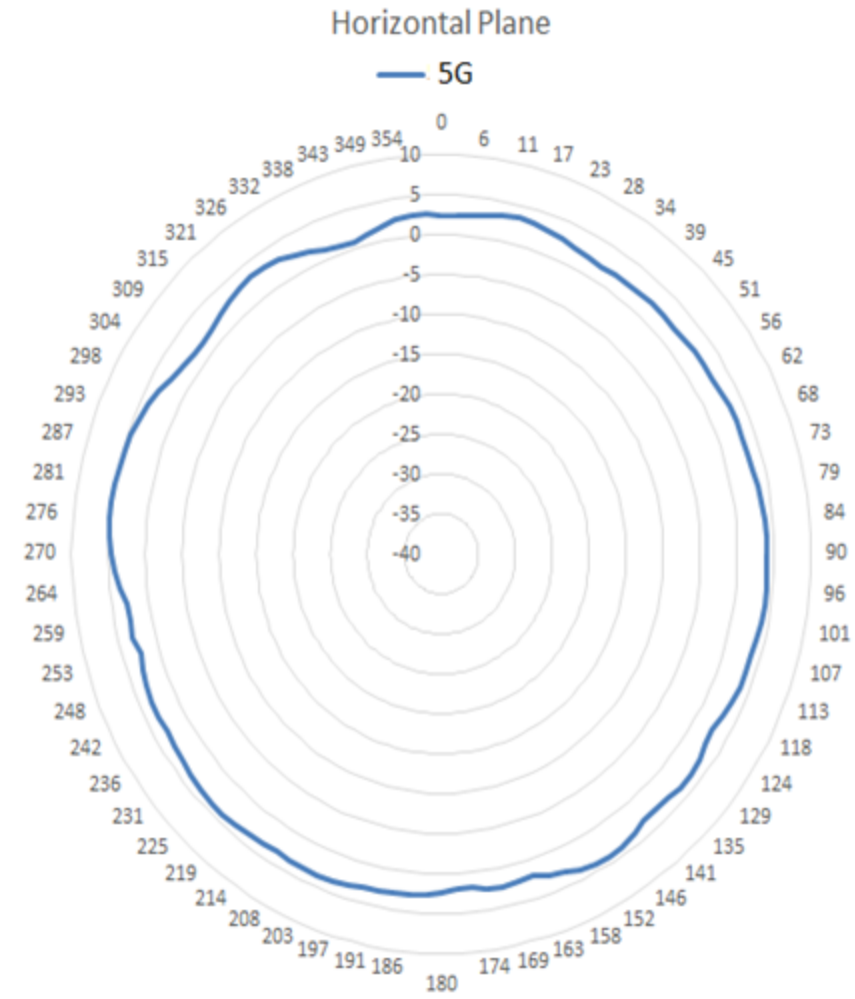
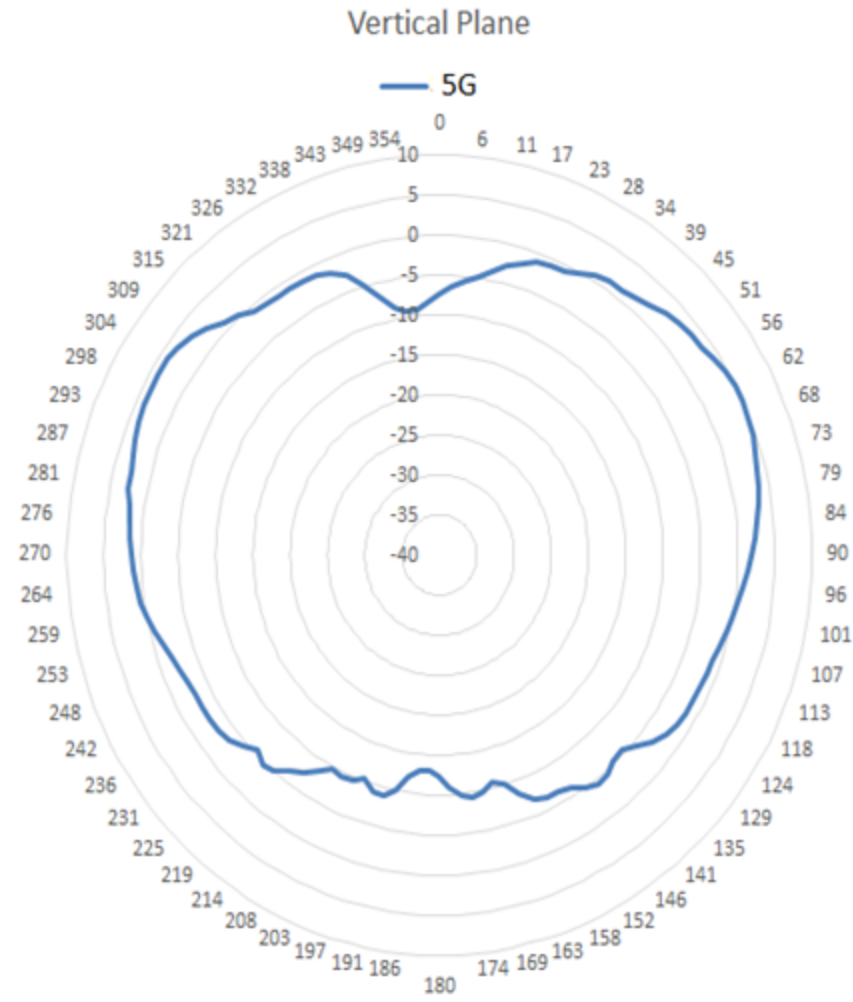


Figure 103: 5 GHz radio 1 azimuth pattern



**Figure 104: 5 GHz radio 1 elevation pattern**

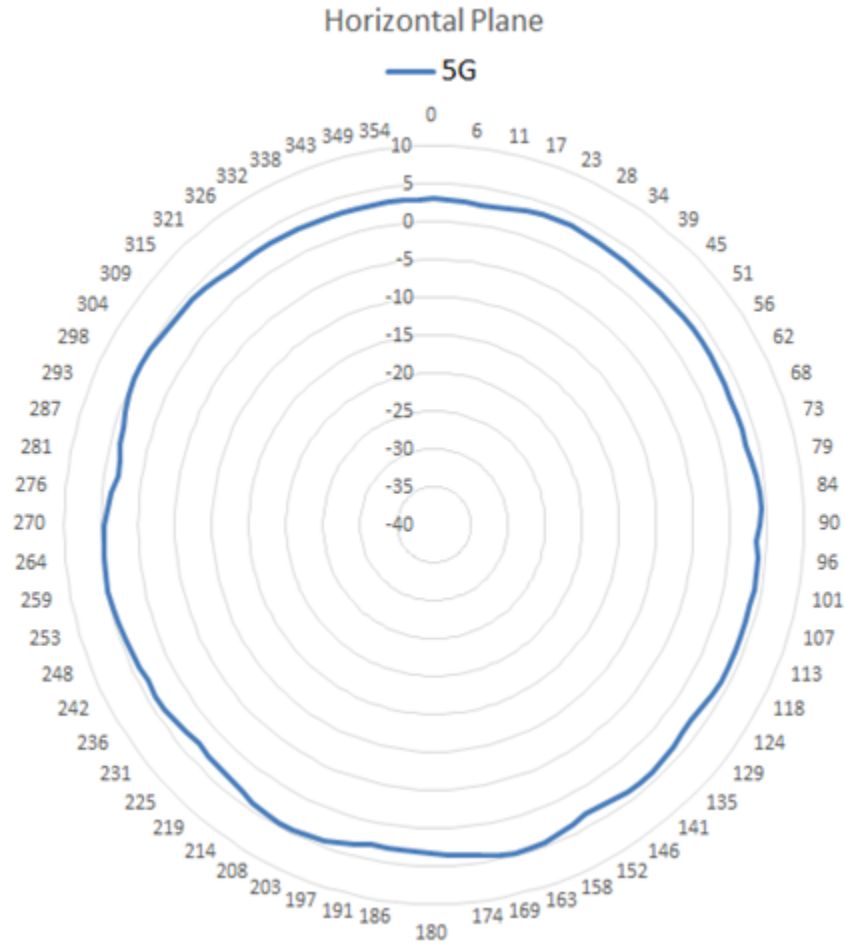


Figure 105: 5 GHz radio 2 azimuth pattern

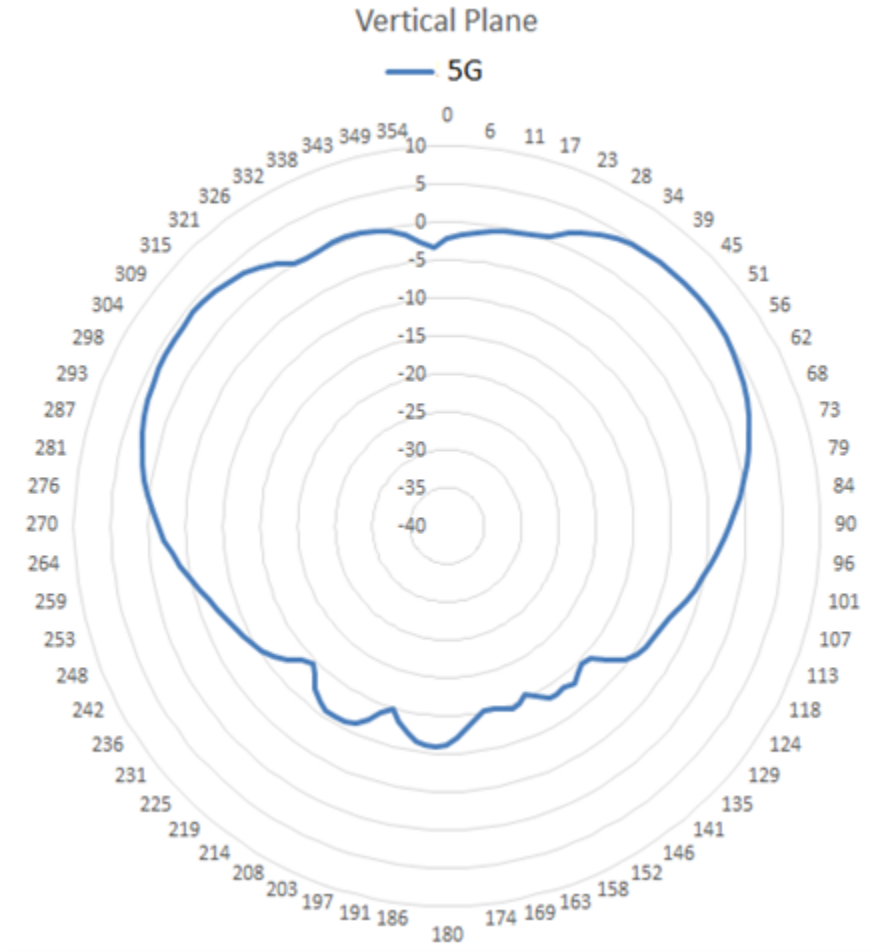


Figure 106: 5 GHz radio 2 elevation pattern

## AP560i Internal Antenna Radiation Patterns

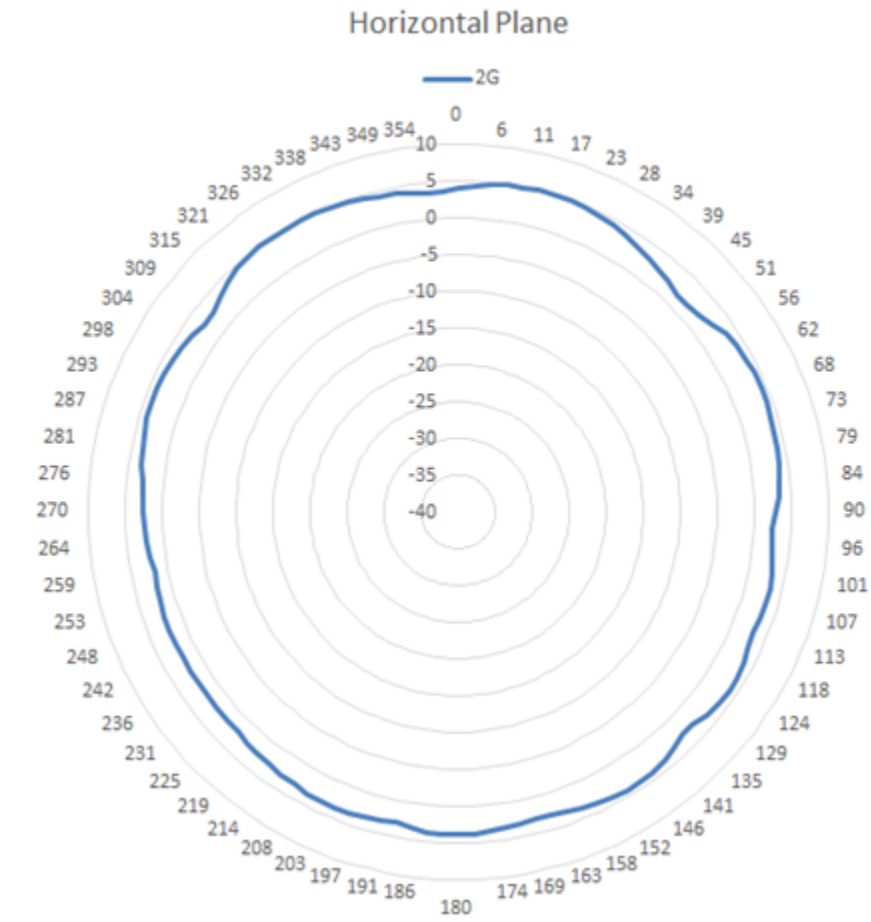
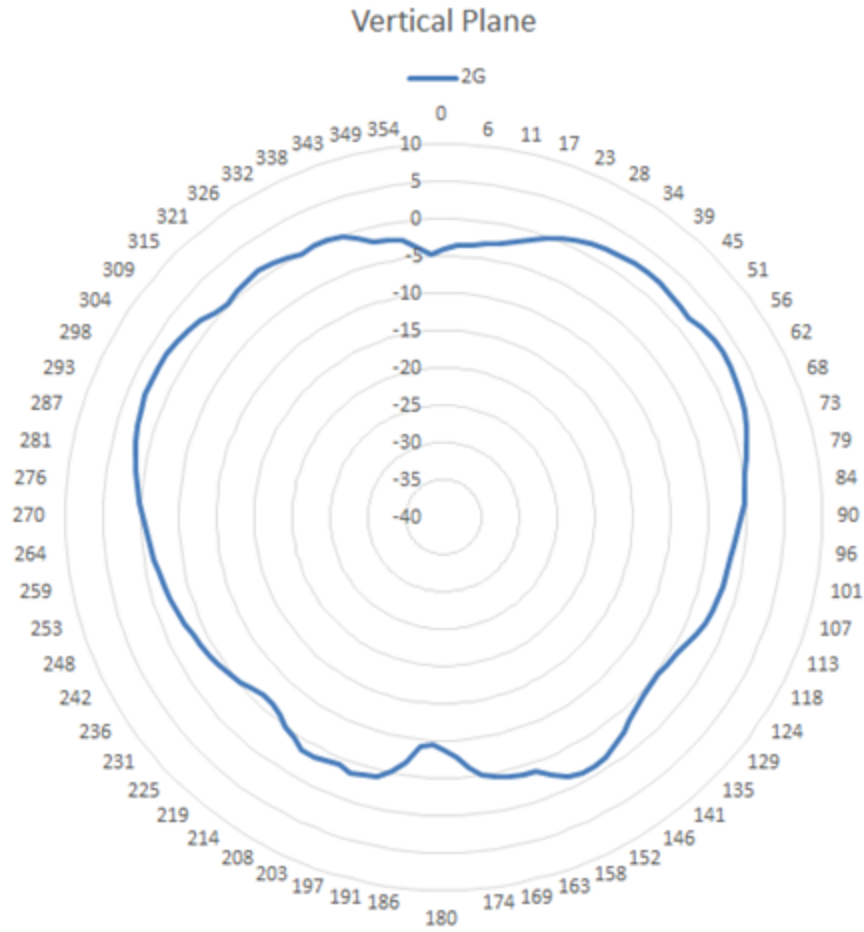


Figure 107: 2.4 GHz azimuth pattern





**Figure 108: 2.4 GHz elevation pattern**

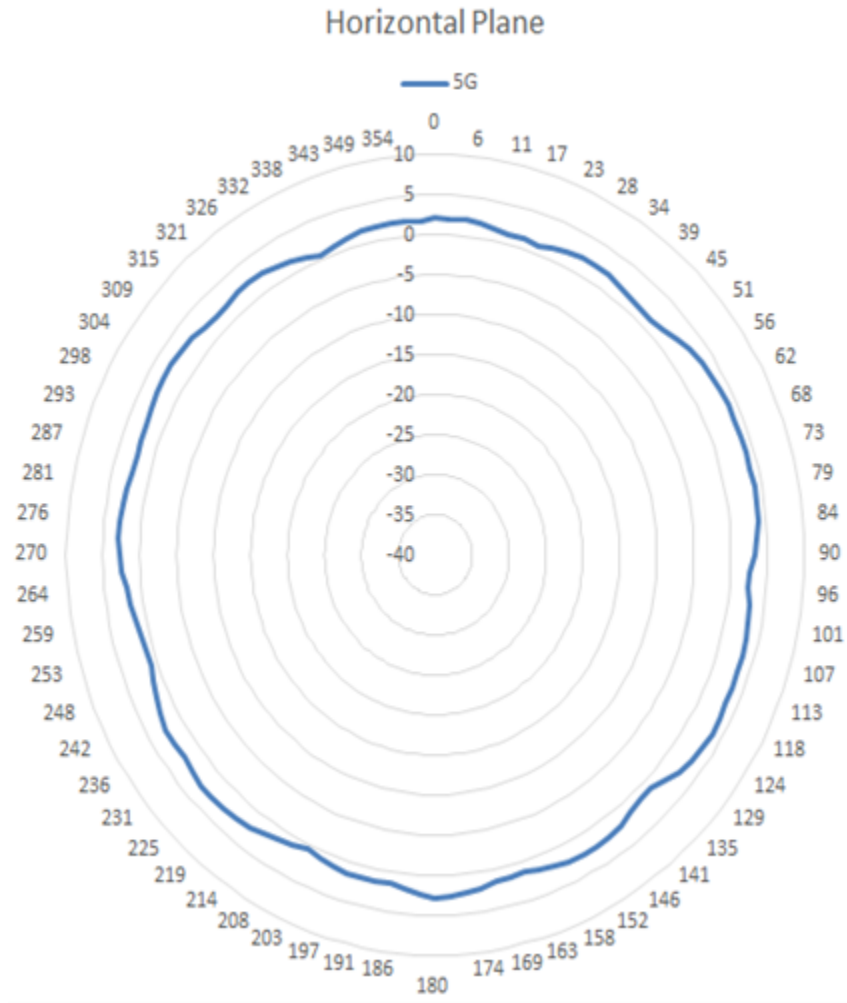


Figure 109: 5 GHz radio 1 azimuth pattern

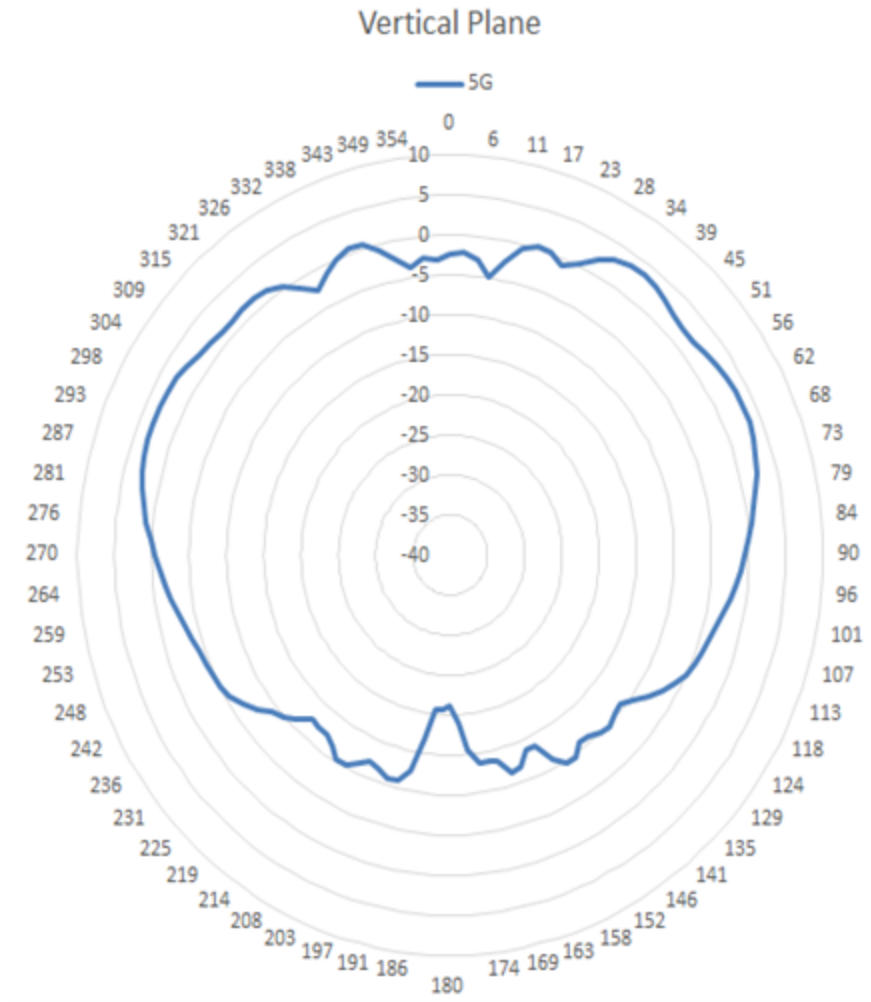


Figure 110: 5 GHz radio 1 elevation pattern

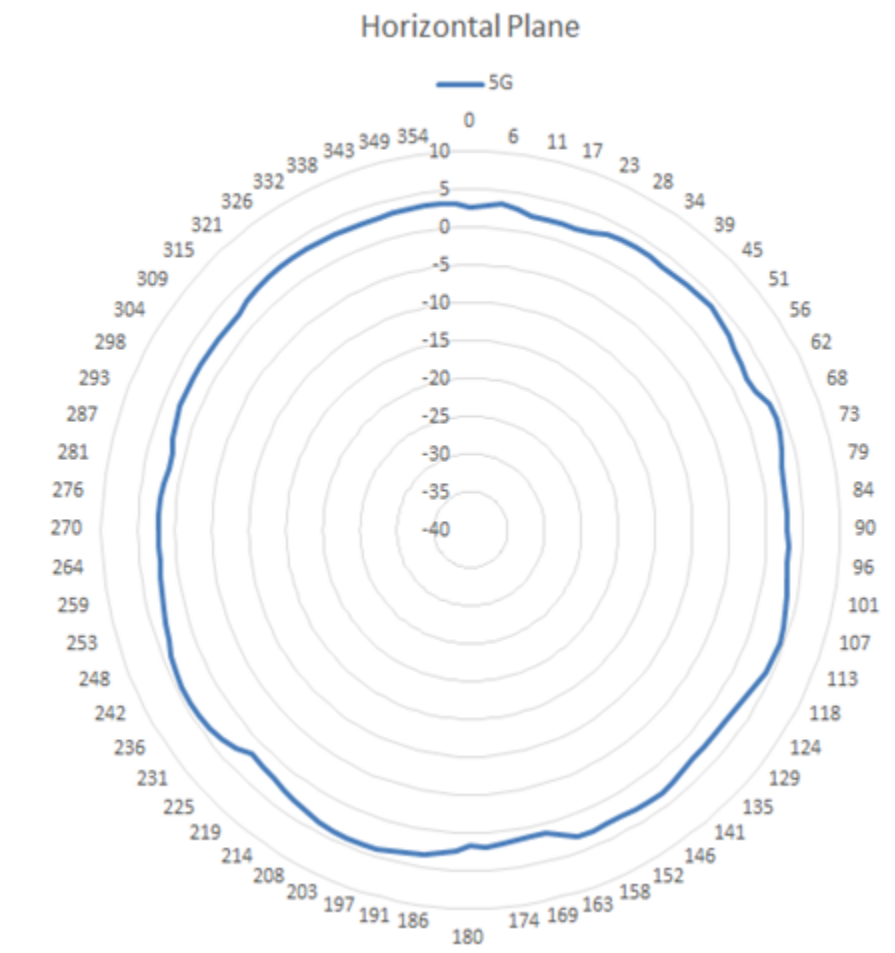
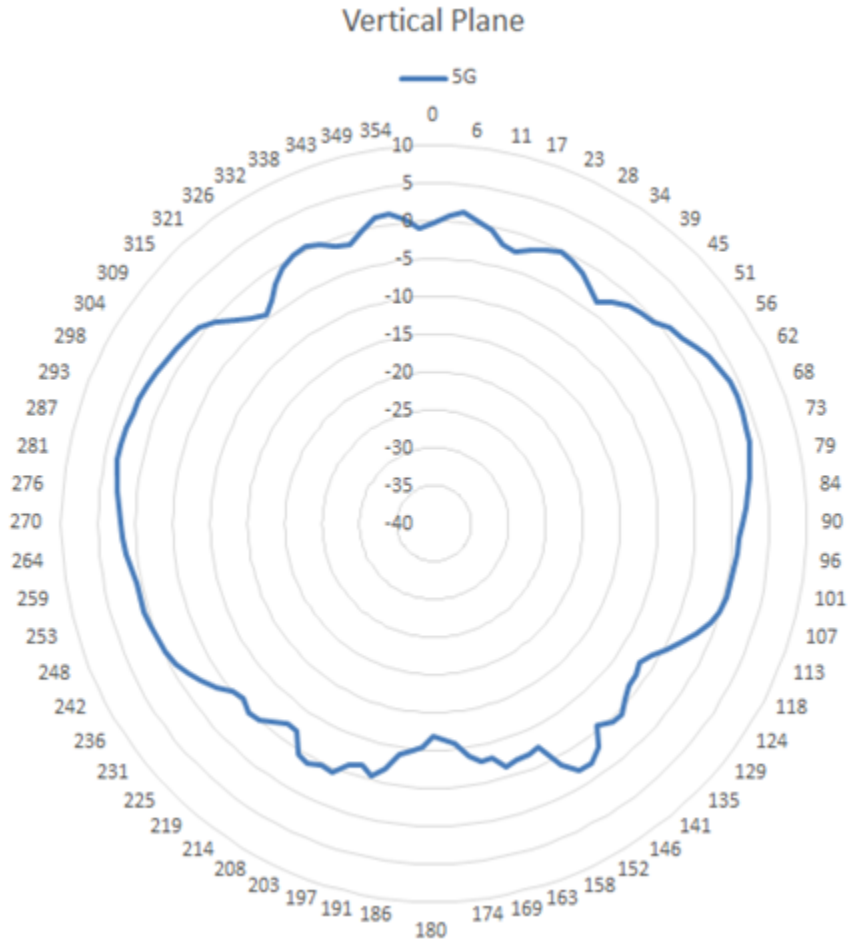
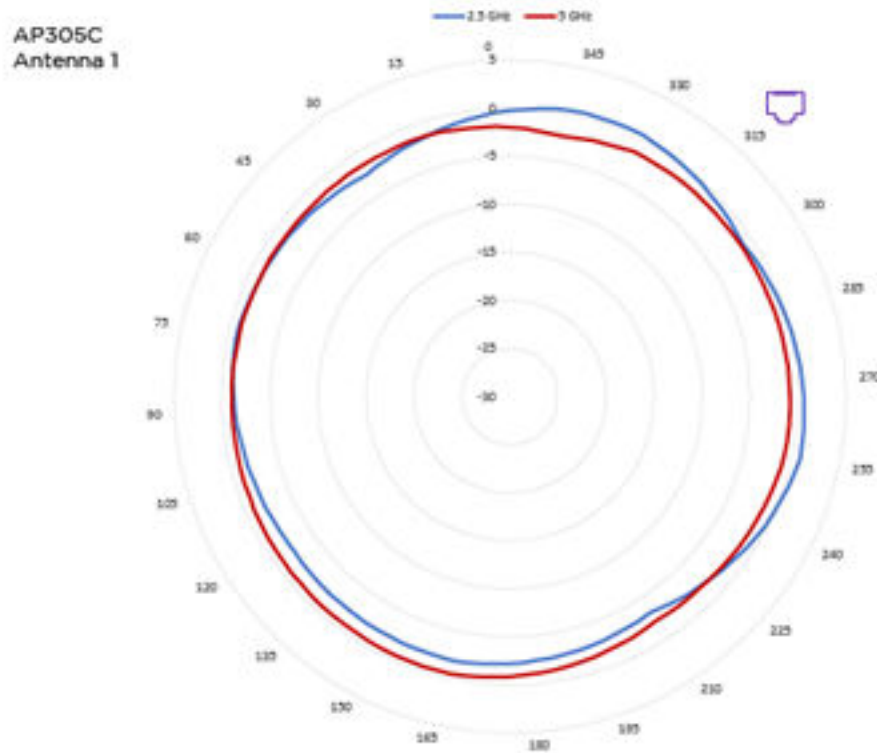


Figure 111: 5 GHz radio 2 azimuth pattern



**Figure 112: 5 GHz radio 2 elevation pattern**

## AP305C Internal Antenna Radiation Patterns



**Figure 113: AP305C antenna 1 2.5 GHz and 5 GHz radiation pattern**

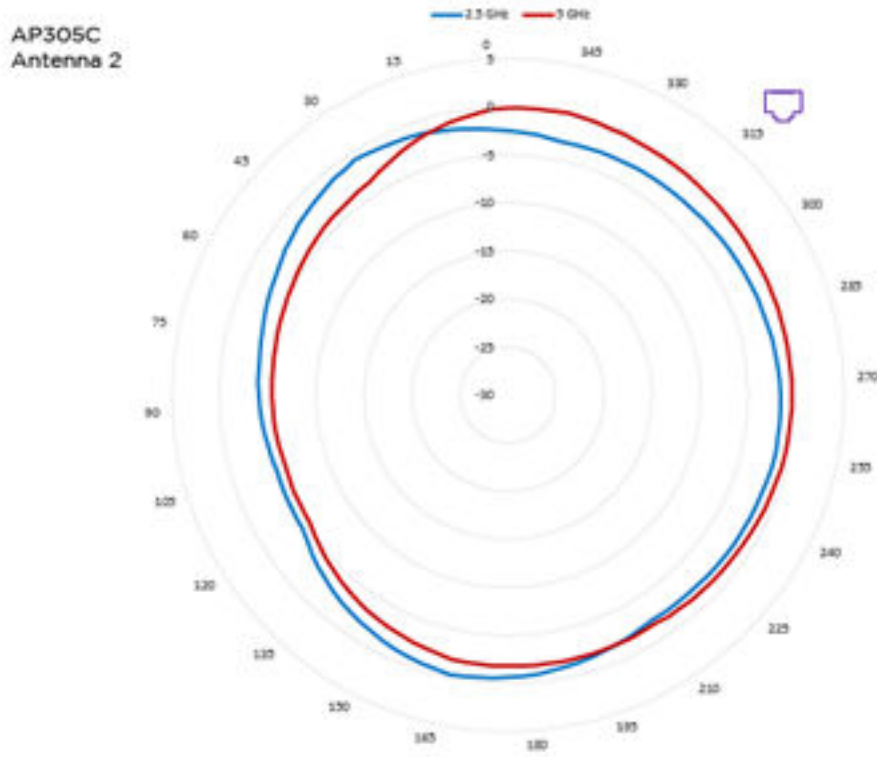


Figure 114: AP305C antenna 2 2.5 GHz and 5 GHz radiation pattern

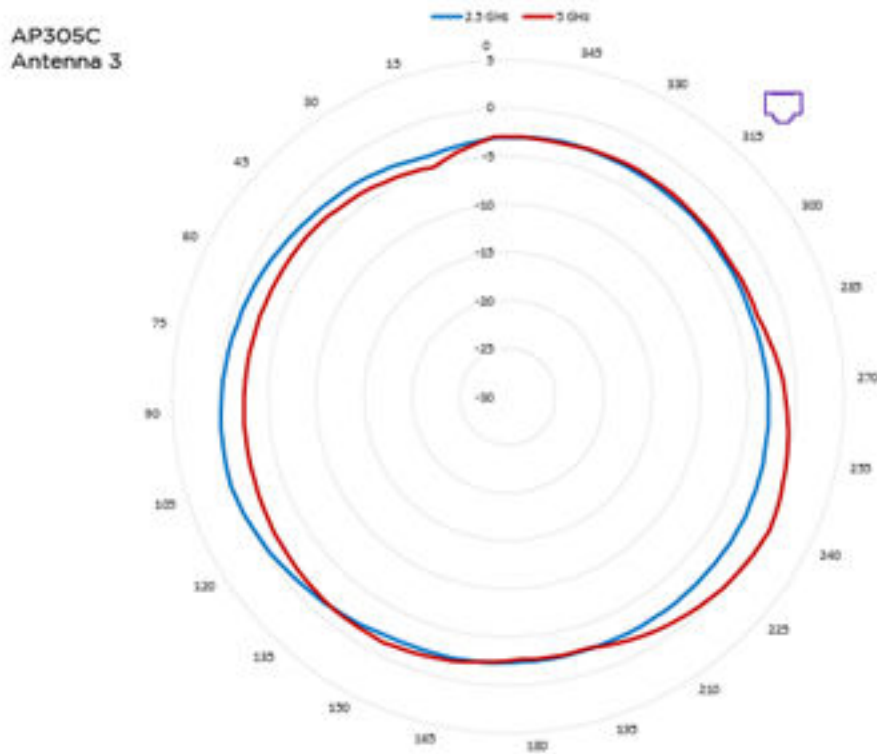
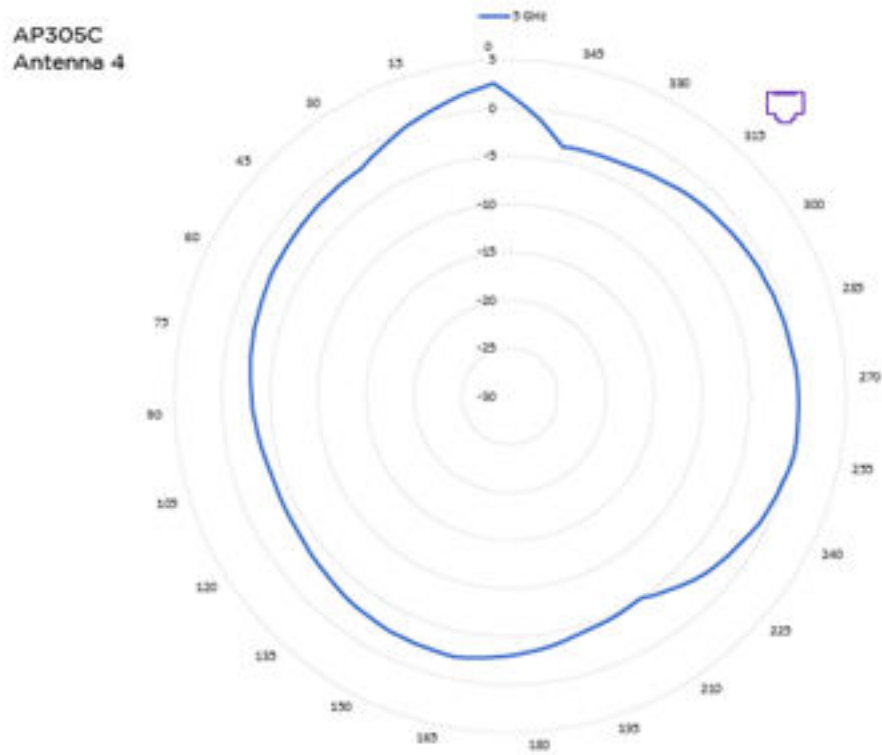


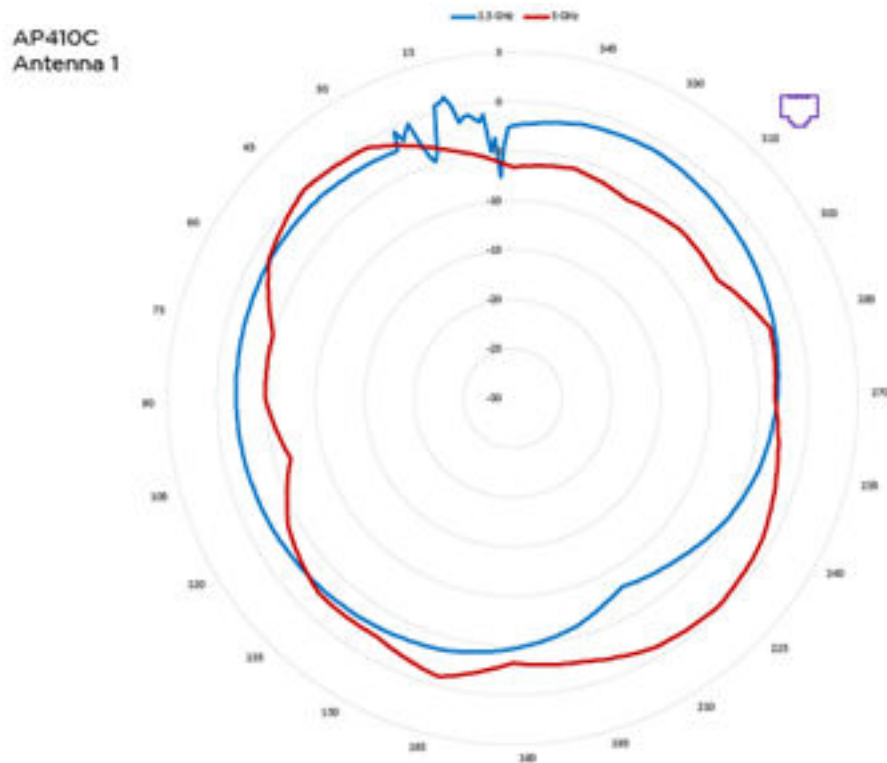
Figure 115: AP305C antenna 3 2.5 GHz and 5 GHz radiation pattern



**Figure 116: AP305C antenna 4 5 GHz radiation pattern**



## AP410C Internal Antenna Radiation Patterns



**Figure 117: AP410C antenna 1 2.5 GHz and 5 GHz radiation pattern**

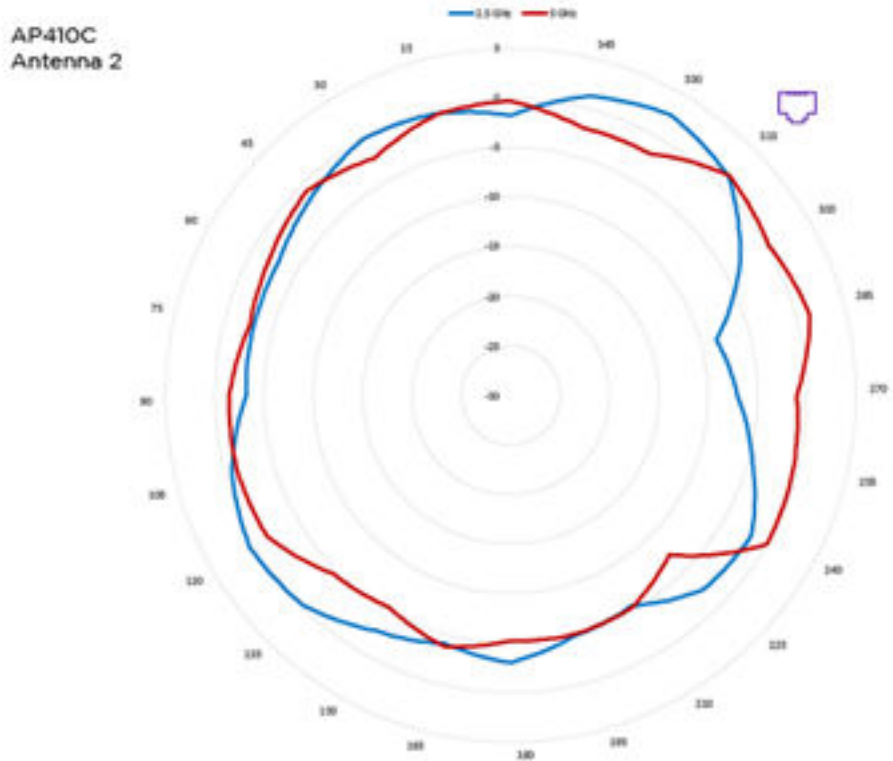


Figure 118: AP410C antenna 2 2.5 GHz and 5 GHz radiation pattern

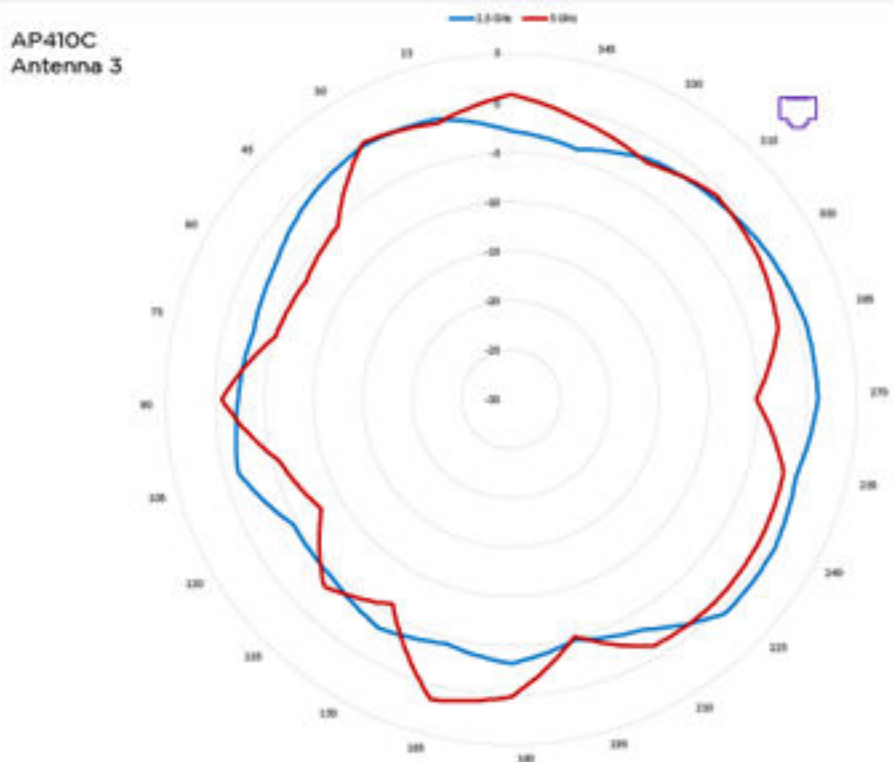


Figure 119: AP410C antenna 3 2.5 GHz and 5 GHz radiation pattern

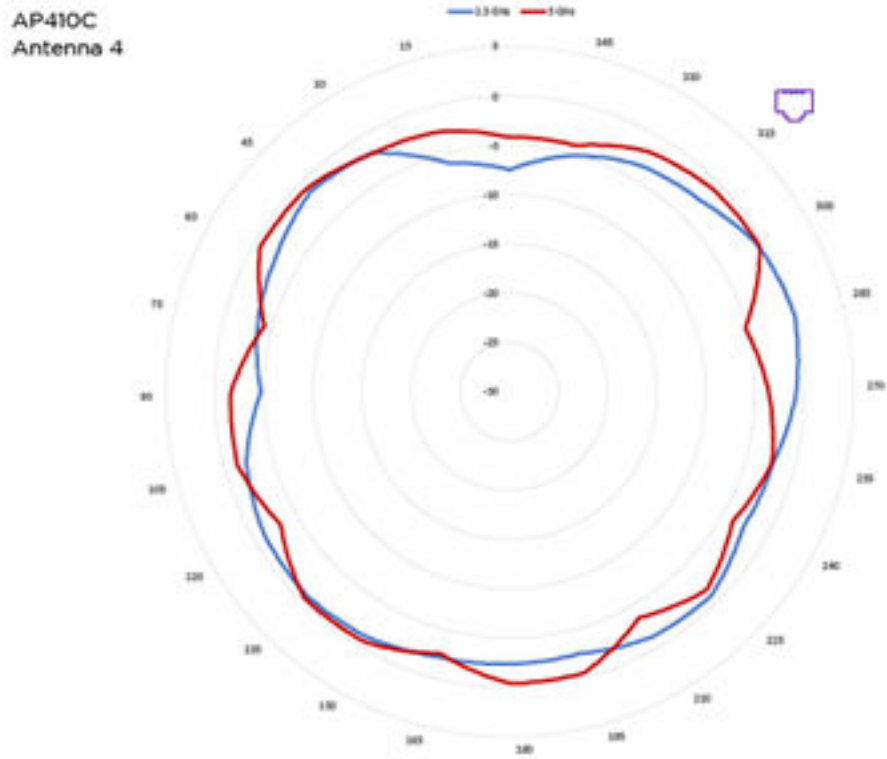


Figure 120: AP410C antenna 4 2.5 GHz and 5 GHz radiation pattern

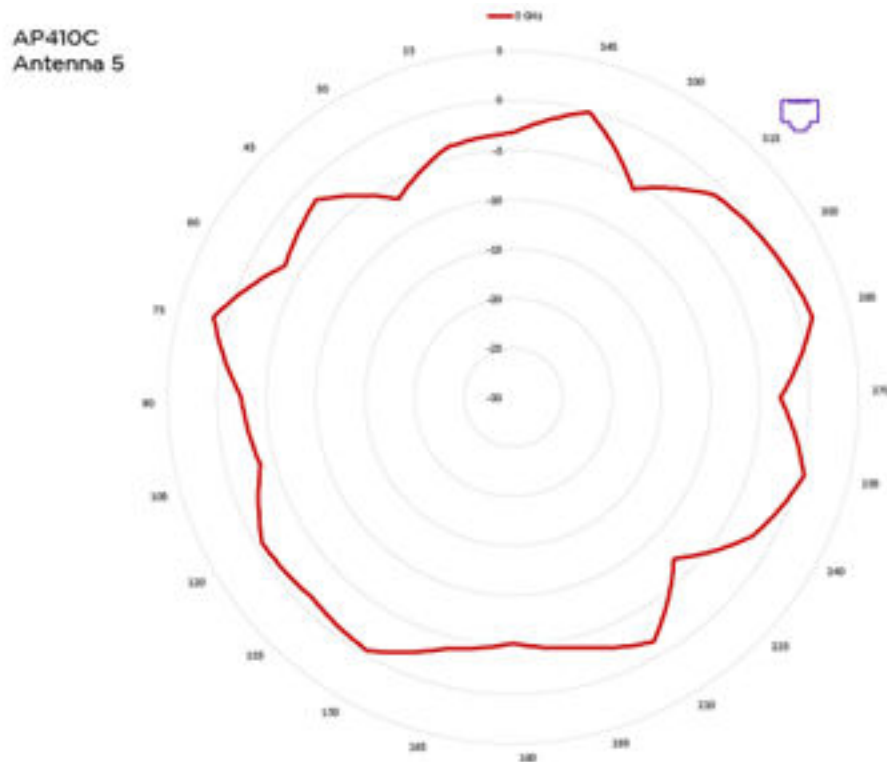
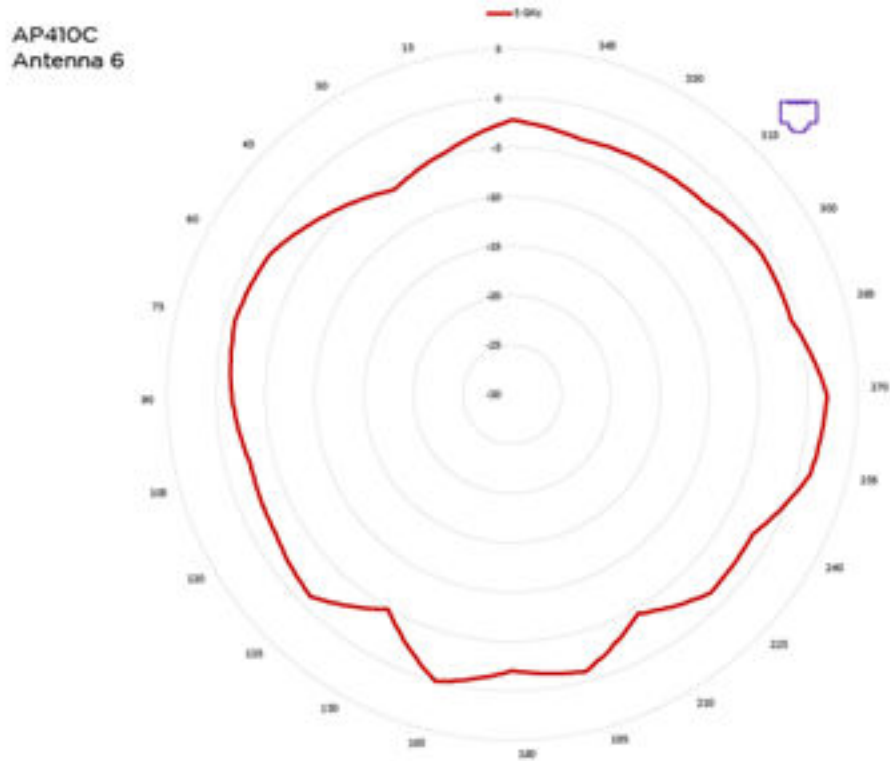
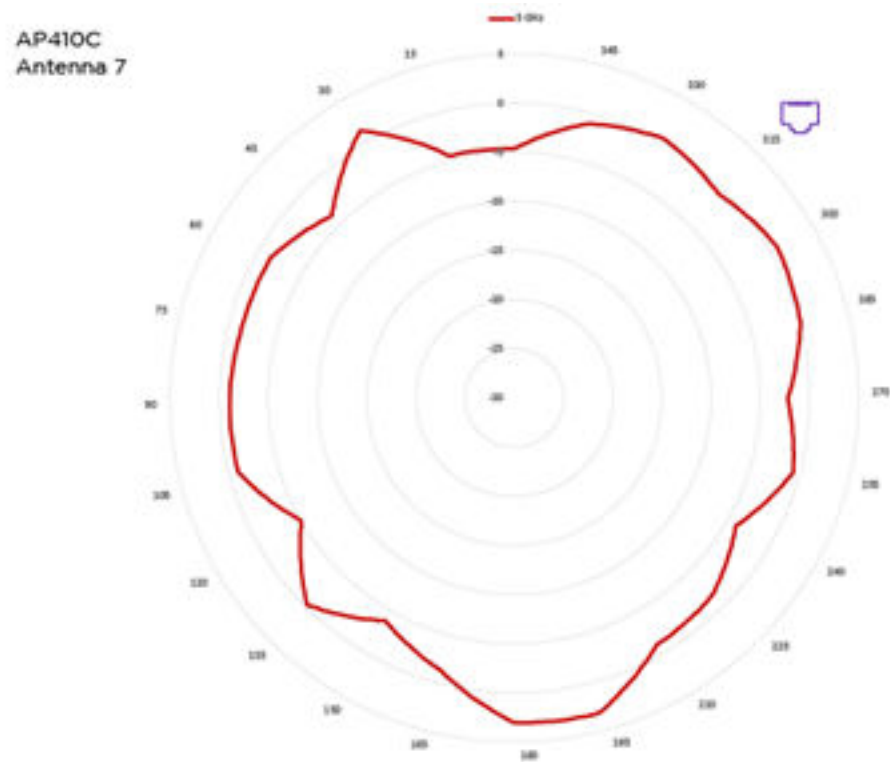


Figure 121: AP410C antenna 5, 5 GHz radiation pattern

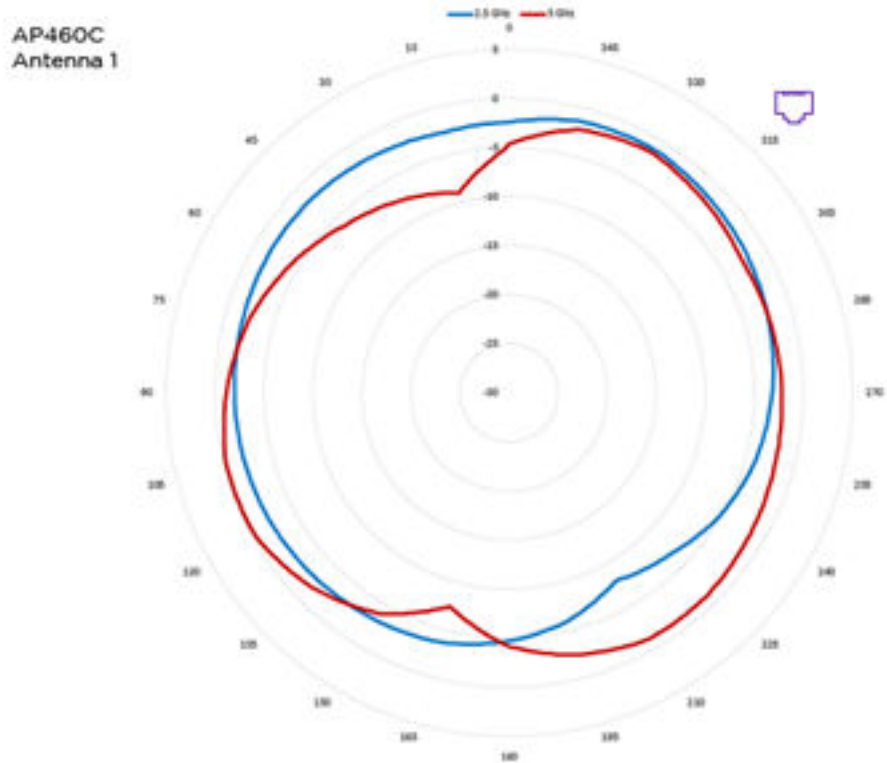


**Figure 122: AP410C antenna 6 5 GHz radiation pattern**



**Figure 123: AP410C antenna 7 5 GHz radiation pattern**

## AP460C Internal Antenna Radiation Patterns



**Figure 124: AP460C antenna 1 2.5 GHz and 5 GHz radiation pattern**

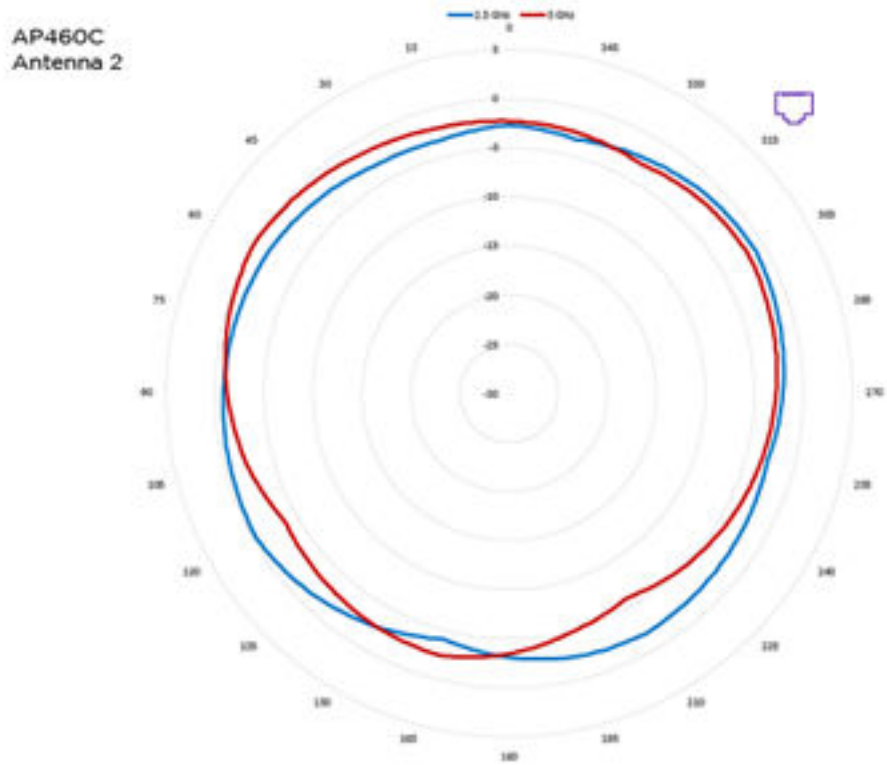


Figure 125: AP460C antenna 2 2.5 GHz and 5 GHz radiation pattern

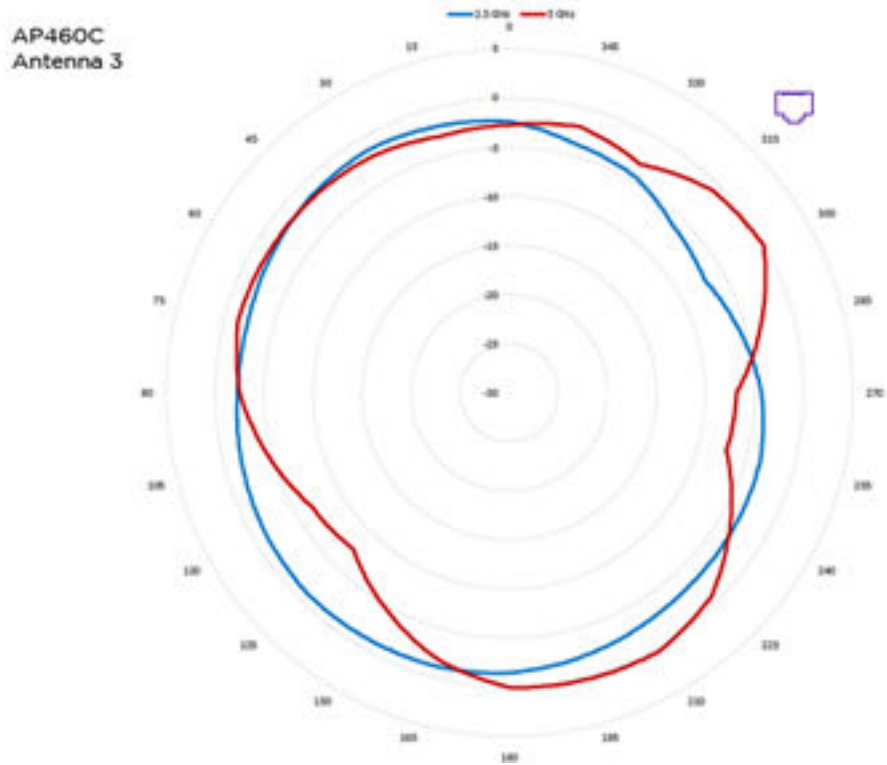


Figure 126: AP460C antenna 3 2.5 GHz and 5 GHz radiation pattern

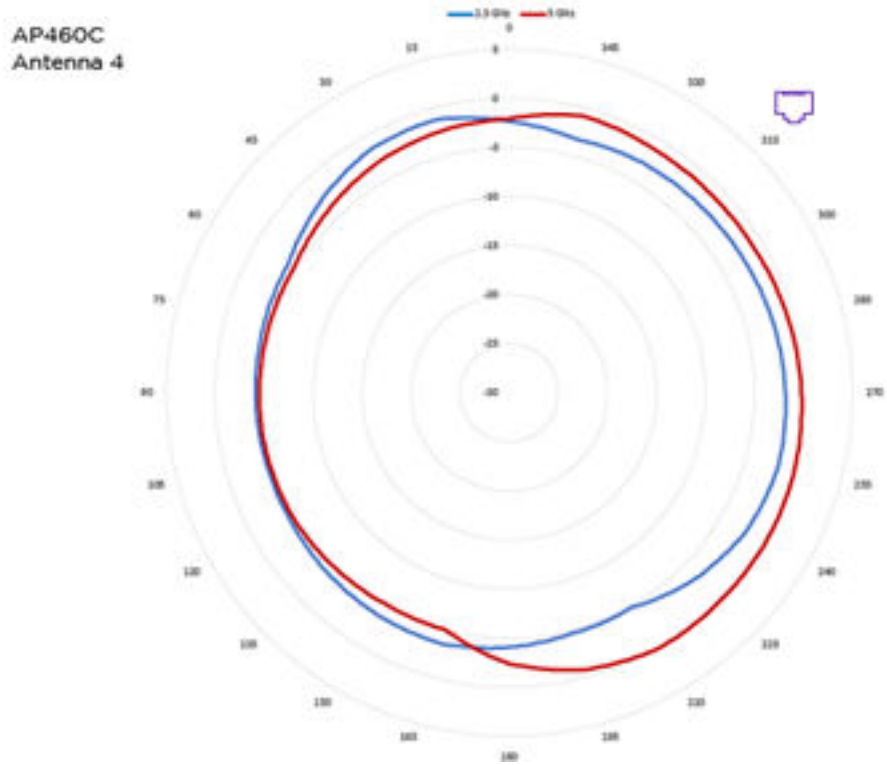


Figure 127: AP460C antenna 4 2.5 GHz and 5 GHz radiation pattern

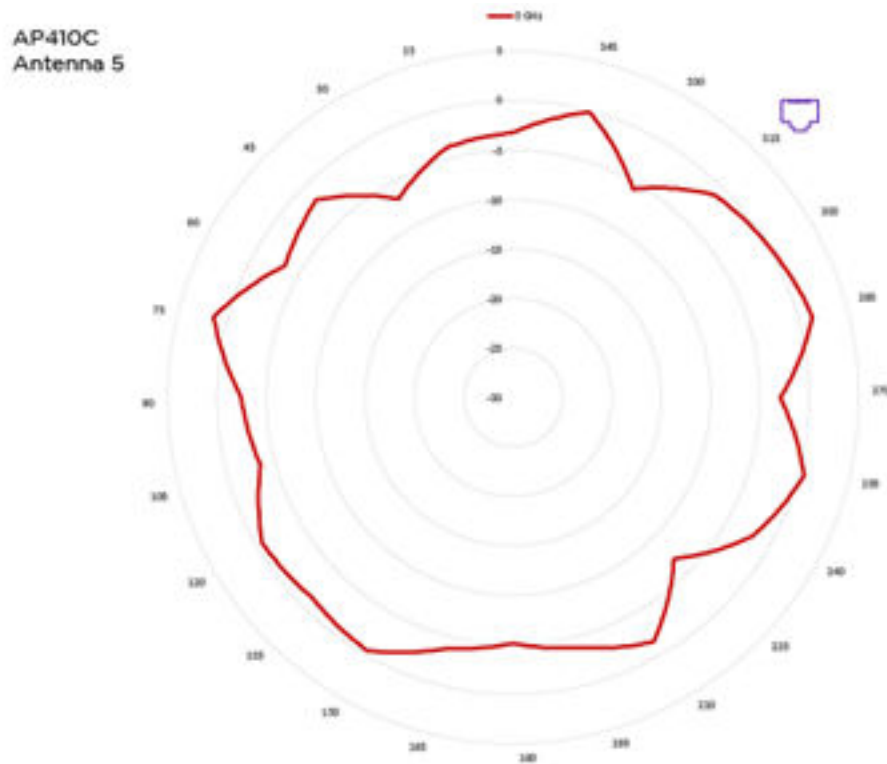


Figure 128: AP460C antenna 5, 5 GHz radiation pattern

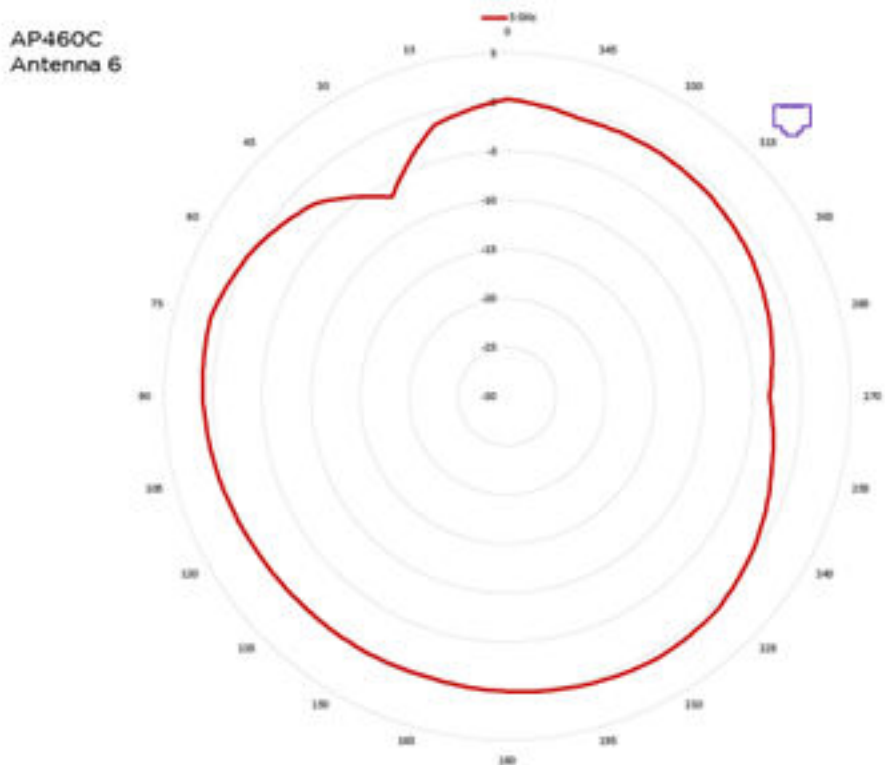


Figure 129: AP460C antenna 6 5 GHz radiation pattern

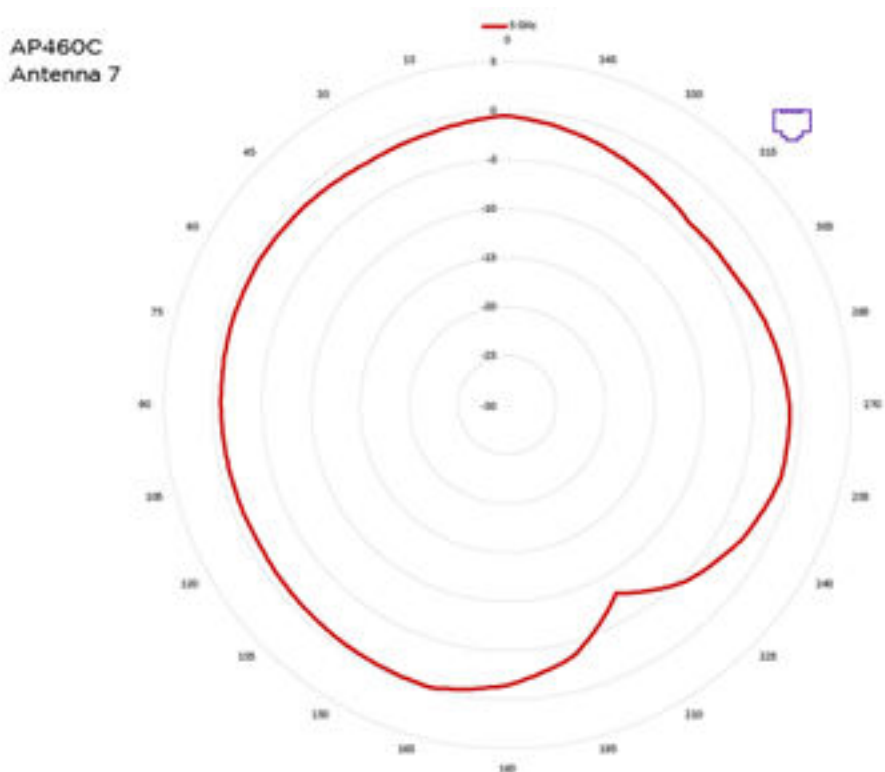


Figure 130: AP460C antenna 7 5 GHz radiation pattern



## AP460S6C Internal Antenna Radiation and Sensor Patterns

AP460S6C access point internal antenna radio patterns

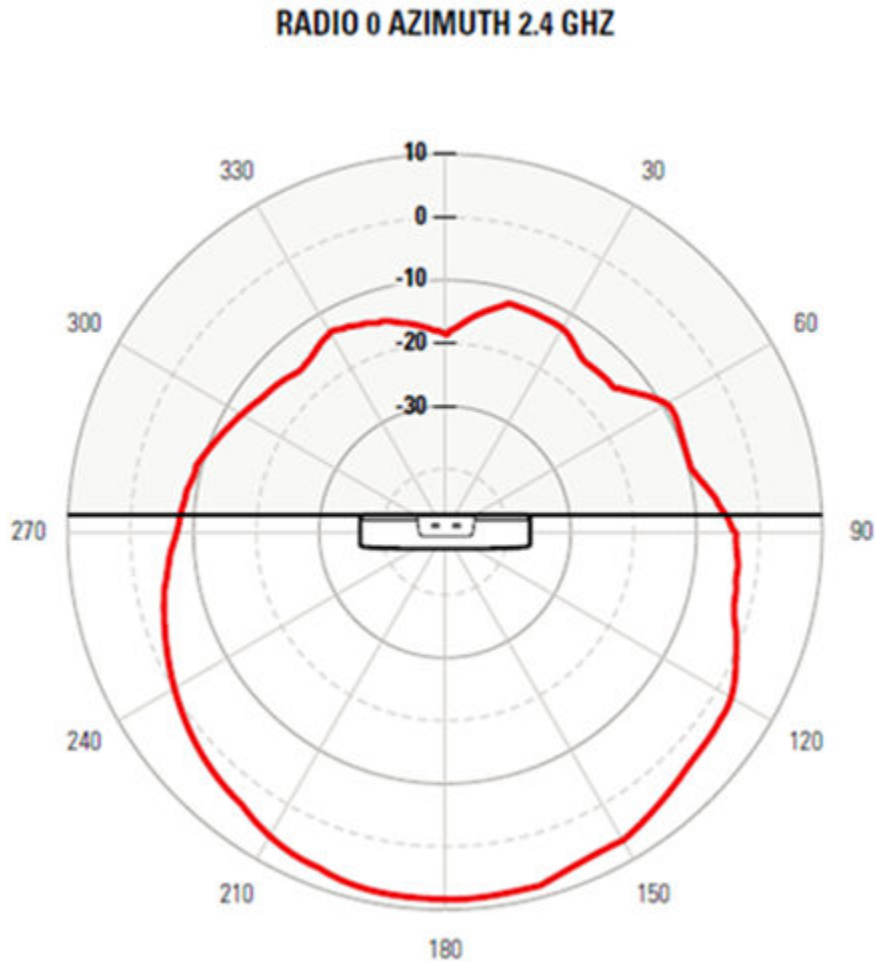
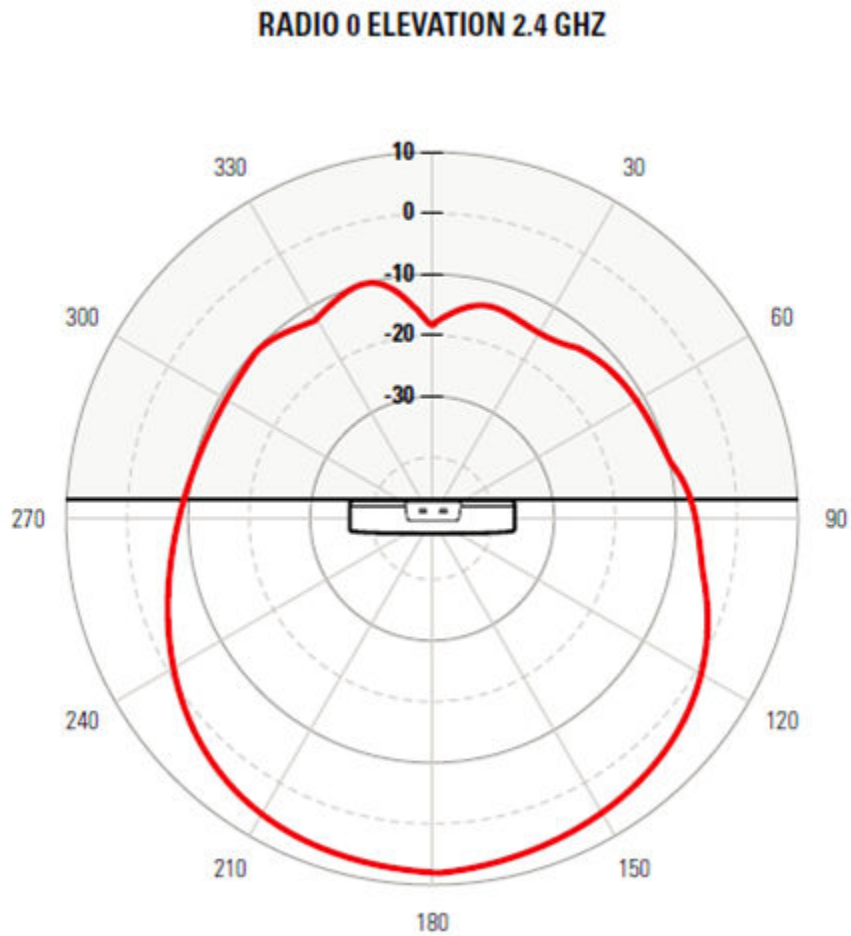


Figure 131: AP460S6C radio 0 2.4 GHz azimuth pattern



**Figure 132: AP460S6C radio 0 2.4 GHz elevation pattern**

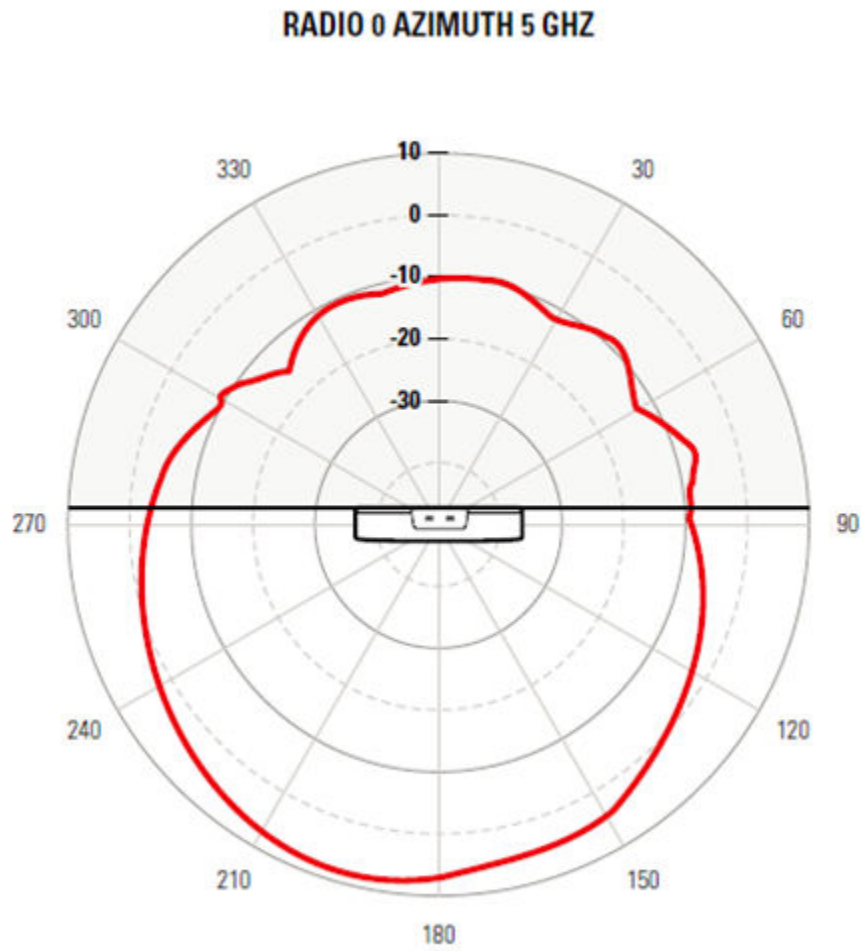


Figure 133: AP460S6C radio 0 5 GHz azimuth pattern

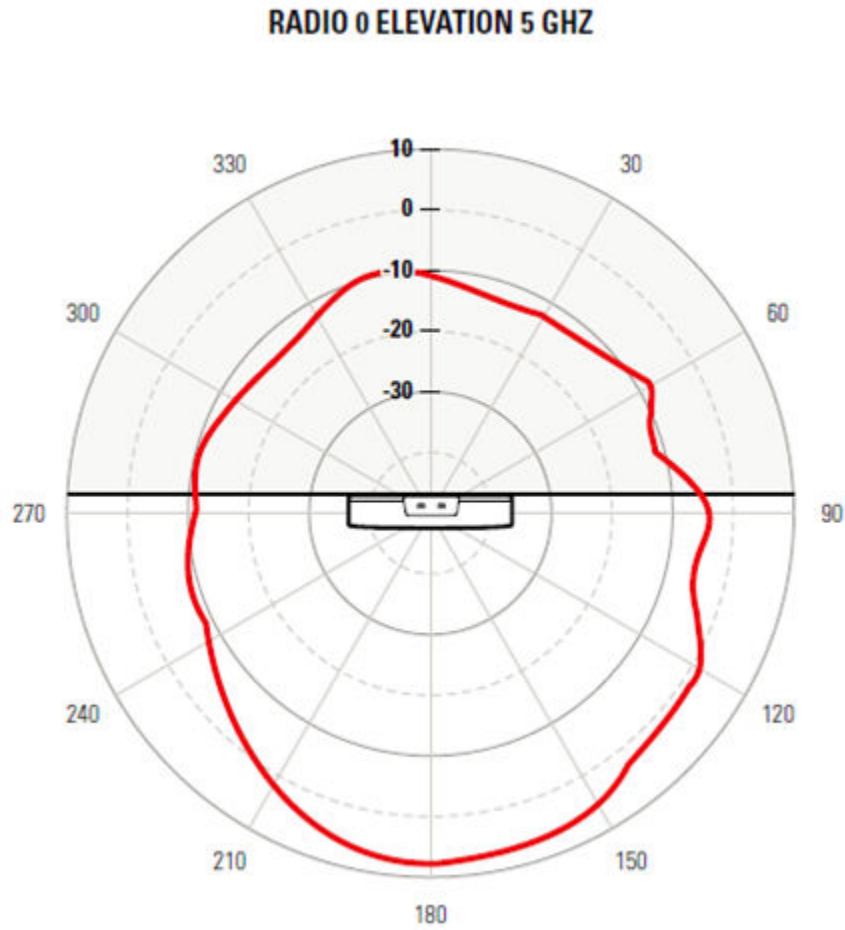


Figure 134: AP460S6C radio 0 5 GHz elevation pattern

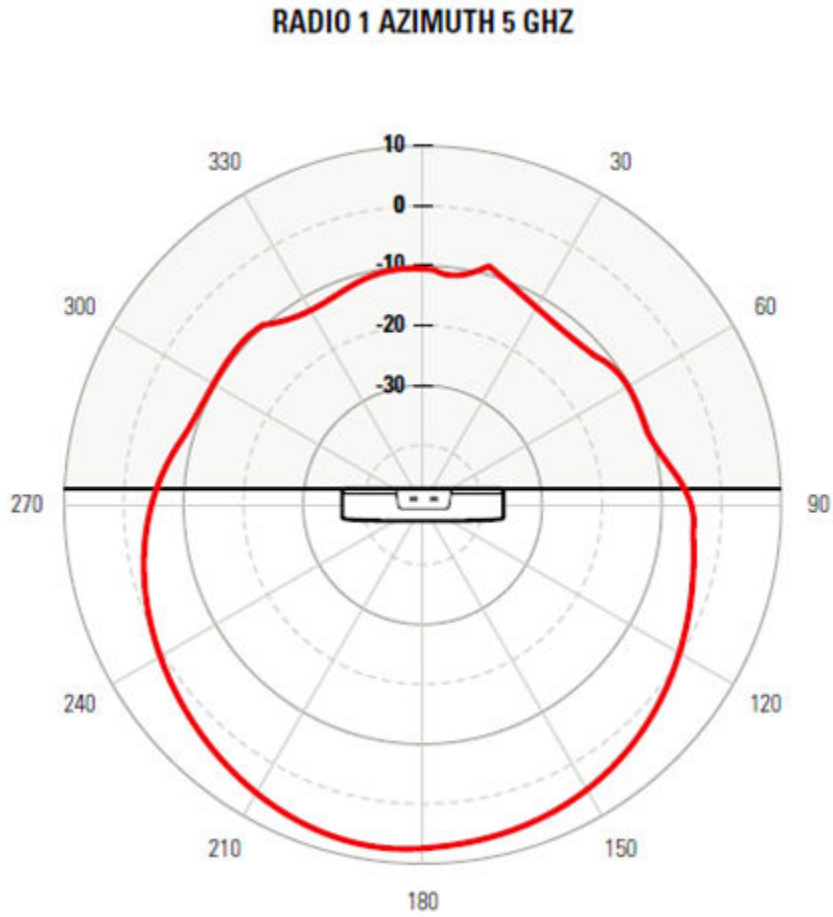
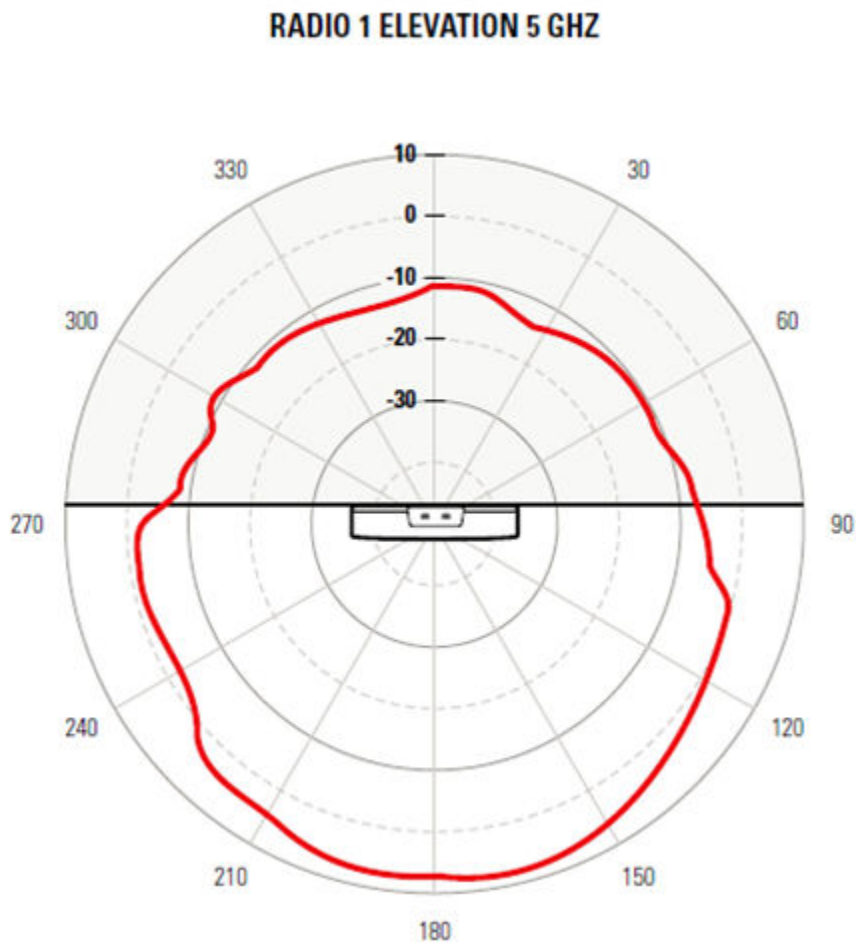


Figure 135: AP460S6C radio 1 5 GHz azimuth pattern



**Figure 136: AP460S6C radio 1 5 GHz elevation pattern**

AP460S6C access point sensor patterns

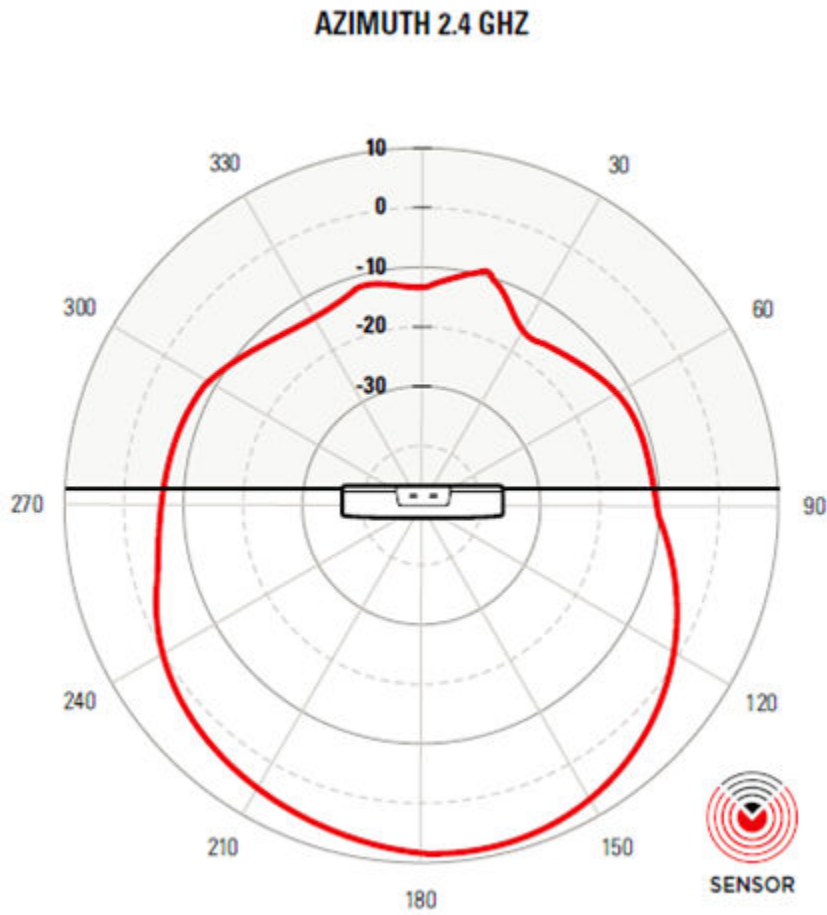


Figure 137: AP460S6C 2.4 GHz azimuth pattern

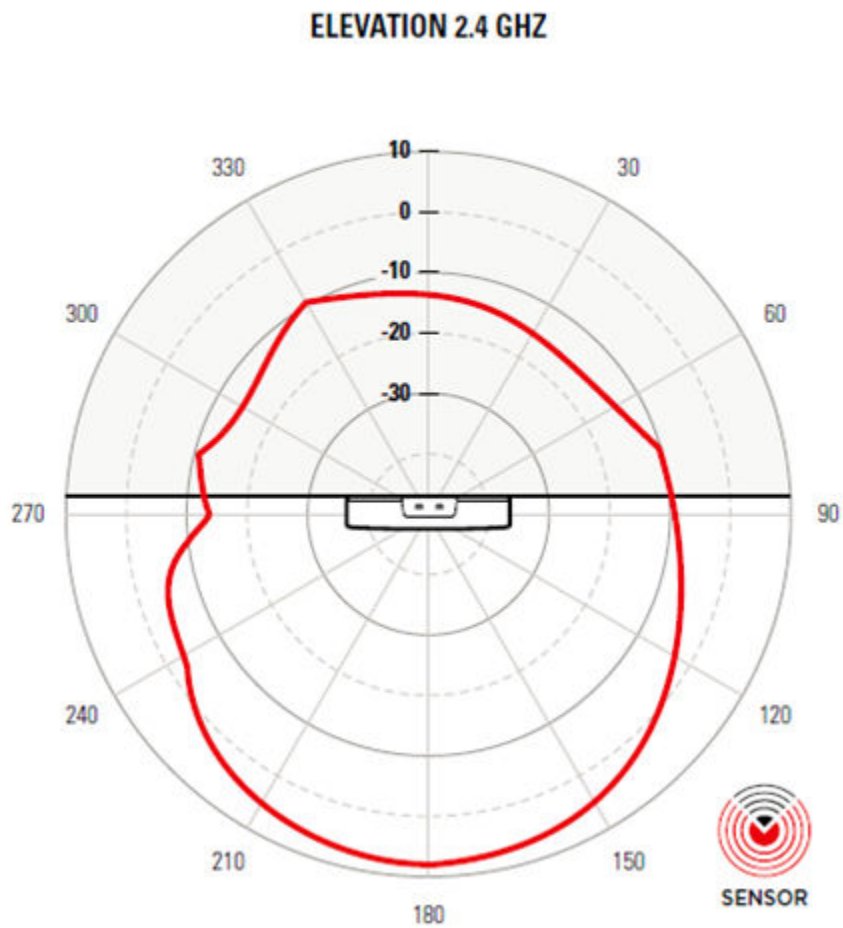


Figure 138: AP460S6C 2.4 GHz elevation pattern



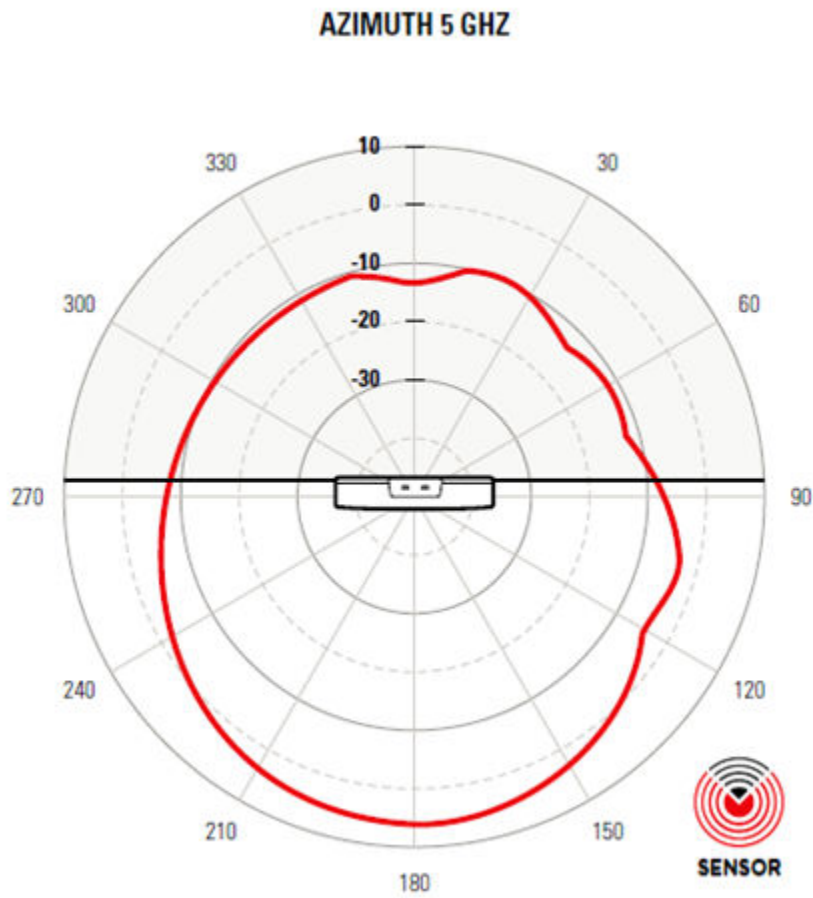


Figure 139: AP460S6C 5 GHz azimuth pattern

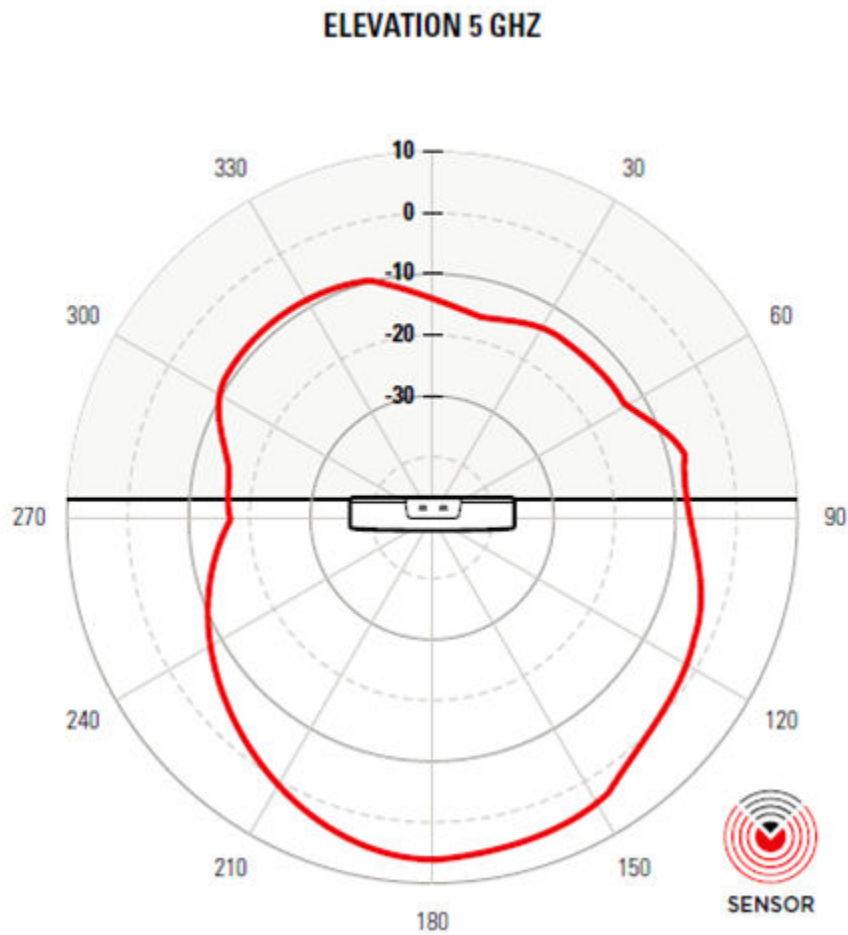


Figure 140: AP460S6C 5 GHz elevation pattern

## AP460S12C Internal Antenna Radiation and Sensor Patterns

AP460S12C internal antenna radio patterns

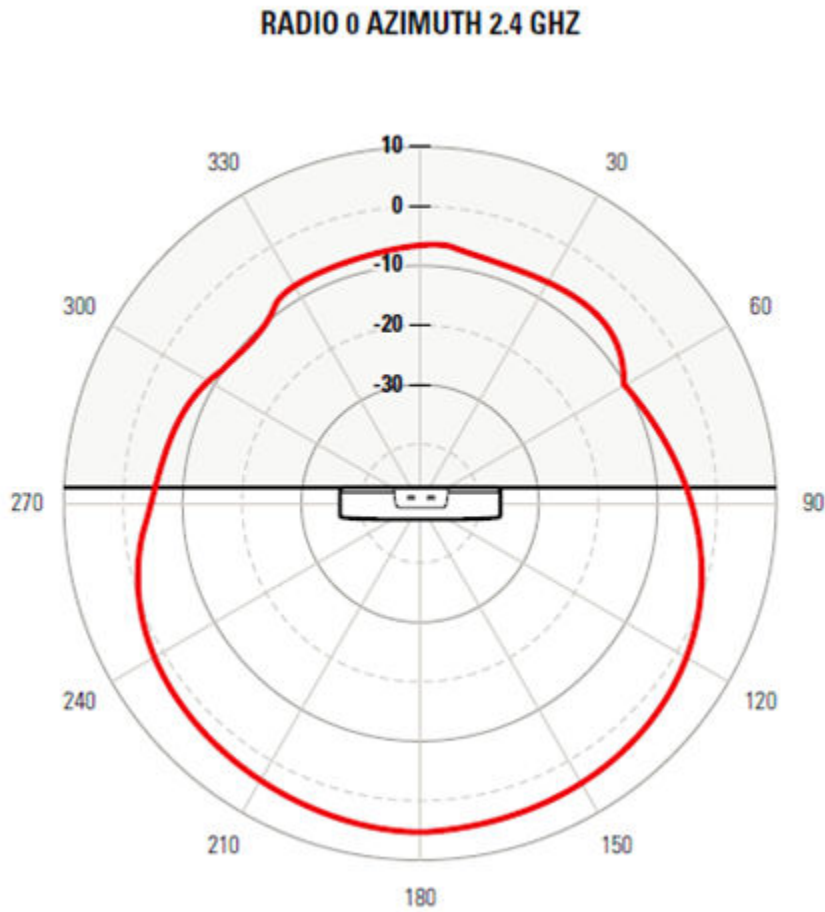


Figure 141: AP460S12C radio 0 2.4 GHz azimuth pattern

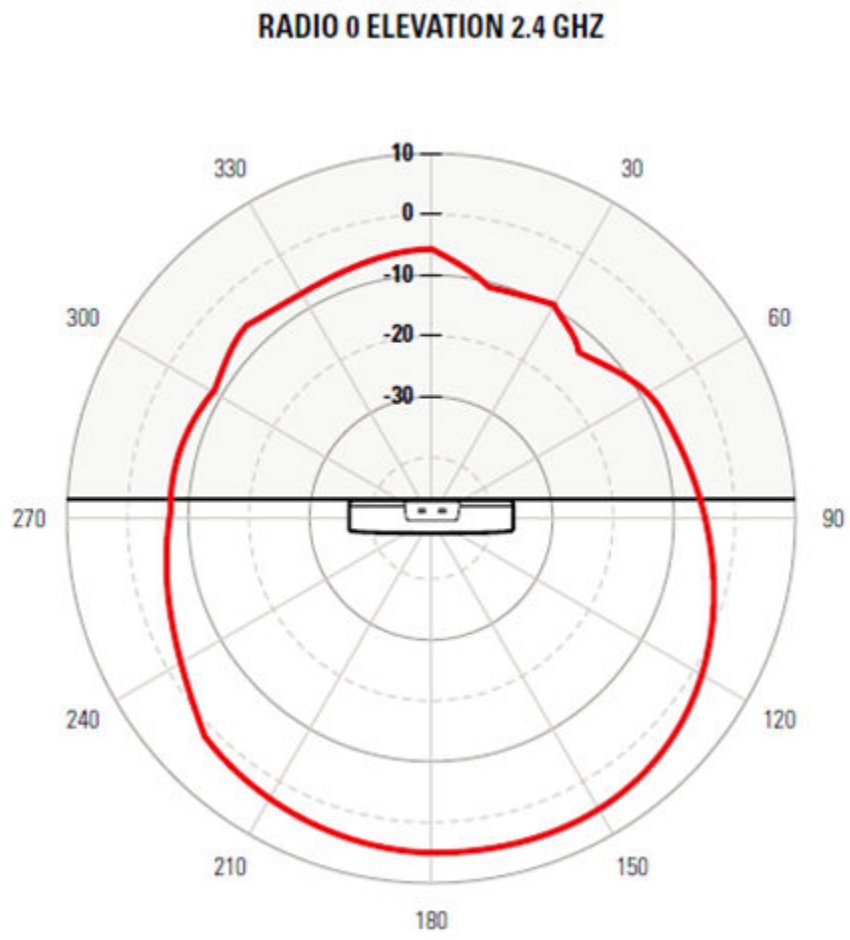


Figure 142: AP460S12C radio 0 2.4 GHz elevation pattern

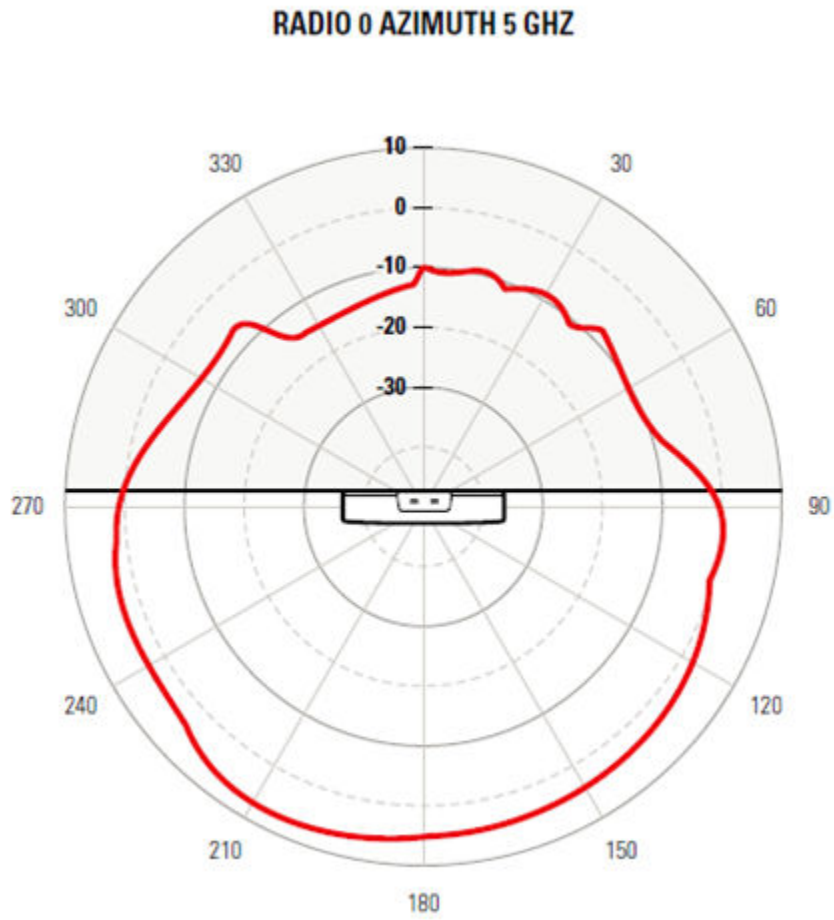


Figure 143: AP460S12C radio 0 5 GHz azimuth pattern

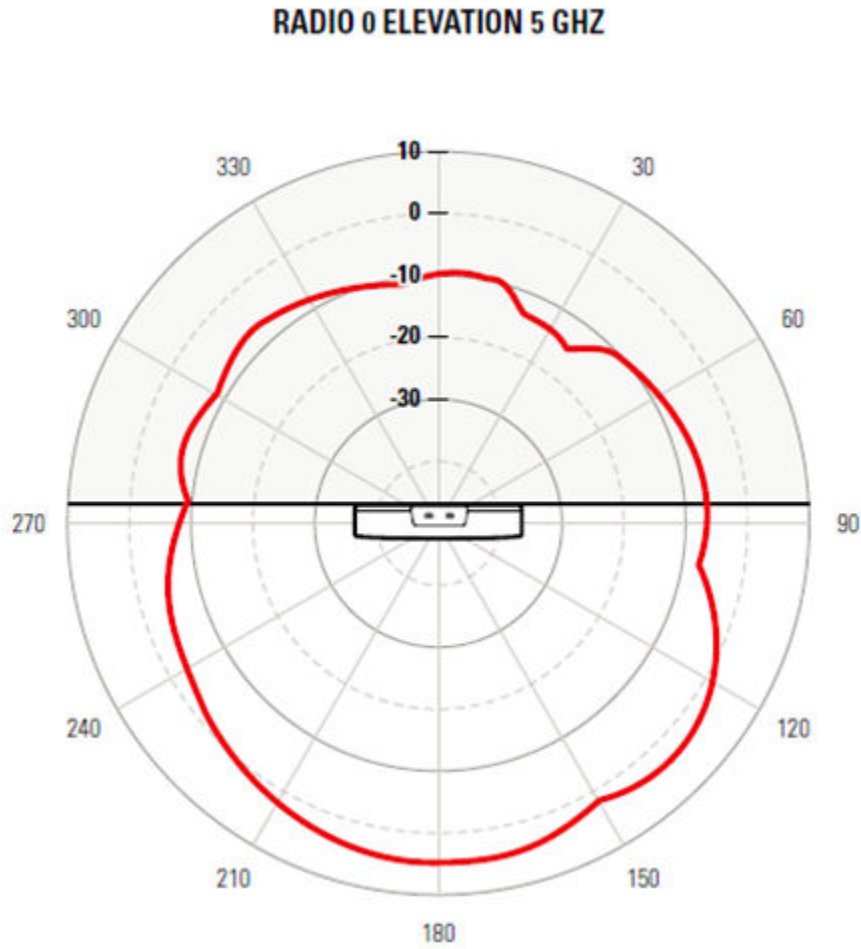
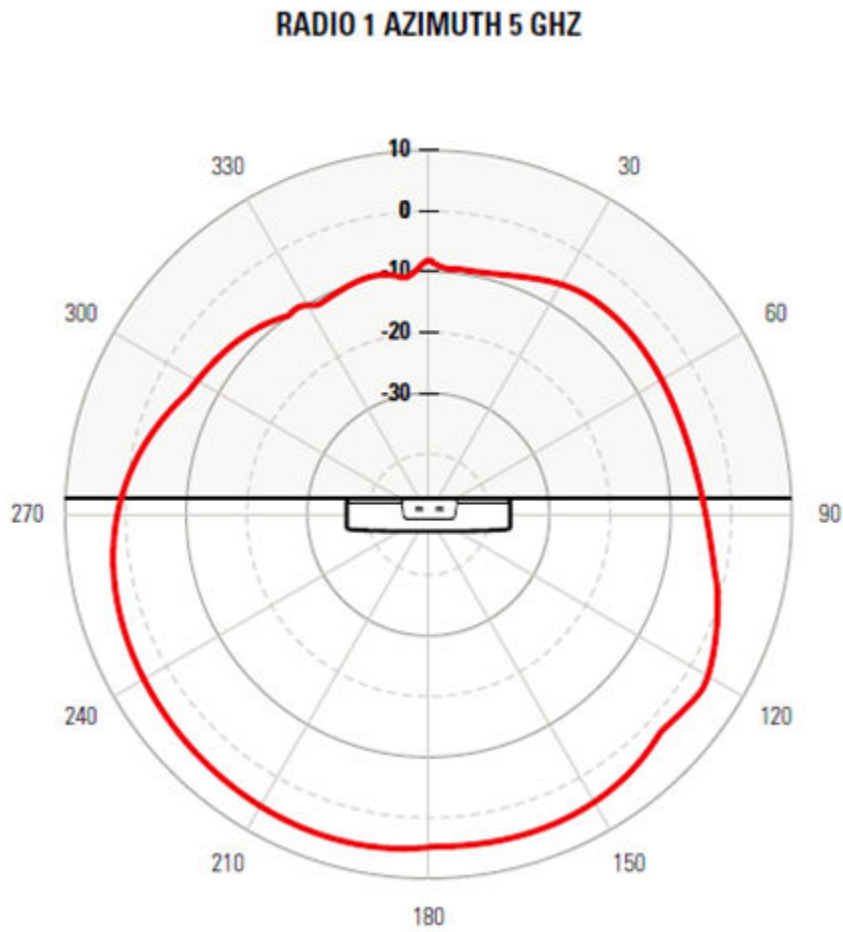
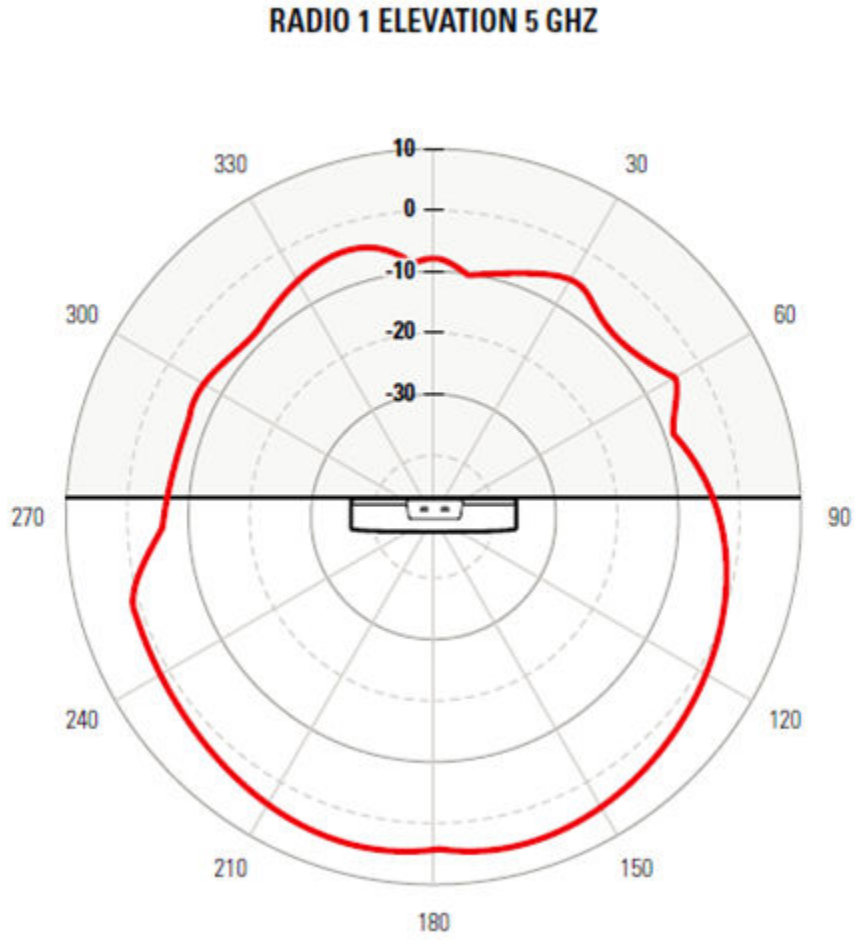


Figure 144: AP460S12C radio 0 5 GHz elevation pattern



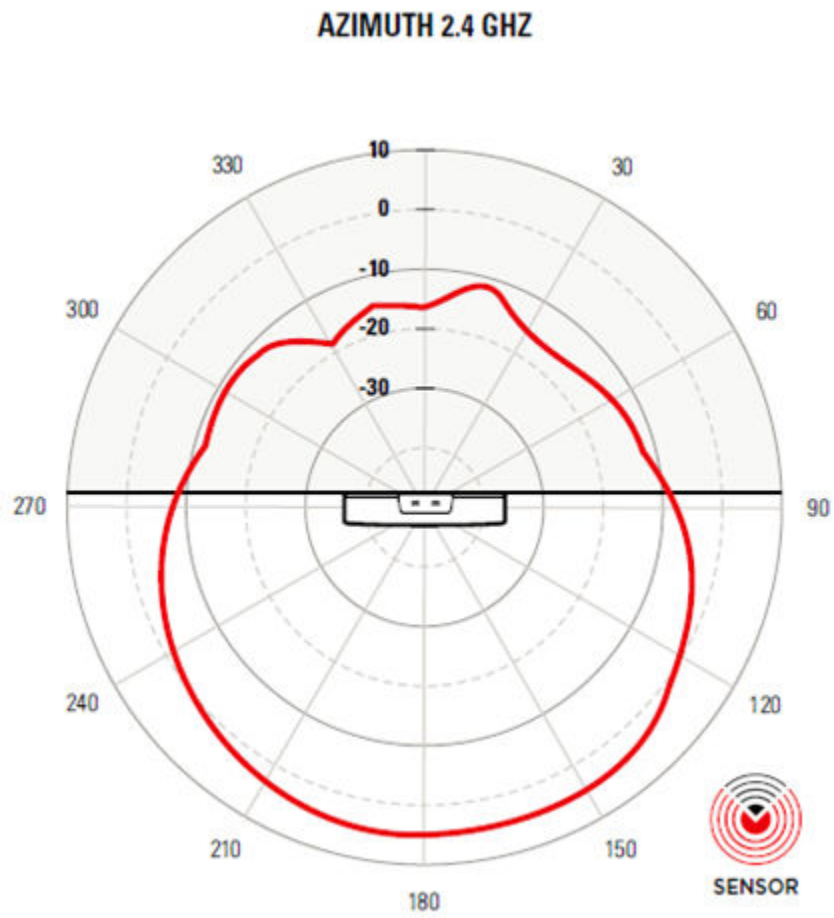
**Figure 145: AP460S12C radio 1 5 GHz azimuth pattern**



**Figure 146: AP460S12C radio 1 5 GHz elevation pattern**



## AP460S12C access point sensor patterns



**Figure 147: AP460S12C 2.4 GHz azimuth pattern**

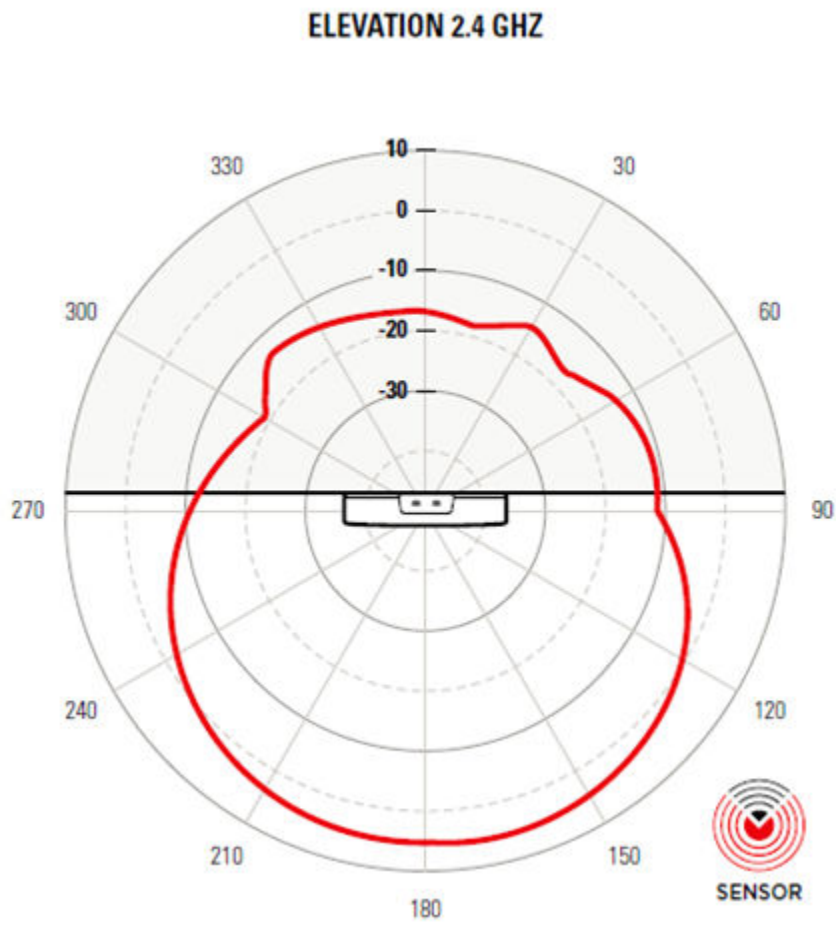


Figure 148: AP460S12C 2.4 GHz elevation pattern

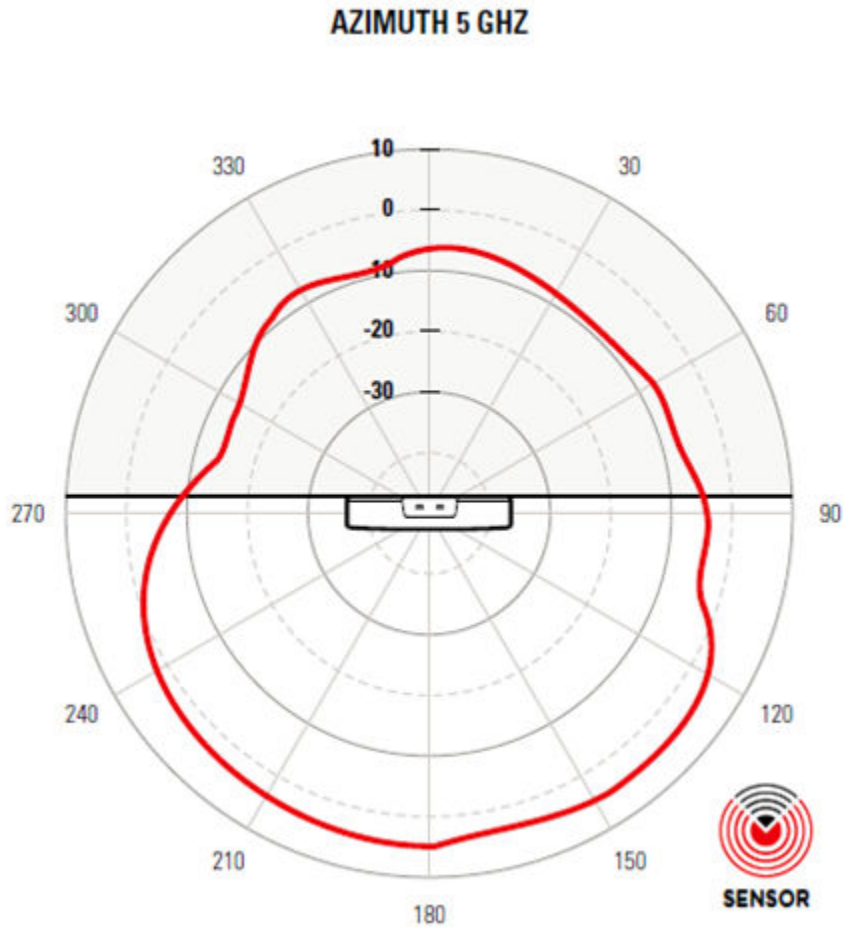
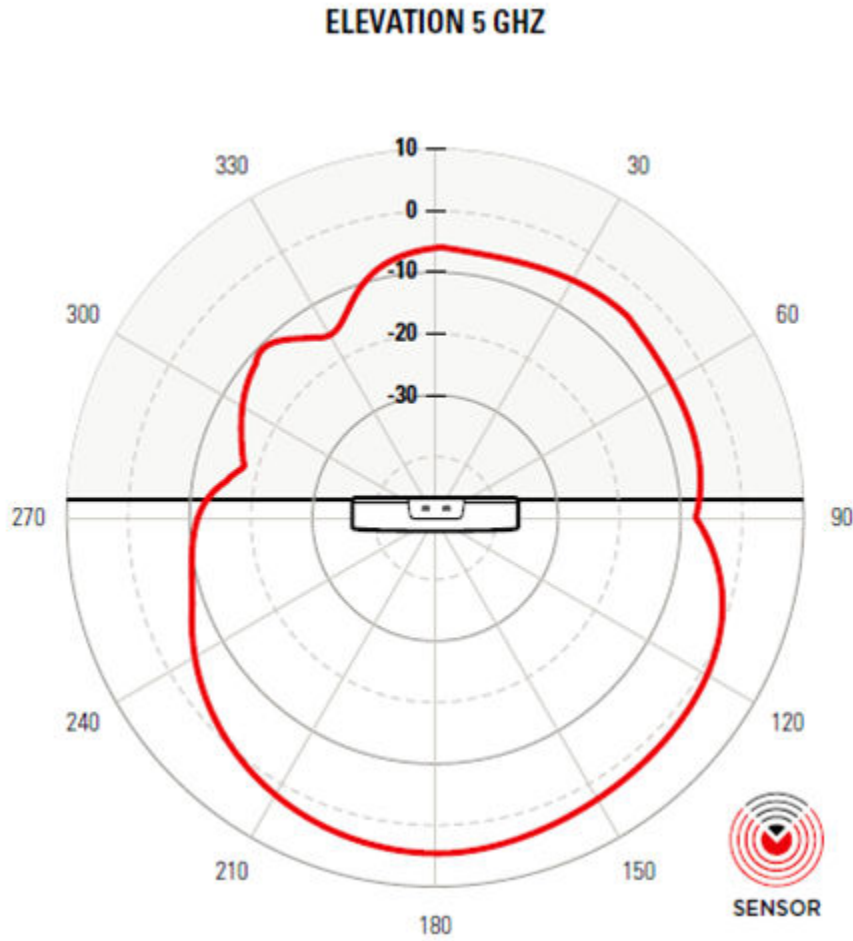


Figure 149: AP460S12C 5 GHz azimuth pattern



**Figure 150: AP460S12C 5 GHz elevation pattern**

[AP3000 Internal Antenna Specifications and Radiation Patterns](#)

Specifications

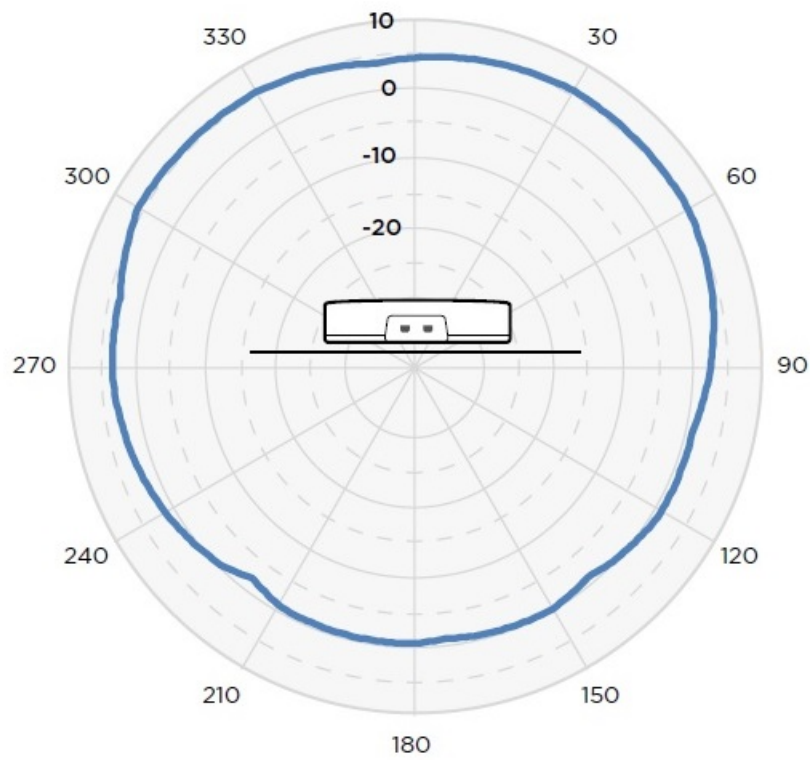
The following table shows the Gain and Beam for the AP3000 internal antenna. Use this information when you plan your installation.

**Table 94: Ports, Gain, and Beam**

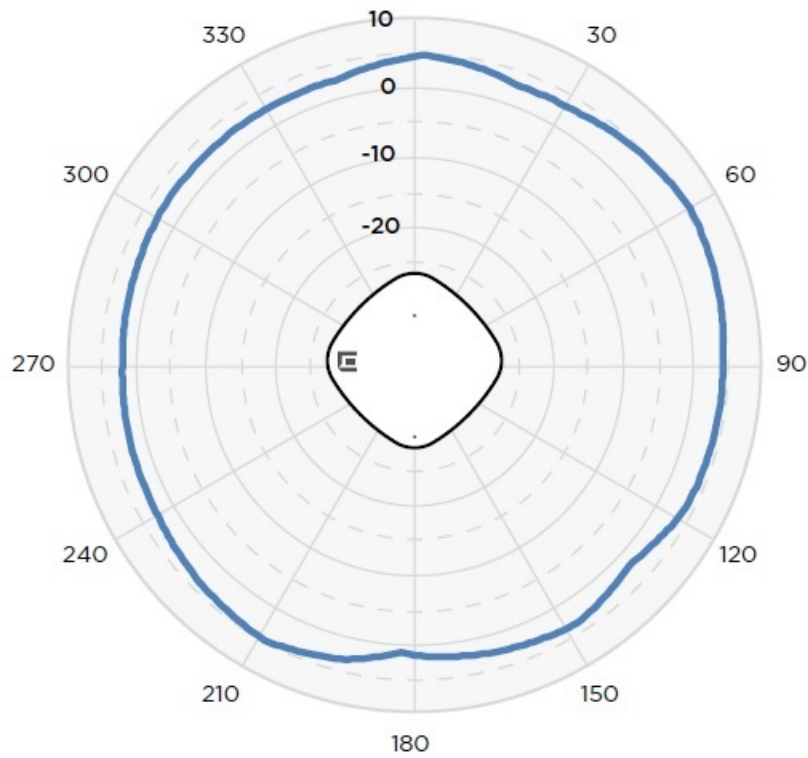
Ports	2.4GHz		5GHz		6GHz	
	Gain	Beam	Gain	Beam	Gain	Beam
-	4.2	360	5.07	360	5.14	360

2GHz Radiation Patterns

The following diagrams illustrate the radiation patterns for the AP3000 2GHz internal antenna.



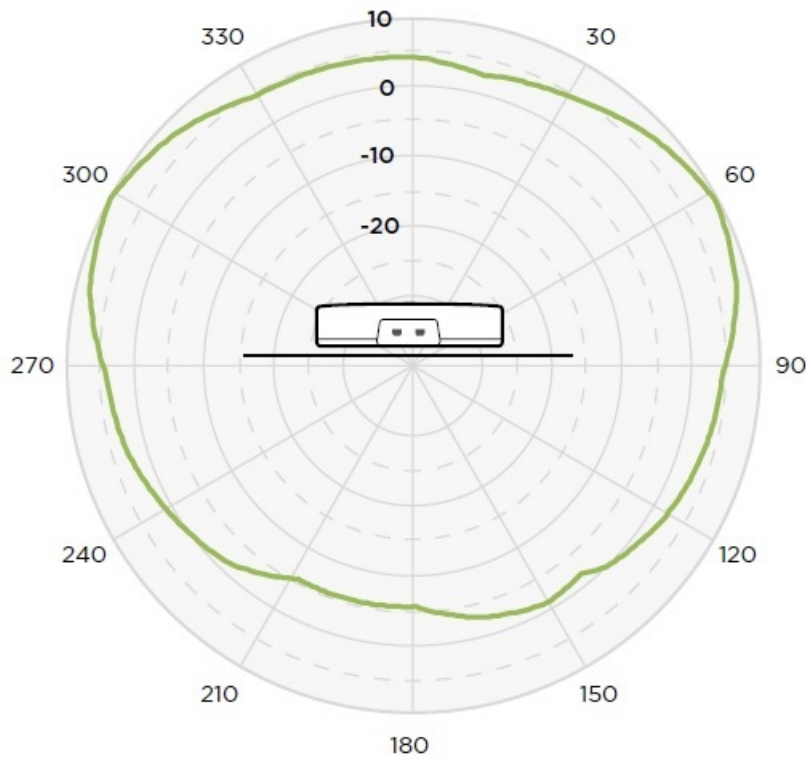
**Figure 151: AP3000 2GHz elevation radiation pattern**



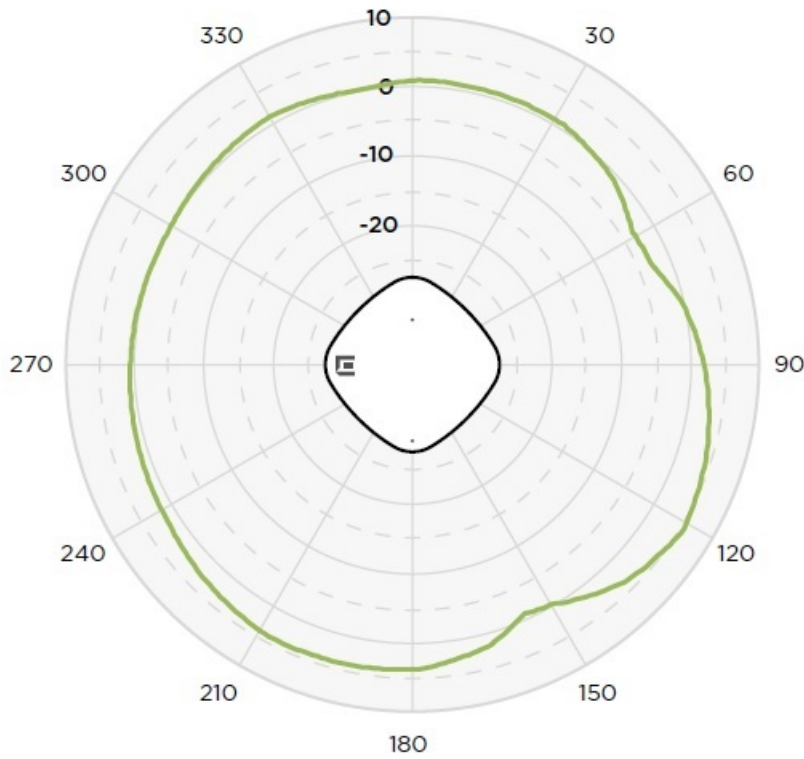
**Figure 152: AP3000 2GHz azimuth radiation pattern**

## 5GHz Radiation Patterns

The following diagrams illustrate the radiation patterns for the AP3000 5GHz internal antenna.



**Figure 153: AP3000 5GHz elevation radiation pattern**

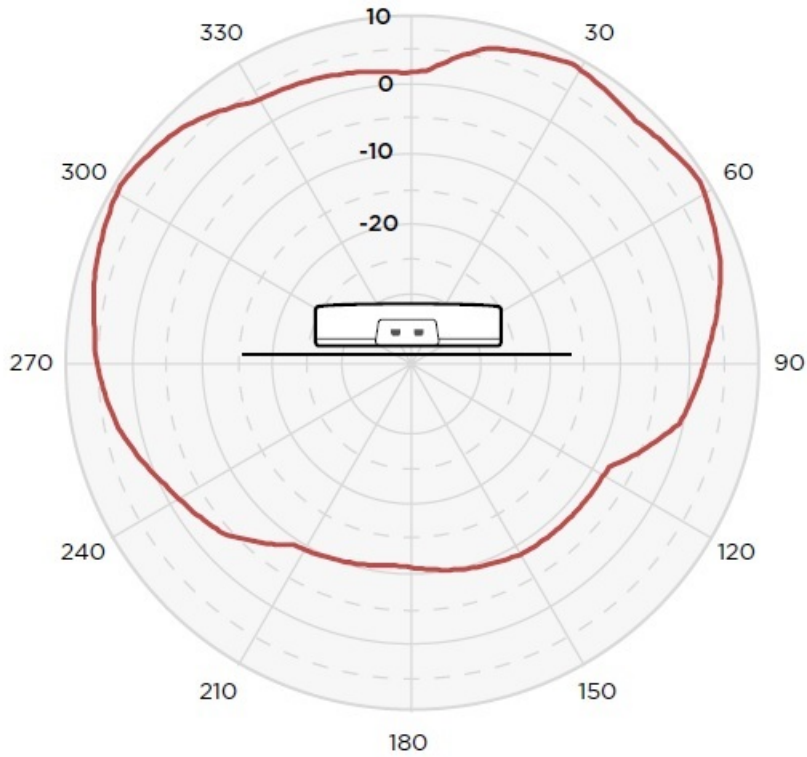


**Figure 154: AP3000 5GHz azimuth radiation pattern**

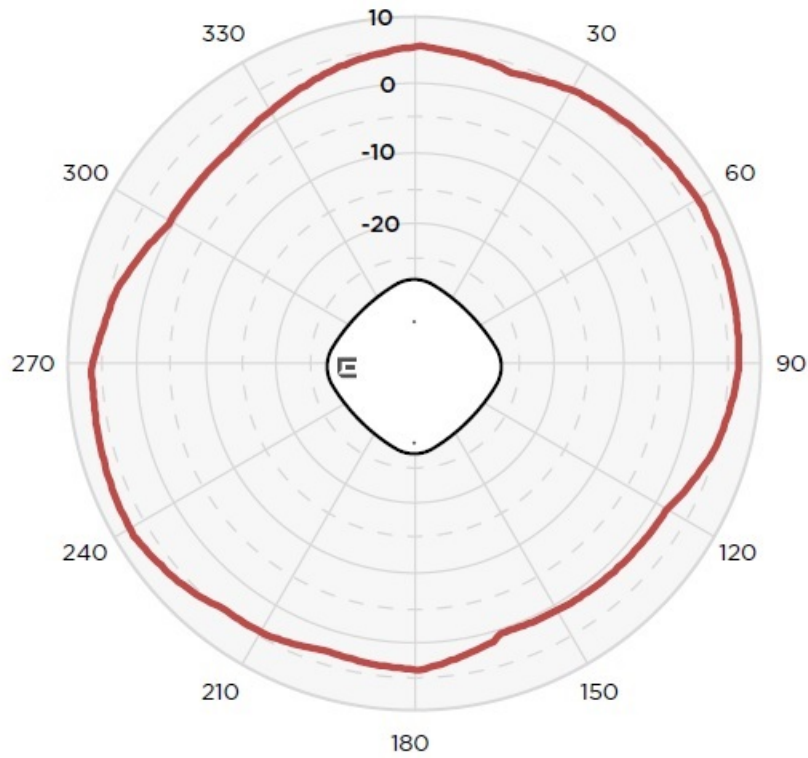
### 6GHz Radiation Patterns

The following diagrams illustrate the radiation patterns for the AP3000 6GHz internal antenna.





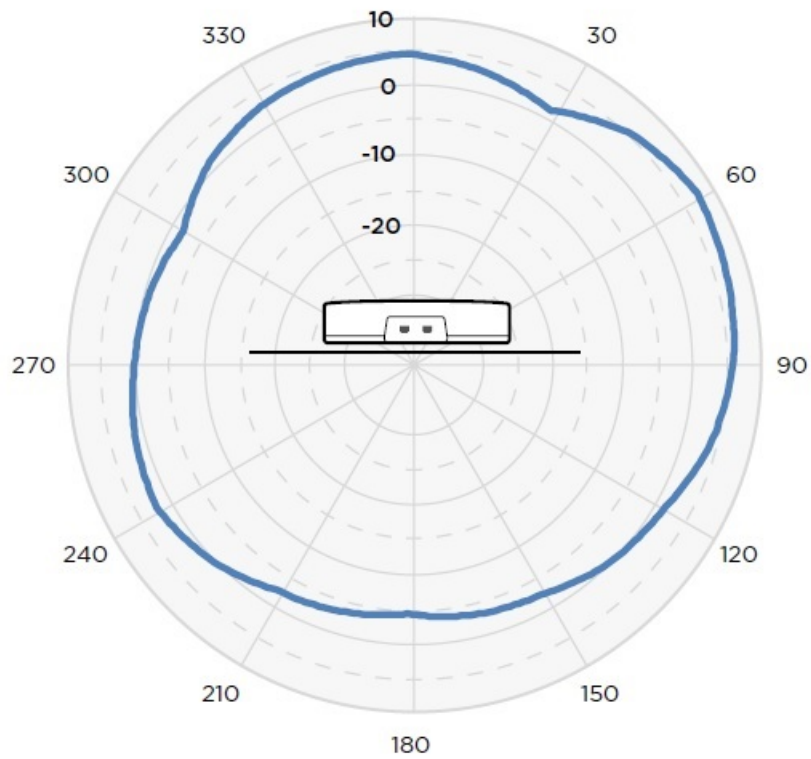
**Figure 155: AP3000 6GHz elevation radiation pattern**



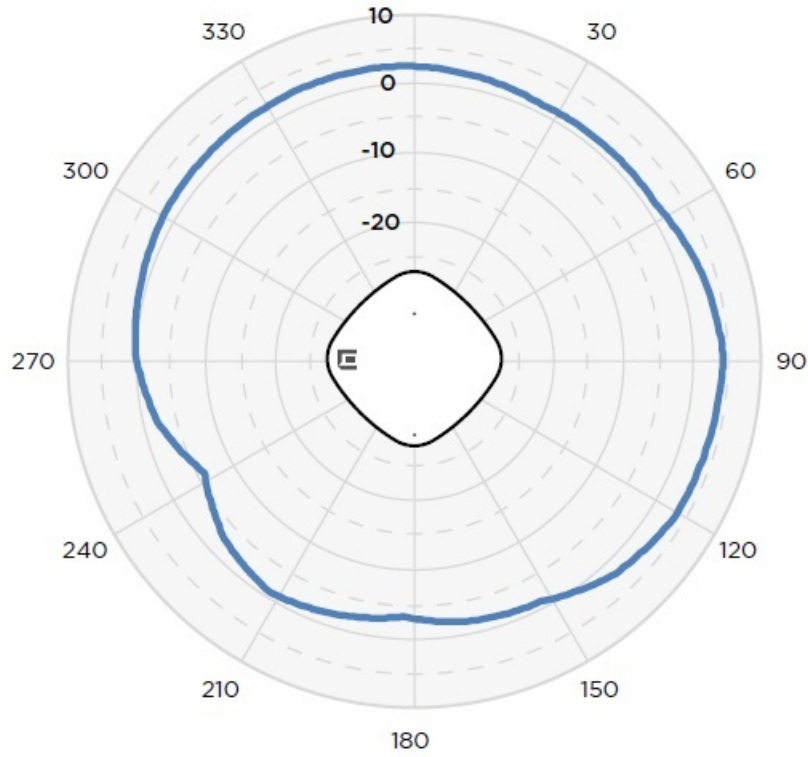
**Figure 156: AP3000 6GHz azimuth radiation pattern**

### Bluetooth Low Energy Radiation Patterns

The following diagrams illustrate the radiation patterns for the AP3000 Bluetooth Low Energy(BLE)® internal antenna.



**Figure 157: BLE elevation radiation pattern**



**Figure 158: BLE azimuth radiation pattern**



# Antenna Installation Information

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- [Weatherproof the Antenna Connections](#) on page 183
- [Drip Loop for Antenna Cables](#) on page 184
- [Install the ML-2452-APA2-01 or ML-2452-APA2-02 Antenna](#) on page 185
- [Install the ML-2452-HPA5-036 Antenna](#) on page 187
- [Install the ML-2452-HPA6-01 Antenna](#) on page 196
- [Install the ML-2452-HPAG4A6-01 Antenna](#) on page 196
- [Install the ML-2452-HPAG5A8-01 Antenna](#) on page 198
- [Install the ML-2452-PTA2M2-036 Antenna](#) on page 200
- [Install the ML-2452-PTA4M4-036 Antenna](#) on page 201
- [Install the ML-2452-PNA5-01R Antenna](#) on page 202
- [Install the ML-2452-SEC6M4-036 Antenna](#) on page 209
- [Install the ML-2452-PNA7-01R Antenna](#) on page 212
- [Install the WS-AI-5Q0460 Antenna](#) on page 216
- [Install the AI-DQ04360S Antenna](#) on page 217
- [Install the WS-AI-DQ05120, WS-AI-DE07025, WS-AI-DE10055, or WS-AO-DQ05120N Antenna](#) on page 225
- [Install the WS-AO-DQ04360N Antenna](#) on page 231
- [Install the AH-ACC-ANT-AX-KT Antenna](#) on page 239
- [Install the Antenna Using the WS-MB-WALLEXT01 Extension Bracket Kit](#) on page 240



## Note

Not all antennas described in this section can be used with every wireless access point. Refer to the [Antenna Compatibility Matrix](#) on page 25 to determine if your access point supports the specified antenna.

## Antenna Installation Best Practices

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Antennas transmit and receive radio signals which are susceptible to Radio Frequency (RF) obstructions and common sources of interference that can reduce the throughput

and range of the device to which they are connected. Follow these guidelines to ensure the best possible antenna performance:

- Install the antenna vertically and mount it with the cables pointing toward 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 building construction material density 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 drywall or wood wall without degrading signal strength.
  - Signals will reflect off thick metal wall and will not penetrate it at all.
  - Signals will reflect off a chain link fence or wire mesh spaced between 1 and 1.5 inches (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.

## WS-MB-WALLEXT01 extension bracket kit details

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The WS-MB-WALLEXT01 (part number 30515) extension bracket is used to extend the antenna tilt up to 90 degrees, when mounted on a wall or a pole. The extension bracket supports the following antennas:

- [WS-AI-DQ05120 antenna \(part number 30702\)](#)
- [WS-AI-DE07025 \(part number 30705\)](#)
- [WS-AI-DE10055 \(part number 30707\)](#)
- [WS-AO-DQ05120N \(part number 30711\)](#)



### Note

The antennas ship with a standard mounting kit that allows for a 70 degree tilt. The wall extension bracket kit is an optional accessory that is used with the standard mounting kit to increase the antenna tilt, up to 90 degrees. The wall extension kit can only be used with the main mounting kit.

### Related Topics

[Antenna Compatibility Matrix](#) on page 25

## Weatherproof the Antenna Connections

---

### About This Task

The following guidelines apply to:

- AP360i/e
- AP460i/e

Extreme Networks recommends that all connections between the AP and antennas are weatherproofed using the following weatherproof kits (not supplied):

- Wireless Weatherproofing Kits:
  - 3M (WK-100)
  - Scotch (WK-101)

Each weatherproofing kit includes  $\frac{3}{4}$ -inch vinyl tape, 2-inch mastic tape, and 2-inch wide vinyl tape.

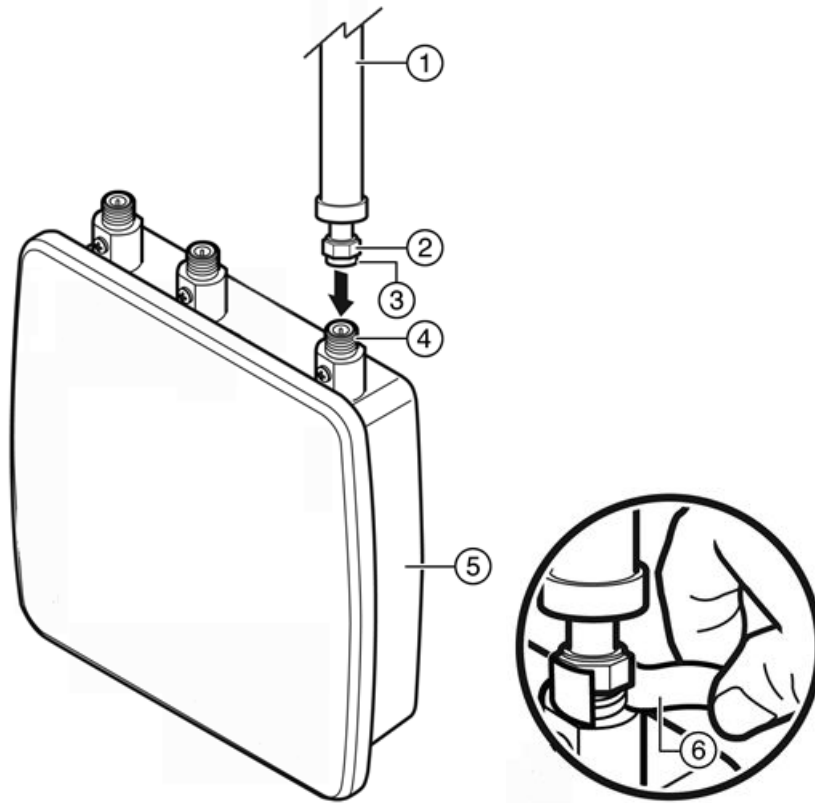
Follow the guidelines to ensure proper installation:

- The weatherproofing tape must be wound tightly over the connectors.
- Ensure that no areas around the edges are exposed.



#### Note

Installation instructions are provided with each weatherproofing kit.



**Figure 159: Weatherproofing the Antenna**

1	Antenna	4	Type-N jack
2	Nut	5	AP
3	Standard polarity Type-N plug	6	Sealing tape (recommended, but not supplied)

### Procedure

1. Secure the antenna in place by tightening the single nut.
2. Follow the manufacturer's instructions provided in the kit to seal the connection between the Type-N jack and the Type-N plug.

## Drip Loop for Anenna Cables

When the cables have been connected to the AP and the connections have been weatherproofed, gather each cable below the AP, and form a drip loop as shown in the figure below.



### Note

The drip loop prevents water from entering the AP by channeling water down and away from the connection points. Drip loops are required to ensure proper operation of the AP.





**Figure 160: Drip Loop**

## Install the ML-2452-APA2-01 or ML-2452-APA2-02 Antenna

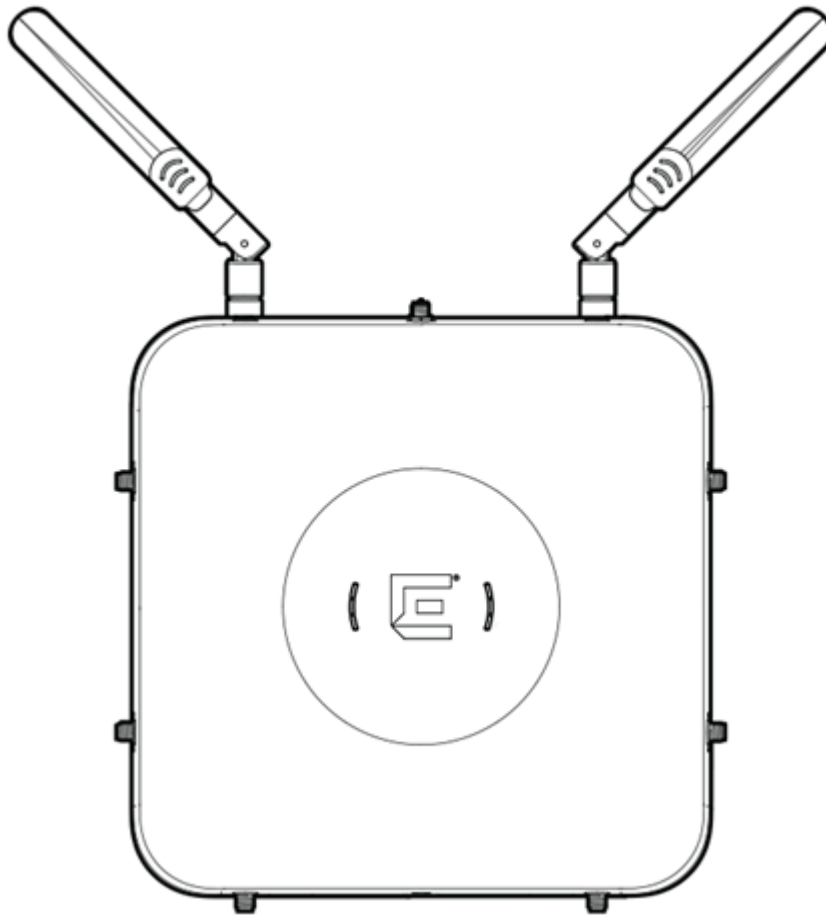
### About This Task

After you install the indoor access point, install the ML-2452-APA2-01 or ML-2452-APA2-02 antenna.

### Procedure

1. Line up the antenna connector and the antenna port on the access point.  
Refer to [External Antenna Connectors](#) topic for information on antenna connector on various access points.

2. Twist the antenna connector clockwise to attach it to the antenna port.



**Figure 161: ML-2452-APA2-01 or ML-2452-APA2-02 antenna attached to the AP510e access point**



**Note**

The ML-2452-APA-02 antenna is also used on the AP305C/CX access point. The procedure to attach the antenna to the access point remains the same.

Related Topics

[ML-2452-APA2-01 and ML-2452-APA2-02 Antenna Specifications and Radiation Patterns](#)  
on page 42

## Install the ML-2452-HPA5-036 Antenna

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### About This Task

The ML-2452-HPA5-036 is an omnidirectional antenna used for 2.4 GHz and 5.0 GHz RF-distribution systems. The antenna can be attached on an I-beam clamp, a mast or a pole, or to a ceiling.



#### Warning

The antenna and all associated accessories must be installed in accordance with local and national electrical code guidelines to ensure safe operation.

The ML-2452-HPA5-036 antenna ships with all required mounting accessories. Antenna box contents includes:

- One ML-2452-HPA5-036 antenna
- One China RoHS sheet
- One WEEE notice sheet
- Hardware mounting kit containing various installation accessories

The following accessories are required for various installations.

- One ceiling mount adapter plate
- Two #6–32 × ¼ in. stainless steel (SS) screws
- Two #6 internal tooth lock washers
- One ¼ in. internal tooth lock washer
- One ceiling hanger bracket
- One 5/16–18 U-bolt
- Four 5/16 in. ss lock washers
- Six 5/16–18 ss hex nuts
- Two omni clamps
- One mast clamp
- Two 5/16 SS flat washers
- One ¼ SS flat washer
- One I-beam clamp
- One 1/4–20 × ½ SS hex head

## ML-2452-HPA5-036 Antenna Ceiling Install

### About This Task

The antenna is mounted on the ceiling using the ceiling hardware accessories.



#### Tip

The best practice is to mount the antenna on a ceiling or roof-level near the center of the coverage area.

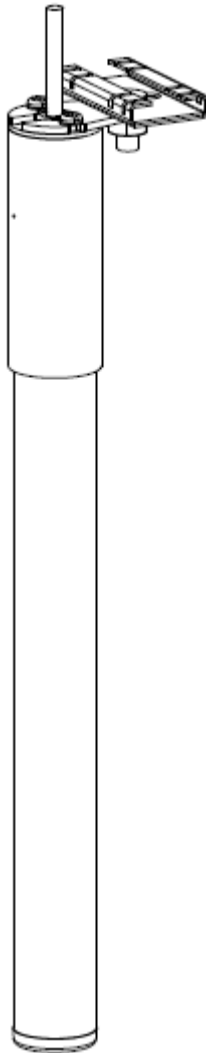
The following hardware is required for installing the antenna on a ceiling:

- Ceiling mount adapter plate
- Two, #6 internal tooth lock washers
- Two, #6-32 × ¼ in. SS screws
- ¼ in. internal tooth lock washer
- Ceiling hanger (grid) bracket
- 5/16 – 18 SS hex nut

#### **Procedure**

1. Attach the ceiling mount adapter plate to the antenna using two SS screws and two #6 internal tooth lock washer.
2. Remove the ¼ in. – 20 hex nut and flat washer from the ceiling hanger bracket.  
Discard the flat washer since it will not be used during installation.
3. Insert the ceiling hanger bracket into the edge hole on the ceiling mount adapter plate.

4. Attach the ceiling hanger bracket to the ceiling mount adapter plate using the  $\frac{1}{4}$  in. –20 hex nut and the  $\frac{1}{4}$  in. internal tooth lock washer.  
The tooth lock washer must be loosely attached to the  $\frac{1}{4}$  in. hex nut.



**Figure 162: ML-2452-HPA5-036 antenna with the ceiling hanger bracket installed**

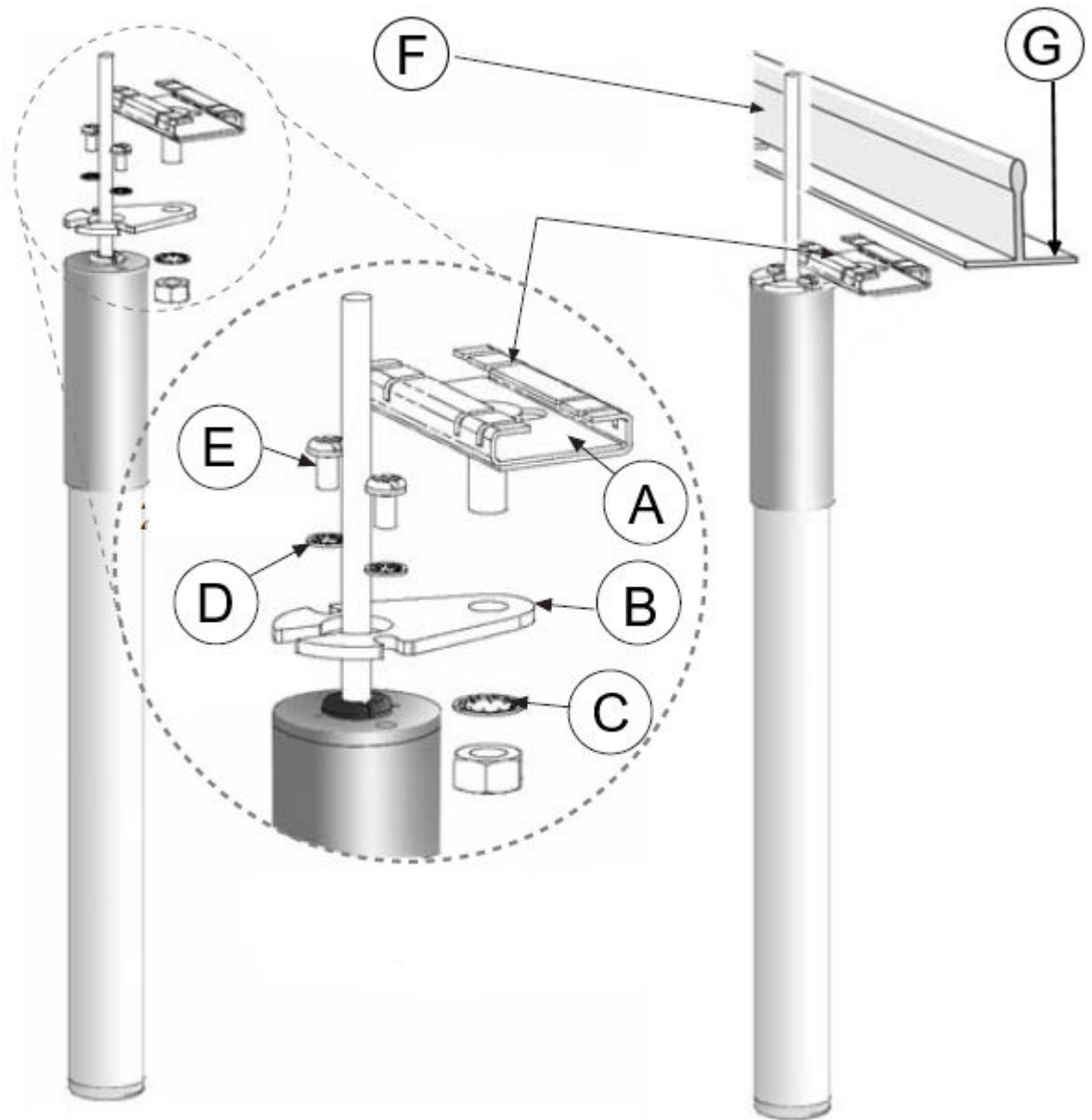
5. Place the ceiling hanger bracket on a ceiling tile runner.
6. Insert the 5/16 – 8 SS hex nut on the  $\frac{1}{4}$  in. – 20 hex nut and tighten it using a 7/16 in. wrench.
7. Secure the LMR cable along the ceiling runner using a tape or cable ties.



**Note**

You need to provide the tape or cable ties.

8. Attach the antenna connector to the access point connector.



**Figure 163: MP-2452-HPA5-036 antenna ceiling installation procedure**

Callout	Description
A	Ceiling hanger bracket
B	Ceiling mount adapter plate
C	1/4 in. internal tooth lock washer and 5/16 – 8 SS hex nut
D	#6 internal tooth lock washer
E	#6-32 × 1/4" SS screw

Callout	Description
F	Ceiling support runner
G	Ceiling support runner area for attaching the ceiling hanger bracket

## ML-2452-HPA5-036 Antenna I-beam Install

### About This Task

The antenna is attached to an I-beam using the bracket plate and other hardware accessories.

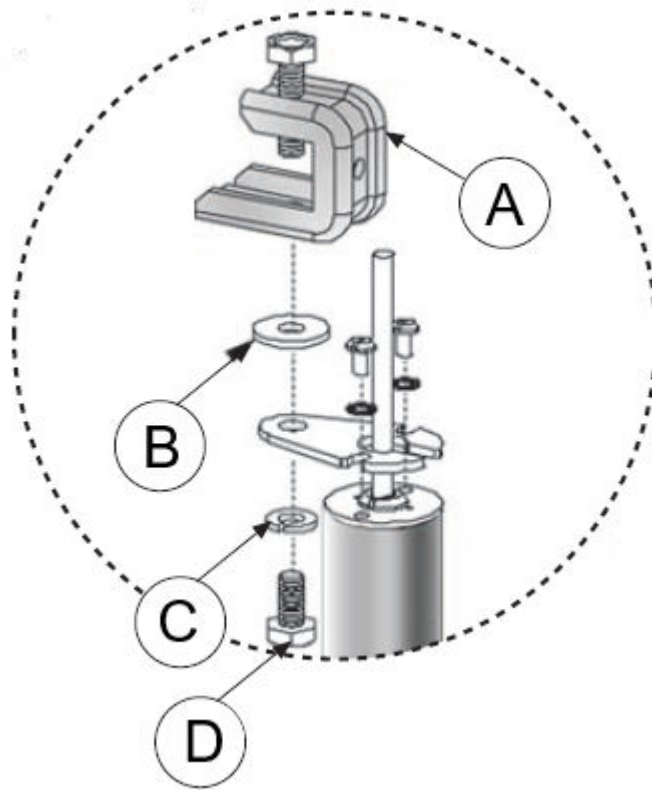
Hardware required for installing the antenna on an I-beam:

- Ceiling mount adapter plate
- Two, #6 internal tooth lock washers
- Two, #6-32 × ¼ in. SS screws
- I-beam clamp
- ¼ in. SS flat washer
- ¼ in. SS lock washer (also known as split washer)
- ¼-20 × ½ SS hex-head

### Procedure

1. Attach the ceiling mount adapter plate to the antenna using two #6 int. tooth lock washers and two #6-32 × ¼ in. SS screws.

2. Install the I-beam clamp to the adapter plate using the  $\frac{1}{4}$  in. SS flat washer,  $\frac{1}{4}$  in. SS lock washer, and the  $\frac{1}{4}$  -20  $\times$   $\frac{1}{2}$  SS hex-head as shown in the following figure.

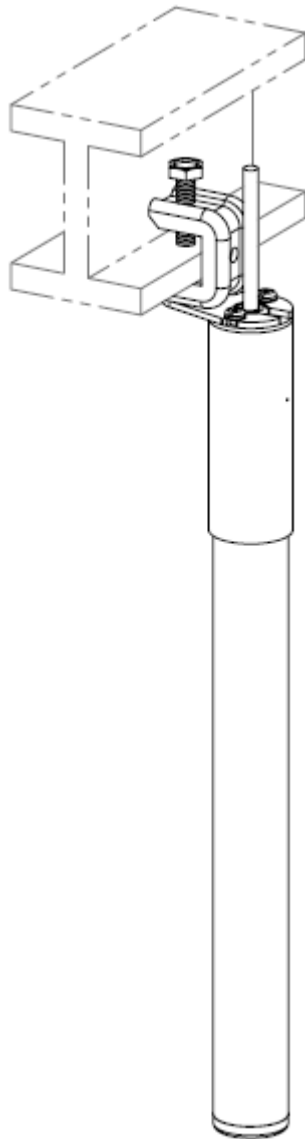


**Figure 164: ML-2452-HPA5-036 antenna I-beam install procedure**

Callout	Description
A	I-beam clamp
B	$\frac{1}{4}$ in. SS flat washer
C	$\frac{1}{4}$ in. SS lock washer
D	$\frac{1}{4}$ -20 $\times$ $\frac{1}{2}$ SS hex-head



3. Tighten the clamp bolt to secure the antenna in place on the beam.



**Figure 165: ML-2452-HPA5-036 antenna installed on an I-beam**

## ML-2452-HPA5-036 Antenna Pole or Mast Install

### About This Task

The antenna is installed to a pole or to a mast using pole mount bracket and other hardware accessories.

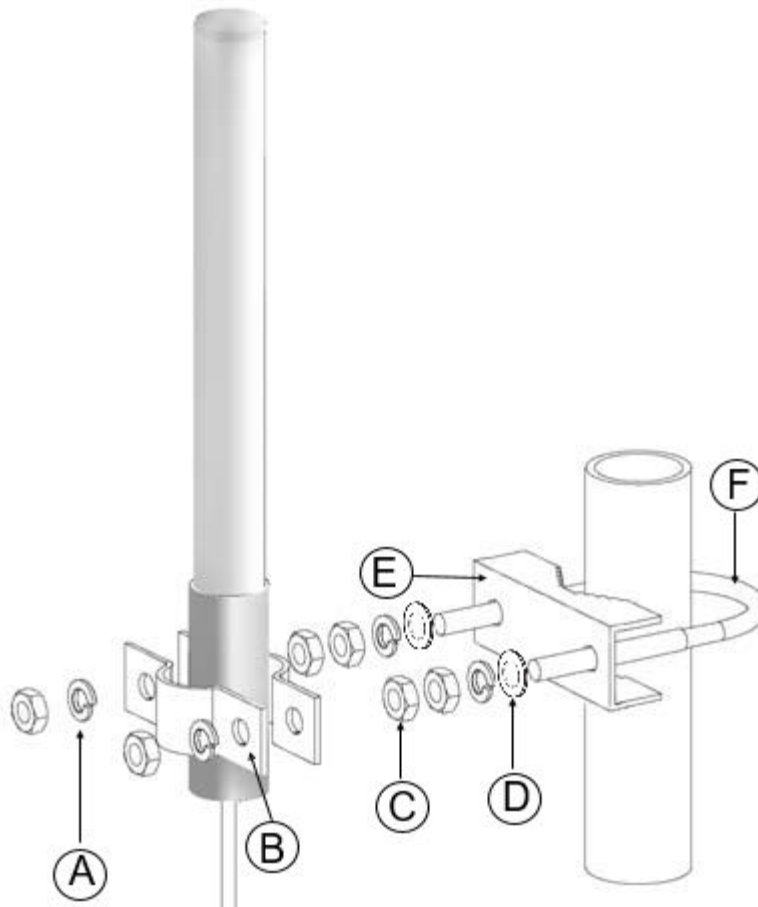
Hardware required for installing the antenna on a pole:

- Four, 5/16 in. SS lock washers
- Two omni clamps (also called base bracket)
- Six, 5/16 in. – 18 SS hex nuts
- Two, 5/16 in. SS flat washers

- One mast clamp (also called V-bracket)
- One, 5/16 in. – 18 U-bolt

### Procedure

1. Place the 5/16 in. – 18 U-bolt and the mast clamp on a pole or mast and attach it using two flat washers, two lock washers, and four hex nuts as shown in the following figure.



**Figure 166: ML-2452-HPA5-036 pole or mast install using pole mounting hardware accessories**

Callout	Description
A	5/16 in. SS lock washer
B	Omni clamp (also called base bracket)
C	5/16 in. – 18 SS hex nuts
D	5/16 in. SS flat washers
E	Mast clamp (also called V-bracket)
F	5/16 in. – 18 U-bolt

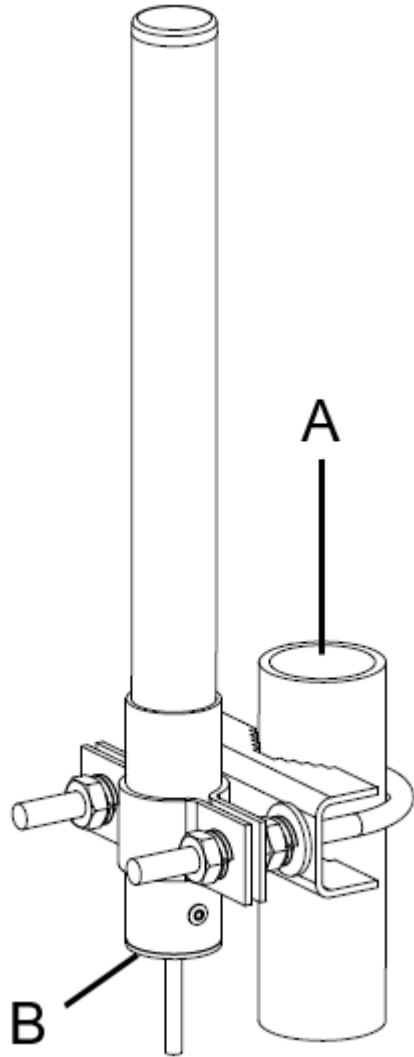
2. Attach the omni clamps around the antenna and slide it on to the U-bolt.

3. Secure the antenna on the U-bolt using two, 5/16 in. SS lock washers and two 5/16 in.-18 SS hex nuts.
4. Secure the LMR cable along the mast or the pole using tape or cable ties.



**Note**

If you are mounting the antenna outside or in a wet environment, ensure that the antenna is vertically mounted with the weep holes facing down.



**Figure 167: ML-2452-HPA5-036 antenna installed on a pole**

Callout	Description
A	Pole
B	ML-2452-HPA5-036 antenna

Related Topics

[ML-2452-HPA5-036 Antenna Specifications and Radiation Patterns](#) on page 45

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## Install the ML-2452-HPA6-01 Antenna

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### About This Task

The ML-2452-HPA6-01 is a dual-band outdoor antenna with a standard N-type plug connector. The antenna can be attached directly to the access point.

### Procedure

1. Line up the antenna connector against the antenna port on the access point.
2. Twist the antenna connector clockwise to attach it to the antenna port.

### Related Topics

[ML-2452-HPA6-01 Antenna Specifications and Radiation Patterns](#) on page 50

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## Install the ML-2452-HPAG4A6-01 Antenna

---

### About This Task

The ML-2452-HPAG4A6-01 is an omnidirectional, co-linear, and vertically polarized antenna used with indoor and outdoor access points. An integrated RF connector is embedded in the antenna base cap for direct access point mounting. The antenna comes with a vent area that permits either upright or inverted orientation for outdoor installations.

If the antenna cannot be mounted directly on the access point, it must be mounted to a pole.



### Warning

Do not mount the antenna next to a column or vertical support since it creates a shadow zone of reduced coverage to one portion of the room.

## ML-2452-HPAG4A6-01 Antenna Direct Attach

### Procedure

1. Line up the antenna connector against the access point antenna port.
2. Twist the antenna connector clockwise to attach it to the antenna port.

## ML-2452-HPAG4A6-01 Antenna Pole Install

### About This Task

The antenna is mounted on a pole if the antenna connector cannot be directly attached to the access point connector.

The following hardware is required for installing the antenna on a pole:

- One mast clamp
- One pole clamp with screws

### Procedure

1. Attach the mast clamp to the antenna using the pole clamp.
2. Place the mast clamp assembly and the antenna to a pole.
3. Tighten the clamp screws on the pole clamp.



**Figure 168: ML-2452-HPAG4A6-01 antenna mounted on a pole**

4. Install a ground rod.



#### Tip

A ground rod is used to drain off static electricity build-up.

5. Connect the ground wire to the pole and the ground rod.

### Related Topics

[ML-2452-HPAG4A6-01 Antenna Specifications and Radiation Patterns](#) on page 53

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## Install the ML-2452-HPAG5A8-01 Antenna

---

### About This Task

The ML-2452-HPAG5A8-01 is an omnidirectional, co-linear, and vertically polarized antenna used with indoor and outdoor access points. An integrated RF connector is embedded in the antenna base cap for direct access point mounting. The antenna comes with a vent area that permits either upright or inverted orientation for outdoor installations.

If the access point has an integrated plug or jack N-connector, the antenna can be directly attached to the access point. If the antenna cannot be mounted directly on the access point, it must be mounted to a pole.



### Warning

Do not mount the antenna next to a column or vertical support since it creates a shadow zone of reduced coverage to one portion of the room.

## ML-2452-HPAG5A8-01 Antenna Direct Attach

### Procedure

1. Line up the antenna connector against the access point antenna port.
2. Twist the antenna connector clockwise to attach it to the antenna port.

The sealing on the antenna connector permits upright or inverted orientation during outdoor mounting.

## ML-2452-HPAG5A8-01 Antenna Pole Install

### About This Task

The antenna is mounted on a pole if the antenna connector cannot be directly attached to the access point connector.

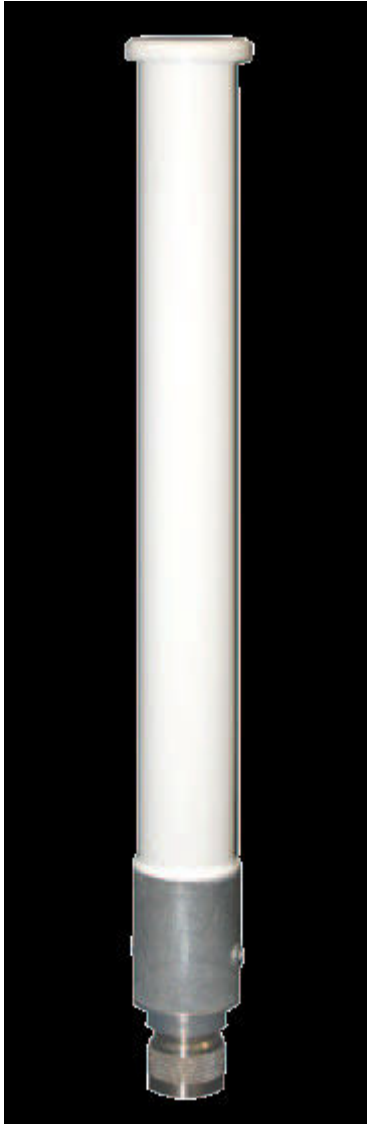
The following hardware is required for installing the antenna on a pole:

- One mast clamp
- One pole clamp with screws

### Procedure

1. Attach the mast clamp to the antenna using the pole clamp.
2. Place the mast clamp assembly and the antenna to a pole.

3. Tighten the clamp screws on the pole clamp.



**Figure 169: ML-2452-HPAG5A8-01 antenna**

4. Install a ground rod.



**Tip**

A ground rod is used to drain off static electricity build-up.

5. Connect the ground wire to the pole and the ground rod.

Related Topics

[ML-2452-HPAG5A8-01 Antenna Specifications and Radiation Patterns](#) on page 56

## Install the ML-2452-PTA2M2-036 Antenna

---

Install the ML-2452-PTA2M2-036 antenna on a T-bar ceiling rail for indoor installations.

### About This Task

The antenna is mounted on a T-bar ceiling for indoor installations. You need to purchase adapter clips for semi-flush ceiling installations.

For more information about recessed or fine line ceiling install, see [ML-2452-PTA2M2-036 Antenna Semi-Flush Ceiling Install](#) on page 200.

## ML-2452-PTA2M2-036 Antenna Flush Ceiling Install

### About This Task

You can directly attach the antenna to a flush ceiling tile.

### Procedure

1. Remove the ceiling tile.
2. Attach the back clip of the antenna to the T-bar ceiling rail.
3. Replace the ceiling tile.

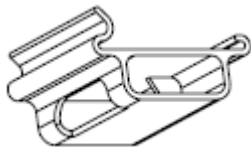
## *ML-2452-PTA2M2-036 Antenna Semi-Flush Ceiling Install*

### About This Task

For semi-flush ceiling install, such as a recessed ceiling or a fine line ceiling grid, you need to purchase the recessed ceiling tile adapter clip or the fine line ceiling adapter clip to install the antenna.

### Procedure

1. Remove the ceiling tile.
2. For recessed ceiling tile, attach the recessed ceiling tile adapter clip to the ceiling.

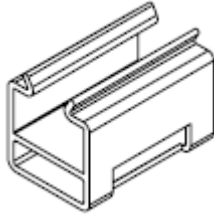


**Figure 170: Recessed ceiling tile adapter clip**

or

For fine line ceiling grid, attach the fine line ceiling adapter clip to the ceiling.





**Figure 171: Fine line ceiling adapter clip**

3. Attach the back clip of the access point to the recessed ceiling tile adapter or the fine line ceiling adapter.
4. Replace the ceiling tile.

#### Related Topics

[ML-2452-PTA2M2-036 Antenna Specifications and Radiation Patterns](#) on page 59

## Install the ML-2452-PTA4M4-036 Antenna

### About This Task

The ML-2452-PTA4M4-036 antenna is designed for wireless LAN (WLAN) application system requirements covering a wide range of operating frequency.



#### Tip

The best practice is to mount the antenna near the center of the coverage area.

## ML-2452-PTA4M4-036 Antenna Ceiling Mount Procedure

### About This Task

When the antenna is mounted on a suspended ceiling, you have access to both the sides of the mounting surface. During this installation, the best practice is to use the threaded post and the mounting nut on the back of the antenna. Follow the installation procedure to securely attach the ML-2452-PTA4M4-036 antenna to a suspended ceiling.



#### Note

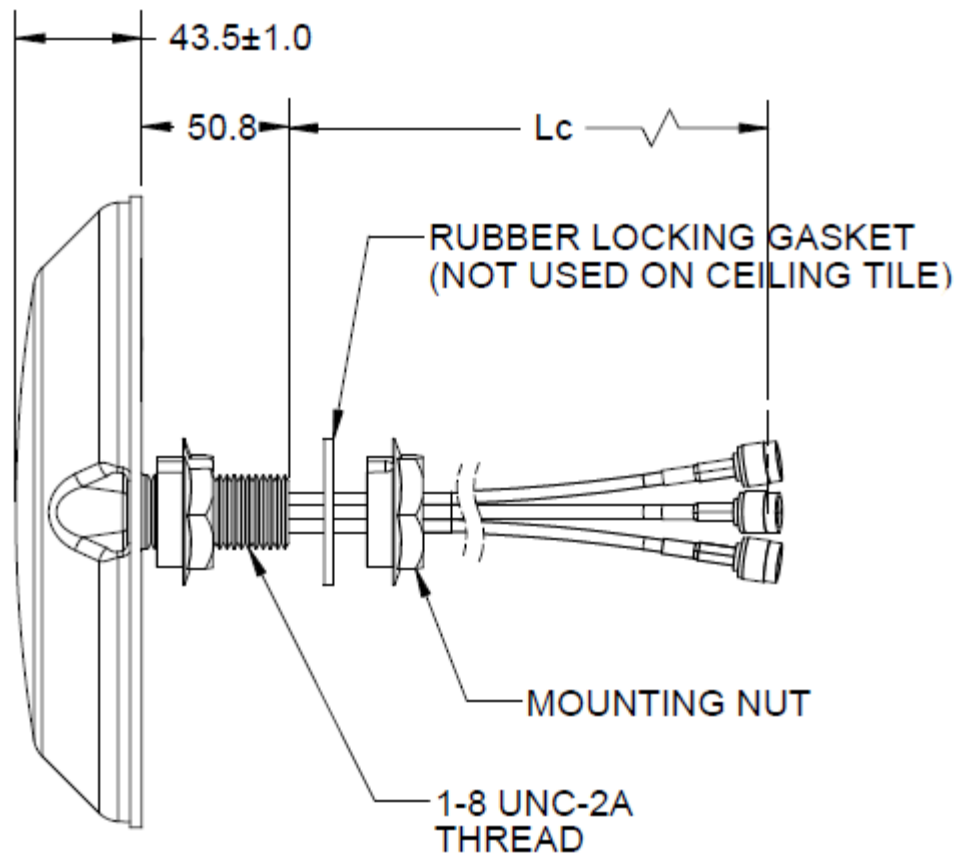
The beam clamp mounting kit is not included with the antenna, and must be purchased separately.

### Procedure

1. Remove the ceiling tile.
2. Mark and cut a 1.57 in. (40 mm) hole in the ceiling tile where the antenna threaded post and mounting nut must go through.
3. Feed the cables through the hole.

- Secure the antenna with the mounting nut.

Use the rubber locking gasket when the antenna is mounted on a solid surface such as dry or wood wall.



**Figure 172: ML-2452-PTA4M4-036 antenna ceiling mount procedure on a suspended ceiling tile**

Related Topics

[ML-2452-PTA4M4-036 Antenna Specifications and Radiation Patterns](#) on page 63

## Install the ML-2452-PNA5-01R Antenna

### About This Task

The ML-2452-PNA5-01R antenna mounts to any flat vertical surface with wall anchors, and can be mounted to a vertical pole using the pole mount kit.



#### Note

The pole mount kit ships with the antenna.

Follow this procedure to securely mount the antenna to a flat vertical surface or to a vertical pole.



**Tip**


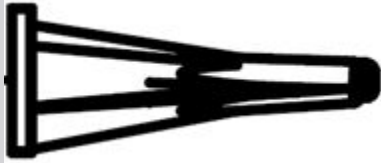
The best practice is to install the antenna on a surface facing the coverage zone.

### ML-2452-PNA5-01R Antenna Flat Surface Install

**About This Task**

The antenna comes with wall anchors and other necessary hardware for flat surface installation.

The following hardware is required for flat surface installation:

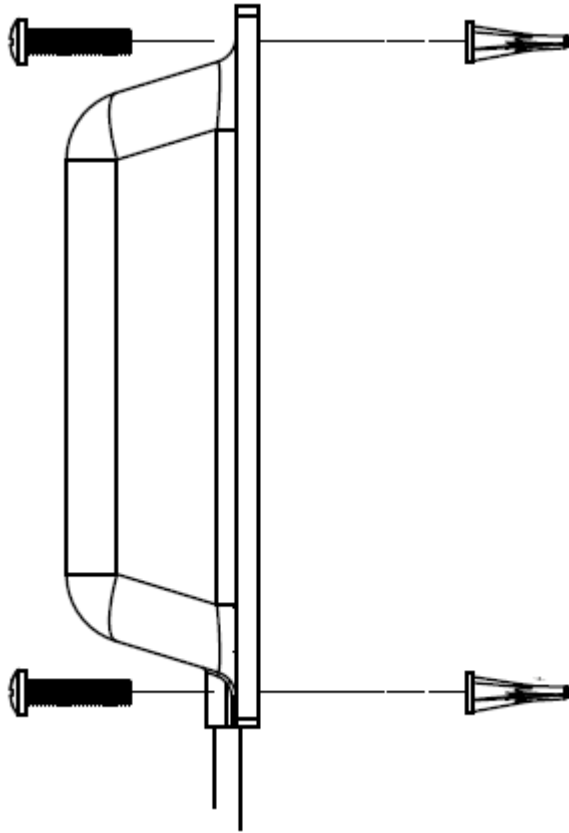
Quantity	Item	Description
2		SS self-tap machine screw
2		Plastic wall anchor

**Procedure**

- Using the antenna mounting holes as a template, mark and drill four holes on a vertical flat surface.

The mounting holes must be 3/16 in. in diameter.

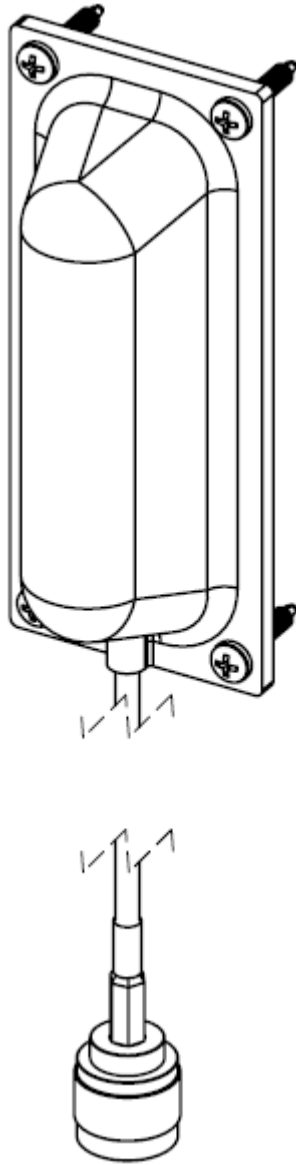
2. Insert the plastic wall anchors into the mounting holes.



**Figure 173: Antenna installation to a flat surface using the plastic anchors and the SS self-tap machine screws**

3. Place the antenna over the wall anchors and attach it to the wall using four SS self-tap machine screws.

4. Torque the screws till the antenna is held in place.





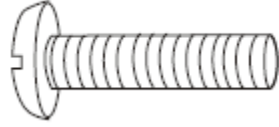

**Figure 174: ML-2452-PNA5-01R antenna installed on a vertical flat surface**

## ML-2452-PNA5-01R Antenna Pole Install

### About This Task

The antenna is mounted to a pole using the hardware that comes with the pole mounting kit. The pole width can be up to 2 in. in diameter.

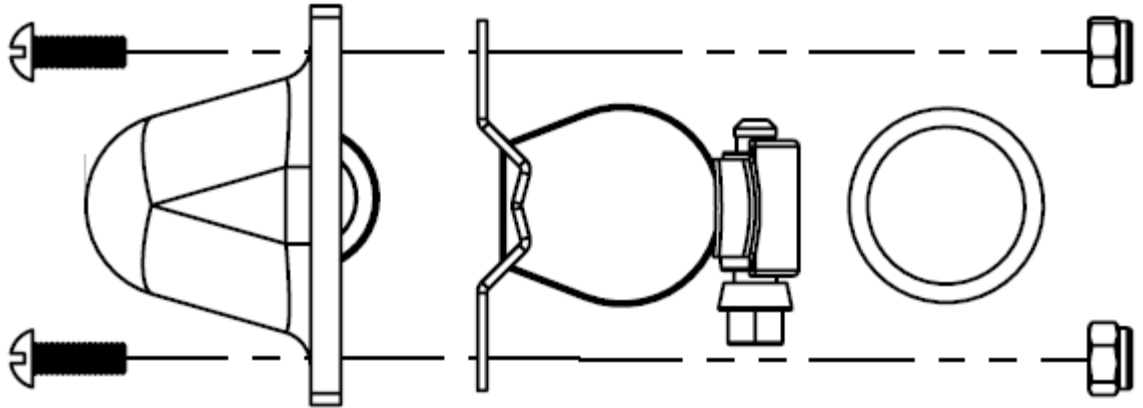
The following hardware is required for pole mount procedure:

Quantity	Item	Description
2		Hose clamp
2		MTE bracket
4		SS machine screw
4		SS nylon hex nut

### Procedure

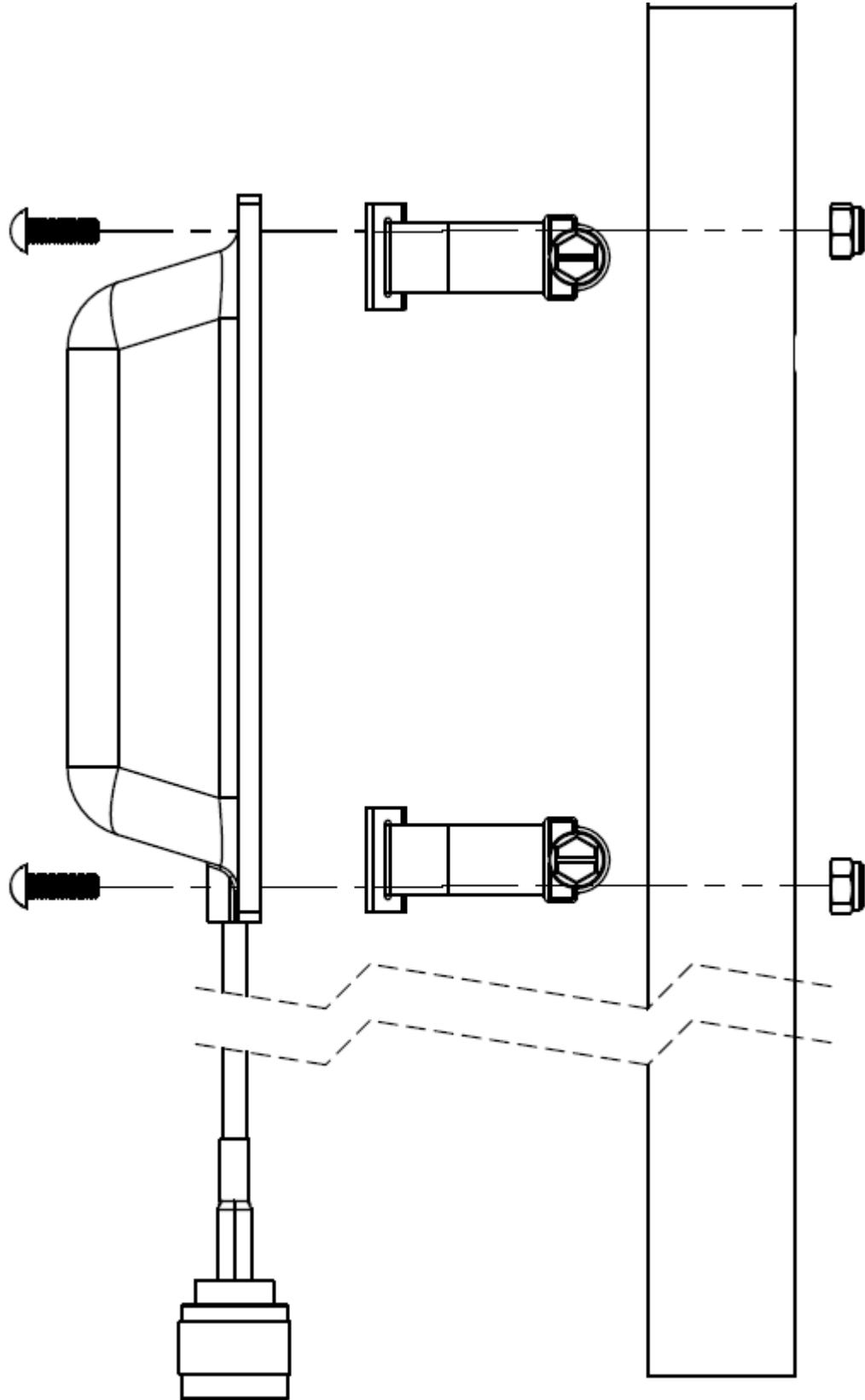
- Slide the hose clamp through the MTE bracket slot.  
Do this for both the MTE brackets.
- Place the hose clamps over the pole and tighten it clockwise.  
Do not over tighten the hose clamps.

3. Align the antenna, MTE bracket with the hose clamp, SS machine screw, and the SS nylon nut as shown in the following [figure](#):



**Figure 175: Hardware parts alignment with the antenna for pole mount procedure**

4. Torque the nylon hex nuts to securely attach the antenna to the pole.



**Figure 176: ML-2452-PNA5-01R antenna pole mount procedure**



## Related Topics

[ML-2452-PNA5-01R Antenna Specifications and Radiation Patterns](#) on page 69

## Install the ML-2452-SEC6M4-036 Antenna

---

### About This Task

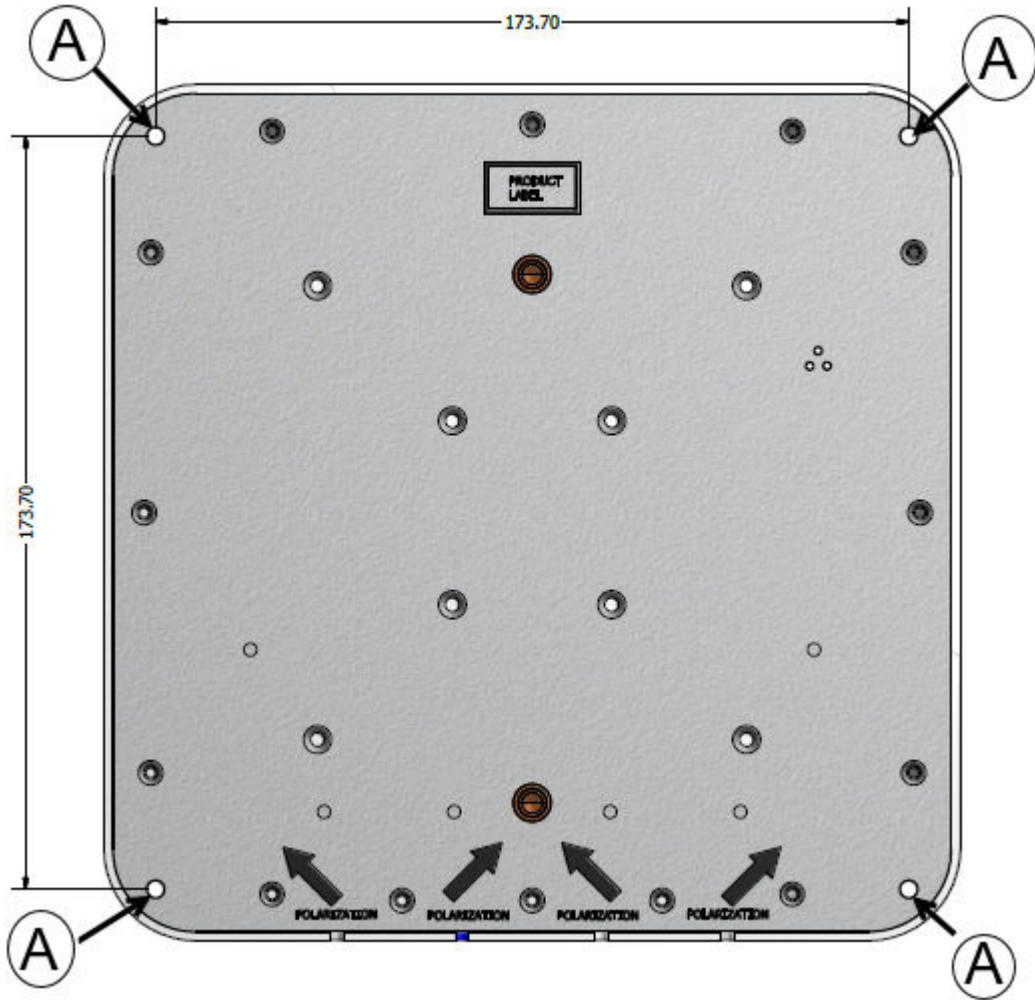
The ML-2452-SEC6M4-036 antenna is mounted to a wall.

ML-2452-SEC6M4-036 antenna box contents:

- A wall mount kit, that includes:
  - Four plastic wall insert plugs
  - Four self-tapping screws
  - Four flat washers
- One ML-2452-SEC6M4-036 antenna
- One wall mount instructions sheet
- One Waste Electrical and Electronic Equipment (WEEE) document
- One China RoHS sheet

**Procedure**

1. Using the ML-2452-SEC6M4-036 antenna holes as a template, mark and drill four, 5 × 35 mm holes on a wall.



**Figure 177: Antenna mounting holes**

Callout	Description
A	Antenna hole templates for wall mount installation

2. Insert four plastic wall insert plugs into the mounting holes.

- Place a flat washer on every antenna mounting hole template, and insert the self tapping screw through the flat washer.



Callout	Description
A	Self tapping screw
B	Flat washer



**Note**

Antenna cables are not shown in the antenna images.

- Insert the self tapping screws into the plastic wall insert plugs, and tighten the screws.



**Figure 178: Self tapping screws inserted into the plastic wall insert plugs**

Related Topics

[ML-2452-SEC6M4-036 Antenna Specifications and Radiation Patterns](#) on page 73

## Install the ML-2452-PNA7-01R Antenna

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### About This Task

The ML-2452-PNA7-01R is a directional patch array enclosed antenna with a UV-stable, weatherproof radome. The ML-2452-PNA7-01R antenna can be mounted at indoor or outdoor locations. It is mounted on a pole or to any flat vertical surface, and comes with a universal articulating mount for wall and pole installations.



#### Tip

The ML-2452-PNA7-01R antenna has a narrow beamwidth. The best practice is to install the antenna away from reinforced block walls, metal cabinets, and steel shelving to experience optimum gain and best performance.

## ML-2452-PNA7-01R Antenna Wall Install

### About This Task

Install the antenna on a flat vertical wall using the universal articulating mount.

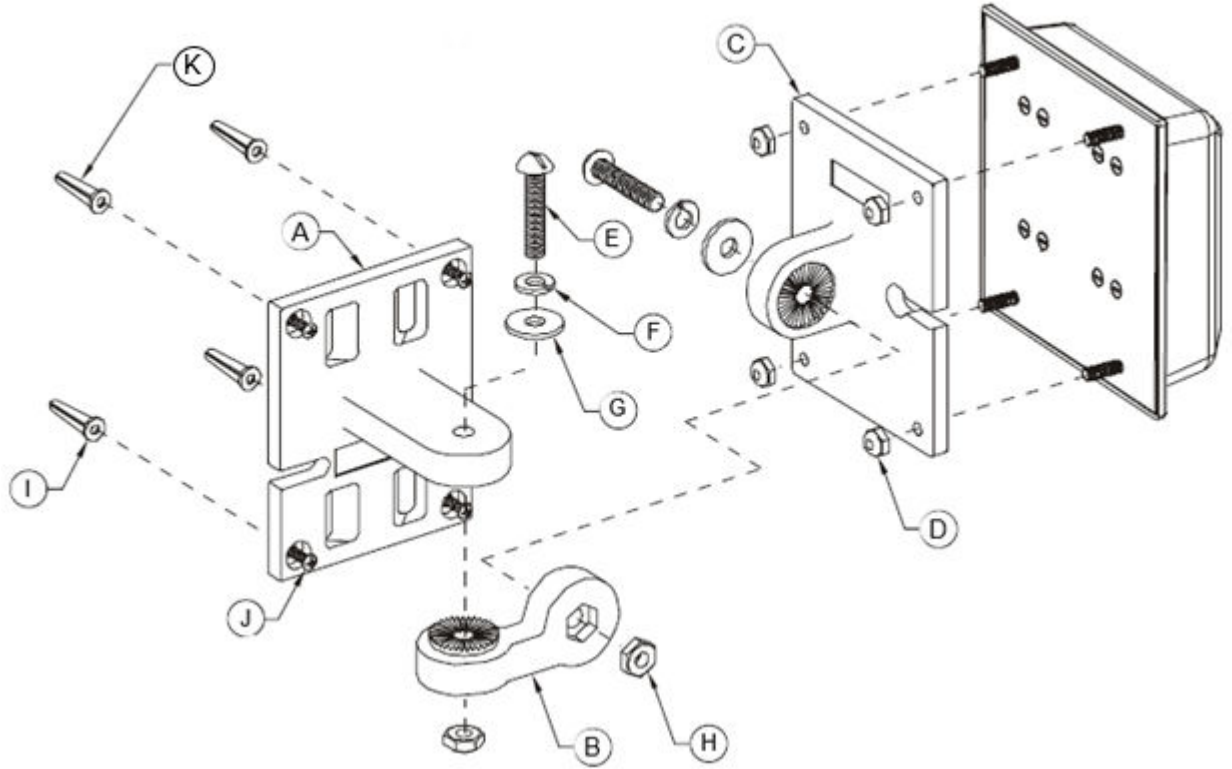
The following hardware is required for wall installation:

- One wall mount
- One articulating arm
- One antenna mount
- Four ¼ in. SS nylon hex nuts
- One machine screw
- One SS split lock washer
- One ¼ in. flat washer
- One ¼ in. – 20 SS hex nut
- Four #8 plastic wall anchors
- Four #8–18 × ¾ in. SS machine screws

### Procedure

1. Attach the antenna mount to the exposed studs on the antenna using four ¼ in. SS nylon hex nuts.

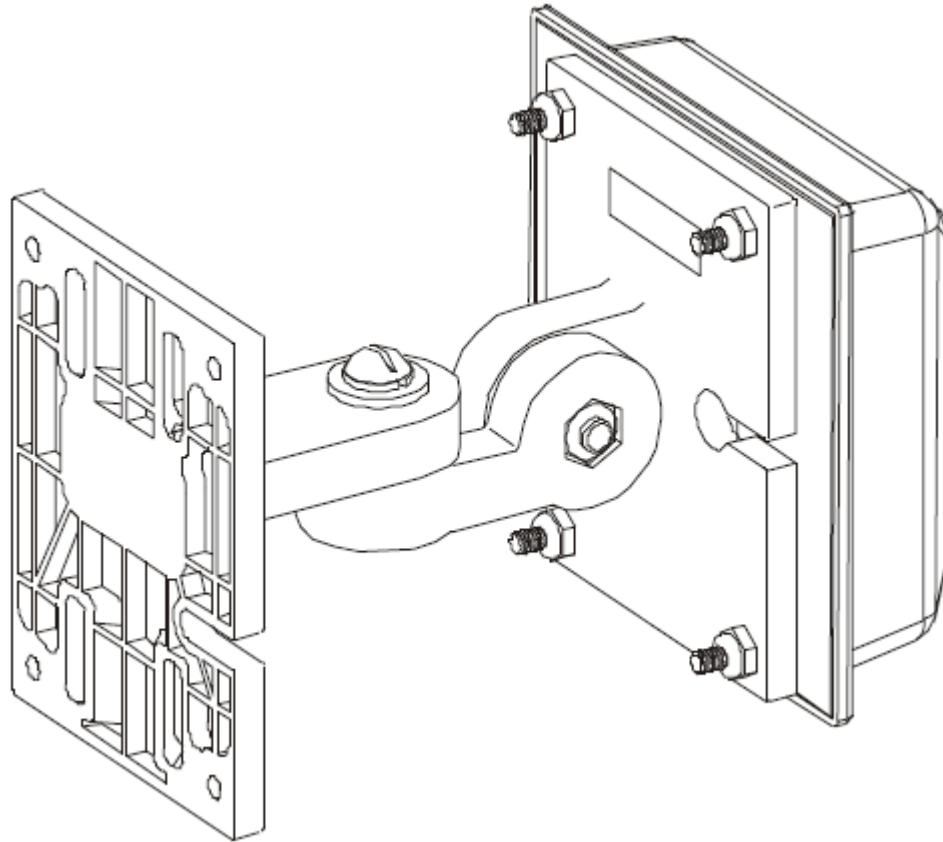
- Attach the articulating arm to the antenna mount using the machine screw, SS split lock washer, ¼ in. flat washer, and ¼ in. – 20 SS hex nut, as shown in the following figure.



**Figure 179: Antenna mount attachment and antenna install to a vertical flat surface**

Callout	Description
A	Wall mount
B	Articulating arm
C	Antenna mount
D	¼ in. SS nylon hex nut
E	Machine screw
F	SS split lock washer
G	¼ in. flat washer
H	¼ in. – 20 SS hex nut
I	#8 plastic wall anchor
J	#8–18 × ¾ in. SS machine screws
K	3/16 in. diameter attachment hole for anchor

- Using the wall mount as a template, mark and drill four attachment holes on a flat vertical surface.  
The attachment holes must be  $\frac{3}{16}$  in. in diameter.
- Install four #8 plastic wall anchors into the attachment holes.
- Attach the wall or pole mount to the flat surface using four #8-18  $\times$   $\frac{3}{4}$  in. SS machine screws.
- Attach the articulating arm to the wall mount using a machine screw, SS split lock washer,  $\frac{1}{4}$  in. flat washer, and  $\frac{1}{4}$  in. – 20 SS hex nut.



**Figure 180: ML-2452-PNA7-01R antenna assembly**

## ML-2452-PNA7-01R Antenna Pole Install

### About This Task

The ML-2452-PNA7-01R antenna is attached to poles up to 2 in. in diameter.

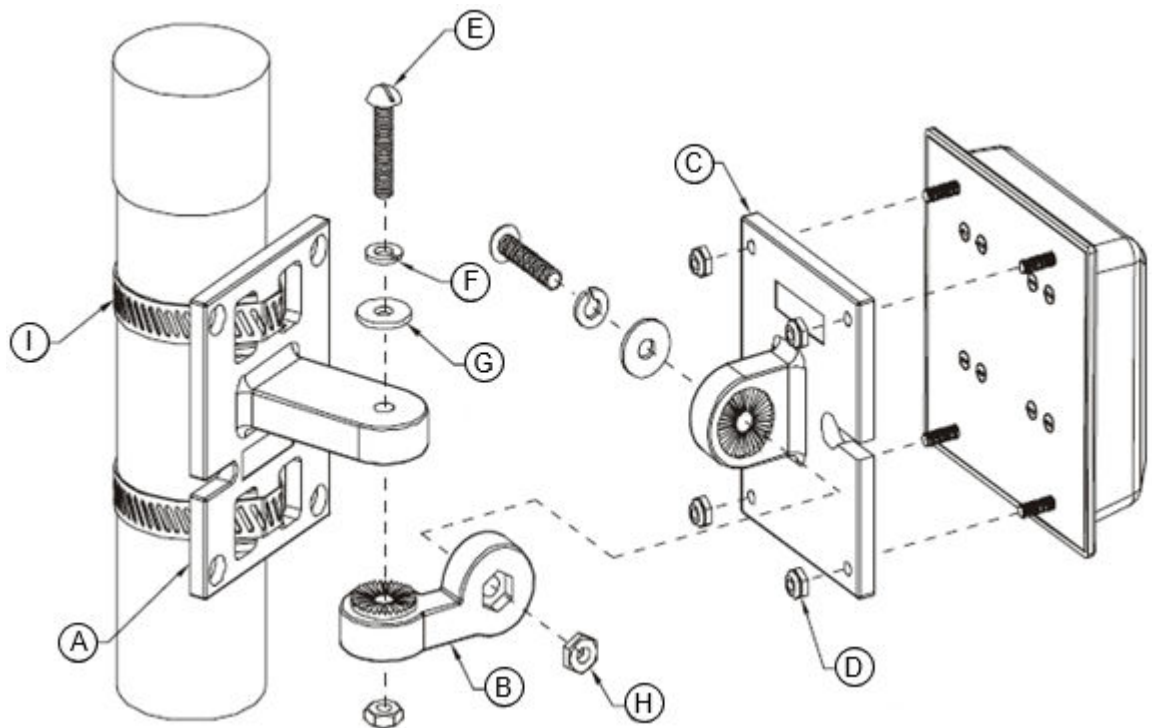
The following hardware is required for pole installation:

- One pole mount
- One articulating arm
- One antenna mount
- Four  $\frac{1}{4}$  in. SS nylon hex nuts
- One machine screw

- One SS split lock washer
- One ¼ in. flat washer
- One ¼ in. – 20 SS hex nut
- Two hose clamps

**Procedure**

1. Attach the antenna mount to the exposed studs on the antenna using four ¼ in. SS nylon hex nuts.
2. Attach the articulating arm to the antenna mount using the machine screw, SS split lock washer, ¼ in. flat washer, and ¼ in. – 20 SS hex nut.
3. Place the hose clamps through the cuts on the pole mount.
4. Attach the pole mount to a pole by tightening the screws on the hose clamps.

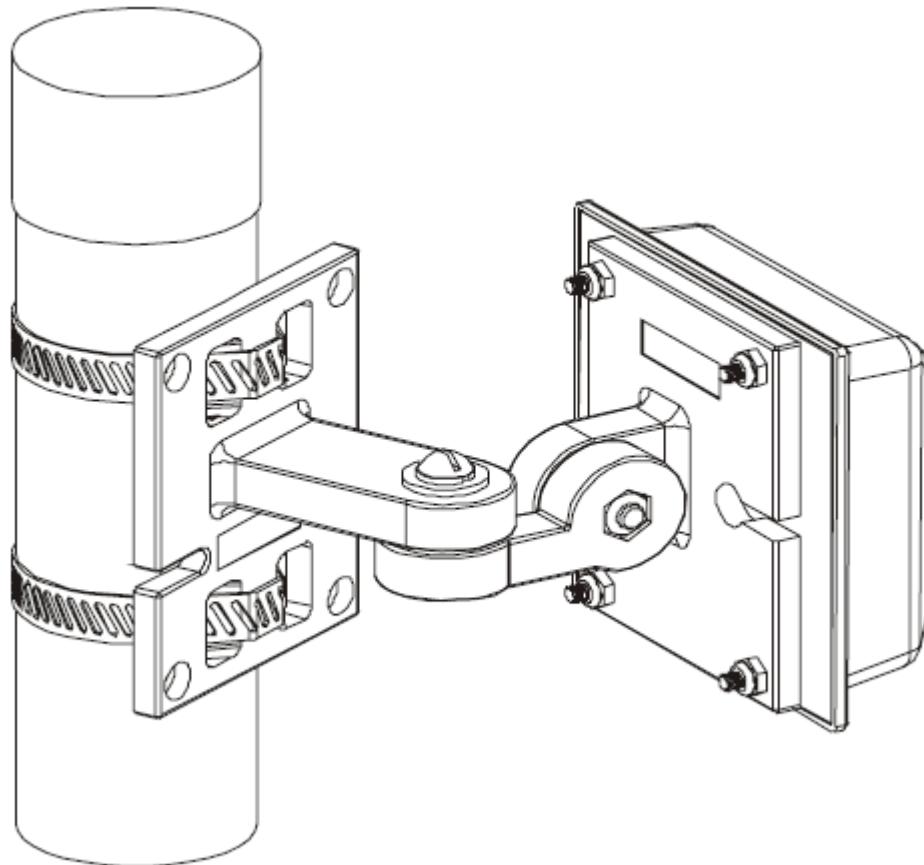


**Figure 181: ML-2452-PNA7-01R antenna being mounted on a pole using a wall or pole mount and hose clamps**

Callout	Description
A	Pole mount
B	Articulating arm
C	Antenna mount
D	¼ in. SS nylon hex nuts
E	Machine screw
F	SS split lock washer

Callout	Description
G	¼ in. flat washer
H	¼ in. – 20 SS hex nut
I	Hose clamp

- Attach the free end articulating arm to the wall or pole mount using a machine screw, SS split lock washer, ¼ in. flat washer, and ¼ in. – 20 SS hex nut.



**Figure 182: ML-2452-PNA7-01R antenna assembly mounted to a pole**

#### Related Topics

[ML-2452-PNA7-01R Antenna Specifications and Radiation Patterns](#) on page 76

## Install the WS-AI-5Q0460 Antenna

### Before You Begin

The WS-AI-5Q0460 antenna is sold with a mount kit for wall mounting. The following hardware is included in the box.

- One WS-AI-5Q0460 RP-SMA plug antenna



- One wall mount kit
  - Antenna bracket attachment
  - Four tapping screws
  - Four flat washers
  - Four plastic insert wall anchors
- One tri-fold compliance sheet

**Note**

The user must provide the pipe mount kit.

One pipe mount kit

- Four screws
- Four screw-in anchors
- Two stainless-steel pole clamps

**About This Task****Procedure**

Related Topics

[WS-AI-5Q04060 Antenna Specifications and Radiation Patterns](#) on page 86

## Install the AI-DQ04360S Antenna

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**About This Task**

The AI-DQ04360S antenna is mounted indoor or outdoor on a flat vertical surface, on a ceiling, or on a pole.

**Note**

If you mount the antenna outdoors, ensure that the antenna cables exit from the antenna bottom to prevent water intrusion and to provide a drain for internal moisture.

The antenna ships with the following mounting hardware:

- One mount interface bracket
- One mount base
- One wall bracket
- One ¼ – 20 × ½ in. cap screw
- One ¼ – 20 wing screw
- Two #10 × ¾ in. screws
- Two #10 × ½ in. screws
- One screen mesh washer
- One spherical washer

- One 3/16 Allen wrench
- One jam nut

AI-DQ04360S antenna box contents:

- Antenna articulating pole mount kit
- Compliance tri-fold China WEEE URL card

You must provide the following hardware for installation:

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

## Vertical Surface Installation

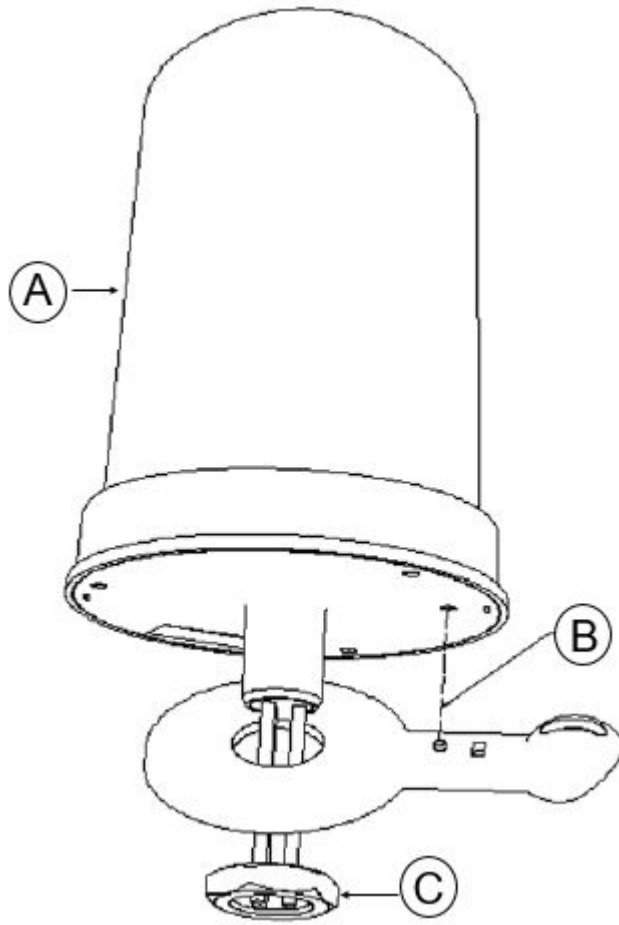
### About This Task

The following hardware components are required to mount the antenna on a vertical flat surface:

- One mount base
- One wall bracket
- One screen mesh washer
- One spherical washer
- One ¼ – 20 wing screw
- Two #10 × ¾ in. screws
- One mount interface bracket
- Two #10 × ½ in. screws

**Procedure**

1. Attach the mount interface bracket to the antenna using the jam nut.

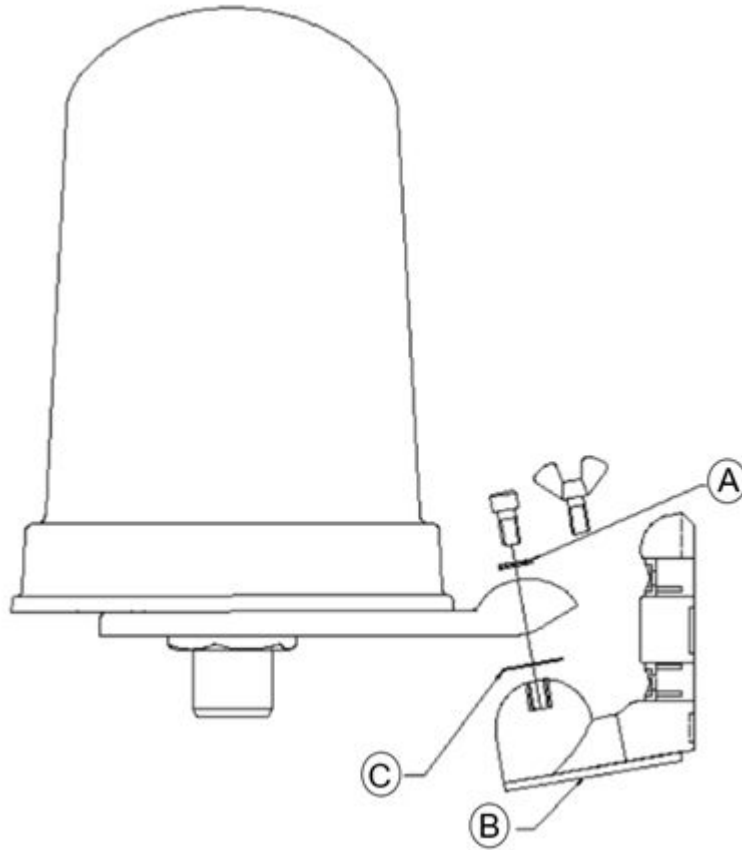


**Figure 183: Antenna mount interface bracket attached to the antenna**

Callout	Description
A	Antenna
B	Mount interface bracket alignment hole
C	Jam nut

2. Place the screen mesh washer between the mount interface bracket and the mount base.

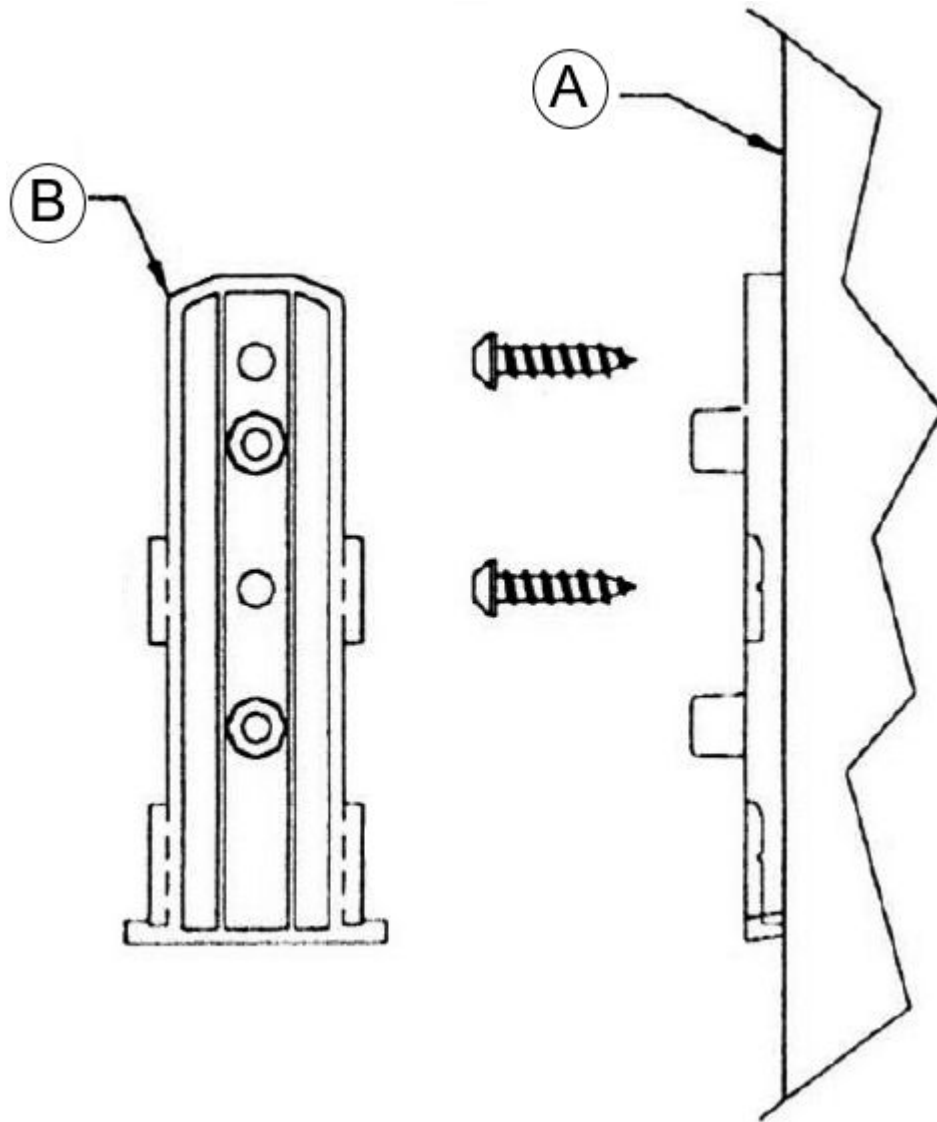
- Attach the mount base to the mount interface bracket using the spherical washer and the ¼ – 20 wing screw.



Callout	Description
A	Spherical washer
B	Mount base
C	Screen mesh washer

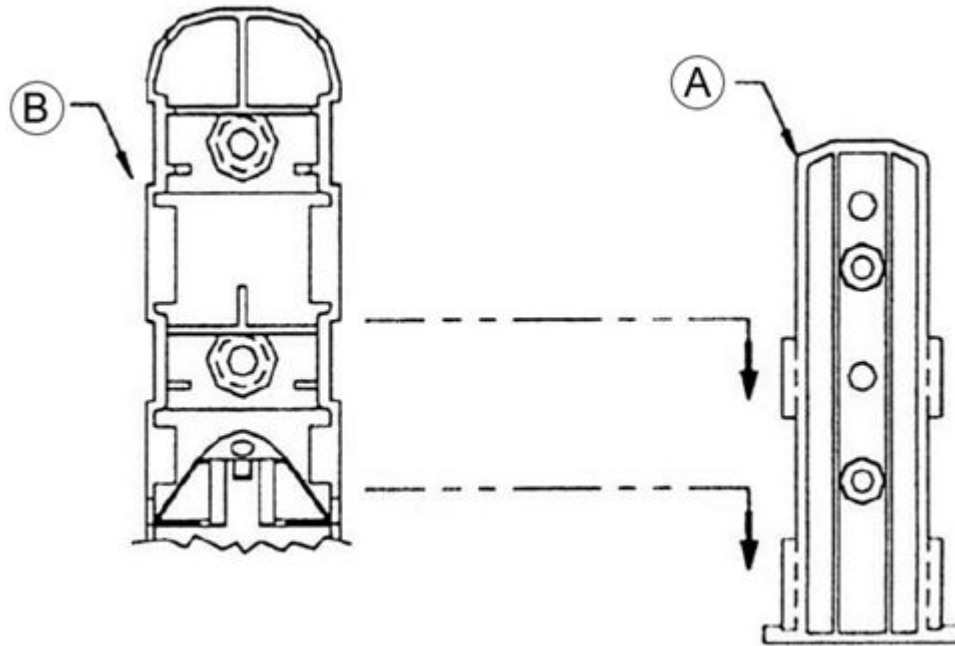
- Use the wall bracket holes as a template, mark and drill two attachment holes on a flat vertical surface.

5. Attach the wall bracket to a wall using two #10 × ¾ in. screws.



Callout	Description
A	Flat vertical surface
B	Wall bracket

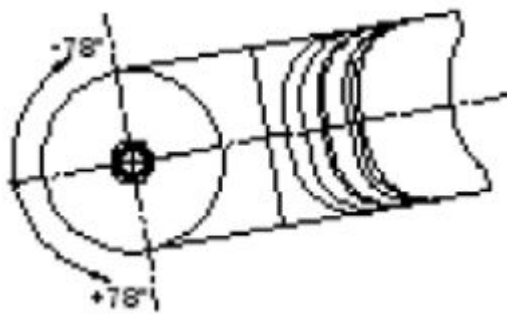
- Slide the mount base on the wall bracket, and secure it in place with two #10 × ½ in. screws.



Callout	Description
A	Wall bracket
B	Mount base

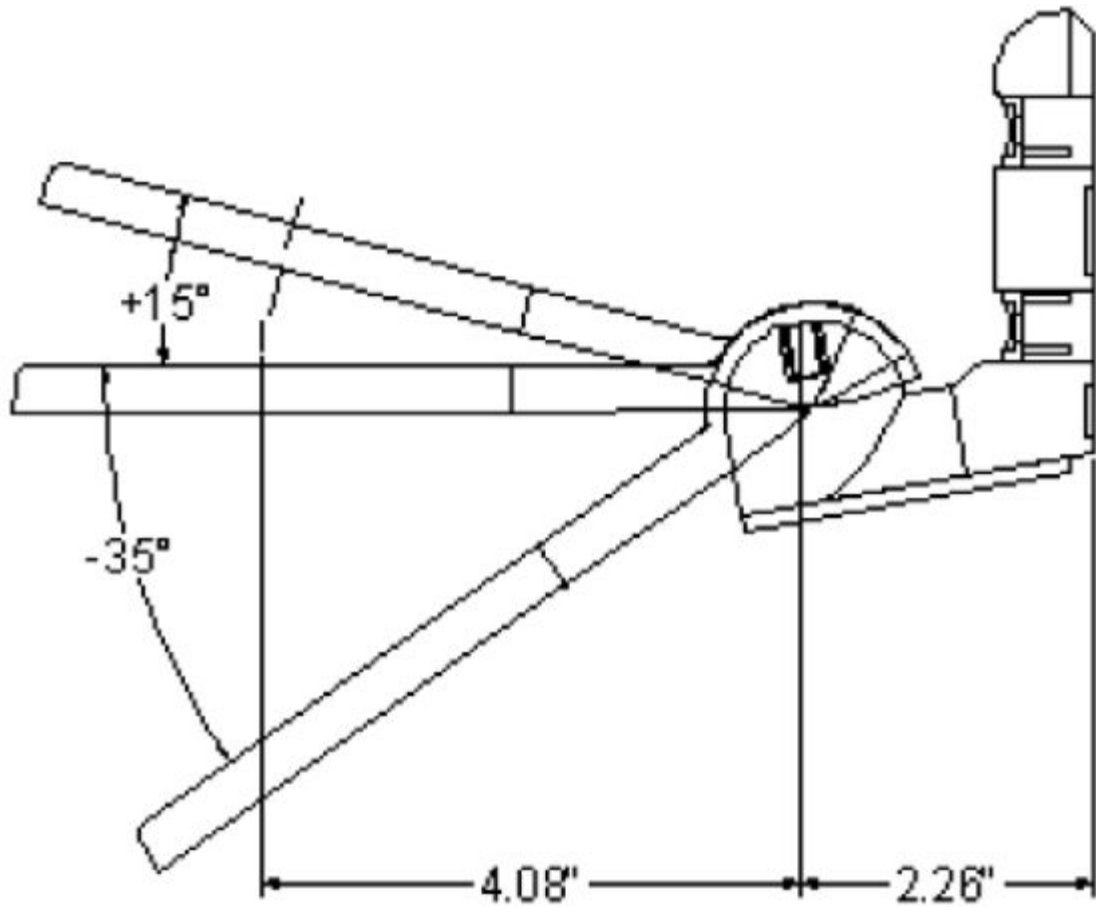
- Adjust the antenna azimuth and elevation.  
To adjust the azimuth and elevation, loosen the jam nut on the mount base.

Azimuth can be adjusted ±78°.



**Figure 184: Azimuth adjustment**

Elevation can be adjusted ±15° and -35°.



**Figure 185: Elevation adjustment**

## Ceiling Installation

### About This Task

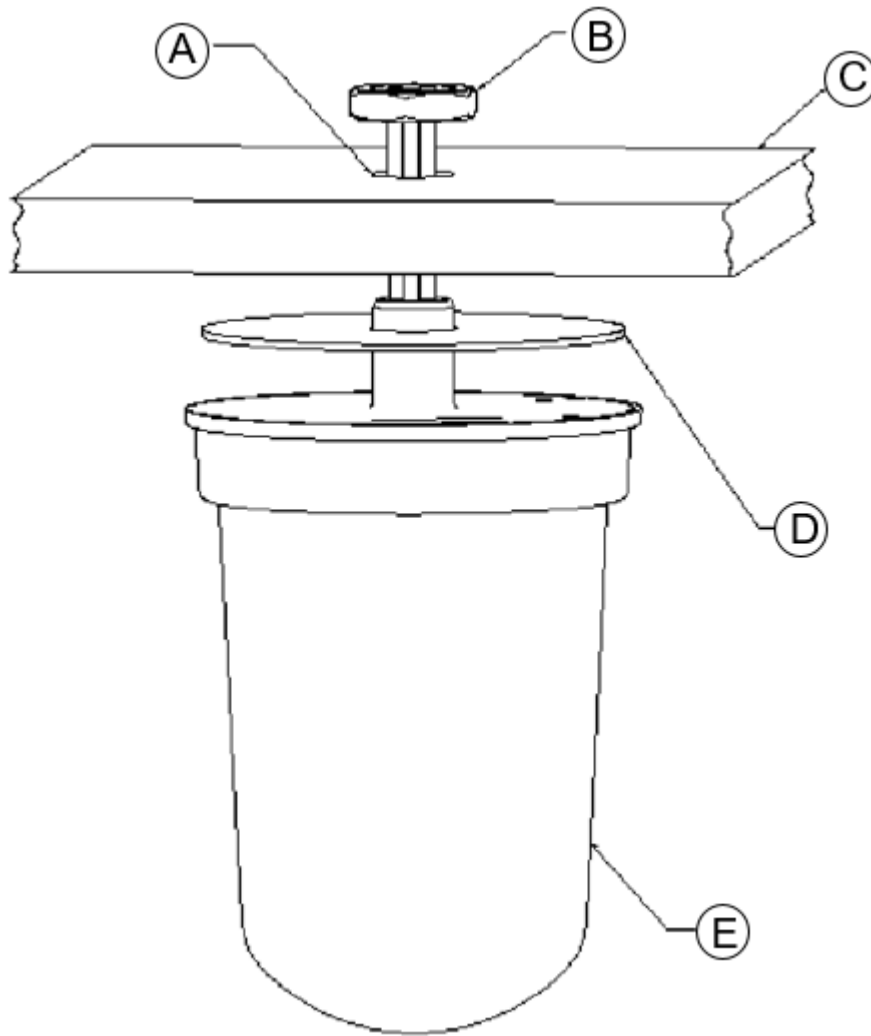
The following hardware is required for ceiling installation:

- One jam nut
- One rubber gasket

### Procedure

1. Drill a 1.25 in. diameter ceiling hole on a ceiling.
2. Fit the rubber gasket onto the bottom of the antenna.
3. Attach the antenna through the ceiling hole.

4. Thread the jam nut onto the antenna shaft, and tighten the jam nut.



**Figure 186: Antenna ceiling install**

Callout	Description
A	1.25 in. diameter ceiling hole
B	Jam nut
C	Ceiling
D	Rubber gasket
E	Antenna

## Pole Installation

### About This Task

The antenna is mounted on a pole using hose clamps.



The following hardware is required for pole installation:

- One mount base
- One mount interface bracket
- One screen mesh washer
- One jam nut
- One spherical washer
- One ¼ – 20 wing screw
- Two hose clamps

### Procedure

1. Follow step 1 to 3 from the [Vertical Surface Installation](#) on page 218 procedure.
2. Position the antenna, the mount base, and the hose clamps on a pole.
3. Tighten the hose clamps and secure the antenna onto a pole.
4. Adjust the antenna azimuth and elevation.

To adjust the antenna azimuth and elevation, loosen the jam nut on the mount base. For more information, see [Figure 184](#) on page 222 and [Figure 185](#) on page 223.

### Related Topics

[AI-DQ04360S Antenna Specifications and Radiation Patterns](#) on page 79

## Install the WS-AI-DQ05120, WS-AI-DE07025, WS-AI-DE10055, or WS-AO-DQ05120N Antenna

### About This Task

The WS-AI-DQ05120, WS-AI-DE07025, WS-AI-DE10055, or the WS-AO-DQ05120N antenna can be mounted to a pole using the pole mount kit. The mount kit allows for 70-degree tilt. If you need to extend the tilt to up to 90 degrees, you can purchase an optional extension bracket, WS-MB-WALLEXT01.

For more details about the extension bracket, refer to the [Install the Antenna Using the WS-MB-WALLEXT01 Extension Bracket Kit](#) on page 240.

The pole mount kit is shipped with the following hardware:

- One antenna bracket attachment
- One elevation adjustable bracket
- One azimuth adjustable bracket
- Four ¼ in. – 20 × ¾ carriage bolts
- Six ¼ in. – 20 hex nuts
- Six ¼ in. – 20 spring lock washers
- Six ¼ in. – 20 flat washers
- Two pole clamps

You must provide the following hardware:

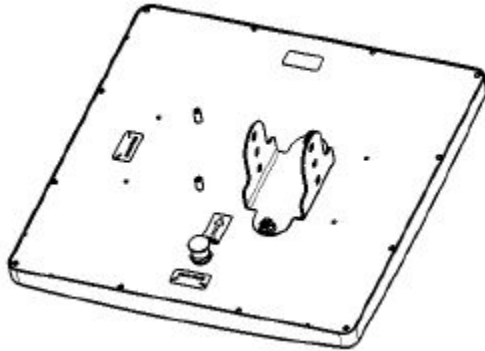
- 7/16 in. wrench

- 8 mm nut driver or flat head screwdriver for hose clamps

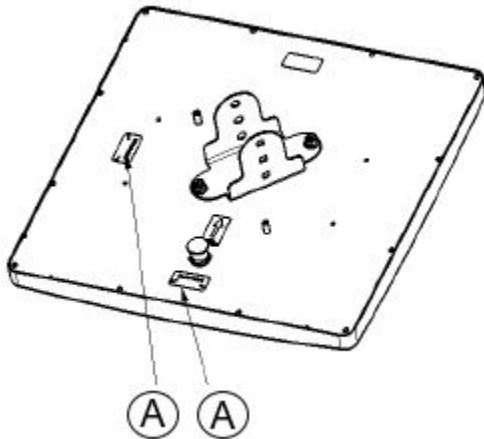


**Note**

The antenna bracket attachment fits in poles that are 1.63 in. – 2.30 in. in diameter. The antenna bracket attachment can be attached to a vertical pole, 45° slant pole, or to a horizontal pole.

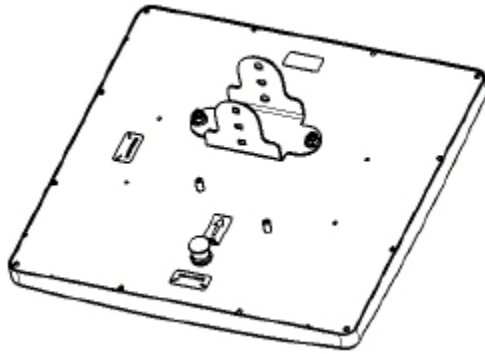


**Figure 187: Antenna bracket attachment position for vertical pole installation**



Callout	Description
A	Drain hole locations

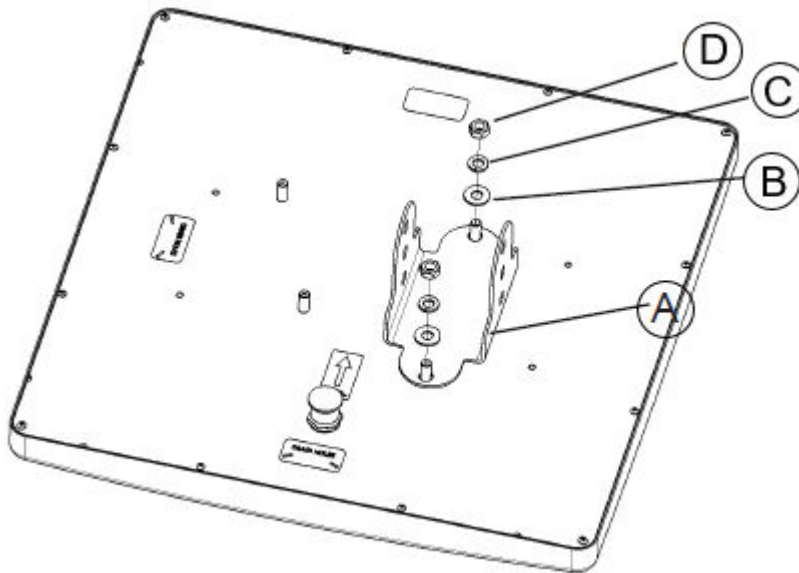
**Figure 188: Antenna bracket attachment position for 45° slant pole installation**



**Figure 189: Antenna bracket attachment position for horizontal pole installation**

**Procedure**

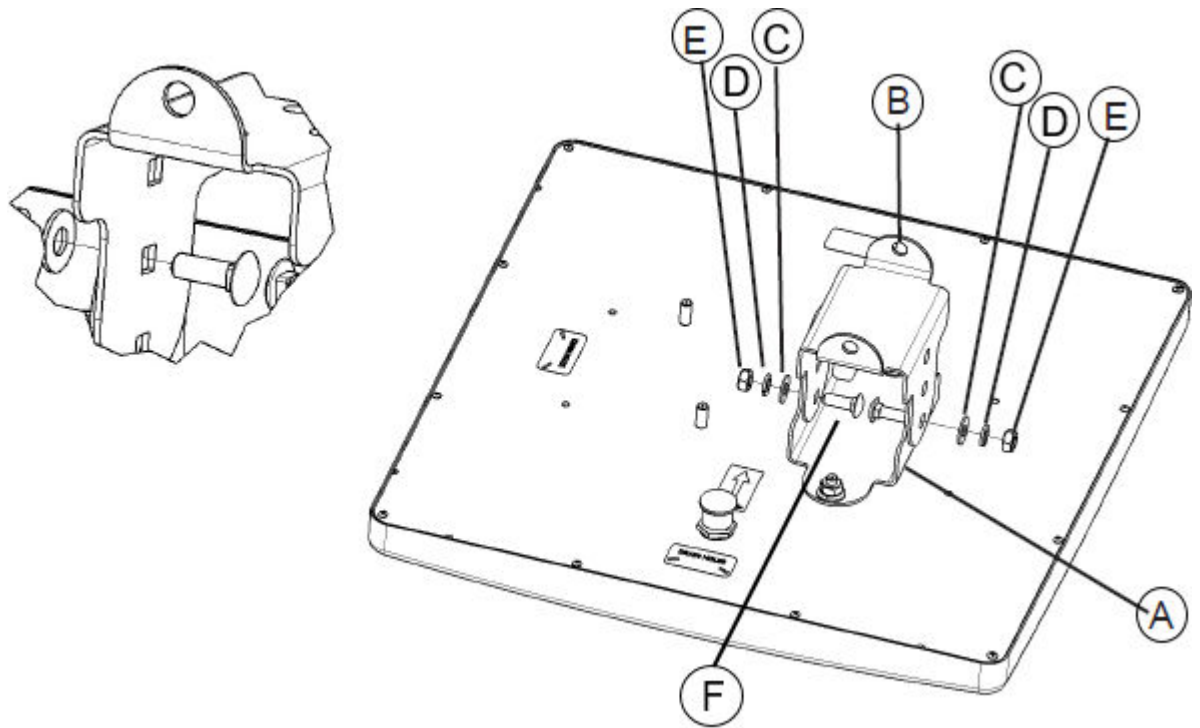
1. Attach antenna mount bracket to the back of the antenna using the flat washer, spring lock washer, and hex nut.



**Figure 190: Antenna bracket attachment procedure for vertical pole**

Callout	Description
A	Antenna bracket attachment
B	¼ in. – 20 flat washer
C	¼ in. – 20 spring lock washer
D	¼ in. – 20 hex nut

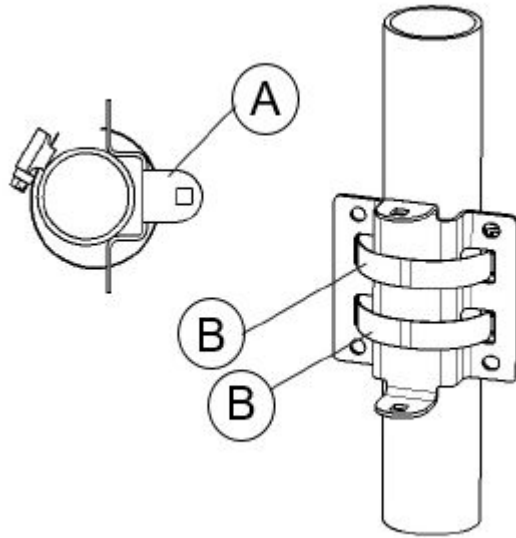
2. Tighten the bolt to a torque of 55 in. lbs.
3. Place one end of the elevation adjustable bracket inside the antenna attachment bracket, and the other end outside the attachment bracket, as shown in [Figure 191](#). Loosely secure the hardware.



**Figure 191: Antenna with antenna attachment bracket and elevation bracket**

Callout	Description
A	Antenna bracket attachment
B	Elevation bracket attachment
C	¼ in. – 20 flat washers
D	¼ in. – 20 spring lock washers
E	¼ in. – 20 hex nuts
F	¼ in. – 20 × ¾ carriage bolt

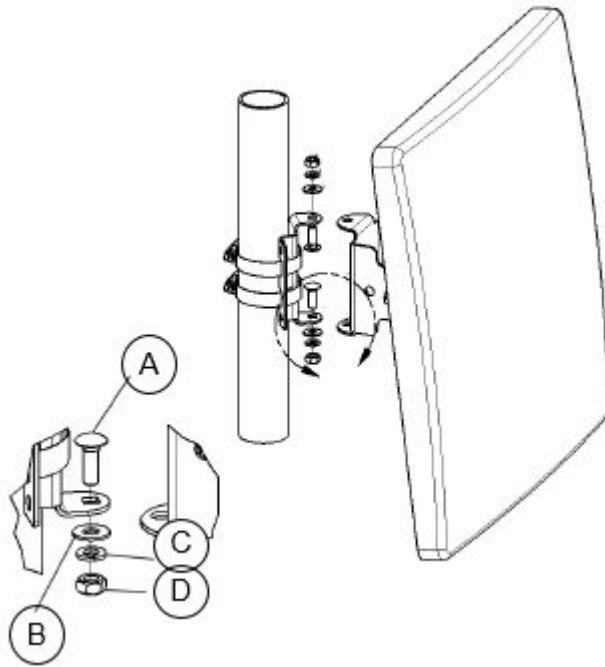
- Attach the azimuth adjustable bracket to a pole using two pole clamps. Tighten the pole clamps to a maximum torque.



**Figure 192: Antenna azimuth bracket attachment to a pole using pole clamps**

Callout	Description
A	Azimuth bracket attachment
B	Pole clamps

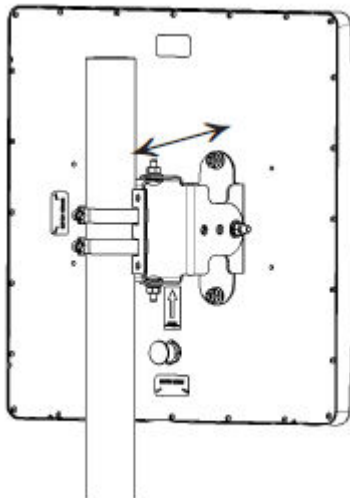
- Attach the antenna bracket attachment to the azimuth bracket attachment on the pole.



**Figure 193: Antenna assembly on a pole with azimuth bracket attachment**

Callout	Description
A	¼ in. – 20 × ¾ carriage bolts
B	¼ in. – 20 flat washers
C	¼ in. – 20 spring lock washers
D	¼ in. – 20 hex nuts

- Adjust the azimuth and elevation bracket angles, and tighten all hardware.



**Figure 194: Antenna assembly on a pole**

## Related Topics

[WS-AI-DQ05120 Antenna Specifications and Radiation Patterns](#) on page 82

[WS-AI-DE07025 Antenna Specifications and Radiation Patterns](#) on page 92

[WS-AI-DE10055 Antenna Specifications and Radiation Patterns](#) on page 99

[WS-AO-DQ05120N Antenna Specifications and Radiation Patterns](#) on page 103

[Install the Antenna Using the WS-MB-WALLEXT01 Extension Bracket Kit](#) on page 240

## Install the WS-AO-DQ04360N Antenna

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### About This Task

The WS-AI-DQ04360N antenna is installed outdoor on a flat vertical surface, on a ceiling, or on to a pole.

**Note**

Ensure that the antenna cables exit from the antenna bottom to prevent water intrusion and to provide a drain for internal moisture.

The antenna ships with the following hardware:

- One mount interface bracket
- One mount base
- One wall bracket
- One ¼ – 20 × ½ in. cap screw
- One ¼ – 20 wing screw
- Two #10 × ¾ in. screws
- Two #10 × ½ in. screws
- One screen mesh washer
- One spherical washer
- One 3/16 Allen wrench
- One jam nut

WS-AI-DQ04360N antenna box contents:

- Antenna articulating pole mount kit
- Compliance tri-fold China WEEE URL card

You must provide the following hardware for installation:

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

## WS-AI-DQ04360N Antenna Vertical Surface Installation

### About This Task

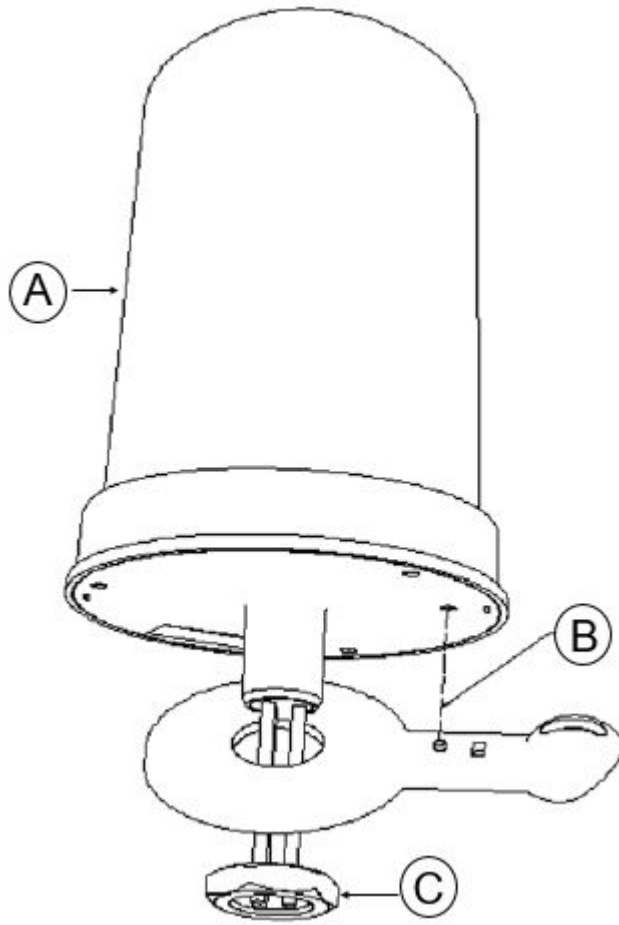
The following hardware components are required to mount the antenna on a vertical flat surface:

- One mount base
- One wall bracket
- One screen mesh washer
- One spherical washer
- One  $\frac{1}{4}$  – 20 wing screw
- Two #10  $\times$   $\frac{3}{4}$  in. screws
- One mount interface bracket
- Two #10  $\times$   $\frac{1}{2}$  in. screws



**Procedure**

1. Attach the mount interface bracket to the antenna using the jam nut.

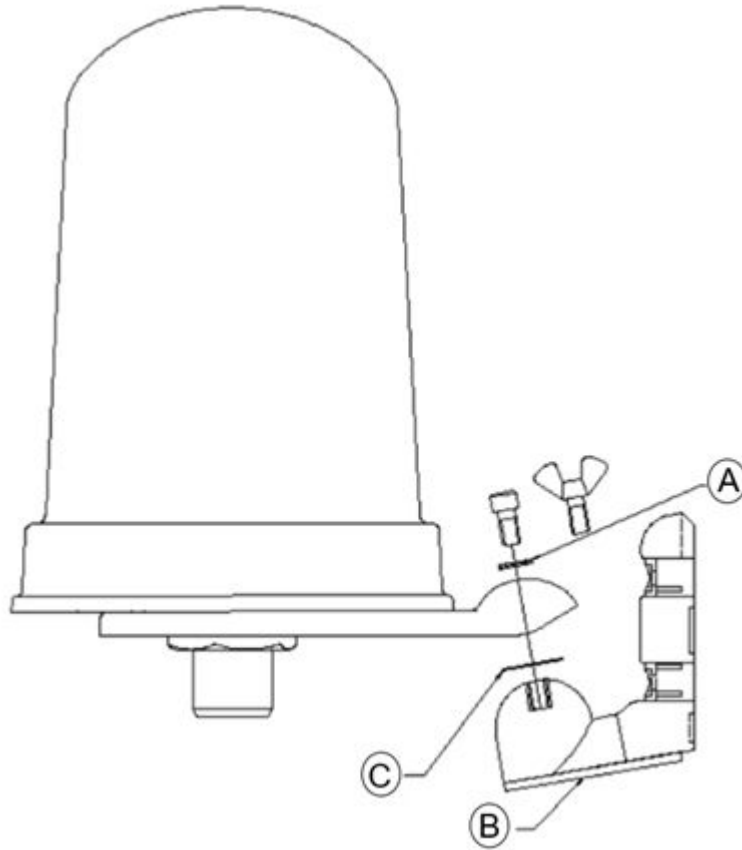


**Figure 195: Antenna mount interface bracket attached to the antenna**

Callout	Description
A	Antenna
B	Mount interface bracket alignment hole
C	Jam nut

2. Place the screen mesh washer between the mount interface bracket and the mount base.

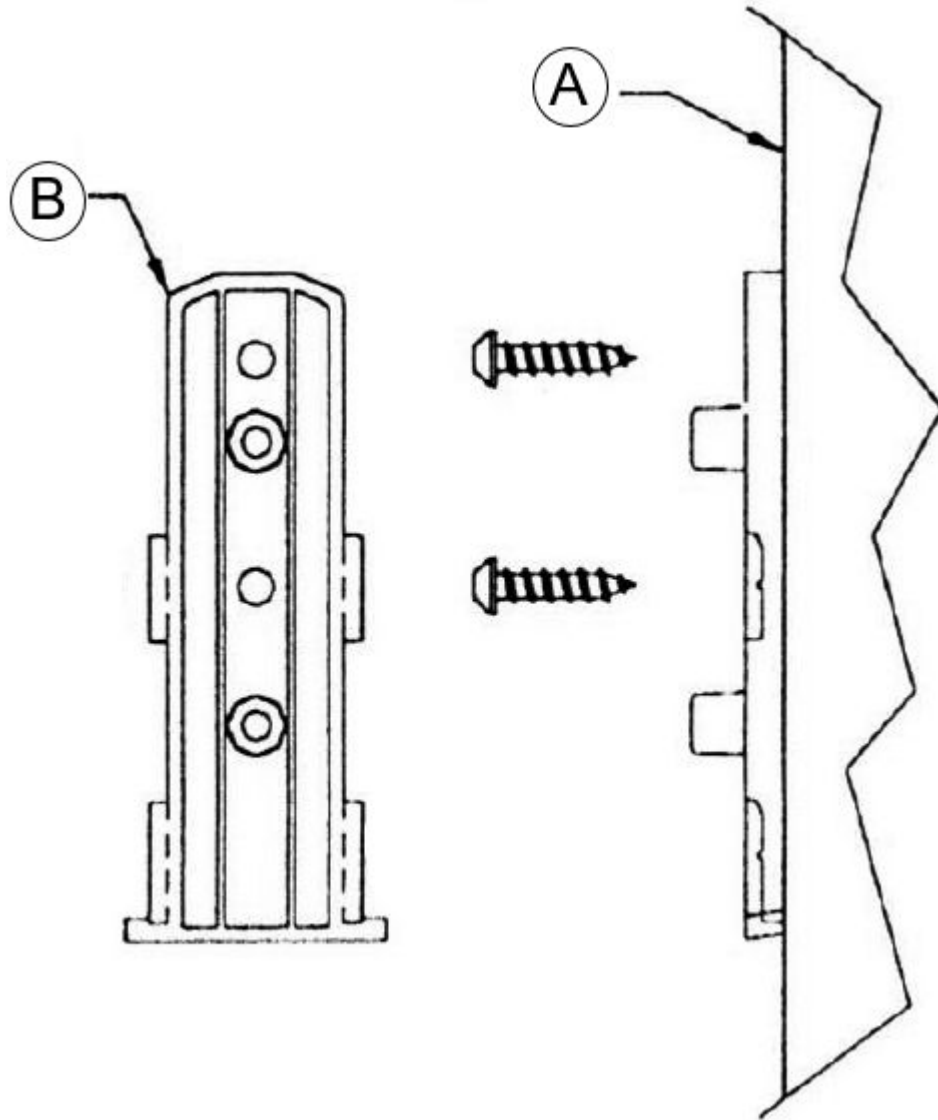
3. Attach the mount base to the mount interface bracket using the spherical washer and the 1/4 – 20 wing screw.



Callout	Description
A	Spherical washer
B	Mount base
C	Screen mesh washer

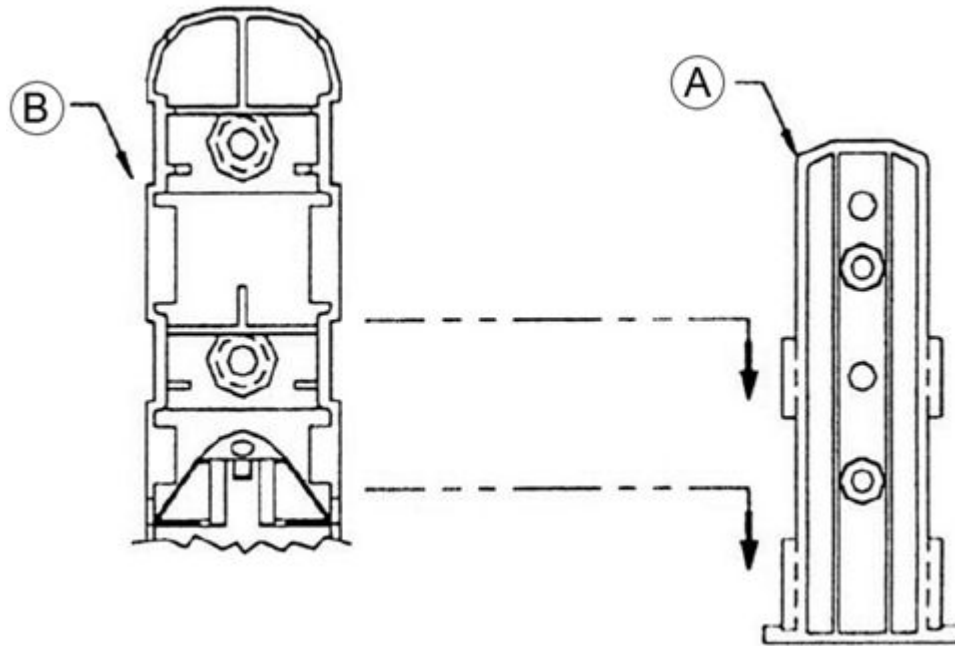
4. Use the wall bracket holes as a template, mark and drill two attachment holes on a flat vertical surface.

5. Attach the wall bracket to a wall using two #10 × ¾ in. screws.



Callout	Description
A	Flat vertical surface
B	Wall bracket

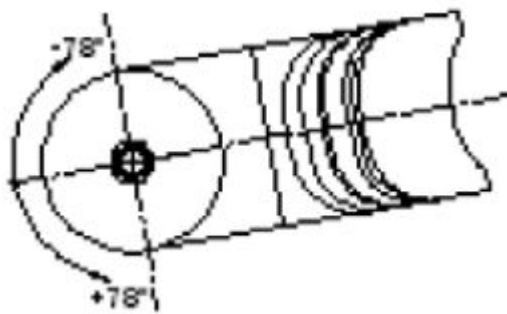
- Slide the mount base on the wall bracket, and secure it in place with two #10 × ½ in. screws.



Callout	Description
A	Wall bracket
B	Mount base

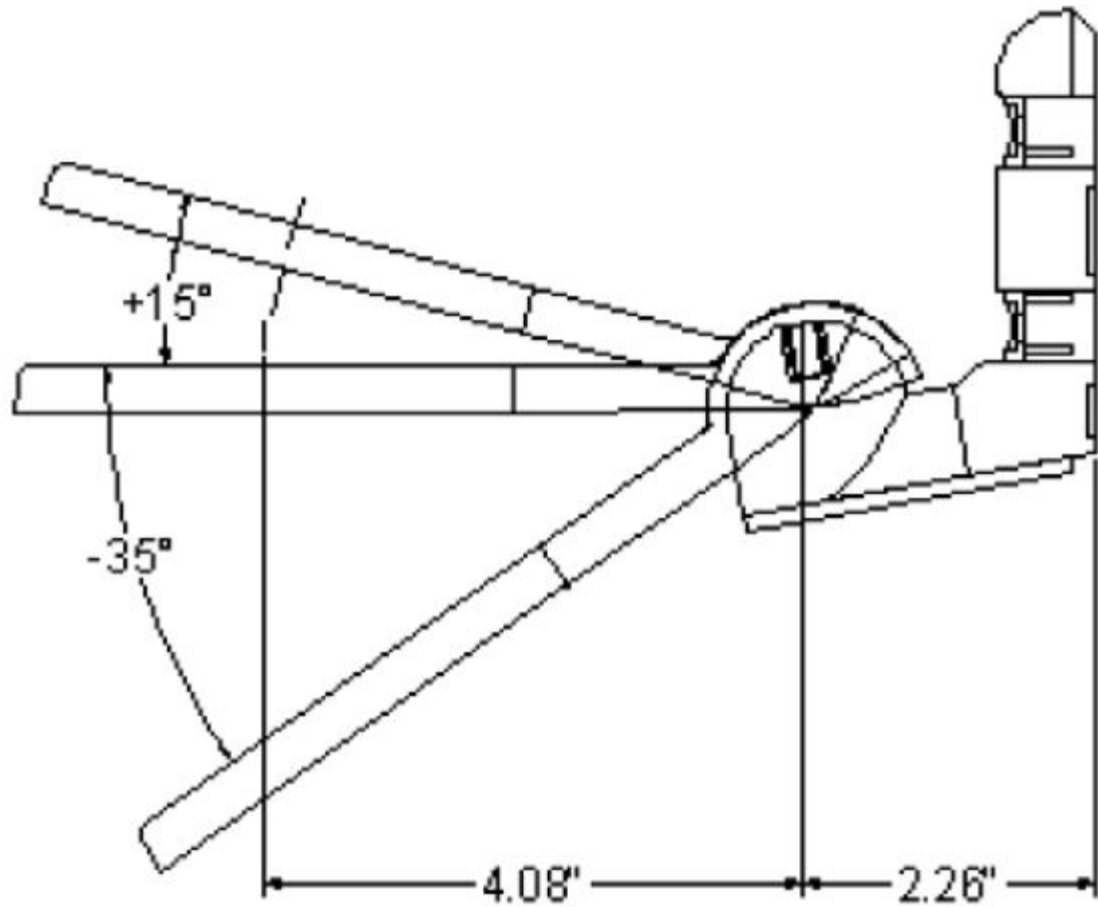
- Adjust the antenna azimuth and elevation.  
To adjust the azimuth and elevation, loosen the jam nut on the mount base.

Azimuth can be adjusted ±78°.



**Figure 196: Azimuth adjustment**

Elevation can be adjusted ±15° and -35°.



**Figure 197: Elevation adjustment**

## Ceiling Installation

### About This Task

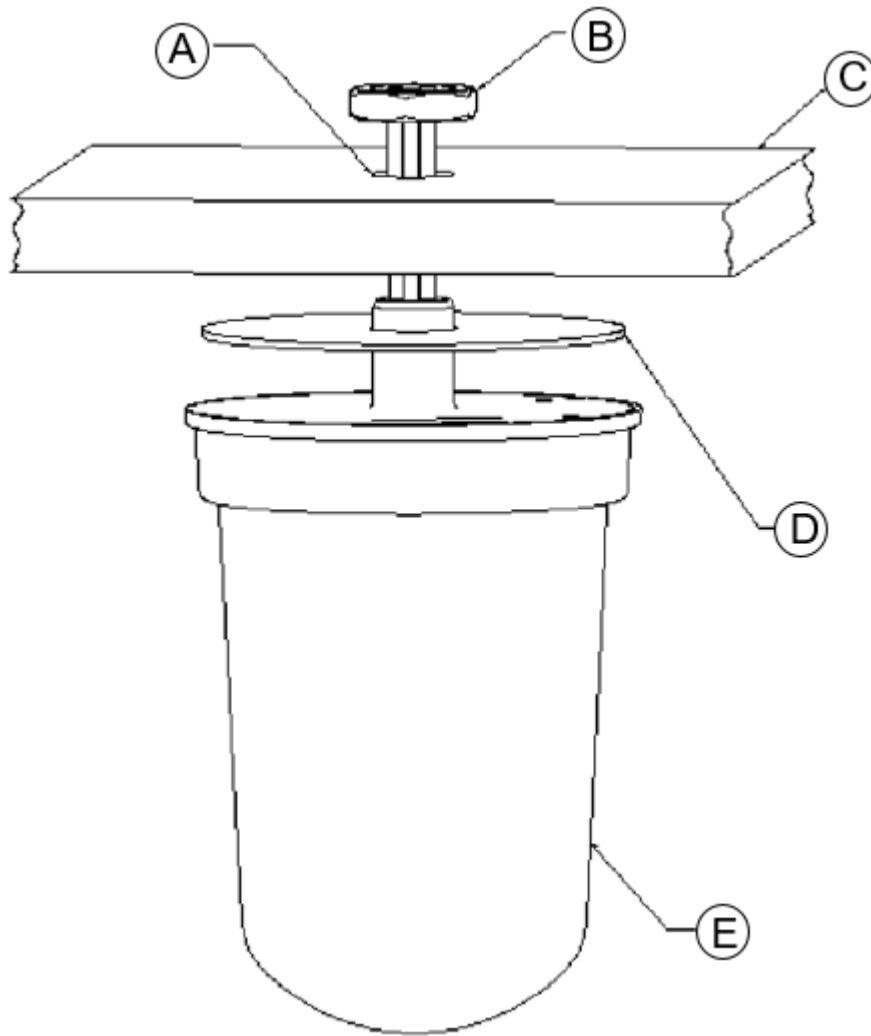
The following hardware is required for ceiling installation:

- One jam nut
- One rubber gasket

### Procedure

1. Drill a 1.25 in. diameter ceiling hole on a ceiling.
2. Fit the rubber gasket onto the bottom of the antenna.
3. Attach the antenna through the ceiling hole.

4. Thread the jam nut onto the antenna shaft, and tighten the jam nut.



**Figure 198: Antenna ceiling install**

Callout	Description
A	1.25 in. diameter ceiling hole
B	Jam nut
C	Ceiling
D	Rubber gasket
E	Antenna

## Pole Installation

### About This Task

The antenna is mounted on a pole using hose clamps.

The following hardware is required for pole installation:

- One mount base
- One mount interface bracket
- One screen mesh washer
- One jam nut
- One spherical washer
- One ¼ – 20 wing screw
- Two hose clamps

### Procedure

1. Follow step 1 to 3 from the [Vertical Surface Installation](#) on page 218 procedure.
2. Position the antenna, the mount base, and the hose clamps on a pole.
3. Tighten the hose clamps and secure the antenna onto a pole.
4. Adjust the antenna azimuth and elevation.

To adjust the antenna azimuth and elevation, loosen the jam nut on the mount base. For more information, see [Figure 184](#) on page 222 and [Figure 185](#) on page 223.

### Related Topics

[WS-AO-DQ04360N Antenna Specifications and Radiation Patterns](#) on page 112

## Install the AH-ACC-ANT-AX-KT Antenna

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### About This Task

You can connect the antenna directly onto the access point. The AH-ACC-ANT-AX-KT antenna is compatible with AP305C/CX and AP510C/CX access points. Attach the antenna after you install the access point.

### Procedure

1. Line up the antenna connector and the antenna port on the access point.  
Refer to the [External Antenna Connectors](#) on page 31 topic for information on antenna connector on various access points.
2. Twist the antenna connector clockwise to attach it to the antenna port.

### Related Topics

[AH-ACC-ANT-AX-KT Antenna Specifications and Radiation Patterns](#) on page 116

## Install the Antenna Using the WS-MB-WALLEXT01 Extension Bracket Kit

Install the antenna on a wall or a pole using the WS-MB-WALLEXT01 extension bracket kit for 90 degree tilt.

### About This Task

The WS-MB-WALLEXT01 (part number 30515) extension bracket is used to extend the antenna tilt up to 90 degrees, when mounted on a wall or a pole. The extension bracket supports the following antennas:

- [WS-AI-DQ05120 antenna \(part number 30702\)](#)
- [WS-AI-DE07025 \(part number 30705\)](#)
- [WS-AI-DE10055 \(part number 30707\)](#)
- [WS-AO-DQ05120N \(part number 30711\)](#)



### Note

The antennas ship with a standard mounting kit that allows for a 70 degree tilt. The wall extension bracket kit is an optional accessory that is used with the standard mounting kit to increase the antenna tilt, up to 90 degrees. The wall extension kit can only be used with the main mounting kit.

The following hardware is required for installing the antenna to a wall or to a pole:

### Main mounting kit hardware requirements:

- One antenna bracket attachment
- One elevation adjustable bracket
- One azimuth adjustable bracket
- Four ¼ in. – 20 × ¾ carriage bolts
- Six ¼ in. – 20 hex nuts
- Six ¼ in. – 20 spring lock washers
- Six ¼ in. – 20 flat washers

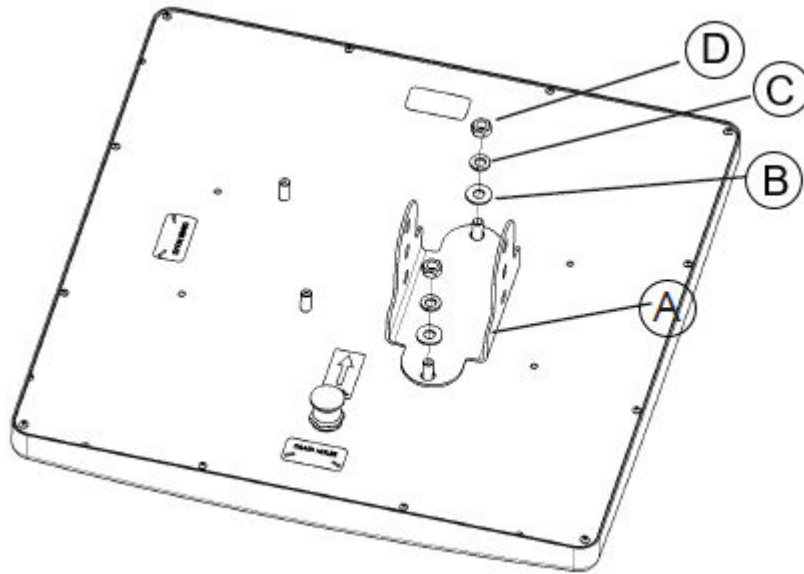
### Extension kit hardware requirements:

- Two bracket extension for the antenna bracket attachment
- One 0.37 in., 3.47 in. long aluminum tube
- Three 0.37 in., 2.33 in. long aluminum tube
- One ¼ in. – 20 × ½ hex bolt



**Procedure**

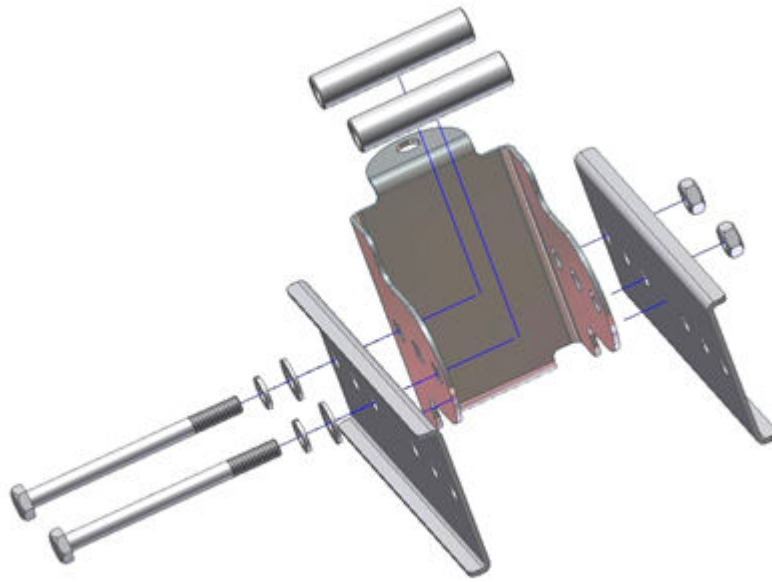
1. Attach antenna mount bracket to the back of the antenna using the flat washer, spring lock washer, and hex nut.



**Figure 199: Antenna bracket attachment procedure for vertical pole**

Callout	Description
A	Antenna bracket attachment
B	¼ in. - 20 flat washer
C	¼ in. - 20 spring lock washer
D	¼ in. - 20 hex nut

2. Tighten the bolt to a torque of 55 in. lbs.
3. Attach the two bracket extension to the elevation adjustable bracket.
  - a. Line up the extension bracket side holes against the side holes on the elevation adjustable bracket.
  - b. Place two of the three 2.33 in. long aluminum tubes on the holes shown in [Figure 200](#).



**Figure 200: Bracket extension and aluminum tube placement**

- c. Using two ¼ in. – 20 × ¾ carriage bolts, ¼ in. spring lock washers, ¼ in. flat lock washers, and ¼ in. – 20 hex nuts as shown in [Figure 200](#), attach the extension bracket to the elevation bracket.



**Note**

The carriage bolts must run through the aluminum tubes.

The elevation adjustable bracket is now attached to one end of the extension bracket.

4. Attach the other end of the extension bracket to the antenna bracket attachment.
  - a. Align the end holes of one end of the extension bracket with the end holes on the antenna bracket attachment.
  - b. Place the 2.33 in. long aluminum tube on the extension bracket and the antenna bracket attachment end holes.
  - c. Using one ¼ in. – 20 × ¾ carriage bolt, ¼ in. spring lock washer, ¼ in. flat lock washer, and ¼ in. – 20 hex nut, attach the bracket extension to the antenna bracket.
5. For wall installations, using the azimuth bracket attachment as a template, mark and drill four holes.

6. Attach the elevation adjustable bracket to the azimuth bracket attachment.
  - a. Place the 3.47 in. long aluminum tube on the elevation adjustable bracket attachment.
  - b. Hold the aluminum tube in place and place the azimuth bracket attachment over the elevation adjustable bracket.
  - c. Using one  $\frac{1}{4}$  in. – 20  $\times$   $\frac{1}{2}$  hex bolt,  $\frac{1}{4}$  in. spring lock washer,  $\frac{1}{4}$  in. flat lock washer, and  $\frac{1}{4}$  in. – 20 hex nut, attach the aluminum tube and the elevation bracket to the azimuth bracket.

You must now have all the bracket parts and the extension arm attached to the access point.

7. Use four screws and screw in-anchors to attach the azimuth bracket attachment to the wall.
8. For pole installations, follow steps 4 to 6 from [Install the WS-AI-DQ05120, WS-AI-DE07025, WS-AI-DE10055, or WS-AO-DQ05120N Antenna](#) on page 225.



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